University of Wisconsin-Madison

October 1996 **No.401**

THE ENVIRONMENTAL IMPLICATIONS OF AGRICULTURE

By

Daniel W. Bromley

AGRICULTURAL & APPLIED ECONOMICS

STAFF PAPER SERIES

THE ENVIRONMENTAL IMPLICATIONS OF AGRICULTURE

Daniel W. Bromley
University of Wisconsin-Madison, USA

Five questions must be addressed in the quest for clarity concerning the environmental benefits from agriculture. These concern: (1) what are "environmental benefits"?; (2) what is the difference between the provision of environmental benefits and the prevention of environmental damages?; (3) what is the role of property regimes in the distinction between creating benefits and preventing damages?; (4) to what extent are environmental benefits unaccounted for in the cost and revenue calculations of farmers?; and (5) what are the policy implications of the "polluter-pays principle"?

The task is complicated because the very idea of a "benefit" is socially constructed. That is, a wetland may be seen as providing a "benefit" by one party (say an ecologist), and as the source of "harm" by another (say a farmer). That is, one who cares about waterfowl habitat will regard a wetland as a beneficial attribute, and a farmer seeking more cultivable land will regard it as a harmful interference with other desired objectives. In Asian agriculture, a rice paddy is beneficial to the farmer, but may be not be so regarded by an urban resident or a naturalist.[1] Or, the burning of crop stubble may allow a farmer to control pests, but may cause damages to those harmed by the smoke. So the same physical condition—or act—can be beneficial or damaging depending upon whom we ask. For that reason, I will use a more general approach in which I talk of the environmental implications of agriculture—some of which will be beneficial, and some of which will be harmful. But this begs the question of what is "beneficial" and what is "harmful."

The answer, which unfortunately begs yet another question, is that a "benefit" is something that moves us closer to some goal or objective, while a "cost" is something that moves us away from that goal or objective. The issue, we see, comes down to a collective determination of goals and objectives.

The problem with this realization about benefits and costs is that it affirms that policy formulation—and policy analysis—has no anchor in absolute truth. In a world that celebrates hard-edged analysis and great precision, it is perhaps disconcerting to realize that policy analysis depends upon some idea of the "public interest" that has no solid analytical core. Despite the well-developed analytics of welfare economics, public policy can

never completely escape its linguistic and conceptual roots—politics. There simply is no policy without politics for the simple reason that policy concerns: (1) collective intentions; (2) collective rules; and (3) collective enforcement of new behaviors such that the collective intentions will be realized. Policy is relatively easy in a dictatorship. In a democracy, policy is a constant struggle among competing visions of the public interest. This means that different interests—with differing and conflicting visions of the public good—will have different ideas about benefits and costs.

Those differences can be clarified if we are careful in how we describe and characterize the environmental implications from agriculture. But we cannot assume that this clarification will resolve the conflicts in policy. Indeed it often happens that clarification simply reinforces the divergent positions of the protagonists. In the interest of some conceptual clarification, I now turn to the problem of how we might classify or categorize the environmental implications of agriculture.

[1] It must also be noted that rice paddies provide important buffering for monsoon rains, thereby reducing flood damages elsewhere.

I. CLASSIFYING ENVIRONMENTAL IMPLICATIONS

I suggest that there are three general classes of environmental implications from agriculture: (1) amenity implications; (2) habitat implications; and (3) ecological implications. While these cannot possibly represent mutually exclusive categories, considering them in this light allows us to focus on important policy dimensions that might otherwise be obscured.

A. Amenity Implications

By amenity implications I mean the large class of visual attributes of the rural countryside that make it pleasing (or unpleasant) to the visual senses. The pleasing rural landscape of northern Europe with its immaculate farms comes to mind here. The sweeping vistas of the Ile de France, the orderly rice paddies of Japan, and the hedged paddocks of southern England comprise what I mean by the amenity implications of agriculture. The rural landscape is both created and managed by agriculture, and this rural character is important in its own right. This serves to remind us that agriculture produces both commodities and amenities [Bromley and Hodge, 1990].

The policy problem arises because there is a market for agricultural commodities, but markets are missing for the amenity aspects of agriculture. This means that changes in the rural landscape dictated by the imperatives of agricultural production may not always be appreciated by those who see agriculture as providing both commodities and amenities. Consider the problem of changes in the agricultural landscape that alter the collective perception of its amenity values. If we imagine a continuum as in Figure 1, we can suppose that the current situation is defined by L*. Here there might be some dispute about the direction of change from the status quo (L*). If policy pushes farmers to provide a "more desired" landscape then they might believe they are "providing" amenity benefits and should be compensated accordingly. On the other hand, if farmers seek to provide a less desirable landscape—to reduce the amenity aspects of the countryside—then they might be accused of causing "harm" and perhaps should be charged accordingly.

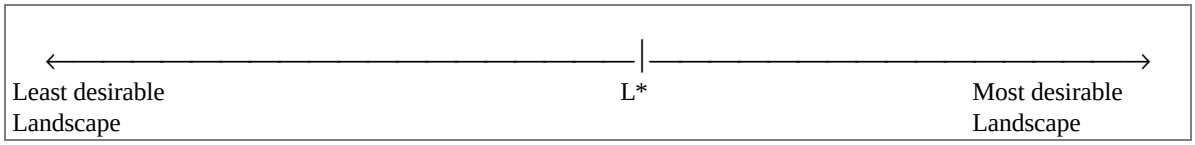

Figure 1. Amenity Implications of Agriculture

We see here the problem of the arbitrary nature of the *status quo ante.* Notice that L* is simply the momentary assessment of the amenity attributes of the rural landscape. This level of amenities becomes the norm against which a change in policy will be evaluated. Assume that urban interests begin to advocate a different landscape in rural areas. We might think of this as L_U. Farmers, in reaction to this might insist that L_F is really the appropriate level of rural amenities and they are already providing L*. In this setting, the distance L_F — L_U becomes the bargaining space for this particular policy dispute. Urban politicians will advocate L_U while rural politicians will be likely to advocate L_F. We might regard these two points at the extremes of the bargaining space as the reference points for the two positions; it is to these two points that the political process will refer to resolve its disagreements.

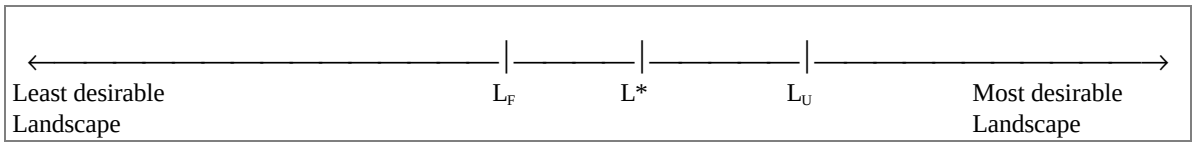

Figure 2. The Policy Space For Amenities

The essence of the policy debate over amenity values from agriculture is that there is no "right" or "correct" level of rural amenity. There are landscapes that are more appealing than others, but there are few precise rules that indicate the correct landscape. Hence the amenity implications of agriculture are probably susceptible to more serious disagreement in the policy process than are the implications of agriculture for habitat and ecological processes.

B. Habitat Implications

By habitat implications I mean those attributes of the agricultural landscape that provide space and sustenance for plants and animals that are not part of the agricultural enterprise. As with the amenity dimension of the agricultural landscape, this aspect tends to focus on the land and water resources directly associated with the land in farms. In European agriculture, habitats are provided for birds and small mammals, and for native plant

species. In Asian agriculture, the habitat component serves fish, small mammals, and native plants. In North America, agricultural habitats support wild game, waterfowl, and a range of native plants.

Unlike the amenity values discussed previously, the habitat implications of agriculture entail more certitude regarding the reference points for policy. Waterfowl require certain minimum areas for nesting. Wildlife require certain feeding conditions and cover. Fish require water of a certain temperature and purity. Wildflowers and songbirds also have certain ecological circumstance necessary for their survival. When agricultural practices are undertaken in a manner to assure that these minimum circumstances are met, then some would argue that farmers are "providing" habitat benefits. When farmers leave swaths of natural vegetation this would be an example of a beneficial habitat implication of agriculture. On the other hand, some might argue that in the absence of agriculture there would be even more of these circumstances and hence the very presence of agriculture has diminished the habitat component of rural areas. When locally unique and valuable habitats are destroyed by farmers then this is an example of damages from agriculture. As with the amenity implications of agriculture, problems arise because the habitat implications of agriculture are characterized by missing markets; there is a market for agricultural products but there are no markets for the habitat aspects of farming.

Wetlands currently constitute a controversial habitat conflict in North America. We might imagine a situation as depicted in Figure 3 in which H* represents the experts' views regarding an absolute minimum level of wetlands in a particular agricultural region, while H_S represents the *status quo ante* level of wetlands. To the right of H* we see the two reference points—H_F for the farming community and H_N for the naturalists who advocate far more wetlands than currently exist (H_S). While farmers do not necessarily seek to push total wetland area down to the absolute minimum (H*), their preferences are to have less wetland area than at present, while naturalists favor larger areas devoted to wetlands.

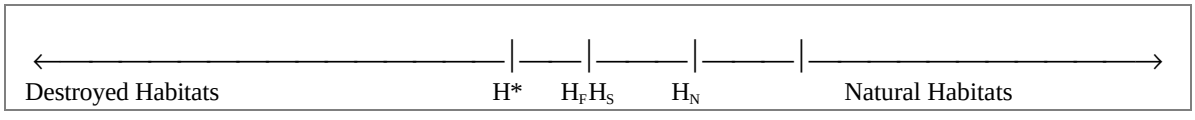

Figure 3. Habitat Implications of Agriculture

As with amenities, the policy response to this situation will differ. Farmers will fail to understand why they should be prevented from moving from H_S toward H_F. Indeed, we sometimes see pressures for financial

compensation of American farmers for the lost income from holding them to H_S rather than allowing them to modify natural habitats to H_F. And of course the naturalists seek to have wetlands restored so that movement in the direction of H_N is achieved. Farmers will suggest that by being restrained to the *status quo ante* they are being made to provide habitat benefits for which compensation should be forthcoming. Naturalists will insist that agriculture has, in fact, destroyed the vast majority of wetlands present at the time of European colonization of North America and that censure—not compensation—is the proper public response. There must be similar habitat debates in other OECD countries.

How does one sort out these disagreements? As will be discussed below, the answer turns on the presumptive property rights situation.

C. Ecological Process Implications

By ecological process implications I mean those attributes of agriculture that affect, positively or negatively, ecological functions beyond the boundary of the farm.[2] One example is present when agricultural chemicals contaminate downstream rivers and lakes. Or when soil erosion clogs downstream waterways. On the other hand, farmers can undertake land-use practices that restore and enhance ecological processes. A wetland can act as a filter and a sink for certain agricultural chemicals, thereby enhancing downstream ecological processes. Improved soil management practices and countouring reduce erosion and thus enhance downstream water quality. Finally, we must recognize land conservation as an important ecological implication. I have earlier talked of erosion control but it is important to stress that paddy field agriculture in monsoon Asia plays an essential role in stabilizing entire mountain sides. We might imagine serious ecological disasters in the absence of the water-control attributes of paddy agriculture.

We can use the familiar figure from before to assess the policy problems associated with the ecological aspects of agriculture. For simplicity, assume that nitrate contamination of groundwater is the problem to be addressed. Let N* represent the upper threshold of nitrate concentrations beyond which medical experts warn that widespread and serious health effects will be prevalent in the general population.[3] Assume that the *status quo ante* level of nitrate concentration is N_S while farmers believe that nitrates in groundwater will not become a problem

[2] Notice that I regard the ecological processes as those beyond the boundary of the farm. This is an analytical convenience only and need not obscure the essential issues under discussion.

until the concentration level reaches N_F. Ecologists, on the other hand, might be expected to advocate a concentration level much closer to N_E.

We see once again that perceptions of what is correct will differ markedly across the various interest groups. Farmers can be expected to advocate a nitrate level that is somewhat higher than the status quo ante, but would certainly resist efforts to reduce it below the current level (N_S). They might not feel comfortable advocating moving too close to N*, but they would probably stick hard to N_S if not necessarily N_F.

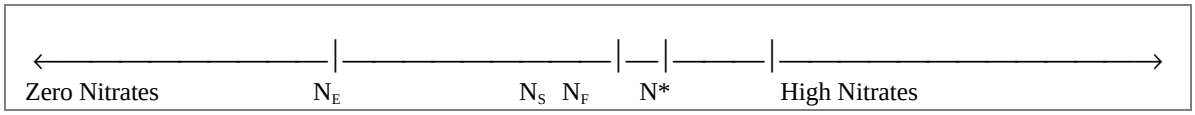

Figure 4. Ecological Implications of Agriculture

These three categories of environmental implications from agriculture will be used to develop ideas about the distinction between providing benefits and preventing harm, about the role of property regimes in this distinction between benefits and harm, about the publicness of environmental implications from agriculture, and about the implications of the polluter-pays

principle.

[3] Danger to the general population comes at a higher nitrate concentration level than for infants and pregnant women, so N* represents a concentration at which certain segments of the population would need to take averting actions.

II. PROVIDING BENEFITS OR PREVENTING HARM?

As the previous discussion makes clear, much difficulty arises from a general confusion in the matter of whether particular agricultural activities and practices provide benefits or prevent harm. If a farmer decides to drain a wetland to grow crops then some would say that this act causes harm. Using the above classification scheme, they would insist that amenity aspects of the rural landscape would be diminished, important wildlife habitat would be destroyed, and ecological processes would likely be undermined. The farmer, on the other hand, might be inclined to suggest that if he does not drain the wetland he is providing benefits in the form of improved amenity attributes, enhanced wildlife habitat, and essential ecological processes. Which view is correct?

Note that the differing perceptions of this issue fuel much of the incoherence—and the political struggle—in environmental policy focused on the agricultural sector. Farmers, often under siege from environmental interests, believe that their stewardship of rural resources constitutes provision of environmental benefits to the larger public. For these they often believe that gratitude should be forthcoming, if not financial rewards. And we know that agricultural policy in many OECD countries does indeed provide financial rewards for farmers to undertake land-use practices that are protective of environmental attributes. Such payments are *prima facie* evidence that—at least in political terms—their actions are regarded as providing these beneficial effects. Another way to think of it is that these environmental benefits would not be provided by farmers unless payments would be forthcoming. In essence the farmer has a contract with the state to provide a bundle of environmental benefits in exchange for financial payments. Whether or not the beneficial effects are real is an empirical question.

The other side of the argument would suggest, however, that farmers should not have to be paid to provide those things which, in the absence of agriculture, would be the natural order of affairs. They would point out that agriculture in the American midwest has already destroyed the vast majority of wetland habitat. In addition, soil erosion and chemical contamination are companions of modern agricultural practices in much of the world. These individuals would point out that industrial polluters are often required to pay for their environmental implications. Why should not farmers face the same financial disincentives?

Can we shed light on these two different perspectives? There are two American legal cases that may help us to understand the issues here. In *Just v. Marinette County*, the Wisconsin Supreme Court (56 Wis. 2d 7,201 N.W.2d 761, 1972) upheld a local zoning rule that prevented the draining of wetlands without prior approval from the county government. The Justs started to drain a wetland but were stopped by the local sheriff. When the case

reached Wisconsin's Supreme Court, the county permit requirement was upheld and the Justs were denied the right to drain their land on the edge of Lake Noquebay. The Court insisted that the Justs had bought land that was wet, and after the permit was upheld, they still owned what they had bought. The permit did not take anything from them that they ever owned—though they may well have supposed that they could drain the wetland and acquire yet more "land." The Wisconsin court ruled that the prohibition on draining the wetland did not call for compensation to be paid to the Justs under the U.S. Constitution's "takings clause" (the fifth amendment).

We see here an argument that goes to the heart of the benefit/harm distinction. The Justs did not dispute the county's position that the wetland along the shores of Lake Noquebay provided important ecological services to the Lake and its downstream watercourse. The Justs did argue, however, that by being denied the opportunity to drain some of the wetland, they were being called upon to "provide" environmental services to the larger Lake Noquebay system. That is, by keeping part of their property in wetlands, they were providing environmental benefits to society at large. This is the difference between H_F and H_S in Figure 3.

The Wisconsin Supreme Court took quite the opposite approach. The Court reasoned that the Lake and its surrounding wetlands had been there longer than had the Justs, or the county government, or indeed any human habitation whatsoever. On that logic, the Court argued that the natural state of affairs was for the wetlands to serve as part of the larger ecosystem. In that role, the wetlands provided nutrient filtering (and a sink) for chemicals that would otherwise harm the Lake and its downstream extensions. The denial of a permit to drain the wetlands did not mean that now, suddenly, the Justs were providing something valuable—the continuation of which warranted paying them compensation. The Justs, said the Court, were not providing a public benefit at all. Rather, the Court insisted that should the Justs drain the wetland they would be visiting harm on the entire Noquebay watercourse. Hence they could not drain the wetland, nor were they to be compensated for this denial.

There is a second important case for untangling the distinction between providing benefits and preventing harm. In *Penn Central Transportation Co. v. City of New York* (438 U.S. 104, 1978), the New York City Landmarks Commission prohibited the Penn Central Transportation Company from erecting a very tall building on top of Grand Central Terminal (which was already owned by Penn Central). The Landmarks Commission argued that such a structure would destroy the aesthetics of Grand Central Terminal.

The U.S. Supreme Court ultimately upheld the decision of the Commission and the benefit/harm distinction played an important role in the Court's finding. Plaintiff (Penn Central) argued that to be prevented

from erecting the massive structure was a "takings" of its property rights to the airspace above the terminal it already owned. If it could not build, it demanded compensation for the lost income the large structure would have brought. Penn Central pleaded that it was being made to provide the public benefit of an unmarred Grand Central Terminal, as well as providing the benefits of open space and light in central Manhattan; other owners had been able to erect monumental structures, why was it now being singled out?

The Court found in favor of the defendants (the Landmarks Commission), and in doing so recognized something very important. The Penn Central Transportation Company argued that if it was to be forced to "provide" the benefits of landmark preservation and open space to others in central Manhattan, then it should be compensated for the denial of its "right" to build. It was, or so plaintiffs argued, entitled to be compensated for the financial loss that it must incur in order to "provide" public benefits to the larger society.

The U.S. Supreme Court found otherwise. As with *Just v. Marinette County*, the Court insisted that the *status quo ante* was one in which Grand Central Terminal and the open space above it were already being "provided." Indeed, the building plans of Penn Central Transportation Company would deprive central Manhattan of precisely those beneficial aspects and this the Court would not allow. Nor was Penn Central to be rewarded with compensation for its inability to destroy those attributes regarded as an essential part of the *status quo ante.*

In both the wetlands case, and the Grand Central Terminal case, we see that courts understand the fundamental distinction between providing a benefit to the general public, and the prevention of harm. Turning back to agriculture, such recognition holds important implications for those who argue that they should receive compensation for "providing" a range of amenity, habitat, and ecological benefits. Of course the legal findings from America are not pertinent throughout the OECD countries. But the logic from these cases offers some insight that may inform the political debate in other places.

We have, in essence, two *status quo antes.* One might be thought of as the political *status quo ante,* while the other is an environmental *status quo ante.* On the political side, agricultural interests will argue that they are providing public benefits. There is a plausible case for this argument when we think of the amenity implications of agriculture. After all, it is the manicured countryside that many non-rural residents now associate with rural areas. As strange as it may seem to environmentalists, many urban residents may indeed hold the well-maintained agricultural landscape in higher esteem than they would a "natural" forest. If so, then agriculture provides net amenity benefits as compared to a more natural landscape. But if fences and hedgerows are ripped out

to permit ever-larger machinery, and if quaint barns and other buildings are removed, then the amenity dimensions of agriculture probably suffer.

The same may well hold for habitat implications of agriculture. If the agricultural landscape is geared toward some provision of wildlife habitat, then agriculture may be a net provider of habitat benefits. We know that a varied landscape is ideal for a range of wildlife, and under the proper circumstances agriculture provides precisely that varied habitat. But of course when farmers undertake to drain wetlands, or to clear forests to expand the area in crops, or to homogenize the landscape in other ways, then the habitat implications of agriculture are negative.

As for the ecological implications of agriculture, there is probably less of a case for the beneficial aspects of agriculture. Of course there are agricultural regimes in which an effort is made to use nature as an ally rather than as an enemy. Sustainable agriculture tends to see itself in this light. But for the most part, "modern" agriculture—with its heavy reliance on chemical inputs—could not lay claim to that status. Here, the ecological case against agriculture is probably compelling.

We see that the idea of a political *status quo ante* and an environmental *status quo ante* is at the heart of much of the struggle over the environmental implications of agriculture. In some instances the difference may be quite obvious. If pure groundwater is contaminated by heavy applications of agricultural chemicals then it stretches credulity to suggest that farmers should be compensated for their inability in the future to carry on such practices. But of course the political power of farmers may be such that they are able to acquire compensation in order to agree to cease these practices. In this case we would say that they have managed to use the political system to define a new *status quo ante*—any change from which must be compensated.

But things are not always so easy. We cannot logically insist that the environmental *status quo ante* is always properly regarded as that prevailing prior to any human action whatsoever. There has been, after all, human activity in western Europe for a very long time and so little of that environment is "natural" or "pristine." This suggests that with amenity and habitat aspects of the rural countryside, a more nuanced approach is necessary. Recall that in Figure 4 the conflict was between so-called "experts" and farmers about the acceptable level of nitrates in groundwater. However, there was certainly no dispute that nitrate concentrations prior to "modern" agriculture were very low indeed. The issue with nitrates is simply one of "acceptable" standards.

Notice, however, in Figures 2 and 3 that the issue is not one of acceptable levels—a threshold—but rather of more general standards of landscape appearance and habitat attributes. Of course there might be disputes about these things as shown in the Figures (2 and 3). But the concern is not to compare the current situation with some pre-human condition. Rather, the concern is to determine in the political arena what level of amenities and natural habitat is regarded as the acceptable reference level against which deviations are to be penalized or rewarded. We see an environmental *status quo ante* and a political *status quo ante* at work here, but in a more subtle way than with nitrate contamination.

But the ultimate test is found in what we regard as the environmental *status quo ante.* Whether or not the general conclusions intimated above really hold up to scrutiny will depend on whether or not the perceived "natural state of affairs" has been improved upon or diminished. So we see that there can be fundamental disagreements about whether particular actions constitute the provision of benefits to the public, whether the benefits would be forthcoming regardless of the efforts of farmers, whether agriculture represents a net decrease in the three environmental implications (amenities, habitat, and ecological processes), or whether the actions of farmers mean that important damages are precluded. And these disagreements lie at the heart of many environmental disputes in agriculture. The resolution of these disputes is found in the particular property rights regime in place at the moment. Or, the resolution depends on a change in the presumed property regime. To that I now turn.

III. Property Regimes in the Benefits/Damages Debate

The previous discussion reminds us that much of the disagreement over the correct policy response to the environmental implications of agriculture arises from the different perceptions about property rights inherent in land. Farmers will argue that since they own the land on which they farm, they are free to treat it as they wish. If a wetland stands in the way of greater agricultural production, then the farmer believes that he has a "right" to pursue that production. Wetlands are an impediment to greater agricultural production just as forested areas were impediments in earlier times. In the farmer's mind, the wetland inhibits higher production and income and so is seen as a liability.

Notice that this matter is not confined only to wetlands. As suggested above, trees can also be seen as impediments to agricultural production. Indeed, agricultural history in Europe and North America has been a constant struggle against the forest. Agriculture keeps the forest at bay. A balance seems to have been struck

between the proportion of the landscape that shall remain forested, and the proportion that shall come under the plough. But forests are not as scarce as wetlands in most areas and so a new controversy persists.

Those who care about rural amenities, rural habitat for wildlife, and general ecological processes will argue that the mere fact of land ownership does not bestow the right to destroy nature. They would point to a range of land uses that are no longer permitted, even though at one time—under different socioeconomic conditions—those particular uses were thought to be acceptable. The advent of town and country planning in Britain following World War II, and indeed land-use controls throughout much of western Europe, reflect these changing social perceptions of "ownership."

In America, even though land-use controls have not reached European proportions, urban zoning has long ceased to be controversial. While we find in America a resurgence in the so-called "property rights" groups that challenge environmental regulations, these reactions are, in all likelihood, a sign of the declining acceptance of the view that ownership of land carries with it some automatic "right" to disregard the larger social interest in land and how it is used [Bromley, 1993; 1995].[4] If property rights were not undergoing transformation, there would be no need for such groups to adopt aggressive tactics.

So the question becomes one of addressing the role of property rights in making sense of the distinction between providing environmental benefits as opposed to preventing environmental harm. Different OECD countries have their own particular rights structures with respect to land and related natural resources. For current purposes it will be sufficient to discuss property rights in a general way.

The obvious starting point is to confront the most extreme position regarding property rights. The natural rights doctrine, derived from the Lockean labor theory of property, holds that individuals acquire rights in land by virtue of having mixed their labor with land [Becker, 1977]. Because humans own their labor power, this self-ownership necessarily precedes civil society. On this basis no state may transgress the "property" of its citizens. We might think of this doctrine as being central to the idea of individual freedom. In other words, if the individual is sacred on natural rights grounds, then governments violate this freedom at their peril. From this foundation it is easy to take the next step which holds that the land and possessions of a free individual—whose freedom stands

[4] The Republicans who came to the U.S. Congress in the 1994 elections brought with them a particularly vigorous attack on environmental regulations. They have since introduced legislation that would require governments to pay compensation when governmental actions or regulations diminished property values by some percentage (sometimes the diminution threshold was as low as 10 percent). A number of state legislatures have seen similar efforts attempted there. So far, very few of these bills have actually been enacted into law.

prior to the state—are absolutely protected from encroachment by the state. In its romantic version, the individual landowner stands immune to the tyranny of governments.

This logic has come under criticism on two fronts. The first is that individuals are not quite the free agents we imagine them to be. If natural rights really existed there would be no need for governments to protect its citizens from each other (and from the state itself). So it is only the authority system we know as governments that can give empirical content to the idea of rights for individuals. Rights only have meaning when there is an authority system to impose duties on others. While the idea of natural rights—and human rights—make fine political rhetoric, rights only have content when they are accompanied by duties on those who would interfere with us. And those duties can only come from a state that agrees to compel civil behavior on the part of its citizens.[5]

The second flaw with the Lockean position on natural rights and freedom arises from the problem of imperfect (incomplete) acquisition. That is, if owning property is to stand as the guarantor of freedom and protection from an arbitrary state, then we find ourselves with a protection of freedom that is at once incomplete and fickle in its application. Whence does the guarantee of freedom for the propertyless arise? In other words, it is incoherent to insist that property rights are the *sine qua non* of liberty when many among us have no property. Does this mean that liberty falls only to the propertied classes?

In addition to these two flaws, Locke himself added a famous—but frequently overlooked— proviso in discussing his theory of property. He insisted that acquisition by labor was only justified if there "was enough and as good" for others. In a world of scarcity, where there is not enough to go around, the labor theory of acquisition fails us completely [Bromley, 1989].

The difficulty in agriculture/environment interactions is that property rights claims are never far from view. While the claims of landowners will often be in terms of so-called natural rights and freedom, property rights are justified by purpose, and limited by necessity [Christman, 1994]. To quote R.H. Tawney:

> The state has no absolute rights; they are limited by its commission. The individual has no absolute rights; they are relative to the function which he performs in the community of which he is a member, because unless they are so limited, the consequences must be something in the nature of private war. All rights, in short, are conditional and derivative, because all power should be conditional and derivative. They are derived from the end or purpose of the society in which they exist. They are conditional on being used to contribute to the attainment of that end, not to thwart it. And this means in practice that, if society is to be healthy, men must regard themselves not as the owners of rights, but as trustees for the discharge of functions and the instruments of a social purpose [Tawney, 1948, p. 51].

[5] The clearest evidence of this issue is found in slavery. If individuals really had natural rights then slavery would have been impossible. States first sanctioned slavery, and later outlawed it. It is the state that has the legal capacity to define one individual "slave" and another individual "owner." Therefore only the state can eliminate those categories.

The idea of property rights as derivative and limited is well accepted in most OECD countries. But visions of property rights as some absolute construct still loom large in public policy discourse concerning the environment. It is this idea that underlies much agricultural policy where anti-social land-use activities are often necessarily modified by the payment of inducements to farmers to adopt alternative practices [Bromley and Hodge, 1990]. Such payments serve to reinforce the idea that farmers have a right to allow top soil to wash away, to drain wetlands, and to apply toxic chemicals. The myth of absolute property rights affirms certain environmental practices, which must then be "bought out." And of course the act of "buying them out" further reinforces the myth of absolute rights.

We see this at work in the very different treatment accorded to industry and agriculture in the realm of responsibility for environmental practices. Some might suggest that industry is treated less graciously than agriculture because of the economic power of the former, and the "perfectly competitive" nature of the latter. A more plausible explanation would concern the political sentimentality of all things agrarian. And of course the Lockean imperative is at work here as well. But there is also the fact that industrial pollution tends to come from the end of a pipe (or a smokestack), while agricultural pollution is more diffuse in its origins. Despite the diffuse nature of agricultural pollution, policy options do exist for addressing the problem. In particular, one solves non-point-source pollution problems by forming associations within particular watersheds and making the group of farmers collectively responsible for water quality. If pollution fees are levied, they are assessed against the collective as a group. This then forces the individual members of the group to monitor each other's behavior, and to assess miscreants accordingly [Bystrom and Bromley 1996].

The practical effect is that agricultural practices that harm the environment are seen as part of the farmer's rights bundle. On this view, such practices can only be stopped with proper financial inducement. In other words, when farmers agree not to drain wetlands, or agree to reduce chemical applications, or agree to countouring practices that will impede the runoff of precious soil, such actions are interpreted as an example of civic-minded behaviors that will suddenly provide valuable environmental benefits to the community at large. For this, the case is then made that cost-sharing is appropriate. Or perhaps some other form of financial beneficence ought to be forthcoming [Bromley and Hodge, 1990].

Notice that if property rights were seen as less absolute than the Lockean myth suggests, then the harm that such practices create could be halted with impunity—and at much lower cost to the public purse.

By way of summary, property rights bestow on the right holder the capacity to compel the state to stand behind the interests of the party with rights. Hence, the state—through its interest in all transactions—chooses to protect certain parties and their interests as against the interests of all others. This means that coherent rights can only be established through a process that starts not with physical acts, but with Kantian reason [Bromley 1991]. And this means that all rights are constructed because they are willfully determined through collective action grounded in Pure Reason.

IV. Missing Markets in Agricultural Externalities

The quest for improved environmental policy is influenced by the extent to which the environmental implications of agriculture fall outside of the decision calculus of farmers. We have, in essence, a problem in which the physical implications of agriculture transcend the boundary of the firm responsible for those implications. When English farmers rip out hedgerows to allow for larger machinery, urban residents are outraged. When American and German farmers use nitrate fertilizers, drinking water is contaminated far beyond the boundary of the farm. When Asian farmers burn off rice stubble, non-farm populations are adversely affected.

We are reminded again that actions taken within the decision confines of the farm firm hold implications for those beyond the decision calculus of that firm. If beneficial environmental implications are forthcoming, say the provision of a more pleasing landscape than otherwise, or the provision of enhanced wildlife habitat, then a case might exist that payments should be forthcoming to farmers to pay for these off-site benefits. Indeed, agricultural policy in many countries probably does that already. Whether or not the "optimal" level of rural amenities and habitat provision is forthcoming is interesting, but such a determination is too difficult, both conceptually and empirically, to undertake with any confidence.

To the extent that modern agriculture is a contributor to degraded ecological processes then the flow of payments to agriculture must be modified accordingly. In a sense we might imagine a regime in which credits and debits are accumulated for the various environmental implications of agricultural practices in particular areas. A

credit or two for amenity benefits, a debit or two for chemical contamination, and perhaps neither credit nor debit for habitat attributes. Each case would need to be assessed individually.[6]

Regardless of how this accounting might work out, it must be seen as a much more elaborated scheme than the simplistic idea that the polluter should pay. For as we shall see, it is not always possible to ascertain which party is the "polluter."

V. The Polluter-Pays Principle

The heart of much environmental policy is the idea that the polluter should pay for the damages being caused. This is only logical. Unfortunately, a problem arises because the very idea of "pollution" is often unclear. So the clarity of a simple rule is clouded by operational realities. The alliterative charm—as well as the superficial equity—of the "polluter-pays principle" explains part of its appeal to policy makers. There is a sense of certitude to the idea that those who "cause" pollution should pay for it. The difficulty, however, is to ascertain precisely who "causes" pollution.

When residential developments spread into areas that are clearly agricultural, the assumed clarity of the polluter-pays principle disappears. After all, agricultural activity implies noise and dust. When a particular region is exclusively agricultural and the dust and odors spread through the vicinity, the idea of "agricultural pollution" is probably an oxymoron. After all, farmers expect to endure noise and dust as part of their livelihood. So the polluter-pays principle does not work here.

Yet when non-agricultural activities encroach on the rural landscape, the normal attributes of agriculture—noise, dust, animal odors—become "nuisances" (and thus "pollution") to the new inhabitants of the countryside. Does the polluter-pays principle now work? Not necessarily.

The polluter-pays principle is the logical outgrowth of the Pigovian perspective on externalities. Pigou saw externalities—specifically pollution—as an activity by one party that harmed another. In its simple Pigovian manifestation, factories emit smoke and thus laundries have to wash their linens again. Coase countered this vision by suggesting that perhaps the laundry might be able, more cheaply, to find another way to dry its linens. Or,

[6] There is no assurance in this system that the wrong incentives would not result in economic waste and a rural environment that is without redeeming virtue.

perhaps the laundry should move so as to avoid the smoke. On this view, the laundry "causes" the problem by locating too close to the smoky factory.[7]

Coherence requires that two distinct issues be separated. First, there is the physical emission of smoke. Second, this smoke is transformed into "pollution" when a victim is within the realm of the emission. Only with the juxtaposition of two parties does the pollution become an "externality" of policy significance. If we momentarily overlook air quality for breathing, there is no pollution (no externality) until a laundry enters the picture. And, as above, when the region is entirely agricultural, noise and dust and odor—though present—do not constitute "pollution" and therefore an externality cannot exist (by definition). As we have noted elsewhere:

> It is therefore impossible to advance a rule that can generally define even the quite narrow question of physical causality. What then is the basis for the Pigovian perception and its implied taxing rule? Is there a universal right to undisturbed natural circumstances? If the answer is a tentative "yes," is this right based on the idea that the cheapest solution to externalities necessarily follows from the way responsibility is construed? Or is the rule hampered by the idea that whoever was there first has the right? [Vatn and Bromley, 1996, p. 8].

The Pigovian approach and its taxing policy (the polluter-pays rule) seems intuitive because the most common pollution cases are ones in which the emitter was <u>not</u> there first but came after long-established uses were well underway. There have always been laundries—or families—hanging out linens, but smoky factories are the product of the Industrial Revolution. But by altering the sequence of things, the apparent clarity disappears. And this is the problem alluded to above when residential developments encroach on long-standing agricultural areas. Consider the famous English case of *Bryant v. Lefever.* Commenting on this case, Coase writes:

> The plaintiff and the defendants were occupiers of adjoining houses which were of about the same height. Before 1876 the plaintiff was able to light a fire in any room of his house without the chimneys smoking: the two houses had remained in the same condition some thirty or forty years. In 1876 the defendants took down their house, and began to rebuild it. They carried up the wall by the side of the plaintiff's chimneys much beyond its original height, and stacked timber on the roof of their house, and thereby caused the plaintiff's chimneys to smoke whenever he lighted fires [Coase 1960, p. 11].

So here the plaintiff, minding his own business, suddenly found that when he tried to light a fire he was forced from his home by his own smoke. But in this case the harm was "caused" by his neighbor who had raised the height of his house, thus destroying the draw of plaintiff's chimney. After all, in the *status quo ante*—before Lefever added to the height of his house—Bryant's chimneys worked quite fine. So Lefever "caused" the pollution

[7] Such logic often causes some to insist that the right should go to the party who was there first. But of course this time-dependent approach cannot always be relied upon. More will be said on this below.

newly experienced by Bryant. The appeal of this particular conflict is that it forces us to reassess our often-simplistic notions of "cause." On the standard Pigovian logic, the plaintiff had a convincing argument. It was not the smoke *per se* that was the problem, for Bryant had been lighting fires for a very long time. Instead, the harm was caused by the neighbor's new higher building.

As the case worked its way through the courts however, things became somewhat less clear. In the trial court, the plaintiff was awarded compensation for the defendant's actions. On appeal, however, the judgment was reversed. To quote from the appellate decision:

> They (the defendants) have done nothing in causing the nuisance. Their house and timber are harmless enough. It is the plaintiff who causes the nuisance by lighting a coal fire in a place the chimney of which is placed so near the defendants' wall, that the smoke does not escape, but comes into the house. Let the plaintiff cease to light his fire, let him move his chimney, let him carry it higher, and there would be no nuisance. Who then causes it? It would be very clear that the plaintiff did if he had built his house or chimney after the defendants had put up the timber on theirs, and it is really the same though he did so before the timber was there. But (what is in truth the same answer), if the defendants cause the nuisance, they have a right to do so. If the plaintiff has not the right to the passage of air, except subject to the defendants' right to build or put timber on their house, then his right is subject to their right and although nuisance follows from the exercise of their right, they are not liable [Coase 1960, p. 12].

So the matter of "cause" turns out to be a tricky one indeed. The easy response is to denounce the appellate court as wrongheaded. But something quite profound is at work here. The trial court seemed convinced by the innocence of plaintiff building a fire in his own home. On the other hand, the appellate court seemed convinced by the need for "progress" and continual change in the *status quo ante.* If defendant was investing in his dwelling, making it larger and more habitable, how then can one quite inadequate chimney be allowed to stand in the way of modernization? Perhaps the plaintiff (Bryant) had underinvested in chimney height when he built his house?

The trial court regarded the "harmed" party as the plaintiff, while the appellate court responded by saying that if the defendant must pay the plaintiff, then the "harm" really falls on the defendant. If the owner of the fireplace "causes" the externality by lighting his own fire, then it hardly qualifies as an externality in the eyes of conventional economic theory. The appellate court saw the essence of the problem in a way that the trial court missed. We see that the application of simple rules about "cause" and "harm" will fail as the grounds for a procedure to determine the appropriate rights structure.

Indeed, environmental policy is often confused because we search for just such a rule. Of course existing activities may give some presumptive claim to a "right," but this claim is just that—presumptive and tendentious rather than substantive and durable. Such presumptive rights are illusory until recognized in some institutionalized

arena of affirmation and ratification. This arena could be a legislature, or a constitutional court. The chimney case *(Bryant v. Lefever)*reminds us that the actions of both parties are of singular importance in externality discussions. In essence, both parties were the "cause" of their new conflict.

An American case (*Spur Industries v. Del E. Webb Corporation*) illustrates another aspect of "pollution" with a direct bearing on agriculture. Spur Industries was engaged in the feeding of large numbers of cattle some considerable distance northwest of the fast-growing metropolitan area of Phoenix, Arizona. When first constructed, the Spur feedlots were very far out in the desert. However, Del E. Webb Corporation undertook the development of a housing complex in the immediate vicinity of the feedlots. The flies and odors associated with the feedlot were a serious impediment to the sale of Webb's homes. The Webb Corporation sued Spur Industries for creating a nuisance.

The court found in favor of the plaintiff (Webb) on the grounds of a genuine nuisance that did indeed harm Webb's financial prospects. But the court ordered Webb to pay the costs for the feedlots (Spur Industries) to move to a new location where the inevitable accompaniments of confined cattle feeding—flies and odor—would not constitute "pollution." Again we see that "pollution" is situation-specific.

We also see in *Spur Industries v. Del E. Webb Corporation*an attention to both efficiency and to equity. On the efficiency front, it is probably more important that residential developments be accommodated near other urban areas than that particular feedlots survive there. While the feedlots of Spur Industries might have been out in the desert when first constructed, it is not unreasonable to suppose that residential developments might invade the desert in such a fast-growing location. On the equity front, Spur Industries seems to have been victimized by the problem of Del Webb "coming to the nuisance." But the court made Spur whole by requiring that plaintiff (Webb) pay for Spur to relocate.

Of course the circumstances of this particular litigation would have been avoided in many countries where rural zoning is more developed. Spur would have been a permitted use where it was, and Del Webb would not have been allowed to approach the feedlots with housing. With zoning, the presence of flies and odor would not have <u>become a nuisance</u> (pollution).

In essence, Coase was commenting on the fact that a strict Pigovian rule might impose costs on the "wrong" party. That is, sometimes the net social dividend would be enhanced if the "victim" were to bear responsibility for solving the conflict. In *Bryant v. Lefever*the "victim" was the plaintiff who merely wished to light his fire without

suffering his own smoke. In the name of progress, the "victim" had only to expend a small amount to extend his chimney to restore its draw. This would surely be preferred, in the long run, to preventing Lefever from expanding his house and adding to the capital stock of the city. But of course, in the name of equity, Lefever might have contributed something to the costs of Bryant's taller chimney. This would be the solution taken from *Spur Industries v. Del E. Webb*.

It may be noticed that neither of these cases can give much comfort to agriculture. First, it is not always the case that "first in time means first in right." The history of the law as instrumental social policy tells us that those things defined as "progress" will inevitably win out over those things which are seen as preserving the status quo. The law is, after all, part of the evolving institutional structure of a society. For the most part, nation-states see their manifest destiny in terms of economic progress. And we must recognize that economic progress implies change.

Second, instances in which other uses (residential developments) "come to the nuisance" (flies and odor) are not always resolved to the satisfaction of the party who did not move. It is possible, through careful zoning, to separate mutually incompatible activities. But over time, it is probably true that activities that emit what will come to be regarded as "pollution" are living on borrowed time in that particular location.

Third, the idea of "cause" can sometimes be counterintuitive. In the stylized Coasean world of bargained solutions to externalities, the only relevant cost in considering judgments about responsibility for action is the level and incidence of transaction costs. Liability for remedial action must lie with the party best able to handle change with the minimum of such costs. Transaction costs are either so high that no change in outcomes is deemed "efficient," or transaction costs are low enough—at least for one side—to permit a bargained transaction. In this case, the cheapest solution will be found through bargaining. But the real world is rarely the idealized Coasean world. After all, in the real world, citizens, legislators, and judges insist that it matters who was there first, and it matters who has the higher moral claim in a conflict. That is why a simple rule about who is "causing" an environmental problem will usually fail us.

VI. Toward a Policy Framework

A. The Policy Context of Agriculture

The subject of interest here is the "environmental implications of agriculture." Unfortunately, posing the question this way overlooks the fact that "agriculture" cannot be defined without reference to the policy context in which food and fibre are produced. After all, "agriculture" *per se* cannot possibly benefit or harm the environment because the term is devoid of the necessary specificity. Rather, agriculture in a particular place, using particular technology, engaged in particular enterprises, and shaped by particular economic incentives operating on farmers (often called agricultural "policies") gives rise to a particular constellation of economic and environmental implications—some of which will be regarded as beneficial by a subset of the population, and some of which will be regarded as harmful by a different subset of the population. Therefore, we simply cannot talk of the "beneficial effects of agriculture on the environment." All we can discuss is the environmental implications of a <u>specific kind of agriculture</u>.

The essential component in any assessment of the environmental implications of agriculture is the political and economic milieu that gives "agriculture" its empirical content. We must, therefore, focus our attention on the "policy context" of agriculture, not merely on the agricultural sector in the abstract.

All economic activity—whether industrial or agricultural—operates in a <u>constructed economic context</u> by which I mean the constellation of prices, laws, costs, technologies, and environmental circumstances that combine to produce a particular agricultural product. As we know, the process of creating some agricultural product also gives rise to other processes and phenomena. The mere existence of agriculture results in flows of income into and out of rural areas that, in many countries, is the social and economic foundation of the non-urban economy. But this contribution of "agriculture" to a particular sub-national region must be understood as an artifact of the political and economic milieu within which this production of food and fibre is embedded. To make the point, imagine how "agriculture" in western Europe would be structured—and how it would function (and look)—with a long history of American agricultural policy rather than with the CAP and the various national refinements thereto. And, as we see from the policy reforms over the past decade in New Zealand, "agriculture" in 1996 is certainly very different from what it was in the early 1980s.

<u>B. The Nature of Agricultural Policies</u>

The policy climate for agriculture must be understood to entail three levels of interaction from the political process. At the most benign level, policy operates to <u>facilitate</u> certain behaviors by farmers that seem to be in the

collective interest. I call these facilitative policies because farmers themselves also find them attractive but somehow unattainable.

The most obvious "facilitative" policies are those that support commodity prices (or protect domestic agricultural markets) and hence generate farm incomes above levels that they would otherwise be in the absence of government programs. The policies must, by definition, satisfy some collective political goal (or else they would not exist), and these policies certainly are in the interest of farmers who benefit from them.

Turning to the environmental domain, another example would be better information about weather and soil moisture conditions to permit more precise applications of nitrogen fertilizers. Such precision would allow the farmer to reduce expenditures for fertilizers, and would also reduce nitrate leaching into groundwater. In the absence of this information, farmers have an incentive to over-use fertilizers on the principle of "better safe than sorry." Agricultural policies geared in this direction would save farmers money, and would probably reduce nitrogen contamination of groundwater.

At the next level of severity, policies can induce farmers to behave in new ways. Here, unlike with facilitative policies, we must deal with the fact that farmers see no particular benefit from undertaking these new behaviors. A tax on a particular chemical would reduce its use by farmers and this may leave their crops exposed to certain pests. Policies that induce new behaviors represent a degree of unwanted intrusion into the decision space of the farmer.

At the most extreme level, some policies will compel farmers to behave in new ways. A ban on a particular chemical, or a law prohibiting a particular production practice, or a law prohibiting the draining of a wetland introduce compulsion to the farmer's choice domain. Policies that compel are the least favored approach from the farmer's perspective, as well as from the perspective of the state. After all, compulsion tends to alienate the compelled, and therefore may entail very high enforcement costs.

C. Value for Money

The enduring mystery of agriculture concerns the profound political influence of farmers in the industrialized OECD countries where farmers are a distinct minority. A long list of explanations (rationalizations) exist for this phenomenon and now is not the time to review that literature. The practical effect is that agriculture has been somewhat indulged and favored in comparison with industrial activities. There may be good and

sufficient reasons for that treatment in certain countries. The important point here is that we must be careful to discern whether or not existing policies give good environmental value for the level of expenditures. I have written elsewhere that the presumptive property rights that attend land and agrarian pursuits have combined to distort economic incentives in perverse ways [Bromley and Hodge 1990]. Farmers are often paid not to destroy nature; or they are given financial inducements to do those environmental things that other sectors would be compelled to do.

But as should be abundantly clear from my earlier comments, environmental goals and objectives (and instruments) remain the province of individual nation-states. There are, of course, certain trans-national imperatives, and so we find some general movement toward uniformity. And the new trading regimes under the World Trade Organization will impose yet another layer of uniformity on agricultural policies.

Within these international regimes, individual nation-states are obviously free to mandate whatever policies they wish. Draining of wetlands can clearly be prohibited with no compensation forthcoming. Agricultural chemicals can obviously be limited or restricted as a country wishes. Farmers need not be compensated or rewarded for good environmental practices. But that is a decision for each country to work out on its own. My remarks here are intended to remind the reader that farmers will, perhaps, hide behind the shield of "property rights" to justify their current practices—or their desire for compensation. Of all the OECD countries, the United States probably has the most stringent protections of "property rights." Yet even here, agricultural policies have managed to: (1) prohibit a range of agricultural chemicals; (3) develop aggressive policies to protect soil, wetlands, and groundwater; and (3) link price supports to conservation behavior of farmers. It surely is easier to do these things in other OECD countries if the political will is present.

D. The Dynamic Dimension

We must always remember that the future is more important than the present. That is, agricultural policies must be evaluated for the incentive effects more than for the immediate response from farmers. By the incentive effects I wish to call attention to the fact that policies (agricultural or otherwise) redefine the choice set of economic agents. If fertilizers are more expensive, two things happen: (1) farmers use less; and (2) there begins a search for a substitute. All prices—indeed all legal-economic circumstances—contain a static effect and a dynamic effect. Policy makers, and policy analysts, too often ask about the immediate response to particular policy reforms when the long-run (dynamic) effects are the more profound.

Another dimension of the long-run incentive effect has already been discussed. Farmers will argue that they have a "right" to do something and will insist that a denial of that "right" calls for compensation. The danger here, of course, is that once compensation is forthcoming, the tendentious "rights claim" of farmers has been politically reinforced. Again, we see that the long-run is more important than the immediate situation. Governments should avoid those policy actions that may bestow future rights (entitlements).

E. Whither Optimality?

I observed above that determining the "optimal" level of rural amenities, habitat, and ecological processes was a most difficult conceptual and empirical task. But it is clear that economic policies in general—and agricultural policies in particular—hold important implications for the environmental aspects of the rural countryside. The policy challenge is to make sure that governments are not paying for behaviors on the part of farmers that should properly be considered as normal good stewardship of environmental resources. At the same time, it is necessary to understand that agriculture is no longer simply an activity that produces commodities for local, regional, national, or international markets. That has been the historical role of agriculture, but it is not the contemporary—or the future—role of agriculture in the developed world. Indeed, in the OECD countries, commodity abundance, not commodity scarcity, is the norm.

Given commodity abundance, it is necessary to begin to see agriculture as primarily a land management activity that provides (and supports) rural livelihoods, and that happens also to produce some marketable commodities. But some essential outputs of agriculture are not, nor could they be, marketed as are the commodities of agriculture. This fundamental redefinition of agriculture allows us to escape the conceptual trap that seems to prevail in many discussions about the environmental attributes of agriculture. That conventional view holds that there is some normal structure of agriculture in each ecological setting which gives rise to some "natural" level of costs of production. This thinking then allows a seamless transition into a discussion of subsidies and "distortions" that contravene some inherent comparative advantage. Recent preoccupation with revising world trade arrangements has tended to reinforce such thinking.

Unfortunately for those who believe they can rather effortlessly spot such "distortions," the very idea of a distortion or a "bias" only has meaning within some prior definition of what is assumed to be "natural" or "inevitable." Too often, there will be a belief that some natural and unfettered market will reveal this idealized

state of affairs. From this supposition, there will then begin serious discussions about comparative advantage in trade. However, the idea of comparative advantage is simply an artifact of a large number of natural and social constructs. Sometimes, the social construction of "comparative advantage" will be rather obvious. If the subject of discussion is automobiles then the purpose of the sector under study—autos—is rather straightforward. However, if the subject of discussion is agriculture, then the purpose of the sector under study is no longer so straightforward. That is, agriculture is no longer just about producing tradable commodities. Agriculture is now a multi-product sector in which simplistic ideas of efficiency, or of "subsidies," will mislead. In a world of commodity abundance and environmental scarcity, the old logic is both incomplete and inadequate. Simply put, the seeming clarity of "distortions" is—*ipso facto*—a phantasm.

F. The Agro-Environmental Ledger

I suggested an accounting structure in which environmental debits and credits might be reckoned with respect to agriculture. There is not time here to develop this idea in great detail, but it seems a good idea and something like it is, perhaps, already underway in the European Community. There is now much interest in reconfiguring national income and product accounts to reflect environmental degradation. We might well imagine a similar, though elaborated idea, for the environmental implications of agriculture.

BIBLIOGRAPHY

Becker, Lawrence C. 1977. Property Rights: Philosophic Foundations London: Routledge and Kegan Paul.

Bromley, Daniel W. and Ian Hodge. 1990. "Private Property Rights and Presumptive Policy Entitlements: Reconsidering the Premises of Rural Policy," European Review of Agricultural Economics 17:197-214.

Bromley, Daniel W. 1989. Economic Interests and Institutions: The Conceptual Foundations of Public Policy Oxford: Blackwell.

Bromley, Daniel W. 1991. Environment and Economy: Property Rights and Public Policy Oxford: Blackwell.

Bromley, Daniel W. 1993. "Regulatory Takings: Coherent Concept of Logical Contradiction?" Vermont Law Review 17(3):647-82.

Bromley, Daniel W. 1995. "Rousseau's Revenge: The Demise of the Freehold Estate," Keynote address at the conference "Who Owns America?" Land Tenure Center, University of Wisconsin-Madison, June 21-24, 1995.

Bystrom, Olof and Daniel W. Bromley, Contracting for Non-Point-Source Pollution Abatement, University of Wisconsin-Madison, Department of Agricultural and Applied Economics, Staff Paper No. 392, March 1996.

Coase, R.H. 1960. "The Problem of Social Cost," Journal of Law and Economics 3:1-44.

Christman, John. 1994. The Myth of Property Oxford: Oxford University Press.

Tawney, R.H. 1948. The Acquisitive Society New York: Harcourt, Brace and World, Inc.

Vatn, Arild and Daniel W. Bromley. 1996. "Externalities: A Market Model Failure," Environmental and Resource Economics (forthcoming).