THE CONCEPTUAL DISCUSSION OF ECONOMICALLY MARGINAL LANDS FOR PLANTING ENERGY CROPS

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ABSTRACT

A major critique of large scale biomass production is competition for land between food and energy crops. A commonly suggested solution is to limit energy crops production to marginal lands. Physical marginality (soil quality, slope and location) is often used when discussing marginal lands. However, as important is the economic marginality. This paper will first identify economically marginal lands by comparing break-even prices for energy crops and food crops and then turn to assess farmers’ willingness to plant energy crops on economically marginal lands by using discrete choice model. By combining economical margin with biophysical margin, we can provide a comprehensive map of marginal lands for food crops, and in so doing identify lands targeted for energy crops.

Keywords: Marginal lands, Bioenergy crops, Break-even price

1 INTRODUCTION

Increasing demand for bioenergy has fueled the research for the sustainable bioenergy feedstocks. Led by switchgrass (\textit{Panicum virgatum}), miscanthus (\textit{Miscanthus x giganteus}) and willow (\textit{Salix spp}), energy crops are currently at the center of considerable attentions and researches by taking advantages of fast growing, high yield and creating environmental benefits (Perlack & Stokes, 2011). Nevertheless, a commercial plantation of energy crops will intensify land competition with food crops (Field, Campbell, & Lobell, 2008) and place greater cost burden on farmers (Duffy & Nanhou, 2001; Volk et al., 2006).

A commonly suggested solution to these two problems is to limit the plantations to marginal lands (Bryngelsson & Lindgren, 2013), while the concept of marginal lands is not well addressed. Marginal lands are intuitively regarded as the lands with barren soil. Soil quality of marginal lands such as soil texture, soil drainage, have been deeply examined by the previous studies (Kang et al., 2013). Other biophysical factors, such as land cover, terrain and climate, also appear in different studies to define marginal lands. However, biophysical factors can only partially
interpret the word “marginal”. The all-sided assessment for the marginal lands should be conducted based on the method presented in figure 1:

Figure 1: Sustainable framework for marginal lands

This figure implies a sustainable and comprehensive view on defining marginal lands. The sustainable assessment for marginal lands will expand the research scope by involving socioeconomic factors, which means it will examine the human role in defining and utilizing marginal lands. Profit, cost, price are the socioeconomic factors contributing to the word “marginal” and, thus, need more attentions. The combined qualitative and quantitative analysis describes the feature of research method for marginal lands. The qualitative analysis aims to do a completed, detailed description. It hints that this analysis usually focus on the small but representative samples that contain rich information. On the other hand, the goal of quantitative analysis is to develop and apply mathematical or statistical models explaining phenomena from large samples. The combination of qualitative and quantitative analysis will present a clear picture of marginal lands with a detailed description and an accurate measurement.

However, most studies just focus on the qualitative and biophysical analysis (Gopalakrishnan, Cristina Negri, Snyder, & Negri, 2006; Tang, Xie, & Geng, 2010), ignoring the socioeconomic parts. Therefore, this study aims to define the economically marginal lands.

2 LITERATURE REVIEW

The history of defining marginal lands from socioeconomic perspective can be dated back to 1930s, when Peterson and Galbraith (1932) define marginal land as land at the extensive margin of production. That is the land where revenue from optimal production just equals the cost (profit equals to zero). In this paper, two features of marginal lands are highlighted. The first one is the “relative”, which means a site as being “marginal” for one crop can result in land being considered profitable for another crop. Thus, specifying minimum two crops (land uses) is prerequisite to examine marginal lands. The other one is “dynamic”, which means marginal lands are not necessarily as permanent. Any change in force governing peoples’ willingnesses to use land will
lead to a transition between “marginal lands” and “normal lands”. The old but not out-of-fashion idea is implemented by Swinton et al. (2011) and Bryngelsson et al. (2013). In Swanton’s study, two different land uses are specified at the beginning: biofuel crops vs. food crops. In addition, this paper also theoretically examines price’s effect on the transition of marginal lands. Brynegelsson et al. (2013) expand this research scope by examining the effects of other parameters such as cost on the changes of land rent.

3 METHODOLOGY

In this study, “economically marginal lands” are interpreted as lands which are marginal to food crops but not marginal to energy crops. Specifically speaking, it is the lands at the extensive margin of food crops but before the extensive margin of energy crops. Therefore, the key for identifying economically marginal lands is to determine the extensive margins (break-even points) for food crops and energy crops. Estimating the break-even points of these different crops using the following equation (Jain, Khanna, Erickson, & Huang, 2010):

\[ P_e \left( \sum_{t=0}^{T} \frac{Y_t}{(1+d)^t} \right) = \sum_{t=0}^{T} \frac{C_t}{(1+d)^t} \]

Where T is the life of the crop; \( C_t \) is the unit production cost of crop in period t; \( Y_t \) is yield in year t and d is the discount rate. Thus, the follow-up research will focus on the estimation of production costs and yields for energy crops and food crops given the incomplete information on prices of energy crops. The yields information will be obtained by running Cycles growth model and the cost information will be obtained from various literatures. The study sites will be across the northeastern region of the United States. The second part of this research will assess the social factors’ effects on the transition of marginal lands via a survey in the study sites. The objective of this study is to examine the marginal lands from a socioeconomics perspective and quantitatively identified economically marginal lands by doing profit analysis. It aims to answer two basic questions: what the economically marginal lands are and how many of the economically marginal lands are available. The answers to these questions will land the basis for further analysis on farmer’s willingness to supply energy crops from the economically marginal lands.

3 LITERATURE CITED


