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Spatial interactions in habitat conservation: Evidence from prairie pothole easements ☆

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ABSTRACT

We examine the role of spatial interactions in conservation easements placed on prairie pothole habitat in western Canada. One of the goals of the conservation easement program we study is to protect contiguous habitat. We identify endogenous spatial interactions among conservation easements and government protected land, independent of spatially correlated landscape features and local economic shocks that influence easement enrollment. We present evidence that easements increase the likelihood of subsequent easements on neighboring land. Government-protected land appears to have little effect on the location of conservation easements. These results imply that conservation agencies have leveraged past conservation investment to enroll more contiguous habitat in permanent easements through a combination of targeting and positive social interactions among neighboring landowners.

Introduction

The importance of the spatial arrangement of conservation activity—including both the size of protected habitat parcels and proximity to other protected habitat—is widely recognized in the ecology and conservation planning literature (Williams et al., 2005). Consistent with this literature, protecting spatially contiguous habitat is one of the criteria used by public and private conservation agencies when allocating scarce conservation dollars.[1] There is a large literature on systematic conservation planning that explores the importance of incorporating ecological benefits, land costs, future risk of

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[1] For example, Oregon's Conservation Reserve Enhancement Program (CREP) offers a one-time bonus if a sufficient quantity of neighboring land is enrolled in the program (Grout, 2009; Hanley et al., 2012). The Nature Conservancy focuses conservation efforts within priority regions, has minimum acreage requirements, and targets new habitat based in part on the protected status of adjacent habitat (Kiesecker et al., 2007).

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conversion, and the spatial arrangement of conserved parcels (Polasky and Segerson, 2009). Recent research has also pointed out challenges associated with conservation planning in regions dominated by privately held land where conservation agencies cannot unilaterally dictate the location of conserved parcels (Polasky et al., 2014; Banerjee and Shogren, 2012). This is particularly problematic in regions where many private landowners have little incentive to coordinate conservation activity (Shogren and Parkhurst, 2011).

In this study, we investigate the extent to which agencies purchasing conservation easements in the prairie pothole region of western Canada are able to protect contiguous habitat. We are primarily interested in identifying the role of endogenous spatial interactions between protected habitat areas. Conservation easements may be placed on habitat adjacent to previously protected areas if conservation agencies attempt to capture ecological benefits arising from contiguous protected habitat. Interactions between neighboring landowners might also lead to spatial spillovers between conserved areas due to landowners learning about easements from their neighbors, possible reputation effects, and changing social norms within landowner social networks. If local conservation activity increases the likelihood that neighboring habitat is protected due to a change in neighbors' preferences or attitudes towards conservation, then agencies can leverage past conservation effort to enroll more contiguous habitat (Chen et al., 2009). Alternatively, easements may be repelled from previously protected areas if there are diminishing returns to additional protected habitat in a given region (Albers et al., 2008). This might arise, for example, if conservation agencies wish to diversify the spatial location of protected habitat.[2]

Recent empirical research examines interactions between government conservation activities and purchases of land by private land trusts.[3] Albers et al. (2008) examine spatial attraction and repulsion between government and privately protected land using a township-level cross-sectional dataset for the states of California, Illinois, and Massachusetts. They find that publicly-protected areas repel private reserves in Illinois and Massachusetts, whereas they attract private reserves in California. Parker and Thurman (2011) investigate the role of crowding in and crowding out of US federal land conservation programs on private land trust activity using a county-level dataset for the years 1990 and 2000. The authors find that federal land conservation programs affect private conservation investment; federal conservation has a small crowding out effect on private land trusts that focus on preserving open space and a crowding in effect on land held in trust by The Nature Conservancy, which selects sites on the basis of biodiversity benefits.

The approach we take in this paper is substantially different from the research cited above. The prior research examining government crowding in and crowding out of private conservation investment makes use of spatially aggregated data. This enables the researchers to examine overall conservation investment within regions, but provides less information about the spatial configuration of protected habitat. In this study, we make use of quarter section-level panel data, which enables us to estimate the extent to which *immediately adjacent* protected quarter sections influence subsequent conservation easement activity via positive or negative spatial spillovers.[4] Further, in contrast to the previous literature that focuses on public versus private conservation investment, in this paper we examine purchases of conservation easements under a public/private joint venture involving two conservation agencies with a common mandate. This allows us to examine endogenous spatial interactions between protected areas over time as well as spatial interactions between the two conservation agencies.

A related line of research examines the role of incentives in encouraging landowners to conserve habitat. van Kooten and Schmitz (1992) present evidence that prairie pothole conservation programs in western Canada relied too heavily on moral suasion and too little on financial incentives for landowners. Several recent papers examine the impact of social norms and reputation effects on the conservation efforts of landowners in the presence of financial incentives (Banerjee and Shogren, 2012; Sorice et al., 2011; Chen et al., 2009). Lewis and Plantinga, 2007 and Lewis et al. (2009) examine the use of incentive payments to reduce habitat fragmentation. A series of theoretical papers investigate methods of providing incentives for conservation program participants to enroll spatially contiguous habitat. Sometimes referred to as “agglomeration bonuses,” this literature focuses on designing formal market mechanisms, such as auctions, in settings with asymmetric information about opportunity costs and spatially-dependent benefits of ecosystem services (Polasky et al., 2014; Drechsler et al., 2010; Parkhurst and Shogren, 2007; Parkhurst et al., 2002).

We build on this literature by examining an incentive-based conservation program operating in an environment with asymmetric information and with a goal of protecting contiguous habitat. From the beginning, the conservation agencies operating in the prairie pothole region of western Canada have relied on one-on-one interactions between field staff and landowners. Agency field staff reside in local communities and attempt to form long-term relationships with networks of landowners, with an objective to change local social norms and to gradually increase awareness of conservation issues within local communities. Similarly, investment in conservation easements is thought to shift social norms such that

[2] Recent research has examined the role of diversification in conservation planning. This research proposes modern portfolio theory to deal with climatic changes in the US prairie pothole region (Ando and Hannah, 2011; Ando and Mallory, 2012).

[3] A couple of related papers (Lynch and Liu, 2007, 2009) assess the role of spatial spillovers in agricultural land preservation programs in Maryland. An important consideration in these papers is the possible impact of the preservation programs on surrounding land values. The conservation easements in our study restrict agricultural uses on parcels and are purchased in a region dominated by intensive production agriculture with little potential for residential development. These easements affect the value of the parcel with the easement but should have little impact on surrounding agricultural land values (Lawley and Towe, 2014).

[4] The Dominion Land Survey system divides most of Western Canada into one square mile sections. Sections are further divided into quarter sections, which are 160 acre square plots of land.