

AGRICULTURE

Over time, longer growing seasons and more carbon dioxide in the atmosphere from climate change may boost crop yields, but extreme weather swings and invasive species may increase the risk of crop failure. If Minnesota agriculture were disrupted, it would impact our economy and affect the global food supply. On the flip side, agriculture plays a role in climate change, releasing emissions through fertilizer application and certain field practices. Farmers face critical decisions about how to meet a growing population's needs, while protecting the environment—the foundation of their livelihood and everyone's quality of life. There are no easy answers, but state leaders, farmers and agricultural businesses will need to work together to address this challenge.

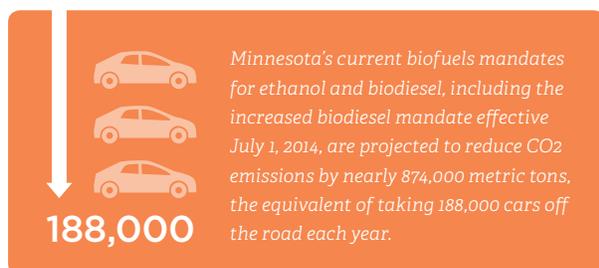
WHAT'S HAPPENING?

Displacing Fossil Fuels with Energy from Plants

The agriculture industry is producing homegrown energy in a number of ways, keeping energy dollars in Minnesota and reducing the state's fossil fuel consumption. "Bioenergy"—energy from organic matter, such as plants, wood or residues from agriculture or forestry—can provide biofuels for transportation and biomass for electricity and heat.

Biofuels

Biofuels displace the amount of fossil fuels that we use. In Minnesota, corn-based ethanol and soybean-based biodiesel have reduced our fossil fuel usage and grown our rural economy by billions of dollars.



By 2015, Minnesota aims to transition 14% of our gasoline to biofuels. (By 2025, we are striving for 30% in biofuels.) Minnesota was the first state to mandate the use of ethanol in its fuel supply. In doing so, the state moved from substandard air quality to achievement of the Clean Air Act standard by the mid-90s.

Advanced Biofuels

In a retrofitted ethanol plant in Luverne, GEVO, a renewable chemicals and advanced biofuels company, produces isobutanol. With 30% more energy content than conventional biofuels, isobutanol already is used as jet fuel in army helicopters and as a replacement for fossil-fuel-based chemicals for making plastics, rubber, textiles, paint solvents and more.

Biomass

Biomass from agricultural and forestry byproducts can be used to produce heat and electricity.

Koda Energy

A combined-heat-and-power plant in Shakopee, Koda Energy is a joint venture with Rahr Malting Company and the Shakopee Mdewakanton Sioux Community. Koda Energy burns agricultural and plant seed byproducts to create steam to generate energy in the form of electricity and heat. Rahr Malting uses residual heat from electricity generation in its malting process, replacing natural gas usage. The community is exploring burning native prairie plants in Koda Energy's facility, which could drive conversion of less-productive cropland to grassland cover and energy crop production; reduce agricultural runoff; and create wildlife habitat.



General Mills provides Koda Energy about 160–200 tons of oat hulls from the processing of its cereals each day.

LOOKING AHEAD

Questions about rising on-farm emissions and protecting water quality are pressing, particularly when crop prices are fluctuating and land prices are high. Between 2007 and 2012, higher crop prices, increased land values and fewer federal conservation incentives encouraged conversion of about one million acres of Minnesota conservation and pasture land to row crops, lowering carbon sequestration. On the horizon, cutting-edge projects offer potential new opportunities to reduce emissions. For example, the University of Minnesota's West Central Research and Outreach Center in Morris has launched a process that takes energy from wind, converts it to hydrogen, and then to ammonia that can be used as fertilizer on surrounding farmlands. Fertilizer accounts for a significant portion of corn production's carbon footprint. Producing fertilizer in a renewable way could significantly reduce its impact.

By the Numbers

ECONOMIC IMPACT



\$75 billion per year

In Minnesota, agriculture and related businesses generate approximately \$75 billion per year for our economy and employ nearly 350,000 people.

BIOFUELS



12,600 jobs and \$5 billion

Total jobs and economic output, respectively, from Minnesota's ethanol industry in 2011.



10%

The amount of corn-based ethanol Minnesotans use instead of gasoline. In 2011, Minnesota exported 880 million gallons, or 79%, of the ethanol it produced.

Protecting Our Waters

When it rains or when snow melts, water runs off of farm fields, carrying sediment, fertilizers and pesticides to ponds, lakes and streams. The **Minnesota Agricultural Water Quality Certification Program** helps farmers adopt on-farm conservation practices that protect nearby waters from agricultural runoff—a critical step in preserving our water quality as we adapt to climate change.



Grassed waterways in the Root River watershed in southeastern Minnesota prevent soil erosion while draining runoff water from adjacent cropland.

Farmers receive technical assistance and a combination of federal and Minnesota Clean Water Legacy funds for a variety of activities, such as removing excess pollutants by filtering water through grasses and other vegetation; adopting tilling methods to minimize erosion; and drainage methods that reduce water runoff into waterways. Upon certification, a farmer will obtain regulatory certainty for a period of 10 years. The program—piloted in four watersheds touching Olmsted, Wabasha, Winona, Stearns, Jackson, Martin, Faribault, Wilkin and Otter Tail counties—could become a model for other parts of the country.

Reducing Emissions by Changing the Way Business Is Done

Minnesota farmers are improving their bottom lines—and reducing their carbon footprints—by changing the way they work. For example, with new technology and seed quality, tractor trips across fields are reduced, lessening emissions. Fertilizing crops with a precise amount at the right time, with the right techniques, keeps nutrients in the soil and lowers nitrous oxide emissions.

Using renewable energy sources on the farm, cover crops and livestock grazing are other strategies. For example, cover crops can be planted when the soil would otherwise be bare before a crop emerges in spring or after fall harvest. These grasses, legumes or other plants improve soil fertility, hold nutrients for the next crop, help sustain ecosystems for wildlife, and improve the land's ability to absorb carbon.

Cover Crops



Grasses, legumes and other plants keep soil covered and sequester carbon.

Ian Cunningham, a fourth-generation farmer in Pipestone, plants cover crops and tills his land less to increase his soil's health and the likelihood cash crops will be more profitable. A mix of annual grasses, broadleaves and winter cereals, grown between corn and soybean crop seasons, also reduces stormwater runoff and helps the soil retain moisture, especially during dry periods. After harvest, Cunningham's cattle graze cover crops and crop residue, such as cornstalks, reducing feed costs and naturally fertilizing the soil.

Renewable Energy



Solar power can help reduce on-farm energy use and emissions, and save money.

Years of heavy rains and flash flooding near Featherstone Farms in Rushford caused owner Jack Hedin to consider the future of agriculture, climate change and how he could reduce his 250-acre farm's energy use and increase its efficiency. With financial assistance from the Minnesota Department of Agriculture, customers and friends, Hedin installed a 38-kilowatt photovoltaic array on a shed roof, which powers about half of his farm's operations.



Learn about how your food is grown. Start by visiting the [Minnesota Grown website](#).

Purchase food from local producers at your grocery store or farmers market.

Try renewable fuels.

