If Hayek and Coase Were Environmentalists: Linking Economics and Ecology

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Economics Working Paper 15102

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February 2015

This essay argues that the focus of ecology and economics on equilibria and externalities misses the dynamic connection between humans and nature and that there is a better alternative for linking ecology with economics, one that builds on the teachings of Nobel laureates Friedrich Hayek and Ronald Coase.

Prepared for a conference on "The Ends of Capitalism," sponsored by the Classical Liberal Institute, NYU School of Law, February 25-27, 2015.

If Hayek and Coase Were Environmentalists: Linking Economics and Ecology

by Terry L. Anderson[*]

Modern environmentalism and neo-classical economics have more in common than is often thought, but unfortunately the commonalities too often cloud how markets and the environment can be productively linked. These commonalities include a focus on equilibrium systems and on the inability of humans to integrate into those systems. Unfortunately, both are inconsistent with the reality of how natural and market systems work and how the two paradigms might be integrated. The purpose of this paper is to provide a way of reconciling environmentalism and markets. It builds on the importance of disequilibria, entrepreneurs, property rights, and markets.[1]

Both ecology and economics rely considerably on static models emphasizing equilibrium conditions. These lead ecologists to focus on the balance of nature, carrying capacity, and stable populations and economists to focus on the cause of market imperfection, Pareto optimality, and social welfare maximization. Both generally conclude that some form of autonomous human action is impeding movement toward a balance of nature or social welfare maximization.

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The notion of equilibrium is analytically appealing and useful within limits. In natural systems, equilibrium analysis allows us to apply terms such as carrying capacity, sustainable yield, and ecosystem stability, each of which depends on a set of *ceteris paribus* conditions. Similarly, neo-classical economic equilibrium analysis can specify profit maximizing conditions, full employment levels, and social welfare maximization, also based on *ceteris paribus* conditions.

Equilibrium models are useful because they allow us to develop hypotheses and predict how nature and people will respond to marginal changes, holding other variables constant. For a natural resource such as wildlife population, scientists can consider what would happen if a certain type of vegetation increases or if a predator is removed. Of course, the modeler knows that the *ceteris paribus* conditions will not hold, because other exogenous changes are occurring all of the time. Nonetheless, partial equilibrium predictions are a useful way of conceptualizing environmental systems. Economists also gain insights from equilibrium modeling. Simple demand and supply models allow us to analyze what will happen if one or the other side of the market scissors shifts, all the time knowing that other exogenous changes could be occurring. No one thinks the exact intersection point on the curves can be found or will hold steady, but such a conceptualization helps understand the direction in which the system will be heading.

Stemming from the focus on equilibrium, both modern environmentalism and neo-classical economics see humans as a major source of disruption to optimal equilibrium states. In the case of environmentalism, human action disturbs natural conditions, defined as a world without humans. Michael E. Soulé (1985, 731), a leading proponent of this perspective, put it this way: “humans tend to sacrifice ecological and geographic heterogeneity for an artificially maintained, energy-intensive, local species diversity.” For example, human deforestation is a

disruptive force to ecosystem stability while naturally caused forest fires are part of natural succession. Similarly, decaying vegetation is a natural part of the carbon cycle, but burning wood or coal is an unnatural contributor to global warming.

In economics, equilibrium modeling identifies human action coupled with poor institutions as the reason that markets do not maximize social welfare. In particular, the divergence between private and social costs and benefits leads to positive and negative externalities and under or over production, respectively. As a result of divergences, natural resource and environmental economists find externalities behind every tree, in every waterway, and over every city and mountain. When a production process emits smoke into the air and the producer pays nothing for using the air for waste disposal, too much of the good and too little clear air will be produced relative to the optimal amounts that would result if all costs were accounted for. Equilibrium analysis says society is below its production frontier and therefore not achieving Pareto optimality. As with the human disruption of nature, externalites in the economy beg for collective action to correct the sub-optimal autonomous actions and restore optimality.

The externality connection between ecology and neo-classical economics is commonly understood under the banner of the "tragedy of the commons," made famous by biologist Garrett Hardin (1968). He explained that "Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest . . . ." For the environmentalist, nature, like the pasture, is a commons exploited by humans who compete to capture nature's value and in the process dissipate its value. The tragedy is made worse by the fact that the pieces of ecosystems are interconnected in ways such that exploiting one part reduces the value of the whole. For

economists, tragedy results because human institutions do not internalize all of the costs and benefits associated with utilizing nature to meet human ends.

This essay argues that the focus of ecology and economics on equilibria and externalities misses the dynamic connection between humans and nature and that there is a better alternative for linking ecology with economics, one that builds on the teachings of Nobel laureates Friedrich Hayek and Ronald Coase. Through the lens of Hayek's Austrian economics and of Coase's property rights economics, our attention is focused on information, feedback mechanisms, and entrepreneurship. Just as non-human species fill niches either through adaptation in the short term or evolution in the long term, humans fill economic niches through specialization, gains from trade, or both (see Ridley 2010). The big difference between non-human and human processes is that humans create institutions—rules for interaction with one another—which in turn generate prices that communicate information about scarcity and value. This in turn links human action with nature. For purposes here, Hayek's (1945) seminal article on "The Use of Knowledge in Society" might be retitled "The Use of Knowledge in Ecosystems" in that it provides a framework for thinking about how human values relate to natural resource constraints and how entrepreneurs act on profit opportunities. Hence, Hayek's thinking about how markets generate information compares with the ways in which Charles Darwin conceived of natural systems as discussed in the next section. Similarly, Coase's (1960) seminal article on "The Problem of Social Cost" might be retitled "The Problem of Ecosystem Cost" in that it provides a framework for thinking about how property rights connect one human's use of natural resources with another's. Coase's emphasis on property rights integrates human action into nature by making property owners account for the costs of using or changing nature. Transaction costs will prevent property rights from being perfect, but such imperfection is an institutional void or a

niche waiting to be filled by the entrepreneur who can establish property rights and gain from trading them. This is not different than a niche in nature which leads to evolving species. In short, ecology and economics are both about dynamics, not stasis.

Darwin Meets Hayek

Charles Darwin's insights in *The Origin of Species* seem to have been lost in modern conceptions of ecology. Indeed, his ideas have much in common with the political economy of his time as espoused by Adam Smith and, of our time, by Fredrich Hayek.[2] Darwin's notion of evolution is distinctly bottom-up as opposed to top-down, with new species emerging through random mutations and existing species slowing evolving, both exploiting changing niches to survive and thrive. As Matt Ridley (2009) notes, "Living beings are eddies in the stream of entropy. That is to say, while the universe gradually becomes more homogeneous and disordered, little parts of it can reverse the trend and become briefly more ordered and complex."

Darwin's theory of natural evolution therefore is akin to Adam Smith's economy which, again in the words of Ridley (2009), is "spontaneously self-ordered through the actions of individuals, rather than ordained by a monarch or a parliament."[3] Of course, a big difference between the two worlds is the extent to which individuals act with purpose. Darwinian evolution is mainly a random accident wherein genetic mutation allows one individual to fare better than another given the resource base upon which the species relies. Even if the resource base is unchanging—which it never is—evolution would continue as a result of mutations that happen to better use that environment. The process is spontaneous in that it starts with the individual, yet ordered in that the successful species thrive and progress. Darwinian evolution may be zero sum to the extent that one species' success crowds out another's.

In contrast, human action results from purposive responses to perceived opportunities for gain. Entrepreneurs, rather than mutation, are the driving force for change. Their actions are not random, but, like Darwinian evolution, they evolve spontaneously from the individual and aggregate to the collective. Also like Darwinian evolution, successful entrepreneurship depends on the entrepreneur utilizing the resource base more efficiently than other individuals. This results when inefficient resource use is crowded out, and such gains are limited only by human ingenuity.

Thought of in this way, nature and the economy are processes in perpetual change rather than equilibrium systems that will remain in equilibrium until disrupted by nature or humans. Biologist Daniel Botkin describes what this means for ecosystems, saying that nature is not a "Kodachrome still-life," but instead "nature is a moving picture show," continually changing in a series of complex patterns (Botkin 1990, 6).[4] Similarly, markets may have a tendency toward order and equilibrium, but any equilibrium is a moving target and therefore never reached. Disruptions may result from non-human changes in the physical environment or from continually changing human preferences and ingenuity. Regardless of the disequlibrating force, however, all species including humans, react by filling niches. In fact, human action may create new niches and increased biodiversity as Chris Thomas (2013, 502) argued in *Nature*:

> New anthropogenic habitats, such as farmland and cities, usually support fewer species than the original ones, but they contain some that were previously rare or absent. . . . . Populations and species have begun to evolve, diverge, hybridize and even speciate in new man-made surroundings. Evolutionary divergence will eventually generate large

numbers of sister species on the continents and islands to which single species have been introduced.

Here we begin to see the important link between nature and markets, namely that species in ecosystems and entrepreneurs in markets react to opportunities based on information that is time- and place-specific. For Darwin, this was a process wherein existing species fill new niches or new species evolve to take advantage of niches. For Hayek, however, human action purposefully seeks out these niches (see von Mises [1949] 2007). Hayek's (1945) focus on "The Use of Knowledge in Society" explains how prices consolidate and condense information about costs of production and values in consumption and use. As he put it, "in a system in which the knowledge of relevant facts is dispersed among many people, prices can act to coordinate the separate actions of different people in the same way as subjective values help the individual to coordinate the parts of his plan." Because "practically every individual has some advantage over all others in that he possesses unique information of which beneficial use might be made, but of which use can be made only if the decisions depending on it are left to him or are made with his active cooperation," (Hayek 1945, 521–522), trade and prices are necessary to coordinate human action. This leads to what Matt Ridley (2010, 47–84) calls the "collective brain," integrated through specialization and trade.

Specialization, trade, and prices guide humans in their use of nature and give them the ability and incentive to react to changing resource constraints and changing human demands. It is the unique cognitive ability of humans to specialize and trade that makes us superior to other species and gives us the capability for using and managing nature. Although there is a strong tradition among ecologists and environmentalists to call for managing nature for nature's sake, it

is difficult to know what nature is after eons of human use. Therefore, some ecologists, such as Peter Kareiva and Michael Marvier (2012, 962) " acknowledge that we live in a world dominated by humans, and therefore, the scientific underpinnings of conservation must include a consideration of the role of humans." Prices and markets provide a way of integrating conservation and humans by signaling changes in resource scarcity, whether from natural conditions or human demands.

Philosopher Mark Sagoff (2010), in a paper that "explores the differences between economic and ecological criteria for identifying, measuring, and evaluating ecosystem services," discusses the disconnect and clash between ecology and economics. Building on Hayek ([1955] 1979) who argued in *The Counter Revolution of Science* that science is incapable of finding objective measures of value to plan human action, Sagoff confronts ecological economists who claim that the "biophysical method does not assume that value is determined by individual preferences, but rather attempts a more 'objective' assessment of ecosystem contributions to human welfare" (Liu et al. 2010, 59). As Sagoff (2010) puts it,

> A comparison is easy to draw between social and natural scientists today who look for ways to valuate ecosystem services and scientists who over two centuries have followed the French Physiocrats to seek non-market measures of production in order to plan economic activity. In this tradition, James Boyd (2008, 3) has called for scientific methods to "describe nonmarket environmental commodities in the context of *systems of ecological production* (italics in original)." (11)

Sagoff concludes:

> Ecological knowledge, like any kind of empirical knowledge insofar as it is relevant to economic activity, is too spread out among people to be captured by any one individual or by any group of individuals—even given careful planning and sufficient resources. A science of ecosystem services that captures economic production or value in "final biophysical units" lies beyond our human potential. The "ecosystem services" project is bound to fail in its attempt to substitute an *in natura* calculation of value for the artifice of market price. (15)

In other words, humans are just like any non-human organism in that they are incapable of modeling the system in which they live. As Sagoff (2010) puts it, "the complexity of modern society makes it impossible for scientific managers to organize the staggering amount of information relevant to any particular economic action" (15). Hence, all organisms respond to the special circumstance of time and place, whether *in natura* or *in civilis*, begging the question: how, if at all, is time- and place-specific information communicated?

Of course, Hayek's answer was prices.

> We must look at the price system as such a mechanism for communicating information if we want to understand its real function. . . . The marvel is that in a case like that of a scarcity of one raw material, without an order being issued, without more than perhaps a handful of people knowing the cause, tens of thousands of people whose identity could not be ascertained by months of investigation, are made to use the material or its products more sparingly; *i.e.*, they move in the right direction." (1945, 526–527)

Blurry Vision

Hayek's reference to the "scarcity of one raw material" could well be applied to the scarcity of environmental goods and services and the inputs required to produce them. In this case, the question would be whether the price system would account for the changing scarcity of environmental amenities. For Hayek, human action "brings about a state of affairs in which prices correspond to costs" provided there are clear, defensible property rights (Hayek 1948, 50). As noted in the introduction, however, this conclusion is not typical of how environmentalists or economists view the interface between the environment and markets.

Economists argue that prices for environmental goods and services do not always correspond to costs and benefits because there is a divergence between private and social costs. The divergence exists "owing to the technical difficulty of enforcing compensation for incidental disservices" (Pigou 1932, 1850) and a divergence between private and social benefits "because incidental services are performed to third parties from whom it is technically difficult to exact payment" (Pigou 1932, 183-84).[5] These divergences result in externalities which reduce social welfare—the "national dividend" as Pigou called it—and thus require government regulation, taxes, subsidies, out right ownership and control of resources or some combination of all four to reduce pollution, correct for free ridership, produce public goods, and generally correct market failures.

The conclusion that "technical difficulties" or transaction costs lead to market failure has been questioned by Demsetz (2003, 282–300). He notes that such costs are no different from any other costs inherent in production processes. Friction leads to "technical difficulties" in transporting goods from one location to another, but economists do not contend that transportation costs are a cause of market failure. If transportation costs preclude profitable

contracting to move oranges from Florida where they have a lower value to Montana where they have a higher value, we do not conclude that the orange market has failed. Technical difficulties, transaction costs, or transportation costs prevent bargains from being struck, but as Coase (1960, 39) noted, "the reason why some activities are not the subject of contracts is exactly the same as the reason why some contracts are commonly unsatisfactory—it would cost too much to put the matter right."

Granting the potential for market failure due to "technical difficulties" does not mean that improvements will occur through political solutions. Anderson and Libecap (2013) discuss the political economy of devising and implementing those policies, but suffice it here to simply quote Pigou (1920, 247-248) who was not sanguine about the prospects of politicians correcting externalities: "It is not sufficient to contrast imperfect adjustments of unfettered private enterprise with the best adjustment that economists in their studies can imagine. We cannot expect that any public authority will attain, or will even wholeheartedly seek, that ideal." More cynically, he recognized self-interest prevails as much in politics as in markets, saying that the political solutions depends on "the intellectual competence of the persons who constitute it, the efficacy of the organisation through which their decisions are executed, their personal integrity in the face of bribery and blackmail, their freedom from domination by the privileged class, [and] their ability to resist the pressure of powerful interests or of uninstructed opinion" (Pigou 1932, 125).

Coase-Colored Glasses

The Pigouvian assertion that there is a divergence between private and social costs without specifically asking what institutions allow this divergence is in sharp contrast to Coase's

exposition of "The Problem of Social Cost." Coase called on economists and lawyers to focus on property rights and transaction costs. He emphasized that scarcity leads to competition for the use of resources, which, in turn, requires clarification of who has the property rights over scarce resources. All of Coase's writings emphasized the importance of knowing what the rights are and how definition, enforcement, and bargaining costs might hinder exchanges between competing parties.

Contrast how Pigou and Coase might approach the disposal of agricultural effluent into a bay where fishing occurs. (Note, I refer to effluent rather than pollution because the former simple describes agricultural waste, while the latter connotes harm resulting from the waste.) Pigouvian analysis would say that the private cost of dumping the effluent does not take into account the social cost of dumping the effluent if the waste reduces fishing output. Coasean analysis, in contrast, would ask who has the right to use the water—the farmer or the fisher—and why is the party without the right not making offers to purchase the right from the party with the rights. Both Pigou and Coase might conclude that "technical difficulties" or "transaction costs," respectively, are preventing bargaining, but Coase would ask who has what rights, while Pigou would assert knowing the rights by saying the farmer's private costs are lower than the social costs. If one accepts the Pigouvian assertion, the question remains: are the farmer's private costs less than social costs because the fisher has not offered to pay the farmer to stop emitting effluent or because the fisher can't enforce compensation for incidental disservices?

Looking at the conflicting uses through Coase-colored glasses immediately brings into focus the reciprocal nature of costs. Claiming that there is a Pigouvian externality implies a direction of causality (see Anderson 2004). Coase was careful not to assume the property rights were known and therefore was a "causal agnostic,"[6] meaning he did not assume which party had

the right. Doing so would implicitly assume a direction of causality. The causality is determined by property rights which, in turn, create the potential for bargaining. Indeed, a search of his seminal article on social cost will not turn up the word "externality" because he understood that using the term assumed away the interesting question.

Returning to say the farmer is imposing an externality on the fisher assumes the direction of causality; namely the farmer is causing a problem for the fisher. However, if the farmer has a right to the water for effluent disposal, the direction of causality is reversed. To call air emissions pollution (meaning to contaminate) assumes who has which rights to the use of air. In the 1950s when smoking was an acceptable social behavior, no one would have thought of saying a room filled with cigarette smoke was polluted because the implicit "property rights" to the air belonged to the smokers. Today that property rights has shifted to the non-smokers, changing the direction of causality.

Bees and pollination services, long considered an example of a positive externality but debunked by Steven Cheung (1973) and by Muth et al. (2003) further illustrate the value of a contractual lens. The "fable of the bees" was that apiarists contract with blossom owners; in some cases, the apiarists pay the blossom owners for the use of their flowers and, in others, the blossom owners pay the apiarists for pollination services.

But suppose the bee pollination services have a negative value, too, as they do in the case of seedless varieties of tangerines, clementines, and mandarin oranges. These varieties remain seedless unless they are cross-pollinated, a real possibility if bees get involved. In California's San Joaquin Valley, bees usually play a positive role in horticulture, especially almond production. Unfortunately, the bees are not discerning and pollinate whatever flowers they land on. When those flowers are for nearby seedless citrus crops, bee pollination can result in fruit

with seeds that significantly reduce their value. To complicate matters, when the seedless citrus growers spray for other pests, apiarists are not happy because the spray kills their bees.

Now ask whether there is an externality and, if there is, in which direction it goes. Are the apiarists imposing a cost on seedless citrus growers who have a right to be free from bee pollination services? Apparently the horticulturists think so. One clementine grower, Paramount Citrus, threatened the apiarists with a lawsuit unless it receives "compensation for any and all damages caused to its crops, as well as punitive damages."[7] But if Paramount's spray kills bees, is it imposing an externality on the apiarists? Should Paramount have to pay damages to the apiarist to move their bees out of harm's way, or "fence" the bees out when it is spraying?[8] Or is there some other technological solution such as developing new almond varieties that do not require pollination. As Robert McCormick put it regarding Coase's example of a factory's soot dirtying a laundry's drying clothes,[9] "Maybe no constable has written or scribed the factory's right to the air, but by any meaningful definition of the word 'right' it belongs to the factory if the constable cannot be call on to enforce a claim by the laundry. That someone might wish the right belongs to the laundry is of no consequence, nor is it an externality." Similarly, if the apiarists have a right for their bees to fly wherever they please, it is the seedless citrus blossom owners who want to use the space in a way that conflicts with the flight of bees.

The property rights have not been sorted out in the case of bees pollinating seedless citrus crops in the San Joaquin, but it clearly illustrates that traditional Pigouvian analysis based on a divergence between social and private costs misses the reciprocal nature of costs as emphasized by Coase. In other words, costs to one party—bees killed—is a benefit to the other—crop saved, and vice versa. Which way the costs go depends on the property rights.

A nineteenth-century example involving drinking water and sewage disposal in London further illustrates the reciprocal nature of costs.[10] In the 1800s, London experienced major cholera epidemics. Prior to centralized sewage disposal, household cesspools meant the stench and disease potential from sewage was relatively localized. However, when households were connected to centralized sewer systems, epidemics became more widespread as the sewage was dumped into the river Thames, the main sources of drinking water supplied by private companies.

This example raises the question of whether sewage was an externality. In an excellent history of London's water supply, Tynan (2014,) concludes that "companies undertook investments to address the increasingly sewage-contaminated state of the river Thames," while describing the interface between sewage disposal and water supply as "two closely related industries facing both complementarities and negative externalities . . . ." (2014, 35). Paraphrasing Tynan, London's experience "reveals the challenges involved when two closely related industries face reciprocal costs for their actions." Seen through this lens, the water supply companies could have paid to clean up the sewage, but instead they "invested in settling reservoirs and sand filtration, moved intakes, and changed water source" (Tynan, 35). Tynan (2014, 7) refers to "negative externalities from wastewater and sewage," yet in the same sentence recognizes that the problem is "due to a combination of ill-defined property rights and costly enforcement." Apparently, the property rights were well enough defined to lead the companies to conclude that they did not have a defensible property right to clean water and thus chose alternative actions.

This example and others show that, when property rights are unclear, competing users must decide whether to accept the status quo rights by not asserting a claim otherwise, bargain

away the conflict, or fight to resolve it. Cooter and Rubinfeld (1989) provide an excellent summary of the settlement-litigation literature in law and economics and a useful starting point for understanding how property rights to ecological values might evolve. Competing uses for a scarce resource require that the competing parties decide whether to assert a claim to the use or to accept the other party's claim and bargain.

The important conclusion for the settlement-litigation approach is that resolving competing claims can result in a negative-sum game in which only one party wins the right, but both expend valuable effort in the fight. The battle over whether water in southern California should flow into Mono Lake to maintain salinity levels for aquatic populations or be diverted for municipal uses in Los Angeles provides a case in point (see Libecap 2007). Though it appeared that Los Angeles had prior appropriation water rights to divert water from Owen Valley to the city, thus lowering the level of Mono Lake, environmentalists filed suit to stop the diversion on the grounds that the public had a right to the water for maintaining certain environmental qualities in the lake. After years of legal battles and millions of dollars spent fighting between the competing claimants, the court finally ruled in favor of the environmental argument, but many more years passed before water finally flowed into Mono Lake. Had the environmentalists simply accepted the Los Angeles claim and bargained to purchase the water, time, money, and the environment would have been saved sooner. Perhaps this explains why markets instream uses of water have increased dramatically[11] and why environmental entrepreneurs are finding ways to settle competing claims for environmental resources rather than litigating.

Environmental Opportunities, not Problems

A Coasean approach provides an alternative way of blending ecology and economics, or put differently, blending natural resources with human demands and human ingenuity. For scarce natural resources, this lens requires us to ask what property rights exist; when incomplete, whether they are worth better defining and enforcing; and whether doing so will generate prices that correspond to costs and benefits. A Pigouvian focus leads to the conclusion that environmental problems are pervasive; a Coasean focus opens the door for entrepreneurs who see opportunities available from creating new property rights where they are lacking or contracting over existing property rights to improve resource use. Whether it is new property rights or new contracts, the entrepreneur captures previously dissipated rents.

Following Coase's lead, Steven Cheung (1983) explained that firms save on the costs of discovering prices and on the costs of measuring and monitoring the contribution of inputs to the production process. Still, however, explanations of why a firm exists beg the question of where the entrepreneur fits into the firm. It was Yoram Barzel (1997) who picked up where Coase and Cheung left off by suggesting that entrepreneurs are the actors who recognize and capture the returns associated with transaction cost savings. The motivation and reward for the entrepreneur come in the form of his or her claim on the residual, the return left after other input owners have been paid for their contributions to the production process.

Barzel's focus on residual claimancy builds on Alchian's and Demsetz's (1972) discussion of the importance of monitoring input contributions to collective output. They argued that the firm owner's claim on the residual is what rewards the owner for efficiently monitoring other inputs. This point helps us understand the challenge faced by entrepreneurs who must

measure and monitor new input combinations, measure and monitor the marketing of new goods and services, or both. Hence, entrepreneurs profit from

1. discovering new resources, rebundling resources into new production processes, discovering new outputs which can be produced from resources, or some combination of all;
2. measuring and monitoring the production process, especially regarding the contribution of inputs combined for team production; and
3. claiming the residual generated by new inputs, by new combinations of inputs, by new outputs, or by some combination of all three (i.e., to become the owner of the firm).

All three of these focus on property rights and contracting costs. Where property rights do not exist, the entrepreneur must create them, meaning he must define the boundaries of the property and exclude others from using it. Since Harold Demsetz's (1967) seminal article, "Toward a Theory of Property Rights," economists have recognized that people invest scarce resources in the production of property rights when the value of the rights produced exceed the costs of defining and enforcing those rights. Though not so at the time, now Demsetz's seemingly obvious point provides a foundation for much of what we understand about the interface between economics and the environment. Whether it is American Indians (Demsetz 1967; Anderson 1995), land and water rights in the American West (Anderson and Hill 1975; Libecap 1981, 2007), mineral rights (Libecap 1999), the electromagnetic spectrum (Coase 1959), wildlife (Lueck 1989) or environmental amenities, people do not assert and defend claims to assets until the net value of doing so is positive. Put differently, if scarcity does not create sufficient conflicting uses to drive up the value of resources, they are rationally left in the commons. Why put up a no trespassing sign or build a fence if no one is interested in trespassing

or if the trespass creates no harm? Because environmental amenities or ecosystem services are relatively new demands on nature's bounty, it should not be surprising that property rights to the components of natural resources necessary to produce the amenities or services are not completely defined, but are evolving.

A growing demand for environmental goods and services provides abundant opportunities for environmental entrepreneurs—enviropreneurs. In particular, enviropreneurs see opportunities in what environmental economists call externalities.

An actual case of agricultural effluent conflicting with fish production comes from New Zealand. In the midst of economic reforms in the mid-1980s, the New Zealand government included privatization of many of its natural resources as part of the reforms. Under the banner of ITQs—individual transferable quotas—the reform program established property rights to a share of the total allowable catch (TAC) to fisheries, including paua or abaloney, and allocated those shares to individuals or companies.

Roger Beattie was one of the fishermen who received a share of the paua quota, a shellfish prized for its meat and decorative shell (see Stanford GSB 2000). Because of the paua quota system, fishermen such as Beattie stopped taking smaller paua, allowing them to grow to larger sizes. Moreover, because paua are not mobile, quota holders could invest in habitat improvements to increase paua growth and reproduction and, in turn, increase the TAC. Not surprisingly, quota values rose dramatically and rapidly from NZ$33,000 per metric ton in 1988 to NZ$320,000 in 1993.

Beattie is an entrepreneur par excellence. He first saw opportunity in purchasing quota from other fishers who did not see the profit potential available when the "race to fish" was eliminated. As a result, he doubled his quota holdings from 17.5 metric tons in 1986 to 35.33

metric tons in two years. Beyond that, however, he realized that investments in habitat could further increase his profits. By seeding beds, Beattie was able to increase natural reproduction and growth. He even went a step further to assist Mother Nature by developing special barrels into which he planted paua larvae. Not only do these barrels increase paua growth, they help him protect his property rights to the shellfish.

When he placed some of the barrels in a bay off New Zealand's South Island, however, he realized that productivity depended on more than his innovative barrels; it depended on the quality of water, too. Agricultural runoff was putting effluent into the water which, in turn, was reducing paua production.

Mr. Beattie, however, did not assert there to be an externality, but rather simply stipulated that the farmers had a right to use the water for effluent disposal (or that the costs of trying to establish that he has a right to clean water through legal action was too expensive) and paid them to change their agricultural practices in order to reduce discharges.[12] Problem of social cost solved!

Another example of innovative contracting for ecosystem services comes from Bolivia (see Asquith 2006). In the Los Negros Valley, Natura Bolivia is a non-governmental organization led by environmental entrepreneur Maria Teresa Vargas. The organization found a contractual way of paying upstream land users to change their land use practices to provide downstream farmers with more cleaner water. The farmers raise vegetable crops such as carrots, tomatoes, and lettuce for local markets using irrigation water from the Los Negros River. In the upstream catchment basin, officially designated a national park with abundant flora and fauna, illegal land incursions, mainly for logging, have reduced the cloud forest cover. This resulted in lower water flows in the river, as well as impacts on wildlife habitat. Because of the remoteness

of the park and the lack of enforcement resources, the downstream farmers could not rely on the government to guarantee their water supply.

As Asquith (2006, 6) put it, "Natura's challenge was therefore to try to provide security of contracts and markets and clarify property rights in a situation where neither security, clarity, or the resources needed to provide them existed." Its solution was to provide the upstream land users with an alternative way of making money from the land, a way that reduced logging and increased downstream water quantity and quality. The alternative was to provide one beehive to the upstream land users in return for their pledge to stop logging on 10 hectares. From 60 beehives protecting 600 hectares in 2003, the project grew to 210 beehives protecting 2,100 hectares in 2006.

This form of payment had self-enforcing elements. Because the bees require forest for honey production and the honey production is more profitable than logging, upstream land users, illegal though their land claims may be, had an incentive to protect the cloud forest, which incidentally ensured adequate river flows. Additionally, with the land more valuable for beekeeping, the upstream land users had an incentive to better define and enforce property rights to the land. To do this, they sought Natura Bolivia's help demarcating land boundaries using GPS to identify boundaries, plotting the boundaries on a satellite image-based land use map, and fencing the parcels with barbed wire once all of the neighbors agree on the boundaries. Again quoting Asquith (2006,6), "The farmers explained that in addition to allowing them to keep their cattle out of environmentally sensitive areas, enclosing their land with barbed wire would help them strengthen their existing land claims."

Given that the ultimate goal is more, cleaner water in the river, measurement and monitoring of flows is required. Farmers undertake twice-weekly measurements of water depth,

periodic calibrations of velocity, and daily measurements of rainfall. Asquith reckons that having the landowners take the measurements helps, "to minimize data collection costs, to increase local credibility in the data, and to try to ensure the scheme's self-sustainability." If water did not increase because upstream loggers did not continue protecting the land, sanctions would be imposed locally and beehives would be taken back. The innovative contractual arrangement whereby beehives and barbed wire were traded for more, cleaner water 1) made both downstream farmers and upstream loggers residual claimants to the rents on both sides of the contract; 2) provided a way of measuring and monitoring the ecosystem services provided; and 3) encouraged self-enforcement to help minimize transaction costs.

If Environmentalists were Hayekians and Coaseans

This paper contends that Hayek and Coase offer a better link between economics and the environment than does neoclassical economics focused on equilibrium conditions and social optimum. It suggests that Hayek's lens is better because it focuses on how disparate knowledge can be assimilated in human systems which interface with nature. Not only are both human and natural systems never in equilibrium, neither scientists nor economists are likely to be able to model the complexity of either in order to manage them. Hayek's understanding of market prices as a way of condensing and communicating information suggests that prices offer a way of valuing nature's bounty, today often referred to as ecosystem services.

Given the complexity of human and natural systems, Coase-colored glasses highlight that property rights hold individuals or groups accountable for costs and reward them for benefits thereby offering a way to resolve conflicting uses of nature. Far from being a panacea, property rights and exchange have transactions costs that limit the prospect of achieving nirvana. Even so,

within the constraints of the costs of defining, enforcing, and exchanging property rights to nature's bounty, environmentalists and economists can find ways of resolving conflicting uses without resorting to zero-sum (perhaps even negative-sum) political solutions. To be sure, there is a role for government in lowering these transaction costs, but that role does not require an omniscient government maximizing social welfare.

The title of this paper ponders what if Hayek and Coase were environmentalists, but it is equally appropriate to ask what if environmentalists understood and followed the thinking of Hayek and Coase. In Hayek's case, the connection should be easy because, properly conceived, the environment is not a static, Kodachrome moment seeking an equilibrium. Humans, like species in nature, respond to disparate information that is time- and place-specific and ever-changing, never in equilibrium. In Hayek's conception of markets, humans can "think like a mountain," to use the title of one of Aldo Leopold's famous essays in *Sand County Almanac*, only if they have signals that convey information about interconnections between themselves and nature and information about values that cannot be derived from scientific modeling.

Using a Coasean lens, environmentalists must decide whether they want to resolve conflicts over resource use by accepting the status quo property rights or whether they want to litigate to establish or redistribute rights. This is easily seen in the context of livestock grazing on public lands in the western United States. Environmentalists accepting that grazing permits are a property right are successfully bargaining with grazing permitees to reduce or eliminate livestock (see Regan 2010; Fretwell 2009), albeit it at costs that are higher due to bureaucratic hurdles to such transfers. Those environmentalists questioning the legitimacy of grazing permits have battled in Congress using slogans such as "no moo in '92" and "cattle free in '93" to no avail. Admittedly a victory for environmentalists in a legislative or judicial venue would

redistribute wealth (property rights) to them, but the victory would have to come at a cost, perhaps a substantial one.

Like nature herself, markets are a process continually adjusting to the specific circumstances of time and place and continually changing those circumstances. For this reason, neither Hayekian nor Coasean lenses are rose-colored. Though markets, prices, and property rights do not lead to nirvana, environmentalists who dare to don these lenses might find that economics is a closer friend of the environment than they think.

Shifting from a Pigouvian externality perspective to a Coasean property rights one is not just a matter of rhetoric. As Randall ([1983] 1993, 145) put it emphatically, "Externality is . . . a vacuous and unhelpful term." Randall recognized the imprecision and confusion caused by the term externality and called for "more precise terminology, based on notions of nonexclusiveness and nonrivalry" (Randall [1983] 1993, 145). Once we recognize the reciprocal nature of costs as Coase taught us, there is little analytical room for the term. Claiming an externality may be useful as an expository device for claiming a right, but it does not help us understand the economics of conflicting resource uses or how property rights to the commons evolve. Long ago, economists should have dropped the Pigouvian externality paradigm which implicitly assumes a structure of property rights that may or may not exist and put in its place the Coasean property rights-transaction costs paradigm to ask what does exist.

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Internalizing Public Health Externalities" with comments by Peter J. Hill at a workshop on *Environmental Quality and Human Health*, PERC, Bozeman, MT, August 12-14.

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Endnotes

[1] I am indebted in so many ways to Matt Ridley for shaping my thinking about the relationships between nature and economies. His books, *The Origins of Virtue* (1996) and *The Rational Optimist: How Prosperity Evolves* (2010), are must reads for anyone wishing to understand the nexus between biology and economics.

[2] See Ridley (2009) for the essay that stimulated my thinking on the connection between Darwin and Smith.

[3] Ridley adds, "Neatly, this year [2009] also sees a Smith anniversary, the 250th birthday of his [Smith's] first book, *The Theory of Moral Sentiments*, a book that is very Darwinian in its insistence that sympathy is what we should today call innate, that people are naturally nice as well as naturally nasty."

[4] In Botkin's (2012, 8) revised edition, titled *The Moon in a Nautilus Shell*, he uses slightly different words to capture changing technology: "We have tended to view nature as a digital camera's still life, much like a tourist-guide illustration of La Salute; but nature with and without people is and always has been a moving-picture show, much like the continually changing and complex patterns of the water in the Venetian lagoon."

[5] For a thorough discussion regarding Pigou's understanding of political action, see Medema (2010).

[6] I acknowledge Henry Smith for giving me this term.

[7] "Tangerine Growers Tell Beekeepers to Buzz Off." Available at: http://inform.com/united-states/tangerine-growers-beekeepers-buzz-118926a.

[8] See Ellickson (1991) for a discussion of fencing out.

[9] Personal e-mail to Terry Anderson, 26 February 2010.

[10] This example was developed in a paper titled "Innovation by London's Water Companies: Internalizing Public Health Externalities" by Nicola Tynan at a PERC Workshop on *Environmental Quality and Human Health*, Bozeman, MT, August 12-14, 2014. Thanks to P. J. Hill for bringing it to my attention.

[11] See Scarborough and Lund (2007).
[12] Of course, if the rights were unclear, a lawsuit or legislative actions would be necessary to clarify them.