RENEWABLE FUELS ASSOCIATION

August 8, 2022

Ms. Cheryl Laskowski, Branch Chief
Transportation Fuels Branch
California Air Resources Board
1001 I St
Sacramento, CA 95814

Re: Low Carbon Fuel Standard July 7th , 2022 Workshop

Dear Ms. Laskowski,

The Renewable Fuels Association (RFA) appreciates the opportunity to comment on the workshop on potential changes to the Low Carbon Fuels Standard (LCFS) program held on July 7, 2022. The RFA supports the LCFS and looks forward to continued engagement in this process to strengthen and extend the program beyond 2030. The RFA is also working around the country in collaboration with other stakeholders to develop and implement similar programs in other states.

These comments update many of the RFA comments in our letter of January 7, 2022, following the December 2021 LCFS workshop, and are responsive to CARB staff's request at the most recent workshop for stakeholder input on specific topics.

The integrity of the LCFS depends on maintaining technology neutrality.

The hallmark of success of the LCFS is its market-based, technology-neutral approach that is driven by the carbon intensity scores of all fuels whether generating credits or deficits. The RFA supports California's goal of carbon neutrality by 2045. This is an aggressive, but achievable goal that will require a broad portfolio of low- and zero-carbon fuel solutions. The LCFS is a centerpiece policy in California's decarbonization efforts and modifying and extending the LCFS regulation beyond 2030 is necessary to achieve carbon neutrality. Any new policies that are introduced to incentivize new innovations and technology development should be equitably available to all low carbon fuels.

A cap on crop-based biofuels is not necessary, would be inconsistent with the technology-neutral design of the LCFS, and would chill investment in lower-carbon fuel technologies.

During the workshop, CARB staff noted that some stakeholders had expressed concern about the LCFS increasing demand for lipid-based feedstocks for biofuels. While this discussion was focused primarily on lipid-based feedstocks for renewable diesel and biodiesel, RFA believes capping any low-carbon fuels under the LCFS is contrary to the successful market-based and technology-neutral design of the LCFS. The inclusion of substantial land use change emissions factors in the program's carbon intensity scoring framework already serves to constrain the use of certain feedstocks and biofuels under the LCFS. And as discussed in these comments, and as documented in studies and data analysis, the iLUC factor in the LCFS for corn ethanol is overstated and should be adjusted downward. The use of ethanol is also already constrained by federal and state regulations that allow only 15% ethanol (E15) to be used in conventional light-duty automobiles.

California is one of only two states that does not yet allow the sale of E15. If some LCFS stakeholders feel it is necessary to take credit generation pressure off lipid-based biofuels like renewable diesel, the easiest and fastest way to do that would be to approve the use of E15.

Further, capping the use of certain feedstocks (like corn) for ethanol production would have no impact whatsoever on consumer food prices or food price inflation rates. Indeed, it has been very well established that the primary driver of food price inflation is energy price inflation (i.e., since energy is used at every step in the food production supply chain). Thus, programs like the LCFS that encourage greater use of lower-cost, lower-carbon alternatives to petroleum play a role in fighting the effects of petroleum market volatility on food inflation. Capping the use of biofuels would only exert more pressure on petroleum markets, drive petroleum prices higher, and spur additional food price inflation.

U.S. ethanol production peaked in 2018 at approximately 16 billion gallons. The pandemic, structural marketplace changes (e.g., more fuel-efficient cars, higher gas prices, higher sales of electric vehicles and increased working from home) have suppressed gasoline consumption and by extension, the usage of ethanol. The EIA forecasts only negligible growth in domestic ethanol production and consumption between 2023 and 2030 and increases in corn productivity (i.e., yield per acre), are generally expected to outpace any increases in the use of corn for ethanol over the next decade.

Meanwhile, modest increases in ethanol production combined with the allowance to sell higher blends can help accelerate the decline in gasoline consumption in California that will be necessary to achieve carbon neutrality by 2045. Given the volume of petroleum fuels that will continue to be in use in 2040 and beyond, accelerated carbon removal is essential in achieving carbon neutrality. This is fully recognized in California's Draft 2022 Scoping Plan.

Ethanol has the unique ability to combine low carbon fuel production with carbon removal through CCS. Two ethanol plants in the US have already commercialized CCS, and the industry is poised for widescale adoption of CCS as long as the appropriate federal and state policy signals remain in place. Capping crop-based biofuels in the LCFS would send the wrong signal to a biofuels industry that is making significant investment in low- and zero-carbon technologies and represents the most immediate and economic path to CCS.

US farmers have supported the significant growth in biofuel production while continuing to supply growing food, feed, and fiber markets. We are attaching to this letter an RFA presentation that goes into more detail on this topic. In summary, due to productivity gains in agricultural production and processing, U.S. farmers have easily satisfied demand growth in all market segments on less crop acreage than in 2007 when the RFS2 regulations were implemented.

Feed corn is the primary feedstock for U.S. ethanol. The production process converts the starch in the corn kernel to ethanol, while concentrating the feed value in the form of high protein feed (DDGS) and the industry continues to fraction off more valuable components of the corn kernel such as corn oil that is an ultra-low carbon input for renewable diesel production and fiber that can be converted to cellulosic ethanol.

Processes to further concentrate the protein for higher value protein markets also increases the corn oil yield. Today, there is over 150 million gallons per year of cellulosic corn fiber ethanol delivered to California and this amount could grow significantly over the next several years with the right market signals provided by the LCFS in California and similar programs in other states. Capping crop-based biofuel production would be the wrong market signal for an industry that continues to grow and innovate in meeting food, feed, fiber, and fuel markets.

RFA supports CARB staff's consideration of stronger LCFS compliance curves before and after 2030.

Strengthening the compliance curves is appropriate to harmonize the LCFS with the goal of carbon neutrality by 2045, and it sends the long-term market signal necessary to encourage the significant new investment in innovative technologies required to meet decarbonization goals. In the early years of the LCFS, political and market uncertainty resulted in low LCFS credit pricing which dampened investment in lower carbon fuels. But following the "readoption" of the LCFS in 2015, credit prices reacted in a way that stimulated investment and growth in low-carbon fuels. From 2018 through the first half of 2021, credit prices held steady around $200 per metric ton, stimulating new investments in growing supplies of lower carbon biofuels, electrification, and refinery improvements. In the last year, credit prices have dipped to below $100 per metric ton, and there is a real risk of not attracting sufficient new investments for the large volumes of low carbon fuels needed to meet future compliance targets. Prices have drifted lower due to the success of the program, with projections of over-compliance and a significant build in the credit bank balance over the next several years absent a significant adjustment to the compliance curve.

Specifically, RFA supports strengthening the 2030 target from a 20 percent reduction to between a 25 and 30 percent reduction. We would suggest that post 2030 targets be set in a linear fashion to be close to 100 percent reductions by 2045. Quickly moving to a steeper and longer-term compliance curve will send a strong market signal that the ultimate success of the LCFS depends on continued innovation and new investments. RFA members have committed to achieving net-zero carbon ethanol production by 2050. A recent study by Informed Sustainability Consulting identified five distinct pathways to net-zero corn ethanol based on a set of 28 emissions reduction actions that were considered. It concluded that “the industry can achieve net-negative (carbon intensity) ethanol by adopting near term technologies and expanding best practices in corn farming.” [1]

However, if CARB were to proceed with an ill-advised cap on crop-based biofuels, it would not be feasible to substantially strengthen the compliance curve—and CARB’s vision of achieving carbon neutrality by 2045 would be put in grave danger.

Higher ethanol blends are necessary to meet a more aggressive LCFS compliance schedule and carbon neutrality goals.

Higher blends of low-carbon ethanol in the current gasoline pool represent the nearest term and most affordable path for immediate reductions of GHG emissions from the light duty fleet. Higher ethanol blends are also necessary to meet the longer term need to decarbonize the liquid fuels that will be in the California transportation system for decades to come.

The University of California’s Institute of Transportation Studies report, “*Driving California ‘s Transportation Emissions to Zero”* (April 2021) clearly documented this challenge and pointed repeatedly to the need for the LCFS and complementary policies to drive the substantial volume of liquid fuels remaining in the system to near zero carbon. To date, ethanol has contributed approximately 30 percent of all LCFS credits, with the vast majority from 10 percent ethanol blends (E10).

Complementary policies to allow for higher blends of ethanol, E15-E100 are a critical component to the future success of the LCFS. Even with ethanol contributing the single largest share of LCFS credits in the program, limiting ethanol to a 10 percent blend has swamped the gasoline pool with net deficits. The first chart shown below is for all fuels showing a net credit surplus of nearly 10 million metric tons to date as reported by CARB.

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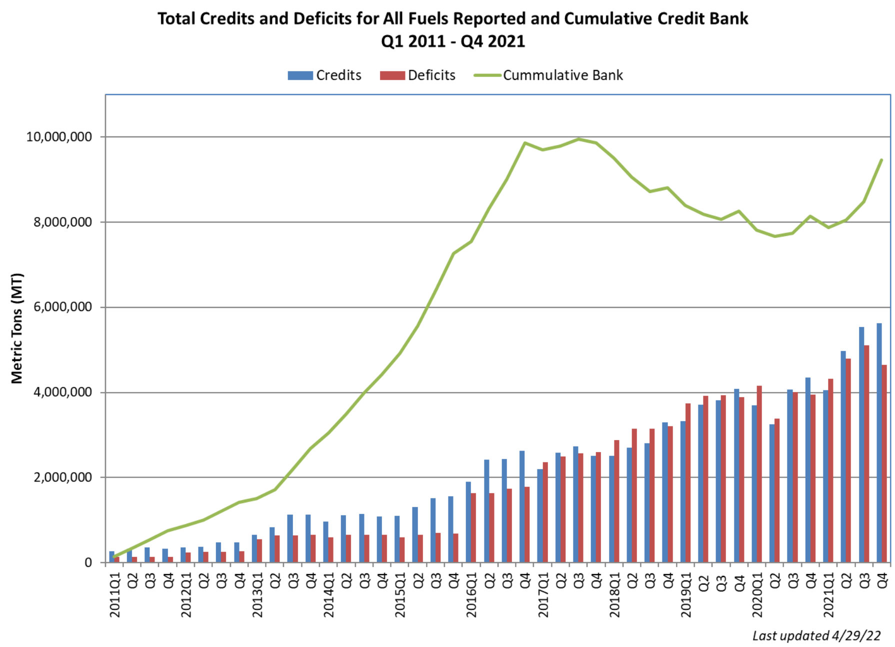
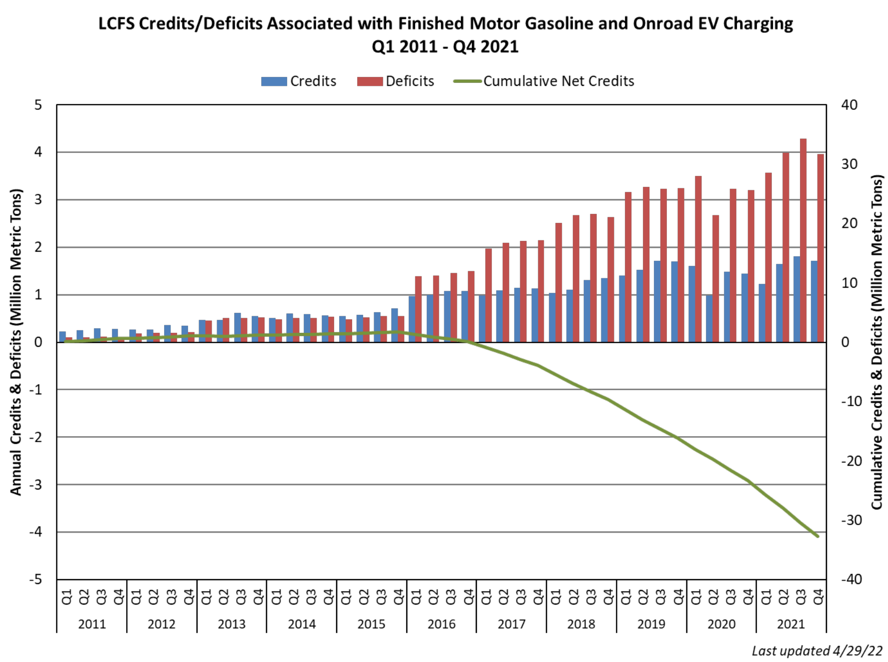
[1] *Pathways to Net-Zero Ethanol: Scenarios for Ethanol Producers to Achieve Carbon Neutrality by 2050;* Emery, I., February 2022; https://ethanolrfa.org/file/2146



However, looking at the gasoline pool separately, as shown in the chart below, a different picture emerges. Ethanol and electricity combined (i.e., the only current replacements for gasoline) are not even close to covering the deficits generated by CARBOB, resulting in a large and growing net deficit of over 30 million metric tons program to date.



Source: California Air Resources Board. Included CARBOB, ethanol and electricity for on-road light and medium duty vehicles

The rapid growth of renewable diesel has provided the excess credits in the program to cover the gasoline deficits. This is not sustainable, as new supplies of renewable diesel are needed to further displace conventional diesel and gasoline substitutes will need to cover gasoline deficits in a transportation system moving toward carbon neutrality. Also, as mentioned above, if some LCFS stakeholders feel it is necessary to take credit generation pressure off lipid-based biofuels like renewable diesel, the easiest and fastest way to do that would be to approve the use of E15.

Achieving carbon neutrality will only be possible with the widespread deployment of low to zero carbon ethanol at blends above 10 percent, along with electrification and other bio-based gasoline substitutes. An important first step is to immediately approve the use of E15 in California. The LCFS should also work in tandem with other CARB polices to encourage, require, or incentivize future ICE engines that can run on very high levels (i.e., 85-100 percent) low to zero carbon biofuels. The Advanced Clean Car Regulation should require that all ICE engines sold starting in 2026 are flex fuel (FFV) capable.

Biofuel producers should qualify for book and claim credits for RNG in the pipeline utilized to substitute for natural gas in the biofuel production process.

This modification to the LCFS would be consistent with the principles of technology neutrality and further incentivizing private investment in low carbon fuels. It is also analogous with the book and claim accounting that is currently allowed for hydrogen producers utilizing pipeline RNG in the manufacturing process of hydrogen for fuel. To ensure fairness, consistency, and neutrality across all low carbon fuel pathways, CARB should allow all low-carbon fuel producers to use the same accounting procedures. Combining RNG for process fuel with carbon capture and sequestration (CCS) projects that are now in the planning stages at many ethanol facilities, moves the industry to the production of ultra-low to zero to negative carbon ethanol. The right policy support from the LCFS facilitates this valuable contribution in meeting the state’s climate goals.

RFA strongly supports allowing low-carbon fuel producers to incorporate site-specific agricultural factors and inputs into fuel pathways.

A significant portion (roughly half) of the full life cycle carbon intensity of ethanol is from the agricultural production of the feedstocks. With the increasing employment of no-till, cover cropping, and other modern precision agricultural practices, farmers have quantified the ability to significantly lower the carbon intensity of feedstock production while also increasing soil carbon levels. These practices result in carbon scoring well below the current averages employed in the CA-GREET model. Currently, the CA-GREET model treats agricultural feedstock production practices as “one size fits all” and does not allow ethanol producers to incorporate lower-carbon agricultural practices into their pathway carbon intensity scores. Allowing fuel producers to provide site specific input agricultural data will further incentivize carbon efficient agricultural practices, resulting in lower carbon ethanol production and contributing to a more successful LCFS. More detailed recommendations for recognizing soil carbon sequestration and other carbon efficient ag practices within CA-GREET are provided in a comment letter from the Low Carbon Fuels Coalition, which was signed and endorsed by RFA. We look forward to working with CARB staff and other agricultural and academic stakeholders to systematically address CARB's questions regarding verification and permanence.

A combination of a high concentration of low to zero carbon ethanol combined with more efficient engines is an opportunity to define new Energy Economy Ratios (EERs).

The high-octane rating of ethanol combined with a higher-compression ratio internal combustion engine offers a significant fuel efficiency improvement and lifecycle carbon intensity reduction. However, the LCFS currently does not provide any opportunity to recognize and encourage these GHG benefits. The use of a high-octane fuel with higher renewable content in a plug-in hybrid with a higher compression ratio engine qualifies as a ZEV and represents an opportunity for defining a new EER. Specifically, our analysis has shown that the use of a high-octane (98 RON) blend containing 30 percent ethanol in a high-compression ratio engine would result in a drivetrain energy efficiency improvement of 11 percent, equating to an EER of 1.11. We encourage CARB to include an EER for high-octane fuels used in high compression ratio engines in both conventional and plug-in hybrid vehicles.

The land use change (LUC) values used by CARB to determine CI scores should conform to updated analytical and empirical data.

A recent analysis by a collaboration of researchers from Environmental Health Engineering, MIT, Tufts, and Harvard concluded that a LUC (direct and indirect) emissions value for corn ethanol of 3.9 g/MJ represents the most credible evolution of the science on the topic.[2] Oregon's Clean Fuels Program uses the Argonne GREET model values of 7.8 g/MJ. These lower values are supported by recent analyses of land use patterns by Purdue University, the U.S. Departments of Energy and Agriculture, University of Illinois, and other institutions. Both values are well below California LCFS value of 19.8 g/MJ, which has not been updated since 2014.

The Argonne GREET model is the basis for the entire life cycle analysis in the LCFS, so it is consistent to use Argonne GREET for land use change values as well. Argonne updates its model regularly (typically on an annual basis) to incorporate the best

[2] *Carbon Intensity of Corn Ethanol in the United States: State of the Science:* Scully, M. et al., January 2021; https://iopscience.iop.org/article/10.1088/1748-9326/abde08

science on all variables. Additionally, in the interest of technology neutrality and with the rapid increase in battery-electric vehicles, the land use impacts of mineral extraction for battery production should also be evaluated [3], along with the land use implications of expanded wind and solar electricity generation [4].

There are several other data sources and studies that should be considered in the analysis of crop-based biofuels.

Responsive to CARB staff's request for other data sources and studies to take into consideration, following are other important and recent studies that should be reviewed on the topics of ethanol's climate and land use change impacts.

- *Retrospective Analysis of the U.S. Corn Ethanol Industry for 2005-2019; Implications for Greenhouse Gas Emission Reductions;* Lee, U et al., May 2021; https://onlinelibrary.wiley.com/doi/10.1002/bbb.2225. The study, conducted by Argonne National Laboratory researchers, found that the carbon intensity of corn ethanol shrank by 23% over the 2005-2019 timeframe, from 58 to 45 gCO2e/MJ (not including the land use change value of 7.4 gCO2/MJ). By 2019, corn ethanol reduced lifecycle emissions by 44-52% compared to gasoline. The researchers determined that corn ethanol reduced transportation related greenhouse gas (GHG) emissions by a cumulative 544 million metric tons CO2e over the study timeframe. Notably they demonstrated that there has been a "downtrend in simulated (land use change) emissions" that the stated "is a result of better developed and calibrated economic models and better modeling of GHG emissions."

- *GHG Emissions Reductions due to the RFS2: A 2020 Update*; Unnasch, S. & Parida, D., February 2021; https://ethanolrfa.org/file/748. The Renewable Fuel Standard (RFS) as expanded in 2007 has resulted in significant reductions in GHG emissions, with cumulative carbon dioxide savings of 980 million metric tons to date. Most of the savings have been associated with the use of ethanol.

- *The California Low Carbon Fuel Standard: Incentivizing Greenhouse Gas Mitigation in the Ethanol Industry*; Lewandrowski, J., Hohenstein, B., & Pape, D., November 2020; https://www.usda.gov/sites/default/files/documents/CA-LCFS-

[3] See, for example, International Energy Agency. "*The Role of Critical Minerals in Clean Energy Transitions.*" May 2021. The report shows highly variable EV carbon intensity based on the minerals used. Mining and processing of cobalt sulfate, for example, is four times more carbon intensive than mining and processing of zinc. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions

[4] A recent study published in Nature, for example, found that the land cover changes, including indirect effects, associated with significant expansion in solar "…will likely cause a net release of carbon ranging from 0 to 50 gCO_2/kWh [0-180 g CO2/MJ], depending on the region, scale of expansion, solar technology efficiency and land management practices in solar parks." See: van de Ven, DJ., Capellan-Pérez, I., Arto, I. *et al.* The potential land requirements and related land use change emissions of solar energy. *Sci Rep* **11,** 2907 (2021). https://doi.org/10.1038/s41598-021-82042-5

Incentivizing-Ethanol-Industry-GHG-Mitigation.pdf. The assessment, which was conducted by researchers from the USDA and ICF, concluded that the value of credits toward California's Low Carbon Fuel Standard (LCFS) provides a strong financial incentive for ethanol facilities to implement GHG-reducing technologies and practices. A series of interviews with ethanol facility managers indicated that the LCFS and other policies, including the RFS, were large drivers of decisions to proceed with plant upgrades, such as process efficiency improvements, process energy modifications, changes to co-product production, and enzyme enhancements.

- *Response to Comments from Lark et al. Regarding Taheripour et al. March 2022 Comments on Lark et. al. Original PNAS Paper*; Taheripour, F. et al., May 2022; https://greet.es.anl.gov/publication-comment_environ_outcomes_us_rfs2. Researchers from the Department of Energy's Argonne National Laboratory, Purdue University, and the University of Illinois system thoroughly assessed the paper by Lark et al. "Environmental Outcomes of the US Renewable Fuel Standard," and they refuted key findings of the work. They showed that indirect land use change was overestimated, and land transitions were misinterpreted; additionally, there were significant issues with the calculation of GHG emissions associated with purported land use change. The authors concluded, "The overestimated emission factors and overestimated land conversion in Lark et al. led to overestimated [land use change] emissions for corn ethanol."

- *A Cautionary Tale: A Recent Paper's Use of Research Based on the USDA Cropland Data Layer to Assess the Environmental Impacts of Claimed Cropland Expansion*; Pritsolas, J. & Pearson, R., June 2021; https://ethanolrfa.org/file/1833/SIUE-Rebuttal-on-USDA-CDL-Use.pdf. A study by Zhang et al. assessed the environmental impacts of cropland expansion in the Midwest between 2008 and 2016, building on previous research that used the USDA Cropland Data Layer (CDL) to estimate the conversion of grassland to cropland. A review of the two studies determined, "The cropland expansion claimed … has a high potential of being false change due to poor classification certainty in the earlier CDL." This occurred since the earlier CDLs underestimated cropland area and grossly overestimated non-cropland area, but both were mapped more accurately as the CDL improved over time. The reviewers pointed out that the USDA has warned about "very low classification accuracy" of pasture and grass-related land cover categories in the CDL.

- *Response to "How Robust Are Reductions in Modeled Estimates from GTAP-BIO of the Indirect Land Use Change Induced by Conventional Biofuels?"*; Taheripour, F., Mueller, S., & Kwon, H., May 2021; https://www.sciencedirect.com/science/article/abs/pii/S0959652621016504. The paper was a response to criticisms by Malins et al. regarding the Global Trade Analysis Project model for biofuel analysis (GTAP-BIO) and the Carbon

Calculator for Land Use Change from Biofuels Production (CCLUB). The authors compared early versus recent results of GTAP-BIO, discussed the treatment of cropland pasture, the yield-to-price elasticity and harvest frequency in the model, and they commented on the CCLUB emissions model. They asserted that as data and models have improved over time, estimates of the emissions associated with induced land use change from biofuels have decreased. It was noted that in the past, the “exclusion of market mediated responses, poor characterization of agricultural supply responses, poor reflection of real-world data, and using models and data not well-suited for addressing ILUC-related questions contributed to over-estimation of land use changes due to biofuels”.

- *Effects of Ethanol Plant Proximity and Crop Prices on Land-Use Change in the United States*; Yijia, L., Miao, R., & Khanna, M., December 2018; https://onlinelibrary.wiley.com/doi/10.1093/ajae/aay080. The analysis showed that land use is inelastic to changes in corn ethanol production capacity. A 1% increase in the effective ethanol capacity in a county led to an increase in corn acreage in that county by about 0.03% to 0.1%, and an increase in total acreage of only 0.02% to 0.03%. The effect of the corn price and aggregate crop price on acreage change from 2008 to 2012 was more than twice as large. The results implied that the effect of changes in corn price on land use was largely at the intensive margin rather than at the extensive margin. Corn prices are influenced by a number of factors, not only ethanol, and it was noted that the effect of crop prices on land use was largely reversed as a result of the downturn in prices after 2012 and was close to negligible by 2014 relative to 2008.

- *Carbon Calculator for Land Use Change from Biofuels Production: Users' Manual and Technical Documentation*; Dunn, J. et al., December 2017; https://greet.es.anl.gov/files/cclub-manual-r4. The Carbon Calculator for Land Use Change from Biofuels Production calculates carbon emissions from land use change for ethanol production pathways, including corn ethanol. It is used in connection with Argonne National Laboratory's GREET model. For corn ethanol, land use change emissions were estimated to be 7.8 g CO_2e/MJ.

- *Lessons Learned from US Experience with Biofuels: Comparing the Hype with the Evidence*; Khanna, M., Rajagopal, D., & Zilberman, D., March 2021; https://www.journals.uchicago.edu/doi/pdf/10.1086/713026. The paper reviews projections that were made about the impacts of biofuels during the initial expansion in the 2000s and presents empirical evidence and modeling results about the effects of increased production on crop and fuel prices, land use change and GHG emissions. Biofuels were one of several significant factors that contributed to the increase in agricultural commodity prices through 2012, but the impact has dissipated over time. Regarding indirect land use change, the authors concluded that “the high initial estimates of the effect of biofuels on ILUC were driven largely by stringent model assumptions and have not been supported by either recent models (that have more advanced features) or the empirical evidence that has emerged over time."

- *Economic Impacts of the U.S. Renewable Fuel Standard: An Ex-Post Evaluation*; Taheripour, F., Baumes, H., & Tyner, W., June 2020; https://www.frontiersin.org/articles/10.3389/fenrg.2022.749738/full. The GTAP-BIO model was used to evaluate the extent to which the RFS and other factors affected commodity markets in the medium to long run, focusing on two time periods: 2004-2011 and 2011-2016. The analysis determined that coarse grain prices were 0.6% higher during the first time period and 0.9% higher during the second period due to the RFS. This was supplemented with a partial equilibrium model, which determined that on a short-term basis the price of coarse grains was 6.7% higher during the second period due to the RFS. Overall, the study concluded that the RFS made major contributions to the agriculture sector, raising U.S. annual farm incomes by $1.4 billion in the first period and by $2.4 billion in the second period. In both periods, the long-run effects of biofuel production and policy on food prices were negligible.

- *Food Versus Fuel: An Updated and Expanded Evidence*; Filip, O. et al., August 2019; https://www.sciencedirect.com/science/article/pii/S0140988317303742. The study was segmented into three time periods, centering around the commodity price escalation that occurred during the second half of the 2000s. The analysis determined that ethanol did not affect agricultural commodity prices prior to June 2008, that it explained approximately 15% of the variance in corn prices and 5% of the changes in other commodity prices from July 2008 to February 2011, and that it contributed to approximately 10% of the variance in commodity prices from March 2011 to May 2016. The authors concluded that the results served as an ex-post correction of early studies that found biofuels had more substantial effects.

- *The Impact of Ethanol Industry Expansion on Food Prices: A Retrospective Analysis*; Informa Economics IEG, November 2016; https://ethanolrfa.org/file/975/Retrospective-of-Impact-of-Ethanol-on-Food-Prices-2016.pdf. A retrospective statistical analysis determined that retail food prices were not impacted in any demonstrable way by the expansion of U.S. corn ethanol production under the RFS. In fact, the study found that food price inflation actually slowed during the "ethanol era." While corn prices were positively impacted by ethanol expansion, the link between corn prices and consumer food prices was shown to be weak.

Making higher blends of ethanol available to consumers promotes equity.

Ethanol reduces GHG emissions, criteria pollutants[5] and lowers cost to the consumer. Life cycle modelling has clearly demonstrated that ethanol reduces GHG emissions compared to gasoline by approximately 50 percent. Corn fiber ethanol production reduces GHG emissions by roughly 70 percent and as discussed, the ethanol industry continues to drive ethanol production toward net zero carbon offering an affordable and viable path for decarbonization in transportation alongside vehicle electrification.

The recent emissions testing on E15, sponsored and supported by CARB, showed significant reductions in most criteria pollutants compared to E10. This can help improve the air quality today in front line communities that have a disproportionate exposure to today's air pollution.

Historically, ethanol has sold at a discount to gasoline. Currently, E85 is typically selling in California at over a $2/gallon discount (or more) to regular gasoline.[6] E85-capable vehicles (flex fuel vehicles) cost the manufacturer just $50-100 more to produce than conventional gasoline-powered vehicles and are significantly less to produce (and purchase) than current electric vehicles. Providing policy support for E15 and flex fuels like E85 helps meet California's ambitious environmental goals while providing consumer choice and lower cost options for California citizens.

RFA applauds CARBs commitment to support the exportability of the LCFS.

Many other jurisdictions across the country are now considering LCFS type programs and California is the leader. The successful policy framework of the LCFS is an excellent model for developing new programs outside of California, but its attractiveness to other jurisdictions depends on maintaining a technology neutral, market-based structure. RFA believes that protecting the integrity of a performance based standard and working on incorporating site specific agricultural inputs improves the exportability of the LCFS program.

RFA urges CARB staff to move expeditiously to make these modifications to the LCFS. The most recent UN IPCC report and subsequent COP 26 meeting in Glasgow make alarmingly clear the imperative of further reducing GHG emissions immediately. The recent rash of extreme heat events, wildfires and flooding around the world are painful reminders of the consequences of the climate crisis and the urgency to act now.

[5] See, for example, the results of recent emissions testing supported by CARB and conducted by the University of California Riverside. https://ww2.arb.ca.gov/resources/documents/comparison-exhaust-emissions-between-e10-carfg-and-splash-blended-e15

[6] See, for example, https://twitter.com/EthanolRFA/status/1554149931325300741?cxt=HHwWioC9hZvIuZErAAAA

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The cumulative impacts of not reducing GHG emissions as soon as possible can be catastrophic. When coupled with the ongoing decrease in the carbon intensity of ethanol, higher ethanol blends like E15 and flex fuels like E85 present a practical and cost-effective opportunity for both immediate and long-term GHG reductions under the LCFS.

RFA looks forward to working with CARB staff and other stakeholders to strengthen and extend the successful LCFS program.

Sincerely,

Kelly S Davis

Kelly Davis
VP of Regulatory Affairs

Thinking Clearly About Agricultural Land Use, Productivity Gains, and the Impact of Ethanol Expansion

Renewable Fuels Association

July 2022

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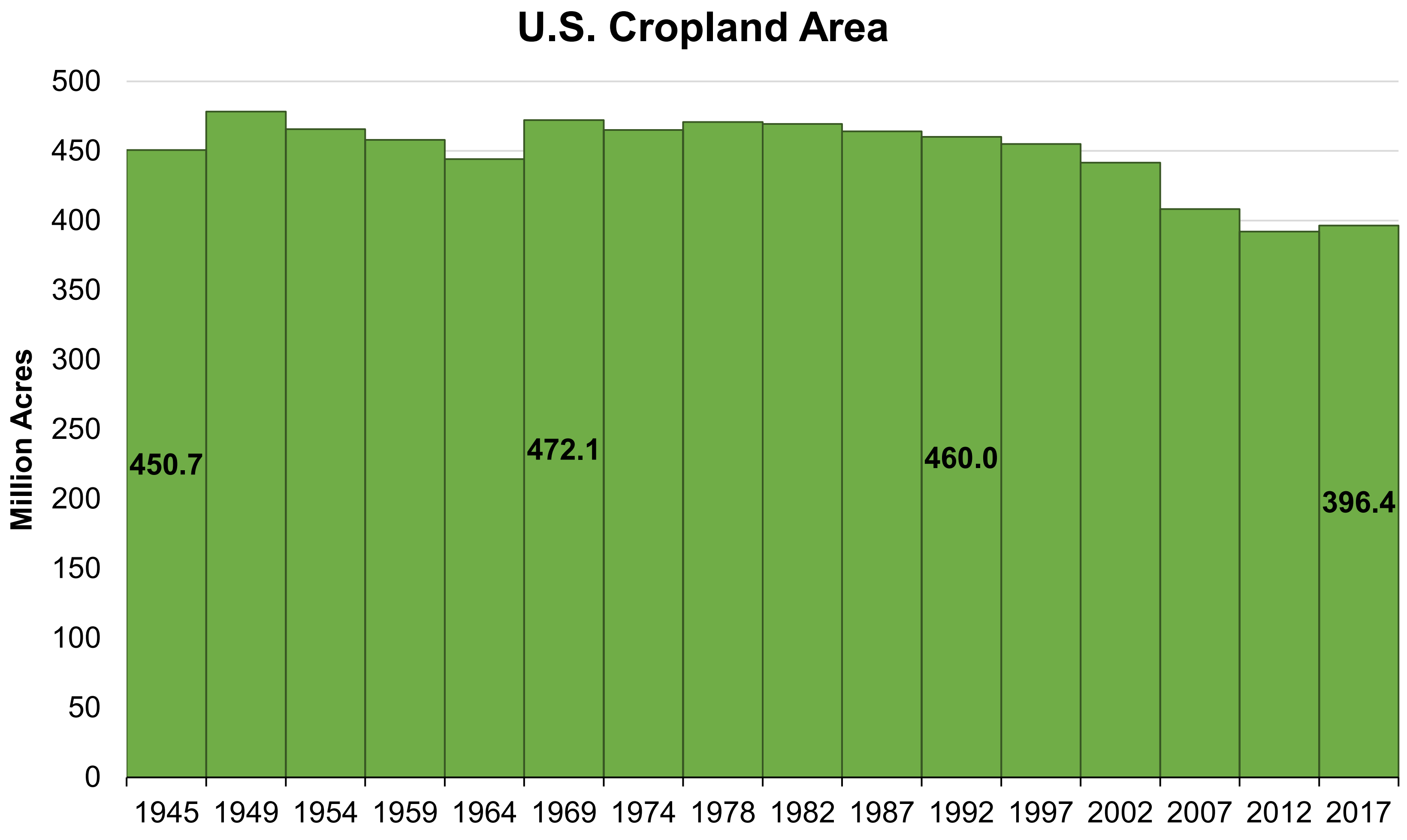
The amount of U.S. land dedicated to crop production continues to shrink



Source: USDA Census of Agriculture (2022 data not yet available)

- Since the late 1960s, U.S. land dedicated to crop production has continued to shrink.
- Between 1969 and 2017, U.S. cropland fell 16%, or 76.7 million acres—an area the size of New Mexico, our fifth-largest state.
- U.S. cropland has remained under 400 million acres since 2008.

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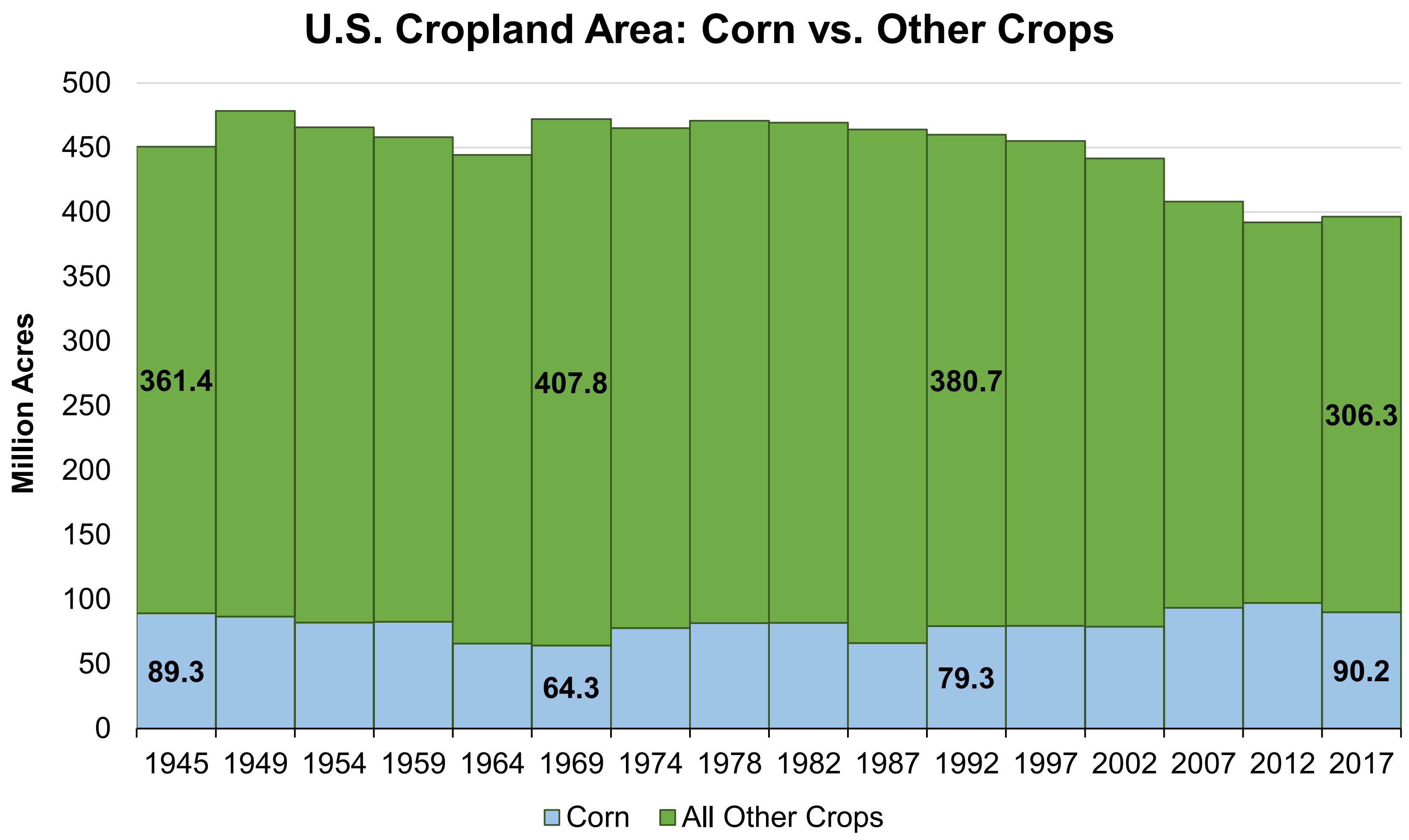
Total cropland is shrinking, even as corn acreage is flat or slightly increasing



- In recent years, corn has accounted for roughly 20% of U.S. cropland.
- Acres planted to corn in 2017 were nearly identical to the amount of land planted to corn in 1945 (less than 1 million acres difference).
- Acres planted to wheat, cotton, oats, sorghum, barley and other crops have trended lower as increased yields and lower demand have reduced land requirements.

Source: USDA Census of Agriculture (2022 data not yet available)

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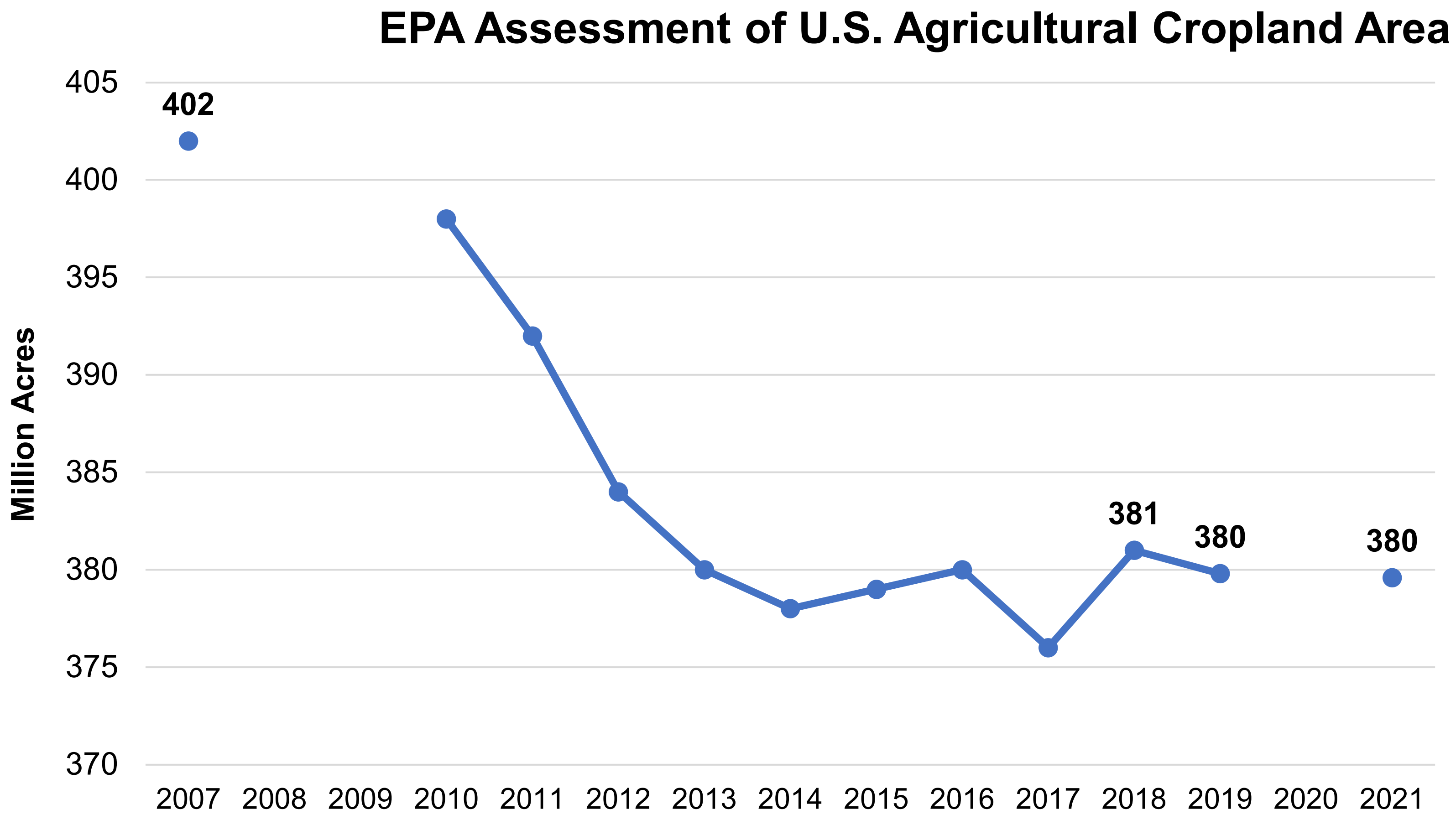
EPA data show nearly 25-million-acre reduction in agricultural cropland since 2007



- The 2007 law establishing the expanded RFS **prohibits** ethanol producers from using corn or other feedstocks from new cropland "cleared or cultivated" after 2007.
- To ensure compliance, U.S. EPA tracks agricultural cropland area annually using USDA data. The data show **no expansion** of U.S. cropland from 2007 levels.
- In fact, U.S. EPA analysis shows a **decrease** in agricultural cropland of 20-25 million acres (roughly 6%) between 2007 and 2017-2021.

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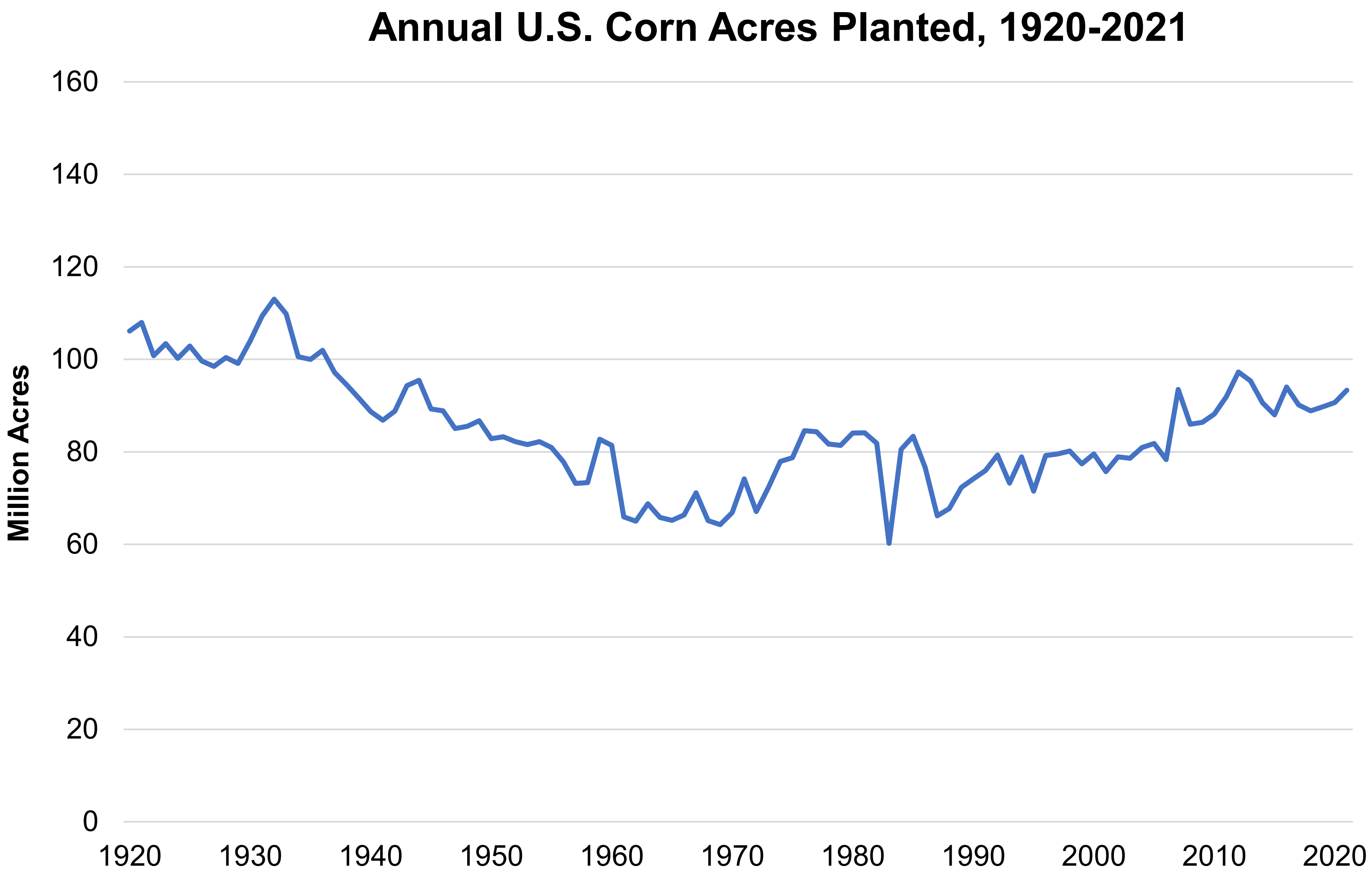
Source: U.S. EPA

Fewer corn acres today than in 1920s-1930s



Source: USDA

- Over the past 100 years, acres planted to corn have averaged less than 85 million annually.
- Corn acres were well over 100 million in the 1920s and 1930s, peaking at 113 million in 1932.
- Corn acres have generally been in the 85 to 95-million-acre range since the RFS was expanded in 2007, as profitability returned to corn farming.
- Corn acres have been trending downward since 2012, as stocks were rebuilt and prices gravitated lower.

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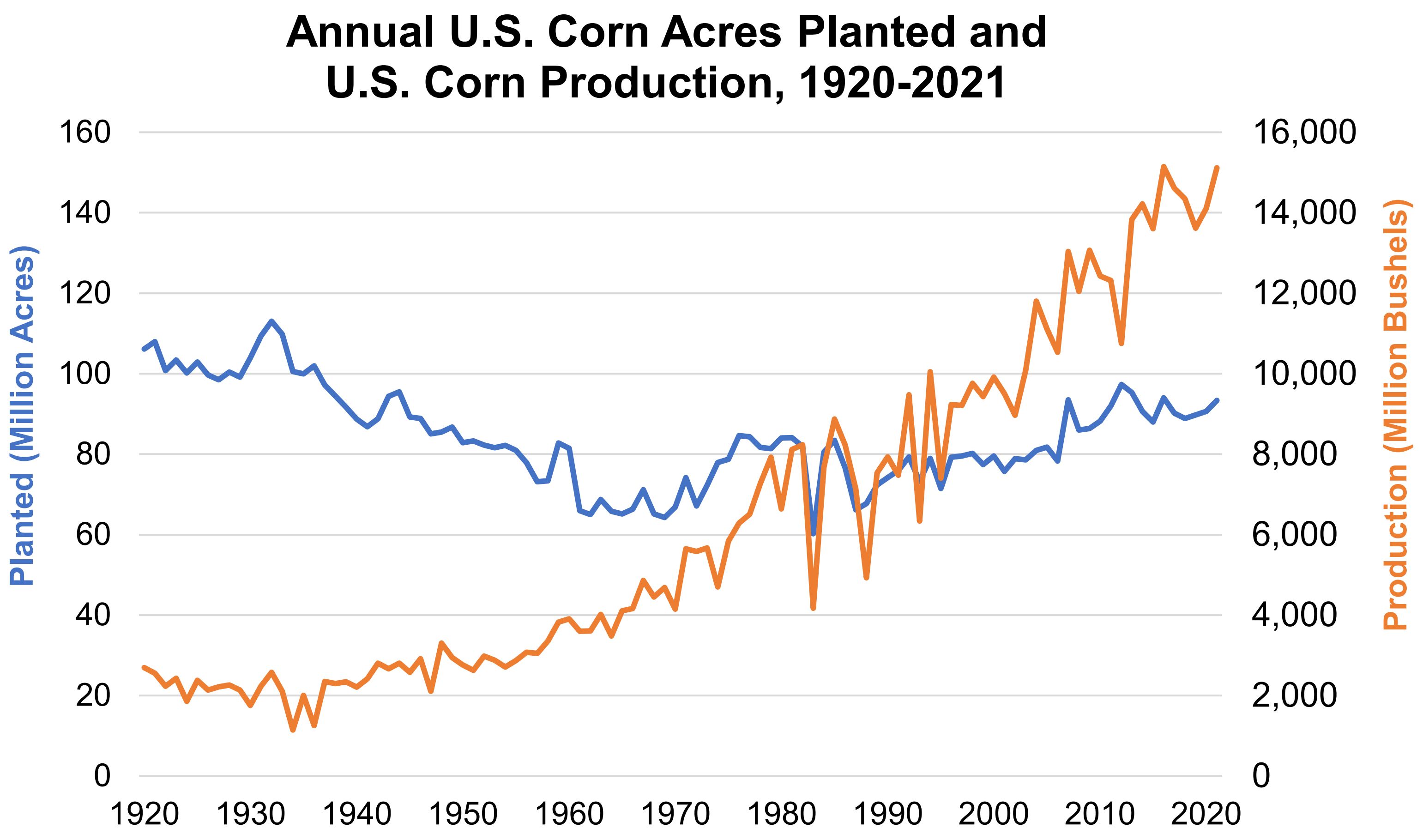
Corn acreage trending downward, while production up nearly 600% since 1920s



Source: USDA

- While corn acres have been relatively flat over the past century, corn production has increased **six-fold**.
- In the 1920s-1940s, annual corn production averaged roughly **2.3 billion bushels** and planted acres averaged 98 million.
- In the 2000s, annual corn production averaged **11 billion bushels** from 82 million acres.
- Since 2010, annual corn production has averaged **13.7 billion bushels** on an average of 92 million planted acres.

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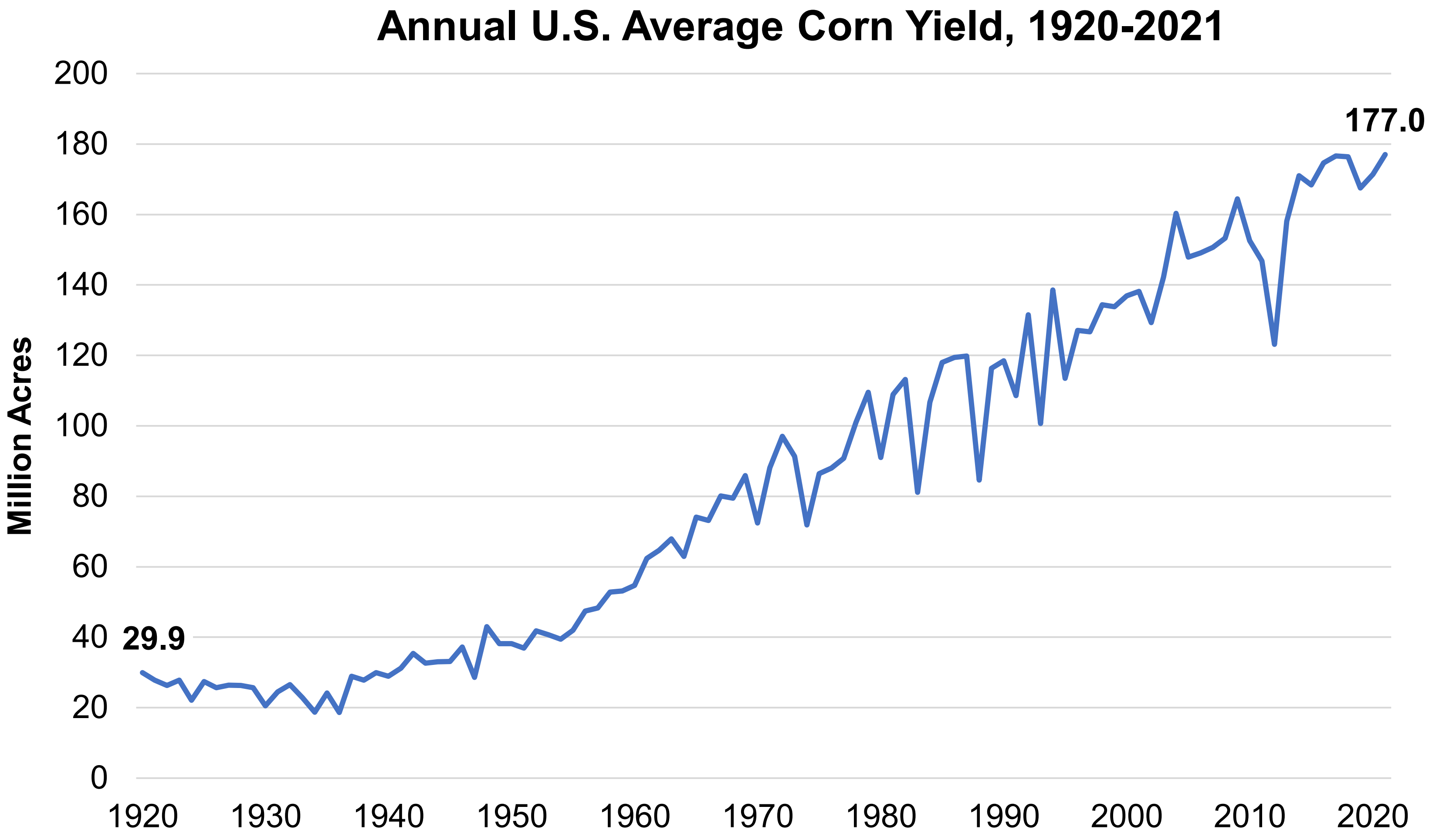
Corn output per acre continues to trend higher; up nearly 600% over past century



- The average amount of corn produced per acre ("yield") has increased nearly **600%** over the past 100 years.
- A new record average yield of **177.0 bushels per acre** was established in 2021. Each bushel of corn weighs 56 pounds.
- Since 1970, yields have grown an average of **2.8% per year**.

Source: USDA

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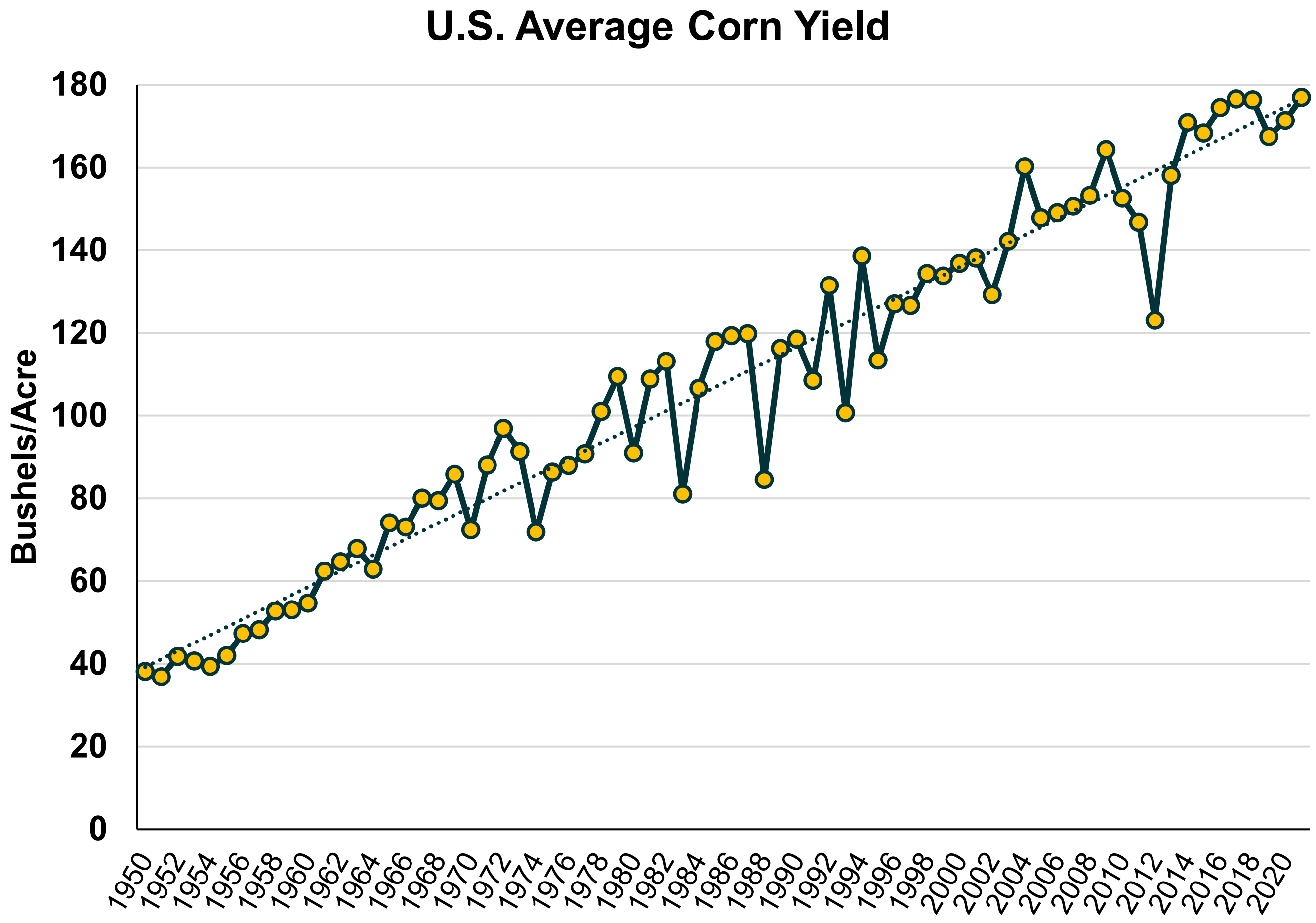
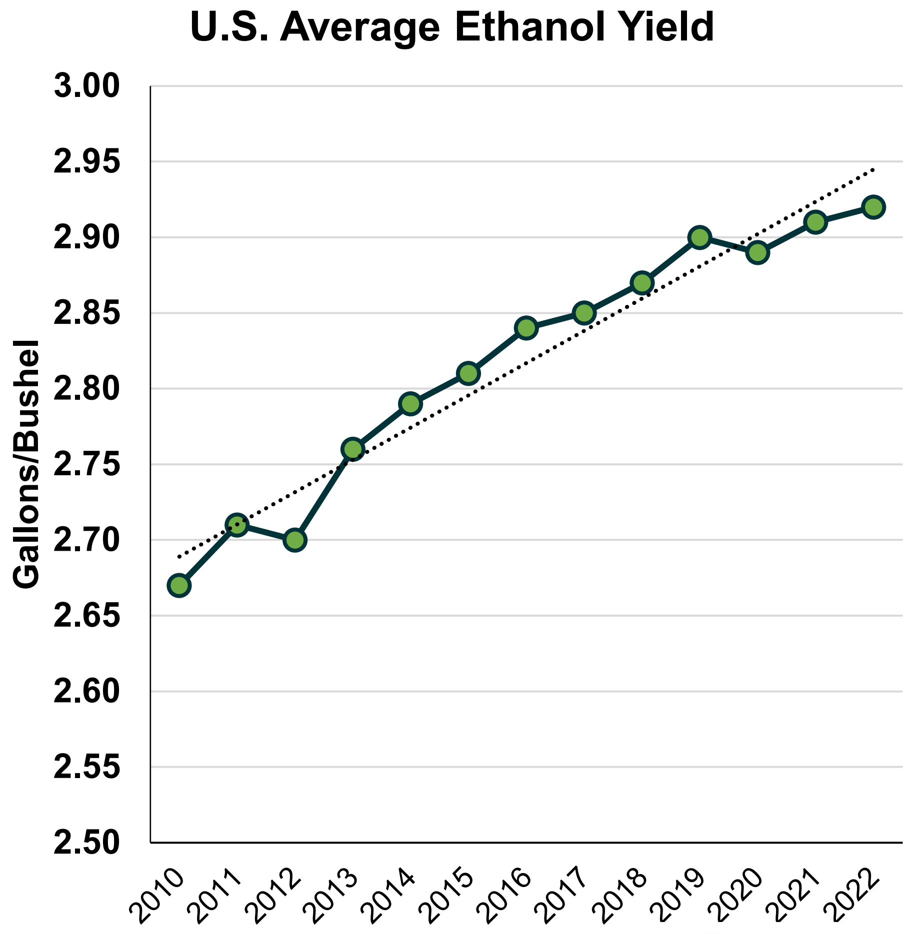
Ethanol biorefineries are also seeing gains in productivity and output per unit of input





Source: USDA, RFA

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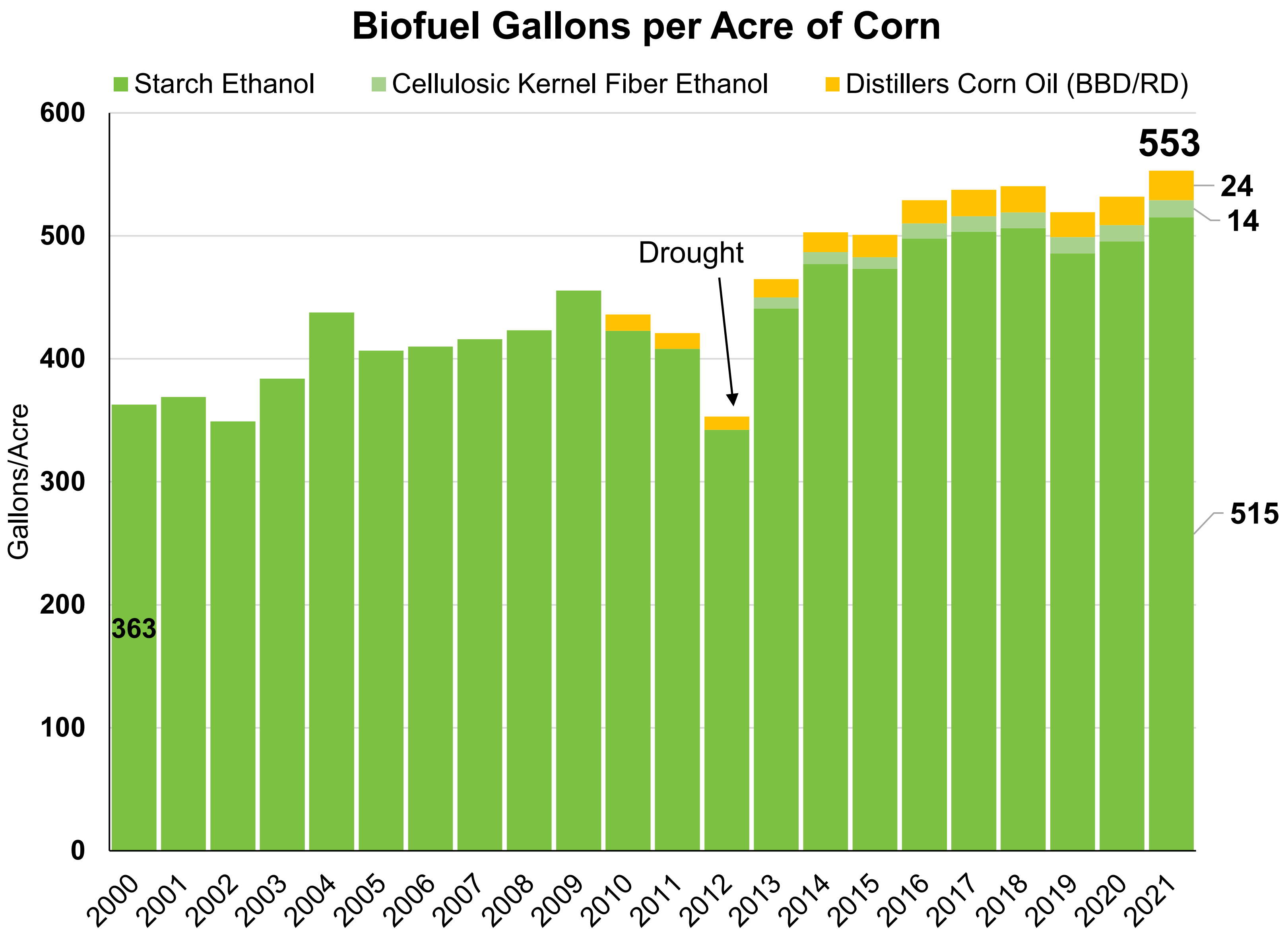

An average acre of corn today can produce 550+ gallons of renewable fuel

- Due to growth in both corn yield per acre and ethanol yield per bushel, ethanol per acre has grown 42% since 2000.
- Fiber conversion and corn oil extraction can add another ~40 gallons of advanced biofuel per acre.
- Each acre also produces 1.2-1.4 tons of high-protein animal feed.

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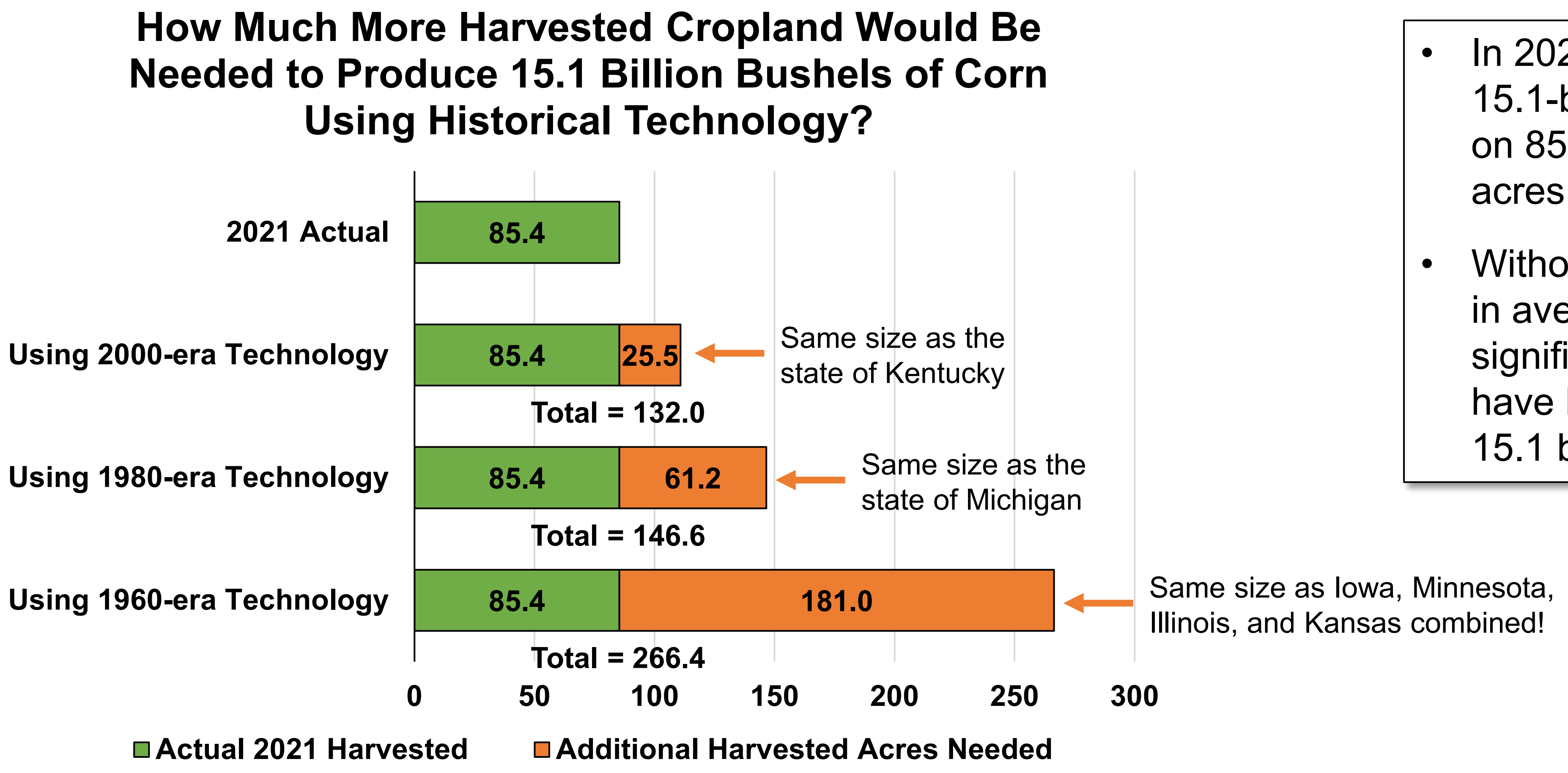
Yield increases have dramatically reduced cropland requirements



- In 2021, farmers produced a 15.1-billion-bushel corn crop on 85.4 million harvested acres (93.4 million planted)
- Without the tremendous gains in average yield per acre, significantly more land would have been needed to produce 15.1 billion bushels.

Source: Calculations based on USDA data. 2000-era = 1999-2001 average; 1980-era = 1979-1981 average; 1960-era = 1959-1961 average

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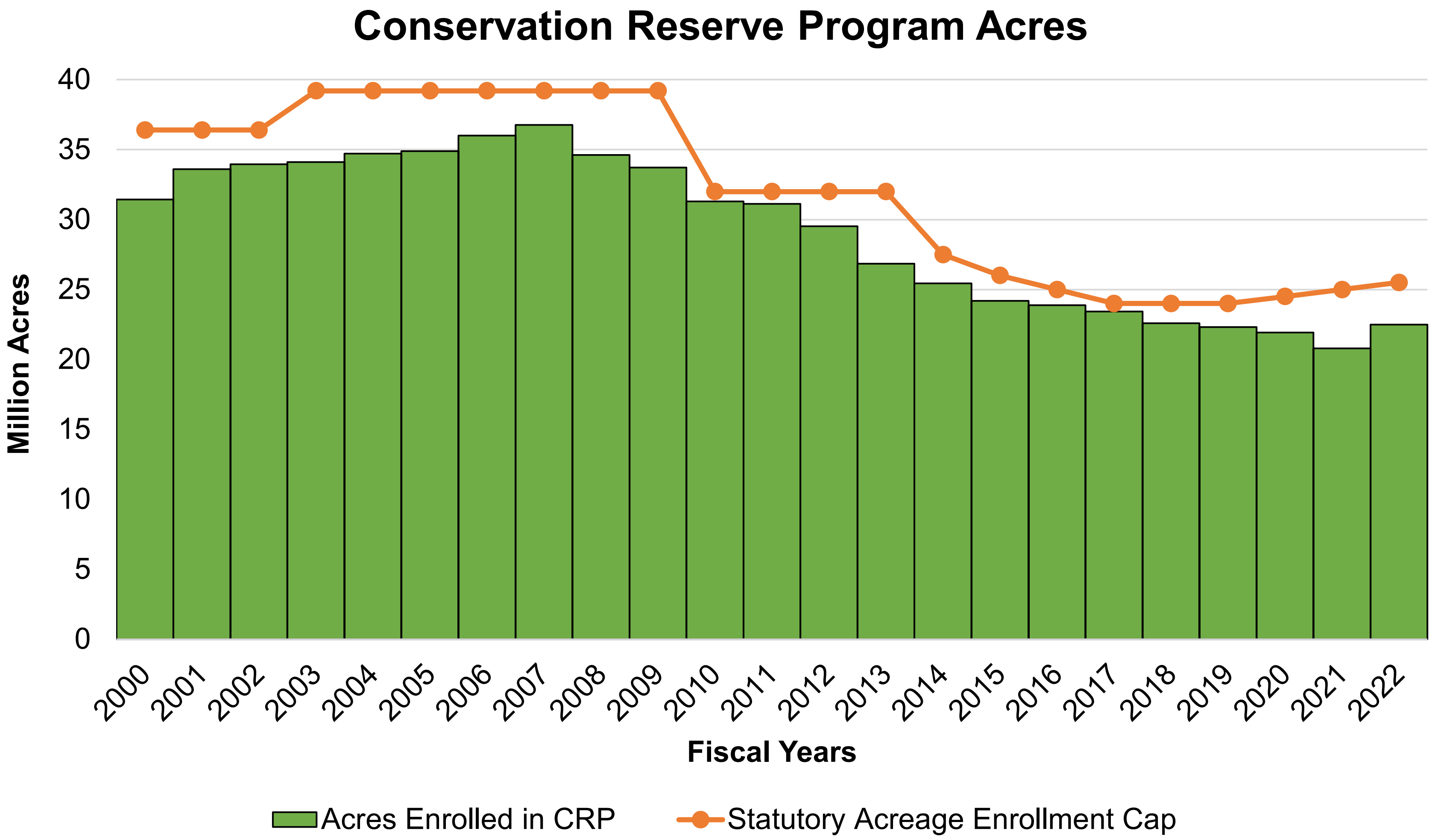
Congress has required reductions in CRP acreage



Source: USDA

- Acres enrolled in the Conservation Reserve Program (CRP) have fallen since peaking in FY 2007 because **Congress has generally reduced the cap on how many acres may be enrolled in CRP**.
- Farmers continue to enroll an amount of land in CRP that is **near the maximum allowed** by Congress.
- Some of the acres previously enrolled in CRP have returned to row crop production, while some of the land is now used for managed pasture or hay production, and some is idle.

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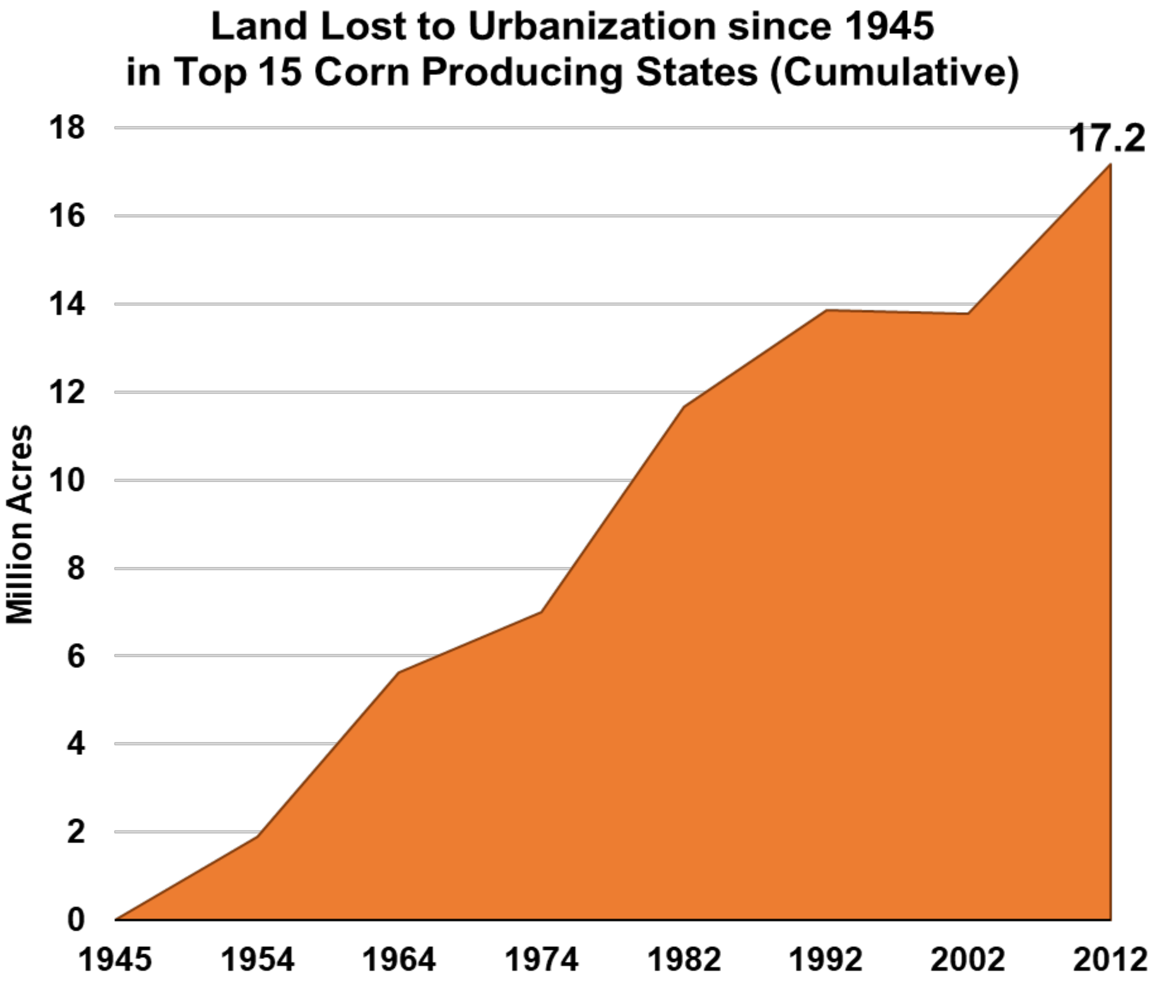
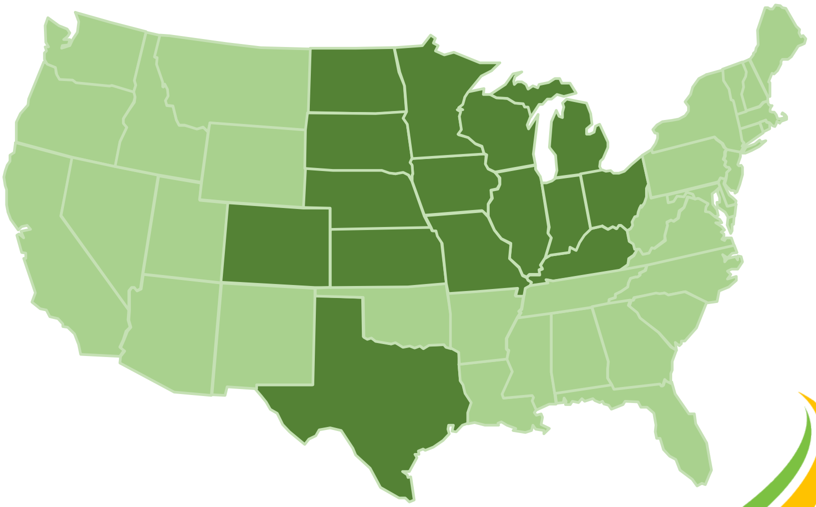
Large amounts of cropland have been lost to urban development in top corn producing states



Source: USDA Census of Agriculture

- The top 15 corn producing states (responsible for 92% of corn production) **lost more than 17 million acres** of land to urbanization between 1945 and 2012.
- Most of the land lost was previously productive cropland.
- 17 million acres is equal to about 20% of the amount of cropland planted to corn, representing 3 billion bushels of corn production that could be made into 8.6 billion gallons of ethanol and more than 20 million tons of distillers grains.



Top 15 Corn Producing States

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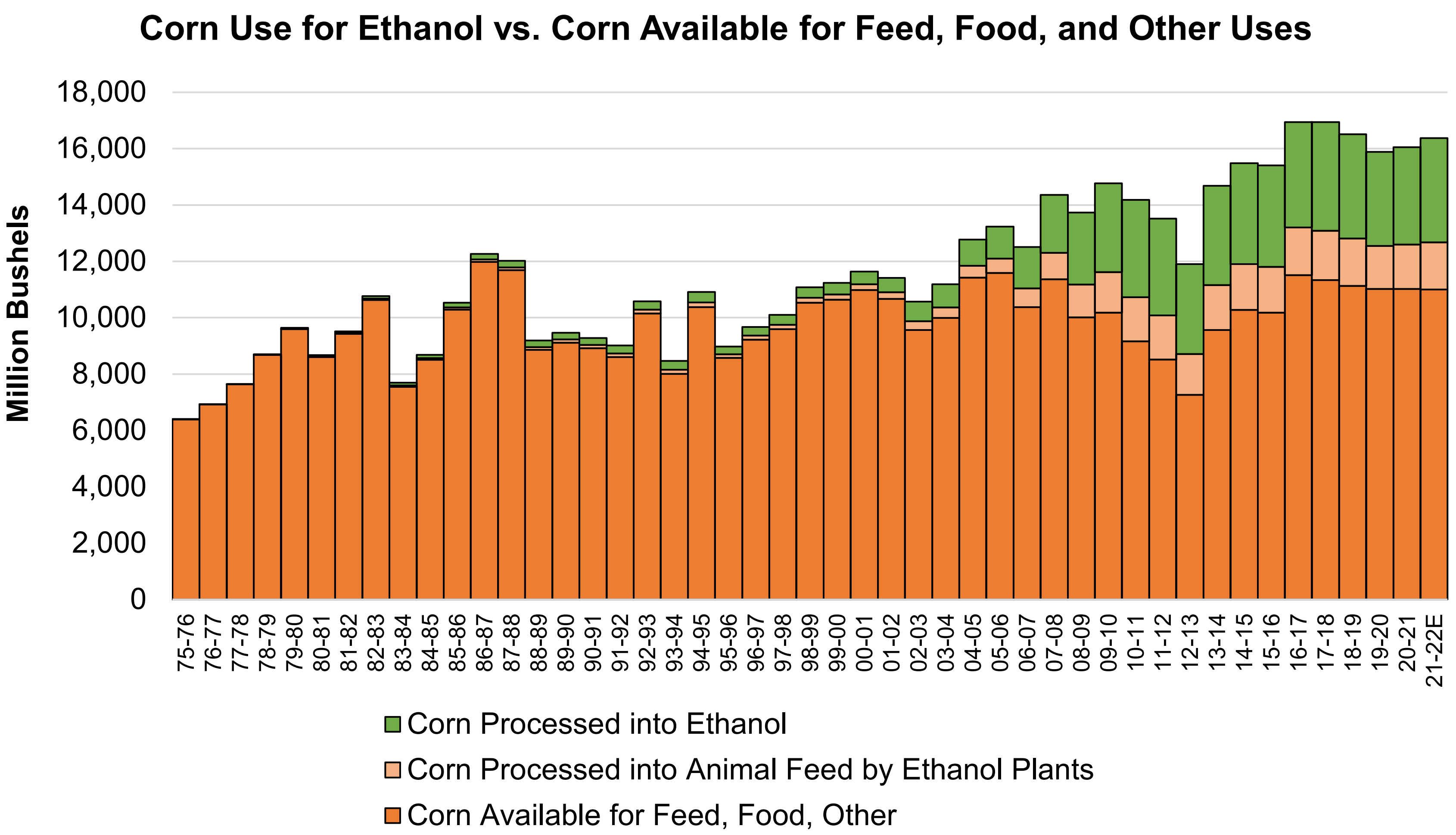
Ethanol expansion has *not* reduced the amount of corn available for feed and food



- One-third of the corn processed by ethanol plants becomes high-protein animal feed (DDGS).
- Only the starch portion of the corn becomes ethanol.
- The ethanol industry provides a value-added market for the additional corn production that results from increases in efficiency.
- Ethanol does not reduce the amount of corn available for feed, food, exports, and other uses.
- The amount of corn (incl. DDGS) available for feed, food, and other non-ethanol uses has been the highest on record in the past six years.

Source: Calculations based on USDA data

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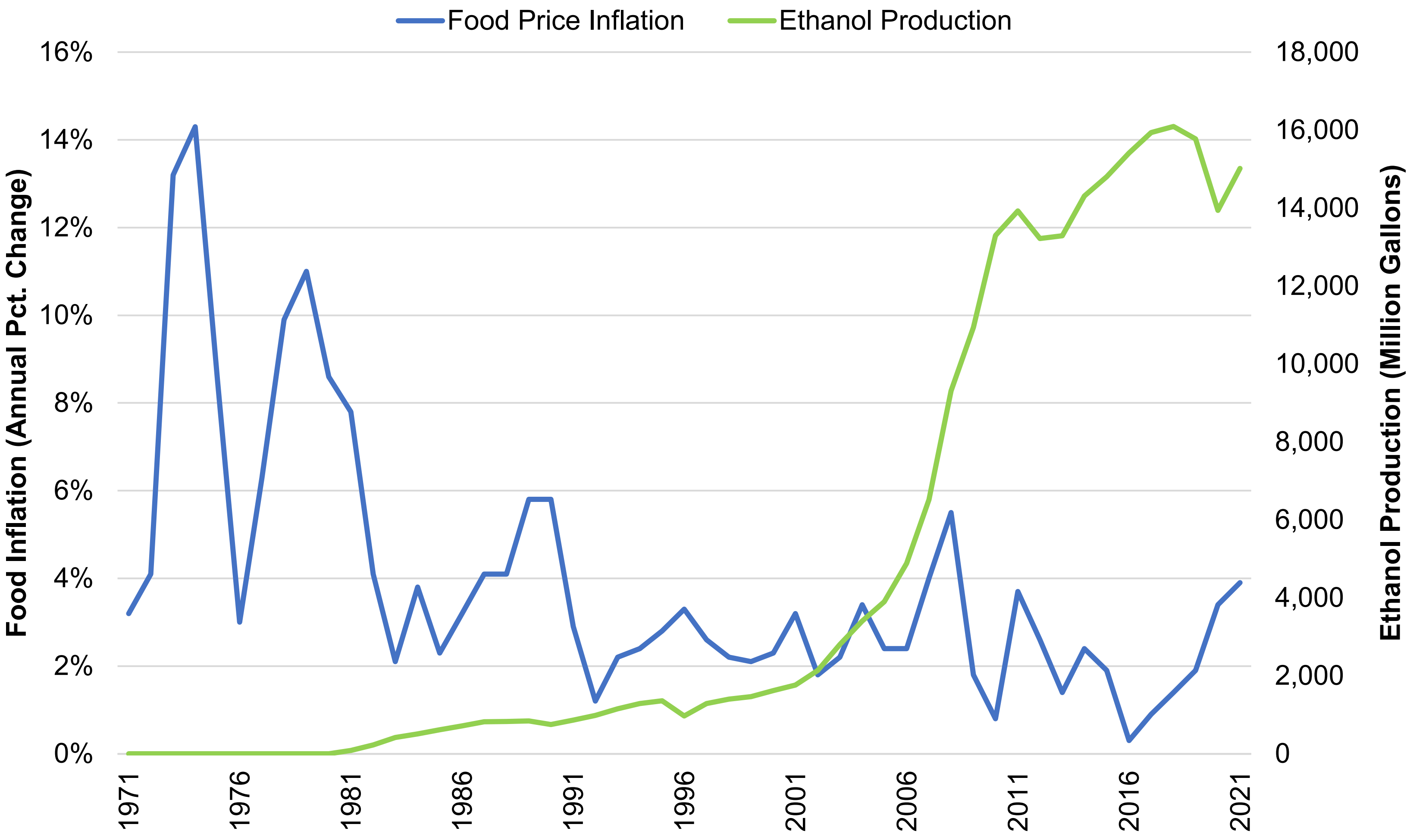
U.S. Consumer Food Price Inflation Is Not Correlated With Ethanol Production



Sources: Bureau of Labor Statistics (Inflation), Energy Information Administration (Ethanol Volumes)

- Over the last four decades, **consumer food price inflation trended downward** until recently, even as **ethanol production expanded dramatically.**
- Ethanol has **not been a significant driver** of food inflation. This is due in part to the fact that ethanol has only a **modest impact on corn prices**, and **corn prices have a miniscule effect on retail food prices**.
- In addition, nearly **one-third of each bushel** processed is **returned as coproducts to the livestock and poultry feed market**.

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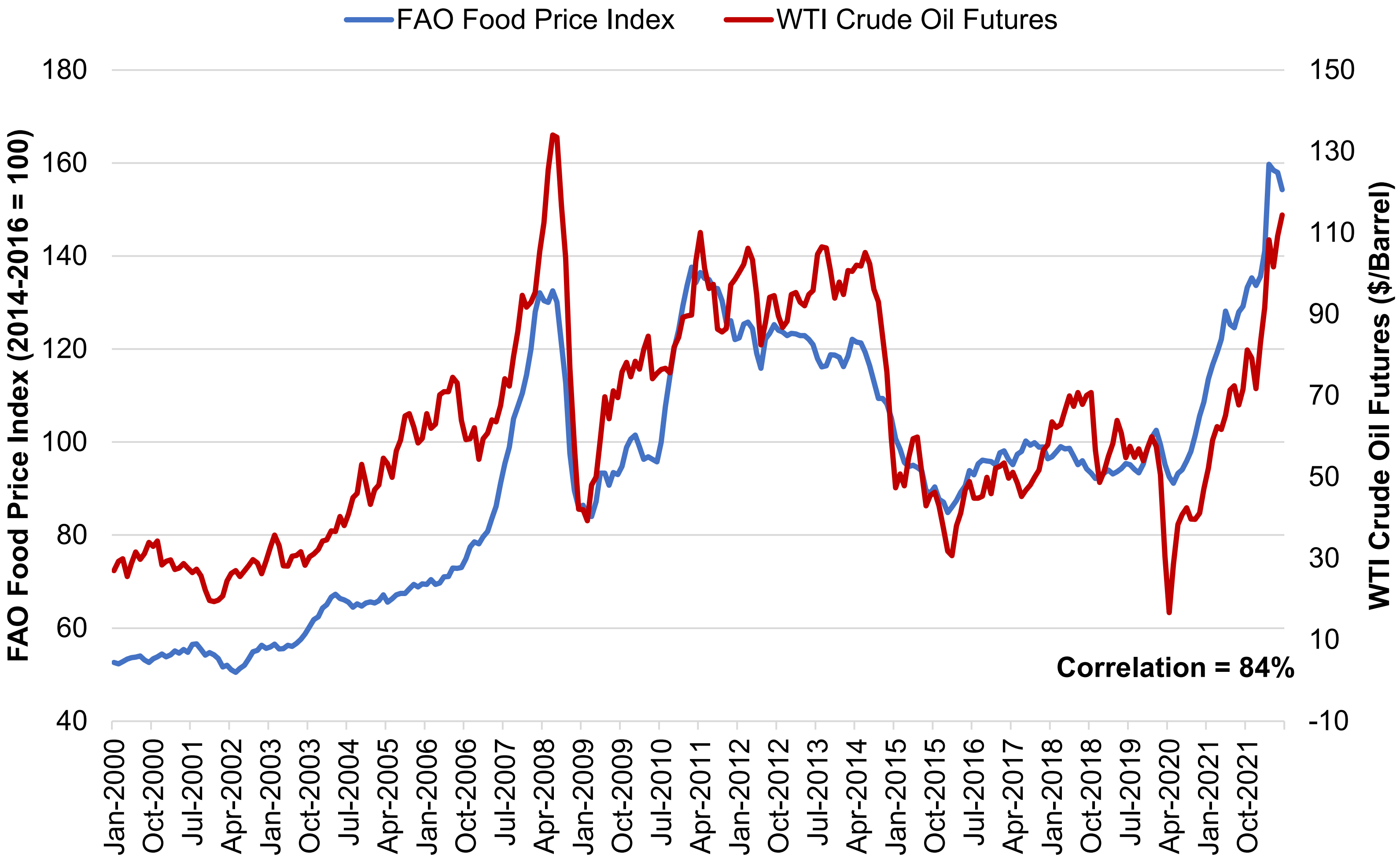
Prices of Global Food Commodities Are Highly Correlated With Crude Oil Prices



- **Fuel is used extensively in all segments of the food supply chain**, to power tractors and combines on farms, transport crops and livestock, run processing and packaging operations, and distribute food to grocery stores and restaurants.
- It is also used to **ship crops and processed products to overseas markets**.

Sources: UN Food and Agriculture Organization (Food Prices), Energy Information Administration (Crude Oil Prices)

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