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Ecosystem Services beyond Valuation, Regulation, and Philanthropy: Integrating Consumer Values into the Economy

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Ecosystem services have been identified as a central link between society, or human systems, and the structure and function of natural systems (e.g., U.S. LTER 2007, MEA 2005). A fundamental economic problem is that while almost everyone—environmental groups, policy makers, and broad segments of the general public—seems to believe ecosystem services are valuable, the available public policy tools and approaches for private action fall short, and often omit, a direct link to the real values of the people. If ecosystem services are of economic value, then a fundamental challenge concerns how to identify the link between ecosystem services and the quality of life of individual households, and how to use that link to integrate ecosystem service values into the decisions of businesses and individuals in society. Given current markets and policies decision–makers are unable to recognize the full value of services ecosystems provide. What can be done to integrate ecosystem service values into the economy? After reviewing a fundamental cause for why markets often overlook ecosystem services, and after considering some limitations of the often effective approaches of philanthropy and government, we consider the potential to leverage experimental economics to create and test approaches to integrate values at the individual level into markets addressing ecosystem services.

A Fundamental Problem

One daunting frontier for ecosystem services originates from the natural character of many services, which sharply restricts or prevents the ability of providers to capture a return from many, often most, beneficiaries. This is the nature of "public goods" and "fugitive resources." Both involve "nonexclusivity": providers cannot exclude beneficiaries from benefit without payment for the cost of provision. For public goods, many people may benefit simultaneously, so no one provider (or user–beneficiary) can exclude anyone else at any particular moment. An owner of undeveloped farm, forest or lake shore often cannot insist on payment from the sprawling, urban–fringe residents who value open space for aesthetic tranquility; therefore, the landowner has little incentive to consider his community's open space values in choices about current use of his land. For fugitive resources, Nature does not allow a provider to contain and control the resource she has provided or protected; rivers flow and wildlife migrate across boundaries. A farmer or lawn–owner whose fertilizer percolates to the Mississippi or Potomac cannot insist on a return from the fishermen who would gain from a smaller Gulf Coast dead–zone, or from the patrons of oyster bars who seek a Chesapeake culture of local shellfish. Moreover, the opportunity for every beneficiary to benefit without payment creates the incentive to "free ride" or hang back and wait for potential providers—or public–spirited philanthropists—to "do the right thing" at their own expense, despite their own opportunity to ride free on others' generosity.

As a result, the could–be bounty of ecosystem services, and the conditions of ecosystem structure and function, often arise as a residual, left–over after–thought of decisions that potential providers make to sustain their livelihoods. For example, even conservation–minded farmers must implement practices within the annual, weather–dependent, schedule of their business, and society receives fish, wildlife, open space and water quality that results (or doesn't result).

Current Solutions

To be sure, we have institutions, public policies and private actions underway that mitigate the nonexclusive nature of Nature's services. But most existing tools remain short on their ability to integrate ecosystem services into the economy in a manner that is fully commensurate with familiar, commercially viable products.

Government authority generates land–use and environmental regulations that place enforceable limits on the degree to which individuals and firms can impose consequences on a broader community, such as through pollution or use of resources held in the public trust, with impacts on public health or endangered species. Government can also implement incentive payments which directly or indirectly compensate providers for actions to provide for ecosystem services, such as through federally funded conservation reserve or wetland reserve programs. It should be noted that, as market–based approaches, government incentive payments primarily focus on the supply side opportunity costs of providers, such as compensating farmers who forego crop production on land enrolled in a conservation reserve. Centrally–guided incentive payments may reflect politically or bureaucratically attenuated demand–side, public values through a benefit–cost analysis, but, in this article, we discuss the potential to integrate demand–side values through more complete market mechanisms.

Philanthropy, such as through wildlife conservation organizations or land trusts, can provide complementary actions. Philanthropists can provide payments for ecosystem services by, for example, compensating ranchers for tolerating wolves or purchasing conservation easements on undeveloped farms or forests. Philanthropists can stimulate government action by offering matching funds for taxpayer–approved conservation bond–issues or providing some offsets for debts of developing countries that protect biodiversity. Of course philanthropy exists under the shadow of incentives for individuals to ride free–waiting for some other donor to step forward.

Clearly, however, the limitations of government and philanthropic action may create additional expenses or opportunities lost. Philanthropists face their dependence on good will of donors, and costs to fight free–riding, and despite the effectiveness and nimbleness that can come from a carefully focused mission, philanthropic approaches can generate bureaucratic costs. Government may be better positioned to provide a broad approach, perhaps including equity considerations, casting a wide umbrella supported by more stable (if sometimes controversial) funding. But government's costs to obtain detailed (local–level) information, to safeguard public integrity, and to balance political tensions, can sometimes create the agility and efficiency of a bull at Tiffany's china shop. Both may find it difficult to focus their mission or goals in detailed alignment with the interests of a diverse public.

In contrast, decentralized market approaches to provision of valued goods and services are respected for agility, responsiveness to diverse preferences, and efficiency in directly aggregating consequences of individual values and choices into fairly universal signals of relative scarcity (called relative prices). Often supported by a coalition of nationally or internationally known, large, commercial firms and philanthropic organizations, we see nongovernmental organizations (NGOs) developing standards and practices for certification of ecosystem or natural resource–based products as "sustainably produced" through harvest and process chains that are environmentally friendly. The Marine Stewardship Council (MSC), concerning seafood, and the Forest Stewardship Council (FSC), concerning forest products, provide two examples, and we are witnessing a proliferation of green–marketing efforts—sometimes supported by third–party verification exemplified by MSC or FSC eco–labeling—whereby firms are recognizing a public demand for attention to environmental stewardship. While laudable, these efforts tie ecosystem services to the consumer's choices among familiar commercial products, rather than directly targeting the consumer's value for specified ecosystem services.

Approaches to ecosystem services based primarily on a natural–science perspective can overlook another significant challenge: identification of what people value, rather than simply what scientists currently measure. From the human household's perspective, what is the service? Physical measures of ecosystem output, such as for water quality and quantity, may often be salient and intuitive for, say, provisioning services like water for drinking or irrigation purposes. But what about measures linking water quality and services of interest for recreation? Egan, Herriges, Kling and Downing (forthcoming) show that individual households, pursuing a diverse set of activities, are responsive to a broad suite of water quality measures suggested by biologists, but careful modeling is needed to link biological measures through the process by which households seek ecosystem services and therefore value various dimensions of water quality.

Innovation Addressing Consumer Values

Private NGOs, government, and academia have stimulated innovative work on the valuation of ecosystem services. Society's representatives' need a better understanding of what it is that households actually value from ecosystems. We need, and are pursuing, better methods to measure value, and to link available actions to restore or sustain ecosystem structure

and functions that yield desirable ecosystem services. Support for the social science of ecosystem services is critical to developing effective policies supporting the public welfare.

But what is substantially missing from the mission of economics relative to ecosystem services is work focused on integrating values directly into the economy, particularly demand–side values. Market–based approaches that integrate demand–side values give the people a direct and immediate voice—an economic voice—to indicate whether particular levels of or changes in ecosystem services are more or less valuable than particular levels of or changes in familiar, commercially produced goods.

How can society stimulate the integration of demand–side values in policies and market–based approaches addressing ecosystem services? This integration is already done for many provisioning services of ecosystems, through long established markets for food, fiber and natural resource–based commodities. How can we directly attack nonexcludability and give beneficiaries an economic voice upon which entrepreneurs can capture a return from enhancement of ecosystem services?

Experimental economists are increasingly investigating mechanisms that stimulate individuals to go beyond baseline donations and to transform a higher portion of their values into revenues in support of public goods. Experimental economists bring human subjects into a controlled laboratory setting to study how incentives and rules of exchange lead to individual or collective choices and outcomes. In public goods experiments, researchers design a set of monetary payoffs that individuals can earn through their choices, and these payoffs simulate the manner in which individuals benefit from real public goods. For example, working agricultural ecosystems might give rural residents aesthetic pleasure when farms provide grassland habitats for songbirds; every member of the community receives a "songbird benefit" whenever the habitat is provided, regardless of who bore the costs. In the laboratory, a group of individuals may be asked to pay for provision of a group–fund that provides a monetary return to everyone in the group, including those members who chose not to invest. Since the group–fund does not exclude noncontributors from benefiting, it comprises an abstract, monetized simulation of a public good.

Such experiments have shown that changing the incentives for individuals to ride free on the contributions of others can increase the degree to which individuals voluntarily pay for the cost of a public good and can bring their payments into a closer correspondence with their own value for the good. While practical mechanisms reduce the incentives for individuals to free–ride, additional effort is needed to evaluate and improve the degree to which mechanisms balance the provision of benefits net of costs. Since many people benefit simultaneously, an efficient balance of costs and benefits occurs when a provider delivers increments of public good until the costs of delivering the last unit are just offset by the combined total amount that all beneficiaries would willingly pay for that increment rather than doing without it.

Since different people have different values, some may value the public good more or less highly than others, so a combined total amount may involve different people paying different prices. This issue is not surprising; obviously with familiar donations mechanisms, different people donate different amounts. But it means the nonexcludable character of some ecosystem services will require entrepreneurs to explain the rationale for market mechanisms to newcomers from the general public.

Real Markets for Ecosystem Services

The insights from economics experiment already offer potential to support markets for real ecosystem services. Through USDA funding, the authors have established an experimental market in Jamestown, R.I. This example shows both promising results and significant areas where progress requires additional work to design and test mechanisms by which entrepreneurs could develop ecosystem service markets.

Jamestown is widely regarded for supporting conservation of undeveloped farm, forest and open space and is in the process of completing transactions to purchase development rights on the last few operating farms. However, while setting aside development rights may prevent the construction of additional residential neighborhoods or other developed uses, it may still be challenging for farmers to maintain farm operations. Moreover, changes in the intensity of farming, along with rising costs for energy or other inputs, push more ecosystem services outside the margin that farmers can sustain while maintaining their business.

This applies, for example, to the cultural or aesthetic services provided by grassland wildlife to residents who seek to live in a rural community that supports a healthy ecosystem. The experimental market centered on selling, to Jamestown residents, an opportunity to protect grassland habitats during the nesting season. This product was presented as contracts with farmers who agreed to forego hay harvesting and restrict grazing on 10–acre fields during eight weeks from the beginning of May to the beginning of July.

Using insights from laboratory experiments, the research design allowed a comparative test of three market mechanisms, including one intended only to measure potential value and two intended to raise rev-

enues sufficient to cover the costs of a contract. The study created an experimental (but nonprofit) business and advertised under the trade mark of the Nature Services Exchange of Jamestown, created as a partnership of the University of Rhode Island and EcoAsset Markets Inc., an independent business in Providence, R.I. Residents were randomly assigned to groups. Each household in a group was asked to make a monetary offer subject to rules of the market mechanism assigned to that group; offers were made by personal check or by credit–card authorization.

The rules for all mechanisms included a "provision point," which corresponds to the minimum amount of funding that a group must provide in order to cover the costs of a public good. In Jamestown, the provision point is linked to the cost of a contract with a farmer who agrees to omit any harvest of hay on a specified, 10–acre field during the late–spring nesting season for Bobolinks, a grassland–nesting bird. Contracts were negotiated to cover the farmer's cost to replace the loss of feed by foregoing a hay harvest and to compensate for additional risk and management inconvenience to manipulate herds around the protected field(s). However, the provision point is more than a simple fundraising goal; rather it also comprises an implicit (beneficent) threat that a specific, quantified increase in the services of a public good will not occur unless the group provides for its costs. Laboratory experiments have shown a money–back–guarantee reinforces the provision point and the tie between contributions and the specific service offered. The guarantee establishes the rule that if funding falls short of the provision point, so the good is not provided, the fundraiser (seller) will not simply redirect revenues to other purposes. The provision point and money–back–guarantee rules reduce the incentives to ride free because group members (should) realize that the responsibility lies with the defined group and no one outside the group, so there are limitations on the opportunity to wait for others to pay. These rules were used in the Jamestown experimental market.

Laboratory experiments have also demonstrated that rules to rebate excess funds to contributors increase the offers that individuals will make, given their values. Rebates reduce the free–riding incentive for individuals to hold–back in a strategic effort to offer just–the–right–amount rather than paying more than was necessary after the contributions of others. The rebate feature was varied across mechanisms tested in Jamestown.

Our "pivotal mechanism" (PM) established a full rebate to any individual whose offer was not needed to meet the provision point for their field after all other contributions from their group were taken into account. This PM creates an incentive for each person to view their own contribution as if it was the last one needed, and their decision would make–or–break the outcome for their group's hayfield. The PM provides incentives for individuals to reveal their full willingness to pay to protect a hayfield for grassland birds, but it's advantage in measuring value is off–set by the practical limitation that very few or no individuals will be pivotal in most situations, so the PM generally fails to raise actual revenues.

Our "proportional rebate" (PR) mechanism is one of two we designed to raise revenues. Under the PR rules, any funds collected above the amount needed to cover the cost of a farm contract would be rebated to each contributor in proportion to their own contribution to the total of all contributions from their group. In our 2007 market, the second revenue–raising mechanism used the set of offers from a group to calculate the lowest possible "uniform price" (UP) such that everyone who paid would receive a rebate of the excess of their offer above the UP; anyone who offered to pay less than the UP would receive a full refund. Under the UP, everyone who pays will pay the same price (after their rebate).

The market generated total offers of around $9700, across all three mechanisms, with substantial variation across groups depending upon the rules by which excess funds would be rebated. Based on laboratory experiments, we expected the PR mechanism to come closest to the "full value" estimated under the pivotal mechanism (PM), and Jamestown's preliminary results support this prediction. While the UP approach was expected to, and did, elicit lower offers (and lower revenues) from groups, in on–going research we are investigating the possibility that similar mechanisms may produce more stable revenues year–after–year, as compared to PR. In the 2007 market, of six hayfields available for bird conservation, revenues met the provision points for three. Initial analysis suggests, however, that for about 400 homes participating there is potential value–as revealed under the various mechanisms– ranging from $8800 to $28,000 to protect a field for grassland birds. The on–going challenge will be finding better ways to align revenues with this potential value.

The Jamestown experience shows that, even in the case of a cultural or aesthetic ecosystem service, experimental economic markets might prove successful. In Jamestown, all three of the fields that were ultimately protected would have been harvested during the 2007 nesting season had the farmers been unable to obtain support to offset costs to their operation. Moreover, other data from this study suggests that not only did residents value contracts focused on Bobolinks, but they may also value contracts that help farmers to restore previously idled hayfields to a state that provides additional habitat and also eliminates invasive plants that may be harmful to other aesthetically–valued wildlife

(like the monarch butterfly). The ecosystem service market may eventually enable farmers to expand their operations with services that Jamestown's exurban residents' value.

Concluding Observations

Developing mechanisms to enable entrepreneurs to leverage consumer values may substantially expand the potential for market approaches to lead to valuable impacts for ecosystem services. Consider for a moment the cap–and–trade approaches used for air and water pollutants, and currently under discussion for carbon emissions. If market mechanisms create a closer alignment between individual and collective values and incentives to support the public good, then markets may create an avenue by which communities can directly influence the key choice of the overall cap on emissions; individuals and groups who value a further reduction in emissions could buy and retire a quantity of permits in a manner that effectively lowers the overall cap. Markets enable private action that can complement or improve upon the government, or philanthropic, actions already underway for ecosystem services.

Here again the Jamestown Bobolink market provides an example. After seeing a summary of the experimental market in Audubon magazine in November 2007, a community–garden club in Grant, Minnesota, contacted the authors and developed their own entrepreneurial approach to protect a hayfield next to their community garden. This year their club members have rented the hayfield in consideration of grassland birds, illustrating that once enabled, entrepreneurship can expand to enhance the provision of ecosystem services in a nimble fashion.

Furthermore, research on the implementation of ecosystem service markets may benefit from interdisciplinary teams and inclusion of outreach. In Jamestown, farmers' independent experimentation is likely to yield modifications to contracts, such as to plan for early–season grazing, that both enhance farmers' ability to deliver ecosystem services and lower the costs (or provision points) implied. At this writing, Jamestown farmers are weighing options to alter grass species in their hayfields, to better manage joint production of grassland birds and feed for livestock (G. Neale, personal communication). Moreover, ecological research on bird behavior may enable the design of methods that allow environmental managers to guide birds toward fields that are likely to be protected in the next season. Such considerations may be critical to establishing hayfield harvest rotations through a series of years that sustain the quality of hayfields for both feed production and habitat. The field experience also has raised a number of questions that were not apparent from a review of experimental economics literature alone, including questions about which mechanisms would produce stable revenues over time or be adaptable to situations where many increments to ecosystem services might be possible.

The challenge of ecosystem services is as complex as the complexity of human and ecological systems combined. Ecosystem services link us with Nature and progress will often require a comprehensive approach with disciplinary, interdisciplinary and integrated teams on the frontier.

For Further Information

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