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Where to drill? The petroleum industry's response to an endangered species listing☆

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ABSTRACT

This paper examines the effect of U.S. Endangered Species Act (ESA) regulations on oil and natural gas well drilling in Kansas and Oklahoma. In 2014 and 2015, petroleum companies faced land use restrictions when the imperiled lesser prairie chicken received threatened species-status under the ESA. In Kansas and Oklahoma, as elsewhere, the petroleum industry has been criticized for damaging environmental quality and developing wildlife habitat. Using data on well locations, I estimate a discrete choice model to measure the effects of ESA regulations on companies' location preferences. While the results show that habitat avoidance increased with regulatory scrutiny, the effect is very modest, which suggests that companies may have discounted the risk of penalties from ESA violations. Results also suggest that pre-listing announcements related to ESA regulations influenced companies' location choice.

1. Introduction

Prohibiting the destruction of threatened and endangered species habitat has made the Endangered Species Act of 1973 (ESA) a controversial law (Burke, 2004). Land use restrictions slow habitat loss, which is the biggest driver of extinction risks (Millennium Ecosystem Assessment, 2005), but they also place the burden of conservation on private landowners and industry. Individuals face civil and criminal penalties in the form of fines of up to $50,000 ($200,000 for corporations) and a year in prison per violation, with all items used to commit the crime seized and forfeited. This makes listing species under the ESA a contentious process, with environmental groups arguing that restrictions are necessary to prevent habitat loss, and landowners and industry arguing that the law violates property rights and hinders economic development.

Economists have long been interested in the debate over the ESA, given the important role behavior has in the success and failure of recovering endangered species. With the right incentives, landowners will protect and restore essential habitat (Langpap, 2004, 2006; Langpap and Kerkvliet, 2012; Langpap and Wu, 2004; Polasky et al., 2001). However, in practice penalties for ESA violations are known to create perverse incentives, in which landowners engage in preemptive habitat destruction to avoid ESA land use restrictions (List et al., 2006; Lueck and Michael, 2003; Zhang, 2004). Like landowners, companies also have a choice between avoidance/mitigation and development when faced with using land harboring an endangered species (Bošković and Nøstbakken, 2017; Eichman et al., 2010; Ferris, 2009; Greenstone and Gayer, 2009; Meyer, 1997; Zabel and Paterson, 2006). These issues have been and continue to be addressed in economic research. Although cost and benefits are not supposed to affect the ESA listing process, economic considerations have influenced amendments to the ESA, are implicit in recovery program funding decisions, and can determine the designation of critical habitat (Brown and Shogren, 1998; Fox and Adamowicz, 1997; Metrick and Weitzman, 1996). In other countries,

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economic research plays an overtly prominent role in the design of endangered species protections (Plantinga et al., 2014).

This study extends research on the economics of protecting endangered species by examining the response of petroleum companies to ESA regulations. In 2014, landowners and companies in western Kansas and Oklahoma became subject to ESA regulations when the lesser prairie chicken (LPC) was listed as a threatened species, meaning that it was likely to become endangered in the near future (Wietelman and Melstrom, 2017). While largely isolated and rural, LPC habitat overlays several major oil and natural gas fields. The petroleum industry was therefore critical of the listing and claimed that regulations would deter oil and gas development in the habitat region (Perry, 2014). This paper examines whether petroleum companies avoided locating wells in the habitat region due to regulations. The location decision is modeled as a discrete choice of a single well. I find the number of wells in protected habitat changed very little due to regulations, which means ESA regulations have generally not impeded energy development in the region as claimed by industry. I also find little evidence of significant preemptive habitat development; although this behavior may have occurred, it was not extensive in size or over time.

I focus on the effect of regulations on petroleum companies for two reasons. First, the LPC's population decline is attributed to habitat loss and fragmentation, most recently due to construction projects undertaken in the energy industry, which includes wind turbines and powerlines, but primarily oil and natural gas wells. The LPC's strong aversion to vertical structures, probably as an instinctual defense against perched predators, means that oil derricks, holding tanks and similar structures can damage large areas of suitable habitat. Emerging energy development prompted the Fish and Wildlife Service—the agency in charge of administering the ESA for terrestrial species—to issue a proposal to list the LPC as threatened in 2012 although the LPC had been a candidate for listing since 1995.

Second, the petroleum industry has indicated a willingness to engage in activities that aid the LPC and thus avoid a listing. In 2013, the Western Association of Fish and Wildlife Agencies (WAFWA) developed a rangewide conservation plan to help companies avoid essential habitat areas and offset habitat lost to development with new habitat brokered through landowner agreements (Van Pelt et al., 2013). Thus, LPC conservation policy emphasizes working with industry and changing land use behaviors. Although WAFWA's conservation program was developed in an effort to work with any company operating in LPC habitat, a large share of participants has come from the petroleum industry (Van Pelt et al., 2015). This is likely because, after agriculture, petroleum development is the most prominent economic activity in the region. Furthermore, some petroleum companies expected that their voluntary conservation efforts and support for WAFWA's conservation plan would help avoid a listing. This argument was made by the Permian Basin Petroleum Association in the suit it filed against the listing decision; this suit was successful, and in September 2015 the U.S. District Court of West Texas vacated the listing rule that had been in place since May 2014 (Wertz, 2015).

The paper is organized as follows. The next section presents the data, and in doing so provides an overview of petroleum development and LPC habitat in the study region. The third section examines graphical summaries of these data. The fourth section describes the location choice model. The fifth section presents and discusses the results. The final section concludes.

2. Data

This analysis draws primarily on two datasets. The first contains oil and natural gas wells recorded by the corporation commissions of Kansas and Oklahoma. I focus on these states because they contain the vast majority of LPC habitat.[1] Individual wells in both databases are identified by their American Petroleum Institute (API) number, lease name and ownership. Descriptive information includes the location, drilling start date, completion date, geological formation targeted and whether the well is producing oil, natural gas or both.[2] Location is described by Public Land Survey System (PLSS) coordinates, which subdivides land in western states by section, range and township. Using this system, locations are described by 6×6 mile townships, which are further subdivided into 1×1 mile sections. Petroleum companies typically identify leases based on PLSS descriptions. More detailed location information is provided by latitude-longitude coordinates for most but not all wells. Every section is identified by a township and range designation and a section number. I narrow the span of time to wells drilled between January 1990 and May 2016 to focus on drilling activities in the time the LPC has been a species of conservation concern.

The second dataset contains information about the distribution of LPC habitat. The Southern Great Plains Crucial Habitat Assessment Tool (SGP CHAT) is a publicly-available online mapping function that classifies habitat for use by industry, to encourage habitat avoidance and participation in WAFWA's conservation plan (Southern Great Plains Crucial Habitat Assessment Tool; Van Pelt et al., 2013). Habitat is heterogeneous and is classified by WAFWA as: focal habitat, suitable habitat (which includes habitat corridors between focal areas) and unsuitable habitat within a 10-mile buffer around the known occupied range. I follow WAFWA's definitions by including in the habitat region all land in the 10-mile buffer. Focal areas can be interpreted as pristine or near-pristine habitat that is a conservation priority. Fig. 1 illustrates the study region; the fragmentation of LPC habitat is obvious, with large gaps in the species' range in Kansas and Oklahoma, and a much larger gap between the Kansas/Oklahoma subpopulation from the Texas/New Mexico subpopulation.

The study area for our analysis consists of western Kansas and Oklahoma. Both states' corporation commissions subdivide their state into four administrative districts. I exclude the easternmost districts, which roughly corresponds to the area east of a line running through Wichita and Oklahoma City.[3] Oil and gas activities are more prevalent in the western half of both states and petroleum companies are unlikely to view locations in the east as substitutes for those in the west; furthermore, LPC habitat is located exclusively in the west. This nevertheless leaves a very sizable area with which to examine land use behavior, with nearly 100,000 sections divided among 112 counties. In this region, between January 1990 and May 2016 nearly 70,000 oil and gas wells were drilled. Due to the 2009–2014 energy price boom, recent years predominate in the data; around 24,000 wells were drilled between January 2010 and May 2016.

I constructed a set of county and section-level variables to describe location attributes that could influence petroleum activity. This includes annual county population density, gathered from the U.S. Census' population estimates program, to proxy the influence of residential and commercial development; the density of natural gas processing plants in a county, interacted with an indicator for whether the well is producing gas, or both oil and gas; and

[1] LPC habitat is also found in Colorado, New Mexico and Texas. Of these states, Texas contains the next largest share. However, as will be discussed further on in the paper, the unit of choice in the model is a 1-square mile section. These sections come from the Public Land Survey System, which is used by Oklahoma and Kansas but was never adopted by Texas. Including Texas wells and spatial locations would have added considerable time to this analysis without adding much additional insight into the effect of regulations.

[2] For records missing the date drilling started, I assume that drilling began three months prior to completion, which is the typical length of time it takes to complete a well. The sample excludes wells labeled as injection or "other" in order to focus on those drilled primarily for the purpose of extracting oil or natural gas.

[3] This includes District 3 in Kansas and Districts I and IV in Oklahoma.