



Research paper

Economic assessment of landowners' willingness to supply energy crops on marginal lands in the northeastern of the United States



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ABSTRACT

A major critique of large scale biomass production is the land competition between food and energy crops. A commonly suggested solution is to limit energy crop production to marginal lands. Physical marginality is often used when discussing marginal lands. However, as important is the socioeconomic marginality. This research fills this gap by evaluating willingness to supply bioenergy crops for landowners who have marginal lands. We conducted contingent valuation surveys at study sites with three model crops: switchgrass, miscanthus and willow. Random utility theory is applied to evaluate factors influencing decision maker's choice to plant energy crops. The results indicate that landowners who own marginal lands are more likely to plant energy crops and they require a lower willingness to accept price compared with landowners who do not have marginal lands. At the same time, we noticed that landowners are unfamiliar with these new crops. Economic concerns are the top reasons preventing them from planting energy crops.

1. Introduction

Government mandates for increasing biofuel production under the Energy Independence and Security Act of 2007 were set to take effect in the year 2008. These mandates aim to increase renewable biofuel production to 36 billion gallons (136.27 billion liter) by the year 2022 [1]. The increasing demand for biofuel has fueled research for sustainable biofuel feedstocks. First-generation energy crops, such as corn and soybeans produced from prime farmland, have typically been the focus. Currently, around 40% of annual corn production is used for biofuel production [2]. With concern over first-generation feedstocks replacing valuable food production, recent legislation has encouraged second-generation feedstocks by limiting renewable biofuel production from first-generation feedstock to 15 billion gallons (56.78 billion liter) [1]. Led by perennial grasses, such as switchgrass (*Panicum virgatum*), miscanthus (*Miscanthus x giganteus*) and woody crops, such as willow (*Salix spp.*), second-generation energy crops are currently being considered because of their environmental and social benefits in many regions of the U.S [3,4]. However, these crops grown at a large enough scale can also cause a conflict between food and fuel. Planting energy crops might come at the cost of food crops if croplands and pasture lands are converted to growing fuel [5,6]. A commonly suggested solution to this problem is to limit energy crop production to marginal lands [7]. Various reasons, such as generating additional revenue and

avoiding land competition, support this solution [8–11].

However, one of the key issues scarcely explored is landowners' willingness to convert their marginal lands to energy crop plantation [12,13]. Previous studies have analyzed landowners' land-use decisions, considering prices, landowners' characteristics, and environmental factors [14–19]. For example, Altman et al. [17] found that price is a very significant factor and leads to an increase in the willingness to supply. Joshi et al. [19] noticed that older landowners have lower motivation to supply biomass. There are also a growing number of studies analyzing landowner's willingness to supply energy crops on marginal lands. For example, Swinton et al. [20] and Skevas et al. [21] found that most landowners are not likely to rent out their marginal lands for energy crop plantations in the Great Lakes Region. However, these studies seldom explore the price at which landowners are willing [20,21] to supply energy crops on marginal lands versus productive lands. This information is important because they can reveal the degree to which "marginal lands" are likely to play a role in the provisioning of biomass and can also be used to evaluate potential economic and environmental impacts of biofuel on the landscape. Therefore, this study aims to fill this gap by assessing landowners' willingness and the likely payment required to supply energy crops on marginal lands. We conducted a landowner survey in three states in the northeastern United States to identify landowners' willingness to supply energy crops and to assess landowner attitudes and characteristics that may be associated

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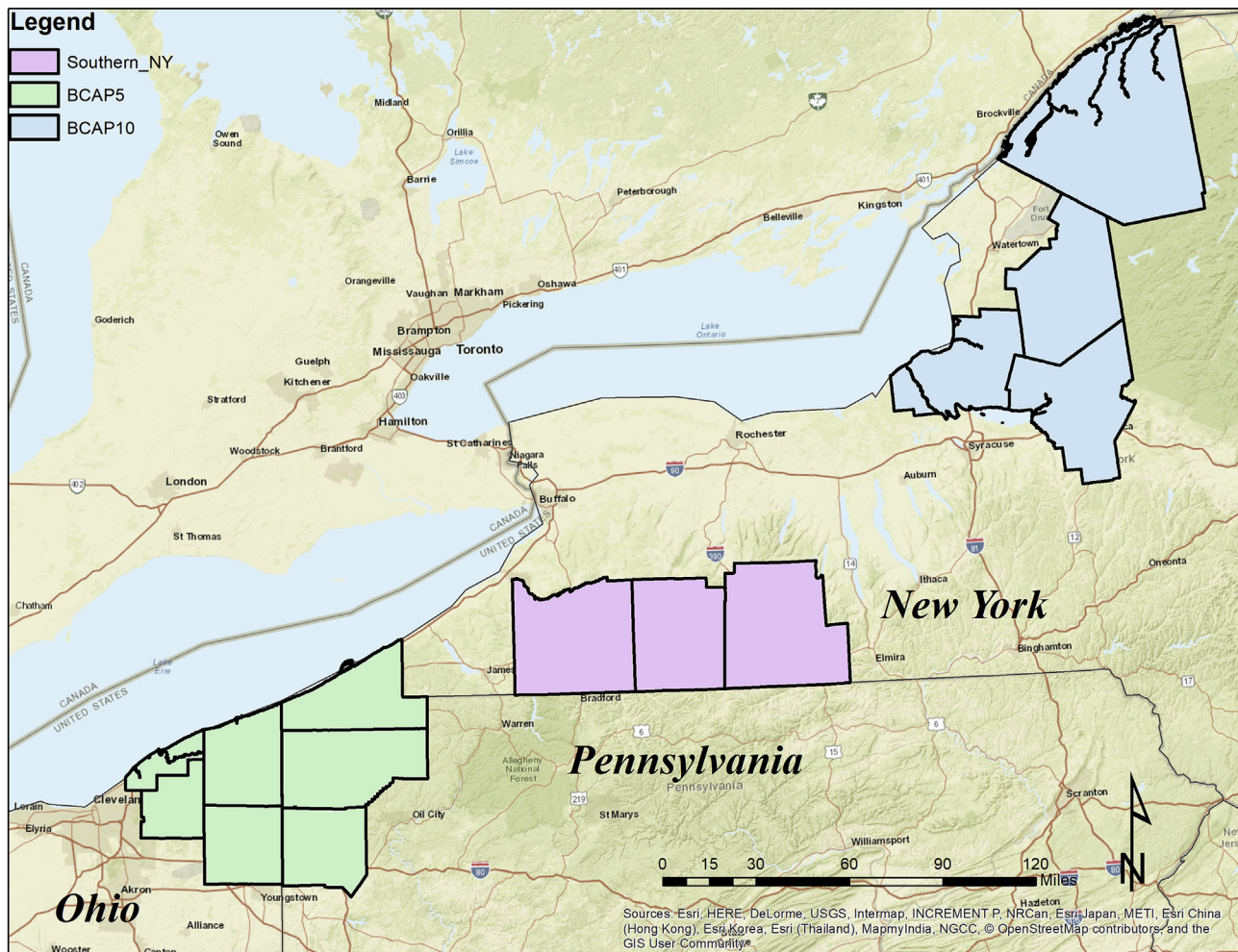


Fig. 1. Study site includes 14 counties. Green region represents BCAP5 area, including Erie, Crawford, Mercer, Lake, Geauga, Ashtabula and Trumbull counties. Blue region represents BCAP10 area, including St. Lawrence, Lewis, Oneida and Oswego counties. Pink region represents the Southern NY region, including: Allegany, Steuben and Cattaraugus counties. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

with willingness to supply.

The article is structured as follows: the second section describes the study area, sampling method, and survey design. The third section presents the conceptual model about land use decisions. The fourth section discusses empirical findings and the final section assesses the implications of our findings for stakeholders.

2. Study area and sampling method

2.1. Study area

Our study site includes 14 counties in Pennsylvania (PA), Ohio (OH), and New York (NY). These sites include two Biomass Crop Assistance Program (BCAP) areas: BCAP5, BCAP10 and one area in southern NY (Fig. 1). The BCAP project, created by the 2008 Farm Bill and reauthorized with modifications by the 2014 Farm Bill, is part of the national strategy to reduce U.S. reliance on foreign oil, improve domestic energy security, and reduce carbon pollution by developing more agricultural products made in rural America [22]. The 2014 Farm Bill allocates BCAP with an annual mandatory funding level of \$25 million through fiscal year 2018, representing around 0.005% of the planned farm bill budget [23].

BCAP5 includes seven counties on the boundary between PA and OH and currently supports the production of perennial miscanthus and switchgrass. BCAP10 includes four counties in NY and currently supports the production of shrub willow [22]. The third region is the

southern NY (SNY) area, which includes three counties.

Three factors make this area attractive for perennial-based energy crops. First, landowners from this area may be more familiar with and more willing to supply energy crops. The area has three local energy crop companies—Ernst Conservation Seeds, Aloterra, and Double A Willow. These companies have planted these three energy crops on over 3,642 ha across OH, PA and NY. The awareness of the companies' activities or even working with these crops may elevate landowners' willingness to supply energy crops. Second, financial subsidies from the BCAP program may be an external drive for landowners to plant energy crops [24]. BCAP provides two categories of financial assistance: (1) annual and establishment payments that share in the cost of establishing and maintaining production of eligible biomass crops; and (2) matching payments that share in the cost of the collection, harvest, storage, and transportation (CHST) of biomass to an eligible biomass conversion facility. These subsidies to some extent ease landowners' concerns about the high establishment and harvest logistics costs [25] and increase the chance of commercial energy crop production in this area. Third, this area is geographically suitable for energy crop growth. In most of the area, the annual precipitation varies between 760 mm and 1,520 mm and the average temperature ranges from 1.6 °C to 14.6 °C [28,29]. It is a suitable climate condition for energy crop growth [5,28,29]. Soils in this area are usually subject to seasonal saturation or near-saturation, but suitable to energy crop growth because these crops have a deeper and more extensive root system, and longer time windows for field operations [30]. In summary, government

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