AGRICULTURAL FINANCE

Future Drivers for U.S. Midwest Agriculture

January 20, 2021

Executive Summary

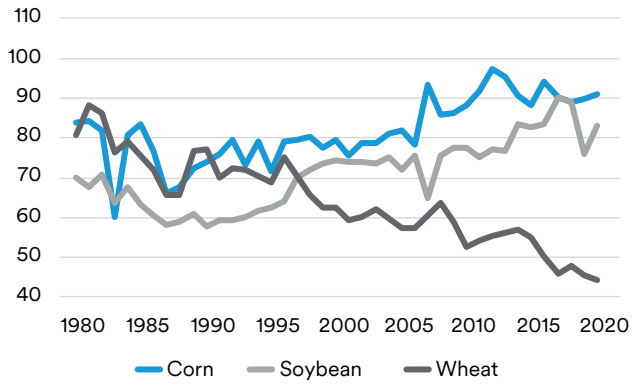
Over the last 40 years, the landscape of the U.S. Midwest has shifted. A confluence of events—including globalization, free trade agreements, and renewal fuel mandates—incentivized farmers to increasingly sow soybeans instead of wheat. And while the corn-soybean rotation still controls Midwest acreage, new industry drivers could soon initiate another change. An increasingly electric economy, a growing alternative protein market, and a changing climate all have the potential to alter what is produced and where it is produced in the U.S. Midwest.

MetLife Investment Management

The Last Shift

A century ago, the U.S. Midwest was characterized as "amber waves of grain" in the poem turned patriotic anthem "America the Beautiful." The U.S. produced 76 million metric tons of wheat and held nearly half of the global export market at its peak in 1981.[1] However, the grain embargo and subsequent farm crisis stalled U.S. agriculture during the 1980s. Major Black Sea wheat producers simultaneously improved output and gained global market share. Midwest growers increasingly sowed soybeans, which have an agronomically-beneficial rotation with corn and strong real profits. Other developments such as the North America Free Trade Agreement, the Renewable Fuel Standard mandate, and China joining the World Trade Organization also contributed to U.S. farmers converting acreage over the last few decades. As a result, U.S. wheat acreage fell 50% between 1981 and 2020 as amber waves of grain transitioned to beige bunches of soybeans (Figure 1).

Figure 1 | U.S. Crop Area Planted (million acres)



Source: USDA, MIM

Even as Midwest growers continue to plant approximately 175 million acres of corn and soybeans annually, it seems another shift could potentially be on the horizon. An electric economy, alternative proteins, and climate change all have the potential to alter what is produced and where it is produced in the Midwest.

Electric Shocks Ethanol

As the U.S. and developed economies increasingly embrace electric vehicles, the outlook for motor gasoline and ethanol could dim. The U.S. Energy Information Administration (EIA) projects domestic motor gasoline consumption to decline 14% by 2030, primarily due to improved fuel efficiency and increased use of electricity and natural gas.[2] Domestic production of ethanol, which is blended with most motor gasoline, is consequently projected to decline 8% (1.2 billion gallons) by 2030.

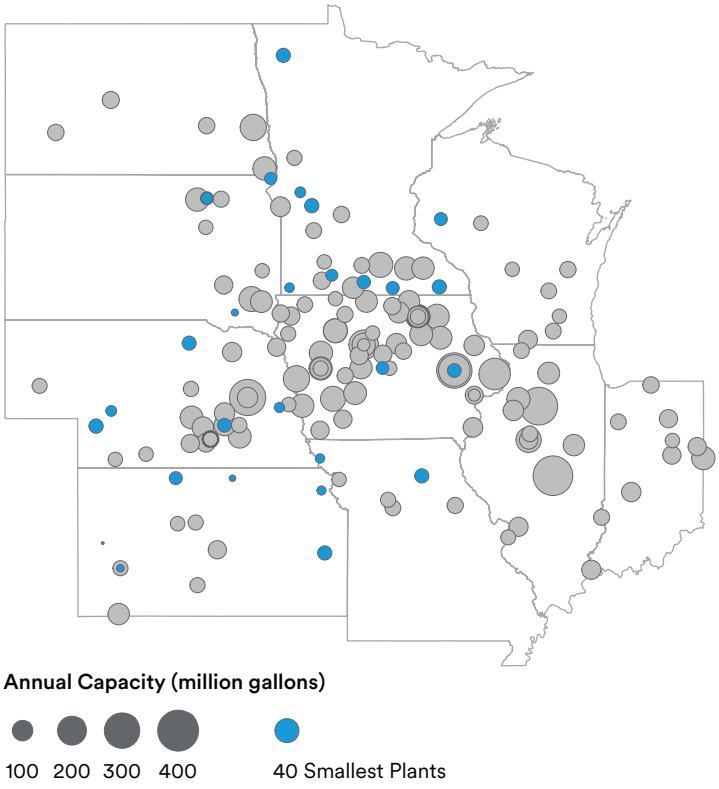
On average over the last decade, 39% of the annual U.S. corn crop was used to produce ethanol. A 1.2-billion-gallon reduction in ethanol production would decrease corn acreage demanded by approximately 5 million acres.[3] EIA's projection does not assume any policy changes, so weaker government ethanol mandates could further pressure that estimate. The most vulnerable corn acres would be those reliant on demand from smaller, more remote ethanol plants. EIA's projected decline in ethanol production is roughly equivalent to the volume produced by the 40 smallest U.S. ethanol plants.[4]

Figure 2 displays the geographic dispersion and size of Midwest ethanol facilities, with those among the 40 smallest in blue. A reduction in ethanol consumption threatens demand for the smallest facilities and surrounding acreage, principally in areas with fewer alternative demand options. If the smaller plants in Kansas shutter, it will impact local corn demand more than a smaller plant closing in Iowa. Consumption from ethanol facilities in Central and West Kansas

represents 8% of regional corn acreage, a sizeable portion of demand. Therefore, corn growers in regions dependent on ethanol demand could receive lower prices, find it difficult to procure other buyers, and face higher transportation costs to deliver to new buyers.

Foreign demand could potentially bolster U.S. ethanol exports, but this seems unlikely as developing nations look past ethanol towards more efficient renewable energies. Increasing use of plastic derived from corn could consume upwards of 10 billion bushels, but the viability of that market is speculative.[5] Still, larger and more efficient ethanol plants are better positioned to fulfill demand increases. If some plants begin to close, producers who are reliant on ethanol demand and are located outside the core area of the Midwest will be most negatively affected.

Figure 2 | Ethanol Plants in the U.S. Midwest



Source: EIA, MIM

An Alternative for Midwest Growers

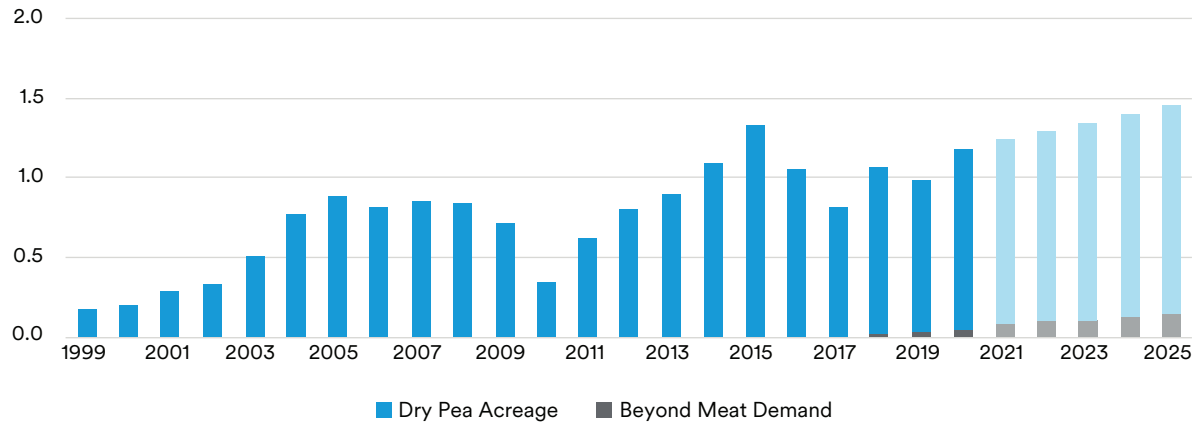
As detailed in our recent publication, it is unlikely that alternative meat will significantly replace conventional livestock products as the primary protein source for the global population. In fact, the alternative meat sector could further support demand for soybeans and other annual crops.

Soybeans are the primary protein source used in alternative meat products, such as tofu. Current estimates project the global soy protein market will grow 5% annually through 2025, driven primarily by increased plant protein product demand among North American consumers.[6] A new venture backed by a major agricultural firm is expected to contract 200,000 soybean acres annually by 2022 for plant protein goods.[7] Over the long term, these types of projects will provide additional demand for Midwest growers on top of rising use for livestock feed—the primary use for domestic soybeans.

Additionally, other crops used in alternative protein products could offer farmers an opportunity to diversify their crop rotation. The field pea is the primary protein used in products from Beyond Meat (Beyond), who holds an estimated 20% share of the alternative meat market.[8] Current projections expect Beyond's revenue to more than quadruple by 2025.[9] This would increase its field pea demand to approximately 100,000 acres from about

30,000 acres in 2020 (Figure 3).[10] [11] Beyond's growing pea consumption would alone boost U.S. field pea acreage demanded by 10%.[12] Other major agricultural firms have also announced expansions into field pea protein products—increasing demand and expanding farmers' opportunity to diversify into field peas.[13] [14]

Figure 3 | U.S. Dry Pea Acreage with Projected Demand from Beyond Meat (million acres)



Source: Bloomberg, USDA, MIM Projections

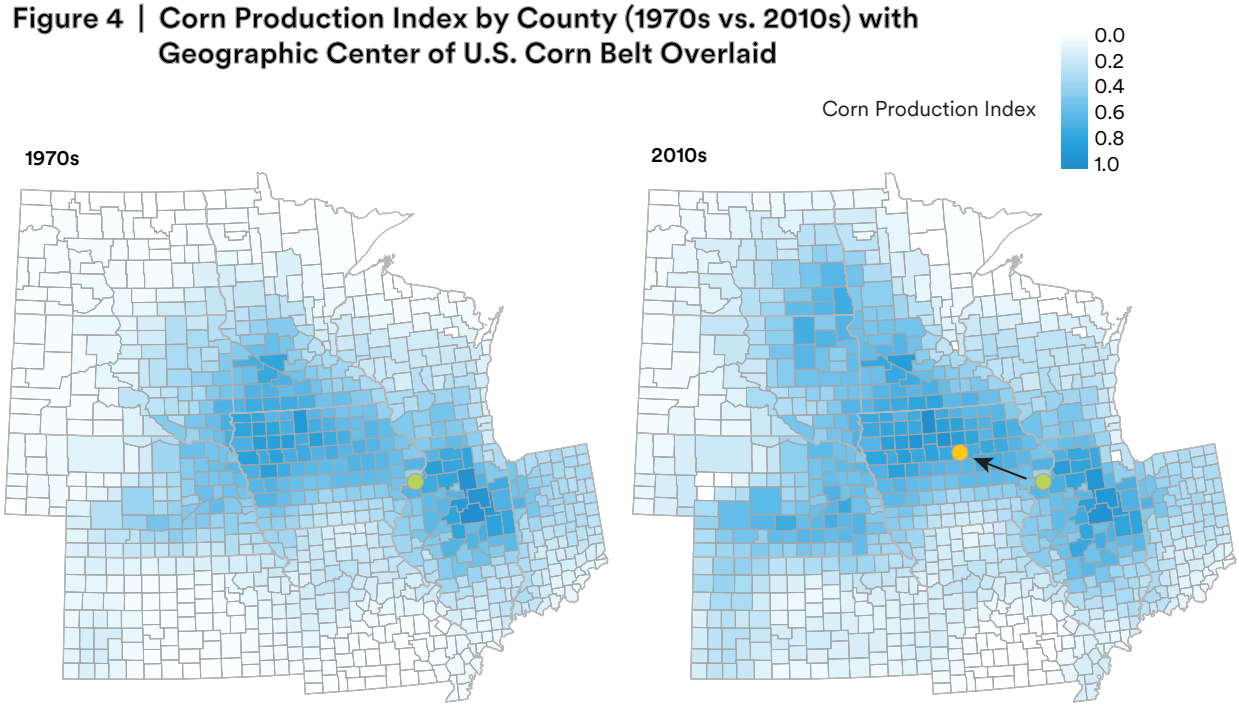
Challenges and Opportunities in Climate Change

For agriculture, the main potential climate change effects are more frequent drought, a larger share of annual precipitation coming from extreme rainfall events, and a higher incidence of heatwaves.[15] The Southern Plains (Kansas, Oklahoma, and Texas) are projected to be most negatively impacted by these dynamics. Agriculture in those states relies on irrigation from the Ogallala Aquifer, which has declining water levels.[16] Combined with the potential for reduced and more erratic rainfall, this region's agriculture has greater potential for stress under future conditions.

While climate change could potentially challenge growers in the Southern Plains, it may benefit producers in the northern Midwest. An increased number of growing days will expand the productivity for farmers in this region and allow them to meet expanding annual crop demand. Figure 4 demonstrates this trend as the geographic center of production in the Corn Belt has shifted approximately 160 miles northwest.[17] Assuming the upper Midwest continues to benefit from increased growing days amid a warming climate, we would expect this trend to persist.

> The geographic center of production in the Corn Belt has shifted approximately 160 miles northwest.

Figure 4 | Corn Production Index by County (1970s vs. 2010s) with Geographic Center of U.S. Corn Belt Overlaid



Source: USDA, MIM

Conclusion

We believe the agricultural sector holds unique, stable long-term fundamentals. Steadily growing food demand driven by an expanding global middle-class population combined with a limited supply of productive soil help support farmland demand indefinitely. Still, farmers will continuously evolve to try and capitalize on trends and maximize returns on their land—demonstrated by the shift in the Midwest from wheat to soybeans over the last 30 years.

The future drivers mentioned above will certainly shape what Midwest growers plant, but these trends will likely have a more profound impact on where it is produced over the long term. A grower in Minnesota or the Dakotas may be better positioned to benefit from changing climate conditions than a farmer in the Southern Plains. This will likely improve productivity for staple crops (corn, soybeans), and farmers may simultaneously see increased demand for products already native to the region, such as field peas. Improved drought-resistant seeds and irrigation techniques will help some producers in areas negatively impacted by climate change, but these innovations come with a cost and consequential comparative disadvantage. It appears to be those farmers with diverse demand options and bullish climate conditions who may hold the future advantage.

Endnotes

1 USDA, Foreign Agricultural Service, December 2020
2 United States Energy Information Administration, 2020 Energy Outlook, January 2020
3 Assumes a corn yield of 174 bushels per acre (bpa) in 2019 and a trendline U.S. corn yield of 188 bpa in 2030.
4 United States Energy Information Administration, U.S. Fuel Ethanol Plant Production Capacity, September 2019
5 National Corn Growers Association, 2020 Mid-Year Report, June 2020
6 Meticulous Market Research, Soy Protein Market Worth $7.3 Billion by 2025, November 2019
7 Bloomberg, Alphabet, Louis Dreyfus Back Custom Soybeans in $150 Million Bet, October 2020
8 Barron's, Impossible Foods Is Gaining on Beyond Meat. What That Means for the Stock, October 2020
9 Bloomberg, Beyond Meat Earnings Projections, October 2020

10 This calculation assumes the following: All protein content comes from pea, 25.5% of pea is protein (Source: Bob's Red Mill), and average U.S. pea yield is 860,464 grams per acre (Source: USDA NASS).
11 This calculation assumes 17.7% of the burger is protein (Source: Beyond Meat).
12 USDA NASS, October 2020
13 Meat + Poultry, Marfrig, Archer Daniels Midland start JV Meat Alternative, October 2020
14 U.S. Global Change Research Program, 2018 National Climate Assessment
15 National Oceanic Atmospheric Administration, National Climate Assessment: Great Plains' Ogallala Aquifer drying out. February 2019
16 MIM Calculation

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