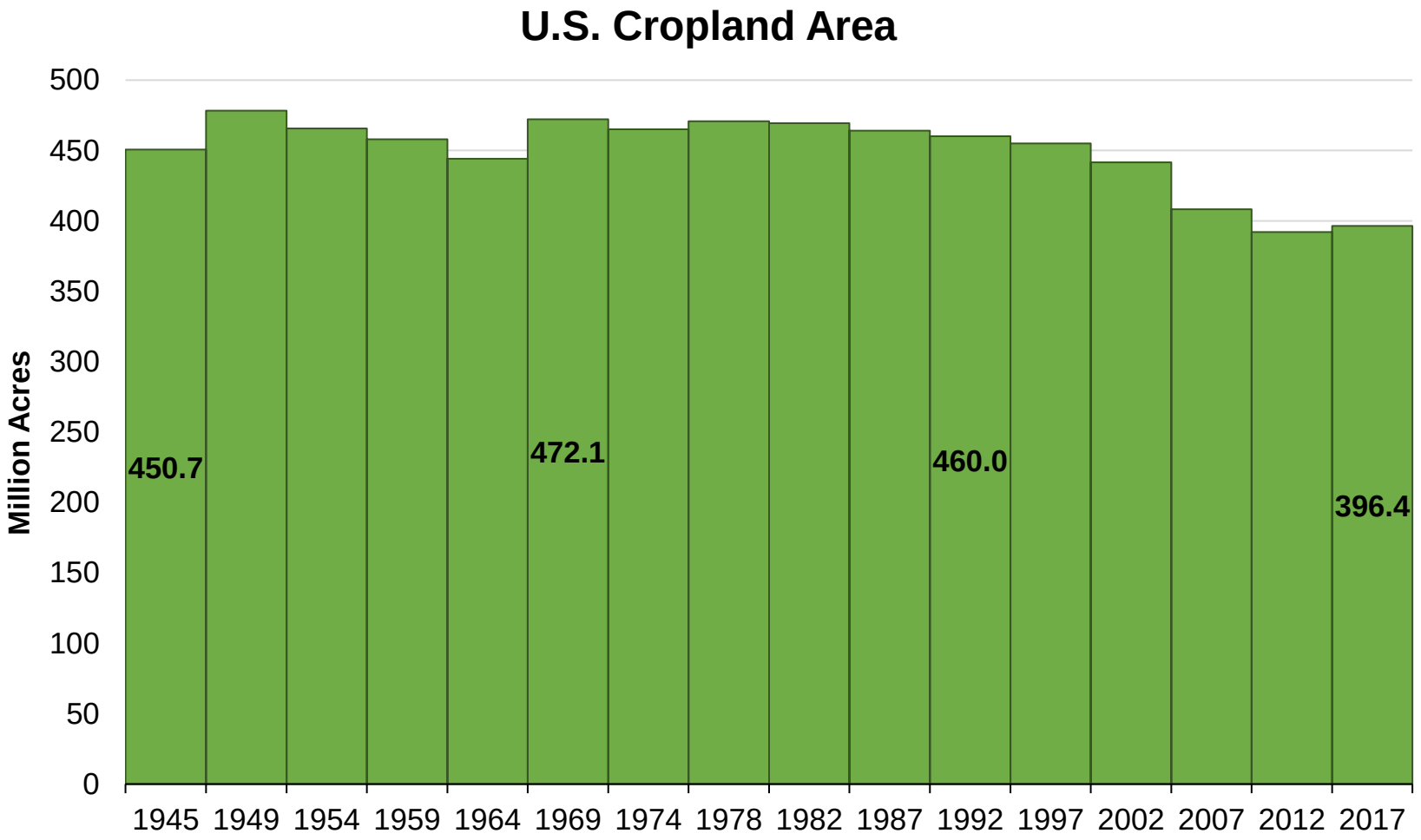
Thinking Clearly About Agricultural Land Use, Productivity Gains, and the Impact of Ethanol Expansion

Renewable Fuels Association

July 2023

RFA
RENEWABLE FUELS ASSOCIATION

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

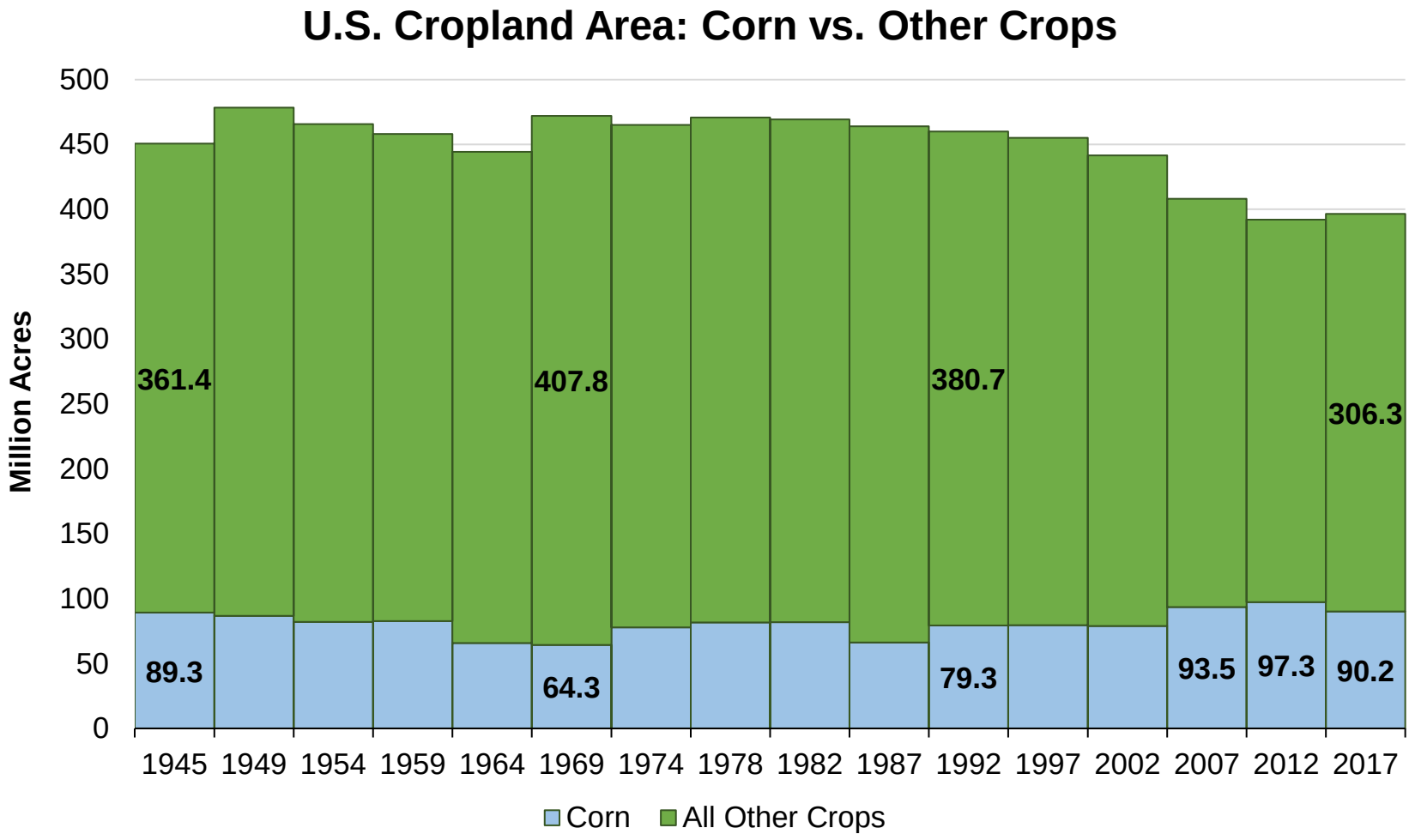


Source: USDA Census of Agriculture (2022 data not yet available)

- 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.

RFA
RENEWABLE FUELS ASSOCIATION

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

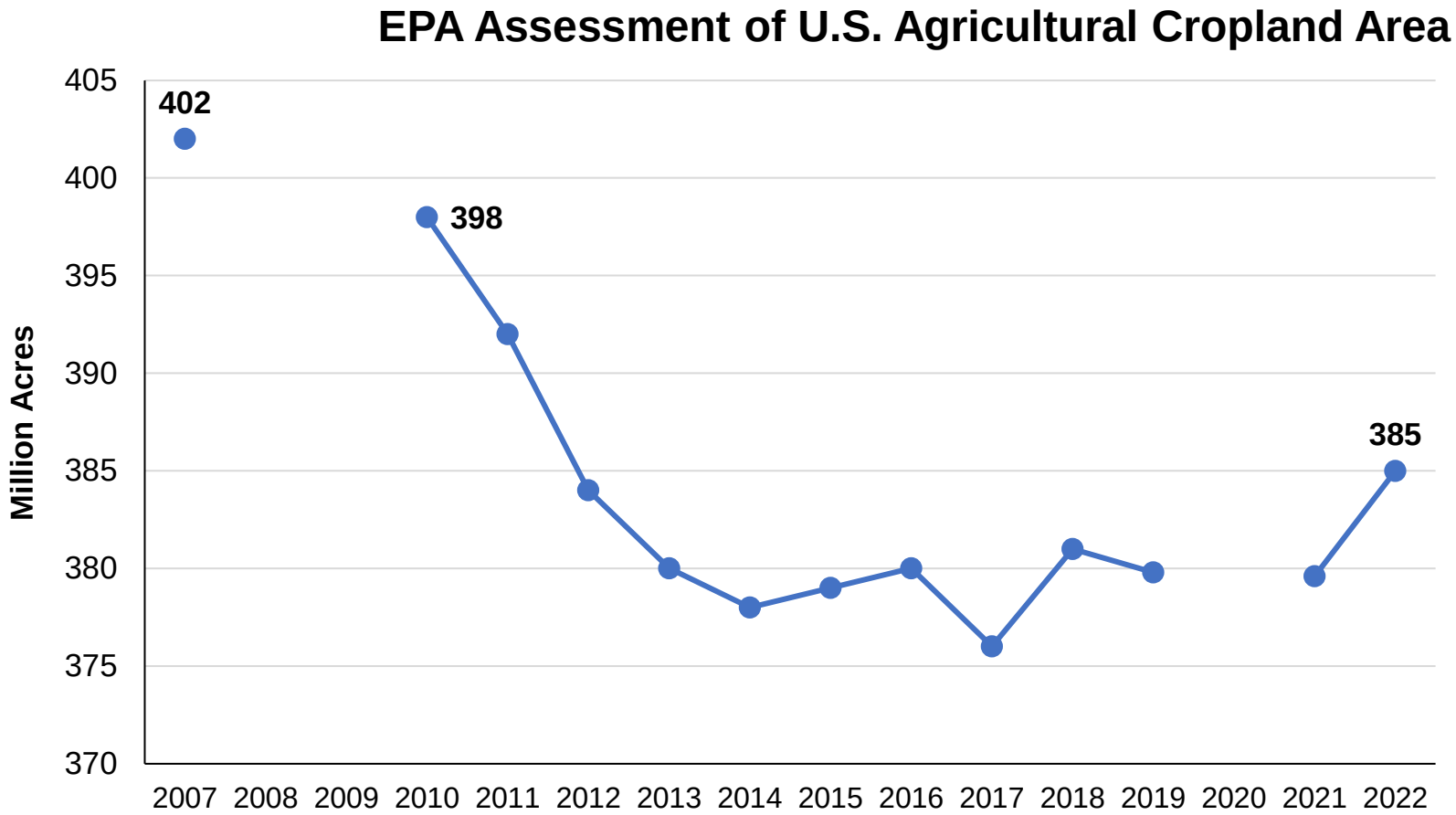


- In recent years, corn has accounted for roughly 20% of U.S. cropland.
- Acres planted to corn in 2017 were nearly identical to the amount of land planted to corn in 1945 (less than 1 million acres difference).
- Acres planted to wheat, cotton, oats, sorghum, barley and other crops have trended lower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

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

RFA
RENEWABLE FUELS ASSOCIATION

EPA data show ~20-million-acre reduction in agricultural cropland since 2007

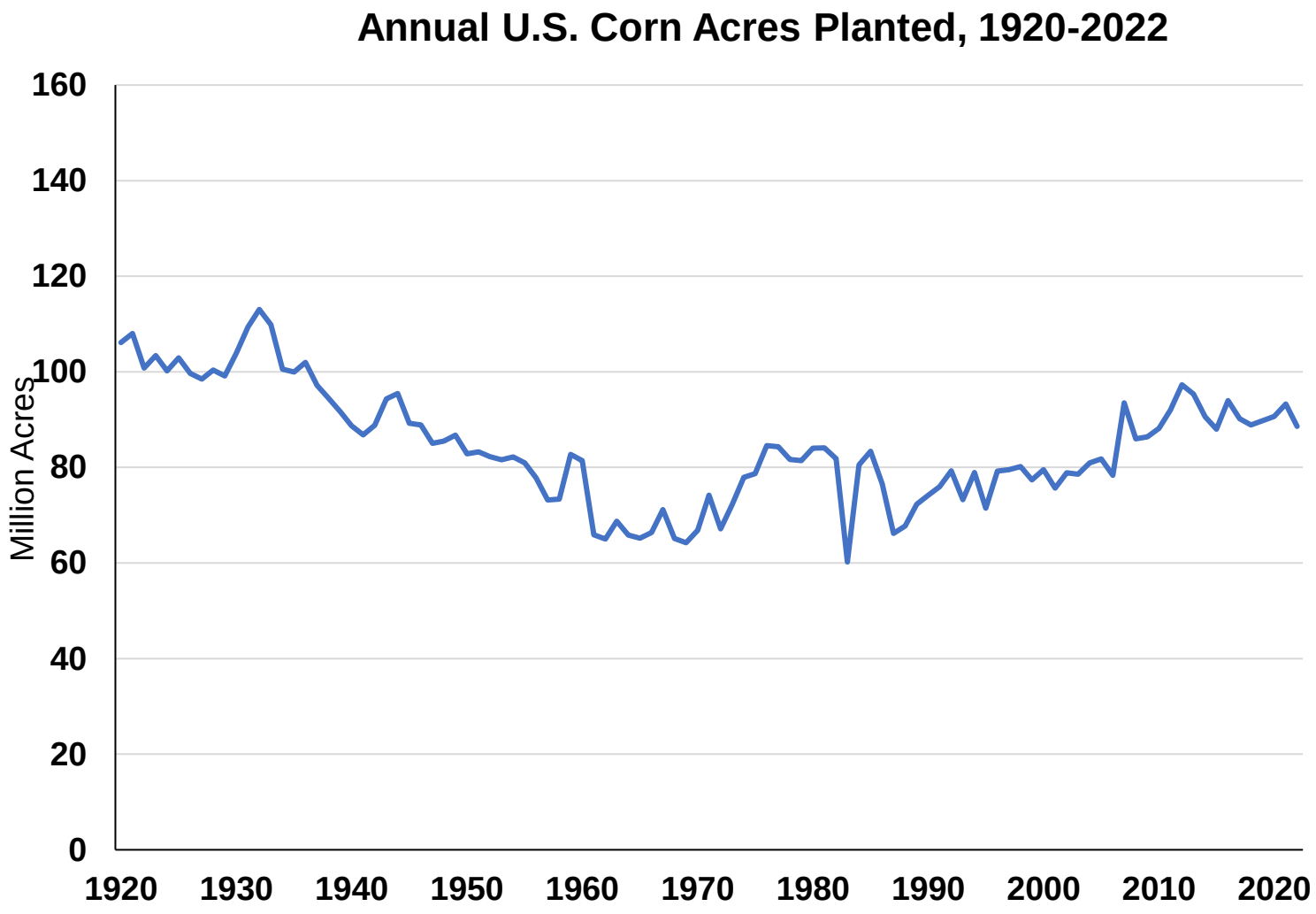


- The 2007 law establishing the expanded RFS **prohibits** ethanol producers from using corn or other feedstocks from new cropland "cleared or cultivated" after 2007.
- To ensure compliance, U.S. EPA tracks agricultural cropland area annually using USDA data. The data show **no expansion** of U.S. cropland from 2007 levels.
- In fact, U.S. EPA analysis shows a **decrease** in agricultural cropland between 2007 and 2022.

RFA
RENEWABLE FUELS ASSOCIATION

Source: U.S. EPA

Fewer corn acres today than in 1920s-1930s

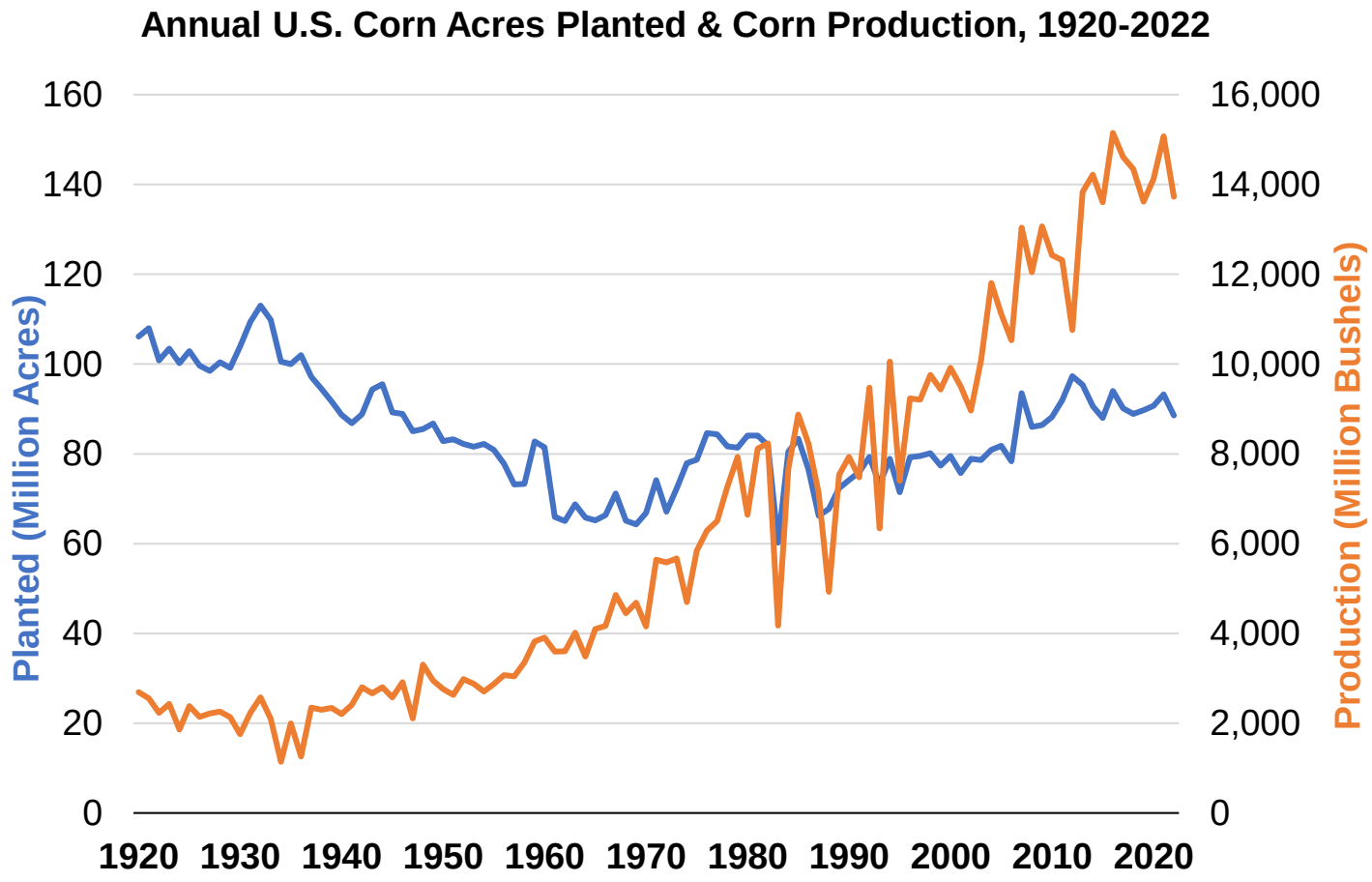


- Over the past 100 years, acres planted to corn have averaged ~85 million annually.
- Corn acres were well over 100 million in the 1920s and 1930s, peaking at 113 million in 1932.
- Corn acres have generally been in the 85 to 95-million-acre range since the RFS was expanded in 2007, as profitability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

Source: USDA

RFA
RENEWABLE FUELS ASSOCIATION

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

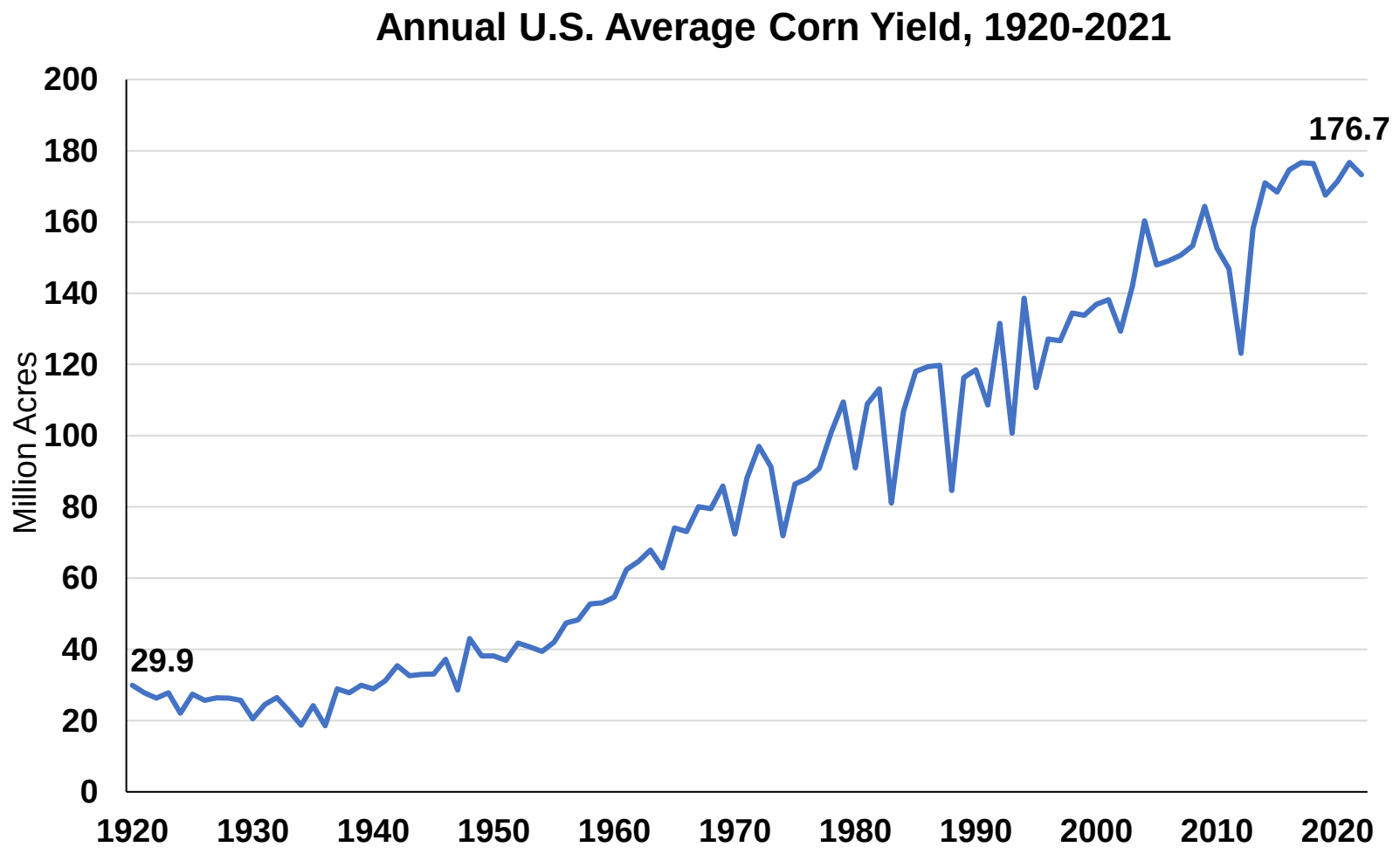


Source: USDA

- 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 91 million planted acres.

RFA
RENEWABLE FUELS ASSOCIATION

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

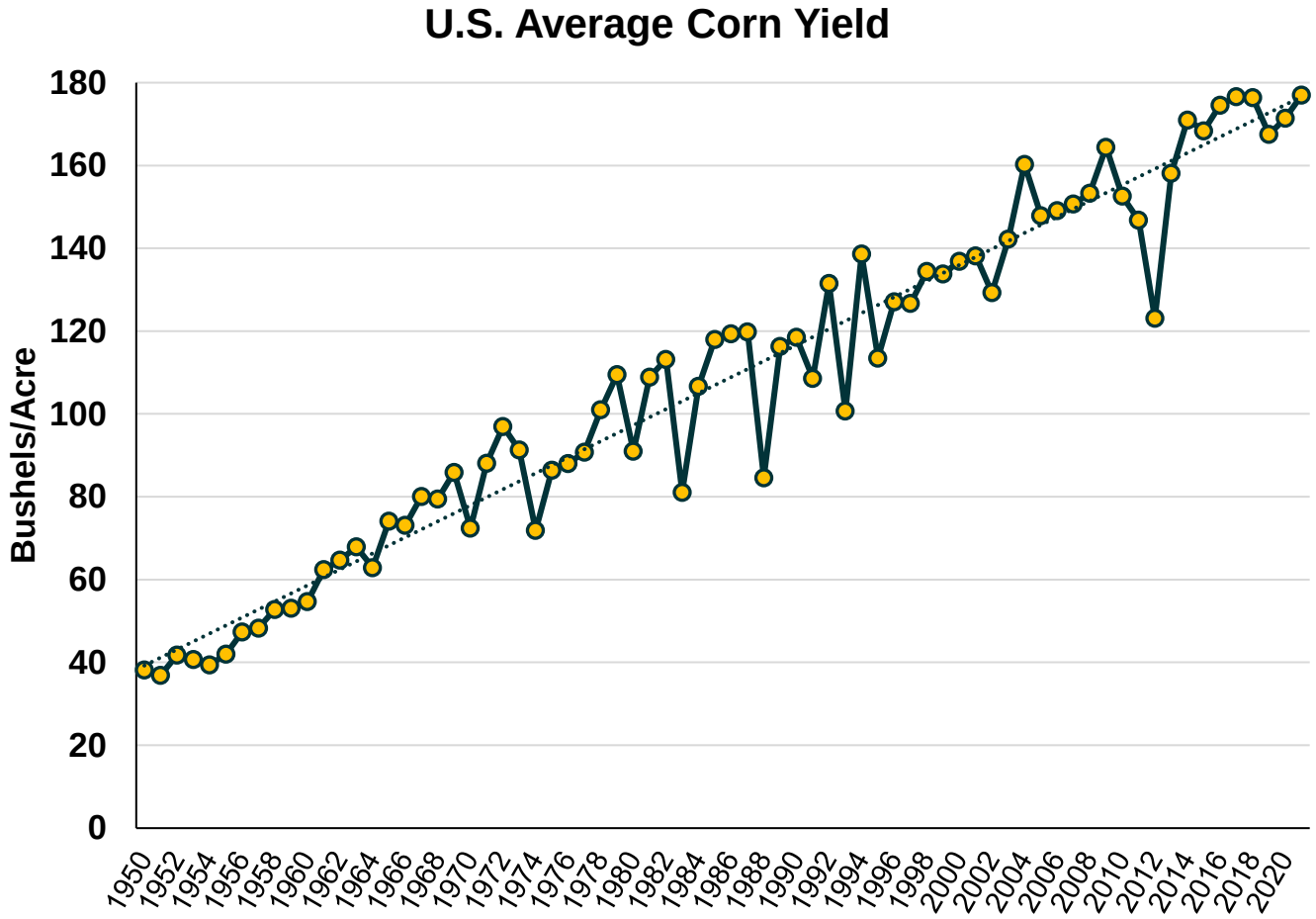


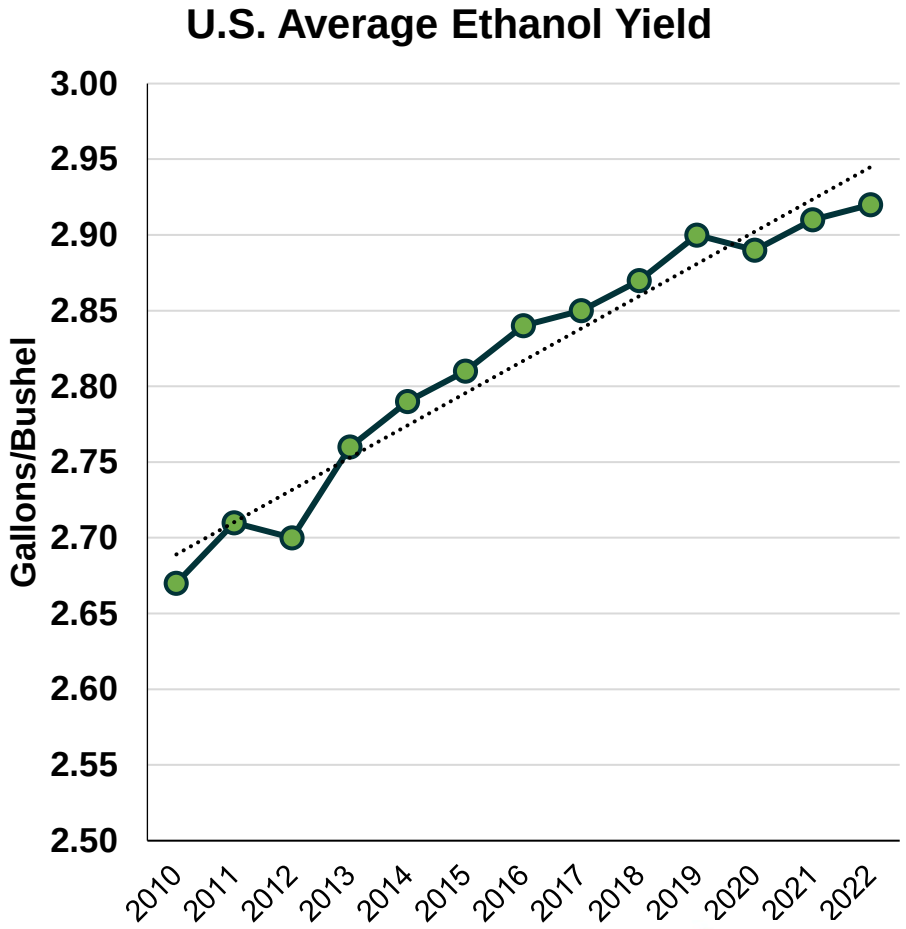
- The average amount of corn produced per acre ("yield") has increased nearly **600%** over the past 100 years.
- A new record average yield of **176.7 bushels per acre** was established in 2021. Each bushel of corn weighs 56 pounds.
- Since 1970, yields have grown an average of **2.7% per year**.

Source: USDA

RFA
RENEWABLE FUELS ASSOCIATION

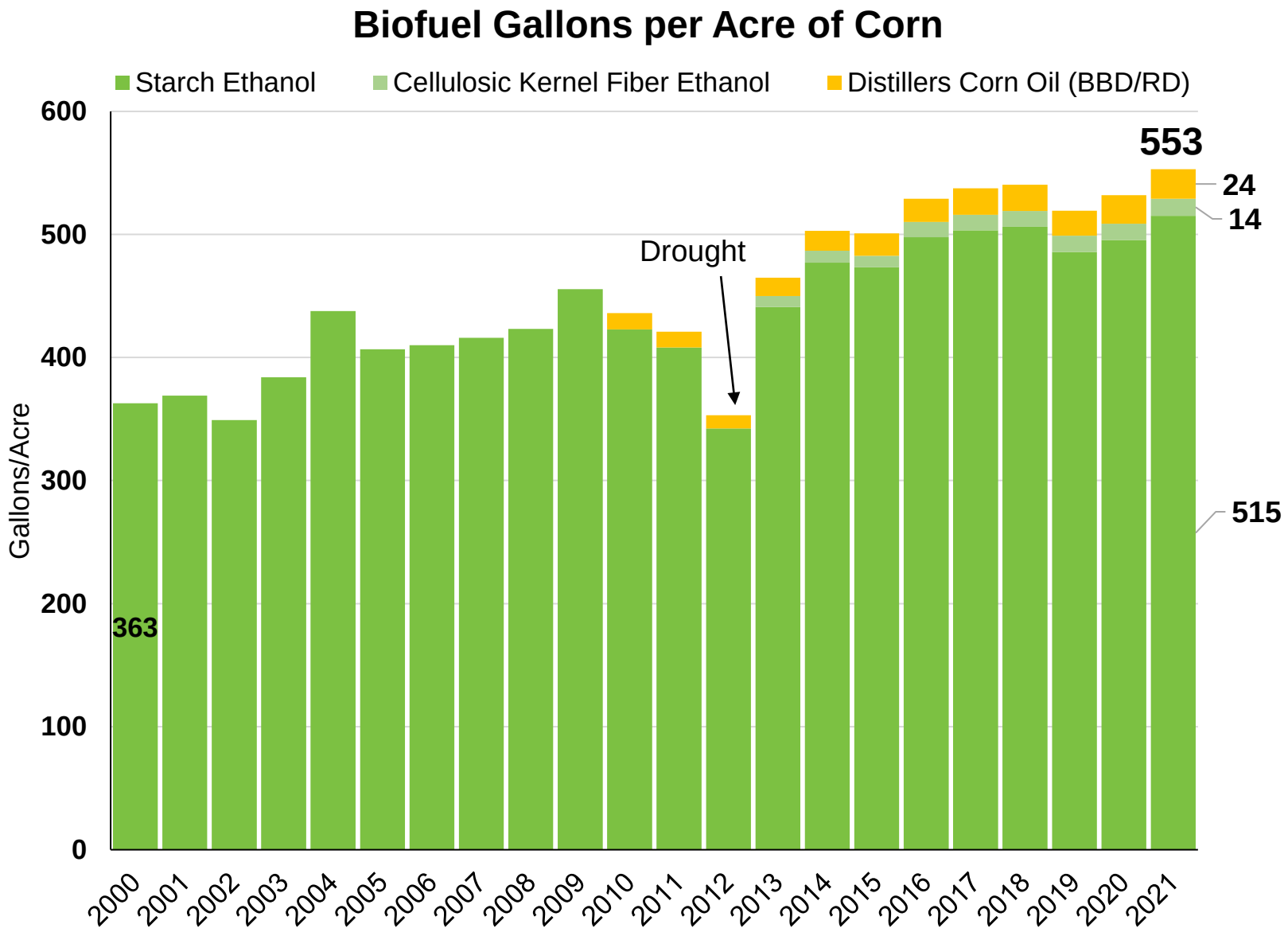
Ethanol biorefineries are also seeing gains in productivity and output per unit of input





Source: USDA, RFA

RFA
RENEWABLE FUELS ASSOCIATION

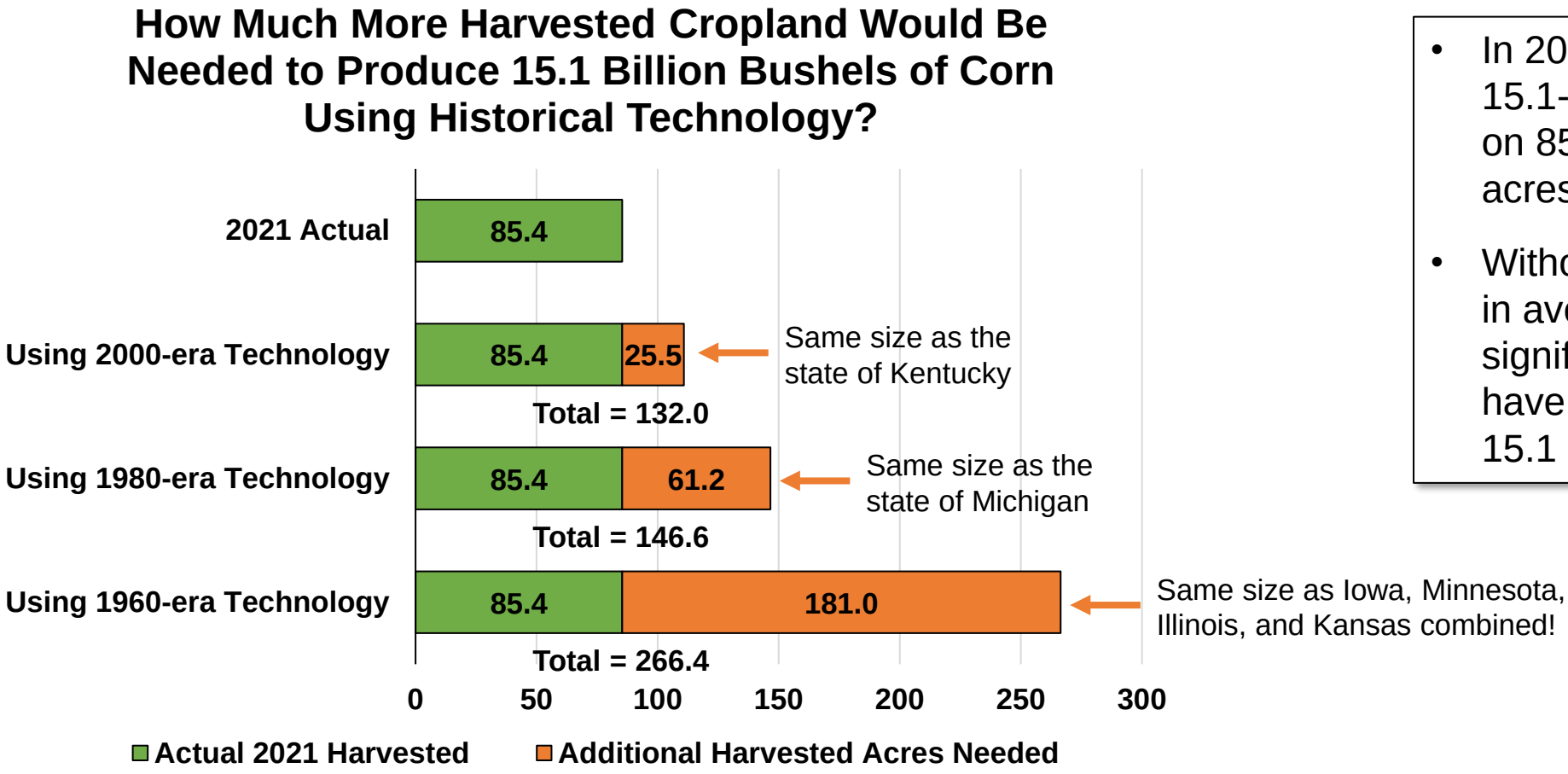


An average acre of corn today can produce 550+ gallons of renewable fuel

- 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.

RFA
RENEWABLE FUELS ASSOCIATION

Yield increases have dramatically reduced cropland requirements

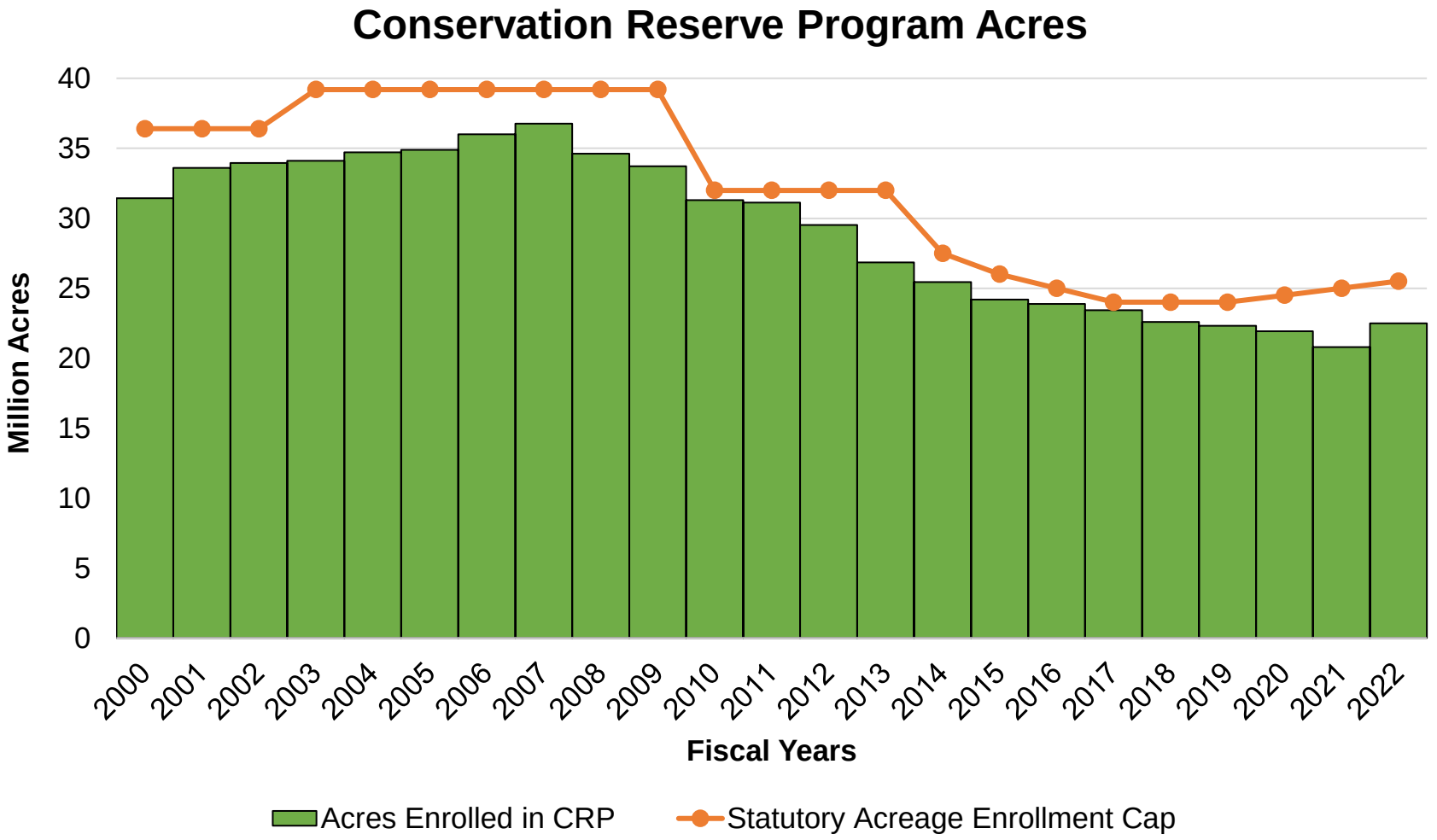


- In 2021, farmers produced a 15.1-billion-bushel corn crop on 85.4 million harvested acres (93.4 million planted)
- Without the tremendous gains in average yield per acre, significantly more land would have been needed to produce 15.1 billion bushels.

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

RFA
RENEWABLE FUELS ASSOCIATION

Congress has required reductions in CRP acreage

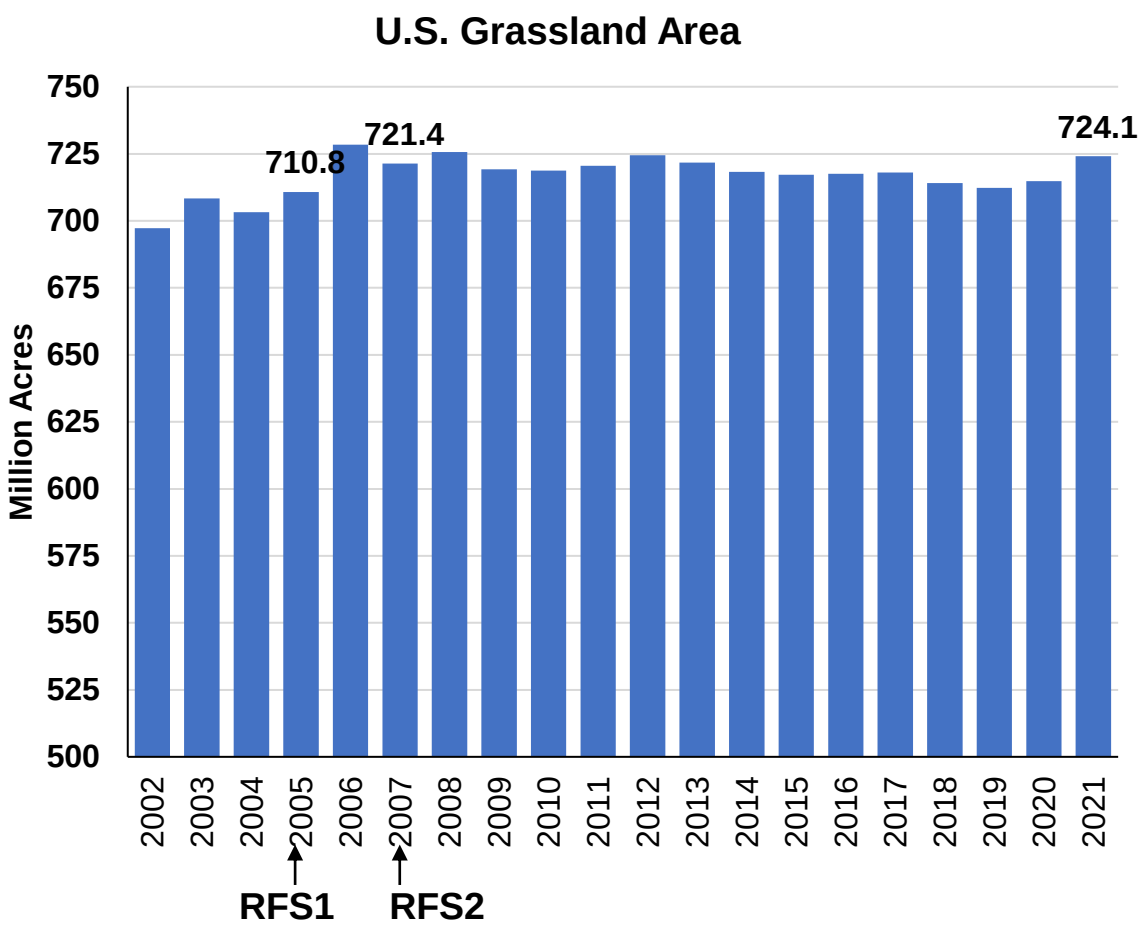


- Acres enrolled in the Conservation Reserve Program (CRP) have fallen since peaking in FY 2007 because **Congress has generally reduced the cap on how many acres may be enrolled in CRP**.
- Farmers continue to enroll an amount of land in CRP that is **near the maximum allowed** by Congress.
- Some of 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.

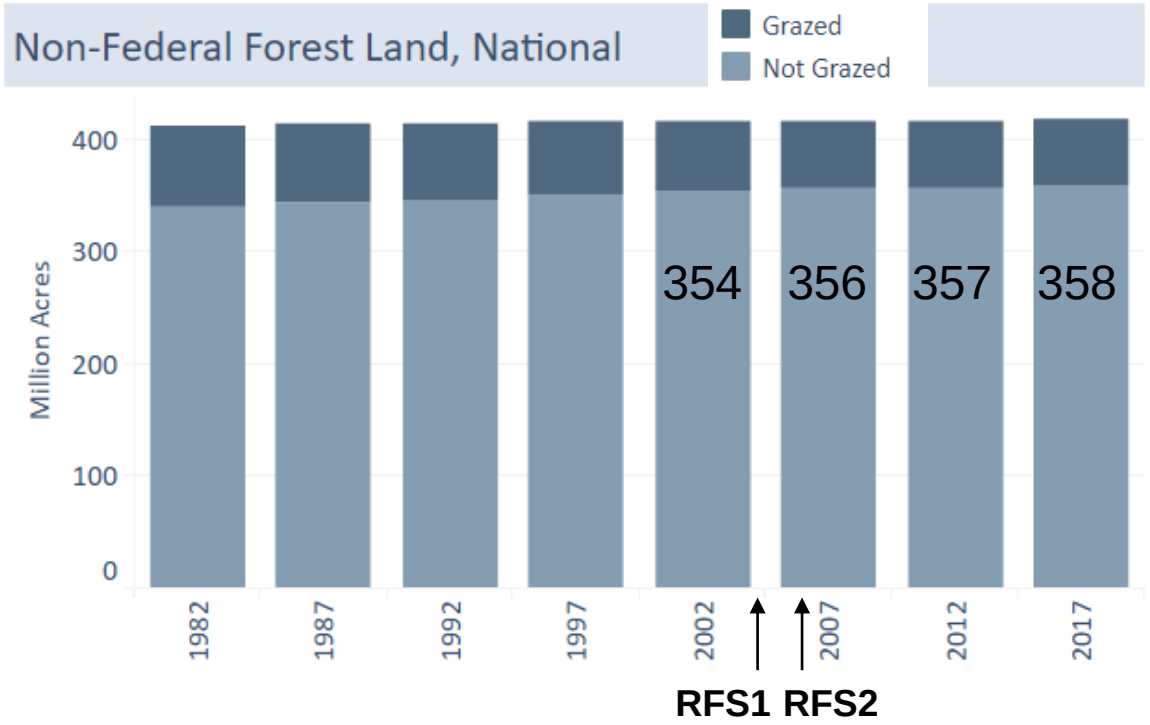
Source: USDA

RFA
RENEWABLE FUELS ASSOCIATION

U.S. grassland and forest land is stable or growing



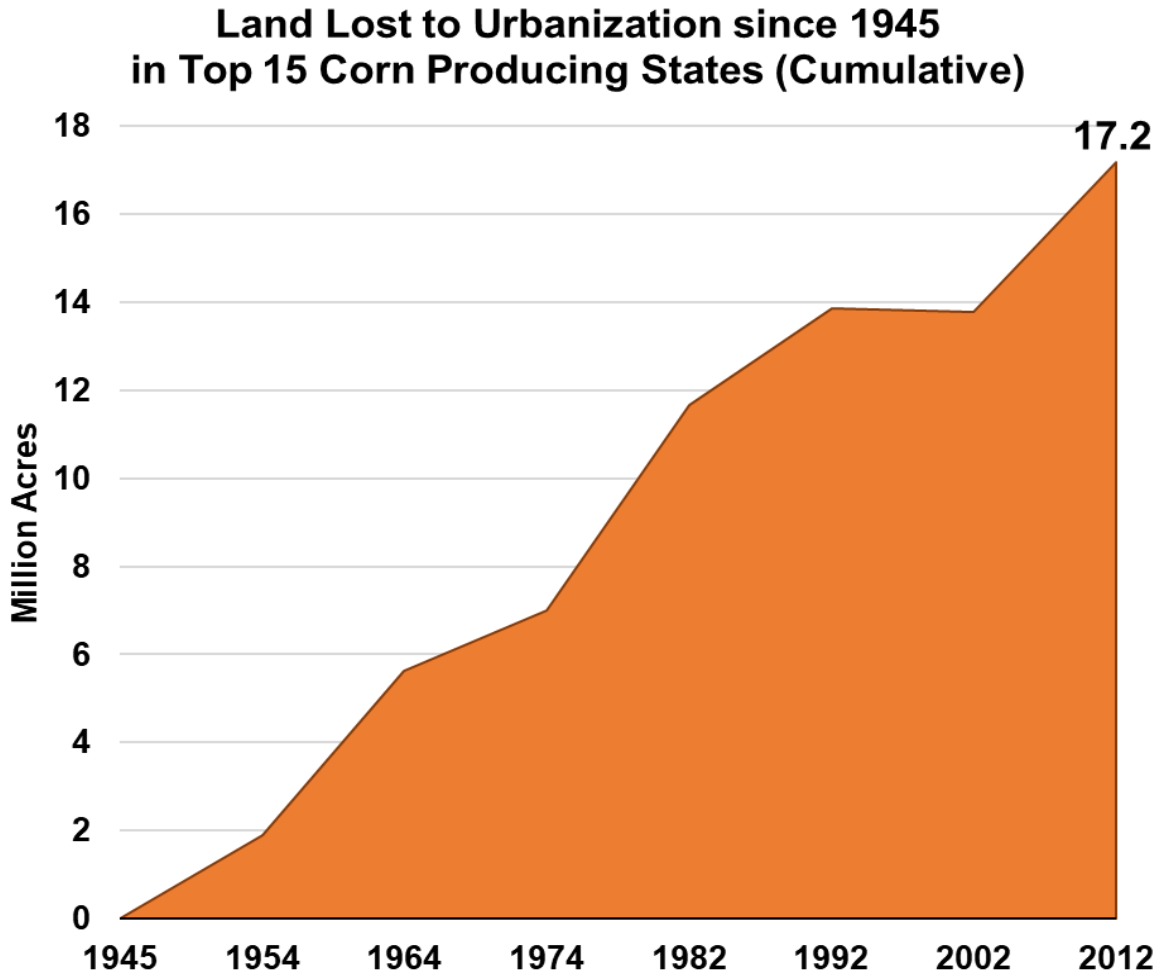
Source: UN Food & Agriculture Organization (using NASA MODIS data)



Source: USDA National Resources Inventory

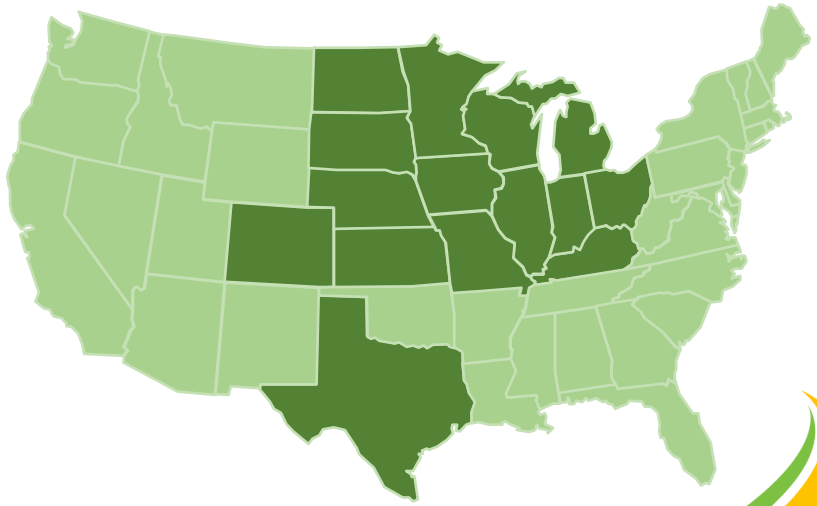
RFA
RENEWABLE FUELS ASSOCIATION

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



Source: USDA Census of Agriculture

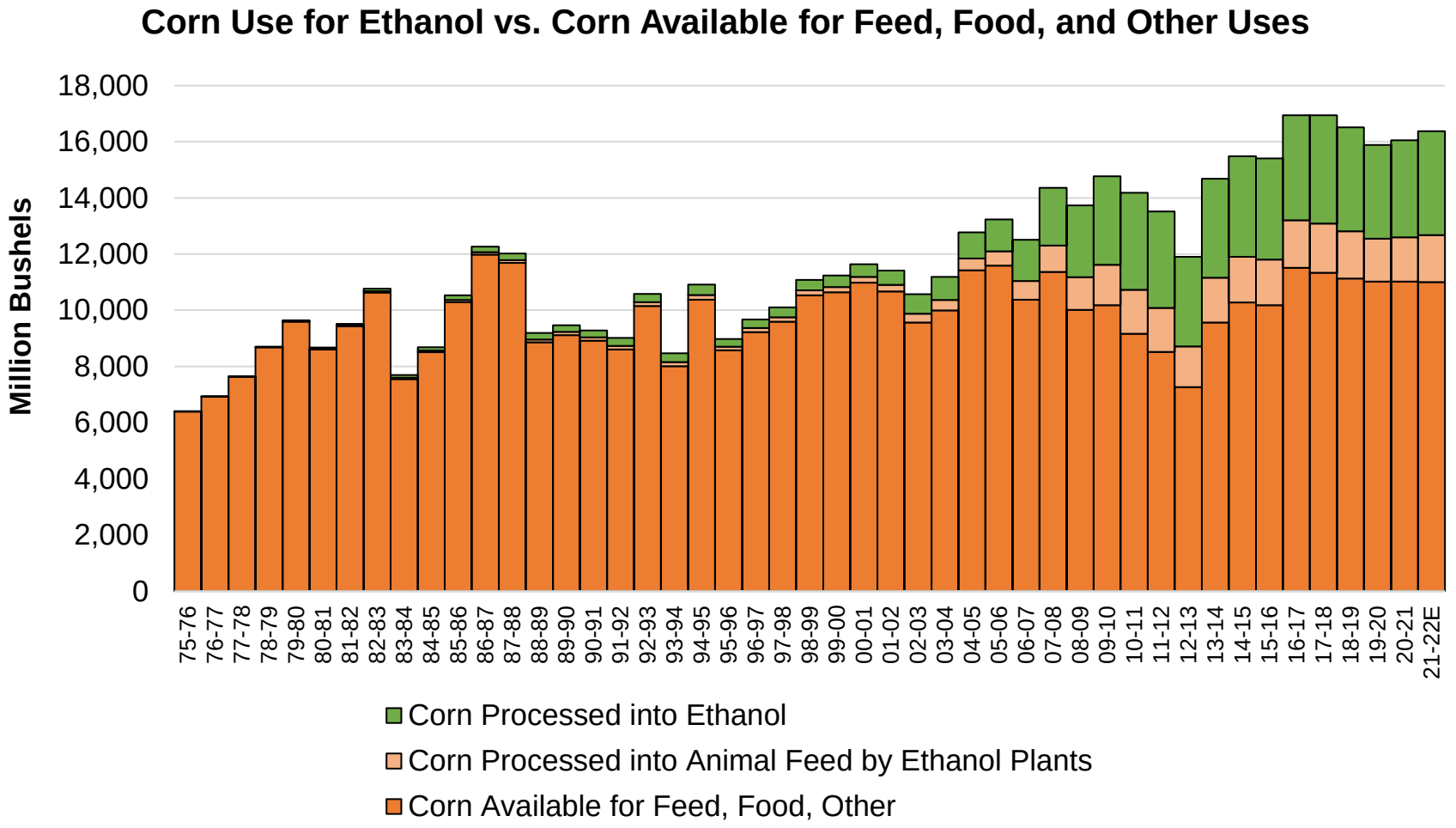
- The top 15 corn producing states (responsible for 92% of corn production) **lost more than 17 million acres** of land to urbanization between 1945 and 2012.
- Much of the land lost was previously productive cropland.
- 17 million acres is equal to about 20% of the amount of cropland planted to corn, 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

RFA
RENEWABLE FUELS ASSOCIATION

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

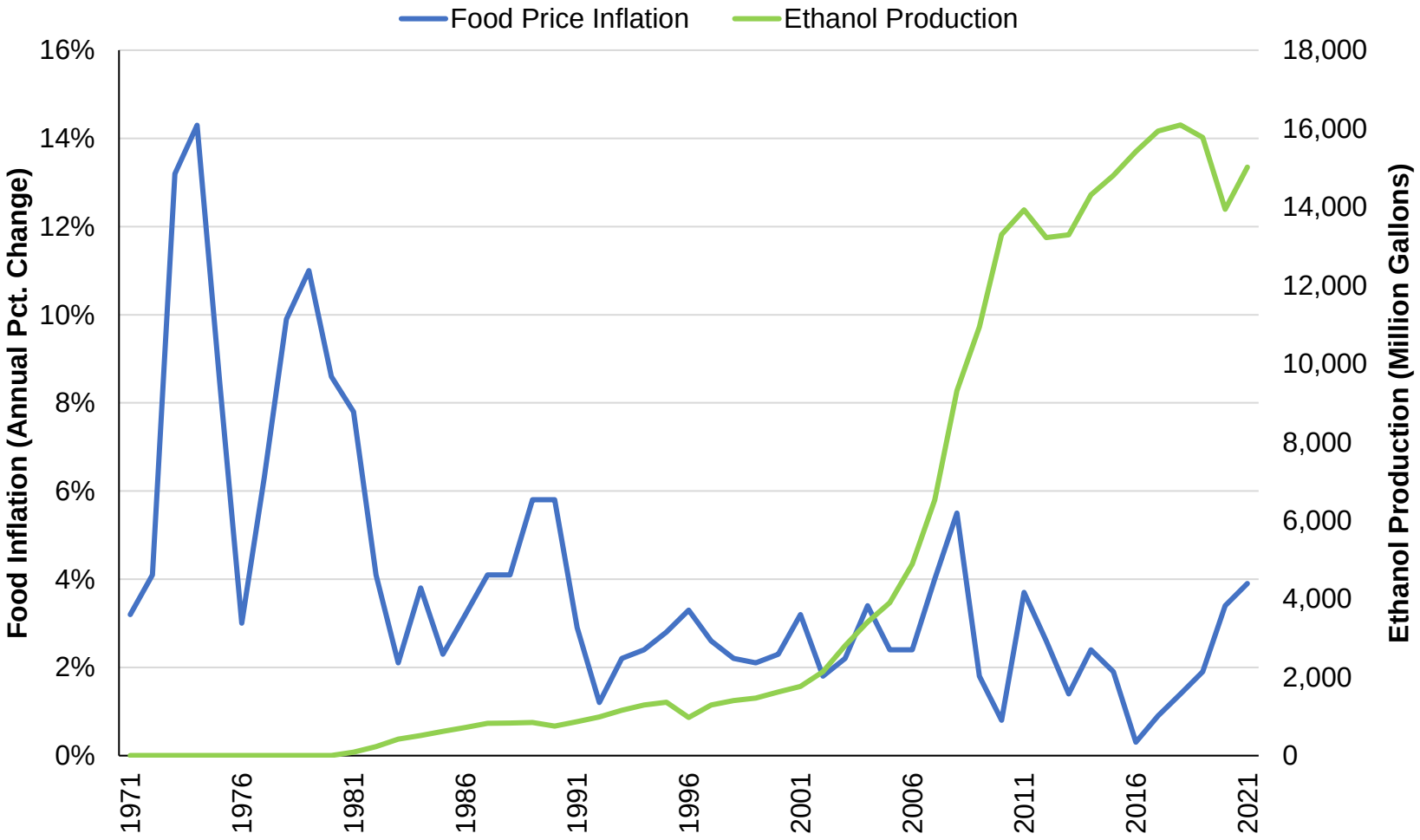


- One-third of the corn processed by ethanol plants becomes high-protein animal feed (DDGS).
- Only the starch portion of the corn becomes ethanol.
- The ethanol industry provides a value-added market for the additional corn production that results from increases in efficiency.
- Ethanol does not reduce 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

RFA
RENEWABLE FUELS ASSOCIATION

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

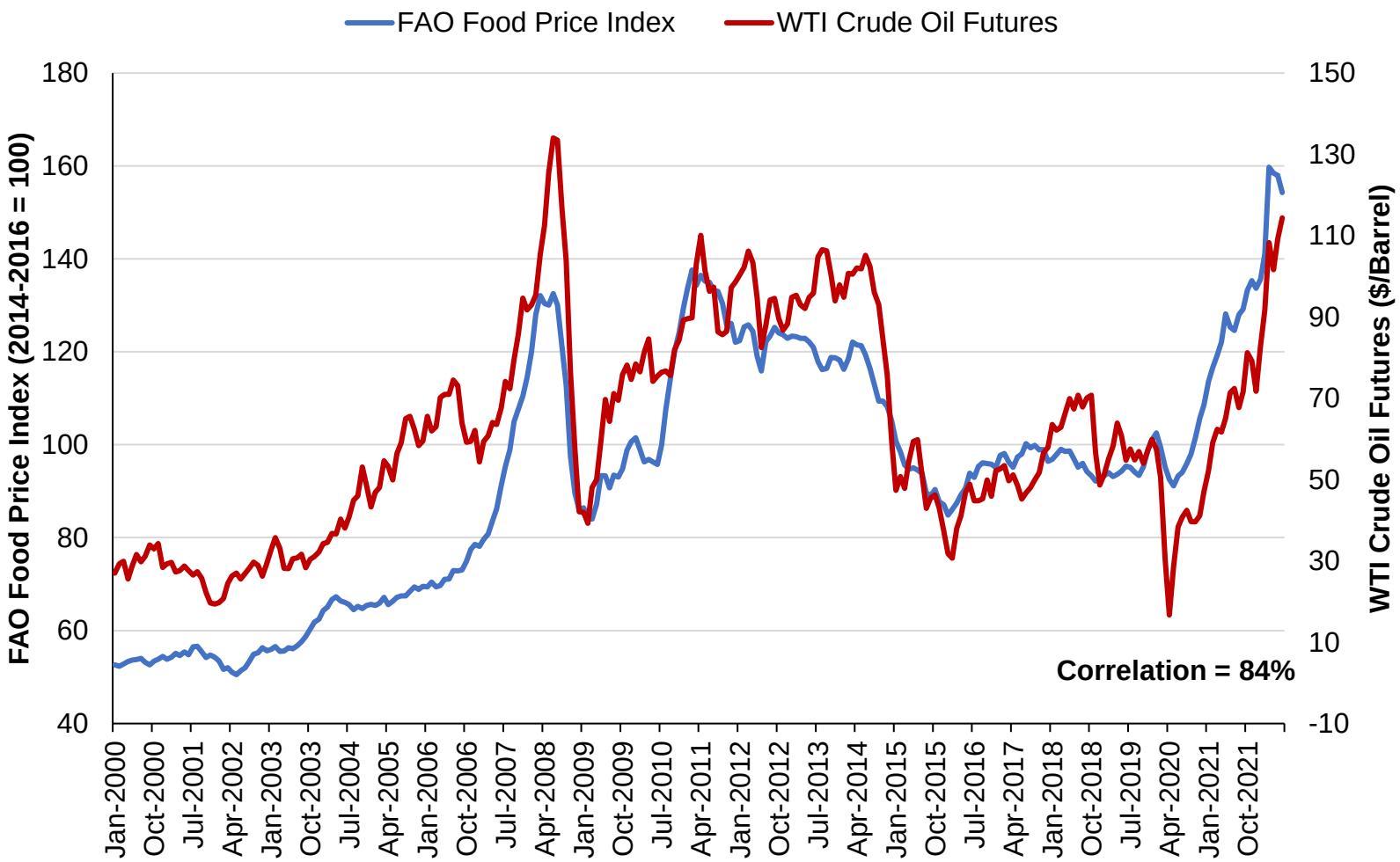


- Over the last four decades, **consumer food price inflation trended downward** until recently, even as **ethanol production expanded dramatically.**
- Ethanol has **not been a significant driver** of food inflation. This is due in part to the fact that ethanol has only a **modest impact on corn prices**, 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**.

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

RFA
RENEWABLE FUELS ASSOCIATION

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)

RFA
RENEWABLE FUELS ASSOCIATION