

# A FIELD OF GREEN? THE PAST AND FUTURE OF ECOSYSTEM SERVICES

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## INTRODUCTION

In understanding the power and challenge of ecosystem services, it is best to start our story fifteen years ago, beneath the blazing Arizona desert sun. There, on September 26, 1991, walking through a crowd of reporters and flashing cameras, eight men and women entered a huge, glass-enclosed structure and sealed shut the outer door. Their 3.15 acre miniature world, called Biosphere II, had been designed with no expense spared to re-create the conditions of the earth (presumably, named Biosphere I). Biosphere II sought to re-create a truly self-sustaining environment, complete with designer rainforest, ocean, marsh, savanna, and desert habitats. The eight plucky adventurers, so-called “Bionauts,” intended to remain inside this micro-world for two years. By sixteen months into their adventure, however, oxygen levels had plummeted 33%, nitrous oxide levels had increased 160-fold to levels causing brain damage, ants and vines had overrun the vegetation, and nineteen of the twenty-five vertebrate species had gone extinct, as well as all of the pollinators. The experiment was abandoned.<sup>1</sup>

What went wrong? With a budget in excess of \$200 million, the designers of Biosphere II had tried to establish biological systems capable of re-creating the basic services that support life itself — services such as purification of air and water, pest control, renewal of soil fertility, climate regulation, pollination of crops and vegetation, and waste detoxification and decomposition. These services of nature, known as “ecosystem services,” are often taken for granted, yet are absolutely essential to our existence, as the inhabitants of Biosphere II ruefully learned.<sup>2</sup>

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<sup>1</sup> Thomas H. Maugh, *2 Years Inside a Living Lab -- Is it Science or a Stunt?*, L.A. TIMES, Sept. 23, 1991, at 1; David Tilman and Joel Cohen, *Biosphere 2 and Biodiversity: The Lessons So Far*, 274 SCI. 1150, 1150 (Nov. 15, 1996); Tim Radford, *The Buck Stops Here: How Do You Calculate the Real Value of the Earth's Life Support System*, GUARDIAN, Mar. 6, 1997, at 6.

<sup>2</sup> In addition to those listed above, other ecosystem services include mitigation of floods and droughts, biodiversity, and cycling of matter. NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 3 (Gretchen Daily ed., 1997) [hereinafter Daily].

Created by the interactions of living organisms with their environment, ecosystem services provide both the conditions and processes that sustain human life. Given their obvious importance to our well-being, one might assume that ecosystem services would be prized by markets and protected by regulators. With rare exception, however, neither is true. The basic reasons for this lack of recognition are three-fold.

## I.

The first is ignorance. In today's society, we enjoy the benefits of food and services at the swipe of a credit card that past kings and emperors could only have imagined, yet we tend to forget where these come from. Is it really surprising that many children, when asked where milk comes from, reply without hesitation, "the supermarket"?<sup>3</sup> Modern society's dissociation between computers, cars and clothing on the one hand and biodiversity, nutrient cycling, and pollination on the other, is very real and hard to overcome for an increasingly urbanized population.

Ignorance of ecosystem services extends beyond the general public, however. To design policy instruments that protect services or manage the landscape to provide services, we have to understand service provision on a local ecological scale — how they are generated and how they are delivered. We have a pretty good idea that clear-cutting a forest, for example, will dramatically weaken the ecosystem services of nutrient retention, water purification, and floodwater control. But, thankfully, most management action does not involve wholesale destruction of an area. Much more common is marginal change — how will cutting twenty percent of *this* forest in *this* place impact water quality, flooding events, or local bird populations? In most cases involving a change in land use, whether it is forests, wetlands, or some other area, we simply do not know the answer.

This lack of knowledge is due in part to the lack of relevant data and in part to the difficulty of the task. Ecosystem level experiments are difficult and must be lengthy in order to gain reliable data. More fundamentally, scientific research to date has focused much more on understanding ecosystem processes than determining ecosystem services. Also, how an ecosystem works is

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<sup>3</sup> See, e.g., Tyrone Cashman, *Where Does it Come From? Where Does it Go?* MEDIA VALUES, Summer 1990, at 12, available at [http://www.medialit.org/reading\\_room/articles49.html](http://www.medialit.org/reading_room/articles49.html); Roberta Mazzucco, *From the Farm to Your Table: Where Does Our Food Come From?* 7 YALE-NEW HAVEN TEACHERS INSTITUTE, (1997), available at <http://www.yale.edu/ynhti/curriculum/units/1997/7/97.07.07.x.html>.

not the same as the services it provides.<sup>4</sup> This has started to change, with studies of service provision in managed landscapes being published in prominent journals, but it is a recent trend.<sup>5</sup>

The second obstacle to recognition and protection of services is economic. Most ecosystem services are public goods. All those who live in a country with secure borders and low crime rates, for example, benefit whether they pay taxes or not. Similarly, those who live downstream from wetlands benefit from the role wetlands play in slowing floodwaters, whether they have paid to conserve the wetlands or not. In fact, many ecosystem services, ranging from flood control and climate stability to pollination, provide such non-exclusive benefits.<sup>6</sup> It's not hard to find markets for ecosystem goods (such as clean water and apples), but the ecosystem services underpinning these goods (such as water purification and pollination) are free. The services have no market value for the simple reason that no markets exist in which they can be bought or sold. As a result, there are no direct price mechanisms to signal the scarcity or degradation of these public goods until they fail (at which point their hidden value becomes obvious because of the costs to restore or replace them). When we buy a wetland property, we pay for location and scenic beauty, not its role as a nursery for sea life or filter of nutrients. These remain positive externalities. Such circumstances make ecosystem services all too easy to take for granted.

This was tragically evident in the recent flooding in New Orleans. The wetlands that could have slowed the floodwaters were steadily degraded over time through pipelines, development and channelization of the Mississippi, which starved the wetlands of sediment.<sup>7</sup> As floodwaters rose in New Orleans, people realized the importance of services that could have been provided by wetlands, but this recognition was too little and too late.

A further economic obstacle to the creation of service markets, in particular, is the problem of collective action. Markets for ecosystem services can only be established if there are discrete groups of buyers (service beneficiaries) and sellers (service provid-

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<sup>4</sup> Claire Kremen, *Managing Ecosystem Services: What Do We Need to Know About Their Ecology?*, 8 *ECOLOGY LETTERS* 468, 468 (2005) (stating that "we have little ability to predict how much land must be protected and how nearby land use must be restricted to provide water of sufficient quantity and quality"); Telephone Interview with Gretchen C. Daily, Associate Professor, Department of Biological Sciences, Stanford University (Jan. 14, 2003).

<sup>5</sup> See page 150, *infra*.

<sup>6</sup> They are also non-rival, in that one person's enjoyment and consumption of the services does not impair another's benefits.

<sup>7</sup> Dennis Hirsh, *Wetlands' Importance Now Made Clear*, *ATLANTA JOURNAL-CONSTITUTION*, Sept. 12, 2005, at A11.

ers). Otherwise, transaction costs become too high for contract formation. The public goods nature of many services makes this a real concern. Biodiversity, for example, benefits agriculture through the insurance service of genetic diversity and benefits pharmacology through provision of antibiotics and other medicinal compounds.<sup>8</sup> The problem is that we all gain from these benefits, yet there is no sufficiently discrete class of beneficiaries with whom we can negotiate, and the transaction costs of gathering enough beneficiaries together to negotiate for the service are too high. Thus, it is no surprise that private purchasers of biodiversity's benefits are hard to come by, which explains why there are so few true markets for biodiversity. As a result, if a land use provides valuable ecosystem services, but they are widely enjoyed by diffuse beneficiaries, it is unlikely that a market for services will arise in the absence of government intervention.

As a final point, it is worth noting that ignorance and public goods — the barriers to market creation — are related. Markets create knowledge. We have a very advanced understanding of how to manage farmland to maximize production of cash crops for the simple reason that *they are cash crops*. It pays to manage land efficiently for crop production. We have a much poorer understanding of how to manage land for service provision, not because services have no value, but because landowners cannot capture any of the value their landscape provides. Agricultural markets provide very clear signals to farmers of the value of clearing remnant vegetation to grow more crops; but there are no markets for biodiversity, water quality, or flood control to reflect the loss in benefits once the land is cleared.

The final obstacle is institutional. As any environmental law class points out in the first session, political jurisdictions rarely align with ecologically significant areas such as watersheds. The straight lines of state, county, and municipal borders do not track ecologically significant boundaries. As a result, efforts to manage landscapes that ensure service provision are easily confounded by collective action problems. In a fascinating break from this practice, New Zealand and a number of Australian states in the last decade have created catchment management bodies that exercise land use planning authority throughout an entire watershed,<sup>9</sup> but these remain a rare exception.

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<sup>8</sup> Roughly one in four pharmaceuticals are derived from plant sources and another one in four from animals and microorganisms. See Norman Myers, *Biodiversity's Genetic Library*, in Daily, *supra* note 2, at 259, 263.

<sup>9</sup> Tasman District Council et al., Integrated Catchment Management for the Motueku River, Project Summary, [http://icm.landcareresearch.co.nz/site\\_details/programme\\_ summ-](http://icm.landcareresearch.co.nz/site_details/programme_summ-)

Given these barriers to recognition, assessment, and management of ecosystem services, it should come as no surprise that our laws do not explicitly protect ecosystem services. Legal protection of ecosystems simply was not a primary (or even secondary) objective when our basic environmental laws were drafted over two decades ago. Generally speaking, our pollution laws (e.g., the Clean Air Act<sup>10</sup> and Clean Water Act<sup>11</sup>) rely on human health-based standards. Our conservation laws (e.g., the Endangered Species Act<sup>12</sup> and Marine Mammal Protection Act<sup>13</sup>) are species-specific. Planning under our resource management laws (e.g., the National Forest Management Act<sup>14</sup> and Federal Land Policy and Management Act<sup>15</sup>) must accommodate multiple and conflicting uses. Of course, parts of these laws, such as the Clean Water Act's Section 404 wetlands permit program and use of water quality standards,<sup>16</sup> the Endangered Species Act's critical habitat provisions,<sup>17</sup> and the National Forest Management Act's use of indicator species such as the spotted owl,<sup>18</sup> clearly can help to conserve ecosystem services. The point, though, is that these laws were not primarily intended to provide legal standards for conservation of natural capital and the services that flow from it and, as many authors have pointed out, in practice they usually do not provide such standards.<sup>19</sup>

## II.

How might we use laws to protect ecosystem services? Let's start with a hypothetical landscape. Water moves through a for-

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ary.htm, (describing Moteuku River Catchment Authority's purpose) (last visited Jan. 31, 2005); Sydney Catchment Authority, About the Sydney Catchment Authority, <http://www.sca.nsw.gov.au/about> (describing SCA's history and purpose) (last visited Jan. 31, 2005).

<sup>10</sup> 42 U.S.C. §§ 740–7671(q) (2000).

<sup>11</sup> 33 U.S.C. §§ 1251–1387 (2000).

<sup>12</sup> 16 U.S.C. §§ 1531–1544 (2000).

<sup>13</sup> *Id.* §§ 1361–421(h).

<sup>14</sup> *Id.* §§ 1600–1614.

<sup>15</sup> 43 U.S.C. §§ 1701–1785 (2000).

<sup>16</sup> Clean Water Act § 404, 33 U.S.C. § 1344 (2000).

<sup>17</sup> 16 U.S.C. § 1533 (2000).

<sup>18</sup> *Id.* § 1604(g)(3)(B).

<sup>19</sup> See, e.g., J.B. Ruhl, *Ecosystem Services and the Common Law of "The Fragile Land System,"* 20 NATURAL RES. & ENV'T 3, 4 (Fall 2005); David W. Burnett, *New Science But Old Laws: The Need to Include Landscape Ecology in the Legal Framework of Biodiversity Protection,* 23 ENVIRONS ENVTL. L. & POL'Y J. 47, 68-69 (Fall 1999); Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management,* 81 MINN. L. REV. 869, 880-83 (1997); J.B. Ruhl, *Biodiversity Conservation and the Ever-Expanding Web of Federal Laws Regulating Nonfederal Lands: Time for Something Completely Different?,* 66 U. COLO. L. REV. 555 (1995).

ested upper watershed, down through a farming valley, and into a lake that provides drinking water for a nearby community. There is mounting concern over nutrient levels in the lake. Water authority engineers want to build a treatment plant. Other engineers, however, believe that nutrient levels could be reduced at a much lower cost if farmers put in fencing alongside the streams on their property. This would allow vegetation to grow along the stream banks and, in the process, capture many of the nutrients flowing toward the stream. When choosing which legal or policy instrument to use in changing the behavior of the farmers, the government can draw from a toolkit of five basic strategies. I like to call these the “Five Ps” — prescription, penalty, persuasion, property rights, and payment.

Through *prescription*, the government relies on command-and-control regulation, mandating certain behaviors, proscribing others, and imposing penalties for noncompliance. “Thou shalt put in place streamside fencing, or else . . .” Financial *penalties* and charges modify behavior through the financial signals of taxes and fees. Such an approach does not ban certain activities outright but, rather, makes them more expensive (such as charging per meter of unfenced stream). *Persuasion* relies on an information approach, educating landholders of the consequences of their management practices on the landscape and informing them of alternate approaches. The goal of this approach is self-regulation — explain to farmers the benefits they will receive by stabilizing their stream banks. The fourth approach is one of *property rights*. This instrument relies on privatization and allocation of access to a resource, whether a right to a particular catch in a fishery or the ability to emit a quantity of air pollution. In our example, one could require farmers either to put in a certain percentage of streamside fencing or hold the equivalent of fencing allowances that could be traded. The final approach is *payment*. This usually takes the form of a subsidy, either as a direct payment or tax break, justified by a public goods argument — society at large benefits from these activities, but because of market failures, does not pay for them. Though less attractive than regulation because of its impact on government budgets, such an approach is often popular with landholders for obvious reasons. Indeed, this is the approach we have primarily used in America when promoting streamside fencing.<sup>20</sup>

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<sup>20</sup> See CONGRESSIONAL RESEARCH SERVICE, REP. NO. 98-451, ANIMAL WASTE MANAGEMENT AND THE ENVIRONMENT, (1998) (describing subsidy programs for riparian buffers on farms).

Thus there are a number of strategies to choose from in designing governmental intervention to ensure streamside fencing. One could, however, view the issue from a totally different perspective. Why not, one might argue, simply recognize this situation for what it is — the provision of valuable services to consumers — through an explicit arrangement of payments for services rendered? Put another way, why not treat farmers' provision of ecosystem services as no different from their provision of other marketable goods? Farmers are certainly well accustomed to contractual arrangements for their agricultural products. Why not treat the provision of water filtration services as a market transaction, where farmers manage their land through streamside vegetation and grass swales to "grow the crop of water quality," much the same as dairy and potato farmers do for their cash crops? In many respects, provision of ecosystem services would be no different than supplying traditional farm produce with the level of compensation dependent on the quality and level of services provided.

### III.

While this may seem like a crazy idea, there are numerous ecosystem service markets operating around the globe. The best known is in America. In the early 1990s, a combination of federal regulation and cost realities drove New York City to reconsider its water supply strategy. New York City's water system provides about 1.2 billion gallons of drinking water to almost nine million New Yorkers every day.<sup>21</sup> Ninety percent of the water is drawn from the Catskill/Delaware watershed, which extends 125 miles north and west of the city.<sup>22</sup> Under amendments to the federal Safe Drinking Water Act, municipal and other water suppliers were required to filter their surface water supplies unless they could demonstrate that they had taken other steps, including watershed protection measures that protect their customers from harmful water contamination.<sup>23</sup>

Presented with a choice between provision of clean water through building a filtration plant or managing the watershed, New York City easily concluded that the latter was more cost effective. It was estimated that a filtration plant would cost between

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<sup>21</sup> ERIC A. GOLDSTEIN & MARK A. IZEMAN, *THE NEW YORK ENVIRONMENT BOOK* 138 (1990); *See also* NEW YORK CITY DEPT OF ENVTL. PROT., 2004 DRINKING WATER SUPPLY & QUALITY REPORT 2, *available at* <http://www.nyc.gov/html/dep/pdf/wsstat04.pdf>.

<sup>22</sup> N.Y. CITY INDEP. BUDGET OFFICE, *THE IMPACT OF CATSKILL/DELAWARE FILTRATION ON RESIDENTIAL WATER AND SEWAGE CHARGES IN NEW YORK CITY* 3 (Nov. 2000), *available at* <http://www.ibo.nyc.ny.us/iboreports/waterreport.pdf>.

<sup>23</sup> Safe Drinking Water Act, 42 U.S.C. §§ 300g-1(b)(7)(C) (2000).

\$6 billion and \$8 billion to build.<sup>24</sup> By contrast, watershed protection efforts, which would include not only the acquisition of critical watershed lands, but also a variety of other programs designed to reduce contamination sources in the watershed, would cost only about \$1.5 billion.<sup>25</sup> Acting on behalf of the beneficiaries of the Catskills' water purification services, New York City chose to invest in natural, rather than built, capital. But New York City is not alone. Costa Rica's Ministry of Environment and Energy charges 20,000 water consumers near San José a small surcharge on monthly water bills.<sup>26</sup> The funds are used to pay upper watershed farmers who have agreed to conserve and manage their forests.<sup>27</sup>

Costa Rica has also launched a nationwide scheme of payments for provision of ecosystem services, known as Pagos por Servicios Ambientales (PSA).<sup>28</sup> The PSA permits the government to enter into binding contracts with landowners for the provision of four services: sequestration of carbon, water quality and quantity (i.e., for drinking, irrigation or hydroelectric power), biodiversity conservation, and aesthetic beauty for ecotourism.<sup>29</sup> By the middle of 2000, roughly 200,000 hectares of forest were being managed for service provision in exchange for payments.<sup>30</sup> An additional 800,000 hectares had been proposed for conservation management but were not included in the program because of inadequate funding.<sup>31</sup>

In Australia, the state of Victoria's Department of Natural Resources and Environment has developed a program, known as BushTender, to conserve native vegetation remnants on private property.<sup>32</sup> In exchange for payments from the state government, the landholders commit to fencing off and managing an agreed amount of their native vegetation for a set period of time.<sup>33</sup> The program is based on the model of the Conservation Reserve Pro-

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<sup>24</sup> GRETCHEN DAILY & KATHERINE ELLISON, *THE NEW ECONOMY OF NATURE* 63 (2004) [hereinafter DAILY & ELLISON].

<sup>25</sup> *Id.*

<sup>26</sup> *Id.*

<sup>27</sup> *Id.* at 65.

<sup>28</sup> *Id.* at 37-40.

<sup>29</sup> *Id.* at 42.

<sup>30</sup> *Id.*

<sup>31</sup> It is important to note, however, that most of the land has been managed for biodiversity, not water services. This is due primarily to the available resources and numbers of willing buyers. The World Bank, with a \$32 million loan, and the Global Environment Facility, with an \$8 million grant, has provided the means to pay for biodiversity conservation. *Id.*

<sup>32</sup> See GARY STONEHAM ET AL., *AUCTIONS FOR CONSERVATION CONTRACTS: AN EMPIRICAL EXAMINATION OF VICTORIA'S BUSHTENDER TRIAL* 12-13 (2002), <http://eprints.anu.edu.au/archive/00002198/01/stoneha1.pdf>.

<sup>33</sup> *Id.* at 10-11.

gram (CRP) in the United States, the largest ecosystem service payment scheme in the world.<sup>34</sup> CRP provides annual rental payments and shares the cost of conservation practices on farmland.<sup>35</sup>

There are many other examples I could present,<sup>36</sup> but these are sufficient to make two basic points. In virtually every robust service market, the government plays a central role. Moreover, because of public goods and collective action barriers, in most markets there is only one buyer. Put simply, most successful service markets to date operate as *monopsonies*, with a dominant buyer for multiple service provider sellers. The reason biodiversity conservation contracts proved so successful in Costa Rica was the dominant role played by the World Bank and the Global Environment Facility as a single, surrogate purchaser who stepped in with millions of dollars to purchase services on behalf of the world. The success of BushTender was also due to it being a monopsony. This was equally true in the Catskills, where New York City's Water Authority was the single purchaser for water purification. Whether for biodiversity or clean water, the government pays for these services on behalf of the citizenry. Such actions are entirely appropriate, it should be noted, since they correct the market failure posed by public goods.

Because most service markets function as monopsonies, these effectively take the form of a *payment scheme*. But payment schemes for ecosystem services, indeed for any services, raise difficult issues that need to be confronted. There are good reasons, after all, that "payments" and "subsidies" are four-letter words to many economists. Indeed, payment schemes can lead to what some might view as quite disturbing policy implications: are we paying the right people? Are we sending messages that encourage or undermine an ethic of land stewardship? Are we effectively paying for rights that landowners never had?

#### IV.

If one thinks back to our example with water passing through a valley and paying farmers to put in riparian fencing, after a moment's reflection, the payment for services suggests a tension. Those farmers who have already put in riparian fencing no longer have a significant potential for increased service provision

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<sup>34</sup> FARM SERVICE AGENCY, FACT SHEET: CONSERVATION RESERVE PROGRAM (April 2003), <http://www.fsa.usda.gov/pas/publications/facts/html/crp03.htm>.

<sup>35</sup> *Id.*

<sup>36</sup> See The Katoomba Group's Ecosystem Marketplace, [http://ecosystemmarketplace.net/pages/section\\_landing.news.php](http://ecosystemmarketplace.net/pages/section_landing.news.php). (providing a comprehensive list of examples).

and, as a result, are unlikely to be paid. Should every landholder who provides environmental services be paid? Given a finite budget, the answer to this would seemingly have to be “no.” It is hard to imagine a practical scheme, for example, that pays everyone whose vegetation reduces nutrient flow in the watershed. If one seeks to pay for discrete cases of ecosystem service provision, clearly some land uses are more important than others. But how should one decide who gets paid and who does not? And more troubling still, should government pay those who, in many respects, may be *causing* the problems?

Should landholders who currently provide services (and have little runoff) or those whose properties pose the greatest nutrient problems (and hence the greatest potential for increased service provision) receive ecosystem service payments? Posing these questions more fundamentally, what is the proper paradigm for ecosystem service provision by farmers? Should we think of farmers as polluters, and therefore subject to the polluter pays principle, the touchstone for much of modern environmental policy? If so, they presumably should not be paid, but regulated or taxed instead. Or, by contrast, are farmers potential providers of valuable services who are as deserving of payments as water treatment plant operators?

To frame this dilemma more starkly, imagine two adjacent farmers, A and B, who raise cows for a dairy operation on gently rolling land beside a stream that flows into a reservoir. Concerned over stream bank erosion, five years ago Farmer A constructed fencing alongside her streams, creating a ten-foot riparian buffer on either side of the bank. This change in land management has significantly reduced the amount of nutrients and soil washing off her land and, consequently, has reduced the eutrophication and turbidity downstream. Farmer B, by contrast, has continued to manage her land much the same way as her predecessors, with nutrient and soil runoff after large storm events affecting water quality in the downstream reservoir. Should the water supplier be willing to make ecosystem service payments to address eutrophication and turbidity control? If so, which farmer should receive payments, and how much?

There is no easy answer to this conundrum. A partial answer, though, lies in consideration of property rights. If one can demonstrate easily that farmers do *not* have the right to allow their manure and soil to run off into watercourses, then paying them is poor policy. Simply enforcing existing property rights should be sufficient. In most cases, though, it is not clear whether

farmers have this right or not. It takes time to change traditional practices, and transitional payments can be used to ease the shift.

In evaluating the relative merits of this argument, it is helpful to consider whether it makes sense in any other setting. Take a step back, for example, and consider this in the pollution context. What would your immediate reaction be to a proposal that we should pay a factory to stop polluting because we all benefit from clean air? Dumb idea? But are farmers any different, in that the service they provide by putting in riparian fencing is really little more than reducing the contribution of their cows to eutrophication downstream? Payments to the factory only seem silly because the duty of care for factory pollution has clearly been established. Pollution laws already limit emissions. As a result, if we want them to improve upon the current standard to obtain even cleaner air, we essentially *do* pay them. In the US Environmental Protection Agency's regulatory innovation program during the Clinton Administration, known as Project XL, the agency promised greater flexibility (an administrative law payment of sorts) in exchange for superior performance.<sup>37</sup> Trading schemes under the Clean Air Act provide a similar lesson.<sup>38</sup> When initial sulfur dioxide permits are distributed based on historical emissions rather than auctioned off, existing plant owners are effectively allocated permits to pollute. Companies that emit less than permitted are rewarded by being allowed to sell their excess allowances to other sources.

Another major concern over payments is that of moral hazards. Recall that Farmer A carefully managed her land, putting in riparian fencing on her own initiative to prevent stream bank erosion, while Farmer B followed traditional practices, allowing her cows to graze in the stream and not putting in fencing. At first glance, paying Farmer B to improve her property through riparian fencing makes good sense. This will reduce pollution loading in the reservoir. But how can this be described as an ecosystem services payment scheme? On its face, this seems to be paying more for the *lack* of ecosystem services. That is, Farmer A is already providing services but will receive less than Farmer B, who currently provides few. The key point to recognize is that we are not really paying for ecosystem services but, rather, for *improvements in service provision*.

Our goal, after all, is improved water quality. In that respect, we should value most those actions that improve the water

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<sup>37</sup> U.S. ENVTL. PROT. AGENCY, WHAT IS PROJECT XL?, <http://www.epa.gov/projectxl/file2.htm>.

<sup>38</sup> Clean Air Act, 42 U.S.C. § 7651 et. seq. (2000).

quality on the margins. Those will primarily be actions taken from today forward that improve the status quo. Through this view, then, we should pay more initially to the Farmer Bs of the world who change their land use than to the Farmer As who have already made the improvements, for the simple reason that the actions of Farmer B will lead to greater marginal improvements.

This approach, however, may pose a problem known as a “moral hazard.” If we say people are being paid to provide a service, then how can we ignore those who already provide it? What kind of message does that send? Are we not essentially paying off the bad actors and thereby encouraging undesirable behavior? More generally, how do we equitably account for the baseline that is already out there? Those farmers who have already made the investments and managed their land responsibly may not receive any payments. Only those who have been less responsible will benefit, the argument goes, creating a disincentive to land stewardship. Responsible land managers can become dispirited if those who employ less responsible land management practices effectively are paid for doing so. This surely is not conducive to the kind of land management ethic we are trying to encourage.

These are not easy challenges to answer. One response, though not entirely satisfying, is simply that life’s not fair. Governments subsidize some agricultural activities more than others all of the time. Sugar cane growers in Florida may receive more federal money than grain farmers in South Dakota; peanut growers in Georgia may receive more advice from extension services than apple growers in Washington. Moreover, neither subsidy politics nor markets are based on equity. Markets are designed to exploit differences among buyers and sellers, not remove them. A market that seeks to eliminate heterogeneity will be a flat market.

Nonetheless, there is a likelihood of unnecessary payments. In other words, a payment scheme will attract bids not only from those who are willing to change their land management practices because of the payments, but also from those who would have made the changes in any case, but appreciate a handout when they can get one. However, this problem of “consumer surplus” may not be very large in practice, because presumably most people who would change land management on their own have already done so.<sup>39</sup>

These points address issues of equity, though, not of perverse incentives. Of possibly greater concern is the likelihood that

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<sup>39</sup> The use of a reverse auction, as in the Australian BushTender scheme, will also reduce the cost of these payments, because these farmers’ bid prices should be quite low (in the sense that they would have done it for free, but some payment is better than none).

the Farmer Bs of the world will delay improving their land management practices in the expectation that they will eventually be paid to do so. In the extreme, one might imagine farmers actively *worsening* their land management practices to increase payments for their potential service provision.

To place this in a more domestic setting, imagine that your condo association wants to address the problem of noisy parties by having the loud apartment owners place a restrictive covenant in their leases.<sup>40</sup> Would offering payment to the noisy neighbors in exchange for restrictive covenants be a good solution? Not if it created a perverse incentive for other neighbors to start cranking up their stereos so they also could be bought off or, worse yet, if word got around and heavy metal fans moved into the building expressly so they could be paid to use headphones. Indeed, a standard economic criticism of subsidies is that they can unwittingly reward the very behavior they are trying to suppress.<sup>41</sup>

Moving back to the landscape, if the relative value of payments is low compared to losses from strategic behavior, then moral hazards are less likely a problem. Once one moves away from moral hazard actions that impose costs, however, the problem becomes more difficult, as in the case of biodiversity conservation. There may be little direct cost in switching to crops or field management that degrade critical habitat, and moral hazard concerns cannot be as easily dismissed.

A related concern over creating markets for ecosystem services centers on the impact this might have on the public's norms toward land stewardship.<sup>42</sup> Do public payments for service provision send the message that private provision is unnecessary or not valued? Government payment programs may risk undermining the land ethic by commodifying environmental stewardship, making responsible land management turn on money instead of fundamental values. Once payments become commonplace, they risk eroding common notions of an environmental duty of care and discouraging private investment in the environment by creating

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<sup>40</sup> This example was adapted from Jonathan B. Wiener, *On the Political Economy of Global Environmental Regulation*, 87 GEO. L.J. 749, 782 (Feb. 1999).

<sup>41</sup> In their well-known book on environmental economics, for example, Baumol and Oates set out an economic proof showing that subsidies given to a polluting industry are counterproductive. WILLIAM J. BAUMOL & WALLACE E. OATES, *THE THEORY OF ENVIRONMENTAL POLICY* 221-24 (2d ed. 1988).

<sup>42</sup> Barton H. Thompson, Jr., *Markets for Nature*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 261-277 (2000).

<sup>43</sup> MIKE YOUNG ET AL., DEPARTMENT OF SUSTAINABILITY AND ENVIRONMENT, DUTY OF CARE: AN INSTRUMENT FOR INCREASING THE EFFECTIVENESS OF CATCHMENT MANAGEMENT 15 (2003), available at <http://www.vcmc.vic.gov.au/Web/Docs/Duty%20of%20care-final.pdf>.

the impression that environmental stewardship is the duty of governments rather than individuals.<sup>43</sup>

Laws clearly can influence norm formation, though in complicated and often indirect ways. In the final analysis, it is helpful and humbling to consider the thoughts of Aldo Leopold — the famed ecologist and the most influential American writer on conservation. While Leopold would have welcomed the commitment of funds for conservation payments, John Echeverria notes,

[H]e thought the “fallacious doctrine that government must subsidize all conservation” would ultimately “bankrupt either the treasury, the land, or both.” Public ownership “can cover only a fraction of what needs to be done, and then only awkwardly, expensively, and with frequent clashes of interest.” At the end of the day, he thought that those concerned about the problem of maintaining the health of the land had to grapple with the reality of private land ownership. “The basic problem is to induce the private landowner to conserve on his own land, and no conceivable millions or billions for land purchase can alter that fact, or the fact that so far he hasn’t done it.”<sup>44</sup>

## V.

While ecosystem service markets have presented perhaps the most exciting developments in the field, three recent events are well worth noting as well, for they may have significant implications for conservation of ecosystem services.

The first was a conference held at Stanford this past May, where representatives of the Nature Conservancy and World Wildlife Fund met with ecosystem service experts from a range of fields to brainstorm over how a services perspective could change the way these groups do business. It is still far too early to speculate whether these organizations will adopt such a perspective, but there clearly is interest.

The main change from a greater focus on ecosystem services, one might think, would be a reconsideration of which land should be protected and how it should be protected. Rather than the traditional focus on the biodiversity value of protected lands,

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<sup>44</sup> John Echeverria, *What Would Aldo Leopold Say?: An Ambiguous Environmental Victory in the House of Representatives*, TOM PAINE.COM, May 11, 2000, <http://www.tompaine.com/Archive/scontent/3094.html>.

conservation organizations could perhaps fully protect a smaller area, while working with landowners over a larger area, to manage their lands productively. The goal would be to do this in a manner that ensures provision of services, whether its biodiversity conservation, pollination, et cetera. The net result would be a greater focus on managing the human-dominated landscape, growing out of the realization that, as important as fully protected refuges are, much biodiversity resides in managed landscapes.

An ecosystem services perspective also holds the potential to provide streams of income to support land conservation and biodiversity-friendly land management. It's too early to speculate on the extent to which these and other conservation groups will seriously consider how a focus on service provision, rather than biodiversity alone, could change their traditional strategies toward the conservation value of working landscapes. It is worth noting, though, that the World Wildlife Fund has been working on small-scale payments for environmental services for quite a while, usually through getting people to pay for forest cover with arguments about water, or coral reefs with arguments about fisheries.<sup>45</sup>

For this to happen, there will need to be a significant increase in scientific research examining the relationship between biodiversity, on the one hand, and the relative intensity and nature of land use, on the other. We need a far deeper understanding of the service capacity of managed landscapes (depending on the scale, type and intensity of land use). This is starting to happen. The National Center for Ecological Analysis and Synthesis, for example, has created two relevant research groups — one examining how to incorporate ecosystem services into conservation planning and nongovernmental organizations work in general, and the second assessing how to restore the ecosystem service of pollination to degraded landscapes.<sup>46</sup>

Another exciting development has been the launch of a virtual ecosystem marketplace. It goes without saying that markets — and environmental markets in particular — do not run on will alone. They require sound policy, strong science, and most of all, timely and transparent information. For markets to work, people need to know they exist, and participants need to see, with clarity and ease, who is buying, who is selling, and at what price. There also needs to be a clear understanding of the policy changes that drive these markets, as well as the science that underpins them.

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<sup>45</sup> E-mail from Taylor Ricketts, Ph.D., Director of Conservation Science, World Wildlife Fund, (Nov. 13, 2005) (on file with author).

<sup>46</sup> National Center for Ecological Analysis and Synthesis, Research Projects (updated Feb. 16, 2006), <http://www.nceas.ucsb.edu/nceas-web/projects/>.

To date, this information gap has been a major barrier to ecosystem service market growth. Over the past year, however, an organization known as “The Katoomba Group” has stepped in to fill this information gap.<sup>47</sup>

The Katoomba Group is a unique organization. It has an intentionally broad-based membership including forest product companies, businesses, bankers, grassroots activists, and journalists, and has brought together experts from Australia, Mexico, Colombia, Sweden, Canada, U.K., Brazil, Indonesia, China, Japan, Uganda, the US, and dozens of other countries.<sup>48</sup> Over the past year, the Katoomba Group has been developing a website known as the Ecosystem Marketplace, with separate launch events at the IUCN Global Congress in Bangkok, London and New York City.<sup>49</sup>

The goal of the Marketplace is ambitious. It seeks to become the “one-stop shop” for basic and timely information on emerging markets and payment schemes for ecosystem services around the world. As noted above, anyone who wants to participate in a market needs basic information — prices, transactions, how the services are measured, packaged and sold, where the buyers and sellers are, et cetera. Lloyds of London is known to everyone today as an insurance giant, but it’s worth remembering that it started as a popular coffee house where merchants came together to exchange information about shipping news.<sup>50</sup> The Marketplace wants to provide the same central source of information and networking to buyers and sellers today, facilitating transactions, catalyzing new thinking, and spurring the development of new ecosystem markets.

The website will provide this information, available with a mouse click to traders in environmental commodities, government regulators, businesses affected by environmental regulation, banks and financiers, scientists, environmental and community development organizations, as well as low-income producers interested in tapping into these markets. All these players need to be involved for environmental markets to reach their full potential. The website will also be providing policy analyses on how these markets operate on the ground, their impact on the ecosystems themselves, and on low-income producers and community groups in developing countries. Support has been provided by a wide range of institu-

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<sup>47</sup> In the interests of full disclosure, I am on the Katoomba Board.

<sup>48</sup> The Katoomba Group, Katoomba Members, <http://www.katoombagroup.org/members.htm>.

<sup>49</sup> See The Katoomba Group Home Page, <http://www.katoombagroup.org>.

<sup>50</sup> Chronology, [http://www.lloyds.com/About\\_Us/History/Chronology.htm](http://www.lloyds.com/About_Us/History/Chronology.htm).

tions, from the World Bank and the U.S. Forest Service to Citigroup and ABN-AMRO.<sup>51</sup>

The last development that could really wake people up concerns the 2007 Farm Bill. Agricultural subsidies are, as everyone knows, significant in America and many other nations. While food security and ensuring the prosperity of farmers may well be laudable goals, the trade impacts of subsidies are powerful and often terribly damaging to developing country farmers who cannot compete with imported grains, fruits, et cetera.<sup>52</sup> Indeed, a number of noted authorities have argued that the most important single step to promote sustainable development would be to eliminate agricultural subsidies.<sup>53</sup> Easier said than done, though, because meaningful reduction of agricultural subsidies has traditionally been off the table at international trade talks.<sup>54</sup> Until recently, everyone thought the issues were too politically sensitive, domestic farm lobbies were too powerful, et cetera.<sup>55</sup>

In a series of cases brought against cotton subsidies in the United States and sugar subsidies in Europe, Brazil dramatically changed the status quo by persuading World Trade Organization dispute settlement panels that these subsidies violated international trade rules.<sup>56</sup> These decisions jump-started discussions already underway in the Doha Round for the next series of international trade rules. There is far more detail one could go into about the nature of the Brazil decisions, the “Peace Clause” and agricultural “boxes” of the Uruguay Round, and the current Doha negotiations.<sup>57</sup> For our purposes, however, it is enough to recognize

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<sup>51</sup> [www.ecosystemmarketplace.com](http://www.ecosystemmarketplace.com)

<sup>52</sup> See Antonio LaViña et al., *Beyond the Doha Round and the Agricultural Subsidies Debate: Toward a Reform Agenda for Livelihoods and the Environment* 6 (World Resources Institute, Working Paper, 2005).

<sup>53</sup> See, e.g., Carmen G. Gonzalez, *Institutionalizing Inequality: The WTO Agreement on Agriculture, Security, and Developing Countries*, 27 COLUM. J. ENVTL. L. 433, 463-465 (2002); James Gathii, *A Critical Appraisal of the NEPAD Agenda in Light of Africa's Place in the World Trade Regime in an Era of Market Centered Development*, 13 TRANSNAT'L L. & CONTEMP. PROBS. 179, 181 (2003); Nsongurua J. Udombana, *A Question of Justice: The WTO, Africa, and Countermeasures for Breaches of International Trade Obligations*, 38 J. MARSHALL L. REV. 1153, 1174 (Summer 2005); Raj Bhala, *World Agricultural Trade in Purgatory: The Uruguay Round Agriculture Agreement and Its Implications for the Doha Round*, 79 N.D. L. REV. 691, 698 (2003).

<sup>54</sup> William Petit, *The Free Trade Area of the Americas: Is It Setting the Stage for Significant Change in U.S. Agricultural Subsidy Use?*, 37 TEX. TECH. L. REV., 127, 147 (Winter 2004).

<sup>55</sup> *Id.* at 132-133.

<sup>56</sup> See Panel Report, *United States - Subsidies on Upland Cotton*, 350-51, WT/DS267/R (Sept. 8, 2004) (requiring the United States to “remove the adverse effects” of its support payments to domestic cotton producers).

<sup>57</sup> See World Trade Organization, *Agriculture-gateway*, [http://www.wto.org/english/tratop\\_e/agric\\_e/agric\\_e.htm](http://www.wto.org/english/tratop_e/agric_e/agric_e.htm) (describing the background and status of agriculture negotiations).

that commodity subsidy programs are now under threat as never before. Direct payment, export support, and supply control programs need to become World Trade Organization complaints. This will require a more transparent decoupling of subsidies and production than has been possible to date. Indeed just such a decoupling has been underway in the European Union.<sup>58</sup>

Why am I going into this seemingly irrelevant history during a discussion of ecosystem services? The farm lobby is not likely to give up its billions of dollars of subsidies without a fight, so it's worth considering the hydraulics of the situation. If these funds cannot go directly to production support subsidies, where might they go instead? A lot of people are talking about these funds going to ecosystem services. There is intense interest in expanding the current suite of United States Department of Agriculture (USDA) programs that support landscape management (with acronyms such as CRP, CSP, WRP, and EQIP).<sup>59</sup> This potential shift could not have been made clearer than in a speech given this past August by Mike Johanns, the Secretary of Agriculture. He declared that, "[t]oday, I am announcing that USDA will seek to broaden the use of markets for ecosystem services through voluntary market mechanisms. I see a future where credits for clean water, greenhouse gases, or wetlands can be traded as easily as corn or soybeans."<sup>60</sup>

It is a sign of the times when the most important government official for farm policy openly calls for a future premised upon the growth and flourishing of ecosystem service markets. It remains to be seen, of course, whether calls such as that by Secretary Johanns for greater reliance on service markets will lead to real reform. They say that lawmaking is as unappetizing as watching sausages being made, and agriculture bills can be even more gruesome. Nonetheless, his statement represents a sea of change in USDA policy and will have important repercussions in the coming months and years. We've indeed come a long way in a short time.

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<sup>58</sup> See EUROPA – Agriculture – CAP Reform – a long-term perspective for sustainable agriculture (adopted Sept. 2003), [http://europa.eu.int/comm/agriculture/capreform/index\\_en.htm](http://europa.eu.int/comm/agriculture/capreform/index_en.htm) (describing the reform of its Common Agricultural Policy).

<sup>59</sup> See United States Department of Agriculture Natural Resources Conservation Service, NRCs Directives, Acronyms, [http://policy.nrcs.usda.gov/scripts/lpsiis.dll/M/M\\_440\\_502\\_B\\_10.htm](http://policy.nrcs.usda.gov/scripts/lpsiis.dll/M/M_440_502_B_10.htm).

<sup>60</sup> The Hon. Mike Johanns, Sec'y, U.S. Dep't of Agric., Remarks at the White House Conference on Cooperative Conservation, *in* Press Release, U.S. Dep't of Agric., Press Release No. 0335.05 (Aug. 29, 2005), *available at* <http://www.usda.gov> (follow "Newsroom" hyperlink; then follow "Transcripts & Speeches" hyperlink; then select "August" and "2005" from the drop-down boxes; then follow "August 29, 2005" hyperlink).

This is an exciting time to be working in the field of ecosystem services. Major players, from conservation groups to multinational corporations, are waking up to the idea that a focus on services can enhance conservation and earn a competitive return on investment. Governments at the local, national and international levels are increasingly aware of the potential for an explicit focus on conserving ecosystem services and creating service markets. As never before, academic researchers face both the daunting responsibility and refreshing opportunity to examine how to move the theory of service market creation to practice.