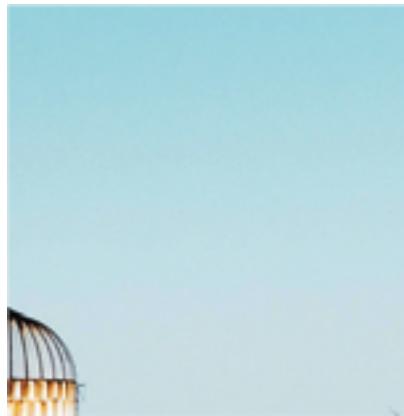


FARMER  AC

THE Feed

Facing the Future

FARMER MAC'S
QUARTERLY
PERSPECTIVE
ON AGRICULTURE
WINTER
2021/2022



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CONTENTS



HOLIDAY

HOME FOR THE HOLIDAYS

Americans are ready to travel for the holidays, but some families are sticking to the smaller gatherings of 2020. _____

5



ENERGY

THE FUTURE OF U.S. BIOFUELS

Ethanol demand has recovered from the recent lows, but there are many changes to supply and demand on the horizon. _____

9



PROTEINS

ALTERNATIVE PROTEINS: NICHE MARKETS OR GAME-CHANGING DISRUPTORS?

The alternative protein market surpassed \$7 billion in 2020, but is it a serious challenger to conventional meat markets? _____

13



CONSERVATION

CARBON SEQUESTRATION: OPPORTUNITIES IN AN UNCERTAIN ENVIRONMENT

Carbon markets could offer some producers a new income stream, but their uncertain nature may put off many farmers and ranchers. _____

19



FARM ECONOMY

FARM INCOME UPDATE: 2021 ENDS ON A STRONG NOTE

The USDA's latest projection shows that the sector's net cash income in 2021 will be almost 20 percent above its average since 2000, though some minor concerns remain. _____

21



WEATHER UPDATE: LA NIÑA EVENT COULD LEAD TO A WETTER WINTER

The ongoing moderate La Niña event has the potential to lead to a stormy, cold winter in the Midwest and Pacific Northwest, though not every region may benefit from the wetter weather. _____

25



GRAIN PRODUCER INCOME TO PULL BACK FROM STRONG 2021

Cash grain markets will enter 2022 on very solid footing, but slower exports and stronger foreign competition will lead to price pullbacks. _____

29



HIGH RETAIL COSTS MAKE THEIR WAY TO CATTLE RANCHERS

After almost two years of low profitability, the momentum has shifted to cattle producers – a trend that may continue well into 2022. _____

33



TREE NUT EXPORTS THREATENED BY SLOWER EMERGING MARKET GROWTH

Strong export growth to emerging markets helped stabilize nut prices in 2021, but economic damage may slow that growth in 2022. _____

35



THE RETURN OF INFLATION?

While current forecasts do not project sharp rises in long-run inflation, producers should be cognizant of how even modest inflation can impact production expenses, farm prices and land values. _____

39

A LETTER FROM FARMER MAC'S CHIEF ECONOMIST

Facing the Future

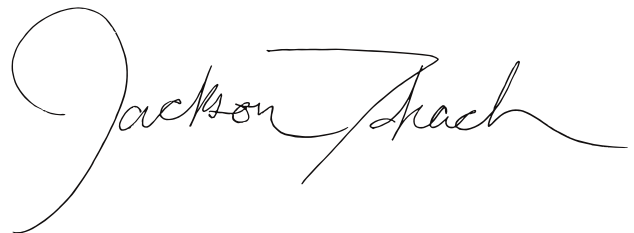
When farmers, ranchers, agribusiness owners, rural utility providers, and lenders talk about the future, there are really two futures in reference. There's the immediate, "What are we going to do next year?" future, in which current market conditions and resource allocation enter into an intricate dance of optimization and intuition. Our rural economic engineers often dedicate more strategic brainpower to near-term planning due to the immediacy and persistence of the agricultural calendar. After all, Iowa dirt doesn't care where the grower is in their strategic planning cycle; April is April! The importance of this near-term future is immense and drives revenue, profitability, lending needs, and general family life. However, another future resides in the minds of producers and lenders, one that doesn't involve purchases of seed, feed, or deeds. This future floats in the next 10, 20, and 30 years, holds millions of possibilities, and can invoke both excitement and anxiety. Uncertainty prevents some managers from even attempting to plan for the long-term, but the ones that make critical decisions today set their operations up for generations to come.

While this issue of The Feed has some near-term analysis, several articles look toward that second, long-term future. A select list of topics covered follows, as well as why we think they're important to keep in mind while looking at the future: First, climate change and carbon management, which are hot topics domestically and globally, and agriculture is smack in the middle of the discussion. Next, carbon capture and credit management have a growing marketplace, from privately-developed markets to smart commodity programs at the USDA. We also examine some opportunities that producers and landowners have to diversify cash flows and improve soil

health, though the path ahead remains murky. Meanwhile, market demand for corn, soybeans, and their by-products is also reaching a consumer and technological crossroads, while consumers and commercial transportation systems are evolving demand functions, and corn-based ethanol may see the biggest threat. That said, biomass-based fuels are not going anywhere soon, and there are many opportunities to participate in that biofuel mix realignment. Finally, animal proteins have had substitute challengers (e.g., plant-based milks, veggie burgers, etc.), but today's and tomorrow's plant-based and cell-cultured protein alternatives might be of a different breed. We are years away from these alternatives being cost-competitive with the existing animal protein complex, but investors are very interested in disruption to the sector. And, of course, no year-end issue would be complete without a final look at farm incomes, land value trends, sector analysis, and some fun holiday food statistics to take back to your dinner table.

The authors, editors, and designers at The Feed hope you enjoy our end-of-year take on both futures, near and far. We, along with the entire Farmer Mac team, wish you the happiest of holiday seasons and the absolute best in 2022.

Cheers,

A handwritten signature in black ink that reads "Jackson Takach". The signature is fluid and cursive, with a large initial "J" and a stylized "T".

Jackson Takach,
Chief Economist at Farmer Mac

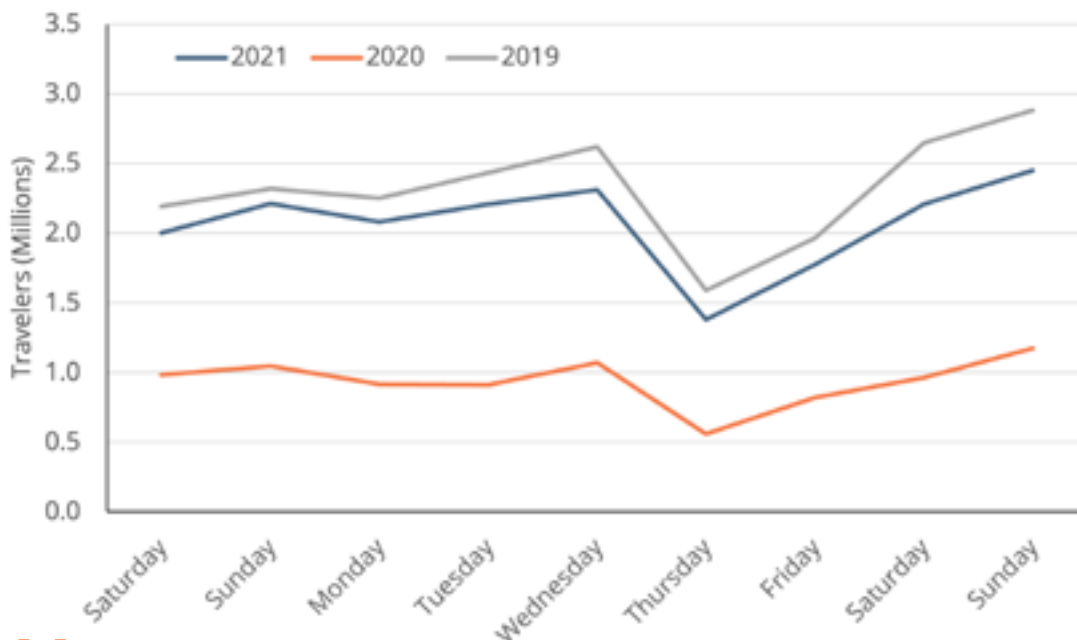
HOME FOR THE HOLIDAYS ^{1, 2, 3, 4}

After a big dip in 2020, almost as many Americans traveled for Thanksgiving this year as did in 2019. However, there is still some evidence that holiday gatherings remained smaller than they were before 2020. These smaller gatherings could benefit less scalable commodities this season, from Christmas trees to turkeys.

The holidays of 2021 have looked and felt much more familiar than last year. For many Americans, tables are a little fuller, guests have come from further away, and squabbles have resumed about why there are twenty different deserts for twelve people. Figure 1 shows the number of people going through airports the week of Thanksgiving. In

2021, more than double the number of individuals flew Thanksgiving week compared to 2020. In one survey, the total share of Americans who indicated that they were traveling in November rose from 26% in 2020 to 38% in 2021. More than two thirds of Americans indicated that they planned to spend Thanksgiving with friends or family outside their households.

Figure 1: Americans Flew Thanksgiving Week Almost As Much in 2021 As They Did in 2019



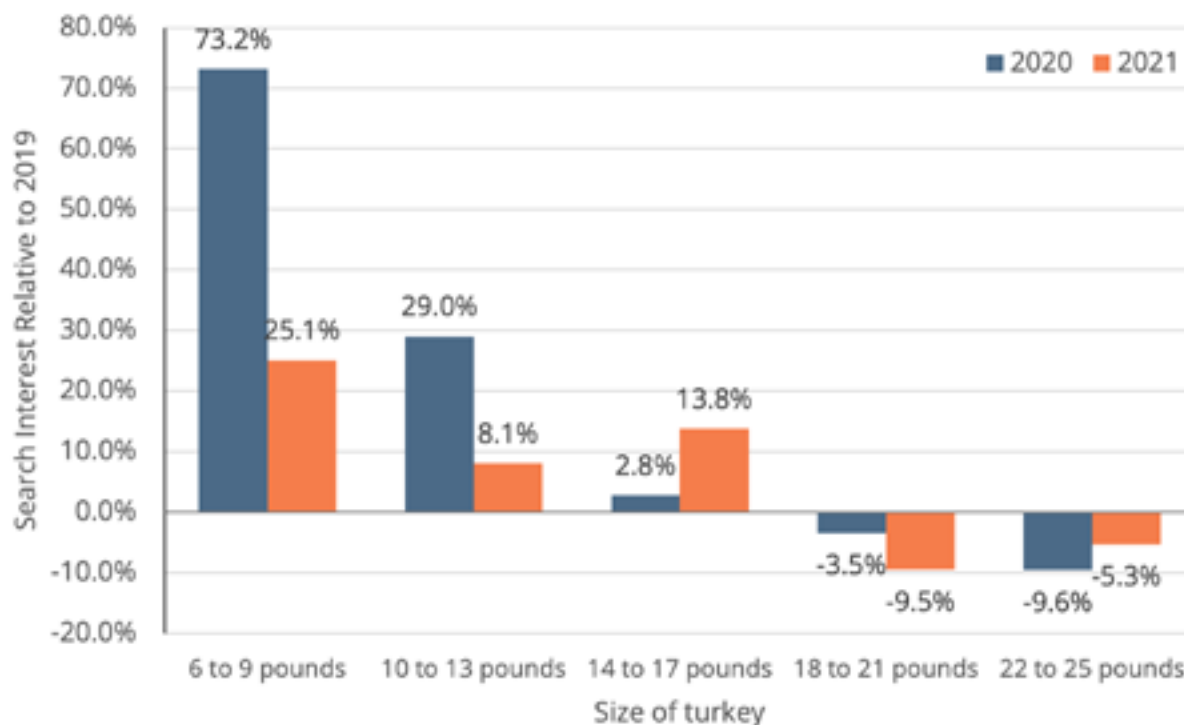
Source: Transportation Service Administration Checkpoint Travel Numbers



While we know that more Americans traveled Thanksgiving week, this doesn't tell us whether Americans went back to typical gatherings of a dozen or more family members per meal. Luckily, there is a tradition that modern Americans engage in each Thanksgiving that is almost as common as cranberries and sweet potatoes: looking up "how long do I cook a turkey" on a search engine. Figure 2 shows Google Trend data for various size turkeys relative to 2019. Last year, we found

a surge of interest for birds under 10 pounds, suited for smaller family gatherings. In 2021, there was still some residual interest in these smaller birds, though nowhere near last year's record levels. These data do suggest that many smaller gatherings persisted, though not at the same rate as 2020. Last year was also a record for another search term, perhaps showing just how many Americans tried their hands at cooking a turkey for the first time: "I think I burned my turkey."

Figure 2: Search Interest for How To Cook Small Turkeys Fell Dramatically Between 2020 and 2021



Source: Google Trends



For America's farmers and ranchers, what does this mean for total consumption? Some data suggest that smaller gatherings actually meant more consumption: Americans bought a record amount of poultry the week of Thanksgiving 2020 and spent almost 20% more than in 2019. Meanwhile, although complete data for Christmas trees are difficult to obtain, select USDA offices also indicate that Christmas tree prices surged in the last year. Due to the smaller and more frequent gatherings of 2020, scalability was an important factor in total cost. That many Americans are still opting for smaller gatherings

suggests that non-scalable goods will continue to see strong sales in 2021. In other words, the record search interest for fruit cakes we witnessed in 2020 could appear again in 2021.

Of course, this will differ on each holiday dining table. Some families changed nothing about their holiday habits over the last two years, while others are still operating very differently in 2021 than they did in 2019. However, many Americans have shown they are ready to celebrate once again. Wherever you are, whoever you celebrate with, Farmer Mac wishes you a happy holiday season.

It would take more than **10,000 acres** of American **sugarcane** to make all the **candy canes** consumed each year in the United States.

Source: Author's calculations



Of the more than **15 million U.S. Christmas trees** that are cut each year, more than half come from just two states: Oregon and North Carolina.

Source: USDA 2017 Census of Agriculture

Americans eat more than **20 million Turkeys** every **Thanksgiving**, and eat almost a third of all turkey production between Thanksgiving and New Year's.

Source: USDA Holiday Fact Sheet



According to OceanSpray, **20% of America's total cranberry** production is eaten during just one meal – Thanksgiving.

Source: OceanSpray

The impact of **pumpkin spice lattes**? Between 2010 and 2020, the amount of fresh pumpkin available per person in the U.S. **increased 50%**.

Source: USDA ERS, Pumpkins: Background & Statistics



THE FUTURE OF U.S. BIOFUELS ^{5, 6, 7, 8}

Ethanol markets have seen a turnaround after the challenges of 2020. But, with potential challenges like soft global demand and a rising fleet of electric vehicles, supply and demand for renewable fuels are in flux. Renewable diesel and aviation biofuel are rising stars in the U.S. bio-mass fuel fleet, and the growing capacity for these advanced biofuels could help create additional demand for agricultural feedstocks for years to come.

Biofuels have played a big part in shaping the face of U.S. agriculture since 2005. With the Renewable Fuel Standard (RFS), policymakers prioritized the production of biomass-based fuels by setting minimum blend requirements for conventional petroleum fuels. The primary objective of this set of laws was to build demand for biofuels while using existing infrastructure to give the nascent industry a chance to mature and bring production to scale. The secondary objective was to spur innovation in low-carbon, energy-efficient biomass-based fuels like cellulosic ethanol and renewable diesel. Since its creation in 2005 and expansion in 2007, the RFS has prompted

more than 200 billion gallons of U.S. ethanol production, helping raise octane and reduce emissions on roughly 2 trillion gallons of gasoline.

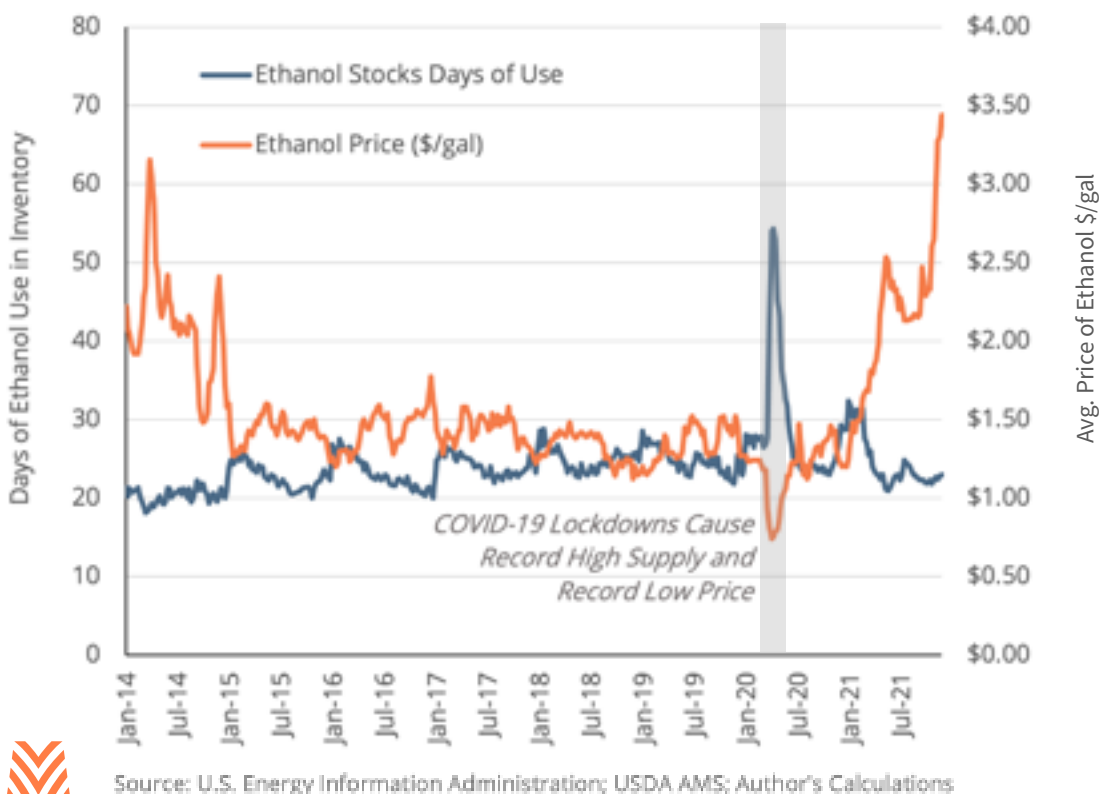
The primary feedstock for ethanol is corn, and ethanol consumes approximately 40% of all corn grown in the U.S. Since 2005, ethanol has expended more than 72 billion bushels of corn, with an annual demand of more than six billion bushels each year. While other biomass-based fuels are beginning to gain in popularity (e.g., biodiesel made from soybean oil and renewable diesel made from soybean, corn, vegetable, or animal fats and oils), corn-based ethanol is still the dominant player in U.S. biofuel production.





Coming out of the initial COVID-19 pandemic, the biofuels industry is at a crossroads. As Figure 3 demonstrates, when consumers stopped traveling for leisure or business, a large percentage of ethanol demand evaporated overnight. This caused a massive upswing in ethanol inventory and a downswing in market price, pushing many ethanol plants to temporarily or permanently mothball production. As consumers took to the roads again in late 2020 and throughout 2021, demand and prices came roaring back, taking ethanol prices and crush spreads to new heights. But the question lingers: What is the industry to do with a near-total reliance on gasoline blending for demand? With increasing consumer and legislator interest in electric vehicles and low-emissions fuels, as well as changing consumer behavior coming out of the pandemic, gasoline consumption in the U.S. is seeing downward pressure, which will be a headwind for future ethanol consumption. Fortunately, some offsets give the biofuels industry (and corn growers) time to reevaluate market conditions and make informed choices for the production and consumption of biofuels.

Figure 3: Ethanol Supply and Price History

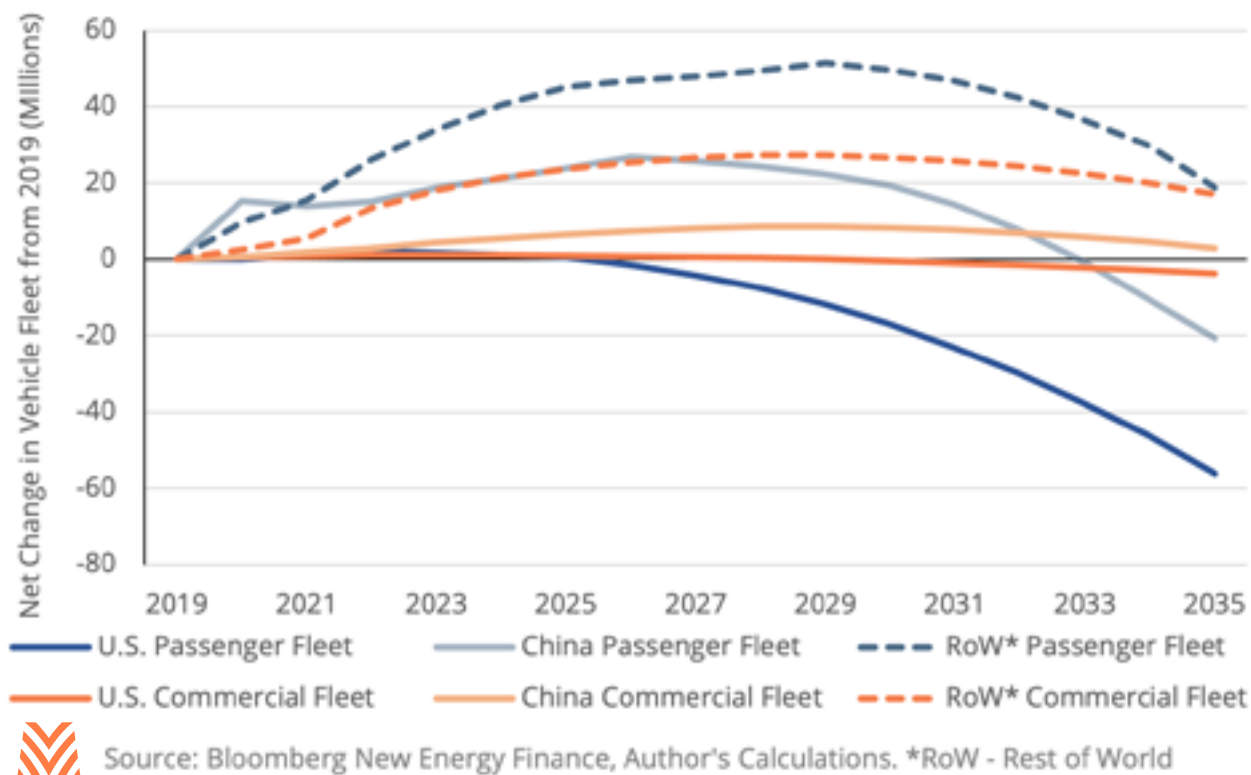




Until COVID-19, ethanol supply and demand were in relative harmony for years. Between 2015 and 2019, ethanol prices averaged \$1.39 per gallon, and 80% of that time, the average weekly price was between \$1.23 and \$1.53 per gallon. That is a very tight price distribution compared to the experience in 2020 and 2021. Between 2014 and 2019, ethanol production grew at a modest 3% per year, and the demand growth was faster in export markets than it was for domestic gasoline blending. While supply will likely increase in 2021, given the persistently high gasoline and oil prices, capacity expansion has slowed considerably since 2018. The RFS

gives the Environmental Protection Agency (EPA) the authority to set required blend minimums beyond 2022, but each year, the EPA takes longer to post the following year's requirements, and there is growing unrest in political circles about the future of biofuel mandates. With rising consumer demand for electric vehicles that do not consume conventional fuels, future demand for ethanol feels less certain today than in years past. Bloomberg New Energy Finance (BNEF) forecasts 50 million fewer conventional passenger vehicles on American highways by 2035. If realized, that would take about a billion bushels of corn out of the demand function through blended ethanol.

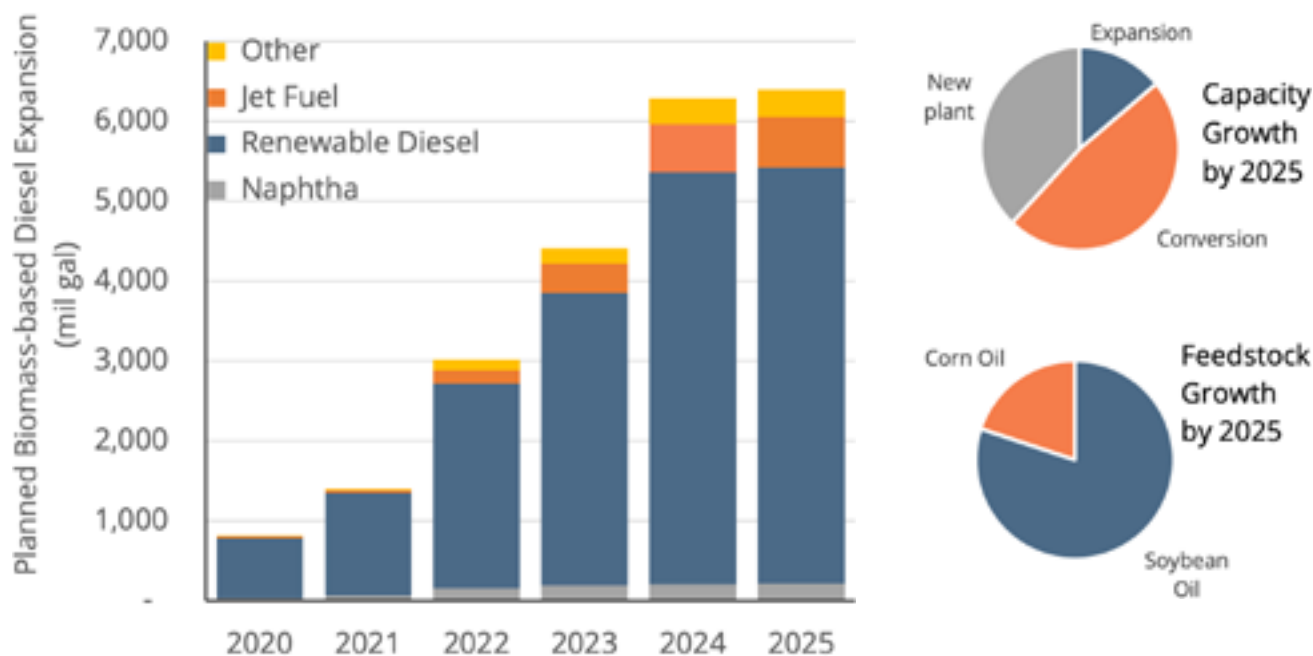
Figure 4: Forecasted Conventional Vehicle Fleet Net Growth (Decline) Through 2035



While ethanol demand faces headwinds from domestic gasoline blending, there are three major tailwinds that will buy time to reevaluate the industry's likely still-bright future. First, the U.S. vehicle fleet will take many years to convert to electric. BNEF forecasts an increase in domestic vehicles using conventional gasoline and diesel fuel until 2027, and their research shows that commercial vehicles will take even longer to convert to electric. Second, international demand for conventionally-fueled vehicles is likely to rise through 2030 and beyond. Electric cars are expensive, and they require reliable electricity infrastructure to power. Advanced economies like those of the U.S. and the EU may be able to afford the fleet conversion, but the switch will take much longer in developing countries like China and India. The growth in conventional fuel usage in foreign markets should create

export opportunities for the next 20 years, as more economies mature and emissions become a genuine concern. Finally, there is a growing interest in other bio-mass-based fuels, like renewable diesel and aviation biofuels. These fuels offer greater lifecycle greenhouse gas reduction, and both the RFS and California's Low Carbon Fuel Standard prioritize their use over conventional biofuels like ethanol and biodiesel. Planned and announced production capacity in the U.S. is set to expand by over 5 billion gallons in the next four years, much of which will come from conversions of existing biofuel plants, with nearly all focused on soybean or corn oil (see Figure 5). Consumption of these advanced biofuels will likely come from commercial transportation, which will probably be much harder to displace with electric alternatives in the intermediate or long-term.

Figure 5: Biomass-Based Diesel Supply Growth



Source: Bloomberg New Energy Finance Bio-based Diesel Outlook

Despite the near-term volatility in supply, demand, and market prices, the intermediate-term prospects for U.S. biofuels are somewhat bright. The feedstock and fuel-type mix will likely have to adjust to consumer, investor, and

policymaker priorities. But there is no off-switch for biofuels in 2022. Demand for liquid fuels remains strong for commercial vehicles and all vehicles abroad, and agricultural feedstocks will continue to be a big part of the future biofuel mix.



ALTERNATIVE PROTEINS: NICHE MARKETS OR GAME-CHANGING DISRUPTORS?

9, 10, 11, 12

In 2020, the U.S. alternative protein market surpassed \$7 billion in sales. Is the future of these products one of niche value to wealthy countries, or could it be a global disruptor that becomes a serious challenge to conventional meat markets?

Animal protein production is a tentpole of American agriculture—between 2011 and 2020, cattle and calf sales averaged more than \$75 billion in annual receipts, poultry averaged more than \$46 billion, while dairy averaged more than \$43 billion and hogs averaged more than \$24 billion. In fact, nearly 50% of all U.S. agricultural cash

receipts come from the sale of animals or animal products and, according to the 2017 Census of Agriculture, over 980,000 farms (48% of all farms) sell animal products. In 2020, Americans bought more than \$162 billion in meat, poultry, and dairy products at grocery stores alone, with billions more purchased at restaurants, leisure, and hospitality locations;

meanwhile, additional billions of dollars' worth of animal protein products are exported to foreign markets each year. Thus, our animal protein sector is not only an important part of American agriculture, but is also deeply embedded in the global economy and the global food system.

The animal protein sector isn't just important because of its output; on the input side, it serves as a huge source of demand for grains. According to the American Feed Industry Association, animals used in protein and product production consume more than 260 million tons of animal feed each year. Corn is a significant input for animal feed, and approximately 45% of domestic U.S. corn demand comes from animal feed. All told, animals in the U.S. consume around 30 million acres worth of corn and another 30 million acres of soybeans.

Demand for animal protein has been on the rise, with U.S. per capita consumption of beef, pork, and poultry approximately 265 pounds per person in 2020, up from about 250 pounds per person in 1999. Global demand for animal proteins and products has also been rising over the last decade. However, the sector is experiencing a pair of substitutes on the rise which threaten to disrupt the animal protein demand trajectory: plant-based proteins, and cultivated meat.



Amidst a backdrop of changing demographics in the U.S. and heightened consumer sensitivity to climate change, more companies are challenging the dominance of animal-based proteins. Plant-based meat and dairy alternatives are already on the market and seeing sales growth, although they remain at less than 1% of total U.S. retail grocery sales. Meanwhile, cultivated proteins (meat created from animal cells in a bioreactor through tissue engineering) are gaining investor interest, and companies are rapidly working to lower production costs. This article examines recent trends for each category and their prospects for disrupting the animal protein sector.

Plant-Based Proteins

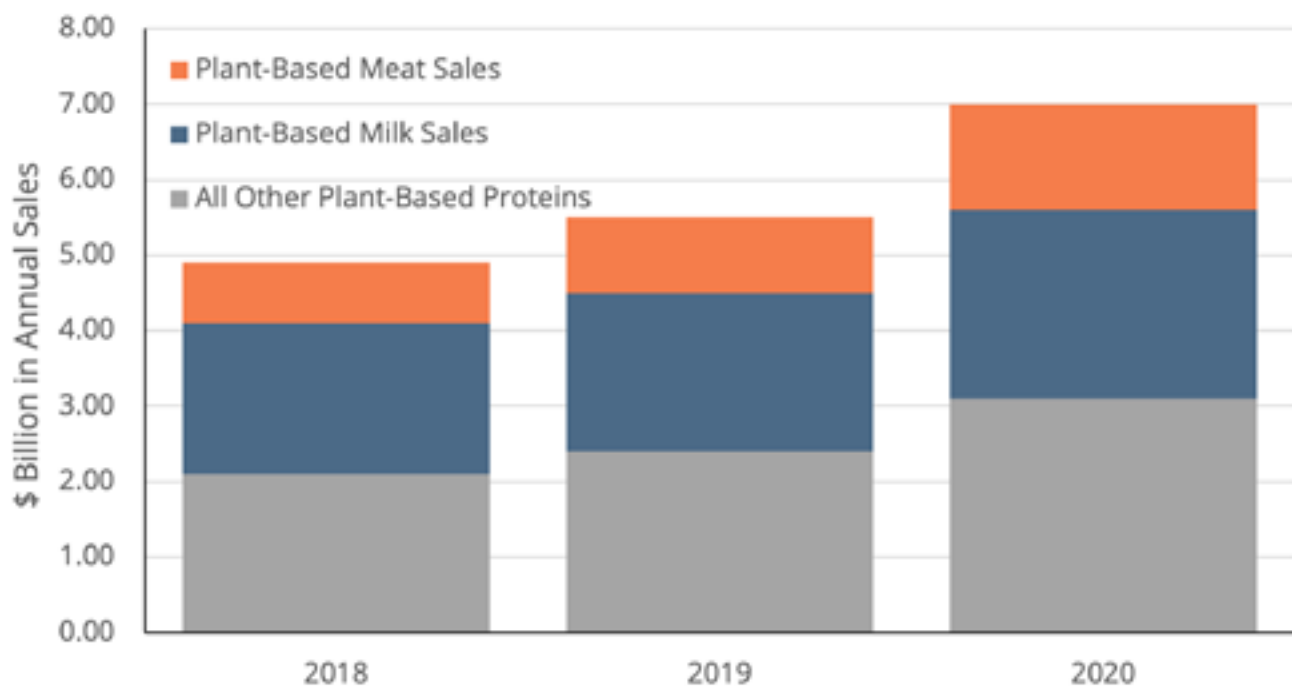
Plant-based meat and dairy alternatives are substitutes made from vegetables, grains, and fruits designed to mimic the structure and flavor of animal products. Plant-based fluid milk alternatives, such as almond milk and soy milk, have become widely available in grocery stores and restaurants, with more than \$2.5 billion in



sales in the U.S. in 2020 (see Figure 6). These products are well-established in the marketplace with decades of brand building, and the milk-alternative sector has built up to a 15% market share for U.S. fluid milk and milk-alternative consumption and a 10% global market share. Meat

alternatives have yet to establish a meaningful market share, but some brands like Beyond Meat and Impossible Foods are building demand in both grocery and restaurant channels. Sales of plant-based meats increased a respectable 45% in 2020, nearly double that of animal-based proteins.

Figure 6: Sales of Plant-Based Proteins by Year



Source: Plant Based Foods Association

Plant-based protein products present some threats to agricultural producers, though there are also some opportunities. Threats include the obvious competition for consumers' protein calories and the more efficient conversion of grains into proteins. Cattle are not terribly efficient at converting feed into protein (it takes an average of six pounds of feed to create one pound of animal weight), so for every pound of beef not consumed, six pounds of feed become at-risk. On the other hand, the primary ingredients for many of these products are easily grown and can be domestically sourced. Soybean products are a common ingredient for many plant-based proteins, and pulse-based products (legumes used as a dry grain) are another one. These types of crops thrive across the Midwest. Today, many of the pulses and beans used to make plant-based meat have to be imported, providing an

opportunity for growers in the U.S. to switch some production into new crops like yellow peas and mung beans. We can see another switch happening in California, where agriculture has been transformed by the rise of almond milk—almond-bearing acres there have doubled in the last 15 years.

It's hard to say how much this sector will continue to grow. Plant-based dairy alternatives went from no share of the market to 15% in under 10 years—though that may not be the best benchmark for adoption, since many consumers of plant-based dairy products have dietary restrictions. Ultimately, though, the appetite consumers have for plant-based substitutes will likely be the determining factor in the timing and level of risk plant-based proteins pose to the animal protein sector.



Cultivated Meat

Going by many names and descriptions, cell-cultivated meat is the textured proteins constructed in a controlled environment using animal cell cultures, growth mediums, and protein scaffolding processes. While the concept of cell-cultivated meat may read like science fiction, the technology does indeed exist. Depending on how quickly new advances are made, farmers and lenders should evaluate the next few years carefully.

The concept has been floating in scientific circles since the 1950s, but the practice and theory really took shape in 2013, when the first lab-grown hamburger was constructed and consumed by researchers and journalists. In the last decade, more than a billion dollars of venture capital have flowed to companies building cultivated meat products (see Figure 7). Many of the major meat processors and integrators are also investing in companies pushing this nascent industry, including JBS (BioTech Foods), Tyson (Upside Foods), and Cargill (Aleph Farms), among others. In December 2020, Eat Just became the first company approved to sell cultivated chicken in a commercial restaurant in Singapore.

Proponents of the industry cite greater efficiency in feed-to-protein conversion and the potential for lower transportation costs and, thus, a lower carbon footprint. Proponents also cite the controlled environment in which the food is created, limiting exposure to diseases and eliminating animal antibiotics. Opponents cite the highly-processed nature of the resulting food, the high energy demand needed for creation, and the high production costs as reasons why the industry might not challenge animal protein producers in the near term, if ever. Due to the early-stage nature of the industry, production scale is low, costs are high, and the USDA and FDA have not yet approved any products for consumption in the U.S.

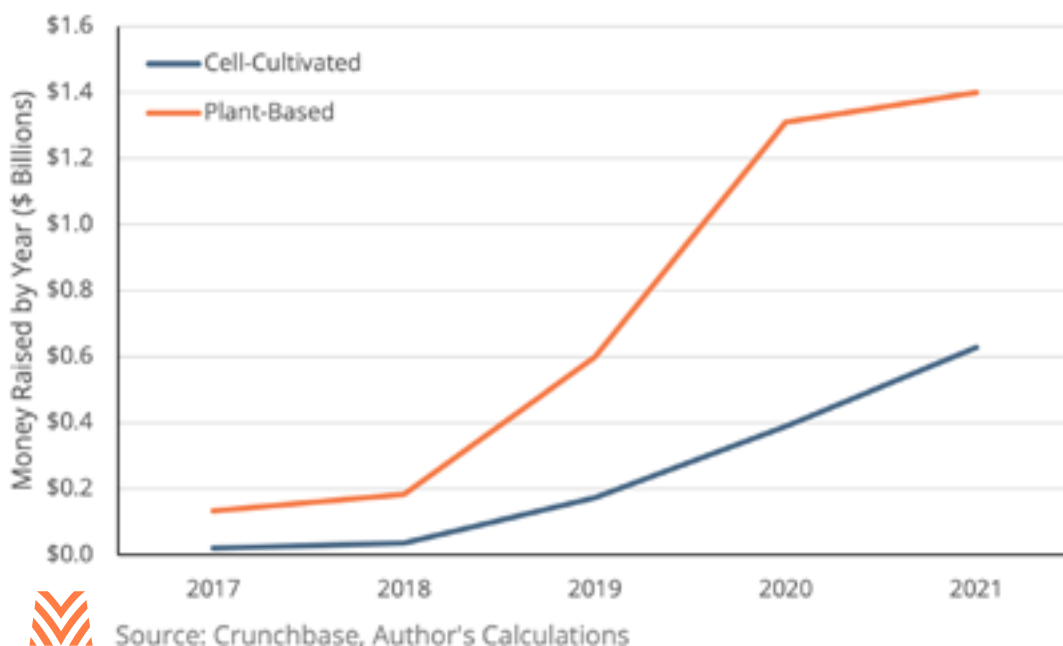
If the science works, the product is priced competitively, and consumers get on board—three big “ifs”—this industry has a high potential for agricultural disruption. But a lot has to go right for the disruption to become a reality, particularly the cost and consumer sentiment elements. Some analysts estimate it will take another decade for cell-cultivated meat to reach price parity with animal proteins.



If this industry does manage to overcome its hurdles, there will be some new opportunities for producers, such as growing the feedstock used to feed and structure the cell-building process (e.g., corn, sorghum, and grains). Challenges could include the transfer of protein production from farmers to the industrial sector and the disruption to feedstock growers.

Like many things that end up in retail sales, much of the future of alternative proteins will be written by consumers. If domestic and international consumers adopt plant-based and cell-cultivated proteins, they are potentially highly disruptive to the protein complex. Marketing and lobbying budgets are likely to get a workout in the coming decade as the battle for consumer sentiment heats up.

Figure 7: *Venture Capital Invested in Alternative Proteins*





CARBON SEQUESTRATION: OPPORTUNITIES IN AN UNCERTAIN ENVIRONMENT

13, 14, 15, 16, 17, 18, 19, 20

Carbon capture technologies may be a way for farmers and ranchers to build soil and retain water while earning modest returns. The USDA has recently made efforts to quantify how much carbon is sequestered through various production and conservation practices, which will address a critical problem for carbon exchange markets. As demand for carbon credits is likely to increase, savvy producers willing to take the time to understand this complicated market could find a valuable way to diversify their income.

Earlier this year, President Biden announced that the U.S. would seek to reduce its greenhouse gas (GHG) emissions by 50% between 2005 and 2030. While agriculture only represents 10% of these emissions, many policymakers see agriculture as an area with significant opportunities for emissions reductions via practices such as no-till farming or the use of certain cover crops. Farmers hoping to find additional revenue streams have found that private carbon markets are willing to purchase agricultural credits, or the right to emit a set amount of GHGs.

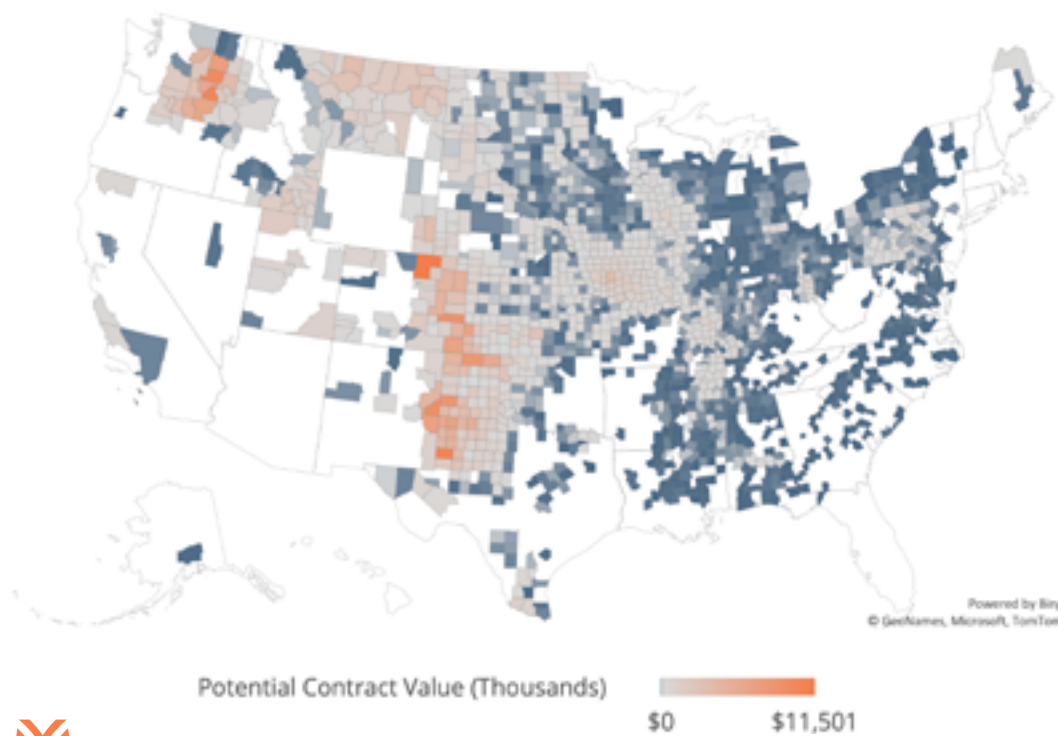
The challenge for producers is that the exact costs and benefits of these practices are not well known. Some private markets have noted that the inability to accurately quantify carbon sequestration from agricultural practices makes it difficult to exchange those credits. The good news is that the USDA is actively working towards supplying more specific details. In October, the USDA launched a \$10 million initiative to quantify the carbon captured by various Conservation Reserve Program (CRP) acres. Combined with

efforts to accurately measure the impacts of no-till farming and other production practices, the department is working to supply the information necessary to enable these transactions.

The potential for carbon markets may be alluring for some producers. Grassland CRP acres alone could offer a substantial revenue stream: a typical contract for grassland offers up to 1 metric ton per

acre of grassland for a period extending five years. Meanwhile, current carbon markets in Texas are offering \$10 to \$20 per acre for these lands. This would imply that if all CRP grassland entered into similar agreements, grassland could supply up to 8 million credits per year with a total contract value of almost \$700 million. Figure 8 shows how the revenues of this one program would be distributed.

Figure 8: Grassland CRP Acres Alone Have Considerable Revenue Potential in Exchange Markets



Source: Farm Service Administration CRP Data, Author's Calculations

This back-of-the-envelope example shows both the promise and peril of carbon markets. USDA researchers have said that pristine grassland could offer up to 5 times the carbon capture potential offered by exchange markets, but the potential needs to be explicitly quantified. Meanwhile, many exchanges only offer contracts for new practices, not existing ones. And a cost and benefit analysis from the University of Illinois found that the cost of entering a wide variety of carbon capture practices exceeded what could be earned from the current carbon exchange market.

Carbon markets as they stand today offer some promise, but there is considerable uncertainty.

Producers must determine how they will engage with the exchange markets and must weigh the costs and benefits of doing so where very little information exists. But when the process is formalized, there could be significant opportunity for savvy producers. Demand for carbon credits is likely to increase as the U.S. approaches its carbon emission deadline and as more states abandon voluntary programs and switch to mandatory ones. Whether or not individual producers try to engage with the carbon markets, it will be increasingly important for their lenders to understand both the opportunities and risks of this new potential income stream.

FARM INCOME UPDATE: 2021 ENDS ON A STRONG NOTE

21

The USDA's third update for 2021 forecast that sector net cash income would be \$133 billion in 2021, almost \$20 billion above its average since 2000. The most recent revision raised expectations for cash receipts while increasing production expenses for 2021. Despite these strong incomes, the USDA's projections describe an agricultural economy that is slightly more leveraged – and more liquid – than the year before.

On December 1, the USDA ERS released their final Farm Income and Wealth Statistics update for 2021. This release is the first to account for new data from the 2020 Agricultural Resource Management Survey (ARMS) and contains price data for 2021 that are largely complete. Despite falling market prices and evidence of rising expenses since the September release, overall sector net cash income forecasts for 2021 were largely unchanged at \$133 billion. This new release confirms the USDA's earlier projections that producers will see very strong incomes in 2021.

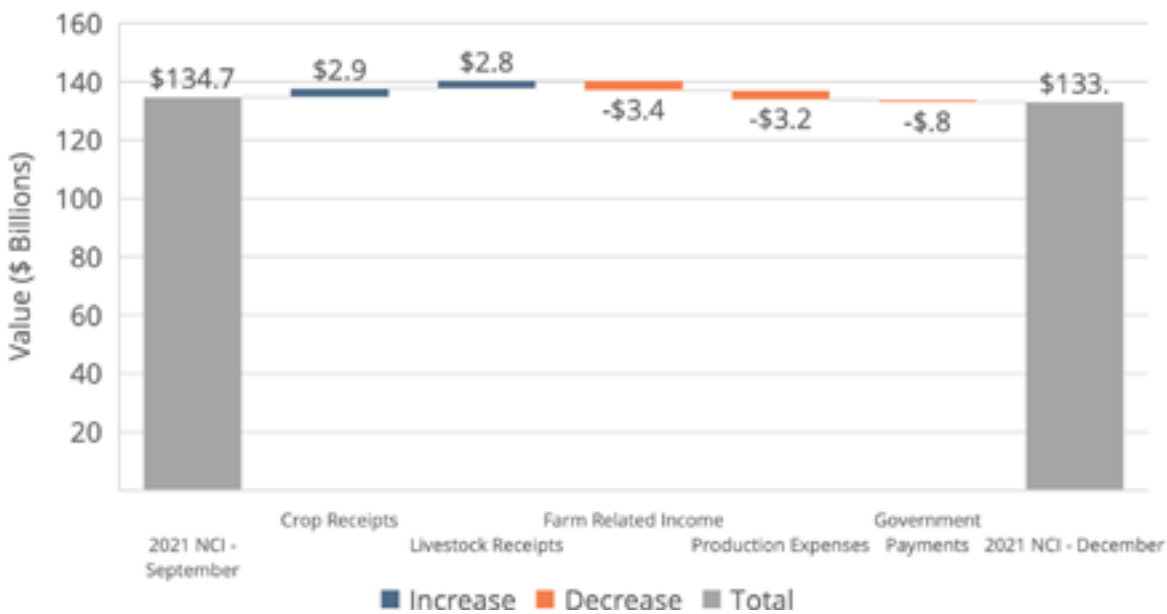


Changes from September

The December forecast for 2021 shows continued good news for farmers and ranchers. The ERS forecasts that cash receipts will be even stronger than suggested by their previous forecast, which had already forecast a sizable increase in cash expenses. The new data show that cash expenses are forecast to rise 8.6% in 2021, rather than the 7.7% the ERS forecast in September. Meanwhile, farm-related income, which ranges from custom work to insurance indemnities, substantially declined between the two reports. This was due almost entirely to a decline in forecasts for 2021 federal indemnities.

At a more granular level, there were several significant changes between the two releases. The USDA's estimate for working capital in 2021 was revised up by more than 10%. This was driven in part by changes in end of year inventory projections, which rose from 15-year lows to average levels on stronger than anticipated production. These changes also led to considerable improvement in sector liquidity and efficiency ratios. Several commodities saw large fluctuations that largely followed recent price movements. Soybeans and hog cash receipts were revised down 10% from September levels, while cotton and poultry receipts rose a similar amount.

Figure 9: Forecast for 2021 Largely Unchanged as Cash Receipt Gains Offset by Expenses, Indemnities



Source: USDA ERS Farm Income and Wealth Statistics

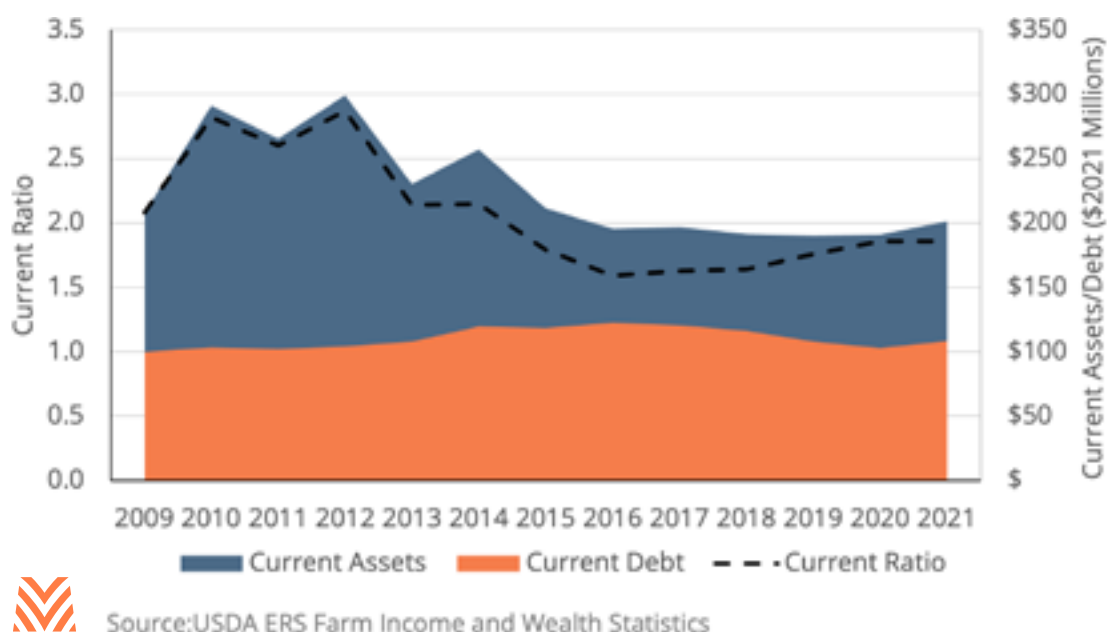
Financial Health

While the December release appears to confirm the USDA's belief that producers will have had a good year in 2021, the USDA report also signals some interesting trends in financial health. Net cash income is forecast to rise 15% over 2020 levels, but the sector's current ratio is forecast to remain unchanged from 2020. Current assets are forecast to rise modestly, but the increase in current debt is forecast to keep pace with this increase. While sector liquidity is higher than it

was during the lower farm income years between 2016 and 2018, the high incomes of 2021 have yet to translate to the sector balance sheets.

There are several reasons why sector liquidity remains lower. First, rapid sales have depleted stocks and have led to moderate inventory values. During the commodity supercycle, the USDA estimates that producers had an additional \$20 billion in assets from crop inventories alone. Producers are also forecast to enter 2022 with the lowest level of purchased inputs since the

Figure 10: Forecast for 2021 Largely Unchanged as Cash Receipt Gains Offset by Expenses, Indemnities



USDA began collecting data in 2012. But the largest difference between the supercycle era and today is producers' other financial assets. In 2012, the USDA estimated that producers had over \$155 billion in these liquid assets. The December forecast for 2021 is less than two thirds of that level, at \$94 billion.

The potential good news for lenders is that the USDA's forecast for financial assets does not reflect 2021 data. The measure for financial assets and net accounts receivable comes from the annual Agricultural Resource Management Survey, which asks producers about prior year incomes and expenses. The USDA estimates for 2021 working capital will not reflect producers' responses for their cash on hand in 2021 until their

second release in 2022. Given the volatility of this series, it is possible that producers' liquidity position will look far better once these data are accounted for.

The USDA's overall picture shows a sector that is modestly more liquid and leveraged. The sector's rate of return and debt service ratio are at their best point since 2014. Measures of profitability are also at their highest point since 2014. But solvency measures like the sector debt-to-asset ratio have continued to deteriorate despite the strong income of 2021. In 2020, the USDA estimates that sector debt-to-asset ratios increased even as farmland values increased by 7%. Current forecasts for 2021 indicate that the sector will be at its most leveraged point since 1999, even if it remains near long-run historic averages.

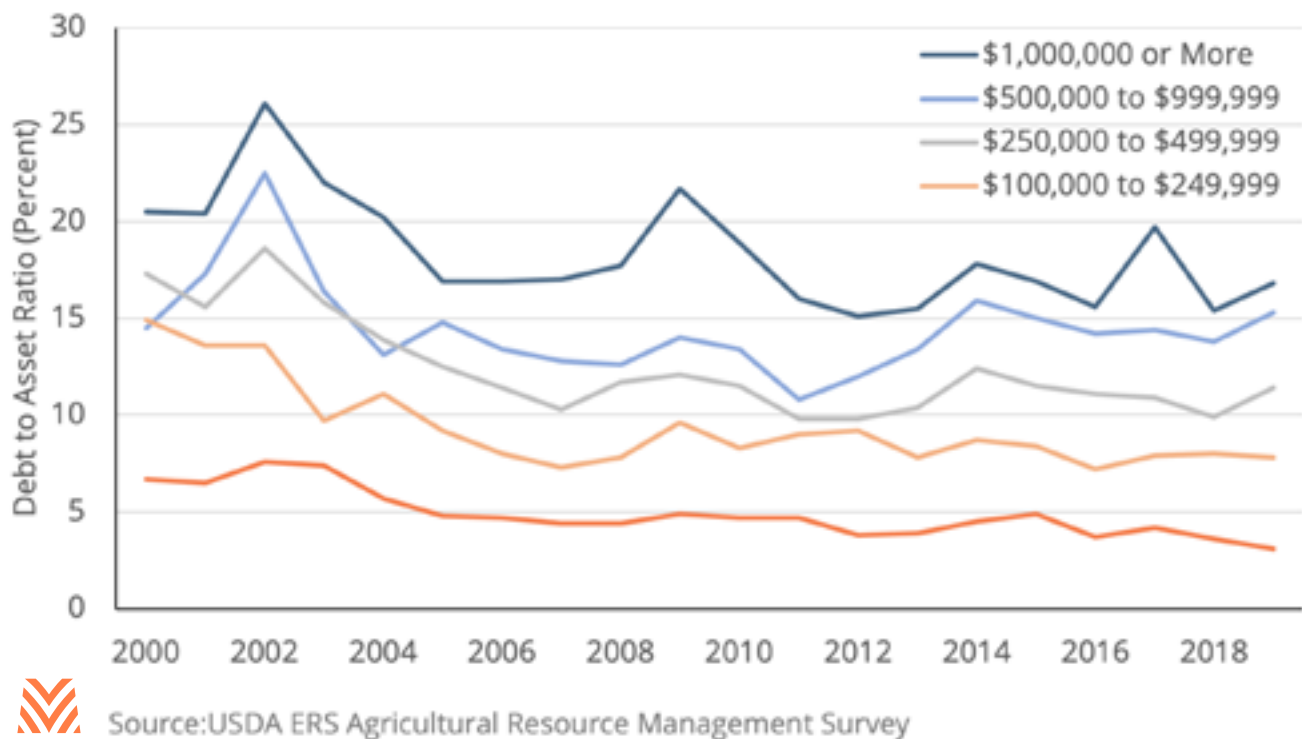


Changing Production

The discussion around sector leverage often misses one important point: the sector is consolidating. Small farms are unlikely to use farm debt, while large ones often do. The USDA releases the ARMS data used for some estimates shortly after their December release. These data allow us to look at financial strain by economic class. Figure 11 shows debt-to-asset ratios for farms by economic class between 2000 and 2019.

The ARMS data suggest that sector leverage is not increasing, except for farms between \$500,000 and \$999,999 in annual gross cash farm income. Since 2000, the number of midsize and large farms has more than doubled, while the number of moderate and small farms (those with less than \$250,000 in gross cash farm income) has declined. This has resulted in a sector-wide increase in debt-to-asset ratios, even as strain levels for most operations have not increased over time.

Figure 11: Most Farm Class Sizes Have Seen Falling Debt to Asset Ratios Over the Last Two Decades



The USDA itself noted that measures of severe strain are declining. The number of farm bankruptcies for the 12-month period ending September 30, 2021 was 344, well below 2019 and 2020 levels. Commercial bank delinquency rates and charge-offs have continued to fall as high incomes allow for greater debt repayment. As the sector continues to consolidate, the USDA ERS's financial health metrics may continue to show deteriorating financial ratios, even if individual farm conditions have improved. In sum, the USDA's December release portrays a farm economy that is recovering from years of lower farm incomes.

Cash receipt income continues to rise as crop prices hold and animal protein markets recover. Expenses are high, but not enough to overwhelm robust prices. Sector liquidity and solvency could be stronger, but the USDA's figures don't contain 2021 survey data and may not be fully accounting for farm consolidation. Farmers and ranchers might not be experiencing the supercycle, but after a very uncertain 2020, the strong incomes of 2021 will be more than welcome.

WEATHER UPDATE: LA NIÑA EVENT COULD LEAD TO A WETTER WINTER

22, 23, 24

While long-term weather forecasts are subject to change, they serve as early indicators for overall seasonal moisture and temperature conditions producers may face. The moderate La Niña event which developed in the equatorial Pacific during the fall is expected to extend into early winter, and will likely be an important driver for weather conditions across the nation. The La Niña signature is evident in expectations for wetter than normal conditions in the Pacific Northwest, while drought conditions are likely to persist through the Southwest. Areas from the northern Plains through the Great Lakes may see colder and stormier conditions than normal.

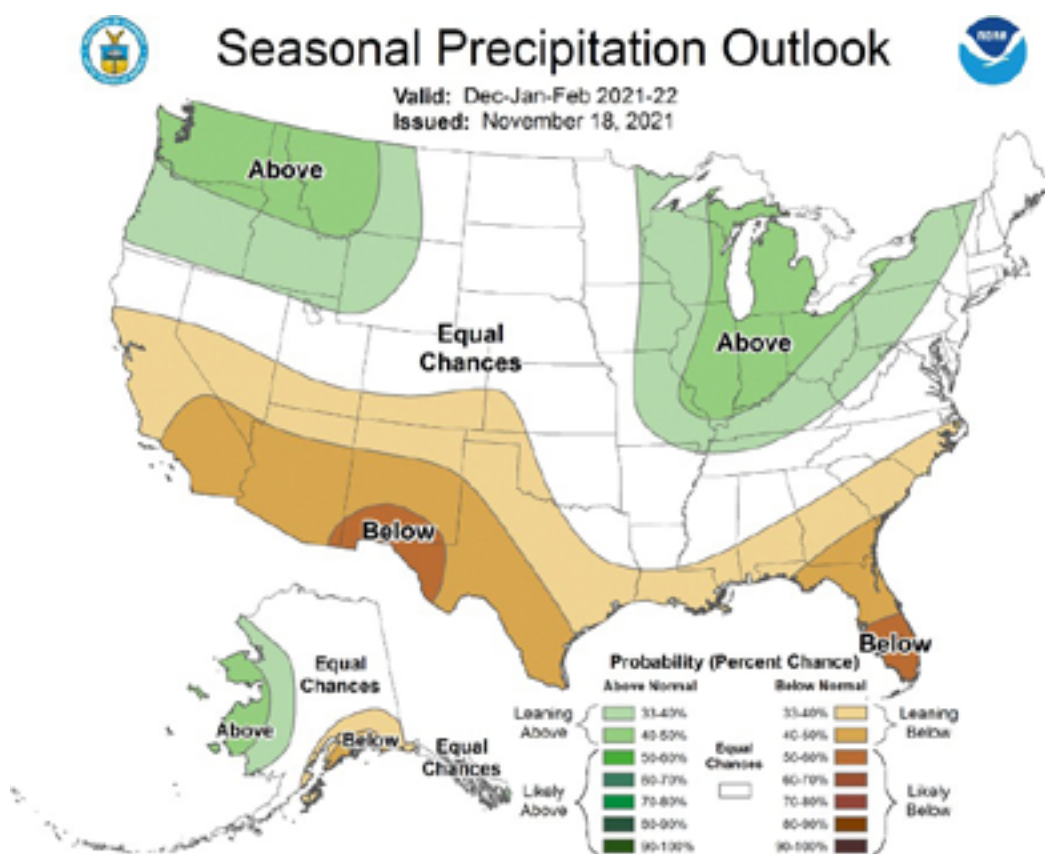
With the 2020/21 crop successfully harvested and winter wheat fully emerged, crop producers are already thinking about next year's weather.

The biggest story in weather remains the severe drought that plagues producers across much of the West Coast and northern Plains. While there were other severe impacts this year, such as from Hurricane Ida, no other single event had such a dramatic impact on production. Though early winter there has been little drought relief as the more northern jet stream track influenced by the

La Niña conditions has resulted in much below normal rain and snow throughout the Southwest. Throughout the Southwest and Intermountain West, snowpack is at extremely low levels, and unfortunately, this trend is generally expected to continue over the remainder of the winter. The lack of snowfall will have significant ramifications for reservoirs and other sources of water in 2022 as it is coming on the heels of a dry year with alarmingly low reservoir levels throughout the region.



Figure 12: Seasonal Temperature Outlook



Source: NOAA

The more northern orientation of the jet stream will be beneficial in both the Pacific Northwest and Great Lakes states, as higher than normal precipitation is likely in these regions through the first part of 2022. These regions are also the most likely to see colder than

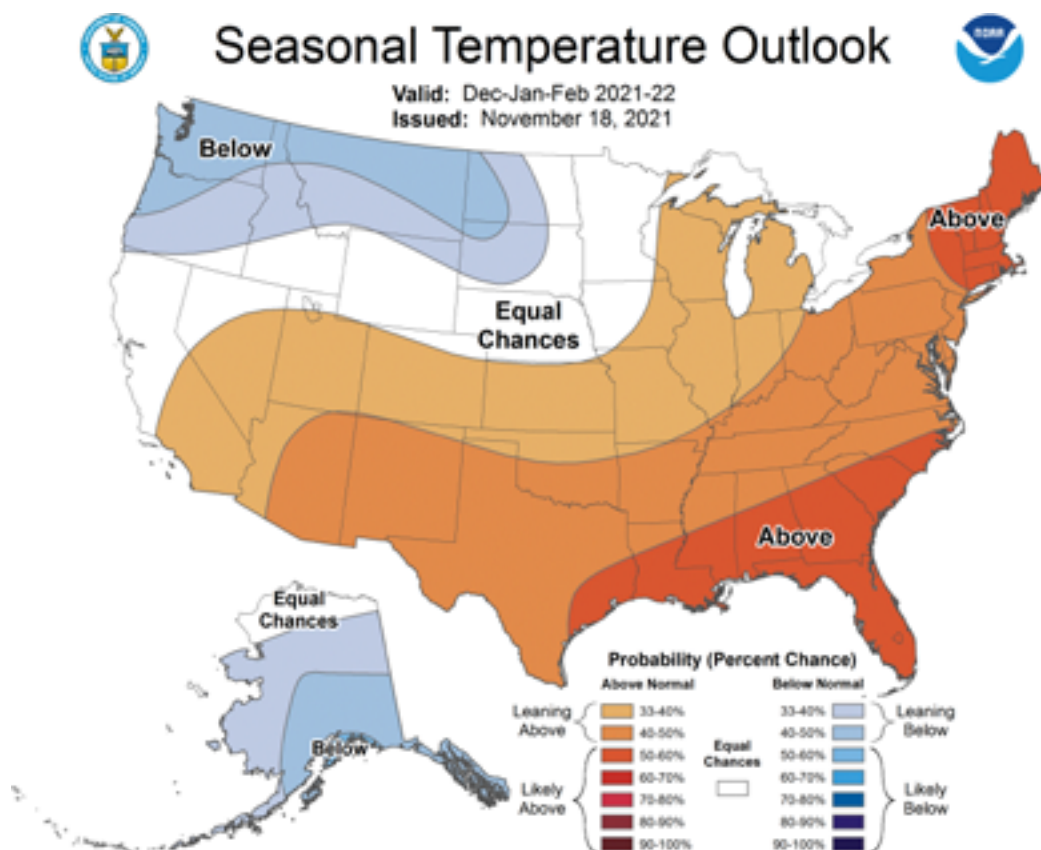
normal conditions this winter, particularly in January and early February.

Long term projections for temperature indicate some potential upside for producers over the near term. The winter seasonal forecast indicates

slightly warmer than normal temperatures in critical dairy regions like the western Great Lakes region and California. For the heartland, NOAA's long-term projections indicate that growing conditions in the Midwest are most likely to either be within normal ranges



Figure 13: Seasonal Precipitation Outlook



Source: NOAA

or potentially slightly warmer. However, there is a high probability of above average temperatures across the West and Southeast, which could exacerbate recent challenges that those regions have had in the forms of drought or hurricanes.

Of course, projections this far in advance are subject to change as we move through 2022. Perhaps the most important lesson of the last three years of extreme weather for farmers across the country is that past is not prologue. The number of severe weather events has

been increasing over the past two decades, but greater probability does not convey certainty. The current long-term forecasts suggest that severe drought in the west or hurricanes in the southeast might be more likely in 2022, but only time will tell.



GRAIN PRODUCER INCOME TO PULL BACK FROM STRONG 2021

25, 26, 27, 28

Cash grain markets will end 2021 on some of their strongest footings in recent years. With a pullback in prices, lower export quantities, and foreign competition heating up, how good of a year can producers expect in 2022?

Many farm income statements look considerably better in 2021 than they did at any point in the last five years. Major grain commodity prices held firm this year, with corn, soybean, and wheat prices touching eight-year highs at some point during the calendar year 2021. Extremely strong exports for both corn and soybeans drove the liftoff in late 2020, and fears of tightening supplies drove a surge in mid-2021. Better-than-expected yield expectations started to bring corn and soybean prices back down in the summer months, but wheat prices continued



to hang at multi-year highs with dwindling quality due to drought conditions across the upper Plains and northwestern states. Spring wheat conditions closed out the 2021 season the lowest in 35 years of recorded history, with only 11% of acres reported as “Excellent” or

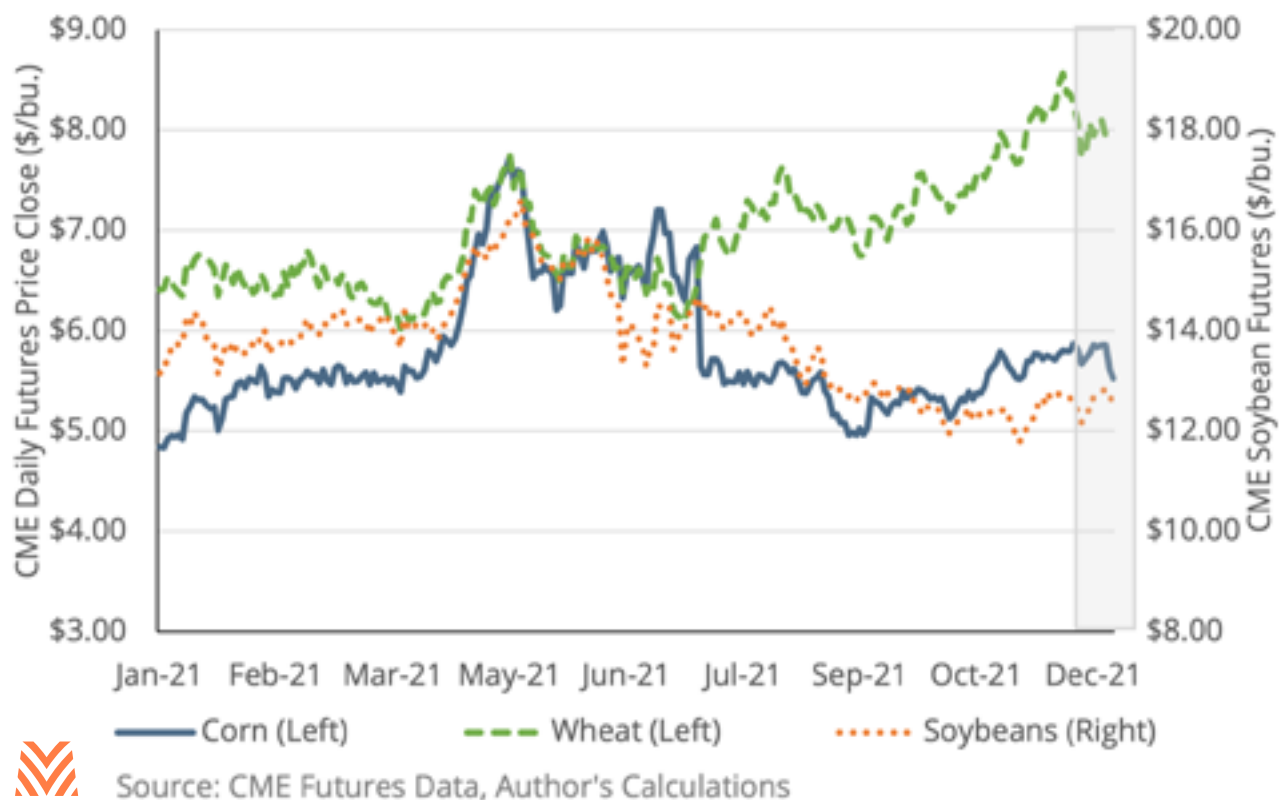
“Good” quality. Global supplies remained tight near year-end, keeping all-wheat prices near supercycle era highs. Global demand and commodity prices were boosted by a 10% drop in the value of the U.S. dollar between March 2020 and June 2021.

The healthier commodity prices raised farmers' pay considerably during 2021. While total incomes were up in 2020, the real growth came from government support payments. Supply chain disruptions combined with overall demand constraints caused an unprecedented amount of government aid to be disbursed in 2020. Through the Coronavirus Food Assistance Program (CFAP) payments, the USDA distributed more than \$23.5 billion to American farmers and ranchers during the year, and between 2020 and 2021 payments,

more than \$11 billion went to corn, soybean, and wheat production. In 2021, the story was slightly reversed. Government payments dwindled as commodity prices surged. The USDA forecasts that crop cash receipts surged nearly 18% in 2021, which came from higher corn, soybean, and wheat prices. The USDA estimates that average farm businesses involved in corn, soybean, and wheat production rose by 44%, 40%, and 20% in 2021 compared to 2020, respectively.



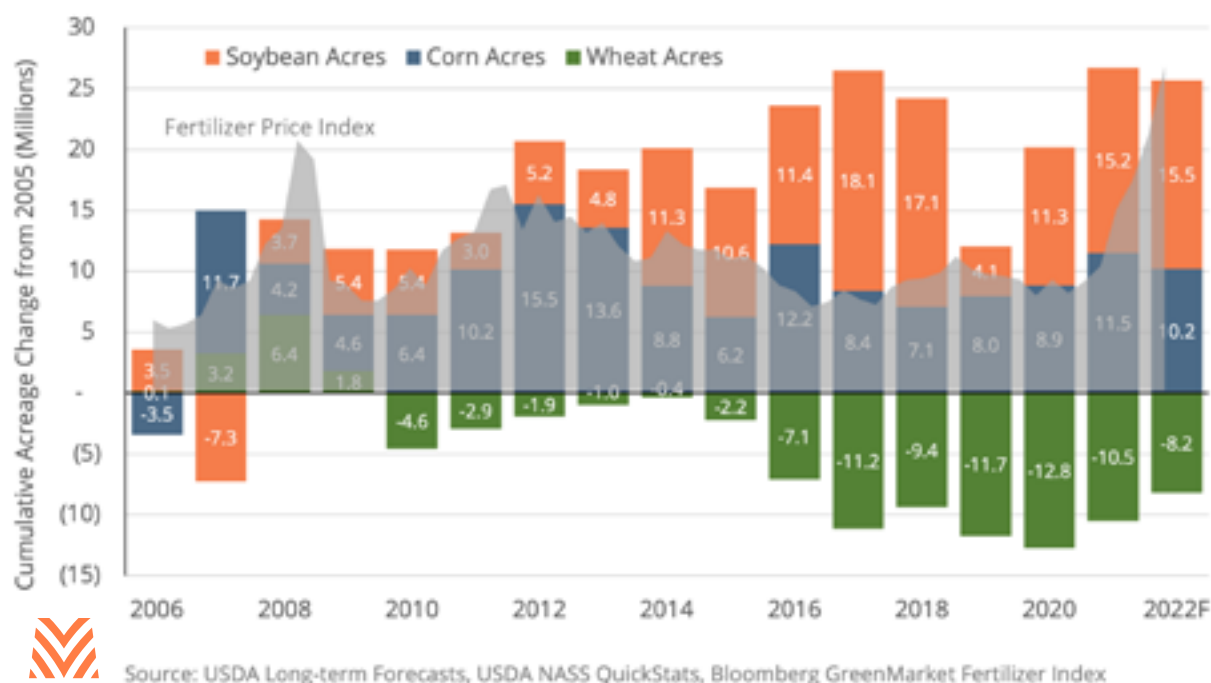
Figure 14: Grain Futures Prices in 2021 and Futures Curve into 2022



As 2021 wraps up, producers turn to plan and strategize the 2022 planting season. Since 2005, U.S. corn acres are up by 15 million, soybean acres are up 10 million, and wheat acres are down 8 million, a result of market demand and crop profitability (see Figure 15). The USDA's first release on 2022 planting expectations shows a modest decline in corn acres (1.3 million acres down), flat soybean acres (0.3 million acres up), and a substantial increase in wheat acres (2.3 million acres up) compared to 2021. That is a very small change overall, considering the level of disruption affecting the input cost equation.

Fertilizer prices are up nearly three-fold compared to late 2020, a result of higher energy prices, tighter global supply chains, and sanctions on Belarusian exports of potash. Fertilizer prices were this high in 2007, and there was a bigger change in acreage then than the USDA projects for 2022. Corn and wheat are much more nutrient-intensive compared to soybeans, and in 2008, nearly 11 million acres came out of corn and wheat and went into soybeans. One outcome in 2022 may be that farmers minimize costs and rotate away from corn in a similar pattern to 2008. However, global supply and demand for soybeans and wheat could tilt the equation back towards stability.

Figure 15: *Planting Trends by Major Crop Commodity and Average Fertilizer Cost*



Land is another important input cost consideration for producers. Midwestern land values had a stellar run in 2021, with good quality farmland experiencing double-digit gains in Iowa, Illinois, Indiana, and Wisconsin. While cash rental rates did not rise substantially during the 2021 season, the combined forces of higher land values and higher profitability make a rise in 2022 much more likely. Cash rental rate increases tend to happen in the same year or on a one-year lag from major increases in commodity prices and profitability. Rental rates also correlate with increases in land values.

These increased input costs may put downward pressure on crop profitability in 2022. Fertilizer costs and land costs combine for some of the largest categories of input expense, and a 1% increase in each causes a 0.75% decrease in producer profitability. Budgets for 2022 should have some buffer built into them in order to absorb the uncertainty of these input costs. There is some movement in energy and nutrient markets that may give hope of a fertilizer price reprieve in time for planting, but for now, these trends look to hold through mid-year 2022.



HIGH RETAIL COSTS FINALLY MAKE THEIR WAY TO CATTLE PRODUCERS

29, 30, 31, 32, 33

Cattle ranchers have at long last seen improvement in the futures markets after two years of a lower return environment. Historic retail prices are finally working their way down to the farm, and processing data suggest that this trend will only continue. Given strong domestic consumption and growing exports, cattle producers could see a sustained period of higher prices.

After almost two years of a difficult price environment, cattle producers are finally seeing some momentum. Futures markets have accelerated in recent weeks, with cash prices rising to their highest point since 2017. An almost 20% improvement in cash markets through November happened just as more good news came along in the form of slaughter data suggesting that a backlog producers have had for almost two years has

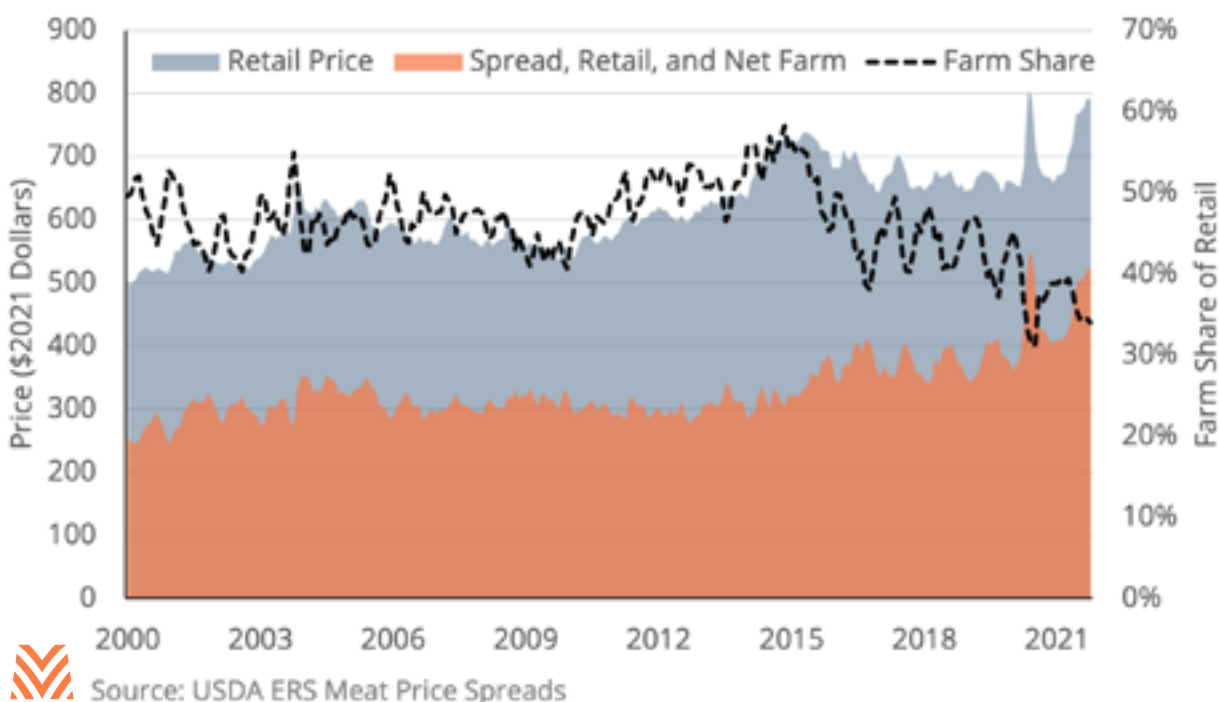
finally dissipated. A combination of strong retail markets and the reduction in processing constraints means that ranchers might see a run of strong prices to start 2022.

In inflation-adjusted terms, retail beef prices are at a record high. We should expect that such high beef prices will eventually be passed down to ranchers, although they're taking a smaller slice of the retail pie than they used to. The last time

prices were near this level, during the commodity supercycle, ranchers could expect to take home more than 50% of total retail prices. However, as of the USDA ERS's latest data from October 2021, just 34% of total retail cost went to farmers.

Figure 16 shows the relationship between retail price and farm price since 2000: In general, producers' income share had been stable up until 2015, when growth in wholesale prices began to outstrip growth in retail and farm pricing.

Figure 16: Ranchers are Receiving a Historically Low Share of Retail Prices




Nevertheless, the latest industry data suggest that beef processing may be losing some leverage over producers. In November, carcass weights fell back to baseline levels for the first time since 2019. Slaughter rates remain elevated, with total annual production 3% above last year's total as of early December 2021. The latest cattle on feed data also suggest that the herd has not seen significant growth and that placements have not yet responded to improving market prices. Combined with USDA forecasts that total domestic beef consumption will rise in 2021, cattle producers could see a situation where demand significantly outstrips supply.

The good news for beef producers is that demand might continue to improve. While exports have historically been a negligible part of U.S. beef consumption, total exports of beef between January and October 2021 are 20% higher than the same period the prior year. Increases in Chinese consumption are primarily responsible,

but considerable growth from partners like South Korea, Japan, and Mexico indicate that this demand growth could be sustainable. In addition, the USDA announced \$32 million in grants to beef and poultry facilities to expand their processing capacity. While these and other recent policy actions will not have immediate impacts on farm-to-retail spreads, it does signal that farmers could see stronger returns in several years.


After several years of lower prices and higher costs, ranchers are more than due for this good news. For some, even these surging prices might be too late. Producers across the country had dealt with rising feed costs and flat-to-low cattle pricing, even as beef prices at their local grocers continued to rise. In areas like the Pacific Northwest, these issues are so critical that local lenders fear that many producers will opt to liquidate their herd. But for those producers who have made it through this hard period, a reprieve is likely on the way.



TREE NUT EXPORTS THREATENED BY SLOWER EMERGING MARKET GROWTH

34, 35, 36, 37

In 2021, very strong exports kept total export values even with prior years despite substantial price declines. Emerging markets have been critical to help ensure global demand does not outstrip domestic production increases. Potential lagging economic damage from the global pandemic is forecast to slow emerging market growth and weaken their currencies, which may dampen export growth to those economies.

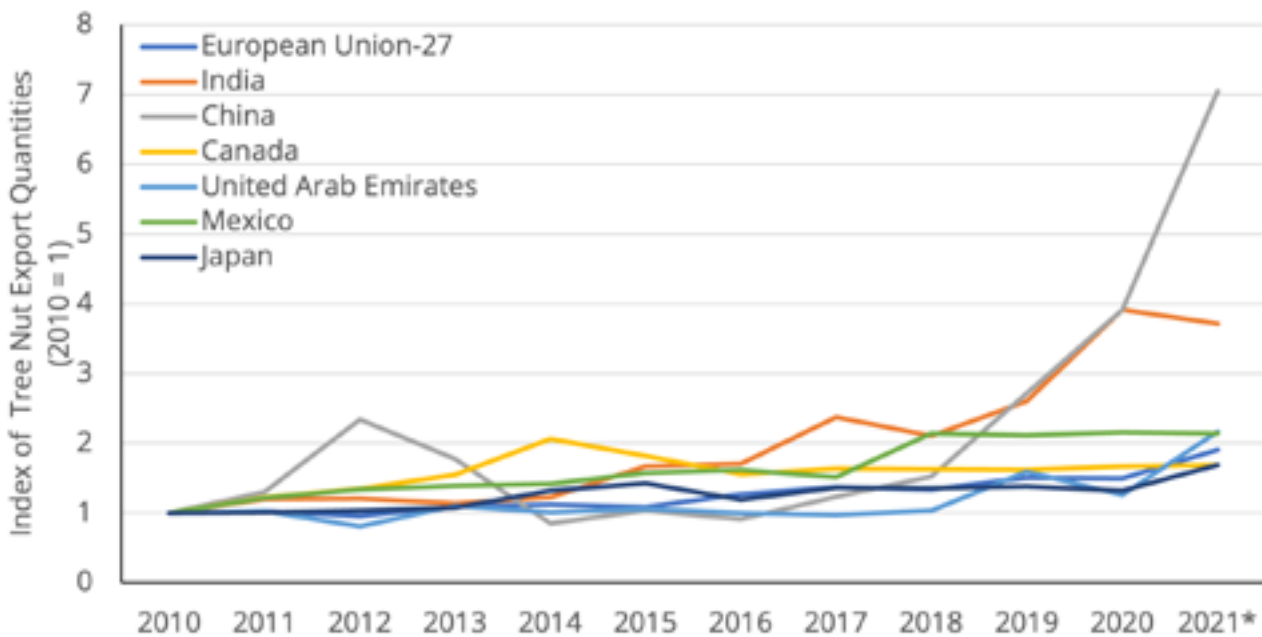


Over the last year, tree nuts have benefitted from rising global demand for almonds, pistachios, and other consumer-oriented goods. This is critical for tree nuts, as U.S. production of nuts like almonds has quadrupled between 2000 and 2021. While wealthy regions like the European Union are the largest export destination for tree nuts, this growth-oriented industry is reliant on growth in emerging markets to keep up with production increases. Export volumes of edible tree nuts to advanced economies more than doubled over the last two decades. Over the same period, exports to emerging economies increased by more than eight times.

Emerging economies are essential to meet the additional production that has been put into almonds, pistachios, and other tree nuts. While the European Union remains the single largest U.S. market for tree nuts, India and China are on pace to eclipse it within a decade. And while India and China are the largest markets, many other

emerging markets will contribute to this growth; countries like Mexico and the Philippines have more than doubled their imports of American tree nuts over the last decade. Figure 17 shows the growth in total tree nut exports for America's largest nut export markets.

Figure 17: Tree Nut Exports to Emerging Markets Has Outpaced Growth to Advanced Economies



Source: USDA Foreign Agricultural Service Global Agricultural Trade System database, *2021 values are estimated by applying the change in January to September export totals to 2020 values



The challenge for nut producers is that a slowdown in emerging economy growth is a very real threat over the near term. In the latest set of global forecasts from the International Monetary Fund, the group noticed that the current recovery was very different from those of earlier recessions. Many emerging economies saw limited impacts from the 2007 financial crisis, and GDP growth in these countries remained well above advanced economies. But the 2020 recession differs, because many emerging economies are tourism-dependent or commodity exporters. These economies saw immediate impacts from the global shutdown, but also have seen lagging impacts due to slow vaccination rollouts.

The first reason the new IMF projections could signal trouble for tree nuts is due to income impacts in these emerging markets. In 2015, the USDA's Economic Research Service found that many emerging markets spent 30% or more of household income on food, compared to less than 10% in the United States. Income declines in these less-advanced economies will directly impact the ability for individuals in those markets to purchase consumer-oriented goods.

Second, slower growth in emerging economies can influence exchange rates. During the financial crisis, the lack of impacts to emerging economies led to negligible differences in how the U.S. dollar fluctuated against emerging and advanced economies. While the recession of 2020 initially strengthened the dollar against most currencies, the trend has diverged. The dollar remains stronger



against a basket of emerging economy currencies but is weaker against advanced economies. The reduction in purchasing power of consumers in emerging economies will compound the impacts of lower income growth.

Many other factors contributed to the record-breaking year tree nut producers saw for exports in 2020 and 2021. Strong almond production led to a glut of supply that allowed prices to decline to attractive levels for international buyers. Global shutdowns led to less spending on services and more spending on goods, including consumer-oriented commodities. But the slowdown in emerging market growth is a considerable risk to tree nuts. Core markets like the European Union may prevent total global declines in nut consumption, but producers must be aware of where the next billion pounds of additional production will go.



THE RETURN OF INFLATION?

38, 39, 40, 41, 42, 43

Lenders and producers alike have become increasingly concerned about the potential for a return to a high inflation environment. While current forecasts do not expect the current period of high inflation to persist, even moderate inflation can negatively impact land values and increase production expenses, like labor and fuel costs. However, many production expenses are more associated with the agricultural economy than the general economy, and modest inflation can put positive pressure on the prices that producers receive.

In November 2021, Farmer Mac and the American Bankers Association asked over 500 agricultural lenders about their top concerns for producers. This year, in a seismic shift, lenders overwhelmingly listed their biggest concern as something they had hardly mentioned in prior surveys: inflation.

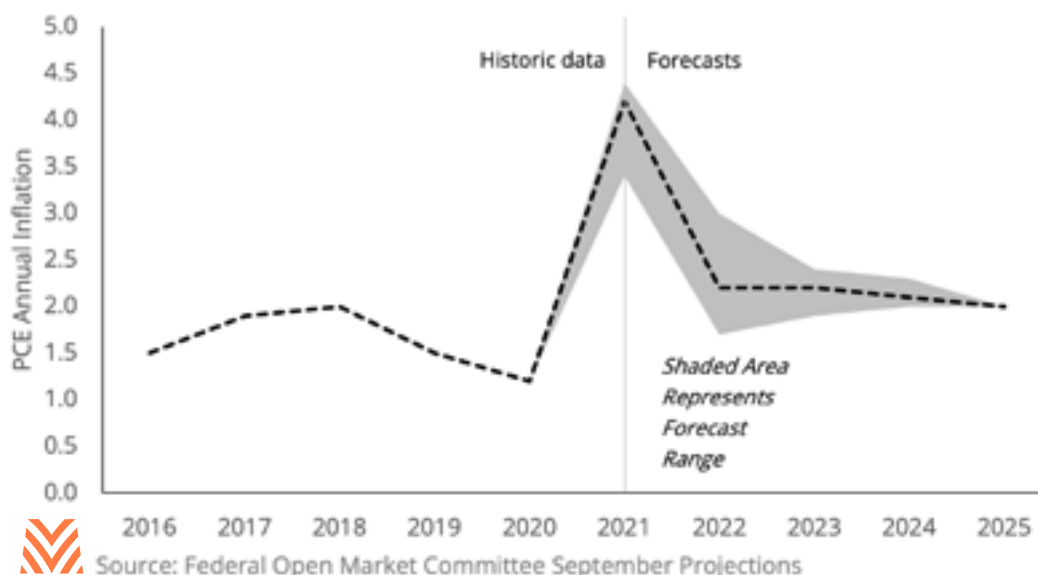
Since the early 1990s, core personal consumption expenditure (PCE) inflation has been very near the Federal Reserve's target of 2% annual growth. The recent return of higher inflation thus adds uncertainty that many lenders have had no experience with

during their careers. However, the farm sector has a strong memory of the potential risks that inflation presents to borrowers. Rising inflation can harm profitability by increasing input costs or can lead to untenable rate increases for highly-leveraged producers with variable rate loans.

The good news is that despite recent sharp increases, current forecasts indicate that there are only modest changes in long-run inflation expectations. Figure 18 shows the September projections from the Federal Open Market Committee (FOMC), with median expectations of 2.2

core PCE inflation by 2022. This was echoed in the November Survey of Professional Forecasters, who forecast that PCE inflation would rise to 4.1% in 2021 before falling to levels just above 2% in 2022. Many economists believe that specific supply shortages, like the used cars shortage, led to transitory inflation that will not lead to significant increases in long-run inflation. That said, items like food are forecast to experience a longer period of price growth. Given the uncertain nature of future inflation, lenders and borrowers should be aware of the risks of an inflationary environment.

Figure 18: Higher Inflation in 2021 Not Forecast To Lead to Material Increases in Future Inflation



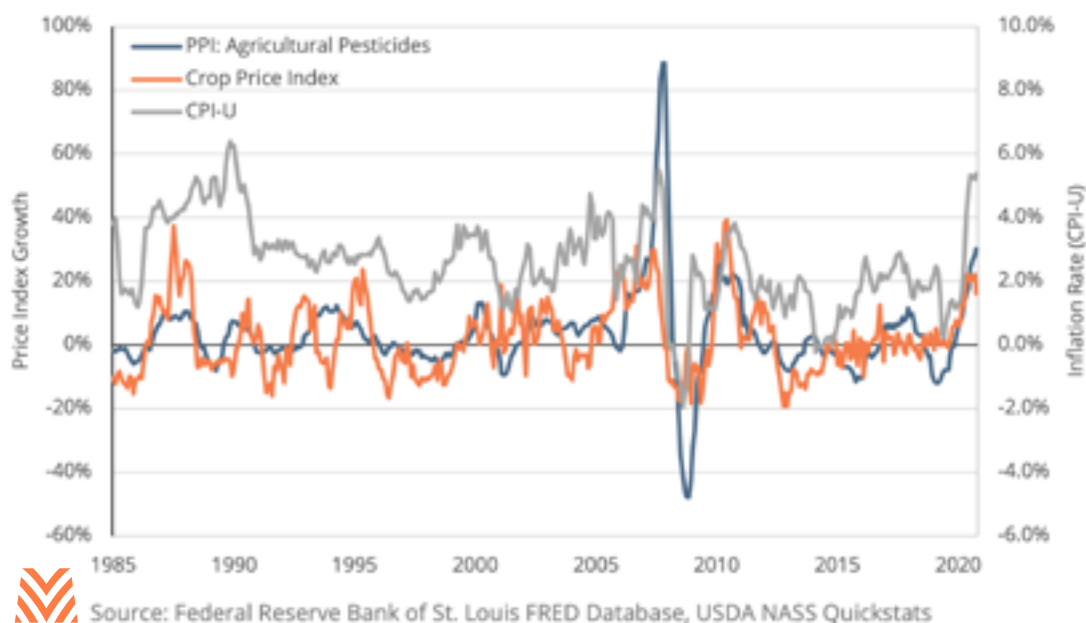
Input Costs

One of the potential impacts of a high-inflation environment could be on production expenses. In December, the USDA forecast that total production expenses will increase almost 9% in 2021. This is due in part to producers taking advantage of high market prices. However, increases in costs

like fuels, labor, and fertilizer are all in some way related to the inflationary environment.

The important thing to understand is where cost increases are coming from. Economists from the University of Illinois have found that fertilizer costs are more tied to the price of corn than to the inflation rate. Similarly, feed costs are a function of market prices, and are less tied to

Figure 19: Prices for Fertilizer Have Historically Tracked With Crop Prices, Not Inflation



inflation. But labor and fuel costs are directly related to inflationary pressures, meaning that inflationary pressures may persist even if the farm economy is not strong. This means that high-labor commodities, like dairy, could feel inflationary pressures even as low-labor ones, like wheat, feel negligible pressure.

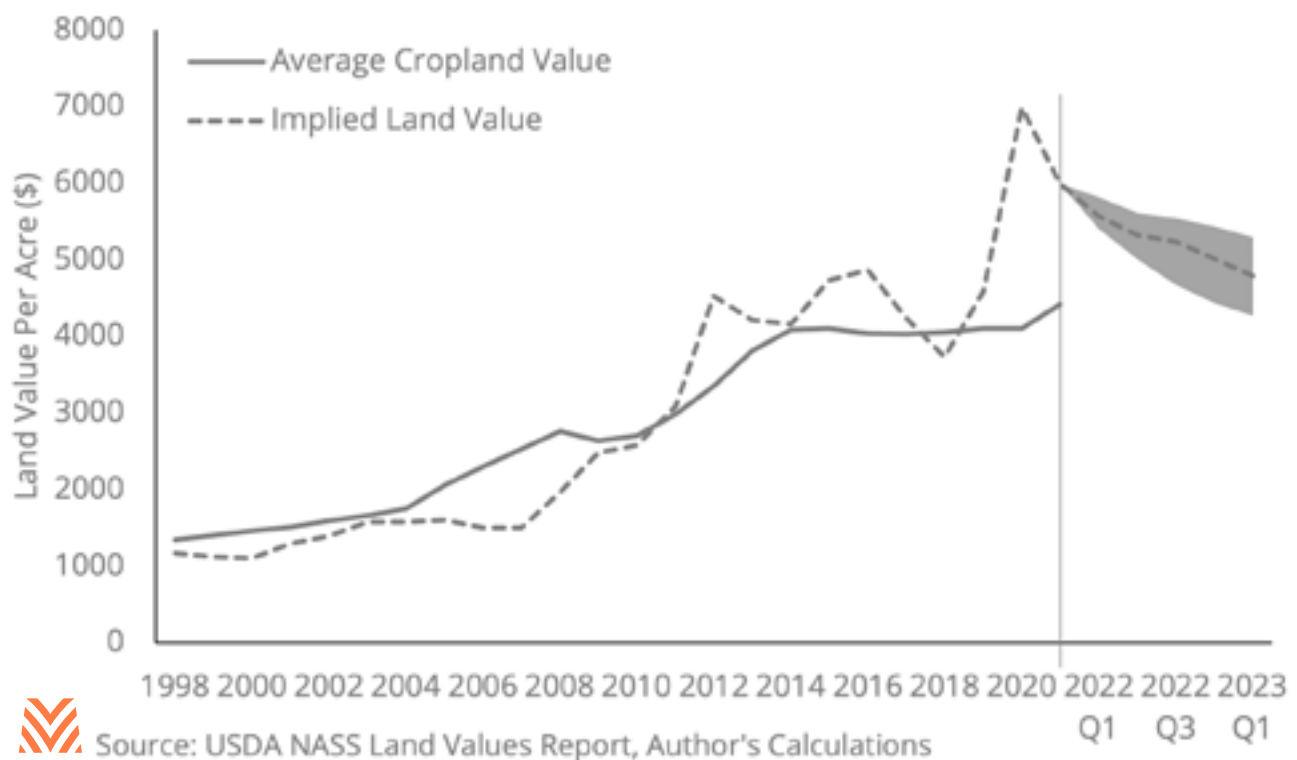
Land Valuation

In addition to its impacts on variable rate payments, inflation also can harm assets by lowering the implied value of farmland. Current projections are that inflation expectations will lead to increases in the federal funds rate between 2023 and 2024. These increases are forecast to mirror the rate increases of the period between 2015 and 2018, with rates rising to between 2% and 2.5% by the end of 2024. Such a rising rate

environment could impact producers through its impact on the capitalization rate for farmland. One theory of agricultural land values suggests that the implied value of farmland is roughly the cash rental rate divided by the capitalization rate.

The capitalization rate can be thought of as the risk-free interest rate (usually the 10-year Treasury yield) plus a portion of the additional returns to riskier assets minus the growth in farmland returns. Figure 20 shows what this implied valuation for cropland is given a range of forecasts from the Survey of Professional Forecasters for the risk-free rate, assuming constant returns to risky assets, and using futures for cash grains to predict growth in cash rents. This model suggests that increases in treasuries alone have the possibility to put downward pressure on cropland values by 2023.

Figure 20: Rate Increases Alone Could Put Downward Pressure on Land Values by 2023



While this model suggests that land values are influenced by monetary policy, recent literature has attempted to quantify how decisions by the FOMC impact farmers and ranchers. Researchers from Iowa State University's Center for Agricultural and Rural Development recently reviewed the relationship between monetary policy changes and land values in the Corn Belt and Great Plains. They found that rate increases can lead to long-lasting impacts to land values, with residual impacts up to 18 years after the increase. For states around the Great Lakes and the Great Plains, they estimate that rate increases between 2015 and 2018 led to land values that were 2.5% lower in 2020 than they would have been without changes in monetary policy. As the FOMC expects future rate increases to mirror the 2015 to 2018 period, this model suggests that land values may see similar impacts in 2024 and on.





Commodity Prices

The silver lining for producers is that modest inflation may carry some benefits. In periods of inflation, storable commodities may serve as a hedge, meaning that increases in expectation for long-run inflation could raise the demand for real commodity prices. Research has specifically found links between some cash grain prices, market volatility, and food price inflation. In the U.S., food price inflation is not likely to change overall consumption. As of 2020, Americans spent just 8.6% of their disposable income on food, down from almost 20% back in 1960.

Modest inflation can also benefit producers by influencing exchange rates. If inflation in the U.S. exceeds that of other countries, then that will put downward pressure on the U.S. dollar relative to other currencies. As a weak dollar makes U.S.

agricultural exports more competitive in the global marketplace, farmers and ranchers could benefit from the modest price pressures.

The net effect of inflationary pressures is likely to be negative for producers, but the impacts may be less severe than some lenders fear. There is currently no indication that inflation will reach the levels seen during the agricultural crisis of the 1980s. Many agricultural input costs are tied more to commodity prices than they are to inflation. Inflation could lead to downward pressure on land values, but near-term forecasts do not suggest that recent price increases are unwarranted. Finally, producers might even benefit from modest food price inflation. Inflation is not yet a cause for true concern, but lenders and producers should be aware of its impacts should inflation continue to climb.

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ABOUT THE FEED

The Feed is a quarterly economic outlook for current events and market conditions within agriculture.

The report is broad-based, covers multiple regions and commodities and incorporates data and analysis from numerous sources to present a mosaic of the leading industry information, with a focus on the latest information from the United States Department of Agriculture and their Economic Research Service.

There are several regularly included sections like weather and major industry segments, but the authors rotate through other industries and topics as they become relevant in the seasonal agricultural cycle. Where the report adds value to readers is through its unique synthesis of these multiple sources into a single succinct report.

Please enjoy.

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