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Institutional incentives for managing the landscape: Inducing cooperation for the production of ecosystem services

Rebecca L. Goldman[a,*], *Barton H. Thompson*[b], *Gretchen C. Daily*[c]

[a] *Interdisciplinary Program in Environment and Resources, Center for Conservation Biology, Department of Biological Sciences, 371 Serra Mall, Stanford University, Stanford, CA 94305-5020, USA*

[b] *Stanford University Law School, 559 Nathan Abbott Way, Stanford, CA 94305, USA*

[c] *Center for Conservation Biology, Department of Biological Sciences, 371 Serra Mall, Stanford University, Stanford, CA 94305-5020, USA*

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ABSTRACT

Agricultural landscapes hold tremendous potential for producing a diverse stream of ecosystem services. Yet, because the spatial configuration of particular ecosystems is critical to the supply of many services, realizing this potential requires that farms be managed in a coordinated way across landscapes rather than as independent units. Under existing incentive programs, this level of coordination is typically neither required nor encouraged.

Here we explore how to achieve such coordination from an institutional perspective using voluntary incentives rather than regulation. We focus on three services operating at contrasting scales, from local to global: pollination, hydrologic services, and carbon sequestration. First, we briefly illustrate how agricultural practices can diminish or enhance their provision. Next, we show how all three services require coordinated, landscape-scale management because provision depends upon particular spatial configurations, of which we provide several stylized examples. Finally, based on these stylized configurations, we evaluate the relative merits of three incentive designs–the "cooperation bonus," the "entrepreneur," and the "ecosystem service district"–to promote cross-farm cooperation to enhance service provision.

All three incentive systems rely on rational self-interest, have cooperative configurations to promote ecosystem services across different scales, use tiered reward systems, and have a major voluntary element. They are distinct in certain key features. The cooperation bonus system rewards conservation even without cooperation but adds a bonus for cooperation. In the entrepreneur incentive, all tiers of reward are contingent upon cooperation. The ecosystem service district scheme is only partially voluntary and forces cooperation of all landowners once the district is formed. Our analysis of these heuristic alternatives integrates biophysical, economic, and institutional factors with the aim of addressing the suite of institutional barriers for landscape-scale management.

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1. Introduction

Agricultural landscapes comprise about 1/3 of global land area and typically the most productive land area (Rosen, 2000). The present focus of activity on this land is food production, but long-term sustainability of these landscapes for food production and for other environmental and societal benefits requires that this focus be expanded to include production

* *Corresponding author*. Tel.: +1 650 723 8139; fax: +1 650 723 5920.
E-mail address: beccag@stanford.edu (R.L. Goldman).

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of a wide array of other ecosystem goods and services (Daily, 1997; MA, 2003). There are multiple challenges in inducing this change in focus: the need for greater scientific understanding, for new revenue streams, for engagement with key stakeholders, and for coordination at a landscape-scale. There is a growing body of work on the first three challenges (e.g., Daily and Ellison, 2002); here we focus on the last.

The most basic institutional challenge for the production of goods and services other than food and fiber from agricultural lands is that most of such services are public goods (Lant et al., 2005). Public goods are those without property rights attached and have two basic properties: 1) they are non-rival (everyone can benefit from the good without diminishing others' enjoyment (resources such as clean air and clean water) and 2) they are non-excludable (once created it is hard, often impossible, to prevent others from accessing them).

Most ecological services are public goods which mean landowners have little incentive to conserve, produce, and enhance the provision of such services. As such, outside inducements must encourage their conservation. In the US, there are number of mechanisms to encourage such conservation including regulation and voluntary incentives. In this paper, we focus on voluntary, financial incentives for landowners. These incentives are the compensation/reward for landowners for protecting resources which they only partially benefit from and in some cases may not benefit from at all. The dilemma we address in this paper is how to create such incentives that will not only minimize the public good problem, but also create cross-boundary, landscape-scale conservation.

Current incentives predominantly use a field-level approach in which each farmer is rewarded for conservation efforts on an individual basis, but landscape-scale coordination is important because the provision of ecosystem services from agricultural lands necessitates particular landscape designs. Landscape designs have two critical components: composition and configuration. Landscape composition refers to aggregate land cover/use in a landscape while configuration refers to the spatial arrangement of land covers/use in a landscape (Turner et al., 2001). A wide array of geological, climatic, and biotic processes influences landscape composition and configuration through time. Yet today, human decisions over land use are primary drivers of both landscape configuration and composition and, therefore, the provision of ecosystem services.

The challenge is to create institutional incentives for service provision that span property boundaries. Existing incentives reward individual farmer behavior with little, if any, inducement for cooperative conservation across property boundaries. US agricultural programs of the US Department of Agriculture (USDA) provide a good example. They use a field-level approach in which each farmer is rewarded for conservation efforts on her land. Programs are application-based, with various criteria that rank applications and then create an agreement between an individual farmer and the government.

Despite the prevalence of incentive programs that focus on individual farms, landscape-scale, cooperative conservation incentives are possible as illustrated in Plainfield, Massachusetts. There, a concerned forest landowner feared that development would harm the area's forests. This landowner worked with the Forest Stewardship Program coordinator of the US Forest Service to extend greater cost-share incentives than are normally provided by this program to induce landowner cooperation and coordination. Neighbors had the opportunity to form Stewardship Neighborhoods (three or more contiguous non-industrial private forest owners) and perform cooperative conservation activities such as creating corridors, devising trail systems, or sharing one logging truck. Natural resource professionals provided a checklist of activities that would be rewarded after an assessment of the "neighborhood". The success of this pilot program was evaluated considering the number of acres, neighborhoods, landowners, and natural resource consultants involved and, ultimately, whether or not neighborhoods led to genuine cooperative activities. Within a year of the concerned landowner's efforts, the pilot program encouraged the creation of two Stewardship Neighborhoods involving eight landowner families, three private consultants, and 457 contiguous acres of forest (about 4% of the total forested land in Plainfield) (Campbell and Kittredge, 1996).

Existing examples of landscape management and landscape-scale incentives, like the situation in Plainfield, are few, local, small-scale, and idiosyncratic (Rickenbach and Reed, 2002). Managing on a farm-by-farm basis, as most existing institutional incentives encourage, is inadequate because this spatial unit of management (the farm) is not generally commensurate with the spatial scale (the landscape) of the service to be generated (Campbell and Kittredge, 1996; Rickenbach and Reed, 2002; Lant et al., 2005). A landscape vision is essential to the conservation of ecosystem services on working landscapes (Tscharntke et al., 2005; Firbank, 2005; MA, 2003).

Our aim in this analysis, therefore, is to first explain why landscape-scale conservation is necessary for ecosystem services and to provide a framework from which to create landscape-scale conservation incentives to promote necessary landscape design for ecosystem service provision. We focus on three classes of services to illustrate the importance of scale: pollination services (operating locally); hydrologic services (water purification and flood control operating regionally), and carbon sequestration for climate stabilization (operating globally). We frame our study by three crucial questions. First, why are these services important, and how do agricultural landscapes threaten their provision? Second, how are landscape approaches critical to the promotion of these services, and what landscape design (both configuration and composition) would most enhance their supply? Finally, and the focus of this paper, what institutional incentives would encourage farm management to realize these landscape designs? We investigate institutional incentive mechanisms that could be integrated into a USDA-type conservation program that will reward the creation of the various landscape designs. Our analysis offers a structural framework for implementing landscape-scale incentives by conservation agencies ranging from government (our focus here) to national and local non-government organizations.

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