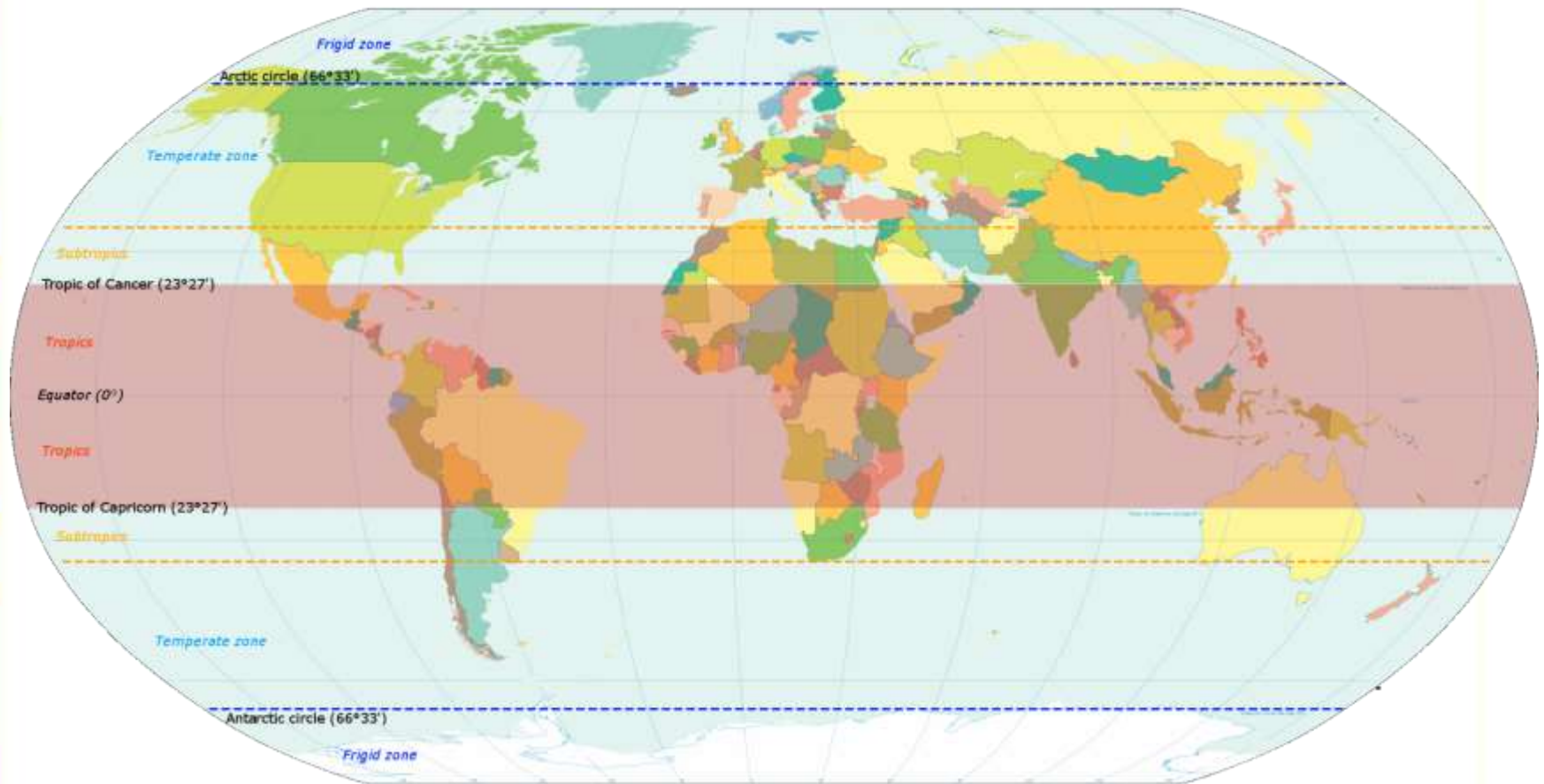


Platform of Brazilian Low Carbon Agriculture Plan: Opportunities to Cooperation with GRA

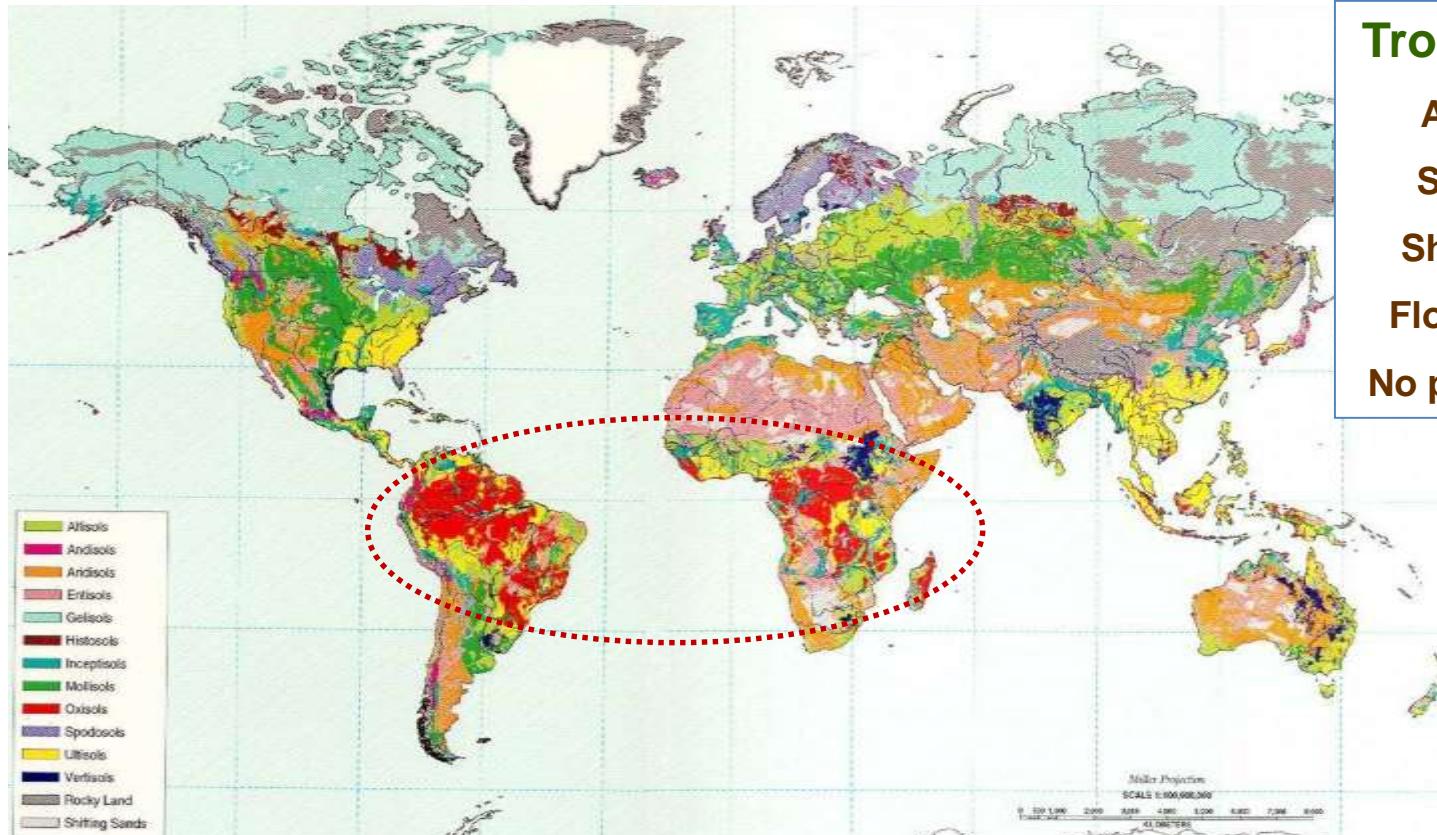
Renato de Aragão Ribeiro Rodrigues

Secretary of Intelligence and Strategic Relations - Embrapa
President of the Council – ICLF Network

Most of the Brazilian Territory is Tropical



Challenging Tropical Environments



Tropical Soils

Acid – 84%

Saline – 2%

Shallow – 7%

Flooded – 16%

No problem – 9%

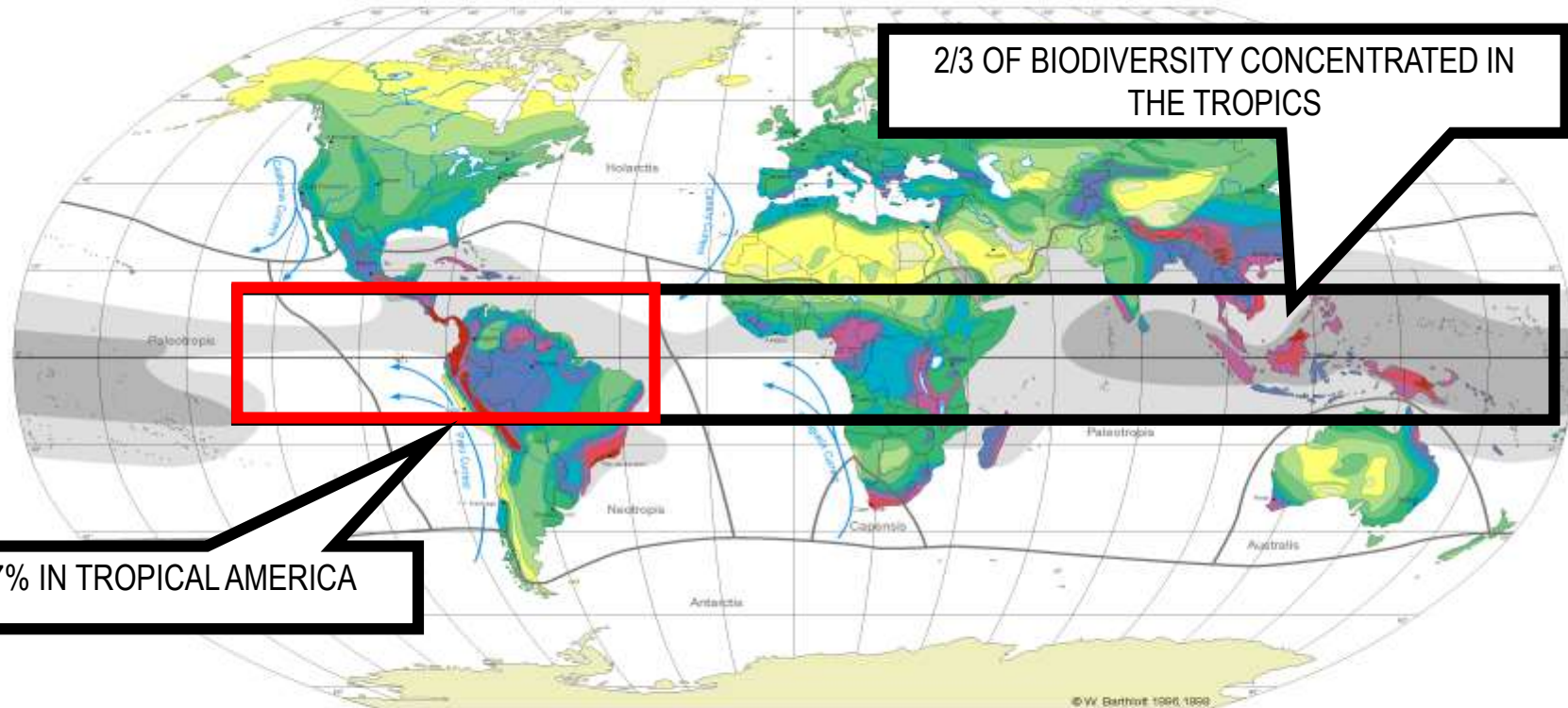
High concentration of acidic and nutrient-poor soils in the tropics

Brazil is a Mega-Diverse Country

It is estimated that Brazil contains greater biodiversity than any other country on Earth.

2/3 OF BIODIVERSITY CONCENTRATED IN THE TROPICS

37% IN TROPICAL AMERICA



Robinson Projection
Standard Parallels 38°N and 38°S

Diversity Zones (DZ): Number of species per 10 000km²



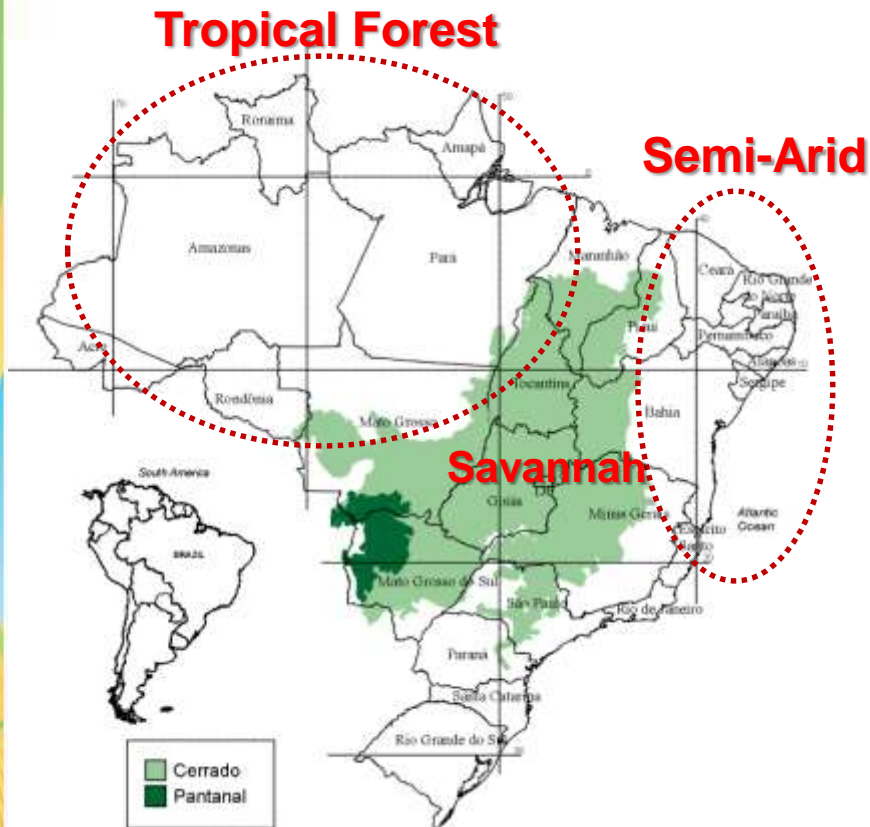
sea surface temperature



W. Barthlott, N. Biedinger, G. Braun, F. Feig, G. Kier, W. Lauer & J. Mutke 1999
modified after:
W. Barthlott, W. Lauer & A. Plagge 1996
Department of Botany and Geography
University of Bonn
German Aerospace Research Establishment, Cologne
Cartography: M. Gief
Department of Geography University of Bonn

Source: Barthlott, W., Biedinger, N., Braun, G., Feig, F., Kier, G. & J. Mutke (1999): Terminological and methodological aspects of the mapping and analysis of global biodiversity. In: Acta Botanica Fennica 162: 103-110.

Agriculture and Rural Development in Brazil



Achieve Food Security

Manage complex biomes

Conserve biodiversity

Conserve soil and water

Reduce GHG emissions

Achieve economic viability

...



Brazil Developed a Science-Based Agriculture

Food and Energy Security in 40 Years

Brazilian Agricultural Research Corporation

Embrapa: The largest Agricultural Research Organization in Latin America

Employees: 9,700

Total Scientists: 2,400

Budget: US\$ 1 billion

42 Research Units

Scientific Cooperation - Labex USA and Europe

Technical Cooperation - Africa and Latin America





First Agricultural Revolution in Brazil

The First Agricultural Revolution in Brazil

Transformation of
acidic, poor soils
into **fertile land**

“**Tropicalization**” of
crops and animal
production systems



Development of a Platform
of **Sustainable Practices**
and **Public Policies**

The First Agricultural Revolution in Brazil

“Building” fertility in our soils

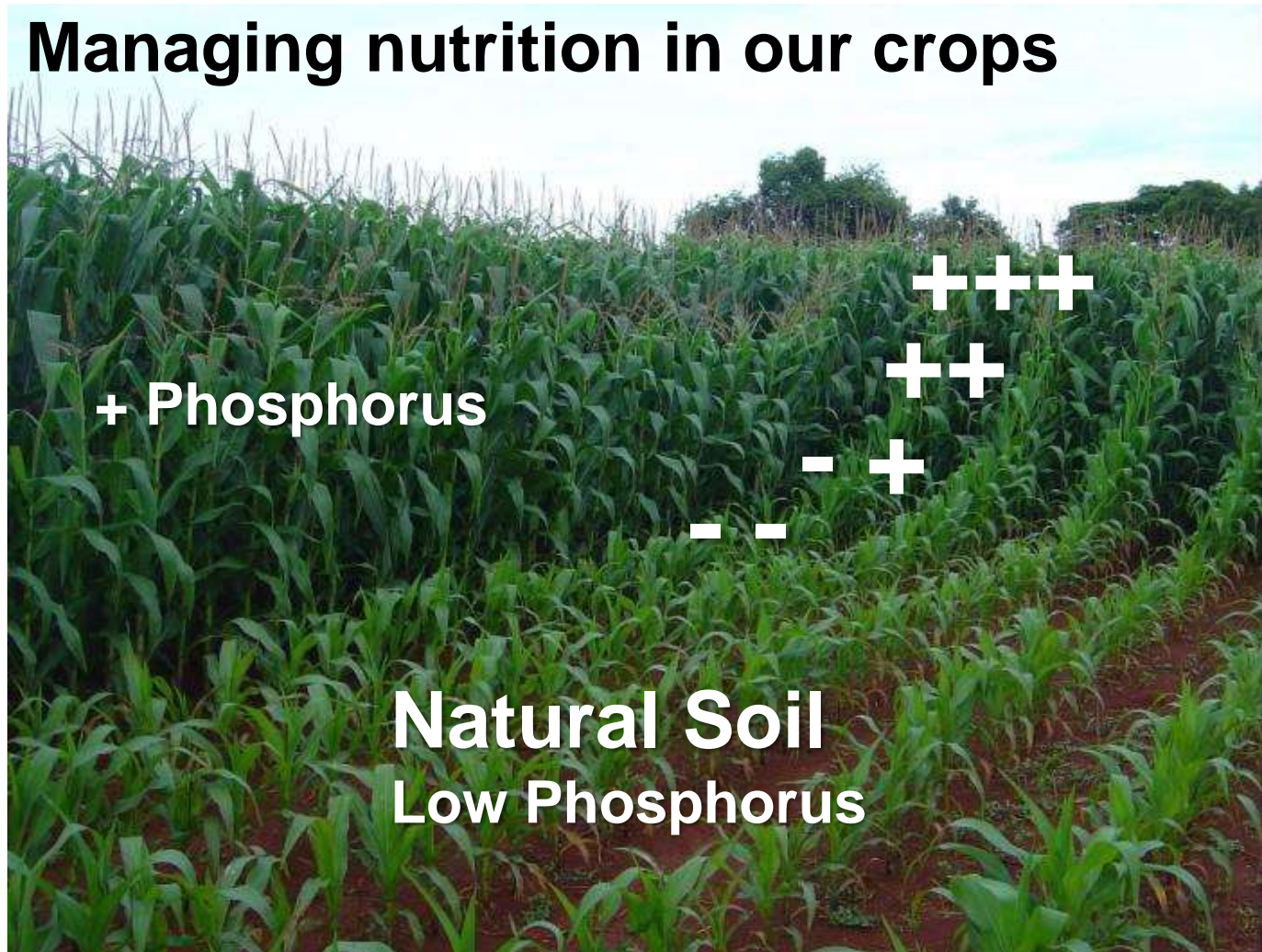
**Soil fertility
built**

**Natural
Soil**



The First Agricultural Revolution in Brazil

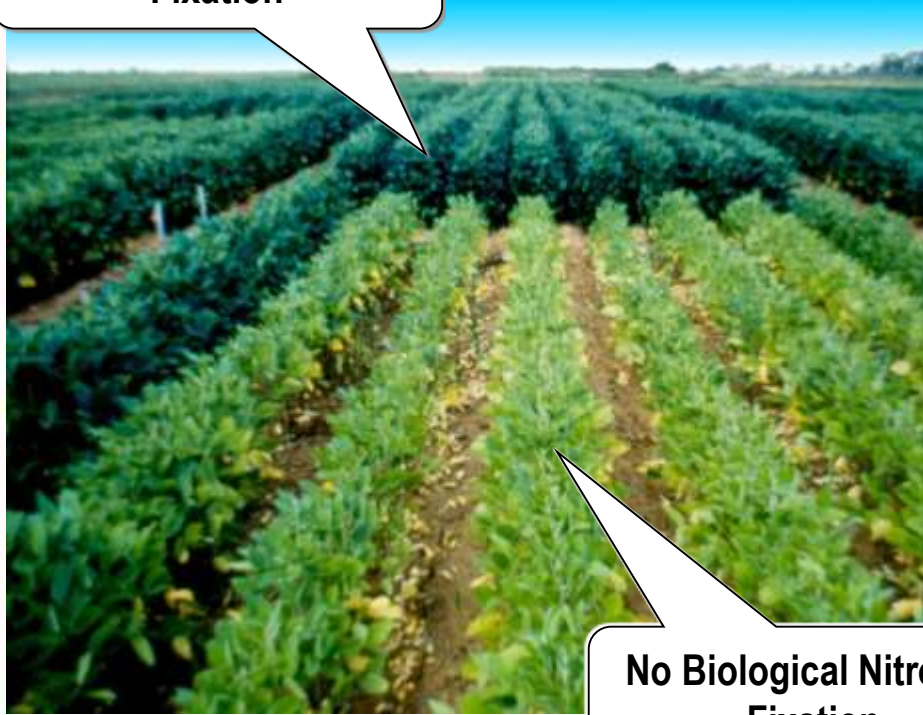
Managing nutrition in our crops



The First Agricultural Revolution in Brazil

Nitrogen fixation in Soybeans

Biological Nitrogen Fixation



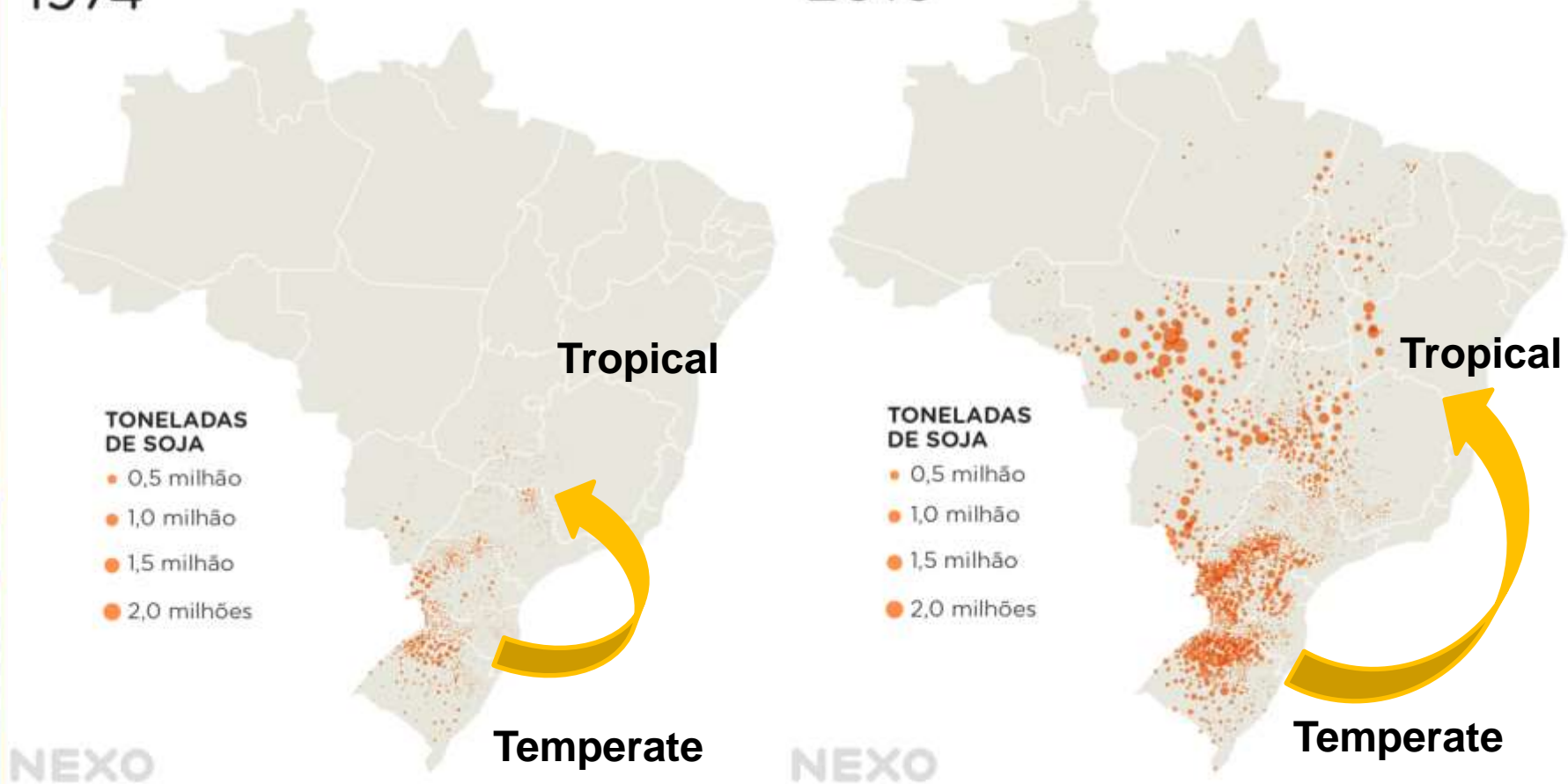
No Biological Nitrogen Fixation



Tropicalization of the Soybean Crop

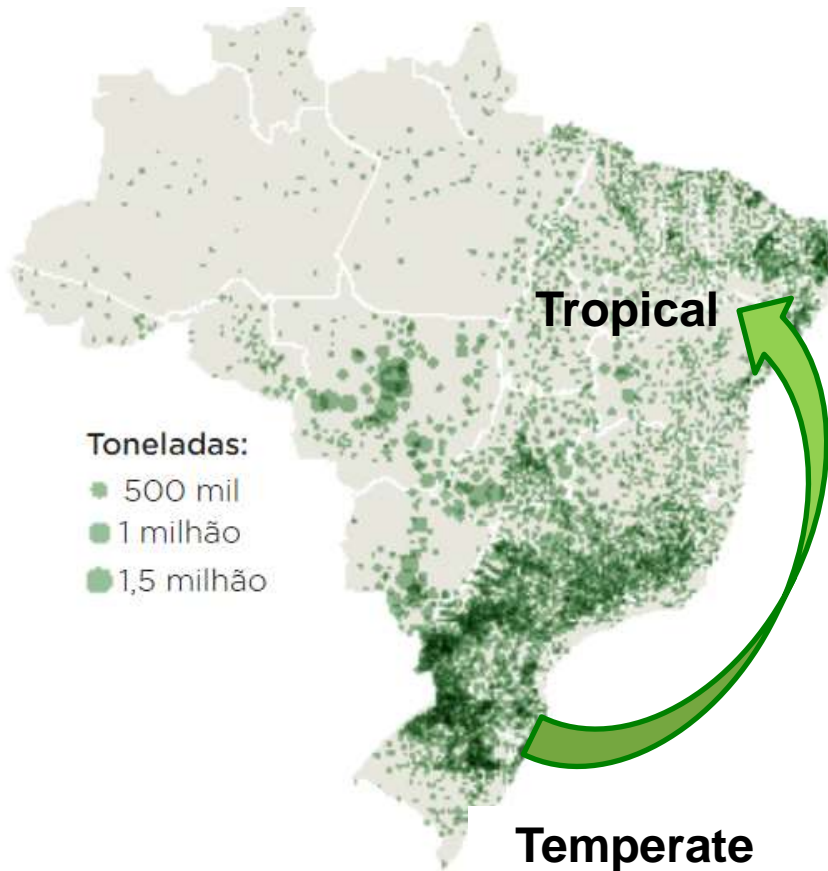
1974

2016

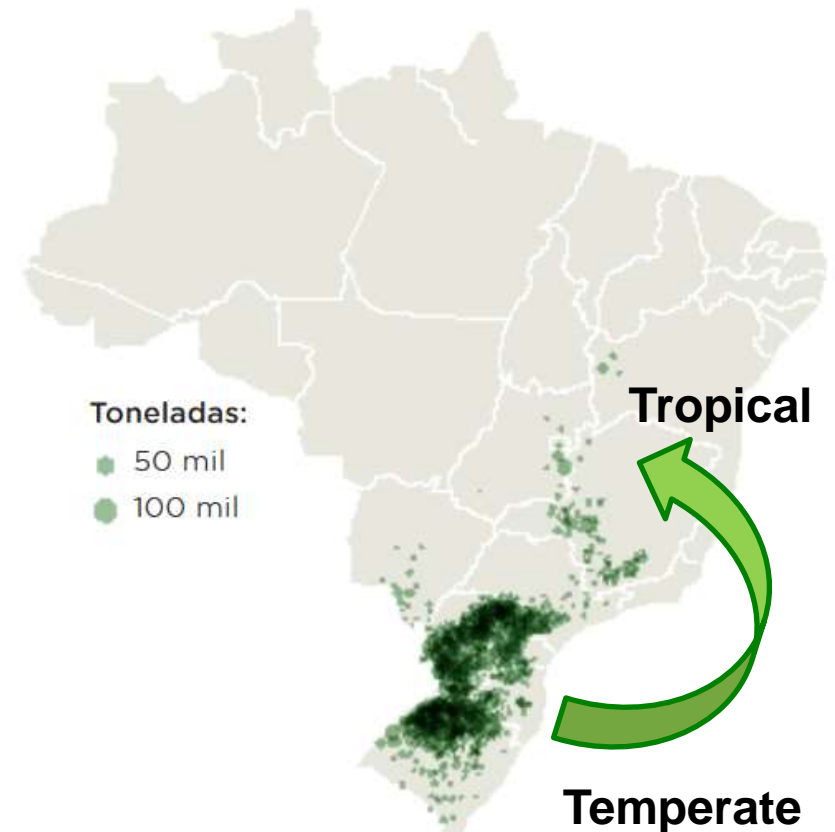


Tropicalization of Cropping Systems

Corn



Wheat



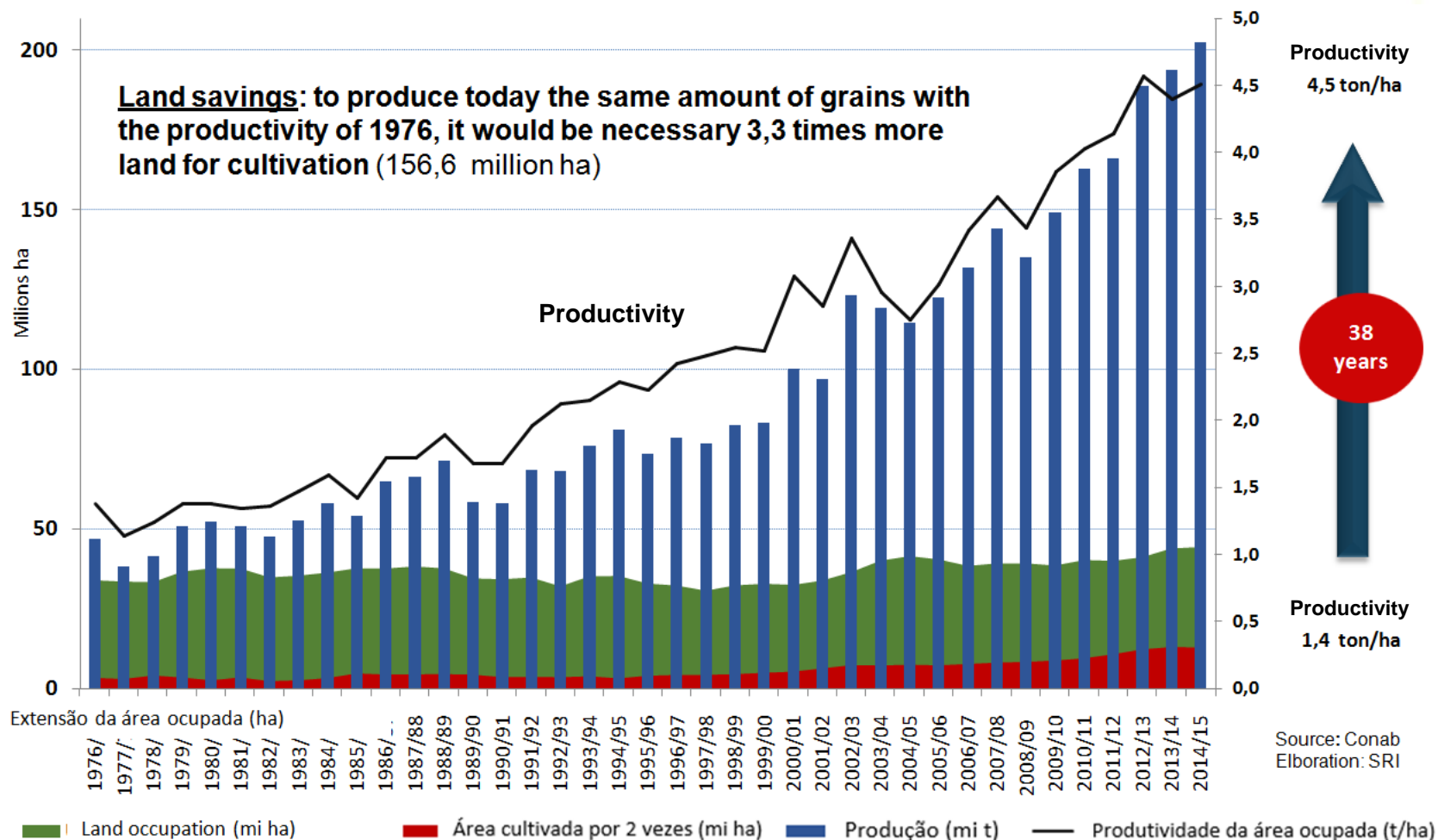
Dissemination of Conservation Practices



**No-Till Systems protect the soil,
incorporate carbon and save water**

Key Results and Impacts

Technology driven efficiency saved land and increased production



Source: Conab
Elaboration: SRI

THE GLOBAL FARM

With its plentiful sun, water and land, Brazil is quickly surpassing other countries in food production and exports. But can it continue to make agricultural gains without destroying the Amazon?

Jeff Tollefson reports from Brazil.

Mateus Batistella used to be a vegetarian, but Brazilian cuisine has worn him down. At lunchtime, virtually all the restaurants offer a classic dish of thin-cut beef with salad, rice and beans, served with a cooked-flour dish called farofa. In cities and towns, traditional butchers and supermarkets alike sell every cut of beef imaginable. "It's everywhere, and it's cheap," says Batistella, who heads a satellite-monitoring research centre in the southern city of Campinas for Embrapa, the research arm of Brazil's agriculture ministry. "Today I eat beef all the time."

That isn't the most politically correct course of action in a country in which cattle ranching is often linked with destruction of the Amazon rainforest. Batistella even has a satellite image on his office wall, showing the world's largest tropical forest under siege from the south by agriculture. Nonetheless, the world, like Batistella, is consuming more and more beef each year.

All that meat has to come from somewhere, and increasingly it is coming from Brazil. This rising agricultural powerhouse has quadrupled beef exports over the past decade, and in 2003 it vaulted past Australia as the world's largest exporter. Capitalizing on its vast natural resources and a booming economy, Brazil



is competing with the United States for the title of world's largest soya exporter. The United Nations Food and Agriculture Organization forecasts that Brazil's agricultural output will grow faster than that of any other country in the world in the coming decade, increasing by 40% by 2019.

There was a time when such figures would have spelt doom for the Amazon. In the past, when demand for commodities such as beef, maize (corn) and soya went up, trees came down. But the opposite has happened in recent years. Despite rising production and persistently high commodity prices since the height of the global food crisis in 2007–08, Amazon deforestation plunged to a historic low last year, nearly 75% below its 2004 peak, and some expect more good news this year. This trend fuels hopes that Brazil is establishing a sustainable agricultural system that will help to feed a growing world in the decades to come — and lower the environmental cost of beef habits like that of Batistella.

"We broke the paradigm in the past five years," he says. "There is no longer a direct correlation between food and deforestation."

Brazil has managed that feat through policy, improvements in agricultural science, better enforcement of environmental laws and pressure from consumers. But the country still faces

numerous challenges as it seeks to boost food production. Conflicts over land-use policies are common, and climate change will take a bite out of many important crops unless plant breeders can keep up.

Fields of soya

Brazil's rise as an agricultural giant began with soya beans, the country's largest food crop, which had a value of nearly US\$17 billion in 2008. In the 1960s, soya range was largely limited to the south of Brazil, but since then breeders have developed varieties that can grow across most of the country. Agricultural scientists tamed the highly acidic soils of the Brazilian savannahs with applications of lime and other nutrients, and reduced fertilizer costs by developing methods to inoculate seeds with rhizobia, bacteria that colonize the roots of plants such as soya and fix nitrogen. Brazilian farmers are now competing with the United States to set the record for soya-bean yields (see graphic).

And after a long delay, Brazil is also making up ground on transgenic crops. A decade ago, the fate of genetically modified (GM) crops in the country was uncertain. A federal commission had approved the first GM soya plant for cultivation in 1998, but a judge later issued a moratorium on planting the herbicide-

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Brazilian agriculture

The miracle of the cerrado

Brazil has revolutionised its own farms. Can it do the same for others?

Aug 26th 2010 | CREMAQ, PIAUÍ | From the print edition



Bloomberg

IN A remote corner of Bahia state, in north-eastern Brazil, a vast new farm is springing out of the dry bush. Thirty years ago eucalyptus and pine were planted in this part of the *cerrado* (Brazil's savannah). Native shrubs later reclaimed some of it. Now every field tells the story of a transformation. Some have been cut to a litter of tree stumps and scrub; on others,

lucose the rootballs to fuel; next, other fields have been tilled; and some have already been turned into white m at Jatobá will plant and harvest cotton, soybeans



Second Agricultural Revolution in Brazil

Forestry Code
Limited Expansion of Agricultural Land

+

Low Carbon Agricultural Plan
Conservation Practices – Low GHG Emissions

Forestry Code
Limited Expansion of Agricultural Land

+

Low Carbon Agricultural Plan
Conservation Practices – Low GHG Emissions

The Brazilian Forestry Code

Land Occupation in Brazil

- **CATEGORIES OF OCCUPATION**
 - URBAN INDUSTRIAL COMPLEXES
 - MINERAL ENERGETIC COMPLEXES
 - ACCESS WAYS AND ITS MODALITIES
 - NATURAL AND ARTIFICIAL WATER COVERED AREAS
 - NON OCCUPIED TERRITORIES (STATE OWNED LAND)
 - **FARMER OWNED LANDS**
- **TWO REALITIES IN AGRICULTURAL LANDS (PRIVATE)**
 - **LAND THAT CANNOT BE USED (MANDATORY PROTECTION)**
 - PERMANENTLY PROTECTED AREAS (APP)
 - LEGAL RESERVATION (RL)
 - **LAND THAT CAN BE USED (TECHNICAL AND TECNOLOGICAL CONDITIONS)**
 - NATURAL AND PLANTED PASTURE
 - ANNUAL AND PERENNIAL CROPS
 - PLANTED FORESTS

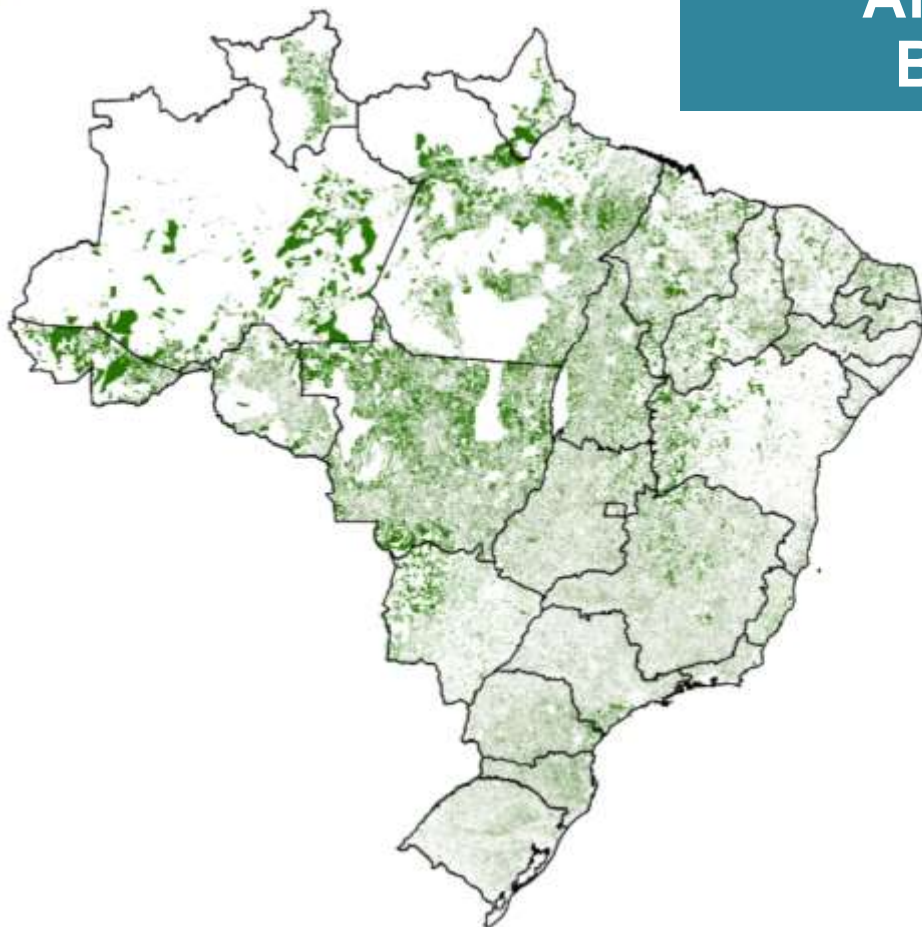
The Brazilian Forestry Code

RURAL ENVIRONMENTAL REGISTRY - CAR
A REQUIREMENT UNDER THE NEW FOREST CODE



The Extent of Land Protection in Brazil

**AREAS PRESERVED BY
BRAZILIAN FARMERS**

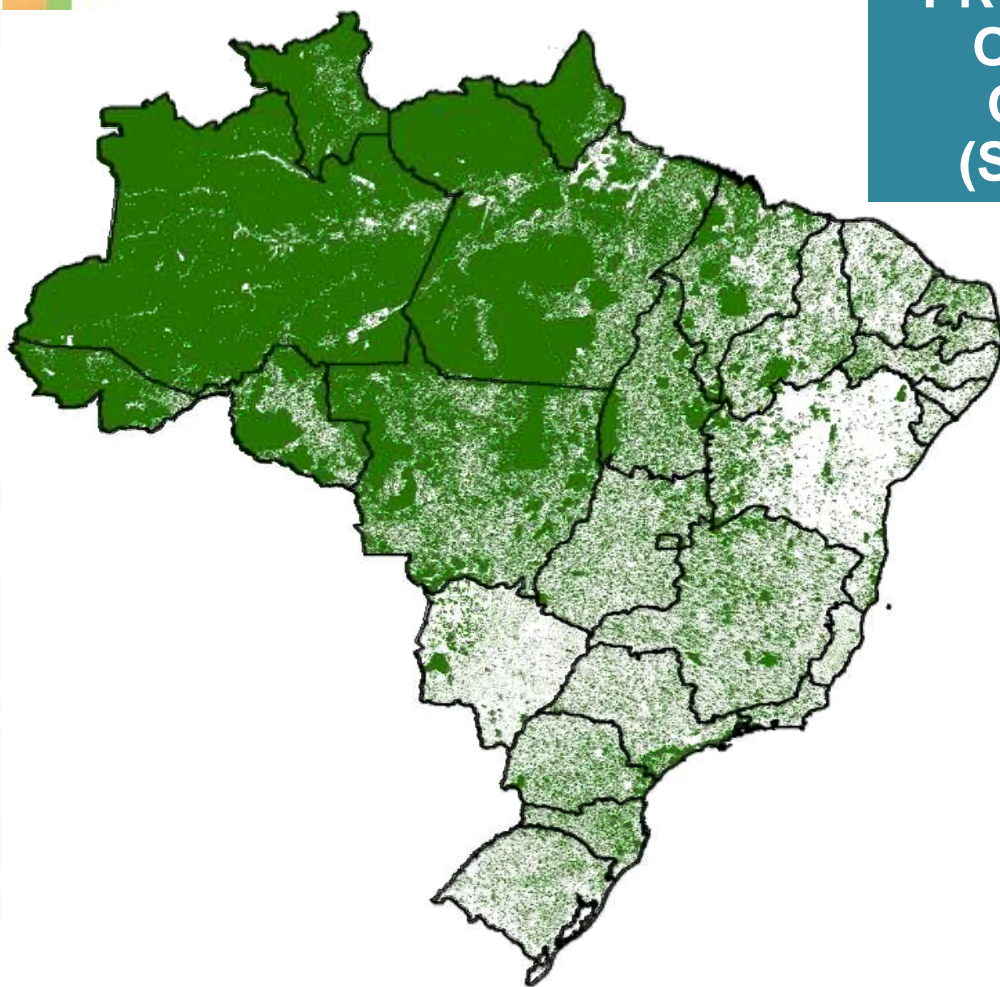


MORE THAN 20% OF BRAZIL

MORE THAN 200 M HA

The Extent of Land Protection in Brazil

**PRESERVATION AND PROTECTION
OF NATIVE VEGETATION, PLUS
OTHER UNAVAILABLE AREAS
(STATE OWNED, MILITARY ETC.)**

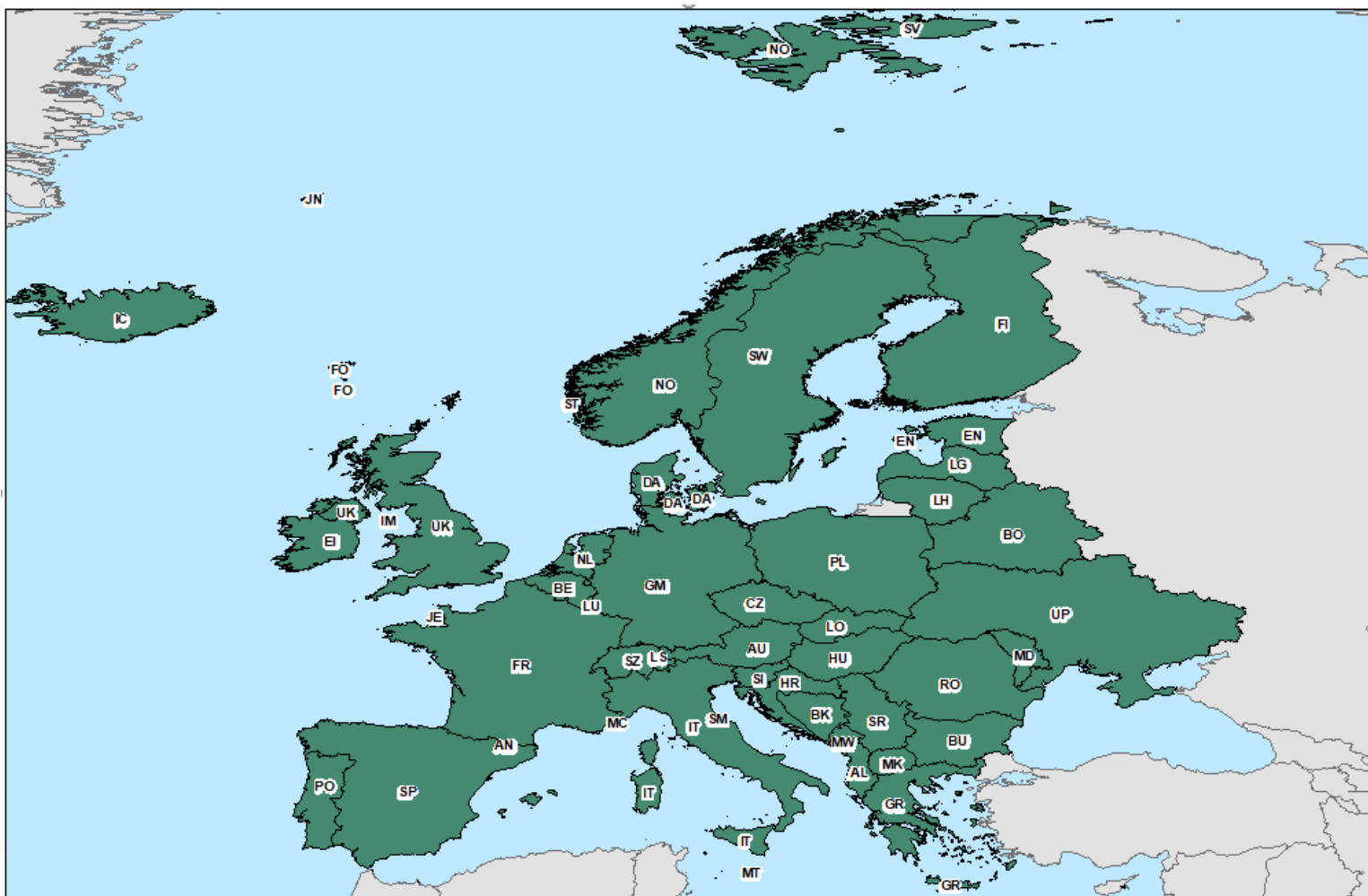


66,3% OF BRAZIL

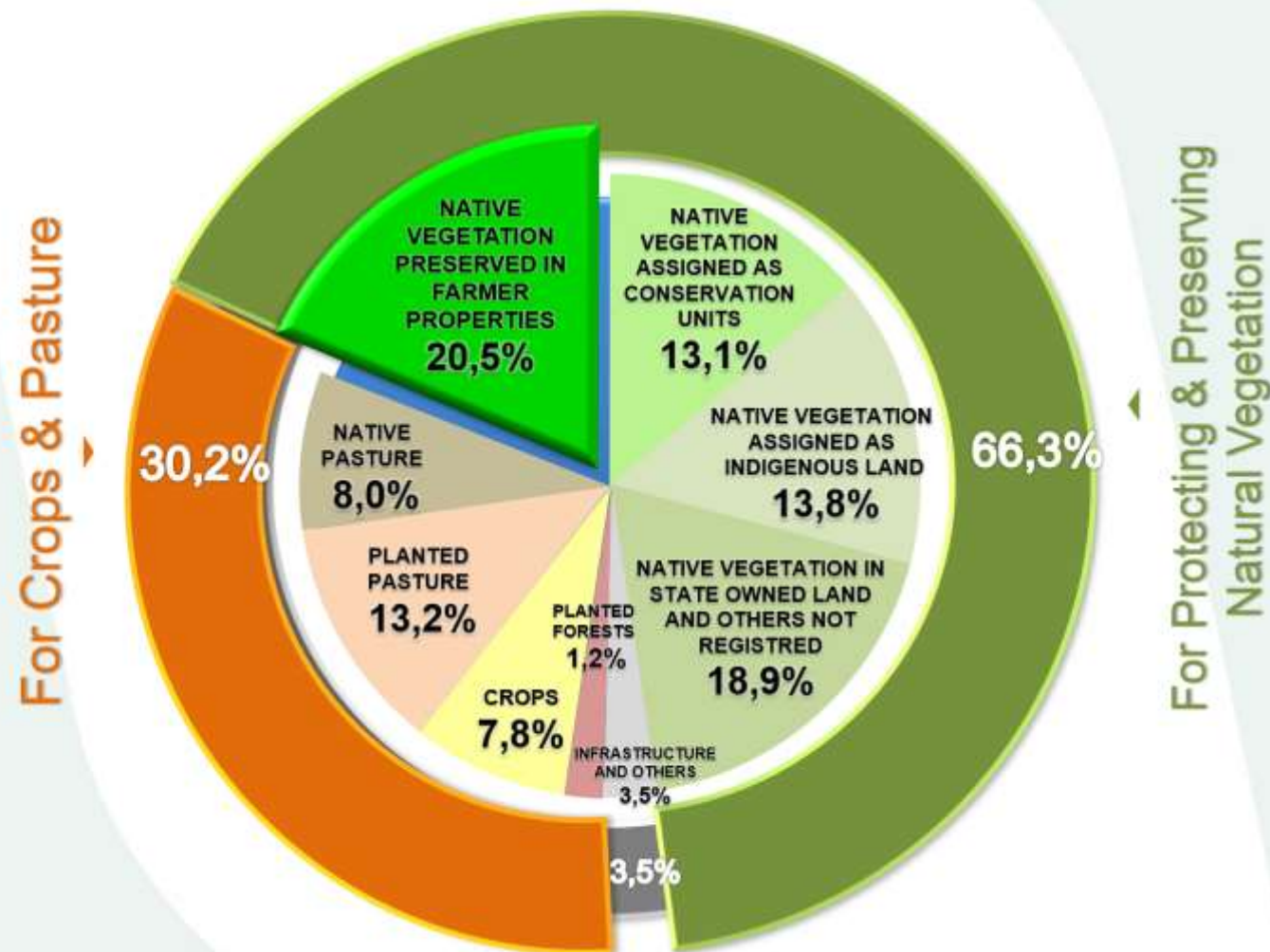
563.736.030 HA

The Extent of Land Protection in Brazil

EQUIVALENT OF THE ENTIRE TERRITORY OF 48 COUNTRIES
IN EUROPE



Land Use and Occupation in Brazil (2016)



Forestry Code
Limited Expansion of Agricultural Land

+

Low Carbon Agricultural Plan
Conservation Practices – Low GHG Emissions

Brazilian Low Carbon Agriculture Plan

Commitments of Agriculture 2010 – 2020

(Area in million hectares, volume in million m³, reduced GHG million tons CO₂ equivalent)

Subprograms	Objectives 2011/2015	Objectives 2016/2020	Estimated reduction of GHG (in 2020)
Recovery of degraded	6.0	9.0	million tons CO ₂ equivalent 83-104 18 - 22 16 - 20 10 8 - 10
Integrated Crop-Livestock-Forest	1.5	2.5	
No-tillage System (ha)	2.8	5.2	
Biological Nitrogen Fixation (ha)	1.0	4.5	
Planted forests (ha)	1.0	2.0	
Treatment of animal wastes(million m ³)	-	4.4	
Total			133,9 to 162,9

¹ Through appropriate management and fertilization.

² Including Agroforestry Systems (AFS).

³ Not computed the Brazilian commitment to the steel industry; and it was not accounted for the GHG emission mitigation potential.



Dissemination of Conservation Practices

Minimum and no-till systems



Bio-Based Solutions for Cropping Systems

Biological fixation of nitrogen



Thanks to biological fixation of nitrogen, with Rhizobia, soybeans cultivated in 35 M ha in Brazil do not need any commercial nitrogen fertilizer

The economy to farmers (and the country) is U\$ 13 billion/year
+ 62 million ton of CO₂-equivalent/year

Bio-Based Solutions for Cropping Systems

Azospirillum brasilense released as a comercial biostimulant
“Plant growth promoting bacterium” that induces increases in root biomass



Brachiaria Grass – 180 M ha of pastures in Brazil

The inoculation of Brachiaria grass with selected strains of ***Azospirillum brasilense*** results in 15% increase in biomass production and up to 25% in total protein content.

Recovery of Degraded Pastures

The next frontier of agricultural expansion, 50 M ha



DEGRADED



RECOVERED

Double Cropping Systems

Double Cropping Systems – Early Cycle Soybean + Corn



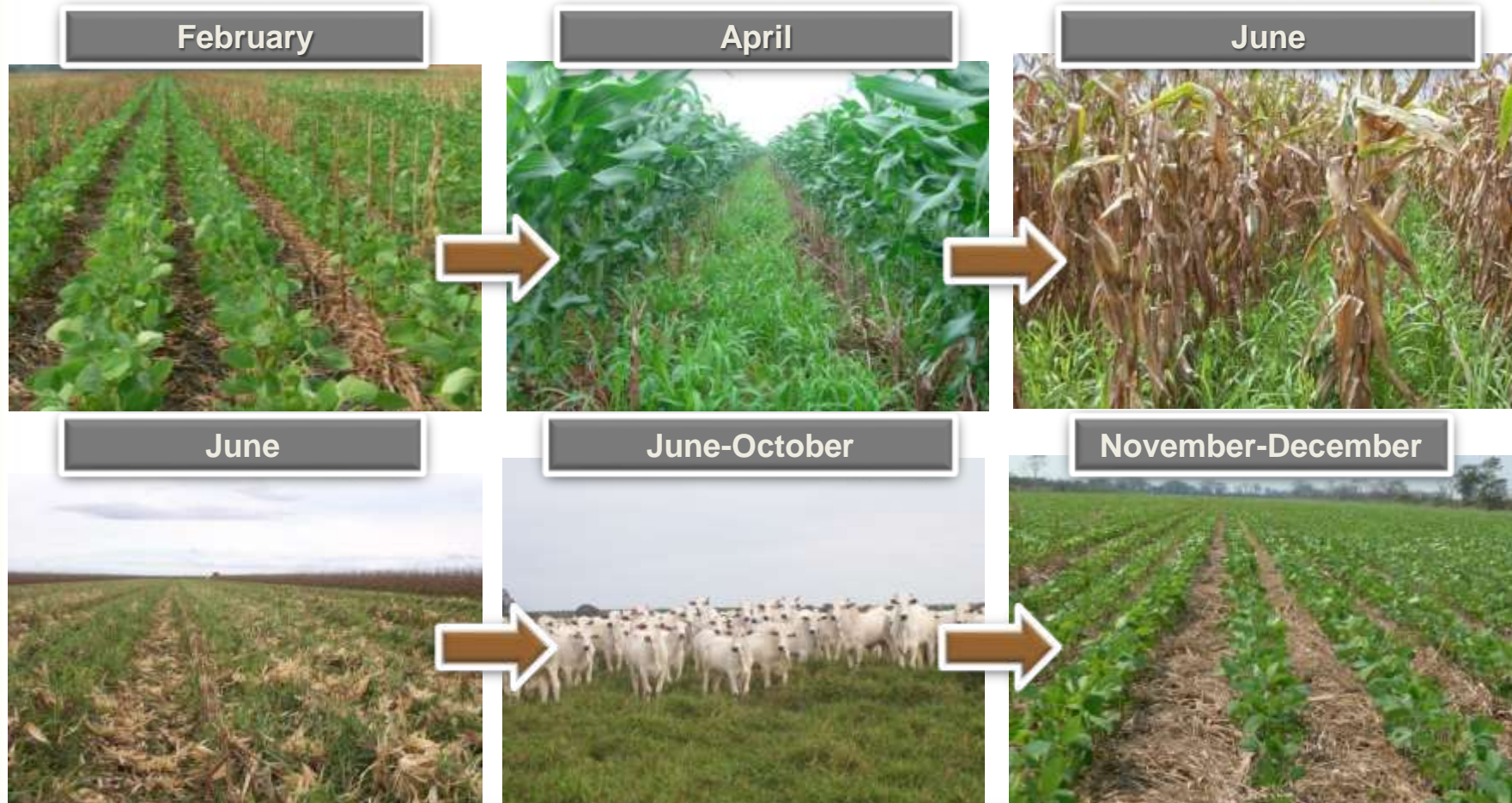


Sustainable Intensification of Land Use

Systemic, Integrated Production Systems



Cycling crops and livestock – 365 days a year!



INTEGRATED SYSTEMS ARE BECOMING A NORM FOR RECOVERY OF DEGRADED LAND

14 MILLION HA OF INTEGRATED SYSTEMS, AND GROWING...

Sustainable Intensification of Land Use

Cycling crops and livestock – and adding trees...



**INTEGRATED SYSTEMS ARE BECOMING A NORM FOR RECOVERY OF DEGRADED LAND
14 MILLION HA OF INTEGRATED SYSTEMS, AND GROWING...**

Sustainable Intensification of Land Use

Cycling crops and livestock – and adding trees...



INTEGRATED SYSTEMS ARE BECOMING A NORM FOR RECOVERY OF DEGRADED LAND
14 MILLION HA OF INTEGRATED SYSTEMS, AND GROWING...

ICLF Benefits

GLOBAL
RESEARCH
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES



Optimization and intensification of nutrient cycling on soil



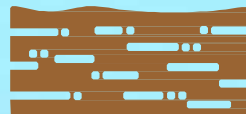
Maintenance of biodiversity and agriculture sustainability



Increase in net income allowing farmer's greater capitalization



Improvement of animal welfare due to greater thermal comfort



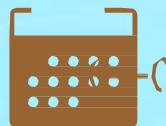
Improvement of soil quality and conservation its productive characteristics



Increased production of grains, meat, milk, timber and non-timber products in the same area



Possibility of applying on farms of all sizes and profiles



Reduction of the labor seasonality in the countryside and the rural exodus



Greater efficiency in the use of resources (water, light, nutrients and capital) and increase of energy balance

ICLF Benefits

GLOBAL
RESEARCH
ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES



Greater optimization of processes and factors of production



Generation of direct and indirect jobs



Improving farmers public image on society



Reduction of pressure by opening new areas with native vegetation

CO₂

Greenhouse gas emissions mitigation



Economic stability with reduction of risks and uncertainties due to the diversification of production



Extraordinary change within 10 years, with support from Embrapa and Extension Service, Mrs Marize Porto, a Farmer in Goiás State (Neotropical Savanna).

Integrated crop livestock forestry system

How to take a farm out of bankruptcy

Brazilian Agriculture

Brazilian Annual Agricultural Production (million tonnes)



Grains

219 (2016/17)



Meat

26 (2016)



Fruit

43,8 (2016)



Milk

35 Billion liters (2016)

Contribution of Agriculture

(approximately)

25% GDP

37% Job

42% Export

63% of the Brazilian Trade Balance

Brazil Numbers

»World's largest exporter of coffee, sugar, orange juice, ethanol, chicken and soybean in 2016.

»In 2016 agribusiness exports reached US\$ 85 billion.

ICLF adoption in Brazil

Evolução da área de adoção da ILPF, em milhões de hectares
Fonte: Plataforma ABC

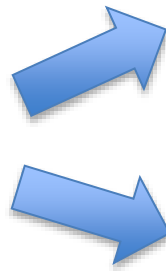


ABC governance in Brazil

GLOBAL
RESEARCH
ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES



Monitoring System



Implementation area

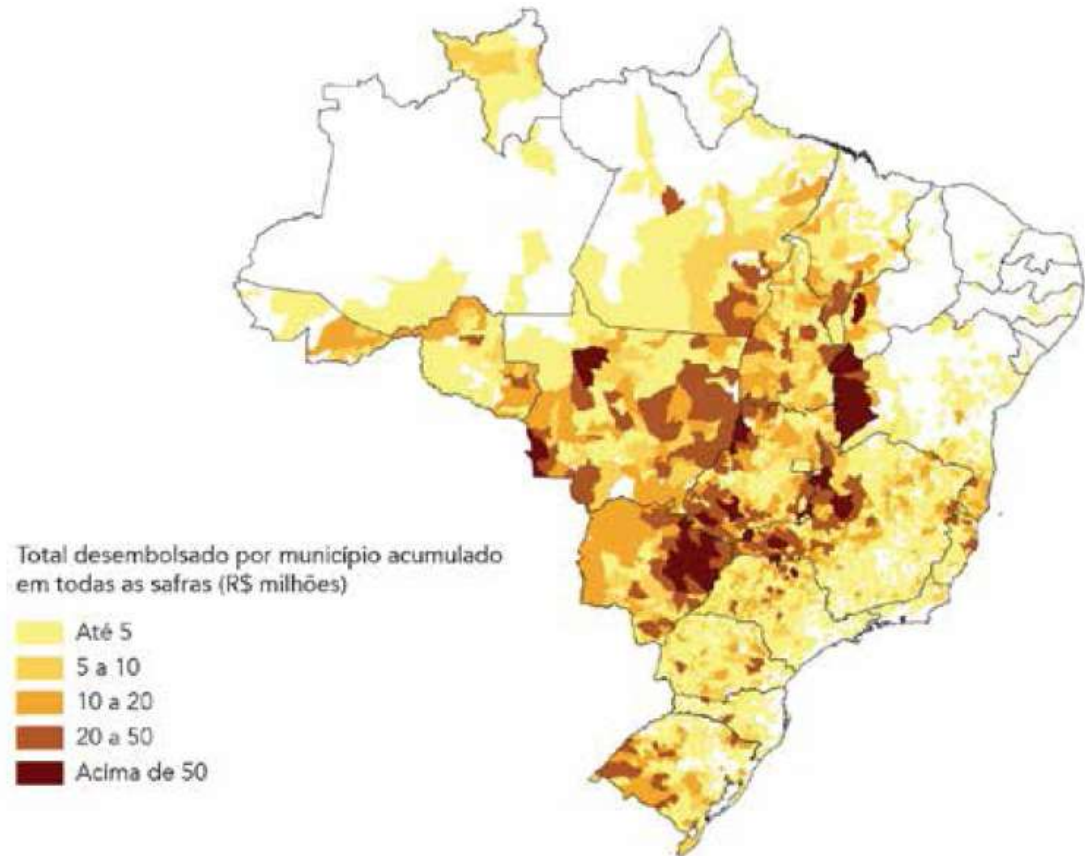
GHG mitigation

ABC governance in Brazil

GLOBAL
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ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES



Monitoring System → Use of resources



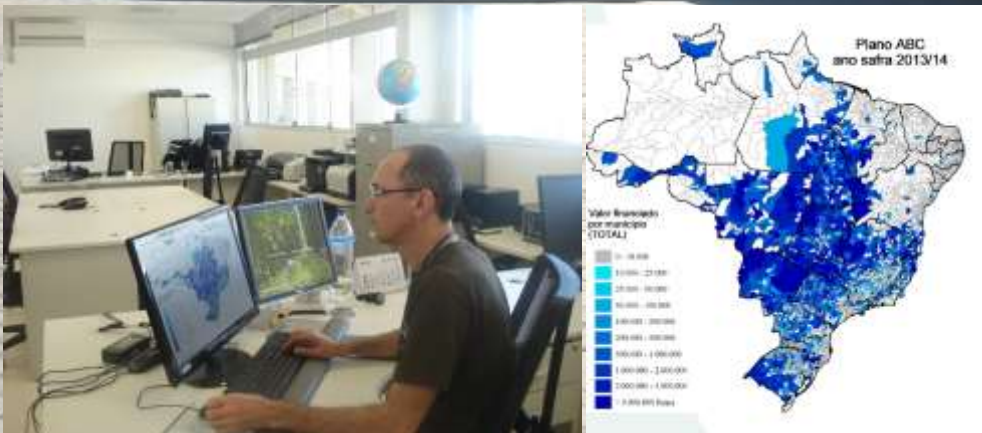
**Multi-institutional Lab for Low Carbon
Agriculture (ABC) Plan Monitoring
Location: Embrapa Environment- Jaguariúna-SP**

Ministry of Environment

Ministry of Agrarian Development

Ministry of Science & Technology

**Ministry of Agriculture,
Livestock and Food Supply**



ABC governance in Brazil

GLOBAL
RESEARCH
ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES



Associados Rede ILPF



Bradesco



cocamar[®]
COOPERATIVA AGROINDUSTRIAL



JOHN DEERE



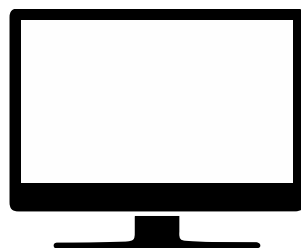
SOESP[®]
Sementes Oeste Paulista

syngenta

Embrapa



R&D



Tech
Transfer



International



Communication



Networking

Some research questions...

- How can the efforts on ABC Plan can be represented in the National Inventory?;
- How to represent the Brazilian agribusiness in an economic model?
- How to represent the current agricultural and environmental policies in Brazil?
- What are the economic impacts of the ABC Plan and the NDC on the agribusiness sector?
- What will be the effects of these policies on the country economic growth, welfare and trade?
- What will be the new pattern of land use and land competition?
- Opportunity of international cooperation in GRA (tropics only?)

Thank you
renato.rodriques@embrapa.br