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INSIDE . . .

UPDATES

The following Information Files have been updated on extension.iastate.edu/agdm:

A1-77 How do Data and Payments Flow through Ag Carbon Programs?

A3-40 Motor Vehicle Cost Analyzer

B1-15 Deductible Livestock Costs for Adjusting Income Tax Returns

C1-05 Farm Analysis Terms

C3-06 Transportation Terms

The following Video and Decision Tool have been updated on extension.iastate.edu/agdm:

A1-10 Chad Hart's Latest Ag Outlook

A3-40 Motor Vehicle Cost Analyzer

The following Profitability Tools have been updated on extension.iastate.edu/agdm/outlook.html:

A1-85 Corn Profitability

A1-86 Soybean Profitability

A2-11 Iowa Cash Corn and Soybean Prices

A2-15 Season Average Price Calculator

D1-10 Ethanol Profitability

D1-15 Biodiesel Profitability

Gaining an understanding of carbon market programs

by Alejandro Plastina, extension economist
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Chad Hart, extension crop market economist

A **carbon credit** is a tradable asset (similar to a certificate or permit) that represents the right to release or emit carbon into the atmosphere. Typically, each credit represents one metric ton (2,204 pounds) of carbon dioxide or an equivalent amount of another greenhouse gas. **Carbon credits** are created when entities (compared to a set baseline) reduce their carbon emissions or sequester carbon.

A growing number of private initiatives are offering farmers compensation for the generation of agriculture carbon credits as well as other ecosystem services, such as improvements in water quality. Agricultural producers can create carbon credits in a variety of ways: moving from conventional tillage to reduced or no tillage, reducing stocking rates on pastures, planting cover crops or trees, reducing fertilizer rates, or converting marginal cropland to grassland. The result of this is an emerging agriculture carbon credits market that is a mixture of coexisting programs, each with different rules, incentives, and players.

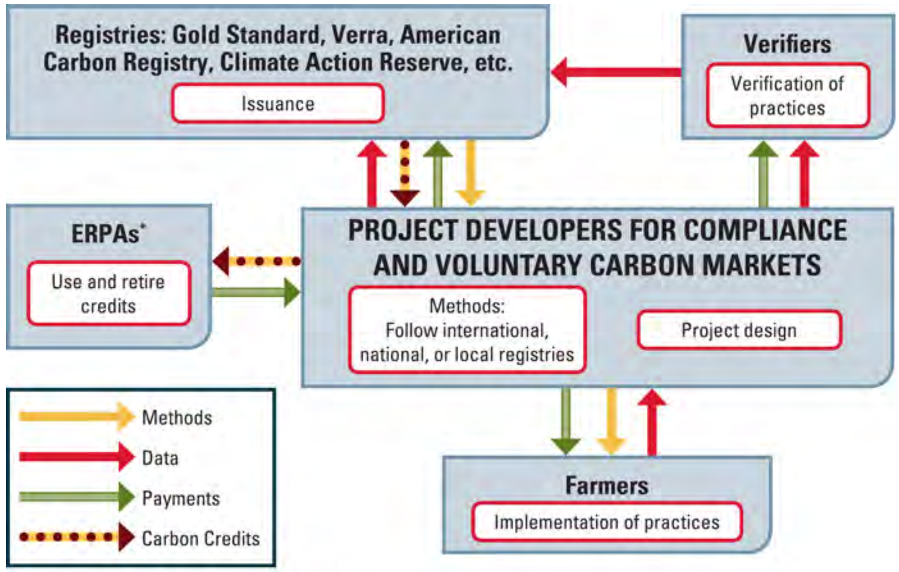
The recently released, Ag Decision Maker File A1-76, **How to Grow and Sell Carbon in US Agriculture**, https://go.iastate.edu/VPHJ0J, begins to navigate this market by comparing 11 voluntary carbon programs across two-dozen characteristics, providing valuable details to help farmers distinguish between the programs and find where they could benefit.

While all programs require **additionality** to generate a credit, or for something "additional" to be occurring, not all programs require that farmers change their production practices. **Additionality** means that farmers must do something **different** to reduce carbon and increase ecosystem services. However, programs use a wide array of benchmarks to determine what is **different**. Some programs require a change of practices with respect to past practices on the same field, while some others require that practices in the field be different from common practices in the area (even if the same practices have been implemented for many years in the field under consideration).

A **carbon offset** is considered a top-quality token for one metric ton of carbon dioxide-equivalent greenhouse gases (CO2e) sequestered through practices that adhere to trusted protocols ensuring additionality and permanence, which are verified by an independent third party, certified, and registered with a unique serial number into a secure ledger called the "registry." The registry is typically linked to a network of registries that serve as a clearinghouse of information on carbon credits (issued, unsold, sold, and retired) to avoid duplications and enhance transparency. When an owner of a carbon offset uses it to compensate for emissions of CO2e somewhere else, the serial number is retired from the registry (and the transaction is transparent to the clearinghouse).

A major difference between the traditional carbon offsets and the carbon credits generated in the newer, voluntary carbon programs resides in the potential gap in their perceived qualities. A carbon credit may or may not be perceived as being of comparable quality to a carbon offset. If carbon credits are perceived as being of lower quality than carbon offsets, then they would tend to attract lower market prices than offsets do. The perceived quality of carbon credits is expected to be higher when verification and issuance are external to the carbon project, and lower when those critical processes are internal to the carbon project.

Figure 1. Traditional Carbon Offset Generation



* ERPAs: Emission Reduction Purchase Agreements

For a visual guide on these programs, the newly released publication, [How do Data and Payments Flow through Ag Carbon Programs?](https://go.iastate.edu/QGA627), https://go.iastate.edu/QGA627, illustrates with flowcharts, a traditional carbon offset generation (Figure 1) as well as nine voluntary carbon programs currently operating in the United States. The various actors under each program are shown with arrows pointing in the direction that data, payments, methods, and carbon credits move within each carbon program. By illustrating whether verification and issuance are external or internal processes to the carbon program, the analysis provides some basis to anticipate differences in the perceived qualities and resulting prices for agriculture carbon credits issued by different programs.

Contract specifics

Before considering a carbon contract, a few initial questions to ask may include: What practice changes does the contract cover? How is the carbon measured? How are the payments and the costs shared? Can your practice changes be used in this carbon opportunity and other government programs? What is the contract length, terms, and exit clauses? What management data and verification are you required to provide? Are you gaining anything by being in on the "ground floor?" Consult your own trusted, legal counsel to review. You don't want any surprises.

Additional resources

Find publications, webinars, and further information on carbon markets on the [Ag Decision Maker Carbon Information webpage](https://go.iastate.edu/BTGKOP), https://go.iastate.edu/BTGKOP.

Methane – powerful but short-lived

By Don Hofstrand, retired extension value-added agriculture specialist;
reviewed by Eugene Takle, retired professor emeritus, Iowa State University

This article is the ninth in a series focused on the causes and consequences of a warming planet.

We are all familiar with natural gas. It plays a very important role in our lives. We may use it to heat our home and office, power our water heater, and heat our stove.

Methane is the primary component of natural gas. When natural gas (methane) is burned, carbon dioxide is emitted, just like with other fossil fuels. But burning natural gas emits only about half the amount of carbon dioxide as coal. Natural gas is sometimes considered a "transition" fuel in the process of moving from coal and oil to clean energy, such as solar and wind.

However, a problem occurs when natural gas (methane) is not burned but escapes into the atmosphere. This can occur when a pipeline leaks. An example is Aliso Canyon in California where a leak led to the escape of over 100 thousand tons of methane in a four-month period.

Methane in the atmosphere is a powerful greenhouse gas. According to the EPA, methane is about 120 times more powerful as a greenhouse gas than carbon dioxide when compared per unit of mass. But its lifespan in the atmosphere is on average about 12 years (compared to hundreds of years for carbon dioxide). If both power and lifespan are taken into account, methane is still about 25 to 36 times more powerful than carbon dioxide. Converting the atmosphere's methane content to a carbon dioxide equivalent, methane emissions make up about 10% of US greenhouse gas emissions.

Cattle have a unique digestive system where fermentation breaks down the feed for digestion. This process produces methane which is exhaled into the atmosphere by the animal. High quality feed, cattle breeds, and higher feed efficiencies result in fewer emissions. So Iowa cattle produce fewer emissions than those in developing countries. Research is being conducted on ways to further reduce these emissions.

Livestock manure produces methane when it is stored or treated in anaerobic conditions (without oxygen). This is usually manure in liquid form kept in pits, tanks, and slurries. But this manure can be processed by means of "anaerobic digestion" where biogas is produced that can be used as an energy source.

Methane is produced and emitted in low oxygen environments like wetlands where the soils are water-logged. Methane is also emitted from landfills.

See the **Ag Decision Maker website**, www.extension.iastate.edu/agdm/energy.html#climate, for more from this series.

How long will strong beef demand continue?

By Lee Schulz, extension livestock economist
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You have likely heard someone say, "Beef demand must be excellent as prices are sharply higher." This may or may not be true.

Demand for beef is a schedule of quantities consumers are willing, and able, to buy over a range of prices. As you would expect, consumers buy less when prices rise. They buy more when prices fall. Importantly, demand is the entire set of those price and quantity pairs.

A line formed by those pairs slopes downward in a chart with price on the vertical axis and quantity on the horizontal axis. A lower price will pair up with higher quantity on that line of price-quantity pairs, and vice versa. Moving from a higher price-lower quantity pair *on that line* to a lower price-higher quantity pair *on that line* is a quantity response driven solely by the change in price. That is a change in quantity demanded, it is not a change in demand.

Economists use a formula to predict how much quantity demanded is expected to change as price changes. It is called price elasticity of demand.

Demand drivers

Factors other than price drive changes in demand. Some are consumer income levels, prices of substitutes and complements, and consumer tastes and preferences.

From April-June 2020, supply chain constraints trimmed beef availability and per-capita consumption fell 8.2% compared to the second quarter of 2019. Assuming the price elasticity for beef is constant over time, retail beef prices should have risen 11.2%. Prices actually surged 17.1%. The greater than expected rise in price says demand increased. Rather than merely sliding to a lower quantity-higher price point on the demand curve, we had a new price-quantity pair on a new demand curve farther to the right on the chart.

Sometimes signals are clear

Normally when quantity rises, the price falls. Sometimes quantity rises and price also rises. Quantity is responding to more than the change in price; demand is rising. In 2020, per-capita beef consumption rose 0.4% from 2019 and real (inflation-adjusted) beef prices spiked 8.4%. During the last 30 years, higher prices also came with higher quantities in 1999, 2000, 2004, 2012, and 2019.

Sometimes lower prices occur with lower quantities. That says beef demand is falling. Per-capita beef consumption fell and real beef prices slipped in 1991, 1992, 1993, 1997, 2005, and 2009.

Unfortunately, the market only provides one price–quantity pair at any one point in time. That complicates attempting to figure out whether a change in quantity is simply a shift up or down an existing demand curve due to a change in price (a change in quantity demanded), or a move to a new demand curve (a change in demand).

A demand index helps measure shifts to a new demand curve. Forming a demand index requires data on domestic production, imports, exports, and cold storage to derive a disappearance measure. This is then converted to a per-capita basis by dividing by the US population. Per-capita disappearance is an approximation for observed consumption. In reality it measures per-capita supply or availability. Beef is perishable. Each year the amount of beef we consume roughly equals the amount of beef we produce. It is price that does the adjusting.

We can construct a demand index that can tell us the status of domestic consumer-level beef demand where the index represents all demand, not just demand at retail outlets. This approach uses total consumption and treats the retail price as a shadow value for the product sold through food service outlets. A demand index functions much like a barometer. Evaluation should focus on direction and relative size of change and not absolute values.

Understand volume signals

You may also hear someone say, "Beef demand must be strong as a large quantity is clearing the market." Again, this may be true or false. At what price is the large quantity being sold? If prices are lower, then demand may be unchanged. If more is being bought at the prevailing price, then demand could in fact be stronger. But if less beef is clearing the market than the price elasticity of demand would indicate demand may actually be lower.

April-June 2021 saw beef demand rise. Per-capita consumption surged by 9.6% compared to the second quarter of 2020 when COVID-19 related challenges constrained the ability to transform cattle into beef. An almost 10% rise in consumption should have trimmed real retail beef prices by 10.7%, but prices actually only slipped 6.1%. The smaller than expected price decline says demand improved.

Little consumer resistance yet

Record-high retail beef prices have drawn much attention. Figure 1 shows the retail Choice beef price and Figure 2 shows the retail all-fresh beef price, both published by USDA's Economic Research Service. The retail Choice beef price is a weighted average of prices of Choice beef cuts and ground beef published by the US Bureau of Labor Statistics. The all fresh beef price series, includes prices for non-Choice cuts and additional ground beef.

Figure 1. Monthly retail choice beef price. Source: US Bureau of Labor Statistics and USDA Economic Research Service. Compiled by LMIC.

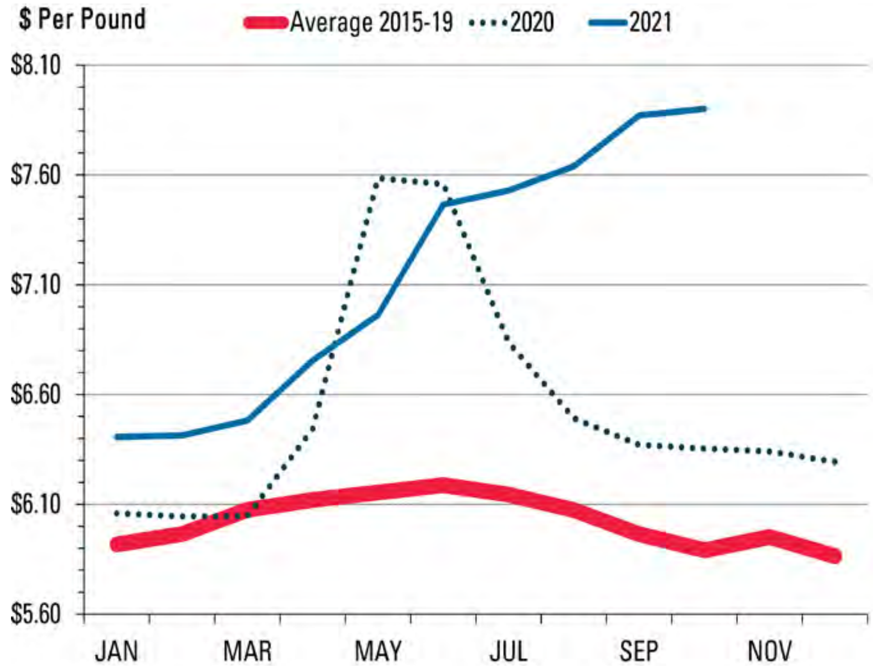
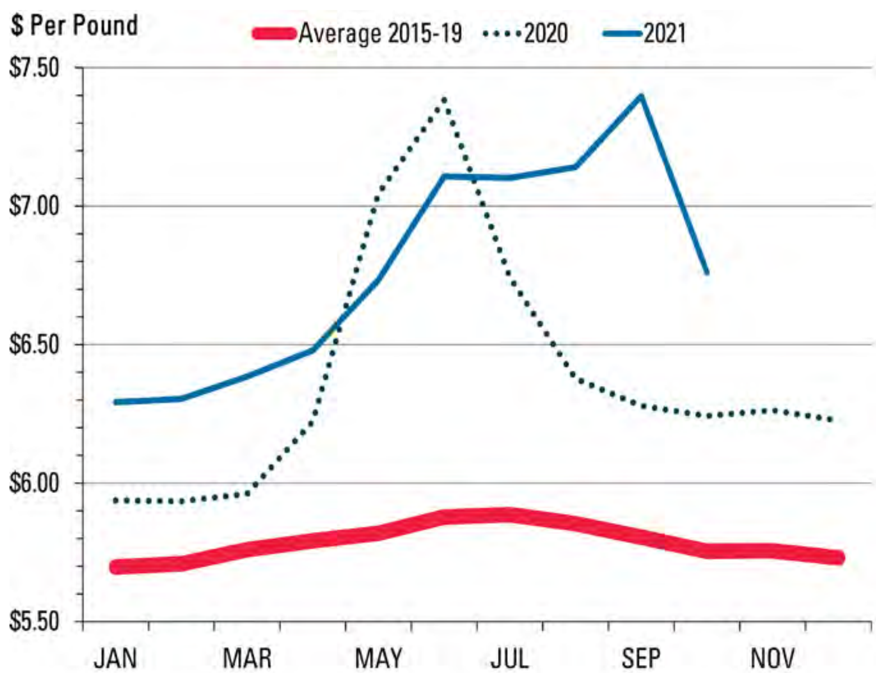


Figure 2. Monthly all-fresh retail beef price. Source: US Bureau of Labor Statistics and USDA Economic Research Service. Compiled by LMIC.



Should we expect consumer pushback against high prices? And even if they do, would this trim producer income? Maybe, but maybe not. Both prices and quantities need to be considered because then and only then can you speak to the total dollars available for the industry.

July-September 2021 saw 6.0% lower per-capita beef consumption than during the same three months in 2020 and inflation-adjusted retail beef prices rose 5.9%. Price elasticity of demand indicates prices should have risen a bit more, say roughly 9.1%. That means the beef demand index did fall compared to the third quarter of 2020. Still, the beef demand index is among the top quarters in the data series that dates back to 1990.

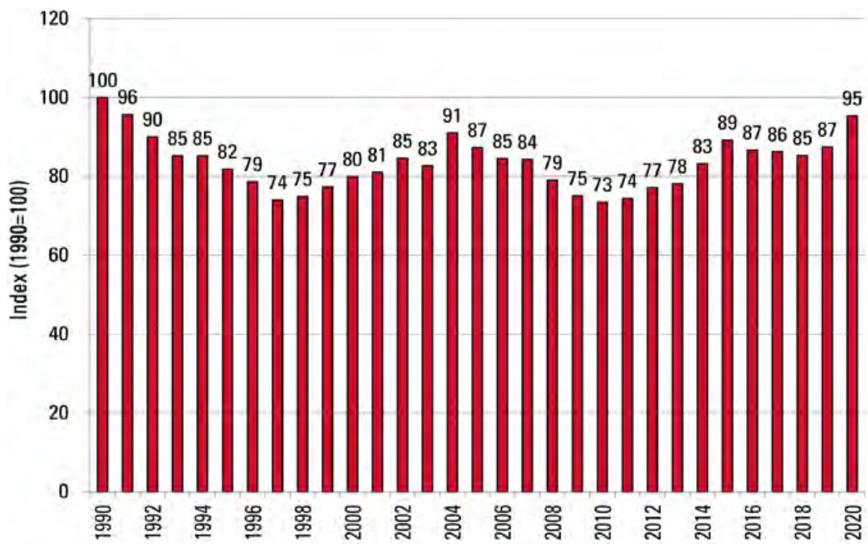
Persistent high retail prices appear to signal strong consumer-level beef demand. Far from wrecking demand. High prices are evidence consumers are "willing, and able, to buy" a relatively high quantity of beef.

Demand is certainly something to watch going forward, as some of the variables are expected to move over a wide range. For example, per-capita beef consumption is expected to trend lower over the next few years. It could slip from 2020's 58.4 pounds to 55.0 pounds in 2023.

Impacts flow to beef producers

During the depths of the Great Recession, beef demand eroded and bottomed-out in 2010 (Figure 3). Since then, beef demand has been generally rising with some bumps along the way. The economic effect on producers is clear. If consumer demand was still at 2010's level, retail beef prices and hence cattle prices would be much lower than they are today. As consumer demand varies, the impacts flow down through the marketing chain to producers through derived demand.

Figure 3. Retail all-fresh beef demand index. Source: US Bureau of Labor Statistics, USDA Economic Research Service. Compiled and analyzed by Lee Schulz.



Understanding shifts in derived demand within the supply chain at specific points in time is complex. For instance, even when consumers are willing to pay more for beef, the retailer buying wholesale beef may not be. Likewise, the packer may not be willing to pay more for fed cattle. The primary reason is costs.

Derived demand for wholesale beef by retailers reflects the prices they are willing, and able, to pay for a given quantity of beef at the wholesale level. In a competitive market, the difference between the retail beef price and the wholesale beef price is the cost of getting wholesale beef to the retail meat case. Suppose those costs rise. Derived demand for wholesale beef by retailers declines, which equates to a lower wholesale price for the same quantity of beef supplied. Consumers aren't changing their retail demand; but wholesale demand is changing.

Similarly, suppose packers' costs rise significantly. Further suppose retail demand and wholesale demand hold steady. Packer demand will shift down and prices for fed cattle will decline.

Projections for 2022

By Chad Hart, extension crop market economist
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Much like kids at Christmastime who start to dream about next year's presents right after opening this year's gifts, the crop markets start preparing and guessing for next year's crop data as this year's crop harvest comes to a close. Projections for 2022 crop acreage have begun to roll in over the last couple of months, but the tenor of those estimates has shifted during the harvest. The early estimates reflected the bullishness of the significant crop prices this year. Later estimates have tempered those prices with the matching increases in agricultural inputs. Let's explore those projections and the factors that shaped them.

One of the earliest sets of projections came from *Farm Futures* magazine. In August, they surveyed producers to test the waters for plans on the next crop year. With corn prices averaging $6.32 per bushel and soybean prices averaging $13.70, producers responded with optimism for 2022, indicating they plan to plant 94.3 million acres to corn and 90.8 million acres to soybeans. Given the current acreage estimates for 2021, that is a one million acre increase for corn and a 3.6 million acre increase for soybeans. Both crops were looking to capture a sizable boost in area. At roughly the same time, the Food and Agricultural Policy Research Institute (FAPRI) was preparing the mid-year update of its agricultural baseline model. While the model wasn't quite as positive as the survey, the crop acreage estimates were still large, with 93.3 million acres of corn and 87.9 million acres of soybeans.

As harvest has progressed, crop prices have been range-bound, but ag input costs have not. USDA reports fertilizer prices each week for central Illinois. At the end of August, anhydrous ammonia was pricing at $750 per ton, urea was at $575 per ton, and potash was roughly $622 per ton. By the end of October, ammonia prices had increased 60%, urea prices were up 41%, and potash prices jumped 25%. Fertilizer prices ramped up due to limited supplies, supply chain problems, some international trade restrictions, and the heightened demand shown in the early acreage estimates. Some agricultural chemicals, and ag land rents and values, are also rising in value. The higher input costs are squeezing expected crop margins for 2022, and therefore, influencing expected crop acreage. But the level of influence is the great debate at the moment.

S&P Global Platts foresees a sizable tilt away from corn and toward soybeans, with 90 million acres of corn and 90.4 million acres of soybeans. That would be a 3.3 million acre decline in corn plantings, with nearly all of that switching to soybeans. Hence, Platts is projecting the total area devoted to corn and soybeans to stay steady. IHS Markit (formerly Informa), on the other hand, projects that total area for corn and soybeans will now decline, with 92.4 million acres of corn and 87.4 million acres of soybeans. Under their projections, corn drops nearly a million acres and soybeans only gain 200,000 acres.

But the projection most have been waiting for is now out. USDA provided their first glimpse at the 2022 crop season. And as far as acreage is concerned, USDA was much closer to the IHS Markit numbers. For corn, USDA projects 92 million acres will be planted, down 1.3 million (Table 1). With a trend yield of 181 bushels per acre, that would result in corn production of 15.24 billion bushels. While USDA has lower acreage, it sees the potential for yields to more than offset that loss. In fact, these projections are for a record yield and production in 2022. So corn supplies are expected to remain large next year.

Table 1. US corn supply and usage table with 2021 and 2022 projections from November. Source: USDA-WAOB and USDA-OCE.

Marketing Year (2021 = 9/1/21 to 8/31/22)		2018	2019	2020	2021	2022
Area Planted	(million acres)	88.9	89.7	90.7	93.3	92.0
Yield	(bushels/acre)	176.4	167.5	171.4	177.0	181.0
Production	(million bushels)	14,340	13,620	14,111	15,062	15,240
Beginning Stocks	(million bushels)	2,140	2,221	1,919	1,236	1,493
Imports	(million bushels)	28	42	24	25	25
Total Supply	(million bushels)	16,509	15,883	16,055	16,323	16,758
Feed and Residual	(million bushels)	5,429	5,897	5,597	5,650	5,750
Ethanol	(million bushels)	5,378	4,857	5,032	5,250	5,250
Food, Seed, and Other	(million bushels)	1,425	1,430	1,437	1,430	1,430
Exports	(million bushels)	2,066	1,778	2,753	2,500	2,400
Total Use	(million bushels)	14,288	13,963	14,819	14,830	14,830
Ending Stocks	(million bushels)	2,221	1,919	1,236	1,493	1,928
Season-Average Price	($/bushels)	3.61	3.56	4.53	5.45	4.80

On the corn demand side, overall usage is expected to be robust as well. Feed and residual use is projected to increase by 100 million bushels, offsetting the same size decline in exports, leaving total corn usage at 14.83 billion bushels, the same as forecast for the 2021 marketing year. Corn usage for ethanol is expected to remain below pre-COVID levels. The gain in production and steady total usage translate to higher ending stocks, with stocks rising to 1.9 billion bushels. The 2022-23 season-average price is projected to fall to $4.80 per bushel, 65 cents below the 2021 price estimate.

Under USDA's 2022 projection, soybeans will only gain a small amount of the cropland corn lost, with plantings increasing to 87.5 million acres (Table 2). Given a trend yield of 51.5 bushels per acre, soybean production is projected at 4.465 billion bushels, 40 million bushels above this year's crop. Combined with stocks going into the 2022 marketing year, that puts total soybean supplies above 4.8 billion bushels.

Soybean usage is projected to grow as well. Domestic crush is expected to increase by 50 million bushels, mainly driven by biofuel demand for soybean oil. Soybean exports are estimated to increase by 90 million bushels, with the bulk of the beans headed to Asian ports. Total soybean usage will roughly equal the total the market experienced in 2020. That will bring 2022-23 ending stocks down to 321 million bushels, but USDA still expects prices to fall. The 2022-23 season-average price estimate is set at $10.50 per bushel.

Taken as a whole, USDA's projections indicate crop revenues in the 2022 marketing year will be lower than those in 2021, but higher than we saw in 2020. With the higher input costs already being penciled in, profit margins will be squeezed in the coming year. The extent of that squeeze will depend on producers' ability to manage costs and capture pricing opportunities from the markets. And currently, the markets are offering some hope. Current futures for the 2022 crops point to season-average prices above USDA's projections, with corn pricing in the $5.35 per bushel range and soybeans pricing around $11.95 per bushel. The after-effects of a drought on the markets are typically some longer-term pricing advantages, as both nearby and deferred futures are boosted by the weather problems. Based on the projections for 2022, we are seeing those after-effects for the 2020-21 drought now.

Table 2. US soybean supply and usage table with 2021 and 2022 projections from November. Source: USDA-WAOB and USDA-OCE.

Marketing Year (2021 = 9/1/21 to 8/31/22)		2018	2019	2020	2021	2022
Area Planted	(million acres)	89.2	76.1	83.4	87.2	87.5
Yield	(bushels/acre)	50.6	47.4	51.0	51.2	51.5
Production	(million bushels)	4,428	3,552	4,216	4,425	4,465
Beginning Stocks	(million bushels)	438	909	525	256	340
Imports	(million bushels)	14	15	20	15	20
Total Supply	(million bushels)	4,880	4,476	4,761	4,696	4,825
Crush	(million bushels)	2,092	2,165	2,141	2,190	2,240
Seed and Residual	(million bushels)	127	105	98	116	124
Exports	(million bushels)	1,752	1,682	2,265	2,050	2,140
Total Use	(million bushels)	3,971	3,952	4,505	4,356	4,504
Ending Stocks	(million bushels)	909	525	256	340	321
Season-Average Price	($/bushels)	8.48	8.57	10.80	12.10	10.50

For more details on the impact of these reports, view the latest **Ag Outlook Presentation video**, https://go.iastate.edu/QV9STY.

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