Creating Markets for Ecosystem Services: Notes From the Field

James Salzman*

* Professor, Emalee C. Godsey Scholar, Washington College of Law, American University. Fulbright Senior Scholar, Australia, 2002-2003. I am grateful for the generous research support in Australia from the Fulbright Commission and Andrew Beattie, Michael Jeffery and Donna Craig at Macquarie University, Judith Birrell and Rod McInness at the Sydney Catchment Authority, David Shelton, Stuart Whitten, Nick Abel, Mike Young and Steve Cork at CSIRO, Neil Gunningham at ANU, and Alastair Grieve at NSW State Forests. Helpful comments were also provided by Chris Elmendorf, Geoff Heal, Jim Rasband, J.B. Ruhl, Josh Sarnoff, Jonathan Wiener, …

I. Introduction

When we bite into a juicy apple, we may think of soil and water but not of the natural pollinators that fertilize the flower so the fruit can set. When we think of clean water, we may not think beyond the tap, but the real source of the clean water lies many miles upstream in the wooded watershed that filters and cleans the water as it flows downhill. When we enjoy a fun holiday at the beach, we may think of the warm sun but not of the carbon sequestration by plants that contribute to climate stability.

Largely taken for granted, healthy ecosystems provide a variety of such critical services. Created by the interactions of living organisms with their environment, these "ecosystem services" provide both the conditions and processes that sustain human life—purifying air and water, detoxifying and decomposing waste, renewing soil fertility, regulating climate, mitigating droughts and floods, controlling pests, and pollinating plants.[1] Although awareness of ecosystem services is certainly not new, efforts to identify and calculate these services' valuable contributions to social welfare are. Recent research by ecologists and economists have demonstrated the extremely high costs to replace many of these services if they were to fail, on the order of many billions of dollars in the United States for pollination alone.[2] Such estimates are inherently uncertain, of course, but the extraordinary costs required to substitute for many important services by artificial means are beyond dispute.

One cannot begin to understand flood control, for example, without realizing the impact that widespread wetland destruction has had on the ecosystem service of water retention;[3] nor can one understand water quality without recognizing how development in forested watersheds

---

1 NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS **xx** (Gretchen Daily ed., 1997) [hereinafter Daily].

2 Daily, *supra* note xx, at xx.

3 *See, e.g.,* THE TRUST FOR PUBLIC LAND, BUILDING GREEN INFRASTRUCTURE: LAND CONSERVATION AS A WATERSHED PROTECTION STRATEGY 13 (2000); Norman Myers, *The World's Forests and Their Ecosystem Services*, *in* Daily, *supra* note xx, at 215, 216-17.

has degraded the service of water purification.[4] The costs from degradation of these services are high, and suffered in rich and poor country alike.[5] One might therefore expect that ecosystem services would be prized by markets and explicitly protected by the law. Despite their economic value and central role in provision of important public benefits, however, ecosystem services are only rarely considered in cost-benefit analyses, preparation of environmental impact assessments, or land use laws.[6] Nor, in the past, have significant markets arisen that capitalize on the commercial value of these services.

This is starting to change, however. From an obscure phrase just six years ago, "ecosystem services" have gone mainstream, with new initiatives and markets for provision of services blossoming around the world.[7] The United States EPA, for example, just created a Science Advisory Board on Valuing the Protection of Ecological Systems and Services.[8] In Australia, a high-level advisory body, known as The Wentworth Group, recently called for a new approach to environmental protection that focuses on provision of ecosystem services.[9] In Costa Rica, the government is administering a nationwide scheme of payments for services.[10] The international climate change negotiations are closely focusing on policy instruments that encourage sequestration of carbon by forests and grasslands.[11] And this is just the tip of the iceberg. A recent study documented 287 cases of payments for forest ecosystem services from around the world.[12]

Scholarship on ecosystem service provision has recently blossomed, as well, with detailed analyses of the economic barriers to creation of service markets,[13] discussions of

---

4 *See, e.g.,* THE TRUST FOR PUBLIC LAND, AN OUNCE OF PREVENTION: LAND CONSERVATION AND THE PROTECTION OF CONNECTICUT'S WATER QUALITY 19 (1998); Katherine C. Ewel, *Water Quality Improvement by Wetlands*, *in* Daily, *supra* note xx, at 329, 330-31, 334-36.

5

> Widespread flooding in China's Yangtze River Basin in 1998 left over 3,000 people dead, hundreds of thousands of homeless and destroyed billions of dollars worth of property. Rapid siltation in hydropower reservoirs in Malawi threatens the future supply of electricity and poor water quality pushes up turbine maintenance costs to unsustainable levels… In a world where one-fifth of the population lacks access to safe and affordable drinking water and half the population lacks access to sanitation, improving our understanding of how markets for forest watershed protection may improve water quality and augment seasonal flows is critical.

NATASHA LANDELL-MILLS AND INA PORRES, SILVER BULLET OR FOOL'S GOLD: A GLOBAL REVIEW OF MARKETS FOR FOREST ENVIRONMENTAL SERVICES AND THEIR IMPACTS ON THE POOR 14-17 (2002) [hereinafter Silver Bullet].

6 James Salzman et al., *Protecting Ecosystem Services: Science, Economics and Policy*, 20 STAN. ENVT'L. L. J. 1 (2000) [hereinafter Salzman].

7 A NEXIS search of "ecosystem services," for example, reveals a steady increase in citations over time – 22 cites in 1996, 70 in 1998, 110 in 200, and 152 in 2002.

8 68 Fed. Reg. 11082 (March 7, 2003)

9 Wentworth Group

10 SELLING FOREST ENVIRONMENTAL SERVICES XX (Stefanoe Pagiola et al., ed., 2002) [hereinafter Pagiola].

11 CDM cite

12 Silver Bullet, *supra* note xx, at 3.

13 Heal, Goulder & Kennedy

institutional design,[14] examinations of the challenges to biophysical and economic valuation,[15] and case studies.[16] While questions and issues surely remain that have not been fully considered, it's fair to say that we have achieved a good understanding of the *theoretical* issues concerning ecosystem service provision. There is also a growing literature, though largely anecdotal, that describes some of the *practical* issues concerning ecosystem service provision. The problem is that theory and practice have not yet been effectively joined so that one meaningfully informs the other. With rare exception, those creating markets have not engaged the theoretical literature and, equally, those developing theory have not participated on the ground in shaping programs.

With that in mind, I recently spent a year as a Fulbright Senior Scholar in Australia, working with the Sydney Catchment Authority and CSIRO to assess ecosystem service market initiatives Down Under and to develop a pilot project for the service of water purification in the Sydney watershed.[17] This article relates my research findings, exploring how our current base of theoretical research can better inform implementation and, equally, how challenges to implementation on the ground can sharpen our theoretical analyses.

Section II of the article reviews the basics of an ecosystem services approach, explaining the relative benefits of investing in natural rather than built capital and the range of policy instruments available to strengthen service provision. It then explains why, despite the obvious importance of ecosystem services, service markets have been difficult to establish, focusing on the obstacles raised by our poor understanding of service provision, the shortcomings of current institutional arrangements, and the economic challenges to private provision of a public good. Despite these obstacles, there are a growing number of ecosystem service markets around the world. Section III briefly tours the globe, describing a range of programs that offer important lessons for any potential scheme. Building off the lessons these programs offer, Section IV lays out the key steps in designing instruments to protect ecosystem services in the field – identifying the service, identifying service providers and beneficiaries, and determining the level of service required. Section V then gets our hands dirty, melding theory with my fieldwork in Australia to address head-on the fundamental objections that have been raised against payments for services – that they violate the polluter pays principle, that they encourage holdouts, free riders, rent-seeking, and moral hazards, and that they invite extortion. The concluding section surveys the landscape of service markets, assessing the terrain we've covered and charting out the most promising routes ahead.

This is an exciting time to be working the field of ecosystem service markets. Governments are increasingly aware of the potential for service markets, at the local, national and international scale, enthusiastically launching new initiatives. More and more scholars are turning their attention to the issues raised by service markets. Much of this scholarship, though, has been written by proponents of service markets, with a heavy emphasis on the potential benefits and less consideration of downsides.

---

14 JS, Heal et al. ESDs

15 Pearce and Costanza

16 NRC, Pagiola, Daily & Ellickson, Silver Bullet

17 explain CSIRO

Indeed, despite the impressive growth of service markets, there remain two powerful reasons why the absolute number of service markets remains small. One is that they're hard to establish. This article considers the practical challenges facing markets and identifies ways to overcome them. The second reason, though, is more fundamental. While lauded in specific instances, paying for ecosystem services can have disturbing implications in broader application. At what point should we pay for beneficial land uses rather then coerce them through regulation or taxes? In which situations do payments make sense and when are they inappropriate? When entitlements are unclear, how should we determine the allocation between public and private interests? These difficult questions are inescapable if one thinks seriously about ecosystem service markets. Given the growing number of initiatives around the world, the time has come to address directly the challenges they pose.

II. An Ecosystems Approach to Environmental Protection

The concept behind ecosystem services is very simple – the environment around us offers critically important services that, if we had to pay for substitutes in markets, would command extremely high prices. Government policies that recognized this basic fact, and that focused on landscape management to ensure and provide services, could result in increased social welfare but would represent a significant departure from how we think about environmental protection, land use controls and service provision strategies.

A. Investing in Natural versus Built Capital

The first insight of an ecosystem services perspective is that investing in natural capital can prove more efficient than built capital in delivering key services.[18] As an example, consider the case of flood control. One can address floodwaters through engineered works (e.g., construction and maintenance of dikes and levees) or through landscape management (restoration of wetlands in flood plains).[19] In some instances, perhaps many, landscape management may prove a better public and private investment strategy for providing flood control once one accounts for the positive externalities of improved water quality, wildlife habitat, and recreational amenities.[20]

A well-known example in the water quality field makes the point in a concrete setting.[21] 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 1.4 billion gallons of drinking water to almost nine million New Yorkers every day. Ninety percent of the

---

18 As measured by environmental improvement per unit of social cost.

19 "Wetlands and other riparian lands also help provide natural filtration of contaminants originating in the watershed. Soils filter out some contaminants from local runoff before the runoff reaches the waterway. Vegetation both slows down runoff, permitting various forms of solid pollutants to settle out, and stabilizes soil, reducing contamination from siltation." SELJ cite.

20 *See, e.g.,* Daily & Ellision*, supra* note xx, at xx (describing the restoration of wetlands in Napa Valley to control flooding).

21 The Catskills case is explained in more detail at page xx. For a detailed description of the Catskills case study, *see* NAS study, Daily & Ellison, SELJ intro

water is drawn from the Catskill and Delaware watersheds that extend 125 miles north and west of the city. Under amendments to the federal Safe Drinking Water Act, municipal and other water suppliers were now 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.

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. New York City estimated that a filtration plant would cost between $6 billion and $8 billion to build and another $300 million annually to operate. 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. Acting on behalf of the beneficiaries of the Catskills' water purification services, New York City chose to invest in natural rather than built capital.[22] Nor is New York City alone. The U.S. EPA estimates that more than 140 cities are considering watershed conservation as a means of ensuring high drinking water quality.[23]

Nor is this approach limited to the United States. In the week before the recent Australian election in New South Wales, Premier Bob Carr announced that the government would pay farmers A$120 million to preserve native vegetation, following the recommendation of the Wentworth Group.[24] As Wentworth Group member Peter Cosier described, "We're not giving farmers' money; we're buying an environmental service from them and that environmental service provides a benefit for the whole community. It's a radical new way of doing business in the bush."[25]

B. Markets for Services

If ecosystem services clearly provide valuable services, then why don't more payment schemes exist? Why are markets so hard to set up? The answer is threefold – ignorance, institutional inadequacy, and public goods.

Perhaps the most basic reason we do not pay more attention to provision of ecosystem services is that we take them for granted. It may come as no surprise that many kids, when asked where milk comes from, brightly answer, "The grocery store!"[26] Our ignorance of the sources of goods and services we depend on goes well beyond the average citizen, however. To design policy instruments that efficiently provide services, at a minimum policy analysis must be able to identify services on a local scale – detailing how they are generated and how they are delivered. We can make empirically sound predictions that actions on a gross scale, such as clearcutting, for example, will affect nutrient flows and services,[27] or that a significant loss of

---

22 update status

23 Buzz MFN.

24 Explain Wentworth Group of scientists, economists, farmers and environmentalists, exchange rate

25 Wentworth cite

26 Lind C. Puig, San Diego Tribune

27 ELQ

populations will reduce ecosystem resiliency.[28] In aggregate, such knowledge can provide policy guidance in warning against extreme actions. But landscape context matters. In most cases, our scientific knowledge is inadequate to predict with any certainty how specific local actions affecting these factors will impact the local ecosystem services themselves, e.g., how developing 30% of this wetland will impact water quality, flooding events, or local birf populations.

This lack of knowledge is due both to the lack of relevant data and to the multivariate complexity of the task. Analysis of how ecosystems provide services has proceeded slowly not only because ecosystem level experiments are difficult and lengthy but also because research to date has focused much more on understanding ecosystem processes than determining ecosystem services; and how an ecosystem works is not the same as the services it provides.[29]

Ironically, this focus has been reinforced, and partly driven, by regulatory requirements. Federal and state wetland regulations assess the adequacy of wetland mitigation on the basis of the site's functional capacity, not on the basis of the services actually provided and their benefits to humans.[30] Indeed, it's fair to say that our laws were not designed with ecosystem services in mind. Legal protection of ecosystems was not a primary objective when the laws were drafted over two decades ago. Generally speaking, our pollution laws (e.g. the Clean Air Act[31] and Clean Water Act[32]) rely on human health-based standards. Our conservation laws (e.g. the Endangered Species Act[33] and Marine Mammal Protection Act[34]) are species-specific. And planning under our resource management laws (e.g. the National Forest Management Act[35] and Federal Land Policy and Management Act[36]) must accommodate multiple and conflicting uses. Of course, parts of these laws, such as the Clean Water Act's 404 wetlands permit program and use of water quality standards,[37] the Endangered Species Act's critical habitat provisions,[38] and the National Forest Management Act's use of indicator species such as the spotted owl[39] clearly can 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 don't.[40]

A second obstacle to creation of service markets is institutional. Political jurisdictions are rarely aligned with ecologically significant areas such as watersheds, exercising authority

---

28 Beattie
29 Personal communication, GCD
30 JS Currencies
31 CAA
32 CWA
33 ESA
34 MMPA
35 NFMA
36 FLPMA
37 CWA, 404
38 ESA, 7
39 Northern Spotted Owl
40 Houck

instead over politically bounded areas as defined by municipal, county, or state lines. Not surprisingly, environmental problems don't track political boundaries. A small number of interstate initiatives, such as the Chesapeake Bay Initiative, have sought to better align political actors within the natural ecosystem boundaries,[41] and a number of states have also aligned political and natural boundaries within their state jurisdictions, as in the cases of the New Jersey Pinelands Commission[42] and the Adirondack Park Agency of New York.[43] But such instances are rare. As a result, consistent efforts to manage landscapes that ensure service provision are easily confounded by collective action problems. In a fascinating break from this practice, in the last decade New Zealand and a number of Australian states have created catchment management bodies that exercise land use planning authority throughout an entire watershed,[44] But these remain a rare exception.

The last reason there are so few markets, and perhaps the most important, concerns the role of markets and public goods. A "public good" is one whose use and benefits cannot be exclusively controlled, such as military defense or law and order. Unlike an apple that can be bought and consumed by one person, all those who live in a country with secure borders and low crime rates benefit from these public goods, whether they pay taxes or not. Similarly, those who live downstream from wetlands benefit from the role wetlands play in slowing floodwaters, whether they paid to conserve the wetland or not. In fact, most ecosystem services, ranging from flood control and climate stability to pollination, provide non-exclusive benefits.[45]

We have no shortage of markets for most 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 themselves 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). This might not be critically important if most lands providing services were public property set aside for conservation, but they are not. Private lands are vital not only for biodiversity conservation but for provision of most other services, as well.[46]

Markets create knowledge. We have a very advanced understanding of how to manage farm land to maximize production of cash crops for the simple reason that *they are cash crops*. It pays to manage land 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 land owners cannot capture any of the value their landscape provides.

---

41 CBI

42 NJPL

43 NY

44 catchment authorities

45 They are also non-rival, in that my enjoyment and consumption of the services does not impair your benefits.

46 Stats for biodiversity on private lands; note that while many water suppliers own land in key watershed areas, many do not.

While a wetland surely provides existence and option values to some people, the benefits provided by the wetland's nutrient retention and flood protection services are both universal and undeniable. Tastes may differ over beauty, but they are in firm accord over the high costs of polluted water and flooded homes. Yet 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. Agricultural markets provide very clear signals to farmers for 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. These remain positive externalities.

Such circumstances make ecosystem services easy to take for granted. Because it is difficult to prevent someone who did not pay for an ecosystem service from benefiting from it, it is equally difficult to get such people to pay for provision of these services. Why pay for something when you have always gotten it for free? As a result, a key challenge in implementing an ecosystem services approach lies in creating a market where none exists – in capturing the value of the service by compensating the providers. Through this approach and, as described in the next section, notably *unlike* regulatory or tax instruments, one views environmental protection much as a business transaction between willing parties.

A further economic obstacle to creation of service markets, noted above in the paragraph on institutions, is the problem of collective action. Markets for services can only be established if there are discrete groups of providers and beneficiaries, 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.[47] The problem is that we all gain from these benefits, yet there is no discrete class of beneficiaries that landholders can negotiate with, 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. Put simply; if a land use provides valuable ecosystem services but they are widely enjoyed by diffuse beneficiaries, in the absence of government intervention it is unlikely a market for services will arise.

C. Instrument Choice to Protect Ecosystem Services – The Five P's

This brief analysis suggests why the government has a critical role to play in ecosystem service markets. Because the provision of public goods can provide great public benefit yet little private benefit, one would expect that market signals will lead to under-provision of ecosystem services. To correct this market failure as well as that of collective action, government can step in and act on behalf of the public. As described below, this might take the form of proscribing behavior, paying for services on behalf of the general public or clarifying property rights. More generally, when choosing which instrument to use in changing the behavior of landholders, the government can choose from a toolkit of five basic strategies.[48]

---

47 Roughly one in four pharmaceuticals are derived from plant sources and another one in four from animals and microorganisms. Daily 1997.

48 These are described in greater detail in Salzman and Thompson primer

One might call these "The Five P's" – prescription, penalty, persuasion, payment and property rights.

Through *prescription*, the government relies on command-and-control regulation, mandating certain behaviors, proscribing others, and imposing penalties for noncompliance. "Thou shalt do this; thou shalt not do that, or else..." The norm for pollution control in industrial settings, such approaches have been used indirectly to provide services from wetlands[49] and the ecosystem service of biodiversity.[50] Such approaches have met with poor success in the United States (and in the rest of the world, for that matter) when applied to non-point source pollution.[51]

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 head of cattle to graze on public lands or per kilogram of CFC purchased).[52]

Persuasion relies on an information approach, educating landholders of the consequences of their management practices on the landscape and informing them of alternate approaches. This has been widespread across America since the depression through the Soil Conservation Service.[53] The goal of this approach is self-regulation. In a recreational example, informed of harm to coral reefs through dropping anchors, most boat owners have developed an ethic not to do so.[54]

The fourth approach is one of *payment*. This usually takes the form of a subsidy, either as a direct payment or tax deduction, 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 regulations because of their impact on government budgets, such an approach is often popular with landholders for obvious reasons. Serious doubts, though, have been raised over the efficiency of such a blunt approach, since payments are usually in the form of a one-size-fits-all scheme (e.g., payments for setting aside wetlands but not calibrated to the quality or service provision of the wetland) and whether they encourage holdouts or create perverse incentives.

The final approach is *property rights*. This instrument relies on privatization and allocation of access to a resource, whether a right to a particular catch in a fishery[55] or the

---

49 Section 404 of the Clean Water Act requires a permit for the dredge and fill of navigable waters. For details on this program and its impact on service provision, *see* Salzman and Ruhl, *Currencies.*

50 Section 7 of the Endangered Species Act prohibits activities by the federal government that jeopardize the viability or adversely modify the critical habitat of endangered species. Section 9 of the act prohibits actions by any person that constitutes a "taking" of an endangered species. *See generally,* Stanford ESA Manual.

51 *See infra,* page xx.

52 CAA

53 SMH

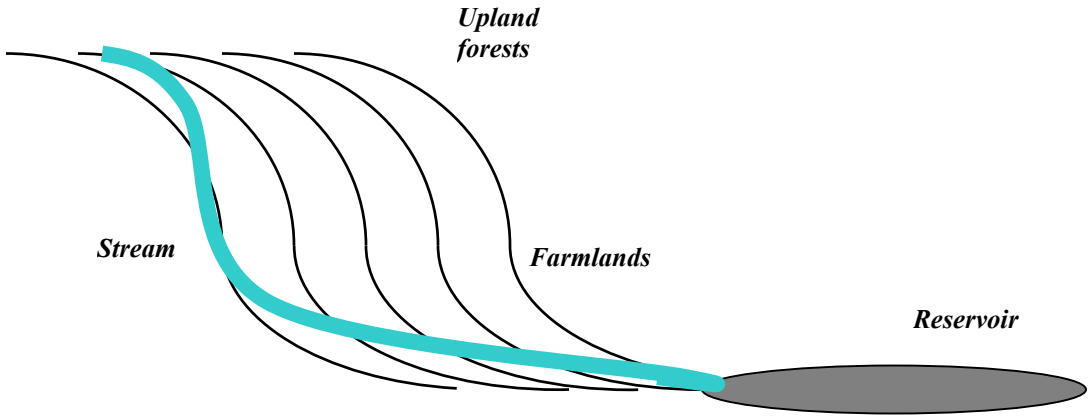
54 Great Barrier Reef cite

55 ITQ cite

ability to emit a quantity of air pollution.[56] In these programs, such as the acid rain trading program in the United States, these entitlements may be traded.[57]

In practice, of course, these instruments often work in combination. Trading programs, for example, rely on regulations to create scarcity. Combined instruments, as well, offer regulated parties a choice that may be perceived as more legitimate and, as a result, facilitate compliance.[58]

To put these different instruments in the context of ecosystem services, take the example of water quality in the figure below.[59] Imagine that the municipal water supplier owns the upland forest, which naturally filters and cleans water as it flows through the upper watershed. Property owners in the farmlands are dairy farmers, grazing cows on their fields and beside the stream that flows into the reservoir. The farmers could manage their land to provide an improved service of water purification by planting riparian vegetation buffers (i.e., erecting fences to protect strips of plants alongside the stream from grazing). Such vegetative buffers capture nutrients and reduce silt before they reach the watercourse. Water consumers downstream benefit from these actions when drinking clean water that does not require extensive pre-treatment.



Traditionally, this would be the end of the story, for few land owners *would actually* plant riparian buffers. They may well have been informed of the benefits of this practice for themselves and downstream users but, either from the hassle and cost of fencing or concerns over the loss of productivity from setting aside pasture, will not change their behavior. And those who did fence off their streams would bear all the costs, with no contributions from those downstream who benefit from the positive externalities of cleaner water.

---

56 examples of air pollution markets

57 Title IV

58 Markell

59 Adapted from Geoffrey Heal et al., ESDs

One could, of course, impose regulations to require farmers to plant riparian buffers. One might levy a tax on farmers who do not have buffers. As described in detail in Section V, however, such approaches have largely proven ineffective in the past because of overbreadth, cost, strong political opposition, and poor compliance behavior in the face of what are viewed as punitive or intrusive measures.

Why not, instead, recognize this situation for what it is – the provision of valuable services to consumers – and realize this 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. Dairy farmers sign contracts to sell their milk; potato farmers do the same for their spuds. Why not treat service provision as a similar business transaction, where farmers manage their land through riparian buffers 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. In contrast to the earlier description of subsidies, ecosystem services payments could focus directly on the quality and quantity of services delivered. Such exchanges would be arms-length payments for services rendered, creating an ongoing incentive for the landholder to manage the property so that service provision is ensured rather than the typical one-off application for funds in grants programs with (in practice) little follow-up by the funding body to ensure value for money. With many farms making little or no profit, it becomes difficult to justify capital investments with long payback periods, uncertain returns, and potentially reduced land productivity. Service payments could address these common concerns by providing consistent funding sources. The farmers would begin to think differently about the nature of running a farm, as well, perhaps instilling new attitudes and priorities toward land management.

III. Examples from the Field

Needless to say, this is a different way of thinking about environmental protection than the traditional approaches of regulation, taxes and subsidy and may immediately give rise to a whole host of objections. If possible, though, please place these to the side for the next few pages, because such payments for services are not simply "pie in the sky" musings. As noted in the Introduction, there are examples from around the world that have put such principles into practice. The next section briefly describes a few of these programs, showing the breadth of services and range of market designs.[60]

---

60 Groups such as The Nature Conservancy and Conservation International rely on direct payments for habitat conservation (usually through conservation easements or outright purchase). While these may be considered examples of service markets for biodiversity, such cases are not described in this section because they are both familiar and relatively well understood. For more details on such schemes around the globe, *see* Paul Ferraro and Agnes Kiss, *Direct Payments to Conserve Biodiversity*, 298 SCIENCE 1718-1719 (2002) [hereinafter Ferraro and Kiss]. For a useful list of projects and websites, *see* <http://epp.gsu.edu/pferraro/special/special.htm>.

A. Conservation Reserve Program (USA)

Created in 1985, the Conservation Reserve Program (CRP) is the largest ecosystem service payment scheme in the world, providing annual rental payments and sharing the cost of conservation practices on farmland.[61] First created to address problems of soil erosion and to support farm incomes at a time of plummeting crop prices, the program has grown over the years, now paying for land changes that promote water quality and wildlife habitat, as well. Its annual payments exceed US$1.6 billion dollars for activities on over 34 million acres.[62] It is estimated that topsoil loss has been reduced on CRP lands by 21% and pesticide and nutrient run off greatly reduced, as well.

CRP contracts extend from 10 to 15 years. To be eligible for CRP support, the farmland must have been planted in two of the five most recent crop years and meet a set of requirements ensuring it can provide services.[63] Farmers wishing to enroll in the CRP have their offers ranked by government field officers according to an Environmental Benefits Index. This index is a composite score, with points for:

- Wildlife habitat benefits resulting from covers on contract acreage;
- Water quality benefits from reduced erosion, runoff, and leaching;
- On-farm benefits of reduced erosion;
- Benefits that will likely endure beyond the contract period;
- Air quality benefits from reduced wind erosion;
- Benefits of enrollment in conservation priority areas where enrollment would contribute to the improvement of identified adverse water quality, wildlife habitat, or air quality; and
- Cost.[64]

Farmers submit a bid for their land to be accepted in the program. To increase the likelihood of their bid being accepted, farmers can stipulate that they will accept a lower rental rate than the local market price. Offers are ranked according to score and bids selected from their relative ranking. CRP offers 100% of the restoration costs and legal fees if farmers are willing to enter into permanent conservation easements.[65]

---

61 Perrot-Maitre 2001

62 USDA monthly summary, July 2003.

63 The land must be be physically and legally capable of growing an agricultural commodity or marginal pastureland that is suitable for planting as a riparian buffer. In addition, the land must also be:

- highly erodible land;
- a cropped wetland;
- dedicated to beneficial environmental practices, such as filter strips or riparian buffers;
- subject to scour erosion;
- located in a national or state CRP conservation priority area; or
- a cropland associated with or surrounding noncropped wetlands.

64 URL

65 To promote revegetation, CRP shares 50% of the costs to provide approved vegetative cover. To restore wetlands, CRP also offers an additional 25% of the costs to restore the site's hydrology. The cost of land use

While the CRP has many supporters, its critics point to four major failings. First, there are concerns over leakage – farmers may be plowing up other land to compensate for land placed in the CRP program. While nine Great Plains states enrolled 17.3 million acres in the CRP from 1985-1992, the total amount of harvested cropland only declined by 2.6 million acres.[66] Second, the land eligibility criteria have been interpreted far too broadly, allowing CRP enrollment for lands that do not need to be set aside. Critics charge that as much as 77% of the CRP land in Minnesota could be farmed with little ecological harm if proper management practices were used.[67] Third, the program can send the wrong message. As one scholar has written, many farmers became frustrated because "they had taken too good care of their land and could not qualify [for CRP funds], even though their land was intrinsically as erodible as their neighbor's."[68] Finally, in many cases farmers seem to have colluded in the bidding process, with bids clustered just below the program's clearance price (which was set as a per hectare price) and well above local market rental rates.[69]

B. BushTender (Australia)

In Australia, the state of Victoria's Department of Natural Resources and Environment (NRE) has developed a pilot program to conserve native vegetation remnants on private property. In exchange for payments from the state government, the landholders commit to fence off and manage an agreed amount of their native vegetation for a set period of time. The first BushTender Trial was completed in 2002 in the north central and north east regions of the state. The program is based on the model of the Conservation Reserve Program in the United States, which pays farmers to set aside land for nature conservation. The innovation of BushTender is its reliance on a robust assessment methodology and reverse auction mechanism to set the price of the contracts.

With the assistance of farmers' associations, NRE publicized that it might be willing to pay farmers to conserve native vegetation.[70] Interested landholders contacted NRE, who then sent out field staff to inspect the sites, explaining to landholders which of their native vegetation were most significant and the kinds of conservation activities that would be most effective. Importantly, and not revealed to the landholders, the field staff assessed the value of each site's native vegetation on two scales of value. One scale was called the Biodiversity Significance Score (rating the site's conservation value according to scarcity of remnant types) and the other called the Habitat Services Score (assessing the proposed management action's contribution to biodiversity improvement, such as fencing or weed control). Landholders were informed of the Habitat Services Score but, importantly, not the Biodiversity Significance Score. Thus they were told which land management changes were most important but not how significant their

---

management ranges from $2 for vegetation to reduce salinity to $226 for planting field windbreaks. Tree planting costs about $59 per acre. Rental rates have ranged from $26-$66 per acre for riparian buffers.

66 Perrot and Maitre

67 Id.

68 Id.

69 Gordon and Walsh 1995. This might require collusion with USDA officials, as well, to learn the clearing price.

70 Stoneham

remnants were. Interested landholders then could choose to submit bids, detailing in a management plan developed with the field officer which remnant vegetation (and how much) they would be willing to conserve as well as the management regime for the remnants. The range of proposed management actions ranged from excluding stock, retaining large trees and controlling rabbits to controlling weeds and revegetation.[71]

Because NRE had an estimate of potential biodiversity importance for each of these sites, they were able to calculate the best value for money (i.e., by identifying those bids that offered greatest biodiversity value for least cost per hectare).[72] Given a limited funding budget, only the most cost-effective bids were funded. In the end, NRE accepted 97 bids, with landholders committing to conserve and manage roughly 3,200 hectares[73] of native vegetation under three-year BushTender Management Agreements for a total cost of approximately A$400,000.[74] Compliance monitoring occurs through random site inspections.

For many landholders, uncleared native vegetation is often viewed as lost income. The key to the BushTender approach is that it requires landholders to determine their own price for setting aside and improving their native vegetation. By having to decide how much they are willing to accept in a competitive setting (because other landholders are also bidding), the landholders must consider seriously the relative values of the land in both its current and future managed state.

Beyond the fact that the scheme was well received and oversubscribed, the environmental benefits seem significant. NRE field staff concluded that most of the successful bids contained sites of high or very high conservation significance, including 24 new populations of rare or threatened plant species.[75] Perhaps the most important and unexpected finding, though, was that many of the bids were for less money than the NRE would have been willing to pay had they negotiated directly with landholders. It is not clear whether the lower price was due to market pressures of competitive bidding, the NRE over-estimating landholders' willingness to accept, or the fact that once landholders understood the non-market value of their native vegetation they were willing to internalize some of the perceived costs of conservation.[76]

C. Environmental Services Scheme (Australia)

---

71 In all, from 216 expressions of interest, field officers visited 223 sites. In the end, 98 landholders submitted 148 bids for 186 sites.

72 The total score, known as the Biodiversity Benefits Index was calculated by multiplying the Biodiversity Significance Score and Habitat Significance Score and dividing by the bid price.

73 There are 2.47 hectares in an acre. The coverage in BushTender was roughly 7,900 acres.

74 Insert exchange rate

75 The National Action Plan for Salinity and Water Quality recently announced it would provide $600,000 for a pilot project by the creators of BushTender that also accounts for biodiversity and salinity benefits.

76 It is an open question whether persuasion instruments, such as brochures or educational visits from conservation staff, would have achieved the same result. At first glance, this seems unlikely because the landholders would not be forced to consider the true value of their willingness to accept land changes.

Inspired by BushTender, the New South Wales (NSW) government has launched a pilot project known as the Environmental Services Scheme that pays 20 farmers to take part in a three-year, A$2 million pilot scheme to provide environmental services on their properties.[77] The program is jointly managed by the NSW Department of Infrastructure, Planning and Natural Resources and NSW State Forests. The farmers whose bids are successful work with an environmental services team to develop a management plan that regenerates parts of their land. Once the regeneration work has been carried out, the government will pay the farmers. Unlike the Bush Tender trial, the Ecosystem Services Investment Fund pilot is broader, covering biodiversity, salinity, acid sulfate soils, carbon sequestration as well as soil and nutrient management. It also requires the farmers to take positive action, changing current land management practices.

The pilot scheme is progressing, with the properties chosen. At the moment, it appears that separate indices of value will be established for each service and no attempt will be made to combine the separate values into a composite environmental benefits index that would account for trade-offs (e.g., actions that promote one goal and hurt another, such as tree planting to combat salinity versus other vegetation that might better promote biodiversity). The scheme is developing GIS-based software that would show landholders how different land management approaches will result in more or less service provision.

D. Macquarie River Food and Fiber and NSW Forests (Australia)

Underneath much of Australia the groundwater is saline, a remnant of the vast salt sea that used to sit atop the continent. In the drive to settle and tame the country, settlers were required to clear most of the native vegetation before they could claim title to the land. As a result, the ecosystem service of evapotranspiration that had long served as a water pump to keep rainwater from reaching the groundwater table well below the surface was seriously weakened. Large expanses of agricultural areas now face the serious threat of salinity – saline groundwater rising to the root zone of plants and stunting their growth.[78] One area where this is just starting to be felt is in the verdant Macquarie River valley.

As a pilot program to combat salinity, NSW State Forests has signed a contract with Macquarie River Food and Fiber (MRFF, an organization that represents 600 Macquarie Valley irrigation farmers) to purchase "salinity credits."[79] In simple terms, rather than mechanically pumping groundwater to keep the water table below the root zone of cash crops, MRFF is purchasing the ecosystem service of evapotranspiration for ten years by paying grazers to plant 100 hectares of native forest in the upper Macquarie River catchments (which, in theory, should lead to a reduction in groundwater levels in the lower catchments). MRFF actually pays NSW State Forests, which then passes on the money as an annuity to landholders in the upper reaches of the Macquarie to plant and manage native forest on their land. Title to the timber resource and the carbon sequestration value is retained by State Forests. This pilot project is not really a

---

77 Grieve

78 This can seem a bit confusing because the Australian problem is the exact opposite of that in America. In Australia, there is too much saline groundwater (i.e., it has risen too close to the surface). In America, because of extraction there is too little freshwater groundwater.

79 URL

competitive market since there is only one buyer (MRFF) and a small number of sellers (the upper catchments grazers) offering their land for tree planting.

The project has provided valuable public relations benefits and improved relations between the irrigation farmers (who have been making money) with the sheep farmers (who have not). In theory, this scheme could provide the extra income that would make timber production a profitable undertaking in traditional grazing areas that have been considered marginal tree cropping country. It also provides a steady income stream that can prove significant during lean crop years.

The key challenge in the project has been biophysical uncertainty – the link between upstream revegetation efforts and downstream salinity reduction. The trees were planted in "salinity hot spots," i.e., known groundwater recharge zones, and estimated to transpire 53.5 megalitres per hectare over ten years. It is not known, however, whether this change in land use and resulting transpiration will lead to any measurable reduction in salinity downstream. Because of the complex hydrology, it is not even known how much land use change is needed for significant salinity changes. Given the poor understanding of causation (and the time lags involved) at this point, MRFF is unlikely to expand the pilot project until it has more confidence in the investment needed (i.e., the amount of upper catchments revegetation) to cause a significant reduction in lower catchments salinity levels.

E. Perrier Vittel (France)

Perrier Vittel S.A. is the largest bottler of mineral water in the world. In the late 1980s, seeking to reduce the nitrates and pesticides entering the springs around its bottling operations in northeastern France, Perrier Vittel employed a range of payment mechanisms to change land uses in the catchment area.[80] For $9 million, Perrier Vittel paid above-market prices to purchase 1,500 hectares around its water springs. In an innovative move, Perrier Vittel than offered to lease use of the land back to the prior owners for farming operations (primarily dairy) if they followed prescribed management practices. Perrier Vittel also signed long-term (18 to 30 years) contracts with 40 farmers covering an additional 10,000 hectares, paying them to use less intensive dairy farming techniques. The payments are intended to cover opportunity costs and average $230/hectare per year for seven years (an investment of about $155,000 per farm). Perrier Vittel has also provided farmers free technical support and paid for farm infrastructure (primarily buildings and machinery). The company retains ownership and has the right to monitor their proper use.

The net result of these initiatives has been a reduction in non-point source pollution and significant changes in local dairy farming and animal waste management practices while eliminating corn cultivation and use of agricultural chemicals.

F. PSA (Costa Rica)

80 Perrot-Maitre 2001

Costa Rica has long recognized the importance of services provided by forested watersheds, providing tax rebates to timber companies for forest conservation since the 1970s.[81] In 1997, Costa Rica launched a nationwide scheme of payments for provision of ecosystem services, known as PSA (Pagos por Servicios Ambientales). The PSA, created by Forestry Law No. 7575, 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.

Rather than mandating that beneficiaries of services pay for them, the law establishes a framework for service payments. Thus, the government is provided authority to act as a broker, negotiating contracts between potential service buyers and providers. The government has created a body called FONAFIFO to administer the program (e.g., to negotiate the agreements, monitor compliance, administer payments, etc.). With the aid of professional foresters, NGOs or the Conservation Areas Agency, landholders develop a sustainable forestry plan of management. This plan is then adapted into a conservation easement that is entered in the property deed, so the obligation runs with the title to all subsequent owners until it expires. Most contracts extend over a five year period (though they can go up to twenty years).

The key to the scheme has been finding both willing buyers and sellers. Overall, the PSA program has been very popular. By the middle of 2000, roughly 200,000 hectares of forest were being managed for service provision in exchange for payments.[82] An additional 800,000 hectares had been proposed for conservation management but not included in the program because of inadequate funding. 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 ($32 million loan) and Global Environment Facility ($8 million grant) have provided the means to pay for biodiversity conservation.

By contrast, only about $100,000 has been paid specifically for water service provision from 2,400 hectares.[83] While the potential purchasers of water services might include water suppliers, hydroelectric power generators, irrigators, industrial users, and people in flood plains, so far the payments for water quality have come primarily from hydroelectric power generators concerned over sedimentation. Deforestation can lead to serious erosion, particularly on hillsides. Forest cover prevents the rush of sediment loads into streams and, eventually, dammed reservoirs, which results in much lower maintenance costs for hydroelectric power plants that would otherwise have to dredge. There have been no contracts to date from water suppliers.

Another Costa Rican initiative worth noting is the initiative of Costa Rica's Ministry of Environment and Energy to charge 20,000 water customers near San Jose a small surcharge on

---

81 Pagiola

82 There have been no studies to date examining the likelihood that this land would have been cleared for logging.

83 Landowners have been paid $10-42 per hectare per year for water quality services, based on the principle that payments should be no less than the landowner's opportunity cost and no greater than the benefit provided.

monthly water bills. The funds are used to pay upper watershed farmers who have agreed to conserve and manage their forests.[84]

G. New York City

As described in Section II, New York City's decision to invest in land management in the Catskills catchment was driven by new drinking water regulations that would have required the construction of a multi-billion dollar treatment plant.[85] The financial attraction of investing in the ecosystem service of water purification, then, was the avoided cost of not having to build the treatment plant. Before deciding to invest, however, New York City first tried to manage land uses in the upper catchment solely by regulation.

In 1905, recognizing the significance of the Catskills and Delaware watersheds to New York City's drinking water, the state assembly had granted New York City zoning authority over these areas.[86] This created the unusual situation, to say the least, of a city with land use controls over communities more than 100 miles away. In the early 1990s, the administration of Mayor David Dinkins announced new land use requirements for the upper catchment that would improve water quality, such as limits on the amount of paved surface on a property, buffers up to 1000 feet wide around reservoirs and up to 500 feet from stream channels, and prohibitions on spreading manure within 100 feet of a watercourse. Not surprisingly, the efforts of "rich city folk" in New York to regulate, without prior consultation, how upstate farmers and landholders managed their properties were met with intense political opposition.

Faced with the concern of the U.S. EPA that New York City could not ensure catchment management would work, the governor of New York state stepped in and organized a stakeholder consultation process. Conducted over two years with more than 150 meetings, the group finally came up with a Memorandum of Agreement signed by 60 towns, 10 villages, 7 counties, and environmental groups. One participant described the exhaustive process as similar to a "rolling Thanksgiving dinner with relatives you only want to see once a year."[87]

While often described as the archetypal model of payments for ecosystem services, it is important to note that, in contrast with the other schemes described above, relatively few of New York City's payments go directly to land management. The Memorandum of Agreement provides for $1.5 billion of spending commitments over ten years, funded by taxes on water bills (which New York City residents voted to allow) and municipal bonds. Of this, $250 million has been targeted to acquisition of fee title and conservation easements in critical areas. $240 million is to be spent by the newly-created nonprofit group, the Catskill Watershed Corporation, for "partnership programs." These range from new sewage treatment infrastructure ($75 million), the Catskill Fund for the Future (economic development projects, $59.7 million), and storm water infrastructure and maintenance ($31.7 million) to improved

---

84 Daily and Ellison 2002

85 For a more detailed, well-written recounting of the story, *see* Daily and Ellison, *supra* note xx.

86 cite sources, *supra* note xx.

87 Daily and Ellison

storage of de-icing materials ($10.2 million) and environmental education ($2 million). The state has also committed $53 million for a range of initiatives.[88]

The key point is that while a few of these programs provide payments to landholders for management (mostly in pilot projects), the majority of the funds are primarily directed either at infrastructure projects (sewers, treatment works, storm water drains) or to municipalities and development interests (i.e., those who were sitting around the table negotiating the Memorandum over two years). In the clearest example of this, New York City has provided up to $9.765 million in "good neighbor payments" for municipal capital projects. Thus, while the Catskills experience provides an important example of paying to manage a catchment for water purification services, paying landholders directly to change their practices represents a relatively small part of the picture.

The initiative has had mixed results to date. New York City's offer to pay farmers $100 per acre every year for up to fifteen years to plant native species along streams resulted in only about 400 acres being planted. The problem, it turned out, was that corn crops provided a much greater return per acre. Most farmers have, however, made use of the free consultation service and infrastructure subsidies for fences and pumps. Efforts to purchase land have also been disappointing. While approximately 270,000 acres had been solicited for purchase by 2002, only 33,764 had been acquired, and only 60% of these were in high priority areas. While the MoA commits a great deal of money for land purchase, ironically this may be a major cause of the poor purchasing success. When a landholder sees someone walking down the driveway with a big bag full of cash, the purchase price has a tendency to rise. Overall, though, it should be kept in mind that the grand experiment has been successful so far. A major review by EPA in 2002 persuaded the agency to extend the waiver treatment of surface waters for a further five years to 2007.[89] Given the special features of the case study – such as New York City's regulatory authority over its watershed, the EPA mandate requiring action, the clear value of the cost avoided in not building a treatment plant, and the ability to raise capital – it's not clear how transferable this model is.[90]

H. Wetlands Mitigation Banking

Since President George H.W. Bush's campaign in 1988, successive administrations have supported a policy to ensure "no net loss" of wetlands.[91] The primary law conserving wetlands in the United States is the Clean Water Act (CWA), passed in 1972. Section 311 of the CWA broadly prohibits "the discharge of any pollutant by any person" into navigable waters and, on its face, seems to prevent the filling of most wetlands.[92] The CWA provides a limited exception to this prohibition in Section 404, which authorizes the Secretary of the Army to "issue permits, after notice and opportunity for public hearings for the discharge of dredged or

88 URL

89 EPA

90 *See generally,* Thompson, *supra* note xx, at 301-303.

91 For a detailed discussion of wetlands mitigation banking, *see* Salzman and Ruhl, *supra* note xx.

92 *See* Natural Resources Defense Counsel v. Callaway, 392 F. Supp. 685, 686 (D.D.C. 1975).

fill material into navigable waters at specified disposal sites".[93] These permits, administered principally through the Army Corps of Engineers (the Corps), are necessary for many routine land development activities require and receive 404 permits before they can proceed. when applying for a 404 permit, a developer must convince the Corps that no reasonable alternatives exist to the development of the wetlands, that the design of the development minimizes harm to the wetlands, and, if these two conditions have been satisfied, that other wetlands have been restored to compensate for the wetlands destroyed (known as "compensatory mitigation").

The EPA and the Corps have traditionally preferred on-site to off-site locations for compensatory mitigation activities, and have preferred in-kind mitigation to mitigation that uses a substantially different type of wetland. As an example, if a mall is built on a salt marsh, on-site mitigation would require restoring a wetland on immediately adjacent land (versus a distant site) and in-kind mitigation would require restoring a salt marsh (versus a fresh water cattail marsh). While attractive in theory, compensatory mitigation was unpopular with developers, who wanted more flexibility, and with environmentalists, because lack of compliance monitoring often led to so-called "landscape mitigation" – planting what was required or regrading where required to meet the minimum letter of the permit –and leaving the "restored wetland" to revert back to its original habitat, usually a wetland in name only, if even that.[94]

In light of these problems, the Corps and EPA started shifting compensatory activities from on-site to off-site mitigation, opening the door for wetlands mitigation banking. This program allows a developer who has mitigated somewhere else in advance of development to draw from the resulting bank of mitigation "credits" as the development is implemented and wetlands are filled. Coefficients are usually required, mandating two or three times more mitigated wetlands to compensate for filled wetlands.

Wetland mitigation banking now resembles a commodity market, with freewheeling, entrepreneurial wetlands banks offering for sale (and profit) finished off-site wetlands as "credits" to anyone who is in need of mitigation for their 404 permits.[95] With the support of federal agencies, as well as many environmental advocacy groups, land development interests, and academics, the wetlands mitigation banking program has blossomed since the early 1990s.[96] In a wide range of fora, its advocates have contended that off-site mitigation banking should be preferred over on-site or near-site compensatory mitigation because of greater efficiency, scale effects, and environmental protection.[97]

I. Carbon Markets

---

93 *cite*

94 *See, e.g.,* Michael J. Bean and Lynn E. Dwyer, *Mitigation Banking as an Endangered Species Conservation Tool*, 30 Envtl. L. Rep. (Envtl. L. Inst.) 10537, 10538-9 (2000) ("The track record of traditional, project-by-project wetland mitigation is dismal.").

95 There are over 600 such commercial mitigation banks operating in the United States today. *Cite.*

96 Since 1999, five states have adopted a formal mitigation banking policy bringing the total number of states to 20. *See* INSTITUTE FOR WATER RESOURCES (IWR), US ARMY CORPS OF ENGINEERS, EXISTING WETLAND MITIGATION BANK INVENTORY, Spring 2000 (Listing state, location, and sponsor of all wetlands mitigation banks).

97 *See* Federal Guidance, *supra* note 16, at 58,607.

While climate change and the goal of minimizing carbon emissions have been high on the global environmental agenda for some time, the emergence of "carbon neutral" schemes targeted at individuals and business is a relatively recent innovation. Carbon neutrality is achieved when a sufficient number of trees are planted to completely "offset" the carbon emissions from the activity under consideration, whether that be manufacturing, travel, product use, etc.[98]

Such an "offset" employs the ecosystem service of carbon sequestration and ensures that increased emissions in one place are balanced by sequestration elsewhere. This may well represent the largest potential service market. Even without the Kyoto Protocol in force, for example, there were over $300 million in carbon trades in 2002.[99] There are many such schemes emerging around the world. One of the pioneers in the area of carbon offsets worth noting is Future Forests. Future Forests operates in a brokerage role.[100] Those wishing (or required) to reduce and/or totally offset their carbon emissions pay Future Forests, who then find sellers (sinks), monitor emission reduction activities (primarily tree planting) and verify the required level of carbon offset. A high profile example includes Avis Europe, who offers a carbon neutral rental option to clients.[101]

IV. Notes from the Field – Instrument Design

The preceding section set out a range of market approaches with important differences. The Catskills case, for example, resembles a procurement purchase. The downside to poor design and implementation is not terribly concerning since, if you're wrong, at worst you overpay or pay the wrong people. In wetlands mitigation banking, by contrast, which relies on trading of nonfungible goods, if the currency design proves inadequate then the provision of ecosystem services suffers (because degrading one wetland can lead to net loss in valuable services despite restoring wetlands elsewhere).

We will explore the implications of particular market designs later in the paper. The key starting observation, however, is that despite the differences among these initiatives in terms of structure, service provided, and size, they all share fundamentally similar design challenges. In designing *any* instrument to protect services in the field, whether fiscal or regulatory, one must be able to answer three basic questions:

- What is the service being provided?
- Who provides the service and who benefits?
- What level of service is needed?

---

98 Carbon neutral schemes differ in an important respect from the other examples described above because, rather than benefiting directly from provision of the service (as do water drinkers in New York or Perrier-Vittel's bottling operations, here the buyers are creating the environmental problem and seeking to offset the total harm. For a discussion on the different types of markets for nature, *see* Thompson, *supra* note xx, at 266.

99 Adam Davis, EPRI, Personal Communication, October 30, 2003. *need to distinguish between CDM and emission trades.*

100 URL

101 http://www.avis-europe.com/avispress/Future%20Forests%20April%202002.html

This section explores these questions in more detail, drawing on insights from the preceding examples just described in Section III. Perhaps surprisingly, instrument choice is secondary to this analysis. Whether one decides to rely on a BushTender strategy to change the behavior of a target group rather than instruments of prescription, penalty, or persuasion, will depend on questions of economic efficiency, equity and politics. But one cannot usefully compare these policy instruments unless one has *first* identified the service to be delivered, how it is provided, who the providers are, and their levels of provision. This is really no different than designing any other policy instrument. One must be clear about who the affected parties will be, their existing entitlements, what you want them to do, and how they will react.

A. What is the service being provided?

In using government instruments to influence ecosystem service provision, the very first question to consider is which service you care about or, more to the point, which problem you care about and whether it can be addressed by land management. In the BushTender pilot, for example, the problem is loss of local biodiversity; the ecosystem service of biodiversity is provided through conservation of remnant native vegetation. In the MRFF case, the problem is a rising saline water table; the remedial service is evapotranspiration provided through reforestation. In the Costa Rica case, the problem is sedimentation of hydroelectric dams; the service of sediment retention is provided through forest conservation.

For the Catskills, though, the answers have been less obvious. In general, the problem is pollution and the service is water purification. But these descriptions are too broad to help in instrument design because they don't indicate the appropriate land management regime to provide the service. Concerns over eutrophication implicate the service of nutrient uptake, for example, while concerns over turbidity indicate the need for greater sediment retention.

A related question concerns how the service is provided. This is a purely technical question. It requires delineating the biophysical pathways of the pollutants. If the service in question is nutrient reduction, what are the landscape processes that keep nitrates and phosphates from fertilizers and manure out of the watercourses? Such an analysis leads to a better understanding of which landscape management practices need to be encouraged by the policy instrument (such as riparian vegetation or swales) or, conversely, those that need to be discouraged (such as land clearing).

B. Who provides the service and who benefits?

To craft a policy instrument, one needs to know not only the behavior one is trying to influence but who the regulatory target is. Take the problem of biodiversity loss. We can't simply legislate against biodiversity loss. We first need to know the specific actions that are reducing biodiversity and those responsible. One clear target audience would be landholders who have large patches of remnant native vegetation on their land; and the specific behavior to be encouraged would be to halt land clearing while, better still, fencing off and managing these remnants.

More specifically, if we are interested in creating ecosystem service markets, one needs a clear idea at the outset of who the buyers will be. As noted in Section II, markets for services can only be established if there are discrete groups of providers and beneficiaries. Otherwise, transaction costs become too high for contract formation. While we all gain from the insurance service and medicinal benefits of biodiversity, there is no locally discrete class of beneficiaries that landholders can negotiate with. Hence the only reason biodiversity conservation contracts were so successful in the Costa Rican program was the unusual role played by the World Bank and the Global Environment Facility, essentially stepping in with millions of dollars as a surrogate purchaser of services for the world. The same is true with BushTender and the Environmental Services Investment Fund. 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.

Water purification, by contrast, can benefit discrete classes of consumers, which explains why there are multiple ecosystem service examples from around the world involving water suppliers acting as buyers.[102] In Costa Rica, for example, every water quality contract to date has involved a single dominant water user in the watershed (i.e., hydroelectric power producers concerned over sedimentation in their dams).

C. What level of service is needed?

To this point, we have identified the service to be provided, how it is provided, and who the providers and beneficiaries are, but we still lack one critical piece of information – the level of service provision. We need more precision than simply identifying potential polluters and service providers. If we choose to regulate, we need to know whom to regulate and what actions should be proscribed. If we decide to tax, we need to know whom to tax and how much to charge. If we end up choosing a payment instrument, we need to know both whom to pay and how much to pay them. Regardless of the instrument, we need information on the specific categories of actors, where they are, and the particular impacts they cause on service provision.

This is a critical point to understand. It is not enough to know that riparian fencing throughout a subcatchment is a good thing because it will improve water quality. Given the reality of limited budgets, the key question becomes *which* riparian stretches need to be fenced off to provide the greatest level of water purification. This is necessarily a landscape-dependent judgment and is far easier said than done.

The PSA program in Costa Rica, for example, does not really consider service provision. While some areas might be classified as priority areas, the program allows any landholder, anywhere in the country, to participate and be paid the same amount, regardless of whether they provide valuable services or not. As one commentator has described, "There was no targeting in micro terms (for example, there was no effort to target particular areas within the watershed that are particularly valuable from the perspective of water services, such as riparian

102 A 2002 study identified 61 cases of markets for water quality in 22 countries. Silver Bullet, *supra* note xx, at 112.

zones or steep slopes)."[103] As a result, the PSA approach resembles a general subsidy scheme, virtually ensuring suboptimal targeting of public funds.

What would be more effective, by contrast, would be targeted funding with payments based on level of service provision, or targeted regulations or taxes on the critical actors. But determining how much service a particular landholder provides and, more to the point, *can provide* through land management changes is both the key and greatest challenge to using policy instruments to ensure provision of ecosystem services. The real success of both the Environmental Services Scheme and BushTender does not lie in their use of reverse auction mechanisms. That's an efficiency improvement. The key lies in their field staff's scoring systems. The Victorian NRE was able to determine the best bids (in terms of ecosystem services bang for the buck) by dividing the site biodiversity value per hectare by the bid price. The NSW pilot project follows the same principles. Such calculations are only meaningful, however, if the scoring systems (which are estimates of service provision) prove robust and credible. If the assessment of biodiversity value proves to be poor, then there is no assurance the money was well spent, that the public is actually getting value for money.

BushTender felt it could provide accurate assessments of biodiversity value through field visits of specific patches of remnant vegetation. Doing so for other services, though, such as salinity in the water table would be far more complicated because of the uncertainties in hydrology models. In many catchments, for example, the groundwater hydrology is not uniform, sometimes operating at a small scale with recharge and discharge on the same properties and sometimes operating throughout an entire subcatchment. Unless there is a clear understanding of the local hydrology, one cannot expect payments for services for the simple reason that people downstream won't know what they're paying for. Nor can one reasonably set taxes or establish regulations with any certainty the desired behavior will result in meaningful service provision.[104] Over time, such uncertainties may be overcome by better modeling and monitoring technologies. But at the moment they confound setting up a market or other policy instruments. That's the reason MRFF is unlikely to continue its reforestation pilot with NSW State Forests. It has no idea if, beyond intangible PR benefits, it is getting value for money by paying to plant trees in the upper catchment.

In keeping with the salinity example, at one end of the spectrum, salinity models have been developed that provide robust estimates of service capacity per hectare based on topography, deep drainage, and runoff under different land uses. This is expensive and time consuming.[105] At the other end, one could rely on "rough and ready" field estimates based on visual observation and scoring. BushTender used this approach in valuing biodiversity and perhaps basic rules of thumb could be developed for water quality, as well (such as proximity to watercourse, slope of land, extent of riparian vegetation, etc.). Whatever the method used, it must be able to take into account spatial variation and landscape context, reflecting the fact that some sites are more important to water quality than others, but not so expensive that transaction costs swamp the efficiency benefits of markets.

---

103 Pagiola 2002

104 Cite Esty info article

105 Nor has it led to consensus among scientists over its accuracy (because of disagreements over the hydrology of the area and how salts are mobilized).

The net result is that some services will be easier to develop markets for than others, for the simple reason that those buying services will be more confident in exactly what they are paying for—in ensuring they receive value for money. How difficult, for example, is linking the contributions of individual land management decisions to water quality in a water supplier's subcatchments? Is this determination more similar to assessments of biodiversity or to salinity control? The success of an ecosystem services approach for water quality depends critically on the accuracy and cost of such assessments and, by extension, the creation of assessment methodologies for use in the field.[106]

It is worth pointing out that the assessment need not involve monetization. Most of the scholarship on ecosystem services reported in the popular press has focused on the absolute dollar value of services provided. The oft-cited Costanza et al. article in *Nature,* for example, calculated the value of nature's services at three time the planet's GNP.[107] While useful for rhetorical purposes in showing how immensely valuable services are to our well-being, such monetary estimates face serious methodological challenges and, fortunately, are not necessary in implementation issues. Most agencies do not need to bother considering how much the ecosystem services of water quality, pollination, or flood control are worth because their actions will not wipe out the service.[108] Rather, the relevant comparison is *between the control costs of built provision and natural provision of ecosystem services.* The key policy comparison in the Catskills, in other words, had nothing to do with the absolute value of the service of water provision. The key data, all other things being equal, were the cost of building a treatment plant and the cost of obtaining a similar service of water quality provision through managing the landscape.[109] And this cannot be calculated without robust biophysical modeling. While they grab headlines, monetary valuation of services is more important for rhetorical or political purposes than market design.[110]

1. Duration of Service Provision

Connected with questions of *how much* services to provide is *how long* to provide them. This is a less important consideration for regulation and taxes since, absent concerted political opposition, once laws go on the books they tend to stay there. But duration is a significant problem faced by payment strategies. While subsidized conservation projects may demonstrate temporary success, as soon as the subsidies cease, landholders often return to their previous management practices, neglecting or in some

---

106 While this paragraph has focused on service markets, the same point could be made for other policy approaches, as well. Absent a clear understanding of causation, no policy instrument can hope for more than rough effectiveness.

107 Costanza et al.

108 This presumes that such assessments are even feasible. Assessment of benefits is technically very hard to do on the margins, particularly in monetary terms. One needs to come up with an aggregate measure of what these complex biophysical processes are worth to people. This is necessarily a landscape-dependent assessment that is data-intensive. *See* Salzman ELQ

109 This assumes, of course, stasis in the existing regulatory regime and entitlements.

110 A likely reason EPA's recent creation of the Science Advisory Board on valuation of ecosystem services, for example, is to help the agency counter demands from the Office of Management and Budget that it justify its regulations through cost-benefit analysis.

cases even destroying the services they had earlier conserved.[111] As a general rule, then, one might think that the longer the contract the better. Costa Rica's PSA program provides for contracts from five to twenty years in length. The BushTender contracts are for three years, the MRFF revegetation contracts for ten years, and CRP contracts for ten to fifteen years.

Longer contracts seem preferable for both parties because service provision is locked in and farmers are ensured a steady source of income. There are three conditions, though, that might counsel for shorter term contracts. First, if the science underpinning estimates of service provision is based more on guesswork than data then the buyers may want to revisit the payments within three to five years. The consumers will want to ensure they are getting value for money and if, for example, hydrology studies show that the water quality service estimates were too high or too low for various properties, the payments should be adjusted accordingly. This was the approach that, in principle, would have been followed by MRFF and NSW State Forests. Second, if increased participation is expected in the future, then contracts may not need to extend beyond five years. Otherwise one risks losing out on the efficiency gains, i.e., increased competition for the payments would drive the price down. Finally, and most practically, not knowing what future obligations and priorities will arise, the agency may not be willing to commit funds in its budget beyond three to five years. This is what happened in the Costa Rican PSA program. The providers' answer most likely depends on their risk profile – weighing the benefits of a regular income stream against the potential lost profits of land not used for agricultural production if the commodity prices shoot up.[112]

2. Ensuring Service Provision

In addition to determining the appropriate level and duration of service provision, one must also ensure the services are, in fact, provided. This is much easier to do for certain types of instruments than others. If we are mandating or paying for specific land use practices or changes, such as in the MRFF or Perrier Vittel schemes, compliance monitoring need only consist of ensuring that trees are planted and maintained in the right place or that particular farming practices are followed. Compliance monitoring proves a good deal more difficult in mitigation markets.

As described above, for example, in terms of ensuring no net loss of wetlands acreage, wetlands mitigation banking has been a success. The implementing regulations, however, require that the mitigated wetland ensure equivalent function to the destroyed wetland[113] and in terms of conserving ecosystem services the picture has been less rosy. In the most comprehensive study to date on this issue, in 2001 the National Academy of Sciences examined the practice of wetlands compensatory mitigation. The very first of the Committee's Principal

---

111 For an example of this in the New Deal efforts to prevent erosion, *see* Elmendorf at 495.

112 From the service providers' perspective, game theory might suggest a preference for short-term contracts so they can adjust their bids more quickly the next time there is a service auction. As described earlier, though, the profit to be gained through changing land use management will be strongly influenced by the costs of conversion in the first place.

113 The *Federal Guidance* provides that "[t]he number of credits available for withdrawal (i.e., debiting) should generally be commensurate with the level of aquatic functions attained at a bank at the time of debiting." Federal Guidance*, supra* note xx, at 58,611. Studies of wetland restorations have found a remarkably low rate of success. The Florida Department of Environmental Regulation found a success rate of forty-five percent for tidal wetlands creation, twelve percent for freshwater wetlands creation. Veltman, *supra* note xx, at 669.

Findings was that "the goal of no net loss of wetlands is not being met for wetland functions by the mitigation program."[114]

There are two reasons for the failure that designers of service markets need to recognize. The first concerns the trading currency. Most mitigation banks use the simple metric of acreage as the trading metric – one acre of destroyed wetland for three acres of restored wetland.[115] This is fine if the goal is no net loss of acreage, but useless if the goal is no net loss of services, since the acreage currency is unable to capture any relevant information on service provision.[116] Banks chose the simple currency to ensure the market remains thick, i.e., so that transaction costs to assess trades are low enough that trading remains attractive. As the currency is refined, capturing service provision as well as acreage, for example, the costs of the trade increase, potentially thinning the market.[117]

The second reason concerns the structure of the mitigation market. In most markets, the buyer ensures quality. Consider when you buy a bicycle. If you find that your bike doesn't brake properly or the seat slips you will be quick to return it to the store for a refund. In a mitigation market, by contrast, the buyer does not care about the quality of the mitigated wetland. All the developer wants is a permit to build the mall. The cheaper she can get the permit, the better. Nor does the seller (the mitigation bank) care about the quality of the mitigated wetland, so long as she can get the Corps of Engineers to sign off on the bank. As a result, it falls on the regulator, who does not have a personal stake in the transaction, to ensure quality and both the Corps and EPA have very spotty records in this regard.[118] Thus, while mitigation markets hold great promise, we can expect that service markets where the buyers and sellers have a direct stake in the quality of service provision stand a greater chance of success.

V. Melding Theory and Practice – Instrument Choice in Robertson

---

114 NAS Report, *supra* note 28, at 2.

115 *See* Salzman & Ruhl, *supra* note xx, at xx.

116 Banking has also led to trades that move wetlands out of areas where they may provide valuable services to urban populations and into sparsely populated areas where, most likely, their service provision is either redundant or less valuable. For example, a recent study of wetland banking in Florida found that trades, even in the same watershed, have produced "a transfer of wetlands from highly urbanized, high-population density areas to more rural low-population density areas." Dennis King and L. W. Herbert, *The Fungibility of Wetlands*, 19 NATIONAL WETLANDS NEWSLETTER 10, 11 (1997). In other words, as can be expected from a market efficiency perspective, developers want to develop wetlands where land is dear (urban) and wetland banks want to locate where land is cheap (rural).

117 Florida is the only state that has directly addressed this issue. A law passed in 2000 requires state and local agencies engaged in wetland mitigation banking to adopt a uniform wetland mitigation assessment method that "must determine the value of functions provided by wetlands and other surface waters considering the current conditions of these areas, utilization by fish and wildlife, location, uniqueness, and hydrologic connection." Fla. H.B. 2365, § 4 (2000) (amending Fla. Stat. § 373.414(18)).

118 Virginia C. Veltman, *Banking on the Future of Wetlands Using Federal Law,* 89 NW. U.L. REV. 654, 670 (1995) ("The California State Coastal Conservancy sponsored a review of fifty-eight permits issued for creation and restoration projects in the San Francisco Bay Area between 1978 and 1983. The report found that only two of the fifty-eight projects could be deemed successful."); Lawrence R. Liebesman & David M. Plott, *The Emergence of Private Wetlands Mitigation Banking*, 13 NAT. RESOURCES & ENV'T 341 (1998) (discussing a Florida state agency study finding a 27 percent success rate of such projects).

Assuming we have identified the desired service, understand how it is provided, who provides it, who benefits from it, and how much we want, we can then turn to issues of instrument choice. Put simply, we now know what we have to do. The problem is how to do so most efficiently and equitably. Perhaps surprisingly, this area has received very little consideration in the ecosystem services scholarship to date.[119]

A. The Sydney Catchment Authority

To make this discussion more concrete, I will use as an example a pilot project I helped design for the Sydney Catchment Authority while in Australia. The Sydney Catchment Authority (SCA) was created in the uproar following detection of cryptosporidium in Sydney's drinking water in 1998.[120] A royal commission formed to examine the outbreak concluded that there was inadequate management of the watershed as a single entity. As the report stated, "The most effective element in the multiple barrier approach to water quality is effective catchment management. Every effort should be made to prevent contaminants from entering catchment waters."[121] In response, the State Parliament created the SCA, charging it with management and protection of the catchment areas and infrastructure across 16 local government areas. In many respects, the SCA was explicitly created as an "ecosystem service district," responsible for ensuring the landscape of greater Sydney provides the service of water purification.[122]

In the context of new land uses, the SCA exercises considerable authority. Development activities that require permit approval must be commented on and, in many cases, approved by the SCA.[123] The SCA has considerably less authority, however, when it comes to regulating *existing* land uses. Indeed, it has no direct authority absent serious pollution

---

119 As John Echeverria noted recently,

> The choice between regulation and acquisition represents one of the most fundamental issues in U.S. environmental legal policy. But the issue has received remarkably little attention, either as a matter of theory or practice. Academic commentators can frequently be assigned to one "camp" or the other, but little scholarly attention has focused on <u>why</u> one option should be preferred over another. Practicing conservationists can be roughly grouped as "land dealers" or "regulatory hawks," but these different camps pursue their agendas quite independently from each other and rarely communicate about how pursuit of one strategy might interact with – or even conflict with – the other.

John Echeverria, *Buying versus Regulating to Achieve Conservation Purposes* (2003).

There is an enormous literature on the pros and cons of various tools for land conservation that promote biodiversity or open space. There is very little, by contrast, on other ecosystem services. The most useful law review publication in the context of water is Buzz Thompson's analysis of policy instruments to ensure instream water flows. *Markets for Nature*

120 A cryptosporidium outbreak illed over 100 people in Milwaukee in 1993. The outbreak in Sydney occurred during the run up to the Sydney Olympics and residents had to boil their water for two months. Fortunately, it turned out be a benign strain.

121

122 Heal et al.

123 Interesting institutional issues raised by the fact that the SCA comments on and, in some cases, approves or rejects proposed land use changes that traditionally would have been the sole decision of the local councils.

incidents, relying instead on an assessment process that does little more than identify land uses that degrade water quality.

My field work was carried out in the Robertson Township, a lovely farming area southwest of Sydney in an area known as the Southern Highlands. Robertson's main claim to fame is its role as the location for the popular pig/dog/sheep movie, "Babe." The SCA's interest in Robertson stems from concerns over eutrophication (excessive nitrates and phosphates leading to algal blooms) in the Wingecarribee Reservoir downstream from Robertson. The SCA's field staff believes that most of the nutrient loading comes from manure leaching into streams from the dairy farms in the catchment. The staff also contends that fencing off stream banks, known as riparian fencing, would significantly reduce the flow of nutrients into the reservoir. Installing riparian fencing, they argue, would increase provision of the ecosystem service of water purification, provided by vegetative uptake of nutrients and phosphate, in addition to trapping of sediment and suspended solids that would reduce turbidity downstream. Given this situation, the SCA wondered, which policy instrument makes the most sense? While the rest of Part V focuses on the problem of nonpoint source pollution and the service of water purification, the analysis has important implications for other ecosystem services, as well.[124]

B. Payments as the Optimal Instrument

In this section, I wish to argue that a payment scheme is the optimal policy instrument for the SCA and, perhaps more controversially, to explore when payments should be the preferable policy instrument for provision of most ecosystem services. In cases of information asymmetry, heterogeneous preferences and heterogeneous service capacity, competitive payment schemes can provide more effective and lower cost results than traditional regulation or tax approaches. They can also, however, potentially lead to unintended, counterproductive results. Indeed, payment schemes can lead to what some might view as quite disturbing policy implications. Section C explores these issues, examining three strong objections that have been raised by researchers against calls for service payments – namely, violation of the polluter pays principle, the inefficiency of subsidies, and creation of conditions for extortion.

1. Information Asymmetry

At the outset, it helps to think of the SCA's service provision problem described above as a problem of asymmetric information.[125] There is no doubt that landowners know their property better than the government. We often think of such information asymmetry as a negative problem. In the context of the Endangered Species Act, for example, it has given rise

---

124 As noted below, there is an extensive literature on conservation payments, some of which operate as competitive markets. There is also a large literature on payments for water, though most of this focuses on payments for water quantity rather than services such as instream flow or water purification. There is remarkably little scholarship, though, contrasting these markets, which differ in important respects. The distinction is important, because researchers working in the same area can draw very different "general conclusions" depending on whether they are focusing on a "water case" or a "biodiversity case." For a similar point on the importance of case studies and general conclusions, *see* Carol Rose. Cite YLJ Symposium on Calabresi & Melamed. For the relative volume of scholarship on policy instruments to promote biodiversity compared to other services, *see infra*, note xx.

125 Latacz-Lohmann and Van der Hamsvoort 1998

to the "shoot, shovel, and shut up" mentality, where landowners actively drive endangered species from their land before the government learns of their presence or alter their land to make it less attractive as habitat.[126] Indeed, the importance in maintaining this information asymmetry may explain in part the vociferous, and successful, opposition to the proposed National Biological Service that would have inventoried biodiversity and habitat across the nation.[127]

Information asymmetry need not have negative consequences, however. After all, landholders know both the opportunity cost of a specific land use change and the price they are willing to accept to implement this change.[128] For its part, the government agency or water supplier knows how much it is willing to pay and which types of land use changes would be most valuable for service provision. The design challenge is how most efficiently to transfer this information from one party to another in a mutually reinforcing fashion.

Prescriptive measures are inefficient at information exchange for the simple reason that they are primarily a one-way discussion – the government telling regulated parties what they can or cannot do. The farmer's knowledge of which land use changes are least cost is ignored. While notice-and-comment rulemaking ensures the discussion is not entirely from the government to regulated parties, this does nothing in the instance of specific application and is a classic shortcoming of Best Available Technology approaches.[129]

Financial penalties suffer the same shortcoming. It falls entirely on the government to determine not only which actions to encourage or discourage but how much financial penalty is needed to induce the appropriate behavior, as well. In theory, one might imagine a perfect Pigouvian tax that internalized externalities but, as with regulation, the costs of gathering such information would be high. Persuasive instruments can foster information exchange but, as voluntary approaches, their success will necessarily be spotty.

a. Payment schemes

And what about payment schemes? Of the four classes of governmental intervention, one might assume that payment schemes hold the greatest promise of ensuring information exchange between government and regulators. After all, at their core markets are simply an exchange of information about willingness to pay and willingness to accept. The market mechanism necessitates that each side reveal information to the other. Indeed, if set up carefully, payment schemes can shift the information burden to the landowners. In the BushTender market, for example, farmers now have an incentive to "self-identify" themselves

---

126 Elmendorf at 432, citing Polasky and Doremus, Lueck and Michael

127 Elmendorf at 437.

128 Stoneham. There is another distinction in the type of information worth noting, as well. In the negative case, the information relates primarily to what the landowner does on her property. In the positive case, the information concerns more the services provided by the land.

105 One could certainly imagine an ambient approach that allowed more flexibility at the level of source-specific regulation but, as noted in the discussion at page xx on field assessments, the information costs for such an approach are significant.

as potentially valuable service providers.[130] This can considerably lower the cost of information gathering. As demonstrated above, it is difficult to obtain the sort of information necessary to precisely target a regulation, tax, or general subsidy. Payment schemes can create a mechanism to shift the costs of providing this information, but the scheme must be carefully designed, for without the landholder's information, the government is at risk of overpaying. Without the government's information, the landholder has little sense of the relative value of land use change or how to optimize her service provision.

There are four basic types of payment schemes to consider. The fundamental question in comparing them is which results in the lowest cost per unit product (i.e., marginal improvement in water quality).[131] The simplest type is *general subsidy*. Decide how much you are willing to pay for certain types of land use measures that will increase service provision and work off of a "first come-first served" basis or off a loosely prioritized scoring system such as the one used in the CRP.[132] Such an approach has lower information and administrative costs than other payment schemes described below and, when scientific uncertainty is greatest, may avoid errors of being too specific and guessing wrong. It may also allow for a period of experimentation to see which sort of land management changes provide the most benefit. General subsidies, however, cannot meaningfully distinguish between those parties who can provide high value services and those who provide low value services. This was the problem with the PSA program in Costa Rica. Indeed, given the opportunity, one would expect farmers to propose changing the management of their least productive land which may or may not correlate with service provision.[133]

Does fencing off a particular stretch of stream provide valuable services? A flat subsidy program cannot determine this, nor does it care. As a result, the program will almost certainly not ensure value for money, nor will it likely spur farmers to think of service provision as a viable "crop." While designed as a more tailored scheme (similar to the reverse auction described below), in practice the CRP has effectively operated as a general subsidy, with loose scoring criteria and a none-too-secret clearing price. One could, of course, imagine a general subsidy scheme that effectively encouraged service provision (e.g., with more precise requirements for eligibility) but, as with regulations and taxes, the information requirements to get it right would be considerable.

In contrast to a subsidy approach, an ecosystem services payment scheme should start with the assumption that different landholders can provide different levels of service and should be compensated accordingly. One obvious mechanism for such targeted payments is *direct negotiation.* The service beneficiary sits down with the service provider and strikes a deal.

---

130 *See* Thompson, *supra* note xx, at 280.

131 This analysis assumes we wish to change behavior rather than purchase land in fee simple. Fee simple purchase might be appropriate in the case of particularly significant biodiversity habitat or watershed lands, but one would be restricted to the options of negotiation, reverse auction, or condemnation.

132 Subsidies can also take the form of tax credits, tax deductions, technical assistance, or cost-sharing schemes.

133 Indeed, in some instances fixed payments can reveal the opposite information that either side wants to know. The farmer reveals the actions he thinks will be most environmentally significant to the government while the government reveals the acceptance price. Stoneham et al. 2002

This is the approach used in the PSA Program in Costa Rica and by Perrier Vittel in France. It has the advantage of allowing individually crafted agreements but can be labor intensive if carried out with a large number of landholders. It also lacks the mechanism of farmers competing against one another to provide services and requires the purchaser to assess accurately the landholder's willingness to accept. Perhaps most important, because the negotiations will likely take place in a serial fashion, it may be hard to develop a catchment-wide strategy for service provision measures if proceeding farm-by-farm.

Reverse auctions are used in the BushTender and Environmental Services Scheme models and rely on a publicized competition among landholders who provide sealed bids to the government of how much they are willing to accept for changes in land use management. BushTender's benefits include effectively communicating goals to the target community, getting farmers to weigh the costs and benefits of land use changes (deciding for themselves which actions to undertake), and changing the way landholders think about the benefits their land produces. Reverse auctions are also well suited to a situation of monopsony, when there is only one buyer and many sellers and, based on the results of the BushTender pilot, would appear to provide the ecosystem service of biodiversity from private lands in a far more cost-effective manner than general subsidies. If there are few sellers, though, there are potential problems of bid-rigging through collusion.[134]

A final option is to follow the New York City example of *paying a third party*, either local government, an existing group such as Landcare, or a specially-created funding body rather than the landholders directly. While a reasonable strategy for ensuring the proper disbursement of millions of dollars, this may be too administratively burdensome for smaller scale programs. Moreover, it simply passes down the problems detailed above – the difficulty in determining how much to pay for particular actions.[135]

In the negotiation and reverse auction approaches, the government lets the landholder know the non-market values of the land. This may prove a wise strategy because it provides an opportunity for the landholders to internalize these values and lower the price they would be willing to accept for changing their land management (as appears to have happened in the BushTender scheme). Conversely, though, this may cause the landholder to raise her price because of the now realized scarcity of her service provision (as appears to have happened with land purchases in the Catskills).

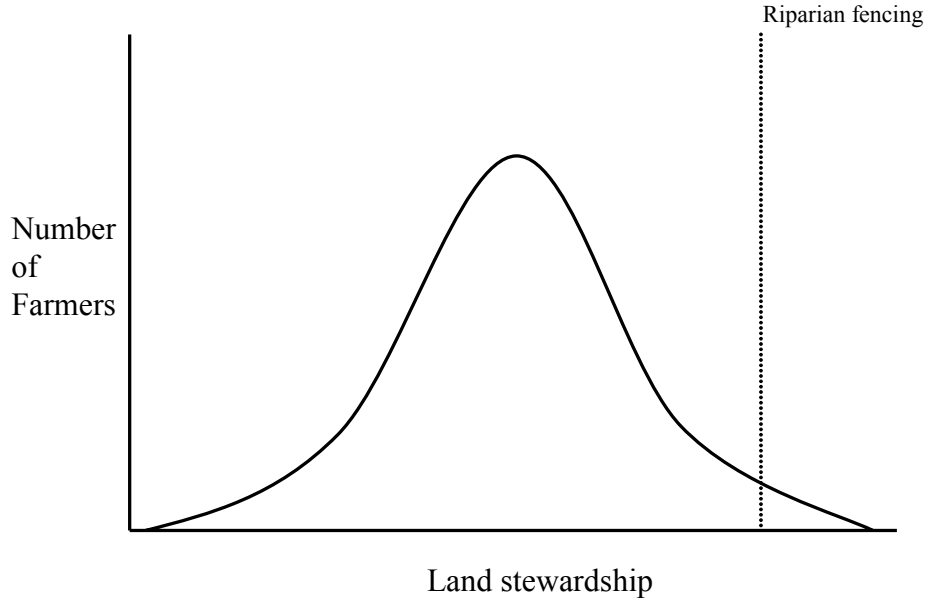
2. Heterogeneous preferences and service capacity

---

134 Spurred by the spectrum auctions in the 1990s, there is a well-developed economics literature on auction design, addressing issues such as how much information should be revealed, multiple round auctions, etc., that could be applied to service auctions, as well. *See, e.g.,* Stoneham, *supra* note __, at xx; John McMillan, *Analyzing the Airwaves Auction*, J. OF ECON. PERSPECTIVES, 10, 1996.

135 Scholars have proposed a number of different third-party models. Chris Elmendorf, for example, calls for the creation of landowner-controlled special districts. *Cite.* Buzz Thompson has suggested environmental brokers. *MFN* at 308-309. And Geoff Heal, myself and others have urged the creation of Ecosystem Service Districts. *SELJ.* To date, however, these remain merely proposals.

Payment schemes are also attractive policy instruments because of heterogeneity in the target audience. The Sydney Catchment Authority's goal is deceptively straightforward – reduce nutrient runoff from land upstream of the Wingecarribee Reservoir at lowest social cost. The target audience consists of landholders, mainly farmers. It stands to reason that, in the absence of significant government intervention, there will be a normal distribution of land care practices in the catchment. The bell curve below, for example, shows the range of preferences for land stewardship.[136] At one end will be those who will refuse to alter their land management practices unless forced to do so. They are balanced at the other end by those who already manage their land in an environmentally sensitive manner and have no need for government inducement or sanction to do so. Most farmers are in the middle of these extremes, willing to change their land uses to provide more services but concerned over the costs involved.[137] To display this in a concrete setting, those farmers who have put in place riparian fencing are to the right of the dotted line on the graph (though this could just as easily represent farmers who have built swales to reduce erosion or barn drain systems to collect manure). We will assume that these preferences are relatively stable over time.

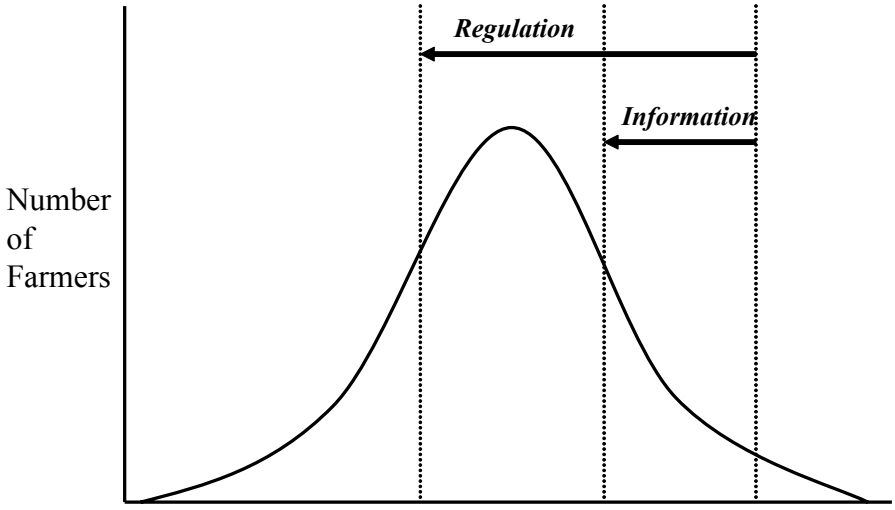


One might expect that the challenge for the policy analyst is how best to change the behavior of the middle group of farmers – graphically, to shift the riparian fencing line to the left. Some instruments will prove more effective than others. As shown below, for example, an information approach such as field visits and demonstration projects may increase the number of farmers who put in riparian fencing. But it's likely that a regulation requiring riparian

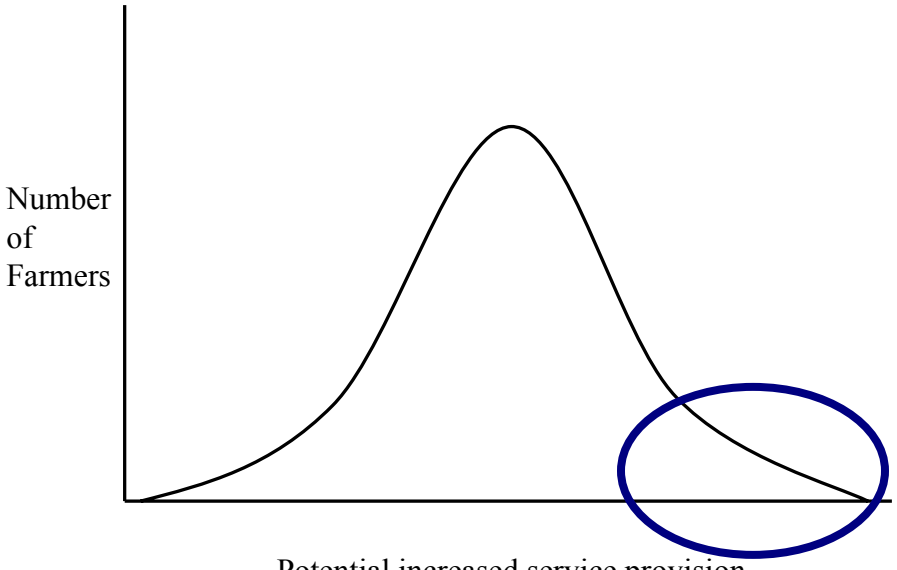
136 Carl Binning, Greening Australia

137 For a more sophisticated description of the range of farmers' land stewardship preferences, *see* the scholarship of Gerry Walters, as cited in Elmendorf at 442.

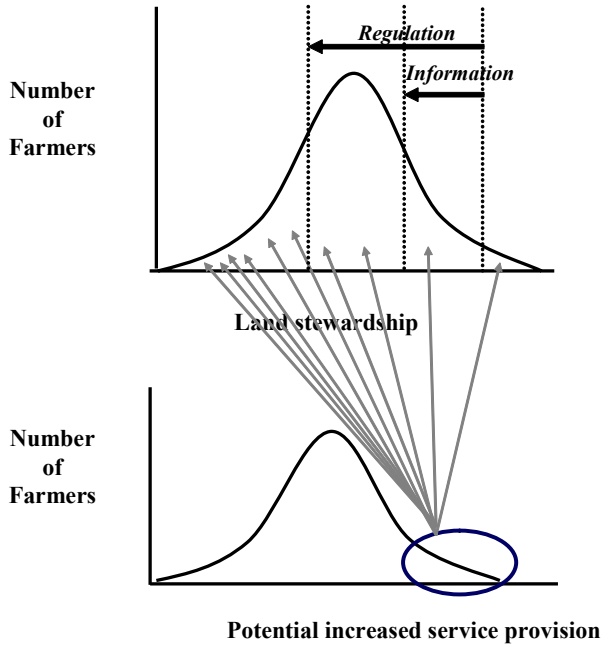
fencing for farms with more than 100 head of cattle, for example, will target an even larger group.



While seemingly obvious, this kind of analysis is misguided if we care about efficiency. The proper analysis is more complicated because the *potential provision* of services by landowners is also heterogeneous. Riparian fencing on some farms will be more effective in reducing algal blooms than fencing on other farms, depending on distance from the reservoir, land slope, number of cattle, proximity to a watercourse, etc. Put simply, landscape context matters. Indeed, one can expect a normal distribution of potential provision of services, as shown below.



As a result, we don't really care about changing the behavior of most of the farmers. This is an example of the "80/20 rule" so common in business management. We may be able to obtain 80% of the desired result by focusing on 20% of the actors (the group circled above). The problem, though, is that a priori we often don't know who these farmers are. Importantly, there is no reason to think that those farmers with the greatest capacity for increased service provision are also those with the greatest preference for land stewardship activities. In fact, the relationship is likely to be *the opposite*, since those who care most about land stewardship will likely have already put in riparian fencing and thus have a low capacity to further increase their service provision. This is depicted below by combining the land stewardship and potential for service provision graphs.



If these figures accurately represent the distribution of land stewardship preferences and the potential for increased service provision in a watershed, then regulation will likely be inefficient. To change the behavior of the target 20%, prescriptive regulation will likely have to be significantly over-inclusive, requiring land management changes for most of the farmers when only a relatively small number are relevant. Making the regulation more restrictive will increase the number of target farms but, equally, require costly land use changes in farms that contribute little to the problem. While one could imagine a regulation that required riparian fencing for all landholders that contribute significantly to eutrophication (e.g., requiring fences where runoff is above X kg per year and has a travel time to the reservoir within 6 hours), we don't often see regulations like this in real life. Much more common are regulations that identify targets based on proxies such as technology or size.[138] In our case, that would present itself as applying to farms with over 100 head of cattle or to lands adjacent to watercourses that feed into the reservoir. This will help narrow the regulated audience, but still result in overbreadth.

Financial penalties are no better. One could imagine taxing farms per head of cow or as a function of proximity to the reservoir, with taxes reduced if riparian fencing is in place. But this will surely be overinclusive, as well. As with regulations, one could certainly imagine Pigouvian taxes on nonpoint pollution that contributed to eutrophication in the reservoir, but the information burden on the government to generate this information would be daunting. Depending on how the instrument is applied, one can see why in some instances (and perhaps many), the social costs of taxing or regulating for discrete service provision will be higher than

138 One might point to the possibility that states can impose tailored, facility-specific regulations to account for heterogeneity (through airshed modeling) under State Implementation Plans in the Clean Air Act. Whether this often this occurs in practice, though, is less clear. Squillace

necessary because they end up over-regulating landowners who aren't the source of the problem or the solution.[139]

Payment schemes will be over-inclusive, as well, if operated as general subsidies. Directed payments, however, can be narrowly targeted to those farmers (our circled 20%) who are interested in changing land use practices *and* have a high potential for service provision. As noted above, this is the case because payments shift the information burden to the landowners. Farmers now have an incentive to self-identify themselves as potentially valuable service providers, hopefully as members of the targeted 20%. Not only does this considerably lower the cost of information gathering, but because farmers are being paid, because money is on the line, one might expect the beneficiaries to pay more attention to compliance than might be the case with the threat of regulatory or tax compliance monitoring, thus lowering both compliance and enforcement costs.[140] Indeed, if the experience of BushTender is any guide, one can expect some farmers to lower their acceptance price.[141]

C. Critiques of Payments and Their (Sometimes) Disturbing Implications

At this point in the argument, or perhaps earlier, you may have started forming some nagging doubts. Service markets may seem like clever and, in some cases, perhaps optimal mechanisms for encouraging provision of ecosystem services, but difficult issues need to be confronted. 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 farmers never had? Perhaps most centrally, service markets raise the fundamental question of when we should pay for land use changes rather than coerce them, and what this means for our understanding of landholders' rights and responsibilities. The following sections explore these difficult issues, addressing in turn the problems of violating the polluter pays principle, the perverse incentives of subsidies, and extortion. Each criticism, while perhaps valid in theory, proves to be less persuasive in practice for many services. At worst, this suggests that payments may sometimes

---

139 A related issue which I do not analyze in this article is the cost of administration. This will likely be higher up front for negotiation and reverse auction schemes than for general subsidies, regulation and taxes because of the costs of contracting. As described below, this will be reduced by the presumably lower costs of compliance monitoring and enforcement. As the Australian projects continue, there should be good empirical data that can address these questions.

140 In the context of markets for instream flows, Buzz Thompson suggests that payments may "lead to the development of significant new conservation measures… [that] could be substantial." Thompson, *supra* note xx, at 276.

141 In his study of attitudes among rural landholders, Elmendorf suggests why this phenomenon might occur in the context of paying for familiar values (such as open space) prior to paying for biodiversity:

> Positive financial incentives also imbue ecological resources with a new use value. When the environmentalist appeals to the landowner's core values - tradition, use, etc. - she challenges wise-use oppositions, and it is here, on the personal, experiential level, that the challenge is likely to connect. With personal rapports established, cognitive dissonance starting to work, and social meanings changing, the environmentalist is finally positioned to negotiate protections for biological diversity. The price probably will be lower and the level of compliance higher than if the environmentalist had made biodiversity the main object of her offers from the beginning.

Elmendorf at 469

be no better than a second-best solution, but in the practical world of environmental protection, it may be that some second-best solutions are still worth striving for.

1. The Polluted Pays Principle

The pilot project proposed for the Robertson subcatchment suggests a tension. Those farmers who have already put in riparian fencing no longer have a significant potential for increased service provision 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's hard to imagine a practical scheme, for example, that pays everyone whose vegetation reduces nutrient flow in the watershed. As the examples in Section III demonstrated, ecosystem service approaches are best suited to the case of heterogeneous land management – i.e., where, in encouraging provision of a public good, the agency desires specific land management in discrete parts of the landscape.[142] If one seeks to pay for discrete cases of ecosystem service provision, however, clearly some land uses are more important than others. But how should one decide who gets paid and who does not?

In the case of Costa Rica, landholders are being paid to keep their lands forested – these are conservation payments *not* to change the land use, to maintain current practices. This is comparable to paying for temporary conservation easements. In the case of New York City, payments are made both for maintaining the status quo and, in some cases, for changing land use practice. In significant contrast to the Costa Rican example, though, some of those being paid are in many respects also causing the problems. Some dairy farmers' cows, for example, are providing significant nutrient loads in the streams and the farmers haven't built sufficient infrastructure or established riparian vegetation to take up the nutrients before reaching the streams.

Which landholders should be supported by ecosystem service payments – those who currently provide services or those whose properties pose the greatest nutrient or sediment problems (and hence the greatest potential for increased service provision)? This proved a real conundrum for the SCA pilot project and will be confronted in many service markets. 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 streambank 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, 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 that affect 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?

---

142 As discussed *infra*, if certain types of land management are desired throughout the landscape, then regulations or taxes are likely more effective since transaction costs are lower than with direct payments and overbreadth is not a major concern.

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?

a. Property rights analysis

It is helpful to think of these questions as problems of property rights and externalities, for this is likely how most farmers think of them. Property rights play out in this analysis in two ways – allocation of rights and unclear rights.

The traditional law and economics analysis of our situation might go something like this: Farmer has the entitlement to graze cows on her farm and have her soil and nutrients flow into the watercourse after storm events. Water supplier wishes to alter this entitlement to ensure a supply of clean water in the downstream reservoir. Farmer and Water Supplier engage in a Coasean solution where Farmer is paid compensation for the costs of riparian fencing, maintenance of the fencing, and lost grazing pasture. This is comparable to the PSA program in Costa Rica and other payments not to change land uses. Landholders have a clear entitlement to log their forests and are being paid to forgo this activity. The stick of a conservation easement has been added to their bundle of rights.

Our case is more complicated, though, because the entitlements are less clear. Imagine, for example, a property owner who wishes to burn brush on her property. While she might argue that her right to do whatever she wants with her landholding is absolute, property rights are not absolute and likely never have been.[143] In this instance, the law immediately recognizes at least two limitations. A duty of care may exist under statutory law (e.g., a party may not emit air pollutant particles in excess of 100 parts per million)[144] or common law precedent (e.g., a property owner pays for nuisance harm caused by downwind air pollution).[145]

In the water quality context, the relevant question becomes – do farmers have the right to manage their land so that manure and soil run off into watercourses and, if so, does a corresponding duty of care limit this right? After all, farmers surely should not be paid to reduce their pollution loads if they never had the right to pollute in the first place. To demonstrate this in an absurd example, one might argue that farmers should not be paid to reduce their water pollution any more than I should be paid to stop mugging people.[146]

---

143 Singer, Gibbs

144 CAA regs

145 cite Ducktown and some other private nuisance cases where damages must be paid even though activity continues

146 Mike Young example

But is this an apt analogy? This sounds absurd only because I clearly don't already have the right to do so. My duty of care in this case is clear – I have no entitlement that I can exchange for payment because criminal sanctions already prevent me from robbing people. But is the duty of care sufficiently strict and clear in the land management context such that paying farmers not to allow manure and soil into watercourses sounds equally absurd? At least at the moment in Robertson, the answer is "probably not." Otherwise, payments would seem ridiculous because regulations already made riparian fencing and grass swales mandatory.[147] And absent a clearly defined duty of care, the argument for payments becomes much stronger.

Payments are being used to clarify the standard of care so that it benefits the public – i.e., farmers are being paid not to exercise their right to allow manure and soil to flow into watercourses. Realize, though, that in paying farmers to change their land management practices, the government is now effectively acknowledging (and perhaps redefining) the farmers' entitlements. As Young and Shi have argued, this is the "point where the 'polluter pays principle' ends and the 'beneficiary pays principle' begins."[148]

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? 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? This turns out to be a less than compelling argument because, as noted above, payments to the factory only seem silly because the duty of care for factory pollution has clearly been established. And, more important, if we want them to exceed the current standard to obtain even cleaner air we essentially do pay them. In the EPA'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.[149] And trading schemes reward companies that emit less than permitted by allowing them to sell their excess allowances.[150]

And what about payments in the context of wetlands regulation? The implication of the argument would seem to be that, instead of the prescriptive regulation of the 404 permit

---

147 The answer is not definitive because, while there are laws on the books that perhaps could regulate nonpoint source pollution, they are either ineffective or not implemented. Whether this state of affairs justifies calling the farmers' ability to emit nonpoint source pollution a property right or a de facto entitlement is debatable. We return to this point, and the extensive literature on allocation and definition of property rights, *infra*, at page xx.

148 One of the main conclusions of the Wentworth Group, for example, was that:

> We need to provide financial support to landholders who supply environmental services to the rest of the community above agreed definitions of duty of care… Paying for the delivery of such services is not "farm welfare," it is recognising the value of these services.

Wentworth Group, Blueprint for a Living Continent (p. 13, 2002). This fails to note what we should do, however, when the duty of care is not clear.

149 Hirsch

150 Tietenberg

process, we should pay wetland habitat owners not to develop them.[151] Why might this seem like a foolish suggestion? In part, because paying nationwide for wetlands protection would be extremely expensive and, in part, because the alternative we've already adopted seems to work pretty well and is "free" for the general public. Because the program is enforced, it establishes an effective baseline presumption in the field *against* the right to develop wetlands.

But keep in mind what the program is trying to achieve, as well. If our sole concern were the service of water purification provided by wetlands, the 404 program would be a tremendously inefficient means of service provision, since conservation of many (perhaps most) wetlands would have little impact on drinking water quality. The nationwide, uniform 404 permit regulations make most sense because we have reached a political decision that the *combined* contributions of wetlands to social welfare (including not only the services of water quality and flood control, but also wildlife habitat, recreation, and non-use values) justify a uniform regulatory approach and is far more efficient than a complicated, multi-factor assessment of each wetland's contribution to these multiple values would be. In the sole context of water quality, by contrast, a payment system might be preferable if we can easily identify the extent to which particular habitats and management practices affect water quality. Realize, though, that this logic cuts both ways. If our concerns over nonpoint source pollution were generalized, and not focused on water quality in particular local reservoirs, then payments likely would *not* be the preferable policy instruments.[152]

Finally, what are the implications of the argument for payments in the biodiversity context? There, the core assertion of property rights advocates has long been that property owners with endangered species on their land should have their critical habitat purchased by the government rather than effectively having it zoned against certain types of development with no compensation.[153] At issue are both the definition of property rights and when compensation should flow from infringing those rights through regulation. The cost borne by these landowners, critics of payments contend, is the price of living in a society where benefits and burdens are not evenly distributed.[154] To require payment in all such cases of regulatory takings, one might go on to conclude, would virtually stop government.[155]

---

151 explain 404 permitting process

152 Thus if our primary concern were hypoxia and the dead zone in the Gulf of Mexico caused by run off along the Mississippi, for example, the information needs would be low – we want a large overall reduction in nonpoint source pollution throughout the river's watersheds -- and we'd likely be best served by broad restrictions on nonpoint sources.

153 PERC, Karkkainen

154 A number of scholars, Eric Freyfogle in particular, take a different tack, arguing that property rights are a construction of public policy and must yield to environmental needs. As Elmendorf describes,

> Freyfogle often argues that the law should embody and express the idea that landowner prerogatives are everywhere secondary to ecological health. The central charge of property and land-use law is to specify duties to the land community, and to fairly apportion the burdens of conservation among owners of ecologically comparable lands. Landowners have no legitimate objection to disparate treatment unless the disparities are ecologically incongruous.

Elmendorf at 500-501

155 find quote

The similarities with water quality from farming seem striking. In the biodiversity case, the landowner isn't compensated for the public good of endangered species conservation and, unlike wetlands, the benefit is discrete and habitat relatively easily identified. Given that, the argument that we should use nationwide regulations because we cannot adequately account for heterogeneity seems inapt. One might contend that, as in the case of pollution, the duty of care has been established by Section 9 of the Endangered Species Act, so payments are unnecessary. But this political fact does not demonstrate that prescriptive regulation should always be the preferable policy instrument. Indeed, in countries without the statutory hammer of the Endangered Species Act (i.e., most of the world), payments for biodiversity protection are commonplace.[156]

There is an immense literature on the nature of property rights and regulatory takings that goes well beyond the scope of this paper.[157] My immediate claim is modest – if one applauds the practice of ecosystem service markets in the case of water purification, acknowledging that they may be preferable to coercive measures, one must also acknowledge that payments may be a more appropriate instrument than regulation for certain aspects of biodiversity conservation.[158] We return to this point at the end of the article.

The second way property rights play out is through the prism of externalities and poorly defined rights. As noted in Section II, the farmer who has already put in riparian fencing is not being paid for the benefits of water purification her vegetation provides. They're public goods enjoyed by downstream consumers for free. But because the landowner can't get anyone to pay for the service, because she can't effectively exercise a property right to the clean water she has generated, there's no financial reason to continue to provide it. From this vantage, by paying the farmer, we're doing no more than overcoming the market failures that arise from public goods and poorly defined property rights.

Implicit in this argument is the assumption that the farmer is generating a good rather than imposing a harm. I have characterized her actions as providing the beneficial service of water purification. But one can equally describe the farmer's actions as classic nuisance – putting something in the water (increased sediment or nutrients because of the lack of vegetative cover) that flows off her property and harms those downstream. There does not appear to be a clean way to determine which description is more accurate beyond reaching deeper to one's vision of the nature of property rights (e.g., communitarian versus individual). In addressing a comparable dilemma, Justice Scalia argued in *Lucas* that a legislature's description of an action as harm preventing or benefit conferring is too malleable to serve as a guide for judges.[159] Instead, he stated, traditional common law nuisance principles should

---

156 *See* Silver Bullet, *supra* note xx, at xx. Indeed, they're common in America. Cite to FWS "Partners for Wildlife" program, Nature Conservancy, etc.

157 cite *Lucas* and progeny articles.

158 This is one a number of issues J.B. Ruhl and I are currently addressing in a draft article, tentatively called, *The Polluted Pays Principle.*

159 *Lucas* pinpoint cite. Professor Peter Byrne has observed that this schism of describing activities as providing benefits versus causing harm mirrors closely Nineteenth Century debates in America over takings. Personal Communication, October 23, 2003.

guide the characterization; but this simply laid himself open to charges that the common law is just as manipulable.[160] We return to this dilemma at the end of the paper.

b. Voting rules analysis

While written in a different context, scholarship by Jonathan Wiener on the influence of voting rules on instrument choice in international environmental law sheds useful light on our analysis.[161] Using the climate change negotiations as an example, Wiener's basic point is that the choice of voting rule affects the choice of policy instrument. Wiener identifies a spectrum of rules, from a "Fiat" rule, where the sovereign authority can compel participation by dissenters, to a "Majority Rule" (so long as over 50% of the voting body supports the action), to a rule of "Voluntary Assent," where the lack of a sovereign authority among nations means that rules bind only those who wish to be bound, and finally to a "Unanimity" rule.[162] Of particular relevance to our concerns, in the shift from domestic to international law, there is a corresponding shift from a Fiat rule to a Voting Assent rule. In such a setting, ensuring meaningful participation is no easy matter because regulatory targets can now walk from the table. Since there is no coercive force to require participation by independent sovereign nations, in other words, each party must be persuaded that compliance with the agreement is in its best interest. A necessary implication of this state of affairs, Wiener argues, is that:[163]

> the "Polluters Pay Principle" cannot succeed under the Voluntary Assent rule. Under such a voting rule, polluters will simply decline to participate in a regime that imposes net costs on them. Trying to establish such a regime will encounter stalemate…
>
> Under the Voluntary Assent voting rule, regulatory instruments must instead follow a "Beneficiaries Pay Principle." The beneficiaries of global environmental protection must attract non-beneficiary sources to participate, because the former cannot compel the latter to comply under Voluntary Assent. This is the converse of the standard approach in national regulatory law. In the national context, we customarily think of forcing sources of externalities to internalize the external costs of their activities. But when the sources can choose whether to internalize their externalities, they might often choose not to do so. Our conventional notions of pollution regulation are built on the crucial unstated premise that Fiat or Majority rule enables sources to be compelled to participate. Under the Voluntary Assent rule, this coercive power is missing, and instrument choice must be differently conceived. Instead of forcing the source to pay for the external costs of its activities, the beneficiaries must pay for the external benefits of restricting the source's activities… [U]nder Voluntary Assent every loser must be paid to play.

---

160 law reviews

161 *See, e.g.,* Jonathan Wiener, Something Borrowed for Something Blue: Legal Transplants and the Evolution of Global Environmental Law, 27 ECOLOGY LAW QUARTERLY 1295-1371 (2001); Jonathan Wiener, On the Political Economy of Global Environmental Regulation, 87 GEORGETOWN LAW JOURNAL 749-794 (1999); Jonathan Wiener, Global Environmental Regulation: Instrument Choice in Legal Context, 108 YALE LAW JOURNAL 677-800 (1999) [hereinafter Wiener].

162 Wiener, *supra* note xx, at 737, 751-752.

163 Id. 752-754. Wiener cites additional sources for this assertion. "Baumol & Oates at 281, 283; Mabey et al. at 11-12 (noting that international cooperation "contradicts the [Polluters Pay Principle]," which depends upon "coercion"); Aronson at 2150-51 (noting that there is no incentive to cooperate if a country's costs of abatement exceed its gains); d'Arge & Kneese at 441, 449 (noting that the "Polluter Pays Principle" is not workable in the global context); Merrill at 974-75, 980-81, 1017-18 (arguing that placing burdens on source states removes incentives for cooperation)."

Such side payments have clearly occurred in the Convention on Biological Diversity, the Montreal Protocol, and the Kyoto Protocol.[164]

The key point to note is that, while Wiener's assertion concerns international environmental law, his insights may well be equally applicable to nonpoint source pollution.[165] In practical terms, the history of efforts to regulate nonpoint source pollution from farms has more closely resembled international than domestic law, more Voluntary Assent than Fiat. J.B. Ruhl, for example, who has undertaken a comprehensive assessment of the environmental impact and regulation of farms, bluntly concludes that:[166]

> efforts to address nonpoint source water pollution in the CWA and other statutes have been feeble, unfocused, and underfunded… In a recent series of comprehensive studies of state law, the Environmental Law Institute identified few states with any meaningful program regulating farm nonpoint source pollution, much less an actively enforced one. Most states have followed the federal lead and focused on point source pollution; of those that have ventured into addressing nonpoint source pollution, most leave farms out of the picture. EPA remains fundamentally powerless to require otherwise.

This stalemate makes sense when viewed through a public choice analysis, since the concentrated interest of the powerful agricultural lobby far more effectively than the diffuse population of those harmed by nonpoint source pollution. One might argue that the context of nonpoint source pollution is fundamentally different than that of international law because the background rule clearly is Fiat. That is, because farmers are part of the polity, subject to local, state and national coercion, they can't walk. For political reasons the rule is not enforced, but one can certainly imagine situations in which opposition to nonpoint source controls were

---

164 Discuss GEF and tech transfer.

165 Wiener notes that non-international settings (such as local residential neighborhood control of externalities) can also exhibit assent-based decisions and require a beneficiary pays approach. *cite*

166 Ruhl, Farms, ELQ. In reviewing the relevant legislation, Ruhl describes that

> Section 208 of the CWA required states to develop area-wide waste treatment management plans that were to include a process for identifying nonpoint sources and establishing feasible control measures… Similarly, in the 1987 amendments, Congress added Section 319 to the statute, requiring states to prepare "state assessment reports" that identify waters which cannot reasonably be expected to meet water quality standards because of nonpoint source pollution. In the absence of any concrete, enforceable federal blueprint for addressing nonpoint source pollution, the success of Sections 208 and 319 depended largely on state initiative. It is little surprise, then, that neither Section 208 nor Section 319 produced meaningful results.
>
> Congress thus took a more aggressive step in Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990, amending the Coastal Zone Management Act (CZMA) to add a requirement that any state with a federally approved coastal zone management plan must develop a Coastal Nonpoint Pollution Program subject to federal review and approval…For coastal states, this requirement can serve as an impetus for more aggressive regulation of nonpoint source pollution, but federal funding assistance is woefully short of the expected cost of plan preparation and implementation…[In terms of the TMDL program,] the most EPA can say is that TMDL load allocations are to be "enforced" through the Section 319 program, which, as pointed out above, fails to secure real gains in control of nonpoint source discharges from farms.

Id. at xx.

overcome and effective regulations imposed. Arguments for payment in this context are controversial. To some, they smack of throwing in the towel, giving up even though effective nonpoint source regulation would be feasible with a new administration.[167] To others, this is normatively disturbing – paying polluters to reduce their harms is simply wrong.

Despite these objections, the effective opposition to meaningful nonpoint source controls stands tall at the moment and seems unlikely to bow any time soon.[168] While Voluntary Assent rules may effectively be operating in the shadow of background Fiat rules, the Fiat rules are so far in the background that we can treat the current context as a sunny Voluntary Assent world. The actions of legislatures provide strong evidence in this regard. As described in the Catskills case study, Mayor Dinkins' attempt to impose nonpoint source controls in the Catskills met with such effective opposition that the regulations were withdrawn and payments offered, instead. In a remarkably similar series of events, following the creation of the SCA in 1999, in its draft enabling regulations the New South Wales Planning Authority explicitly granted the agency authority over existing land uses. In the face of harsh backlash by farmers, rural communities and Members of Parliament, the Authority backed off and in its final rules gave the SCA authority over only new land uses. That's why the SCA asked me to examine the use of a payment scheme in Robertson.

To place this in context, then, the sections above argued from theory that in certain circumstances service payments will be a preferable instrument over regulations and taxes because of concerns over information asymmetry, overbreadth, and property rights. This argument, by contrast, is decidedly pragmatic, suggesting that even if one believed regulations or taxes were theoretically preferable, they still would not be preferable in practice because nonpoint source controls effectively operate in a Voluntary Assent world.[169]

---

167 Indeed, Lois Schiffer, the Assistant Attorney General for the Environment Division in the Clinton Administration, contends that nonpoint sources would now be regulated if Al Gore had won the election. Personal Communication, November 7, 2003.

168 Discuss success of CAFO rules, potential of TMDLs, etc.

169 It remains an open and interesting question whether the Voluntary Assent world effectively operates in other service contexts, as well. Wiener focuses his analysis on climate change, where carbon sequestration is clearly of fundamental importance. And while the Endangered Species Act clearly operates in a Fiat context, it's worth considering whether a Voluntary Assent approach might prove more effective over the longer term. Provision of instream flows raises similar issues. As Thompson writes,

> Political feasibility explains much of the reason for the government's turn to voluntary acquisition. Existing water users have strongly and successfully opposed efforts to return significant amounts of water to western waterways… Virtually all of the major regulatory reallocations of water to the environment have involved the judicial invocation of either the court-created public trust doctrine or the Endangered Species Act, which few, if any, members of the adopting Congress ever expected to interfere with longstanding water uses… In recent years, moreover, voters in a number of states have approved bond issues for the acquisition of water and sensitive lands, demonstrating strong political support for such environmental expenditures…. By contrast, legislative efforts to reduce existing withdrawals have been almost singularly unsuccessful.

Thompson, *supra* note xx, at 272-273, 278-279.

2. Subsidies and Their Ills

While common in public policy, subsidies and payment programs raise all sorts of red flags for policy analysts. These criticisms can be grouped into three broad categories – payments are inefficient because of holdouts and free riders, lead to rent-seeking and the diversion of funds from more socially worthwhile causes, and create moral hazards that encourage undesirable behavior. The relevance of these concerns varies a great deal depending on the service in question.

a. Holdouts and Free Riders

The problems of holdouts and free riders are most easily seen in the context of biodiversity conservation. The functional value of a reserve design or wildlife corridors depends critically on contiguous parcels. If successful, the benefits from the sum of land parcels managed for biodiversity conservation should be greater than its parts. This can be frustrated, though, by the actions of a very small number of landholders who can hold out for prices well above market rates. Without their participation, it may not be possible to create effective habitats. Moreover, neighbors of those who dedicate their lands to biodiversity conservation may do nothing to conserve biodiversity on their own land but, instead, free ride on the wildlife amenities on adjacent land.[170] Given these two obstacles to competitive markets, one can understand the calls for coercive instruments. It remains an important and unresolved empirical question, however, whether these theoretical problems are important in practice. After all, there has been a boom in land trusts since the 1990s.[171]

Holdouts and free riders are likely much less of a concern in the context of water purification services because the effectiveness of landscape management, for example, is less likely to turn on the actions of a handful of landholders. Certainly, if the targeted 20% identified in the earlier graph hold out there will be a significant increase in price,[172] and collusion is surely a possibility if the number of eligible landholders is low. But if the BushTender and Environmental Services Scheme experiences with reverse auctions are

---

170 "Voluntarism unmodified is not an attractive alternative, given the harvest that holdouts and free-riders would reap." Elmendorf at 503

171 There are currently over 1,200 land trusts, an increase of 63% since 199x. Land held by trusts has increased 135% over this period. **Get cite from Buzz.** Nor is acquisition limited to land acquisition. For a description of groups that purchase instream flows, *see* Thompson, *supra* note xx, at 271.

The success of the land trust movement does not, of course, prove that holdouts are not an important or common occurrence – just that they are not sufficiently significant to block payments and markets. As Chris Elmendorf, who worked on conservation easements and real estate transactions in practice, notes, "I can attest that the basic attitude of many practitioners to the holdout problem is 'hope against hope.'" Personal communication, 10/1/03.

172 This seems to have occurred in the Catskills, where land prices have been much higher than New York expected.

transferable, this will not play out in practice so long as the reverse auction is competitive.[173] The danger of holdouts can also be reduced through selective information disclosure. In the BushTender program, for example, farmers are told which land management changes would be most valuable (their Habitat Significance Score) but not in any detail how valuable their biodiversity is. By not being told their Biodiversity Significance Score, farmers have difficulty knowing whether their land is critically important and, therefore, are more likely to bid based on the opportunity cost of fencing off native vegetation.

If successful in providing services efficiently, one might expect that payments could become a regular process. For instance, a landholder who had signed a ten year contract for a particular land management regime might compete for a new contract. The possibility of repeat players recasts the problem of holdouts in the guide of extortion. Consider, for example, a barely concealed threat along the lines of, "Now that the first ten years have passed, I'd like payments for another ten years (at a premium of 20% to take inflation into account, of course) or else I may have my cows start visiting the streams again." In the context of water quality, absent payments how likely is it that a farmer will change her land use in a manner that degrades water quality, perhaps removing the fencing and swales?

In theory, repeat payments for water purification services need not be expensive. If most of the payment covers capital costs, then after the initial payment the farmer will be providing more services than before and, when the next round of payments occurs, will likely get no more than maintenance payments since there will be other bidders offering greater potential increases in service provision. There may be an argument to pay more than maintenance costs if there is a credible risk of losing service provision. Such payments would act as a type of insurance premium. Even with such payments, however, some farmers may be tempted to hold out for still higher payments.

The likelihood of holdouts who have already received payments will depend in large part on three considerations – the competitive dynamic among the landholders, the landholder's contribution to upfront costs and the size of future opportunity costs. If the landholder contributed significantly to the costs of putting in swales or fencing, for example, then taking them out will be less likely. Indeed, in economic terms, the land management should only change when the profits from new land uses outweigh both the current income and the land management transition costs. And even if the farmer did not pay for the initial capital costs, she may well now regard the fencing and swales as an asset, adding value to her farm. The threat of holdouts, moreover, is much more significant in the context of biodiversity than with water quality. If a farmer is paid to fence off a stretch of native vegetation and, when payments cease, allows her cattle to roam through and graze, then most of the benefits of biodiversity conservation may be lost as the available habitat for an endangered population becomes scarcer still and extortion become likelier.[174] With water quality, in contrast, the benefits from the service of water purification have been enjoyed throughout the contract, and if you don't get the services from one farm, hopefully you can get comparable services or better from another.

---

173 If payments continue into the future, as discussed at page xx, then collusion becomes more likely (and, in fact, can be easily modeled using game theory. This may well be what has happened with the CRP program and the problem of bid prices at or near the clearing price.

174 This assumes that such an action would not constitute a Section 9 violation of the Endangered Species Act.

b. Rent-Seeking

Whenever public funds are made available, one can expect potential beneficiaries both to try and channel the funds to themselves and to increase funding. The CRP, for example, which was launched as a short-term program to promote better stewardship of erodible lands is now a huge, stable $1.6 billion dollar a year farm subsidy. Efforts to closely tailor its implementation seem to have been largely frustrated in practice to ensure broader participation. The history of the Agricultural Conservation Program is also a case study in how well-intentioned programs can be overtaken by local political interests.[175] Given the agricultural agreements from the Uruguay Round and the current negotiations at the World Trade Organization focusing on agriculture, the possibility of traditional production-based subsidies being squeezed into a "Green Box" and excluded from trade disciplines is very real.[176]

c. Moral Hazards

In a heterogeneous landscape, some farmers provide services and some currently generate negative externalities. How do we equitably account for the baseline that's already out there? What kind of policy instruments ensure we don't send the wrong incentives to farmers?

Returning to our Farmer A and Farmer B example, 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 most value those actions that improve the water quality on the margins, and those will primarily be actions taken from today that improve the status quo. Through this view, then, we should pay more initially to the Farmer B's of the world who change their land use than Farmer A's who have already made the improvements, for the simple reason that Farmer B's actions 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? Aren't we essentially paying off the bad actors and potentially encouraging undesirable behavior? 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, the argument goes, will benefit, creating a disincentive to land stewardship. As critics of the CRP program have made clear, responsible land managers can become dispirited if those who employ more polluting land management practices effectively

---

175 Elmendorf at 497 (describing how, in the Agricultural Conservation Program, "Congress overrode the USDA and forced it to subsidize whatever practices the local 'county committees' wanted subsidized.")

176 describe Green Box and Amber Box operation.

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. Government subsidizes some agricultural activities and not others all the time. Sugar can growers in Florida may receive more federal money than grain farmers in South Dakota. After all, 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.

Moreover, not all landholders may need to be paid. As described above, if land care preferences follow a normal distribution (i.e., the bell curve shown on page xx), at one end will be those who refuse to alter their land management practices unless forced to do so. They are balanced at the other extreme by those who are willing to manage their land in an environmentally sensitive manner, with or without government intervention. They don't need payments as an inducement. The Nature Conservancy and Greening Australia, for example, work with many landholders who are willing to pay the legal fees to place conservation easements on their properties.[177] Those between the extremes, willing to change their land uses to provide services but concerned over the costs involved, are the prime target audience for a service payment scheme, not those who have already incorporated a stewardship management ethic.

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 those who would have made the changes, anyway, but like a handout when they can get one. This problem of "consumer surplus," though, may not be a very large in practice, since presumably most people who would change their land management on their own have already done so. The use of a reverse auction, as in BushTender, will reduce the cost of these payments, as well, since 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).[178]

These points address issues of equity, though, not perverse incentives. Of possibly greater concern is the likelihood that the Farmer B's of the world will delay improving their land management practices in the expectation that they will eventually be paid to do so. Indeed, paying farmers for biodiversity conservation has been criticized by some as tantamount to granting landholders an implicit right to hold the environment and others ransom.[179] In the extreme, one might imagine farmers actively worsening their land management practices to increase payments for their potential service provision.[180]

---

177 Binning interview

178 Thompson, *supra* note xx, at 284.

179 Young and Tsai.

180 Wiener has also criticized this approach in the context of climate change.

> The most straightforward strategy to achieve the Beneficiaries Pay Principle would be to offer nonbeneficiary source countries (cooperative losers) a pure payment to cover their cost of abatement. But making actual payments to enlist the cooperation of nonbeneficiary sources is essentially a subsidy for

To place this in a more domestic setting, imagine that your condo association wants to address the problem of noisy parties by having all the apartment owners place a restrictive covenant in their leases.[181] Would offering payment to the noisy neighbors in exchange for restrictive covenants be a good solution? Not if it created the perverse incentive for other neighbors to start cranking up their stereos so they could be bought off, as well, or, even worse, 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.[182]

While theoretically and intuitively an obvious problem, how serious a concern should this be in the field? We have a good understanding of how to address moral hazards that arise under the polluter pays principle (i.e., victims inviting the harm),[183] but in the service payment scheme such approaches are not easily applicable.[184] Nonetheless, in the context of ecosystem services, moral hazard concerns seem more doubtful unless the expected private benefits of poor land management exceed the costs. Actively encouraging erosion of the topsoil or stream banks on your farm is far different than cranking up Aerosmith after 10pm or increasing production at a polluting factory. Increasing your attractiveness for potential service payments can carry a significant cost in long term farm productivity. Such a strategy also carries a significant risk if payments are granted on a competitive basis, since some farmers may receive no funds for running down their land. After all, given the likely budgets for payments, it is likely that less funding will be available than the potential recipients request. Both BushTender and the Costa Rican programs, for example, were oversubscribed.[185]

> abatement, and in like fashion it creates moral hazard - the perverse incentive for increased emissions or resource use that is the basic problem with both domestic and international pollution abatement subsidies. The subsidy for abatement - paying the source's costs of externality control - induces recipients to increase their risk-making activities.

181 *Adapted* from Wiener, *supra* note xx, at 782.

182 In their well-known book on environmental economics, for example, Baumol and Oates set out an economic proof of a polluting industry, showing that:

> although a subsidy program may reduce the emissions of each firm by itself, the subsidies, far from yielding a reduction in total industry emissions like a pollution tax, may, in fact, increase emissions from their unregulated level!... In a competitive industry, where polluting emissions are a fixed and rising function of the level of industry output, equal tax and subsidy rates will normally *not* lead to the same output levels of to the same reductions in total industry emissions. Other things being equal, the subsidy will yield an output and emission level not only greater than those that would occur under the tax, but greater even than they would be in the absence of either tax or subsidy.

WILLIAM J. BAUMOL AND WALLACE E. OATES, THE THEORY OF ENVIRONMENTAL POLICY 221-222 (1988, 2nd ed.).

183 One can require the polluter to pay the state rather than the victim, or reduce compensation through doctrines such as mitigation of damage or contributory negligence. *See* Wiener, *supra* note xx, at 771.

184 Both Wiener and Baumol and Oates argue that a trading regime is more effective at reducing moral hazard problems than payments. While this may well be the case in the general context of polluting industries, the practical challenges of creating a cap-and-trade regime for nonpoint source pollution are considerable. Indeed, no truly effective trading programs have been established for this problem. Tietenberg cite.

185 The CRP guards against the moral hazard problem by requiring that the farmland have been plant in two of the past five years. To guard against providing an incentive for poor management (i.e., worse than the status quo),

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.

d. Hazards to Morals

A further concern over creating markets for ecosystem services centers on the impact this might have on the public's norms toward land stewardship. Do public payments for service provision send the message that private provision is unnecessary or not valued? As Buzz Thompson describes in the context of instream flows,[186]

> by paying for instream flow, the government also may undercut an ethos of conservation. Aldo Leopold believed that the only effective means to achieve sustainable resource use was by developing a new norm, a 'land ethic,' under which property owners would incorporate the needs of the ecosystem as a whole into their stewardship of land, water, and other resources. Several recent scholars, in turn, have suggested that legal regulations or standards may encourage the development of new norms consistent with those regulations or standards. Some have worried that government acquisition programs, by contrast, might undermine the fostering of a new land ethic by making environmental stewardship an issue of money rather than fundamental values.

Mike Young and Tian Shi have raised similar concerns in assessing markets for services in Australia. Once payments become commonplace, they charge, this risks eroding common notions of an environmental duty of care and discouraging private investment in the environment by creating the impression that the care of the environment is the duty of governments rather than individuals.[187]

These concerns cannot really be answered. How norms change is, of course, a complicated process[188] and the role of service markets in norm transformation is simply not known. It is worth considering, though, why payments should be any more harmful to development of a land ethic than regulations or taxes directed at the same policy goal. To the contrary, as noted in the Introduction, one can imagine how a transformation of farm commerce from growing crops to growing services truly would inspire a different vision of the land.

Regardless of the merits of payments versus regulation or taxes for shifting norms, John Echeverria's description below of Aldo Leopold's views on the proper balance among policy instruments provides a useful dose of humility for how much *any* policy instrument can achieve in this regard. While Leopold would have welcomed the commitment of public funds for conservation payments, Echeverria notes,[189]

---

one could also condition eligibility for payment on a variant of the neutral or beneficial effects test – recent evidence of land management that has not degraded water quality.

186 Thompson, *supra* note xx, at .

187 Mike Young and Tian Shi, Duty of Care: An Instrument for Increasing the Effectiveness of Catchment Management (CSIRO Draft Options Paper, 2003).

188 cite to Posner, Adler, etc.

189 John Echeverria, *What Would Aldo Leopold Say*, at http://www.tompaine.com/feature2.cfm/ID/3094.

> At the same time, he would have cautioned that public acquisition of private lands is only a partial solution. "Let's buy land by all means," he once said, "but let's not delude ourselves into thinking that buying land is a comprehensive solution." Indeed, he 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."

Payment schemes may be preferable in some instances to coercive instruments, but they can only get us so far.

D. Instrument Choice Revisited

1. Instrument designs that address the critiques of payments

To what extent can instrument design address the problems described above? A number of commentators have argued that payments should only serve a temporary transition purpose while instruments such as regulations or taxes are introduced and tightened.[190] Such "legislative grace," one might argue, would aid people whose reasonable expectations of land use were being upset.[191] This would reduce the moral hazard problem and, more fundamentally, address the normative charge of the polluter pays principle – that farmers should not be paid indefinitely for costs that they can internalize. The figures on the following pages represent this graphically.[192]

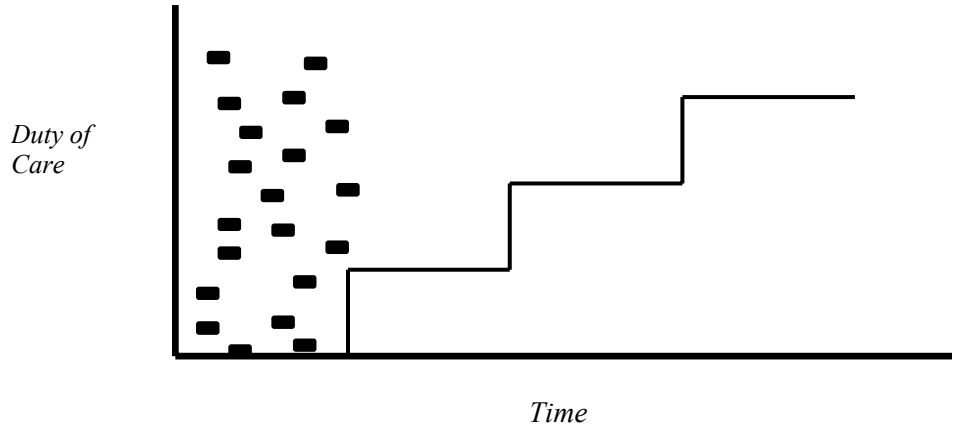
---

190 most notably Mike Young at CSIRO; *see also* Gunningham and Young piece in 24 ELQ 243 (1997); Farrier rules, 19 HELR 303, 397-399 (1995).

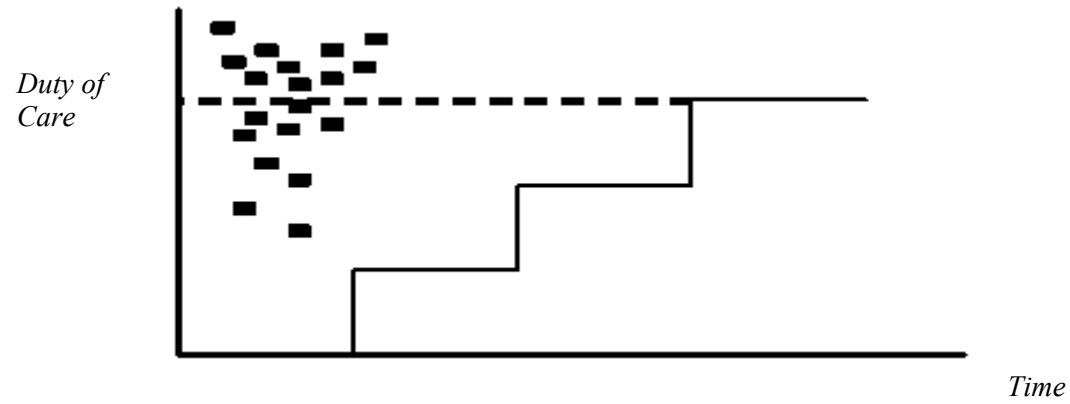
191 A variant of this approach was used in the Wilderness Act of 1964, where mining was allowed for twenty years following passage of the Act. Lazarus for cite. Carol Rose for transitional devices.

192 suggested by Mike Young.

The x-axis shows time from point zero while the y-axis shows the duty of care. The higher up the y-axis, the greater the duty of care (e.g., the larger the amount of land that must be fenced off along streams). At time zero the duty of care has not been imposed and there is a range of land management practices by the farmers (represented by rectangles).



As time passes, though, the policy instruments of payment and prescription are used in tandem. Those below the duty of care are paid to raise their performance by service payments; but in time the duty of care rises, as well, payments stop, and penalties kick in. On the graph below, those underneath the dotted line are now fined. One might imagine an official telling a farmer, "in 10 years, either you meet the standard or we'll sanction you. Because we're changing expectations (and perhaps entitlements), though, we'll help you make the transition in the meantime." This approach sends clear messages that farmers must internalize their land management costs, does not obligate future payments with revenue streams that are not guaranteed, and avoids the problem of continuing transaction costs into the future.



Thus, for example, imagine a scheme where the duty of care will require in ten year's time that everyone must fence watercourses 20 meters on either side of the stream. There could be a payments scheme where if you fence off the land this year, you are reimbursed $100/km of

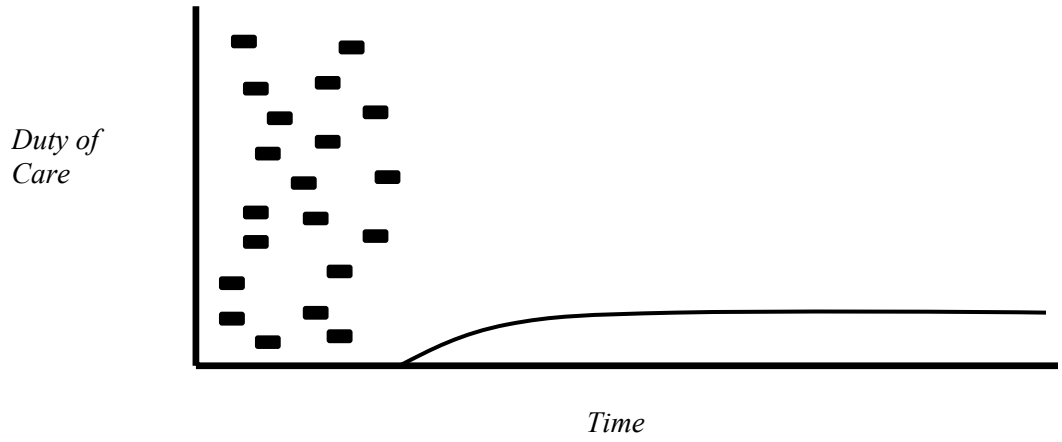
fencing; if you fence off next year, the payment is $80/km; and so on until after 10 years there are no payments but penalties, instead. The Swedish city of Malmo used this type of fixed payment scheme to ease the transition to new requirements for sewage tanks.[193]

One could use service payments rather than fixed payments, but the point is the same. Through this approach, short term transitional payments act as "circuit breakers," easing the internalization of a higher duty of care. As Young writes,[194]

> … the case for compensation collapses to one of the need to achieve and retain political and community acceptability during the transition period when assumed, but unspecified, property rights are redefined. The guideline is that where compensation is necessary, it should only be offered for a transitionary period as an equitable means of bringing about a rapid and irreversible transition.

This approach addresses the moral hazard of farmers degrading their land in expectation of payments because a clear and increasing duty of care baseline has been established. It also goes some way in addressing those farmers who delay improving their stewardship in the hope they'll be bought out, since this practice risks becoming a liability as the duty of care increases.

Realize, though, that under this approach the size of ecosystem service payments are directly correlated to the transition to the new duty of care. The farmer's willingness to accept (her bid price) depends on what the duty of care standard will be 3, 5 and 10 years from now. Such an approach becomes much less effective if tightening of standards is unlikely over the medium to long term. As the figure below shows, if the progression of the duty of care "goes flatline" (to borrow a popular phrase from TV hospital dramas), then payments effectively take the form of purchasing an entitlement – paying the farmer not to exercise her right to manage the land in certain ways – rather than a transition payment easing internalization of costs.



The key question, then, is whether the relevant agency has (1) the authority, (2) the political backing, and (3) the political will to raise the duty of care and threaten coercive

193 Mike Young, personal communication

194 Young et al. 1996. Perhaps surprisingly, Eric Freyfogle supports payments in this situation, as well. Elmandorf at 501.

instruments unless standards are met by a certain time. If the agency (or even a quasi-governmental water authority) has a credible big stick that it is willing to use soon, then the payments will justifiably be regarded as transition payments that will end over a period of time. Given the history of regulatory efforts to address nonpoint pollution from agriculture, though, a bit of skepticism may be in order if this strategy is used for water purification.[195]

There may well be a fourth question, as well – whether the public believes that the property right is correctly identified as privately rather than publicly held, i.e., whether there is general agreement that the services "stick" is initially part of the of the property owner's bundle rather than a public right. Property rights come from prescriptive statements by government and courts, but these pronouncements are inextricably bound up with popular notions of who owns what. And determining whether an entitlement "clearly" should be a public property right takes us right back to the earlier discussion of whether the farmer is generating a good or causing a harm. Presumably, one reason that paying farmers for water purification may prove hard for some people to accept is that it sure looks like the owner's activity is generating a negative externality – pollution – which she had no real right to generate to begin with. Although nonpoint pollution may not have been traditionally regarded as a nuisance, it fits comfortably within that common law box. One can argue away these concerns, but the characterization as polluter versus service provider remains a difficult one to settle.

Preservation of habitat, by contrast, presents a different line drawing challenge. Although one can imagine settings where degrading critical habitat can create obvious negative externalities such as erosion, making habitat less attractive to species seems closer to eliminating positive externalities such as nesting, forage and water retention than our innate sense of negative externalities. In this setting, it does seem harder to argue that society should demand generation of positive externalities without payment.[196]

As a result, a reasonable strategy may be to decide where entitlements rest now, pay for those services dependent on clear private rights, and have a transitional system for those services that already are or should be public property rights. This recognizes the fact that, in the real world, there is genuine uncertainty about the bundle of sticks and it may make sense to pay for some rights, even if you don't think they started out in the right place.

While I have focused on the policy approach of payments linked to a rising duty of care, there are other instrument hybrids that should be considered in the context of service provision. The "command and covenant" approach, for example, relies on negotiation between the government and regulated parties over performance and information generation.[197] First pioneered in Europe, it is gaining increasing attention in America and, while focused to date on traditional industrial pollution, might be transferable to service provision.[198] Following the lead

---

195 *See* discussion, *supra*, at page xx.

196 Though, as noted earlier in the text, of course, this is subject to the qualification that the distinction between harm-preventing and benefit-confering activities are easily manipulable.

197 The main idea is that the government sets basic requirements which the regulated parties and government then "bargain around," relaxing controls in some places and tightening them in others so as to achieve a most efficient result. *Cite* Don Elliott, Jason Johnston, Eric Orts.

198 The "payments" in this setting would take the form of regulatory relief rather than money.

of the PSA program (and standing BushTender and CRP on their head), one might pay those who currently provide valuable services (Farmer A's) and not those who manage their land poorly, thus providing an incentive to improve service provision below a certain baseline. Such an approach could also be used to divide and conquer political opposition to prescriptive regulation.[199] Depending on the service, a cap-and-trade approach might work, rewarding the most efficient service providers, as well as other instruments worth that rely on a predetermined mix of mandatory and compensated actions.[200] Theoretically, then, clever instrument combinations can overcome the problems of holdouts, moral hazards, and rent-seeking. The challenge is to move beyond theory and see how they perform in the field.

2. The dynamic between payments and prescription

Part V has considered in detail the challenges in instituting a services market for water purification in the Robertson catchment and the implications for other service markets. As the last section demonstrated, few policy instruments operate in isolation and this last part rounds out the analysis by considering the dynamic relationship between payments and coercive instruments.

Despite their seeming attractiveness to politically powerful landholders, in practice service payments may not be preferable to taxes or regulations. From the politician's perspective, payments have to come from a budget that seeks to satisfy many other constituencies, as well. From this vantage, regulations are a much smaller drain on the fisc and taxes/fees provide for revenue.[201] Moreover, payment schemes can be surprisingly

---

199 Chris Elmendorf has suggested such an approach in a policy that:

> that *combines* proscriptive regulation of "really bad" land uses, with payments for landowners willing to make "exceptional" improvements. Such a policy would be distributionally quite different from the various proposals for uniform, graduated transition payments, and would create a different set of incentives, too. The resulting regime would have much in common with nuisance law conceived in Ellickonian terms. The promise of payments could fracture the usually quite homogenous landowner lobby (creating hope for a breakthrough in the policy logjam). At the same time, the presence of minimal baseline regulations would satisfy some of the enviros' expressive concerns, and their desire not to create (by implication) a new property regime that absolves landowners of any ecological duty.

Personal communication, 10/1/03

200 Buzz Thompson describes an example of this in the Central Valley Project Improvement Act.

> Where the need for instream flows is particularly acute (e.g., where crucial to endangered fish species) and water users can readily reduce their use, a strong argument can be made for mandated reductions. Legislative reductions will prove more difficult where needs are less acute or reductions more expensive to water users. Governments can turn to voluntary acquisitions in the latter situations without undermining the argument for mandatory reductions in the former. The Central Valley Project Improvement Act (CVPIA) takes this approach, mandating reallocations in excess of 800,000 acre feet of water while authorizing voluntary acquisitions of several hundred thousands of acre feet more.

MFN, at xx.

201 In the context of instream fows, Buzz Thompson notes that "Budgetary outlays for voluntary acquisitions have historically been quite low, and political theory would suggest that legislative appropriations are unlikely to fully reflect public support for instream acquisitions." Thompson, *supra* note xx, at .

controversial. [202] Part of this is due to rural landholders' distrust of government involvement in land use, payments or not. As was evident in opposition to the Memorandum of Understanding in the Catskills case, part stems from a sense of unfairness that local development is being sacrificed for the interests of distant urban water consumers, even if payments are provided to offset the opportunity cost.

And part comes from the concern over a slippery slope – that payments will lead to coercive restrictions down the road. The preceding section explored how payments can be used to ease transition costs to more coercive instruments. Some landholders may view payments with suspicion, as the thin end of a wedge that eventually leads to regulation. If landholders view regulation as a likely consequence of payment schemes, not only will there be opposition to the scheme but a key benefit of service markets, self-identification and lowered information costs, simply won't occur. Why provide the government information on a beneficial change in your land management for possible payment if they can simply turn around and fine or force you to make the change, instead?[203]

Payments can also tip the balance toward coercive measures through backlash. If payments are preferred because nonpoint source controls cannot be mandated in a Voluntary Assent world, one would expect that if the payments become high enough then the political economy dynamics will change. It may now be worth the effort for buyers of services to oppose the concentrated interests of providers and jolt the political equilibrium enough to change entitlements (i.e., to overcome the challenge of collective action). In the example of water quality, this would play out as the demand for effective implementation and enforcement of nonpoint source restrictions in combination or, ultimately, in place of payments.[204]

In the final analysis, though, it's not clear whether acceptance of payments makes subsequent regulations more or less likely. In the context of instream water flows, Buzz Thompson argues that[205]

> by paying some water users for instream flows, the government may undercut the argument for direct regulation. Opponents of regulation are likely to point to the voluntary acquisition program as evidence that mandated reallocations are unfair and unnecessary. While mandatory reallocations may be a tough political sell, some environmentalists would prefer that fight over under-funded acquisition programs that give regulatory opponents yet another argument against mandatory reallocations.

---

202 "A 1989 proposal to establish a voluntary instream acquisition program in Montana 'created a public policy controversy seldom seen in the halls of the [Montana] Capitol.'" *Id.*

203 John Dwyer suggests a similar dynamic to explain why the Clean Air Act offsets markets have been so thin. *cite*

204 On its face, it seems more likely that payments would strengthen the entitlement rather than cause a buyer's backlash and demand for regulation. Payments both strengthen the landowner constituency and give them more to lose if the regime shifts from payment to coercion. Environmental groups risk losing credibility if they shift their support from a payment to coercive scheme, particularly if the payment scheme increased provision of services.

205 MFN

Concerned that payments may create a sense of entitlement that payments will (and should be) forthcoming for service provision, John Echeverria contends recent takings decisions can be read to suggest that:[206]

> The scope of the constitutional obligation to pay compensation for a taking may depend in part on the degree to which government officials have elected to pursue their conservation goals through acquisition strategies. In other words, if government frequently extends monetary payments to property owners to achieve conservation goals, then the courts may more readily find that government has a constitutional obligation to pay compensation to landowners to enlist their participation in conservation programs.

Resolution of these issues will have to wait for empirical data.

In the final analysis, it is important to emphasize that instrument choice and design is, as my Australian colleagues would say, a case of "horses for courses." I am not suggesting that markets and payments replace coercive instruments for all provision of services. Indeed, in many settings, markets for service provision may prove a poor policy. My concern is that, in most settings, the service markets horse isn't even entered. And that needs to change.

VI. Conclusion

In recent years, recognition of ecosystem services' critical contributions to our welfare and new initiatives to ensure provision of services have been on the rise. While our understanding of the theory of service provision has tracked this growth, our insights into practical implementation have not kept pace. There is no substitute for doing and, whether the initiatives end in failure or success, notes from the field lay the foundation for better crafted initiatives to follow. By exploring in detail the practical and theoretical issues raised by service markets currently operating, I have sought both to draw some preliminary conclusions and to lay out a research agenda for scholars.

Theory already tells us a number of preconditions for successful service markets – there must be discrete consumers and providers of services, clear biophysical understanding of service provision, delivery pathways, etc. By drawing on field experiences, I have suggested that payments for services are best suited to two conditions – (1) when there is a heterogeneous landscape, we seek discrete land use changes that will provide beneficial services, and land use entitlements are either uncertain or at or below the current land use practices; and, (2) when the political context creates the equivalent of a Voting Assent world and coercive measures are infeasible (i.e., service consumers cannot impose regulations or taxes on service providers). My sense is that these two scenarios cover more situations than we might imagine, and an initial research task lies in categorizing the different landscape and political settings for service provision.

The larger research agenda for service markets leaves much to do, as well. While I have drawn from a number of service examples, most of the analysis has come from my work on water quality and cattle grazing, and how transferable the findings for water purification

---

206 Echeverria cite. See Buzz cites on psychological research on endowment effect.

markets are to other services such as carbon sequestration, biodiversity, or flood control remains an open question. I have not touched on the issue of how big the market needs to be or the level it should be funded.[207] I have not empirically assessed the relative costs of payment schemes compared to coercive instruments. Do the information burdens of regulations or taxes exceed the implementation costs of payment schemes? How likely are holdouts or moral hazards in practice, and when are these most likely to appear? Nor have I considered how payment schemes could change farm economics. Could paying more to potential service providers than current service providers (more to Farmer B's than to Farmer A's) create a sufficient competitive advantage that would, perversely, allow them to undercut the better steward of the land? Conversely, are service payments more likely to save farms operating on the margin than regulations or taxes would? Is that environmentally a good or bad thing?

There are a whole series of questions over which markets make sense in developing countries, where provision of services such as biodiversity is most valuable, yet most challenging. How can service markets be made to work in an environment of limited institutional capacity and weak rule of law?[208]

The determination of willingness to accept offers a rich area for study, as well. To be sure, decisions of landowners to bid for service provision, and how much to accept, are not purely driven by the bottom line. The influences of peers, social norms, and local experience matter and need to be considered in market design. In some areas, local opposition to service provision may be so deeply ingrained, such as providing wide-scale habitat for prairie dogs, that payment schemes will likely fail.[209] As Chris Elmendorf describes, while market logic might counsel paying those landowners who offer the biggest biodiversity bang for the buck,[210]

> Social psychology suggests a different strategy. Of course the field representative should target areas of ecological significance, but within these locales she would do better to make contact with the most respected landowners or, if local gradients of esteem elude the outsider, the most objectively typical landowners. If respected or typical landowners collaborate with the environmentalist, others are likely to follow.

Finally, we need to understand far better the normative assumptions underlying creation of service markets. At what point should we pay for beneficial land use changes rather than regulate or tax? The article has addressed this question through an efficiency analysis (arguing that coercive instruments can prove more costly than payments), a political analysis (coercive instruments are infeasible in a Voting Assent world), and from other vantages, but these different arguments all eventually seem to find themselves in the same corner, grappling with a

---

207 Reverse auction design raises more issues than I have addressed in this paper, including whether payments should be based on input or output payments (e.g., installation of riparian fencing or improvement in water quality) and who bears the risk of innocent loss. These are addressed in detail in the report I wrote for CSIRO, *cite.*

208 *See, e.g.,* Silver Bullet, *supra* note xx, at xx; Ferraro & Kiss, *supra* note xx, at xx (detailing the challenges of creating markets in the context of uncertain land tenure, limited opportunities for contract enforcement, and unfamiliarity with particular market mechanisms).

209 Elmendorf at 470-1

210 Elmendorf at 468

more difficult analysis – deciding whether service provision is fundamentally a benefit to be encouraged or a harm to be prevented. Early in the piece, in considering the case of riparian fencing, I urged the reader to "recognize the situation for what it is – the provision of valuable services to consumers." As we've seen, though, reasonable observers might recognize this situation instead as imposition of a harm. Should we be punishing polluters or paying providers? This may well be an intractable question that, at root, turns less on biophysical measures or ecological modeling than on our sense of what the allocation and definition of entitlements ought to look like and how they should change over time.

Service markets clearly pose potential concerns but, in a second best world, may well provide the most effective and desirable means of providing services in many more settings than we currently assume. In fact, through rose-colored lenses the future of service markets could be very exciting, indeed. The chart below sets out the balance sheet from a farm today and its potential ncome streams twenty years from now.[211]

Commodity	**Share of $$$ today**	**Share of $$$ in 20 years**	**Client**
Cereals	40%	40%	World Market
Wool	40%	15%	World Market
Timber	20%	10%	Pulp & Paper
Wetlands Credits	---	10%	Land Developers
Flood Control Credits	---	8%	Flood Board
Water Filtration Credits	---	7%	Water Supplier
Biodiversity Credit	---	5%	Philanthropic Trust
Carbon Credits	---	5%	Steel Company

The implication of this visionary accounting exercise is that landowners of the future could manage their land very differently than today. If sufficient new markets arise, farmers will continue to earn money growing crops and raising livestock but, in addition, also enjoy revenue from provision of services, whether that be storing carbon, conserving biodiversity, or purifying water. Is this just crazy musing? Time will tell, but there are examples from around the world for every one of these income streams. The challenge is how to create the conditions so that these markets can be understood, improved, and transplanted to places where conditions are fertile for the creation and growth of new ecosystem service markets.

211 adapted from Steve Cork and David Shelton, CSIRO.