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Farms and Ecosystem Services

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Over the past decade two themes have emerged as organizing principles in natural resources policy. One, ecosystem management, builds a framework for landscape-level decision making (Christensen et al. 1996). The other, ecosystem services, opens a new dimension for thinking about what we hope to achieve through ecosystem management (Daily 1997; Costanza et al. 1997). The convergence of these two themes has become a driving force behind the concept of agricultural multifunctionality, the idea that farms can have multiple outputs—not just commodities—and thus can contribute to several societal objectives simultaneously (Jordan et al. 2007; OECD 2001).

Agriculture has been engaged in ecosystem management since long before the term came into the natural resources policy lexicon. Farms alter and then manage ecological processes and functions on small and large scales. In so doing, farms reconfigure ecological attributes to maximize what are known as *provisioning services*—the food, fiber, energy, and other commodities supplied by nature (Millennium Ecosystem Assessment (MEA) 2005). Farms manage these provisioning services to optimize on-site farm production, often at the expense of off-site environmental conditions. Farms are associated, for example, with soil erosion, nutrient and pesticide runoff, and groundwater depletion (Ruhl 2000; Vitousek, Mooney, Lubchenco and Melillo 1997).

Another off-site impact of farming heretofore little noticed, however, is the depletion of *regulating services*. These are the economically beneficial results of ecosystem functions that modulate ecological conditions, such as gas sequestration, water recharge, pollination, temperature and humidity regulation, and stormwater adsorption (Millennium Ecosystem Assessment 2005). Unlike provisioning services, the market value of which is embedded in commodity prices and thus easily measured and monitored, regulating services tend to behave more like nonmarket public goods (Costanza and Farber 2002). Farms thus have all the incentive to optimize provisioning services available to them, but little incentive to provide regulating services

that benefit other lands (Swinton, Lupi, Robertson and Landis 2006). The question is whether a renewed focus on agricultural multifunctionality using the balance between provisioning and regulating services as its fulcrum can lead to new ideas about how to strike a more socially optimal balance for agricultural production (Abler 2004; Dobbs and Pretty 2004; Smith 2006). This essay outlines the factors that must be considered as that conversation unfolds.

A Framework for Thinking about Farms and Ecosystem Services

In *The Law and Policy of Ecosystem Services* (2007), Steven Kraft, Christopher Lant, and I build an analytical framework for identifying obstacles to socially optimal management of ecosystem services and designing effective policy responses. The framework moves through three stages. First, place the problem in its ecological, geographic, and economic contexts. Second, examine and assess the capacity of existing property rights, regulations, and social norms. Third, identify policy drivers and models, the trade-offs of different policy approaches, and the instruments and institutions that are well suited to transition to new policy designs. The question of whether and how farms can move to new ecosystem service production frontiers presents an opportunity for application of our framework.

Context

Farms, individually and in working agricultural landscapes, have ecological, geographic, and economic attributes that influence the stream of ecosystem services they manage and provide. In this respect farming is perhaps the classic case study of the obstacles society faces in designing policy around the goal of yielding appropriate flows of regulating ecosystem services.

Almost nothing takes place on a farm without ecological impacts somewhere else. In this respect a farm is like any other ecological unit—changes in one ecosystem usually affect other ecosystems, however we draw the boundar-

ies. But as highly managed ecological units, farms significantly tilt the production frontier for ecosystem services toward provisioning services and away from regulating services (MEA 2005; OECD 2001). Ecological practices at a cornfield are designed to produce corn efficiently within the relevant regulatory environment. Putting aside the question whether regulation of farms has established appropriate environmental performance baselines (Ruhl 2000), unless paid to provide regulating services such as carbon sequestration, one would not expect to find significant flows of off-site regulating services from farms except as incidental to management of provisioning services. Hence, the ecological context for agriculture with respect to ecosystem services is that we need to know more about the geographic and economic contexts before we can assess the prospects of realigning the ecological profile.

Agriculture presents a difficult geographic scenario for purpose of developing generalized strategies for ecosystem services. Farms are numerous, dispersed, come in all sizes, and produce many different commodities under many different climate and landscape conditions. Farms also manage ecological resources for relatively small spatial scales (the farm) and short temporal scales (the next harvest). The focus on optimizing on-site provisioning services also tends to sever farms and larger agricultural landscapes from surrounding ecological resources. Managing ecosystem services sustainably, by contrast, requires multi-scalar approaches that integrate connected ecological units across space and time (Holling, Gunderson and Peterson 2002).

These geographic disconnects strongly influence the economics of farming and the bias toward provisioning services. The payoff for providing regulating services, assuming some mechanism for compensation, is likely to be marginal compared to

commodity production or, worse, selling to urban development interests. In the absence of any compensation, economically rational farmers will not provide free regulating services to off-site lands unless doing so is incidental to optimization of on-site commodity production or is forced by regulation (Daly and Farley 2003). Promoting farm multifunctionality, therefore, is a balancing exercise between providing farms the flexibility to continue benefiting from their skill at managing provisioning services on the one hand, and providing the impetus to produce more regulating services for society on the other. Moreover, market distortions from subsidies, which have promoted intensive production on marginal and environmentally sensitive lands, have made it only that much more difficult to integrate ecosystem service values into agricultural production decisions. Society cannot assume that the flow of regulating services off of farms (or any land for that matter) will continue to be provided for free, lest they not be provided at all, nor can we expect farmers to forego the incentives the collection of production and insurance subsidies deliver. Ideally, the economics of farming, including market distorting subsidy policies, can be worked on to change the flow of services, rather than forcing the issue through command-and-control regulation.

Existing Capacity

Farms are often portrayed in policy circles as the “first stewards of the land.” As noted above, however, what this really means is that agriculture has done a very effective job at stewarding land for provisioning services, and the evidence is that this has come at considerable cost to not only the environment, but also the supply of regulating services to society. The negative environmental externalities of farms, though well documented to be significant and pervasive, have persisted for decades even while other

polluting industries have been subjected to intense social pressures to change (Ruhl 2000). This legacy will make it all the more difficult to overcome the associated effect that farms are depleting regulating services of tremendous value to society.

To a large extent we are in this position as a result of an even longer history of the development of property rights in such a way as to deter the production of regulating services. Although true stewardship was promoted by the British common law of property as a result of its densely settled agricultural landscape, the open frontier of American settlement prompted common law courts, gradually but unmistakably, to shift away from doctrines promoting stewardship and toward pro-development doctrines (Sprankling 1996). In short, there is nothing in American property law to suggest to a landowner that there is any advantage to continuing to supply regulating services to society, much less an obligation to do so.

Nor has regulation filled this gap. While other industries are evolving through second and third generations of environmental regulation, the regulation of agriculture is decades behind the curve in terms of scope and innovation. To be sure, the task of regulating hundreds of thousands of farms raising different crops and livestock under different conditions around the nation would be daunting. But rather than try, federal and state legislatures have provided farms what amounts to a safe harbor from environmental regulation, and agriculture has fought tooth-and-nail against any retreat (Ruhl 2000). To this day there is no clear message in regulatory frameworks for what the baseline norm of environmental performance is for farms, other than there is none. As a consequence, opening a discussion of farms and ecosystem services runs headfirst into the ecological, geographic, and economic problems discussed above, with capacity for building policies existing in what

is truly a vacuum in so far as property rights, regulations, and norms are concerned.

Policy Design

Farming thus typifies what Kraft, Lant, and I (2007) call the Tragedy of Ecosystem Services. In the absence of regulation or incentives to steer them toward production of regulating services, farms naturally manage their ecological resource base toward the provisioning services associated with the production of agricultural commodities. Unlike Hardin's famous Tragedy of the Commons (1968), which resulted in an over-exploitation of the resource base, the Tragedy of Ecosystem Services results in undersupply of valuable regulating services. And whereas better design of property rights, regulations, and norms has been shown to overcome the Tragedy of the Commons (Ostrom, Burger, Field, Norgaard and Policansky 1999), as noted above there has been little traction gained on the effects of farming from either of those sources.

Of course, it is important to stay focused on what the goal of agricultural multifunctionality is. We *do* want farms effectively to manage provisioning services to provide society food, fiber, and energy. And we should *not* force farms unfairly to bear the cost of supplying regulating services to society in addition. We pay farmers for corn; how much should we also pay them for supplying carbon sequestration and groundwater recharge? The answer to the Tragedy of Ecosystem Services when it comes to agriculture cannot be simply to regulate farms toward greater production of regulating services. That is not only politically unrealistic, it may also be economically inefficient and normatively inappropriate. On the other hand, just like all landowners, we should demand that farmers meet a minimum baseline of environmental performance as part and parcel of

respecting the property rights of others before it would be appropriate to consider paying them for higher performance levels.

An intelligent approach, therefore, must start with identification of the drivers at the interface between agriculture and ecosystem services and developing a model of how these drivers operate. How do farm subsidy programs influence farm behavior toward ecosystem services? How do the upstream and downstream food and fiber industries affect farm behavior toward ecosystem services? If we were to change these or other conditions, how would farms respond with respect to ecosystem services? And which regulating ecosystem services do we wish to promote?

As we understand more about how and why farms manage ecosystem services in particular ways, we must then widen the lens to consider the trade-offs associated with different policy approaches (Rodríguez et al. 2006). How would encouraging farms to shift toward greater production of regulating services, however accomplished, affect farm income, food prices, and land costs? Who would benefit, and by how much, where, and when? Would moving a significant portion of existing agricultural lands into, say, carbon sequestration, simply prompt conversion of undisturbed lands into farming to replace lost food supply? Would promoting a particular regulating service such as carbon sequestration, have a trade-off effect with other regulating services, such as groundwater recharge? How will other services that farms might provide, such as providing cultural and historical context for surrounding communities, be enhanced or degraded by moving to greater farm multifunctionality?

Once these trade-offs are better understood, the difficulties of transitioning to new policy regimes can be identified. The costs and benefits of new policies almost never are evenly

distributed. For example, are global, national, regional, or local regulating services to be favored, and which interests are affected positively and negatively by that decision? What new skill sets will farmers need to acquire to take advantage of the new policies, and how much will gaining them cost? Will agricultural communities prosper with increased farm multifunctionality? Those who stand to "lose" under new policy regimes are likely to oppose them unless their interests are appropriately accounted for in the transition. After decades of habituating farms (and farm communities) to subsidies designed around provisioning services, it may be unfair and unwise to shift to new policies without addressing the impact to those interests most affected. Should those farms be exempt from new programs, or compensated for losses suffered, or simply forced to play under the new rules?

Ultimately, if promoting greater production of regulating services is the goal for agricultural policy over the next decade, we must choose the instruments and institutions to make it happen. As with almost all else in agricultural policy, political expediency will point toward incentive programs administered through federal agencies. Indeed, putting aside the politically charged question of what baseline of performance to demand from farms, a strong case can be made for incentive-based approaches, as it is appropriate for farms to receive at least some compensation for satisfying public demand for economically valuable regulating services. But federal agencies may be poorly equipped to administer the incentives for all relevant services. Ecosystem services are, after all, benefits to human populations, meaning they satisfy demand at different scales. Some services relevant at national and global scales, such as carbon sequestration, seem well suited for incorporation into federal programs designed to influence land retirement or crop selec-

tion. By contrast, ecosystem services such as groundwater recharge, water quality control, and sediment capture are most valuable to local populations. Farmers should be paid in such cases to provide local services, but only based on local demand, meaning local government programs are more likely to calibrate compensation for local services efficiently. Indeed, as the economic values of ecosystem services become better appreciated, local land trusts and other nongovernmental organizations are also likely to play an expanding role in providing payments and other incentives for farm multifunctionality.

The point is to ensure that incentives for ecosystem services, as opposed to general environmental and ecological performance, are demand driven, not supply driven. In this sense policies designed to promote farm production of regulating services may give multifunctionality a renewed purpose and goal at local scales, connecting farms to their urban and suburban surroundings in ways that make all interests recognize the advantages of maintaining working agricultural landscapes.

A New Direction?

The concept of ecosystem services is no panacea for agricultural policy, but agricultural policy must awaken to its message. For decades, social, political, and economic forces have driven farms to manage ecological resources toward production of food, fiber, and energy commodities. They have done so well, but at the expense of maintaining the stock of natural capital necessary to provide a sustainable flow of ecosystem services of more general benefit to society, such as groundwater recharge, water purification, and flood control. Natural disasters and the effects of climate change are focusing society on the value of those services. While it may be a long time before we think of buying units of services from farms the way we do ears

of corn at the grocery store, it is not too soon to think of ways to change the economic incentives farmers face to induce production of a more balanced portfolio of commodities and services. Doing so through Farm Bill reform, reorienting “green” subsidy programs toward a more multifunctional agricultural suite of outputs, will be an important component of the effort. But the goal of balanced, sustainable flows of ecosystem services from agricultural lands presents new opportunities for state and local programs to tap into and promote farm multifunctionality with true demand-driven market incentives. In the long run, such measures could reconnect agricultural lands and their surrounding communities in ways federal policy could never hope to achieve.

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