

Symposium:

Decentralized Approaches to Environmental Management

Transaction Costs and Environmental Markets: The Role of Entrepreneurs

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Introduction

Natural resources and environmental amenities are of particular interest to economists because of the potential for markets to result in inefficient outcomes. In the case of natural resources, the issue is whether resource use is optimal. Are too many fish being harvested? Is groundwater being pumped to fast? Are trees being harvested at the right time? In the case of the environment, the issue is whether sufficient environmental quality is being produced or preserved. Are water and air quality high enough? Are enough acres dedicated to wilderness? Is there enough open space?

The optimal provision of environmental goods and use of natural resources depends on whether private actors in the marketplace fully account for all benefits and costs. As long as production or use occurs at the point where marginal social benefits equal marginal social costs, markets are efficient. However, if the marginal private benefits are less than marginal social benefits, markets will provide too little environmental quality, and if marginal private costs are less than marginal social costs, markets will overuse a natural resource.

Of course, underproduction of environmental quality and overuse of natural resources are really opposite sides of the same coin. Coase (1960) emphasizes this point when he describes the reciprocal nature of environmental problems. For example, too little air quality implies too much use of air for emission disposal. Too little instream flow for fish implies too much extraction of water for consumption. Too little open space implies too much land development for housing.

Although underproduction and overuse are opposite sides of the same coin, underproduction of environmental quality is usually seen through the lens of public goods, while overuse of natural resources (a market failure on the cost side) is usually seen through the lens of incomplete property rights and prohibitively high transaction costs. Yet both types of environmental

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We thank Spencer Banzhaf and two anonymous referees for helpful comments.

Review of Environmental Economics and Policy, volume 0, issue 0, 2013, pp. 1–17
doi:10.1093/reep/ret011

problems are fundamentally property rights and transaction cost problems. Therefore whether markets can resolve environmental problems depends on whether well-defined and tradeable property rights can be created.

Thanks first to the work of [Demsetz \(1967\)](#), we understand that the evolution of property rights does not just happen on its own; rather, property rights are typically produced by entrepreneurs who see the benefits of producing them to be lower than the transaction costs. To [Schumpeter \(1934\)](#), entrepreneurs were those who introduced new methods of production, opened new markets, or reorganized industry. To a new institutional economist, entrepreneurs also define and enforce property rights and reduce the transaction costs of production (see [Anderson and Hill 1975, 2004](#); [Demsetz 1967](#); [Libecap 2007](#); [North 1990](#); [Spulber 2009](#); [Williamson 1985](#)).¹ As [Coase \(1937\)](#) explained, the firm is an institutional arrangement for lowering transaction costs, and [Barzel \(1987, 103\)](#) adds that the “entrepreneur assumes the role of the residual claimant because his actions are more costly to monitor than those of the factors with which he collaborates.” To scholars of common-pool resources, successful entrepreneurs are those who devise institutional arrangements to prevent resource collapse ([Ostrom 1990](#)).

The purpose of this article, which is part of a symposium on Decentralized Approaches to Environmental Management,² is to critically examine the transaction costs that cause the underprovision of environmental goods and the overuse of natural resources by identifying what prevents (or promotes) innovation (environmental entrepreneurship) to reduce transaction costs. We explain how entrepreneurs can benefit from reducing transaction costs and, at the same time, improve resource allocation. We define environmental entrepreneurs as those who lower the transaction costs associated with the free rider problem and the tragedy of the commons and provide examples of three types of environmental entrepreneurs: those who contract over existing property rights in innovative ways, those who create new environmental property rights, and those who elicit private payments for public goods.

In the next section we describe the legacies of A. C. Pigou and Ronald Coase and explain how they both understood that transaction costs prevent markets from achieving theoretically optimal resource allocation. With this understanding, we compare alternative institutional arrangements, asking how entrepreneurs might be able to reduce transaction costs and improve resource allocations. This is followed by a discussion of the impact of actions by institutional entrepreneurs on the evolution of property rights. Next we provide examples of different types of environmental entrepreneurship and conclude the article by suggesting how government can encourage or discourage these institutional innovations.

The Legacies of Pigou and Coase

The writings of A. C. [Pigou \(1932\)](#) are the starting point for almost any analysis of suboptimal resource allocation, whether on the benefit or the cost side. On the benefit side, Pigou said the

¹The term *new institutional economics* describes a methodological approach to economics that differs from neoclassical approaches primarily in the extent of attention paid to organizational arrangements, transaction costs, property rights, and social norms. The main scholars associated with this field include four Nobel laureates: Ronald Coase, Douglass North, Elinor Ostrom, and Oliver Williamson.

²The other articles are [Banzhaf, Fitzgerald, and Schnier \(2013\)](#), which introduces the symposium and provides an overview of the Coasean (property rights) and Pigouvian (public economic theory) perspectives, and [Kotchen \(2013\)](#), which focuses on the public economics perspective and examines voluntary- and information-based approaches to improving environmental quality.

problem of underproduction of goods and services occurs because it is “technically difficult to exact payment” (1932, 183–84) from those who benefit. On the cost side, Pigou argues that the divergence between marginal private costs and marginal social costs is due “to the technical difficulty of enforcing compensation for incidental disservices” (185).

Coase’s (1960) article, “The Problem of Social Cost,” challenges some of the conclusions drawn from Pigou’s analysis, in particular the desirability of always holding polluters liable for damages, but the similarities between Coase and Pigou are often overlooked. Coase (1960) maintains that without transaction costs, optimal resource use will emerge through mutually beneficial agreements, and there is nothing in Pigou (1932) to suggest he would disagree. Moreover, Coase’s focus on transaction costs is actually akin to Pigou’s focus on “technical difficulty.” For Coase (1960), transaction costs are the costs incurred to “discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on” (15).

Coase explains that “If such market transactions are costless, such a rearrangement of rights will take place if it would lead to an increase in the value of production” (15). This argument has been called the “Coase theorem” (Stigler 1988, 113), although Coase himself did not call it that. The Coase theorem implies that efficient resource allocation depends on well-defined and enforced property rights and on zero transaction costs. Thus it is easy to infer that voluntary market transactions will not be efficient because transaction costs are always positive. Whether transaction costs are the costs of defining and enforcing property rights or the costs of trading well-defined and enforced property rights (see Allen 1991), they drive a wedge into the allocation process that leads to outcomes that are inferior to those that would result in a world of zero transaction costs.

Transaction Costs and Public Goods

The examples given by Coase—ranchers with cattle versus farmers with crops, the doctor versus the confectioner, and railroads versus trees owners—highlight the transaction costs of getting one party to consider the impacts of its production on another. However, the notion of transaction costs is also usefully applied to public goods. Thanks to Samuelson (1954), we understand that public goods are both nonrival and nonexclusive in consumption. Nonrival in consumption means that one person’s enjoyment of a good does not preclude another person from deriving value from that same good. For example, two people can enjoy watching a movie at a theater (provided they do not make noise or block each other’s view) at the same time without one person’s enjoyment interfering with another’s. In contrast, two people cannot both enjoy drinking the same soda without one person’s consumption reducing the amount of soda left for the other. Nonexclusive in consumption means that once a good is supplied to one person, others can consume it free of charge. For example, if one person reduces air emissions to derive value from cleaner air, another person can enjoy the value from the same cleaner air without having to pay for it.

The nonrival characteristic of a public good does not preclude voluntary market provision of the good, as illustrated by the movie theater example. Both movie goers can watch the movie, but they will only get to do so if they buy a ticket from the theater owner. In contrast, the nonexclusive characteristic poses problems for market provision because producers of

nonexclusive goods cannot extract payment from nonpayers who capture some of the value. Also known as the free-rider problem, nonexclusive consumption means that the voluntary supply of public goods may fall short of what is socially optimal.

The undersupply of public goods is fundamentally a transaction costs problem because it can be “technically difficult to exact payment” (Pigou 1932, 183–84) from those who would otherwise free ride. But getting free riders to pay also requires discovering “who it is that one wishes to deal with” and conducting “negotiations leading up to a bargain” (Coase 1960, 15). These transaction costs would be enormous in some settings, but it is important to emphasize that efficient supply does not require payment from all consumers.

Consider a public good such as scenic open space near a public highway that is enjoyed by both the owner of the open space land and passersby. If the quantity of open space that the landowner supplies to meet her own demand is greater than the quantity demanded by the most view-loving passerby, then the private supply is optimal and the higher transaction costs of extracting payment from passersby are irrelevant. For these reasons, Lindsay and Dougan (forthcoming) conclude “the gains from many public goods whose benefits reach nationwide populations are largely realized at group sizes far smaller than even county or municipal jurisdictions.” Haddock (2008, 283–84) summarizes the point by noting, “Because a public good is not used up as an individual enjoys it, the appropriate amount cannot be determined from the population of users, but instead depends on the preferences of a subset of users—the most avid one(s).”

Nevertheless, the private supply of public goods is not always optimal, making it necessary to extract payment from the potential free riders. If the transaction costs of extracting such payments are high, government intervention may lead to a more optimal level of provision of the public good. This intervention could come in various forms. It could be through direct government ownership of the resource, in which case the government determines the supply, the production techniques, and the price, which is how federal lands, such as those under the jurisdiction of the US Forest Service or National Park Service, are managed. Alternatively, government intervention could regulate private decisions, as with water quality standards under the US Clean Water Act and land use restrictions under the US Endangered Species Act, or setting catch limits, fishing seasons, and gear restrictions to control overfishing. Finally, government intervention could be through subsidies used to increase the private benefits of public goods provision, as with open space bonds to encourage private land conservation.

Need for Comparative Institutional Analysis

Neither Pigou nor Coase provides a definitive answer as to whether markets are preferred to governmental intervention. Pigou said that the extent to which government alternatives improve on markets will be conditioned by “the intellectual competence of the persons who constitute it, the efficacy of the organization through which their decisions are executed, their personal integrity in the face of bribery and blackmail, their freedom from domination by a privileged class, [and] their ability to resist the pressure of powerful interests or of uninstructed opinion” (quoted in Medema 2009, 69–70).

Even before the emergence of the literature on rent seeking (Rowley et al. 1988), Pigou (1912, 248) recognized that “every public official is a potential opportunity for some form of self-interest arrayed against the common interest.” [Hence] “It is not sufficient to contrast the

imperfect adjustments of unfettered private enterprise with the best adjustment that economists in their studies can imagine. For we cannot expect that any public authority will attain, or will even wholeheartedly seek, that ideal” (Pigou 1932, quoted in Medema 2009, 69).

Coase (1960) also recognized the tradeoffs between the transaction costs of using the market to allocate resources, and the collective action problems of using government, noting “in choosing between social arrangements within the context of which individual decisions are made, we have to bear in mind that a change in the existing system which will lead to an improvement in some decisions may well lead to a worsening of others. Furthermore, we have to take into account the costs involved in operating the various social arrangements (whether it be the working of a market or of a government department), as well as the costs involved in moving to a new system” (44).

To summarize, Pigou and Coase understood that determining whether government intervention improves on market allocation requires comparative institutional analysis of the transaction costs and incentives under either market or governmental systems. This suggests that phrases like “market failure” or “government failure” are meaningless unless the market and government systems are compared with each other. Taking this a step further, we also argue that comparisons should be dynamic rather than static because the costs and benefits of using any system are continuously evolving in response to institutional entrepreneurs. Thus, although the transaction costs of defining and enforcing property rights at one point in time may preclude market provision of environmental goods and suggest the need for government intervention, innovation can lower those transaction costs, altering the optimal institutional mix over time. Institutional entrepreneurs who are the first to recognize these lower transaction costs can profit from improving the allocation process.

Institutional Entrepreneurs and the Evolution of Property Rights

Demsetz (1967) and Anderson and Hill (1975) argue that property rights to natural resources are often consciously produced by people who devote effort and other inputs to the definition and enforcement of those rights when the expected benefits of definition and enforcement exceed the expected costs. The benefits depend primarily on the value of natural resources if rights are defined and enforced. The costs of reorganizing and further delineating property rights are a function of available technologies and the political and legal challenges of initiating institutional change. Opportunities for institutional innovation—be they formal or informal—arise when the expected benefits of changing property rights exceed the costs.

The driving force behind the evolution of property rights is the entrepreneur who establishes new forms of organization, production processes, and business methods (Schumpeter 1934). Barzel (1987, 1997) defines the entrepreneur as one who “assumes the role of the residual claimant.” That is, he is the person who first recognizes new gains from trade, hires other inputs to carry out his idea, and finds ways to capture the returns associated with transaction cost savings. The entrepreneur needs well-defined rights to resources in order to become a residual claimant, be they informal customary rights or formal legal rights.

Evolution of Informal Property Rights

Anderson and Hill (1975) examine the evolution of property rights to land, livestock, and water in the American West. For example, the invention of barbed wire in the 1870s caused a dramatic decrease in the damages caused by roaming cattle and hence in the costs faced by farmers in enforcing their rights to land. Although in theory farmers had formal legal protection prior to the 1870s, in practice their legal rights were not enforceable without fencing.³ The sudden availability of cheap barbed wire significantly lowered the transaction costs related to enforcing land use contracts between farmers and ranchers, a case specifically described by Coase (1960). Rapid growth in population and agricultural productivity in the Great Plains ensued as a result of this innovation (see Hornbeck 2010).

Demsetz (1967) emphasizes the benefits of better defining and enforcing property rights. In the context of seventeenth-century North America's fur trade, he showed that informal property rights to hunting grounds were better defined and enforced by Native Americans when the value of furs, especially beaver pelts, rose. Recreational surfers also generate informal rights to surfing waves. Kaffine (2009), for example, shows that the informal rights to surfing waves are stronger at the highest quality spots as a result of local surfers aggressively excluding outsiders from riding the good waves.

Evolution of Formal Property Rights

Although barbed wire, higher fur prices, and high-quality waves led to greater definition and enforcement of informal property rights without government action, in other settings stronger property rights evolved more formally through legislative and judicial channels. For example, formal water law in the American West evolved as state legislatures adapted informal efforts to define extraction levels in mining camps and irrigation regions to create the prior appropriation doctrine. This doctrine allocates water rights on a first-in-time, first-in-use basis. That is, those who divert water from streams first have rights that are senior to those who come later, so that in drier years, when not all demands can be met, junior users must refrain from diversions until senior rights are met. This approach first emerged in the mining camps and irrigation districts west of the 100th meridian in response to growing water scarcity (Anderson and Hill 1975). Property rights to mining in Australia and in other parts of the United States followed a similar pattern. As the value of the mineral resources grew, the number of miners increased, and as technologies for diverting water improved, competition increased, leading to explicit contracts for exclusive property rights (see La Croix 1992; Libecap 2007; Umbeck 1977). These property rights required protection and enforcement, which occurred initially through miners' organizations and the establishment of mining camp rules, and later through changes to state codes.

Although in general, rights to resources tend to become more strongly demarcated as they become more valuable, the opposite can also be true. For example, in the case of the American bison, the soaring prices of buffalo hides in the mid-nineteenth century, combined with the development of American railroads and the decimation of Native American populations,

³That is, they did not have the economic rights described by Barzel (1997).

weakened property rights to bison at a time when their potential market value was perhaps at its highest (Lueck 2002; Taylor 2011). More generally, increases in the value of a natural resource could potentially hasten its extraction if international forces to extract occur before local property rights institutions can adapt.

Entrepreneurs and Institutional Adaptation

When property rights do adapt, it is often due to the entrepreneur, whose actions “are essential forces that drive the economy” and whose “activities lead to the establishment of most economic institutions” (Spulber 2009, 151). To illustrate the process of institutional adaptation, consider again the American West. During the last half of the nineteenth century, cattlemen drove their cattle north to capture the rents from free grass. Without entry restrictions, these rents would be expected to decline in a tragedy of the commons. Economists might view this as market failure, with marginal private costs being less than marginal social costs. However, in the longer run, the squandered rents actually provided an incentive for institutional innovation.

The transition *From Free Grass to Fences*, as Fletcher (1960) titled his story of the transition from open range to property rights, occurred because institutional entrepreneurs exploited the opportunity for capturing rents by creating cattlemen’s associations (see Anderson and Hill 2004). These associations helped establish customary (i.e., informal) grazing territories and facilitated a market in the rights to those territories (see Dennen 1976). When the range was full, the cattlemen’s association declared the territory closed. By excluding outsiders from joining in the association’s roundups (with their extensive scale economies), these associations effectively prevented entry by nonmembers.

This example of the evolution of property rights in the American West illustrates the role of the entrepreneur in averting a tragedy of the commons and also serves as a word of caution against the top-down (i.e., government) imposition of property rights. Incomplete property rights mean there are uncaptured rents and hence gains to be had from making the property rights more complete. In other words, a temporary condition of market failure may be a market opportunity for entrepreneurs in the longer run if they can capture the value that is being lost due to the market failure.

By contrast, the top-down imposition of property rights gives institutional entrepreneurs fewer options to adapt property rights to local customs, knowledge, and culture. As noted by Ostrom (1990), adaptive governance of common-pool resources works best when rights evolve from the bottom up.

Examples of Environmental Entrepreneurship

Focusing on entrepreneurs as reducers of transaction costs helps us understand how markets can improve environmental quality and the conservation of natural resources. More specifically, to the extent that transaction costs or “technical difficulties” (as Pigou calls them) thwart Pareto-improving resource allocation, entrepreneurs who can better define and enforce property rights, and thus reduce transaction costs, will be motivated by the prospect of capturing higher rents. Of course, entrepreneurs can never drive transaction costs to zero any more than engineers can reduce friction to zero, nor can they perfectly define and enforce property rights. However, if, as noted earlier, we view environmental and natural resource problems as property

rights problems, it becomes clearer how environmental entrepreneurs (and environmental markets) can improve resource allocation in a world of positive transaction costs.

Evolution of Environmental Problems

Before examining contemporary examples of environmental entrepreneurship, it is useful to point out that what constitutes a natural resource or environmental problem is constantly evolving. For whalers trying to harvest leviathans, the problem was how to reward the risk takers who threw harpoons from small boats in rough seas, and the institutional innovation was to establish rules such as “fast-fish, loose-fish” or “iron-holds-the-whale” (Ellickson 1989). Today, the problem is how to prevent overharvesting (Costello, Gaines, and Lynham 2008).

For the “Forty-Niners” in the California gold camps, the problem was how to divert water from streams and convey it to where it was needed for sluicing, and the institutional innovation to solve it was the prior appropriation doctrine (see Anderson, Scarborough, and Watson 2012). Today, the problem is finding ways to put water back into streams for fish or recreation (Scarborough 2010).

For the first farmers in the midwestern United States, the problem was determining how to establish property rights to the land so that the farmers could clear the inventory of trees and plant crops; the institutional innovation was metes and bounds, and later it was rectangular surveys in regions lacking natural topographical boundaries (see Libecap and Lueck 2011). Today, the problem is preserving the land’s wildlife habitat and ecosystem services, and one of the institutional innovations is contracts for ecosystem services (Ferraro 2008; Salzman 2010).

For oil companies punching wildcat wells in open access oil pools in Texas, the problem was determining how to prevent overpumping, and the institutional innovation was unitization—establishing regulations to require all pumpers in a given area to agree on a pumping rate and distribution of revenues (Libecap and Wiggins 1984). Today, the problem is how to reduce carbon emissions and limit the water quality risks related to hydraulic fracturing.

The point of these examples is that there have always been institutional entrepreneurs who focus on natural resources, but what they have considered to be environmental problems has changed over time depending on the relative value of resources.

Three types of environmental entrepreneurs have helped solve these problems by improving resource-use efficiencies. The first type of entrepreneur contracts over existing property rights in innovative ways that reduce transaction costs. The second type of entrepreneur creates new property rights where they previously did not exist, thus capturing the rents related to ownership of environmental resources. The third elicits private payments for public goods, thus reducing the free-rider problem.

Contracting over Existing Property Rights

In any market transaction, sellers must contract with input owners to produce goods and services, buyers must find sellers, and the two must agree on the terms of trade. In cases where property rights are clearly defined and enforced, the costs of contracting over them can drive a wedge into the gains from trade. The entrepreneur who can reduce transaction costs increases efficiency and captures a share of the gains from trade.

The Nature Conservancy and fishery habitats

To illustrate this type of environmental entrepreneurship, consider how the Nature Conservancy (TNC) has reduced bycatch of depleted seafloor species such as rockfish—many of which are not commercially valuable—and reduced seafloor habitat damage off the coast of central California. Because further regulation of fishers would have been contentious and might not have helped TNC achieve its goals, TNC purchased trawling permits and trawling vessels from commercial fishers (see [Deacon and Parker 2009](#)). TNC recognized that rather than challenging the right of fishers to trawl, it was better to focus on the permits held by fishers, which conveyed certain rights to use the seafloor in ways that competed with the preservation of habitat for nontarget species. This recognition of rights enabled TNC to bargain with fishers to change their fishing techniques and to meet an emerging demand for what it calls “sustainably harvested seafood” and nontarget species preservation.

TNC could have retired the permits and scrapped or sold the vessels, but because it was the residual claimant, TNC was able to use more cost-effective and innovative practices. It leased the fishing rights back to fishers, who were willing to agree to restrictions on where and when to fish and what gear to use. This control over the fishery gave TNC the opportunity to experiment and to “pioneer new ways to catch groundfish” while at the same time earning a stream of payments.⁴

Livestock and grazing on public land

Another example of environmental entrepreneurship when property rights exist involves the conflict over livestock grazing on federal land in the United States. Ever since the creation of both the US Forest Service and the Bureau of Land Management in the early twentieth century, livestock grazing on federal lands has been a contentious issue. In the early days, the conflict was over who would get the grazing rights, but now it is between grazers who want to capture the rents from forage and environmentalists who want more rents from recreation or other environmental amenities. One obvious environmental market solution to these competing uses would be for environmentalists to purchase the grazing permits and use them as they see fit, but this solution requires that the permits be well established and transferable rights and that the regulations be changed to allow permit holders to not graze.

With this background, consider two very different responses to a proposed policy change to make the permits transferable to nongrazers. One environmental leader says he can raise the money to retire the permits, and he supports the necessary regulatory changes to make the permits transferable to nongrazing environmental groups. Another environmental leader acknowledges that transferability of the permits would get the cattle off the land, but he argues that the grazers should not be allowed to have those permits. The first leader accepts the status quo rights and paves the way for entrepreneurial solutions. The second uses political slogans to reduce support for grazing, presumably because he thinks his objective of reducing grazing can be achieved at lower cost through political means.

⁴See www.nature.org/ourinitiatives/regions/northamerica/unitedstates/california/howwework/central-coast-groundfish-project.xml (accessed May 29, 2013).

Putting aside the normative question of whether grazers should have permits, it appears that the rights are clearly defined and enforced and that the only “technical difficulty,” or barrier, is the transferability of the rights themselves. This means that the environmental leader who asserts that grazers should not have the permits is seeking rather than creating rents and, in the process, raising the transaction cost for markets.

Yellowstone National Park: Grazing rights versus the reintroduction of wolves

To further illustrate contracting for existing property rights, we examine the issue of wolf predation on livestock following the reintroduction of wolves into Yellowstone National Park. Led by Hank Fischer, Defenders of Wildlife and the National Wildlife Federation have used contracting for grazers’ status quo property rights to address wolf predation. When the wolves were introduced into Yellowstone in the late 1990s, Defenders of Wildlife raised private funds to create a fund for compensating livestock owners whose livestock were killed by wolves (see [Anderson and Leal 2001](#)). In a sense, Defenders of Wildlife was taking responsibility for wolf predation in the same way that a pet owner is responsible for the animals he or she owns; both assume liability for damages to property, although in the case of Defenders of Wildlife, this assumption of liability was self-imposed. There had to be proof that wolves were responsible for the livestock loss, but once proven, Defenders of Wildlife compensated the livestock owner.

More recently, Fischer has teamed up with the National Wildlife Federation to remove cattle from harm’s way around Yellowstone, where grizzly bears and wolves prey on livestock and bison may transmit brucellosis, a disease that causes cattle to abort their young. Rather than lobbying to close federal lands to grazing, Fischer and the National Wildlife Federation have negotiated with the US Forest Service and grazing permit holders to move cattle to areas where they are less vulnerable to both predation and disease transmission. As Fischer puts it, “We aren’t getting rid of grazing; we’re redistributing where it occurs—away from core wildlife areas near national parks and wilderness areas and closer to low-conflict areas.”⁵ In this way, the program has taken nearly a half million acres around Yellowstone and Grand Teton National Parks out of grazing by acknowledging the status quo rights of grazers and negotiating with them and the government agencies in charge of land management.

Creating New Property Rights

When property rights do not exist, the challenge for environmental entrepreneurs is to find ways of lowering the costs of defining and enforcing new property rights. This may involve improving the delineation of the resource’s boundaries (see [Libecap and Lueck 2011](#)) or identifying new uses with higher values that have not been recognized or captured by existing owners. We focus here on examples of the latter, including the conservation easement, which is now used by land trusts to conserve millions of acres of land in the United States (see [Parker and Thurman 2011](#)).

⁵Quoted at <http://thinkexist.com/quotation/we-aren-t-getting-rid-of-grazing-we-re/1344203.html> (accessed May 29, 2013).

Conservation easements

The early pioneers of the land trust movement in the United States recognized that it was not necessary to buy land outright. Rather, they could potentially achieve their goal of conserving undeveloped land in its present state at a lower cost by simply contracting with landowners to refrain from certain land uses such as developing subdivisions, strip mining, and clear-cutting (see Boyd, Cabellero, and Simpson 2001; Parker 2011). However, the transaction costs of contracting were high because easements that “run with the land” were not defensible under common law. This meant that land trusts seeking to assemble contiguous tracts of land for conservation would have to renegotiate contracts when land ownership changed hands, which would likely lead to delays, holdups, and other contracting problems that could frustrate strategic conservation planning (see Elmendorf 2004).

To overcome these obstacles to a better allocation of land toward open space, land trust entrepreneurs pushed for the creation of a new property right—the conservation easement—which is outside the scope of common law. Conservation easements rely on statutory law for enforcement, and each US state has now passed a statute that enables easements, with the first in 1969 (Massachusetts) and the last and most recent in 2001 (Wyoming and Pennsylvania). Easement-enabling statutes include basic enforcement provisions that override common law defenses and allow the restrictions on land use to “run with the land” even if land ownership changes hands. This legal innovation dramatically lowered the transaction costs of contracting for land and ecosystem services. Moreover, the transaction costs will likely continue to fall as land trusts become more experienced in writing, monitoring, and enforcing conservation easements (see Parker 2004).

Modern land trusts do not always try to achieve their goals through conservation easements. Instead their focus is on land ownership arrangements that economize on transaction costs (see Parker 2004). For example, when land trusts seek to actively engage in ecological restoration, they tend to do so through outright ownership rather than writing complex easements that may be difficult to enforce. However, when land trusts simply want to preserve open space on working agricultural lands, they tend to do so through standard conservation easements. In other words, land trusts try to use cost-effective means to achieve their goals.

Water for the environment

Another example of environmental entrepreneurs creating new property rights comes from the semiarid US West, where water is the lifeblood. To accommodate large-scale diversions of water, nineteenth-century miners and farmers established the prior appropriation system, which, as discussed earlier, allocated water on a first in time-first in right basis. This meant that the first person to put the water to beneficial use by diverting it established a right to that quantity of water. Subsequent diverters established similar rights, with each required to leave enough water for earlier claimants. This property rights system provided enough security to attract both mining and agricultural investments tied to water.

A key part of the prior appropriation doctrine was the diversion requirement, which lowered the cost of defining and enforcing water rights (see Anderson and Johnson 1986). It was easy to determine if the diversion was active, and, if it was not, “use it or lose it” allowed someone else to claim the unused water, ensuring that it was put into production. Thus the environmental entrepreneurs of the nineteenth-century created a property rights system that

worked well for allocating water from the stream, and the diversion requirement lowered transaction costs.

Fast forward to the late twentieth and early twenty-first century when the demand for instream flows—rather than diversions—increased due to the increased demand for recreational pursuits such as fishing and rafting and ecosystem services such as clean water. Purchasing water rights to leave water instream first had to address the beneficial use requirement of the prior appropriation doctrine, which required diversion of water (and thus allowed any undiverted water to be claimed by other users).

To remove this requirement, the Fresh Water Trust (initially called the Oregon Water Trust), and sister organizations in other states, changed Oregon's water law in order to put markets to work for "saving our streams" (see Scarborough and Lund 2007). That is, they had to make instream flows a legally recognized beneficial use so that rights to water left instream would not be forfeited because of nonuse. The changes in state laws have prompted a burgeoning market in instream flows through leases and sales of water rights from landowners to conservation groups. Thus environmental entrepreneurs have created new legal institutions by enhancing and creating new property rights that have spurred a market for habitat conservation.

African wildlife management

African wildlife management offers a final example of environmental entrepreneurs creating new property rights. In this case, property rights to wildlife were created for communities that live with wildlife. During the 1990s, it became clear to wildlife managers throughout southern Africa that top-down regulation of wildlife was not working, especially in a world where wildlife destroys crops or kills livestock and where selling ivory or horns from dead animals makes them worth more dead than alive. Making matters worse, governments subsidized traditional crops and livestock production.

Recognizing this as a property rights problem, wildlife experts initiated efforts to devolve wildlife management to private landowners and local communities (see, e.g., Child 2004). Child (2004) describes what he accomplished: "Around the campfire and talking to villagers in remote parts of the Beitbridge district in southern Zimbabwe, I worked out the details for translating theory into practice with four highly motivated community leaders. . . . Economically speaking, we converted wildlife into a private good, shifting the power to make decisions from the center (the capital city or district headquarters) to ordinary people."

Supported by the World Wildlife Fund, one of the world's largest environmental organizations, Child's effort became known as CAMPFIRE (the Communal Areas Management Program for Indigenous Resources) in 1989. Says Child (2004, 4–5), "We formed the CAMPFIRE Collaborative Group, a small group of innovative, dedicated people who began fighting for the rights of rural people to benefit from the wildlife that surrounded them." CAMPFIRE clearly illustrates how government can devolve property rights to more local levels and reduce transaction costs.

Other countries have learned from CAMPFIRE's success and have adopted similar approaches. For example, Botswana, Namibia, and Tanzania all use some form of community-based natural resource management. As Douglas Williamson (n.d.), a forestry officer with the Food and Agricultural Organization (FAO) Forestry Department, puts it, "the most

effective way of delivering benefits to rural people is to give them the right and the responsibility to manage wildlife.”⁶

Eliciting Private Payments for Public Goods

In the previous examples, environmental entrepreneurship has taken place even though the entrepreneurs created benefits that are neither entirely excludable nor entirely rivalrous in consumption. This is true of the rockfish habitats in California, the wolves in Yellowstone, the ecosystem services preserved by land trusts, and the instream water flows secured by water trusts. But how have environmental entrepreneurs been able to make progress given the free-rider problem? That is, how have they been able to create market exchange through contracting when it is difficult to extract payment from all those who benefit?

There are two reasons for the success of environmental entrepreneurs, which is not to suggest that entrepreneurs have magically solved the problem of public goods. First, successful (and even optimal) provision of public goods does not require payment from every free rider. Rather, it requires payment from the subset of demanders whose preferences and abilities to pay are the strongest (Haddock 2004; Lindsay and Dougan 2012). Second, most environmental goods, including those in our examples, are not pure public goods; many are club goods (i.e., public goods that are excludable but nonrivalrous), and private benefits can be tied to their production (see Kotchen 2013). Indeed, the most successful environmental entrepreneurs find ways to bundle private and public goods.

Land trusts, for example, often bundle or package environmental amenities with private tourism and charge user fees. To illustrate, TNC owns and operates nature reserves with overnight lodging for guests. A vacation stay at the conservancy’s 18,000-acre Pine Butte Swamp Reserve in Montana offers mountain hiking, horseback riding, and the potential for viewing grizzly bears in their natural habitat. Land trusts also bundle private and public benefits in more subtle ways, for example by making a point of giving donors conspicuous recognition.⁷

Ted Turner’s Flying D Ranch in Montana provides another example of bundling.⁸ On this 100,000-acre property, Turner raises bison rather than the traditional cattle raised on neighboring ranches. This example is of particular relevance to our discussion because the ranch has a public road running through it that leads to a campground and trailhead on adjacent national forest land. Because the road has a public easement, it would be “technically difficult” for Turner to erect a toll gate and extract payment from those who enjoy the sight of bison grazing on his land. In other words, the public easement creates a free ride for sightseers and, except for any congestion or deterioration of the road due to more cars, there is zero marginal cost of viewing the bison. Furthermore, Turner has placed conservation easements on the ranch that limit development and create spectacular vistas for those driving on the public road.

Turner’s entrepreneurial approach was to bundle provision of a public good with the private consumption of a meal, by selling bison meat at his chain of Ted’s Montana Grill restaurants. This is not to suggest that all of Turner’s private costs—which include fencing, vaccinating, herding, and feeding the bison—are offset by restaurant revenues. However, Turner’s private

⁶See <http://www.fao.org/docrep/005/y4744e/y4744e12.htm> (accessed May 29, 2013).

⁷The Gallatin Valley Land Trust in Bozeman, Montana, devotes nearly half of its newsletter space to listing the names of its donors.

⁸This discussion is based on Haddock (2008).

enjoyment from seeing the bison on his ranch helps make up for the difference. Moreover, Ted's Montana Grill has increased the popularity of eating bison and provides incentives for other ranchers to build bison herds, which leads to public good provision elsewhere.

Evolving technologies can also play an important role in overcoming some of the technical difficulties in excluding free riders. Just as barbed wire revolutionized fencing, satellite monitoring, lasers, and remote sensors make it feasible to record and charge for use. On highways, it is now common to use digital devices to detect and enforce pay-for-use of faster moving lanes. Some fisheries couple boats equipped with transponders that are authorized to use the fishery, with real-time satellite monitors to detect trespassers. Finally, tracers can be introduced into air and water emissions to identify and hold accountable owners of the sources. In short, entrepreneurs who lessen the free-rider problem by innovating and using new technologies are rewarded by capturing the rents from better defined and enforced property rights.

Conclusions

The legacies of Pigou and Coase suggest that resource inefficiencies result from high transaction costs. Examples of resource inefficiencies abound: smoke in the air, depleted fisheries, clear-cut hillsides, land subsidence due to groundwater withdrawals, and species endangered by habitat degradation. These and related examples would appear to indicate that markets have failed and beg for a solution, one that is often based on government regulation.

However, a deeper reading of Pigou and Coase suggests a more nuanced conclusion, one that recognizes that failure is relative in the second-best world we live in. That is, while Pigou and Coase both understood that markets might fail to achieve Pareto optimality due to transaction costs, they also recognized the importance of asking, "Compared to what?" As noted earlier, Pigou (1932, quoted in Medema 2009, 69) concluded, "It is not sufficient to contrast the imperfect adjustments of unfettered private enterprise with the best adjustment that economists in their studies can imagine." And Coase (1960, 44) called for starting "our analysis with a situation approximating that which actually exists" and deciding "whether the new situation would be, in total, better or worse than the original one."

We press this point further, arguing that the literature has too often treated transaction costs as fixed, when in fact property rights evolve and transaction costs tend to fall as the net benefits of contracting for environmental quality rise. We argue that environmental entrepreneurs are the essential economic force behind this evolution. They are the institutional entrepreneurs who contract for environmental assets in innovative ways, create new property rights, or bundle private benefits with public good provision. Entrepreneurship does not always achieve Pareto efficiency, and some efforts at private contracting will fail to get off the ground. Yet the growing value of environmental goods and the emergence of new exclusion technologies create conditions that support successful institutional entrepreneurship of the type described here.

The examples we have presented illustrate how government can help to lower the transaction costs associated with the definition, enforcement, and exchange of property rights. In some cases—including water trusts, grazing rights, and marine fishery buyouts—the main role of government was to remove legal barriers to exchanging property rights. In other cases, such as land trusts and CAMPFIRE, governments have played a more active role in creating new

property rights. Governments have played a similar role in other settings, for example by applying cap and trade to fisheries and air emissions (Costello et al. 2008, Stavins 1998).

However, government can also stand in the way of lowering transaction costs by allowing special interests to create barriers to exchange. This could have happened in our earlier example of grazing permits, where one environmental leader wanted to buy and retire grazing permits and the other wanted to use politics to restrict grazers from obtaining permits. It could also happen today. For example, some government agencies in the United States are precluding environmental groups from owning individual tradable quotas in fisheries, thereby limiting their participation in environmental markets (see Grainger and Parker, forthcoming). In short, government can discourage environmental entrepreneurship and divert it toward the zero-sum game of rent seeking (as described by Baumol 1992) if it puts restrictions on property rights and exchange, or it can facilitate environmental entrepreneurship by supporting robust conceptions of property rights.

In summary, we have argued (and illustrated) that environmental entrepreneurs can succeed when they see positive transaction costs as an opportunity rather than a problem. By adopting innovative strategies that lower the transaction costs of economic exchange, these entrepreneurs are constantly finding new ways to capture the value of environmental resources. If we accept the common assumption that transaction costs are too high for bargaining over resource use to succeed, then the environmental market “glass” looks half empty. By contrast, if we focus on environmental entrepreneurship, then the glass looks more than half full.

References

- Allen, Douglas W. 1991. What are transaction costs? *Research in Law and Economics* 14: 1–18.
- Anderson, Terry L., and Peter J. Hill. 1975. The evolution of property rights: A study of the American West. *Journal of Law and Economics* 18 (1): 163–79.
- . 2004. *The not so wild, wild West: Property rights on the frontier*. Stanford, CA: Stanford University Press.
- Anderson, Terry L., and Donald Leal. 2001. *Free market environmentalism*. Rev. ed. New York: Palgrave.
- Anderson, Terry L., and Ronald N. Johnson. 1986. The problem of instream flow. *Economic Inquiry* 24 (4): 535–54.
- Anderson, Terry L., Brandon Scarborough, and Lawrence R. Watson. 2012. *Tapping water markets*. Washington, DC: Resources for the Future Press.
- Banzhaf, H. Spencer, Timothy Fitzgerald, and Kurt Schnier. 2013. Non-regulatory approaches to the environment: Coasean and Pigouvian perspectives. *Review of Environmental Economics and Policy* 7 (2): 238–58.
- Barzel, Yoram. 1987. The entrepreneur’s reward for self-policing. *Economic Inquiry* 25 (1): 103–16.
- . 1997. *An economic analysis of property rights*. New York: Cambridge University Press.
- Baumol, William J. 1992. Entrepreneurship: Productive, unproductive, and destructive. *Journal of Political Economy* 98 (5): 893–921.
- Boyd, James, Kathryn Cabellero, and R. David Simpson. 2000. The law and economics of habitat conservation: Lessons from an analysis of easement acquisitions. *Stanford Environmental Law Journal* 19 (January): 209–55.
- Child, Brian. 2004. Building the campfire paradigm: Helping villagers protect African wildlife. *PERC Reports* 22 (2): Summer.
- Coase, Ronald N. 1937. The nature of the firm. *Economica* 4 (16): 386–405.
- . 1960. The problem of social cost. *Journal of Law and Economics* 3: 1–44.
- Costello, Christopher, Steven Gaines, and John Lynham. 2008. Can catch shares prevent fisheries collapse? *Science* 321 (5896): 1678–81.

- Deacon, Robert T., and Dominic P. Parker. 2009. Encumbering harvest rights to protect marine environments: A model of marine conservation easements. *Australian Journal of Agricultural Economics* 53: 37–58.
- Demsetz, Harold. 1967. The evolution of property rights. *American Economic Review* 57: 347–59.
- Dennen, Taylor R. 1976. Cattlemen's associations and property rights in land in the American West. *Explorations in Economic History* 13 (4): 423–36.
- Ellickson, Robert C. 1989. A hypothesis of wealth-maximizing norms: Evidence from the whaling industry. *Journal of Law, Economics, and Organization* 5 (1): 83–97.
- Elmendorf, Christopher S. 2004. Securing ecological investments on other people's land: A transaction-cost perspective. *Natural Resources Journal* 44 (2): 529–61.
- Ferraro, Paul J. 2008. Asymmetric information and contract design for payments for environmental services. *Ecological Economics* 65 (4): 810–21.
- Fletcher, Robert. 1960. *Free grass to fences: The Montana cattle range story*. Helena, MT: Historical Society of Montana.
- Grainger, Corbett, and Dominic P. Parker. Forthcoming. The political economy of fishery reform. *Annual Review of Resource Economics*.
- Haddock, David D. 2004. When are environment amenities policy-relevant? *Natural Resources Journal* 44 (2): 383–424.
- . 2008. Why individuals provide public goods. In *Accounting for mother nature: Changing demands for her bounty*, ed. Terry L. Anderson, Laura E. Huggins, and Thomas Michael Power. Stanford, CA: Stanford University Press.
- Hornbeck, Richard. 2010. Barbed wire: Property rights and agricultural development. *Quarterly Journal of Economics* 125 (2): 767–810.
- Kaffine, Daniel. 2009. Quality and the commons: The surf gangs of California. *Journal of Law and Economics* 52 (4): 727–43.
- Kotchen, Matthew J. 2013. Voluntary- and information-based approaches to environmental management: A public economics perspective. *Review of Environmental Economics and Policy* 7 (2): 276–95.
- La Croix, Sumner J. 1992. Property rights and institutional change during Australia's gold rush. *Explorations in Economic History* 67 (2): 257–52.
- Libecap, Gary D. 1981. Bureaucratic opposition to the assignment of property rights: Overgrazing on the western range. *Journal of Economic History* 41 (1): 151–58.
- . 2007. The assignment of property rights on the western frontier: Lesson for contemporary environmental and resource policy. *Journal of Economic History* 67 (2): 227–52.
- Libecap, Gary D., and Dean Lueck. 2011. The demarcation of land and role of coordinating property institutions. *Journal of Political Economy* 119 (3): 426–67.
- Libecap, Gary D., and Steven N. Wiggins. 1984. Contractual responses to the common pool: Prorating of crude oil production. *American Economic Review* 74 (1): 87–98.
- Lindsay, C. M., and William R. Dougan. 2012. Efficiency in the provision of pure public goods by private citizens (May 2012). *Public Choice*, doi: 10.1007/s11127-012-9942-z.
- Lueck, Dean. 2002. The extermination and conservation of the American bison. *Journal of Legal Studies* 31 (2): 609–52.
- Medema, Steven G. 2009. *The hesitant hand: Taming self-interest in the history of economic ideas*. Princeton University Press.
- North, Douglass C. 1990. *Institutions, institutional change and economic performance*. Cambridge University Press.
- Ostrom, Elinor. 1990. *Governing the commons*. Cambridge: Cambridge University Press.
- Parker, Dominic P. 2004. Land trusts and the choice to conserve land with full ownership or conservation easements. *Natural Resources Journal* 44 (2): 483–518.
- Parker, Dominic P., and Walter N. Thurman. 2011. Crowding out open space: The effects of federal land programs on private land trust conservation. *Land Economics* 87 (2): 202–22.
- Pigou, A. C. 1912. *Wealth and welfare*. London: Macmillan.
- . 1932. *The economics of welfare*. 4th ed. London: Macmillan.
- Rowley, Charles K., Robert D. Tollison, and Gordon Tullock, eds. 1988. *The Political Economy*

- of Rent Seeking*. Boston, MA: Kluwer Academic Publishing.
- Salzman, James E. 2010. Designing payments for ecosystem services. PERC Policy Series No. 48. Bozeman, MT: Property and Environment Research Center.
- Samuelson, Paul A. 1954. The pure theory of public expenditure. *Review of Economics and Statistics* 36 (4): 387–89.
- Scarborough, Brandon. 2010. Environmental water markets: Restoring streams through trade. PERC Policy Series 46.
- Scarborough, Brandon, and Hertha Lund. 2007. Saving our streams: Harnessing water markets. Bozeman, MT: PERC.
- Schumpeter, Joseph A. 1934. *The theory of economic development*. Leipzig: Duncker and Humblot, 1912. English ed. Cambridge, MA: Harvard University Press.
- Spulber, Daniel. 2009. *The theory of the firm: Microeconomics with endogenous entrepreneurs, firms, markets, and organizations*. Cambridge: Cambridge University Press.
- Stavins, Robert N. 1998. What can we learn from the grand policy experiment? Lessons from SO₂ allowance trading. *Journal of Economic Perspectives* 12 (3): 69–88.
- Stigler, George. 1988. *Memoirs of an unregulated economist*. New York: Basic Books.
- Taylor, M. Scott. 2011. Buffalo hunt: International trade and the virtual extinction of the North American bison. *American Economic Review* 101: 3162–95.
- Umbeck, John. 1977. The California gold rush: A study of emerging property rights. *Explorations of Economic History* 14: 197–226.
- Williamson, Oliver E. 1985. *The economic institutions of capitalism*. New York: Macmillan.