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Creating Markets for Ecosystem Services: Notes from the Field

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CREATING MARKETS FOR ECOSYSTEM SERVICES: NOTES FROM THE FIELD

JAMES SALZMAN*

Ecosystem services are created by the interactions of living organisms with their environment, and they support our society by providing clean air and water, decomposing waste, pollinating flowers, regulating climate, and supplying a host of other benefits. Yet, with rare exception, ecosystem services are neither prized by markets nor explicitly protected by the law. In recent years, an increasing number of initiatives around the world have sought to create markets for services, some dependent on government intervention and some created by entirely private ventures. These experiences have demonstrated that investing in natural capital rather than built capital can make both economic and policy sense. Informed by the author's recent experiences establishing a market for water quality in Australia, this Article examines the challenges and opportunities of an ecosystem services approach to environmental protection. This Article reviews the range of current payment schemes and identifies the key requirements for instrument design. Building off these insights, the piece then examines the fundamental policy challenge of payments for environmental improvements. Despite their poor reputation among policy analysts as wasteful or inefficient subsidies, payment schemes are found throughout environmental law and policy, both in the U.S. and abroad. This Article takes such payments seriously, demonstrating that they should be favored over the more traditional regulatory and tax-based approaches in far more settings than commonly assumed.

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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 apple blossom so the fruit can set. When we drink a cool glass of water from the tap we may think of the local reservoir, but the real source of the water quality 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 contributes 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 has demonstrated that the extremely high costs of replacing many of these services if they were to fail are 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 has degraded the service of water purification.[4] The costs from degradation of these services are high, and suffered in rich and poor countries alike.[5] One might

[1] Gretchen C. Daily, *Introduction: What Are Ecosystem Services?*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 1, 3–4 (Gretchen C. Daily ed., 1997) [hereinafter NATURE'S SERVICES].

[2] For discussions of the value and vulnerability of pollinator systems, see Claire Kremen & Taylor H. Ricketts, *Global Perspectives on Pollination Disruptions*, 14 CONSERVATION BIOLOGY 1226 (2000) (summarizing case studies that assess vulnerability of pollinator systems worldwide) and Gordon Allen-Wardell et al., *The Potential Consequences of Pollinator Declines on the Conservation of Biodiversity and Stability of Food Crop Yields*, 12 CONSERVATION BIOLOGY 8 (1998) (establishing consensus regarding extent and magnitude of declines in pollinators and resulting declines in pollination services).

[3] *See, e.g.*, TRUST FOR PUB. LAND, BUILDING GREEN INFRASTRUCTURE: LAND CONSERVATION AS A WATERSHED PROTECTION STRATEGY 13 (2000) (discussing impact of development on water percolation), http://www.tpl.org; Norman Myers, *The World's Forests and Their Ecosystem Services*, *in* NATURE'S SERVICES, *supra* note 1, at 215, 215–17 (discussing impact of deforestation on water flows in downstream territories).

[4] *See, e.g.*, TRUST FOR PUB. LAND, AN OUNCE OF PREVENTION: LAND CONSERVATION AND THE PROTECTION OF CONNECTICUT'S WATER QUALITY 5–8 (1998) (discussing impact of land development on water purity), http://www.tpl.org; Katherine C. Ewel, *Water Quality Improvement by Wetlands*, *in* NATURE'S SERVICES, *supra* note 1, at 329, 334–36 (discussing effects of wastewater discharges on wetlands).

[5] Degraded ecosystem services contribute to many natural disasters. Indeed, many commentators have argued that the devastation of the recent tsunami in southeast Asia was worsened by the destruction of mangroves for coastal development. The net effect was weakening of the ecosystem services of flood and storm buffers. *See, e.g.*, Earth Island Inst., *Loss of Mangrove Forests Contributed to Greater Impact of Tsunamis!*, *at* http://www.earthisland.org/map/tsunami.htm#1; University of Wyoming Press Release, UW Professor: Tsunami Destruction Could Have Been Reduced, Jan. 5, 2005, *at* http://uwacadweb.uwyo.edu/barbier/Tsumani%20document%20-%20UW%20PROFESSOR.pdf. Consider, as well, the importance of water retention and purification provided by forests:

> Widespread flooding in China's Yangtze River Basin in . . . 1998 left over 3,000 people dead, hundreds of thousands homeless and destroyed billions of dollars worth of property. Rapid siltation in hydropower reservoirs in Malawi threatens the future supply of electricity

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, ecosystem services are only rarely considered in cost-benefit analyses, preparation of environmental impact assessments, or wetlands mitigation.[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 their origins as an obscure phrase just nine years ago, "ecosystem services" have gone mainstream, with new initiatives and markets for provision of services blossoming around the world.[7] The United States Environmental Protection Agency (EPA), for example, has 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, has 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 carbon sequestration.[11] And this is just the tip of the iceberg. A recent study documented 287 cases of payments for forest ecosystem

> 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 dry season flows is critical.

NATASHA LANDELL-MILLS & INA T. PORRAS, INT'L INST. FOR ENV'T & DEV., SILVER BULLET OR FOOLS' GOLD? A GLOBAL REVIEW OF MARKETS FOR FOREST ENVIRONMENTAL SERVICES AND THEIR IMPACT ON THE POOR 111 (2002) (citation omitted), http://www.iied.org/docs/flu/psf_silvbullet.pdf.

6 James Salzman et al., *Protecting Ecosystem Services: Science, Economics, and Law*, 20 STAN. ENVTL. L.J. 309, 311 (2001).

7 As a recent example, just before this article went to press the popular magazine *The Economist* devoted its cover, editorial and lead article to ecosystem service markets. Editorial, *Rescuing Environmentalism*, ECONOMIST, Apr. 23, 2005, at 11; *Are You Being Served?*, *id.* at 76. As another example, a LEXIS combined newspaper search for "ecosystem service" reveals a steady increase in citations over time—14 cites in 1996, 69 in 1998, 106 in 2000, and 145 in 2002.

8 Sci. Advisory Brd., Request for Nominations for Experts for a Panel on Valuing the Protection of Ecological Systems and Services, 68 Fed. Reg. 11,082 (Mar. 7, 2003).

9 *See* WENTWORTH GROUP, BLUEPRINT FOR A LIVING CONTINENT 3, 14 (2002), *at* http://www.ccsa.asn.au/Blueprint_for_a_Living_Continen.pdf.

10 Stefano Pagiola, *Paying for Water Services in Central America: Learning from Costa Rica*, *in* SELLING FOREST ENVIRONMENTAL SERVICES 37, 37–62 (Stefano Pagiola et al. eds., 2002).

11 *See* United Nations Framework Convention on Climate Change, *The Mechanisms Under the Kyoto Protocol: Joint Implementation, the Clean Development Mechanism and Emissions Trading* (describing operation of Clean Development Mechanism in Kyoto Protocol), *at* http://unfccc.int/kyoto_mechanisms/items/1673.php (last visited Feb. 18, 2005).

services from around the world[12] and an international marketplace website for services has just been launched.[13]

Scholarship on ecosystem service provision recently has blossomed as well, encompassing detailed analyses of the economic barriers to creation of service markets,[14] discussions of institutional design,[15] examinations of the challenges to biophysical and economic valuation,[16] and case studies.[17]

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12 LANDELL-MILLS & PORRAS, *supra* note 5, at 3.

13 The Katoomba Group's Ecosystem Marketplace, *at* http://www.ecosystemmarketplace.com/ (last visited Feb. 18, 2005). The author of this Article serves on the Katoomba Group's Ecosystem Marketplace Advisory Board. Michael Jenkins, the president of the nonprofit organization Forest Trends, described the website as a "Bloomberg meets Google meets CNN" for the emerging environmental services market. *World's First Multi-Billion Dollar Green Marketplace Opens*, ASIA PULSE, Oct. 12, 2004, LEXIS, News Library, Asia Pulse File.

14 *See, e.g.*, GEOFFREY HEAL, NATURE AND THE MARKETPLACE: CAPTURING THE VALUE OF ECOSYSTEM SERVICES (2000) (examining use of market mechanisms to mitigate environmental impacts); Lawrence H. Goulder & Donald Kennedy, *Valuing Ecosystem Services: Philosophical Bases and Empirical Methods*, *in* NATURE'S SERVICES, *supra* note 1, at 23, 23 (addressing need for philosophical and empirical framework to value alternative uses of nature).

15 *See, e.g.*, Steve Cork et al., *A Framework for Applying the Concept of Ecosystem Services to Natural Resource Management in Australia*, *in* THIRD AUSTRALIAN STREAM MANAGEMENT CONFERENCE 157, 157–62 (Ian Rutherford et al. eds., 2001) (describing framework for identifying ecosystem services and encouraging investment in them), *available at* http://www.ecosystemservicesproject.org/html/publications/docs/framework_for_ecosystem_services.pdf; Geoffrey Heal et al., *Protecting Natural Capital Through Ecosystem Service Districts*, 20 STAN. ENVTL. L.J. 333 (2001) (providing conceptual framework for governmental authorities to manage and protect ecosystem services).

16 *See, e.g.*, Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 253 (1997) (estimating value of world's ecosystem services at $33 trillion per annum, with confidence interval of $16 trillion to $54 trillion), *reviewed by* David Pearce, *Auditing the Earth: The Value of the World's Ecosystem Services and Natural Capital*, 40 ENVIRONMENT 23, 23–28 (1998) (disputing bases for estimate but supporting effort); James Salzman, *Valuing Ecosystem Services*, 24 ECOLOGY L.Q. 887, 898–99 (1997) (explaining why economic valuation of services is so difficult).

17 *See generally* GRETCHEN C. DAILY & KATHERINE ELLISON, THE NEW ECONOMY OF NATURE: THE QUEST TO MAKE CONSERVATION PROFITABLE (2002) (studying efforts to measure, capture and protect ecosystem services); LANDELL-MILLS & PORRAS, *supra* note 5 (reviewing 287 market-oriented approaches to environmental management); NAT'L RESEARCH COUNCIL, WATERSHED MGMT. FOR POTABLE WATER SUPPLY: ASSESSING THE NEW YORK CITY STRATEGY (2000) (studying legal framework protecting New York City drinking water and recommending improvements); Graciela Chichilnisky & Geoffrey Heal, *Economic Returns from the Biosphere*, 391 NATURE 629, 629–30 (1998) (discussing examples of economic instruments that have allowed returns on environmental assets), *available at* http://www.p-i-r.com/pdfs/papers/151.pdf (last visited Feb. 19, 2005); Pagiola, *supra* note 10 (examining Costa Rica's environmental service payment system). The most impressive example of current research efforts is the Millennium Ecosystem Assessment. The Ecosystem Assessment is an ambitious program with over 500 contributors from around the globe. Launched in 2001, the Assessment focuses on the provision of ecosystem services—how these services affect human well-being, how provision of services is changing, how changes may affect human well-being, and response options that could be adopted on local, national and global scales. Millennium Ecosystem Assessment, *About the Millennium Ecosystem Assessment*, *at* http://www.millenniumassessment.org/en/about.overview.aspx? (last visited Feb. 18, 2005).

While questions and issues surely remain that have not been fully considered, it is 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.[18] The problem is that theory and practice often have not 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 spent from 2002 through 2003 as a Fulbright Senior Scholar in Australia, working with the Sydney Catchment Authority and the Commonwealth Scientific and Industrial Research Organisation (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.[19] This Article builds on my findings to explore how our current base of theoretical research can better inform implementation of ecosystem service markets and how challenges to implementation on the ground can sharpen our theoretical analyses.

More fundamentally, I examine the contentious policy challenge of paying for ecosystem services. Despite their poor reputation among policy analysts, government payment schemes are surprisingly common throughout environmental law and policy. This Article takes such payments seriously, demonstrating that they should be favored over the more traditional regulatory and tax-based approaches in far more settings than commonly assumed.

Part 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

[18] *See, e.g.*, DAILY & ELLISON, *supra* note 17 (analyzing both promise and problems of various experiments with ecosystems services markets); SELLING FOREST ENVIRONMENTAL SERVICES, *supra* note 10 (containing articles on market-based mechanisms for conservation, such as watershed services, biodiversity, forest conservation, ecological value-added taxes, and forest sinks).

[19] The Sydney Catchment Authority (SCA) is a public agency responsible for providing clean water for distribution to the greater Sydney region. Sydney Catchment Auth., *About the SCA*, *at* http://www.sca.nsw.gov.au/about/ (last visited Feb. 19, 2005). The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is an international institute for applied natural and social science research. Commonwealth Scientific & Indus. Research Org., *About CSIRO*, *at* http://www.csiro.au/index.asp?type=aboutCSIROIndex (last visited Feb. 19, 2005).

economic challenges to private provision of a public good. Despite these obstacles, there are a growing number of ecosystem service markets around the world.

To begin our understanding of how markets overcome obstacles and to ensure our analysis is grounded in practical experiences, Part III briefly tours the globe, describing three major ecosystem service markets. Building on these notes from the field, Part IV takes a close look at market design, using theory and practice to identify the key steps and challenges in crafting service markets in the field—identifying the service, service providers, beneficiaries, and level of service required.

Because of the public goods problems and the other challenges described above, fully private markets are difficult to establish for most ecosystem services. As a result, in most cases government plays a critical role—typically as the dominant buyer to spur market provision of services. Part V considers the implications of this role and delves into implementation details, melding theory with my fieldwork in Australia to assess instrument choice. Employing a range of analytical frameworks, Part V explores the circumstances that favor government payments for services over more traditional regulatory and tax-based approaches.

Such payments are controversial, often derided as wasteful subsidies or payoffs. Part VI addresses directly the fundamental objections that have been raised against payments for services—that they violate the polluter-pays principle, that they encourage holdouts and rent-seeking, that they create moral hazards, and that they undermine a land ethic. Part VII concludes with a survey of the landscape of service markets, charting out the most promising routes for the future.

This is an exciting time to be working in the field of ecosystem service markets. Governments at the local, national and international levels are increasingly aware of the potential for service markets, as are scholars. Much of the scholarship, though, has been written by proponents of service markets, with a heavy emphasis on the potential benefits and less consideration of the potential downsides.

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 are hard to establish. This Article considers the practical challenges facing markets and identifies ways to overcome them. The second reason, however, 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 than coerce them through regulation or taxes? In which situations, and for which services, 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 the broader application of 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 offers critically important services for free that, if we had to pay for substitutes in markets, would command extremely high prices.[20] Government policies that recognize this basic fact, and that focus on landscape management to ensure and provide services, could result in increased social welfare but would represent a significant departure from how we currently 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 using built capital to deliver key services.[21] As an example, consider the case of flood control. One can address floodwaters through built capital, such as engineered works (e.g., construction and maintenance of dikes and levees) or through natural capital, such as landscape management (e.g., restoration of wetlands in flood plains).[22] 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.[23]

A well-known example in the water quality field makes the point in a concrete setting.[24] In the early 1990s, a combination of federal regulation and cost realities drove New York City to reconsider its water supply

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20 *See generally* Daily, *supra* note 1, at 3–6 (describing what ecosystem services are).

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

22 Natural watersheds provide a range of water purification services.

> 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.

Barton H. Thompson, Jr., *Markets for Nature*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 261, 295 (2000) (footnotes omitted).

23 *See, e.g.*, DAILY & ELLISON, *supra* note 17, at 100–01 (describing restoration of wetlands in Napa Valley to control flooding).

24 The Catskills case is explained in more detail in Part III.A. For a detailed description of the Catskills case study, see generally NAT'L RESEARCH COUNCIL, *supra* note 17 (evaluating New York City management program).

strategy. New York City's water system provides about 1.5 billion tons of drinking water to almost nine million New Yorkers every day.[25] Ninety percent of the water is drawn from the Catskill/Delaware watershed, which extends 125 miles north and west of the city.[26] Under amendments to the federal Safe Drinking Water Act, municipal and other water suppliers were required to filter their surface water supplies unless they could demonstrate that they had taken other steps, including watershed protection measures, to protect their customers from harmful water contamination.[27]

Presented with a choice between provision of clean water through building a filtration plant or managing the watershed, New York City easily concluded that the latter was more cost effective. It was estimated that a filtration plant would cost between $6 billion and $8 billion to build.[28] 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.[29] Acting on behalf of the beneficiaries of the Catskills' water purification services, New York City chose to invest in natural rather than built capital. Nor is New York City alone. As of 1996, the EPA had indicated that over 140 municipalities qualified to use watershed conservation as a means of ensuring high drinking water quality.[30]

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.[31] 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

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25 ERIC A. GOLDSTEIN & MARK A. IZEMAN, THE NEW YORK ENVIRONMENT BOOK 138 (1990) ("The city itself takes more than 90 percent of this cut, just over 1.4 billion gallons.").

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

27 42 U.S.C. §§ 300g-1(b)(7)(C) (2000).

28 DAILY & ELLISON, *supra* note 17, at 63. Unless otherwise noted, all currency in dollar amounts refers to United States dollars.

29 *Id.*

30 *See* TRUST FOR PUB. LAND, PROTECTING THE SOURCE: LAND CONSERVATION AND THE FUTURE OF AMERICA'S DRINKING WATER 20 (1998), http://www.tpl.org.

31 Peter Williams, *Carr Does About Face on Farm Vegetation Plan*, AAP NEWSFEED, Mar. 15, 2003, *available at* LEXIS, News Library, Australia File. This is the equivalent of $90 million. The Wentworth Group is a group of nationally prominent Australian environmental scientists. *See, e.g.*, TERENCE JEYARETNAM, WENTWORTH GROUP'S BLUEPRINT FOR SUSTAINABILITY, *at* http://ees.ieaust.org.au/pdf/Wentworth_Group.pdf (last visited Feb. 13, 2005).

community . . . . It's a radical new way of doing business in the bush."[32]

B. Markets for Services

If the provision of ecosystem services is clearly valuable, then why don't more payment schemes exist? Why are markets so hard to set up? The answer is threefold: ignorance, institutional inadequacy, and the problems inherent in public goods.

Perhaps the most basic reason we do not pay more attention to the provision of ecosystem services is that we take them for granted. It may come as no surprise that many children, when asked where milk comes from, brightly answer, "The grocery store!"[33] 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 analysts must be able to identify services on a local ecological 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, or that a significant loss of animal and plant populations will reduce ecosystem resiliency.[34] In the 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 undertake meaningful marginal analysis—to predict with any certainty how specific local actions affecting these factors will impact the local ecosystem services themselves. For example, it is difficult to predict how developing thirty percent of *this* wetland will impact water quality, flooding events, or local bird 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

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32 Williams, *supra* note 31.

33 *See, e.g.*, Tyrone Cashman, *Where Does it Come From? Where Does it Go?*, MEDIA & VALUES, Summer 1990, at 12, *available at* http://www.medialit.org/reading_room/article49.html; Roberta Mazzucco, *From the Farm to Your Table: Where Does Our Food Come From?*, *in* 7 YALE-NEW HAVEN TEACHERS INSTITUTE, CURRICULUM UNIT: ENVIRONMENTAL QUALITY IN THE 21ST CENTURY (1997), *at* http://www.yale.edu/ynhti/curriculum/units/1997/7/97.07.07.x.html.

34 *See, e.g.*, Gene E. Likens et al., *Effects of Forest Cutting and Herbicide Treatment on Nutrient Budgets in the Hubbard Brook Watershed-Ecosystem*, 40 ECOLOGICAL MONOGRAPHS 23 (1970) (classic study on how clearcutting forested watershed fundamentally changes local ecology); Harold A. Mooney & Paul R. Ehrlich, *Ecosystem Services: A Fragmentary History*, *in* NATURE'S SERVICES, *supra* note 1, at 11, 16 (noting that species diversity is vital to resilience of ecosystems).

determining ecosystem services. And how an ecosystem works is not the same as the services it provides.[35]

Ironically, this focus has been reinforced and, at times, 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.[36] Indeed, it is 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 relevant laws were drafted over two decades ago. Generally speaking, our pollution laws (e.g., the Clean Air Act[37] and Clean Water Act[38]) rely on human health-based standards. Our conservation laws (e.g., the Endangered Species Act[39] and Marine Mammal Protection Act[40]) are species-specific. And planning under our resource management laws (e.g., the National Forest Management Act[41] and Federal Land Policy and Management Act[42]) must accommodate multiple and conflicting uses. Of course, parts of these laws, such as the Clean Water Act's Section 404 wetlands permit program and use of water quality standards,[43] the Endangered Species Act's critical habitat provisions,[44] and the National Forest Management Act's use of indicator species such as the spotted owl,[45] clearly can help to conserve ecosystem services. The point, though, is that these laws were not primarily intended to provide legal standards for conservation of natural capital and the services that flow from it and, as many authors have pointed out, in practice they usually do not.[46]

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35 Claire Kremen, *Managing Ecosystem Services: What Do We Need to Know About Their Ecology?*, 8 ECOLOGY LETTERS 468, 468 (2005) (stating that "we have little ability to predict how much land must be protected and how nearby land use must be restricted to provide water of sufficient quantity and quality"); Telephone Conversation with Gretchen C. Daily, Stanford University Biology Department (Jan. 14, 2003). Unless otherwise noted, the telephone conversations, interviews, and email communications between the Author and his sources in this and subsequent footnotes could not be verified by the *New York University Law Review*.

36 James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 648–68 (2000) (examining ability of laws and environmental markets to capture values of ecosystem services).

37 42 U.S.C. §§ 7401–7671q (2000) .

38 33 U.S.C. §§ 1251–1387 (2000).

39 16 U.S.C. §§ 1531–1544 (2000).

40 *Id.* §§ 1361–1421h.

41 *Id.* §§ 1600–1614.

42 43 U.S.C. §§ 1701–1785 (2000).

43 Clean Water Act § 404, 33 U.S.C. § 1344 (2000).

44 16 U.S.C. § 1533 (2000).

45 *Id.* § 1604(g)(3)(B).

46 *See, e.g.*, David W. Burnett, *New Science But Old Laws: The Need to Include Landscape Ecology in the Legal Framework of Biodiversity Protection*, 23 ENVIRONS ENVTL. L. & POL'Y J. 47, 68–69 (1999) ("[T]he Endangered Species Act will never efficiently protect biodiversity. . . . There will never be any ecologically optimum sequence chosen through the use of the Endangered Species Act. The ESA wasn't designed to even consider the possibility."); Oliver A.

A second obstacle to the creation of service markets is institutional. Political jurisdictions are rarely aligned with ecologically significant areas such as watersheds; instead, they exercise authority over areas defined by state, county, or municipal borders.[47] Not surprisingly, environmental problems don't track political boundaries. The Chesapeake Bay Initiative is one of a small number of interstate initiatives that have attempted to align political actors with ecosystem boundaries.[48] Some states have aligned political and natural boundaries within their jurisdictions, for example, New Jersey's Pinelands Commission[49] and New York's Adirondack Park Agency.[50] However, these are rare examples. 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, New Zealand and a number of Australian states in the last decade have created catchment management bodies that exercise land use planning authority throughout an entire watershed,[51] 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"

Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 880–83 (1997) (observing that commercial interests inevitably "wear . . . down" agencies attempting to implement environmental protection statutes); Robert B. Keiter, *Beyond the Boundary Line: Constructing a Law of Ecosystem Management*, 65 U. COLO. L. REV. 293, 295 (1994) (arguing that "federal public land law runs directly counter to ecosystem management principles" but that ESA, National Environmental Policy Act (NEPA), National Forest Management Act (NFMA), and Federal Land Policy Management Act (FLPMA) are beginning to break down boundary limitations and legal compartmentalization to obligate federal land managers to broaden management perspective and to vest land managers with authority to experiment with ecosystem management concepts); J.B. Ruhl, *Biodiversity Conservation and the Ever-Expanding Web of Federal Laws Regulating Nonfederal Lands: Time for Something Completely Different?*, 66 U. COLO. L. REV. 555 (1995) (analyzing NEPA, Clean Water Act (CWA), ESA, and other environmental regulations and their effects on ecosystem services and concluding that biodiversity could be better conserved through melding of disorganized system of federal biodiversity regulation into one single law that is more flexible and less coercive than current laws).

47 Heal et al., *supra* note 15, at 354.

48 Chesapeake Bay Initiative Act of 1998, Pub. L. No. 105–312, tit. V, 112 Stat. 2961 (1998) (empowering Secretary of Interior to identify, conserve, restore and interpret natural recreational, historical and cultural resources within Chesapeake Bay Watershed).

49 State of N.J. Pinelands Comm'n, *New Jersey Pinelands Commission Homepage* (describing history and purpose of The Pinelands), *at* http://www.state.nj.us/pinelands/ (last visited Jan. 31, 2005).

50 N.Y. State Adirondack Park Agency, *About the Adirondack Park*, *at* http://www.apa.state.ny.us/about_park/index.html (last visited Jan. 31, 2005).

51 Integrated Catchment Mgmt. for the Motueku River, *Project Summary* (describing Moteuku River Catchment Authority's purpose), *at* http://icm.landcareresearch.co.nz/site_details/programme_summary.htm (last visited Jan. 31, 2005); Sydney Catchment Auth., *About the Sydney Catchment Authority* (describing SCA's history and purpose), *at* http://www.sca.nsw.gov.au/about (last visited Jan. 31, 2005).

is one whose use and benefits cannot be exclusively controlled, such as national 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 wetlands or not. In fact, most ecosystem services, ranging from flood control and climate stability to pollination, provide non-exclusive benefits.[52]

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).[53] This might not be critically important if most lands providing services were public property that could be set aside for conservation, but they are not. Private lands are vital not only for biodiversity conservation, but also for provision of most other services.[54]

A further economic obstacle to the creation of service markets 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.[55] The problem is that we all gain from these benefits, yet there is no sufficiently discrete class of beneficiaries with whom landholders can negotiate, and the transaction costs of gathering enough beneficiaries together to negotiate for the service are too high.

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

53 For a more detailed discussion of the challenges to conservation posed by public goods, see Heal et al., *supra* note 15, at 341–42.

54 *See* David Farrier, *Conserving Biodiversity on Private Land: Incentives for Management or Compensation for Lost Expectations?*, 19 HARV. ENVTL. L. REV. 303, 310 (1995) ("Existing areas of publicly owned land are inadequate to conserve representative ecosystems."). While many water suppliers own land in key watershed areas, many, as was the case with New York City and the Catskills and Delaware watersheds, do not. Thompson, *supra* note 22, at 299–300.

55 Roughly one in four pharmaceuticals are derived from plant sources and another one in four from animals and microorganisms. *See* Norman Myers, *Biodiversity's Genetic Library*, *in* NATURE'S SERVICES, *supra* note 1, at 259, 263.

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, it is unlikely that a market for services will arise in the absence of government intervention.[56]

As a final point, it is worth noting that ignorance and public goods—the barriers to market creation—are related. Markets create knowledge. We have a very advanced understanding of how to manage farmland to maximize production of cash crops for the simple reason that *they are cash crops*. It pays to manage land efficiently for crop production. We have a much poorer understanding of how to manage land for service provision, not because services have no value but because land owners cannot capture any of the value their landscape provides. Agricultural markets provide very clear signals to farmers of the value of clearing remnant vegetation to grow more crops; but there are no markets for biodiversity, water quality, or flood control to reflect the loss in benefits once the land is cleared. Thus, while a wetland surely provides existence or option value 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. 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. This approach, notably *unlike* that of traditional regulatory or tax instruments as described in the next section, views environmental protection much as a business transaction between willing parties.

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

The preceding analysis suggests why the government has a critical role to play in ecosystem service provision. Because a stable supply of public goods can provide great public benefit yet little private gain, one

[56] For further discussion of government instruments that can spur conservation of ecosystem services, see *infra*, Parts V.B. and VI.C., and HEAL, NATURE AND THE MARKETPLACE, *supra* note 14, at 33–41.

would expect that private markets will systematically lead to the under-provision of ecosystem services. To correct this problem of 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.[57] One might call these the "Five P's"—prescription, penalty, persuasion, property rights, and payment.

Through *prescription*, the government relies on command-and-control regulation, mandating certain behaviors, proscribing others, and imposing penalties for noncompliance. "Thou shalt do this; thou shalt not do that, or else . . . ." The norm for pollution control in industrial settings, prescription has been used indirectly to provide services from wetlands[58] and to protect the ecosystem service of biodiversity.[59] 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.[60]

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).[61]

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 and Dust Bowl through the Soil Conservation Service.[62] The goal of this approach is self-regulation. In a

57 These fundamental policy approaches apply to any environmental issue and are described in greater detail in JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW AND POLICY 40–53 (2003).

58 Section 404 of the Clean Water Act requires a permit for the discharge of dredged or fill material into navigable waters at specified disposal sites. Clean Water Act § 404, 33 U.S.C. § 1344 (2000). For details on this program and its impact on service provision, see Salzman & Ruhl, *supra* note 36, at 648–52.

59 Section 7 of the Endangered Species Act directs federal agencies to "insure" that their actions are "not likely to jeopardize" the viability or adversely modify the critical habitat of endangered species. 16 U.S.C. § 1536(a)(2) (2000). Section 9 of the act makes it unlawful to "take" an endangered species. 16 U.S.C. § 1538(a)(1) (2000). *See generally* SALZMAN & THOMPSON, *supra* note 57, at 265–66 (describing regulatory proscriptions of ESA).

60 *See infra*, Part V.B.4.

61 *See*, *e.g.*, 26 U.S.C. § 4681 (2000) (imposing tax on sale of ozone depleting chemicals).

62 Douglas Helms, *Two Centuries of Soil Conservation*, 5 OAH MAG. OF HIST. 24, 24–28 (1991), *reprinted in* READINGS IN THE HISTORY OF THE SOIL CONSERVATION SERVICE (1992), *at* http://www.nrcs.usda.gov/about/history/pdf/Readings_in_the_History_of_001.pdf (last visited Feb. 1, 2005).

recreational example, informed of harm to coral reefs through dropping anchors, boat owners have been developing an ethic not to do so.[63]

The fourth approach is one of *property rights*. This instrument relies on privatization and allocation of access to a resource, whether a right to a particular catch in a fishery[64] or the ability to emit a quantity of air pollution.[65] In most programs, such as the acid rain trading program in the United States, these entitlements may be traded. In practice, property rights instruments often work in combination with other instruments. Trading programs, for example, rely on regulations to create scarcity.[66]

The final approach is *payment*. This usually takes the form of a subsidy, either as a direct payment or tax break, justified by a public goods argument—society at large benefits from these activities but because of market failures does not pay for them. Though less attractive than regulation because of its impact on government budgets, such an approach is often popular with landholders for obvious reasons. 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 are not calibrated to the quality or service provision of the wetland) and payments could be seen to encourage holdouts and create perverse incentives.[67] As we shall see in the examples in Part III, payments can be made available on a competitive basis, effectively creating a market as recipients compete with one another for the scarce funds. This can avoid some of the efficiency concerns raised above.

To put these different instruments in the context of ecosystem services, take the example of water quality in Figure 1 below.[68] Imagine

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63 *See, e.g.*, REEF RELIEF, FINAL REPORT OF THE NEGRIL REEF MOORING BUOY WORKSHOP & INSTALLATION PROJECT, *at* http://www.reefrelief.org/jamaica.html; Ocean Watch Foundation, More About Ocean Watch Foundation, *at* http://www.oceanwatch.org/moreabout.htm.

64 Individual transferable quotas, known as ITQs, have become a common management tool for fisheries in Canada, New Zealand, Iceland, and other countries. *See generally* Alison Rieser, *Prescriptions for the Commons: Environmental Scholarship and the Fishing Quotas Debate*, 23 HARV. ENVTL. L. REV. 393 (1999).

65 The EPA has implemented trading markets for acid rain, 42 U.S.C. § 7651 (2000); chlorofluorocarbons, 40 C.F.R. §§ 82.5, 82.12 (2000); leaded gasoline, 40 C.F.R. § 80.20(d) (1973), *repealed by* Prohibition on Gasoline Containing Lead or Lead Additives for Highway Use, 61 Fed. Reg. 3832, 3834 (Feb. 2, 1996) (deleting § 80.20, former banking and trading program implementing lead phasedown program), and other pollutants.

66 Combined instruments also offer regulated parties a choice that may be perceived as more legitimate and, as a result, facilitate compliance. In most trading programs, for example, parties can choose whether to trade for pollution allowances and wetlands mitigation banking credits, on the one hand, or simply to comply with the regulatory limits on emissions or wetlands development, on the other. The flexibility offered by the trading program is available, but need not be used.

67 *See, e.g.*, *infra* note 268.

68 Adapted from Heal et al., *supra* note 15, at 344 (showing service of water purification through hypothetical watershed, farmland, river, and reservoir).

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 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.[69] Downstream water consumers benefit from these actions, which provide them with clean drinking water that does not require extensive pre-treatment. Farmers might benefit from reduced streambank erosion.

FIGURE 1

[Printer: insert fig1.doc here]

Traditionally, this would be the end of the story. No benefits would be produced, for few land owners *actually would* plant riparian buffers. Farmers may well have been informed of the benefits of this practice for themselves and for downstream users, but it is unlikely that they would change their behavior because of the hassle and cost of fencing and the concerns over the loss of productivity from setting aside pasture. 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.

So how could the government ensure clean drinking water? The traditional engineer's approach ("I've never seen a problem I can't build around") would likely involve building a pre-treatment plant. An ecosystem service approach of riparian buffers, however, would likely be less expensive. But what role should government play in ensuring provision of services?

The traditional regulator's approach would likely impose prescriptive regulations to require farmers to plant riparian buffers. One could equally rely on financial penalties, levying a tax on farmers who do not have buffers, or trying to persuade farmers to put in buffers. As described in detail in Part V, such approaches have largely proven ineffective in the past because of overbreadth, strong political opposition, and poor compliance behavior in the face of what are viewed as punitive or intrusive measures.

One could, however, view the issue from a totally different perspective. Why not, one might argue, simply recognize this situation for what it is—the provision of valuable services to consumers—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

69 *See supra* note 22.

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 the provision of water filtration services 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 arm's-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. For cash-strapped farms, 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
NOTES FROM THE FIELD

Needless to say, this is a different way of thinking about environmental protection than the traditional approaches of regulation, taxes, and subsidies. Such an approach may immediately give rise to a whole host of objections: How could this work in practice? Are we paying the polluters? Will this create perverse incentives making things worse? These are legitimate concerns and we will fully consider them later in the Article, but they should be put on hold for the moment because such payments for services are not simply "pie in the sky" musings. As noted in the Introduction, despite the theoretical objections to, and the practical difficulties of, creating markets for services, there are examples from around the world that belie these concerns; and their number is growing. With the goal of grounding our analysis in fact, this section tells some stories from the field. It briefly describes three of the most influential ecosystem service markets around the globe—New York City's drinking water protection program, BushTender in Australia, and Pagos por Servicios Ambientales in Costa Rica. These short case studies will give the reader a more practical sense of where these markets came from and how

they operate. Note in particular how the markets have overcome the obstacles of public goods, lack of information on service provision, and the institutional barriers described earlier, as well as how the unavailability of more traditional instruments such as regulation and taxation has led to payment schemes. There are more stories to tell of other markets, but we will turn to them in Parts IV and V, which examine and critique specific market design issues in detail.

A. New York City

As described in Part II, New York City's decision to invest in land management in the Catskills catchment is the best known example of an ecosystem service market and has effectively become the "poster child" of ecosystem service advocates. The city's investment decision was driven by new drinking water regulations that would have required the construction of a multi-billion dollar treatment plant.[70] The financial attraction of investing in the ecosystem service of water purification was justified by the avoided cost of not building 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 the early part of the twentieth century, recognizing the significance of the Catskills and Delaware watersheds to New York City's drinking water, the state assembly granted New York City the right to condemn land and regulate development in these areas.[71] This created the situation, unusual to say the least, of a city with land use controls over communities more than one hundred miles away. In the early 1990s, the administration of Mayor David Dinkins proposed 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, restrictions on development, obligations to collect and treat storm water, and limitations on watershed farming activities.[72] 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.[73]

Faced with the EPA's concern that New York City could not ensure the success of this catchment management program, the governor of New York State stepped in and a stakeholder consultation process emerged.[74] After two years and more than 150 meetings, the group finally came up

70 For a more detailed, well-written recounting of the story, see DAILY & ELLISON, *supra* note 17, at 61–85.

71 *See* N.Y. Public Health Law § 73 (1909) (codified as amended at N.Y. Public Health Law § 1104 (McKinney 2002)); DAILY & ELLISON, *supra* note 17, at 69.

72 DAILY & ELLISON, *supra* note 17, at 73.

73 *Id.*

74 *Id.* at 74.

with a Memorandum of Agreement signed by sixty towns, ten villages, seven counties, and various environmental groups.[75] One participant described the exhaustive process as similar to a "rolling Thanksgiving dinner with relatives you only want to see once a year."[76]

While often described as the best example of payments for ecosystem services, New York City's system, in contrast with the other schemes described below, makes relatively few payments directly to land management. The Memorandum of Agreement provides for $1.5 billion of spending commitments by New York City over ten years, funded by city water and sewer user charges.[77] Of this, $250 million has been targeted to acquisition of fee title and conservation easements in critical areas.[78] In addition, New York City will spend over $270 million on "partnership programs" fostering water quality and economic development in the Catskill/Delaware Watershed, many of which will be administered by the newly-created nonprofit Catskill Watershed Corporation.[79]

The key point is that while a few of these programs provide payments to landholders for management (mostly in pilot projects),[80] the majority of the funds are primarily directed either at infrastructure projects (sewers, treatment works, storm water drains) or to municipalities and development interests.[81] In the clearest example of this, New York City has provided up to $9.765 million in "good neighbor payments" for municipal capital projects in watershed communities.[82] 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 program.

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

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75 *Id.*

76 *Id.*

77 *Id.*; *see generally* City of N.Y. Dep't of Envtl. Prot., *Watershed Agreement Overview* (describing in detail Memorandum of Agreement), *at* http://www.ci.nyc.ny.us/html/dep/html/agreement.html#Watershed (last visited Jan. 31, 2005). Information on the water and sewer use charges was provided through personal email communication with Al Appleton, Former Director of New York City Department of Environmental Protection (Mar. 21, 2005) (on file with the *New York University Law Review*).

78 City of N.Y. Dep't of Envtl. Prot., *supra* note 77.

79 "Watershed Protection and Partnership Programs" established by the Watershed Agreement 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 storage of de-icing materials ($10.25 million) and environmental education ($2 million). New York State has also committed $53 million for a range of initiatives. Catskill Watershed Corp., *Summary Guide to the Terms of the Watershed Agreement*, *at* http://www.cwconline.org/about/moa/moappp.htm (last visited Nov. 23, 2004).

80 City of N.Y. Dep't of Envtl. Prot., *supra* note 77.

81 *Id.*

82 Catskill Watershed Corp., *supra* note 79.

species along streams resulted in only about 400 acres being planted by the fall of 2000.[83] The problem, it turned out, was that corn crops provided a much greater return per acre.[84] Most farmers have, however, made use of the free consultation service and infrastructure subsidies for fences and pumps.[85] Efforts to purchase land have not met expectations, either.[86] While the Memorandum of Agreement commits a great deal of money for land purchase, ironically this may be a cause of the lack of success in making purchases.[87] 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 so far has been successful. A major review by the EPA in 2002 persuaded the agency to extend the waiver treatment for surface waters a further five years to 2007.[88] The size of the payment scheme is impressive, but 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 is not clear how transferable the model is.[89]

B. BushTender (Australia)

In Australia, the State of Victoria's Department of Natural Resources and Environment has developed a pilot program to conserve native vegetation remnants on private property.[90] In exchange for payments from the state government, the landholders commit to fencing off and managing an agreed amount of their native vegetation for a set period of time.[91] The program is based on the model of the Conservation Reserve Program (CRP) in the United States, one of the largest ecosystem service payment

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83 DAILY & ELLISON, *supra* note 17, at 80.

84 *Id.*

85 *Id.*

86 While approximately 270,000 acres had been solicited for purchase by 2002, only 33,764 had been acquired, with almost sixty percent of these in high priority areas. City of N.Y. Dep't of Envtl. Prot., *New York City's 2001 Watershed Protection Program Summary, Assessment and Long-term Plan* 47 (2001), *at* http://www.ci.nyc.ny.us/html/dep/pdf/moapdf/fadplan.pdf.

87 *Id.* at 30 (noting that as of November 2001, almost $58 million had been spent on land acquisition).

88 Press Release, EPA Region 2, EPA Grants NYC a New Waiver from Filtering Most of Its Drinking Water Supply; City to Expand Watershed Protections, Benefitting Upstate Environment and Economy (Nov. 26, 2002), *at* http://www.epa.gov/region02/news/2002/02123.htm.

89 *See* Thompson, *supra* note 22, at 301–03 (describing unique aspects of Catskills example).

90 *See* GARY STONEHAM ET AL., AUCTIONS FOR CONSERVATION CONTRACTS: AN EMPIRICAL EXAMINATION OF VICTORIA'S BUSHTENDER TRIAL 12–13 (2002) (web-published paper by members of Department of Natural Resources and Environment and Melbourne Business School in Australia), *at* http://eprints.anu.edu.au/archive/00002198/01/stoneha1.pdf.

91 *Id.* at 10–11.

schemes in the world.[92] CRP provides annual rental payments and shares the cost of conservation practices on farmland.[93] First created in the 1980s 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.[94] As of January 2005, its annual payments exceeded $1.6 billion for activities on over thirty-four million acres.[95] The Farm Service Agency estimated that as of October 1996, topsoil loss had been reduced on CRP lands by twenty-one percent and pesticide and nutrient runoff had also been reduced.[96]

CRP contracts extend from ten to fifteen years.[97] To be eligible for CRP support, the land must have been planted in four out of the six years from 1996 to 2001 and must meet a set of requirements ensuring it can provide services.[98] Farmers wishing to enroll in the CRP submit a bid for

92 In 2002 and 2003, the Conservation Reserve Program (CRP) paid out roughly $1.7 billion each year to participants in rental and cost-share payments. FARM SERVICE AGENCY, USDA, CONSERVATION RESERVE PROGRAM FISCAL YEAR SUMMARY 2003 1 (Nov. 2004), *at* http://www.fsa.usda.gov/dafp/cepd/stats/FY2003.pdf [hereinafter CRP 2003 FISCAL YEAR SUMMARY].

93 FARM SERVICE AGENCY, USDA, CONSERVATION RESERVE PROGRAM FACT SHEET, *at* http://www.fsa.usda.gov/pas/publications/facts/html/crp03.htm; *see also* DANIÈLE PERROT-MAÎTRE & PATSY DAVIS, CASE STUDIES OF MARKETS AND INNOVATIVE FINANCIAL MECHANISMS FOR WATER SERVICES FROM FORESTS 37 (2001) (examining three categories of financial mechanisms, namely, self-organized private deals, trading schemes, and public payment schemes).

94 JAMES B. JOHNSON & RICHARD T. CLARK, THE CONSERVATION RESERVE PROGRAM (2003), *at* http://www.farmfoundation.org/2002_farm_bill/jbjohnson.pdf.

95 FARM SERVICE AGENCY, USDA, CONSERVATION RESERVE PROGRAM MONTHLY SUMMARY, *at* http://www.fsa.usda.gov/dafp/cepd/crp_statistics.htm (last visited Feb. 16, 2005) [hereinafter CRP Monthly Summary].

96 For the figure on reduction in topsoil loss, see FARM SERVICE AGENCY, USDA, HISTORY OF THE CRP, *at* http://www.fsa.usda.gov/dafp/cepd/12crplogo/history.htm (last visited Mar. 30, 2005), and for information on the reduction in pesticide and nutrient runoff, see INDIANA OFFICES FOR THE FARM SERVICE AGENCY, THE CONSERVATION RESERVE PROGRAM, *at* http://www.fsa.usda.gov/in/crp.htm (last visited Mar. 30, 2005). In the 2003 CRP Fiscal Year Summary, eighty-five percent of respondents reported improved control of soil erosion and thirty-nine percent of respondents reported improvements in water quality. CRP 2003 FISCAL YEAR SUMMARY, *supra* note 92, at app. 2. In 2003, the CRP program reported a 446 million ton reduction in soil erosion, a 655,000 ton reduction in nitrogen application, and 1.8 million acres in restored wetlands. *Id.* at iii.

97 CONSERVATION RESERVE PROGRAM FACT SHEET, *supra* note 93.

98 7 C.F.R. § 1410.6(a)(1) (2005). The land must be physically and legally capable of growing an agricultural commodity, be a marginal pastureland that is suitable for planting as a riparian buffer, or be devoted to a new wetland practice or a wildlife habitat buffer practice. In addition, the land must also be: (1) highly erodible, (2) cropped wetland, (3) dedicated to beneficial environmental practices (such as filter strips or riparian buffers), (4) subject to scour erosion, and (5) located in a national or state CRP conservation priority area; or be a cropland associated with or surrounding noncropped wetlands. § 1410.6(a)–(b).

their land to be accepted in the program.[99] Their offers are ranked by government field officers according to an Environmental Benefits Index measuring improvements in erosion control, wildlife habitat, water quality, air quality, and cost.[100] Farmers' offers are then ranked according to score and bids are selected from their relative ranking.[101]

While the CRP has many supporters, its critics point to four major failings. First, there are concerns over "slippage"—farmers may be plowing up other land to compensate for land placed in the CRP program.[102] Second, the land eligibility criteria have been interpreted too broadly, allowing CRP enrollment for lands that do not contribute significantly to service provision.[103] 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."[104] In managing their lands responsibly, they had paid for

99 Katherine H. Reichelderfer & William G. Boggess, *Government Decision Making and Program Performance: The Case of the Conservation Reserve Program*, 70 AM. J. AGRIC. ECON. 1, at 1–2 (1988). To increase the likelihood of their bids being accepted, farmers can stipulate that they will accept a lower rental rate than the local market price. *Id.* at 3.

100 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; enduring benefits; air quality benefits from reduced wind erosion and greenhouse gas sequestration; and cost. FARM SERVICE AGENCY, USDA, CONSERVATION RESERVE PROGRAM (CRP) SIGN-UP 29—QUESTIONS AND ANSWERS, *at* http://www.fsa.usda.gov/pas/FullStory.asp?StoryID=1904 (last visited Mar. 30, 2005).

101 Reichelderfer & Boggess, *supra* note 99, at 3. To promote revegetation, CRP pays up to fifty percent of the eligible costs of establishing new conservation measures. 7 C.F.R. § 1410.41(a) (2005). The CRP determines annual rental payments on a weighted average soil rental rate based on the relative productivity of the soils within each county and the average dry-land cash rent, with an additional incentive payment for certain practices, including continuous sign-ups. § 1410.42(b). The average per-acre rental payment for farmable wetland was $120.80 in 2003. CRP 2003 FISCAL YEAR SUMMARY, *supra* note 92, at 1. Farmers can also offer land at a lower rental rate to increase the likelihood of their being selected for the program. § 1410.31(c)(3). The maximum amount of rental payments that can be received by any person under the CRP is $50,000 per year. § 1410.42(d).

102 *See* JunJie Wu, *Slippage Effects of the Conservation Reserve Program: Reply*, 87 AM. J. AGRIC. ECON. 251, 254 (2005) (finding that leakage accounted for thirteen to forty-five percent of CRP acreage in Corn Belt and Lake Belt states); Greg Gordon & James Walsh, *Success in Saving Topsoil or Misguided Conservation?*, STAR TRIB., June 25, 1995, at 1A (stating that nine Great Plains states enrolled 17.3 million acres in CRP from 1985 to 1992, but total amount of harvested cropland only declined by 2.6 million acres).

103 Gordon & Walsh, *supra* note 102 (noting that as much as seventy-seven percent of CRP land in Minnesota could be farmed with little ecological harm if proper management practices were used, and presenting conclusion of General Accounting Office that strategically setting aside 6 million acres of cropland as riparian buffers would protect water quality better than current CRP program which is six times larger); Reichelderfer & Boggess, *supra* note 99, at 5.

104 Gordon & Walsh, *supra* note 102 (quoting Philip Gersmehl, University of Minnesota geography professor). Personal email communication from Steven Kraft, Professor, Department of Agribusiness Economics, Carbondale, IL, Southern Illinois University (Feb. 6, 2005) (noting

conservation measures out of their own pocket and now could not apply for CRP funds. Finally, perhaps as a result of collusion in the bidding process, farmers' bids clustered just below the program's clearance price (which was set as a per hectare price) and above local market rental rates.[105]

BushTender improves upon the CRP through its reliance on a robust assessment methodology and reverse auction mechanism to set the price of the contracts.[106] The first BushTender trial was completed in 2002 in the north central and northeast regions of the state.[107] With the assistance of farmers' associations, the Victorian Department of Natural Resources (NRE) publicized that it might be willing to pay farmers to conserve native vegetation.[108] 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 what kinds of conservation activities would be most effective.[109] 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 the Habitat Services Score (assessing the proposed management action's contribution to biodiversity improvement, such as fencing or weed control).[110] Landholders were informed of the Habitat Services Score, but importantly, not the Biodiversity Significance Score.[111] Thus they were told which land management changes were most important, but not how significant their 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 they would implement for the remnants. The range of proposed management actions ranged from excluding stock,

that this was important concern during early years of CRP).

105 Gordon & Walsh, *supra* note 102 (citing research by Steven Taff, agricultural economist at University of Minnesota, that Department of Agriculture officials set secret ceilings on rents they would pay, but farmers always seemed to know ceilings and "[i]f the maximum was $50 an acre . . . everybody bid $49.99."). But see STONEHAM ET AL., *supra* note 90, at 22, and Reichelderfer & Boggess, *supra* note 99, at 10, for argument that similar results could occur through sequential learning without collusion.

106 STONEHAM ET AL., *supra* note 90, at 11.

107 *Id.* at 12.

108 Details of the BushTender case are taken from STONEHAM ET AL., *supra* note 90, at 11–13, and Interview with Gary Stoneham, Senior Economist, Victorian Department of Natural Resources, in Melbourne, Austl. (Oct. 14, 2002). Further details are available on the government department website at http://www.dse.vic.gov.au/dse/nrence.nsf/LinkView/15F9D8C40FE51BE64A256A72007E12DC8062D358172E420C4A256DEA0012F71C.

109 Interview with Gary Stoneham, *supra* note 108.

110 STONEHAM ET AL., *supra* note 90, at 11.

111 *Id.*

retaining large trees, and controlling rabbits, to controlling weeds and revegetation.[112]

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—those squares on the right side of Figure 2, below).[113] Given a limited funding budget, only the most cost-effective bids were funded.[114]

FIGURE 2: THRESHOLD-BBI AND BID DATA

[Printer: insert fig2.doc here]

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 or improving their native vegetation.[115] 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 states.

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 twenty-four new populations of rare or threatened plant species.[116] 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.[117] It is not clear whether the lower price was due to the market pressures of competitive bidding, the NRE overestimation of 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.[118]

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112 In all, from 126 expressions of interest, field officers assessed 223 sites. In the end, 98 landholders submitted 148 bids for 186 sites. *Id.* at 14.

113 The total score, known as the Biodiversity Benefits Index (BBI), was calculated by multiplying the Biodiversity Significance Score and Habitat Significance Score and dividing by the cost (or price) of the bid. *Id.* at 12.

114 In the end, the Department of Natural Resources and Environment (NRE) accepted ninety-seven bids, with landholders committing to conserve and manage roughly 3200 hectares of native vegetation under three-year BushTender Management Agreements for a total cost of approximately A$400,000. Compliance monitoring occurs through random site inspections. *Id.* at 14–17.

115 *Id.* at 13.

116 Interview with Gary Stoneham, *supra* note 108.

117 STONEHAM ET AL., *supra* note 90, at 18.

118 It is an open question whether persuasive instruments, such as brochures or educational visits from conservation staff, would have achieved the same result as competitive bidding. At first glance, this seems unlikely because the landholders would not be forced to consider the true

Based on the success of BushTender, the Victorian government has funded BushTender II, with a focus on biodiversity and salinity reduction services.[119] The model has also been adopted in the neighboring state of New South Wales.[120]

C. Pagos por Servicios Ambientales (Costa Rica)

Ecosystems provide valuable services in countries rich and poor alike, and markets are emerging in both developed and developing countries. 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.[121] In 1997, Costa Rica launched a nationwide scheme of payments for provision of ecosystem services, known as Pagos por Servicios Ambientales (PSA).[122] The PSA permits the government to enter into binding contracts with landowners for the provision of four services: sequestration of carbon, water quality and quantity (i.e., for drinking, irrigation or hydroelectric power), biodiversity conservation, and aesthetic beauty for ecotourism.[123]

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

value of their willingness to accept land changes.

119 Interview with Gary Stoneham, *supra* note 108.

120 Inspired by BushTender, the New South Wales government has launched a pilot project known as the Environmental Services Scheme that pays twenty farmers to take part in a three-year, A$2 million pilot scheme to provide environmental services on their properties. 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 pays the farmers. Unlike the BushTender trial, the Ecosystem Services Scheme (formerly known as the Environmental Services Scheme) 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. At the moment, it appears that separate indices of value will be established for each service and that no attempt will be made to combine the separate values into a composite environmental benefits index that would account for tradeoffs (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). *See* N.S.W. Dep't of Infrastructure, Planning and Natural Res. 2001, *Environmental Services Scheme*, *at* http://www.dlwc.nsw.gov.au/care/es_scheme.html (last visited Nov. 23, 2004); N.S.W. Dep't of Infrastructure, Planning and Natural Res. 2001, *Environmental Services Scheme at a Glance* 1–2, 12, *at* http://www.dlwc.nsw.gov.au/care/enviro_services%20_eoi1.pdf (last visited Mar. 4, 2005).

121 Details of the Pagos por Servicios Ambientales (PSA) program are taken from Pagiola, *supra* note 10, at 37. "The PSA program did not start with a blank slate. Beginning in the 1970's, concern over dwindling timber supplies had led Costa Rica to provide incentives for reforestation. Initial efforts focused on tax rebates." *Id.* at 40.

122 *Id.* at 40.

123 *Id.*

called FONAFIFO to administer the program (e.g., to negotiate the agreements, monitor compliance, administer payments, etc.).[124] 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.[125] Most contracts extend over a five-year period (though they can go up to twenty years).[126]

The key to the scheme has been its success in finding both willing buyers and sellers. By the middle of 2000, roughly 200,000 hectares of forest were being managed for service provision in exchange for payments.[127] An additional 800,000 hectares had been proposed for conservation management but not included in the program because of inadequate funding.[128] It is important to note, however, that most of the land has been managed for biodiversity, not water services. This is due primarily to the available resources and numbers of willing buyers. The World Bank, with a $32 million loan, and the Global Environment Facility, with a $8 million grant, have provided the means to pay for biodiversity conservation.[129]

By contrast, only about $100,000 has been paid specifically for water service provision from 2400 hectares.[130] While the potential purchasers of water services might include water suppliers, 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.[131]

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.[132]

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124 *Id.* at 40–41.

125 *Id.* at 41, 50.

126 *Id.* at 50.

127 There have been no studies to date examining the likelihood that this land would have been cleared for logging. *Id*. at 53.

128 *Id.*

129 *Id.* at 42.

130 *Id*. at 56. 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. *Id.* at 49, 52.

131 *Id.* at 42. Sedimentation reduces the capacity of a hydroelectric plant's reservoir and correspondingly reduces the amount of power that the plant can generate. *See* Castaldi et al., *A Study of Hydroelectric Power: From a Global Perspective to a Local Application* 8 (2003), *at* http://ww.ems.psu.edu/~elsworth/courses/cause2003/finalprojects/vikingpaper.pdf.

132 Another Costa Rican initiative worth noting is similar to the Catskills case. Costa Rica's

IV
NOTES FROM THE FIELD—INSTRUMENT DESIGN CHALLENGES

Part II set out why service markets are so hard to design. Part III showed that, despite these challenges, service markets can be created and already exist. Let us now take a closer look, melding the theory of Part II with the practice of Part III to examine *how* to design an ecosystem service market that works. The key starting observation is that, despite the significant differences among Part III's market examples in terms of structure, service provided, and size, they all share fundamentally similar design challenges. Indeed, as any environmental policy course makes clear in the first class, these are the same challenges facing *any* policy instrument, fiscal or regulatory, designed to conserve natural resources. In other words, regardless of the policy instrument employed—whether prescription, penalty, persuasion, property, or payment—one must determine: (1) *what* services need to be delivered, (2) *how* they are to be provided, (3) *who* the providers and beneficiaries are to be, and (4) *how much* service provision is necessary.[133]

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 BushTender, for example, the problem is loss of local biodiversity; the ecosystem service of biodiversity is provided through conservation of remnant native vegetation. In the case

Ministry of Environment and Energy charges 20,000 water consumers near San José a small surcharge on monthly water bills. The funds are used to pay upper watershed farmers who have agreed to conserve and manage their forests. DAILY & ELLISON, *supra* note 17, at 65.

[133] There is a huge body of literature on the general design of environmental policy instruments. *See, e.g.*, ENVIRONMENTAL POLICY: OBJECTIVES, INSTRUMENTS, AND IMPLEMENTATION (Dieter Helm ed., 2000) (providing glimpses of potential to apply economic concepts to environmental policy); PUBLIC POLICIES FOR ENVIRONMENTAL PROTECTION (Paul R. Portney & Robert N. Stavins eds., 2d ed. 2000) (examining six trends in environmental policy developments since 1989); THOMAS STERNER, POLICY INSTRUMENTS FOR ENVIRONMENTAL AND NATURAL RESOURCE MANAGEMENT (2002). Scholarship on instrument design for ecosystem service conservation, by contrast, is quite meager. The best overall assessment from an economic perspective is by Geoffrey Heal. HEAL, *supra* note 14, at 133–41. The best article analyzing instruments for land conservation is Christopher S. Elmendorf, *Ideas, Incentives, Gifts, and Governance: Toward Conservation Stewardship of Private Land, in Cultural and Psychological Perspective*, 2003 U. ILL. L. REV. 423, 495 (2003). Elmendorf draws upon sociological and psychological studies of attitudes toward land, community, and environment, and on social psychology of group conflict. *Id.* The best legal overview of market instruments for service conservation (with particularly good examination of instruments to provide instream water flows) is Thompson, *supra* note 22, at 295–98 (2000). This Article builds on this scholarship, with the major addition that my concerns and analysis were driven by the practical need to develop and implement a pilot program in the field.

of the CRP, the problem initially was erosion; the ecosystem service of soil retention was provided through plants' root systems. In Costa Rica, the major 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 do not indicate the appropriate land management regime to provide the service. Concerns over eutrophication (excessive nitrates and phosphates leading to algal blooms) implicate the service of nutrient uptake, for example, while concerns over turbidity indicate the need for greater sediment retention.

B. How Is the Service Provided?

The next 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 the 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).

Consider, for example, the pilot program to combat salinity along the Macquarie River in Australia.[134] 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 often required to clear most of the native vegetation before they could claim title to the land.[135] 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.[136] Large expanses of agricultural areas now face the serious threat of

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134 Macquarie River Food and Fibre (Austl.), *Welcome to Macquarie River Food and Fibre* (explaining background and purpose of reforestation project), *at* http://www.mrff.com.au/forests.html (last visited Feb. 16, 2005).

135 Australian Bureau of Statistics, *Early History of Land Tenure*, OFFICIAL YEAR BOOK OF THE COMMONWEALTH OF AUSTRALIA, 1910, *available at* http://www.abs.gov.au/Ausstats/abs@.nsf/0/88fd067140fc3f4dca2569e300102388?OpenDocument (noting that Land and Pastoral Acts of 1869 required settlers to cultivate land).

136 *See* David Bennett & D.K. Macpherson, *A Salty Bunch of Dates 1772–1899: A History of Salinity in Western Australia: Important (and Some Unimportant) Dates*, *at* http://agspsrv34.agric.wa.gov.au/environment/salinity/intro/history1.htm (last updated March 16, 2004); Dept. of Agriculture, Western Austl., *Salinity at a Glance*, *at* http://agspsrv34.agric.wa.gov.au/environment/salinity/intro/salinity_at_a_glance.htm (last updated March 17, 2002).

salinity—saline groundwater rising to the root zone of plants and stunting their growth.[137] One area that is just starting to feel this effect is the verdant Macquarie River valley.

As a pilot program to combat salinity, New South Wales State Forests signed a contract with Macquarie River Food and Fiber (MRFF, an organization that represents more than 600 Macquarie Valley irrigation farmers and their families)[138] to purchase "salinity control credits."[139] 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).[140] 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).[141] 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.[142] 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 over service provision—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.[143] It is not known, however,

137 *See* MICHELE JOHN & ROSS KINGWELL, A REVIEW OF OPTIONS FOR DRYLAND SALINITY MANAGEMENT IN LOW RAINFALL AGRICULTURAL ENVIRONMENTS IN WESTERN AUSTRALIA (Sustainability & Econ. in Agric., Working Paper No. 02/07, 2002), *at* http://www1.crcsalinity.com.au/newsletter/SeaNews/dpap0207.htm (last revised May 21, 2003); Nat'l Audit Office, *Administration of the National Action Plan for Salinity and Water Quality* (reporting on planning and governance of National Action Plan for Salinity and Water Quality administered by Department of Agriculture, Fisheries and Forestry, Department of Environment and Heritage), *at* http://www.anao.gov.au/WebSite.nsf/Publications/F176D586559BC247CA256F6A006E587D (last visited Mar. 4, 2005).

138 Macquarie River Food and Fibre (Austl.), *Macquarie River Food and Fibre* (explaining background and purpose of MRFF), *at* http://www.mrff.com.au/about.html (last visited Apr. 12, 2005).

139 Macquarie River Food and Fibre (Austl.), *Welcome to Macquarie River Food and Fibre* (explaining salinity control credits), *at* http://www.mrff.com.au/salinity.html (last visited Feb. 16, 2005); Interview with Sue Salvin, Consultant, N.S.W. State Forests, Sydney, (Nov. 18, 2002).

140 Macquarie River Food and Fibre (MRFF) actually pays N.S.W. 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. Macquarie River Food and Fibre, *supra* note 134.

141 Interview with Sue Salvin, *supra* note 139.

142 *Id.*

143 *Id.*

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 how the service is provided 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.[144]

C. 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 also who the regulatory target is. Take the problem of biodiversity loss. We cannot simply legislate against biodiversity loss. We first need to determine the specific actions that are reducing biodiversity and the parties responsible for these actions. One clear target for regulation would be landholders who have large patches of remnant native vegetation under threat on their land. The specific behavior to encourage would be to halt land clearing. Active management of these remnants for conservation would be better still.

More specifically, if we are interested in creating ecosystem service markets, we need a clear idea at the outset of who the buyers and sellers will be. As noted in Part II, markets for services can be established only if there are discrete groups of providers and beneficiaries.[145] Otherwise, transaction costs become too high for contract formation. While we all gain from the insurance service and medicinal benefits of having a vast store of potential disease cures in nature's biodiversity, there is no locally discrete class of beneficiaries with whom landholders can negotiate for biodiversity conservation efforts.

As a result, to overcome collective action problems, most successful service markets to date operate as *monopsonies*, with only one buyer for multiple service provider sellers. The only reason biodiversity conservation contracts were so successful in Costa Rica was because of the unusual role played by the World Bank and the Global Environment Facility as a single, surrogate purchaser that stepped in with millions of dollars to purchase services on behalf of the world. The success of BushTender was also due to it being a monopsony. Monopsonies have arisen to create successful markets for other types of ecosystem services as well. In the Catskills, there was only a single purchaser, namely New York City's water authority. Whether for biodiversity or clean water, the government pays for these services on behalf of the citizenry. Such actions

144 *Id.*

145 *See supra* notes 55–56 and accompanying text.

are entirely appropriate, it should be noted, since they correct the market failure posed by public goods.

Nor are monopsony buyers limited to governments alone. In Costa Rica, 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).[146] One might argue that water utilities and energy companies operate in a quasi-governmental capacity, but purely private markets often act as monopsonies, as well. Consider, in this regard, the case of Perrier Vittel, the largest bottler of mineral water in the world.[147] In the early 1990s, 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.[148] For an estimated $9 million, Perrier Vittel paid above-market prices to purchase 1500 hectares around its water springs.[149] In an innovative move, Perrier Vittel then offered to give back free usufruct rights to the land to the prior owners if they followed prescribed management practices.[150] Perrier Vittel also signed long-term (eighteen to thirty years) contracts with forty farmers covering an additional 10,000 hectares, paying them to use less intensive dairy farming techniques.[151] 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.[152]

D. How Much Service Is Needed?

So far 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, which actions should be proscribed, and by how much. If we decide to tax,

146 Pagiola, *supra* note 10, at 49.

147 MARITTA KOCH-WESER & WALTER KAHLENBORN, BISHKEK GLOBAL MOUNTAIN SUMMIT 2002, LEGAL, ECONOMIC, AND COMPENSATION MECHANISMS IN SUPPORT OF SUSTAINABLE MOUNTAIN DEVELOPMENT § 2.5, *at* http://www.mtnforum.org/resources/library/kochx02a.htm (last visited Feb. 16, 2005).

148 *Id.*

149 PERROT-MAÎTRE & DAVIS, *supra* note 93, at 5.

150 *Id.*

151 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 with 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. *Id.*

152 *Id*. at 4.

we need to know not only whom to tax, but also how much to charge. If we end up choosing a payment instrument, we need to know not only whom to pay, but also how much to pay them.

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 the level of service provision. While some areas might be classified as priority areas, the program allows any landholder, anywhere in the country, to participate and to be paid the same amount, regardless of whether they provide valuable services or not. As one commentator has stated, "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 zones or steep slopes)."[153] As a result, the PSA approach resembles a general subsidy scheme, virtually ensuring the suboptimal targeting of public funds.

What would be more effective, by contrast, would be targeted funding with payments based on level of service provision, targeted regulations, or differential 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 the greatest challenge to using policy instruments to ensure provision of ecosystem services.[154] The real success of both the Environmental Services Scheme and BushTender does not lie in their use of reverse auction mechanisms; that is an efficiency improvement. The key to their success lies in their field 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. Such calculations are only meaningful, however, if the scoring systems (which are estimates of service provision) prove credible. If the assessment of biodiversity value proves to be poor, then there is no assurance that the money was well spent nor that the public is actually getting value for money.

BushTender felt it could provide accurate assessments of biodiversity value through field visits to specific patches of remnant vegetation. Doing

153 Pagiola, *supra* note 10, at 54.

154 Note, as well, that in some cases, perhaps many, landscape management may not provide adequate levels of service provision, and built provisions such as tertiary treatment plants for water quality problems *may* be necessary. This is generally the case, for example, in heavily developed watersheds.

so for other services, such as salinity in the water table, however, 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 will not know what they are paying for. Nor can one reasonably set taxes or establish regulations with any certainty that the desired behavior will result in meaningful service provision. Over time, such uncertainties may be overcome by better modeling and monitoring technologies.[155] But, at the moment, they confound setting up a market or other policy instruments. That is the reason MRFF is unlikely to continue its reforestation pilot with NSW State Forests. Beyond intangible public relations benefits, MRFF has no idea if it is getting value for the money it pays to plant trees in the upper catchment.

So how can MRFF and others paying for services ensure the effectiveness of their investments? They need reliable and robust monitoring capacity. To assess the impact of vegetative barriers in preventing salinization, for example, the most reliable salinity models developed to provide estimates of service capacity per hectare take into account topography, deep drainage, and runoff under different land uses.[156] Yet use of these models is too expensive and time consuming, even if it can be done with reasonable accuracy[157]—hence MRFF's dilemma. Far better would be a "rough and ready" field estimate based on visual observation and scoring. BushTender used this approach in valuing biodiversity and similar rules of thumb potentially could be developed for water quality (such as proximity to watercourse, slope of land, extent of riparian vegetation, etc.).[158] 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, while ensuring that transaction costs do not swamp the efficiency benefits of markets.[159]

The net result is that it will be easier to develop markets for some

155 *See generally* Daniel C. Esty, *Environmental Protection in the Information Age*, 79 N.Y.U. L. REV. 115 (2004) (examining potential of improved information collection and analysis on environmental protection).

156 Personal communication with David Shelton, Ecosystem Services Group, Commonwealth Scientific Industrial Research Organization, Canberra, Austl. (Oct. 22, 2002).

157 *Id.* 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).

158 Personal communication with Rod McInness, Staff Economist, Sydney Catchment Authority (Mar. 20, 2003).

159 The methodology must also be sufficiently objective to prevent improperly favoring some beneficiaries over others.

services than for others, for the simple reason that those buying services will be more confident that they are receiving value for their money. How difficult, for example, is linking the contributions of individual land management decisions to water quality in a water supplier's subcatchment? 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.[160]

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. An oft-cited 1997 article in *Nature*, for example, calculated the value of nature's services at around twice the planet's GNP.[161] While useful for rhetorical purposes in showing how immensely valuable services are to our well-being, such monetary estimates face serious methodological challenges and 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 in total because, fortunately, their actions will not wipe out the service.[162] Rather, the relevant comparison is *between the 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.[163] And this cannot be calculated without robust biophysical modeling. While they grab headlines, monetary valuations of services are more important for rhetorical or political purposes than market design.[164]

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160 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.

161 Costanza, *supra* note 16, at 253.

162 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, *supra* note 16, at 889–98.

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

164 For example, I believe that a likely reason behind the EPA's recent creation of the Science Advisory Board on valuation of ecosystem services is to help the agency counter demands from the Office of Management and Budget that it justify its regulations through cost-benefit analysis. For more information on the Board, see EPA Sci. Advisory Bd., *Committee on Valuing the Protection of Ecological Systems and Services*, *at* http://www.epa.gov/science1/panels/vpesspanel.html (last visited Mar. 4, 2005).

1. Ensuring Service Provision

In addition to determining the appropriate level 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 one is 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. Some of the potentially largest service markets, however, may prove to be mitigation markets where service provision is far more difficult to ensure. Under the Clean Development Mechanism of the Kyoto Protocol, for example, countries will be able to sell credits for the service of carbon sequestration through reforestation and other permitted land use changes.[165] As described below, wetlands mitigation banking poses similar challenges.[166]

Since President George H.W. Bush's campaign in 1988, there has been a consistent national policy to ensure "no net loss" of wetlands.[167] On its face, the primary law conserving wetlands, the Clean Water Act (CWA), seems to prevent the filling of most wetlands.[168] The CWA provides a limited exception, however, through a permit system administered principally through the Army Corps of Engineers (the Corps).[169] These "404 permits" are necessary for many routine land development activities before they can proceed. When applying for a permit, a developer must convince the Corps that no reasonable alternatives exist to the development

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165 SECRETARIAT OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, DESCRIPTION OF THE CLEAN DEVELOPMENT MECHANISM, *at* http://unfccc.int/kyoto_mechanisms/cdm/items/2718.php (last visited Feb. 17, 2005).

166 Buzz Thompson draws a distinction between "markets for nature," where parties seek to restore or preserve nature, and "regulatory markets," where parties such as factories and developers engage in trades in order to harm the environment. The main purpose of regulatory markets, he argues, is not better environmental protection but more *efficient* protection. Thompson explains that in "providing the regulated community with greater flexibility . . . [g]overnments superimpose market structures onto these regulatory systems primarily to ensure that the limited rights to pollute, develop wetlands, and divert water are used efficiently, thus minimizing the cost of the regulation to the economy." Thompson, *supra* note 22, at 262.

167 For a detailed discussion of wetlands mitigation banking, see Salzman & Ruhl, *supra* note 36, at 648–68. In its National Wetlands Mitigation Action Plan issued on December 24, 2002, President George W. Bush's administration continued this trend, stating its commitment to no net loss of wetlands. *See* Nat'l Wetland Mitigation Action Plan, *at* http://www.mitigationactionplan.gov/maphtml.html (last visited Apr. 16, 2005).

168 Clean Water Act § 301, 33 U.S.C. § 1311(a) (2000). Section 301 of the CWA prohibits "the discharge of any pollutant by any person" into navigable waters. *Id*. § 1311 (2000). *See* NRDC v. Callaway, 392 F. Supp. 685, 686 (D.D.C. 1975) (finding term "navigable waters" in Clean Water Act not to be "limited to the traditional tests of navigability" since Congress had "asserted federal jurisdiction over the nation's waters to the maximum extent permissible").

169 Section 404 of the CWA authorizes the Secretary of the Army to "issue permits, after notice and opportunity for public hearings for the discharge of dredged or fill material into the navigable waters at specified disposal sites." Clean Water Act § 404, 33 U.S.C. § 1344(a) (2000).

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").[170]

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.[171] Over time, however, the Corps and the EPA have allowed compensatory activities to move from on-site to off-site mitigation, opening the door for wetlands mitigation banking.[172] 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.[173] Wetland mitigation banking now resembles a commodity market, with freewheeling, entrepreneurial wetlands banks offering for sale finished off-site wetlands as "credits" to anyone who is in need of mitigation for their 404 permits.[174] There were between 370 and 400 such commercial mitigation banks operating in the United States as of January 2000.[175]

Banking advocates argue that the wetlands market prevents net loss more efficiently than on-site compensatory mitigation.[176] This begs the question, however, of "net loss" *of what*? Banking has ensured no net loss of wetlands acreage, but the implementing regulations require that mitigation banking operate *as a service market*.[177] In particular, the mitigated wetland must provide equivalent function to the destroyed wetland.[178] And in terms of conserving ecosystem services, mitigation

170 Salzman & Ruhl, *supra* note 36, at 651–52.

171 *Id.* at 651.

172 Michael J. Bean & Lynn E. Dwyer, *Mitigation Banking as an Endangered Species Conservation Tool*, 30 ENVTL. L. REP. 10,537, 10,538–39 (2000) (explaining how mitigation banking can promote wildlife conservation).

173 *Id.* Coefficients are usually required, mandating two or three times more mitigated wetlands to compensate for filled wetlands. New Jersey, for example, "generally requires a 2:1 mitigation ratio for both coastal and freshwater wetlands." Thomas W. Ledman, Note, *Local Government Environmental Mitigation Fees: Development Exactions, The Next Generation*, 45 FLA. L. REV. 835, 855 (1993); *see also* N.J. Admin. Code tit. 7, § 7E-3.27(h)(9)(ii)(3) (2004), *available at* www.state.nj.us/dep/landuse/7-7e.pdf (stating that ratio for created wetlands is "two acres created to one acre lost").

174 Bean & Dwyer, *supra* note 172, at at 10,550.

175 *See* INST. FOR WATER RES. (IWR), U.S. ARMY CORPS OF ENG'RS, EXISTING WETLAND MITIGATION BANK INVENTORY, SPRING 2000, *at* http://www.iwr.usace.army.mil/iwr/regulatory/banks.pdf (listing state, location, and sponsor of all wetlands mitigation banks).

176 *See* Federal Guidance for the Establishment, Use and Operation of Mitigation Banks, 60 Fed. Reg. 58,605–07 (Nov. 28, 1995) [hereinafter Federal Guidance].

177 Salzman & Ruhl, *supra* note 36, at 657–58.

178 The Federal Guidance provides that "[t]he number of credits available for withdrawal (i.e.,

banking has performed poorly.[179] In the most comprehensive study to date, in 2001 the National Academy of Sciences concluded that "[t]he goal of no net loss of wetlands is not being met for wetland functions by the mitigation program . . . ."[180]

There are two reasons for this failure that designers of service markets need to consider. The first concerns the trading currency. Most mitigation banks use the simple metric of acreage as the trading metric—three acres of restored wetland for two acres of destroyed wetland.[181] 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 cannot capture any relevant information on service provision.[182] Banks chose the simple currency to ensure the market remains thick—that is, so that transaction costs to assess trades are low enough that trading remains attractive. As the currency is refined, by assessing service provision as well as acreage, for example, the costs of trades increase, potentially thinning the market.[183]

The second reason concerns the structure of the mitigation market. In most markets, the buyer ensures quality. Consider when you buy a bike.

debiting) generally should be commensurate with the level of aquatic functions attained at a bank at the time of debiting." Federal Guidance, *supra* note 176, at 58,611. Wetland values must be determined "by applying aquatic site assessment techniques generally recognized by experts in the field and/or the best professional judgment of Federal and State agency representatives, provided such assessments fully consider ecological functions included in the Guidelines." *See* Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines, 55 Fed. Reg. 9211–12 (Mar. 12, 1990).

179 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 and twelve percent for freshwater wetlands creation. Virginia C. Veltman, *Banking on the Future of Wetlands Using Federal Law*, 89 NW. U. L. REV. 654, 669 (1995).

180 COMM. ON MITIGATING WETLAND LOSSES, NAT'L RESEARCH COUNCIL, COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT 2 (2001), *available at* http://books.nap.edu/openbook/0309067774/html/index.html.

181 *See* Salzman & Ruhl, *supra* note 36, at 660–61.

182 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." James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 666 (2001) (quoting Dennis King & Luke W. Herbert, *The Fungibility of Wetlands*, 19 NAT'L WETLANDS NEWSL. 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).

183 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. STAT. ANN. § 373.414(18) (West Supp. 2005).

If, in your first ride around the neighborhood, you immediately find that the brakes do not work or that the seat slips out of place, 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 to sign off on the bank. As a result, it falls on the regulator, who does not have a stake in the transaction, to ensure quality, and both the Corps and the EPA have very spotty records in this regard.[184]

There is no question that mitigation markets hold great promise for provision of ecosystem services. Indeed, with the recent entry into force of the Kyoto Protocol, the Clean Development Mechanism may dwarf all service markets to date.[185] But unless buyers and sellers have a direct stake in the quality of service provision, which will generally not be the case in a mitigation market, one can expect that services will be underprovided without strong government oversight.[186]

V
INSTRUMENT CHOICE IN ROBERTSON, AUSTRALIA—PAYMENTS FOR SERVICE PROVISION

We have now reviewed the barriers to ecosystem service market creation, surveyed markets that have overcome these obstacles, and considered the fundamental design issues for creating and maintaining markets. This analysis, however, has begged a rather basic question—whether we should encourage markets for service provision in the first

[184] Veltman, *supra* note 179, at 670 ("The California State Coastal Conservancy (SCC) 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, 341 (1998) (discussing Florida state agency study finding twenty-seven percent success rate of such projects).

[185] The Kyoto Protocol entered into force on Feb. 16, 2005. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 32 (1998). *See also* Mark Landler, *Mixed Feelings as Kyoto Pact Takes Effect*, N.Y. TIMES, Feb. 16, 2005, at C2. Even without the Kyoto Protocol in force, there were over $300 million in carbon trades in 2002. Interview with Adam Davis, Director, Peregrine Consulting, Wash., D.C. (Oct. 30, 2003). This figure includes payments for both carbon sinks (e.g., paying for reforestation and afforestation) and carbon reductions (e.g., reducing emissions through technology improvements).

[186] And this will inevitably be a concern because, rather than benefiting directly from provision of the service (as do water drinkers in New York or Perrier-Vittel's bottling operations), in mitigation markets the buyers are creating the environmental problem and seeking to offset the total harm. For a discussion of the different types of markets for nature, see Thompson, *supra* note 22, at 266–67.

place. In this Part, we address the question of instrument choice head-on, examining whether and when market payments should be preferred for service provision instead of one of the other "Five P's," the more traditional instruments such as regulations, taxes, or persuasion. Perhaps surprisingly, instrument selection has received very little consideration in the ecosystem services scholarship to date. Publications generally assume payments are desirable and focus on relevant case studies.[187] As John Echeverria has tellingly observed:

> 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 *why* 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.[188]

Grounding this discussion in practice, Section A describes the problem of reducing runoff from farms in the area of Robertson, southwest of Sydney, where I worked in 2003 with the Sydney Catchment Authority. Section B then presents a range of analytical frameworks to assess the optimal policy instrument. Employing Coasean, information asymmetry, efficiency, political, and property rights analyses, this Section identifies when market payments should be the preferable policy instrument for provision of *most* ecosystem services. This finding is controversial and its critiques, which are considerable, are taken up in Part VI.

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.[189] A royal commission formed to examine the outbreak concluded

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187 *See generally* DAILY & ELLISON, *supra* note 17 (describing use of markets for various environmental services); LANDELL-MILLS & PORRAS, *supra* note 5 (analyzing cases of emerging markets for forest environmental services).

188 John D. Echeverria, Buying Versus Regulating to Achieve Conservation Purposes 1 (draft paper on file with author). The most useful law review publication assessing instrument choice is Barton Thompson's analysis of policies to ensure instream water flows. *See* Thompson, *supra* note 22, at 261–62.

189 Cryptosporidium is a microscopic parasite that causes cryptosporidiosis, a diarrheal disease that is one of the most common waterborne diseases found in humans in the United States. A cryptosporidium outbreak also killed over 100 people in Milwaukee in 1993. DAILY & ELLISON,

that there was inadequate management of the watershed as a single entity.[190] As the report stated, "[t]he 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."[191] In response, the State Parliament created the SCA, charging it with management and protection of the catchment areas and infrastructure across sixteen local government areas. In many respects, the SCA was explicitly created as an ecosystem service district, responsible for ensuring that the landscape of greater Sydney provides the service of water purification.[192]

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.[193] The SCA has considerably less authority, however, when it comes to regulating *existing* land uses. Indeed, it has no direct authority absent serious pollution incidents, relying instead on an assessment process that does little more than identify land uses that degrade water quality.[194]

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.[195] Robertson's main claim to fame is its role as the location for the popular pig/dog/sheep movie, "Babe." As with the hypothetical

supra note 17, at 62. The outbreak in Sydney occurred during the run up to the Sydney Olympics and residents had to boil their water for two months. Fortunately, there were no outbreaks of cryptosporidiosis. SYDNEY CATCHMENT AUTH., WATER QUALITY: WATER AND ITS TREATMENT, *at* http://www.sydneywater.com.au/Publications/Factsheets/WaterAndTreatment.pdf (last updated Nov. 2003).

190 SYDNEY CATCHMENT AUTH., ANNUAL ENVIRONMENTAL REPORT, 2000–01 24 (2001) (summarizing report's conclusion that "holistic" approach to managing entire catchment is necessary), *at* http://www.sca.nsw.gov.au/publications/37.html (last visited Apr. 21, 2005).

191 2 PETER MCCLELLAN, QC, PREMIER'S DEP'T, SYDNEY WATER INQUIRY: FINAL REPORT (FIFTH REPORT), ch. 14 (1998), http://water.sesep.drexel.edu/outbreaks/Sydney_5/r5chapter14.html.

192 For further exploration of ecosystem service districts—governmental authorities created to provide ecosystem services, see Heal et al., *supra* note 15, at 334.

193 A fascinating institutional issue posed by the SCA's planning power is its preemption of land use decisions that traditionally had been the sole decision of local councils. *See* Sydney Water Catchment Management Act 1998, Part V, Div. I, § 53 (Austl.) ("[r]egional environmental plan to be made"), *available at* http://www.austlii.edu.au/cgi-bin/download.cgi/download/au/legis/nsw/consol_act/swcma1998330.txt.

194 *See* Sydney Catchment Auth., *Catchments, Planning and Development Control*, *at* http://www.sca.nsw.gov.au/catchments/regionalplan.html.

195 My activities as a Fulbright Senior Scholar in Australia focused on the creation of markets for ecosystem services. My field work in Robertson included close cooperation with the Sydney Catchment Authority's field, economics, and policy staff in developing a pilot project to reduce nutrient runoff into the Wingecarribee Reservoir. This involved a series of interviews with farmers and members of the Catchment Authority staff.

watershed discussed in Part II, the SCA's interest in Robertson stemmed from concerns over eutrophication in the Wingecarribee Reservoir downstream from Robertson. The SCA's field staff believed that most of the nutrient loading came from manure leaching into streams from the dairy farms in the catchment. The staff also contended that fencing off stream banks, known as riparian fencing, would significantly reduce the flow of nutrients into the reservoir. Installing riparian fencing, they argued, 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 made the most sense?

B. Determining the Optimal Instrument

In order to explore which instruments best promote the provision of ecosystem services, the following sections apply separate analytical frameworks to the case of the Robertson subcatchment. Despite their disfavor in the literature,[196] each mode of analysis suggests strong practical and theoretical reasons to support payment schemes in particular settings. While the analyses in the following subsections focus on the problem of nonpoint source pollution and the service of water purification, each analysis has important implications for other ecosystem services.[197]

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196 *See, e.g.*, WILLIAM J. BAUMOL & WALLACE E. OATES, THE THEORY OF ENVIRONMENTAL POLICY 221–22 (2d. ed. 1988) (arguing that subsidies to reduce environmental harms are often counterproductive).

197 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. *See, e.g.*, Steven P. Erie & Pascale Joassart-Marcelli, *Unraveling Southern California's Water/Growth Nexus: Metropolitan Water District Policies and Subsidies for Suburban Development, 1928–1996*, 36 CAL. W. L. REV. 267 (2000) (examining potential water payment schemes between cities and suburbs); Duane Mecham & Benjamin M. Simon, *Forging a New Federal Reclamation Water Pricing Policy: Legal and Policy Considerations*, 27 ARIZ. ST. L.J. 507 (1995) (proposing water pricing policies as means of conservation); Barton H. Thompson, Jr., *Institutional Perspectives on Water Policy and Markets*, 81 CAL. L. REV. 671 (1993) (arguing that traditional water policy can benefit from introduction of market values). There is remarkably little scholarship, however, 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, *The Shadow of* The Cathedral, 106 YALE L.J. 2175, 2197 (1997); this work discusses the necessity of realistic assumptions in drawing accurate deductions. For the relative focus of scholarship on policy instruments to promote biodiversity compared to other services, see *supra* note 54.

1. Coasean Bargaining

Created by an act of the New South Wales Parliament, the SCA was granted a range of powers over new land development, but it deliberately was not granted regulatory or financial penalty authority over existing land uses.[198] Therefore, on its face, the entitlement under the act clearly lay with the party providing the service—that is, farmers had the right to have manure flow into the stream. Because the entitlement lay with the farmers, only two viable policy instruments remained—persuasion and payments. Persuasion can be effective in particular settings, but is necessarily limited in its reach.[199] The argument for payments therefore arose from sheer necessity—it was the only real arrow left in the SCA's policy quiver.

A basic law and economics analysis of this situation clearly supports payments. The argument might go something like this: Farmer has a legal entitlement to graze cows on her farm and have her soil and nutrients flow into the watercourse after a storm. 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.[200] This is comparable to the PSA program in Costa Rica and other payments to refrain from changing land uses. Landholders have a clear entitlement to log their forests and are being paid to forgo this activity.

2. Information Asymmetry

The preceding argument is decidedly pragmatic, suggesting that even if one believed regulations or taxes were theoretically preferable, they still would not be preferable in practice because the SCA has no regulatory or taxation authority. Payments are the best we can get. This section addresses a more controversial position, examining whether a payment scheme would be the optimal policy instrument for the SCA *even if* it could regulate or tax land uses.

In this context, it helps to think of the SCA's service provision challenge as a problem of asymmetric information.[201] There is no doubt

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198 Email from Elizabeth Hanlon, Staff Attorney, Sydney Catchment Authority, to Judith Birrell, Senior Resource Planner, Sydney Catchment Authority (on file with the *New York University Law Review*); *see also* SYDNEY CATCHMENT AUTH., SUSTAINING THE CATCHMENTS: THE REGIONAL PLAN FOR THE DRINKING WATER CATCHMENTS AND ADJACENT REGIONAL CENTRES (2004), *at* http://www.sca.nsw.gov.au/publications/files/Section1chapter1_10.pdf (2004) (comparing first draft of plan with revised version which removed planning control table and offered protection for existing land use rights).

199 *See supra* Part II.C.

200 *See generally* Ronald H. Coase, *The Problem of Social Cost*, 3 J. L. & ECON. 1 (1960).

201 *See* STONEHAM ET AL., *supra* note 90, at 19–21; Uwe Latacz-Lohmann & Carel Van der

that landowners know their property better than the government. We often think of such information asymmetry as a negative situation. In the context of the Endangered Species Act, for example, it has given rise 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 preemptively alter their land to make it less attractive as habitat.[202] Indeed, the importance to landowners 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 habitats across the nation.[203]

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. 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 *both* types of information—(1) willingness to pay/accept, and (2) service provision resulting from a land use change—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 costly is ignored. While the opportunity for the public to comment on proposed agency rules ensures that regulatory discussion is at least informed by parties outside of the government, this does nothing in the instance of specific application of the rule and is a classic shortcoming of approaches that mandate specific technologies.[204]

Financial penalties suffer the same shortcoming. It falls entirely on the government to determine not only which actions to encourage or

Hamsvoort, *Auctioning Conservation Contracts: A Theoretical Analysis and An Application*, 79 AM. J. AGRIC. ECON. 407, 414 (1997) (an examination of design issues for conservation contracts).

202 Elmendorf, *supra* note 133, at 432 (citing Robert H. Nelson, *Shoot, Shovel, and Shut Up*, FORBES, Dec. 4, 1995, at 82); *see also* Dean Lueck & Jeffrey A. Michael, *Preemptive Habitat Destruction Under the Endangered Species Act*, 46 J.L. & ECON. 27 (2003) (discussing influence of this phenomenon in endangering woodpecker species).

203 Elmendorf, *supra* note 133, at 437.

204 One could certainly imagine an ambient approach that allowed more flexibility at the level of source-specific regulation but, as noted in the earlier discussion on field assessment methodologies, the information costs for such an approach are significant. *See supra* Part IV.D. One might also point to zoning laws that closely reflect local landscape attributes. Interview with Chris Schroeder, Professor, Duke University Law School, Durham, N.C. (Nov. 18, 2003).

discourage, but also how much financial penalty is needed to induce the appropriate behavior. 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.

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 the government and regulated entities. 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" as potentially valuable service providers.[205] 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. By partially privatizing a public good, 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. Equally, without the government's information, the landholder has little sense of the relative value of the alternative land use or how to optimize the service provision.

a. Information Costs of Payment Schemes

Knowing that payment schemes can encourage low cost information exchange does not, in itself, tell us *which* type of payment scheme should be used. The fundamental question in comparing them is which results in the lowest cost per unit product (i.e., marginal improvement in water quality).[206] The following paragraphs describe the range of payment schemes and their relative costs.

The simplest type of payment scheme is *general subsidy*—deciding how much you are willing to pay for certain types of land use measures that will increase the service provision and then working off of a "first-come, first-serve" basis or a loosely prioritized scoring system such as the one

205 *See* Thompson, *supra* note 22, at 280.

206 This analysis assumes that 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.

used in the CRP.[207] Such an approach has lower information and administrative costs than other payment schemes described below and, when scientific uncertainty is greatest, may 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 a problem with the PSA program in Costa Rica.[208] 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.[209]

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.[210] 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 required 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*, where individual negotiations can take into account differing levels of service provision. The service beneficiary sits down with each service provider and strikes a deal. 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

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

208 *See supra* Part IV.D (stating that PSA program does not really consider level of service provision, allowing any landholder to participate regardless of whether they provide valuable services).

209 Indeed, in some instances fixed payments can reveal the *opposite information* that either side needs to know. The farmer nominates the land he thinks will be most important to the government for service provision, while the government reveals the acceptance price without knowing the farmer's actual opportunity costs in dedicating the land to service provision rather than agriculture. *See* STONEHAM ET AL., *supra* note 90, at 20.

210 The problem of rent-seeking to channel subsidies to particular parties discussed *infra* at note 268 is worth bearing in mind, as well.

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.[211]

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. This type of payment scheme most effectively creates a market dynamic, where potential purchasers bid against one another for the payment. Reverse auctions are particularly well suited to the special market situation of monopsony, when there is only one buyer and many sellers. Based on the results of the BushTender program, such an approach appears 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.[212]

A final option is to follow the New York City example of *paying a third party*, either local government, an existing nongovernmental organization, 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.[213]

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211 It is worth noting that direct payments are the norm for private habitat conservation. Groups such as The Nature Conservancy and Conservation International usually purchase conservation easements or land in fee simple. For more details on such schemes around the globe, see Paul J. Ferraro & Agnes Kiss, *Direct Payments to Conserve Biodiversity*, 298 SCIENCE 1718, 1718–19 (2002). For a useful list of projects and websites, see the list maintained by Paul J. Ferraro, *Global Conservation Payment Initiatives*, *at* http://epp.gsu.edu/pferraro/special/special.htm (July 2002).

212 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 ET AL., *supra* note 90; R. Preston McAfee & John McMillan, *Analyzing the Airwaves Auction*, 10 J. ECON. PERSP. 159 (1996) (analyzing auction-based approach).

213 Scholars have proposed a number of different third-party models. Christopher Elmendorf, for example, calls for the creation of landowner-controlled special districts. Elmendorf, *supra* note 133, at 426. Buzz Thompson has suggested environmental brokers. Thompson, *supra* note 22, at 308–09. And Geoffrey Heal, myself, and others have urged the creation of Ecosystem Service Districts—governmental authorities charged to provide services but given zoning and tax

In the negotiation and reverse auction approaches, the government lets the landholder know the non-market value of the land (because of the lack of a functioning market for most services, it is worth recalling, the monetary value of the services may well be perceived as zero). 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).[214] 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).

3. Efficiency Analysis

Simply because payments can reduce costs of information exchange does not mean, of course, that payments are therefore the optimal policy instrument for service provision. In fact, when information costs are low, the savings from self-identification will be low as well, and the potential problems of payment schemes (such as creating moral hazards or rent seeking, discussed in Part VI) may well favor regulation or taxes. As information costs increase, however, payment schemes become increasingly attractive compared to regulation or taxation. Importantly, as demonstrated below, this is likely to be the case in the SCA example and in other service settings because of heterogeneous preferences and service capacity in the target audience.

The Sydney Catchment Authority's goal is deceptively straightforward—to 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 in Figure 3 below, for example, shows the range of preferences for land stewardship.[215] 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.[216] To display this in a

authority throughout the relevant natural boundary where the service is produced. Heal et al., *supra* note 15, at 343. To date, however, these remain merely proposals.

214 This may provide an interesting twist on the polluter-pays principle. If the farmer truly is internalizing costs, then the polluter is paying to reduce her negative externalities.

215 This graph was suggested by Carl Binning, Director, Greening Australia, Canberra.

216 For a more sophisticated description of the range of farmers' land stewardship preferences,

concrete setting, those farmers who have put in place riparian fencing to maintain their streambanks 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.

FIGURE 3

[Printer: insert fig3.doc here]

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 in Figure 4, for example, an information approach, such as one involving field visits and demonstration projects, may increase the number of farmers who put in riparian fencing. But it is likely that a regulation requiring riparian fencing for farms with more than one hundred head of cattle, for example, will impact an even larger group, as would a stiff tax per meter of unfenced streambanks or per head of cattle.

FIGURE 4

[Printer: insert fig4.doc here]

While seemingly obvious, this kind of analysis turns out to be 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. Some landowners have greater potential to improve the level of service provision than others. Indeed, one can also expect a normal distribution of potential provision of services, as shown below in Figure 5.

FIGURE 5

[Printer: insert fig5.doc here]

As a result, we do not 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 eighty percent of the desired result by focusing on twenty percent of the actors (the group circled above). The problem, though, is that *a priori* we often do not 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,

see Christopher Elmendorf's discussion of Gerry Walter's scholarship, Elmendorf, *supra* note 133, at 442 (citing Gerry Walter, *Images of Success: How Illinois Farmers Define the Successful Farmer*, 62 RURAL SOC. 48, 55–64 (1997)).

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 in Figure 6 by combining the land stewardship and potential for service provision graphs.

FIGURE 6

[Printer: insert fig6.doc here]

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 twenty percent, prescriptive regulation will likely have to be significantly overinclusive, 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 110 kg per year and has a travel time to the reservoir within six hours), we do not often see regulations like this in real life. Much more common are regulations that identify targets based on proxies such as technology or size.[217] In our case, that would present itself as applying to farms with over one hundred 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 necessary because they end up over-regulating landowners who are neither the source of the problem nor the solution.[218]

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[217] One might point to the possibility that states can impose tailored, facility-specific regulations to account for heterogeneity through airshed modeling (i.e., modeling the impacts of emissions by specific sources on ambient pollution across an area) under State Implementation Plans in the Clean Air Act. Clean Air Act, 42 U.S.C. § 7410(a)(1) (2000). Whether this often occurs in practice, though, is less clear. Interview with Mark Squillace, Professor, Toledo Law School, Provo, Utah (Aug. 4, 2003).

[218] A related issue which I do not analyze in this Article is the cost of administration. This

Payment schemes will be overinclusive, as well, if operated as general subsidies. Directed payments tendered on a competitive basis, however, can be narrowly targeted to those farmers (our circled twenty percent) who are interested in changing land use practices *and* have a high potential for service provision. As noted above, this is the case because competitive 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 twenty percent) and compete for the government funds against other service providers. Not only does this considerably lower the cost of information gathering but, because farmers are being paid, 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 monitoring and enforcement costs.[219] Indeed, if the experience of BushTender is any guide, one can expect some farmers to lower their acceptance price.[220]

It is important to note that this conclusion may seem contrary to traditional economic wisdom. In economic theory, penalties and payments are regarded as equivalent—the net social cost is the same; the only issue is distributional—whether the public pays through subsidies/tax breaks or the farmers pay through fines/taxes.[221] While true as a theoretical matter, in practice this need not be the case. As the analysis of the Robertson situation demonstrated, if information costs are high enough, they can be dispositive in instrument choice because of the savings generated by payment schemes from self-identification.

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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. Monitoring costs for specific contractual arrangements also will be higher than generalized commitments. As described below, this will be reduced by the presumably lower costs of compliance monitoring and enforcement. But effective compliance monitoring will be essential. As the history of wetlands mitigation makes clear, *see supra* Part IV.D.1, lax monitoring by the government can doom even the best-designed program. As the Australian projects continue, there should be good empirical data that can address these questions.

219 In the context of markets for instream flows, Barton Thompson suggests that payments may "lead to the development of significant new conservation measures . . . [that] could be substantial." Thompson, *supra* note 22, at 276.

220 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) that are connected to "rural heritage" and experience, prior to paying for conservation unconnected to the landowners' core values, such as biodiversity. *See* Elmendorf, *supra* note 133, at 469 ("Positive financial incentives also imbue ecological resources with a new use value.").

221 As an example, we can encourage a farmer to put in riparian fencing either by granting her a $200 tax credit for doing so or taxing her $200 for not doing so. The net result is the same, as is the net social cost. The only issue is distributional—whether the cost is borne by the government or the farmer. Personal communication with Nathaniel Keohane, Professor, Yale School of Management and Organization, New Haven, Conn. (Mar. 9, 2004). *But see* BAUMOL & OATES, *supra* note 196, at 213 (arguing that fees and subsidies are not symmetrical in practice).

4. Political Analysis

In the preceding examples, we considered cases of absolute entitlements. In our Coasean analysis, farmers held the right to graze cows and have manure run off their land. In our efficiency analysis, government held the right to halt this runoff. A more interesting, common, and difficult issue arises when these entitlements either conflict or are unclear.

Consider, for example, the case where the government has a *de jure* entitlement and farmers have a *de facto* entitlement. What if, for example, the government has the legal authority to reduce manure runoff from farms (e.g., through public nuisance suits) but never exercises the right? As a result, farmers allow their cows to graze and do not put in riparian fencing. Why should the government pay farmers for fencing when it can tax or regulate instead?

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.[222] 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.[223] 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 fifty percent of the voting body supports the action), to a rule of "Voluntary Assent," where the lack of a sovereign authority over nations means that rules bind only those who wish to be bound, and finally to a "Unanimity" rule.[224] Of particular relevance to our concerns is that in the shift from domestic to international law, there is a corresponding shift from a Fiat rule to a Voluntary Assent rule. In such a setting, ensuring meaningful participation is no easy matter, because regulatory targets can now walk away from the table. Since there is no coercive force to require participation by independent sovereign nations, 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:

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222 *See generally* Jonathan B. Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677 (1999) [hereinafter Wiener, *Global Environmental Regulation*] (addressing whether polity's legal framework affects type of regulation it prefers); Jonathan B. Wiener, *On the Political Economy of Global Environmental Regulation*, 87 GEO. L.J. 749 (1999) (stating, *inter alia*, that voluntary assent voting in international law makes adopting regulation cooperative enterprise rather than coercive, making it difficult to enact broadly applicable regulation); Jonathan B. Wiener, *Something Borrowed for Something Blue: Legal Transplants and the Evolution of Global Environmental Law*, 27 ECOLOGY L.Q. 1295 (2001) (comparing consent voting rule of international environmental regulation to general voting rules for national legislation and international treaty development and tracing borrowing of legal ideas from national law into international law, focusing on emissions trading).

223 Wiener, *Global Environmental Regulation*, *supra* note 222, at 685.

224 *See id.* at 736–38, 751–52.

> [T]he "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 . . . [o]ur 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.[225]

Unable to force the polluting source to pay for the costs it imposes, the beneficiaries must instead pay the source to reduce its activities. Such side payments have clearly occurred in the Convention on Biological Diversity, the Montreal Protocol, and the Kyoto Protocol through the Global Environment Facility.[226]

The key point to note is that, while Wiener's assertion concerns international environmental law, his insights may well be equally applicable to the Robertson example of nonpoint source pollution.[227] 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 the federal government's

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225 *Id.* at 752–54. Wiener cites a number of prominent economists who have made similar assertions, including Baumol and Oates, Aronson, d'Arge and Kneese, and Merrill. *Id.* at n.277; *see* BAUMOL & OATES, *supra* note 196, at 21–22, 29 (discussing consequences of pareto-optimal state); Ralph C. d'Arge & Allen V. Kneese, *State Liability for International Environmental Degradation: An Economic Perspective*, 20 NAT. RESOURCES J. 427, 433–34 (1980) (discussing pareto-optimal state as discouraging action); Thomas W. Merrill, *Golden Rules for Transboundary Pollution*, 46 DUKE L.J. 931, 968–71 (1997) (providing example of coercive power in absence of pareto-optimal state); *see also* Adam L. Aronson, Note, *From "Cooperator's Loss" to Cooperative Gain: Negotiating Greenhouse Gas Abatement*, 102 YALE L.J. 2143, 2160–74 (1993) (proposing move towards pareto-optimal state as means of inducing cooperation).

226 *See* DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 1501–02 (2d ed. 2002) (discussing Global Environment Facility as mechanism for providing financial resources to implement these conventions).

227 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. Wiener, *Global Environmental Regulation*, *supra* note 222, at 782 (arguing that quantity-based instrument coupled with side payments would work in Voluntary Assent contexts and would not create same perverse incentives as pure payment scheme or tax and payment scheme).

"[e]fforts to address nonpoint source water pollution in the CWA and other statutes have been feeble, unfocused, and underfunded." Nor have the states done any better.[228]

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 cannot walk. For political reasons the rule is not enforced, but one can certainly imagine situations in which opposition to nonpoint source controls was 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 and enforcement would be feasible with a new administration in Washington.[229] To others, this is normatively disturbing—paying polluters to reduce their harms is simply wrong.

Despite these objections (which are explicitly addressed in Part VI), the effective opposition to meaningful nonpoint source controls stands tall at the moment and seems unlikely to bow any time soon.[230] 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 were offered instead. In a remarkably similar series of events following the commencement of the SCA's operations in 1999,[231] the harsh backlash from farmers, rural communities, and Members of Parliament forced the New South Wales Planning Authority to back off its draft enabling regulations for the SCA

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228 J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263, 298 (2000). This stalemate makes sense when viewed through a public choice analysis, since the concentrated interests of the powerful agricultural lobby organize far more effectively than the diffuse population of those harmed by nonpoint source pollution. For a detailed review of the federal nonpoint legislation and why it has been ineffectual, see *id.* at 299–300.

229 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 in 2000. Interview with Lois Schiffer, Former Assistant Attorney General, Environmental Division, Department of Justice, Cambridge, Mass. (Nov. 7, 2003).

230 This can also be seen in the successful Congressional rider in 2000 that blocked funding of the Water Quality Planning and Management Regulations Concerning Total Maximum Daily Load, Military Construction Appropriations Act of 2001, Pub. L. No. 106–246, 114 Stat. 511, 567 (codified at 40 C.F.R. § 130.7 (2000)).

231 HELEN CHENEY ET AL., INSTITUTE FOR SUSTAINABLE FUTURES, REVIEW OF SYDNEY CATCHMENT AUTHORITY'S ENVIRONMENTAL AND ESD INDICATORS: FINAL REPORT 26 (June 2004), *at* http://www.isf.uts.edu.au/whatwedo/SCAreview.pdf.

and explicitly grant SCA regulatory authority over only new land uses.[232]

5. Property Rights Analysis

Finally, consider the case when entitlements directly conflict with one another. 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.[233] 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)[234] or common law precedent (e.g., a property owner must pay for nuisance harm caused by downwind air pollution).[235]

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[232] Email from Elizabeth Hanlon, *supra* note 198 (discussing changes in draft regulations regarding extent of SCA regulatory authority). The harsh backlash over land use regulation was the reason why the SCA asked me to examine the use of a market in Robertson in the first place. Kevin Rozzoli, *The Devil in Development: What's Gone Wrong?*, SYDNEY MORNING HERALD, Jan. 15, 2003, at A1 (discussing community protests against first draft of SCA regulations). A similar course of events followed the 1997 outbreak of pfisteria in the Chesapeake Bay. Pfisteria is an aquatic microorganism that, in nutrient-rich waters, produces toxins responsible for large-scale fish kills and is potentially responsible for a range of human health effects ranging from nausea to memory loss. For more information on pfisteria, see EPA, *Pfiesteria Piscicida, Fact Sheet*, *at* http://www.epa.gov/owow/estuaries/pfiesteria/fact.html (last visited Mar. 4, 2005). Due to a harsh backlash from chicken and pig farmers, Daina Savage, *County Farmers Face "Pfisteria Hysteria,"* INTELLIGENCER JOURNAL (Lancaster, Pa.), Apr. 13, 1998, at 1, whose manure runoff had likely caused the problem, OFFICE OF WATER, EPA, ENVIRONMENTAL IMPACTS OF ANIMAL FEEDING OPERATIONS B27-B28, *at* http://www.epa.gov/ostwater/guide/feedlots/envimpct.pdf (Dec. 31, 1998), the state legislature opted not to regulate and instead paid them off—increasing its funding to farmers for "Best Management Practice[s]" such as riparian fencing and planting. The federal-state initiative is called the Conservation Reserve Enhancement Program (CREP) and offers farmers and landowners a one-time sign up bonus of up to $150 an acre and up to 87.5% cost-share for most practices as well as maintenance payments. The program operates as a flat subsidy, however, with noncompetitive funding of applicants. For further details, see MD. DEP'T OF NATURAL RES., CREP FACT SHEET, *at* http://www.dnr.state.md.us/wildlife/milo.asp (last visited Mar. 4, 2005); MD. DEP'T OF NATURAL RES., COST-SHARE BENEFITS AND PRACTICE INCENTIVE PAYMENTS (PIP), *at* http://www.dnr.state.md.us/download/crep_brochure_2.pdf (last visited Mar. 4, 2005).

[233] Henry Smith describes the nature of interdependent property rights, stating:

> No longer can the owner of Blackacre claim with much force that ownership entails the right to use the resource without interference. As long as the ownership of Blackacre is a bundle of sticks, any given right—say the right to exclude others from a beach—can just as easily be assimilated to anyone's bundle as to the owner's. Thus, the idea that a property right is a right to a thing that avails against the world has been replaced with the idea that a property right is only one possible entitlement plucked from a wide range of equally privileged results.

Henry E. Smith, *The Language of Property: Form, Context, and Audience*, 55 STAN. L. REV. 1105, 1106 (2003).

[234] *See, e.g.*, 40 C.F.R. § 60.390–98 (2004) (limiting air emissions for automobile and light duty truck surface coating operations).

[235] *See, e.g.*, Madison v. Ducktown Sulphur, Copper & Iron Co., 83 S.W. 658 (Tenn. 1904) (requiring payment to downwind farmers harmed by smelter's air pollution but allowing activity

In the water quality context, the relevant question becomes: Do farmers have the right to manage their land such 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.

As Coase pointed out, this is fundamentally not a pollution problem, but a cost problem.[236] The issue of assigning property rights is not simply one of internalizing externalities or stopping pollution, but rather of minimizing total social cost.[237] There is no easy answer as to who should end up with the entitlement. If we stop the farmers from polluting, we harm them, but if they continue to pollute, they harm the public. The fact that property entitlements are currently unsettled or conflicting makes the resolution more complicated, but does not change the basic choice—deciding who should get the initial entitlement. The preceding analysis has demonstrated that when information costs are high and there are heterogeneous preferences and service capacities, payments to farmers may be the preferable option because they lower information costs through self-identification.

Poorly defined rights play out in another way, as well. As noted in Part II, the farmer who has already put in riparian fencing is not being paid for the benefits of water purification her vegetation provides. These benefits are public goods, enjoyed by downstream consumers for free. But because the landowner cannot get anyone to pay for the service, because she cannot effectively exercise a property right to the clean water she has generated, there is no financial reason to continue to provide it. From this vantage point, by paying the farmer, we are 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 of putting in riparian fencing as providing the beneficial service of water purification. But even with the fencing, one can still describe the farmer's overall actions as generating a *harm*—a classic nuisance—by releasing something into 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 v. S.C.*

to continue).

236 Coase, *supra* note 200.

237 *See id.*

Coastal Council that a legislature's description of an action as harm-preventing or benefit-conferring is too malleable to serve as a guide for judges.[238] Instead, he stated, background common law nuisance principles should guide the characterization;[239] but this simply laid him open to charges that the common law is just as manipulable.[240]

Robert Ellickson's analysis of this dilemma is worth considering. In an influential article written in 1973, Ellickson assessed whether a nuisance action should succeed against a particular land use by relying on a common measure of "normalcy."[241] He argued that evaluative terms such as beneficial and harmful are meaningful because "people have remarkably consistent perceptions of normal conditions and thus can agree in characterizing deviations from normalcy. In any community, observers empirically establish standards of normal conduct for repetitive activities."[242] As a result, "legal rules should seek to transfer wealth from those whose actions have unusually harmful external impacts and to those whose actions are unusually beneficial to others."[243]

In the Robertson case, however, normalcy is difficult to determine. The region is agricultural and allowing cows to graze near streams has long been common practice. Grazing by the stream bank has little effect on downstream properties beyond the impact on water quality. The direct cost imposed by this practice falls on the municipal water supplier (and ultimately on water consumers). Does that make it "unusually harmful"? Discussion of the difficult dilemma of distinguishing between beneficial and harmful practices is re-engaged at the end of this Article.

VI

CRITIQUES OF PAYMENTS AND THEIR (SOMETIMES) DISTURBING IMPLICATIONS

As described earlier, because most service markets function as monopsonies (with a dominant buyer and many sellers), the market effectively takes the form of a *payment scheme*. In addition, as the last section demonstrated, payment schemes can offer important advantages

238 Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1014, 1029–31 (1992). Professor Peter Byrne has observed that this schism of describing activities as providing benefits versus causing harm closely mirrors nineteenth century debates in America over takings. Interview with Peter Byrne, Professor, Georgetown Law School, Wash., D.C. (Oct. 23, 2003).

239 *Lucas*, 505 U.S. at 1031.

240 For a critique of Scalia's position in *Lucas*, see John S. Harbison, *Constitutional Jurisprudence in the Eyes of the Beholder: Preventing Harms And Providing Benefits in American Takings Law*, 45 DRAKE L. REV. 51, 57 (1997) (arguing that balancing method to determine whether harm is nuisance is also malleable).

241 Robert C. Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls*, 40 U. CHI. L. REV. 681, 729–31 (1973).

242 *Id.* at 729.

243 *Id.* at 729–30.

over prescriptive instruments. Nonetheless, by this point you may have started forming some nagging doubts. Service markets may seem like clever and, in some cases, optimal mechanisms for encouraging provision of ecosystem services, but difficult issues need to be confronted. There are good reasons, after all, that "payments" and "subsidies" are four-letter words to many economists. Indeed, payment schemes can lead to what some might view as quite disturbing policy implications: Are we paying the right people? Are we sending messages that encourage or undermine an ethic of land stewardship? Are we effectively paying for rights that farmers never had? Perhaps most centrally, service markets raise the fundamental question of when we should encourage land use changes through payment rather than coercion, and what this means for our understanding of landholders' rights and responsibilities.

This Part explores these difficult issues, addressing in turn the problems incurred through violating the polluter-pays principle, the perverse incentives created by subsidies, and their expressive consequences. Each criticism, while valid in theory, proves to be less problematic in actual practice for many services. This Part ends by considering hybrid instrument designs, building off of literature in other fields on the use of payments to bridge transitions of entitlements. At worst, this analysis suggests that payments may sometimes 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.

A. The Polluted-Pay 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 is hard to imagine a practical scheme, for example, that pays everyone whose vegetation reduces nutrient flow in the watershed. As the examples in Part V demonstrated, ecosystem service approaches are best suited to the case of heterogeneous land management—that is, where, in encouraging provision of a public good, the agency desires specific land management changes in discrete parts of the landscape.[244] If one seeks to pay for discrete cases of ecosystem service provision, however, clearly some land uses are more important than others.

[244] As discussed *infra* at note 261 and accompanying text, if certain types of land management are desired throughout the landscape, then regulations or taxes are likely more effective because transaction costs are lower than with direct payments and overbreadth is not a major concern.

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, and instead to maintain current practices. 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 in many respects also are *causing* the problems. For example, because some dairy farmers have not built sufficient infrastructure or established riparian vegetation, their cows are discharging significant nutrient loads into 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 to be a real conundrum for the SCA pilot project and will continue to be to be so for many other 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, has reduced the eutrophication and turbidity downstream. Farmer B, by contrast, has continued to manage her land much the same way as her predecessors, with nutrient and soil runoff after large storm events affecting water quality in the downstream reservoir. Should the water supplier be willing to make ecosystem service payments to address eutrophication and turbidity control? If so, which farmer should receive payments, and how much?

Posing these questions more fundamentally, what is the proper paradigm for ecosystem service provision by farmers? Should we think of farmers as polluters, and therefore subject to the polluter-pays principle, the touchstone for much of modern environmental policy? If so, they presumably should not be paid, but regulated or taxed instead. Or, by contrast, are farmers potential providers of valuable services who are as deserving of payments as water treatment plant operators?

To 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.[245] But is this an apt analogy? This sounds absurd only because I clearly do not already have the right to assault. My duty of care in this case is clear—I have no entitlement that I

245 Interview with Mike Young, Division Chief, CSIRO, Adelaide, Austl. (Apr. 25, 2003).

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.[246] And, as noted above in the discussion of unclear or conflicting entitlements, without a clearly defined duty of care the argument for payments becomes much stronger.[247]

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? Sounds silly, right? But are farmers any different, in that the service they provide by putting in riparian fencing is really little more than reducing the contribution of their cows to eutrophication downstream?

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. More importantly, if we want them to improve upon 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.[248] And trading schemes under the Clean Air Act provide a similar lesson.[249] When initial sulfur dioxide permits are distributed based on historical emissions rather than auctioned off, existing plant owners are effectively allocated permits to pollute. Companies that emit less than permitted are rewarded by being allowed to sell their excess allowances to other sources.[250]

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246 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. *See supra* Part V.B.4. 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 in Part VI.C.2.

247 Recall that the analysis of how to resolve conflicting entitlements suggested that we choose payment schemes so that farmers will self-identify and reduce information costs. *See supra* Part V.B.3.

248 EPA, WHAT IS PROJECT XL?, *at* http://www.epa.gov/projectxl/file2.htm (last visited Feb. 19, 2004); *see also* Dennis D. Hirsch, Symposium Introduction, *Second Generation Policy and The New Economy*, 29 CAP. U. L. REV. 1, 9 (2001) (discussing regulatory flexibility of Project XL, EPA initiative allowing regulated entities to demonstrate excellence by developing innovative pollution control projects across multiple media).

249 Clean Air Act, 42 U.S.C. §§ 7651–61 (2000).

250 *See, e.g.*, SALZMAN & THOMPSON, *supra* note 57, at 96–97 (describing operation of

Indeed, according to Robert Ellickson, just such an approach favoring incentive payments over penalties was endorsed by the father of environmental economics, A.C. Pigou.

> Modern scholars may be surprised that Pigou thought the proper way to handle air pollution was to give bounties to factories that cleaned up emissions, rather than to tax polluters. In an era when it was normal to pollute with coal-burning fireplaces, Pigou was probably right in recognizing that rewards were the most efficient internalization system and in perceiving the rare nonpolluter as a producer of beneficial externalities.[251]

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 process, we should pay wetland habitat owners not to develop them.[252] 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 have 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. Costs are directly borne by developers.

Yet we also must keep in mind what the program is trying to achieve. 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 and uniform 404 permit regulations make the 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

environmental trading markets); Richard L. Revesz & Jonathan R. Nash, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 ECOLOGY L.Q. 569, 575 (2001) (describing function of typical tradeable emission permit regime). Hence the acid rain trading program under Title IV of the Clean Air Act is an example of effectively paying a business to go above what is required (i.e., by allowing it to profit from further reductions). 42 U.S.C. § 7651. It should be noted, though, that tradable permits phase out this reward over time, as the allocation of permits based on historic use is phased out over time. SALZMAN & THOMPSON, *supra* note 57, at 96–97. Purchasers of tradable permits do not need to repurchase the pollution reduction repeatedly over time—once a permit is sold, that is the end of the story.

251 Ellickson, *supra* note 241, at 731. It is important to note that this strategy endorses payments on the margins (i.e., to super-beneficial performers).

252 Section 404 of the Clean Water Act requires those who discharge dredge and fill material into navigable waters to first obtain a permit. Clean Water Act § 404, 33 U.S.C. § 1344(a) (2000).

uniform regulatory approach that is far more efficient than a complicated, multi-factor assessment of each wetland's contribution to these values. In the context solely of water quality provided by wetlands, 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 a preferable policy instrument to broad regulation.[253]

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.[254] At issue are both the definition of property rights and when compensation should flow from infringing those rights through regulation. At a certain level, the argument goes, restrictions on land use rise to the level of a Fifth Amendment taking.[255] The cost borne by these landowners, critics of payments reply, is the price of living in a society where benefits and burdens are not evenly distributed.[256] As Justice Holmes famously noted, "government hardly could go on" if payment were required in all cases of property value reduced by regulation.[257]

The similarities between biodiversity and runoff from farming seem striking. In the biodiversity case, the landowner is not compensated for the public good of endangered species conservation. Unlike wetlands, the

253 Thus if our primary concern were hypoxia, leading to the creation of the dead zone in the Gulf of Mexico caused by runoff into 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 would likely be served best by broad restrictions on nonpoint sources.

254 Some property rights advocates focus on Section 5 of the Endangered Species Act, which provides authority to purchase habitat from the Land and Water Conservation Fund. 16 U.S.C. § 1534 (2000). The agency should rely on this authority, they contend, rather than restricting land uses. *See, e.g.*, Michael Vivoli, "*Harm"ing Individual Liberty: Assessing the U.S. Supreme Court's Decision in* Babbitt v. Sweet Home, 32 CAL. W. L. REV. 275, 320–321 (1996) (arguing that Section 5 offers "constitutionally palatable method" of land acquisition).

255 To date, only one case has found a taking under the Endangered Species Act. *See* Tulare Lake Basin Water Storage Dist. v. United States, 49 Fed. Cl. 313, 314 (2001) (finding that plaintiffs' contractual right to water use was taken when federal government enforced water use limitations under Endangered Species Act); *see generally* Bradley C. Karkkainen, *Biodiversity and Land*, 83 CORNELL L. REV. 1, 85–98 (1997) (exploring potential takings arising from biodiversity conservation).

256 A number of scholars, most notably Eric Freyfogle, build off the imperatives of Aldo Leopold's land ethic, arguing that property rights are a construction of public policy and must yield to ecological needs. *See generally* ERIC T. FREYFOGLE, THE LAND WE SHARE: PRIVATE PROPERTY AND THE COMMON GOOD (2003); *see also* Elmendorf, *supra* note 133, at 500–01.

257 Pa. Coal Co. v. Mahon, 260 U.S. 393, 413 (1922).

benefit is discrete and the habitat is relatively easily identifiable. 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 air pollution, the duty of care to conserve endangered species has been established by Section 9 of the Endangered Species Act, so payments are unnecessary.[258] 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.[259]

There is an immense literature on the intersection of property rights and environmental regulation that goes well beyond the scope of this paper.[260] My immediate claim is modest—if one applauds the practice of ecosystem service payments 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.[261]

B. 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, payments lead to rent-seeking and the diversion of

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258 16 U.S.C. §1531 (2000).

259 *See* LANDELL-MILLS & PORRAS, *supra* note 5, at 25. Indeed, they are common in America. The U.S. Fish and Wildlife Service's "Partners for Wildlife" program, for example, offers technical and financial assistance to private landowners to voluntarily restore fish and wildlife habitats. From 1987 to 2002, the program was responsible for the restoration of nearly 640,000 acres of wetlands, over 1,000,000 acres of prairie and other uplands and over 4700 miles of streamside and in-stream habitat. U.S. FISH & WILDLIFE SERV., PARTNERS FOR FISH AND WILDLIFE PROGRAM—OUR PARTNERS, *at* http://partners.fws.gov/What_we_do/overview.html (last visited Feb. 19, 2005).

260 *See, e.g.*, Robert J. Goldstein, *Green Wood in the Bundle of Sticks: Fitting Environmental Ethics and Ecology into Real Property Law*, 25 B.C. ENVTL. AFF. L. REV. 347, 353 (1998) (examining theory of "green wood" and its place in both property and environmental law); Richard J. Lazarus, *Putting the Correct "Spin" on* Lucas, 45 STAN. L. REV. 1411, 1422 (1993) (arguing that *Lucas* decision makes it easier for environmental protection measures to survive takings claims); Joseph L. Sax, *Property Rights and the Economy of Nature: Understanding* Lucas v. South Carolina Coastal Council, 45 STAN. L. REV. 1433, 1455 (1993) (criticizing Court's decision in *Lucas* for adopting antiquated view of property incompatible with ecological awareness).

261 I do not go so far as many property rights proponents who advocate the general principle that payments will (and should) be forthcoming to conserve and provide services. As described earlier, payments may be appropriate where entitlements are unclear or performance above the current entitlement is required, but in other cases prescriptive instruments likely will prove more efficient.

funds from more socially worthwhile causes, and payments create moral hazards that encourage undesirable behavior. The relevance of these concerns varies a great deal depending on the service in question.

1. 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 corridor 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 be impossible to create effective habitats. Moreover, neighbors of those who dedicate their lands to biodiversity conservation may choose not to conserve biodiversity on their own land but, instead, free ride on the wildlife amenities on adjacent land.[262] 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.[263]

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 twenty percent identified in Figure 6 hold out, there will be a significant increase in price,[264] and collusion is surely a possibility if the number of eligible

262 Chris Elmendorf, who structured conservation land deals before entering academia, similarly argues that reliance solely on voluntary conservation is inadequate. "[V]oluntarism unmodified is not an attractive alternative, given the harvest that holdouts and free-riders would reap." Elmendorf, *supra* note 133, at 503.

263 There were over 1200 land trusts in the United States in operation by the end of 2000, with nearly sixty-five percent of those having been created since 1981. These trusts permanently protect nearly 6.5 million acres of land. Roughly forty percent of this land is protected by the over 11,670 conservation easements deeded by private landowners to local, state, and regional land trusts. Nancy A. McLaughlin, *The Role of Land Trusts in Biodiversity Conservation on Private Lands*, 38 IDAHO L. REV. 453, 454 (2002). Nor is acquisition limited to land. For a description of groups that purchase instream flows, see Thompson, *supra* note 22, 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, such concerns are very much on the minds of people trying to bring these deals to fruition. "I can attest that the basic attitude of many practitioners to the holdout problem is 'hope against hope.'" Interview with Chris Elmendorf, Professor, U.C. Davis Law School (Oct. 1, 2003).

264 This seems to have occurred in the Catskills, where land prices have been much higher

landholders is low. But if the BushTender and Environmental Services Scheme experiences with reverse auctions are any guide, this will not play out in practice so long as the reverse auction is competitive. 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 told 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.

So long as payments are a one-off exercise, our analysis to this point is sufficient. Realistically, though, it is incomplete in one important respect, because the relative advantages of policy instruments shift depending on the time period. In other words, if payment schemes prove successful in providing services efficiently, one might expect that payments could become a regular process. If so, then the issues raised by a payment scheme change significantly over the longer term, implicating problems of rent seeking, moral hazard, price equilibrium, and norm shaping. If payments continue into the future, for example, then collusion becomes more likely. This may well be what has happened with the CRP program and the problem of bid prices at or near the clearing price.

The possibility of repeat players recasts the problem of holdouts in the guise of extortion. For instance, a landholder who had signed a ten-year contract for a particular land management regime might compete for a new contract. 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 twenty percent 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, without 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.

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than New York expected. *See supra* Part III.A.

The likelihood of holdouts who have already received payments will depend in large part upon 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.

It turns out that the threat of holdouts is much more significant in the context of biodiversity than in 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 and extortion becomes more likely.[265] With water quality, in contrast, the benefits from the service of water purification have been enjoyed throughout the contract, and if the services are not received from one farm, hopefully a comparable level of service or better can be received from another.[266] Moreover, changing the land use to discourage biodiversity (such as mowing the lawn) imposes fewer costs on the farmer than removing riparian fencing that may lead to soil loss from erosion or loss of stream banks.

2. Rent Seeking

Whenever public funds are made available, one can expect potential beneficiaries to 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 annual farm subsidy.[267] Efforts to closely tailor its implementation seem to have been largely frustrated in practice in order to ensure broader participation. The history of the Agricultural Conservation Program is also a case study in how well-intentioned programs can be

265 This assumes that such an action would not constitute a Section 9 violation of the Endangered Species Act. 16 U.S.C. § 1538 (Section 9 prohibits "taking," harming, or altering habitat of endangered species).

266 The likelihood of repeat players does suggest, however, that there will be less heterogeneity of bids as farmers come to learn which aspects of their land are valuable and which bids have been successful in other markets. This may provide an alternate explanation to collusion as to why the CRP bids are just below the clearing price. *See supra* note 105 and accompanying text.

267 CRP Monthly Summary, *supra* note 95.

overtaken by local political interests.[268] Even if a payment scheme were established that created a competitive dynamic among farmers to provide services at least cost, there is a very real possibility that, over time, this could follow the path of the CRP and transform into a blunt subsidy.[269]

3. Moral Hazards

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

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

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[268] Agricultural Conservation Program Objective, 7 C.F.R. § 701.3 (2004). Elmendorf, *supra* note 133, at 497 n.426 (describing how, in Agricultural Conservation Program, "Congress overrode the USDA and forced it to subsidize whatever practices the local 'county committees' wanted subsidized."). Whether rent seeking amounts to agency capture is a complex question that turns on transparency and concentration of impacts, among other factors. Personal Communication with Michael Levine, Professor, Yale Law School, New Haven, Conn. (Feb. 20, 2004).

[269] A study of farmer-irrigators in Arizona provides an interesting insight into the farmer-government political dynamic. The researcher, Helen Ingram, was trying to figure out why farmers were supporting a water project that would charge more per acre foot than they could afford. Why would rational economic actors support a water project they could not afford to use? Ingram found that support for the project was, on its face, economically irrational because the projected water costs were greater than the farmers' willingness to pay. Instead, farmers made a political judgment, deciding on what Ingram termed their "willingness to play." If they could get the government to build the project, farmers reasoned, the government would bail them out if it proved too expensive and would provide a subsidized supply. As Joseph Sax describes:

> [F]armers were willing to "play" the game of politics, and to bet that the rules of the game would change. In fact, a long history of western water projects gave credence to the farmers' tactic: in decade after decade, the government had effectively forgiven agricultural debts on projects that legally required repayment.

Joseph L. Sax, *The Fate of Wetlands in the Face of Rising Sea Levels: A Strategic Proposal*, 9 UCLA J. ENVTL. L. & POL'Y 143, 149–50 (1991) (citing research done by Helen Ingram, William E. Martin, & Nancy K. Laney, *A Willingness to Play: Analysis of Water Resources Development in Arizona*, *in* WATER AND AGRICULTURE IN THE WESTERN U.S. 139, 139 (Gary D. Weatherford ed., 1982)).

Farmer B's of the world who change their land use than to the Farmer A's who have already made the improvements, for the simple reason that the actions of Farmer B will lead to greater marginal improvements.

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

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

Nor do all landholders need to be paid. As described above, if land care preferences follow a normal distribution (as shown in the bell curve in Figure 3), 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 do not 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.[270] Those between the extremes, willing to change their land uses to provide services but concerned about 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

[270] Interview with Carl Binning, Director, Greening Australia, Canberra, Austl. (Mar. 23, 2003).

willing to change their land management practices because of the payments, but also from those who would have made the changes in any case, but appreciate a handout when they can get one. However, this problem of "consumer surplus" may not be very large in practice, because presumably most people who would change land management on their own have already done so. The use of a reverse auction, as in BushTender, will also reduce the cost of these payments, because these farmers' bid prices should be quite low (in the sense that they would have done it for free, but some payment is better than none).[271]

These points address issues of equity, though, not of 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 ransom.[272] In the extreme, one might imagine farmers actively *worsening* their land management practices to increase payments for their potential service provision.[273]

To place this in a more domestic setting, imagine that your condo association wants to address the problem of noisy parties by having the loud apartment owners place a restrictive covenant in their leases prohibiting loud music after 10 p.m.[274] Would offering payment to the noisy neighbors in exchange for restrictive covenants be a good solution? Not if it created a perverse incentive for other neighbors to start cranking up their stereos so they also could be bought off or, worse yet, if word got around and heavy metal fans moved into the building expressly so they could be paid to use headphones. Indeed, a standard economic criticism of subsidies is that they can unwittingly reward the very behavior they are trying to suppress.[275]

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271 Thompson, *supra* note 22, at 284.

272 MIKE YOUNG ET AL., DUTY OF CARE: AN INSTRUMENT FOR INCREASING THE EFFECTIVENESS OF CATCHMENT MANAGEMENT 15 (CSIRO Draft Options Paper prepared for Victoria Catchment Mgmt. Council & Dep't Sustainability Env't, 2003), http://www.vcmc.vic.gov.au/Web/Docs/Duty%20of%20care-final.pdf.

273 Wiener has also criticized this approach in the context of climate change, arguing that "making actual payments to enlist the cooperation of nonbeneficiary sources is essentially a subsidy for abatement, and in like fashion it creates moral hazard . . . . The subsidy for abatement—paying the source's costs of externality control—induces recipients to increase their risk-making activities." Wiener, *Global Environmental Regulation*, *supra* note 222, at 755–56.

274 This example is adapted from Wiener, which presented a hypothetical in which a homeowners' association wants to limit noise but also requires the assent of its residents regarding restrictive covenants. *Id.* at 782.

275 In their well-known book on environmental economics, for example, Baumol and Oates set out an economic proof showing that subsidies given to a polluting industry are counterproductive.

> [A]lthough a subsidy program may reduce the emissions of each firm by itself, the subsidies,

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),[276] but in the service payment scheme such approaches are not easily applicable.[277] Nonetheless, in the context of ecosystem services, moral hazard concerns do not seem worrisome 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 10 p.m. 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 probable that less funding will be available than the potential recipients request. Both BushTender and the Costa Rican programs, for example, were oversubscribed.[278] In sum, if the relative value of payments is low compared to losses from strategic behavior, then moral hazards are less likely a problem.

Once one moves away from moral hazard actions that impose costs, however, the problem becomes more difficult, as in the case of biodiversity conservation. There may be little direct cost in switching to crops or field management that degrade critical habitat, and moral hazard concerns cannot be as easily dismissed.

> 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 or 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.

BAUMOL & OATES, *supra* note 196, at 221–22 (emphasis in original).

276 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, *Global Environmental Regulation*, *supra* note 222, at 771.

277 Wiener argues that a trading regime is more effective at reducing moral hazard problems than payments. *Id.* at 780. 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. Interview with Tom Tietenberg, Professor, Colby College, Santa Barbara, Cal. (Aug. 20, 2003).

278 The CRP guards against the moral hazard problem by requiring that the farmland be cultivated in four of the past six years. *See supra* note 98 and accompanying text. To guard against providing an incentive for poor management (i.e., worse than the status quo), 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.

4. 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 purchasing water rights for instream flows,

> by paying for instream flow, the government also may undercut an ethos of conservation. Aldo Leopold (one of the most influential environmental thinkers of the 20th century) 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.[279]

Government payment programs may risk undermining the land ethic by commodifying environmental stewardship, "making environmental stewardship an issue of money rather than fundamental values."[280]

Mike Young, Tian Shi, and Jim Crosthwaite 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 environmental stewardship is the duty of governments rather than individuals.[281]

These are difficult concerns to address. Laws clearly can influence norm formation. As Carol Rose has explained, "our laws are not just our controllers, but our teachers. For better or worse, normative or hortatory

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279 Thompson, *supra* note 22, at 277–78.

280 *Id.* at 278.

281 YOUNG ET AL., *supra* note 272, at 15. Carol Rose has made a related observation in comparing the moral suasion of property (which she calls PROP) and prescriptive instruments (RIGHTWAY). Property and payment schemes may be more efficient than direct regulation, but their lack of moral grounding can weaken their effectiveness.

> PROP loses RIGHTWAY's moral thrust by surrounding pollution with rights-talk, by using a rhetoric of entitlement to pollute. When we reconceptualize the use of common resources as individual property rights, we attenuate the moral rhetoric of contribution and trying harder for the common good. This attenuation occurs even though economic incentives may persuade would-be polluters, on self-interested grounds, that they indeed should try harder. . . . [I]t may be well to consider that the adoption of the sophisticated PROP techniques, without attention to their rhetorical message, may come at the price of a diminution in a certain element of moral suasion. In turn, this moral diminution may work against the overall effectiveness of PROP by creating a cultural climate in which one is not expected to do the right thing unless it is in one's direct interest to do so.

Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 DUKE L.J. 1, 34.

lessons are embedded in our laws, and we need to think about the education they impart when we adopt legal institutions to manage resources . . . ."[282] But *how* norms change and influence behavior is a complicated process. Indeed all instruments have normative objections. Regulations can be seen as denigrating private ordering and, in turn, can lead to private resistance. Markets and taxes, by contrast, have negative connotations of commodification and abdication of governmental control.[283] Nor do empirical studies provide clear direction on the messages policy instruments send and their impacts on social learning.[284] The role of service markets in norm transformation is simply not known.[285] 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. Regulations and taxes certainly have not created a Leopoldian land ethic to date. 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 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

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[282] *Id.* at 38.

[283] *See generally* STEVEN KELMAN, WHAT PRICE INCENTIVES?: ECONOMISTS AND THE ENVIRONMENT (1981) (discussing ethical concerns with trading pollution rights); Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957, 966 (1982) (arguing that certain objects, such as body parts, should not be subject to commodification unless they are separated from oneself and quintessential property of personhood severed).

[284] In studying problems of collective action and the NIMBY ("not in my backyard") phenomenon, Daniel Kahan has reviewed payment schemes that reward communities in exchange for siting noxious facilities. He has found that such compensation-based siting policies, though lauded as clever alternatives to mandated siting decisions, were a major disappointment. Communities continued to oppose proposed sitings, regardless of revenue sharing offers.

> Indeed, there is evidence that compensation schemes sometimes make the NIMBY problem *worse*. According to some studies, residents often bridle at "compensation offers . . . as attempts to buy them off or bribe them." . . . . It would be a mistake, however, to conclude that compensation schemes *never* work. At least some opinion studies have shown that offers of compensation can significantly increase willingness to accept the siting of a noxious facility. Moreover, compensation in one form or another *has* nearly always been a part of the successful waste-facility siting efforts in the United States and Canada in recent decades.

Dan M. Kahan, *The Logic of Reciprocity: Trust, Collective Action, and Law*, 102 MICH. L. REV. 71, 86–87 (2003) (emphasis added).

[285] The law has played a role in norm formation in many areas. *See generally* Melvin A. Eisenberg, *Corporate Law and Social Norms*, 99 COLUM. L. REV. 1253 (1999) (examining corporate law); Dan M. Kahan, *Gentle Nudges vs. Hard Shoves: Solving the Sticky Norms Problem*, 67 U. CHI. L. REV. 607 (2000) (examining criminal law); Jody S. Kraus, *Legal Design and the Evolution of Commercial Norms*, 26 J. LEGAL STUD. 377 (1997) (examining commercial law).

conservation payments, Echeverria notes, 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."[286]

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

C. Instrument Choice Revisited

1. Transition Payments

To what extent can instrument design address the problems of moral hazards and holdouts described above? While not written in the context of ecosystem service markets, there is a significant legal literature on transition losses and gains.[287] A number of commentators have argued that payments best serve a temporary transition purpose, while instruments such as regulations or taxes provide longer-term instruments that can be subsequently introduced. Recall Robert Ellickson's endorsement of Pigou's insights, for example, "that rewards were the most efficient

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[286] John Echeverria, *What Would Aldo Leopold Say?* (May 11, 2000), *at* http://www.tompaine.com/feature2.cfm/ID/3094.

[287] Writing in the context of tax policy, Kyle Logue raises the same basic concerns that are raised by ecosystem services.

> That unexpected rule changes produce losers and winners is uncontroversial. Disagreement arises over the question of what, if anything, should be done about these transition effects. To put the question slightly differently, what should our "transition policy" be? Or put differently still, to what extent should the government deliberately try to alleviate the "retroactive" effects of rule changes?

Kyle D. Logue, *If Taxpayers Can't Be Fooled, Maybe Congress Can: A Public Choice Perspective on the Tax Transition Debate*, 67 U. CHI. L. REV. 1507, 1507 (2000) (reviewing DANIEL SHAVIRO, WHEN RULES CHANGE: AN ECONOMIC AND POLITICAL ANALYSIS OF TRANSITION RELIEF AND RETROACTIVITY (2000)). *See generally* Holly Doremus, *Takings and Transitions*, 19 J. LAND USE & ENVTL. L. 1 (2003) (arguing that, with regard to regulatory takings, key factors to consider in allocating costs of rule transitions between property owners and government are justification for transition, foreseeability, abruptness, and generality); Farrier, *supra* note 54 (focusing on formal mechanisms employed by federal government and private organizations to induce private landholders to conserve biodiversity in United States); Neil Gunningham & Mike D. Young, *Toward Optimal Environmental Policy: The Case of Biodiversity Conservation*, 24 ECOLOGY L.Q. 243 (1997) (analyzing costs and benefits associated with multiple-instrument and single-instrument approaches to environmental regulation).

internalization system and in perceiving the rare nonpolluter as a producer of beneficial externalities."[288] It may be efficient, in other words, to pay on the margins to jump-start the transition and then penalize those who later refuse to change. Carol Rose has similarly observed the role initially played by payments through the takings doctrine in clarifying or adjusting entitlements. As legislatures begin to assert public rights over pre-existing private entitlements, there are both fairness and estoppel reasons to ease this transition by compensating owners, particularly if the public authorities have been "quite late in determining that particular private land uses cause damage to other persons and to public resources, or . . . have suggested that these uses could continue."[289]

Takings claims are not appropriate every time expectations of property use change, of course,[290] but such "legislative grace" may be justified for people whose reasonable expectations of land use have been upset. Such transitional payments can 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. Figure 7 represents these approaches graphically.[291]

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).

FIGURE 7

[Printer: insert fig7.doc here]

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

288 Ellickson, *supra* note 241, at 731.

289 Carol M. Rose, *A Dozen Propositions on Private Property, Public Rights, and the New Takings Legislation*, 53 WASH. & LEE L. REV. 265, 284 (1996). 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. 16 U.S.C. § 1131 (2000) (originally enacted in 1964). Personal communication with Richard Lazarus, Professor, Georgetown Law Center, Wash., D.C. (Nov. 13, 2003).

290 As Robert Ellickson notes, housing standards improve all the time (e.g., requirements for flush toilets or fire alarms) but takings challenges for losses incurred as a result of these changes invariably fail. Personal communication with Robert Ellickson, Professor, Yale Law School, New Haven, Conn. (Mar. 22, 2003); *see, e.g.*, Queenside Hills Realty Co. v. Saxl, 328 U.S. 80 (1946) (upholding laws requiring lodging houses to install automatic wet pipe sprinkler systems); Hutchinson v. City of Valdosta, 227 U.S. 303 (1913) (upholding ordinance requiring property owners to connect to sewer system). A more recent decision showing the same trend is *Stern v. Halligan*, 158 F.3d 729 (3d Cir. 1998) (denying takings claim based on town's requirement that landowners connect their property to municipal water supply).

291 Figure 7 was suggested by Mike Young, Division Chief, CSIRO, Adelaide, Austl.

also rises, payments stop and penalties kick in. In Figure 8, 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 will sanction you. Because we are changing expectations (and perhaps entitlements), though, in the meantime we will help you make the transition." This approach sends a clear message 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.

FIGURE 8

[Printer: insert fig8.doc here]

Thus, for example, imagine a scheme where the duty of care will require in ten years that everyone fences watercourses twenty meters on either side of the stream. There could be a payments scheme in which if you fence off the land this year, you are reimbursed $100/km of fencing; if you fence off next year, the payment is $90/km; and so on until after ten years there are no payments, but instead are penalties. The Swedish city of Malmo used this type of fixed payment scheme to ease the transition to new requirements for sewage tanks.[292]

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 and transition to a higher duty of care. Such short-term and conditional payments help retain support of the political and local communities as contested or uncertain property rights are redefined. Payments are being used to clarify the standard of care so that it benefits the public—that is, farmers are being paid not to exercise their right to allow manure and soil to flow into watercourses. As Young notes, however, 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 faster and irreversible transition."[293]

This approach also 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 goes some way in addressing those farmers who delay improving their management practices in the hope they will be bought out, since this practice risks becoming a liability as the duty of care increases. Realize, though, that in paying farmers to change their land management practices, the government is now effectively

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292 Personal communication with Mike Young, Division Chief, CSIRO, Adelaide, Austl. (Apr. 25, 2003). One could equally operate the payments as a market, allowing potential beneficiaries to submit competitive bids during a limited time period.

293 Gunningham & Young, *supra* note 287, at 296.

acknowledging (and perhaps redefining) the farmers' entitlements. As Young, Shi, and Crosthwaite have argued, this is the "point where the 'polluter pays principle' ends and the 'beneficiary pays principle' begins."[294]

Realize, as well, that under this approach, the size of ecosystem service payments is directly correlated to the transition to the new duty of care.[295] The farmer's willingness to accept (as expressed in her bid price) depends on what the duty of care standard will be three, five, and ten years from now. Such an approach becomes much less effective if the tightening of standards is unlikely to occur over the medium to long term. As Figure 9 shows, if the progression of the duty of care "flatlines" (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.

FIGURE 9

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The key question, then, is whether the relevant agency has (1) the authority, (2) the political capital, and (3) the political will to raise the duty of care and threaten coercive instruments unless standards are met by a certain time. If the agency 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.[296]

There may well be an implicit fourth question that must be considered, as well—whether the public believes that the property right is correctly identified as privately rather than publicly held, that is, whether there is general agreement that the provision of services "stick" is initially part of the property owner's bundle. Property rights come from prescriptive statements by government and courts, but these pronouncements are inextricably bound up with popular notions of who owns what.

294 YOUNG ET AL., *supra* note 272, at 5. In the same vein, one of the main conclusions of the Wentworth Group was to "provide financial support to landholders who supply environmental services to the rest of the community *above* agreed definitions of duty of care." WENTWORTH GROUP, *supra* note 9, at 13 (emphasis added). This fails to note what we should do, however, when the duty of care is not clear.

295 Nor is it clear that this can be described as a market. It seems more accurate to call this a side payment, similar to grandfathering old power plants under the Clean Air Act. 42 U.S.C. § 7411(d) (2000).

296 *See* Ruhl, *supra* note 46, at 298 (describing attempts to regulate nonpoint source water pollution as "feeble, unfocused, and underfunded"). Such an approach also raises the question of what should happen if the duty of care is tightened after the transition period: Should there be a further series of payments?

Determining whether an entitlement "clearly" should be a public property right takes us back to the earlier discussion of whether the farmer is generating a good or preventing a harm. Presumably, one reason that paying farmers for water purification may prove hard for some people to accept is that it looks like the owner's activity is generating a negative externality—pollution—which she initially had no right to generate. 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 of polluter versus service provider remains a difficult one to settle. One may be able to argue persuasively for payments on efficiency grounds; but realize that efficiency is a normative goal, one that can conflict with another normative goal—the principle that pollution is a blameworthy action and that polluters should internalize the costs of their pollution. Choosing between these goals is ultimately a value judgment. This point was made abundantly clear by the consistent reactions of participants in the workshops where I presented this paper. Almost without exception, economists were untroubled by payments while environmentalists were disturbed and, in a few cases, outraged by paying the farmers to put in fencing.

Management 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 providing nesting and foraging grounds and water retention. In this setting, it does seem harder to argue that society should demand generation of positive externalities without payment.[297]

As a result, a reasonable strategy may be to follow a variant on Robert Ellickson's proposal. For ecosystem service markets, this would entail deciding where entitlements popularly rest now, paying for those services dependent on clear private rights, and having a transitional system for those services that already are, or should be, public property rights.[298] This recognizes the fact that, in the real world, there is genuine uncertainty about the bundle of rights and it may make sense to pay for some rights, even if you do not think they started out in the right place.

While I have focused on the policy approach of transition payments linked to a rising duty of care, there are other instrument hybrids that

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297 Though, as noted earlier in the text, arguing that regulation should not demand the generation of positive externalities is subject of course to the qualification that the distinction between harm-preventing and benefit-conferring activities is easily manipulable. *See supra* Part V.B.5.

298 Ellickson, *supra* note 241, at 683.

should be considered in the context of service provision. One instrument might be the "command and covenant" approach, which relies on negotiation between the government and regulated parties over performance and information generation.[299] First pioneered in Europe, command and covenant is gaining increasing attention in America and, while it has focused to date on traditional industrial pollution,[300] it might be transferable to service provision. Following the lead of the PSA program (and standing BushTender and CRP on their heads), 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.[301] Depending on the service, a cap-and-trade approach might work, rewarding the most efficient service providers, as well as other innovative instruments that rely on a predetermined mix of mandatory and compensated actions.[302] Ian Ayres has suggested a pay-or-be-paid approach.[303] Theoretically, then, clever instrument combinations can overcome the problems of holdouts,

299 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 the most efficient result. *See* E. Donald Elliott, *Toward Ecological Law and Policy*, *in* THINKING ECOLOGICALLY: THE NEXT GENERATION OF ENVIRONMENTAL POLICY 170, 183 (Marian R. Chertow & Daniel C. Esty eds., 1997) (discussing shift "'From Command and Control' to 'Command and Covenant'"); Eric W. Orts, *Reflexive Environmental Law*, 89 NW. U. L. REV. 1227, 1231–32 (1995) (describing range of "self-referential" reflexive environmental regulations).

300 The "payments" in this setting have taken the form of regulatory relief rather than money. *See* Elliott, *supra* note 299, at 182; Eric W. Orts & Kurt Deketelaere, *Introduction: Environmental Contracts and Regulatory Innovations*, *in* ENVIRONMENTAL CONTRACTS: COMPARATIVE APPROACHES TO REGULATORY INNOVATION IN THE UNITED STATES AND EUROPE 1, 5–11 (Eric W. Orts & Kurt Deketelaere eds., 2001) .

301 Christopher Elmendorf has suggested such a policy approach that would combine proscription by regulating "really bad" land uses and payments for landowners who chose to make "exceptional" improvements. This combination, he argues, is politically attractive because 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 environmentalists' expressive concerns, and their desire not to create (by implication) a new property regime that absolves landowners of any ecological duty. Email from Christopher Elmendorf, Professor, UC Davis Law School, Davis, Cal., to the author (Oct. 1, 2003).

302 The Central Valley Project Improvement Act in California, Reclamation Projects Authorization and Adjustment Act of 1992, Pub. L. No. 102-575, §§ 3401–12, 106 Stat. 4600, 4706–31 (1992) (Title XXXIV of Act is Central Valley Project Improvement Act), for example, mandates reallocations of over 800,000 acre-feet of water when there is an acute need for instream flows (such as to protect an endangered species of fish) but, when needs are less pressing, also authorizes the voluntary purchase of hundreds of thousands of acre-feet. Thompson, *supra* note 22, at 278.

303 *See* Ian Ayres & Paul M. Goldbart, *Optimal Delegation and Decoupling in the Design of Liability Rules*, 100 MICH. L. REV. 1, 5 (2001) (discussing polluter's option to pay for right to pollute or to be paid not to pollute).

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 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 transition payments example demonstrated, however, few policy instruments operate in isolation. This last Section 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. From this vantage point, regulations are attractive as a much smaller drain on the fisc, while taxes and fees provide revenue.[304] Moreover, payment schemes can be highly controversial.[305] Part of this is due to rural landholders' distrust of government involvement in land use. As was evident in the challenge to the Memorandum of Understanding in the Catskills case, part of the opposition 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.[306]

Part of the opposition also 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. Thus 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 also a key benefit of service markets, self-identification resulting in lowered information costs, simply will not 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?[307]

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304 In the context of instream flows, Buzz Thompson notes that "[b]udgetary 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 22, at 276.

305 A 1989 legislative proposal in Montana, for example, sought to create a voluntary conservation program that would pay for instream acquisitions. Surprisingly, the proposal "created a public policy controversy seldom seen in the halls of the [Montana] Capitol." *Id.* at 274 (citation omitted).

306 *See supra* note 73 and accompanying text.

307 John Dwyer suggests a similar dynamic to explain why the Clean Air Act offset markets

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 to 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 with, or ultimately in place of, payments.

Conversely, payments could strengthen the entitlement, rather than cause a buyer's backlash and a demand for command-and-control regulation. Payments both strengthen the landowner constituency and give them more to lose if the regime shifts from payment to coercion. Because of path dependence, a payment strategy may effectively *rule out* a later transition to prescriptive instruments. In other words, once the government has started down the path of payments (and environmental groups have supported such schemes), it may not be politically feasible to actively oppose them or to transition toward regulation. Witness the difficulty, in a related context, of trying to change the ridiculously low fee for mining patents established by the General Mining Law of 1872.[308] Thus, in the context of instream water flows, Buzz Thompson has argued that paying some water users has undercut the argument for regulation, noting that even though "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."[309]

John Echeverria, by contrast, contends that payments may create a sense of entitlement and may influence takings decisions. If public conservation payments to landowners become commonplace, he warns, "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."[310]

In the final analysis, it simply is not clear whether acceptance of

have been so thin. *See* John P. Dwyer, *The Practice of Federalism Under the Clean Air Act*, 54 MD. L. REV. 1183, 1199–204 (1995) (describing attempts by EPA to force states to implement EPA requirements, since EPA lacked administrative resources, expertise, and necessary technical data on emissions to adopt specific criteria for land use and transportation controls).

308 *See* JAMES RASBAND ET AL., NATURAL RESOURCES LAW AND POLICY 1034 (2004) (noting that miners pay $2.50 or $5.00 per acre for mining claim, making this probably "one of today's great real estate bargains").

309 Thompson, *supra* note 22, at 277.

310 Echeverria, *supra* note 188.

payments makes subsequent regulation more or less likely. In either case, though, it is important to emphasize that instrument choice and design must be, as my Australian colleagues would say, a case of "horses for courses"—specific solutions for specific problems. 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.

VII
CONCLUSION

In recent years, increased recognition of ecosystem services' critical contributions to our welfare has spurred new initiatives to ensure provision of services. 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 and delivery pathways, and determination of the service levels required. By drawing on field experience and theory, I have suggested that payments for services may be preferable to other policy instruments in a wide range of settings—(1) when entitlements lie with service providers and regulatory authority is lacking; (2) when there is information asymmetry between providers and consumers of services and information costs are high; (3) when there is a heterogeneous landscape, we seek discrete land use changes that will provide beneficial services, and entitlements are either conflicting or below desired land use practices; or, (4) 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 different scenarios cover more situations than we commonly assume, and an initial research task lies in categorizing the different landscapes and political settings for service provision.

The larger research agenda for service markets also leaves open many areas for study. 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 markets

are to other services, such as carbon sequestration, biodiversity, or flood control, remains an open question. I have not touched on a range of design issues, such as how big the market needs to be, who bears the risk of innocent loss, whether payments should be based on inputs or outputs (e.g., installation of riparian fencing or improvement in water quality), et cetera.[311] 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?

A whole array of questions exist dealing with which markets make most sense in developing countries and what types of services, such as biodiversity, are most valuable. An additional important question is how service markets can be made to work in a country with limited institutional capacity and a weak rule of law.[312]

The determination of willingness to accept also offers a rich area for study. To be sure, decisions of landowners to bid for service provision, and how much to accept, are not driven purely 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 a particular service provision, such as providing large-scale habitat for prairie dogs, may be so deeply ingrained that payment schemes will likely fail.[313] While market logic might counsel paying those landowners who offer the biggest biodiversity bang for the buck, social psychology suggests a different strategy of targeting landowners who have the most persuasive force within the community.[314]

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311 These are addressed in detail in the report I wrote for CSIRO, entitled, "A Scoping Study for Provision of Ecosystem Services in the Sydney Catchment" (available from author upon request), and in STONEHAM ET AL., *supra* note 90, at 483–87 (examining auction and contract design issues).

312 *See generally* LANDELL-MILLS & PORRAS, *supra* note 5 (using case studies to explore development of ecosystem service markets in developing countries); Ferraro & Kiss, *supra* note 211, at 1718 (detailing challenges of creating markets in context of uncertain land tenure, limited opportunities for contract enforcement, and unfamiliarity with particular market mechanisms).

313 Elmendorf, *supra* note 133, at 470–71 (noting that beliefs held by ranchers that prairie dogs compete with livestock for forage reduce feasibility of prairie dog reintroduction).

314 Thus Chris Elmendorf proposes focusing on an area's ecological *and* social landscape. He notes:

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 Voluntary Assent world), and from other vantage points, but these different arguments all eventually seem to find themselves in the same corner, grappling with a far more difficult analysis—deciding whether landowners' activities are fundamentally a beneficial service to be encouraged or a harm to be prevented. Early in the piece, in considering the case of dairy farmers and riparian fencing, I urged the reader to "recognize this situation for what it is—the provision of valuable services to consumers."[315] As we have seen, though, reasonable observers might recognize this situation instead as the 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. These questions, in the end, are value judgments.

Service markets clearly pose potential concerns but, in an imperfect world, may well provide the most effective and desirable means of providing services in many more settings than we currently assume. While an ecosystem services approach can sharpen insights at a theoretical level, perhaps its greatest power is as a practical lens, focusing the attention of service providers on landscape management as an alternative to built solutions, and on the use of markets as an efficient alternative to more prescriptive policy instruments.

In fact, if one ventures to be thoroughly optimistic, the potential of service markets could be very exciting, indeed. Imagine, for example, how things would change if ecosystem service markets were commonplace twenty years from now. A farmer would no longer gain income solely, or perhaps even primarily, from growing commodity crops. Instead, as demonstrated in Table 1, she could "grow services," earning a regular income from provision of ecosystem service. One could imagine, for example, how a farmer's balance sheet today might compare with her

> 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.

Elmendorf, *supra* note 133, at 468.

315 *See supra* Part II.C.

accounts twenty years from now in an economy where ecosystem service markets had become commonplace.[316]

TABLE 1

[Printer: insert table1.doc here]

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, slowing floodwaters, or purifying water. The implication of such a visionary accounting exercise is that landowners of the future would manage their land very differently than today. Is this just crazy musing? Time will tell. In the meantime, the challenge lies in creating the conditions for these service markets to be understood, improved, and transplanted to places where conditions are fertile for the creation and growth of new ecosystem service markets.

316 Adapted from presentation given by Steve Cork & David Shelton, CSIRO, in Brisbane, Austl. (Sept. 2001).