



2021 Markets in Review

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Fryar Price Risk Management Center of Excellence

**Agricultural Economics & Agribusiness Department
Dale Bumpers College of Agriculture Food & Life Sciences
and
University of Arkansas System Division of Agriculture**

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About the Fryar Center

In 2020, the Fryar Price Risk Management Center of Excellence was established in the department of Agricultural Economics and Agribusiness at the University of Arkansas through a generous gift from Dr. Ed and Michelle Fryar. Dr. and Mrs. Fryar are both alumni of the department, and after receiving his Ph.D. in agricultural economics, Dr. Fryar returned to the department and served as a faculty member for 13 years.

The mission of the Fryar Center is to deliver a stakeholder-informed, internationally recognized research programs in price risk management that improves decision making for farms and businesses, offers unparalleled educational opportunities for students, and enhances professional opportunities for faculty and staff.

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Review of Markets and Farm Income Estimates

John D. Anderson, Andrew McKenzie, Scott Stiles, and Eunchun Park

The past year has been, in many respects, a much quieter year than the pandemic year of 2020. For the most part, the comprehensive shutdowns that accompanied the first wave of COVID-19 were avoided in 2021. Still, pandemic effects continued to dominate the economy in 2021. On the demand side, a combination of mandatory interventions and voluntary risk avoidance continued to affect consumer behavior, particularly with the emergence of the Delta variant of COVID-19 in the latter half of the year. On the supply side, the cumulative impact of COVID-related effects contributed to supply chain challenges that continue to affect large swaths of the economy.

One of the more notable features of the economy in 2021 has been a persistent rise in prices for many goods and services. The rise in prices is evident in agricultural commodities markets. Table 1 shows average prices for 2019, 2020, and 2021 (year-to-date) for several major agricultural commodities.

Table 1. Average Prices for Select Agricultural Commodities: 2019 through 2021 year-to-date

	2019	2020	2021
Rice (\$/cwt) ¹	\$13.60	\$14.00	\$14.80
Soybeans (\$/bu) ¹	\$8.57	\$10.80	\$12.10
Corn (\$/bu) ¹	\$3.56	\$4.53	\$5.45
Cotton (\$/lb) ¹	\$0.5960	\$0.6630	\$0.900
Broiler Composite ²	\$88.42	\$73.21	\$98.43
Boxed Beef Cutout ³	\$219.13	\$233.24	\$275.30
Pork Cutout ⁴	\$77.14	\$77.09	\$107.26
Fed Steer (live) ⁵	\$116.78	\$108.51	\$119.08
Feeder Steer ⁶	\$143.69	\$136.48	\$145.65
Market Hog ⁷	\$67.95	\$61.06	\$92.67

¹ National marketing year average price (USDA World Agricultural Outlook Board).

² National broiler composite (USDA Agricultural Marketing Service).

³ 5-Area comprehensive boxed beef cutout (USDA Agricultural Marketing Service).

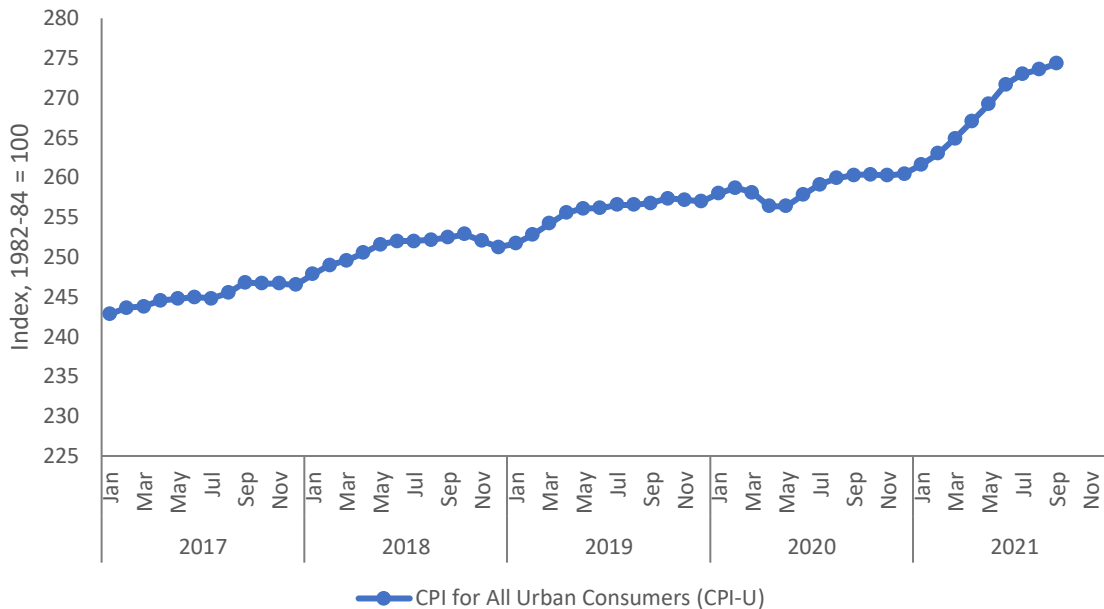
⁴ National comprehensive pork cutout value (USDA Agricultural Marketing Service).

⁵ 5-Area weighted average live steer negotiated price (USDA Agricultural Marketing Service).

⁶ OKC 700-800 pound medium & large frame #1 steers (USDA Agricultural Marketing Service).

⁷ National weighted average, prior day producer-sold hogs, (USDA Agricultural Marketing Service).

Some of the increase in prices in 2021 represents a recovery following the unprecedented disruptions of 2020. Still, for the most part, prices have increased well beyond pre-pandemic levels. This is evident not only in the commodity price data presented in table 1 but also in the more comprehensive data on inflation reported by the Bureau of Labor Statistics. The Consumer Price Index for all Urban Consumers (CPI-U) compiled by the U.S. Department of Labor, Bureau of Labor Statistics (BLS) rose to 274.3 in September. That value represents a 5.4 percent increase from September 2020 and a bit less than a 7 percent increase from September 2019. Figure 1 shows monthly CPI-U values for the past five years. Clearly, the rate of increase in the general price level ramped up quite a bit in 2021 – not too surprising given the combination of supply chain disruptions and the release of pent-up demand stemming from pandemic effects.



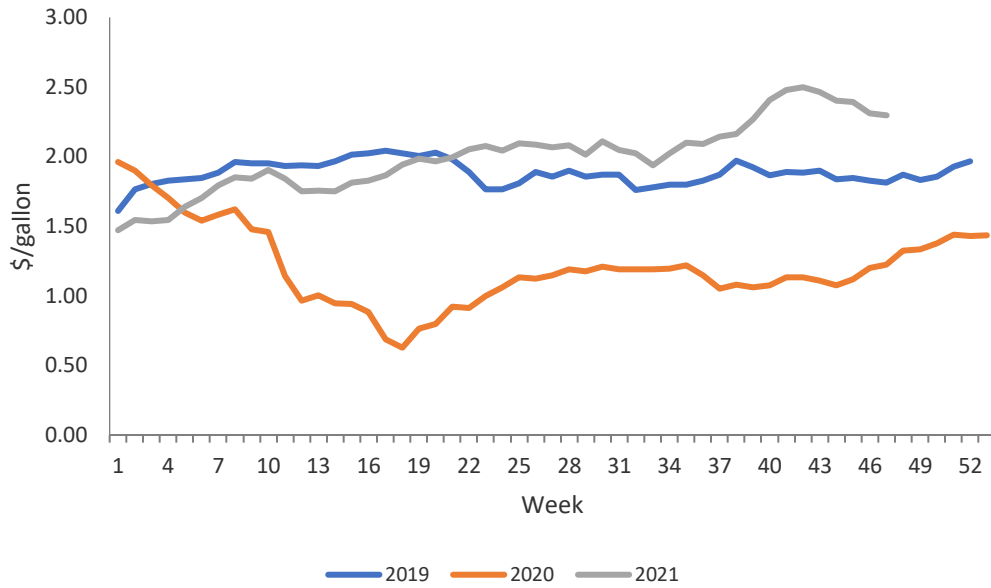
Data Source: U.S. Department of Labor, Bureau of Labor Statistics.

Figure 1. Consumer Price Index – All Urban Consumers: monthly, 2017-2021

While food price inflation has gotten quite a bit of press this year, overall food price inflation has actually been lower this year than it was in 2020 and not much above the 20-year average. According to data compiled by USDA Economic Research Service (ERS), the CPI for all food has averaged an annual increase of 2.4 percent over the past twenty years. Through the first three quarters of this year, the food CPI has increased by 3.0 percent -- down from an annual increase of 3.4 percent in 2020. The perception of much higher food prices seems to be largely driven by relatively large increases in prices on specific food items – primarily meat – over the past two years. In 2020, the CPI for pork increased at almost double the rate of the all food category. The CPI for beef increased at almost triple that rate. So far for 2021, beef and pork prices are both increasing at about double the rate of prices in the all food category.

For agricultural producers, higher commodity prices have a positive effect on income. On the other hand, an overall increase in prices means that prices on key inputs are also increasing. Two key inputs that have witnessed significant increases in price in 2021 are fuel and fertilizer.

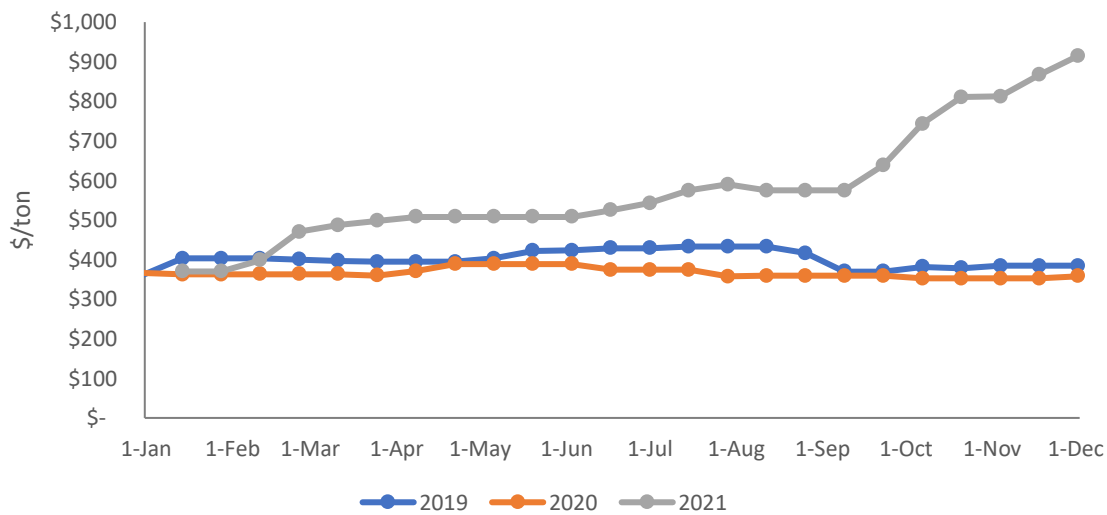
Diesel prices fell dramatically during the pandemic. Between the first week of January and last week of April in 2020, the wholesale price of ultra-low sulfur number 2 diesel at the U.S. Gulf Coast fell by almost 70 percent. Since that time, wholesale diesel prices have rebounded more or less steadily, rising sharply beginning in late August. For the month of October, the Gulf Coast wholesale diesel price in 2021 was more than double the 2020 price. While prices have retreated through November, they remain substantially higher than a year ago. This is a bit of a misleading comparison, though, considering the pandemic effects on prices. Still, this year’s fall price has been about 30 percent higher than the same period in 2019. Figure 2 shows weekly Gulf Coast wholesale diesel prices for the past three years.



Data Source: U.S. Department of Energy, Energy Information Administration.

Figure 2. U.S. Gulf Coast Ultra-Low Sulfur Number 2 Diesel Wholesale Price: Weekly, 2019-2021

The recent rise in fertilizer prices has probably garnered more interest among the farm community than the rise in fuel prices. Fertilizer prices have risen rapidly since late summer. USDA Agricultural Marketing Service reports prices for a number of major fertilizer types in a bi-weekly cost of production report for Illinois. This is one of the best sources of public information on fertilizer prices available (see the most recent report at https://www.ams.usda.gov/mnreports/gx_gr210.txt). Figure 3 shows bi-weekly urea prices from this report for the past three years.



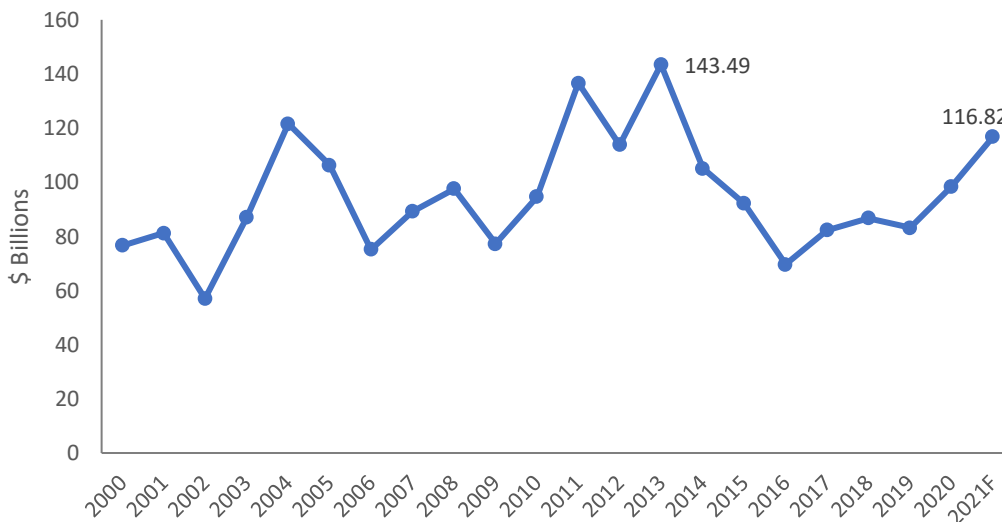
Data Source: U.S. Department of Agriculture, Agricultural Marketing Service.

Figure 3. Urea (granular) Farm Price: Illinois Statewide Average, \$/ton

Urea prices in late-October/early-November this year were well over twice the price at the same time in 2020 or 2019. In fact, by most metrics, fertilizer prices have reached their highest levels ever, surpassing previous highs dating back to 2008. For example, the Green Markets weekly North American fertilizer price index (a composite index based on urea, potash, and diammonium phosphate wholesale prices) climbed above 1,000 for the first time ever in late October, eclipsing its previous high of 932 from late-July 2008.

It wouldn't be fair to pin all of the rise in fertilizer prices on COVID, though the general logistical snarls to which COVID has contributed are certainly a factor. More significantly, a series of weather events – including Hurricane Ida – in late summer seriously disrupted Gulf Coast fertilizer manufacturers. Also, an increase in the world price of natural gas related to delays in the operation of the Russian Nord Stream 2 pipeline to western Europe has contributed to higher prices for natural gas-related products, including nitrogen fertilizer. Finally, and on a rather positive note for crop farmers, rising grain and oilseed prices are contributing to strong fertilizer demand. Rising demand against constrained supply equates to a very strong market.

For crop producers, the rise in input costs currently underway in the market is mostly an issue for next year's crop. Consequently, the net effect of rising prices so far has been to raise farm income. USDA Economic Research Service's (ERS) September farm income forecast estimated real net farm income for 2021 at \$116.8 billion – a better than 18 percent increase over 2020, whose NFI was also about 18 percent higher than in 2019. If realized, this will be the highest real NFI since 2013, a year in which the effects of a major drought in 2012 resulted in record commodity prices. Figure 4 shows real NFI since 2000.



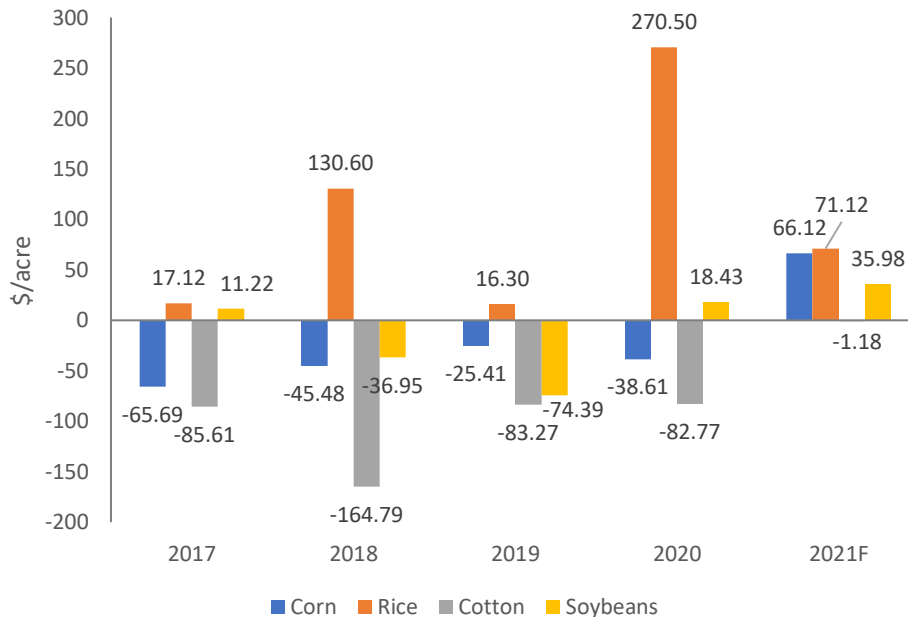
Notes: F=forecast; inflation adjusted using gross domestic product chain-type price index: 2021=100.
 Data Source: U.S. Department of Agriculture, Economic Research Service.

Figure 4. U.S. Net Farm Income: 2000-2021F

The last two years have been the strongest two-year period of growth for NFI since 2010-11, when strong global demand and relatively tight global supplies were resulting in historically high grain and oilseed prices. Of course, 2020 was a highly unusual year. In response to the pandemic, government

support was distributed widely across the economy, including in the agricultural sector. In 2020, net government transactions to farmers (i.e., government payments net of property taxes and vehicle registration taxes and fees) amounted to over \$30 billion and accounted for just under a third of that year’s net farm income. For 2021, net government transactions remained elevated compared to recent years, totaling more than \$11 billion and accounting for not quite 10 percent of net farm income. In historic context, this is not an unusual level of government support in the sector – net government transactions in the early 2000s routinely accounted for anywhere from 10 to 30 percent of net farm income. This year’s robust growth in farm income was mostly driven by higher value of production in the crop sector. The value of crop production increased by about 17 percent in 2021 compared to the prior year, reaching its highest level in inflation-adjusted terms since 2014.

With healthy growth in farm income, upward pressure on input prices as a result of increasing demand should be expected, even apart from the aforementioned supply-side pressures in some key sectors. Fuel and fertilizer prices have already been discussed. Land prices are also likely to see considerable upward pressure over the next several months as well. Land values and rental rates are harder to monitor than fuel and fertilizer prices because data is not collected and reported as widely or as frequently. Still, preliminary evidence suggests that land values are definitely on the rise. On November 23, the Federal Reserve Bank of Kansas City released results of a cropland value survey across four Federal Reserve Districts (Seventh, Ninth, Tenth, and Eleventh) covering primarily the Corn Belt and Great Plains states. Their survey results showed an average of a 15 percent year-over-year increase in non-irrigated crop land value for the third quarter of 2021. They note that this is the fastest rate of growth in crop land value since 2013.



Data Source: USDA Economic Research Service and USDA World Agricultural Outlook Board

Figure 5. Estimated per Acre Net Returns for Selected Major Crops: US Data, 2017 – 2021 (forecast)

Figure 5 provides some additional detail related to farm income numbers for four of Arkansas’ major crops. The figure charts estimated net returns per acre based on USDA Economic Research Service (ERS)

cost of production estimates along with gross revenue estimates based on national average yields and prices for 2017 through 2021 (forecast). Note that for corn, soybeans, and cotton, estimated net revenues for 2021 are projected to be the highest of the past five years. Rice returns are expected to be down from 2020 but remain positive and about even with the most recent five-year average. Based on the most recent cost of production forecasts for 2022 from USDA and yield and price forecasts from the current *World Agricultural Supply and Demand Estimates (WASDE)* report for 2022, projections on net returns for all four of these crops currently show a sharp increase from 2021 returns. The preceding discussion on input prices is important to consider, though. USDA cost of production estimates for next year were put together well before recent increases in fuel, fertilizer, and land values. The process of bidding higher expected returns into input prices appears to be well underway. This process will continue to change expectations of 2022 profitability between now and next year's planting season.

State level farm income projections are not yet available for 2021, but prospects for Arkansas farm income are probably not as good as the national numbers suggest. At the national level, higher production and higher prices on both corn and soybeans – the two largest crops in the country by acreage – account for a significant share of farm income growth. Arkansas' crop sector is relatively more dependent on rice; it is the second largest crop in the state by acreage. Rice prices have improved some since 2020, but not nearly as much as corn and soybean prices. Overall, the value of major crops produced in the state in 2021 will likely improve over 2020 but probably not by as much as at the national level. With regard to livestock and poultry, modest year-over-year growth in broiler production should translate into a bit of a bump in the state's farm income compared to 2020. Likewise, generally stronger prices for cattle this year compared to last should translate into a positive contribution to this year's farm income.

In summary, 2021 has been a year of somewhat fitful recovery from the worst of the pandemic. Both consumers and producers moved back toward normal, not being sure exactly what normal should be. Recurrent COVID surges, particularly of the Delta variant beginning in late summer, have contributed to a two-steps-forward-one-step-back pattern to the economic recovery in general. In spite of this, signs of genuine and, hopefully, durable recovery are appearing. This includes the return of moderate inflation across the economy as a whole, suggesting that consumers are returning to spending mode after a long COVID-driven season of financial retrenchment. In the agriculture sector, particularly, rising prices on basic commodities have translated into higher farm incomes, with a second consecutive year of strong growth in real net farm income despite a sharp year-over-year drop in government support. Of course, higher prices overall also mean higher costs of production. Fertilizer and fuel prices have risen sharply and will certainly challenge margins next year. Likewise, land values – stagnant at best since around 2014 in most major agricultural regions – appear to have come to life again, supported by a couple of years of good returns in the sector and historically low interest rates. On a final note, under the cloud of the new Omicron variant, global economic uncertainty going into 2022 remains high as reflected in volatile stock markets.

Livestock, Meat, and Poultry Markets in 2021

James Mitchell

Summary

In 2020, the COVID-19 pandemic challenged the livestock and poultry industries on all fronts. The expectation for 2021 was for recovery in supply, demand, international trade, and prices (see 2021 Markets in Review for a discussion of commodity prices). Indeed, this year's biggest theme for several sectors of the agricultural economy was recovery. Of course, the rate of pandemic recovery has been different for each industry, supply chain, and business involved in agriculture, and there are lingering challenges that will carry over into 2022.

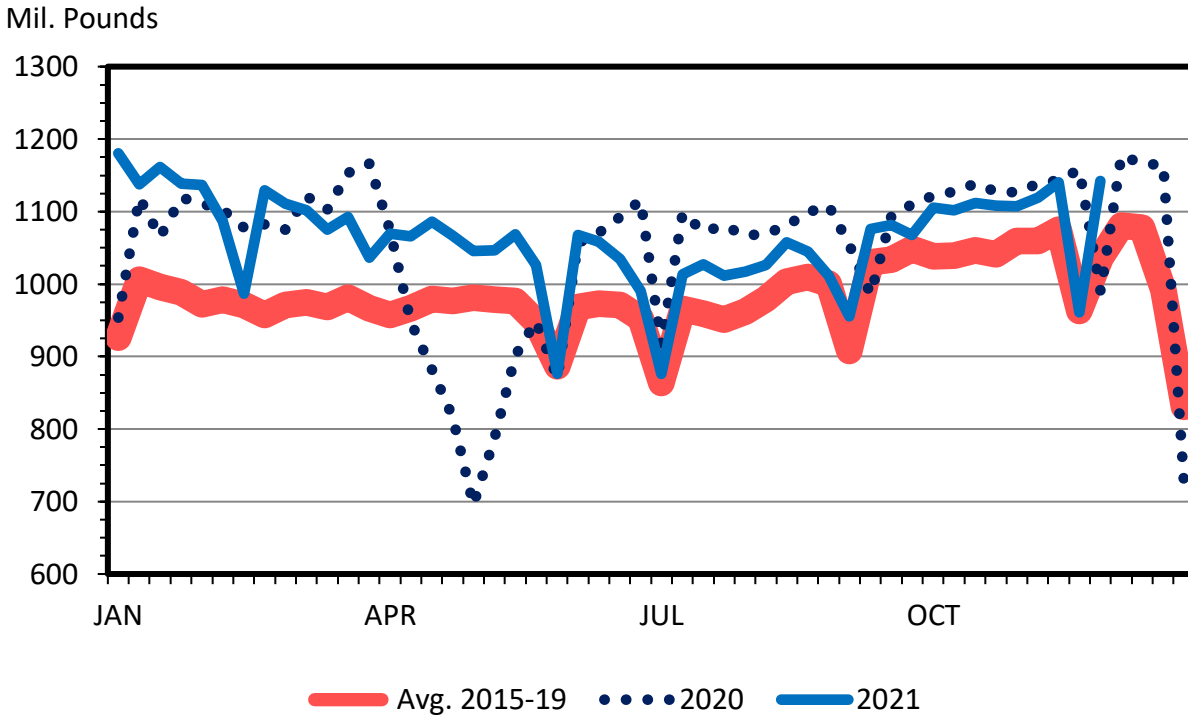
This year we did not have any significant supply chain disruptions from widespread meat and poultry processing plant closures like we did in 2020. USDA expects total red meat and poultry production to finish the year close to even with 2020 production. Retail prices set records in 2021, with red meat and poultry prices averaging 6.3 percent and 4.2 percent higher year-over-year. Despite higher prices, consumer demand remained relatively strong this year. The vaccine rollout and relaxed COVID-19 restrictions were supportive factors for consumers returning to dining out. Trade flows returned to more normal seasonal dynamics. USDA forecasts beef and poultry exports to finish 17 percent and 2 percent higher year-over-year and pork exports 1 percent lower. Some country-specific trade patterns remain impacted as countries recover from the pandemic at different rates.

There are several pandemic-related challenges that the livestock and poultry industries will have to manage in 2022. There are questions about whether the demand strength observed this year is sustainable. Food price inflation is always a concern. However, the rate of food price inflation is historically high this year and could pressure consumer spending in 2022. Labor and logistical challenges continue to pressure meat and poultry supply chains. Higher input costs will influence on-farm decisions, which have dynamic effects that will show up in 2022-2023 meat and poultry production.

Supply

In 2020, the pandemic created several significant challenges for food supply chains. The most noticeable challenges for the livestock industry were the pandemic's effects on the meat processing sector. As COVID-19 began impacting the labor supply in April 2020, many processing plants closed for unknown periods, and many more were operating at reduced capacity. Figure 1 provides a good illustration of the pandemic's effects on weekly total red meat production. At its lowest, red meat production was 29 percent below the previous 5-year average. Despite the significant challenges that COVID-19 presented, 2020 total red meat and poultry production ended up being 1.2 percent higher year-over-year.

Table 1 reports 2020 total red meat and poultry production estimates and 2021 forecasts from USDA. In 2021, USDA estimates that red meat and poultry production will total 106.732 billion pounds or 0.2 percent higher year-over-year. Larger red meat and poultry production in 2021 is mainly due to increased beef production. USDA forecasts have beef production 2.6 percent higher, pork production 2.2 percent lower, broiler production 0.5 percent higher, and turkey production 2.3 percent lower year-over-year.



Source: USDA-AMS, LMIC

Figure 1. Total red meat production

Early 2022 forecasts are for total red meat and poultry production to decline 0.4 percent. Commercial beef production peaked in 2021 following five consecutive year-over-year gains (Figure 2). USDA forecasts beef production to decline 3.2 percent in 2022. Since 2015, commercial pork production has been increasing by a rate of 3.7 percent per year. USDA expects commercial pork production to decrease 0.3 percent in 2022. Next year, decreased beef and pork production will be supportive of cattle and hog prices. Broiler and turkey production are expected to increase 0.9 percent and 1.6 percent in 2022.

Table 1. Total US Red Meat and Poultry Production

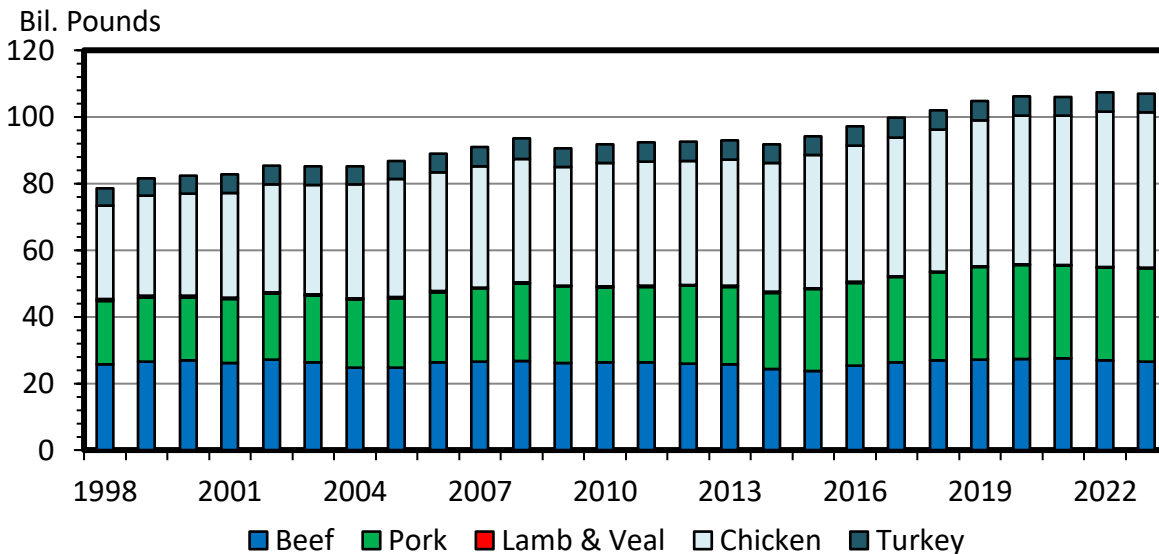
Production	2020	2021 ^a	2022 ^b
Beef	27,174	27,885	27,000
Pork	28,303	27,678	27,585
Lamb and mutton	138	135	134
Broilers	44,583	44,828	45,240
Turkeys	5,743	5,612	5,700
Total red meat and poultry	106,556	106,732	106,269

Source: WASDE and USDA-ERS Livestock, Dairy, and Poultry Outlook for November 2021.

^aEstimate

^bForecast

This year was another record for beef production, totaling 27.89 billion pounds or 2.6 percent higher year-over-year according to USDA estimates. There were questions about whether we would see increased beef production in 2021. Large portions of the western United States have been in some degree of drought since 2020. At the beginning of the year, it was difficult to anticipate the effects the drought would have on cattle slaughter—specifically, the effects of the drought on beef cow and heifer slaughter. Year-to-date total beef cow slaughter is 10 percent higher, and total heifer slaughter is 5 percent higher year-over-year. Total female slaughter has been the main factor contributing to larger beef production in 2021.



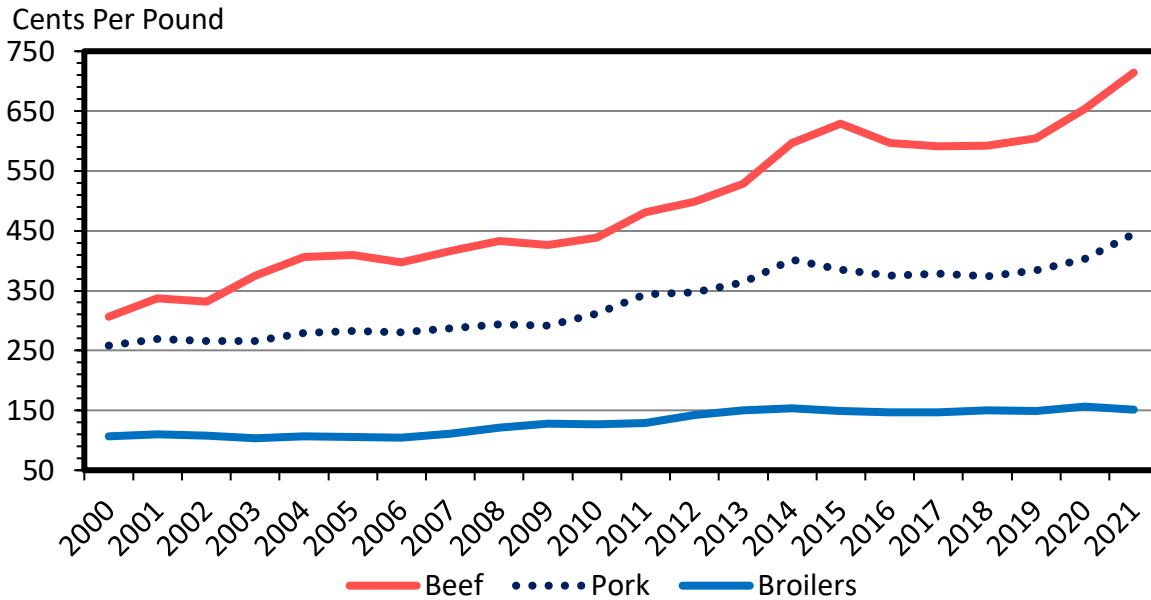
Source: USDA National Agricultural Statistics Service and Livestock Marketing Information Center

Figure 2. Commercial Meat and Poultry Production Estimates and Forecasts: 1998-2023

Demand

Meat demand was strong in 2021. The rollout of the vaccine and relaxed pandemic restrictions supported dining out for U.S. consumers. Through the first three quarters of 2021, personal consumption expenditures on foodservice and accommodations averaged 26 percent higher year-over-year and were close to even with pre-pandemic 2019 levels. Consumer meat expenditures have also increased in 2021.

Per capita meat expenditures for beef, pork, and poultry through the first three quarters of 2021 have averaged 7.6 percent, 7.1 percent, and 9.4 percent higher year-over-year. Despite beef prices averaging 7.6 percent higher, per capita beef consumption remained stable in 2021, averaging 0.5 percent higher year-over-year. High retail beef prices and a slight increase in beef consumption can only happen if there is strong beef demand. Similarly, per capita poultry consumption has averaged only 0.7 percent lower in 2021, while retail poultry prices have averaged 4.2 percent higher year-over-year. Per capita pork consumption has averaged 2.6 percent lower while retail prices have averaged 7.2 percent higher year-over-year. Consumers will purchase smaller quantities as prices increase, so the decline in pork and poultry consumption is an expected result.



Source: BLS, USDA-ERS, LMIC

Note: 2021 prices are Jan-Oct average

Figure 3. Nominal retail meat and poultry prices, 2000-2021

There are concerns that food price inflation and new emerging COVID variants could impact consumers purchasing decisions in 2022. These concerns are reflected in the University of Michigan’s Domestic U.S. Consumer Sentiment Index (MCSI). The index provides a barometer of consumer expectations about their personal finances and a broad outlook for the U.S. economy. Preliminary estimates for November have the MCSI reaching a 10-year low.

International Trade

This year, U.S. trade flows are starting to recover from the effects of the pandemic. The most recent data from USDA-ERS for October 2021 shows cumulative U.S. beef and veal exports that are 20 percent higher year-over-year. Cumulative U.S. broiler exports are 3 percent higher year-over-year. USDA expects U.S. beef and veal exports to finish 17 percent higher year-over-year. U.S. broiler exports will end the year 2 percent higher year-over-year. Beef, pork, and broiler exports are expected to finish the year above pre-pandemic 2019 levels.

In other markets, the U.S. is experiencing significant growth. For example, cumulative beef exports to Mainland China are 545 percent higher year-over-year. Mainland China has become a top-five destination for U.S. beef. For the pork industry, cumulative exports to Mexico are 32 percent and 28 percent higher than 2020 and 2019 exports, respectively. Year-over-year pork exports to Mainland China increased 105 percent and 202 percent in 2020 and 2019, respectively. This year pork exports to China are down 40 percent, reflecting the Chinese rebuilding their pig herd following struggles with African Swine Fever.

Still, other export markets have not fully recovered from the pandemic's effects on trade. As of October, U.S. beef exports to Mexico are 16 percent higher year-over-year but are still 28 percent below 2019 export volumes. Cumulative beef exports to Canada are down 7 percent year-over-year, but 1 percent higher compared to 2019. U.S. pork exports to South Korea are 4 percent above 2020 trade volumes but 18 percent below 2019 levels. Pork exports to Canada are down 2 percent year-over-year.

Table 2. U.S. meat trade, million pounds, carcass-weight equivalent

	2019	2020	2021^a	% Chg Year Ago	% Chg Two Years Ago
Beef and veal exports	3,026	2,951	3,455	17.1%	14.2%
Beef and veal imports	3,058	3,342	3,260	-2.5%	6.6%
Pork exports	6,321	7,280	7,193	-1.2%	13.8%
Pork imports	945	904	1,145	26.7%	21.2%
Broiler exports	7,103	7,367	7,545	2.4%	6.2%
Turkey exports	639	571	566	-0.9%	-11.4%

Source: WASDE and USDA-ERS Livestock, Dairy, and Poultry Outlook for November 2021.

^aUSDA forecast.

U.S. and Global Rice Markets in 2021

Alvaro Durand-Morat

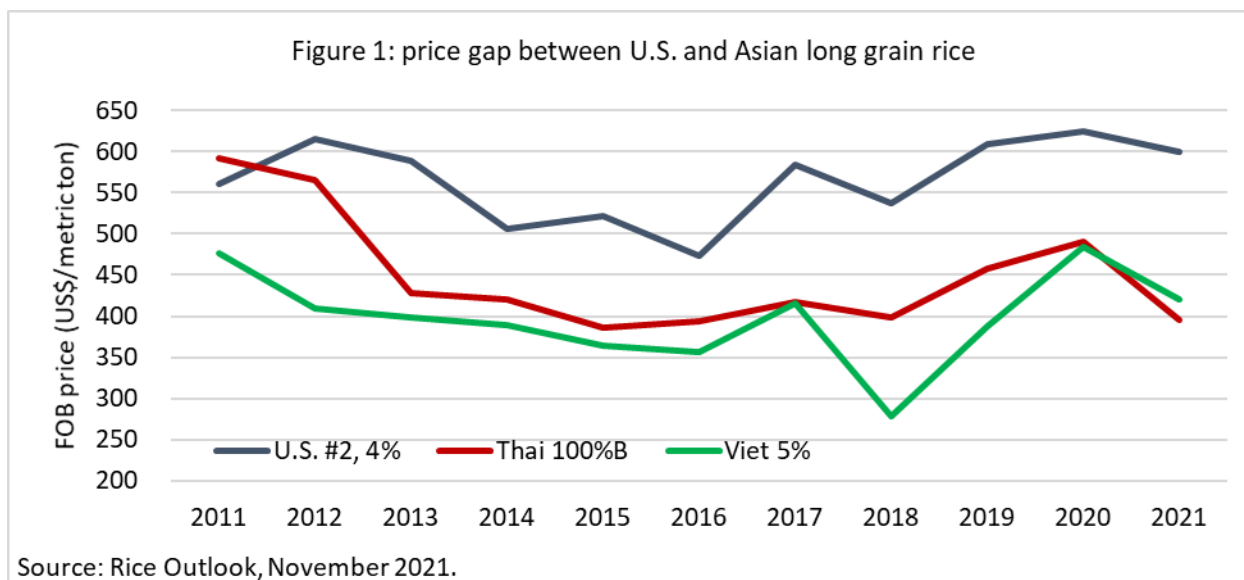
Global Rice situation

Both global rice production and consumption have been setting new records every year for the last 15 years, and 2021 is no exception.¹ Global rice production is projected to reach 511.7 million metric tons (mmt, milled basis) in 2021, an amount unthinkable a decade ago when production was hovering at around 460 mmt. The bulk of the growth in global production in the last decade has come from yield gains, as total rice area increased only slightly. The main driver on the global production side of the market is India, where rice production increased by almost a third in the last decade, reaching 122 mmt (milled basis) in 2020. Good monsoon weather and price support policies that favor rice production are some of the reasons supporting such growth. Production in China, which remains the largest rice producer in the world, also grew but at a more modest rate of 7 percent in the last decade. Similar to India, China also intervenes in the rice market via price support and input subsidies, which coupled with trade restrictions guarantee rice profitability.

Global rice demand in 2021 is projected to reach 509.0 mmt, slightly below the global production estimate. Per-capita rice consumption is flattening out or even decreasing in many Asian countries, but population growth keeps total rice consumption on the rise in most countries. For example, the downward trend in per-capita and total consumption in Japan is well established, but in China the decrease in per-capita consumption is more than offset by population growth, which keeps total rice demand growing. In other parts of the world, primarily in Africa, growth in per-capita consumption coupled with population growth leads to significant demand growth.

Global rice trade in 2021/22 is projected at around 48.5 mmt, just slightly above the 48.2 mmt traded in 2020/21, but significantly above the 45.5 mmt traded on average over the last five years. Despite the growth in global rice trade observed over the last decade, rice remains a thinly traded commodity (relative to the volume of production) for many reasons, including the continued prevalence of protectionist policies. A relatively new development is the emergence of India as a steady export leader. India was always considered a residual exporter, but over the last decade, they have developed an export-oriented sector that is highly competitive. Since 2014 India has been the largest rice exporter, and reached the historic record of 20 mmt exported in 2020. Thailand, who has been the largest exporter for most of the last 30 years, is currently ranked 3rd behind India and Vietnam. Thailand's competitiveness has been undermined by policies (e.g., the infamous pledging program of the early 2010s), and more recently unfavorable weather conditions that limited rice production in both rainfed and irrigated areas. A big difference between India and Thailand is that the Thai rice sector is much more export oriented (historically exporting over half of its crop every year) and thus more susceptible to changes in trading conditions than India. Long grain rice from the Western Hemisphere (e.g., U.S. and Uruguay) sells at a high premium relative to the bulk of long grain Asian rice (Figure 1). On the import side, most of the action centers on Sub-Saharan Africa, and in particular in West Africa, where the significant growth in demand is, for the most part, being serviced by imports.

¹ 2021 refers to the marketing year 2021/22. For the U.S., the 2021/22 marketing year for rice starts in August 2021 and ends in July 2022.



U.S. Rice Market and Trade Prospects

With the 2021 U.S. rice crop already harvested, estimated total rice production stands at 193.8 million hundredweight (cwt), around 15 percent below a year earlier and 6.7 percent below the average for the last five crops (2016 through 2020). Higher initial stocks partially offset the decrease in production, leaving total rice supply for 2021 at 272.5 million cwt, that is, 6.1 percent below a year earlier and slightly (-1.7 percent) below the average for the last five crops. In concert with the decreasing supply, total use is projected to decrease by 3.7 percent relative to the previous year due to a decrease in both domestic use and exports, but right at par with the average use observed in the last five years.

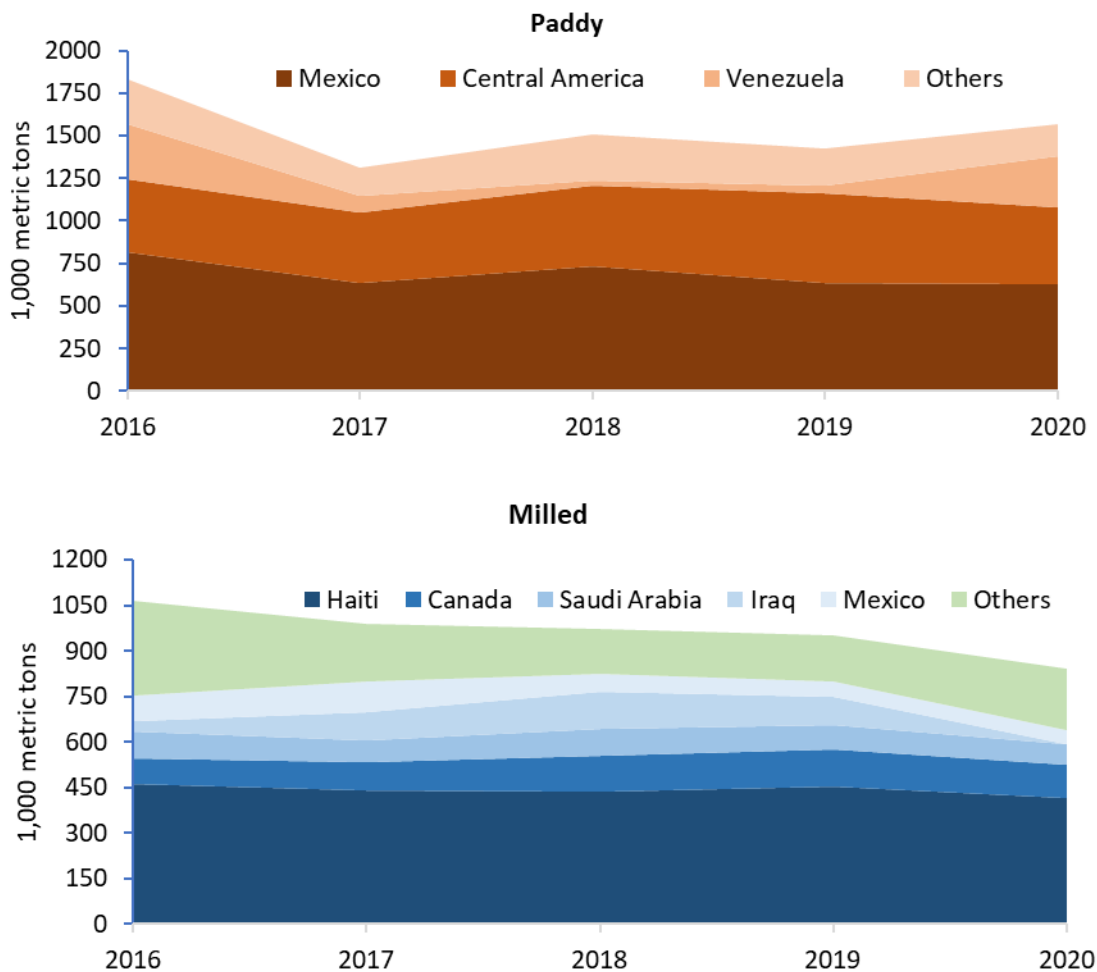
By type, the production of long-grain (LG, which accounted for 73 percent and 89 percent of the total volume of rice produced in the U.S. and Arkansas, respectively, in the last five years) and medium/short-grain (MG) rice is down by 14.1 percent and 17.0 percent, and total supply is down by 5.4 percent and 8.5 percent from a year earlier, respectively. On the demand side, exports of LG rice are projected to remain within 2 percent of those realized last year, while exports of MG are projected down by almost 10 percent from its 2020 level.

Based on the November World Agricultural Supply and Demand Estimates (WASDE) report, market prices are firm at around \$13.00/cwt for long-grain and \$14.00/cwt and \$23.00/cwt for medium/short grain from the Mid-South and California, respectively.

On the trade side, exports of LG paddy rice have shown stability at around 1.5 mmt (paddy basis), while long grain milled rice has shown a steady decrease in recent years, reaching a low of 1.5 mmt (paddy basis) in 2020 relative to the average 1.9 mmt in the three-year period 2014-2017. In general, competition in the paddy rice segment is limited to few countries, primarily Argentina, Brazil, Uruguay, and more recently, Paraguay. Regional trade integration and the proximity of the most important paddy markets grant the U.S. a significant advantage over its competitors, which makes the paddy export segment less risky than the milled segment. The U.S. dominates the Mexican paddy market, and there is little to suggest that this will be challenged in the coming years. The U.S. continues to dominate the paddy market in Central America (the second destination for paddy rice after Mexico), but competition from Brazil and to a less extent Uruguay, Argentina, and Paraguay, is rising. As part of DR-CAFTA trade

agreement, U.S. paddy and milled rice are set to receive duty-free treatment by 2023 in all Central America except Costa Rica, who ratified the agreement later than the rest of the countries, and negotiated a longer, 20-year tariff-reduction scheme. With that said, it is safe to say that the U.S. is well positioned to continue to dominate the Central American paddy segment in the coming years. The highest risk on the paddy segment is Venezuela, which accounted for almost 20 percent of U.S. paddy exports in 2021 but has imported only 27,000 metric tons in the first three months of the current marketing year. The political rather than economical nature of trade relations with Venezuela, on top of the social and economic hardship experienced in that country over the last several years, make this market risky and unreliable. Finally, Colombia has emerged as a sizable market for paddy rice in the last five years thanks to the duty-free quota for rice negotiated as part of the Colombia-U.S. Trade Promotion Agreement. The quota, administered by Col-rice, has been consistently filled since its creation in 2012. However, the quota was mostly unfilled in 2021, in part due to a good domestic crop in Colombia that pushed prices down and made imports less competitive.

Figure 2: U.S. exports of long grain rice by destination



Source: USDA FAS Global Agricultural Trade System

The risk in the LG milled rice segment is high due in large part to the political and economic unrest in Haiti, which happens to be the largest destination for U.S. LG milled rice (accounting for around 45 percent of the total volume of exports). While rice demand and imports are expected to keep growing in Haiti, the big question is whether private importers will have the financial resources to keep their operations going, or whether the Haitian government may get involved in the importation and open the door for government-to-government deals that could favor Asian suppliers. Demand for LG milled rice from Canada (U.S.'s second largest export market with an 11 percent market share) has been growing in the last several years, averaging 116 thousand metric tons (tmt) in 2020-2021 relative to 89 tmt in 2017-2018), while it has remained stable in Saudi Arabia, U.S.'s third largest market for LG milled rice with an 8 percent market share. Iraq has been the center of attention for many years now, and a hit-and-miss market for U.S. rice at best. Much like Venezuela, trade relations with Iraq are highly political and unpredictable, which makes this market very risky. For example, the U.S. exported only 33 tmt in 2016, over 100 tmt a year on average in 2017-2019, and no exports in 2020. In the current 2021 marketing year that started in August the U.S. already sold 120 tmt to Iraq, and there are expectations for more sales to come in the first quarter of 2022.

While the MG segment of the market is much less relevant for the Mid-South rice sector, it is important to notice the rise of China as a fierce competitor. For instance, Chinese medium grain rice dominates the Puerto Rican market, and has taken over other markets of interest such as Turkey and Egypt. The fact that most of the Chinese rice stock is supposed to be medium grain, and the position of the Chinese government to decrease stocks via exports, creates many uncertainties in this segment of the market in the short and medium term.

Key Variables to Follow in 2022

- The price gap between Asian and Western Hemisphere long grain rice, currently at more than US\$ 120/metric ton, and whether such a large difference could jeopardize U.S. exports.
- The political and economic situation in Haiti, and how that may affect U.S. exports to that core market.
- Whether Iraq will return to the market for Western Hemisphere rice, and how much U.S. rice can be sold.

Flood Impact Estimates on Cropland using Satellite Imagery¹

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Satellite imagery has been widely promoted as a decision-making tool in agricultural production. Many agricultural software companies, crop consultants, and farm managers have integrated satellite imagery into their data analytics for production monitoring and management. Such data and analytics show promise for supporting field zone mapping, identifying relative variations in crop yield, and monitoring water use. There are also cases where satellite imagery can be useful for mapping the impacts of extreme weather events. This year's southeast Arkansas flooding provide a timely example of this type of application.

In June 2021, a 100-year flood event occurred in Southeast Arkansas. When such events happen, it is imperative that impact estimates are conducted as soon as possible to identify how and where to best support producers. The public imagery typically available for agricultural applications comes primarily from the NASA/USGS Landsat or EU Copernicus Sentinel missions. While imagery from these platforms comes at sub-monthly time-steps and relatively high spatial resolutions (30 and 20 meter pixels, respectively), it often isn't available for several weeks after the images are taken due to processing. However, commercial imagery, such as that produced by Planet Labs, offers opportunities for higher spatial resolution of 3-5 meters at near daily time-steps and becomes available in hours to days. When more than 15 inches of rain dropped over Southeast Arkansas, Planet Scope imagery was used to estimate the flood extent over cropland and illustrates the potential for more rapid cropland monitoring applications.

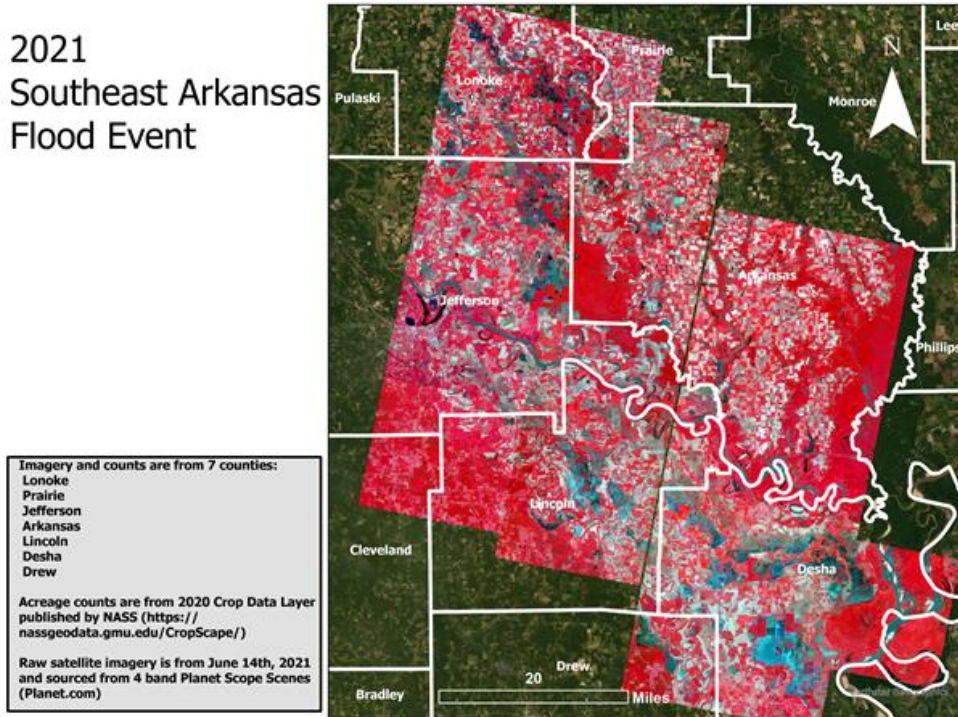
Figure 1 shows the color-infrared (CIR) imagery, flood extent, and heavy flooding (>1 ft) by crop type based on USDA National Agricultural Statistics Service's (NASS) cropland data layer (CDL). Planet Scope records four bands of multispectral data for each pixel, including red (R), green (G), blue (B), and near-infrared (NIR). Many producers are familiar with the normalized difference vegetation index (NDVI), which is derived from NIR and R bands and corresponds to crop greenness. NIR reflects strongly when vegetation is present, and absorbs heavily when water is present. This relationship is very useful, as in this case, for mapping flooded fields. Based on the flood extent identified with thresholds for NIR, the CDL, and ground reference information provided by local county extension agents, there were 254,323 soybean, 190,150 rice, 54,817 corn, and 34,864 cotton acres estimated to have heavy flooding during this event in Arkansas. This information was generated within days of the flood event for the seven hardest hit counties. After a few weeks, impact estimates were generated for the broader area including 12 counties. Economic impacts from the event were estimated at approximately \$60 million for corn, \$6 million for cotton, \$68 million for rice, \$71 million for soybeans, and \$1 million for wheat at an approximate total of \$206 million.

Satellite imagery applications for agriculture are most commonly thought of for in-season monitoring and post-season assessment of maximum greenness to map field management zones. However, a lesser known but useful application of satellite imagery is for flood or natural disaster mapping. When flood events, derechos, or other natural disasters occur, estimating the extent of crop damage in a short timeframe is of utmost importance to best support recovery. We often rely on conversations and phone

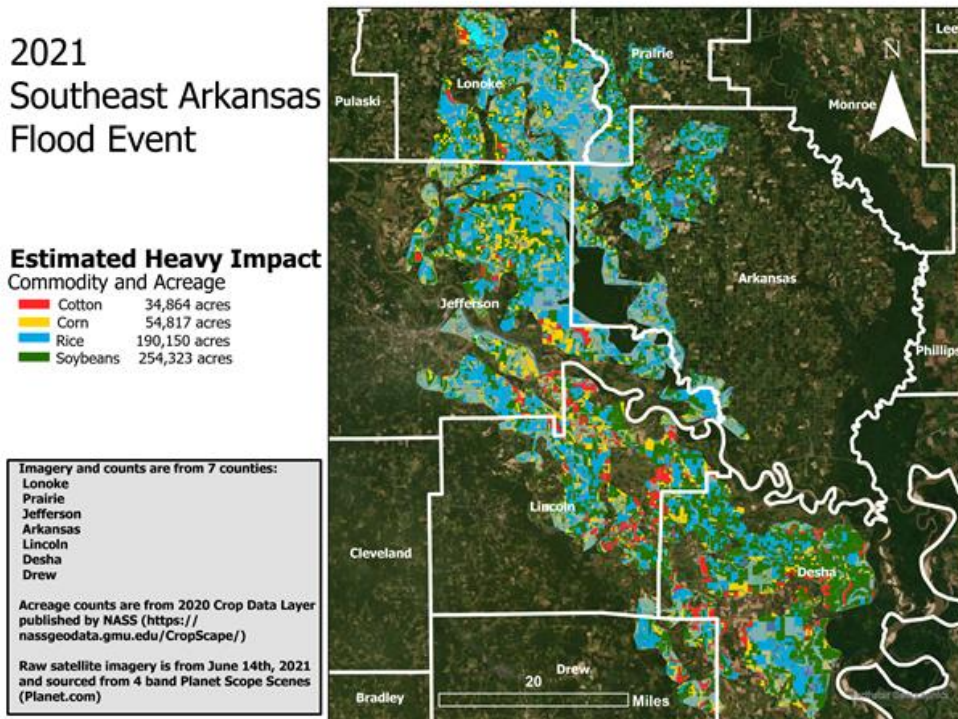
¹A version of this article was published on Southern Ag Today (<https://southernagtoday.org/>).

calls with county extension agents, producers, and crop consultants to gain an initial estimate of crop impacts. Satellite imagery can provide an additional tool for making damage estimates in those critical days and weeks following an event, especially when combined with on-the-ground conversations and validation. Planet and other satellite platforms will continue to play a role in improving and supporting agricultural production as wider access becomes available. This case represents one of many opportunities for satellite imagery to increase in its adoption and applications in crop production.

2021 Southeast Arkansas Flood Event



2021 Southeast Arkansas Flood Event



Source: Acreage counts are from the 2020 Cropland Data Layer published by USDA NASS. (<https://nassgeodata.gmu.edu/CropScape/>). Raw satellite imagery is from June 14th, 2021 and sourced from 4-band Planet Scope Scenes (<https://www.planet.com/>).

Figure 1: Estimates of Flood Extent and Acreage Impacts in Southeast Arkansas, June 2021

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