Food, Land and Water: Can Wisconsin Find Its Way?

By James Matson*
May 8, 2016

EXECUTIVE SUMMARY**

Our food system is under stress, and so are the natural resources that sustain it. Where do we go from here?

Feeding Wisconsin

- Food production uses more land and water than any other human activity, and has a profound impact on our natural environment. In an increasingly urbanized world, our lives depend on a vast food system that few of us understand.
- Wisconsin consumes (or wastes) about 30 million lbs. of food *every single day*, and our population is growing. Our cities have about one week's supply of food on hand at any given time. Our food supply must be replenished without fail, every day of every year, for all generations to come.
- Grain and animal products provide most of the energy (calories) in our diet. In 2000, the U.S. consumed 25% more calories per person than we did in 1970.
- The U.S. wastes almost 1/3 of its total food supply. We dump about 30 million *tons* of food in landfills each year – enough to feed everyone in Wisconsin for 5 years. When we waste food, we also waste land, water, energy, and farm inputs.

Food from Far Places

- Wisconsin is part of a vast, worldwide food system. Most Wisconsin food products are shipped out of the state, and most of what we eat comes from beyond our state borders. Food production is geographically specialized, and our food comes from many distant places. For example, nearly half of all U.S. fresh vegetables come from California.
- Foreign imports now provide about 17% of the U.S. food supply, including 50% of our fresh fruit, 20% of our fresh vegetables, and 90% of our seafood (half from aquaculture, and much illegally caught). Two-thirds of our apple juice now comes from China. Food imports *doubled* over the last decade, to over $104 billion in 2013.
- We export even more food than we import. The U.S. is the world's biggest food exporter, and much of that food comes from the rich prairie soil of the upper Midwest – one of our most precious natural resources. We export 20% by volume of all U.S. farm products, including 50% of our wheat, 40% of our soybeans, 20% of our corn, 20% of our processed vegetables, 20% of our pork and poultry, and 16% of our dairy products.
- U.S. food exports *tripled* over the last decade, to over $175 billion in 2014. Wisconsin participated in this export surge. Wisconsin dairy exports to foreign countries grew by 41% in 2013 alone.

---

* James Matson retired in 2011 after 28 years as chief legal counsel for the Wisconsin Department of Agriculture, Trade and Consumer Protection.

** This is a summary of a longer paper that may be downloaded, free of charge, from the Wisconsin Land and Water Conservation Association website at http://wisconsinlandwater.org/programs/food-land-water-project. The complete paper includes charts, maps, illustrations, and supporting citations.

Feeding the World

- Population growth and changing diets are driving a surge in world food demand. In the last 100 years (just one long human lifetime), Wisconsin's population has *doubled*, the U.S. population has *tripled*, and the world population has *quadrupled*. By mid-century, when today's children are middle-aged, world population is expected to grow by another 25% – to over 9 billion people.
- Our food system, like our financial system, is now heavily exposed to the world market. World supply and demand powerfully affect commodity prices and land use decisions in Wisconsin. That has a big impact on Wisconsin's environment.
- Rising nations like China want more animal protein in their diets, and they can now afford to pay for it on world markets. By one U.N. estimate, the world may consume 73% *more* meat and eggs and 58% *more* dairy products by 2050, when today's children are middle-aged.
- A diet high in animal protein (such as the U.S. diet) requires far more land, water and crop production than a diet based on plant protein alone, because livestock require a lot of feed. The biggest cash crops in the U.S. – corn and soybeans – go mainly to feed livestock.
- Next to livestock, *cars* are the biggest consumers of U.S. corn. Over 30% of the entire U.S. corn crop now goes for car fuel. Only about 10% of the U.S. corn crop goes directly to human food (mostly refined oils and sweeteners).
- If current use (and waste) trends continue, the world may need to produce *twice as much* grain by 2050 to keep food prices stable. But food production is already testing the limits of our land and water resources.

Food, Energy and Greenhouse Gas

- The U.S., with 5% of the world's population, consumes about 20% of the world's annual fossil fuel production (all uses).
- From farm through home kitchen, the U.S. food system accounts for roughly 16% of all U.S. fossil fuel use. We use 7-10 Calories (kcal) of fossil fuel to produce, process and deliver each food Calorie (kcal) that we consume. We live, almost literally, on fossil fuel.
- Our home kitchens and grocery store trips account for 28% of overall food system energy use. Commercial food processing accounts for 19%, farming for 15%, and non-household transportation for 4%. Relatively cheap, efficient bulk transportation has contributed to the "de-localization" of our food system.
- The U.S. food system, from farm through home kitchen, accounts for roughly 22% of all U.S. greenhouse gas emissions. Carbon dioxide (from fossil fuel combustion) accounts for 13%, while nitrous oxide and methane (from fertilizer and livestock) account for 9%.

Food and the Wisconsin Economy

- Food industries are important to Wisconsin's economy. Agriculture, farm supply and wholesale food processing contributed $88 billion to Wisconsin's economy in 2012, up from $60 billion in 2007. Farming itself accounted for less than 1/4 of this total.
- Wisconsin food industries depend heavily on livestock. The dairy industry alone contributed $43 billion to Wisconsin's economy in 2012. The meat industry is Wisconsin's 4th largest manufacturing industry. Most of our farm revenue comes from milk, meat, poultry, and livestock feed (including grain and forage crops). High feed prices help grain producers but can hurt livestock producers.

A Changing Food System

- Today, few consumers produce even a tiny fraction of their own food, and few farmers sell food directly to consumers. Direct farm-to-consumer sales (such as farmers markets) currently account for less than one-half of 1% of all U.S. farm revenue.
- Farmers *and* consumers now depend on a vast industrial network of commodity dealers, warehouses, processing plants, transport systems, wholesale distributors and retail food chains. Farmers also depend on industrial networks to provide their seed, fertilizer, pesticides and other inputs. Many of these networks are now dominated by a handful of global companies.
- Industrialized food production has fed a rapidly growing population at reduced *per capita* cost. The average U.S. household now spends about 10% of its income on food, compared to 40% in 1900. Industrialization has also brought us convenience and variety. The average U.S. supermarket now carries more than 42,000 items from all over the world.
- But industrialization has also brought unsettling changes. Giant companies now dominate, and production is highly concentrated. For example:
  - Just 4 companies (including 2 foreign companies) now slaughter 70% of all U.S. hogs. Ninety-five percent of our pork comes from plants that slaughter *over a million hogs a year per plant* (compared to 27% in 1976). Just 100 farm operators now raise *half* of all U.S. hogs. The number of U.S. hog farms fell by 90% in just 3 decades, from 1980 to 2010.
  - Just 2 companies, Monsanto and DuPont, now supply 70% of all U.S. corn seed (up from 45% in 2004) and 60% of all U.S. soybean seed (up from 40% in 2004). They also hold restrictive patents on most of the seed sold by their competitors. Most farmers are now captive seed buyers, rather than independent seed producers. In 1982, soybean farmers still produced 50% of their own seed; today, they produce almost none.
  - The top 4 grocery retailers, led by Wal-Mart, now control 40% of the U.S. grocery market (up from 17% in 1992). They buy from a limited number of favored suppliers, and their procurement demands affect the entire food system – right down to the farm level.
- We now depend on fewer, larger farms. Just 2% of U.S. farms now account for *over half* of all U.S. farm product sales. Over half of all farms with annual sales under $350,000 are losing money.
- Just 13% of Wisconsin farms account for 76% of Wisconsin farm product sales, and operate 43% of all Wisconsin farmland. Wisconsin has fewer than 10 thousand dairy farms, compared to 140 thousand in 1950. Just 3% of Wisconsin dairy farms now produce 30% of Wisconsin's milk. "America's Dairyland" now has twice as many prisoners as dairy farm operators.
- Absentee owners now control 34% of Wisconsin farmland. Farm families constitute less than 8% of Wisconsin's *rural* population. Most farm household income now comes from *off-farm* sources, and fewer than half of all farmers consider farming to be their primary occupation. The average Wisconsin farm operator is 57 years old.

Food and Land

- Over 40% of the world's land area is now devoted to agriculture, compared to 17% in 1700. Even so, population growth and food demand are outpacing production capacity.
- Today, the world has only *half as much farmland per capita* as it did just 50 years ago. That *per capita* loss is mainly due to a doubling of world population. But good farmland is also being lost to development, drought, erosion, salinization, declining fertility, overgrazing and environmental degradation. The U.S. is no exception.

- Nearly all of the world's useful farmland is already under production, and further conversion of marginal lands (such as rain forest, wetlands and dry grassland) will come at great cost to the environment. There will be no more "new" continents to exploit. Our future depends on saving what we have, and using it wisely.
- In just 3 decades, from 1982 to 2010, the U.S. lost 24 million acres of farmland to development. *That is equal to about 70% of the total land area of Wisconsin.*
- Wisconsin has been losing over 20 thousand acres of farmland each year. In just 25 years, from 1982 to 2007, over 777 thousand acres of Wisconsin rural land (including 520 thousand acres of farmland) were converted to development. *That is an area the size of Dane County.* Farmland loss and fragmentation are continuing at a steady pace.

Food and Water

- Agriculture is, by far, the nation's biggest water user – accounting for up to 80% of consumptive water use. Water shortages have reached crisis levels in drought-stricken western states, and irrigation is depleting ancient groundwater reserves.
- Wisconsin has abundant water compared to many states, and we are less dependent on irrigation. But irrigation is important in some areas, such as the Central Sands, where the rapid growth of high capacity wells is affecting groundwater and surface water levels.
- Rapid urban development has depleted groundwater in Waukesha, which now wants to import drinking water from Lake Michigan. But, like many thirsty locations in the U.S., Waukesha lies *outside* the Great Lakes watershed. The Waukesha case reminds us of the potentially huge demands on our Great Lakes, one of the world's most important fresh water resources.
- Storm water management has become a big, expensive problem throughout Wisconsin. The problem is aggravated by urban sprawl, farmland loss, and a pattern of heavier storms. As farms, forests and wetlands are converted to hard-surface urban uses that accelerate runoff, destructive runoff and flooding problems will grow.

Intensive Crop Production

- Despite a shrinking *per capita* land base, farmers have met soaring crop demand by producing far more per acre of land. For example, U.S farmers now produce *five times more corn* than they did in 1950, on roughly the same number of acres.
- Yield increases have come from high-yield genetics, mechanization, irrigation, geographic specialization, and extensive use of fertilizers and pesticides, among other things. But the push for higher crop yields has had serious environmental side effects.
- Commercial fertilizer provides important crop nutrients, including nitrogen and phosphorus. Wisconsin imports large quantities of nitrogen and phosphorus fertilizer from outside the state. Livestock manure also provides nitrogen and phosphorus to crops.
- Nitrogen fertilizer now provides up to half the nitrogen required by crops worldwide. Without it, world food production (and population) would collapse. But even with sound management, some of that nitrogen ends up polluting our air (as nitrous oxide, a greenhouse gas) and water (as nitrate).
- Today, U.S. farmers apply *5 times more nitrogen fertilizer* than they did in 1960. Wisconsin farmers have *doubled* their nitrogen fertilizer applications over the last decade. Some crops, like corn, are especially heavy nitrogen consumers.

- Nitrate, leached mainly from nitrogen-rich farm fields, is Wisconsin's most pervasive groundwater contaminant. Nitrate can cause health problems, including potentially fatal "blue baby" syndrome in infants. Heavy nitrogen applications increase nitrate pollution risks.
- In the heavily farmed areas of southern Wisconsin, 20-30% of private wells exceed the state enforcement standard for nitrate. One-third of all Wisconsin families get their drinking water from private wells. Municipal well contamination is also increasing. In 2012, Wisconsin communities spent over $32.5 million to remedy nitrate contamination of municipal drinking wells.
- Phosphorus runoff, mainly from farms, causes potentially toxic algae blooms that are choking many Wisconsin lakes. Wisconsin soil phosphorus levels have been rising for decades, due to regular fertilizer and manure applications (local conditions vary). Soil erosion from farm fields carries phosphorus to lakes and streams. Hundreds of Wisconsin watersheds are affected.
- Phosphorus pollution risks grow when farmers fail to control erosion, or add too much phosphorus to soils that are already phosphorus-rich. Intensive row cropping, reduced perennial vegetation cover, and a recent pattern of heavy storms (possibly related to global warming) are making matters worse.
- 34% of all Wisconsin drinking wells contain detectable levels of one or more pesticides (most are within safety margins). Heavy pesticide use has spurred the growth of more resistant pests. Crop monoculture has reduced bio-diversity and natural pollinators, and increased system-wide vulnerability to diseases and pests. GMO crops have solved some problems, but caused others.

Intensive Livestock Production

- A production revolution has profoundly altered the U.S. livestock industry. Specialized breeding, automation, scientific feeding, antibiotics, pharmaceuticals, and industrial-scale production have dramatically increased efficiency.
- Today, for example, Wisconsin has 40% *fewer* dairy cows and 93% *fewer* dairy farms than we did in 1950, yet we produce 80% *more* milk. Milk production per cow has *tripled*, and there is no end in sight. But the production revolution has had an unsettling effect on farms and rural communities, and has profoundly affected our relationship to farm animals and the environment.
- California pioneered industrial-scale dairy farming in the 1980's, and soon rocketed past Wisconsin as the top U.S. milk producing state. California now produces 50% more milk than Wisconsin, although Wisconsin has 5 times more farms. The average California dairy farm has over 1,000 cows, compared to about 124 in Wisconsin. But Wisconsin is moving in California's direction. Wisconsin milk production is expanding rapidly, and dairy herds are getting bigger. Just 3% of Wisconsin dairy farms now produce 30% of Wisconsin's milk.
- Modern livestock production is a "high wire act." The performance is stunning; but there is little room for error, and the risks are palpable. Large facilities require big capital investments and flawless management. Heavy animal waste concentrations pose new environmental challenges, and crowded populations of genetically uniform animals may be susceptible to disease.
- When things go wrong in a highly concentrated production system, they can go wrong in a big way. In 2015, a deadly bird flu virus ravaged the Upper Midwest. The disease spread quickly among large poultry facilities (some housing *millions* of birds). Nearly 50 million chickens and turkeys died. The disease cost nearly $1 billion and 6,000 jobs in Iowa alone (operator losses were partly indemnified by U.S. taxpayers). Wisconsin was also heavily affected.

- The livestock industry accounts for nearly 80% of all U.S. antibiotic use. Excessive use can promote drug-resistant pathogens – a major threat to animal and human health. Dairy farms do not routinely feed antibiotics to promote animal growth (some other livestock sectors do), but they do use antibiotics for common conditions like mastitis. Farmers may not ship milk from cows that are being treated. Dairy plants must test for antibiotics, and discard contaminated milk. The amount of discarded milk has fallen by half – to about 4.4 million lbs. per year. That represents less than 1/10 of 1% of Wisconsin's annual milk production.

America's Dairyland: Milk and Manure

- In 1950, Wisconsin had 140 thousand dairy farms, and the average farm had only 15 cows. Today we have only 10 thousand dairy farms, but the farms are much bigger. The average Wisconsin dairy farm now has about 124 cows, and the biggest has about 8,000 cows.
- Wisconsin now produces nearly 28 billion pounds of milk a year – a 25% increase in just 10 years. More milk means more manure. Manure production has increased by roughly 7% in 10 years. Just 3% of farms produce roughly 30% of the state's manure.
- Milk and manure production have become far more geographically concentrated. Manure is a good fertilizer, but it has become a serious environmental challenge in some parts of Wisconsin.
- 90% of Wisconsin's milk goes for cheese, and 90% of that cheese is consumed outside the state. Wisconsin cheese production grew by nearly 21% over the last decade. Wisconsin is America's top cheese state, producing 26% of all U.S. cheese. Higher milk production has boosted Wisconsin's cheese industry.
- Wisconsin leads the nation in artisan cheese (23% of our cheese is considered "specialty" cheese), but most of our cheese goes for mass-market uses such as pizza. Cheese is easily transported, so competition comes from many states and foreign nations. Many competitors make mass-market cheese, and would love to grab Wisconsin's slice of the pie.
- Wisconsin's dairy growth has been focused in certain geographic areas, and has been especially strong near cheese manufacturing hubs in the northeastern part of the state. In high growth areas, manure concentrations are becoming more acute.
- Some dairy growth areas have shallow karst bedrock that can allow direct manure runoff to groundwater. In some areas, dairy growth is also colliding with suburban sprawl and farmland fragmentation. In those areas, more manure is being spread on less land – often near homes and drinking wells.

Managing Manure

- A 1,000 cow dairy herd produces about as much fecal waste as Stevens Point, a city of 25,000 people. Dairy waste is typically spread on land in untreated form. In most areas, the soil can safely assimilate the waste – but only if it is not overloaded.
- Liquid manure is kept in large storage tanks (or in-ground "lagoons") until it can be applied. At least 10 million gallons of storage capacity are normally needed for 1,000 cows for one year. Farmers who lack adequate storage capacity may be forced to spread manure when runoff risks are high (especially in winter).
- A 1,000 cow dairy farm hauls about 12 million gallons of liquid manure a year, and may need well over 2 thousand acres of land for safe manure disposal. Some farmers may have trouble finding enough acreage. Manure is expensive to haul, so there may be a tendency to apply too much manure on nearby fields. That adds water pollution risks.

Managing Nutrients

- In 2014, dairy manure supplied about 209 thousand tons of nitrogen to Wisconsin cropland, while imported commercial fertilizer supplied up to 367 thousand tons.
- In 2014, dairy manure supplied about 36 thousand tons of phosphorus to Wisconsin cropland, while commercial fertilizer provided up to 105 thousand tons.
- In order to minimize pollution risks, today's farmers need sound nutrient management plans. Farmers should test their soils, calculate nutrient needs based on cropping plans, determine the amount of land required for safe manure disposal, and credit nutrient contributions from all sources – including, but not limited to, manure and fertilizer.
- Without careful planning, operators can easily apply too much manure and fertilizer. They can also pay for nutrients that they don't really need. Only about 30% of Wisconsin farms have written nutrient management plans at this time.

Soil Erosion and Nonpoint Pollution

- By some estimates, the U.S. may be losing an inch of topsoil every 35 years. A third of our native topsoil may already be gone. Erosion and runoff from the Upper Midwest Farm Belt are blamed for a "dead zone" (now the size of Connecticut) in the Gulf of Mexico.
- Soil erosion is the primary vehicle by which phosphorus moves from farms to lakes. Phosphorus loading causes lake eutrophication and potentially toxic algae blooms.
- Wisconsin soil erosion rates are higher than at any time since the 1980's, due to crop changes, cropping intensity, reduced perennial vegetative cover, and more extreme weather events. Large tracts of perennial vegetation have been converted to erodible row crops like corn. The shift to intensive row cropping has also reduced crop rotation strategies that limit erosion.

Agriculture and the Native Environment

- Agriculture, by its very nature, converts complex native ecosystems to narrower human-centered uses. The U.S. has converted nearly 100% of its native prairie to agriculture and development. The land now supports *many* more people (and a high – even wasteful – level of consumption), but many important things have been lost. In just 2 short human lifetimes, much of the virgin prairie soil – perhaps the most precious life-giving soil on the planet – has been blown or washed away.

Finding a Way Forward

As we look forward together, we might ask ourselves the following questions:

- What makes Wisconsin a good place to live, work and raise our children?
- What things about our state do we cherish most deeply?
- How important are food, land and water?
- What is our vision for the future of Wisconsin food, land and water?
- Are we moving toward our vision, or away from it? Where does our current path lead?
- Can we realize our vision? If so, how? What will it take?
- What legacy will we leave to future generations?
- What does "Wisconsin" stand for? What image and values do we want to project as a state, a community, an industry, a business, a landowner or a citizen?
- How do our personal or business choices affect others? How do they affect our shared future?
- What can I do? What can we do?
- How can we work together to make Wisconsin a shining example for generations to come?