

# FACTORS CREATING RISK IN U.S. GRAIN MARKETS

WAY TOO EARLY GRAIN MARKET OUTLOOK TO 2050

22<sup>ND</sup> NATIONAL WORKSHOP FOR DAIRY ECONOMISTS & POLICY ANALYSTS | APRIL 30, 2015



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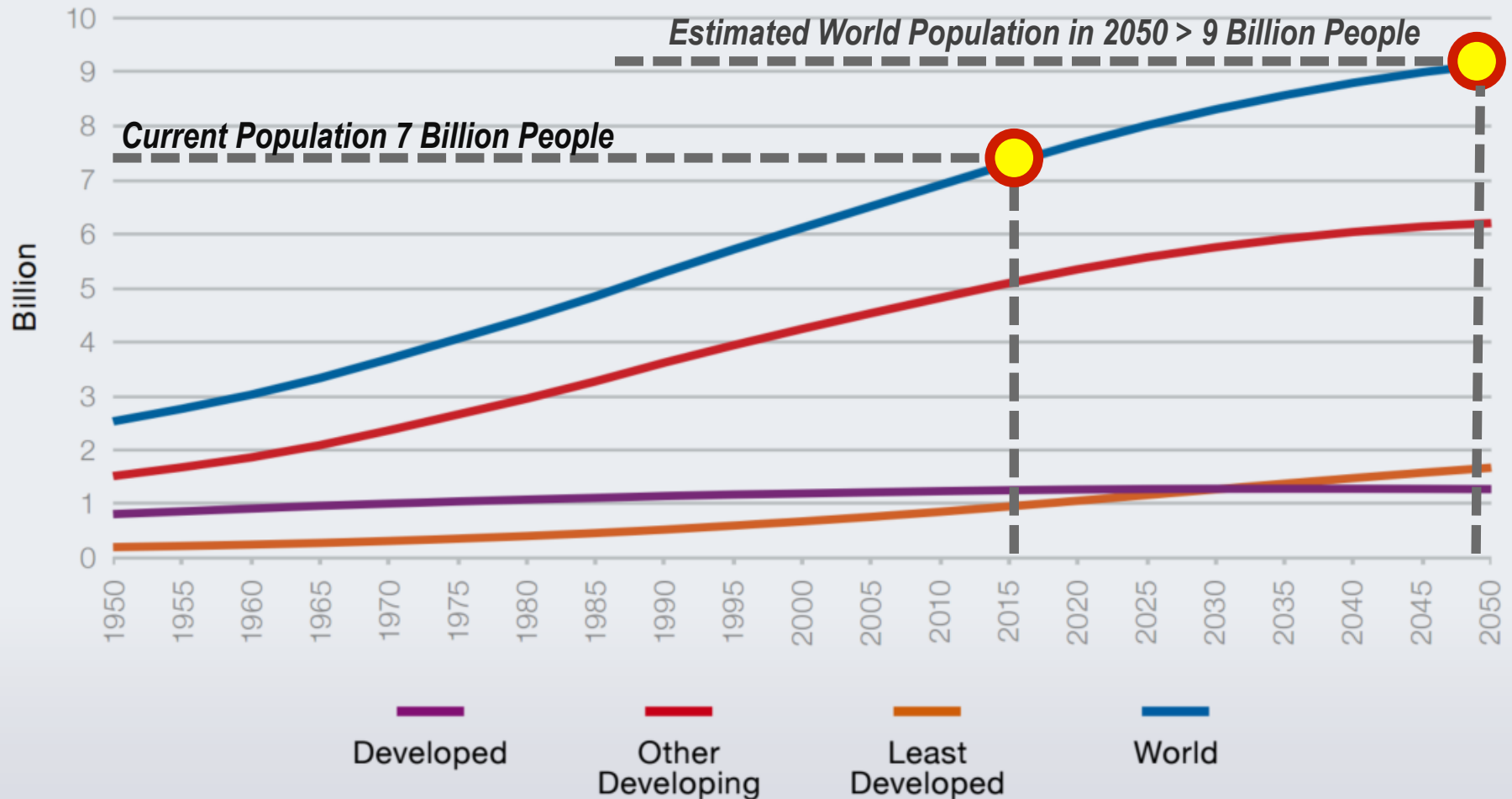
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# 2050: WORLD POPULATION EXPECTED TO GROW BY 1/3

## Population growth



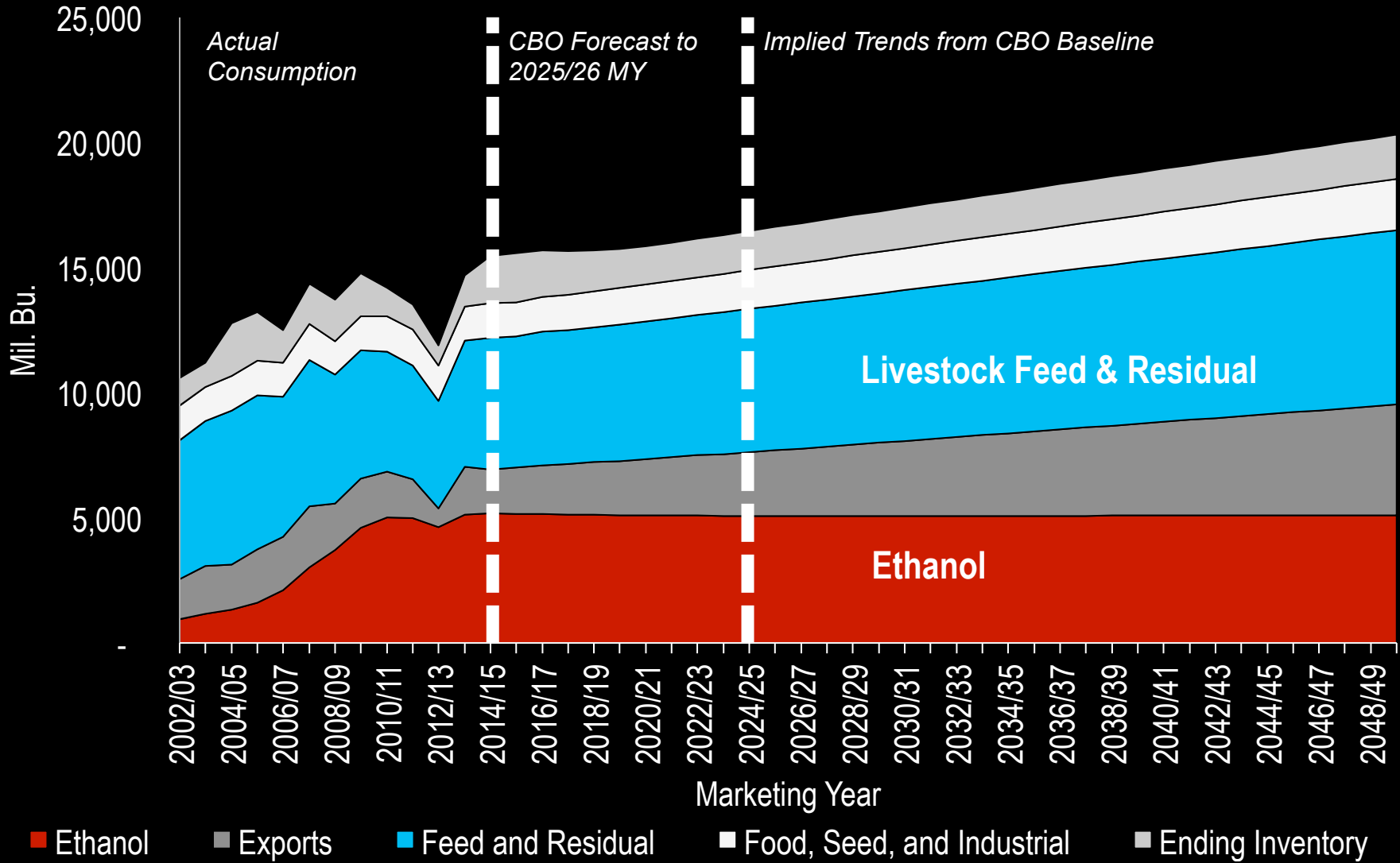
Source: FAO, UN 2015

Majority of population growth expected to occur in Africa

**“FEEDING THE NINE BILLION WILL REQUIRE  
TECHNOLOGY AND INNOVATION THAT WILL HELP  
FARMERS RAISE MORE ANIMALS FOR FOOD AND  
GROW MORE CROPS ON THE LAND ALREADY IN  
PRODUCTION.”**

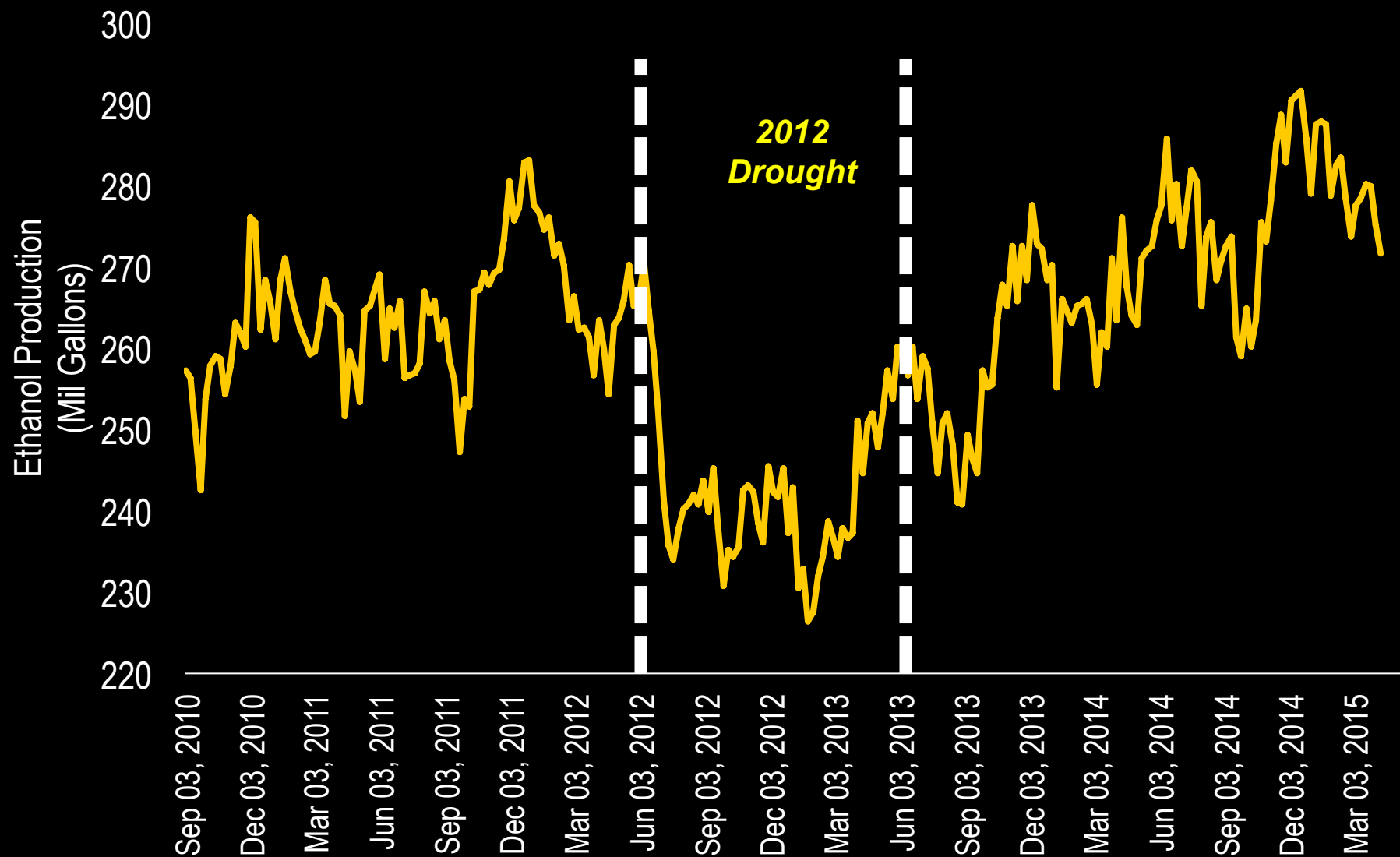
- C. ARNOT,  
THE CENTER FOR FOOD INTEGRITY

**BY 2050, U.S. CORN CONSUMPTION AT 18.5 BIL. BU. w/ ETHANOL >5 BIL. BU. FEED AND RESIDUAL USE IS THE LARGEST CATEGORY AT 7 BIL. BU.**

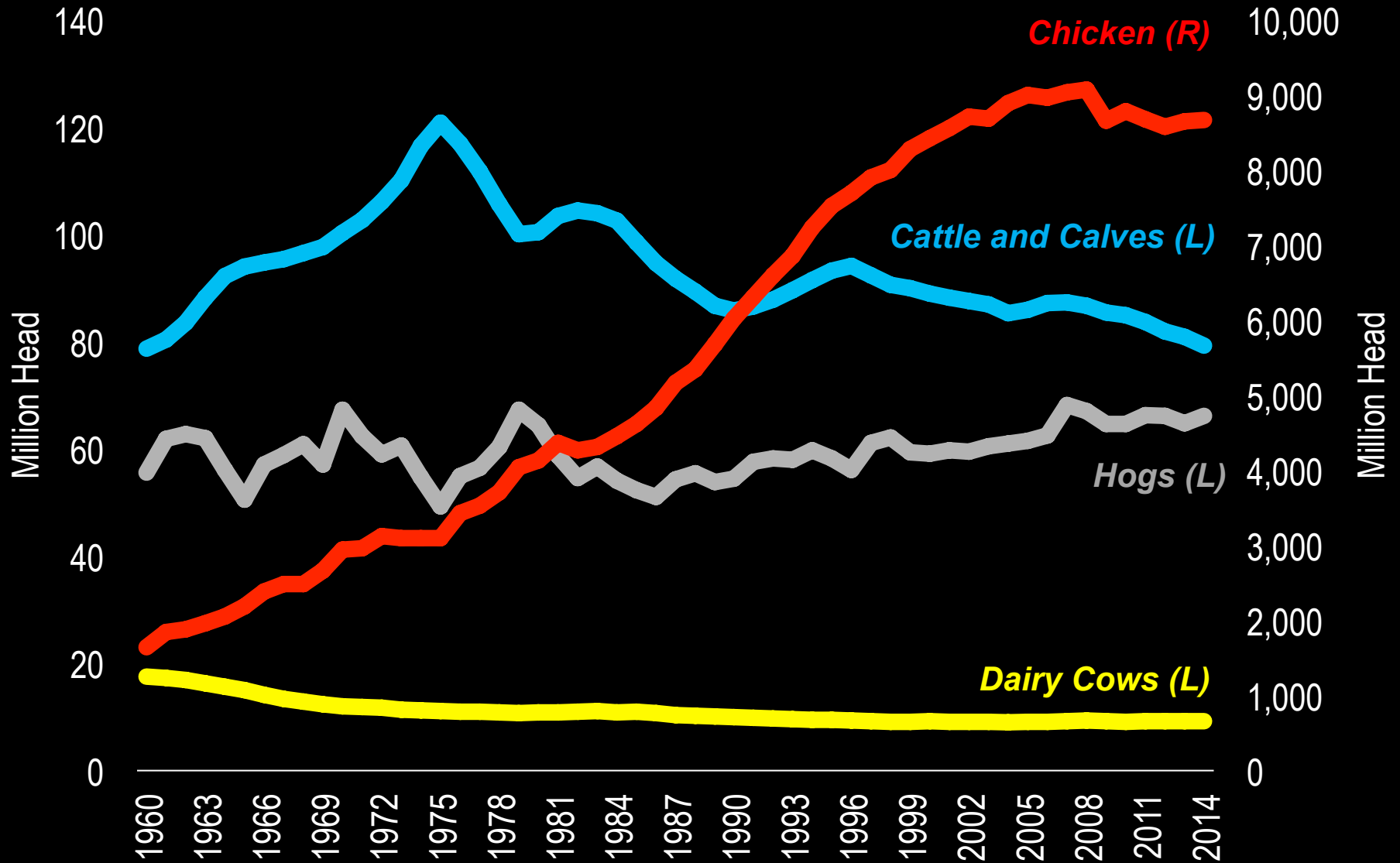


Source: USDA, CBO, & Author's Calculations

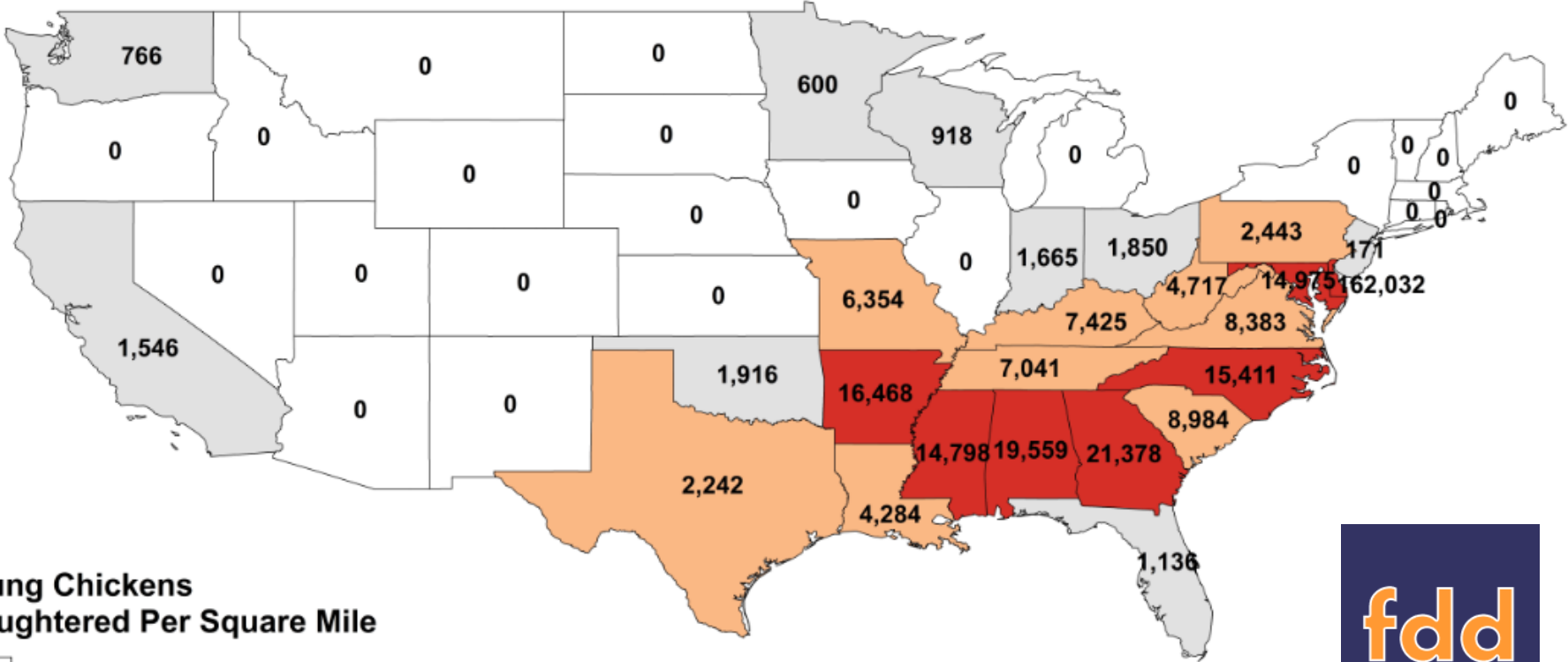
**CORN USE FOR ETHANOL NOW MORE THAN 5 BILLION BUSHELS A YEAR, IN 2002 LESS THAN 1 BILLION BUSHELS. CORN USE FOR ETHANOL INCREASED 400%.**



# TRENDS IN GRAIN CONSUMING ANIMAL UNITS. ASCENDING POPULATION OF HOGS AND CHICKEN, DOWNWARD SLOPING TREND IN ALL CATTLE.



# 8.5 BILLION YOUNG CHICKENS SLAUGHTERED DURING 2014, >350 MILLION LAYERS IN U.S.



**Young Chickens Slaughtered Per Square Mile**

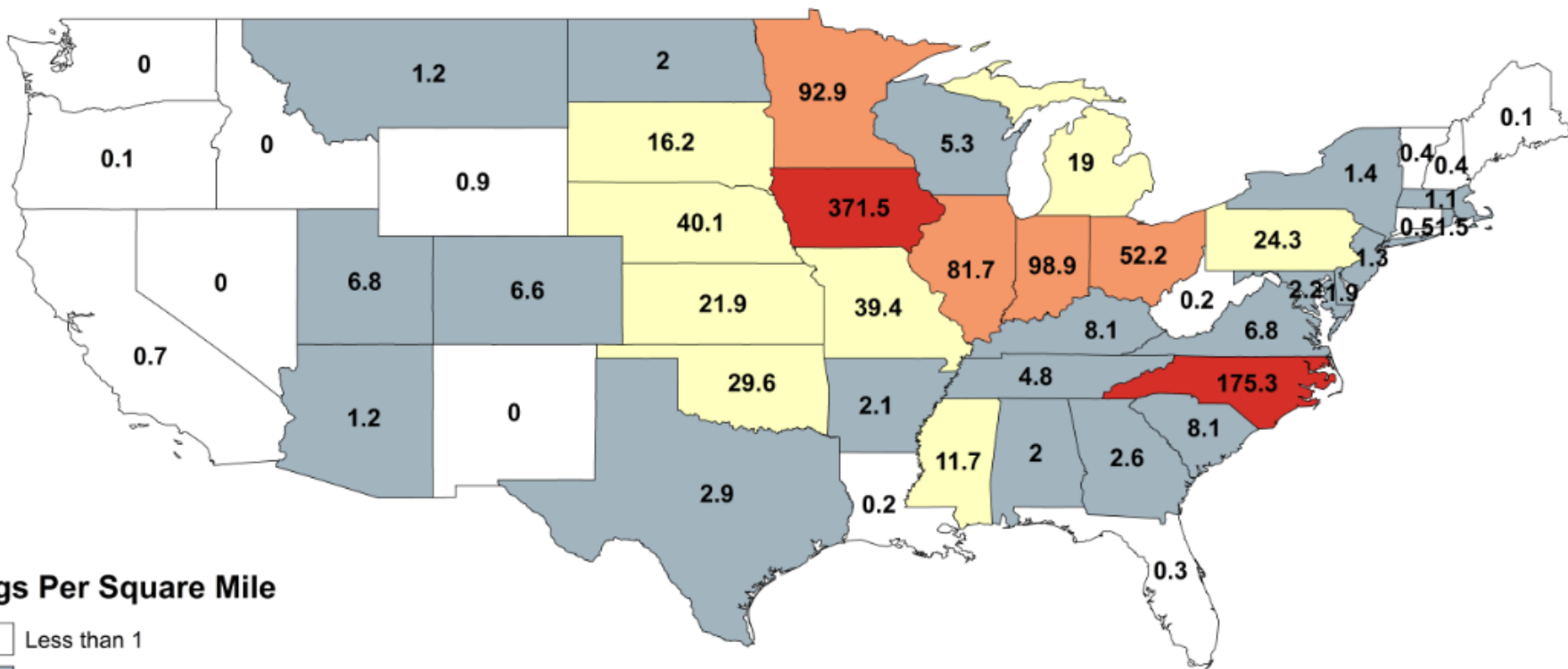
- No Chickens Slaughtered or Restricted Data
- Less than 2,000
- 2,001 to 10,000
- Greater than 10,000

Based on USDA, NASS data



*Animal Concentration in S. East, w/ Heavy Concentration in Chesapeake Bay Watershed*

# ASCENDING DEMAND FOR HOGS PRESENTS COMPETITION FOR LIVESTOCK FEED, **>65 MIL. HOGS IN U.S.**



**Hogs Per Square Mile**

- Less than 1
- 1 to 10
- 10.1 to 50
- 50.1 to 100
- Greater than 100

Based on USDA, NASS data

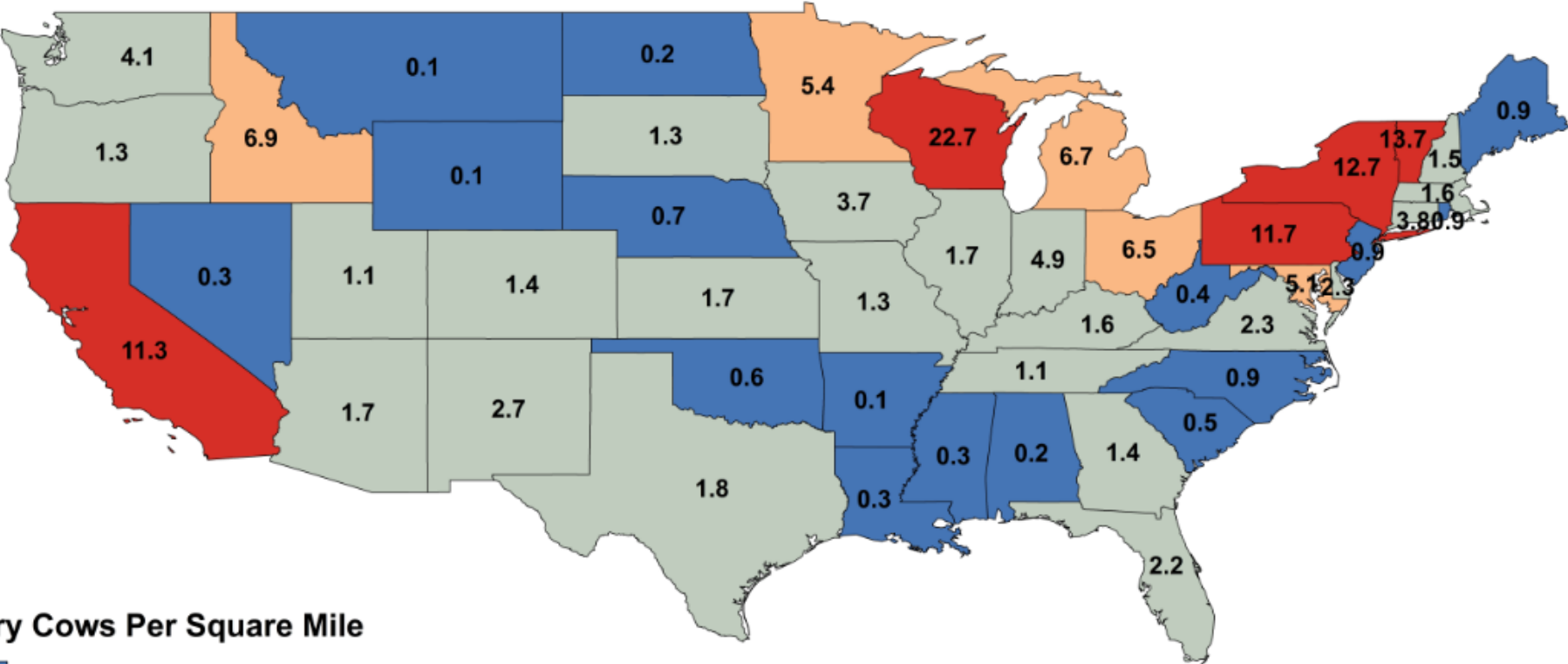
*Animal Concentration in Midwest and Southeast*







# DAIRY COW NUMBERS STEADY AT > 9 MILLION HEAD ANIMAL PRODUCTIVITY INCREASING



Dairy Cows Per Square Mile

- Less than 1
- 1.1 to 5
- 5.1 to 10.0
- Greater than 10

Based on USDA, NASS data

*Animal Concentration in West, Upper Midwest, and Northeast*

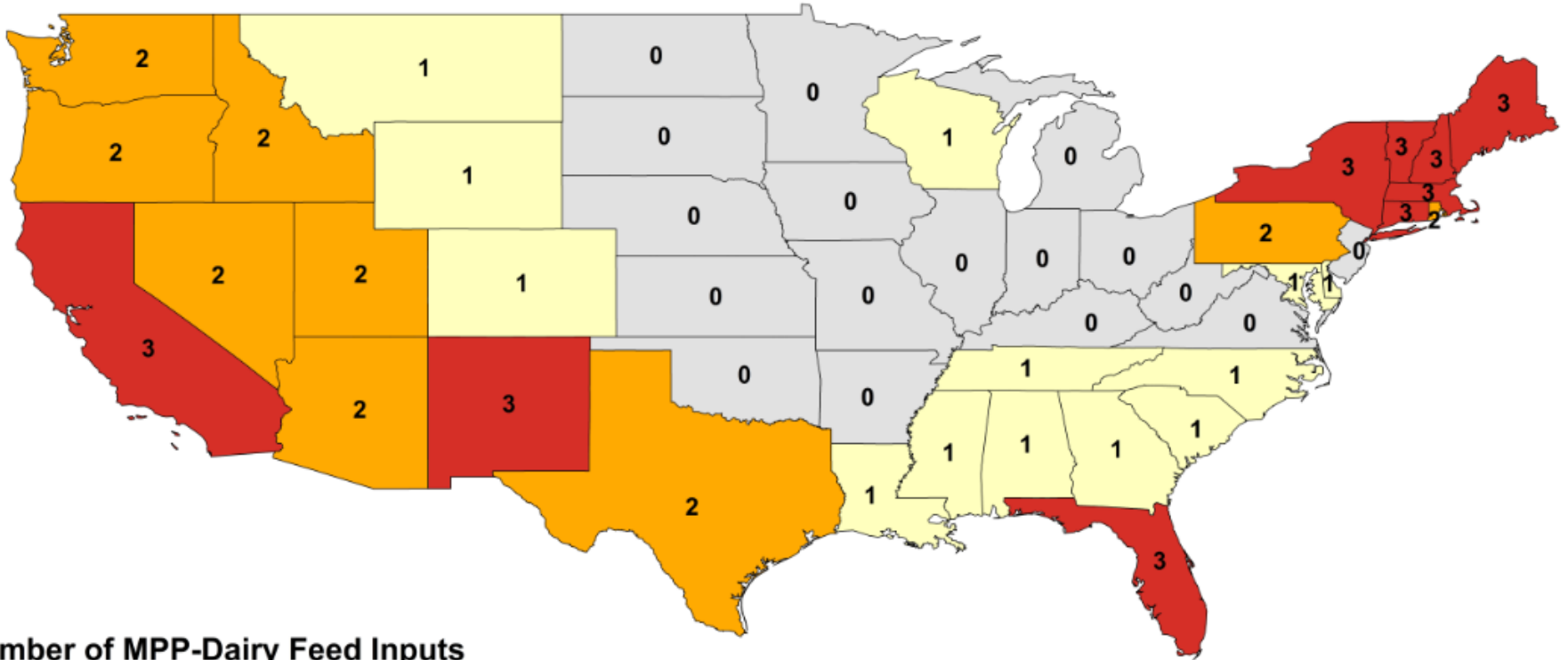


**CATTLE AND HOG INVENTORY CONCENTRATED  
IN MIDWEST AND UPPER MIDWEST – NEAR CORN  
BELT. POULTRY CONCENTRATION IN S. EAST.**

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**DAIRY FARM OPERATIONS OUTSIDE UPPER  
MIDWEST MAY SEEK ALTERNATIVE FEED  
INGREDIENTS AND/OR SOURCE FROM CORN  
BELT.**

# MPP-DAIRY: 2/3 OF U.S. IS SHORT ONE OR MORE OF FEED RATION INGREDIENTS



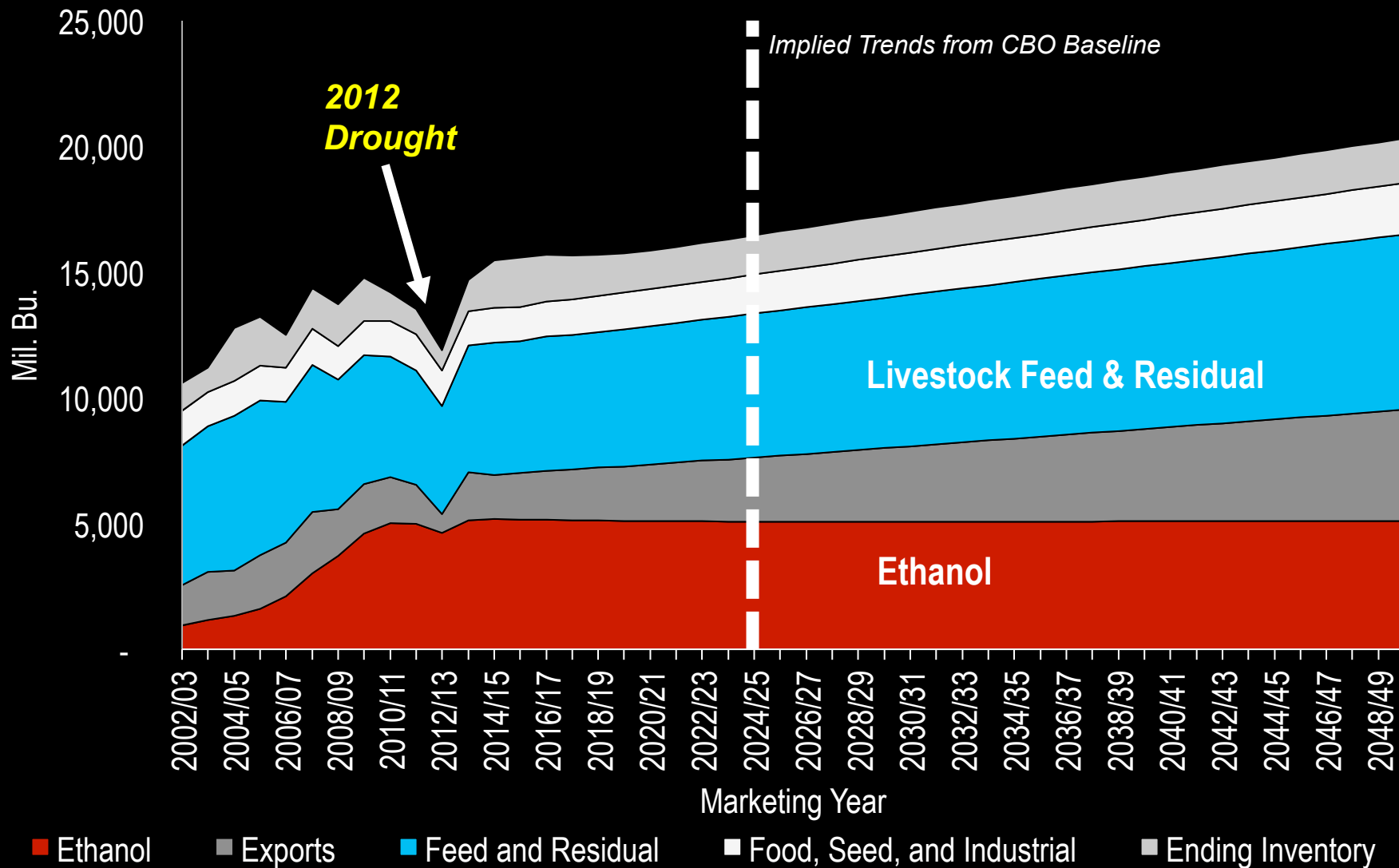
## Number of MPP-Dairy Feed Inputs

- Surplus of MPP-Dairy Feed Ingredients
- Deficit 1 MPP-Dairy Feed Ingredient
- Deficit 2 MPP-Dairy Feed Ingredients
- Deficit 3 MPP-Dairy Feed Ingredients

Source: Author's calculations based on feed ration in MPP-Dairy formula, USDA Crop Production, and 2014-15 marketing year projections of total milk production.

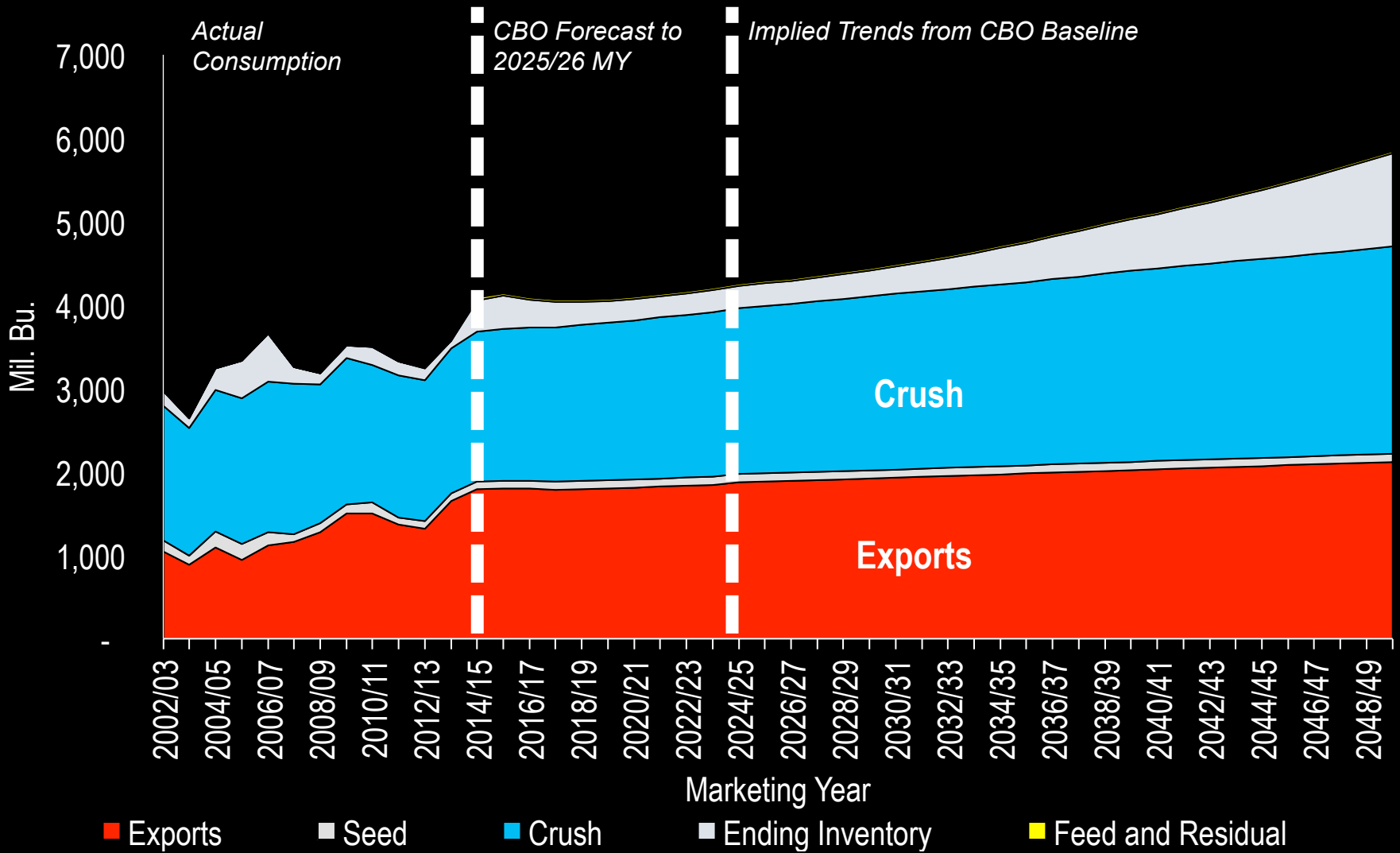


**HIGHER USE IN ETHANOL MAKES CORN PRICE MORE SENSITIVE TO SUPPLY SHOCKS. DURING 2012 DROUGHT CORN USE IN ALL CATEGORIES RATIONED.**



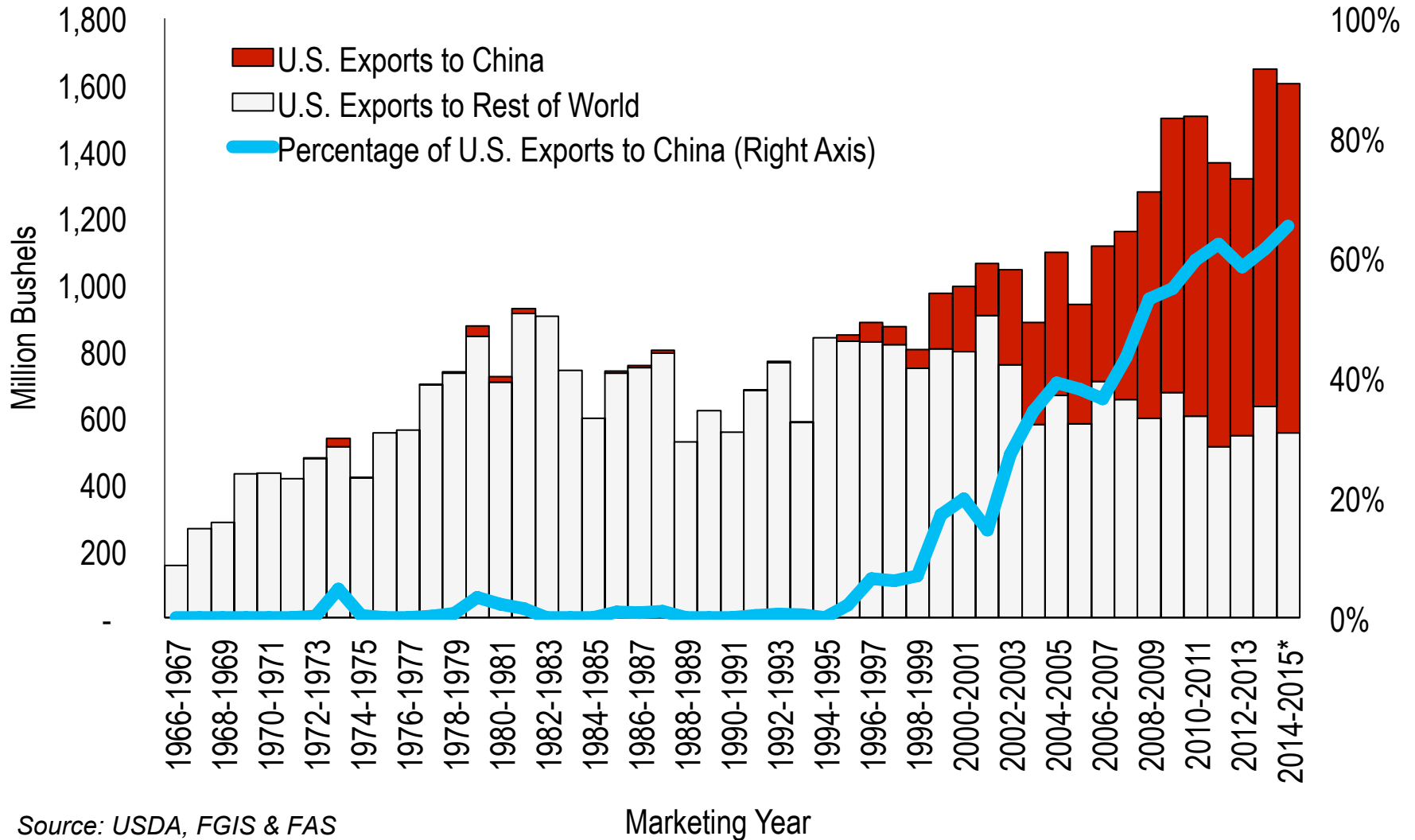
Source: USDA, CBO, & Author's Calculations

**BY 2050, U.S. SOYBEAN CONSUMPTION COULD EXCEED 4 BIL BU.  
DOMESTIC CRUSH AND EXPORTS ARE THE LARGEST CATEGORIES  
AT >2 BIL. BU. EACH.**



Source: USDA, CBO, & Author's Calculations

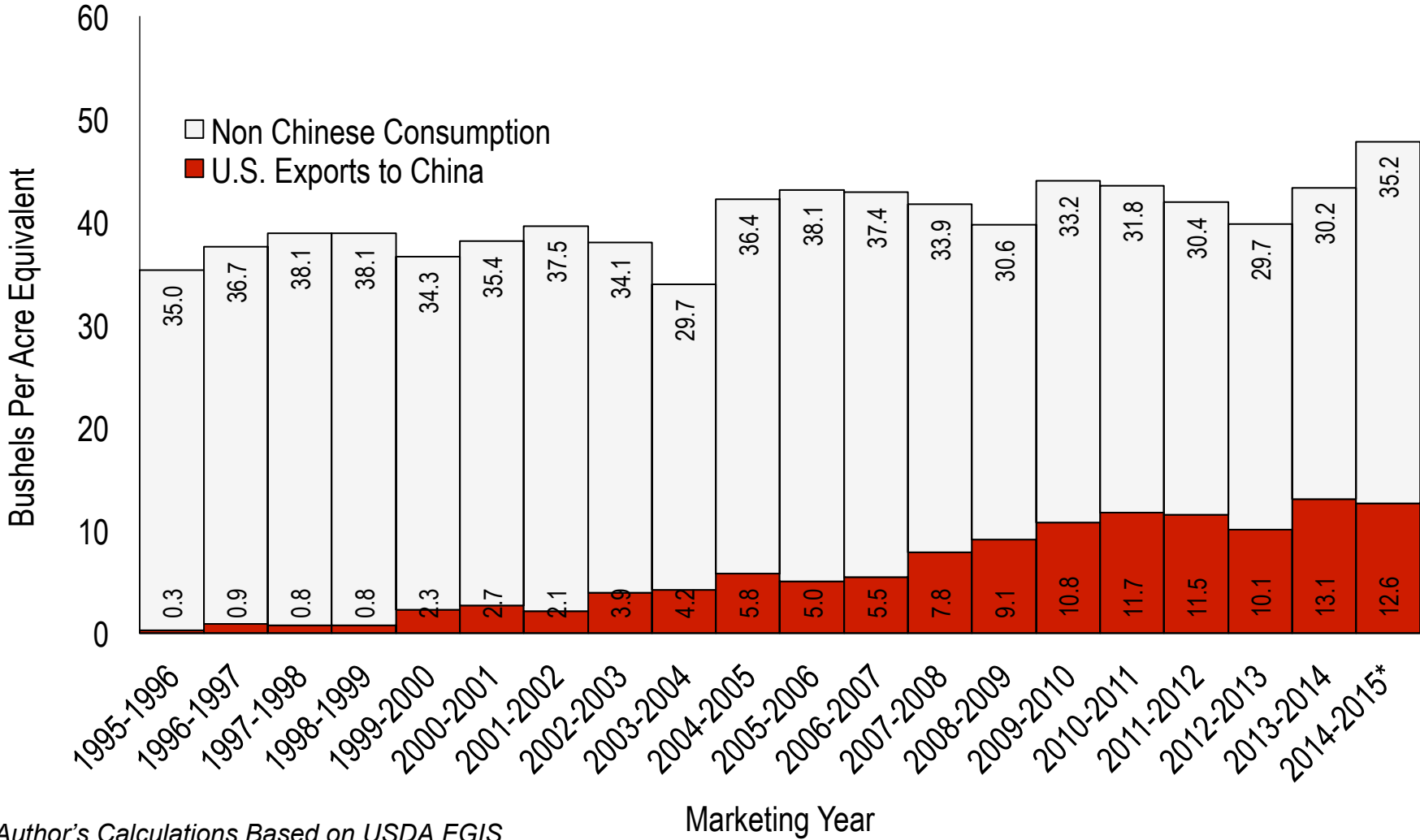
# CHINESE DEMAND REPRESENT EQUIVALENT OF **60 MILLION ACRES WORLDWIDE**, IMPORT 20 MIL. U.S. ACRES (1 BBU)



Source: USDA, FGIS & FAS

\*Marketing year to date (March 19, 2015)

# WINDSHIELD SURVEY: 1/4 OF EVERY SOYBEAN ACRE PRODUCED IN 2014 NEEDED FOR CHINESE DEMAND



\*Author's Calculations Based on USDA FGIS

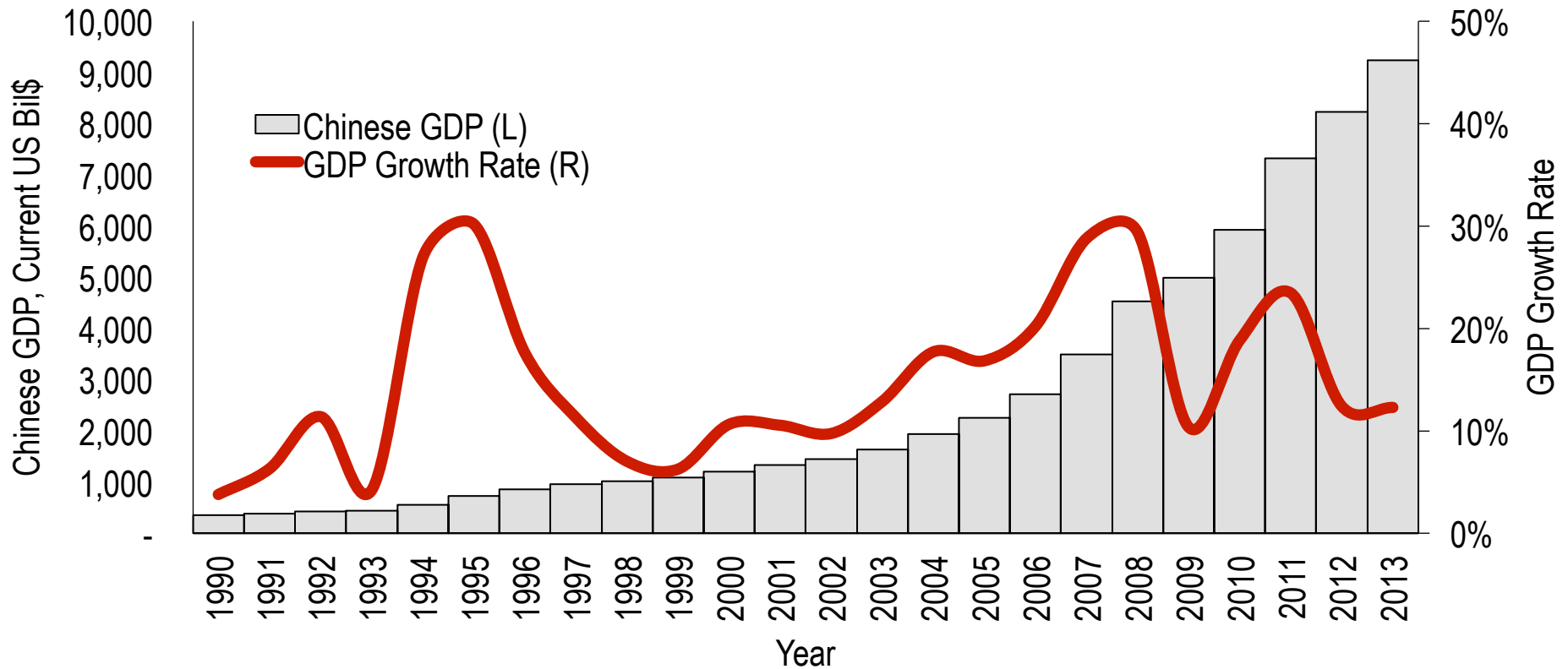


# CHINESE DOMINANT U.S. EXPORT PARTNER AT >65%, NEXT CLOSEST IS MEXICO AT <5%



# GDP GROWTH IN CHINA PROJECTED TO **SLOW TO UNDER 7% BY 2017.**

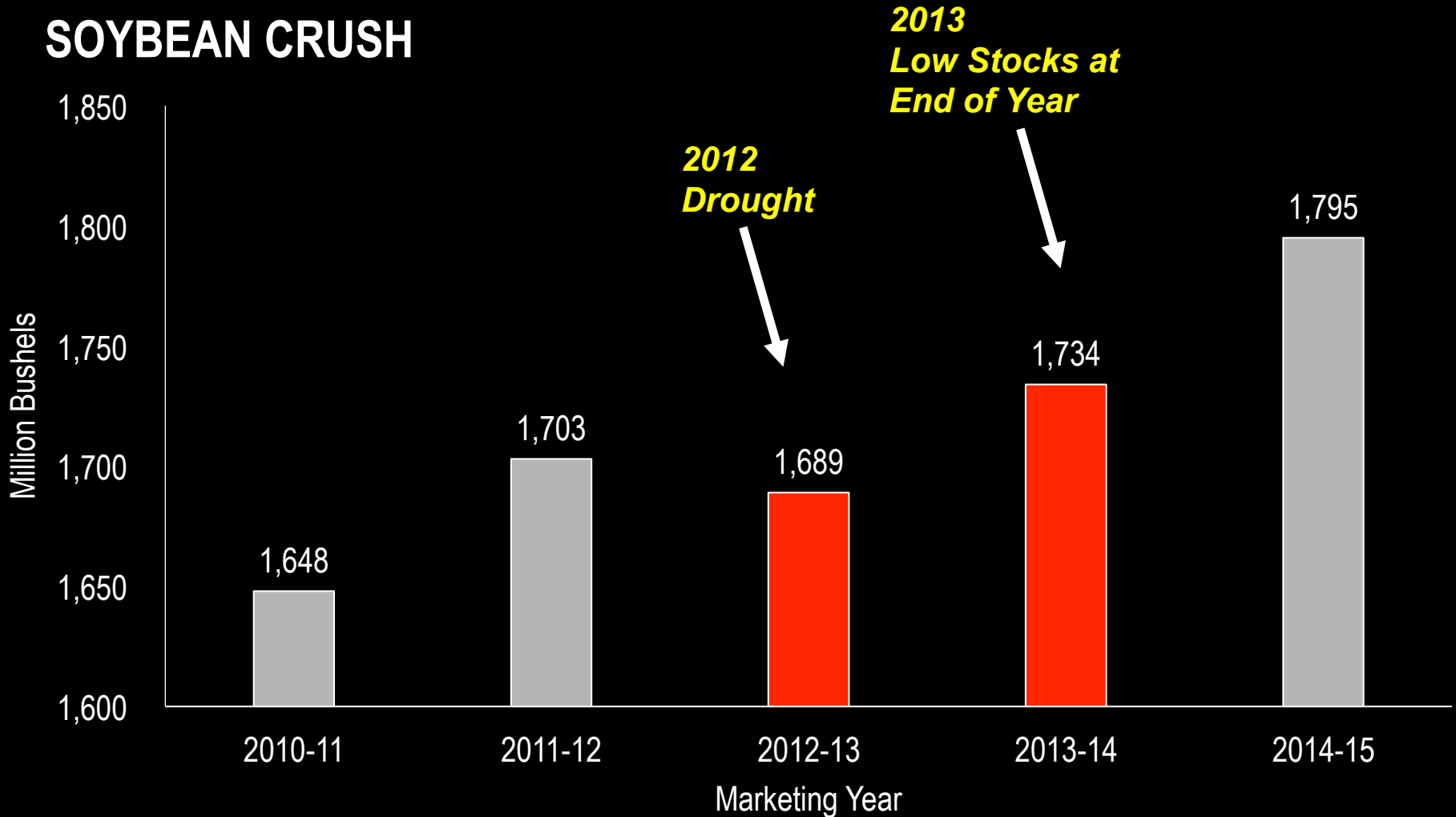
Chinese Gross Domestic Product in Current U.S. Dollars and Annual Growth Rate, 1990-2013



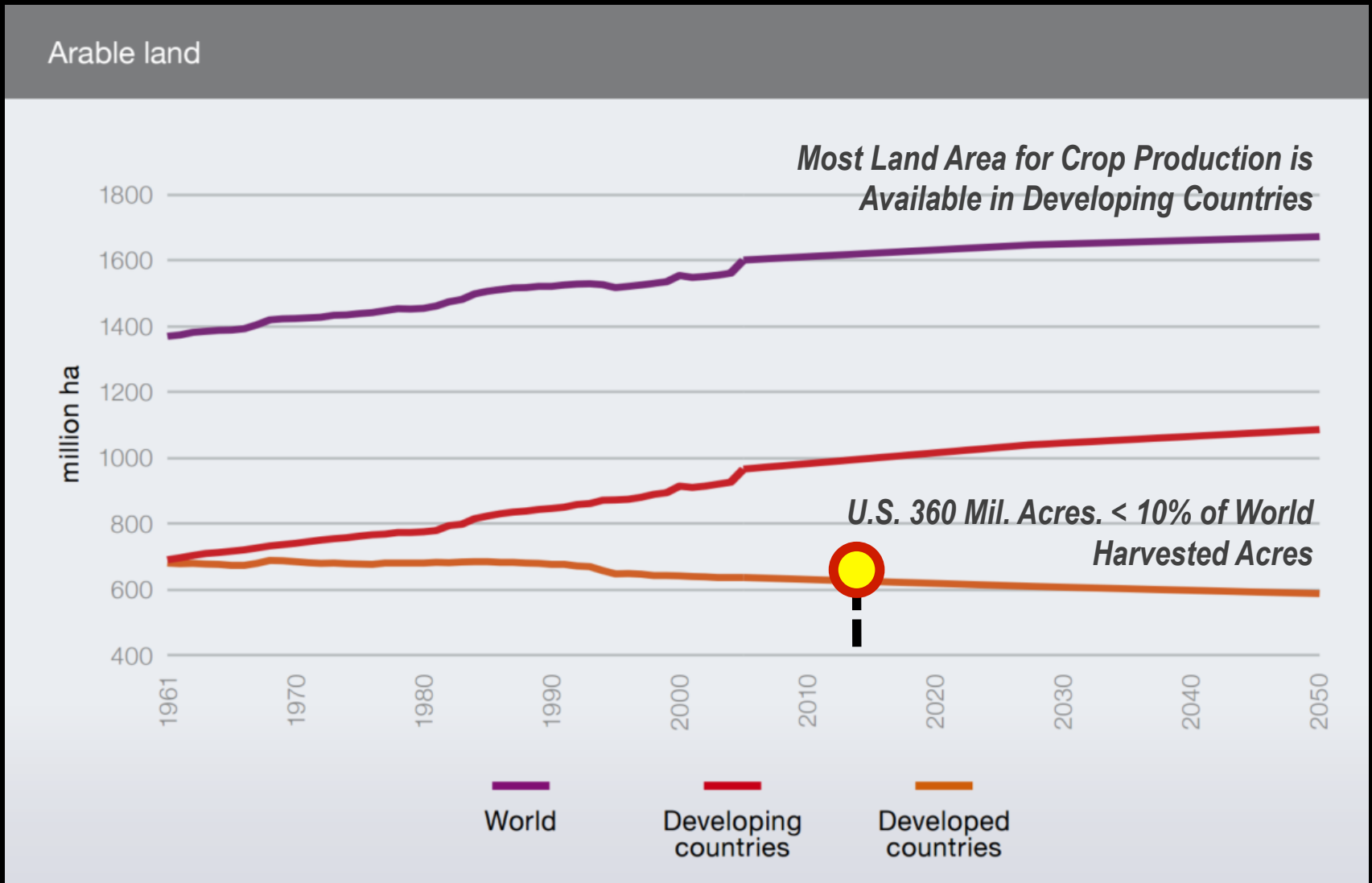
Source: The World Bank

# IMPLICATIONS ON SOYBEAN MEAL PRICES. **TIGHTER SUPPLIES AND COMPETITION WITH EXPORTS.**

## SOYBEAN CRUSH

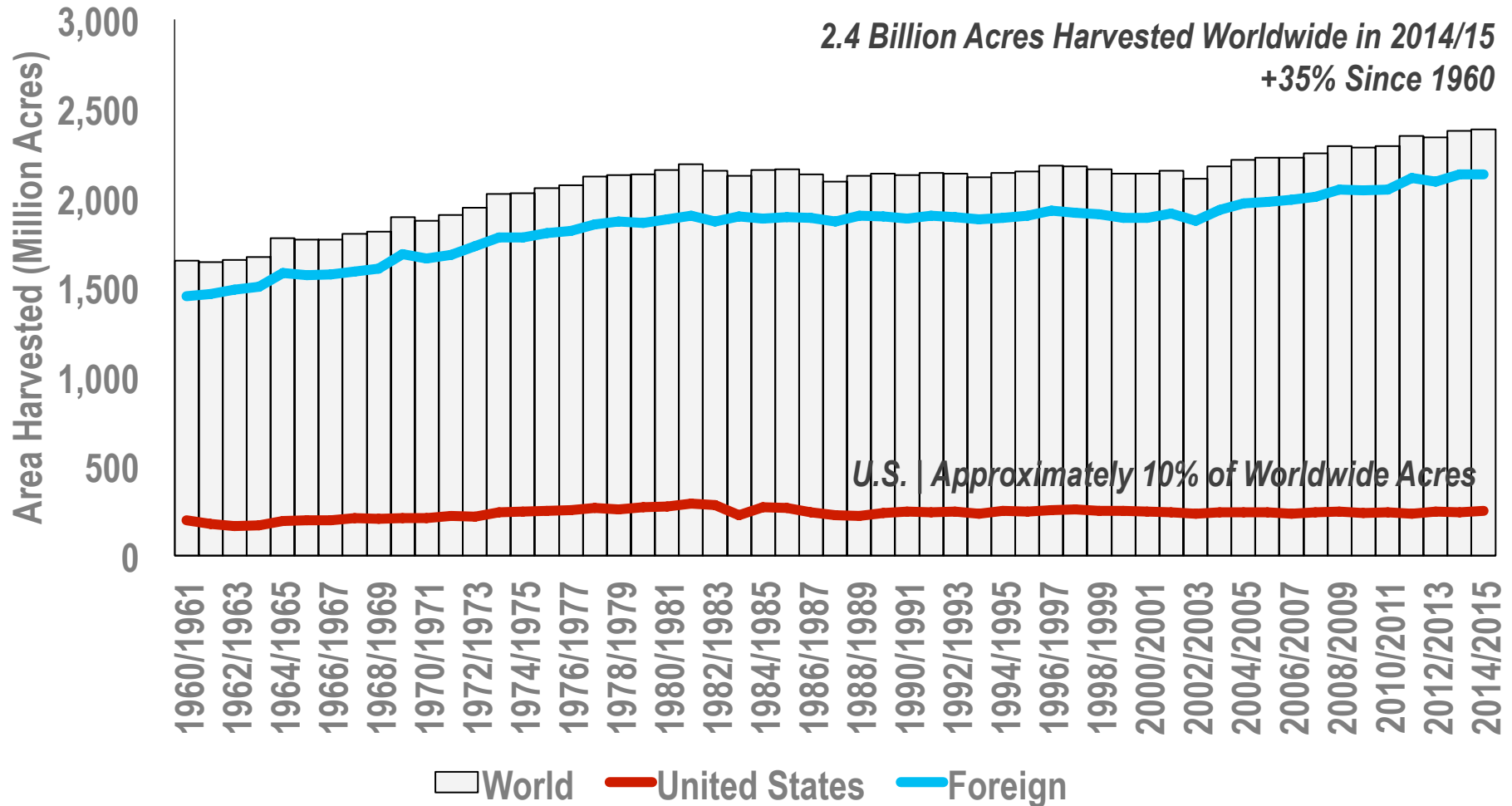


# TO MEET INCREASED GLOBAL DEMANDS FOOD PRODUCTIVITY **NEEDS TO GROW 70%-110%**



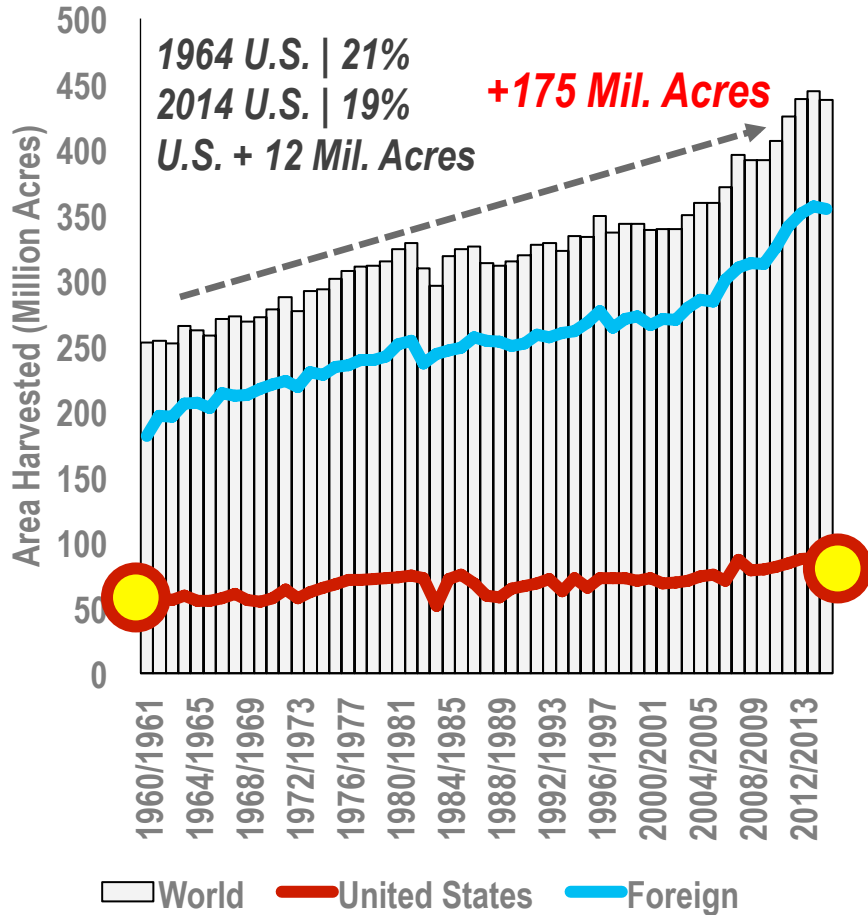
# ACRES MAY SHIFT, BUT **LAND AREA IS FINITE**

## Harvested Acres Worldwide, All Grains and Oilseeds 1960 - 2014

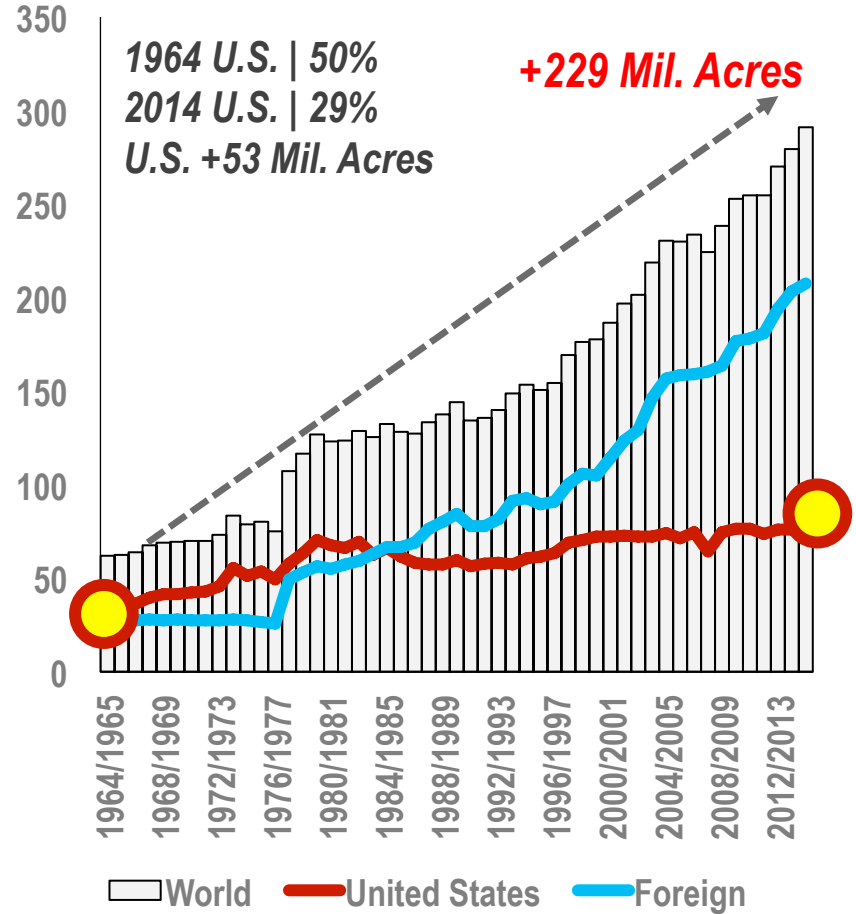


# 369% GROWTH IN OILSEED ACRES IN PRODUCTION

Harvest Acres Worldwide, Corn  
1960 - 2014



Harvest Acres Worldwide, Soybeans  
1960 - 2014

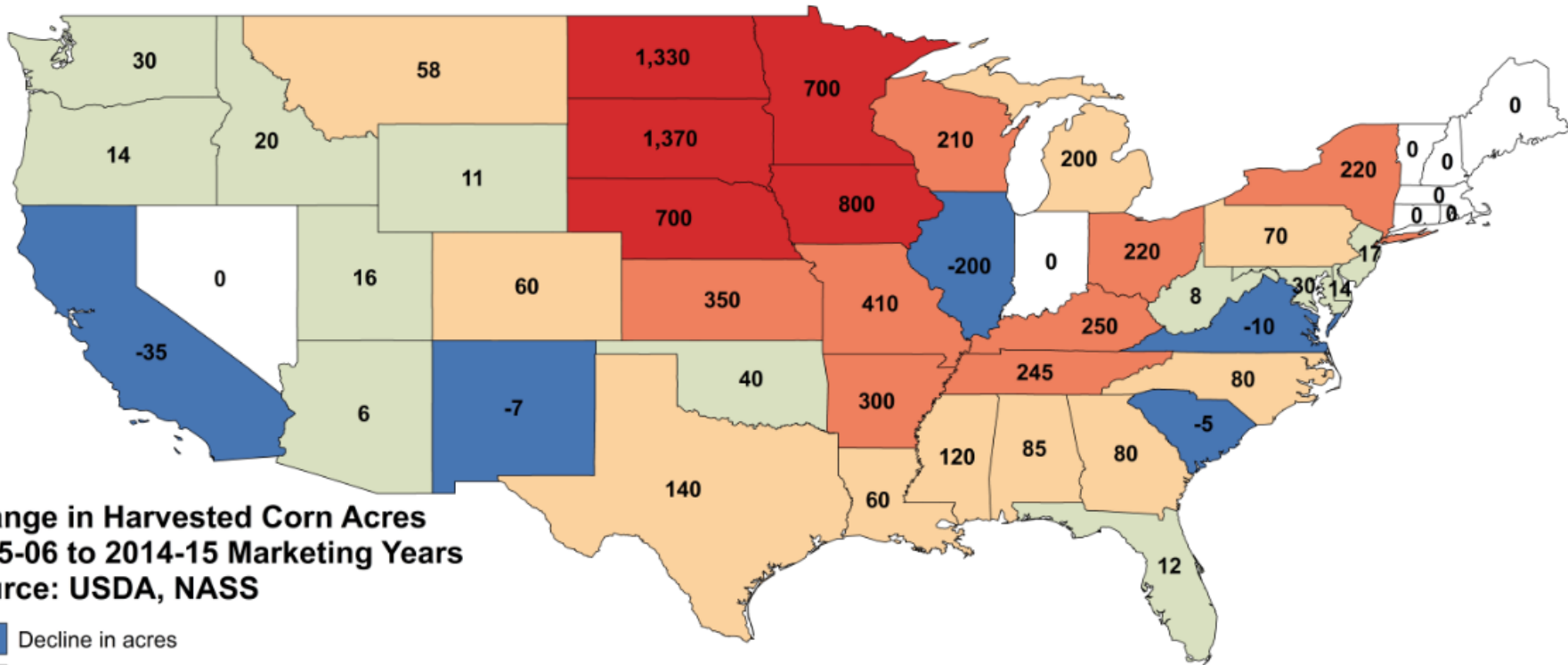


IN THE U.S. LAND USE FOR CORN AND SOYBEAN  
PRODUCTION HAS GROWN BY **40 MILLION  
ACRES** SINCE 1996 FREEDOM TO FARM ACT  
(1996 FARM BILL)

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**20 MILLION** OF THOSE ACRES ADDED DURING  
**RENEWABLE FUELS ERA** (DEC 2006+)

# BIOFUELS DROVE RECENT GROWTH IN CORN ACRES, CORN PRICE DOUBLED AND ADDED 8 MIL. AC.



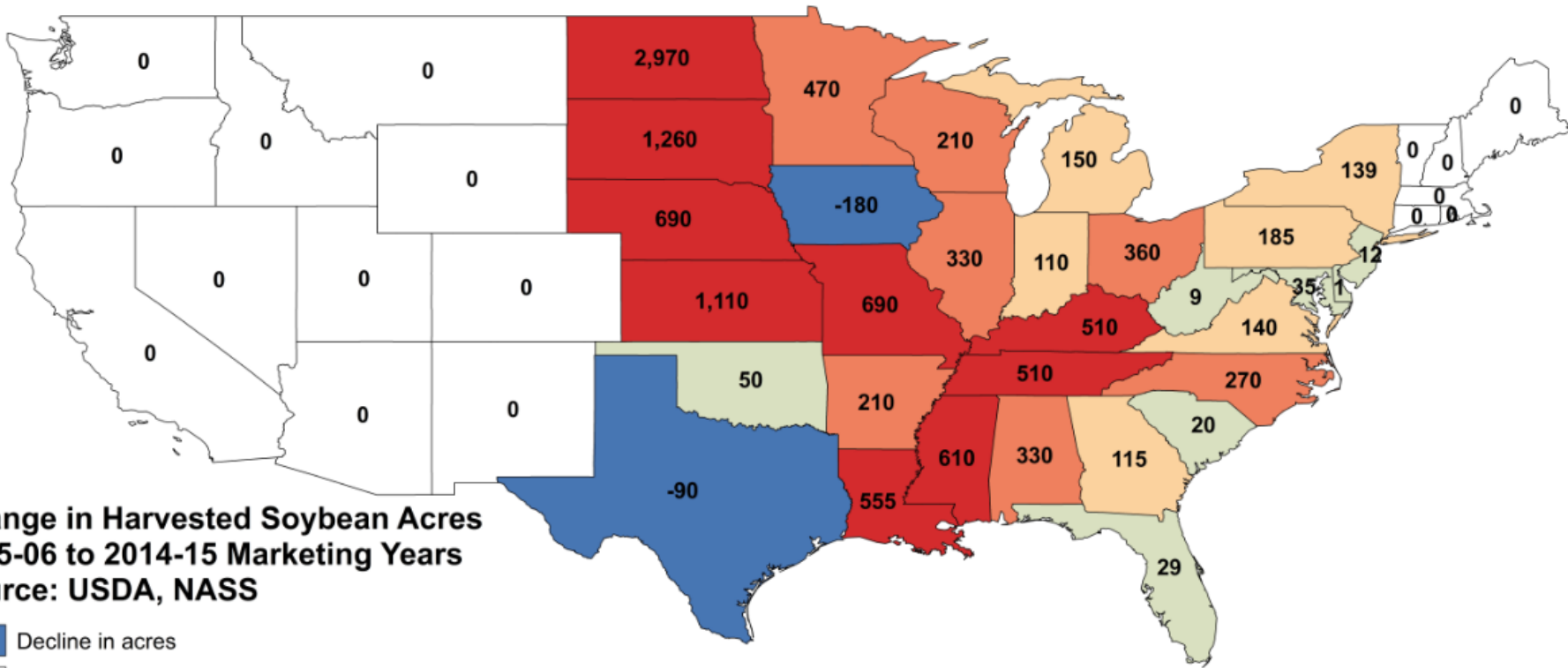
**Change in Harvested Corn Acres  
2005-06 to 2014-15 Marketing Years**  
Source: USDA, NASS

- Decline in acres
- No change or data not available
- 1 to 50 thousand acres
- 51 thousand to 200 thousand acres
- 201 thousand to 500 thousand acres
- Greater than 500 thousand acres





# SOYBEAN PRICE DRIVEN BY INCREASED CHINESE DEMAND, **12 MIL. ACRES ADDED**



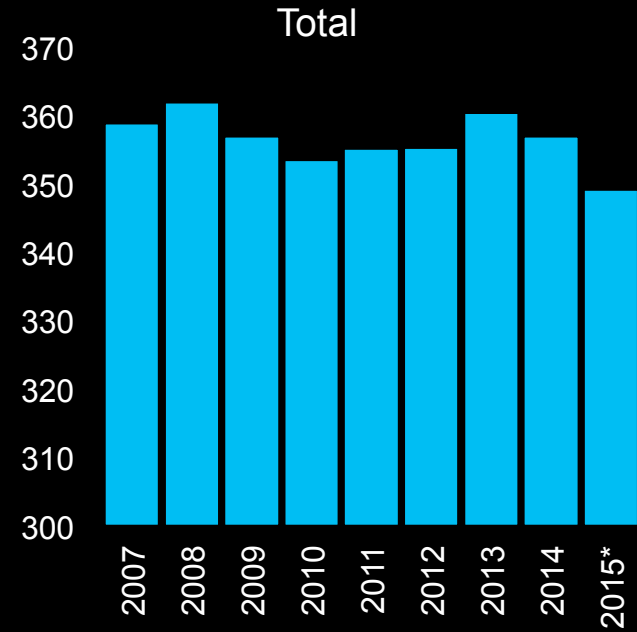
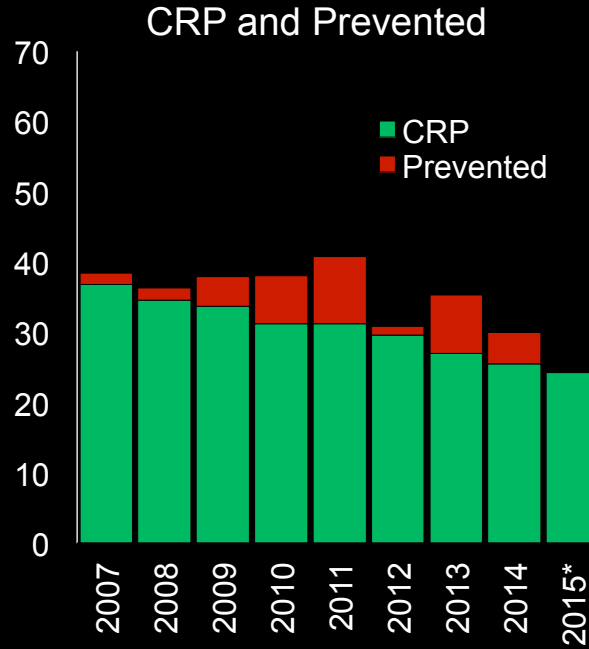
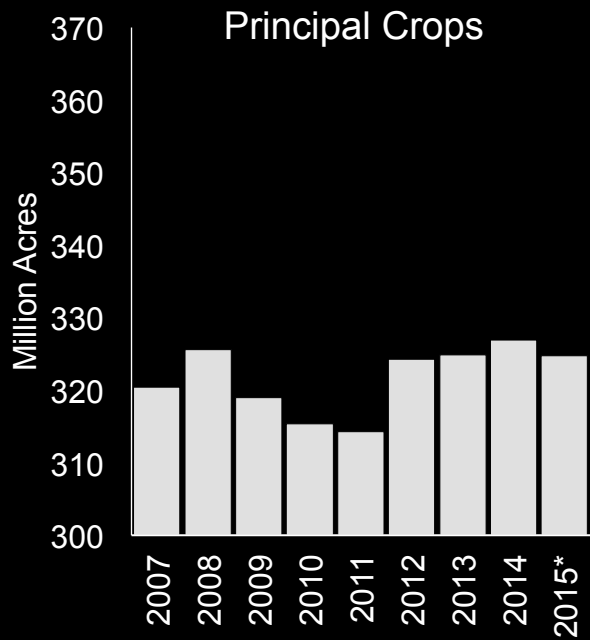
**Change in Harvested Soybean Acres  
2005-06 to 2014-15 Marketing Years**  
Source: USDA, NASS

- Decline in acres
- No change or data not available
- 1 to 50 thousand acres
- 51 thousand to 200 thousand acres
- 201 thousand to 500 thousand acres
- Greater than 500 thousand acres



# 350 TO 360 MILLION ACRES IN CROPLAND (+/-2% YOY)

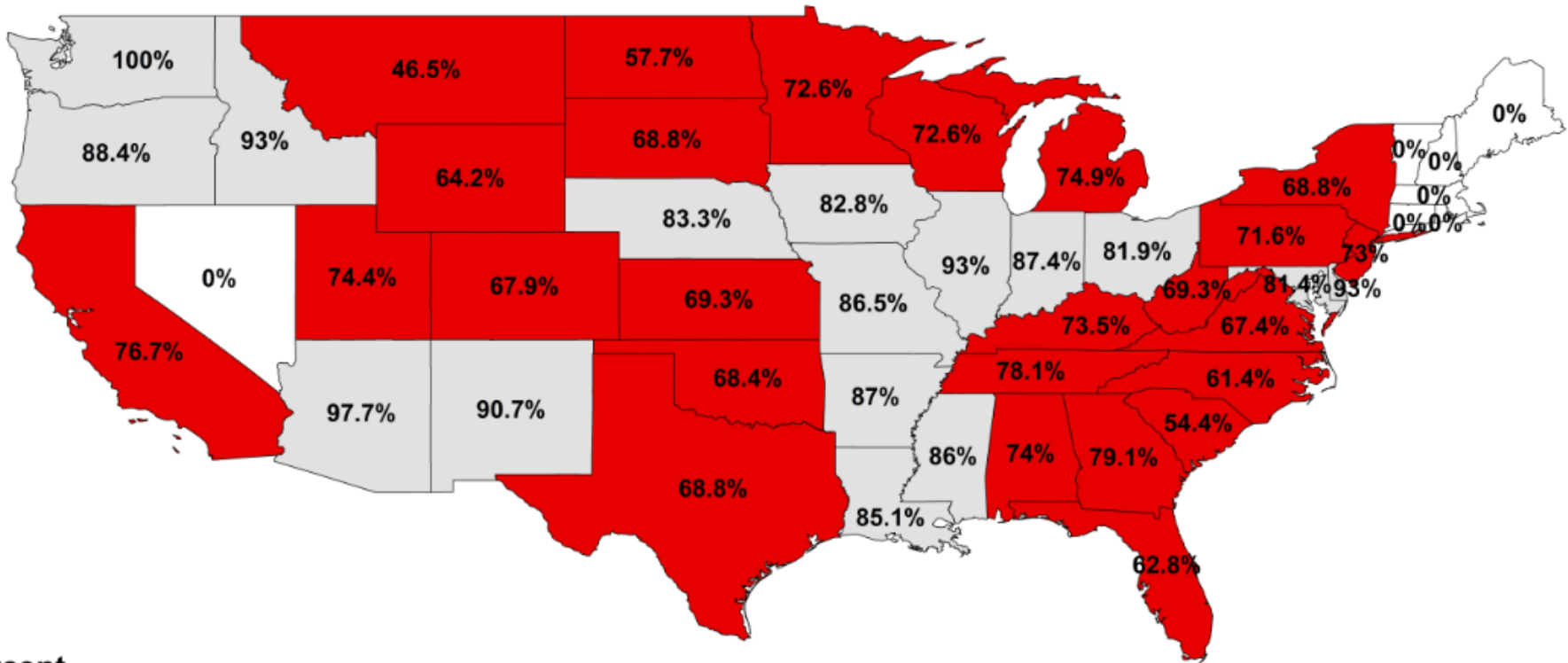
## U.S. NEEDS TO BE COMPETITIVE IN PRODUCTIVITY






Crop	2007	2008	2009	2010	2011	2012	2013	2014	2015*
Principal Crops	320.4	325.6	319.0	315.4	314.3	324.3	329.9	326.9	324.8
CRP	36.8	34.6	33.7	31.2	31.2	29.7	27.1	25.6	24.3
Prevent Plant	1.6	1.7	4.2	6.9	9.6	1.2	8.3	4.4	0
<b>Total</b>	<b>358.8</b>	<b>361.9</b>	<b>356.9</b>	<b>353.5</b>	<b>355.1</b>	<b>360.3</b>	<b>356.9</b>	<b>356.9</b>	<b>349.1</b>

# MARGINAL LAND MOVED INTO CORN PRODUCTION

## Percentage of State-Level Corn Yield Relative to Maximum Observed Corn Yield (215 BPA) in U.S., 2014



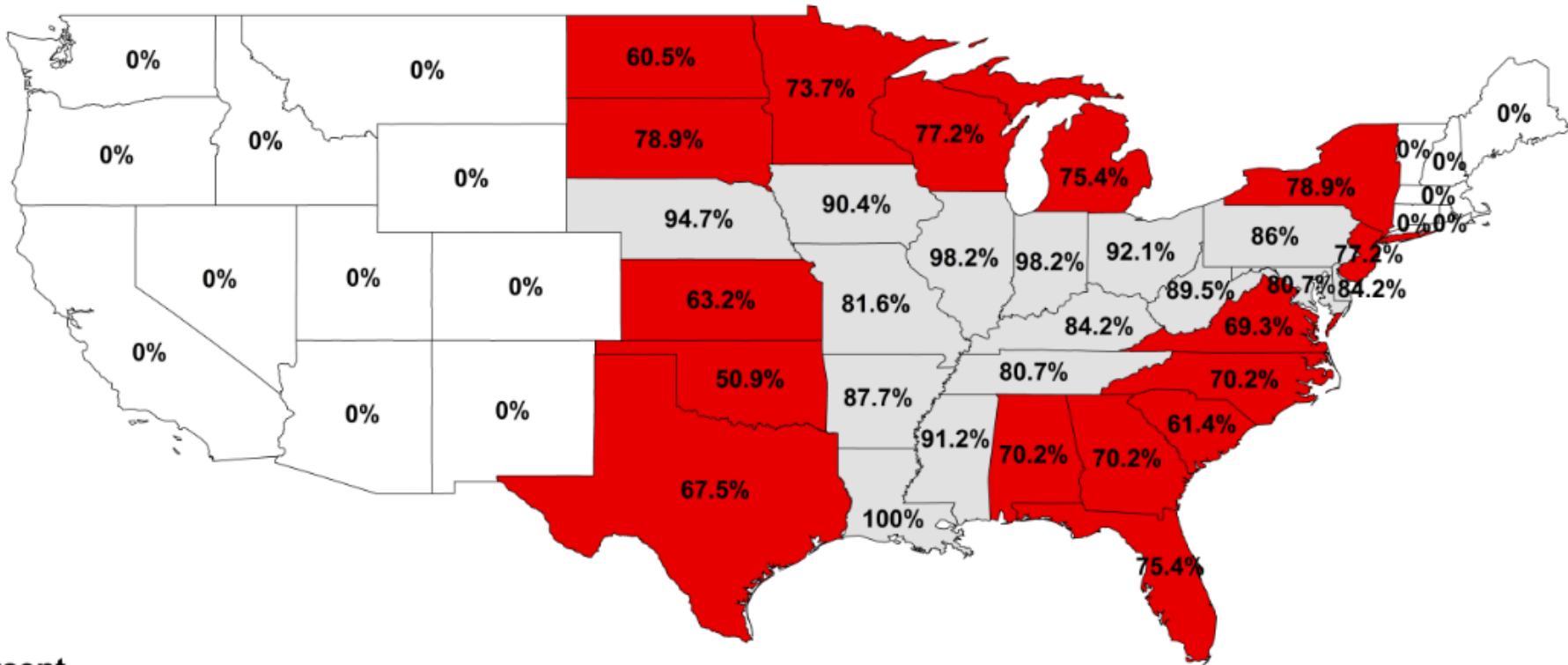
### Percent

-  No Corn Grain Production
-  Less than 80%
-  Greater than 80%

Based on USDA, NASS data

# MARGINAL LAND MOVED INTO SOYBEAN PRODUCTION

## Percentage of State-Level Soybean Yield Relative to Maximum Observed Soybean Yield (57 BPA) in U.S., 2014



### Percent

- No Soybean Production
- Less than 80%
- Greater than 80%

Based on USDA, NASS data

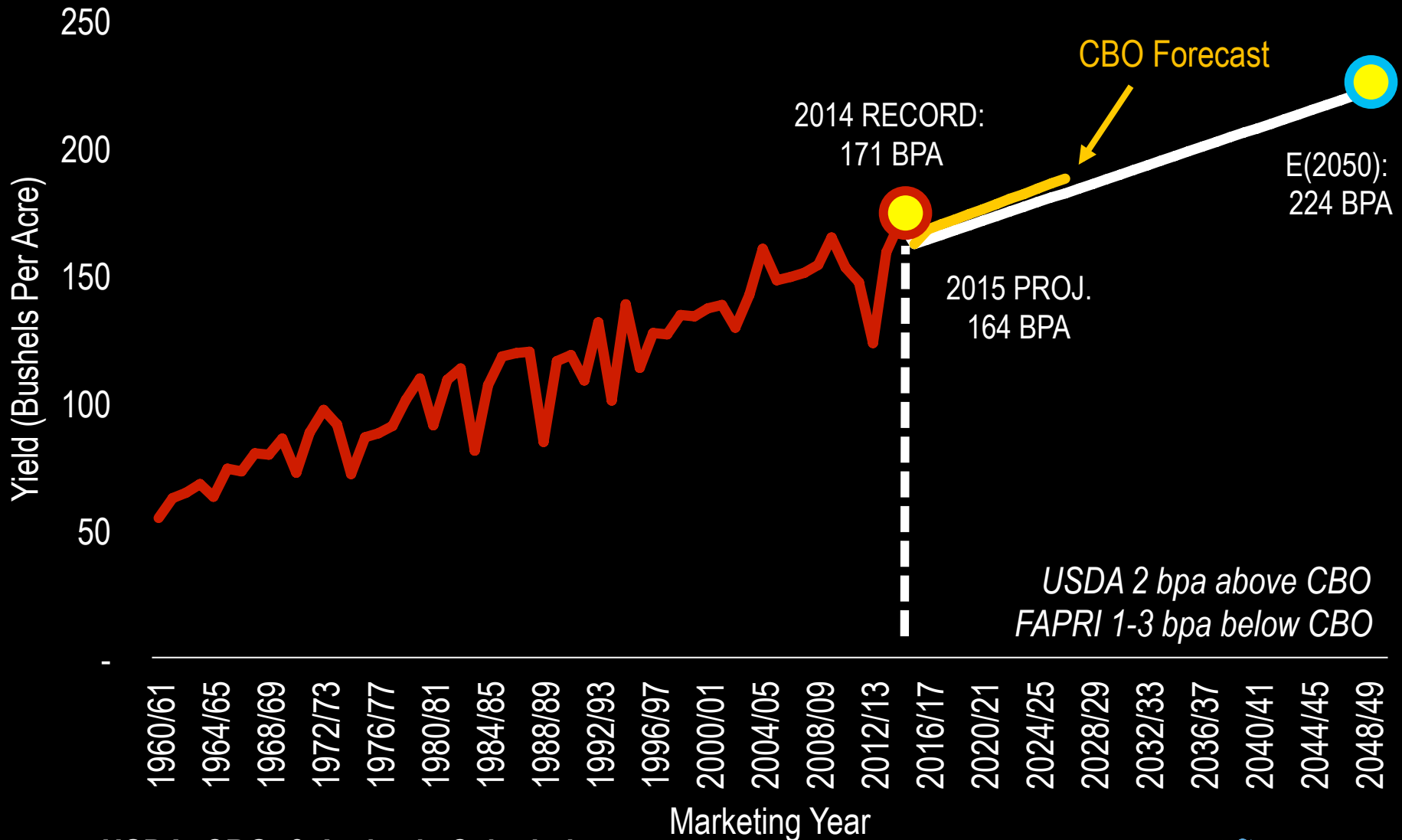


**GENETIC IMPORVEMENTS IN CORN HAVE  
RESULTED IN YIELD INCREASES OF 3 ½  
BUSHELS PER ACRE (BPA) IN RECENT YEARS.**

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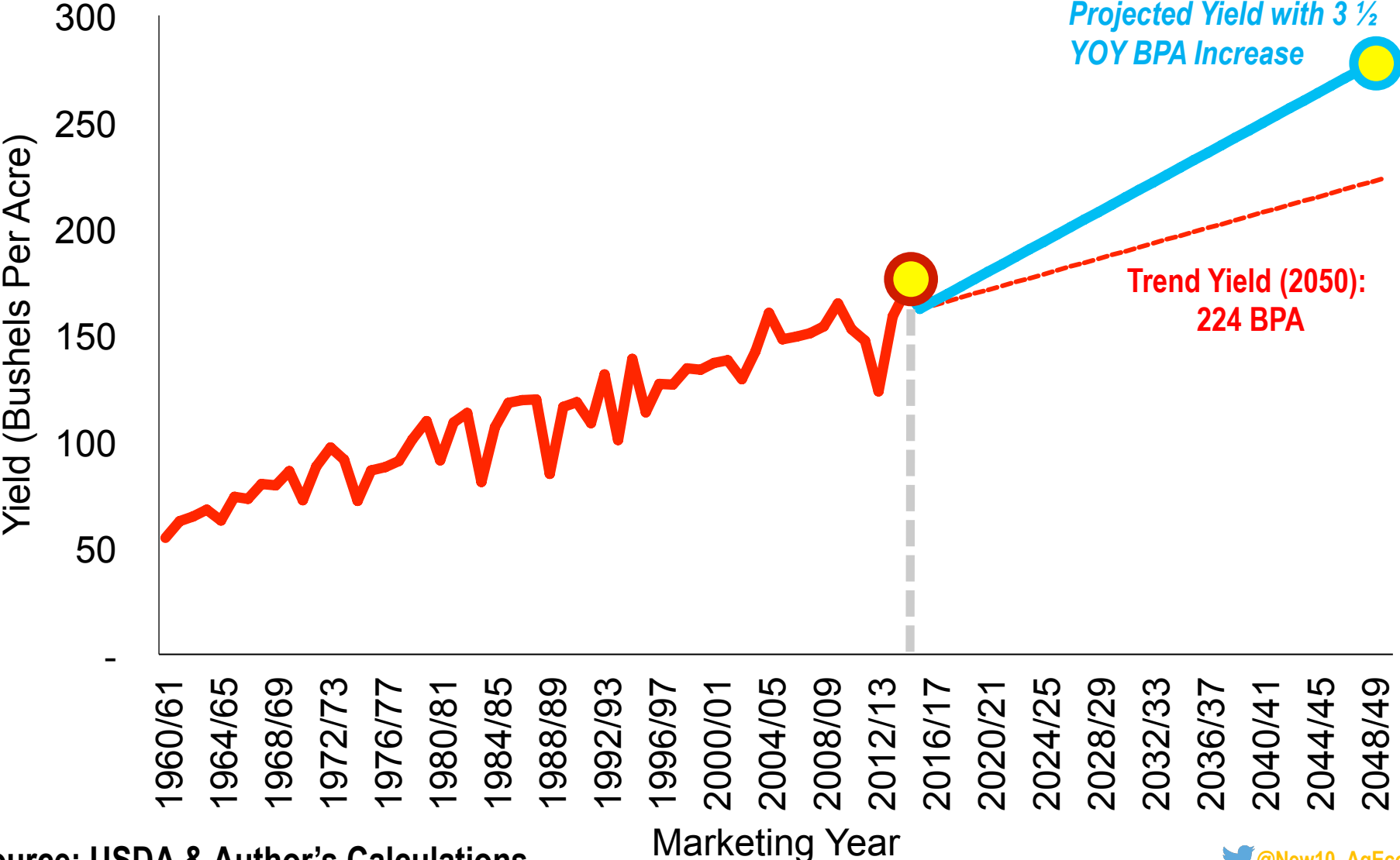
**MONSANTO PROJECTIONS INCLUDE 300 BPA BY  
2030 WITH ACHIEVEABLE GOALS OF 500 BPA.**

# U.S. AVERAGE CORN YIELD WAS A RECORD IN 2014. MULTIPLE PROJECTIONS ARE FOR +/- 224 BPA BY 2050.



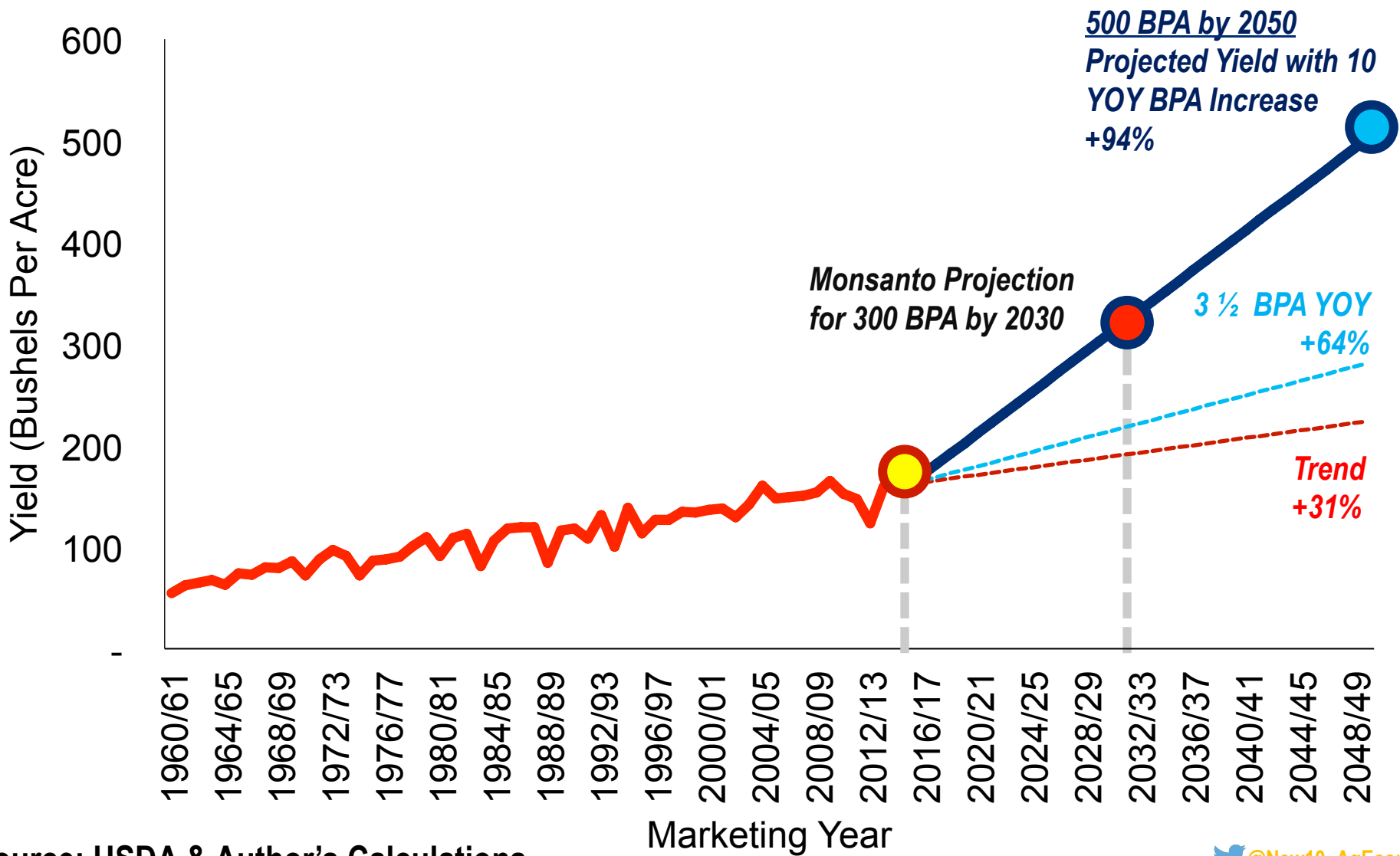
USDA 2 bpa above CBO  
FAPRI 1-3 bpa below CBO

# 3 ½ BPA YOY IN GENETIC IMPROVEMENTS BRINGS U.S. AVERAGE CLOSE TO 300 BPA BY 2050



Source: USDA & Author's Calculations

# “ELUSIVE 500” IS UNLIKELY ON U.S. SCALE ABSENT SIGNIFICANT EFFICIENCY GAINS

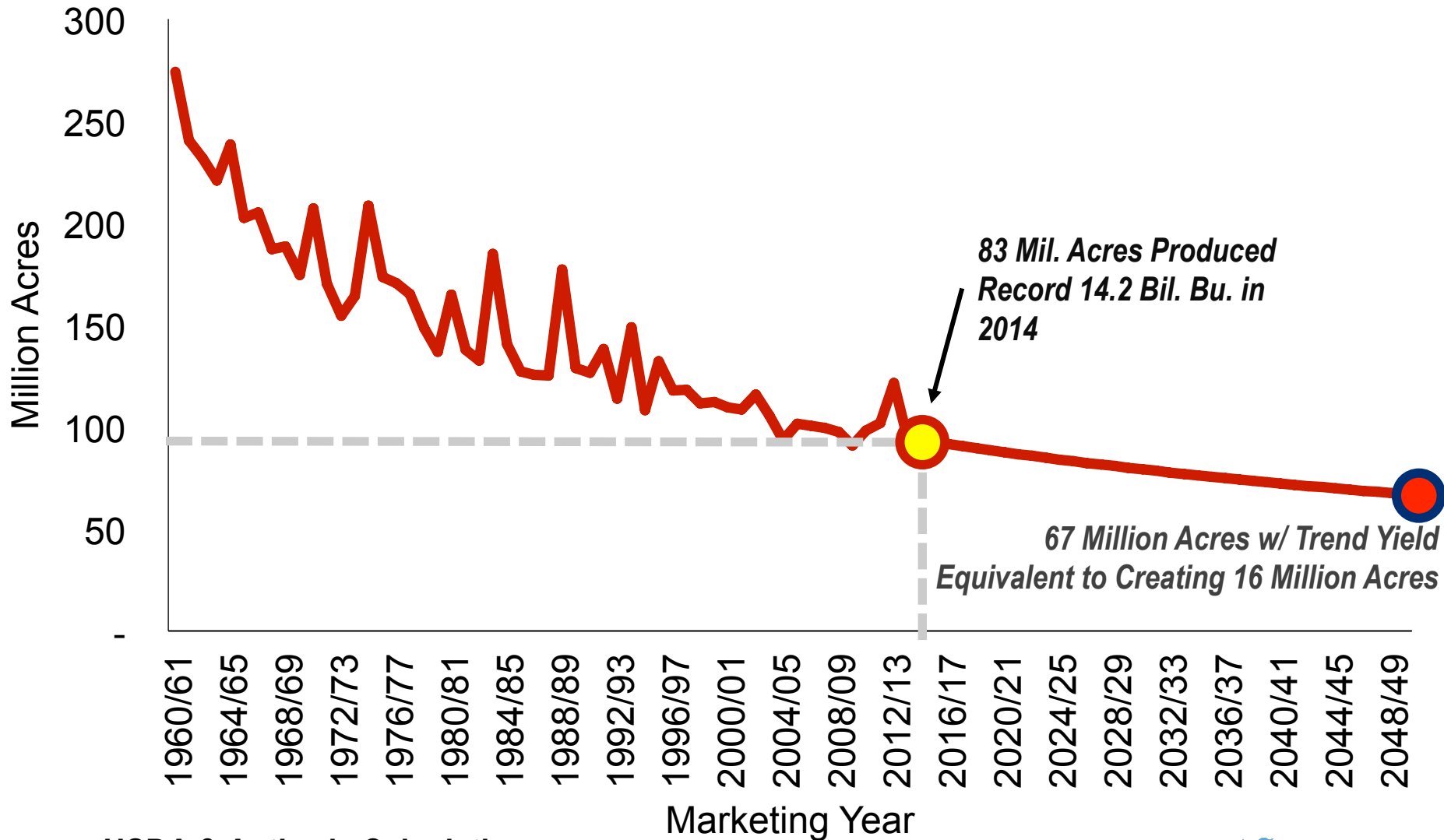


Source: USDA & Author's Calculations

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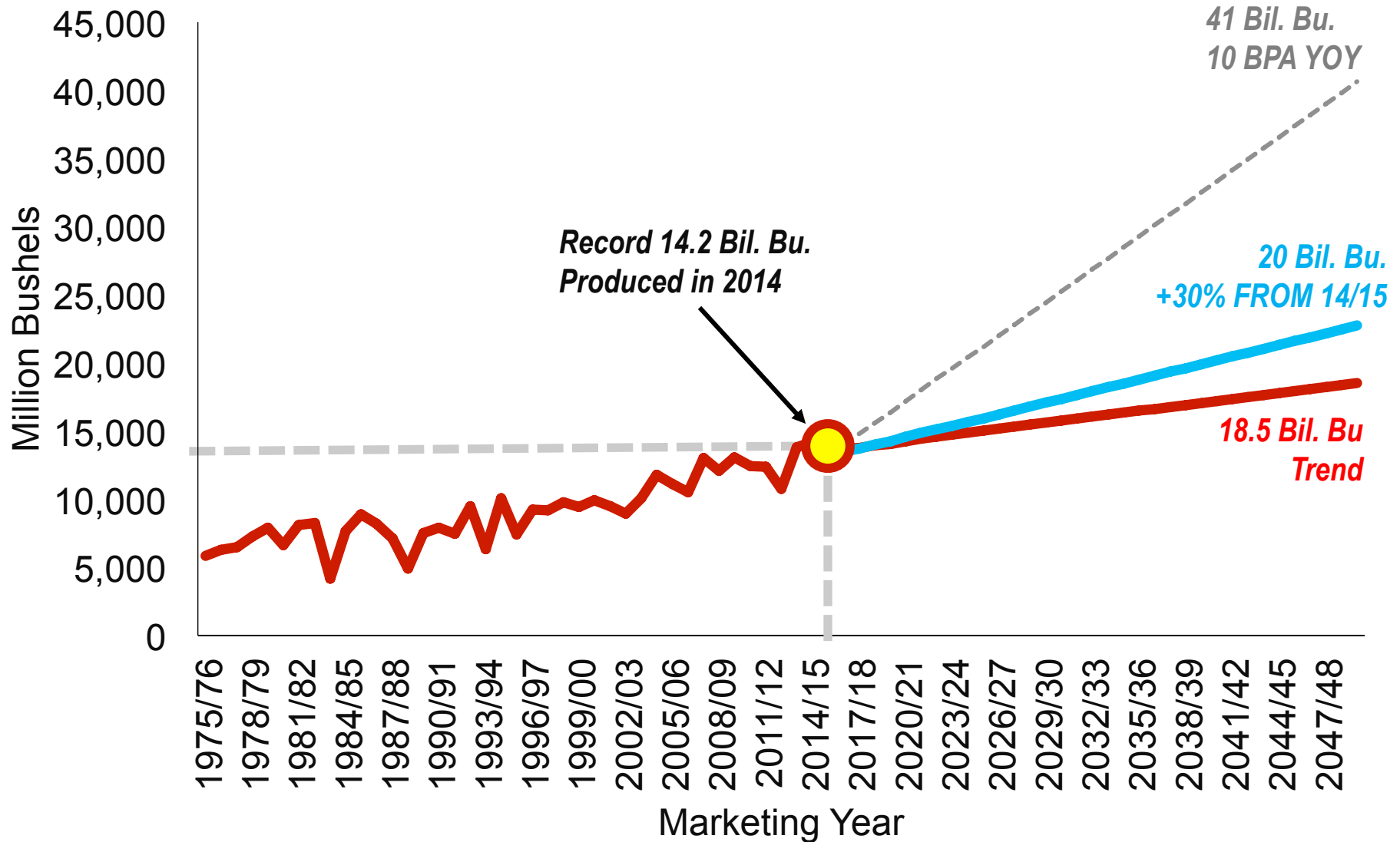


# 1960, 275 MIL. ACRES NEEDED TO PRODUCE TODAY'S CROP. BY 2050 U.S. COULD "CREATE" 16+ MIL. ACRES



Source: USDA & Author's Calculations

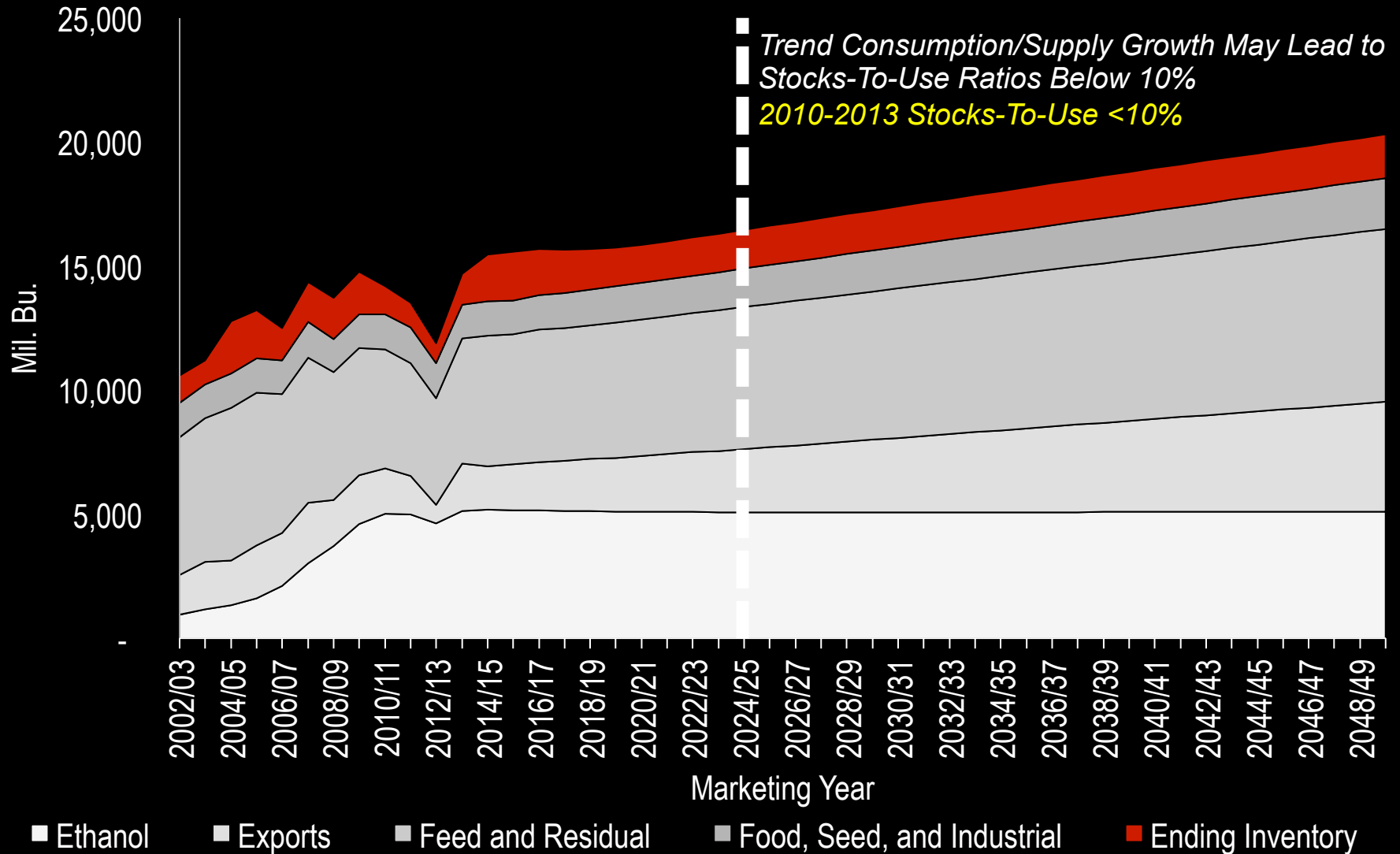
# CONSISTENT CORN ACREAGE LEADS TO A NUMBER OF POTENTIAL SUPPLY OUTCOMES. 18 TO 20 BBU



Source: USDA & Author's Calculations

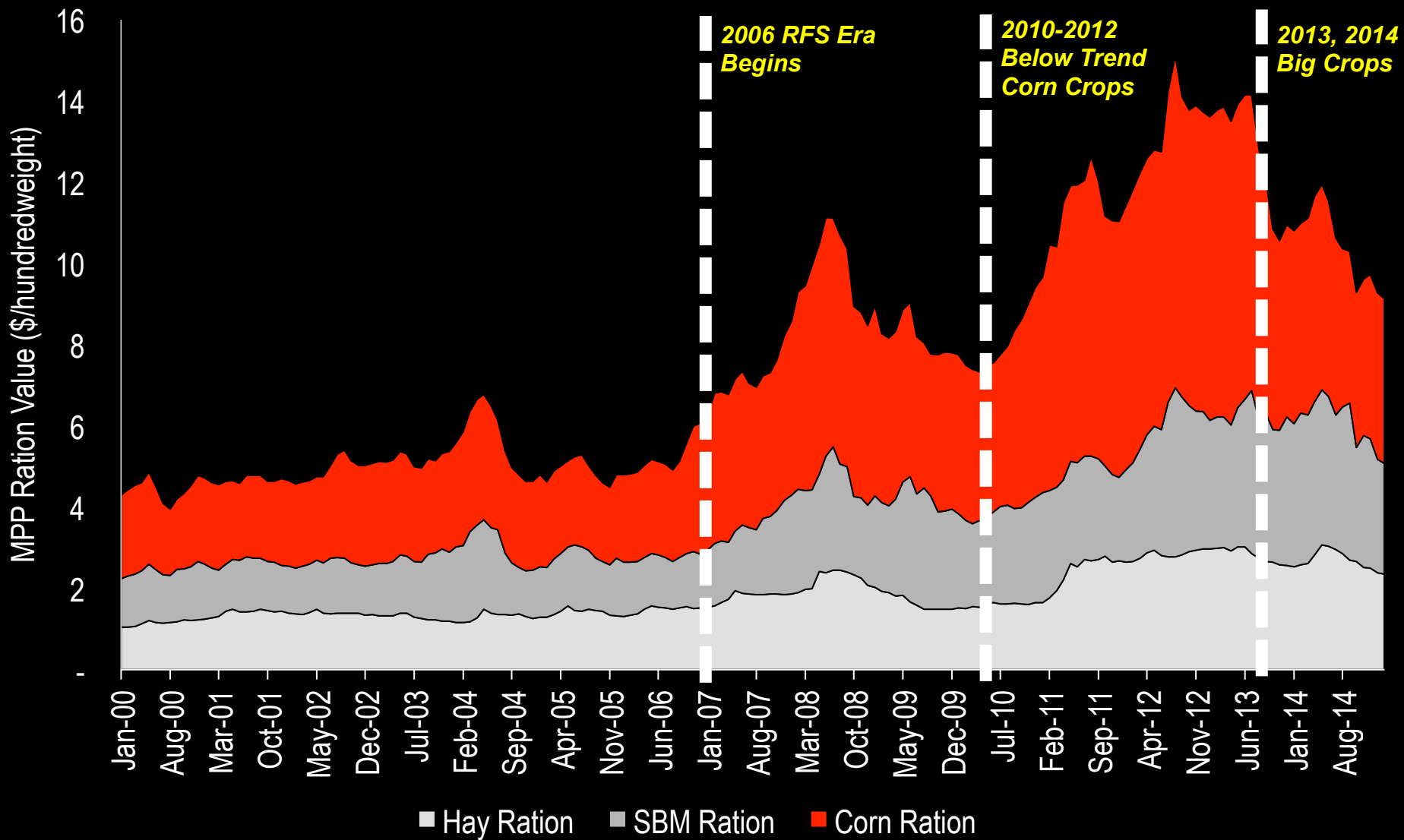
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# WITH SUCH HIGH LEVELS OF CONSUMPTION, MODERATE YIELD SHOCKS LIKELY TO RESULT IN STRONG CORN PRICE SPIKES



Source: USDA, CBO, & Author's Calculations

# U.S. CORN SUPPLY HAS EXPERIENCED **THREE BELOW TREND-YIELD CROPS** IN RFS ERA, **EACH W/ PRICE SPIKE**.



## POPULATION OF 9 BILLION, REALLY?

MOST OF THE GROWTH IN GLOBAL POPULATION IS PROJECTED TO OCCUR IN AFRICA. SIGNIFICANT ECONOMIC DEVELOPMENT NEEDED TO BECOME MAJOR IMPORTERS.

## RENEWABLE FUEL MANDATES

ADVANCED BIOFUELS COULD SPUR SOYBEAN DEMAND. **COULD DEMAND BE SUSTAINED WITHOUT MANDATES?** INFRASTRUCTURE FOR CORN ETHANOL PRODUCTION IN PLACE.

YIELD GROWTH COULD SLOW  
CHALLENGES FOR INCREASED PRODUCTIVITY  
INCLUDE CLIMATE CHANGE, **GRAIN YIELD**  
**STAGNATION**, AND **LIMITATION OF MARGINAL**  
**LAND AREAS.**

GETTING TO “ELUSIVE” 500-BUSHEL CROPS  
FACTORS DRIVING IMPROVEMENT INCLUDE  
GENETIC IMPROVEMENTS IN SEED, **VARIABLE**  
**RATE SEEDING**, & TECHNOLOGICAL CHANGE IN  
FARM EQUIPMENT ETC.

2015-2016 MARKETING YEAR EXPECTATIONS:

**CORN: 1.4 MIL FEWER ACRES IN 15/16 THAN 2014.**

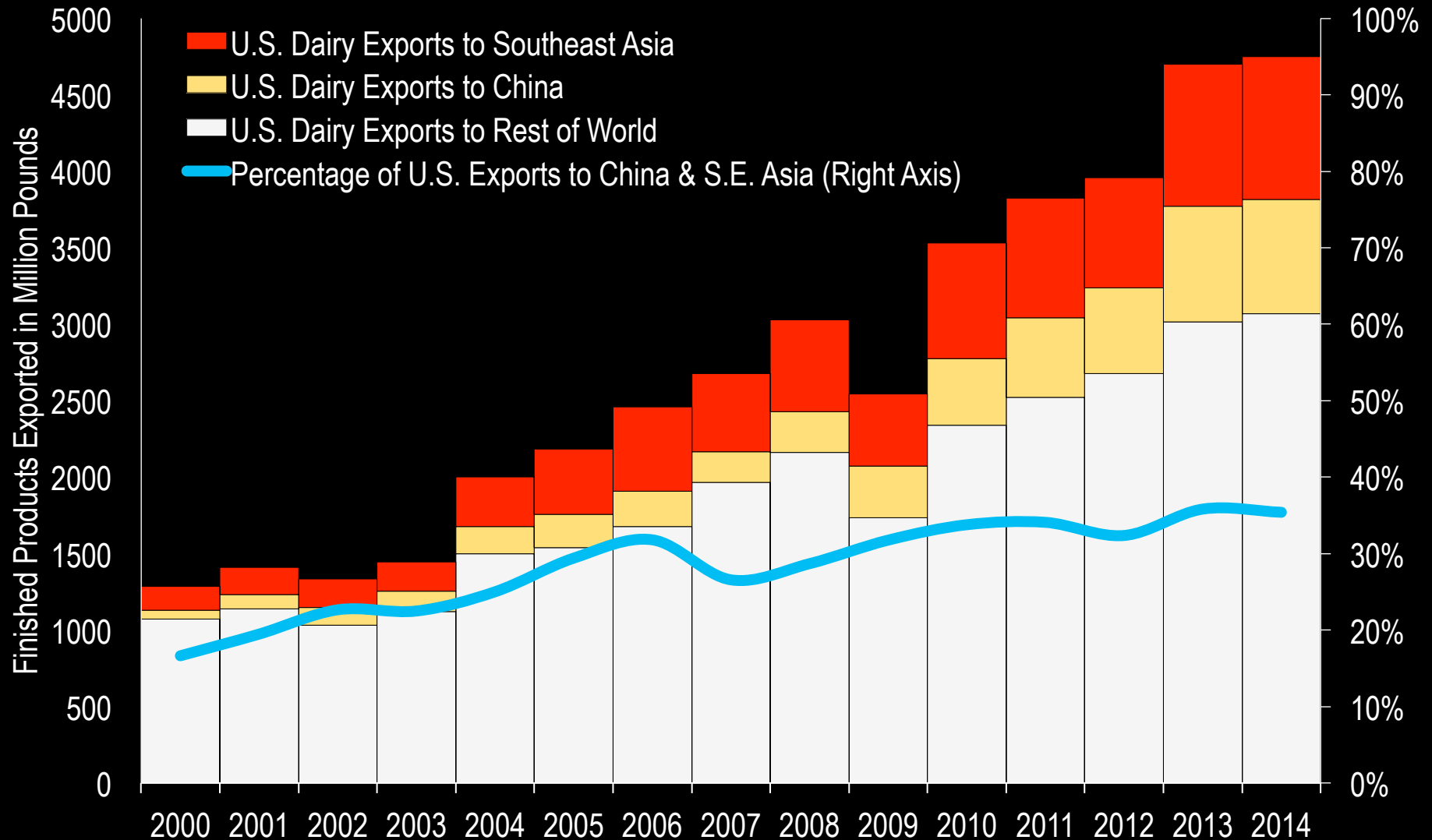
89.2 MILLION ACRES W/ 164 BPA. STRONG CONSUMPTION COULD LEAD TO **HIGHER PRICES.**

**SOYBEANS: 934K MORE ACRES IN 15/16.** 84.6

MILLION ACRES W/ 44.3 BPA. CONSUMPTION DECLINES FOLLOWING RECORD EXPORT YEAR COULD LEAD TO **LOWER PRICES.**

**WHAT IF U.S. HAS ANOTHER BIG CROP YEAR?**

# CAN DAIRY FOLLOW GRAIN'S PATTERN? U.S. DAIRY EXPORTS UP +268% SINCE 2000. 42% OF GROWTH CAME FROM CHINA & S.E. ASIA.





# QUESTIONS

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# APPENDIX

22<sup>ND</sup> NATIONAL WORKSHOP FOR DAIRY ECONOMISTS & POLICY ANALYSTS | APRIL 30, 2015



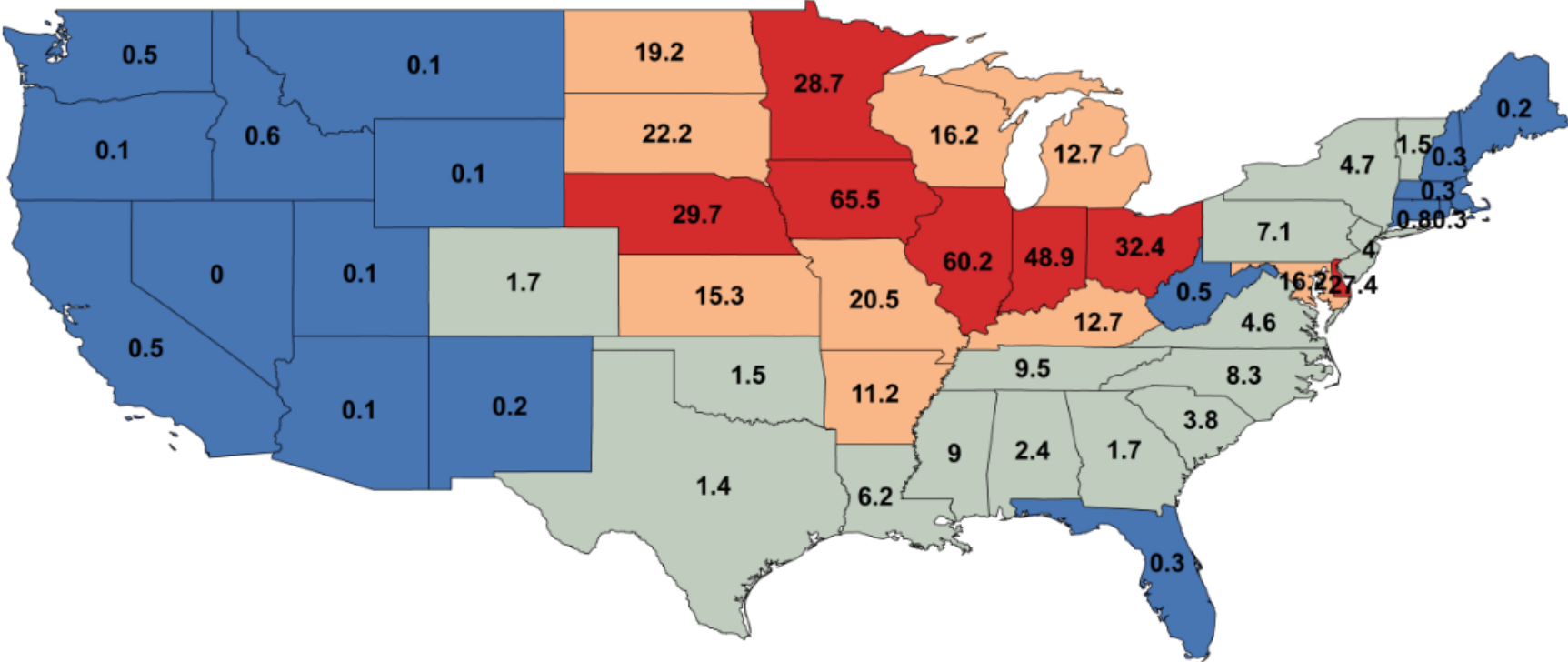
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# ILLINOIS & IOWA WITH >60% LAND AREA IN CORN OR SOYBEAN PRODUCTION



Percent of Land Area in Corn and Soybean Planted Acres, 2014  
 Source: USDA NASS

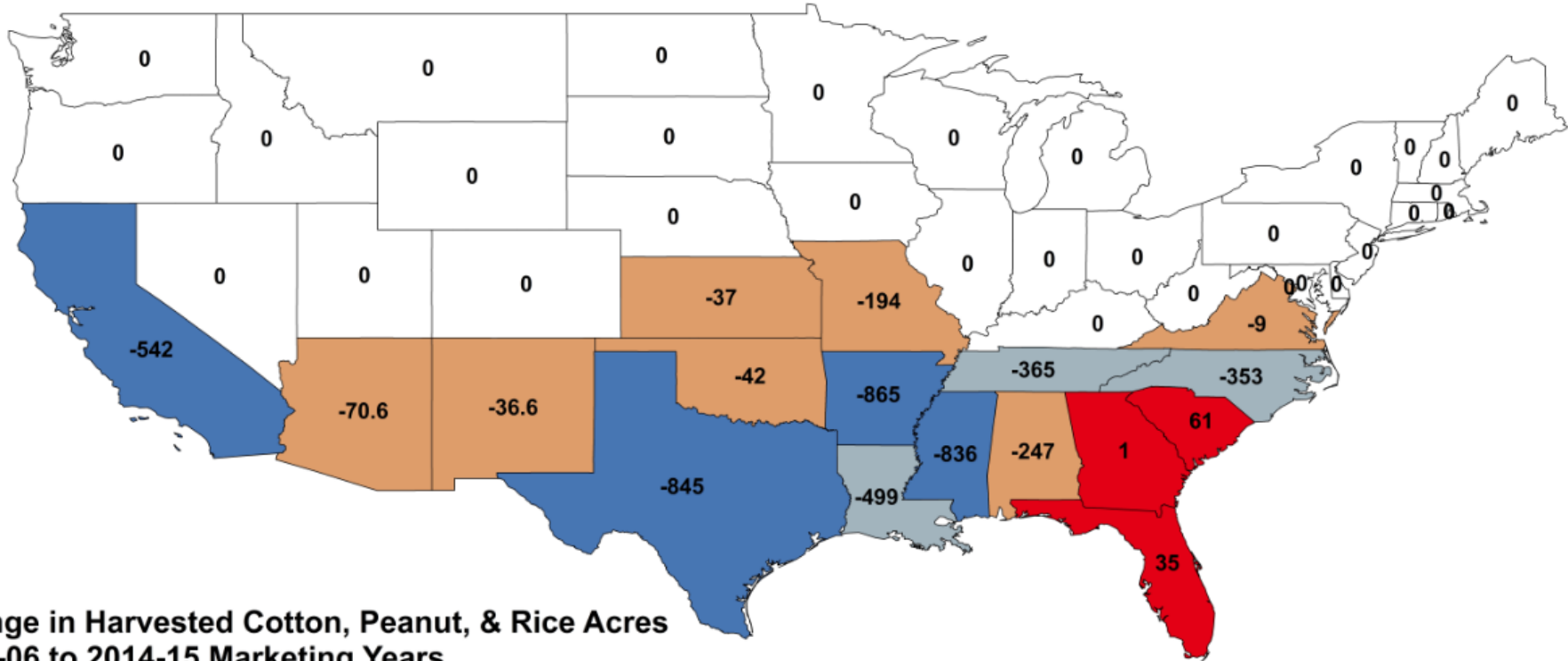
- <=1%
- 1.1% to 10.0%
- 10.1% to 25.0%
- >25%



# CROSS-COMMODITY SUBSIDIZATION - "DECOUPLING"

## KEEP BASE ACRE \$, SWITCH TO CORN/BEAN ROTATION

(-5 MIL. ACRES)



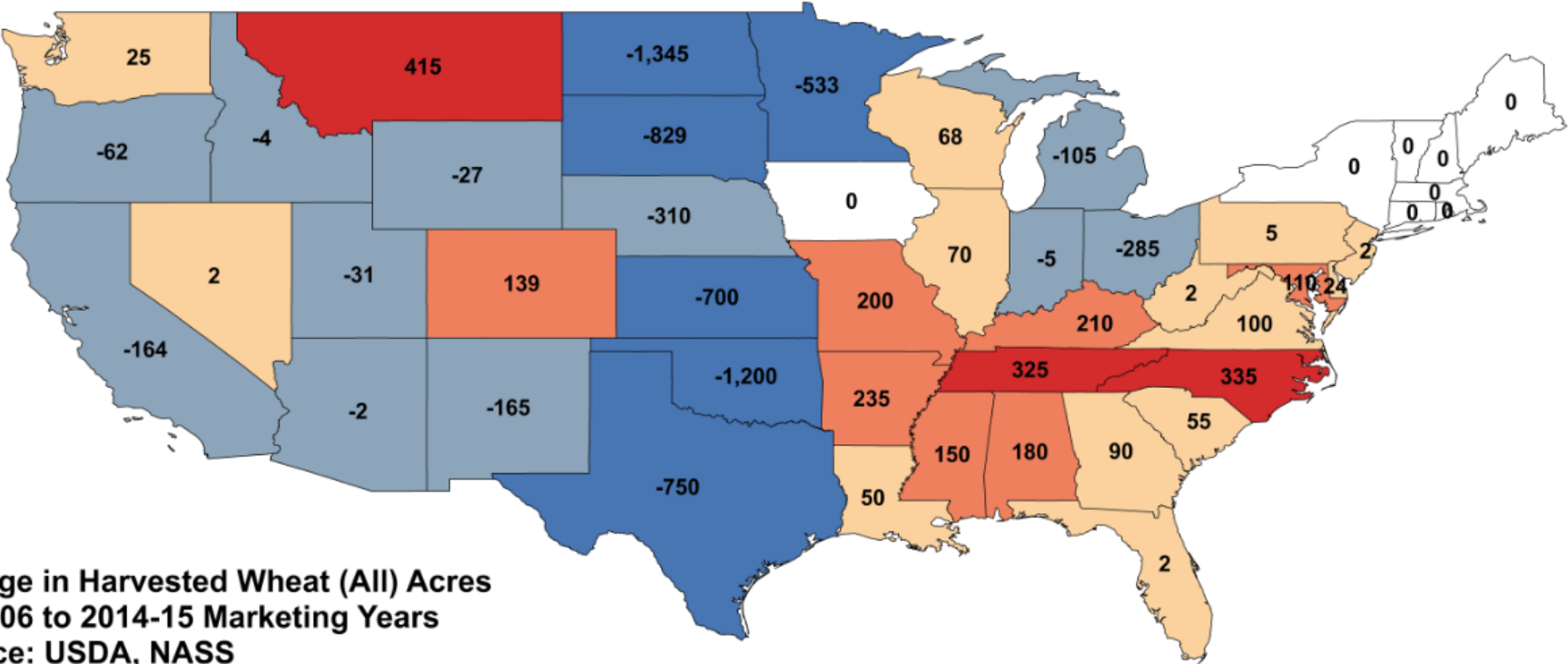
Change in Harvested Cotton, Peanut, & Rice Acres  
2005-06 to 2014-15 Marketing Years

Source: USDA, NASS

- Less than -500 thousand acres
- 500 thousand to -250 acres
- 250 thousand to -1 acres
- No change or data not available
- Increase in acres



# HIGHER RETURNS IN CORN/BEANS PULLED ACRES OUT OF WHEAT (-4 MIL. ACRES)

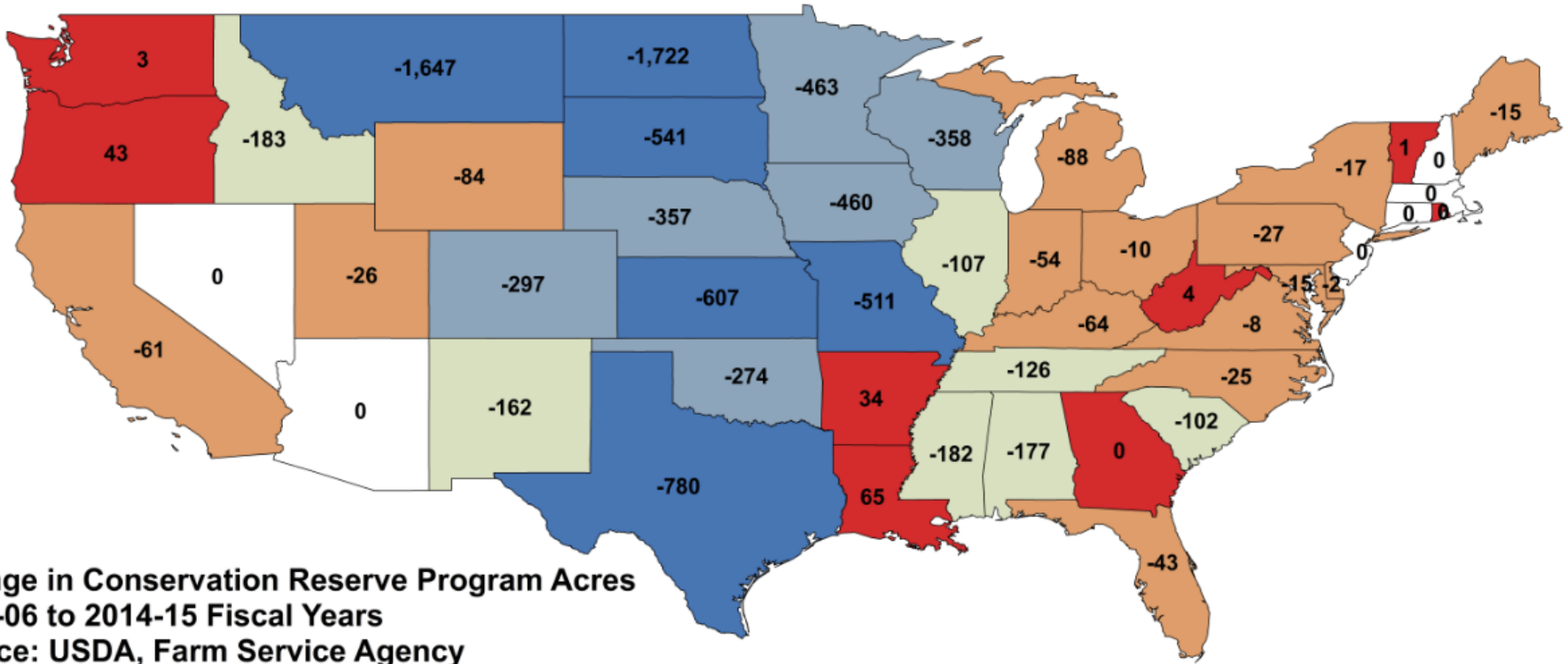


**Change in Harvested Wheat (All) Acres  
2005-06 to 2014-15 Marketing Years**  
Source: USDA, NASS

- Less than -500 thousand acres
- 500 thousand to -1 acres
- No change or data not available
- 0 to 100 thousand acres
- 101 to 250 thousand acres
- Greater than 250 thousand acres



# LAND IN CRP WAS 35 MIL. ACRES IN 2005, **DROPPED 10 MIL. ACRES BY 2014**

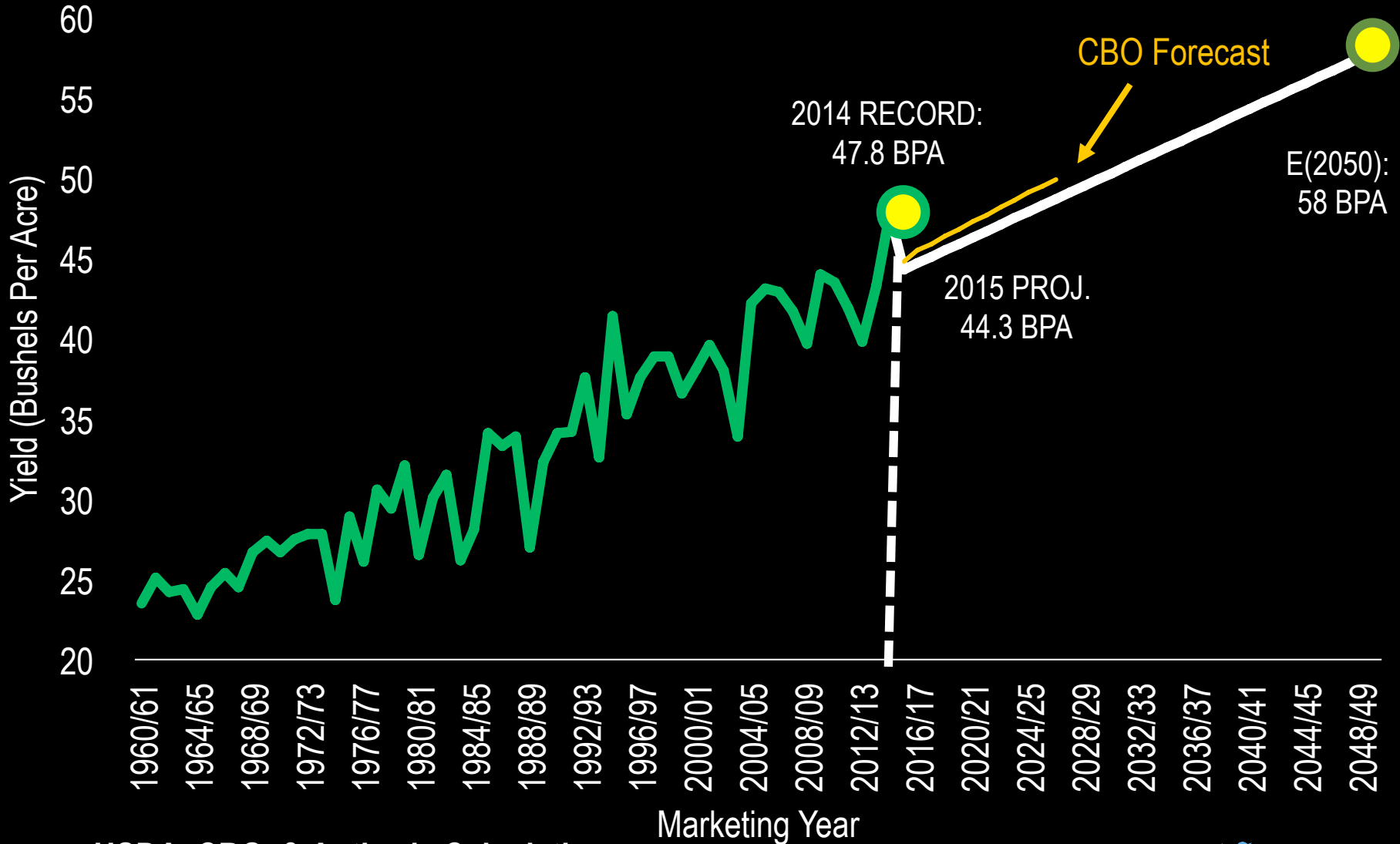


**Change in Conservation Reserve Program Acres  
2005-06 to 2014-15 Fiscal Years**  
Source: USDA, Farm Service Agency

- Less than -500 thousand acres
- 500 thousand to -250 thousand acres
- 250 thousand to -100 thousand acres
- 100 thousand to -1 acres
- No change or data not available
- Increase in CRP acres



# U.S. AVERAGE SOYBEAN YIELD WAS A RECORD IN 2014. MULTIPLE PROJECTIONS ARE FOR +/- 60 BPA BY 2050.



Source: USDA, CBO, & Author's Calculations

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