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# Climate and Cropping Patterns in Brazil

Mark D. Brusberg

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USDA Office of the Chief Economist / World Agricultural Outlook Board

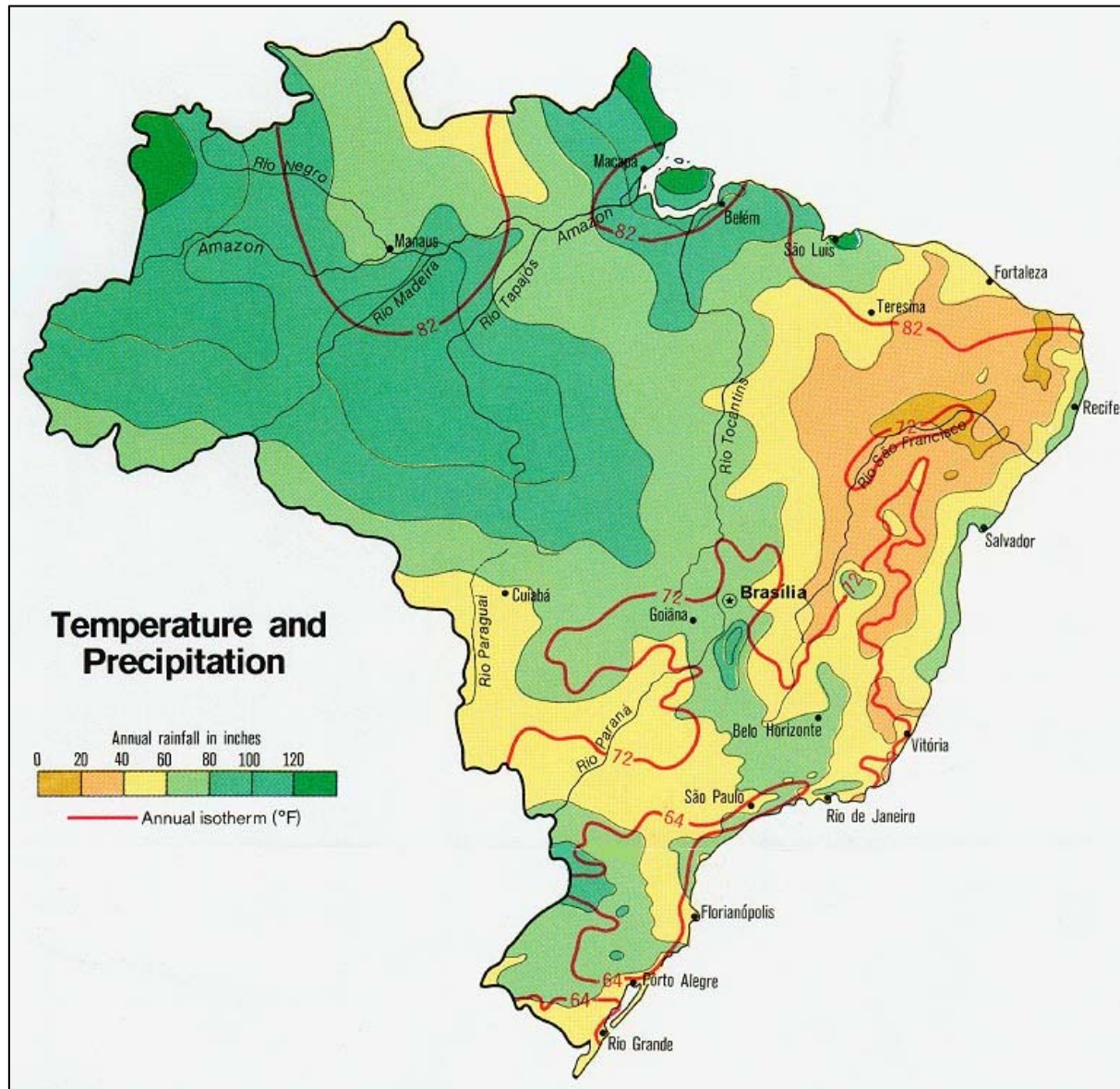
Presented on Behalf of the

**USDA 2016 Agricultural Outlook Forum:**

**Transforming Agriculture**

February 26, 2016

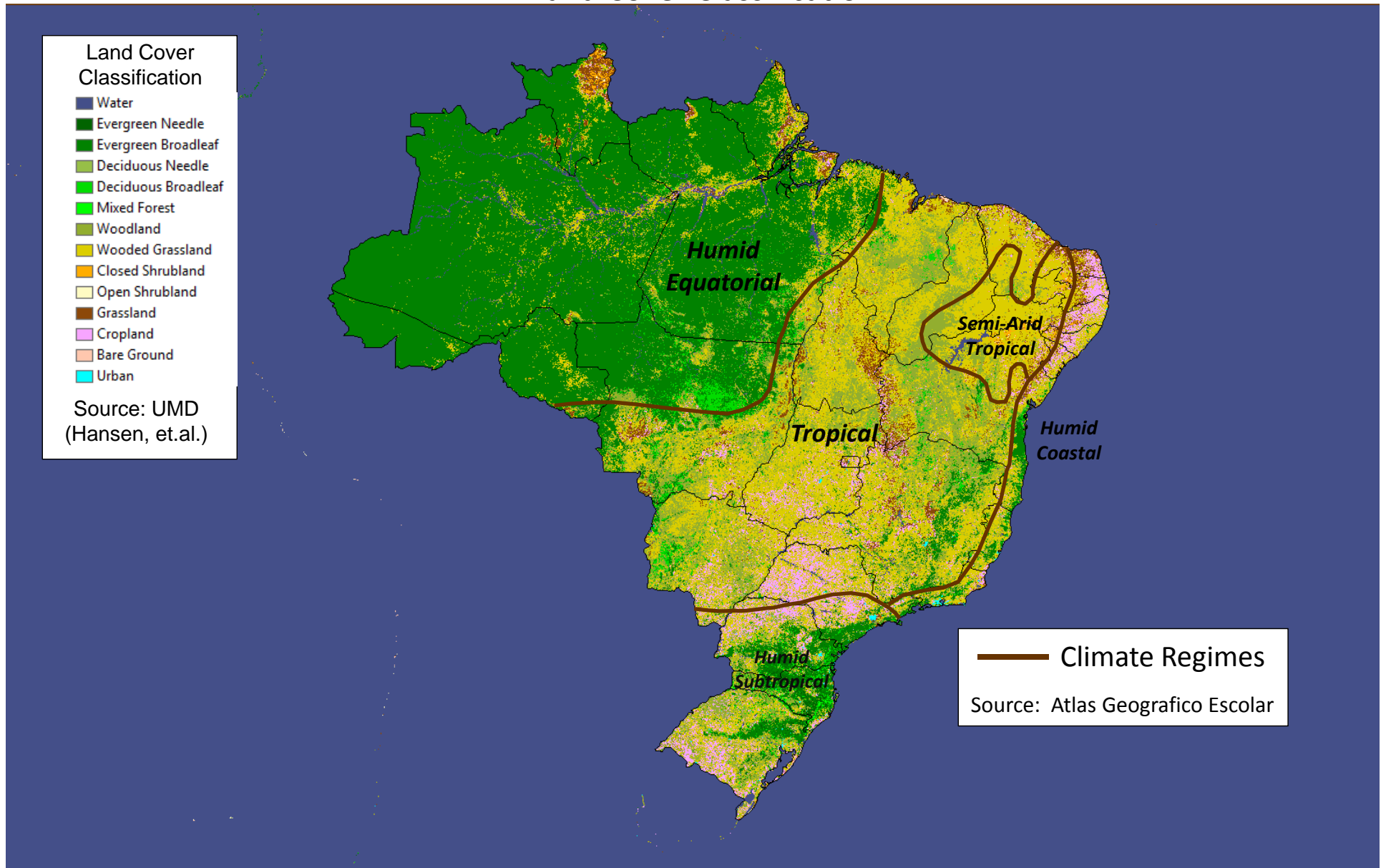
# Part I: Climate



# University of Maryland \*Land Cover Classification



# University of Maryland \*Land Cover Classification

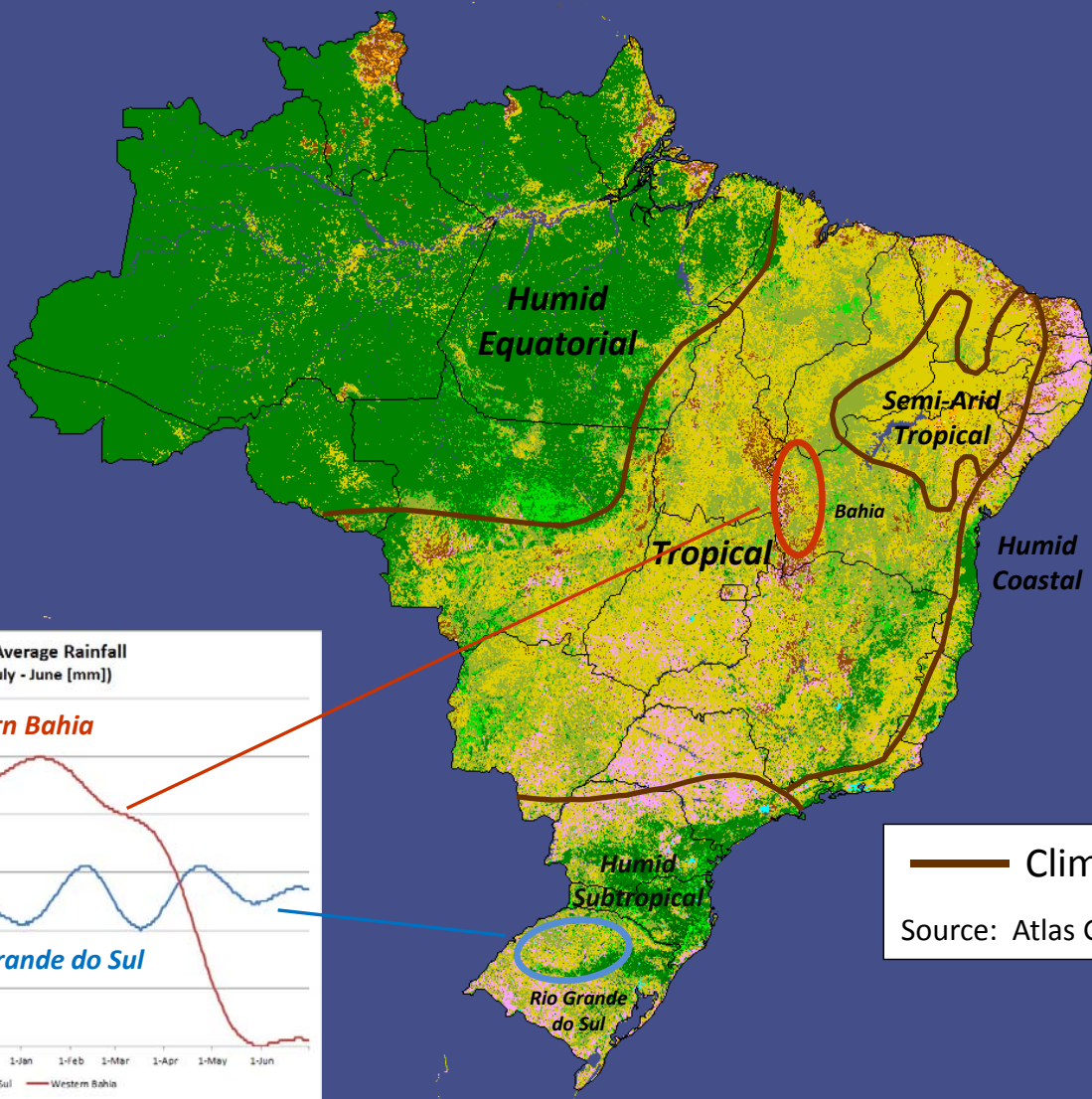


# University of Maryland \*Land Cover Classification

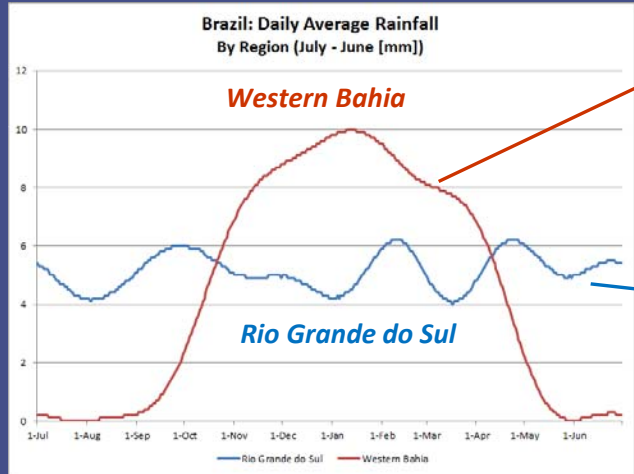
**Land Cover Classification**

- Water
- Evergreen Needle
- Evergreen Broadleaf
- Deciduous Needle
- Deciduous Broadleaf
- Mixed Forest
- Woodland
- Wooded Grassland
- Closed Shrubland
- Open Shrubland
- Grassland
- Cropland
- Bare Ground
- Urban

Source: UMD  
(Hansen, et.al.)

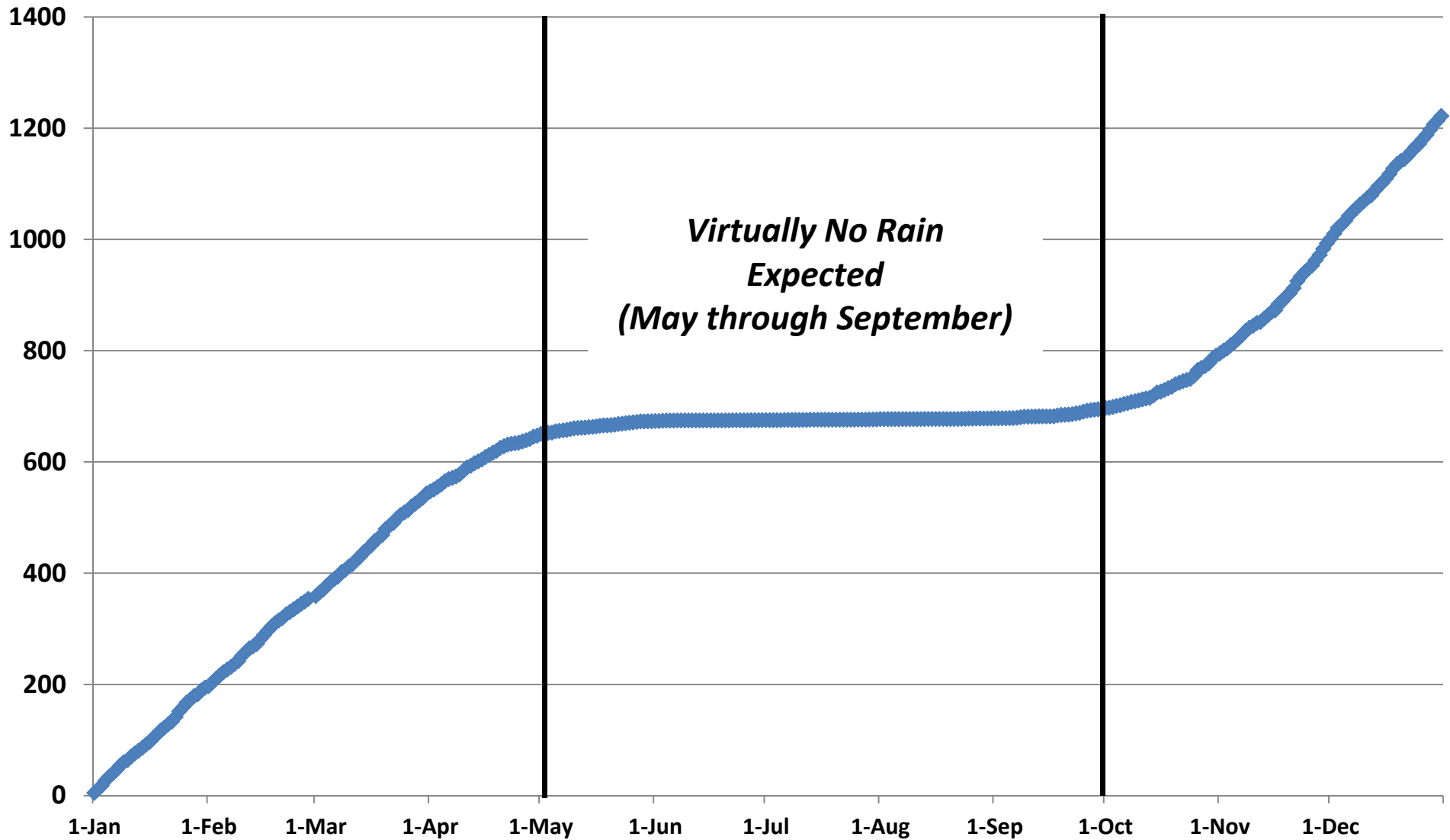


— Climate Regimes  
Source: Atlas Geografico Escolar



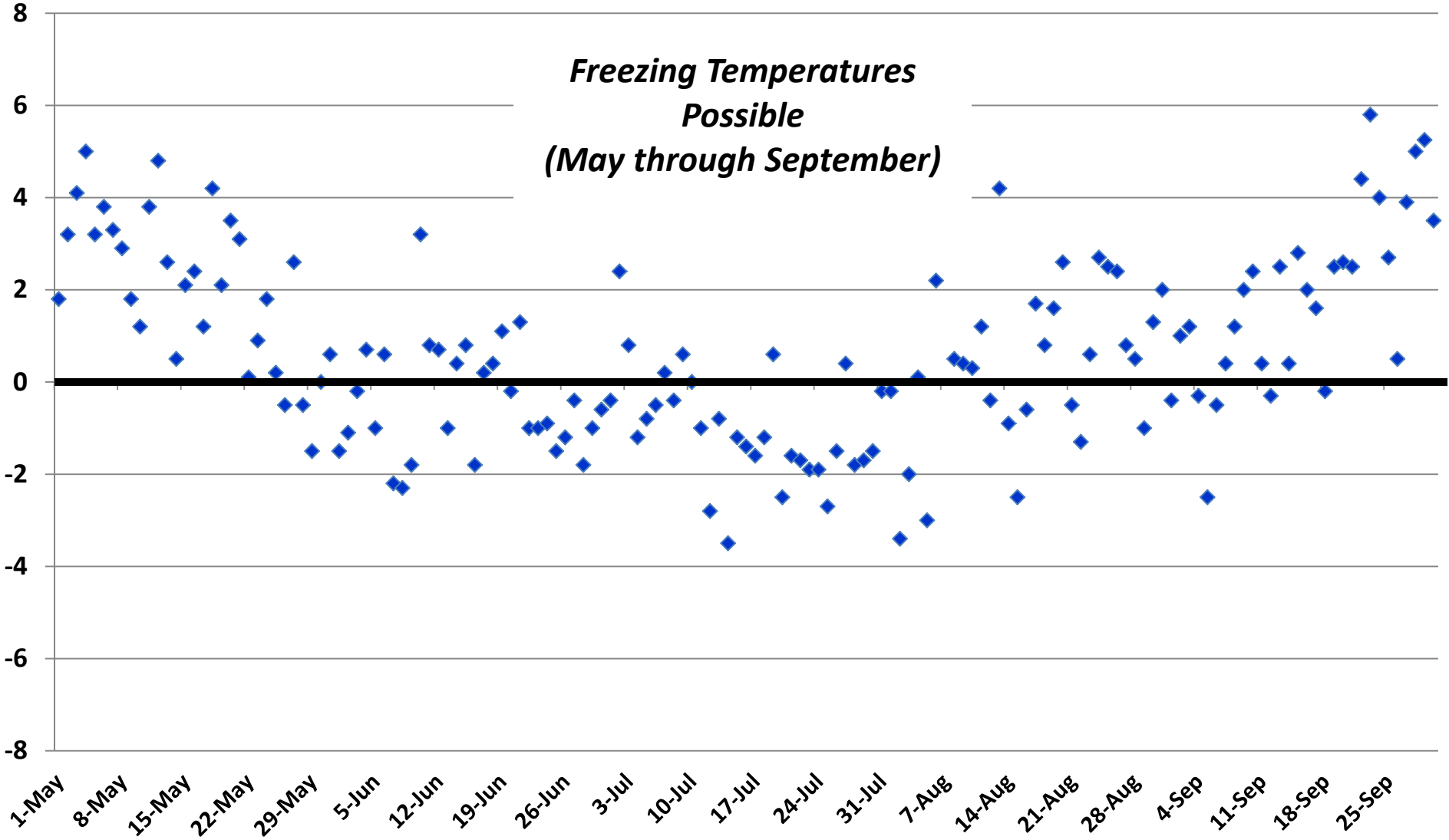
# Western Bahia

## Cumulative Average Daily Rainfall (mm)



# Rio Grande do Sul

## Lowest Minimum Temperatures by Day (°C)

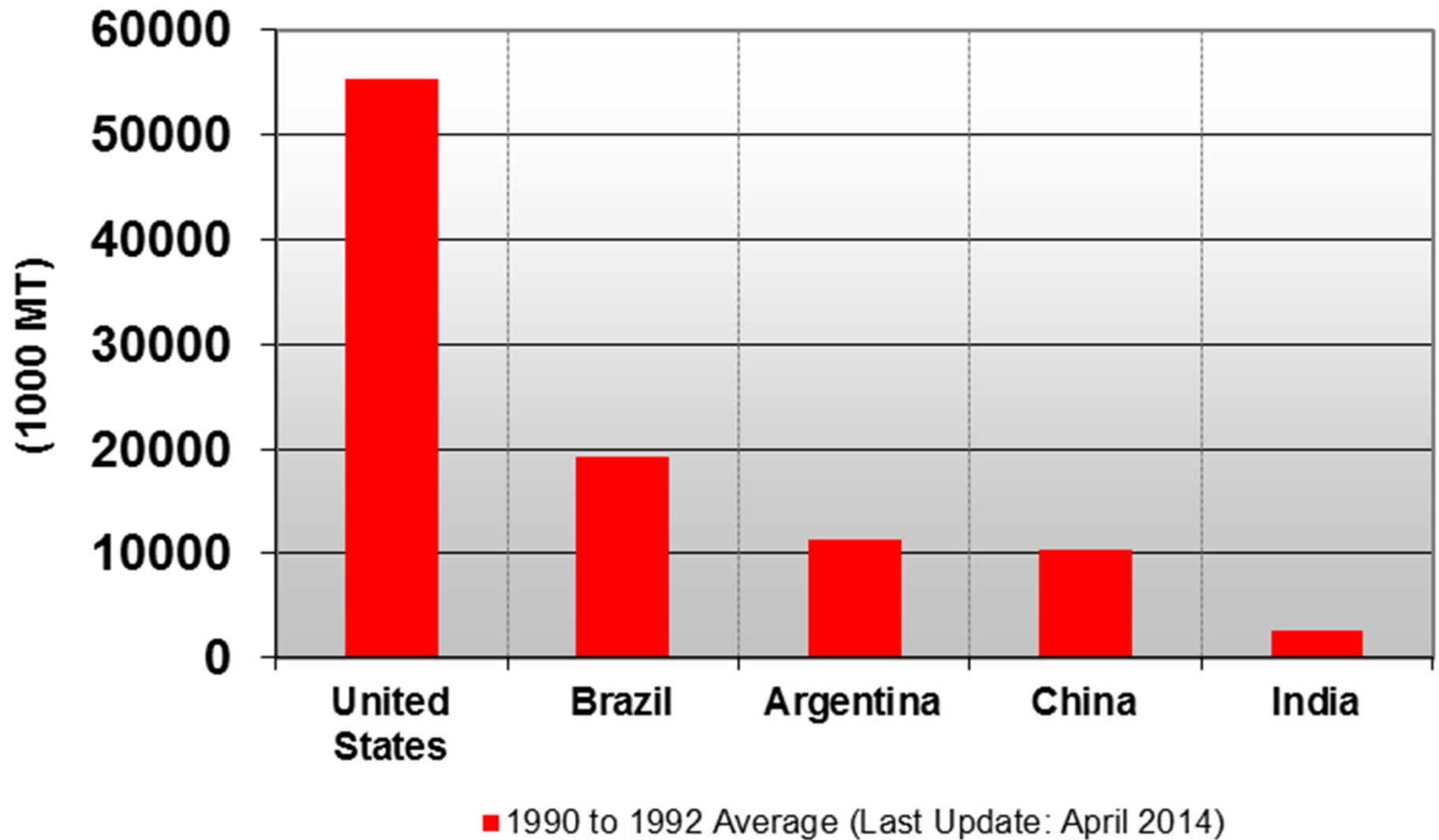




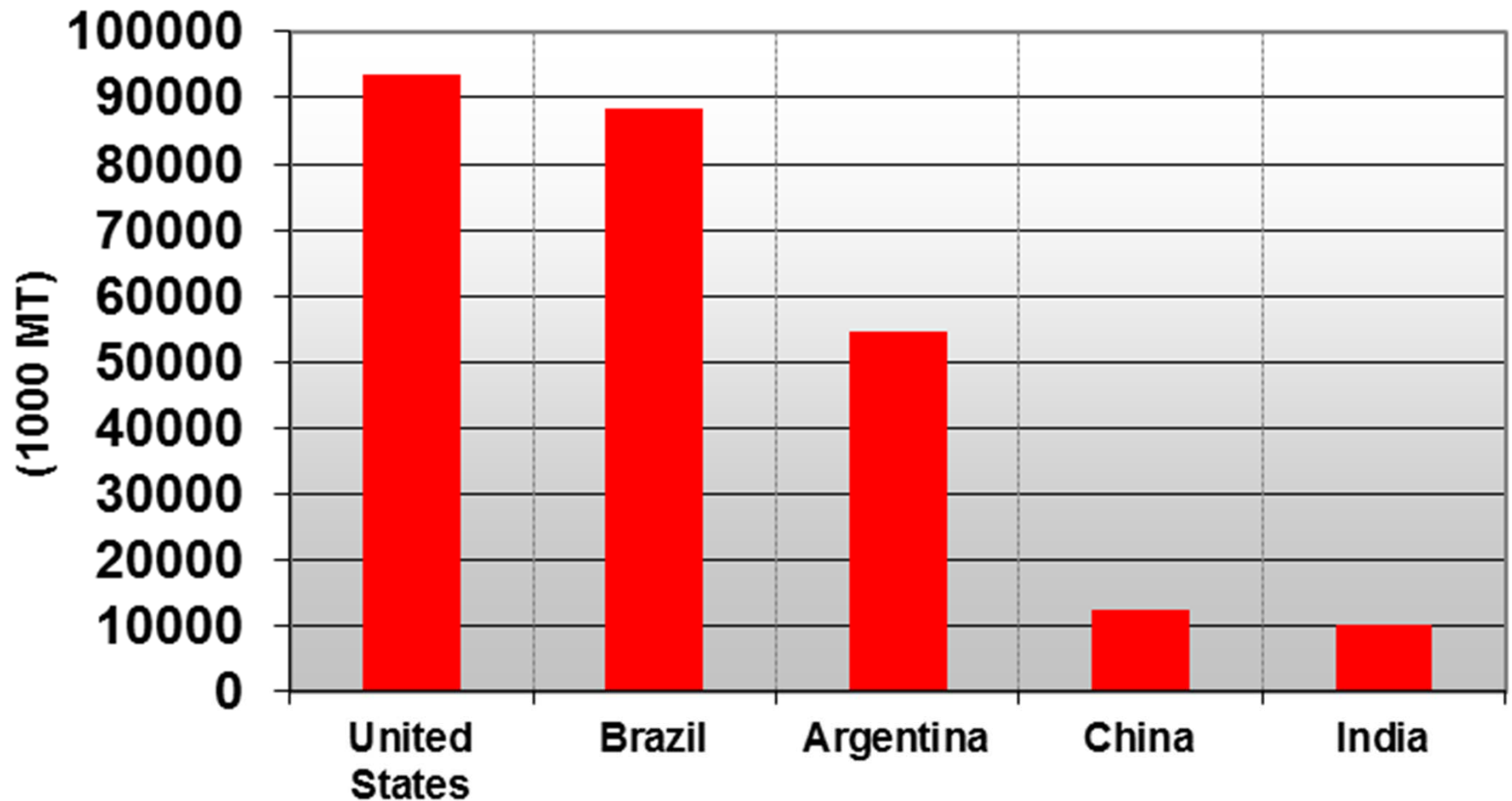
# Part II: Agricultural Expansion



# Oilseed, Soybean Production

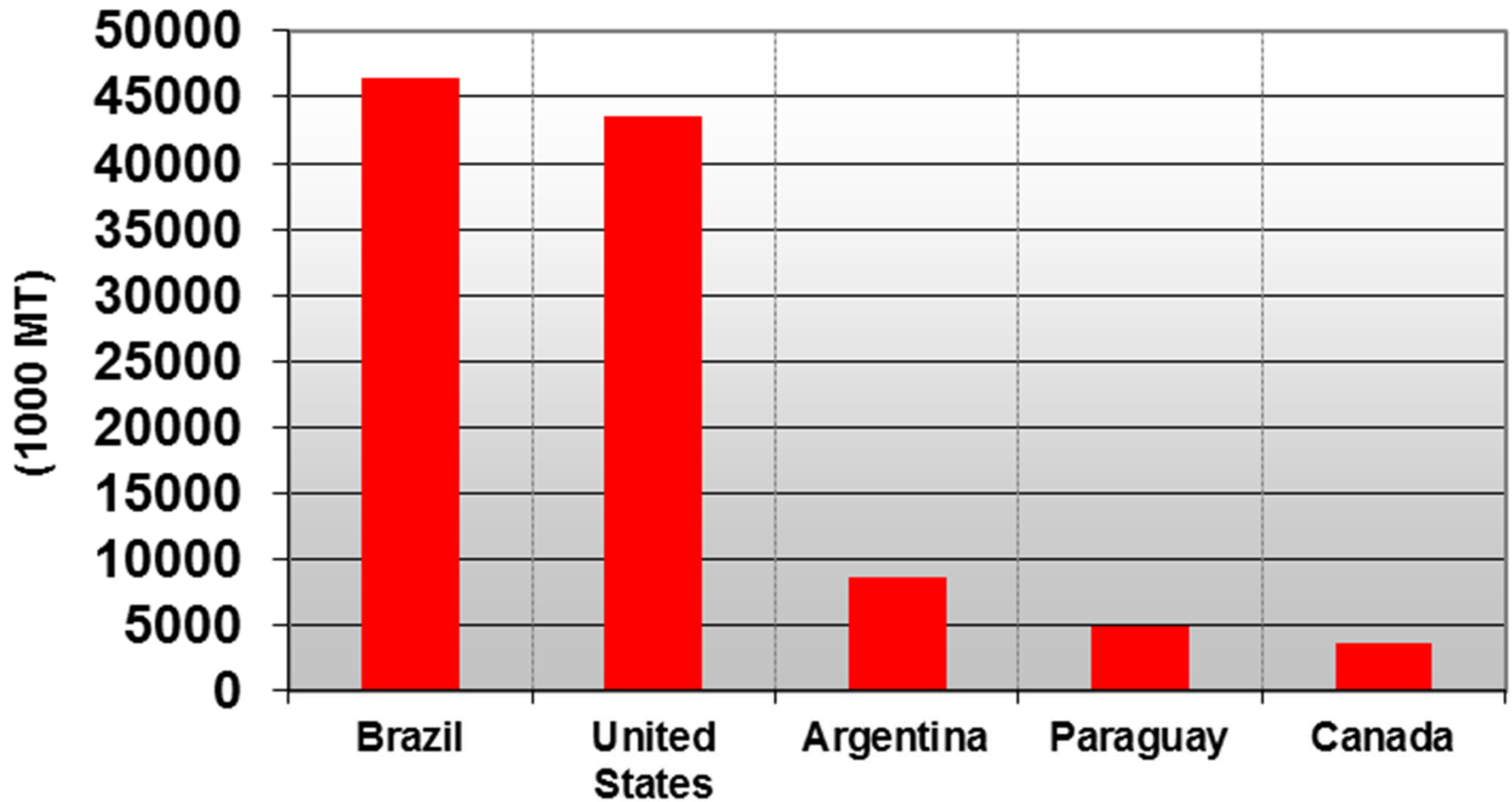


# Oilseed, Soybean Production



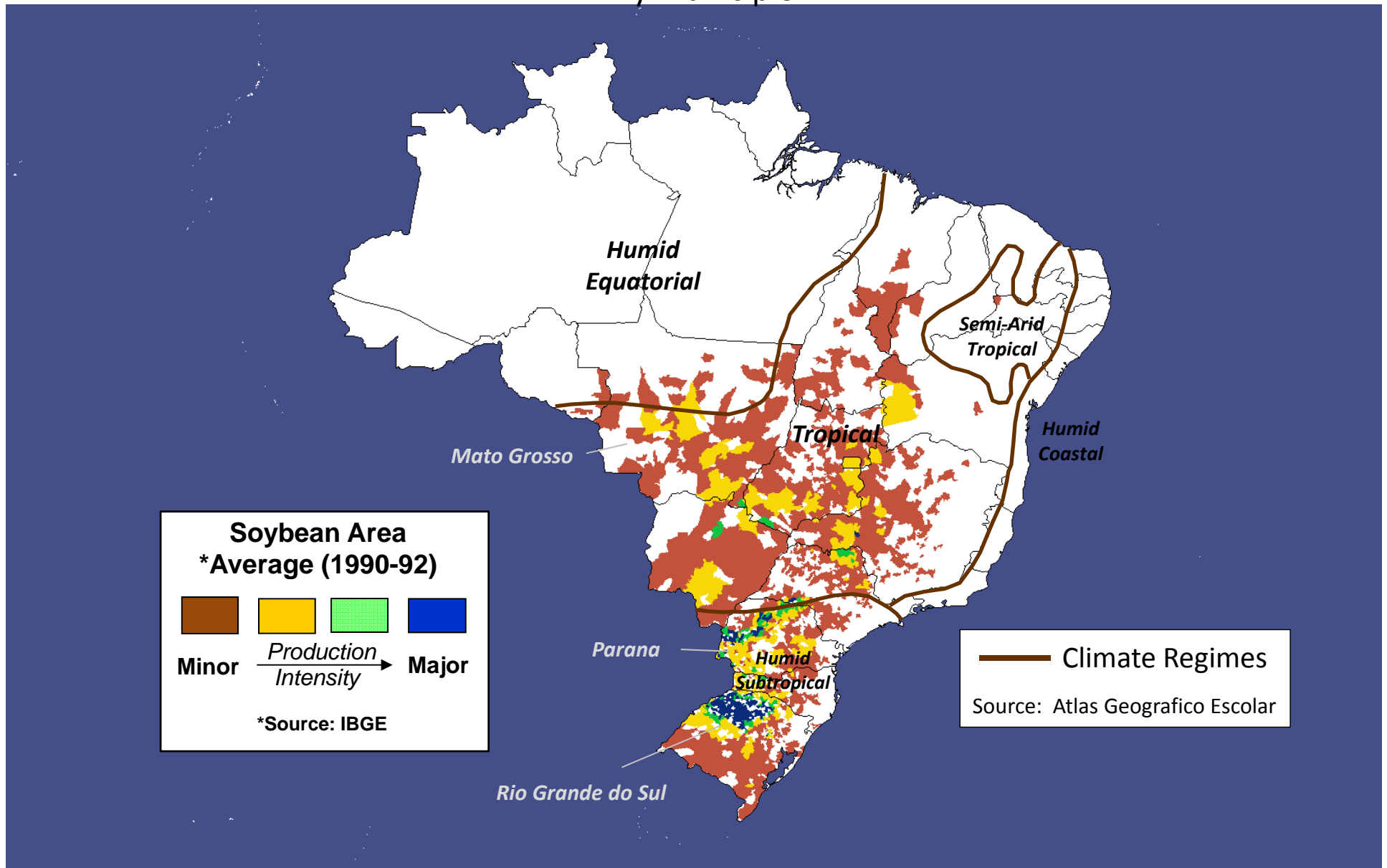
■ 2012 to 2014 Average (Last Update: February 2016)

# Oilseed, Soybean Exports



■ 2012 to 2014 Average (Last Update: February 2016)

# Soybean Area \*By Municipio

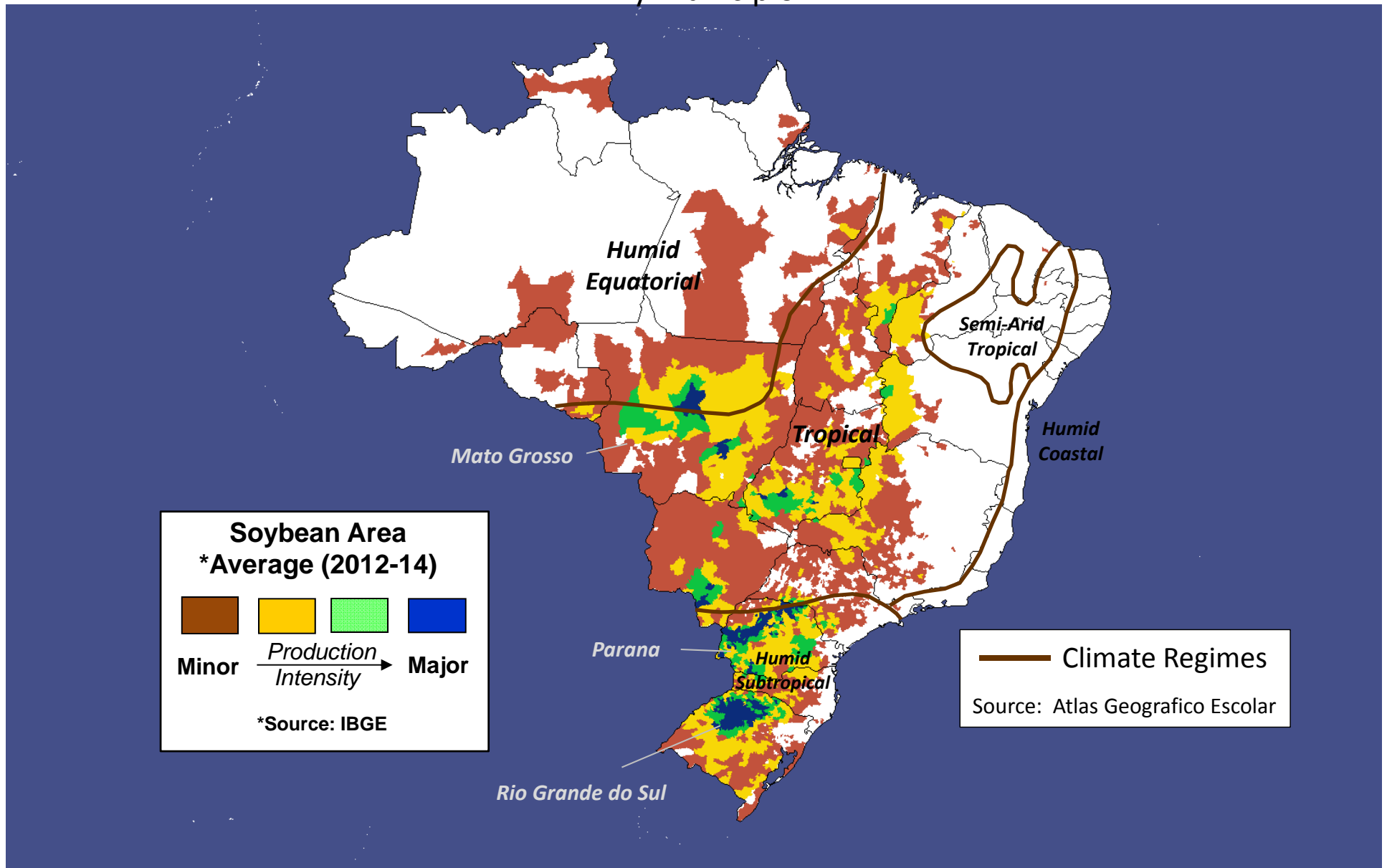


## Brazil Soybean Production By State (1990-92 Average)

State	Planted Area (ha)	Harvested Area (ha)	Production (mMT)	Percent of Total (%)
Rio Grande do Sul	3,177,338	3,169,731	4,727,577	26.2
Parana	2,019,915	2,016,944	3,873,811	21.5
Mato Grosso	1,394,725	1,382,014	3,148,623	17.5
Mato Grosso do Sul	1,102,469	1,087,355	1,975,912	11.0
Goias	875,977	864,343	1,572,457	8.7
Sao Paulo	510,078	510,078	924,772	5.1
Minas Gerais	501,755	500,165	898,194	5.0
Santa Catarina	281,047	277,185	384,738	2.1
Bahia	296,672	296,672	380,472	2.1
Federal District	46,202	46,202	91,196	0.5
Tocantins	13,887	12,520	18,435	0.1
Maranhao	13,671	13,646	12,081	0.1
Rondonia	3,240	3,240	7,012	0.0
Piaui	1,683	1,683	1,492	0.0
Pernambuco	9	9	4	0.0
<b>Total</b>	<b>10,238,667</b>	<b>10,181,787</b>	<b>18,016,774</b>	<b>100.0</b>

Source: IBGE

# Soybean Area \*By Municipio

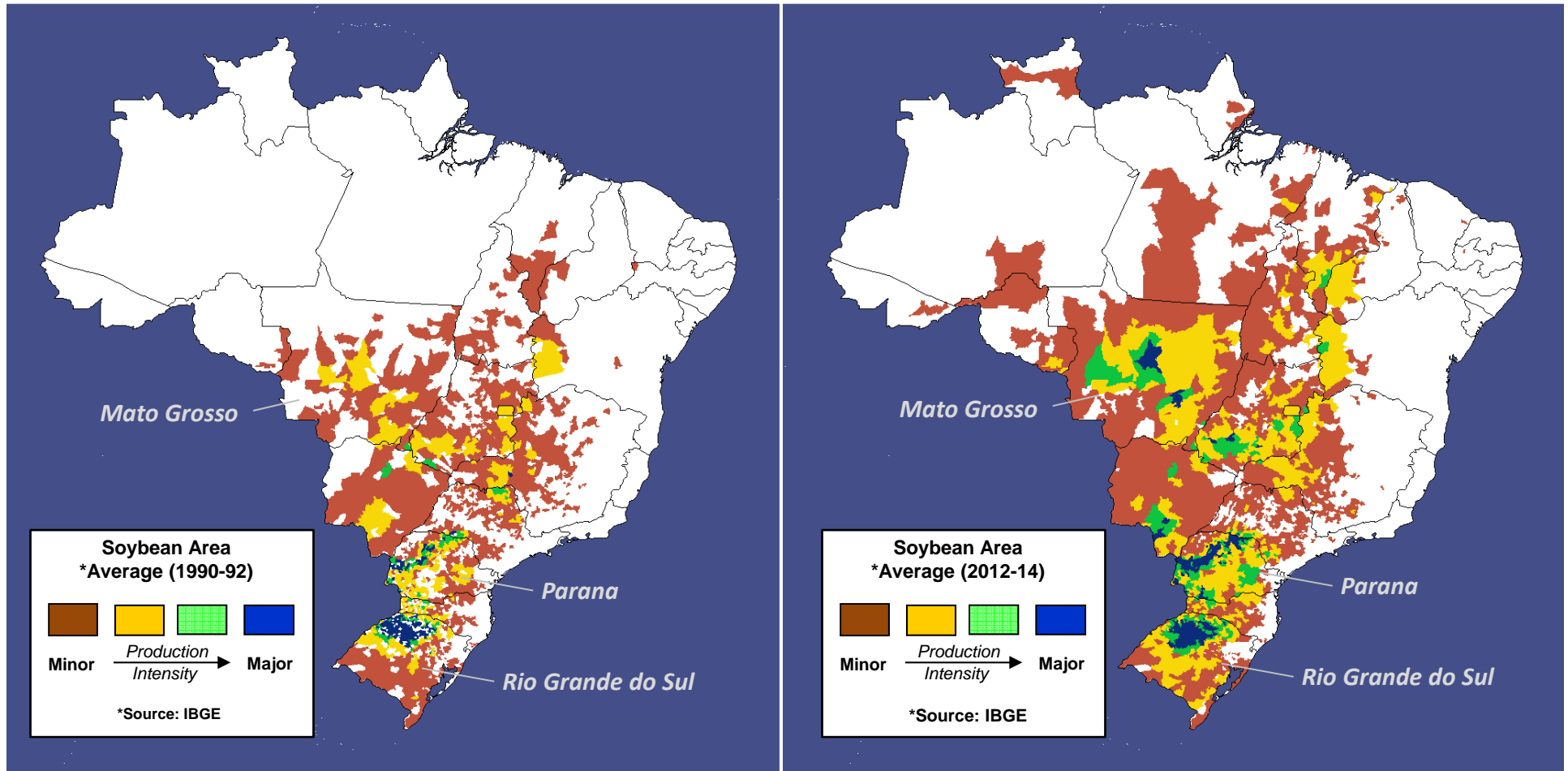


## Brazil Soybean Production By State (2012-14 Average)

State	Planted Area (ha)	Harvested Area (ha)	Production (mMT)	Percent of Total (%)
Mato Grosso	7,847,068	7,835,990	23,917,983	30.7
Parana	4,743,520	4,743,181	13,929,563	17.9
Rio Grande do Sul	4,662,374	4,623,486	10,581,180	13.6
Goias	2,931,615	2,931,592	8,750,173	11.2
Mato Grosso do Sul	1,961,379	1,960,562	5,497,821	7.0
Minas Gerais	1,142,239	1,138,682	3,264,913	4.2
Bahia	1,200,088	1,200,088	3,061,562	3.9
Sao Paulo	622,231	621,896	1,707,045	2.2
Maranhao	599,421	599,028	1,699,221	2.2
Tocantins	557,121	556,794	1,642,989	2.1
Santa Catarina	511,262	510,939	1,444,759	1.9
Piaui	541,072	534,923	1,217,390	1.6
Rondonia	173,737	172,664	553,354	0.7
Para	177,745	177,678	519,528	0.7
Federal District	59,850	59,850	181,470	0.2
Roraima	11,967	11,967	29,383	0.0
Amapa	10,885	10,177	26,849	0.0
Ceara	1,145	1,145	3,854	0.0
Acre	230	229	625	0.0
Paraiba	350	175	420	0.0
Amazonas	120	120	360	0.0
<b>Total</b>	<b>27,755,417</b>	<b>27,691,164</b>	<b>78,030,443</b>	<b>100</b>



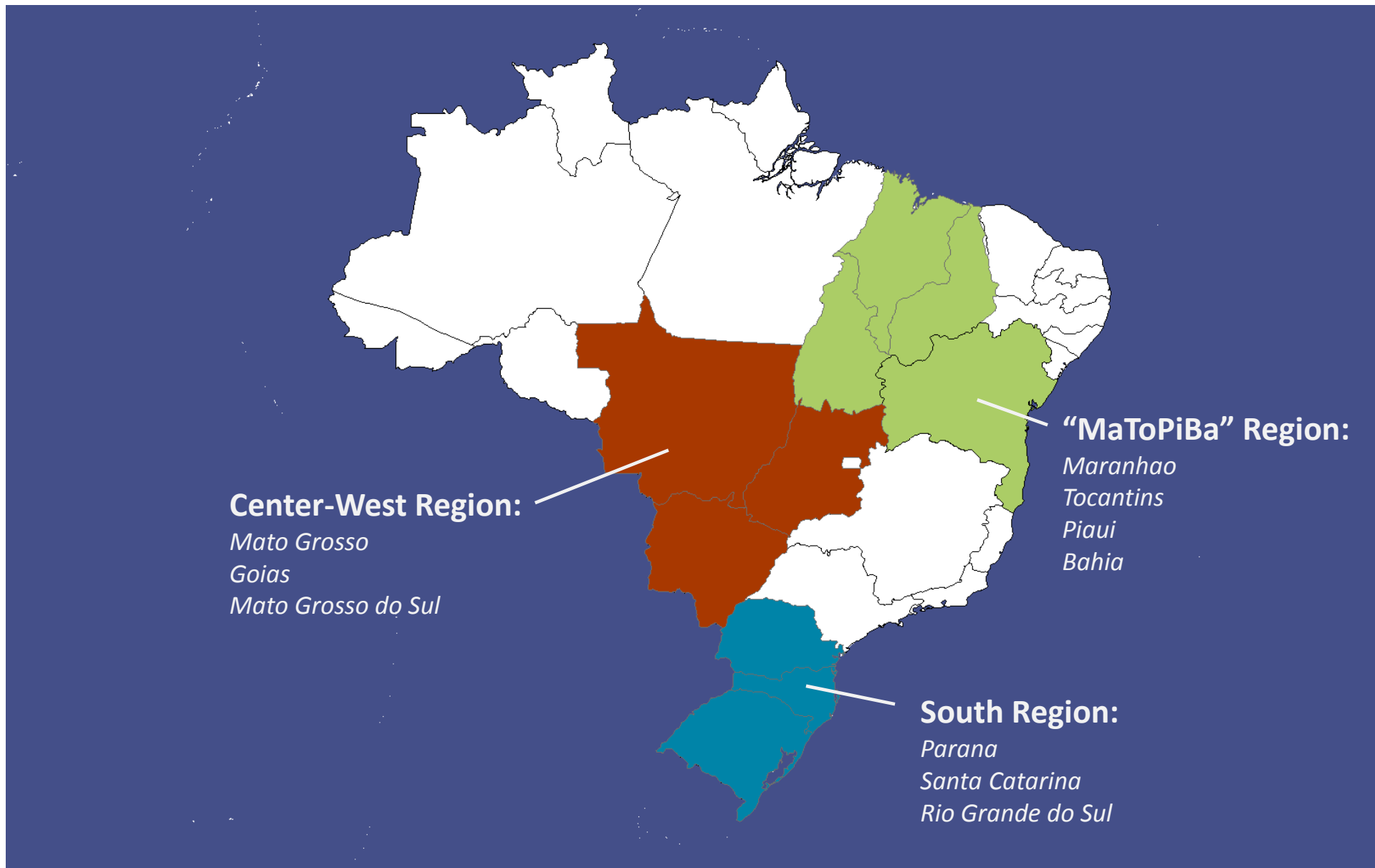
# Brazil Soybean Area 1990-92 versus 2012-14



## Shift in Area (% of Total Area)

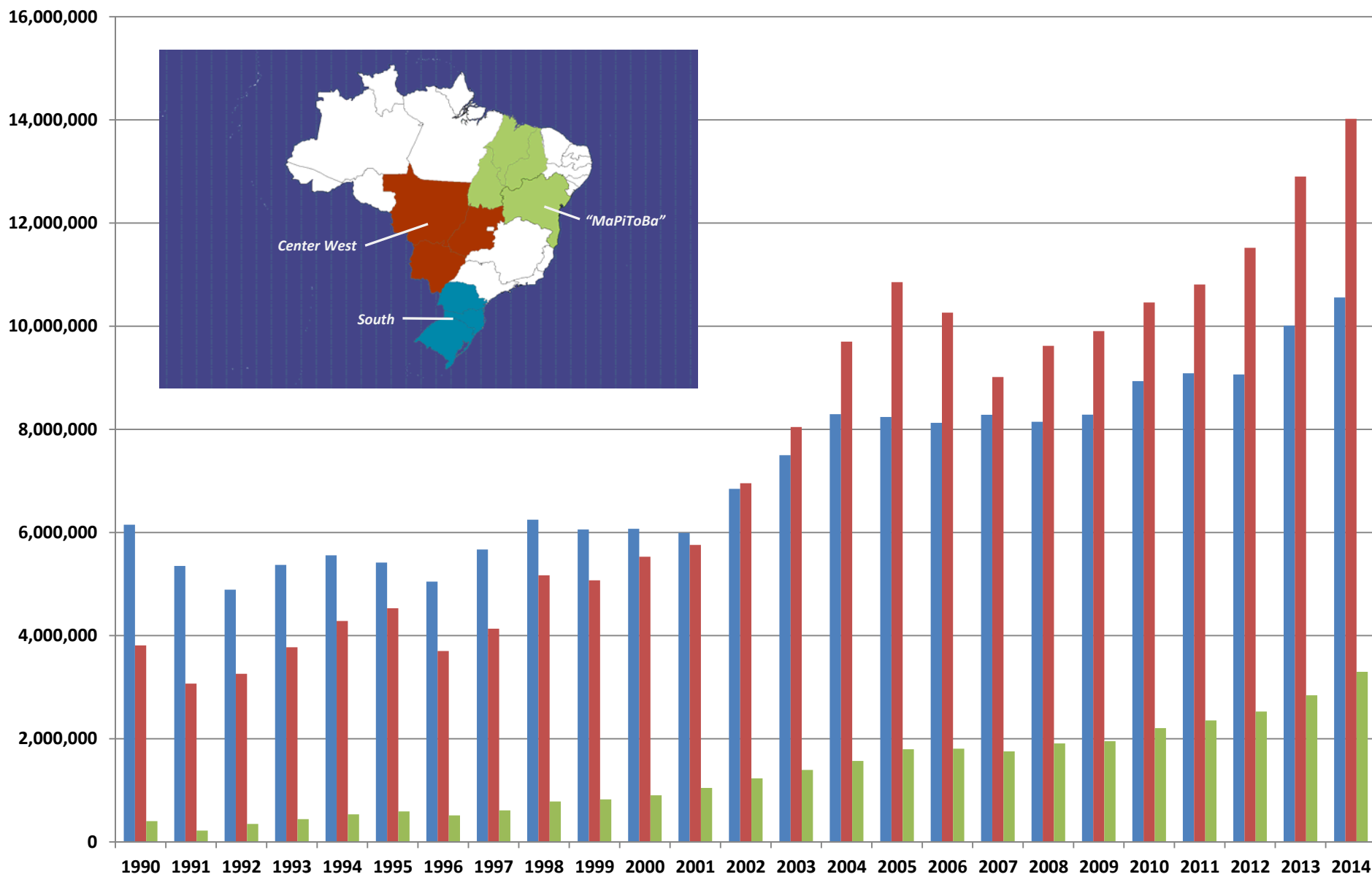
	<u>2012-14</u>	<u>1990-92</u>
Mato Grosso	30.7%	17.5%
Parana	17.9%	21.5%
RGDS	13.6%	26.2%

## Brazil: Key Production Regions

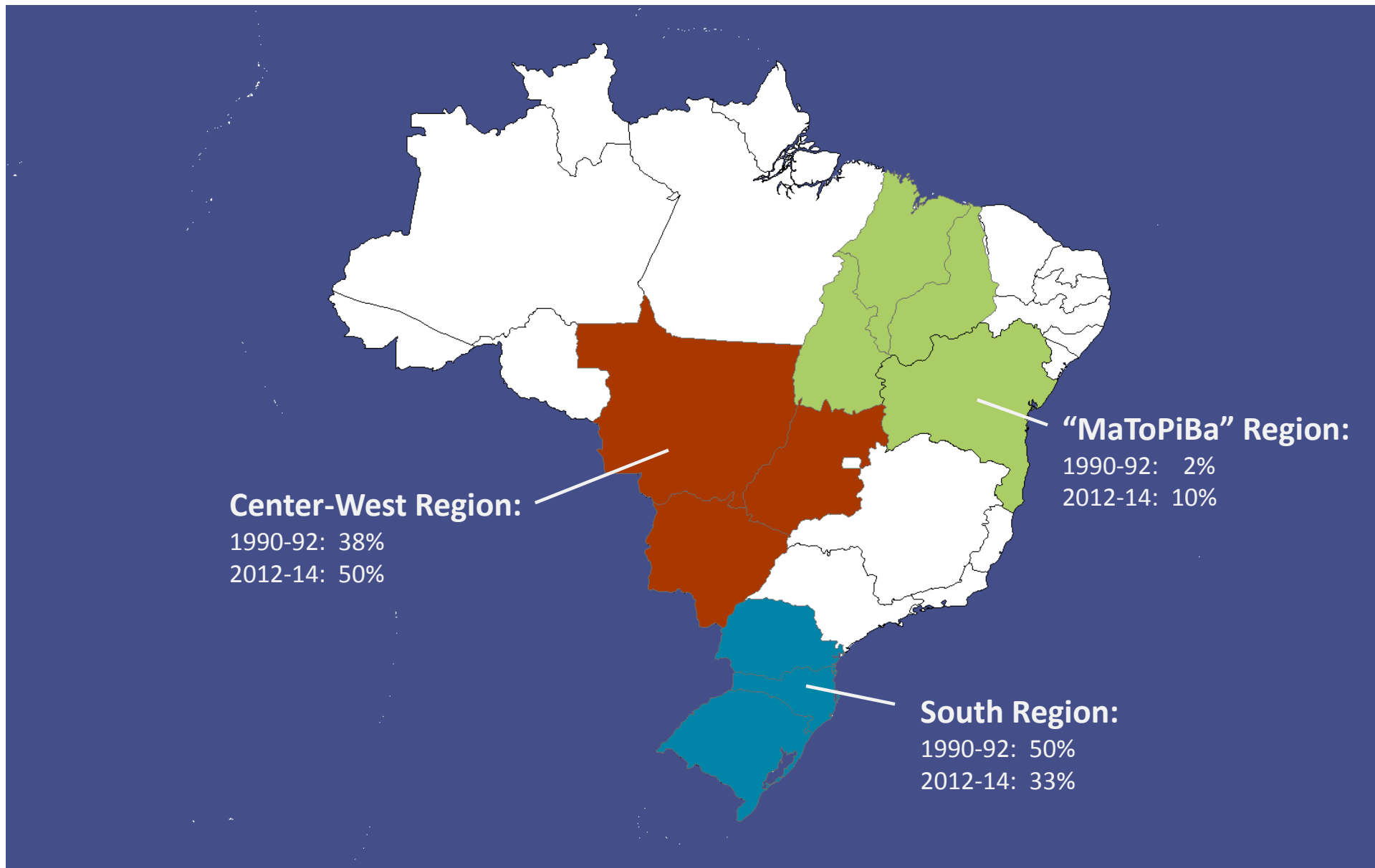


# Brazil Soybean Area (ha)

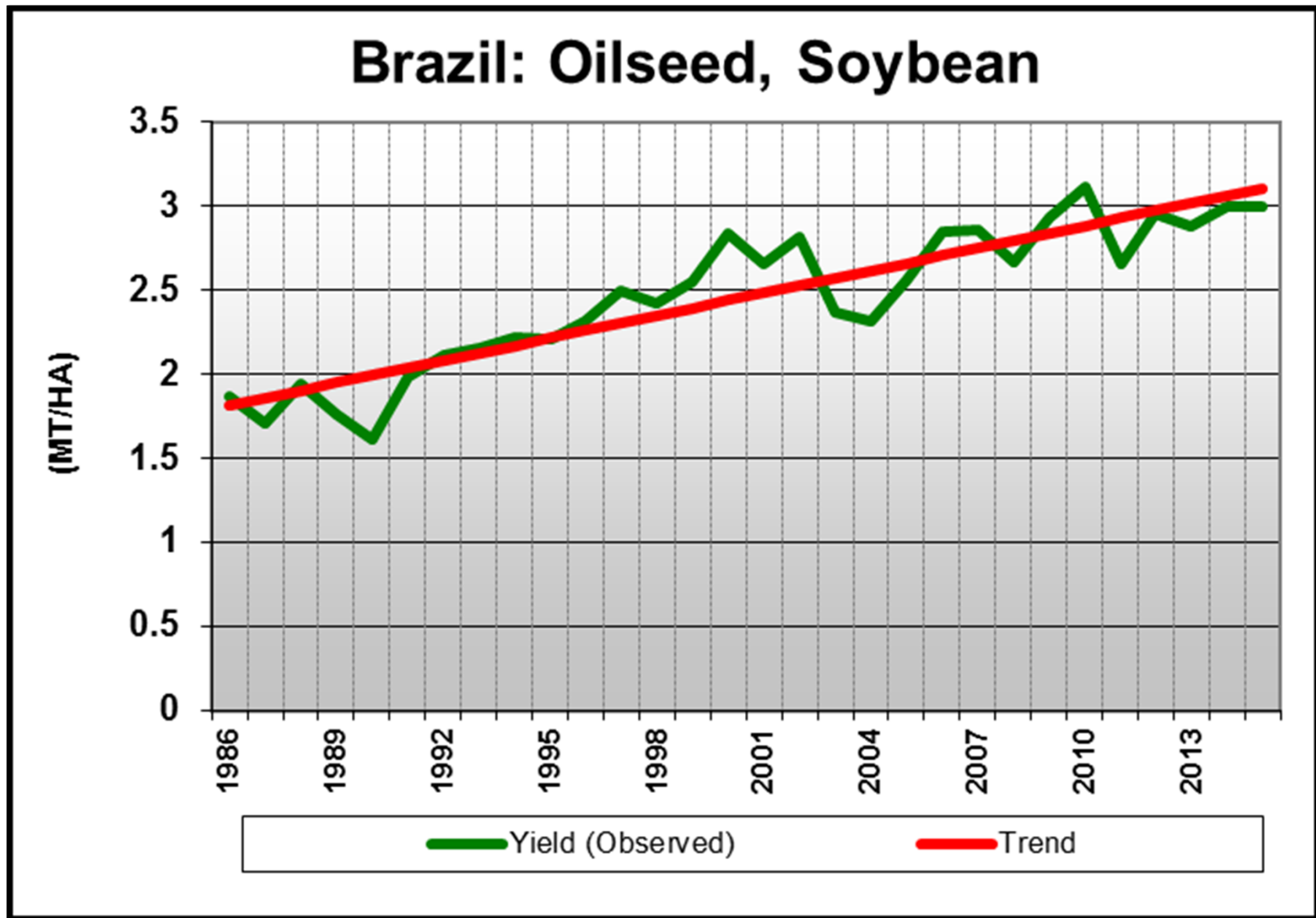
## By Region



## Brazil: Key Production Regions Percent of Total National Production

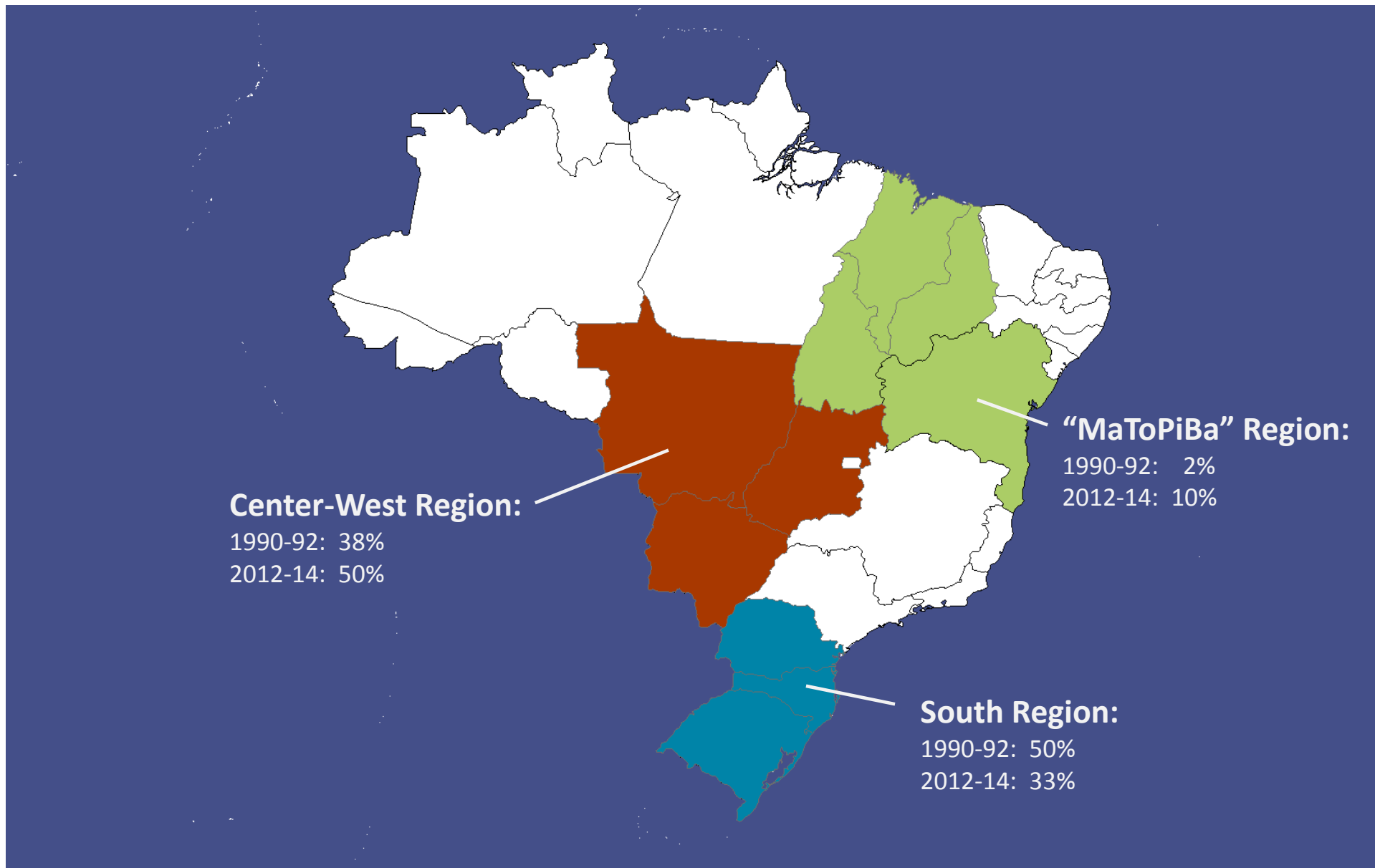


# Part III: Impacts on National Production

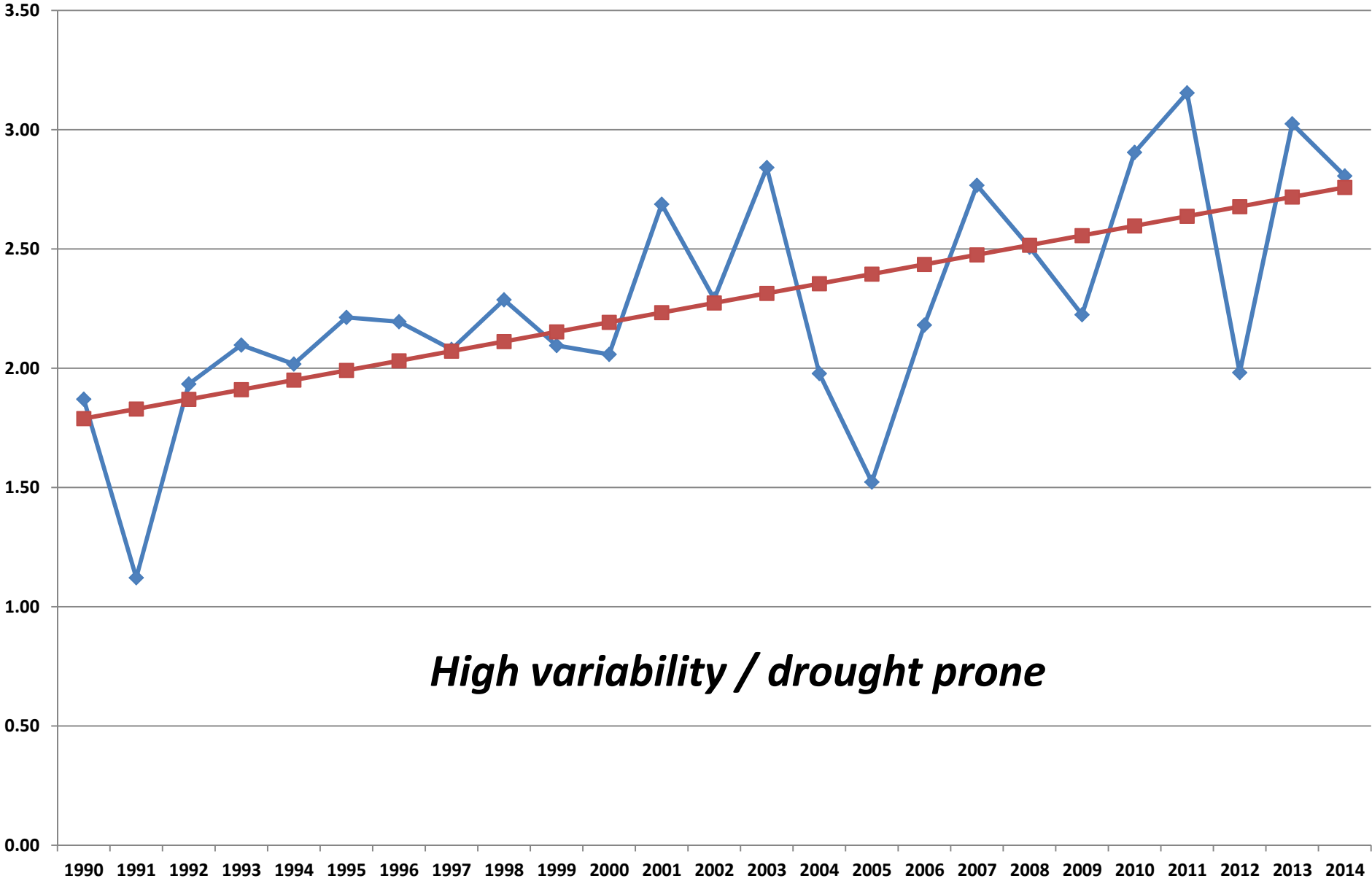


## Brazil: Key Production Regions

Percent of Total National Production

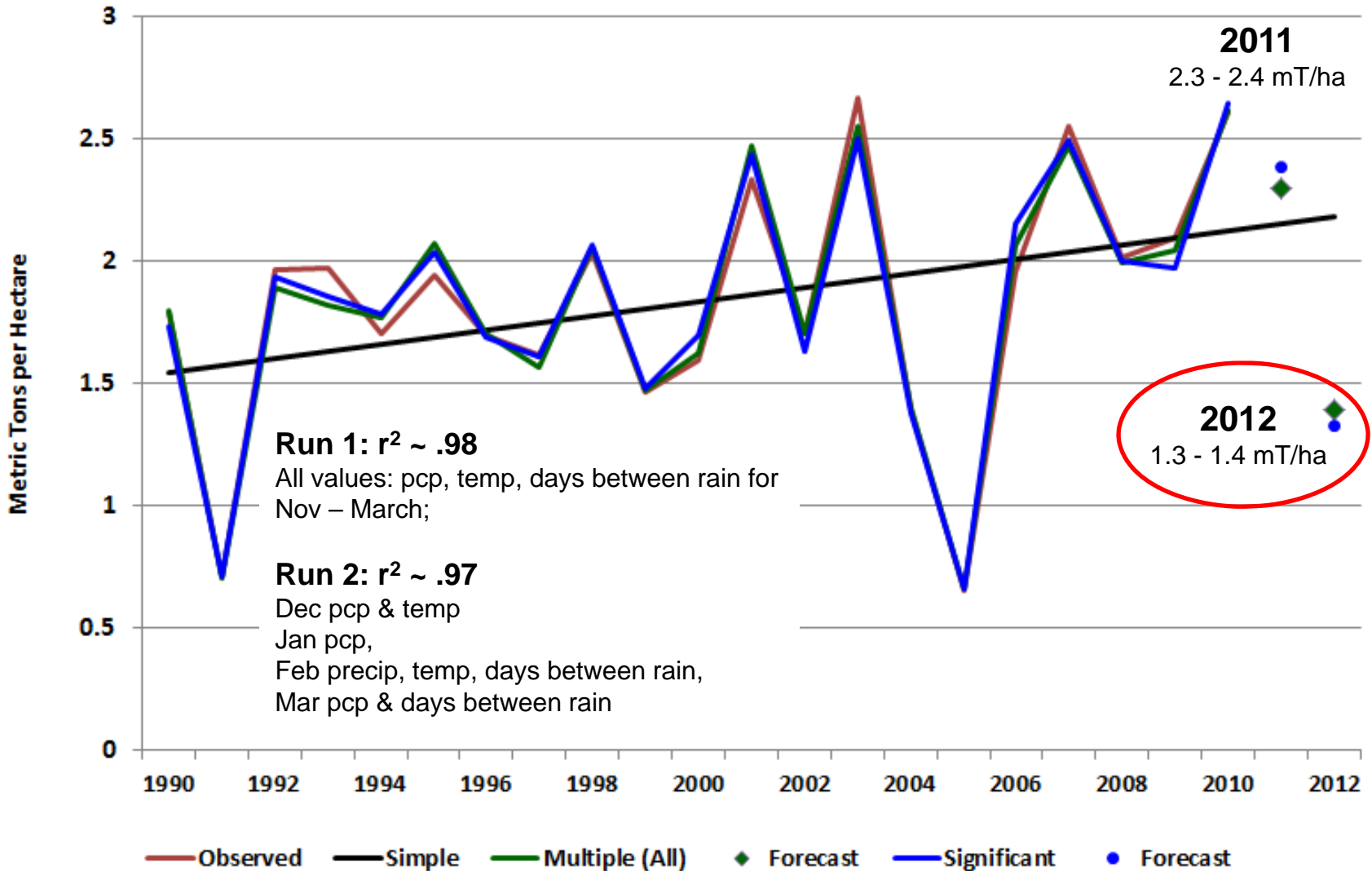


# South Soybean Yields



*High variability / drought prone*

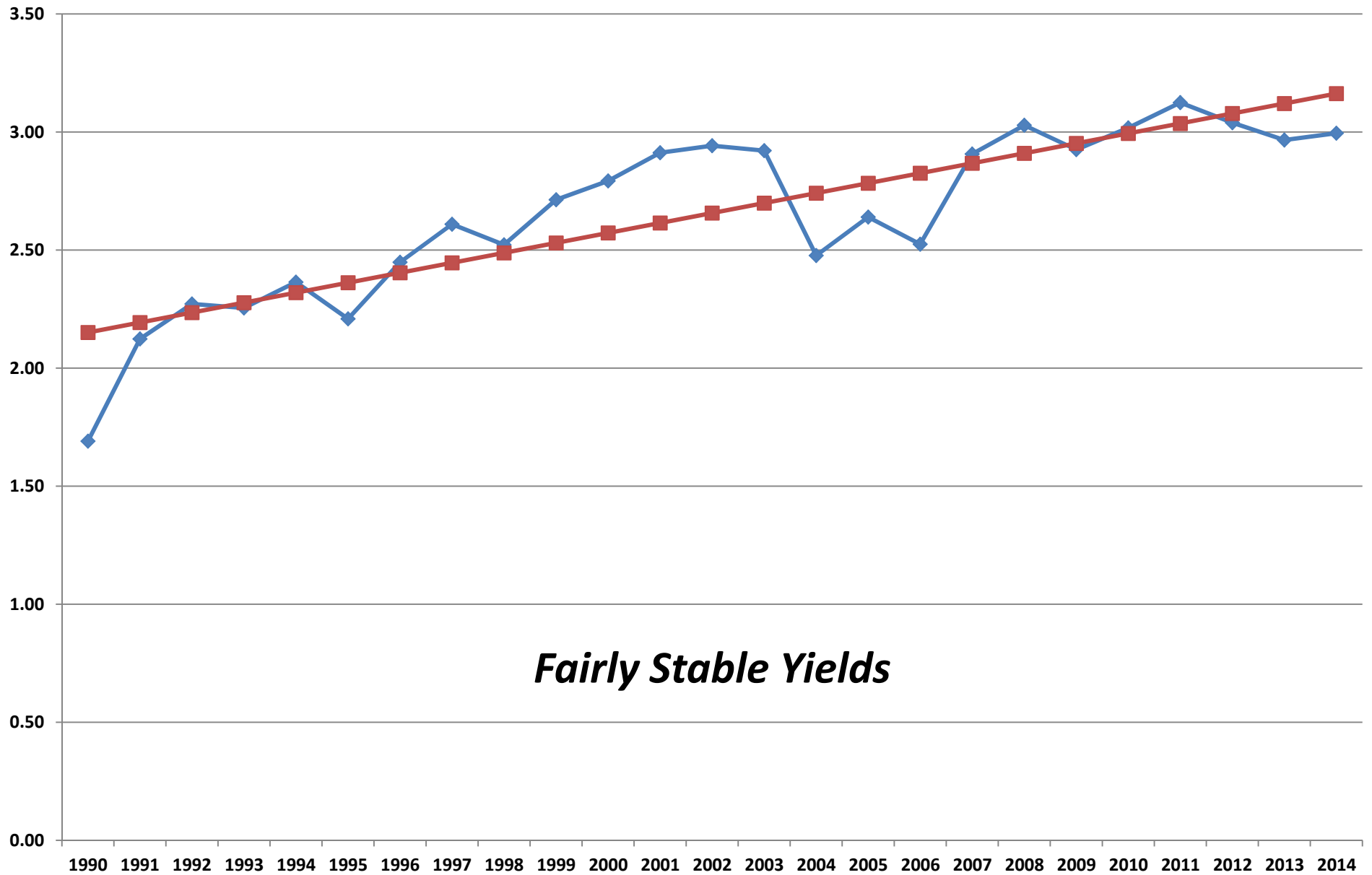
# RGDS Soybean Yields





# Center West

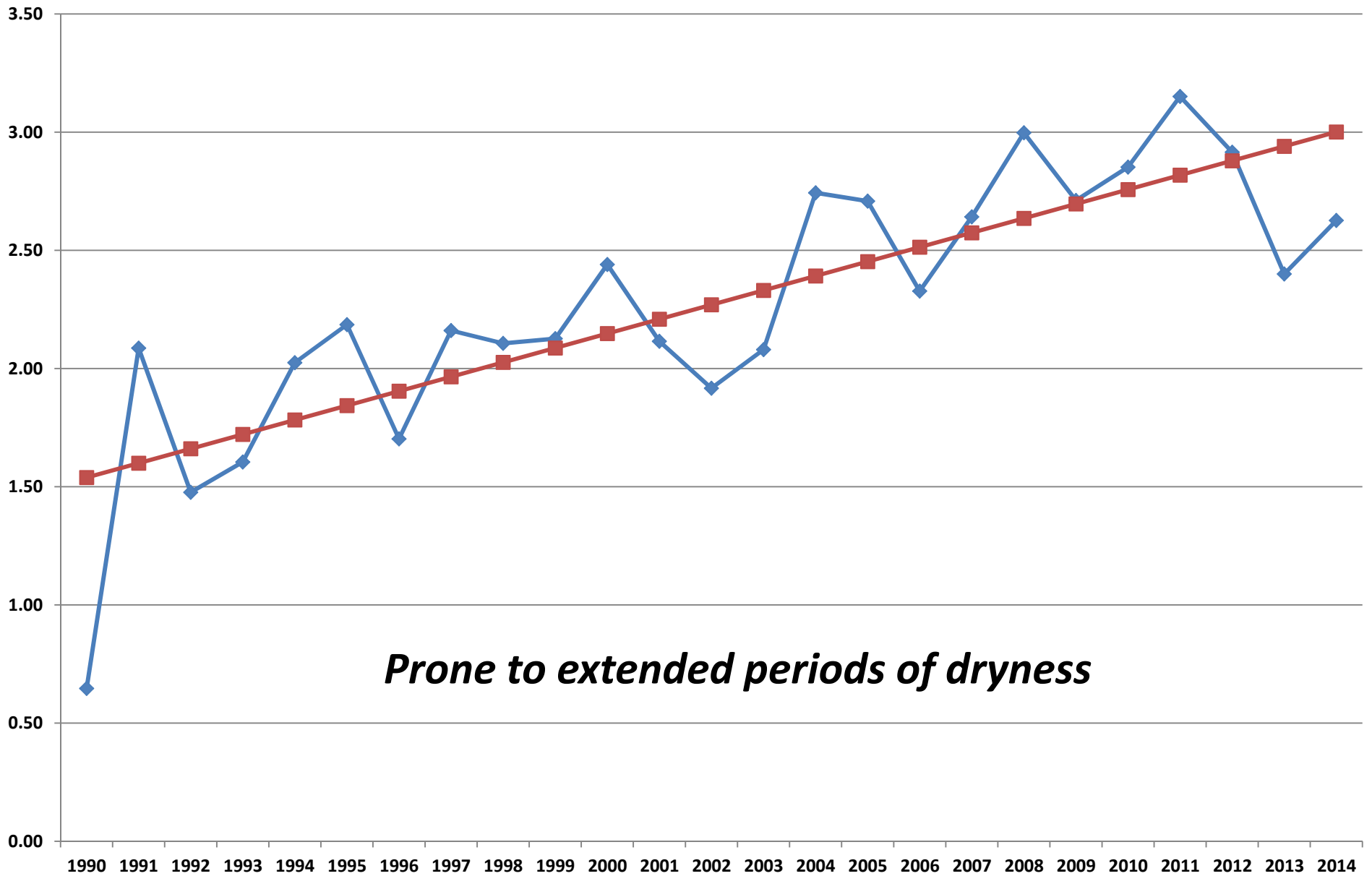
## Soybean Yields



*Fairly Stable Yields*

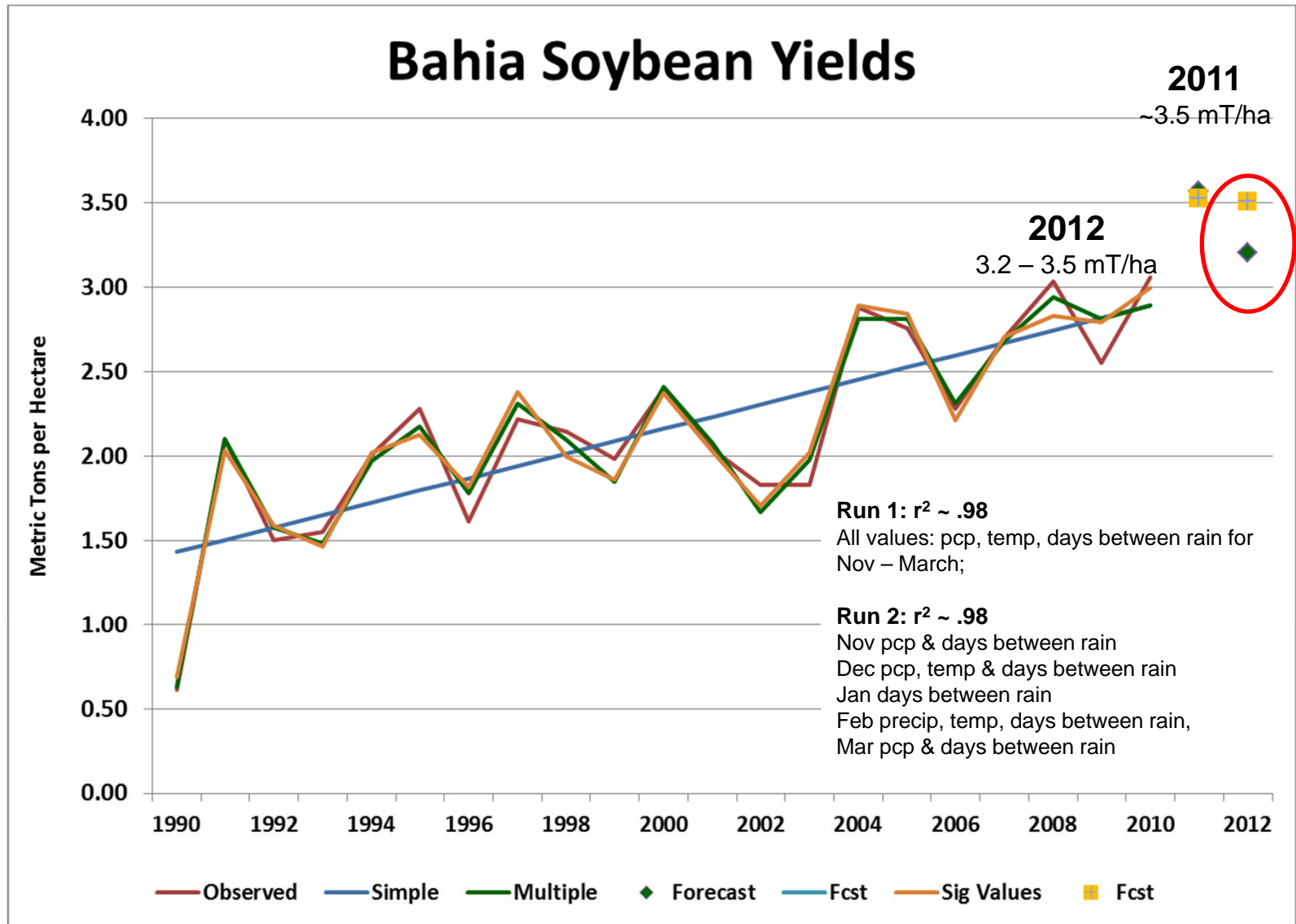
# MaToPiBa

## Soybean Yields



*Prone to extended periods of dryness*

# Bahia Soybean Yields

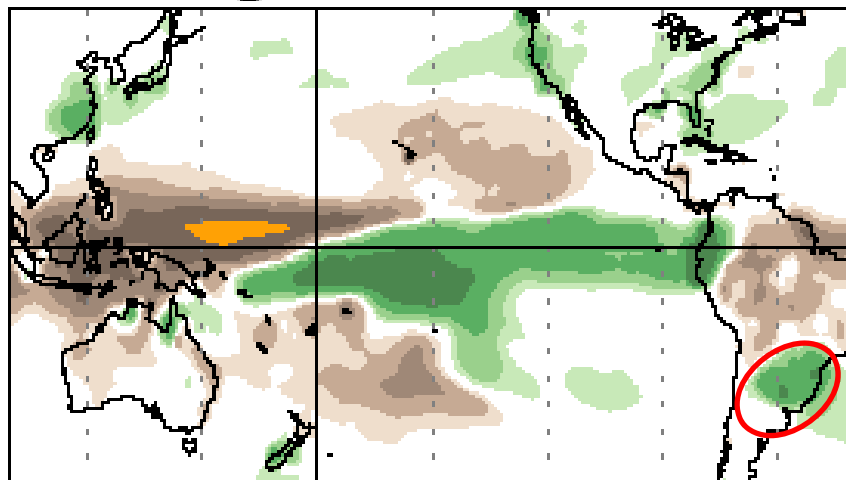


# ENSO-Related Rainfall Patterns

Typical Rainfall departures (mm)

**El Niño**

**Departures (x100)**



120E 150E 180 150W 120W 90W 60W

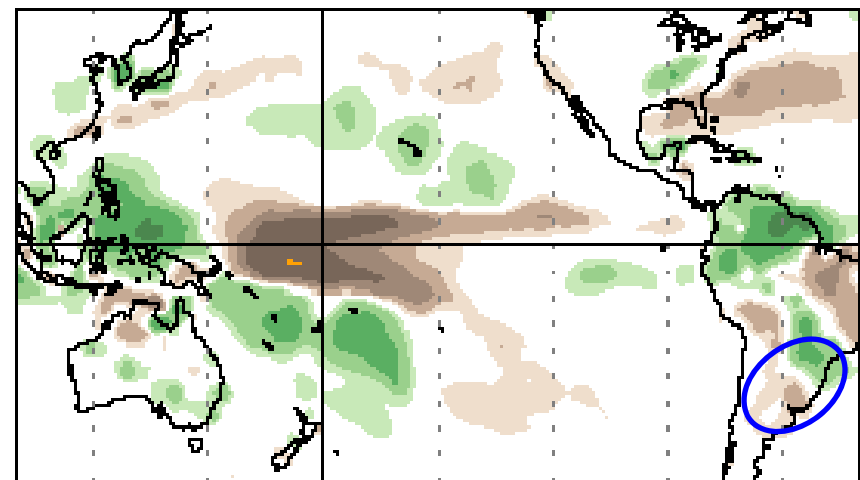


-8 -4 -2 -1 -0.5 0.5 1 2 4

**Jan-March 1998**

**La Niña**

**Departures (x100)**



120E 150E 180 150W 120W 90W 60W



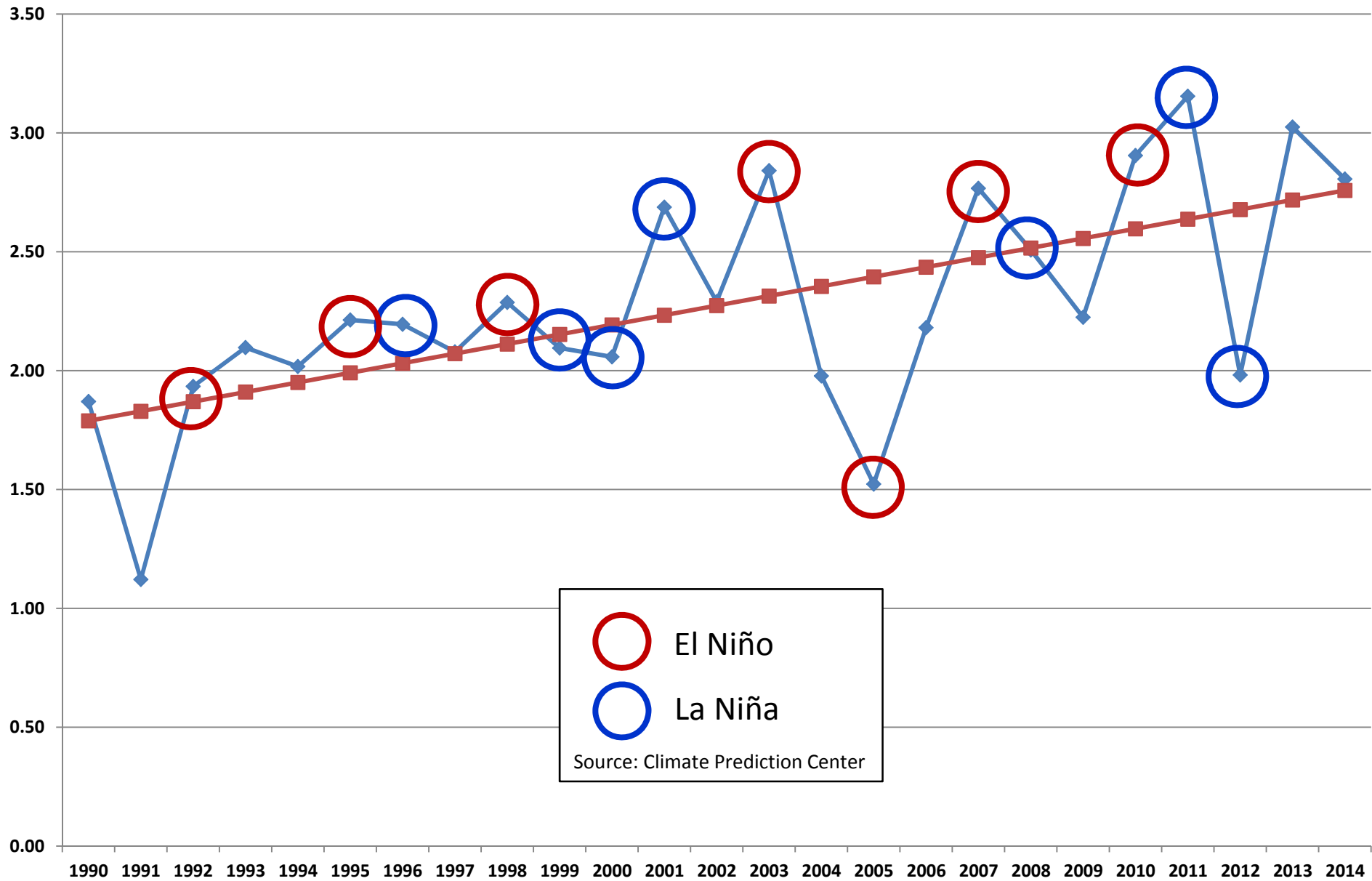
-8 -4 -2 -1 -0.5 0.5 1 2 4

**Jan-March 1989**

For more information go to: <http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml>

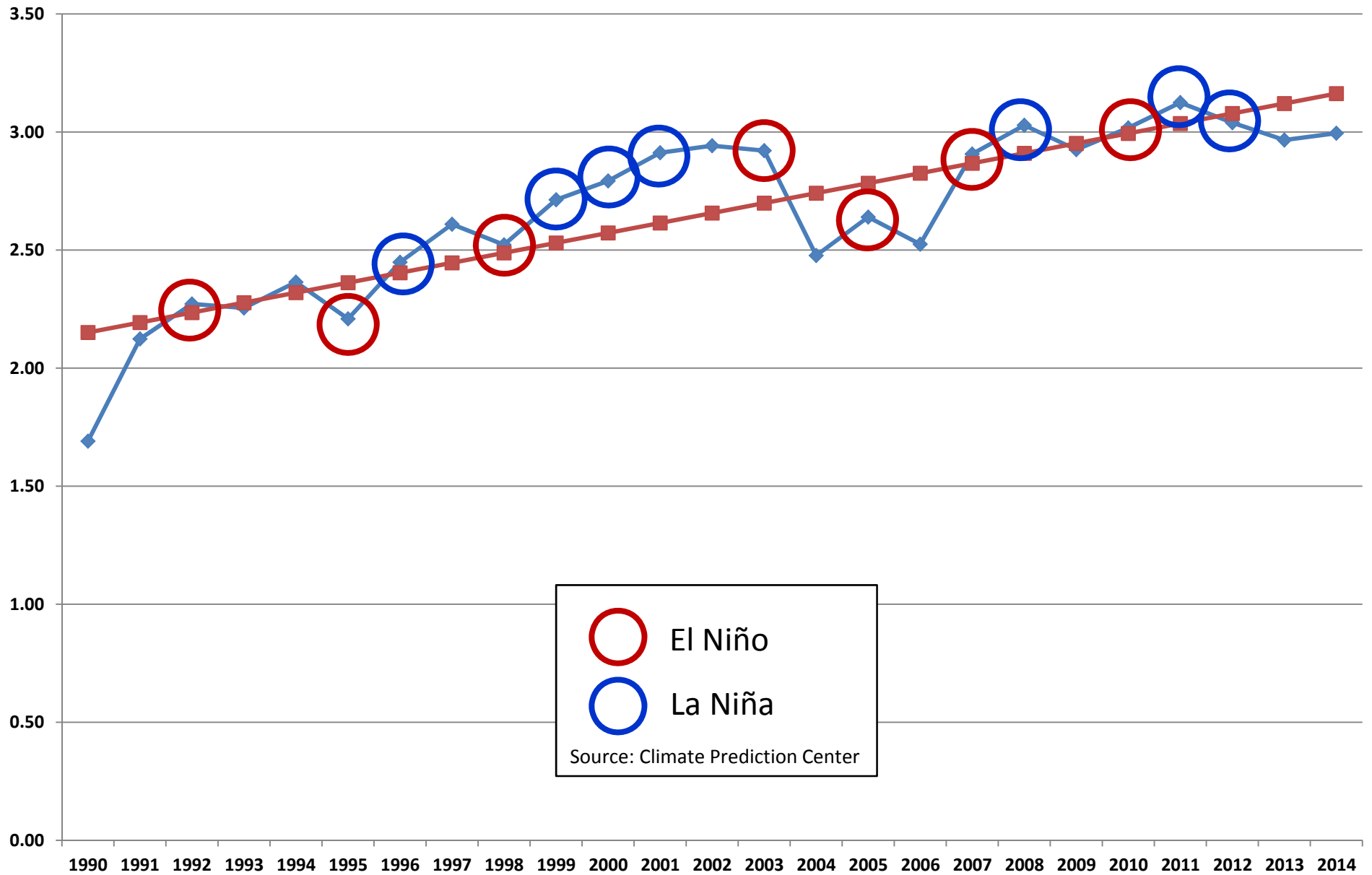
# South

## Soybean Yields



○ El Niño  
○ La Niña  
 Source: Climate Prediction Center

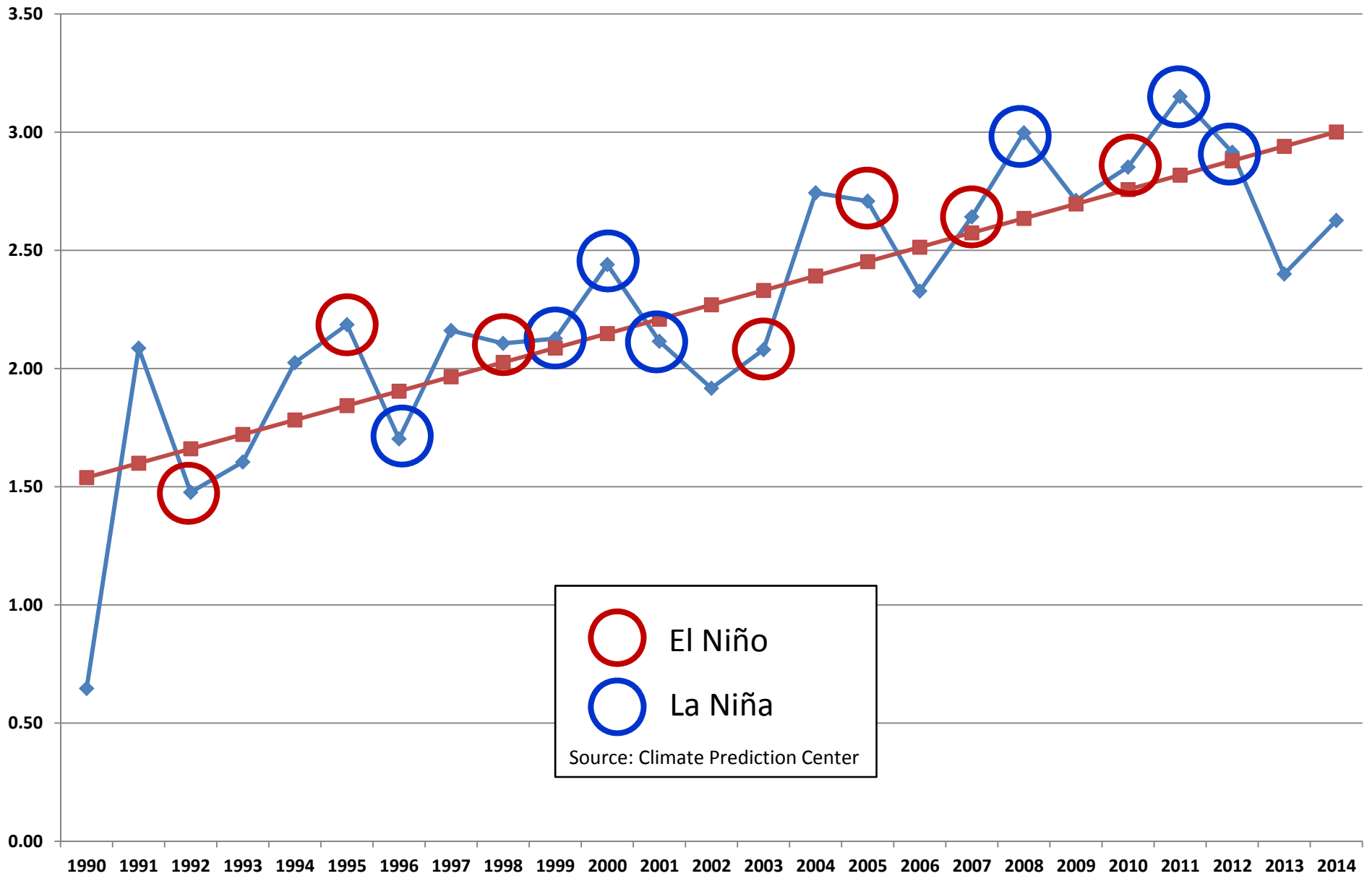
# Center West Soybean Yields



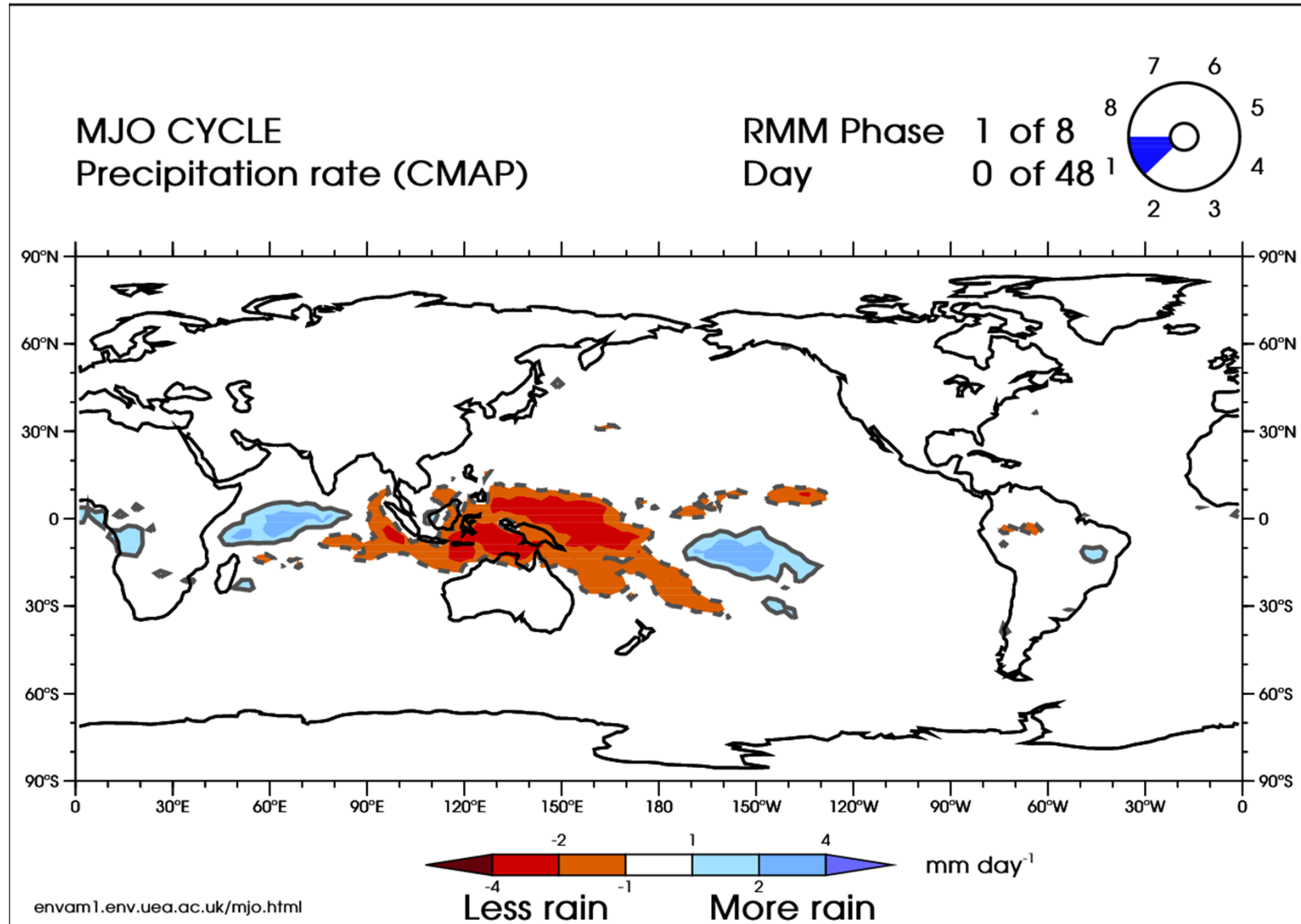
○ El Niño  
○ La Niña  
Source: Climate Prediction Center

# MaToPiBa

## Soybean Yields



# Madden Julian Oscillation

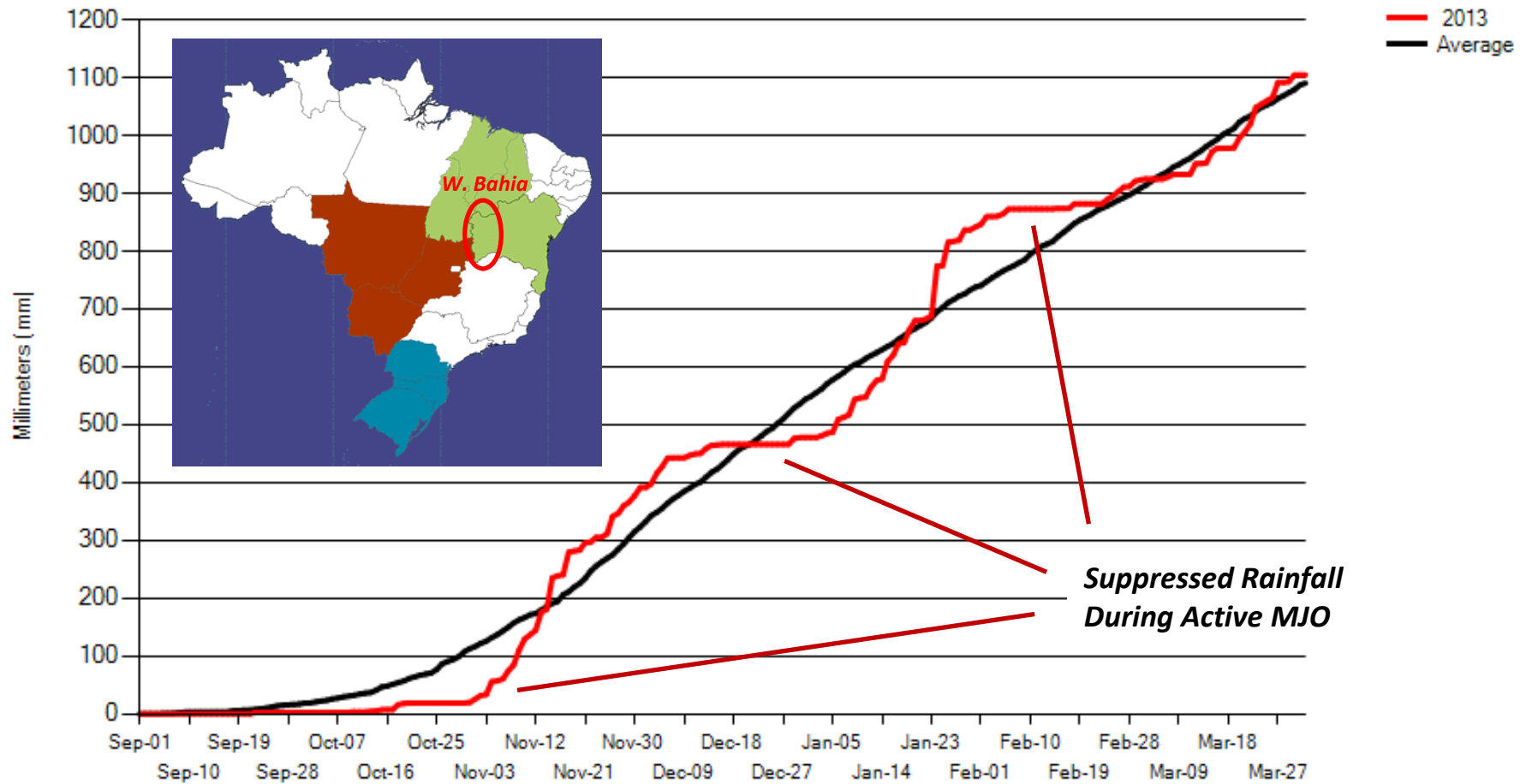


Professor Adrian Matthews School of Environmental Sciences and  
School of Mathematics, University of East Anglia, Norwich, UK

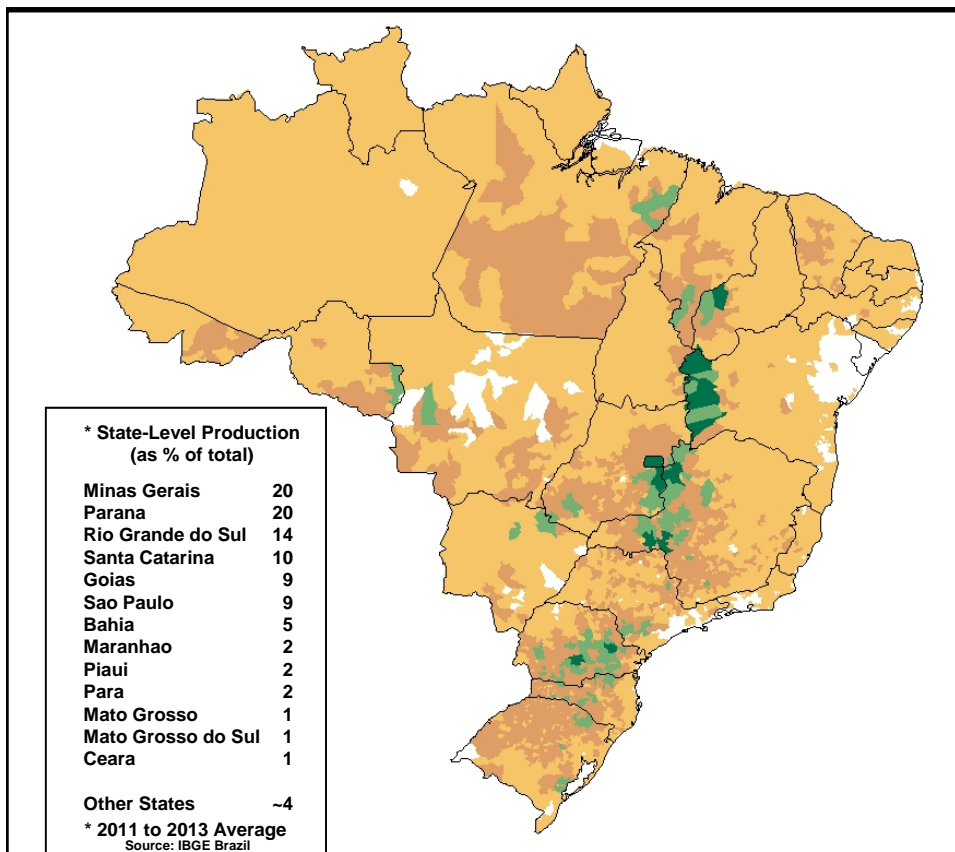


# 14 - WESTERN BAHIA

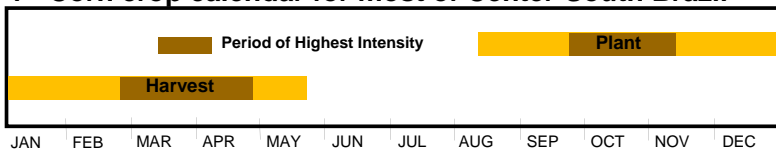
## Cumulative Precipitation



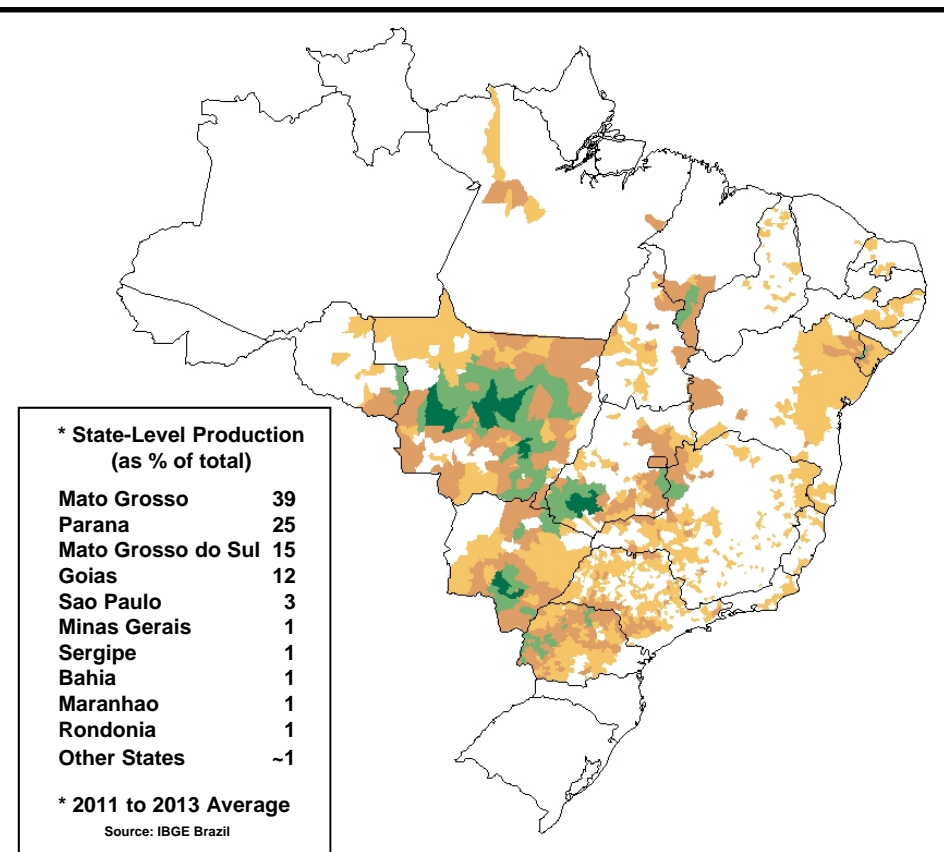
# Brazil Corn Production



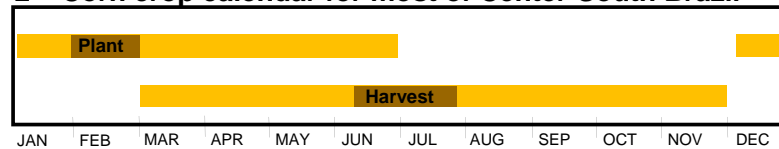
**1<sup>st</sup> Corn crop calendar for most of Center-South Brazil**



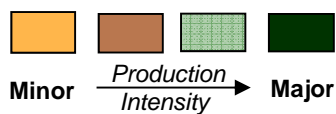
*In Northeast Brazil, 1<sup>st</sup> crop planted Dec - Jan (harvested May - Jul).*



**2<sup>nd</sup> Corn crop calendar for most of Center-South Brazil**

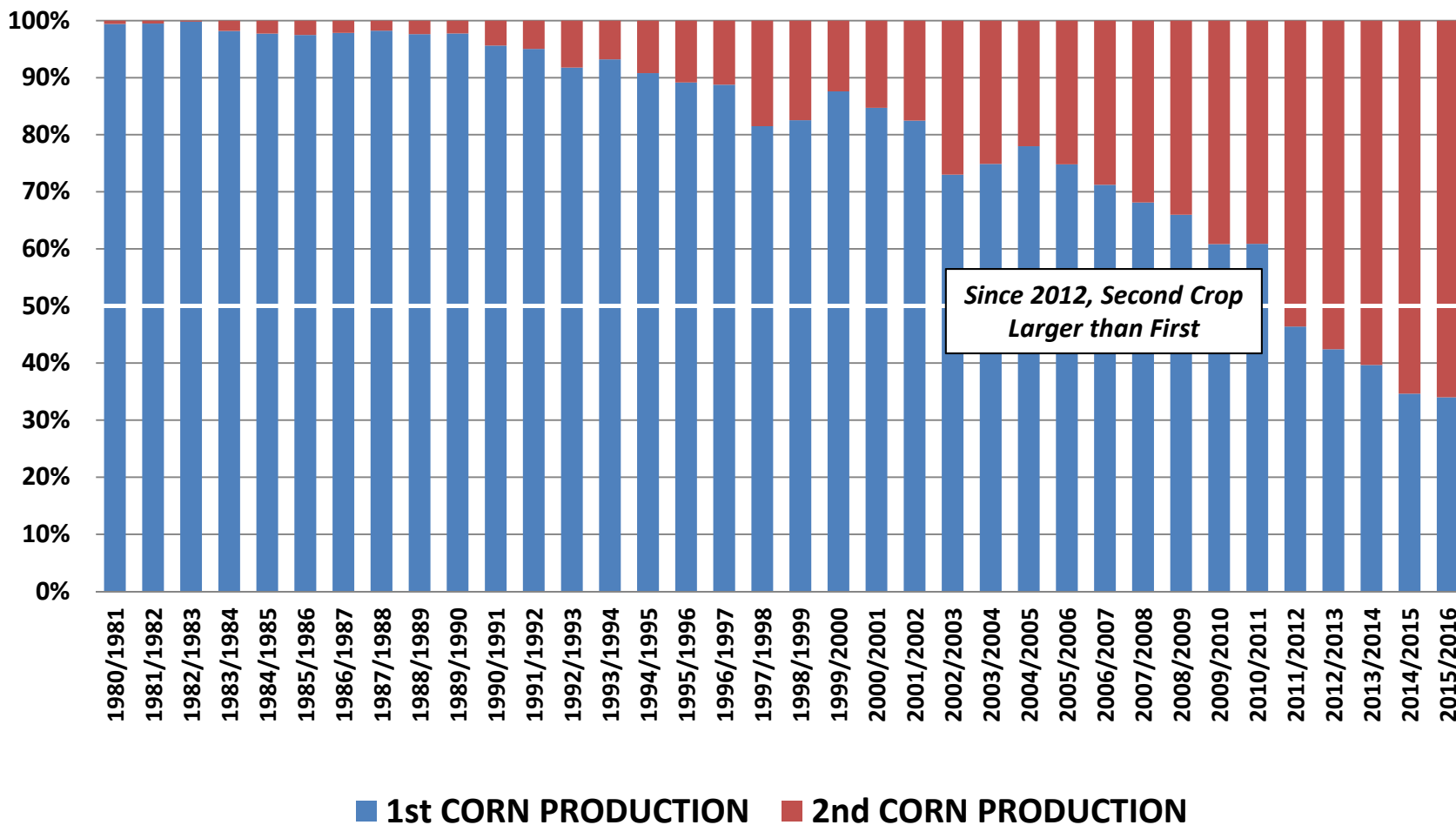


## Corn Production \*Average (2011-13)



\*Source: IBGE

## Brazil Corn Production: Percent of Total Production by Season



Source: 1980/81 to 2012/13 CONAB-Series Historica

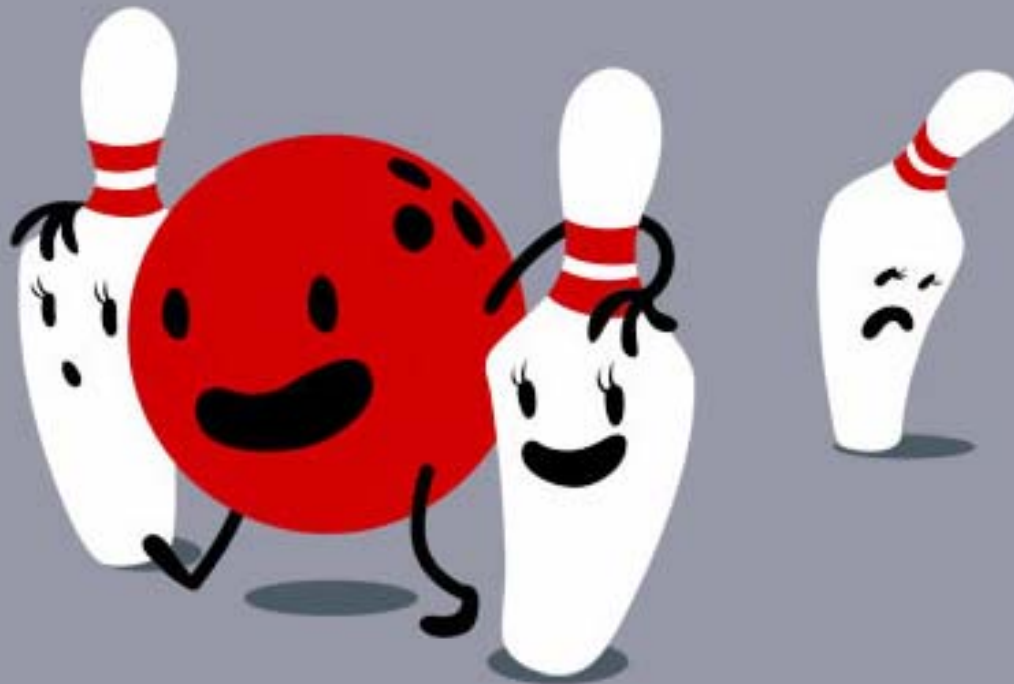
# Summary

- **Brazilian agricultural production has increased over the past 25 years, largely due to a significant shift toward farming in central Brazil and the northeastern interior;**
- **One of the main benefits to this migration is a reduction in the percent of acreage in drought-prone areas;**
- **Another benefit has been the ability of farmers in the Center-West Region to expand the production of second-crop corn.**

**Thanks!**

[mbrusberg@oce.usda.gov](mailto:mbrusberg@oce.usda.gov)

# SPARE

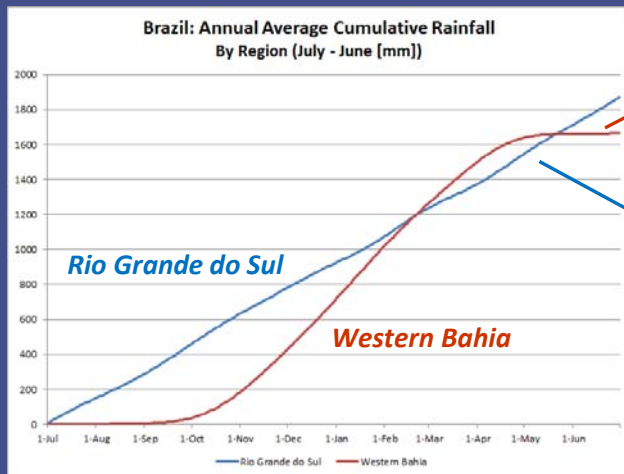
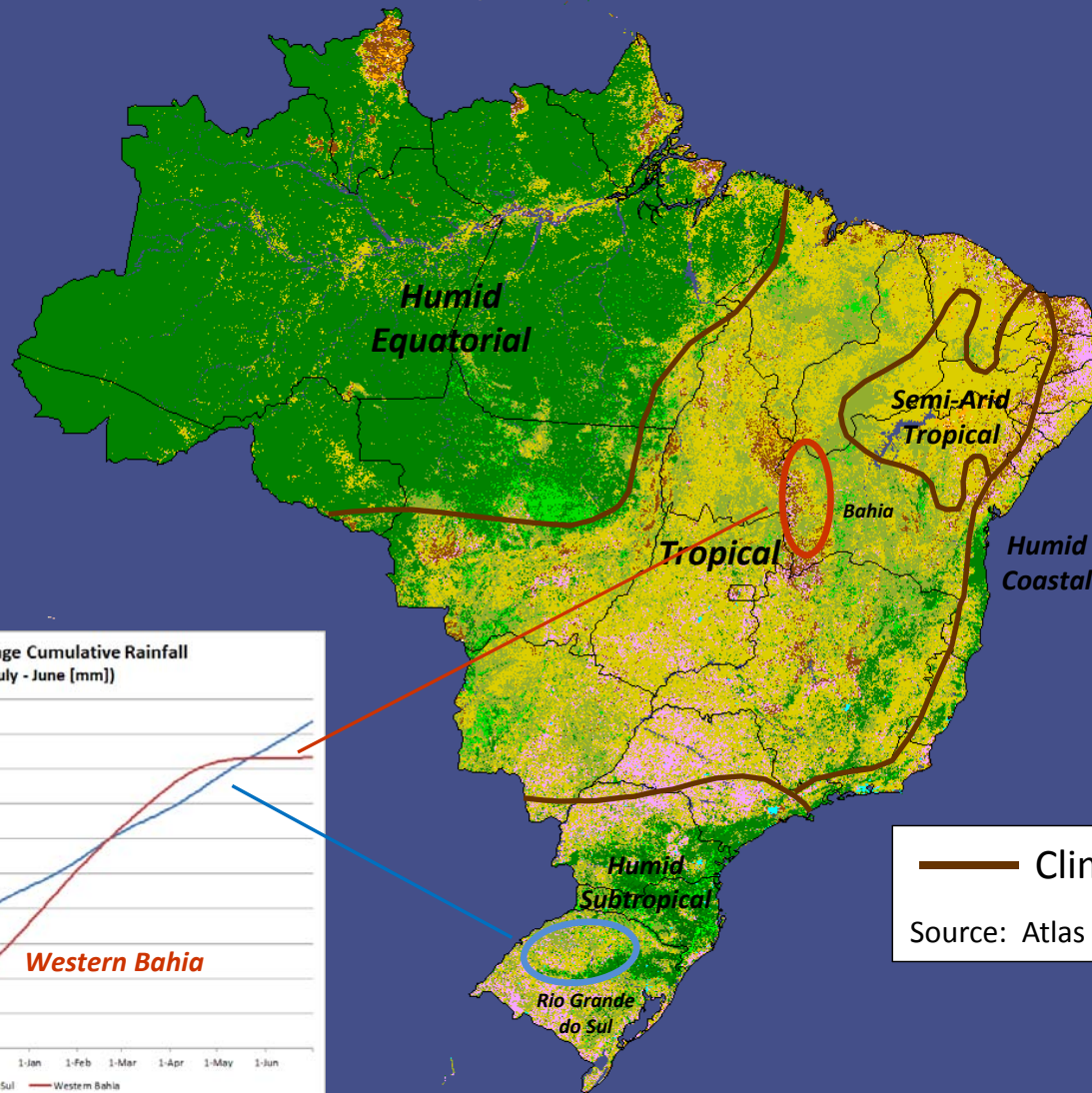


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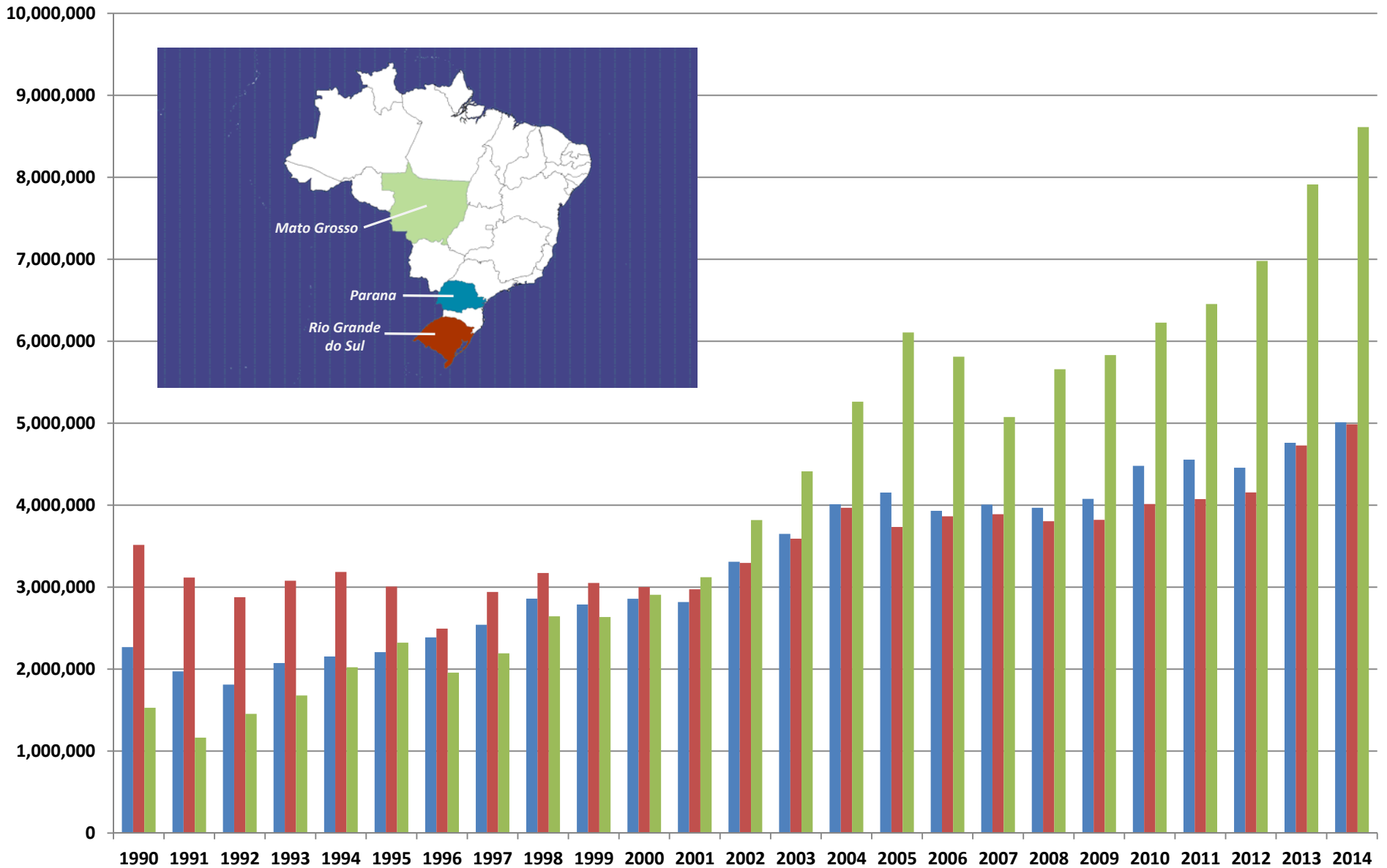
Source: UMD  
(Hansen, et.al.)



— Climate Regimes  
Source: Atlas Geografico Escolar

# Brazil Soybean Area (ha)

## Selected States



# Oilseed, Soybean Exports

