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Limitations of Agricultural Land Use Planning Tools in Rural Wisconsin

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ABSTRACT

Recent opinion polls suggest that farmland preservation is one of the most widely shared goals for local land use planning in Wisconsin. Although the state has long been a leader in the use of tax and zoning policy tools to protect agricultural lands from residential or commercial development, continued high rates of farmland loss have cast doubt on their effectiveness.

This paper critically examines statistical evidence for the effectiveness of farmland tax credit and exclusive agricultural zoning policies in Wisconsin. Using data collected at the township level (the local unit of land use decision-making in most counties), and controlling for the influence of other factors, the findings suggest that tax credits and zoning have had very limited success at mediating spatial patterns of farmland loss. Evidence from case studies of town government decision-making is then used to help explain why traditional land use policies have been unimpressive. Among the findings is the fact that local communities often fail to embrace or rigorously enforce land use plans or zoning districts.

INTRODUCTION

Because of the state's traditionally rural landscape and agricultural economy, protecting farmland and farmers have been widely shared goals for local and regional land use planning in Wisconsin. Recent statewide surveys found that two out of three state residents believe that it is "very important" to preserve farmland and roughly half think that "preserving farmland is so important that the requirements and restrictions cannot be too high and must be put in place regardless of cost" (On Common Ground, 1999). Even amongst farmers – often thought to be less supportive of land use policies – clear majorities support the idea that "local govern-

ments should restrict nonfarm development in important agricultural areas" (Jackson-Smith, 2000).

As a result of this longstanding public support, the state has been a leader in the use of tax and planning/zoning policies designed to protect rural and agricultural resources. As early as the 1930s, Wisconsin pioneered the use of planning and zoning as tools to protect forests and water resources in its rural areas. More recently, the state Farmland Preservation Program, adopted in 1977, became a model for many other state efforts to link tax relief for farmers with incentives for local land use and conservation planning (Emelock, 1989; Barrows and Yanggen, 1978; Stokes et al., 1997).

Despite several decades of policy implementation, however, annual rates of farmland loss in Wisconsin have continued at relatively high levels and critics have cast doubt on the effectiveness and wisdom of our public farmland preservation programs. Recent legislative proposals have ranged from the reform or complete elimination of traditional farmland preservation programs (tax-relief and planning and zoning laws) to efforts to create funds to allow the public purchase of development rights from agricultural landowners.

This paper begins with a brief summary of the “farmland loss problem” in Wisconsin. It then provides an overview of Wisconsin’s main farmland preservation policies, and critically examines the theoretical and practical arguments for their success or failure. Next, using sub-county data on farmland losses during the 1990s, a statistical model is estimated to quantify the net impact of tax-relief and zoning policies on the rate of farmland loss at the local level. The paper concludes with a critical assessment of agricultural land use policy as implemented in Wisconsin, and discusses the potential value of innovative approaches to rural planning and zoning.

FARMLAND LOSS IN WISCONSIN

Wisconsin has long been one of the nation’s most important agricultural states. It currently ranks in the top 10 in the number of commercial scale farms, production of milk, acres of corn and hay, and net cash income from farming (USDA, 1999). Recent economic studies suggest that the roughly three billion dollars of cash receipts received by dairy farmers for the sale of milk contribute another 14 billion dollars in state economic activity from farmer input purchases and the processing of milk into cheese and other dairy products (Deller et al., 1994).

Despite the continued importance of agriculture to its economy and rural communities, Wisconsin’s farm sector has been in a state of decline since the early 1980s. Between 1982 and 1997 overall farm numbers have fallen by 20 percent, and the number of dairy farms has fallen by almost half (Buttel, 1999). While declines in farm numbers have been a long-term historical trend in the state, increases in productivity and expansion among the remaining farms are no longer adequate

to compensate for these losses. As a result, the value of total gross farm sales (adjusted for inflation), volume of milk production, and acres used for farming have all either stagnated or declined over the last 15-20 years (USDA, 1999; Jackson-Smith, 1996).

Meanwhile, during the 1990s there has been a steady and almost unprecedented period of economic growth and prosperity in Wisconsin’s non-farm sector. Real wages and personal income have increased, unemployment rates are among the nation’s lowest, and population and housing growth have been particularly high surrounding many of the state’s urban centers (WDOC, 1998).

The combination of a depressed farm economy and a vibrant nonfarm sector have placed pressure on landowners to convert farmland to other uses. Although most observers agree that there has been a significant decline in the amount of Wisconsin land used for farming, precise estimates of the magnitude of that decline differ somewhat. Table 1 presents a number of different estimates of the acres of farmland in Wisconsin for selected years between 1978 and 1997.

It is worth noting that the amount of farmland reported in the periodic Census of Agriculture includes a considerable amount of land on which crops were not harvested (roughly 42-43 percent of the total). Much of this land consists of woodland or permanent pastureland that is interspersed within a diversified farm operation. Hence, while annual farmland losses reported in the Census ranged from 125,000-229,000 acres per year, losses of *harvested cropland* – the kind of land that springs to mind when most people imagine the process of farmland conversion – were in the 44,000-106,000 acres per year range (USDA, 1999). Using different methods, the Wisconsin Agricultural Statistics Service consistently reports somewhat higher total farmland acreages for the state than does the Census (WASS, 1999).

Meanwhile, a third estimate in Table 1 is the total acreage in Wisconsin that is determined by local property tax assessors to be in agricultural use. As will be discussed below, because it is available at the town level, this is the indicator of farmland acreage that we will be using in our analysis below¹. While the point estimates reported here reflect slightly lower total acreages than either the Census or WASS figures, it is significant that the

TABLE 1: Estimated Acres of Farmland In Wisconsin, 1978-1997

	Farmland (Census) ¹	Harvested Cropland (Census) ²	Farmland (WASS) ³	Land Taxed as Farmland (WI-DOR) ⁴
Acres of Farmland				
1978	17,838,982	10,062,154	18,800,000	<i>n.a.</i>
1982	17,234,127	9,863,051	18,500,000	<i>n.a.</i>
1987	16,606,567	9,335,007	17,700,000	15,289,791
1992	15,463,551	8,843,649	17,300,000	14,809,872
1997	14,900,205	8,625,011	16,800,000	14,167,746
Annualized Net Loss				
1978-1982	-151,214	-49,776	-75,000	<i>n.a.</i>
1982-1987	-125,512	-105,609	-160,000	<i>n.a.</i>
1987-1992	-228,603	-98,272	-80,000	-95,983
1992-1997	-112,669	-43,728	-100,000	-128,425

NOTES:¹ Census of Agriculture, various years. Includes all farmland operated.

² Census of Agriculture, various years. Includes only harvested cropland acres.

³ Wisconsin Agricultural Statistics Service estimates, various years.

⁴ Wisconsin Department of Revenue Statistics.

estimated annual losses are quite close in magnitude to those reported by WASS.

Overall, there has been a growing public concern that Wisconsin is at risk of permanently losing some of its best agricultural soils to pressure from both urban sprawl and rural recreational land development. These discussions have been highlighted by the release of a recent national study by the American Farmland Trust that identified the southeastern quarter of the state as the third most threatened agricultural area in the country (Sorenson et al., 1997).

PROGRAMS TO SLOW FARMLAND LOSS IN WISCONSIN

Since the 1970s, Wisconsin has had a strong reputation as a national leader in programs designed to protect farmland (Daniels and Bowers, 1997). The state initially adopted a comprehensive Farmland Preservation Program in 1977, which consisted of two basic approaches to provide incentives for protecting prime agricultural soils from nonfarm development (Barrows and Yanggen, 1978). The first approach provided direct tax relief to farmers. This was done through an income tax credit program

that offered direct credits on state income taxes to farmers who agreed to enroll their farmland in the state program. Enrollment entailed agreeing to refrain from selling or converting the land for nonfarm purposes, and payments were made on a sliding scale (depending on total household income) and were only available to farmers who had a gross farm income above a particular threshold. Penalties for pulling land out of the program included paybacks of all tax credits received on the parcels affected, plus interest on the money for the period payments were accepted. In addition to the acres formally enrolled in FPP contracts, all owners of agricultural land with any reported farm income were allowed to claim income tax credits up to 10 percent of their property taxes paid in the same year (up to a fixed limit)².

Along with the tax credits, the state FPP also provided incentives to local governments to adopt agricultural land use plans and exclusive agricultural zoning (EAZ) ordinances (Runde, 1999). The general idea was to begin a process of more general land use planning in rural places, with a particular emphasis on identifying important agricultural resource areas and protecting them from future development. In order to qualify for the tax credits, farmers had to live in a county that had an agricultural land use plan. By the early 1980s, almost every county had adopted a plan that met the standards of the statute (Emelock, 1989). In addition, to receive full credits under the tax relief provisions, farmers had to live in a town which had adopted an exclusive agricultural zoning ordinance (or at least recognized and functioned under a county EAZ ordinance).

Many town governments now have adopted land use plans (Ohm and Schmidtke, 1999) and EAZ ordinances. Our review of state records suggest just that almost 70 percent of towns now operate under some type of general zoning ordinance, over 40 percent of towns enforce specific EAZ ordinances. The most active towns have periodically revised their land use plans and ordinances to conform to shifting community priorities and concerns. Others still operate under the terms of their original plans, most of which were adopted between 1979 and 1981.

Evaluating Wisconsin's Farmland Preservation Policies

It is worth noting that maintenance of agriculture – particularly commercial scale farms – is typically a central goal of most town land use plans in Wisconsin. However, attendance at any town board meeting quickly reveals an interesting irony of local land use decision-making. In most public forums, it is often the nonfarm residents (many of whom had recently moved to their rural homes) that are the most ardent supporters of policies discouraging farmland conversion, while the older farmers who attend such meetings frequently seek to preserve their rights to sell their lands however they see fit as they plan for their own retirements. The debate between these parties is also made more frustrating by the fact that there is considerable uncertainty about whether or not the policies or incremental land use decisions made by town governments have any substantive impact on the overall trends in farming and farmland conversion.

This should not be too surprising when one realizes that despite decades of policy innovation and the adoption of some forms of farmland preservation program in most states and regions of the United States during the 1970s and 1980s, we still know relatively little about the effectiveness of different policy tools in practice (Daniels, 1990). One of the primary problems has been the absence of data collection mechanisms that would allow a careful assessment of policy impacts across localities or regions, controlling for the influence other background factors (Coughlin, 1991; Barrows and Trout, 1989; Bushwick, 1989; Hiemstra and Bushwick, 1989). Moreover, because of limitations in publicly available data, most of the empirical research literature has focused on relatively large geographic units – either cross-country comparisons (Alterman, 1997), states (Daniels and Nelson, 1986), multi-county regions (Kline and Alig, 1999), and individual counties (Heimlich and Krupa, 1994; Vesterby et al., 1991). Because the farmland conversion rates (and the underlying conditions that contribute to conversion) can vary quite widely within a geographic unit as small as most counties, it is difficult to attribute firm causal relationships from the results of these studies. Moreover, because local land use policy is often implemented by local governments – either counties or sub-county juris-

dictions, like cities, villages, and townships – it is likely that the impact of state programs will be quite variable across the landscape depending on how they are implemented.

In the absence of authoritative empirical studies, it is worth outlining the theoretical strengths and weaknesses of Wisconsin's tax-relief and zoning policies. Tax relief programs, for example, are representative of a broader category of *income supplementation* policies that seek to increase the financial viability of current farms as a means of supporting agriculture and protecting farmland. By putting more money in the hands of agricultural producers, it is argued, we can keep farmers on the land longer and decrease incentives to sell land to nonfarm developers.

This general approach has long been critiqued by land economists who have argued that tax relief or other types of direct income supplementation offer only short-term benefits to the farm sector. In the short run, while lower taxes can increase the income-earning potential of farmland (by reducing the holding cost of owning land), under competitive market conditions it is likely that the market value of farmland will rise as farmers and other land users become willing to pay more for a given acre of land (Anderson, 1989). Moreover, as farmland changes hands, much of the financial windfall received by the original owners is likely to be capitalized into the underlying value of the land. Future generations of farmers are thus less likely to be better off from a farm financial standpoint (Henneberry and Barrows, 1990). Additionally, since the cost of owning land is decreased under a tax-credit program, it can be argued that some land speculators will find it more attractive to buy and hold farmland pending future development.

Wisconsin's Farmland Preservation Program Tax Credit program has been specifically criticized on a number of grounds. Initially, to gain political support for the program, farmers in every county across the state were made eligible for tax relief, spreading a limited total amount of public investment across a relatively large number of potential recipients. This lack of targeting makes fewer dollars available in the regions where the threats to agricultural land are greatest. More importantly, the original per acre tax relief benefits have not been indexed to inflation, such that the value of the credit is increasingly small relative to the financial rewards

gained from selling the land for development. Indeed, in most of the urbanizing and near-urban counties in Wisconsin the net benefits of converting farmland to nonfarm uses may exceed the annual value of the FPP credit by ten to twenty times or more. Finally, although there are provisions in the FPP tax credit law that require landowners to repay the state for the value of tax credits they had received if they remove their land from the program, a number of factors – including a lack of enforcement staff, poor interjurisdictional coordination, and ambivalent views towards the program among state legislators – have prevented this from serving as much of a disincentive for pulling land out of the program. Landowners have also found that they can minimize their payback penalties if they only seek rezoning of small portions of affected parcels upon their sale and subsequent development.

Given the limitations of tax-credit approaches to saving farmland, it has become common for local municipalities to explore the use of *regulatory programs* to prevent unwanted development and to protect agricultural and natural resources. Typically these regulatory programs involve some combination of land use planning and zoning. Indeed, within most Wisconsin municipalities struggling to manage development pressure on their farmland, the typical monthly town or county board meeting agendas are dominated by numerous requests to divide and/or rezone agricultural lands for the purposes of single home development. In most cases, it is the local land use plans, combined with building permit, land division, and zoning ordinances, that provide guidance to those who must make decisions on these requests.

In principle, planning and zoning should provide a firm line of defense for the preservation of farmland. Communities identifying farmland preservation as a goal can (and usually do) establish restrictive "agricultural zones" that prohibit most residential or non-agricultural commercial development. Assuming that these ordinances are rigorously enforced – i.e., that waivers, variances, or rezonings are rare – it is likely that there will be noticeably less development on protected agricultural lands.

In practice, two sorts of problems are often encountered with planning and zoning for agriculture. First, though land use plans may state that preservation of agricultural lands is a top priority,

local government officials may find it difficult to turn down all development proposals that would infringe upon agricultural property. This is particularly true in rural areas when the farmland owner is a former commercial farmer with few retirement savings, and someone who has been a longtime resident of the area with close ties to the local officials. Many local farmland preservation plans are also written without a full consideration of the complexity of enforcement or implementation, particularly when planning is done simply to meet state or federal requirements. In such cases the plan may not be used as a binding document for making land use decisions.

A second potential problem with rural and agricultural planning and zoning is reflected in the conventional practice of large-lot zoning to protect farming and other natural resources. In Wisconsin, for example, state law requires minimum lot sizes of at least 35 acres in order for property to be zoned for “exclusive agriculture” and hence to receive maximum income tax credit benefits. The logic behind large-lot zoning is that 35 or 40 acre parcels will be unattractive to nonfarm rural homebuyers, and that these large parcels have the potential to be viable agricultural units. In addition, large lot sizes help maintain relatively low overall population density and also preclude unwanted concentrations of new houses in a confined area.

After twenty or thirty years of experience, large-lot zoning approaches have been roundly criticized on a number of grounds. Initially, it is clear that modern agriculture requires significantly more acres than typical minimum lot sizes allow to be economically viable (often upwards of 300-400 acres per farm).³ Moreover, it has been shown that 35-40 acre parcels are still quite attractive to non-farm residents seeking to build a home in the country, particularly where rural land prices are still quite low compared to buying building lots within or on the margins of urban areas. In Wisconsin, “the 35-acre rule” associated with the FPP-EAZ statute has forced many municipalities to approve a significant number of rural residential homes on relatively large lots. In aggregate, it is likely that significantly more farmland acreage has been withdrawn from agriculture – in large 35 or 40 acre chunks – because of the large minimum lot size requirement than would have been the case if the law had allowed a similar number of developments but permitted them

on smaller parcels. In addition, even when nonfarm landowners choose to rent out their excess farmland, in the long run parcelization of the landscape makes farming more difficult and impractical for the remaining commercial farm operators.

METHODS

This paper attempts to examine how variation in local land use policy implementation may influence the rate of farmland conversion. To do this, data were collected on the rate of farmland loss between 1990 and 1997 for the over 800 towns¹ in Wisconsin that make land use decisions on virtually all farmland in the state. Additional information about background characteristics and local land use policy context were also collected for each town.

Towns provide a unit of analysis that is fine-grained enough to measure sub-county variability, while retaining the ability to analyze meaningful policy implementation. Although there are farms in almost every town in Wisconsin, we know that the northern third and some portions of the central part of the state are relatively non-agricultural. In addition, some of the most highly urbanized townships are for all practical purposes becoming cities. Since these extreme cases of the most rural/forested and most urban towns can skew the fit of a regression model, we decided to limit our analysis to those towns which could reasonably be seen as having some significant agricultural lands and which were not completely urbanized. To do this, we required that towns in our study meet four criteria:

1. Based on satellite land cover images, at least 33% of land cover must consist of row crops, forage crops, or grassland;
2. In addition, at least 20% of a town's land cover had to be in row crop production;
3. At least 20 persons had to live on farms in the 1990 Census of Population; and
4. The town had to have at least 1,500 acres of land taxed as farmland in 1990.

The net effect of imposing these restrictions was to eliminate roughly a third of Wisconsin towns from the analysis. The resulting 844 towns are considered Wisconsin's agricultural towns, and are included in all tables and analysis discussed below.

For an indicator of farmland loss trends we selected the percent change in the total acres in a town that were taxed as “agricultural land” between 1990 and 1997. This indicator has several strengths, including the fact that it is intuitively easy to understand, reflects aggregate levels of land conversion that are consistent with other sources of data (see Table 1 above), is measured in a reasonably consistent manner over time, and is the most readily available source of town-level data. Some possible limitations or weaknesses of this variable are related to the fact that acres of farmland on the tax roll may shift for reasons other than conversion to non-agricultural uses. For example, if a portion of a town is annexed into a city or village, the annexed agricultural lands formerly in the town will no longer show up on the tax rolls (though these lands are usually slated for intense and immediate development, and hence appropriately thought of as “lost” from agricultural uses). It is also possible that the hiring of a new tax assessor may be associated with the reclassification of particular parcels from agricultural to other land use categories. While we have no direct way of identifying these parcels, we do not believe that reclassification is widespread enough during the study period to materially affect our findings.

Among the towns in our study, roughly 5 percent of all agricultural land was removed from the tax rolls during the seven-year study period, with a median of just over 3 percent (See Table 2). There were a handful of towns that actually increased their farmland acres (usually by relatively small absolute numbers), and several that saw declines of over 25 percent between 1990-1997.

Because there are a large number of other non-policy factors that influence the pace and character of farmland losses (Lee, 1979; Kline and Alig, 1999; Sorenson et al., 1997), a multivariate model is used to control for the effects of other background variables. The background non-policy variables include indicators of agricultural density and intensity, population density, and the rate of housing growth. Descriptive statistics for the variables used in the analysis are found in Table 2.

As indicators of agricultural density and intensity, we selected three main variables. Initially, we were able to use the results of a recent digitized satellite land cover survey of the state to estimate the acres of land that was used for either row cropping,

forage crops, or grassland (most of which is permanent pasture or CRP land in rural Wisconsin). We then calculated the proportion of that farmed land cover which was in row crops (the most intensive type of agricultural land use). Overall in our sample, just under half of all farmed land was used for row crops, though it ranged from 9 percent to over 90 percent across the state. Since dairy farming is one of the most intensive form of agriculture in the state (usually involving a year-round labor commitment and a diversified crop-livestock operation), we also gathered data about dairy farm operations by township from the state Dairy Producer List maintained by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (WDATCP). In 1990, the average town in our study had 1 dairy farm per square mile, though it ranged from less than 0.1 to over 3 dairy farms per square mile. Third, we used the proportion of farmland in a town that was taxed as “agricultural” property as a measure of the overall importance of agricultural land to a given town unit.

Demographic pressure was measured using census data on initial population density (persons per square mile in 1990) and an estimate of the percent growth in housing stock between 1990-1997 provided by the state Department of Administration. Both variables were disaggregated to the town level.

Land use policy at the town level was measured using four variables. Initially, we determined if a town had a certified Exclusive Agricultural Zoning ordinance. Results suggest that roughly 40 percent of towns had some kind of EAZ statute (either one adopted on their own, or they had adopted the county EAZ ordinance). More generally, we also gathered information about whether a town has any kind of zoning ordinance, and if so, whether or not a town- or a county-ordinance was in effect. Over half of the towns in our study had adopted county zoning, and another 21 percent had adopted town zoning. All three zoning variables are coded as they exist at the time we collected data (spring, 1998). We recognize that a small number of towns likely adopted new zoning ordinances during the study period, but we feel that they are not numerous enough to affect the results reported below.

As a final land use policy variable, we gathered information from the Wisconsin Department of Revenue about how many acres of farmland

Table 2: Descriptive Statistics of Variables Used in Analysis

Description	Units	Mean	Median	S. D.	Min.	Max.
<u>Dependent Variable</u>						
<i>Percent change in land taxed as agriculture, 90-97</i>	<i>percent</i>	-4.60	-3.02	5.00	-27.52	8.27
<u>Agricultural Density and Intensity</u>						
<i>Proportion of farmland in row crops</i>	<i>percent</i>	45.11	0.45	16.21	9.10	92.12
<i>Dairy farms per square mile</i>	<i>farms</i>	1.06	1.00	0.54	0.06	3.05
<i>Proportion of town land base taxed as farmland</i>	<i>percent</i>	66.51	0.69	15.65	17.65	98.99
<u>Demographic Pressure</u>						
<i>Population density (people per square mile, 1990)</i>	<i>persons</i>	39.10	25.19	44.57	6.70	527.68
<i>Percent growth in housing stock, 1990-1997</i>	<i>percent</i>	16.09	13.74	11.48	-0.30	135.33
<u>Local Land Use Policy Variables</u>						
<i>Has Town adopted Exclusive Agricultural Zoning?</i>	<i>binary</i>	0.42	0.00	0.49	0	1
<i>Has Town adopted own zoning?</i>	<i>binary</i>	0.21	0.00	0.41	0	1
<i>Has Town adopted county zoning?</i>	<i>binary</i>	0.56	1.00	0.50	0	1
<i>Percent of farmland claimed on income taxes under Farmland Preservation Program</i>	<i>percent</i>	27.84	19.06	25.23	0	100

(N=844 for all variables)

were claimed by town residents under the Farmland Preservation Program tax credit program in 1993, 1994, and 1995. We then compared the acres claimed to the total farmland acreage in the town. This allowed us to calculate an average annual percent of a town's farmland that was claimed under the FPP tax credit program. The results suggest that an average of 28 percent of town farmland is claimed on income tax forms, with a great deal of variation from place to place.

Because of the complex relationships between the major categories of independent variables, we closely examined patterns of bivariate correlation among the variables used in our model to see where there might be a problem with multicollinearity. The results are shown in Table 3. It is apparent that only a few pairs of variables have bivariate correlations greater than 0.5, and only one (percent of farmland enrolled in FPP tax credits and town EAZ status) exceeds 0.7. By selecting and specifying variables in the way we do, we feel confident that we have minimized the potential for multicollinearity.

Table 3: Correlations among variables used in the analysis.

	<i>Percent change in farmland, 1990-97</i>	<i>Proportion land base in agriculture.</i>	<i>Proportion of farmland in row crops</i>	<i>Dairy farms per square mile</i>	<i>Log of 1990 pop density = ln(persons/sq. mile)</i>	<i>Percent growth in housing stock, 1990-97</i>	<i>Town adopted Exclusive Agric. Zoning (EAZ)</i>	<i>Town adopted own general zoning ordinance</i>	<i>Town adopted county general zoning ordinance</i>
<i>Proportion land base in agriculture.</i>	0.064								
<i>Proportion of farmland in row crops</i>	0.039	.224**							
<i>Dairy farms per square mile</i>	.238**	.496**	-.090**						
<i>Log of 1990 pop density = ln(persons/sq. mile)</i>	-.519**	-0.017	.311**	-.140**					
<i>Percent growth in housing stock, 1990-97</i>	-.354**	-.257**	0.031	-.244**	.348**				
<i>Town adopted Exclusive Agric. Zoning (EAZ)</i>	-0.06	.222**	.259**	-0.034	.232**	-0.05			
<i>Town adopted own general zoning ordinance</i>	-.153**	.074*	.199**	0.05	.328**	.122**	.226**		
<i>Town adopted county general zoning ordinance</i>	-0.028	0.008	0.06	-.182**	0.014	0.042	.212**	-.581**	
<i>Percent of town farmland enrolled in FPP</i>	.104**	.230**	.147**	.145**	0.013	-.165**	.764**	.189**	.146**

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

RESULTS

Crosstabular Analysis

As an initial step toward understanding the factors linked to farmland conversion, we examined the mean rate of farmland loss among towns classified in a variety of ways. The marginal column on the far right in Table 4 reflects the different rates of farmland loss for towns with relatively low or high agricultural density or intensity, and low or high degrees of demographic pressure. The marginal column on the bottom of Table 4 reflects the mean rate of farmland loss under different policy regimes. The interior columns in Table 4 indicate the mean losses among towns with different land use policy regimes in place cross tabulated against agricultural and demographic variables.

The results suggest that – ignoring the influence of the other factors – the presence of dairy

farms is associated with a decline in farmland losses. Conversely, the bivariate relationship between row crop production and farmland loss is not very systematic. Meanwhile, both demographic pressure variables are strongly linked to farmland losses (with lower population density and slower housing growth associated with the slowest rate of farmland conversion).

The policy variables had mixed impacts. FPP tax credit participation generally slows farmland losses, and this effect is more pronounced among places with less agricultural intensity. The patterns also indicate that towns with more land claimed on tax forms under the FPP were less likely to see an impact of the three demographic pressure variables. In all cases, there is no convincing evidence that the presence of an Exclusive Agricultural Zoning ordinance has a strong mediating impact on the rate of farmland loss for the subgroups of towns.

Table 4: Mean Change in Acres of Farmland on Town Tax Rolls, 1990-1997, by Agricultural Density and Intensity Indicators and Local Policy Variables

		Percent of Town Farmland Claimed on Income Taxes under FPP Program			Presence of Exclusive Agricultural Zoning Ordinance		All Cases
		<i>None</i>	<i>Less than half</i>	<i>More than half</i>	No	Yes	
Dairy farms per sq. mile	Less than 1 farm	-6.73	-5.41	-4.59	-5.30	-6.12	-5.65
	1 to 2 farms	-3.94	-3.80	-3.32	-3.62	-3.74	-3.67
	More than 2 farms	-0.19	-2.58	-3.47	-1.93	-3.83	-2.61
Percent of farmed land cover in row crops	Less than 33%	-5.53	-4.87	-2.92	-4.65	-4.71	-4.66
	33 to 50%	-5.32	-4.53	-3.82	-4.27	-5.19	-4.60
	More than 50%	-6.72	-4.24	-4.03	-4.10	-4.89	-4.56
Population per Square Mile (1990)	< 20 persons per sq. mile	-3.29	-2.82	-2.31	-3.00	-2.36	-2.82
	20-50 persons per sq. mile	-4.40	-4.04	-3.72	-4.02	-4.03	-4.03
	>50 persons per sq. mile	-12.74	-9.39	-6.45	-10.58	-8.97	-9.57
Percent Change in Housing Stock, 1990-1997	Less than 10%	-2.24	-2.72	-3.59	-2.47	-3.51	-2.92
	10 to 20%	-6.25	-4.49	-3.46	-4.44	-4.80	-4.60
	More than 20%	-7.19	-6.69	-4.99	-6.26	-7.09	-6.59

Regression Results

While the bivariate results seem to suggest that participation in the FPP Tax Credit program has slowed the rate of farmland loss, the presence of EAZ ordinances is surprisingly associated with the opposite effect. Of course, this should not be treated as *prima facie* evidence that the EAZ law itself has accelerated farmland loss. Rather, we believe that it reflects the fact that municipalities that are facing greater threats to their agricultural lands (i.e., those with already high rates of farmland loss) are more likely to adopt EAZ ordinances in the first place.

To provide a more definitive test of the impact of land use policy on farmland conversion, we constructed a multivariate regression model to predict rates of farmland loss among our sample of 844 Wisconsin towns. This model is designed to capture the influence of non-policy factors that also drive farmland loss, and to control for those when examining land use policy impacts. In other words, the model can compare the net impact of FPP Tax Credit programs and EAZ ordinances among towns that have similar agricultural and demographic characteristics.

Our approach was based on a two-step process. Initially, we constructed a “base model” that would incorporate the best fitting set of theoretically interesting non-policy variables. Then we introduce our four policy variables (individually and in concert) to see if they were able to improve our ability to explain the spatial variation in farmland losses. In all models, the dependent variable is the rate of change in acres taxed as farmland between 1990 and 1997.

Table 5 reports the standardized regression coefficients, significance tests, and goodness of fit statistics for the base model and the five models incorporating combinations of the policy variables. Model A serves as a base model – using information about the density and intensity of agriculture and the degree of demographic pressure in a town during the 1990s to explain as much about farmland conversion as we can. The variables included in the base model were chosen based on the results of a separate spatial analysis of farmland loss that considered a sizeable number of other non-policy factors (see Jackson-Smith and Bukovac, 1999), and reflect the most efficient and influential subset of non-policy variables available to us at the town level.

It is worth noting that Model A explains roughly 40 percent of the underlying variation in the rate of farmland loss. Indicators of agricultural intensity produced generally positive coefficients (i.e., they slowed farmland loss). As expected, towns with more dairy farms per square mile, and those areas with higher proportions of their farmland planted to row crops – those areas with more dense commercially oriented farms – are both associated with less severe farmland conversion. The negative coefficient on the proportion of land taxed as agriculture – an indicator of the general importance of agriculture on the landscape – is difficult to explain, but relatively small in magnitude, and should be understood as the net effect once the influence of dairy farm and row crop density are accounted for. It is worth noting that the bivariate relationship between percent of land in agriculture and farmland loss is modestly positive (see Table 3 above).

The variables that are most strongly associated with farmland loss are the three indicators of non-farm demographic pressure. The base model includes two core demographic variables – initial population density in 1990 and a measure of the rate of housing growth over the study period. To account for some skewness in the distribution of towns by population density, we chose to use a natural log transformation of the density variable (the resulting indicator more closely approximates a normal distribution). We expected both variables to be negatively associated with farmland retention. In addition, because the influence of housing growth (measured on a percentage basis) may be mediated by the initial density of population/housing, we also introduced an interaction term to capture possible differences in the impacts of housing development in more or less densely populated towns. Specifically, we hypothesized that the influence of housing growth on farming will be less severe in less populated or more rural settings.

The results of the demographic variables are generally consistent with our expectations. Although the first order housing growth coefficient has a significant negative sign, the net impact of the first order and interaction terms predict that faster housing growth will accelerate the rate of farmland loss in all but the least densely populated areas. This will be further discussed below.

Table 5: Standardized Regression Coefficients and Model Fit Statistics for Base Model and Various Policy Models.

	A	B	C	D	E	F
<i>Standardized Regression Coefficients (significance in parentheses)</i>						
<u>Agricultural Density and Intensity</u>						
<i>Dairy farms per square mile</i>	0.234 (p=0.000)	0.231 (p=0.000)	0.234 (p=0.000)	0.237 (p=0.000)	0.237 (p=0.000)	0.222 (p=0.000)
<i>Proportion of farmland in row crops</i>	0.253 (p=0.000)	0.247 (p=0.000)	0.255 (p=0.000)	0.249 (p=0.000)	0.253 (p=0.000)	0.253 (p=0.000)
<i>Proportion of land base taxed as agriculture</i>	-0.147 (p=0.000)	-0.154 (p=0.000)	-0.146 (p=0.000)	-0.153 (p=0.000)	-0.152 (p=0.000)	-0.147 (p=0.000)
<u>Population Density</u>						
<i>log(persons per square mile, 1990)</i>	-0.385 (p=0.020)	-0.386 (p=0.000)	-0.379 (p=0.000)	-0.392 (p=0.000)	-0.383 (p=0.000)	-0.364 (p=0.000)
<u>Demographic Pressure, 1990-97</u>						
<i>Percent growth in housing stock, 1990-1997</i>	0.293 (p=0.000)	0.303 (p=0.016)	0.294 (p=0.020)	0.292 (p=0.020)	0.299 (p=0.018)	0.319 (p=0.012)
<i>Interaction term = log(pop density) * pct pop growth</i>	-0.526 (p=0.000)	-0.529 (p=0.000)	-0.526 (p=0.000)	-0.522 (p=0.000)	-0.525 (p=0.000)	-0.542 (p=0.000)
<u>POLICY VARIABLES</u>						
<i>Town has county zoning</i>			-0.005 (p=0.883)		-0.023 (p=0.550)	-0.032 (p=0.413)
<i>Town has own zoning</i>			-0.019 (p=0.605)		-0.037 (p=0.357)	-0.049 (p=0.231)
<i>Town adopted EAZ</i>				0.028 (p=0.339)	0.039 (p=0.230)	-0.032 (p=0.502)
<i>Pct. of farmland in FPP</i>		0.054 (p=0.056)				0.091 (p=0.044)
<u>MODEL FIT:</u>						
Sign. of ANOVA overall F-test	0.000	0.000	0.000	0.000	0.000	0.000
R²	0.390	0.393	0.390	0.391	0.391	0.394
Adj. R²	0.385	0.387	0.384	0.385	0.385	0.387
Significance of F statistic for R²	-	0.056	0.852	0.339	0.623	0.213

The five models on the right side of Table 5 presents the regression coefficients for the models that combined the base model with different specifications for characterizing the local land use policy context. Overall, none of the policy variables contributes very much to the explanatory power of the model, and there are no visible effects on the coefficients of the base model variables when we introduce information about the policy context. Only the farmland preservation tax credit participation variable has a significant (or nearly significant) coefficient in the predicted direction, suggesting that areas with more land actively enrolled in the FPP tax credit program witnessed lower rates of farmland loss, net of the impact of the other factors. There is no support for a measurable impact of general or agricultural zoning statutes.

Visualizing Results of the Regression Modeling Exercise

Because regression coefficients are rather difficult to interpret, particularly when some of the variables have been specified in a complex way – such as the log transformation of population density – or interacted with other variables in the model. To help illustrate the relationships between some of the more influential independent variables in the model and the dependent variable, the regression coefficients were used to generate graphs of the mean predicted rate of loss over various ranges of values for key independent variables. In each graph, the sample mean values for all independent variable that are not shown were held constant.

Figures 1 and 2 help us understand the impact of the base model variables on farmland loss. Figure 1 illustrates the impact of both population density (the x-axis) and housing growth (reflected by different lines) on farmland loss. It is clear that the impact of increasing population density is significant as you move from relatively low population densities up until populations reach roughly 100 person per square mile, at which point the relative impacts are more modest. Meanwhile, the influence of percent growth in housing stock has relatively little net impact in towns with less than 50 people per square mile, but quickly creates a net negative impact as you move into higher population density towns. Figure 2 illustrates the combined influence of the two indicators of agricultural intensity. Initially, higher proportions of farmland in row crops is associated with slower rates of farmland conversion. Similarly, places with more dairy farms per square mile see significantly lower average rates of farmland losses, all other variables held constant.

FIGURE 1: Impact of Population Density and Housing Growth on Loss of Farmland From Town Tax Rolls

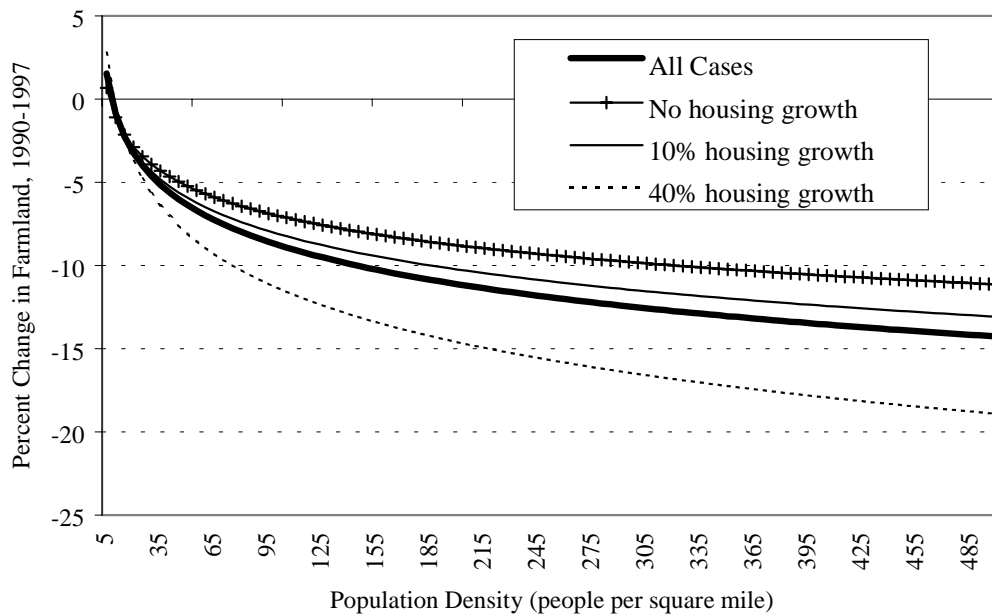


FIGURE 2: Relationship between Intensity of Agricultural Land Use and Preservation of Farmland

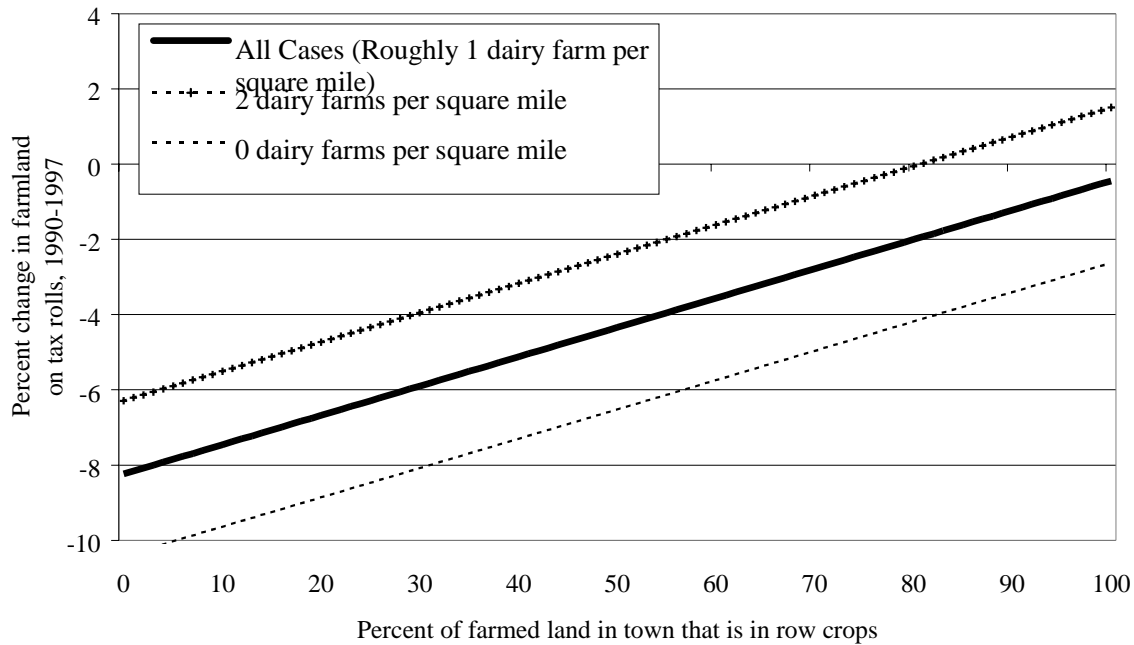
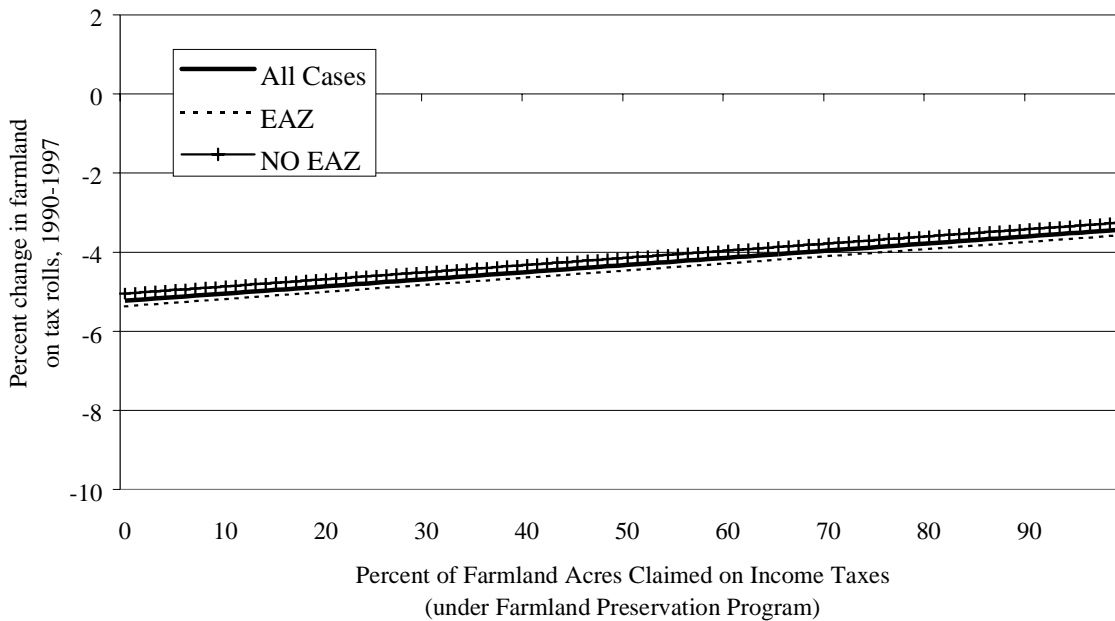


Figure 3 presents a graphic illustration of the influence of the two key policy variables used in this analysis. It is evident that there is weak but positive impact of enrolling lands in the FPP tax credit program on farmland retention. However, the

impact of EAZ status is negligible and in fact counter to the predicted direction (that is, places with EAZ have slightly higher rates of farmland loss than those without, though this relationship is highly insignificant).

FIGURE 3: Impact of State and Local Policy on Farmland Retention



DISCUSSION

What seems to explain farmland losses in Wisconsin?

Usually, one of the primary goals of town and county land use plans in Wisconsin is to protect farmland resources and the agricultural character of the landscape. However, widespread public support for farmland preservation derives from a complex mixture of motivations, including sustaining commercial agricultural operations, protecting environmental quality and an open space aesthetic, and preventing costly and inefficient growth patterns in areas surrounding urban centers (Kline and Wichelns, 1996). In this environment, there has emerged a surprising level of disagreement among local residents and officials concerning the concrete steps that should be taken to “preserve farmland.” People have begun to realize that specific land use policies that maximize one type of goal (say open space preservation) are not necessarily the ones that best achieve other type of goals (like preservation of commercially viable farms).

This situation is complicated by the considerable uncertainty about the underlying forces that are driving farmland losses. Most explanations fall into one of two main camps. The first (the “Push” model) sees the decline in farmland acres as a symptom of a depressed agricultural economy. Specifically, they point to increasingly low profit margins, the graying/aging of the farm population, and a deteriorating critical mass of farms and agricultural infrastructure as all contributing to an exodus of farmers from the land. Finally, in places which have increasing numbers of non-farm rural residents, there are growing conflicts over the noise, dust, and odors associated with a mixed crop-livestock system of agriculture. Conversion, according to this camp, occurs mainly because it is no longer viable to operate a farm in many parts of Wisconsin.

The second group (the “Pull” model) would see farmland conversion as the product of a much broader pattern of unregulated urban development and sprawl. In their view, farmland is lost because of the combined impact of a lack of controls on the siting of new houses and commercial facilities, along with the effects of a host of public subsidies (highways, public utilities, low gasoline taxes) that make it cheaper and easier to live and build in the

country. If we protect farms from these forces, it would be argued, we would see far fewer acres converted out of agriculture.

It is likely that both the push and pull arguments are reasonably accurate depictions of the underlying processes at work. Moreover, they are not mutually exclusive. It is certainly the case that the depressed economic conditions facing agriculture have created a situation where young farmers are increasingly reluctant to enter the sector, and continuing or near retirement farmers are more willing to sell their farms to whomever makes them the best offer. At the same time, demand for rural farmland from nonagricultural interests has been rising steadily in the state. In 1997, for example, roughly a fourth of all farmland sold in Wisconsin was converted to non-farm uses. In the places experiencing such growth, the associated rise in property taxes and conflicts with nonfarming neighbors have made it particularly difficult and discouraging for the farmers that remain.

In our study, we found that there is considerable variability in the rate of farmland loss across the state. All other things held equal, places that have well established and agricultural communities – particularly those with many dairy farms and ample row crop production – tended to retain farmland more effectively than places with more marginal forms of agriculture. Meanwhile, indicators of urban proximity, population density, and growth in the housing stock were among the most influential explanatory variables in our model. In other words, holding the other factors constant, areas facing relatively intense growth pressures are more likely to loose farmland than more stable communities.

What did we learn about the effectiveness of local land use policy in Wisconsin?

The results of our analysis suggest that the Wisconsin Farmland Preservation Program (FPP) income tax credits have produced some of their intended benefits. Overall, the rate of conversion was lower in towns where more people had enrolled farmland acreage in the FPP and claimed it on their taxes. Moreover, it is clear that the benefits from FPP income tax credits are most clear in towns that have dense populations already and that face the highest rates of housing development. Our findings

also support the view that the FPP has not made much difference in the rate of farmland loss in towns that are more heavily agricultural, less densely populated, or that face relatively little growth pressure. The fact that the influence of the tax credit program was relatively modest compared the agricultural and demographic variables in the model suggests that its value as a farmland preservation policy might be reduced because participation is not targeted to parts of the state that are losing farmland most rapidly.

Meanwhile, the presence or absence of general zoning or exclusive agricultural zoning ordinances in Wisconsin towns did not appear to be systematically related to the pace of farmland conversion. This may be because our indicators of local zoning policy are fairly crude, reflecting only the presence or absence of a zoning ordinance. It is likely that more detailed information – such as the content of different zoning ordinances, their relation to a local land use plan, and the year in which the ordinances or plans were originally adopted or revised – would provide a clearer picture of their utility. For example, towns with more rigorous or detailed zoning ordinances, or towns that had well articulated land use plans and ordinances designed to protect farmland, might be found in future research to have significantly lower rates of farmland loss. Unfortunately, such detailed information about local policy is not publicly available for any significant number of towns in the state (to the best of our knowledge).

The fact that town zoning was not consistently related to rates of farmland loss does not necessarily mean that zoning cannot be a useful tool. Indeed, the results of a parallel in-depth study of farmland losses in Dane County, Wisconsin suggest that strong local land use plans and ordinances are a necessary but not sufficient condition for an effective farmland preservation policy (Bukovac, 1999). In particular, we found that the most important factor influencing a town's ability to slow farmland loss is its willingness to strictly enforce the language in their plans and ordinances. Towns with relatively strong farmland protection language in their land use plans, but who frequently approved rezoning proposals that were inconsistent with their stated policies typically lost farmland much more rapidly. Meanwhile, towns with relatively modest plan language, but who were able to muster the political will to

consistently deny requests for development that violated farmland protection provisions fared relatively well. Those with no plans or ordinances tended to consistently lose farmland rapidly, though not necessarily faster than those failing to enforce their local plans. Finally, the interviews suggested that the degree to which the local town government embraced the goals of farmland preservation in spirit was at least as important as the content of their particular land use plan or set of local zoning ordinances.

Overall, the results of our cross-tabular and regression analyses suggest that local land use policies (at least those that we measured) have not dramatically altered the pace of farmland loss in most parts of the state. This is likely because the state's Farmland Preservation Program has not been targeted towards areas facing the greatest pressure on their farmland resources, and the general and exclusive agricultural zoning ordinances that have been adopted do not always materially affect local decisions to convert farmland to other types of land uses.

ENDNOTES

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² Ohio Field Representative, American Farmland Trust.

³ More specifically, the amount of farmland lost in towns (excluding acreage within the incorporated boundaries of cities and villages) is used in the present analysis. In 1997 this represented a total of 13,931,788 acres, or over 98 percent of all agricultural land on the state property tax rolls.

⁴ More recently, the Wisconsin State legislature passed a landmark bill to begin assessing agricultural lands according to their value for agricultural production, and not according to their fair market value at their highest and best use (Sheil, 1996). The initial legislation called for a 3 year freeze in farmland property tax assessment valuations (1996-1998), to be followed by a 10 year phase-in period in

which “use value” based on actual commodity prices was gradually approached in 10% increments (1999-2008). However, a notably depressed farm economy and other political pressures led the state Department of Revenue to implement “full use value” assessment by administrative rule, effective in the 2000 tax year. Although this program is likely to have significant impact on farmland owner behavior, it is not examined in this paper since it postdates most of the time period under study here (1990-1997).

⁵ Of course, some types of high-value, low-acreage agriculture (like market gardening, greenhouses, and horticultural operations) can be viable on much less than 35 acres, but these are usually economically and numerically much less significant than traditional farm commodity producers.

⁶ Wisconsin’s unincorporated rural municipalities are officially called “towns,” though they loosely correspond to the U.S. Public Lands Cadastral Survey “townships” that are found in most other states. We will use the technically correct term “towns” in this paper.

REFERENCES

- Alterman, Rachel. 1997. “The Challenge of Farmland Preservation: Lessons from a Six-Nation Comparison,” *Journal of the American Planning Association*, 63(2):220-243.
- Anderson, John E. and Howard C. Bunch. 1989. “Agricultural Property Tax Relief: Tax credits, tax rates, and land values,” *Land Economics* 65(1): 13-22.
- Barrows, R. and D. Yanggen. 1978. “The Wisconsin Farmland Preservation Program,” *Journal of Soil and Water Conservation* 33:209-212.
- Barrows, R. and E. Troutt. 1989. “A National Perspective on Data Needs for Agricultural Land Use in Urbanizing Areas,” pp. 1-14 in Heimlich (ed.) *Land Use Transition in Urban Areas: Research and Information Needs*. The Farm Foundation and United States Department of Agriculture: Washington D.C.
- Bukovac, Jill. 1999. “Town Government’s Role in Explaining the Spatial Variation of the Rate of Farmland Loss: Dane County, Wisconsin,” Unpublished masters thesis, University of Wisconsin-Madison.
- Bushwick, Nancy. 1989. “State and Local Concerns: Information Needs and Local Actions for Protecting Agricultural Land,” pp. 15-28 in *Land Use Transition in Urban Areas: Research and Information Needs*. The Farm Foundation and United States Department of Agriculture: Washington D.C.
- Buttel, Fred. 1999. Wisconsin Agriculture in the 1990s: Perspectives from the 1997 Census of Agriculture PATS Research Report No. 5. Madison: Program on Agricultural Technology Studies: University of Wisconsin. October.
- Coughlin, Robert E. 1991. Formulating and Evaluating Agricultural Zoning Programs. *Journal of the American Planning Association*, 54 (4): 183-192.
- Daniels, Thomas L. 1990. “Policies to Preserve Prime Farmland in the U.S.A.: A Comment,” *Journal of Rural Studies*. 6(3):331-336.
- Daniels, Tom and Deborah Bowers. 1997. *Holding Our Ground : Protecting America’s Farms and Farmland*. Washington, DC: Island Press.
- Deller, Steven, A. Roth, and E. Jesse. 1994. “The Contribution of Dairy to Wisconsin’s Economy,” *Economic Issues*. Department of Agricultural Economics, University of Wisconsin-Madison. December.
- Emelock, Sharon. 1989. “Wisconsin: Managing Growth and Limiting Taxes,” pp. 9-22 in Hiemstra and Bushwick (eds.), *Plowing the Urban Fringe: An Assessment of Alternative Approaches to Farmland Preservation*. FAU/FIA Joint Center for Environmental and Urban Problems: Florida Atlantic University, Fort Lauderdale.
- Heimlich, Ralph E. and Kenneth S. Krupa. 1994. Changes in Land Quality Accompanying Urbanization in U.S. Fast-growth Counties. *Journal of Soil and Water Conservation*, 49 (4): 367-374.
- Henneberry, David M. and Richard L. Barrows. 1990. “Capitalization of exclusive agricultural zoning into farmland prices.” *Land Economics* 66(3): 249-258.

- Hiemstra, H. and N. Bushwick. 1989. *Plowing the Urban Fringe: An Assessment of Alternative Approaches to Farmland Preservation*. FAU/FIA Joint Center for Environmental and Urban Problems: Florida Atlantic University, Fort Lauderdale.
- Jackson-Smith, Douglas. 1996. "Wisconsin Agriculture in Historical Perspective: Economic and Social Changes, 1959-1995," Technical Report No. 4. Agricultural Technology and Family Farm Institute. University of Wisconsin: Madison. June.
- Jackson-Smith, Douglas. 2000. "A Critical Analysis of Farmer and Public Support for Farmland Preservation in the Upper Midwest ." Paper presented at the annual meetings of the Rural Sociological Society, Washington, D.C., August.
- Jackson-Smith, Douglas and J. Bukovac. 2000. "Explaining Spatial Variation in Farmland Loss: Evidence from Wisconsin Towns Between 1990-1997." PATS Staff Paper No. 3. Program on Agricultural Technology Studies, University of Wisconsin-Madison.
- Klein, Linda R. and John P. Reganold. 1997. Agricultural Changes and Farmland Protection in Western Washington. *Journal of Soil and Water Conservation*. 52 (1): 6-12.
- Kline, Jeffrey and Dennis Wichelns. 1996. "Public Preferences Regarding the Goals of Farmland Preservation Programs," *Land Economics* 72(4):538-49.
- Kline, Jeffrey D. and Ralph J. Alig. 1999. Does Land Use Planning Slow the Conversions of Forest and Farm Lands? *Growth and Change*. 30 (1): 3-23.
- Lee, Linda. 1979. Factors Affecting Land Use Change at the Urban-Rural Fringe. *Growth and Change*. 10 (4): 25-32.
- Ohm, Brian J.D. and Erich Schmidke, J.D.. 1999. An Inventory of Land Use Plans in Wisconsin. Extension Report 98-3. Extension Report Series. Madison, Wisconsin: University of Wisconsin-Extension.
- On Common Ground Foundation. 1999. "The People Speak...In Support of Our Agricultural Heritage." On Common Ground. Fall.
- Runde, Al. 1999. "Farmland Preservation and Tax Relief Credits." Wisconsin Legislative Fiscal Bureau Research Paper #25. Madison: Wisconsin Legislative Fiscal Bureau.
- Sheil, Richard. 1996. "Use Value Assessment in Wisconsin," *Journal of Property Tax Management*. Winter: 12-17.
- Sorensen, Ann A., Richard P. Greene and Karen Russ. 1997. *Farming on the Edge*. Washington, DC: American Farmland Trust.
- Stokes, Samuel N., A. Elizabeth Watson, and Shelley S. Mastran. 1997. *Saving America's Countryside: A Guide to Rural Conservation*. Johns Hopkins University Press: Baltimore.
- United States Department of Agriculture (USDA). 1999. 1997 Census of Agriculture. Volume 1, Geographic Area Series, Part 49: Wisconsin State and County Data. National Agricultural Statistics Service, U.S.D.A.: Washington, D.C. March.
- Vesterby, Marlow, Ralph E. Heimlich, Kenneth S. Krupa. 1991. Land Use and Demographic Change: Results from Fast Growth Counties. *Land Economics*. 67 (3)
- Wisconsin Agricultural Statistics Service (WASS). 1999. Wisconsin Agricultural Statistics: 1999. Madison, Wisconsin: Wisconsin Agricultural Statistics Service.
- Wisconsin Department of Commerce. 1998. "What a Difference a Decade Makes." Brochure. Department of Commerce: Madison.
- Wisconsin Department of Revenue. 1993 "A Study of Use-Value Assessment of Farmland in Wisconsin."

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