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Putting Prices on Mother Nature

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Recently, a group of economists took a stab at estimating the economic value of the services provided by the entire suite of the biosphere's natural ecosystems. While the authors were roundly criticized by some for the audacity of even attempting such a task (and by others for the methods actually used), their estimate of 33 trillion dollars annually provides at least an interesting benchmark with which to think about the earth's natural assets. The larger point made by the study was that the earth's natural assets, like man-made commercial assets, produce flows of services that not only support and enhance life, but that are economically valuable to humans. Examples of ecosystem services include: nutrient recycling, water and air filtration services, pollution assimilation, gene banks, aesthetic services, recreational services, wildlife habitat, etc.

Ecosystem services are what economists often call non-market services, in the sense that they are mainly provided, without charge, by the earth's many and varied ecological systems. The fact that they often carry no explicit price does not mean that they do not have value to humans, of course, and as the 33 trillion dollar estimate suggest, they probably have enormous value. But why would we want to go to the trouble of measuring the economic value of such services? One reason is simply to know the value and to put it in perspective compared with other monetary measures that value the services from man-made assets, such as Gross National Product (GNP). For example, the 33 trillion dollars is equivalent to 1.8 times the entire world's GNP. The other reason is because nonmarket goods and services from natural ecosystems tend to get misused by humans. And for resources that are misused (particularly overused), it may be important to develop "proxy" market values so that we, at minimum, know the value of what

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we are losing through misuse. We may also want proxy values so that policy makers can make decisions about these resources that accurately reflect the values of ecosystem services when they conflict or otherwise interact with conventional market values. For example, while everyone knows that forests provide wood products, they also remove carbon dioxide, produce oxygen, stabilize climate, store and purify water, and provide habitat for plant and animals. These non-timber services clearly have value and some of them are diminished when forests are removed. An important public policy question is how large the non-market ecosystem service values are compared with traditional monetary timber values. In a similar vein, agriculture provides many benefits such as green space, wildlife habitat, and aesthetic vistas to urban, suburban and rural residents. These kinds of services clearly have value, but they are generally provided without compensation by farmers as a by-product of ordinary farming operations.

How and why do these kinds of resources get overused? The popular literature often attributes environmental overuse problems to "capitalism", or "greed", or a lack of "ethic" about the environment. But in a paradoxical way, it may be the absence of normal market forces that is the source of the problem. As it turns out, whether a natural resource is owned as private property is one important determinant of the degree to which it will be overused. Private property is generally an important stimulus to conservation and wise use of natural resources. A farmer who owns his own land does not generally degrade the productive capacity of his own soil, since by doing so he reduces the value of his land. On the other hand, the same farmer may contribute (marginally) to overdrawing an aquifer beneath his land, precisely because he doesn't "own" the aquifer. With a farmer's soil, the consequences of his own decisions are internalized in the sense that he must bear all (or most) of the costs of his own overuse decisions. With the aquifer, on the other hand, an individual farmer cannot be expected to account for the fact that as he makes a decision that draws the water table down for himself, he raises the pumping costs to all others (if even by a small amount). The same farmer may not pay enough attention to the costs imposed on downstream users of a watercourse bordering his land when it is used to carry away runoff containing pesticides, herbicides, and soil contaminants, because again, he has no "ownership" interests in the assimilative capacity of the river as a natural asset. The accumulation of these "spillover effects" or "externalities" arising from uncoordinated decisions impinging on a shared resource is often referred to as the "tragedy of the commons".

Three broad approaches have emerged about how to reduce the spillovers that arise out of uncoordinated use of shared or common resources. The first and most familiar simply involves setting limits on aggregate use for the whole system and then regulating individual users to ensure that the limits are not exceeded. For example, automobile air pollution regulations begin with some absolute standards for air quality in the worst case cities. Then, regulators calculate just how stringent the controls must be on new automobiles to reach those standards in the worst case cities. In a similar fashion, the Bureau of Land Management determines how much grazing is acceptable while maintaining long run land quality, and then regulates the number of "animal units" that will protect against overuse. Recreational hunting and fishing and commercial fisheries are managed similarly; biologists determine an allowable harvest, and then bag limits, closed seasons, and closed areas are used to achieve the allowable catch. Until recently, these kinds of centralized and "command and control" regulations were about the only kind used and envisioned by resource managers.

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Over the last decade or so, two other methods of controlling overuse have evolved, mostly at the advice of economists. One method involves "pricing" the services of natural assets. This generally means taxing or otherwise raising the price of use, and it works by charging users for the service in question, much as a market would if the asset were private. When conventional goods and services become more scarce, their prices typically rise, calling forth both a moderation in their use, and also innovation and development of substitutable goods and services. In contrast, when an unregulated environmental service like the assimilative capacity of a river or the air (or the filtration services of a watershed, or the aesthetic services associated with a natural vista) become more scarce, there is no market feedback mechanism that raises the price to users so that they will alter the behavior that is causing degradation. Programs like emissions taxes placed on each ton of sulfur content in coal are designed to put a "price" on the use of the air to account for its real value in carrying away sulfur-laden waste. In Europe, many countries have instituted taxes on water discharges into rivers that carry away wastes. In principle, this price charged for the assimilative service causes individual users to moderate their demands on the natural assets' services compared with being able to use them for free. Regulators expect that the totality of all uses will then be kept within the carrying capacity of the system's ability to absorb waste.

The second type of decentralized policy that is increasingly garnering attention is to actually create property or ownership in a previously unowned resource. The tradeable emission programs for sulfur is an example that has been implemented in the coal-burning sector of the electric power industry. Emissions-permit programs give each firm or company the "right" to emit a certain amount of pollution. Firms can trade these rights and hence they take on value just like a farmer's land has value. As permits become valuable, their prices rise, which creates an "opportunity cost" associated with using them. For example, if a firm can reduce emissions by a ton at a cost of $300, and permits are selling for $500 per ton, then it pays to adopt the new practices rather than buying a unit of pollution rights. These kinds of schemes involving privatization of natural assets are controversial, and many critics object on an almost gut reaction to the idea of actually giving firms a right to continue to pollute. But these methods are proving to have a dramatic affect on not only the amount of polluting activities, but also on the incentives to develop and adopt newer and cleaner technologies that mitigate the problem in the first place.

The use of property right-based systems will probably continue to supplant cumbersome command and control systems as a method of choice to address the overuse of natural assets in the future. It is even being adopted for use with resources that many claimed could never be "owned." In commercial fisheries, for example, the U.S. and other countries have used biologically determined allowable-harvest targets together with closed seasons and gear restrictions almost exclusively since World War II. But as protein has continued to grow in value, fish prices have risen, attracting more and more participants. The problem, again, is that commercial ocean fisheries are not "owned," and hence no one controls the amount of effort attracted to the industry. Imagine, for example, what would happen if farmers could not own their land and that they could only claim it each year by encircling a plot with a tractor and disc. Think of a scenario in which everyone lined up on the border of each farming state, and then rushed in like the Oklahoma land rush, to stake their claims. What would happen is that farmers would build bigger and faster tractors each year, with the intent of racing out and claiming more of the resource before their neighbors did. Absurd as this sounds, this is exactly what has happened with many of the world's valuable fisheries. Fishermen have built larger and larger vessels in order to claim a larger share of the allowable harvest, even as total allowable harvest has remained unchanged. As fishing power has multiplied, regulators have had to shorten

seasons, impose efficiency reducing gear restrictions, and close off areas from exploitation. The result has reached ridiculous proportions in some fisheries, with entire seasons conducted over 4-5 days (Pacific Halibut), or even a few hours (Pacific roe herring).

The most interesting solution to the fisheries problem was first introduced in Iceland and New Zealand in the early 1980s. Both countries effectively "privatized" their fisheries, by creating a system of fractional rights to the biologically determined allowable catches for each species. For example, a fishermen might own rights to take .03% of the total allowable catch of orange roughy, and .05% of the allowable catch of red snapper for each year. Under the old system, this fisherman did not own any rights and was forced to rush out to take his harvest as quickly as possible before his neighbor got it. Under the new system, the fisherman can take his fixed quantity when prices are high, when costs are low, or whenever it fits better into his year of activities. Since the permits are also marketable, fishermen can buy and sell them until they hold quantities and portfolios that best fit their skills and management practices.

If there has been a lesson learned over the past several decades of trying to deal with environmental and other social problems, it is that centralized command and control systems are costly, cumbersome and inflexible. In contrast, decentralized systems, whether they price ecosystem services administratively or create property rights and encourage markets, allow individuals to make choices but with a system of altered incentives. It is likely that the future will bring more of both pricing and property rights-based systems, but with a tilt in favor of market solutions. Institutions such as private or public land trusts are purchasing development rights from farmers in order to purchase, on behalf of the public, the aesthetic and other green-space services associated with open agricultural land. Wetlands mitigation banking programs are another example, allowing land development in a flexible manner that allows growth, but that also preserves the non-market values of wetlands by replacing those lost. These are all examples of new and creative solutions to environmental problems that involve harnessing individual initiatives, but within a system that gets the prices on Mother Nature right.

For more information

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