Summer 2010

Wisconsin Land Use

MEGATRENDS

background, impacts, policy…information you need to know

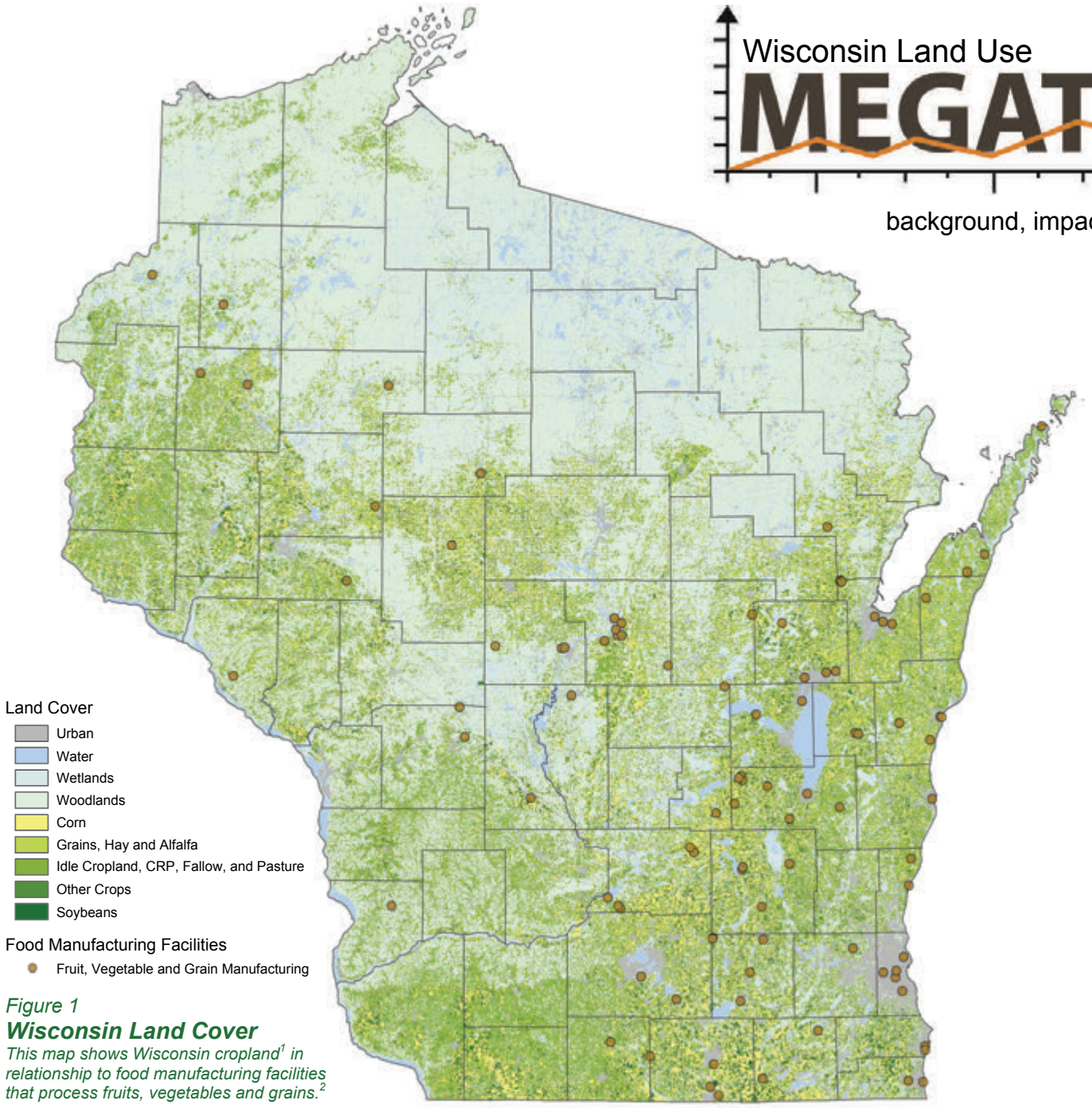


Figure 1

Wisconsin Land Cover

This map shows Wisconsin cropland[1] in relationship to food manufacturing facilities that process fruits, vegetables and grains.[2]

Find Your Community

What type of cropland is located in and around your community?

AGRICULTURE

The Changing Face of Wisconsin Agriculture

Historic Farmland Trends

Wisconsin's history is closely tied with agriculture. In 1848, when the state was founded, two out of every three residents lived on a farm.[3] At that time, the state's 20,000 farms averaged less than 100 acres each. By the start of World War I, farming became quite profitable. It attracted new investment, new young farmers, and immigrants to work in the fields and dairies.[3]

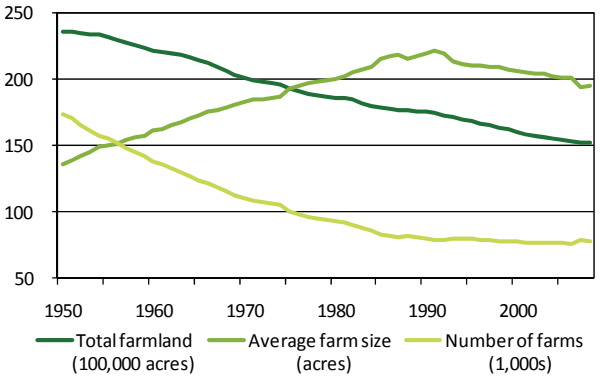
During the Great Depression, Wisconsin agriculture experienced significant setbacks. Farms lost a third of their value, farm wages plummeted 70 percent, and prices for grain and livestock dropped 45 percent.[3] By 1935, there were just under 200,000 farms in Wisconsin. Since that time, the number of farms and total acreage in farming have steadily declined.

Following World War II, farm operations experienced a second resurgence. Increased mechanization and the development of new high-yield hybrids, fertilizers and pesticides led to dramatic increases in farm productivity. Today, there is increasing pressure for farms to specialize and grow in size to meet the demands of national and global retail markets.

Figure 2

Wisconsin Farm Trends, 1950-2008

The number of farms in Wisconsin peaked at just under 200,000 in 1935. Since that time, the number of farms and total amount of farmland in the state has steadily declined. Meanwhile, average farm size has grown, peaking in the early 1990s.[4]



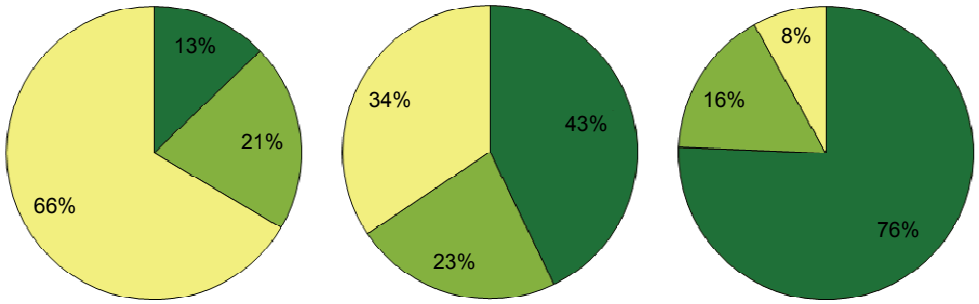
As shown in Figures 2 and 3, there are currently about 78,000 farms in Wisconsin producing $9 billion in sales on 15.2 million acres of land.[5] Average farm size is 195 acres, down from a peak of 222 acres in the early 1990s. Just 2.6 percent of Wisconsin's population, or fewer than 140,000 residents, live on farms.[6] Less than one percent live on full-time commercial farms.

Farm Size and Diversity

Wisconsin farms are diverse, differing in size, value of sales, products produced, marketing techniques, land management practices, technology, employment, ownership structure, and other characteristics.

Figure 3 classifies farms into three categories based on annual sales and primary occupation of the farmer. While large commercial operations comprise just 13 percent of all farms in Wisconsin, they account for 43 percent of all acreage and 76 percent of all sales. Intermediate farms, which are small commercial operations, make up one out of five farms. Rural residence farms comprise two-thirds of all farms.[5] These farms include a mix of hobby farms, retirement farms, small you-pick and other direct market operations, and farms held for hunting, recreation, investment and other purposes. Most of these farmers rely on other sources of income and subsidize their farming activities as part of a rural lifestyle.[7]

While large farms dominate Wisconsin's agricultural landscape, small diverse farms appear to be a growing phenomena. Since 1992, the number of small farms doubled. During the same time period, mid-sized farms declined by about a third.[5]



Number of Farms (78,463 farms)

Land Owned (15.2 million acres)

Market Value of Sales ($9.2 billion)

Figure 3

Farm Typology

Two-thirds of all farms in Wisconsin are considered 'rural residence' farms. These farms have sales of less than $250,000 and are generally not engaged in farming as a full-time occupation. Sales of these operations average just $14,000 and net farm income is negative at -$300 per farm. 'Intermediate' farms have sales less than $250,000 and an operator whose primary occupation is farming. Sales and net farm income average $92,000 and $30,000, respectively. 'Commercial' farms include farms with sales greater than $250,000 and farms that have a hired manager or non-family corporate/cooperative structure. Sales of commercial farms average $690,000 while net farm income averages $225,000. Commercial operations comprise only a small portion of all farms in Wisconsin, but own close to one-half of all farmland and produce three-quarters of all sales.[5]

Commercial Farms | Intermediate Farms | Rural Residence Farms

Photo 1
Century Farmstead in Dane County, Wisconsin

Farm Demographics

As the status of agriculture has evolved, so too has the face of agriculture — the farmer. As a whole, farm operators are getting older and are less likely to participate in farming as a full-time occupation. Between 1982 and 2007, the average age of farmers increased from 47 to 53. Nearly one in four is age 65 or older — a typical retirement age among other professions. One in two is age 55 or older.[5]

The percent of farm operators reporting farming as their primary occupation declined from 70 percent to less than 50 percent over the last 25 years.[5] This is likely due to a combination of factors, including difficulty covering operational expenses on small and mid-sized farms, a desire for more stable wages and health insurance, and an increase in residential-lifestyle farms.

The majority of farms in Wisconsin are owned by individuals or family corporations. Most continue to rely heavily on family labor. Just less than a quarter of Wisconsin farms employ hired labor. In 2007, 18,000 farms employed 76,000 workers for a total payroll of $785 million. Of these farms, four percent report hiring migrant labor.[5] An emerging trend since 2000 is the presence of immigrant labor on dairy farms. Roughly 40 percent of hired workers on Wisconsin dairy farms are recent immigrants, primarily of Hispanic descent.[8]

Online Feature — Wisconsin's Migrant and Immigrant Agricultural Labor Force

In contrast to the hired labor force, diversity among farm operators is relatively low. Approximately one percent of farm operators report a race or ethnicity other than Caucasian.[5] Twelve percent of principal farm operators are women, an increase of 25 percent from 2002 to 2007. Women comprise nearly a third of all farmers when considering principal, second and third operators.[5] Over the last two decades, the number of Amish dairy farms has doubled. Together, the Amish and Mennonite operate 1 in 10 dairy farms in this state.[9]

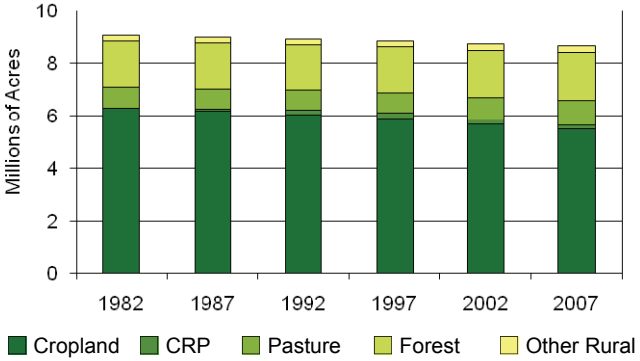
Online Feature — Amish Own Significant Number of Wisconsin Dairy Farms

Threats to Agriculture

Over the last 25 years, Wisconsin has lost over 800,000 acres of prime cropland[10] (see Figure 4). For every acre of prime farmland that is lost to scattered residential or urban development, another one-half to one acre is thought to become idle due to what researchers call the 'impermanence syndrome.' Land use conflicts between farmers and suburban neighbors, increased rates of land speculation, and inflated agricultural land values oftentimes foreshadow the conversion of agricultural land. Anticipating this situation, farmers may begin to delay investment in farm buildings, machinery, livestock and conservation practices, and reduce the intensity of production.[11]

Photo 2
New homes replace farmland in Dane County, Wisconsin

Figure 4
Prime Farmland by Land Cover/Use
Between 1982 and 2007 the state lost nearly 800,000 acres of prime cropland.[10] About half was likely diverted to other agricultural uses (CRP, pasture, forest, other) while the remainder may have been permanently converted to non-agricultural uses.



Online Feature — Map of Agricultural Land Use Change

Declining farm profitability is another major threat to agriculture. Generally, only farms with annual sales greater than $250,000 have positive rates of return.[11] Unless farmers are willing to offset agricultural losses through off-farm employment or as part of a residential lifestyle, they are unlikely to continue in farming.

As farmers look to retire, relocate or exit farming, another challenge will be nurturing the next generation of farm workers. Several programs in Wisconsin are providing skills training and opportunities to link beginning farmers with those looking to exit. Some of these programs include Wisconsin's Farm Link program, the Wisconsin School for Beginning Dairy and Livestock Farmers, and the Agribusiness Incubator Project in North Central Wisconsin.

Commodity Agriculture

Since World War II, farmland in Wisconsin has been largely dedicated to the production of agricultural commodity crops. The USDA Census of Agriculture classifies over 10 million acres of the state as cropland, with the predominant uses being corn for grain (32%), hay and forage (27%), and soybeans (13%).[5] Figure 5 shows the distribution of cropland in Wisconsin and harvested acreage of selected crops.

The majority of Wisconsin farmland is farmed in a large-scale fashion that emphasizes higher yields per acre and reduced labor costs through mechanization. In some cases, the drive to "get big or get out" has taken on monumental scales. John Deere, a farm equipment manufacturer based in Illinois, recently introduced a 120 foot wide corn planter that can plant 48 rows of corn in a single pass, allowing an operator to sow between 90 and 100 acres of cropland in an hour's time.[12]

Figure 6

Adoption of Genetically Engineered Crops

This graph shows the adoption of genetically engineered crops in Wisconsin. Genetically engineered corn increased from 18 percent of all corn planted in 2000 to 80 percent in 2010. Genetically engineered soybeans increased from 51 percent in 2000 to 88 percent in 2010.[13]

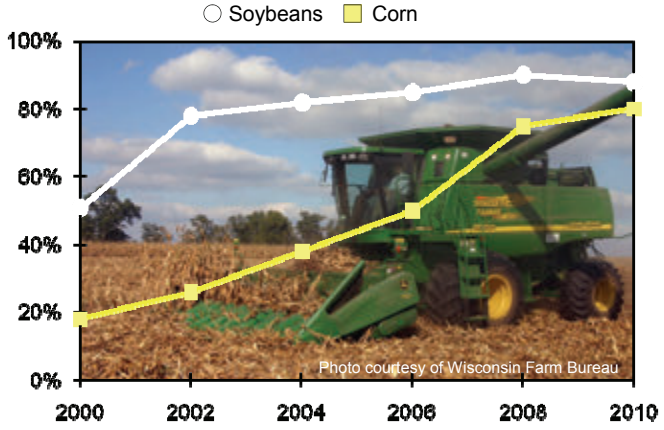
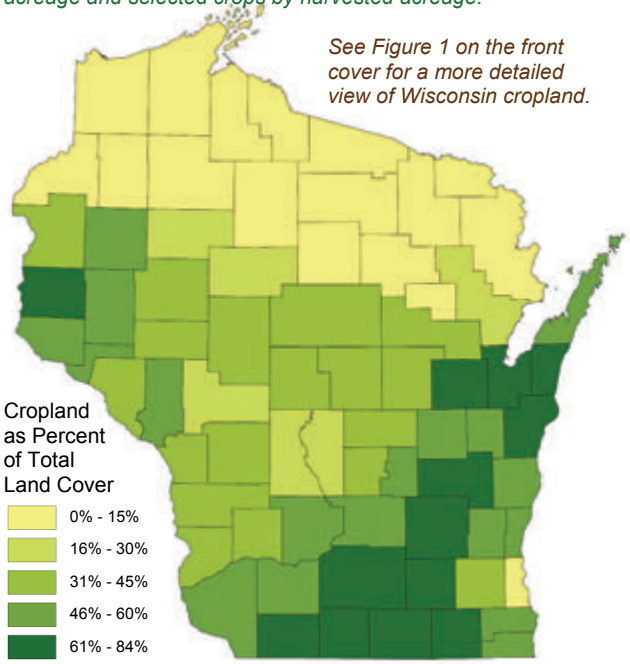


Figure 5

Wisconsin Cropland

This map shows the percent of total land cover in each county classified as cropland.[1] The table below shows farmland use by acreage and selected crops by harvested acreage.[5]



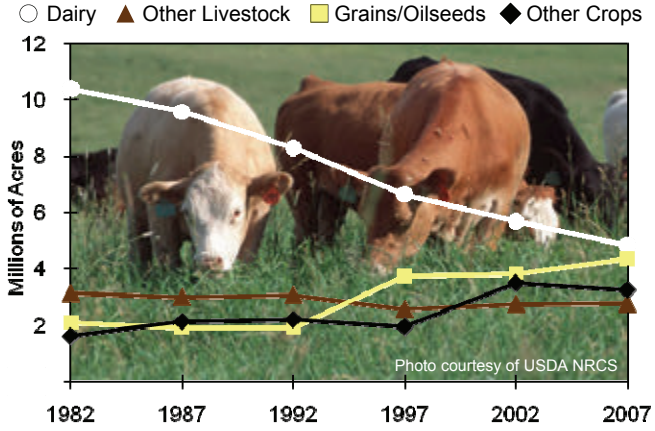
	Acres
Cropland	*10,116,279*
Selected Field Crops	
Corn for Grain	*3,250,847*
Soybeans for Beans	*1,363,124*
Corn for Silage	*732,626*
Wheat for Grain	*280,464*
Oats for Grain	*166,794*
Other Crops	
Vegetables	*291,223*
Orchards and Berries	*30,215*
Hay and Forage	*2,797,497*
Woodland	
Permanent Pasture and Rangeland	*1,065,814*
Farm Buildings, Roads, etc.	*1,088,497*
All Land in Farms	*15,190,804*

New developments in the life sciences and chemical industry have also lead to widespread changes. Since their introduction in 1996, Wisconsin farmers have widely adopted genetically engineered crops. As shown in Figure 6, soybeans with herbicide-tolerant traits have been most widely and rapidly adopted, followed closely by corn with herbicide-tolerant and insect-resistant traits.[13] Massive consolidation of seed and chemical companies has allowed large companies to extract huge price increases. In the last 9 years, prices for seed corn to farmers shot up 135 percent while the Consumer Price Index rose just 20 percent.[14] These ongoing developments have significant impacts for Wisconsin crop producers as well as the dairy and livestock farmers that grow and use a major percentage of Wisconsin crops.[14]

Figure 7

Farmland by Agricultural Sector

This graph shows the amount of farmland associated with major agricultural sectors as defined by the North American Industry Classification System (NAICS). Over the last 25 years, the amount of farmland dedicated to raising grains and other crops roughly doubled. During the same time period, farmland associated with dairy farming declined by roughly half, while that associated with raising other livestock declined by approximately 10 percent.[5]



Dairy and Livestock

Farms geared towards animal production account for over 7.5 million acres of land use in the state, roughly half of all farmland. The vast majority of this acreage is dedicated to cattle production, with over 4.8 million acres dedicated to dairy and two million acres to beef.[5] Economies of scale are changing dairy and livestock operations, with the largest dairy operation in the state planning to manage 8,000 cows at a single site.[15]

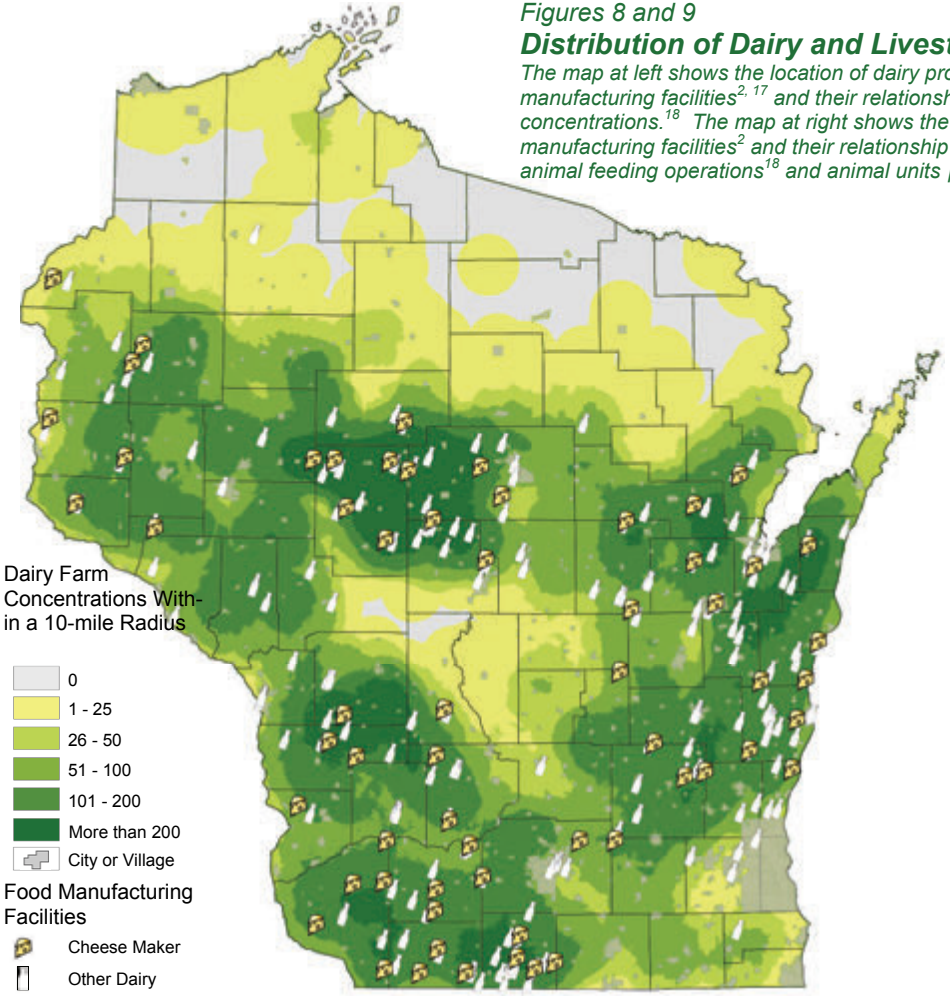
Nationwide there has been massive consolidation and widespread vertical integration of poultry, pork and beef sectors, with packers and processors exercising near total control over these markets and the farmers who produce the livestock.[14] Wisconsin dairy farms have been fairly resistant to these changes, in part because of a long history of family-owned farms and a robust system of farmer-owned cooperatives.[14] As shown in Figure 7, the number of farms and amount of farmland dedicated to animal production, particularly dairy, has steadily declined. Nonetheless, Wisconsin farmers have been able to maintain productivity by increasing herd sizes and introducing other efficiencies. Wisconsin ranks first nationally in the production of cheese and dry whey, and second in the production of milk and butter. It is second only to California in the number of milk cows.[16]

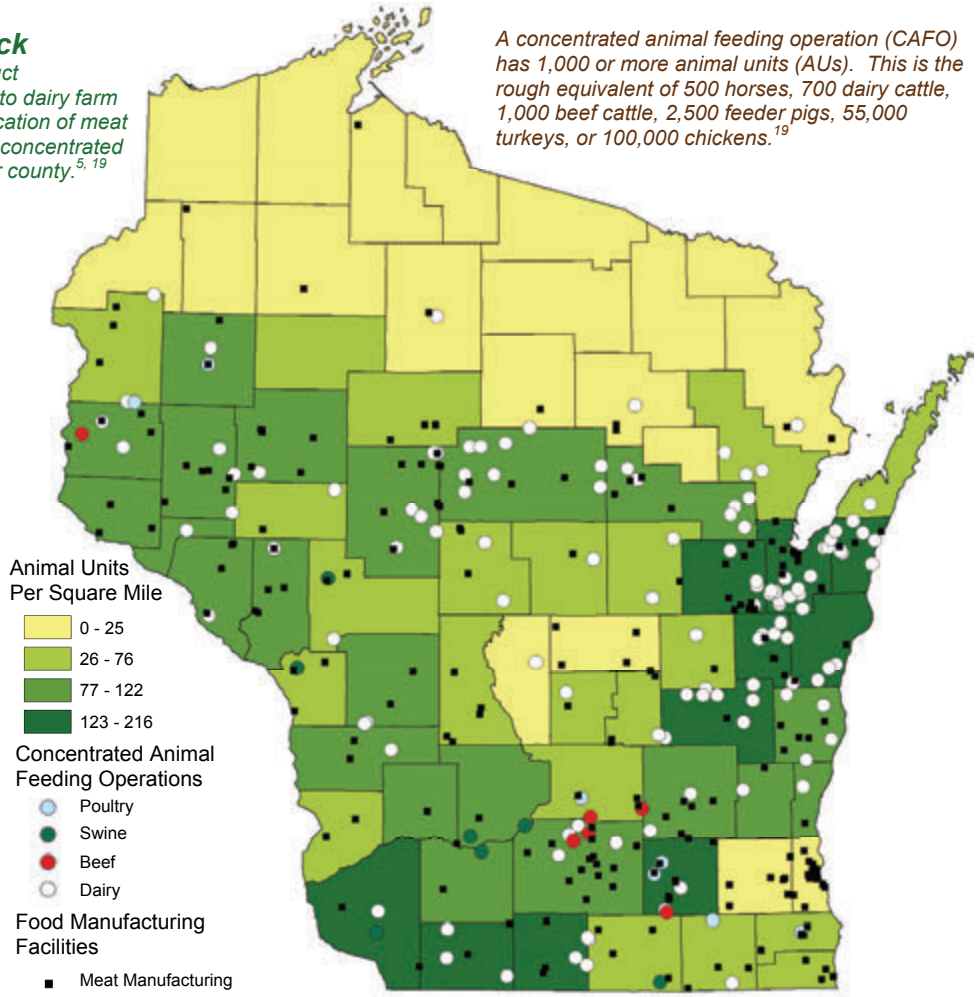
Figures 8 and 9

Distribution of Dairy and Livestock

The map at left shows the location of dairy product manufacturing facilities[2, 17] and their relationship to dairy farm concentrations.[18] The map at right shows the location of meat manufacturing facilities[2] and their relationship to concentrated animal feeding operations[18] and animal units per county.[5, 19]

A concentrated animal feeding operation (CAFO) has 1,000 or more animal units (AUs). This is the rough equivalent of 500 horses, 700 dairy cattle, 1,000 beef cattle, 2,500 feeder pigs, 55,000 turkeys, or 100,000 chickens.[19]





Specialty Crops

Production

In addition to major commodity crops, Wisconsin is a leading producer of some specialty crops such as cranberries and potatoes. While cows and crops cover the landscape, the dinner plate is how people intimately connect with Wisconsin agriculture. Farming of specialty crops, however, accounts for only 400,000 acres, or four percent of the state's total cropland.[20] The number of farms and acres in specialty crops is increasing. Figures 10 and 11 provide a snapshot of the specialty crops grown in Wisconsin. Compared to other states, Wisconsin ranks first nationally in the production of cranberries, ginseng, and snap beans for processing. Wisconsin is second in the production of carrots and sweet corn for processing.[16]

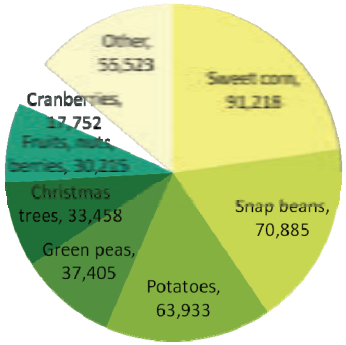


Figure 10
Specialty Crops by Acreage, 2007
Sweet corn, snap beans, potatoes and green peas comprise two-thirds of all acres devoted to specialty crops.[5]

Figure 11
Growth in Specialty Crops[20]

	2002		2007	
Crop	Farms	Acres	Farms	Acres
Fruits, tree nuts, berries	1,839	28,336	1,959	30,215
Vegetables, potatoes, melons	2,850	252,693	3,319	291,223
Dried beans, peas, lentils	17	7,398	16	6,716
Nursery, green-house, floriculture	722	n/a	1,179	n/a
Christmas trees, woody crops	1,387	47,699	1,140	33,544
Maple syrup	1,067	n/a	1,486	n/a
Other	n/a	n/a	20	n/a

Direct Sales

Wisconsin has seen growth in farm to consumer sales through the expansion of farmers' markets, community supported agriculture, roadside stands, and on-farm sales. In 2007, agricultural products sold directly to consumers for human consumption accounted for $43.5 million or 0.5 percent of total agricultural sales.[5] Between 2002 and 2007, the number of farms selling directly to consumers and the acreage in direct sales production doubled.[5] Agritourism is also a part of Wisconsin agriculture. These types of farms usually offer on-farm sales or activities and are open to the public for at least part of the year. In 2007, 568 farms reported over $6.8 million in income from agritourism.[5]

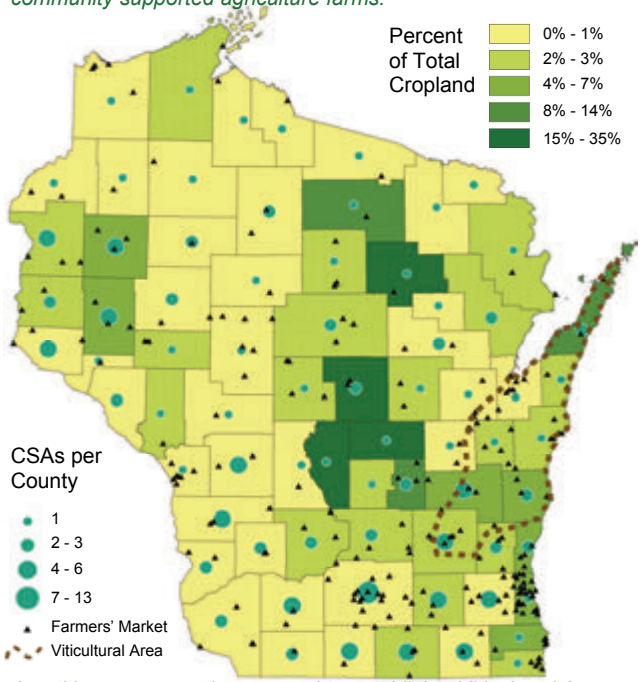
Marketing for Expansion

Marketing plays a critical role in the expansion of specialty crops. The state's 'Buy Local, Buy Wisconsin' program is an economic development effort designed to increase the purchase of Wisconsin-grown food products. The competitive grant program and local marketing guide have increased the demand for locally grown food.[22] A website (grocersbuylocal.com) has also been developed to assist farmers in marketing their crops directly to grocers. Many specialty crops such as hops, fruits and berries have growers' associations that offer support and marketing for new farmers. The Farm Fresh Atlases (farmfreshatlas.org) for five regions of the state have also increased farm to consumer sales.

Issues

Collection, distribution and storage sites are needed for specialty crops to facilitate purchases made by schools, hospitals, restaurants, and other large institutions. Lack of processing facilities and commercial kitchens also hampers the expansion of these crops. While many crops offer a high return per acre, lack of financing for steep set-up costs may be prohibitive for some farmers.

Figure 12
Distribution of Specialty Crops and Markets
This map shows the distribution of specialty crops[5] as a percent of total cropland and the location of farmers markets[17] and community supported agriculture farms.[22]



A petition was recently approved to establish a Viticultural Area on the Niagara Escarpment. This has the potential to expand investment in local wineries and grape-growing throughout the region. Currently, about 500 acres of the state are planted in grapes, 200 of which are located on the escarpment.

Online Feature — Map of Wisconsin Wineries and Breweries

Organic Agriculture

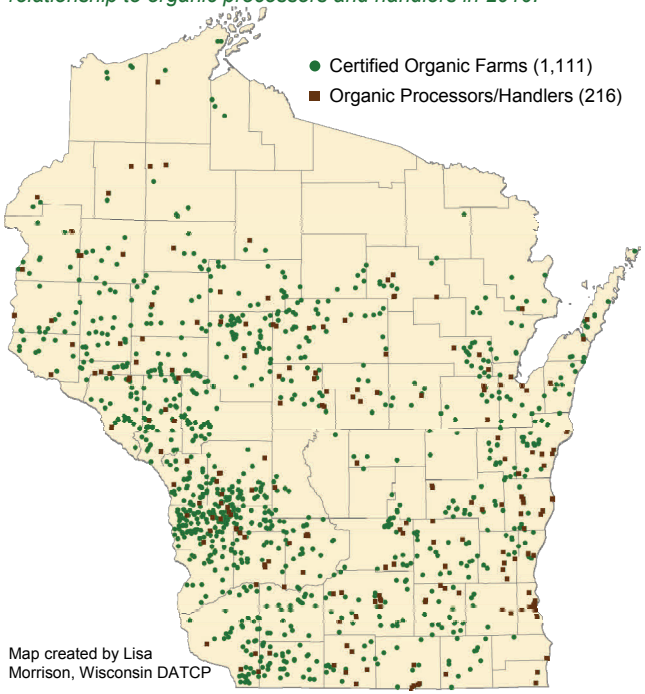
The national organic industry is booming. Organic sales expanded at a rate of 20 percent per year from the early 1990s through 2007. As a result of the economic downturn sales growth has since slowed. It was estimated at 17 percent in 2008 and 5.5 percent in 2009.[23] As shown in Figure 13, organic agriculture in Wisconsin has also grown rapidly. Over the last decade, the number of organic farms and acres roughly doubled, while organic product sales increased five-fold. In 2007, organic agriculture constituted 1 percent of total farms and acres, and 1.5 percent of agricultural sales.[5]

Wisconsin's organic farms produce a diverse array of products. Sixty-four percent of organic sales are derived from milk, 13 percent from other livestock, 16 percent from field crops, and 7 percent from fruits and vegetables.[25] In terms of farm size, the majority of organic crop, livestock and dairy farms have 100 or more acres of farmable land. Organic vegetable and poultry farms tend to be more diverse in size.[23]

Figure 14

Certified Organic Farms and Processors

This map shows the distribution of certified organic farms in relationship to organic processors and handlers in 2010.[24]



Map created by Lisa Morrison, Wisconsin DATCP

Figure 13

Growth of Organic Agriculture in Wisconsin[24]

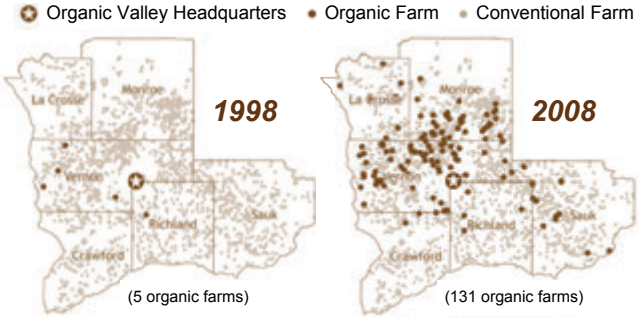
	2002	2008	Percent increase
Certified organic farms	547	1,016	86%
Certified organic acres	81,026	170,953	111%
Organic processors and handlers	72	243	238%
Organic sales (in thousands)	$20,828[5]	$132,764[25]	537%

Expanding the organic industry is likely dependent on increasing the number of organic food processors and handlers. Currently, about two-thirds of all organic sales in Wisconsin go directly to organic growers' cooperatives, processors, mills and packers.[25] These types of facilities have grown quickly in recent years. There are currently 216 organic processors or handlers in the state.[24] Roughly a third process dairy or cheese products. The location of organic farms, processors and handlers is shown in Figure 14.

Southwestern Wisconsin remains the hub of organic production due in large part to the Coulee Region Organic Producer Pools (CROPP). This is the largest farmers' cooperative in the nation and the largest source of organic milk. CROPP markets products under the Organic Valley label and also sells some milk to other companies. CROPP formed in 1988 with seven Wisconsin farms and has grown to include 1,652 farms across the country.[26] Figure 15 shows the expansion of organic dairy farms in the six county region surrounding CROPP. The number of organic dairies expanded from five in 1998 to 131 in 2008.[27] As shown in Figure 16, milk prices paid by CROPP/ Organic Valley are consistently higher and more stable than conventional milk prices, likely contributing to the rapid expansion of organic dairy farms in this region.

Figure 15

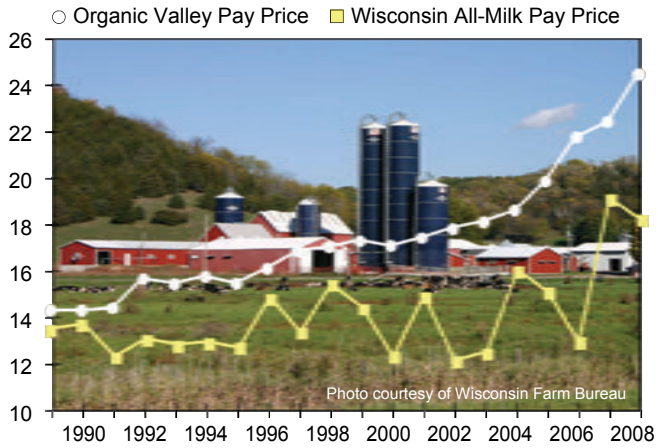
Spatial Expansion of Organic Dairy Farms in Southwestern Wisconsin[27]



Maps courtesy of Brad Barham, Program on Agricultural Technology Studies

Figure 16

Pay Price for Organic vs Conventional Milk[27]



Agriculture as a Source of Energy

Growing concerns over energy security, energy prices, and climate change have driven the demand for fuels derived from renewable products such as corn, soybeans, and wood. With no native sources of fossil fuels, replacing energy imports with Wisconsin biofuels is a strategy for keeping money circulating within the state. Federal and state subsidies for ethanol production and the state's goal to produce 25 percent of its energy from renewable sources by 2025 are other factors that have contributed to a growing amount of land being dedicated to biofuel and biomass energy production.

Agricultural Crops

Not every acre of corn and soybeans in Wisconsin is destined to become a part of the food system. From 2004 to 2008, total production of ethanol from corn in Wisconsin quadrupled, from 106 million gallons to over 460 million gallons.[28] Over half of this ethanol is exported to neighboring states. From 2008 to 2009, the total amount of ethanol remained largely unchanged despite a steep drop in the retail price of gasoline. Soy-based biodiesel fuel production during the same time period hovered around 7.5 million gallons.[28] These amounts constitute 15 percent of Wisconsin's annual consumption of 3.2 billion gallons of gasoline and diesel.[29]

Photo 3
Ethanol facility in Friesland, Wisconsin

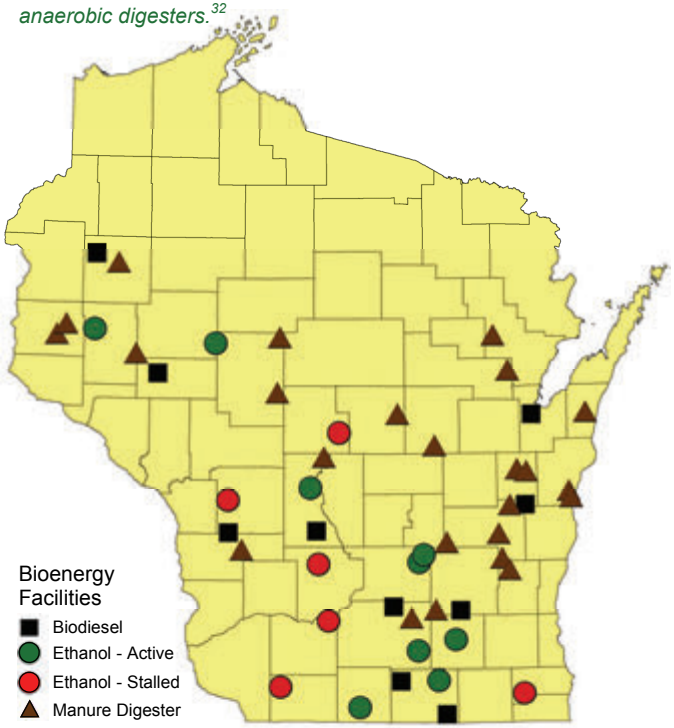
As the market for ethanol grows, farmers will meet increased demand for energy crops by increasing productivity, substituting corn for relatively less profitable crops like soy and wheat, and expanding corn crops into land not currently cultivated.[30] Ideally, growing plants for energy would complement existing food production systems and would not be done on lands that are marginal due to steep slopes or drainage issues. Unfortunately, there is evidence from Wisconsin and elsewhere that the growth of biofuel markets and escalating grain prices are creating incentives for farmland owners to exit conservation and land set-aside programs.[30] Total acreage in the USDA's Conservation Reserve Program declined by nearly a third from 2007 to 2009 after nearly a decade of stability.[31] Other potential tradeoffs include increased risks of soil erosion and increased costs of corn for livestock producers.

Converting plant material into refined fuel products requires specific facilities and infrastructure. Ethanol refineries, for example, need to be in close proximity to sources of corn as well as rail infrastructure for transporting finished products. In addition, refineries require major capital investments. As shown in Figure 17, construction on a number of ethanol refineries has been stalled prior to becoming operational.

Agricultural Wastes

Wisconsin is a leading state in the operation of farm-based anaerobic digester systems. These systems extract energy from manure in the form of methane. As of spring 2010, the state had 24 dairy farms with operating anaerobic digester systems.[32] Wisconsin digesters average approximately 70 tons per week of digested solids and 130,000 cubic feet per day of biogas.[33] Farms investing in anaerobic digester systems have benefited from the steady revenue stream from the sale of electricity, commodity by-products, and reduction of onsite expenses such as fertilizer, bedding, heat and electricity. Anaerobic digesters also mitigate some environmental problems associated with large scale dairy operations such as odor.[33]

Figure 17
Location of Bioenergy Facilities
This map shows the locations of biodiesel production sites,[34] active and stalled commercial ethanol facilities,[35] and farm-based anaerobic digesters.[32]



Environmental and Human Health Impacts

With its vast acreage, agriculture affects environmental and human health. While some government programs and farmers have worked for decades to minimize agricultural externalities such as soil loss, pesticide exposure, and nutrient loading to lakes, rivers and groundwater, much remains to be done.

Agricultural Irrigation

Approximately 377,000 acres, or four percent of all cropland in Wisconsin is irrigated.[5] This is a 70 percent increase from the late 1970s.[36] Figure 18 shows agricultural irrigation by county. Portage, Waushara, and Adams counties, each located within central Wisconsin, account for almost one-half of total agricultural irrigation. These counties also lead the state in the production of potatoes, sweet corn and other assorted vegetables.[36]

Studies in the 1960s and 1970s, and more recent work since 2000, warned that the growth in groundwater pumping for agricultural irrigation in the Wisconsin Central Sands could substantially lower regional water levels and stream flows.[37] Since 2000, water levels and stream flows in this region have been notably depressed, at least in areas that contain large densities of high capacity wells. High capacity wells are wells on a property where total pumping is more than 100,000 gallons per day.[38] As shown in Figure 19, areas with large densities of approved high-capacity wells appear to be associated with sandy glacial sediments.

Areas of the Central Sands with large densities of high capacity wells experienced record low water levels in 2000-2008.[37] This stands in sharp contrast to regions with few high capacity wells. The Little Plover River, a former high-quality trout stream in this area has dried annually in stretches since 2005. Long Lake near Plainfield, which formerly covered 45 acres has been dry to near dry since 2005. Declines of around four feet or more in water levels by pumping are possible beyond climatic influences.[37]

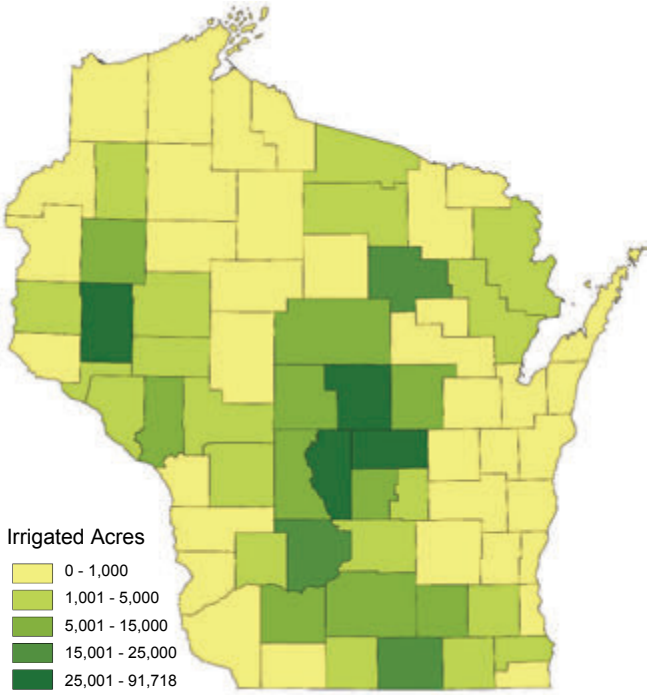
Online Feature — Time series maps showing growth of approved high capacity wells in the Central Sands from 1960-2010

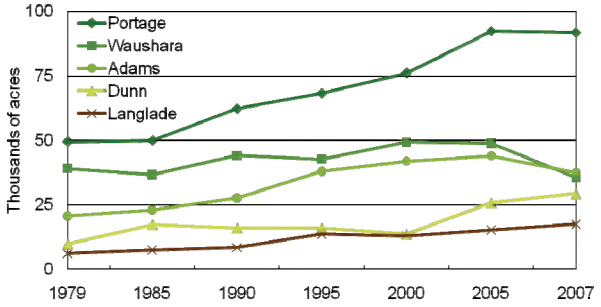
In 2004, Wisconsin passed its first law to address groundwater quantity and high capacity wells.[39] In 2009, additional state groundwater quantity legislation was proposed, but did not pass.

Photo 4
Central pivot irrigation system

Photo 5
Dry streambed at the site of the Little Plover River

Figure 18
Agricultural Irrigation
This map shows irrigated acres by county.[5] Most agricultural irrigation is focused on the counties in the central part of the state largely due to more permeable, sandy soils. The graph below shows agricultural irrigation for selected counties.[5, 36]





Groundwater use trend data for each county is available at http://wi.water.usgs.gov/gwcomp/find

Figure 19

High Capacity Wells

This map shows the locations of high capacity wells used for agricultural and non-agricultural purposes.[38] Agricultural wells are most prevalent in central Wisconsin largely due to more permeable soils.

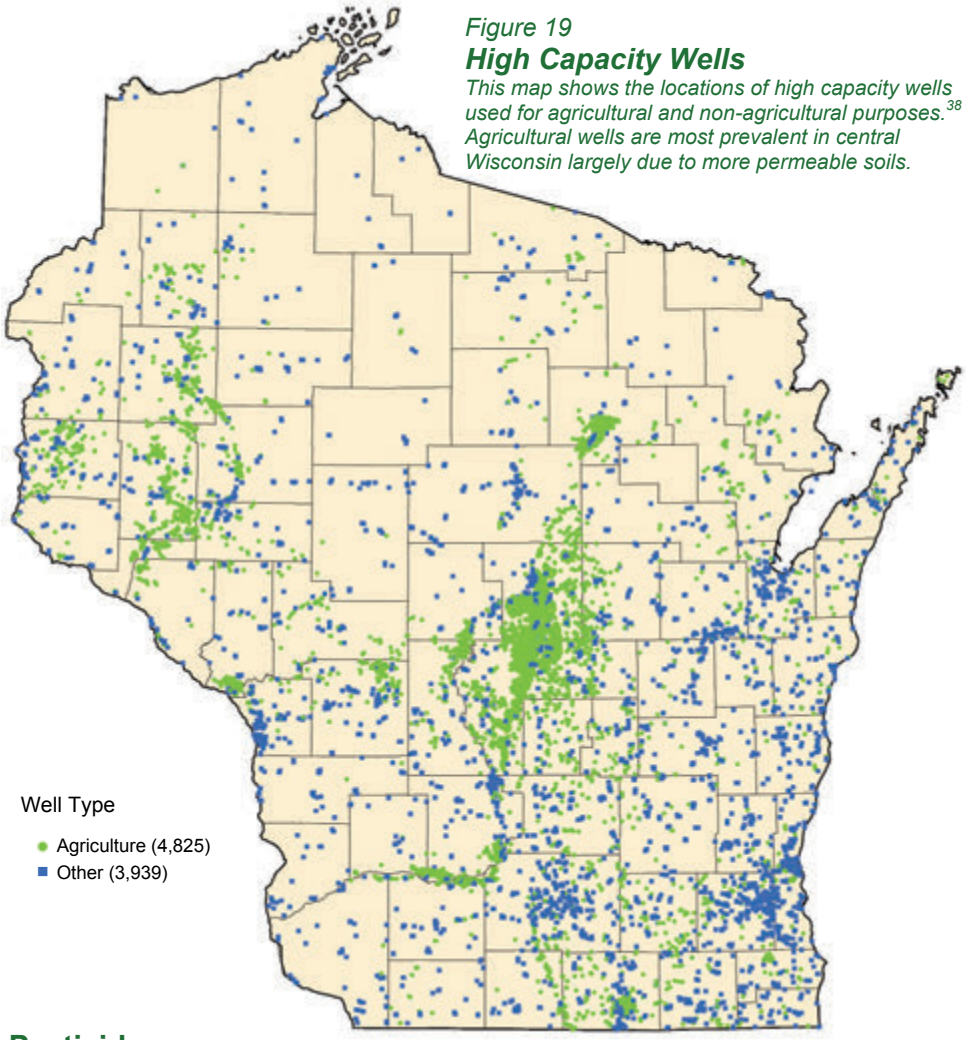
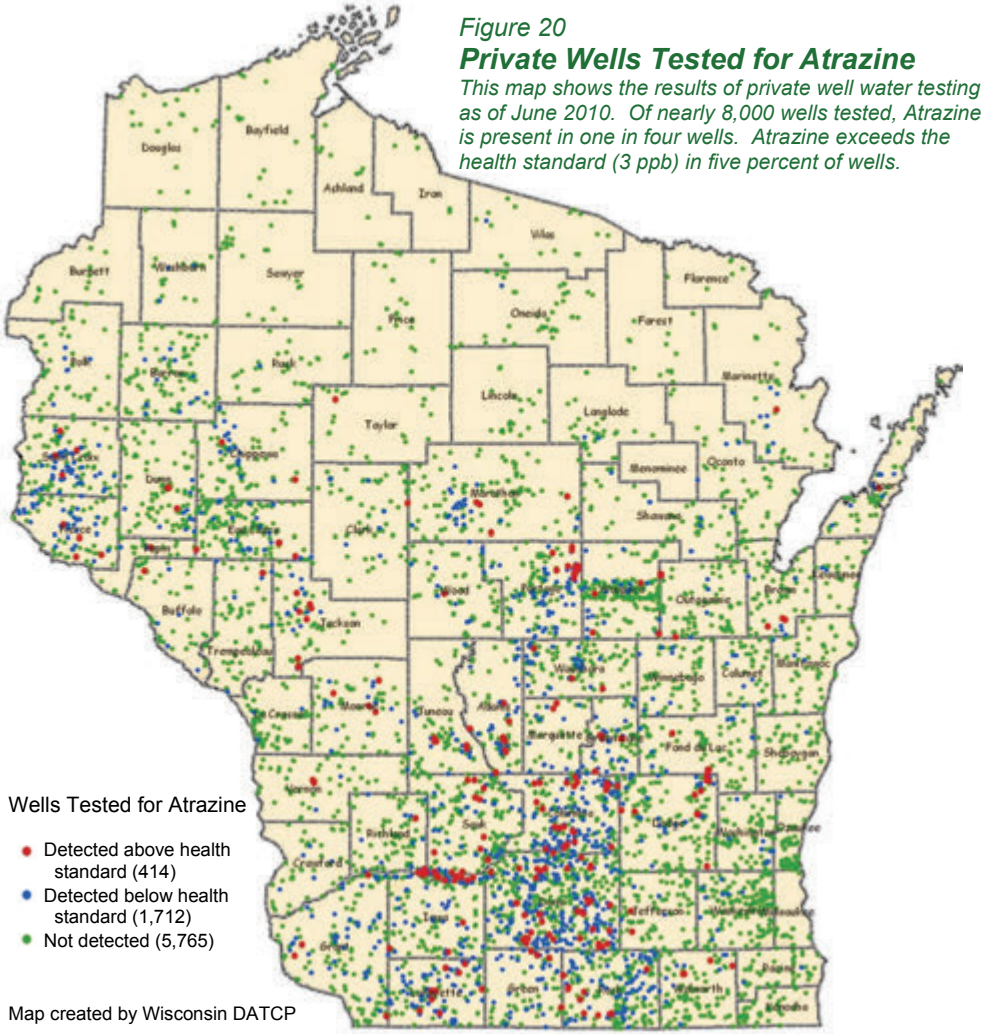


Figure 20

Private Wells Tested for Atrazine

This map shows the results of private well water testing as of June 2010. Of nearly 8,000 wells tested, Atrazine is present in one in four wells. Atrazine exceeds the health standard (3 ppb) in five percent of wells.



Map created by Wisconsin DATCP

Pesticides

Approximately 13 million pounds of pesticides (herbicides, insecticides and fungicides) are applied to major agricultural crops in Wisconsin each year.[40] Figure 21 shows the amount of pesticides farmers report applying by crop. The top five agricultural pesticides by quantity applied are: Glyphosate (2,482,500 lbs), S-metolachlor (1,766,000 lbs), Atrazine (1,626,400 lbs), Acetochlor (1,009,000 lbs), and Pendimethalin (391,700 lbs).[40]

Once a pesticide is applied, it will ideally only harm the target pest and then break down through natural processes into harmless substances. However, pesticides may also come into direct contact with humans during application, evaporate and drift for miles depending on particle size and wind conditions,[41] attach to soil particles and get tracked into homes, be absorbed by the plant or remain on the plant surface until harvest, leach into groundwater, or enter surface water through runoff.[42]

The health effects of pesticide exposure vary by pesticide. Atrazine, for example, is a popular corn herbicide. It has been used in Wisconsin for over 25 years and was used on 2.1 million acres of corn in the state in 2005.[40] Figure 20 shows where atrazine has been detected in private wells, and where it exceeds the health standard. Atrazine has been linked to cardiovascular damage and reproductive difficulties in some people when consumed at levels over the drinking water limit for many years.[43] Wisconsin has created

atrazine prohibition areas covering 1.2 million acres where atrazine and its metabolites are over the health-based drinking water limit. County maps showing these areas are available at: *http://datcp.state.wi.us/arm/agriculture/pest-fert/pesticides/atrazine/cnty_list.jsp.*

Other pesticides have been linked with cancer. Of the top five agricultural pesticides used in Wisconsin, there is evidence that three are possible human carcinogens.[44] Pesticides are also being tested for other health effects such as endocrine disruption and learning disabilities, and for effects on plants and animals.

Online Feature — Cancer Risks of Pesticide Exposure

Studies in 2001 and 2007 estimated that around 35 percent of private drinking water wells in Wisconsin contain a detectable level of an agricultural herbicide or herbicide metabolite.[45] As shown in Figure 22, areas with higher percentages of land in cultivation generally have greater percentages of wells with detectable pesticides. Many pesticides do not have health-based drinking water limits.[45]

Figure 21

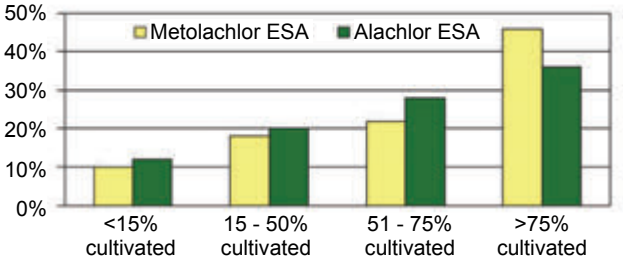
Pesticide Application Rates, 2004-05[40]

Crop	Pounds applied	Pounds per acre
Apples	*163,300*	*28*
Potatoes	*950,000*	*14*
Tart cherries	*14,700*	*8*
Carrots for processing	*29,400*	*7*
Snap beans	*251,600*	*3*
Sweet corn	*198,000*	*2*
Field corn	*6,503,000*	*2*
Green peas for processing	*33,500*	*1*
Soybeans	*1,770,000*	*1*
Cucumbers for processing	*3,800*	*1*
Cabbage, fresh	*2,700*	*1*
Barley	*5,000*	*0.1*
Oats	*25,000*	*0.1*

Figure 22

Private Well Water Contamination Rates

This graph shows the percentage of private wells tested in 2001 and 2007 that contain Metolachlor ESA and Alachlor ESA.[45] *Pesticide contamination rates appear to be positively correlated with the amount of land under agricultural cultivation.*



Nutrients

Surface water and groundwater contamination from agriculture is an ongoing concern. An estimated 200 million pounds of nitrate enters Wisconsin's groundwater each year—up to 90 percent from agricultural applications.[46] In a 2007 statewide study, nitrate exceeded the health-based drinking water limit in 16 percent of the private well samples tested.[45] County level data is at: *http://aqua.wisc.edu/publications/pdfs/nitratefactsheet.pdf*. Approximately 85-90 percent of private wells in the state have never been sampled for nitrate.[47]

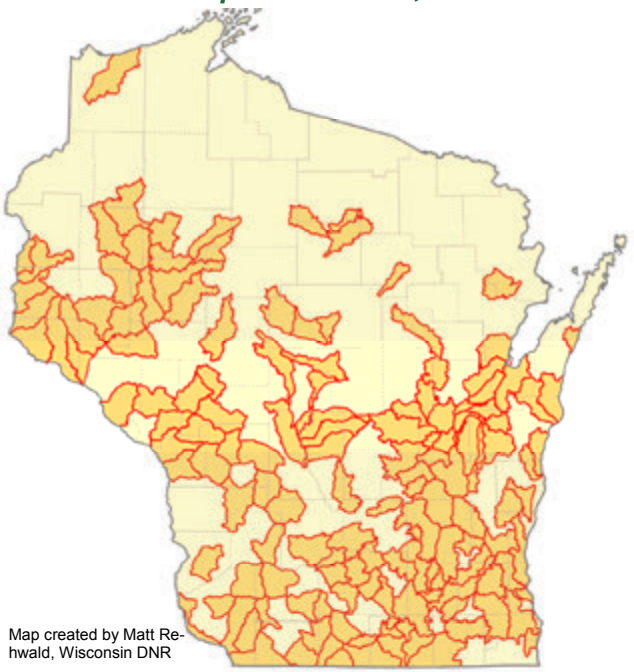
Stormwater runoff events can also have serious impacts on the health of people and the environment. Acute effects, such as fish kills and well contamination, and chronic effects, such as algae blooms and decreased fisheries health have been attributed to runoff events.[48] In the winter and spring of 2004-2005 there were 52 reported manure-related runoff events in Wisconsin.[48] Once manure and sediment enters the water, it can impact all water downstream from the entry point. As shown in Figure 23, there were 57 lakes and 205 streams that were federally listed on Wisconsin's 303d list of impaired waters in 2010 as a result of excess sediment or phosphorus.[48]

Sediments

The environmental impact of conservation tillage (no-till, ridge-till, and mulch-till) is well documented. By leaving at least 30 percent of crop residue covering the soil surface after planting, conservation tillage reduces soil erosion by wind and water, increases water retention, reduces soil degradation, and reduces water and chemical runoff.[49] Surveys conducted by the Wisconsin Department of Agriculture in the 2000s indicate that 10 to 20 percent of Wisconsin farmers are practicing no-till agriculture.[50] As a result of no-till and other conservation measures, soil erosion in Wisconsin decreased from 1982 through 1997, but has since been increasing.[50] Without increased implementation of soil conservation practices, changes in the intensity of storms are projected to more than double soil loss in Wisconsin by 2050.[50]

Figure 23

Watersheds with Designated Phosphorous or Sediment Impaired Waters, 2010



Map created by Matt Rehwald, Wisconsin DNR

Economic Impacts

Wisconsin's economy is closely tied with agriculture. In 2007, Wisconsin's agriculture and food processing industries contributed 353,991 jobs, $20.2 billion in income, and $59.16 billion in sales.[51] These values equal 10 percent of total employment, nine percent of total income, and 12.5 percent of total industrial output.[51] Other aspects of the agricultural economy are explored below, including land values, net farm income, and the role of government subsidies.

Land Values

Figure 24 shows farmland values (adjusted for inflation) broken down by three regions. Overall, farmland values have increased. In the last three decades values have been equally volatile across all regions of the state. With higher farmland values in southeast Wisconsin compounded by population and development pressures, the premium on agricultural land conversion is very high in comparison to other parts of the state.

Figure 24

Regional Farmland Values, 1850-2007[52, 5]

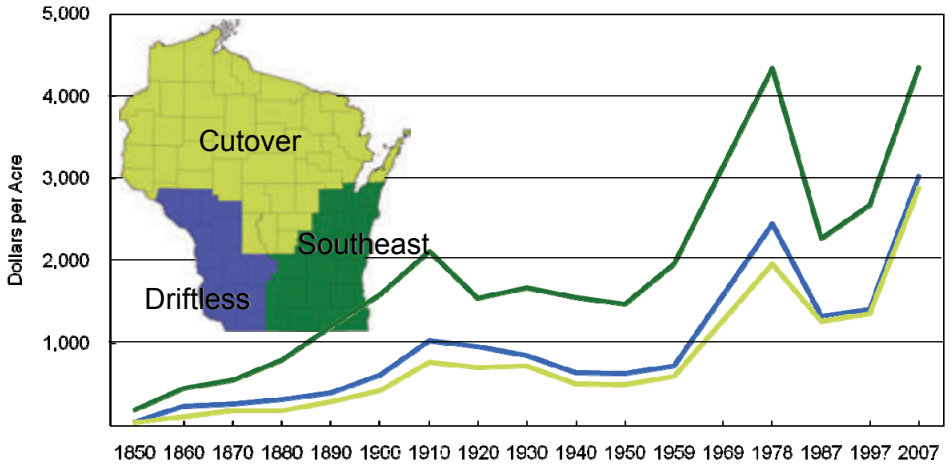


Figure 25 shows the difference in agricultural land sale prices per acre for land remaining in agriculture versus land being converted to other uses. There are two points to note. First, there are very high premiums paid for agricultural land conversion in the heavily urbanized areas of southeast and northeast Wisconsin. Second, the premium on agricultural land conversion in other parts of the state remains relatively low or is actually negative, meaning there is a premium paid for keeping land in agriculture.

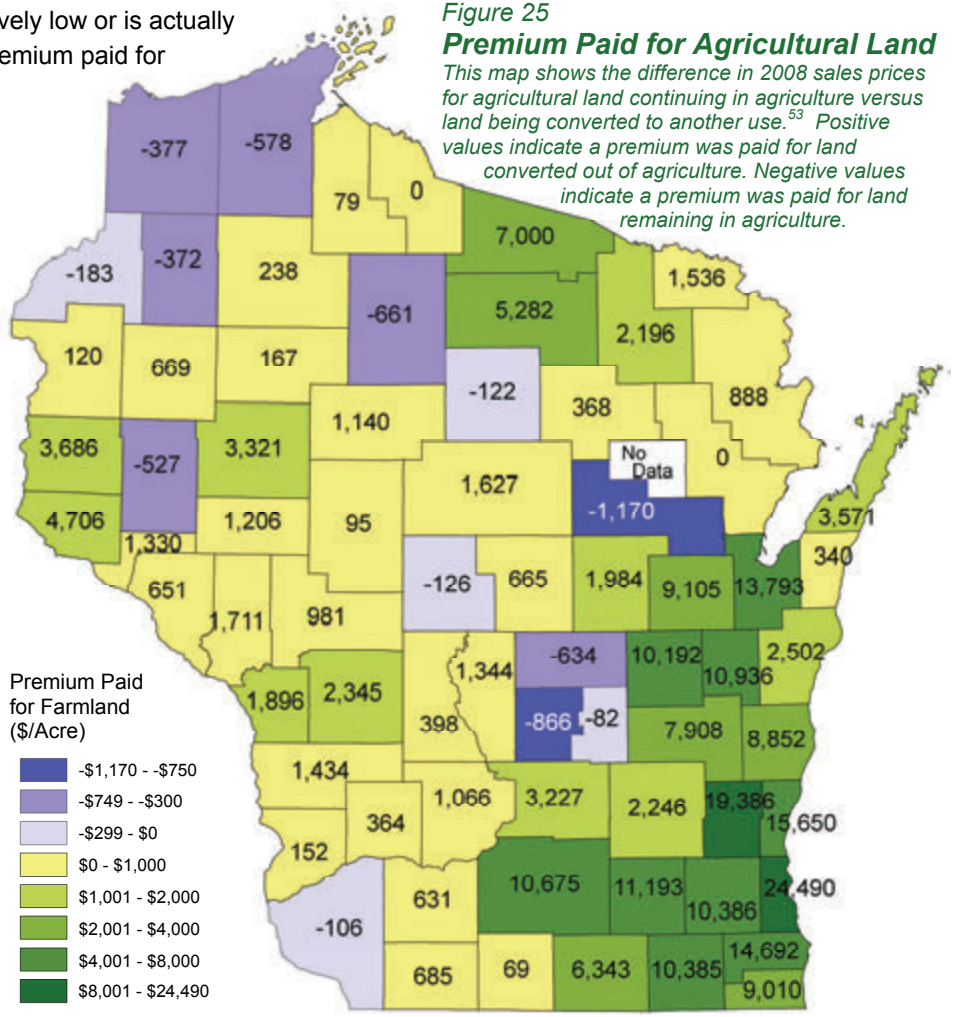
Farm Income

Figure 26 provides a snapshot of net farm income by county. Farm income includes sales, government payments, and other farm-related income such as animal boarding. Except for Douglas and Forest counties in northern Wisconsin, net farm income is positive for all other counties. That is not to say that net farm income is positive for all farms in each county. Dane County has the highest net farm income in Wisconsin at $160,000 per farm.[5] Net farm income is also high in portions of north central, northeast, south central, and southwest Wisconsin.

Figure 25

Premium Paid for Agricultural Land

This map shows the difference in 2008 sales prices for agricultural land continuing in agriculture versus land being converted to another use.[53] Positive values indicate a premium was paid for land converted out of agriculture. Negative values indicate a premium was paid for land remaining in agriculture.



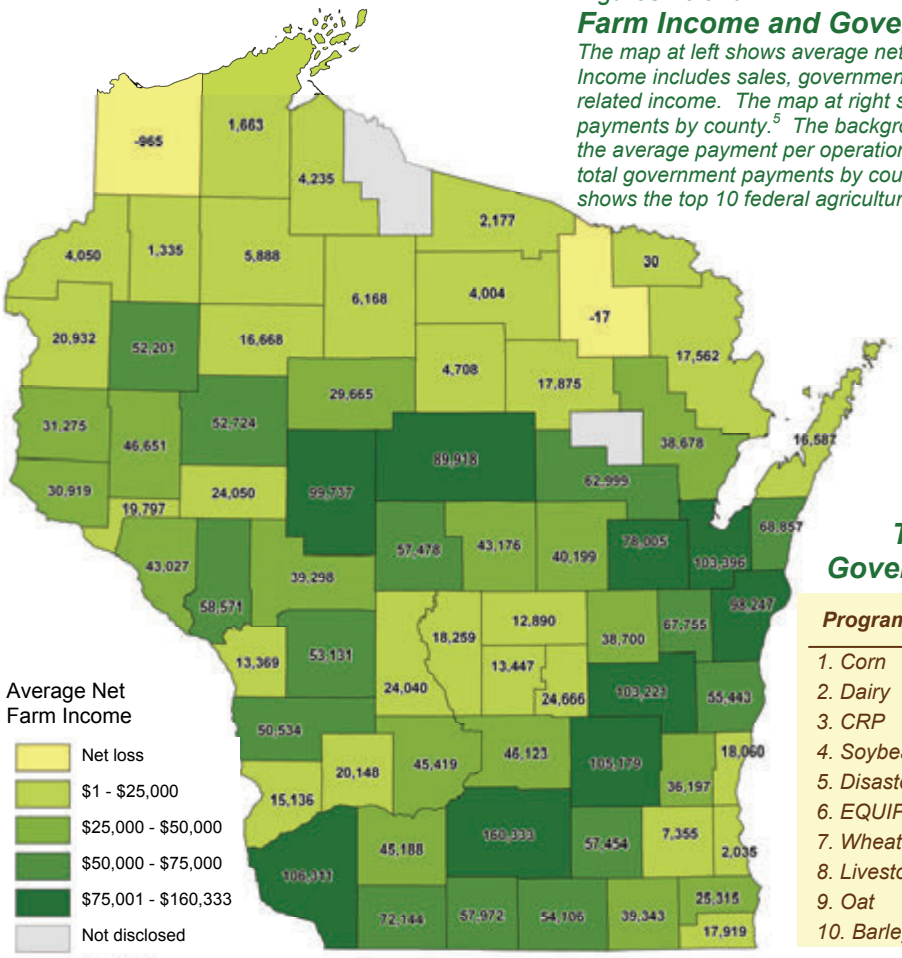
Federal Government Payments

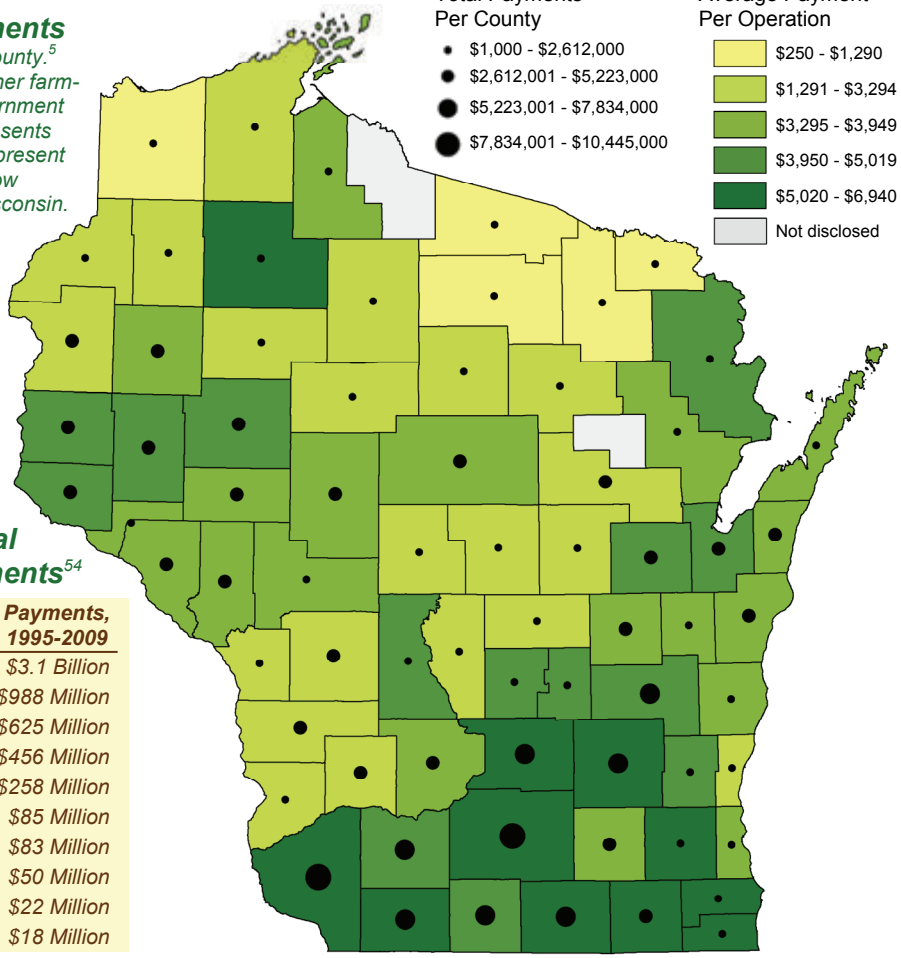
In Wisconsin, government payments to farmers total almost $196 billion.[5] This figure includes direct payments to producers for agricultural commodities, payments for participation in federal conservation programs, loan deficiency payments and disaster payments. Crop insurance, Commodity Credit Corporation proceeds, and state and local agricultural program payments are not included. In 2007, two-thirds of all farms in Wisconsin received government payments. Those with high market values (greater than $100,000) and very low market values (less than $1,000) were more likely than their peers to receive government payments. Two thirds of all payments went to farms with market values greater than $100,000 and to farms with 260 or more acres.[5] Though large, high-value farms receive the largest portion of government payments, government payments comprise a greater percentage of total market value for low-value and mid-sized farms. For example, farms with market value less than $1,000 derive 92 percent of their total value from government payments.[5] Figure 27 shows the amount of government payments to farm operations in two different ways. The colored portion of the map shows average government payments per operation. The black dots show total government payments by county. Not surprisingly, the highest government payments are located in southern Wisconsin where farming dominates.

Figures 26 and 27

Farm Income and Government Payments

The map at left shows average net farm income by county.[5] Income includes sales, government payments and other farm-related income. The map at right shows federal government payments by county.[5] The background shading represents the average payment per operation, while the dots represent total government payments by county. The table below shows the top 10 federal agricultural payments to Wisconsin.





Top 10 Federal Government Payments[54]

Program	Recipients, 1995-2009	Payments, 1995-2009
1. Corn	77,358	$3.1 Billion
2. Dairy	40,866	$988 Million
3. CRP	39,781	$625 Million
4. Soybean	33,843	$456 Million
5. Disaster	30,140	$258 Million
6. EQUIP	7,560	$85 Million
7. Wheat	21,396	$83 Million
8. Livestock	21,256	$50 Million
9. Oat	56,471	$22 Million
10. Barley	20,471	$18 Million

State and Local Policy

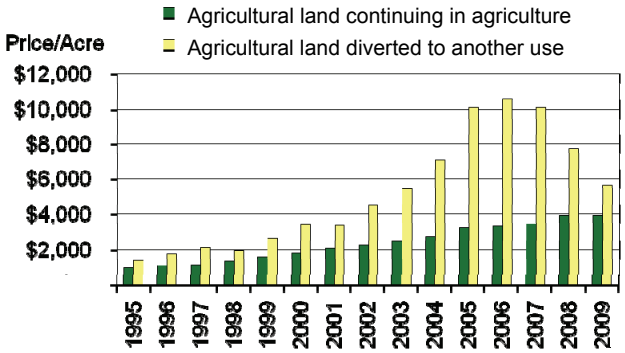
The State of Wisconsin and local counties and municipalities use a variety of planning, regulatory and incentive-based tools to manage agricultural land. Some of these tools are described below.

Agricultural Use Valuation

Wisconsin's use value law, which was enacted as part of the 1995-97 Biennial Budget Act, is intended to provide property tax relief for farmers and to reduce urban sprawl. Under use value assessment, property taxes are assessed on land that is used primarily for agricultural purposes based on the land's productivity, rather than its full market value. In 2008, approximately 12 million acres of agricultural land, or 35 percent of all land in Wisconsin, was assessed under use value.[55]

Figure 28 shows land sales data for agricultural land continuing in agriculture versus land being diverted to other uses. In 2007, there was a premium of $7,315 paid on land being diverted from agricultural use. Based on this graph, it appears that use value assessment has been successful in moderating agricultural land values, even during the recent recession.

Figure 28
Wisconsin Agricultural Land Sales[53]



Wisconsin's use value assessment policy has come under criticism in recent years. A 2010 analysis by the Legislative Audit Bureau looked at a cross-section of 14 communities across the state. In 9 of the 14 communities, more than 50 percent of the land under use value assessment was zoned for non-agricultural purposes. In 7 of 14 communities, more than 20 percent of the land was owned by a real estate or property development company.[55] Both of these trends suggest that agricultural land is being used as a low-cost holding zone for future development.

Livestock Facility Siting Standards

Wisconsin's Livestock Facility Siting Law and Rule (ATCP 51) took effect in May 2006. The livestock siting rules established new siting standards related to odor, waste, and runoff; a predictable siting process; and a new appeals process. The new rules apply only to new and expanding livestock facilities if a local permit is required and if the facility will have more than 500 animal units. Local governments are not required to regulate livestock facilities under the rule. The following website has a map showing local municipalities that regulate livestock facilities through licensing or zoning: *https://datcpgis.wi.gov/livestock/.*

Agricultural Runoff Standards

Wisconsin's rules to control polluted runoff from farms and other sources went into effect in October 2002. DNR rule NR 151 sets performance standards and prohibitions for farms; establishes runoff management grant programs; and controls point-source permitting of storm water and agricultural runoff sources. The partner DATCP rule ATCP 50 identifies conservation practices that farmers must follow to meet performance standards. The DATCP rule also sets out requirements for nutrient management plans. In July 2007, DNR finalized revisions to NR 243 which outlines the Wisconsin Pollutant Discharge Elimination System (WPDES) permit program and the regulations for the management and land-spreading of manure from large-scale livestock operations. These revisions include additional restrictions on land application of manure to frozen and snow-covered ground. For more information on agricultural runoff management, visit: *http://dnr.wi.gov/runoff/index.htm.*

Wisconsin Working Lands Initiative

The Wisconsin Working Lands Initiative (WLI) went into effect in July 2009. The goals of this program are to overhaul and modernize Wisconsin's 30-year-old farmland preservation program; to help local governments modernize outdated farmland preservation plans and zoning ordinances; to enhance soil and water conservation programs; and to create a new statewide program for targeted purchase of agricultural conservation easements. The ultimate goal is to give local governments more flexibility to protect farmland and promote agricultural businesses.

Wisconsin's Farmland Preservation program, the precursor to WLI, was first adopted in June 1977. The original goals of this program were to preserve farmland through local planning and zoning; to promote compliance with soil and water conservation standards; and to provide property tax relief to farmers. Individual landowners in counties that had adopted a certified farmland preservation plan could quality for tax credits if their land was zoned under exclusive agricultural zoning or if they had signed a farmland preservation agreement. At its peak in 1991, 25,000 farmers

participated in the program for a total of 6.4 million acres of farmland and $29.5 million in tax credits. By 2004 that total had dropped to 19,500 farmers with 4 million acres of land and $14.4 million in tax credits.[56]

A key component of the farmland preservation program was the provision of farmland preservation tax credits. These credits continue under WLI. Credits increase if a farm is in a preservation area identified in a farmland preservation plan, is under farmland preservation zoning, and is in an agricultural enterprise area.

The 35 acre minimum lot size previously required under exclusive agricultural zoning has been eliminated under WLI. As shown in Photo 9, this policy had the unintended consequence of encouraging large-lot residential development in agricultural areas. Another important outcome under WLI will be the modernization of farmland preservation plans. Many counties had not updated their plans since the late 1970s or early 1980s.

A new component of WLI is a Purchase of Agricultural Conservation Easements (PACE) program. PACE allows willing landowners to place agricultural land into an easement in exchange for a one-time payment. The farmer retains full ownership of the land but is restricted from developing the land for nonagricultural purposes. Through this program, participating farmers can augment their income while continuing to farm the land. The state may issue up to $12 million in bonds to fund the PACE program. For more information, visit: *www.datcp.state.wi.us/workinglands/index.jsp.*

Photo 6
Potential result of a 35 acre minimum lot size policy. Large tracts of land are converted to residential use. Homes and driveways in the middle of the lots make it difficult to convert this land back to productive agricultural use.

Purchase of Development Rights

Success in places like the Town of Dunn in Dane County helped to convince lawmakers that introducing a statewide PACE program would be useful for farmland preservation. The Town of Dunn Purchase of Development Rights (PDR) program has been operational since 1997. The Town holds conservation easements on 24 properties covering 2,835 acres, or 12 percent of the town. Other organizations have also preserved land in the town for a total of almost 5,500 acres, or 25 percent of the town.[57]

While PDR and PACE programs are only beginning, land trust and other types of organizations have purchased conservation easements and received donated or bequeathed land for many years. More than 200,000 acres of all types of land, including agriculture, have been preserved through this method.[58]

Local Planning and Zoning

At the local level, counties and municipalities are making innovative use of zoning and subdivision regulations to enforce minimum and maximum lot sizes, density limits, clustering, and other development standards.

Conservation subdivisions are characterized by common open space and clustered compact lots. The purpose of a conservation subdivision is to protect farmland or other natural resources while allowing for the maximum number of residences under current community zoning and subdivision regulations. In some cases a density bonus is offered to encourage this type of development. Generally, this tool is only used on parcels 40 acres or greater.

Rather than specifying the smallest or minimum lot size allowable within a zoning ordinance, communities are also beginning to specify maximum lot sizes and density limits. For example, a community could specify that lots within an agricultural district be no larger than 2 acres and no smaller than 1/2 acre. They could also specify that no more than two buildable sites be allowed on a parcel of 40 acres. When these types of tools are paired with clustering and limits on the type of soil that can be built upon, agricultural land can be preserved.

Jefferson County is a case in point. Its multi-pronged policy involves directing development to urban areas, allowing a specified number of splits on prime agricultural soils, a maximum lot size, and clustering. To date, Jefferson County has preserved approximately 27,000 acres of land.[59]

Photo 7
In contrast to the previous photo, a clustering policy could help to achieve this result. Home sites are limited in size and clustered near an existing road. The remaining land includes actively managed woodlots and agriculture.

References and Acknowledgements

On The Web

The Wisconsin Land Use Megatrends series is on the web at: *www.uwsp.edu/cnr/landcenter/megatrends*. Previous publications in this series have focused on forestry, housing, recreation, energy, and climate change. Additional content is available in the online version of this report as indicated by the symbol: *Online Feature*.

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