Land Use Policy 79 (2018) 320–325

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Estimating the demand and supply of conservation banking markets in the United States

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ARTICLE INFO

Keywords:
Endangered Species Act
Conservation banking
Supply and demand elasticity
Two-Stage least squares
Conservation credit price

ABSTRACT

This paper presents an econometric analysis of factors influencing the demand and supply of habitat conservation credit markets in the United States. Two-stage least squares is used. The results suggest that both the demand and supply for habitat conservation credits are inelastic. The results also suggest that the availability of habitat conservation credits (and new habitat bank formation) is likely to decrease with increases in land value. These results are only suggestive as the dataset used has some significant limitations. Data challenges point to the need for greater public availability of transaction-level data. The availability of such data can help improve the modelling efficiency of habitat conservation banking markets.

1. Introduction

Habitat conservation banks are permanently protected lands which are managed for endangered species and their habitat (USFWS, 2016a). Over the past 20-plus years, habitat conservation banking has been implemented as an incentive to encourage landowners to manage their land in ways that conserve endangered species habitat and as a compensatory mitigation option for developers who have to legally take endangered species habitat. Habitat conservation banking is similar to wetland mitigation banking, but differs in terms of legislative instruments, policy frameworks, and the implementing agency (Boisvert, 2015). Habitat conservation banking allows landowners/bankers to create "credits," which can be sold to others who intend to meet their regulatory requirements to offset the loss of endangered species habitat (Fox and Nino-Murcia, 2005; Boisvert, 2015).

The economic benefits from conservation banking are realized through the gains from trade. The buyers are developers whose development activities are required to offset development impacts and to comply with the Endangered Species Act of 1973 (ESA); the sellers are the habitat conservation bank owners (Fox and Nino-Murcia, 2005). Conservation credits are the metric used to quantify the ecological functions or services supplied at bank sites and the sites where impacts are required to be offset. The number of credits available at a given site is based on habitat quality, land conserved, and species involved (USFWS, 2016a). A credit is typically expressed as a measure of surface area and services supplied (e.g., an acre-year of services), number of individuals or mating pairs of a particular species, habitat function (e.g., habitat suitability index), or other appropriate metrics that can be consistently quantified (USFWS, 2016a).

Since the implementation of the program in 1996, the U.S. Fish and Wildlife Service (USFWS) has approved over 135 habitat conservation banks (as of December 2016). More than 142,000 acres of land are conserved by these banks (USFWS, 2016a). Several studies (e.g., Fox and Nino-Murcia, 2005; DOI, 2016) have reported increasing numbers of habitat conservation banks leading to more areas of land under conservation. Consequently, attempts have been made to evaluate the performance of the conservation banking markets and the experience of bank sponsors or owners (Gamarra and Toombs, 2017; DOI, 2016), focusing on understanding the motivations of the USFWS and bankers. These studies have not evaluated the supply and demand of conservation credits or the relative importance of the underlying factors that affect them. This paper uses transaction data and a two stage least squares (2SLS) approach to help understand the conservation bank market and the dynamics of conservation credit supply and demand.

The demand for credits varies across potential purchasers and is affected by the intensity, type, and location of mitigation requirements (DOI, 2016). Even though the demand for credits (quantity) is affected by the available compensatory mitigation options, the unit price of a credit can substantially vary across the regions (e.g., states), across endangered species and habitat types (e.g., animal, plant), between bank types (public and private), and other economic factors (e.g., construction activities, land value). The equilibrium price of a credit is

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https://doi.org/10.1016/j.landusepol.2018.08.032
Received 1 February 2018; Received in revised form 20 August 2018; Accepted 20 August 2018
0264-8377/ Published by Elsevier Ltd.

determined by the interaction between developers and the bankers. The primary factors that play a role in determining credit price include the land value, the area of land, cost associated with the production of credits, and other market forces.

The purpose of this paper is to address the following issues:

- The factors that determine the supply of, and the demand for, habitat conservation credits; and
- The extent to which prices vary across different species and bank types.

2. Literature review

In 1995, USFWS released first policy defining habitat conservation credit trading in California (Wheeler and Strock, 1995). In the same year, the first conservation bank was established by Bank of America, federal, and the state environmental regulators in Carlsbad Highlands on the California coast north of San Diego (Lawrence, 2001). This was seen as a breakthrough model using a market-based mechanism to support endangered species conservation (Lawrence, 2001). By 2002, California had about 30 habitat conservation banks (Fox and Nino-Murcia, 2005). In 2003, the USFWS adopted the habitat conservation-banking approach and released guidelines for the establishment, use, and operation of habitat conservation banks (USFWS, 2003). Fox and Nino-Murcia (2005) first provided a comprehensive analysis of the habitat conservation banking market in the United States. They summarized the biological, financial, and political experience of habitat conservation banking. Relying on 35 conservation banks data, they found that most of for-profit habitat conservation banks were breaking even or making money and that the credit prices were in the range from $3000 to $125,000 per acre across different species. They concluded that more information sharing and fewer bureaucratic delays could increase the number and size of habitat conservation banks.

Since then, there has been limited literatures on the subject. Some researchers have developed theoretical frameworks and undertaken policy and institutional analysis in an effort to assess habitat conservation banking (for example, Ferraro et al., 2007; Drechsler and Wätzold, 2009; Vatn, 2014; Boisvert, 2015; Vaissière et al., 2017; Galik and McAdams, 2017). Pawliczek and Sullivan (2011) studied the ecological and economic pattern associated with habitat conservation banking in the U.S. They, too, reported increased numbers of habitat conservation banks and bank area and recommended that actual data on trade and credit prices should be made available and published for the better understanding of the conservation banking markets.

Kreuter et al. (2017) analyzed the development of habitat conservation banking for four at risk species (Golden-Cheeked Warbler, Dune Sage Brush Lizard, Lesser Prairie-Chicken, and the Greater Sage-Grouse) and found that a wide distribution in habitat and habitat range of species creates both opportunities and challenges for habitat conservation banking. Opportunities such as many potential suppliers (private landowners) and consumers (federal agencies, energy companies, and developers) may facilitate negotiations and the establishment of a more competitive pricing mechanism for conservation credits (Kreuter et al., 2017). They showed that the development of habitat conservation banking markets that bridge state boundaries could create a more general market-oriented framework for the conservation of a broader suite of species that are under pressure (Kreuter et al., 2017). Gamarra and Toombs (2017) assessed 103 more banks than the previous analysis and found that information availability remains as a major limiting factor. On whether the habitat conservation banking mechanism is sufficient for endangered species protection, they claimed that the recovery of listed species remains elusive and that stakeholders and practitioners should seek to advance habitat conservation banking policy and practice.

In January 2017, USFWS (2017) published a policy to provide incentives for landowners to conserve candidate species, that are not listed under ESA. BenDor et al. (2017) analyzed the frequency and characteristics of pre-listing conservation of candidate species for which the USFWS has committed to making a listing determination by 2018. They found that, while habitat conservation banks could be established before a species is formally protected, entrepreneurs appear generally reluctant to make the necessary capital investments until species are designated as threatened or endangered. They concluded that bankers might face uncertainties and higher degree of risk in the demand for credits, especially over a large habitat range species. Fox and Nino-Murcia (2005) and Madsen et al. (2010) had similar findings.

Rea (2017) documented that in California, credits for endangered vernal pool fairy shrimp typically sell for $200,000 to $300,000 per acre; and in Florida, a county commission paid $1.9 million for 1500 Florida panther habitat units. Rea (2017) reported that in Florida ecological and economic conditions would support the development of habitat conservation banking and thus, there should be opportunities for bankers. Rea (2017) also found that some states have no habitat conservation banks. These findings show that the overlap between endangered species and land development brings opportunities for habitat conservation banking. As stated earlier, none of these previous studies has sought to model the demand and supply of credits.

3. Econometric model development

This paper assumes that habitat conservation credit markets are competitive. This is a strong assumption, given the relatively thin markets for habitat conservation credits. As of December 2016, there were 135 approved conservation banks. The majority of which were located in California and Florida. The transaction data (599 observations) used in this paper were from 43 different banks. While a small number of firms do own many banks and thus the credit market might have some oligopolistic characteristics this analysis assumes perfect competition at a starting point. The model could, in future research, be extended to include models of imperfect competition.

3.1. Conceptual framework

The crucial factors that affect the market for conservation credits are associated with the level of development/economic activities, price of the credit, cost of the credit production, land value, the availability of suitable habitat for the species in question, and the acreage of land included in the habitat conservation bank. We have categorized these important factors into two major groups: ecological and economic factors.

Ecological factors include the habitat and species type and the associated acres of land acquired for bank development. For example, about half of the presently known endangered species Florida Panther population in South Florida occurs on the private lands and needs a large amount of habitat especially in comparison to other range-limited organisms (Maehr, 1990). There is a relationship between the land area and the species it is designed to serve, with charismatic megafauna such as the Florida Panther requiring larger amounts of acreage. Thus, the production of credits associated with wide-ranging species requires significantly more land area and perhaps restoration investments.

Economic factors that influence habitat conservation bank development includes land ownerships, interest rates, development alternatives, and land value. The demand for credits can be taken as a function of development alternatives, relative return from self-mitigation projects compared to the cost of credits purchased from a bank, and any expectations of future permit requirements. On the other hand, the supply of conservation credits is influenced by the costs associated with credit production. These costs include startup costs (e.g. land acquisition, environmental restoration, ecological and economic assessments), annual operation costs, monitoring costs, and the opportunity cost of alternative land uses. The magnitude of these costs depends on the forgone opportunity cost from the time of initial establishment to final