Climate and Cropping Patterns in Brazil

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Presented on Behalf of the

USDA 2016 Agricultural Outlook Forum:

Transforming Agriculture

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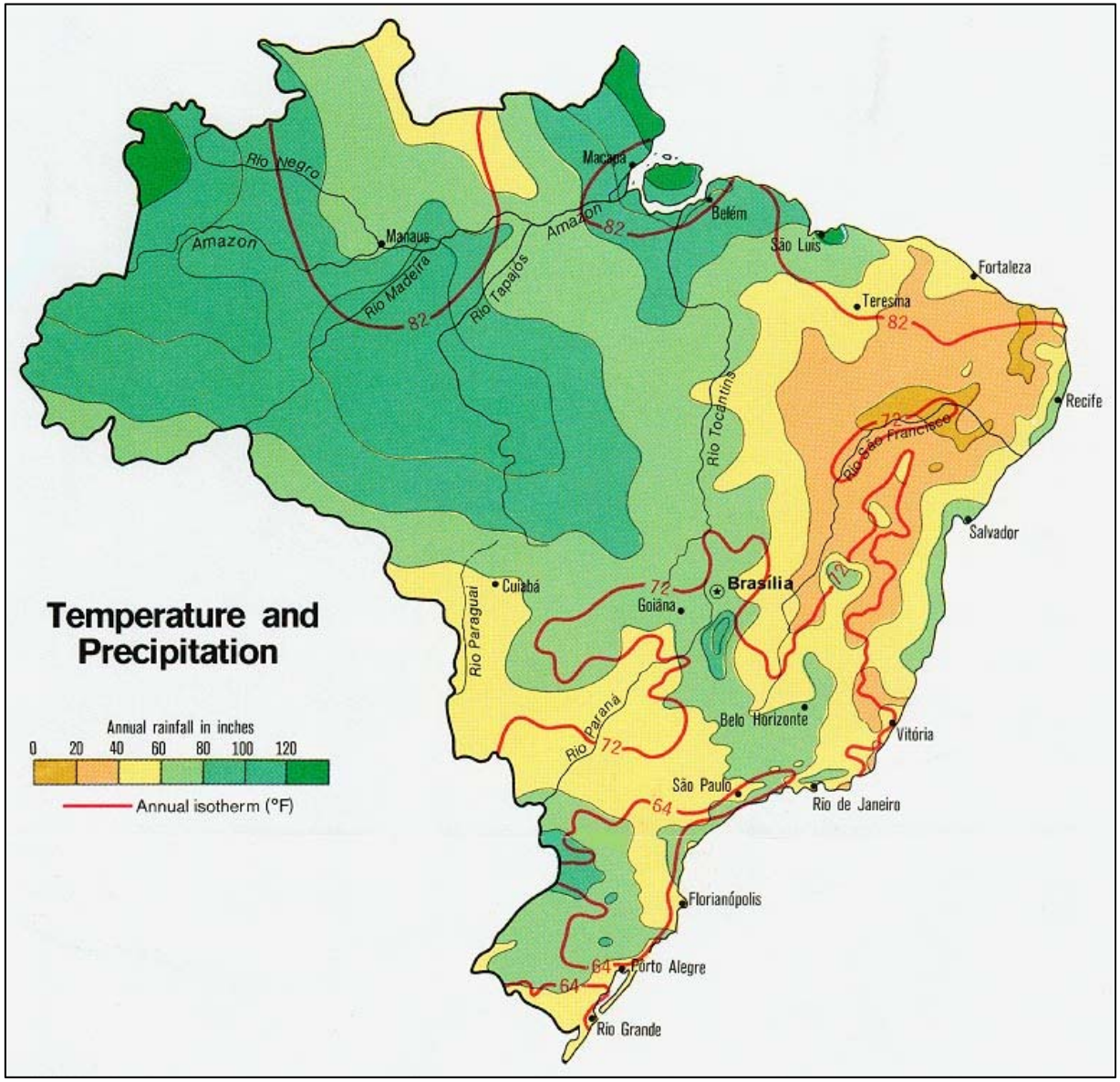
Part I: Climate



Source: Perry-Castañeda Library Map Collection (University of Texas at Austin)

University of Maryland
*Land Cover Classification

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*Coverage Date 1981-1994

University of Maryland
*Land Cover Classification

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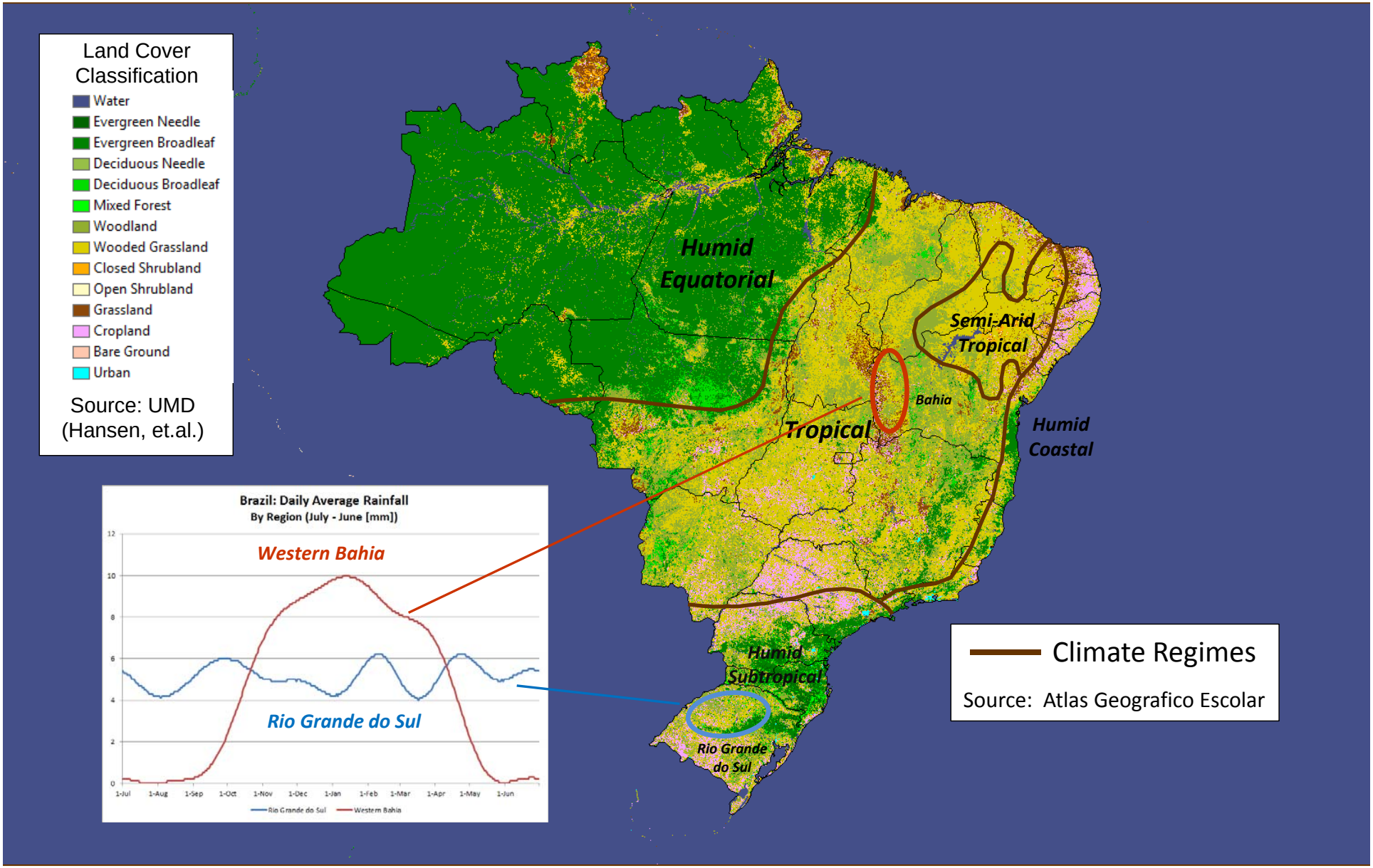
World Agricultural Outlook Board

*Coverage Date 1981-1994

University of Maryland
*Land Cover Classification



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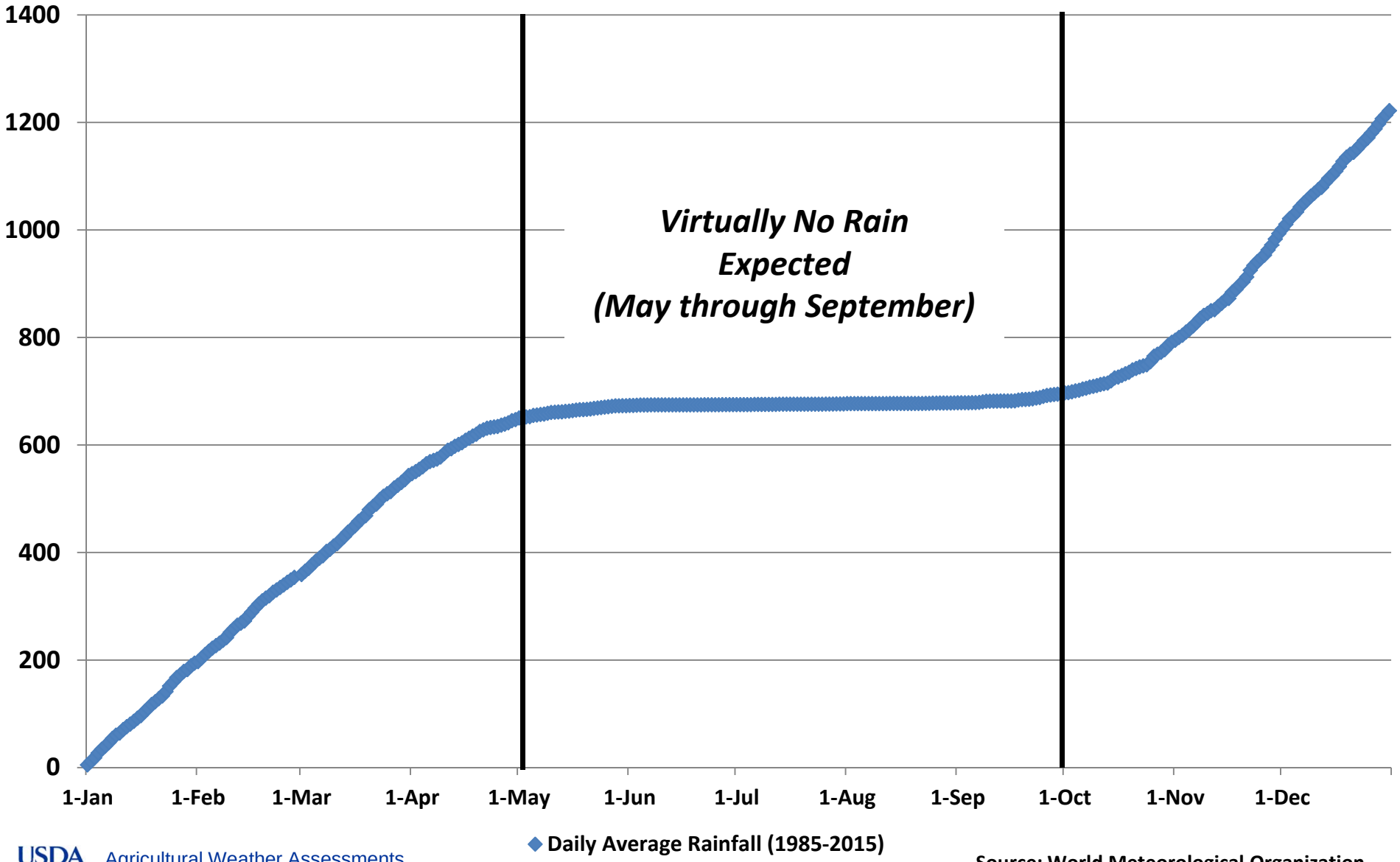
*Coverage Date 1981-1994

Western Bahia

Cumulative Average Daily Rainfall (mm)



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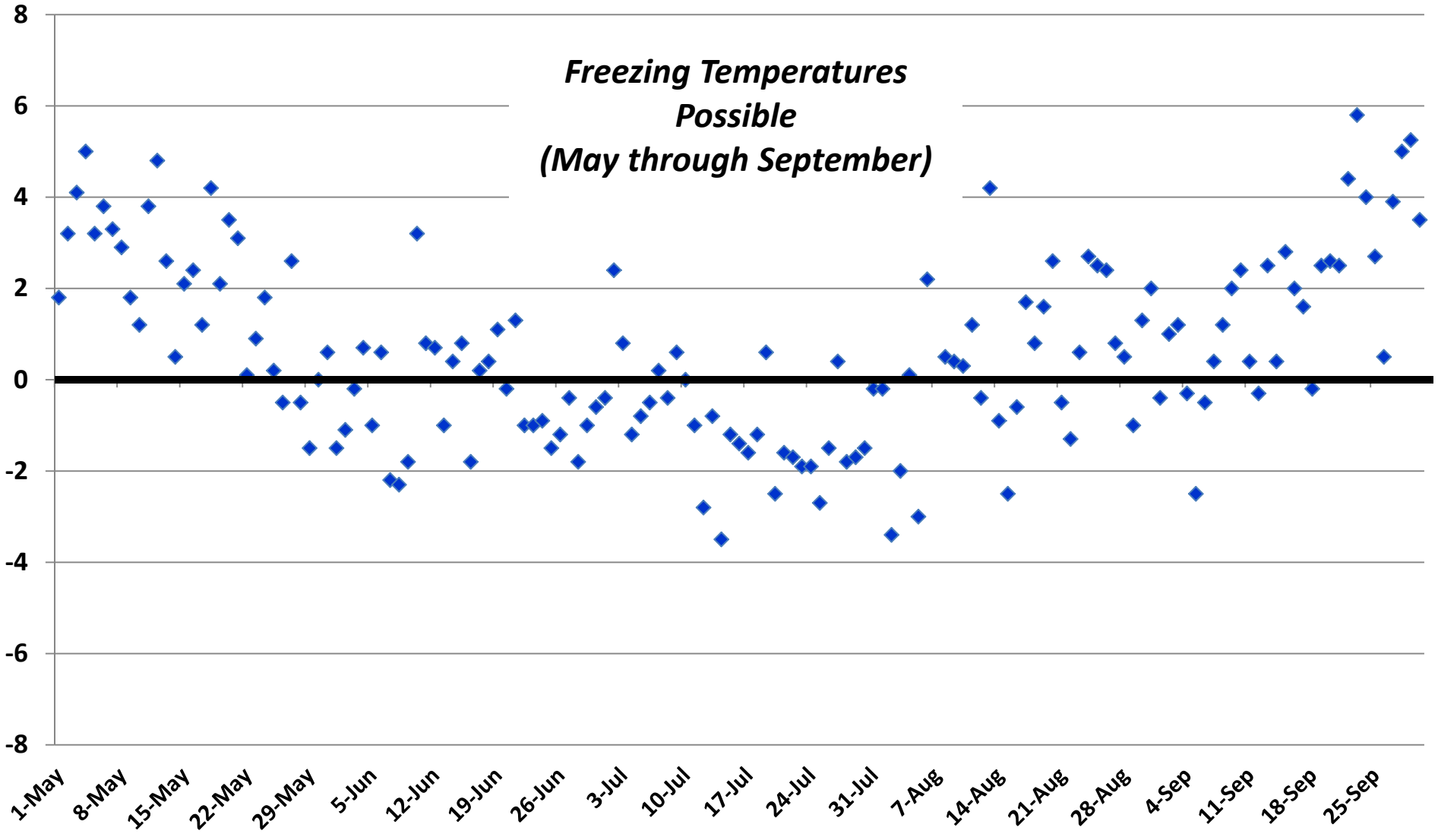
Source: World Meteorological Organization

Rio Grande do Sul

Lowest Minimum Temperatures by Day (°C)



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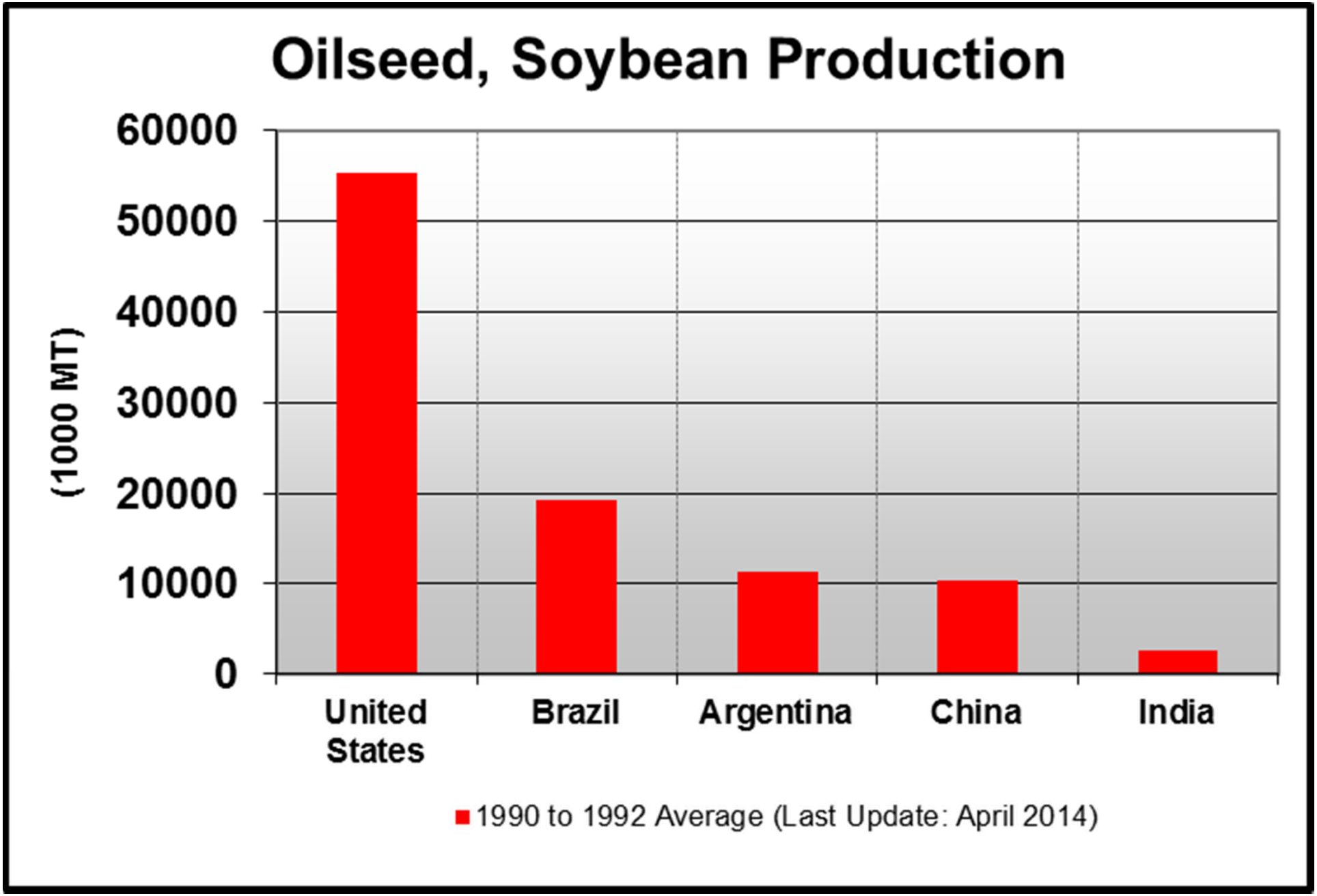
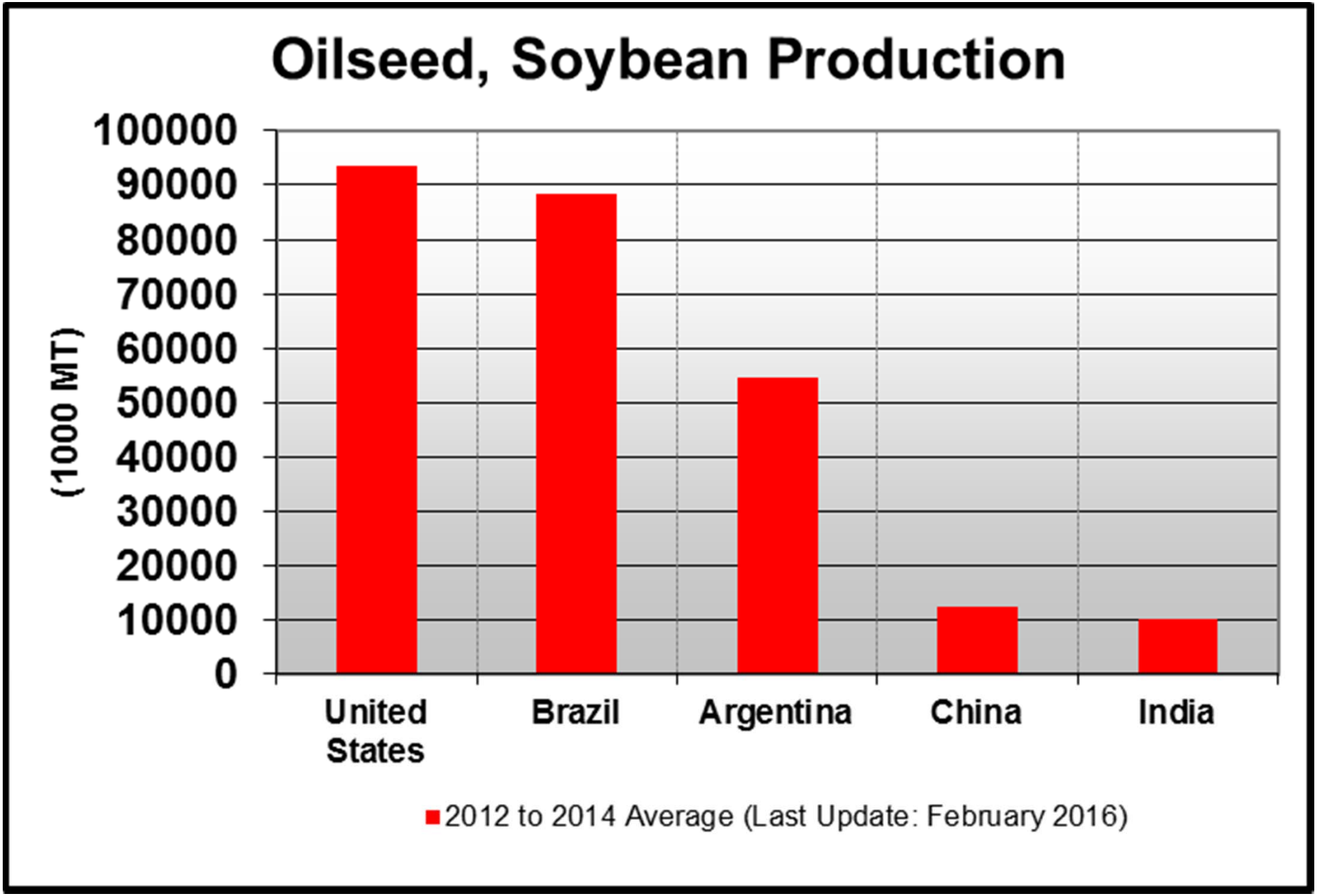
Source: World Meteorological Organization

Part II: Agricultural Expansion

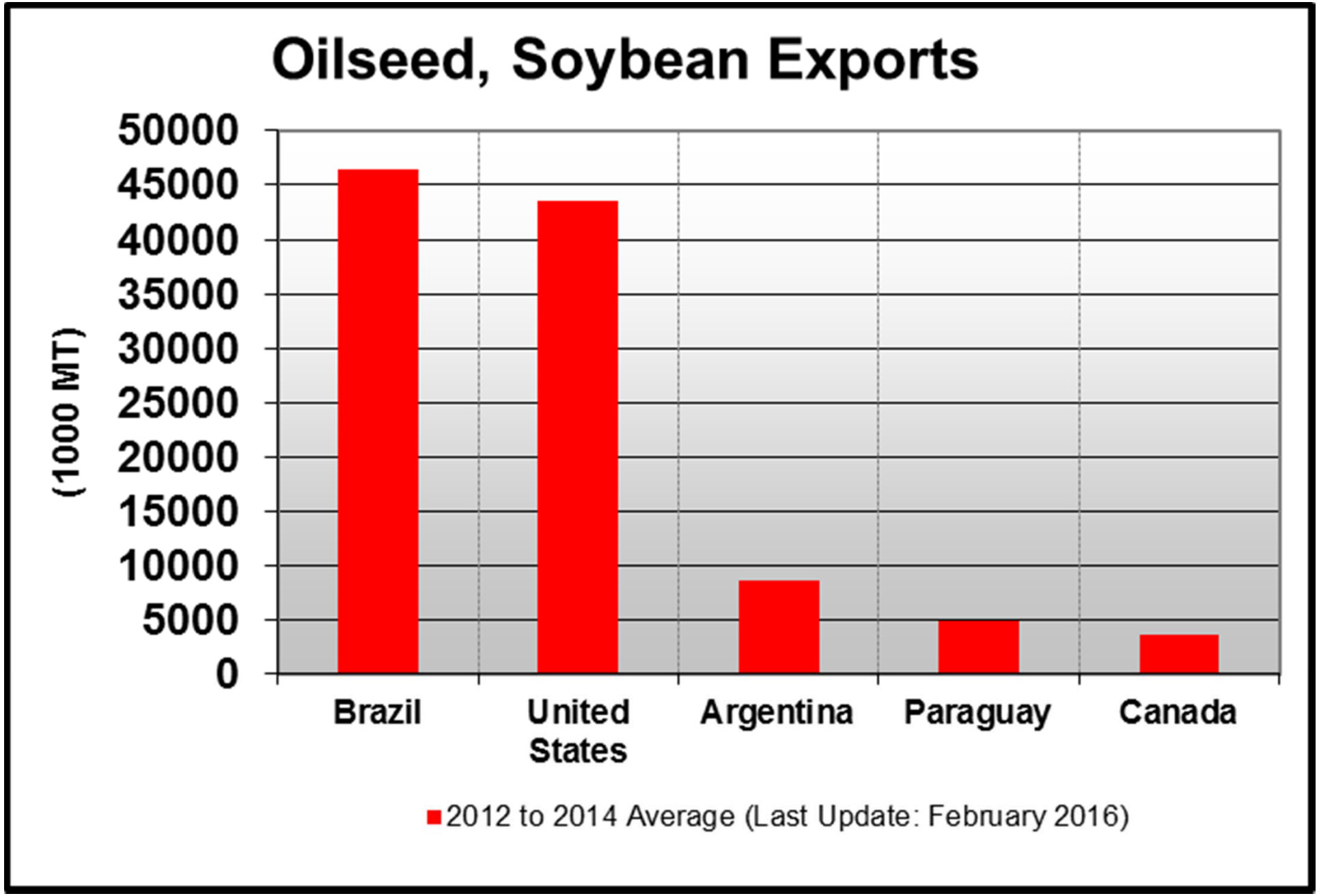
Photo: Jose Reynaldo da Fonseca



Source: PSD-Online

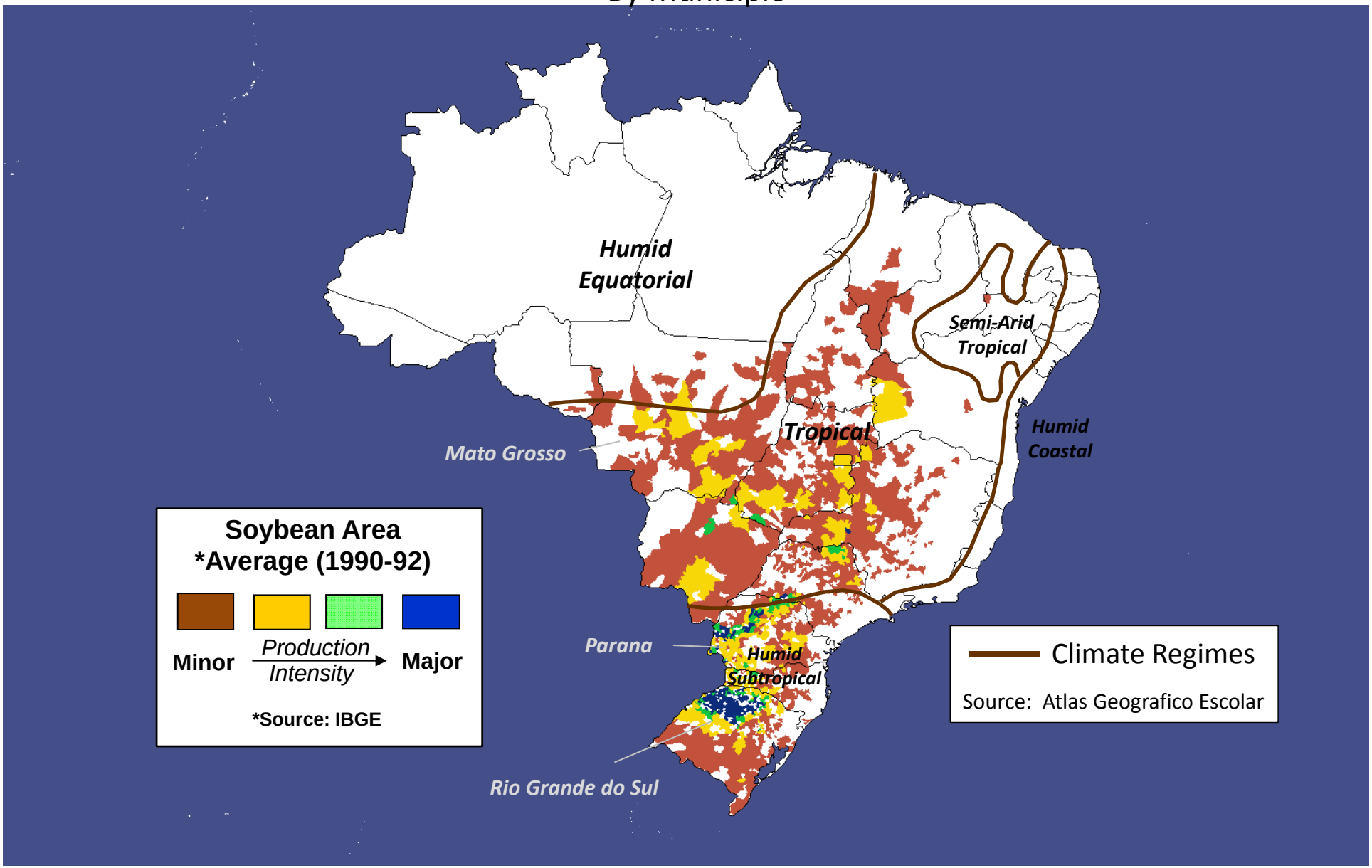


Source: PSD-Online



Source: PSD-Online

Soybean Area
*By Municipio



*Source: IBGE

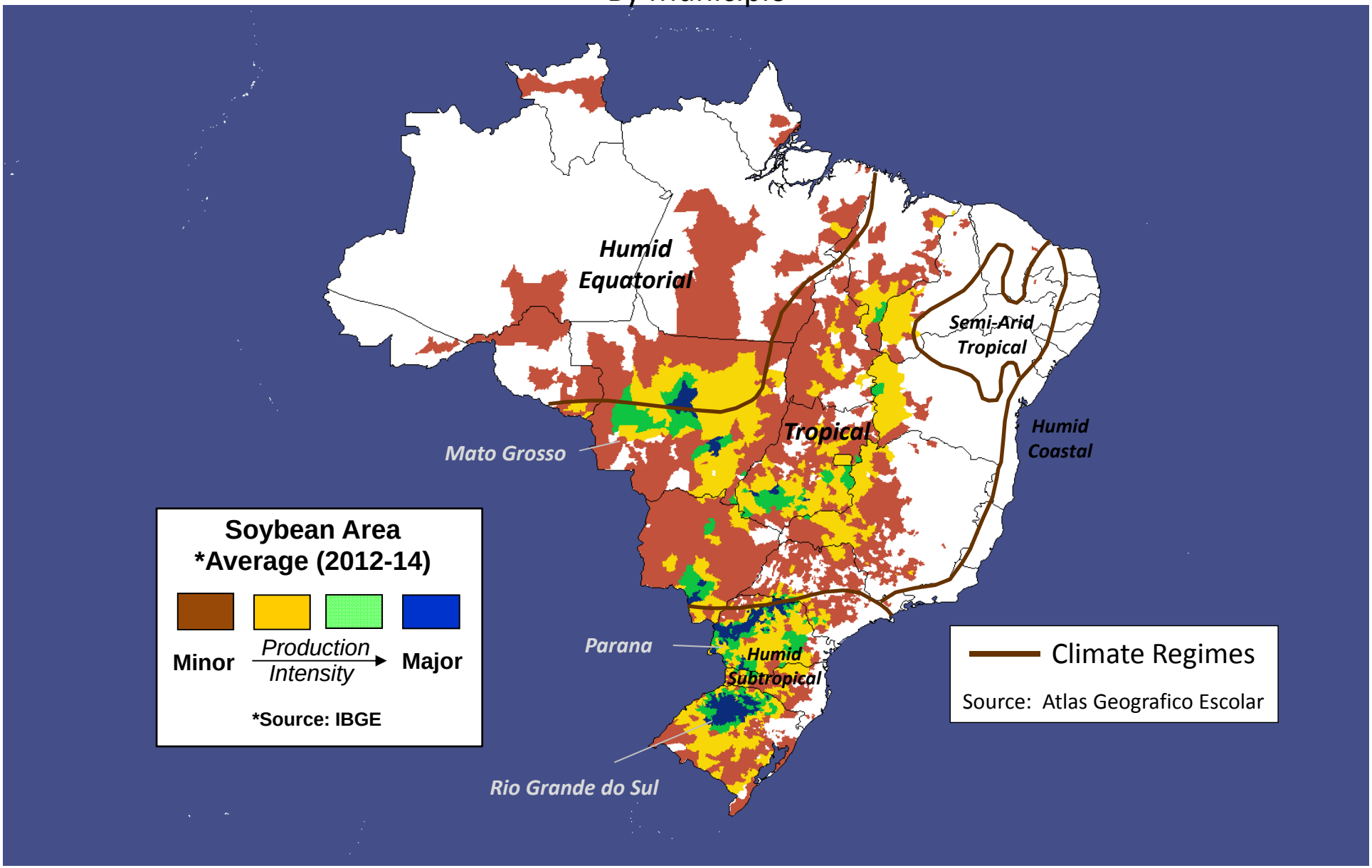
Brazil Soybean Production

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
Total	10,238,667	10,181,787	18,016,774	100.0

Source: IBGE

Soybean Area
*By Municipio



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*Source: IBGE

Brazil Soybean Production

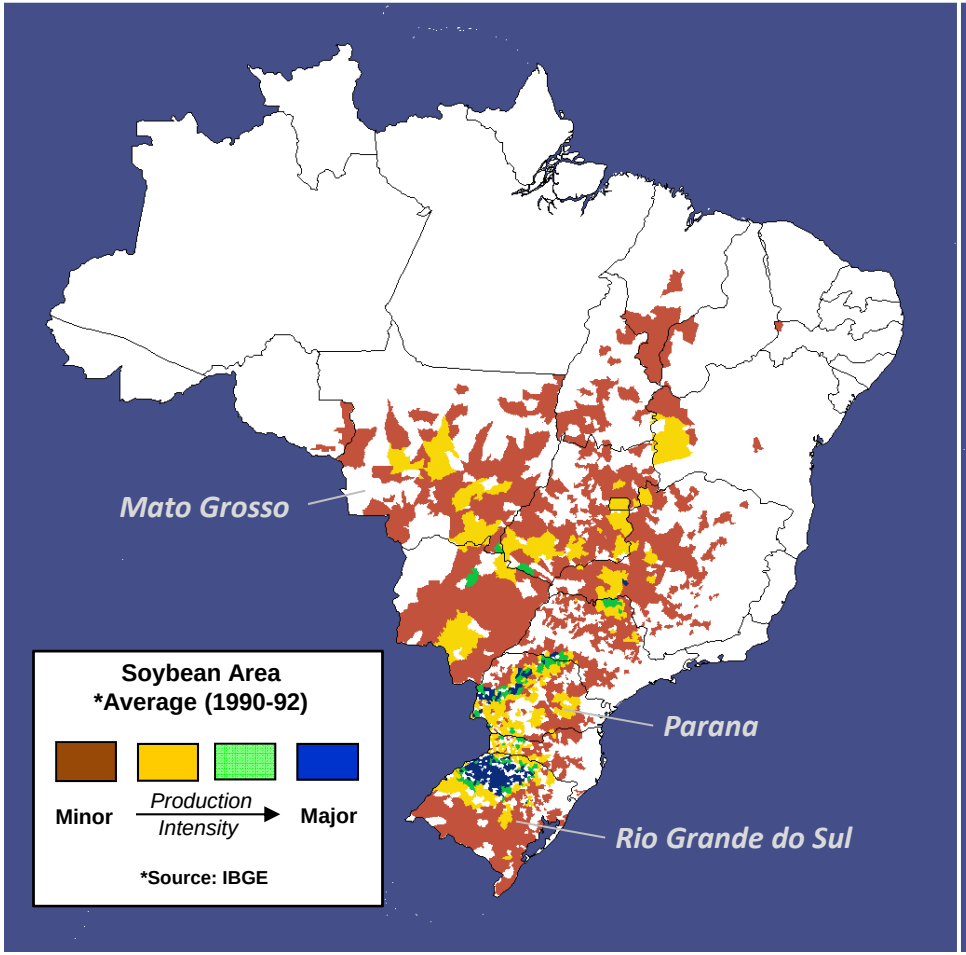
By State (2012-14 Average)

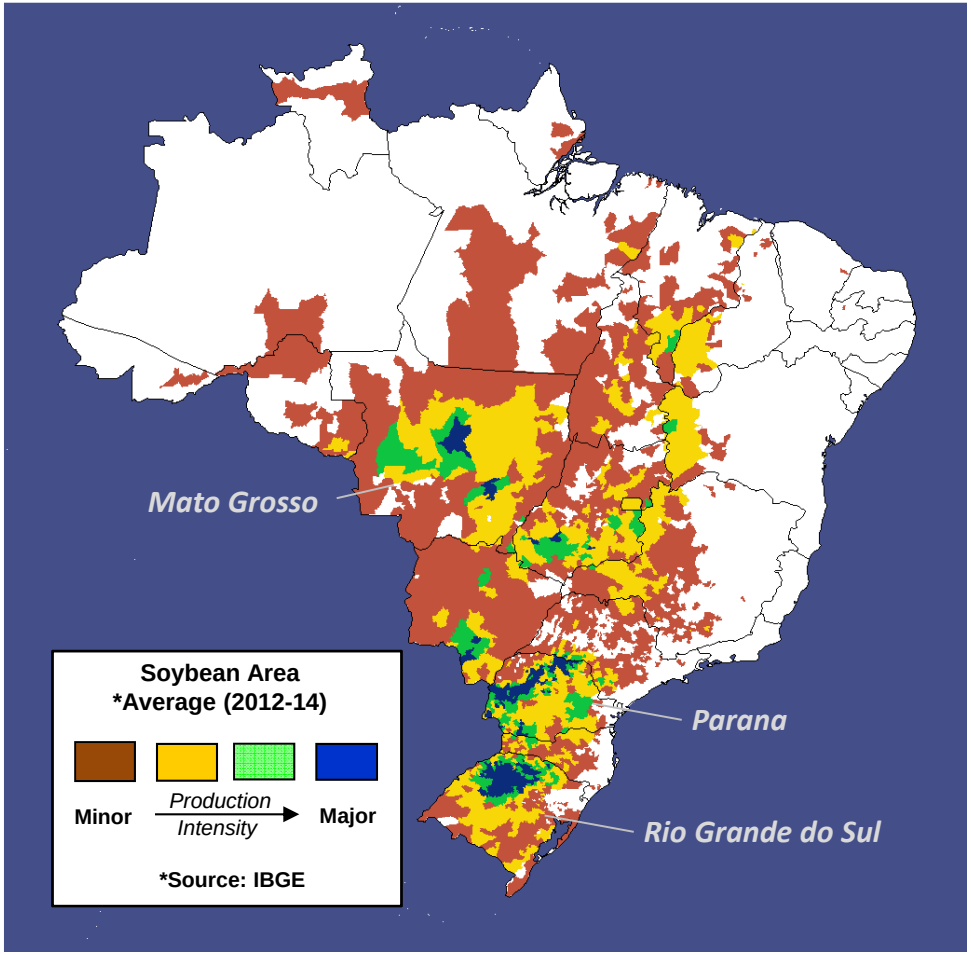
State	Planted Area (ha)	Harvested Area (ha)	Production (mMT)	Percent of Total (%)
Mato Grosso	7,847,068	7,835,990	23,917,983	30.7
Parana	4,743,520	4,743,181	13,929,563	17.9
Rio Grande do Sul	4,662,374	4,623,486	10,581,180	13.6
Goias	2,931,615	2,931,592	8,750,173	11.2
Mato Grosso do Sul	1,961,379	1,960,562	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
Total	27,755,417	27,691,164	78,030,443	100

Source: IBGE

Brazil Soybean Area

1990-92 versus 2012-14





Shift in Area (% of Total Area)

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

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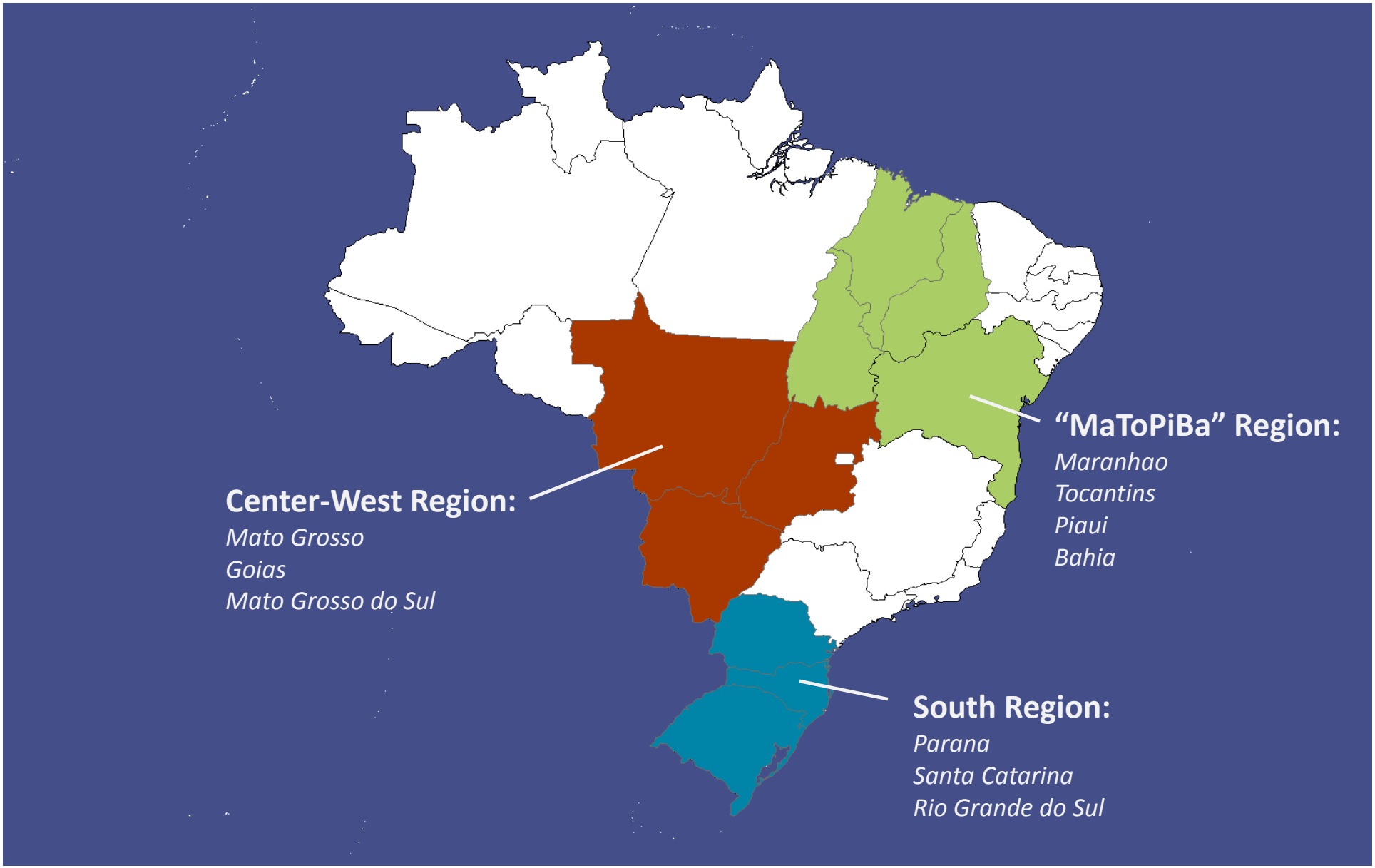
Brazil: Key Production Regions



Brazil Soybean Area (ha)

By Region

16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

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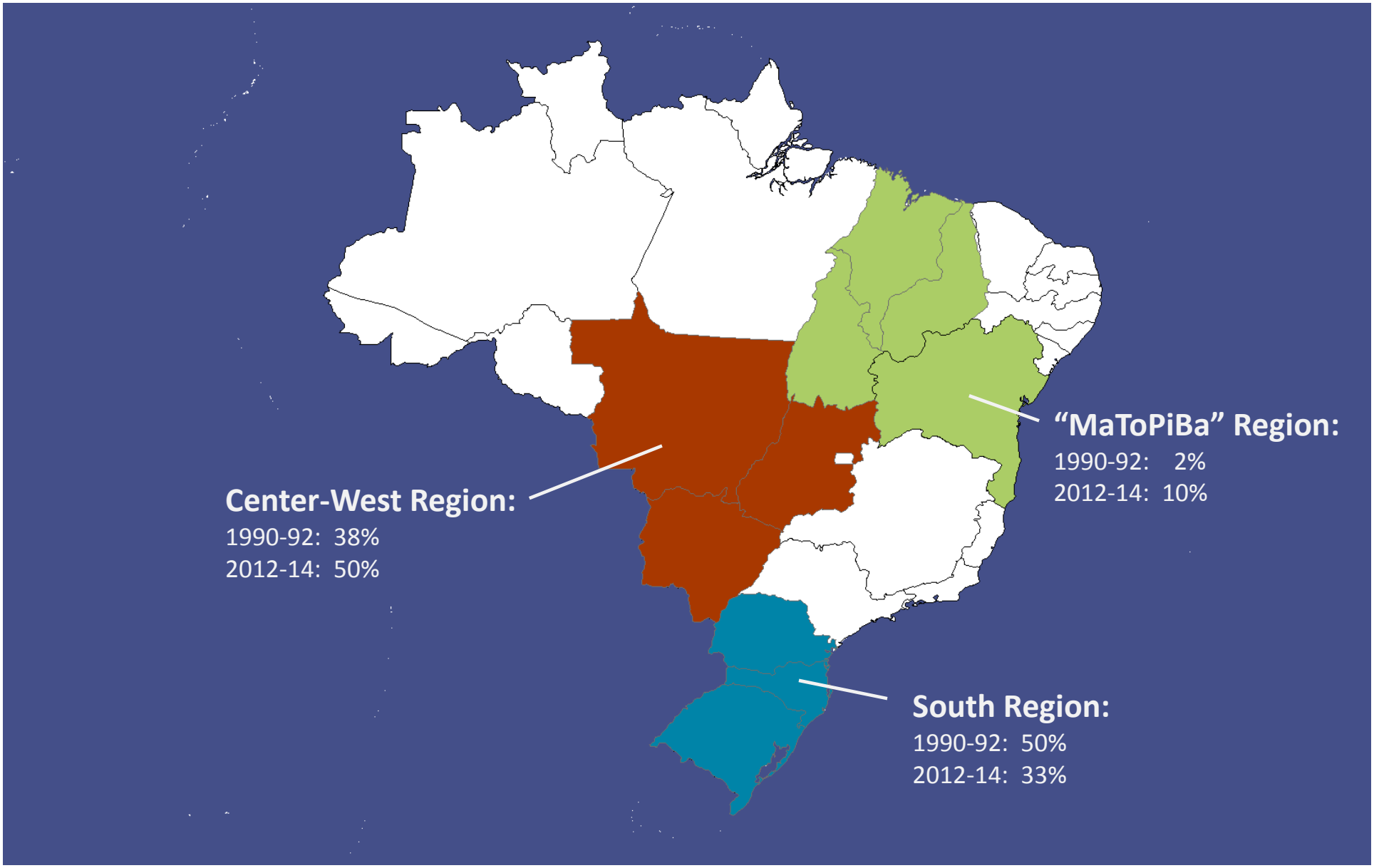
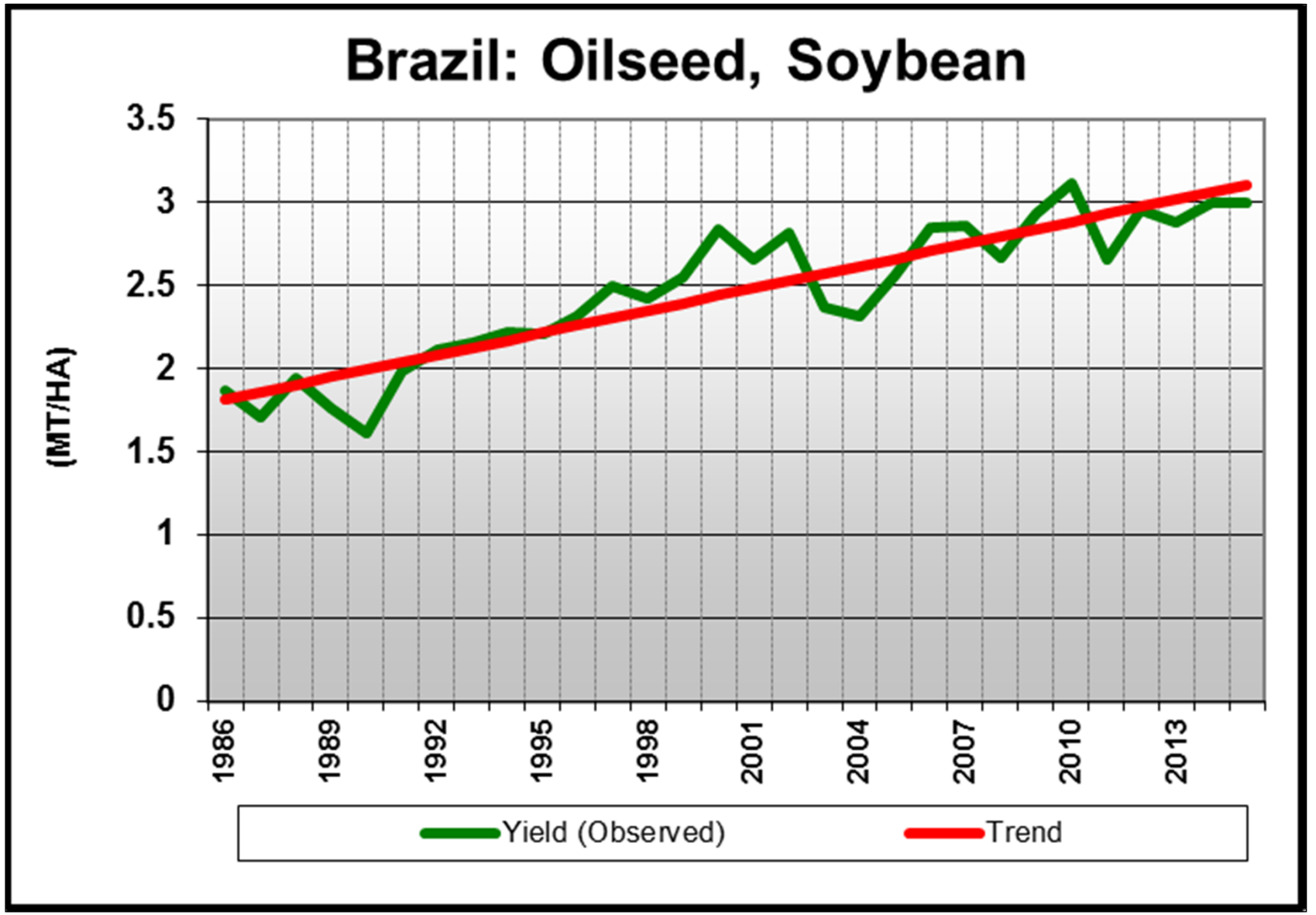
Sul Centro-Oeste MaPiToBa

Brazil: Key Production Regions

Percent of Total National Production



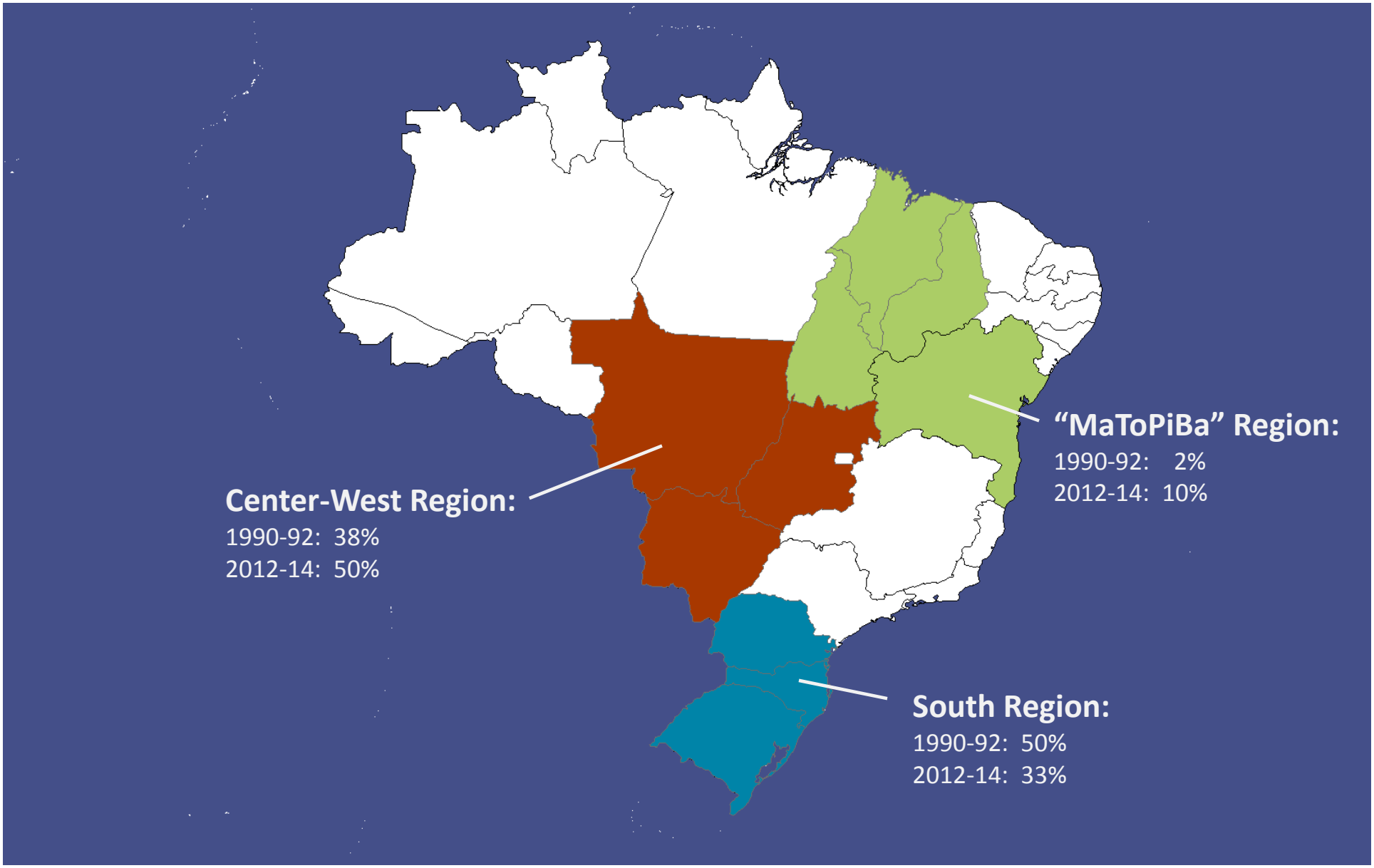
Part III: Impacts on National Production



Source: PSD-Online

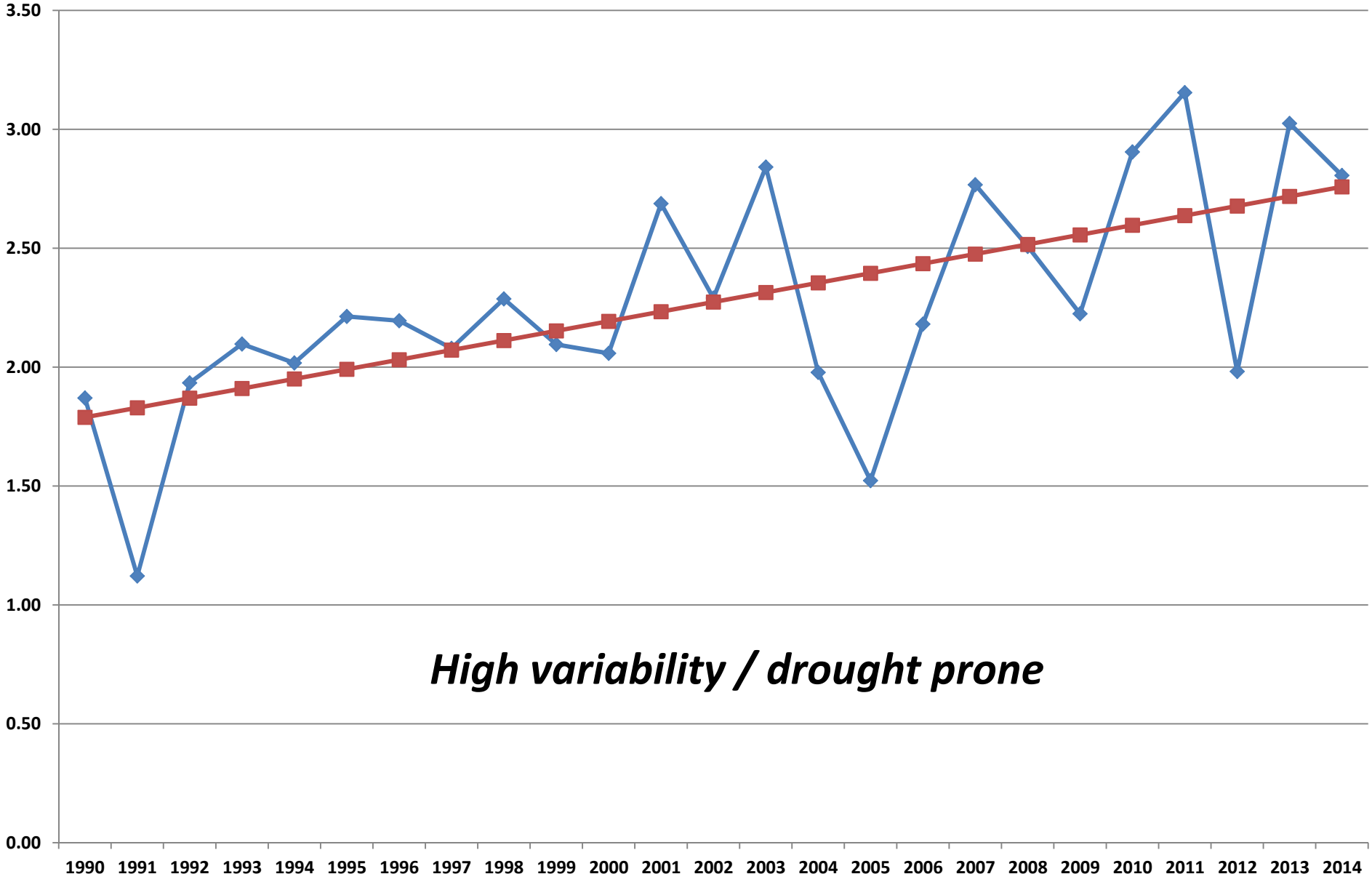
Brazil: Key Production Regions

Percent of Total National Production



South

Soybean Yields



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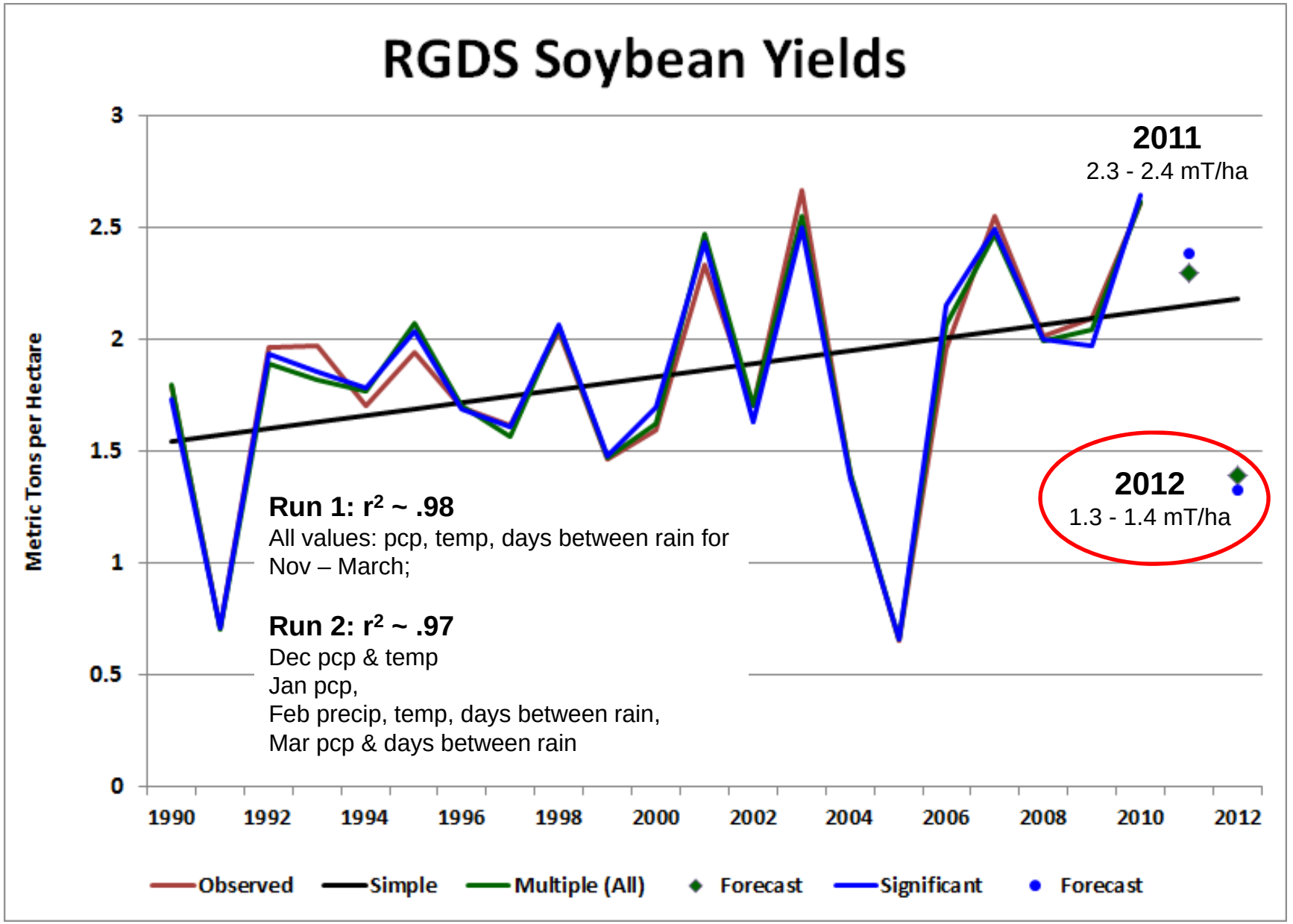
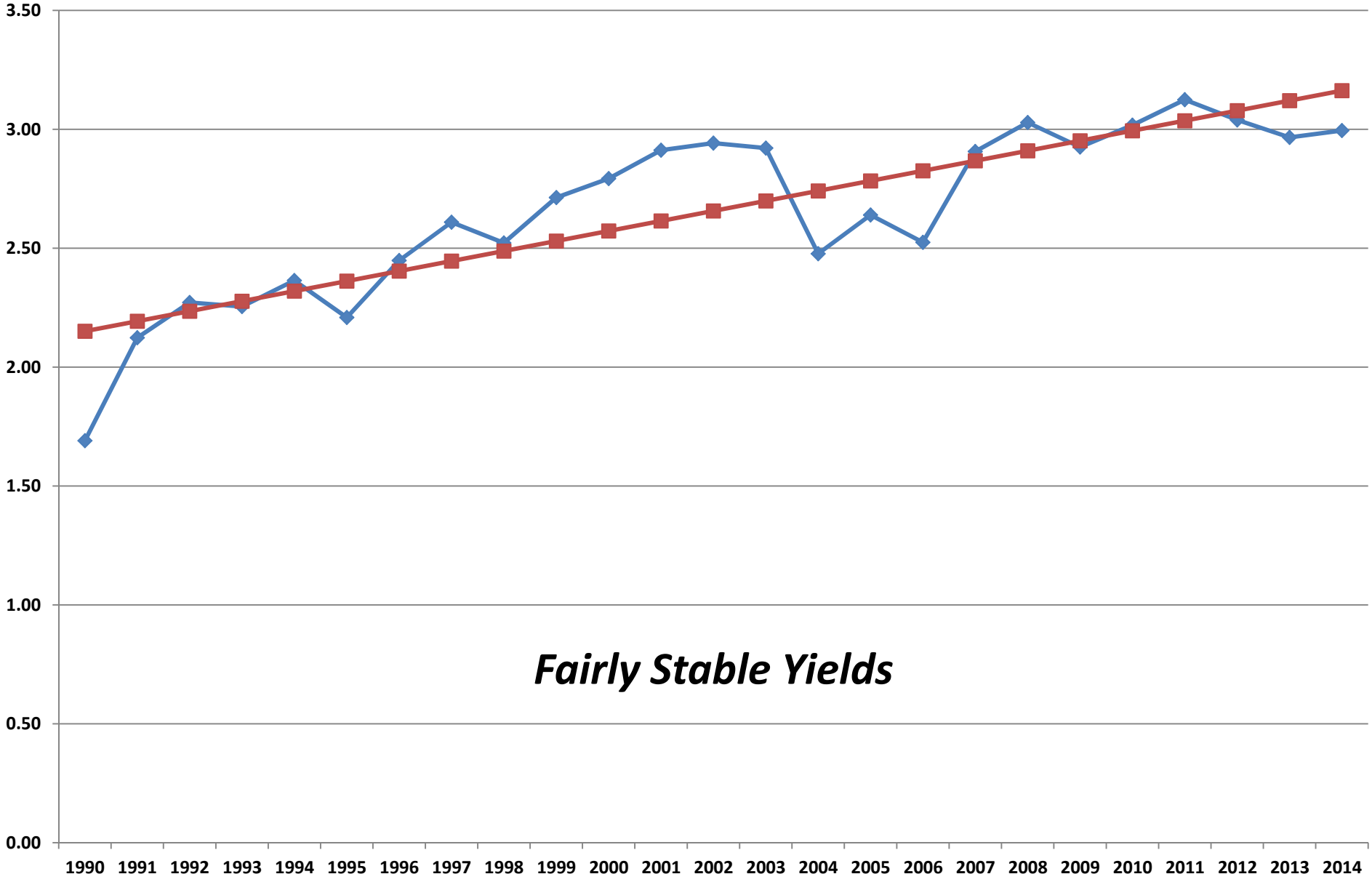
Source: IBGE


RGDS Soybean Yields
Metric Tons per Hectare
3
2.5
2
1.5
1
0.5
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2011
2.3 - 2.4 mT/ha
2012
1.3 - 1.4 mT/ha
Run 1: r² ~ .98
All values: pcp, temp, days between rain for Nov – March;
Run 2: r² ~ .97
Dec pcp & temp
Jan pcp,
Feb precip, temp, days between rain,
Mar pcp & days between rain
Observed
Simple
Multiple (All)
Forecast
Significant
Forecast

Center West

Soybean Yields



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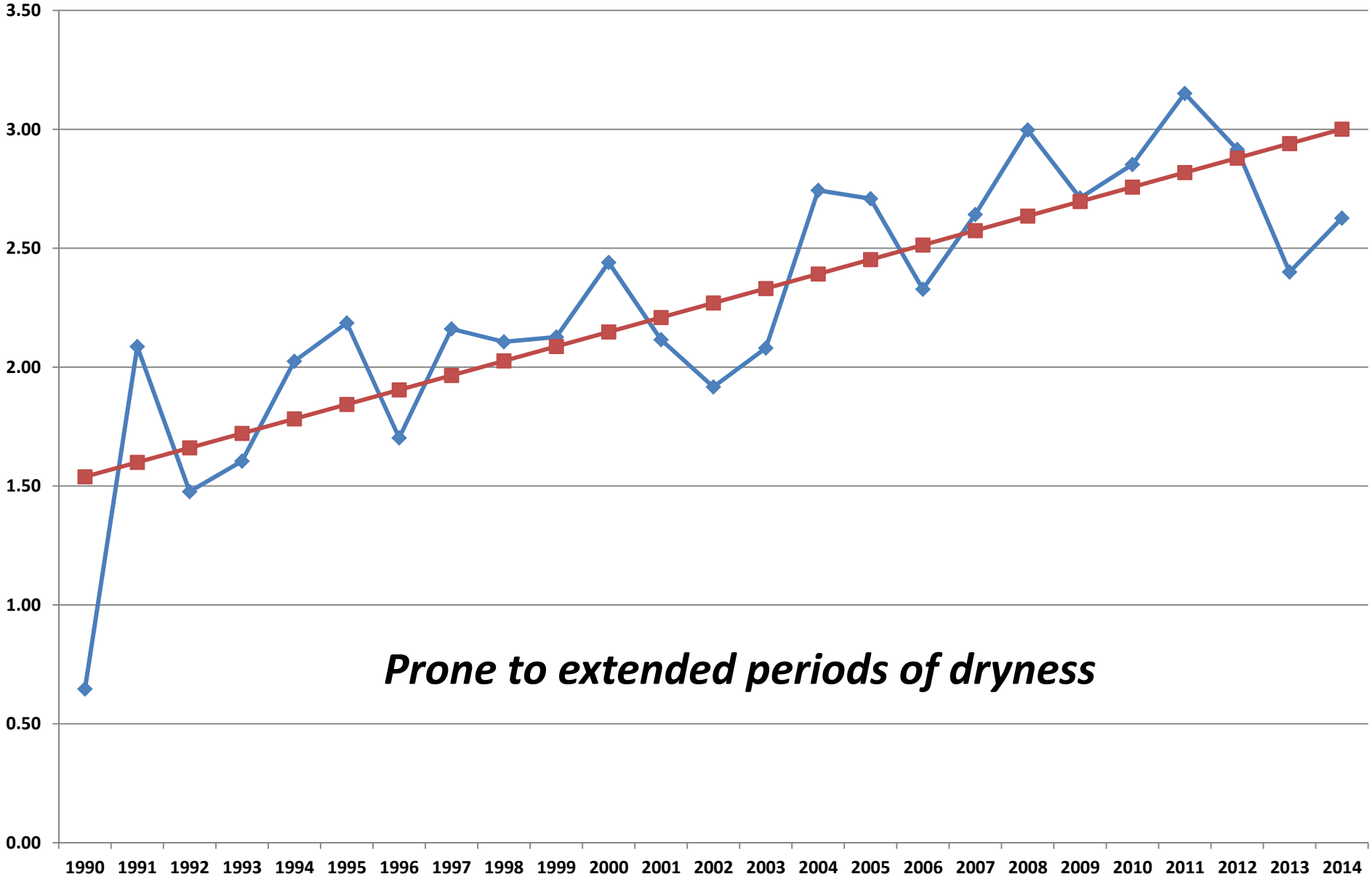
Source: IBGE

MaToPiBa

Soybean Yields



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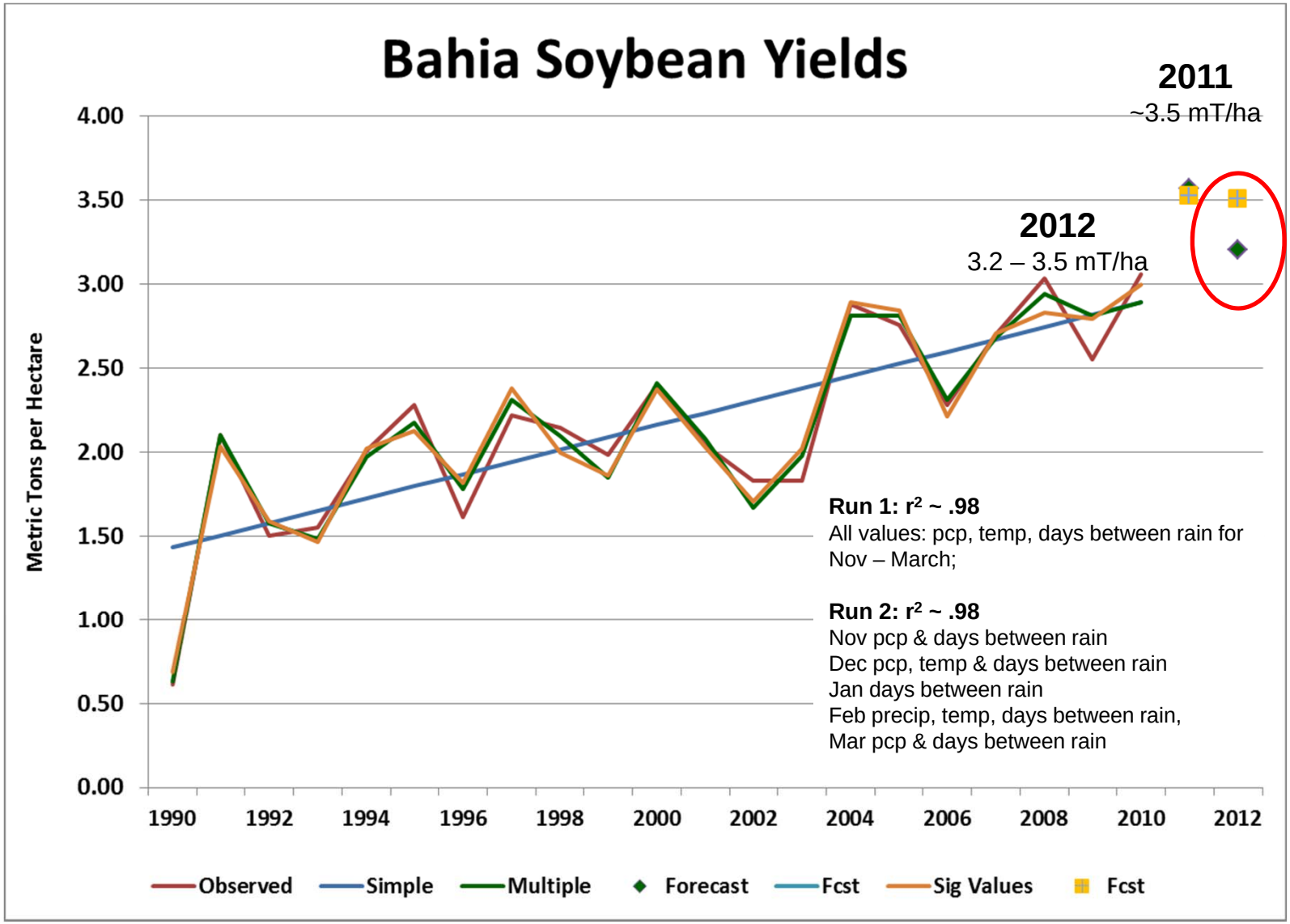
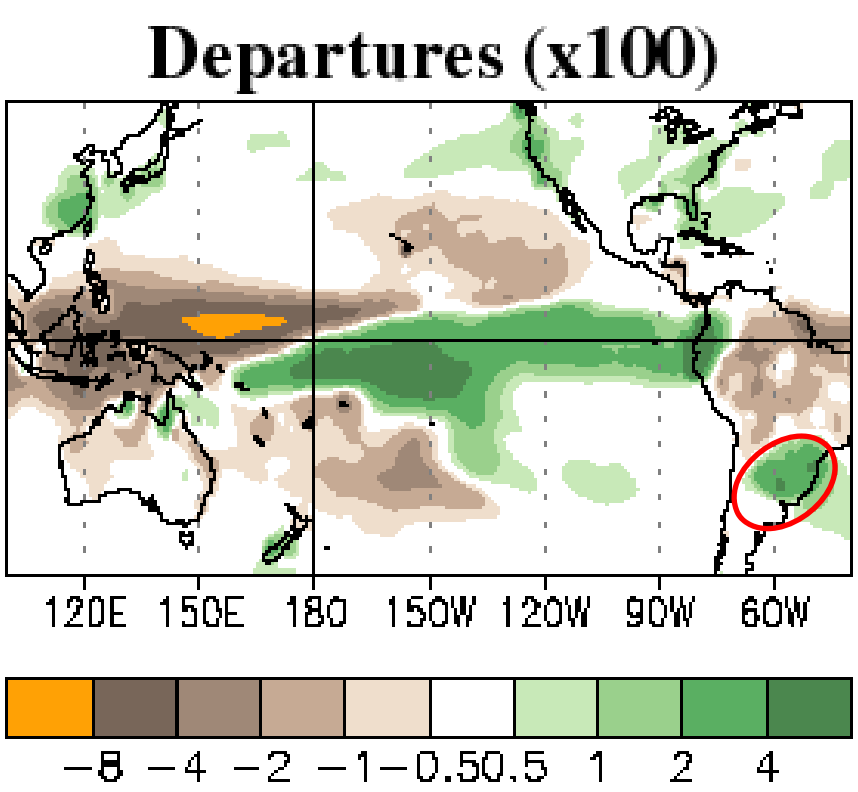
Source: IBGE


Bahia Soybean Yields
2011
~3.5 mT/ha
2012
3.2 – 3.5 mT/ha
Metric Tons per Hectare
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Run 1: r² ~ .98
All values: pcp, temp, days between rain for Nov – March;
Run 2: r² ~ .98
Nov pcp & days between rain
Dec pcp, temp & days between rain
Jan days between rain
Feb precip, temp, days between rain,
Mar pcp & days between rain
Observed
Simple
Multiple
Forecast
Fcst
Sig Values
Fcst

ENSO-Related Rainfall Patterns

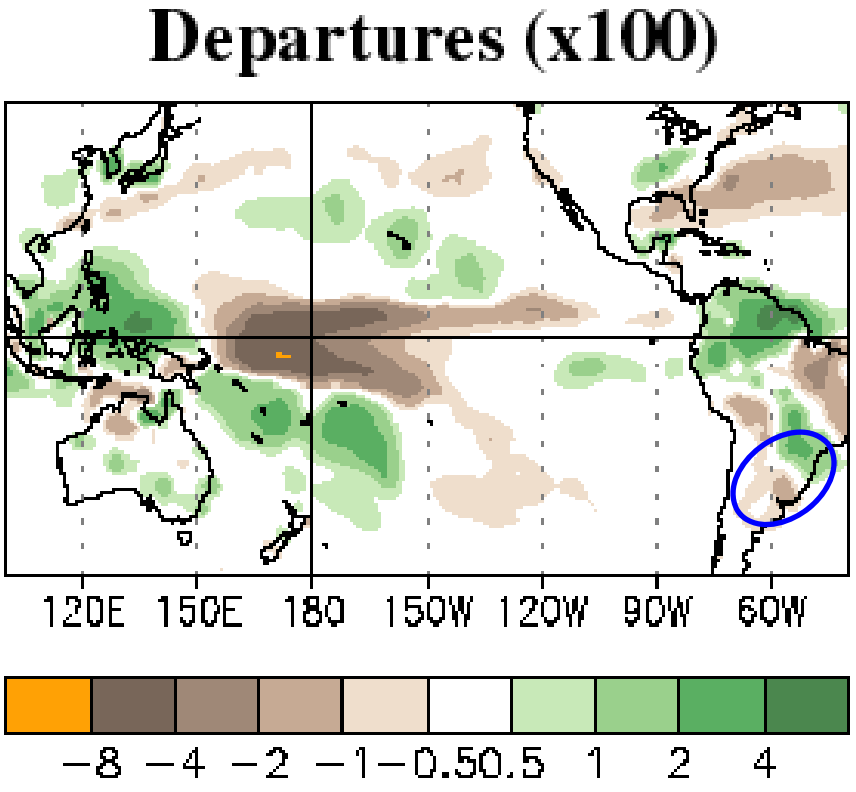
Typical Rainfall departures (mm)

El Niño



Jan-March 1998

La Niña

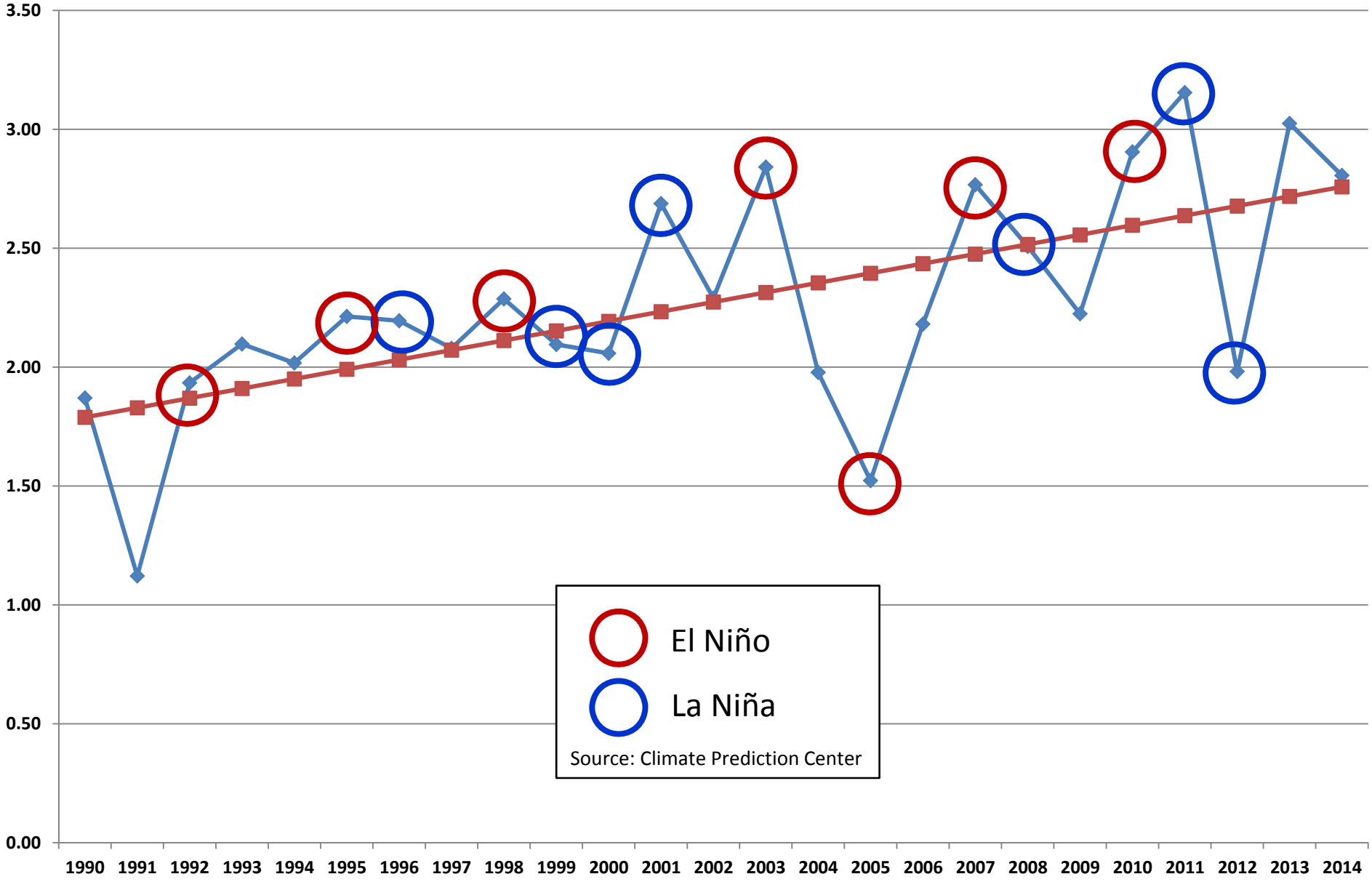


Jan-March 1989

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

South

Soybean Yields



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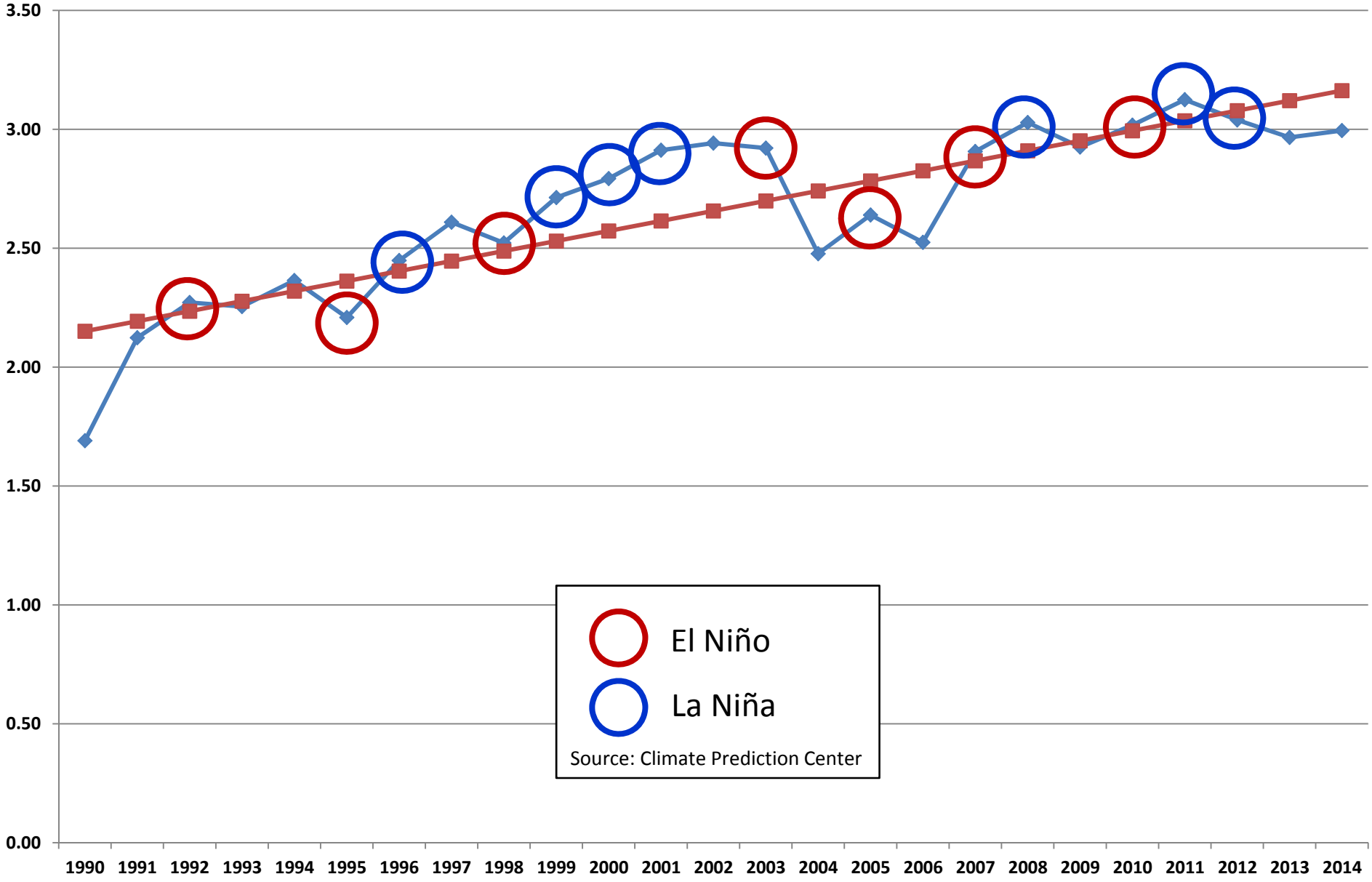
Source: IBGE

Center West

Soybean Yields



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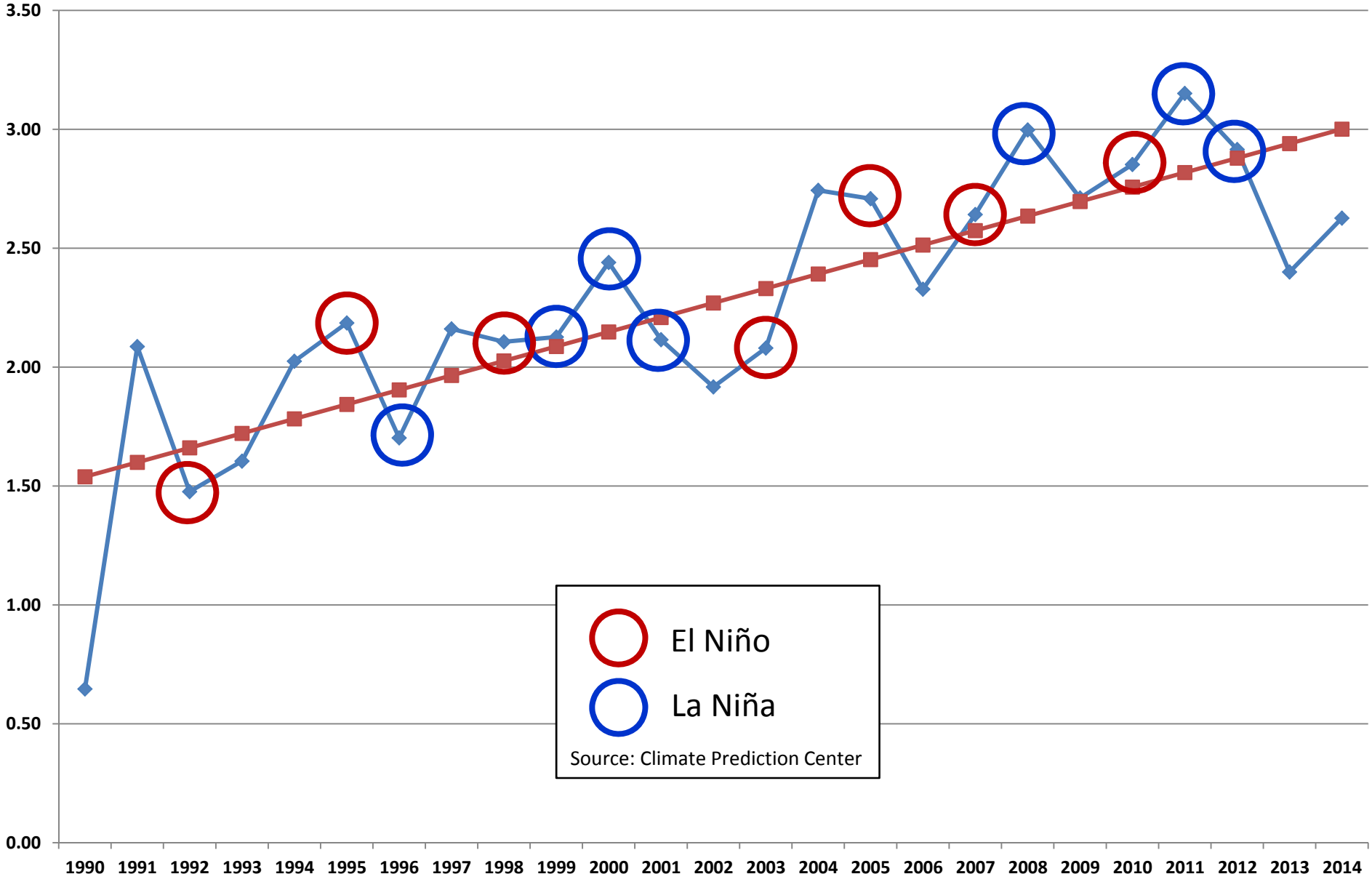
Source: IBGE

MaToPiBa

Soybean Yields



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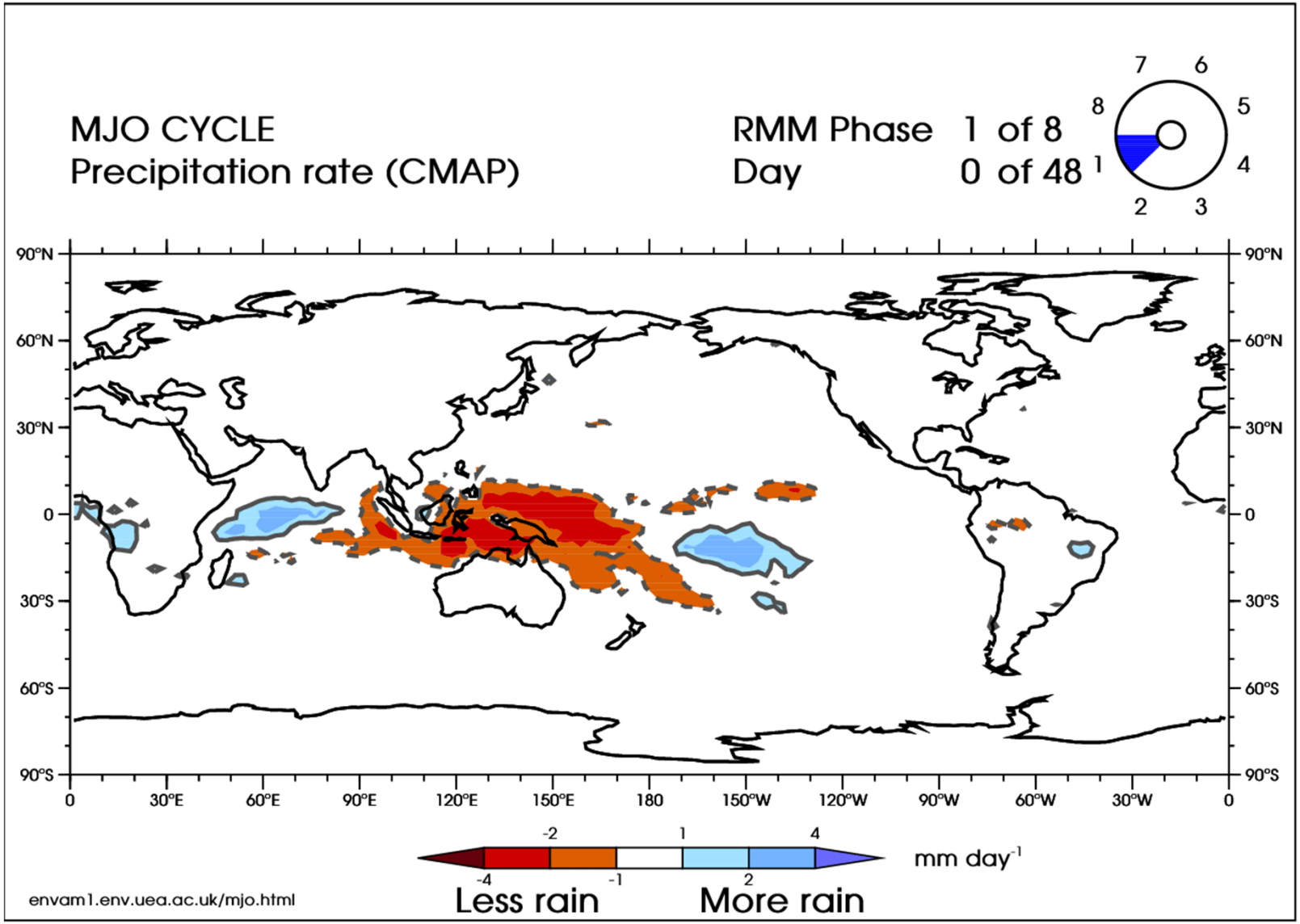
Source: IBGE

Madden Julian Oscillation

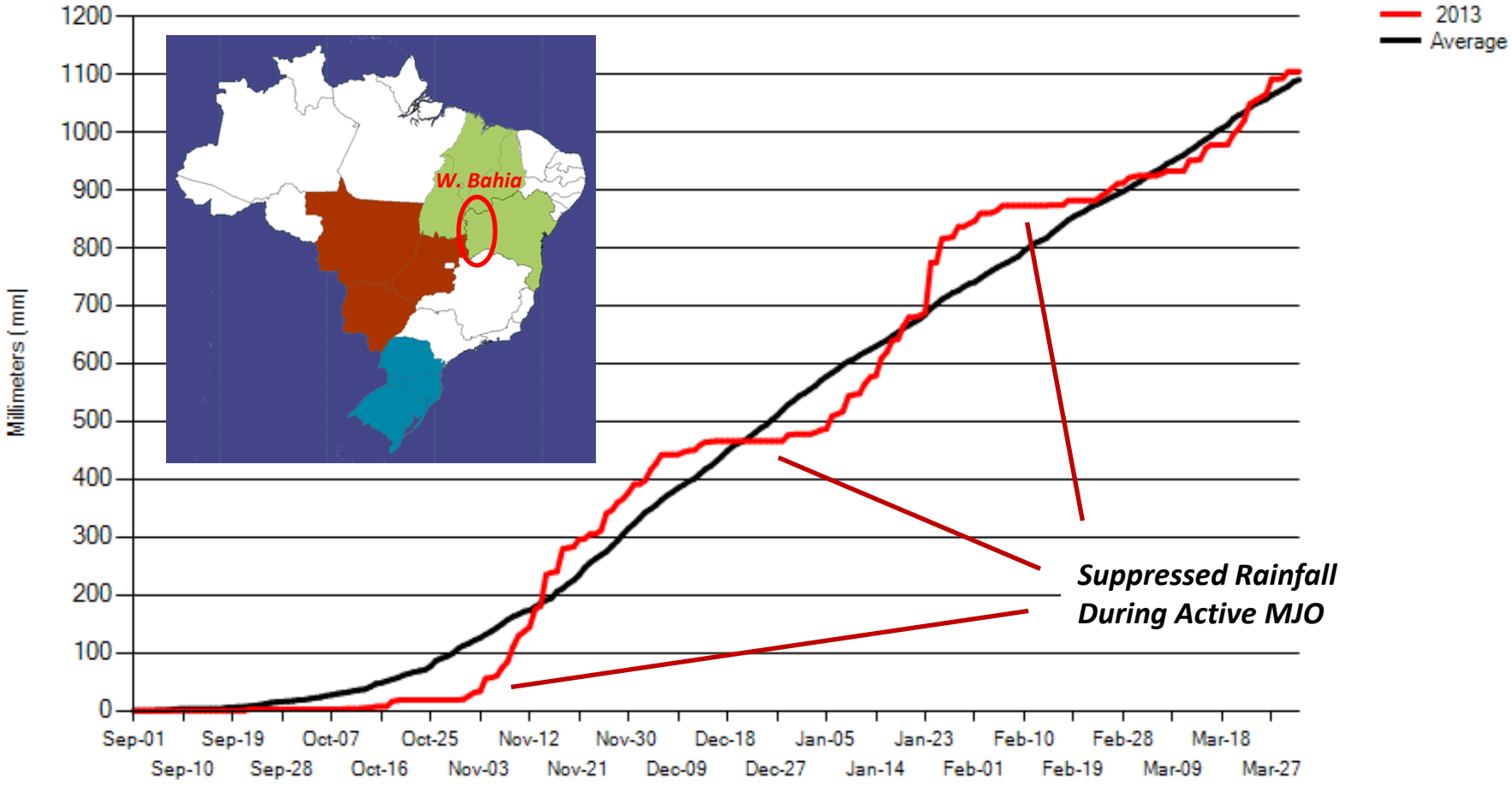


Professor Adrian Matthews School of Environmental Sciences and School of Mathematics, University of East Anglia, Norwich, UK

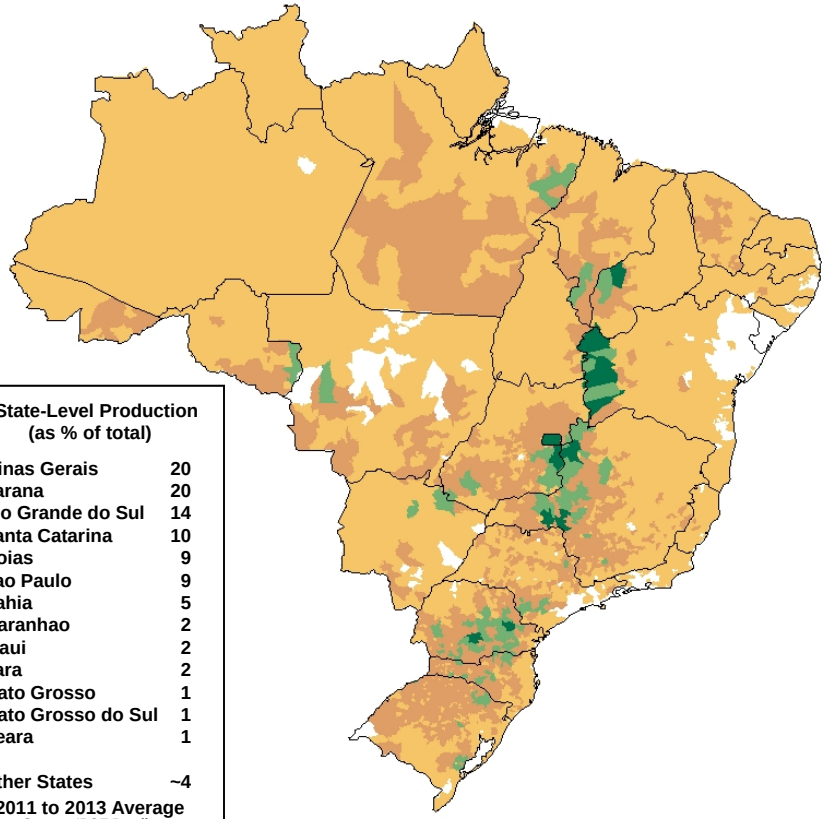
http://envam1.env.uea.ac.uk/mjo.html

14 - WESTERN BAHIA

Cumulative Precipitation



Brazil Corn Production

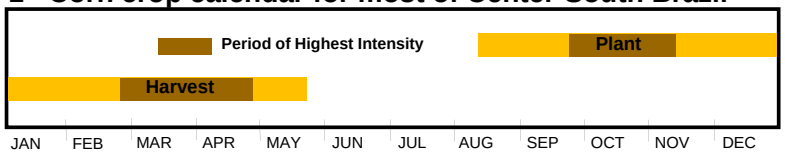


* State-Level Production (as % of total)	
Minas Gerais	20
Parana	20
Rio Grande do Sul	14
Santa Catarina	10
Goias	9
Sao Paulo	9
Bahia	5
Maranhao	2
Piaui	2
Para	2
Mato Grosso	1
Mato Grosso do Sul	1
Ceara	1
Other States	~4

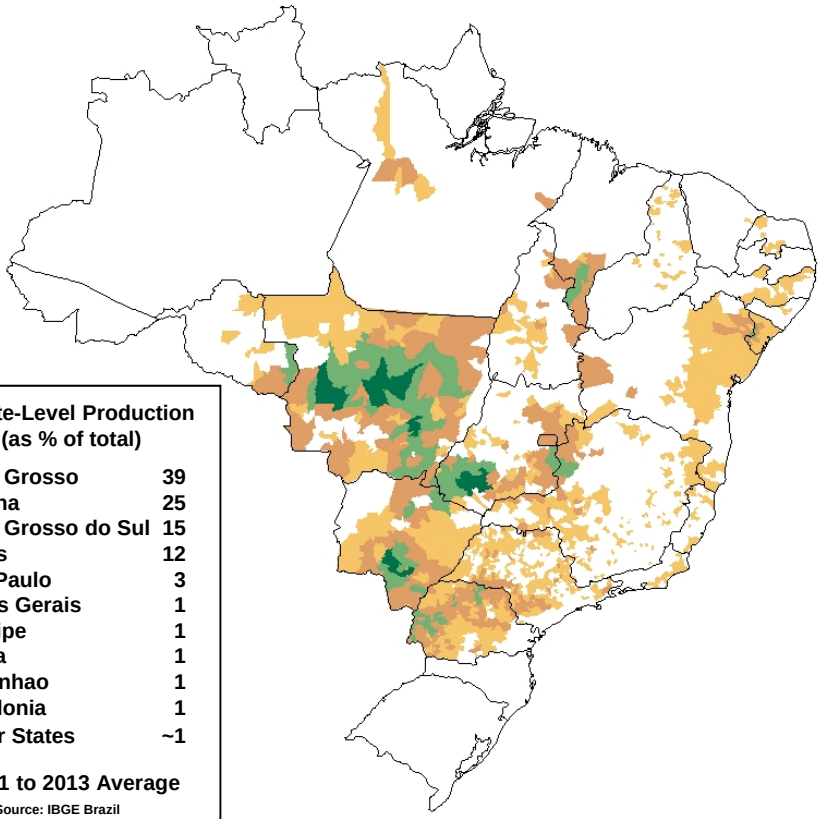
* 2011 to 2013 Average

Source: IBGE Brazil

1st Corn crop calendar for most of Center-South Brazil



In Northeast Brazil, 1st crop planted Dec - Jan (harvested May - Jul).

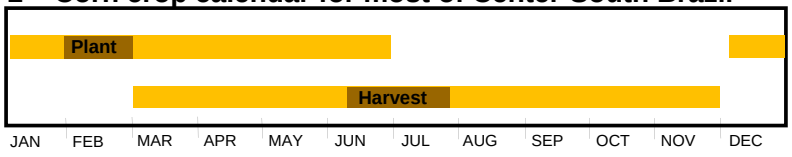


* State-Level Production (as % of total)	
Mato Grosso	39
Parana	25
Mato Grosso do Sul	15
Goias	12
Sao Paulo	3
Minas Gerais	1
Sergipe	1
Bahia	1
Maranhao	1
Rondonia	1
Other States	~1

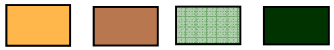
* 2011 to 2013 Average

Source: IBGE Brazil

2nd Corn crop calendar for most of Center-South Brazil



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



Minor — *Production Intensity* → **Major**

***Source: IBGE**

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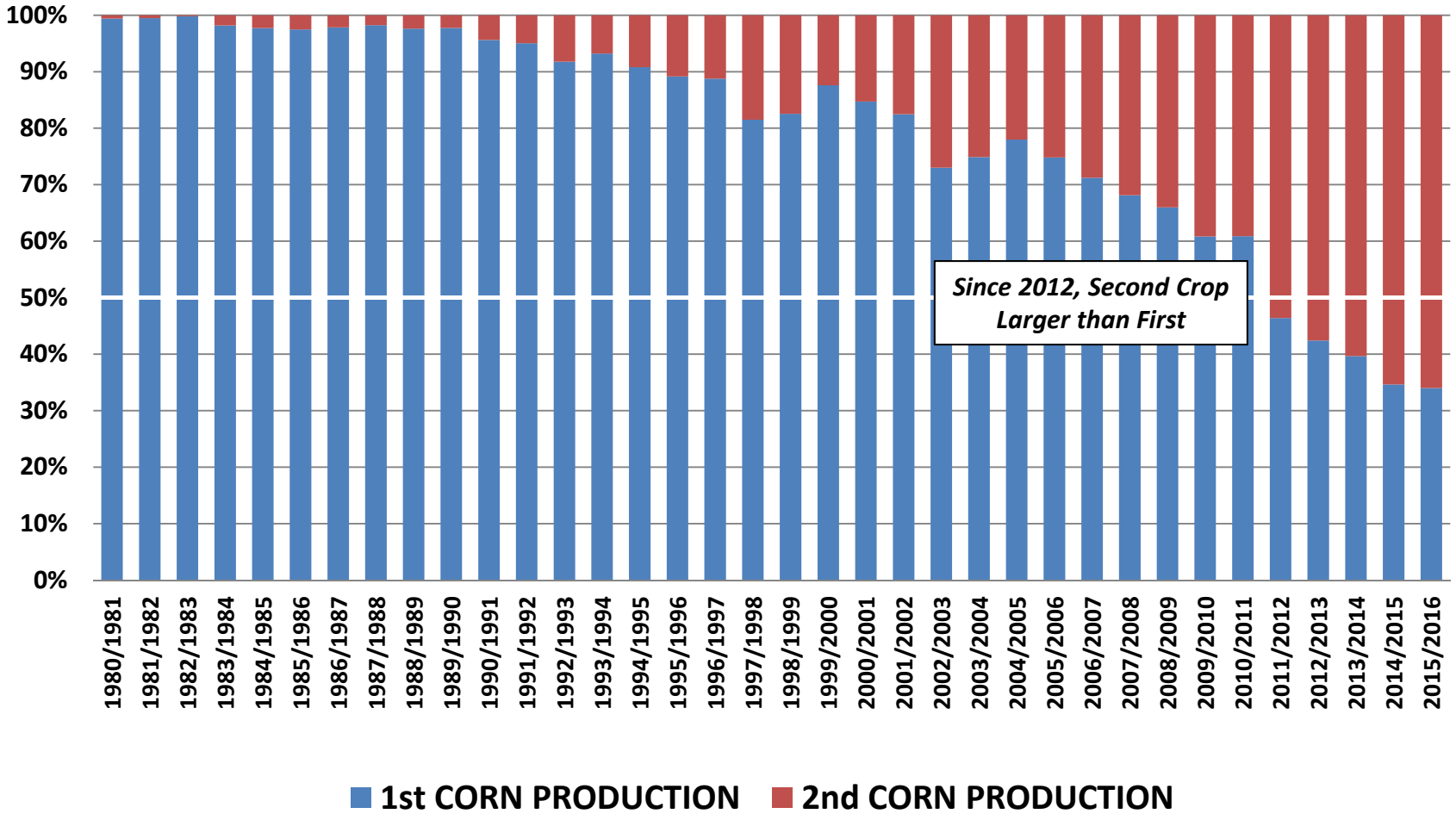
Brazil Corn Production: Percent of Total Production by Season



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

Summary

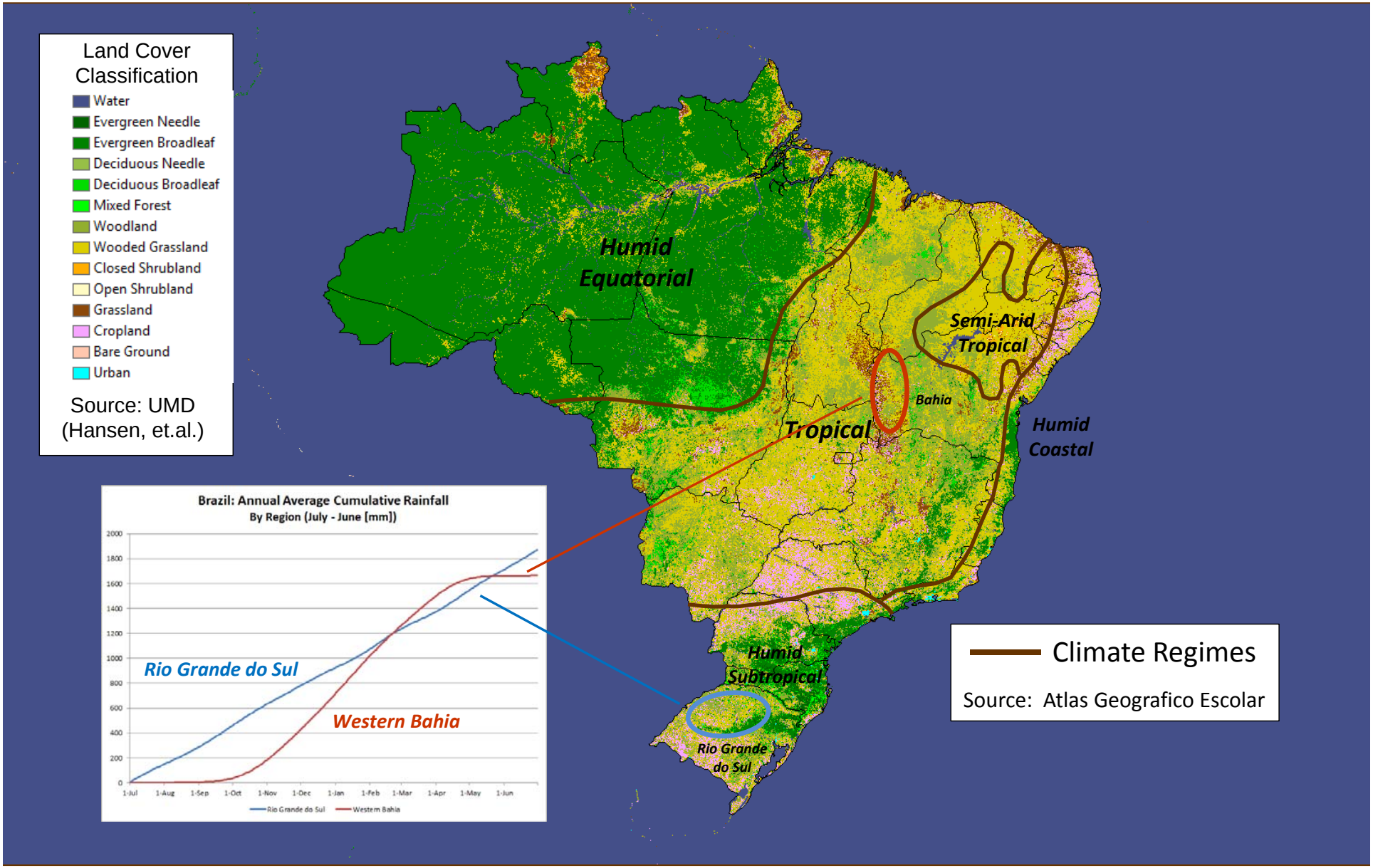
- **Brazilian agricultural production has increased over the past 25 years, largely due to a significant shift toward farming in central Brazil and the northeastern interior;**
- **One of the main benefits to this migration is a reduction in the percent of acreage in drought-prone areas;**
- **Another 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

SPARE

University of Maryland
*Land Cover Classification



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*Coverage Date 1981-1994

Brazil Soybean Area (ha)

Selected States

10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

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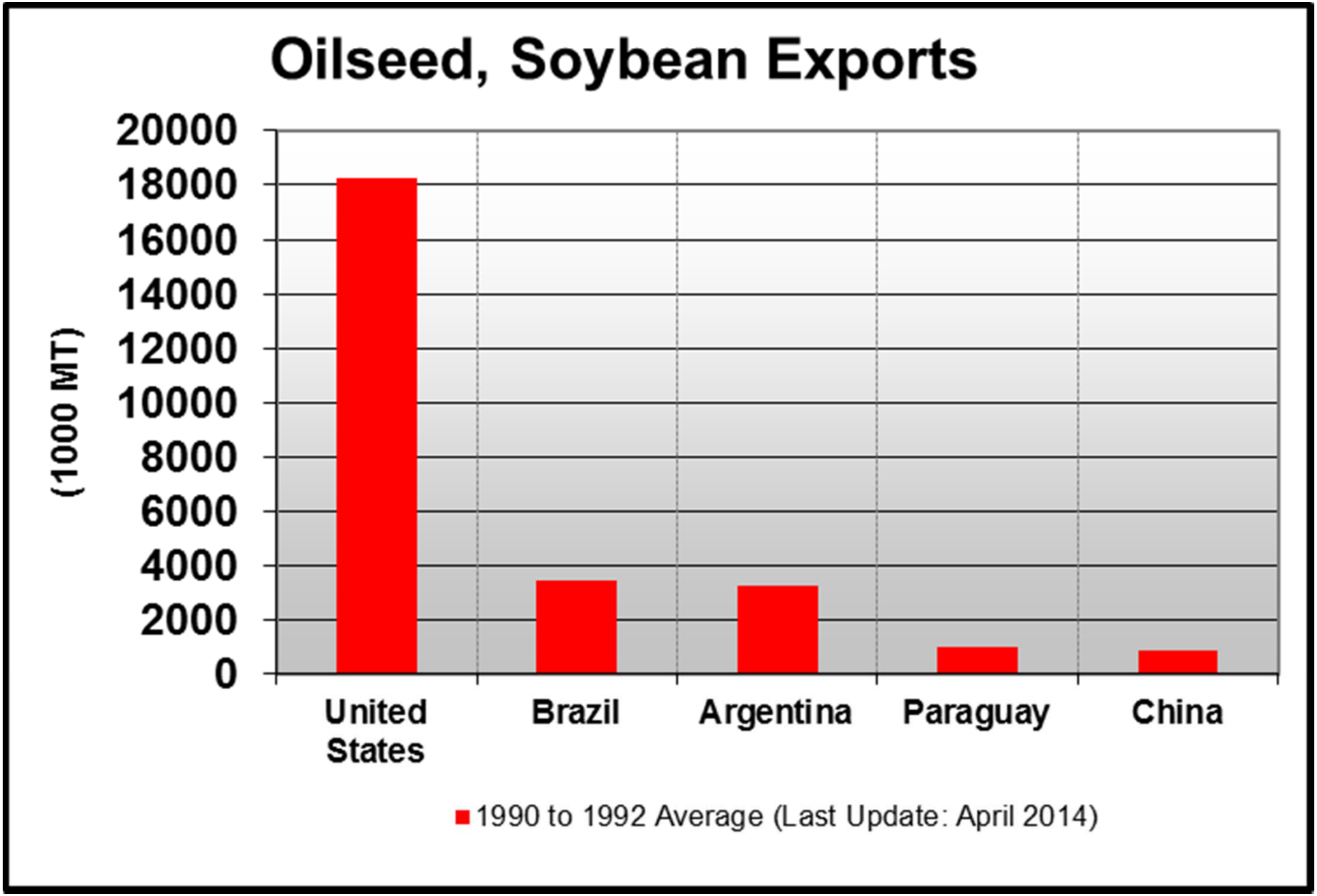
Paraná Rio Grande do Sul Mato Grosso



Source: PSD-Online