Progress or Devastation? The Effects of Ethanol Plant Location on Local Land Use

Alan Turnquist

T. Randall Fortenbery

Jeremy Foltz

Department of Agricultural and Applied Economics, University of Wisconsin- Madison

Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27-29, 2008.

Introduction

Growth in biofuels production and corn ethanol in particular has received considerable attention in both the popular press and academic literature. Despite the attention, however, there appears little consensus relative to the balance of positive and negative impacts resulting from continued expansion of the domestic biofuels industry. Current sentiment ranges from arguments focused on the potential for energy independence and increased national security (Daschle 2007) to a perception that the entire biofuels movement is nothing more than a "scam" (Grunwald 2008), and an attempt to subsidize both production agriculture and large agribusiness.

The lack of consensus concerning actual impacts of biofuels production encompasses assessments at the global, national, and local levels. At the global level, for example, recent debate has centered on the impacts increased corn-based ethanol production will have on global land use, environmental quality, and world food prices (Searchinger et al. 2008; Fargione et al. 2008; Runge and Senaur 2007). Debate at the national level also focuses on commodity price impacts and environmental issues (Jackson 2007), but encompasses impacts on domestic cropping strategies and national land prices as well (Hovey 2007; Hicks and Perkins 2008). At the local level the debate often centers on the expected community impacts of a specific plant. Again, this includes environmental impacts, but also job creation, estimation of income multipliers, and impacts on both agricultural and residential land values (Fortenbery 2005; Fortenbery and Deller 2008; Swensen 2005; Hoyer and Saewitz 2007). In addition some have claimed that corn ethanol plants, especially when locally owned, promise to enrich local farmers and revitalize rural communities where they are located (Morris 2006). To some degree, these claims have been substantiated by peer reviewed literature that have shown positive economic impacts associated with ethanol plant siting (Fortenbery and Deller 2008; McNew and Griffith

2005; Olson, et al. 2007). However, none of the empirical research has directly addressed the actual impact on real estate prices (seemingly, increased commodity price effects would increase the value of agricultural land in proximity to the ethanol facilities, but the impact on residential land is less clear), nor attempted to value any environmental externalities (positive or negative) that might occur.

Thus, current work provides some measure of a subset of impacts that are expected to occur, but does not address another subset of apprehensions concerning the localized effects that do not contribute directly to job creation or income growth. In Wisconsin, for example, local citizen groups have voiced concerns over quality of life degradation resulting from air, water, noise, and light pollution (Eg. Cambrians for Thoughtful Development; Menomonie Area Concerned Citizens; Stop the Ethanol Plant). In addition, groups have claimed that such externalities translate into lower property values (Cambrians for Thoughtful Development, *citing* Chay and Greenstone 2005). Further, this argument is not unique to Wisconsin. In 2007, a consulting firm hired by the City of Portsmouth, Virginia concluded that the construction of a 216 million gallon per year ethanol plant in nearby Chesapeake, Virginia would result in a decline in housing values of between 8 and 46 percent within two miles of the plant site (Hoyer and Saewitz 2007). Unfortunately, however, the methodology used has not been made public. The study does indicate that results were based on property values experienced in a few Texas communities where ethanol plants were built, but the communities are not identified and a thorough search of the literature does not reveal any publically available, peer reviewed assessments of real estate impacts, either in Texas or anywhere else. The result is a less than clear understanding of the likelihood that the projected impacts will actually be realized.

Objectives

The objective of the research here is to more carefully investigate the claims of localized impacts on two fronts. The first is the impact a local ethanol plant has on the rate of agricultural land conversion to other uses (if an ethanol plant increases the value of local agricultural land as a result of increased commodity prices, one might expect a slower rate of conversion relative to other communities). Second, we investigate whether the siting of an ethanol plant has had a negative impact on local residential land values.

We address the first issue by asking whether agricultural land use trends are different in areas where agricultural production contributes to an ethanol plant's feedstock source compared to areas that are outside the purchase range of an ethanol plant. To address the second issue we compare residential land values in municipalities that host ethanol facilities with municipalities that do not have such facilities and evaluate whether ethanol plants contribute to lower residential values. In both cases we rely on market data, and attempt to measure actual experience rather than project what is likely to happen based on various assumptions of market performance. The intent is to provide a more complete understanding of the local impacts experienced by communities hosting ethanol plants, and replace some of the conjecture in the current debate with measured results.

The paper proceeds with a brief review of literature related to measurement of land values and land value changes. Next we provide a description of our specific data and findings, and finally we discuss our results followed by a short conclusions section.

Literature

There is a rich literature on measuring the effects of industrial sites on neighboring property values. There are several potential negatives associated with industrial development, including noise, air, and water pollution that may have a negative impact on local residential property values. Saphores and Aguilar-Benitez (2005) examined industrial development impacts in southern California and found that industrial odors can negatively affect local housing values by up to 3.4 percent. Similarly, Anstine (2003), using hedonics, showed that noticeable pollution – such as sound or odor – negatively impacts housing values in rural locations. Anstine found that less noticeable disamenities associated with manufacturing or industrial facilities may not affect property values in the way that more obvious ones do. This finding is bolstered by research indicating that information on health and environmental effects of some pollution streams is hard to come by, and thus cannot be readily incorporated into consumer choices on housing location (and thus price) (Kohlhase 1991; Kask and Mani 1992).

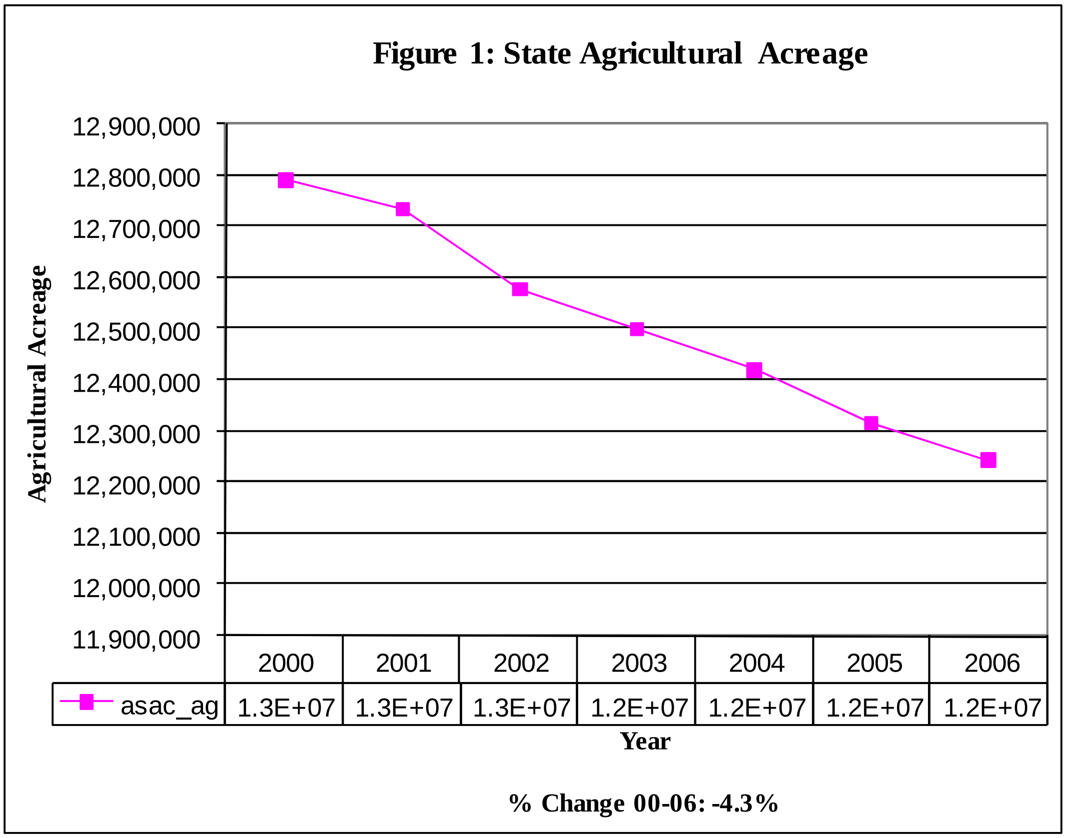
Construction of ethanol plants typically increases both truck traffic for feedstock inputs and train traffic to deliver the finished product to market in the communities where they locate. This may appreciably increase the noise, pollution, and safety related externalities in the community, which in turn may result in a downward push on property values. Hedonic studies have shown that rail and highway development have a negative effect on neighboring property values (Cervero 2004). Further, a Norway study found that noise from railroad traffic decreased both the sales price and the appraised value of homes within 100 meters of the track (Strand and Vagnes 2001). These negative impacts are especially evident when the transportation corridor in question does not create additional benefits to proximate landowners via improved accessibility to the existing transportation infrastructure (Kilpatrick, et al. 2007). Moreover, research suggests that downward pressure on property values due to transportation corridors may be particularly acute in rural areas where the baseline noise and pollution levels are initially minimal (Cervero

2004). This could be a particularly relevant concern with ethanol plants given the propensity to locate in rural communities.

In general, previous work focused on the real estate impacts of industrial development and transportation corridors is consistent with concerns expressed by opponents of ethanol plant sitings. Thus, concern by local groups that ethanol plants will create local disamenities that in turn affect property values may be valid. On the other hand, some of the positive impacts identified in earlier work on ethanol plants (positive employment impacts, for example) may mitigate some of the negative impacts realized with other type manufacturing facilities, especially if the ethanol plant represents a sizeable increase in economic activity and /or employment. This leaves the question: are the negative effects previously found with the development of manufacturing facilities present in rural Wisconsin communities with ethanol facilities, or do potentially positive effects such as job creation and improved services and infrastructure balance off the potential negatives?

Background

Agricultural land is on the decline across Wisconsin. As figure 1 indicates, between 2000 and 2006, the state converted 4.3 percent (551,000 acres) of its farmland to other uses. During that same time, developed acres (residential, manufacturing, and commercial lands) increased by over 260,000 acres. While that development growth is substantial, and has certainly contributed to agricultural and forest land conversion, it accounts for less than half of the loss of agricultural land. Much of the remaining loss in agricultural land during that time went to what the Wisconsin Department of Revenue refers to as "undeveloped lands."



Research conducted by the Program on Agricultural Technology Studies at the University of Wisconsin – Madison has shown that much of the growth in the undeveloped land category is due to previously farmed land going out of agricultural production but not into commercial development. This indicates that there are factors other than development pressure that are driving agricultural land conversion. The fallowing of land also implies that much of the agricultural land losses of the past five years are not irreversible, as the fallowed lands remain available for future production.

Ethanol Production in Wisconsin

There are currently eight operating corn ethanol operations in Wisconsin (Renewable Fuels Association). For this analysis, we relied upon the most recent tax assessment data, which runs through 2006-2007, and so our sample is limited to the four plants that were in operation in

2006. As table 1 shows, those four plants, if operated at total capacity, would produce 200 million gallons of ethanol per year. Assuming a rate of 2.8 gallons of ethanol per bushel of corn, operating at full production capacity would require 71 million bushels of corn per year. Given the recent average state yield of 143 bushels per acre, that equates to approximately 500,000 acres of corn, or 18 percent of the 2.8 million acres of corn harvested in the state (WASS).

Table 1: Wisconsin Ethanol Plants (Operating)

Plant	Location	Date Production Began	Gallons/year (millions)	Bushels/year(millions)
ACE Ethanol	Stanley	Jun-02	42	15.00
Badger State Ethanol	Monroe	Oct-02	55	19.64
Utica Energy	Oshkosh	Apr-03	52	18.57
United Wisconsin Grain Producers	Friesland	Apr-05	51	18.21
Western Wisconsin Energy	Boyceville	Sep-06	52	18.57
United Ethanol	Milton	Mar-07	40	14.29
Central Wisconsin Alcohol	Plover	?	4	1.43
Renew Energy	Jefferson	Nov-07	130	46.43
Castle Rock Renewable Fuels	Necedah	Feb-08	50	17.86

Data

The data that used to measure land use and land value impacts is the annual tax assessment data from the Wisconsin Department of Revenue (WisDOR). Our data set contains information on acreage and assessed values of various land use types at the municipal level from 2000 to 2006. This data set allows for an analysis of agricultural acreages and residential land values in individual municipalities over time. One limitation is that the assessed value data for agricultural land is based on use-value assessment, and not on market value. Because the formula for calculating use value for taxation purposes underwent changes between 2000 and 2006, it cannot be used to analyze agricultural land value (production or market based) in this study.

Methodology

To investigate the effects of corn ethanol production facilities on local land use and land values, we located the facilities by geographical coordinates and created zones of two, ten, twenty-five, and fifty miles around each plant. We then assigned a distance field to each Wisconsin municipality depending on where its center point fell. If that point fell within a given (linear) distance of one or more of the four facilities, then we assume the entire municipality to fall within that zone. Plants are not linked to municipalities until the year that they began ethanol production.

Table 2 shows the frequency of observations for municipalities within each spatial zone in 2006. Less than one-half of one percent of all municipalities are within two miles of an ethanol plant. That percentage grows considerably as the zones increase. At fifty miles, our simulated feedstock zone encompasses nearly half (47 percent) of all Wisconsin municipalities.

Table 2: Distribution of Municipalities Across Zones

Zone	Frequency (percent of municipalities)
2-Mile	7 (0.4%)
10-Mile	49 (2.6%)
25-Mile	258 (13.6%)
50-Mile	894 (47.0%)
Rest of State	1009 (53.0%)

Results

Table 3 summarizes the average changes in land use within different geographic zones between 2000 and 2006. There are four distance zones (2, 10, 25, and 50 miles) demarking varying degrees of proximity to one of the operating ethanol plants. Additionally, table 3 includes data for those municipalities outside of the fifty mile zone, and for the state as a whole. On average, population and residential acreage grew at a faster rate in the vicinity of the ethanol facilities than in the rest of the state.[1] With the exception of the fifty mile zone, the average value of residential land increased more slowly in proximity to ethanol facilities than in areas outside of the feedstock zones. In municipalities immediately surrounding the ethanol facilities, where one would expect the largest potential negative impact, residential land increased by nearly 50 percent over the six year period, compared to an 80 percent change in the rest of the state. While that difference appears to be fairly large, a standard t-test shows that the difference is not significant at the five percent level.

Table 3: Summary Information for Zones Surrounding Ethanol Facilities: Changes from 2000 - 2006

Zone	% Change Population	%Change Agricultural Acreage	% Change Undeveloped Acreage	% Change Residential Acreage	% Change Residential Land Value
2-Mile	10.7	-3.3	-4.1	24.1	49.7
10-Mile	6.0	-4.1	17.1	31.1	37.5
25-Mile	5.1	-4.2	16.7	17.5	70.5
50-Mile	6.5	-4.4	19.4	19.6	85
Rest of State	3.6	-4.2	16.6	14.4	80.2
Entire State	**4.7**	**-4.3**	**18.0**	**16.2**	**82.2**

Change in agricultural acreage was much more comparable across zones than was residential value. In most cases, the average changes in acreages were between 4.1 and 4.4 percent. The only exception was that the mean percent change in agricultural acreage in the

[1] Population change is especially high in the 2 mile zone. Importantly, a large prison complex was completed in one of these municipalities, and may explain much of this population growth.

areas immediately surrounding ethanol facilities showed somewhat slower declines in agricultural acreage (3.3 percent). However, a t-test shows that none of these differences are statistically significant at the five percent level.

Conclusions

A preliminary examination of the market data indicates that Wisconsin ethanol facilities have not had dramatic effects – positive or negative – on residential land values or agricultural land conversion in their proximity. In terms of effects on residential land values, it appears that municipalities surrounding ethanol production facilities have experienced neither the progress nor the devastation that some studies or interest groups have thought possible. Our data indicate that, in every case, municipalities within two miles of ethanol production facilities have experienced continued growth in residential land values after the facility began production. While the increase in value is, on average, less than that of municipalities beyond the two-mile zones, the variability of experience among municipalities renders these differences statistically insignificant. These results suggests that, though there may be some winners and losers within these municipalities, any significant positive or negative effects of ethanol facilities on residential land values are offsetting at the municipal-level.

Agricultural land conversion also appears to be unaffected by proximity to ethanol production facilities. Between 2000 and 2006, agricultural acreage declined in the primary feedstock zones of existing ethanol plants at a rate nearly identical to that of areas outside of those zones. This indicates that the moderate, positive, localized, commodity price effects found in previous studies are not so large as to influence the most primary of choices: to farm or not to farm. It also suggests that, if ethanol is helping farmers proximate to the facilities, then that effect is not discernible from how it affects farmers on lands not serving as a primary feedstock zone.

While this analysis provides a first pass at understanding the effects of corn ethanol production facilities on agricultural land conversion and residential land values, a more detailed analysis is needed to tease out more subtle effects. This would likely include a complete statistical analysis that attempts to explain land use and land value determinants across space and time. Additionally, examining more localized (sub-municipal) effects on residential land value would be useful to determine winners and losers, as previous studies on industrial externalities show significant differences in effects in as little as one-hundred yards. Finally, a greater focus on agricultural land sales and values could help to reveal other potential impacts of corn ethanol production on local farmers.

References

Anstine, J. 2003. “Property values in a low populated area when dual noxious facilities are present.” *Growth and Change* 34: 345-58.

Cambrians for Thoughtful Development. http://homepage.mac.com/oscura/ctd/ctd.html. Last visited, April 14, 2008.

Cervero, R. 2004. “Effects of Light and Commuter Rail Transit on Land Prices: Experiences in San Diego County.” *Journal of the Transportation Research Forum* 43: 121-138.

Chay, K.Y. and M. Greenstone. 2005. “Does Air Quality Matter? Evidence from the Housing Market.” *The Journal of Political Economy* 113: 376-424.

Daschle, T. 2007. “Food for Fuel?; Debating the Tradeoffs of Corn-Based Ethanol.” *Foreign Affairs* 86: 157-162.

Fargione, J., J. Hill, D. Tilman, S. Polasky, P. Hawthorne. 2008. “Land Clearing and the Biofuel Carbon Debt.” *Science* 319: 1235-1238.

Foltz, J. and A. Turnquist. 2006. “Working Lands in Wisconsin: Current Trends and Future Policies.” PATS Research Report no. 18. Available at: http://www.pats.wisc.edu/

Fortenbery, T. R. 2005. “Biodiesel Feasibility Study: An Evaluation of Biodiesel Feasibility in Wisconsin,” Department of Agricultural and Applied Economics, UW-Madison, Staff paper No. 481. Available at: http://www.aae.wisc.edu.

Fortenbery, T. R. and S. Deller. 2008. “Understanding Community Impacts: A Tool for Evaluating Economic Impacts from Local Bio-Fuels Production.” *Journal of Extension*, forthcoming.

Grunwald, M.. “The Clean Energy Scam.” *Time*, 27 March 2008.

Hicks, L. and J. Perkins. “Farmland More Valuable than Ever; Demand for Ethanol, Exports

Drive up Prices." *USA Today*, 5 February 2008, A1.

Hovey, A. "Ethanol Spurs Rising Land Values." *Lincoln Journal Star*, 22 March 2007, 1.

Hoyer, M. and M. Saewitz. "Study Denounces Project's Impact." *Virginia-Pilot*, 20 November 2007.

Jackson, H. C. "Corn Boom Threatens to Grow Gulf 'Dead Zone.'" *Madison Capital Times*, 19 December 2007, A 13.

Kask, S.B., and S.A. Maani. 1992. "Uncertainty, information and hedonic pricing." *Land Economics* 68: 170-184.

Kilpatrick, J.A., R.L. Throupe, J.L. Carruthers, and A. Krause. 2007. "The Impact of Transit Corridors on Residential Property Values." *The Journal of Real Estate Research* 29: 303-320.

Kohlhase, J.E. 1991. "The Impact of Toxic Waste Sites on Housing Values." *Journal of Urban Economics* 30: 1-26.

McNew, K., and D. Griffith. 2005. "Measuring the impact of ethanol plants on local grain prices." *Review of Agricultural Economics* 27: 164-180.

Menomonie Area Concerned Citizens. www.menomoniecitizens.org (15 April 2008).

Morris, D. "The New Ethanol Future Demands a New Public Policy." 21 June 2006. Available at : http://www.ilsr.org/columns/2006/ethanolfuture.pdf

Olson, A., N. Klein, and G. Taylor. "The Impact of Increased Ethanol Production on Corn Basis in South Dakota." Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Portland, OR, July 29 - August 1, 2007.

Renewable Fuels Association. http://www.ethanolrfa.org/ (23 April 2008).

Runge, F. C. and B. Senaur. 2007. "How Biofuels Could Starve the Poor." *Foreign*

Affairs 86: 41.

Searchinger, T. R. Heimlich, R.A. Houghton, F. Dong, A. Elobeid, J. Fabiosa, S. Tokgoz, D. Hayes, and T. Yu. 2008. "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change." *Science* 319: 1238 – 1240.

Stop the Ethanol Plant. Town of Elba opposition to ethanol. http://www.powerweb.net/heisey/ (15 April 2008).

Saphores, J., and I. Aguilar-Benitez. 2005. "Smelly Local Polluters and Residential Property Values: A Hedonic Analysis of Four Orange County (California) Cities. *Estudios Economicos* 20: 197-218.

Strand, J., and M. Vagnes. 2001. "The Relationship Between Property Values and Railroad Proximity: a Study Based on Hedonic Prices and Real Estate Brokers' Appraisals." *Transportation* 28: 137-156

Swensen, D. 2005. "Model Economic Analysis: An Economic Impact Assessment of an Ethanol Facility in Iowa." Department of Economics, Iowa State University. Available at: http://www.econ.iastate.edu/research/webpapers.

WASS (Wisconsin Agricultural Statistics Service). http://www.nass.usda.gov/Statistics_by_State/Wisconsin/index.asp (23 April 2008).