The Challenge of Achieving Sustainable Food Production in the Tropical Belt of the World
- The Case of Brazil -

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Brazilian Agricultural Research Corporation – Embrapa
International Institute for Applied Systems Analysis - IIASA

Session 5:

Assuring Access to Clean Water, Sanitation, and Adequate Food for All

Food Security

Access and Use of Natural Resources

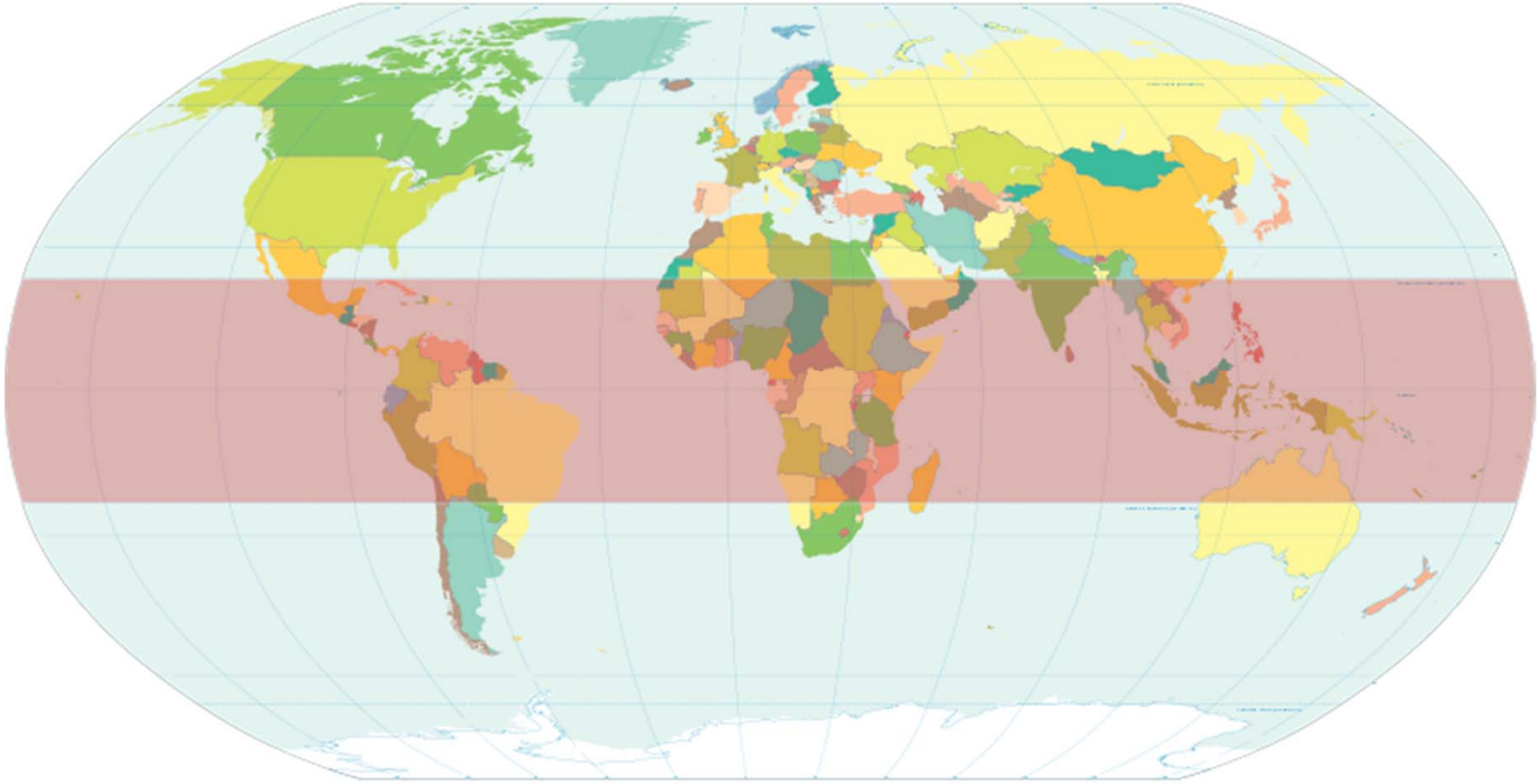
Sustainable Development

IAP-SPEC CONFERENCE

How Can Science and Technology Contribute to the Reduction of Poverty and Inequality

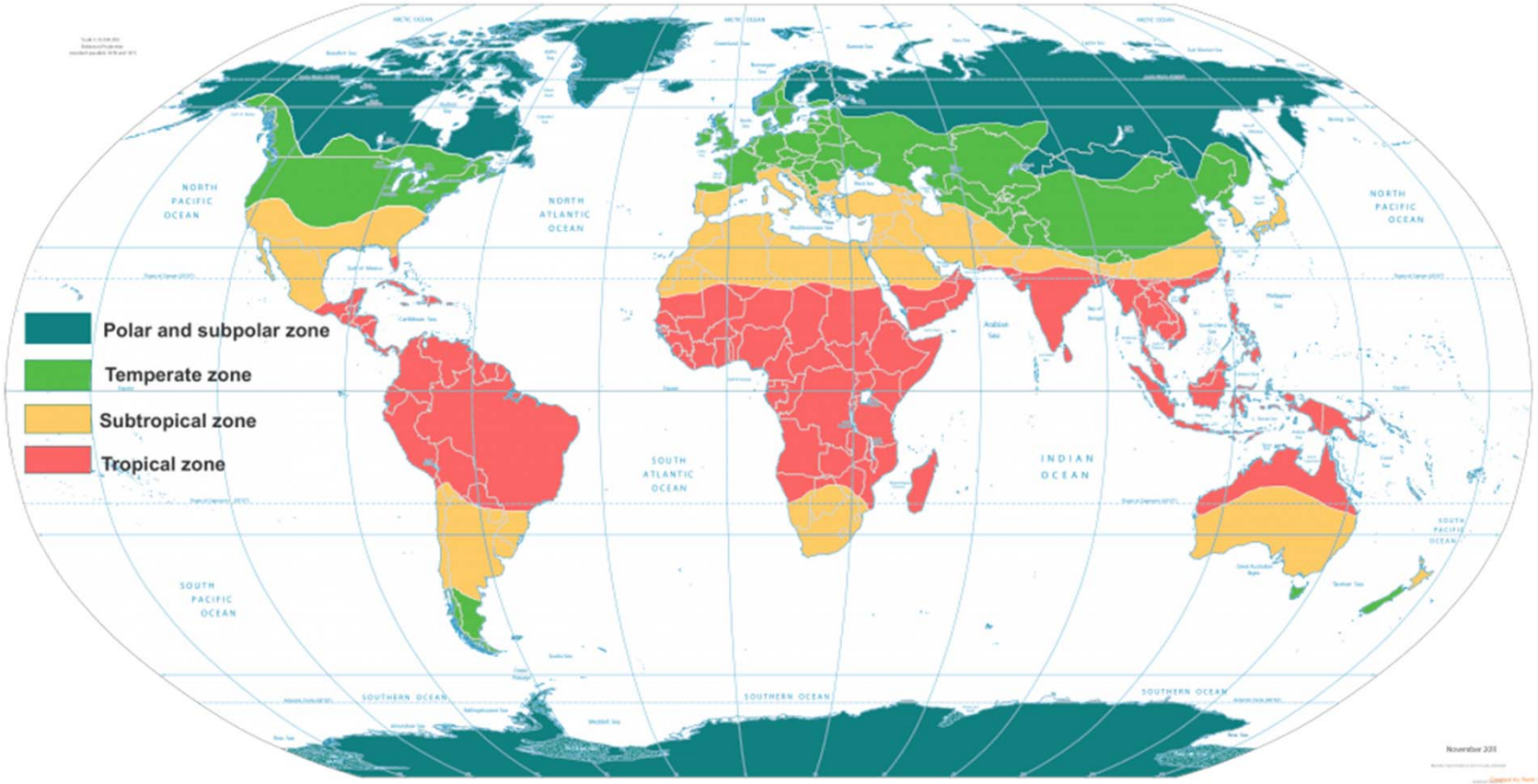
The Tropical Belt of the World

Area bound by the Tropics of Cancer and Capricorn
Most persistent and serious problems of poverty and inequality



Embrapa

The Tropical Belt of the World



Map Source: https://content.meteoblue.com/nl/meteoscool/general-climate-zones

- Severe Impacts of Climate Change and Stress Intensification -

Intense biotic (pests) and abiotic (drought, soil acidity, low nutrients, etc) stresses.

Higher frequency of extreme events, flooding and waterlogging, heat waves, etc.

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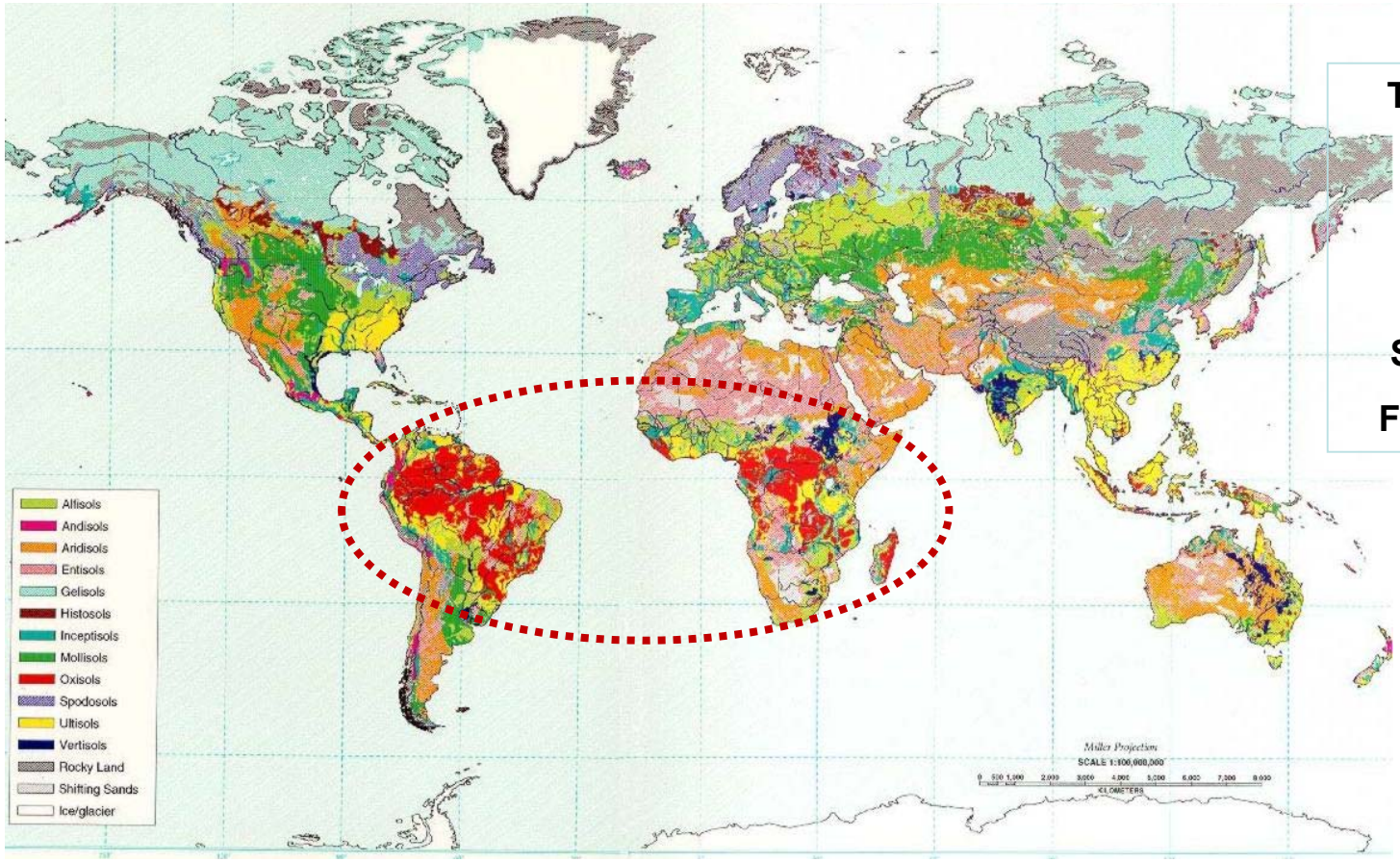
The Tropical Belt of the World

World Soil Type Distribution



Tropical Soils

Acid – 84%

Saline – 2%

Shallow – 7%

Flooded – 16%

Distribution of acidic and nutrient-poor soils in the tropics

Source: http://www.nhq.nrcs.usda.gov/WSR/mapindx/metadata/Maps/ORDERS.JPG

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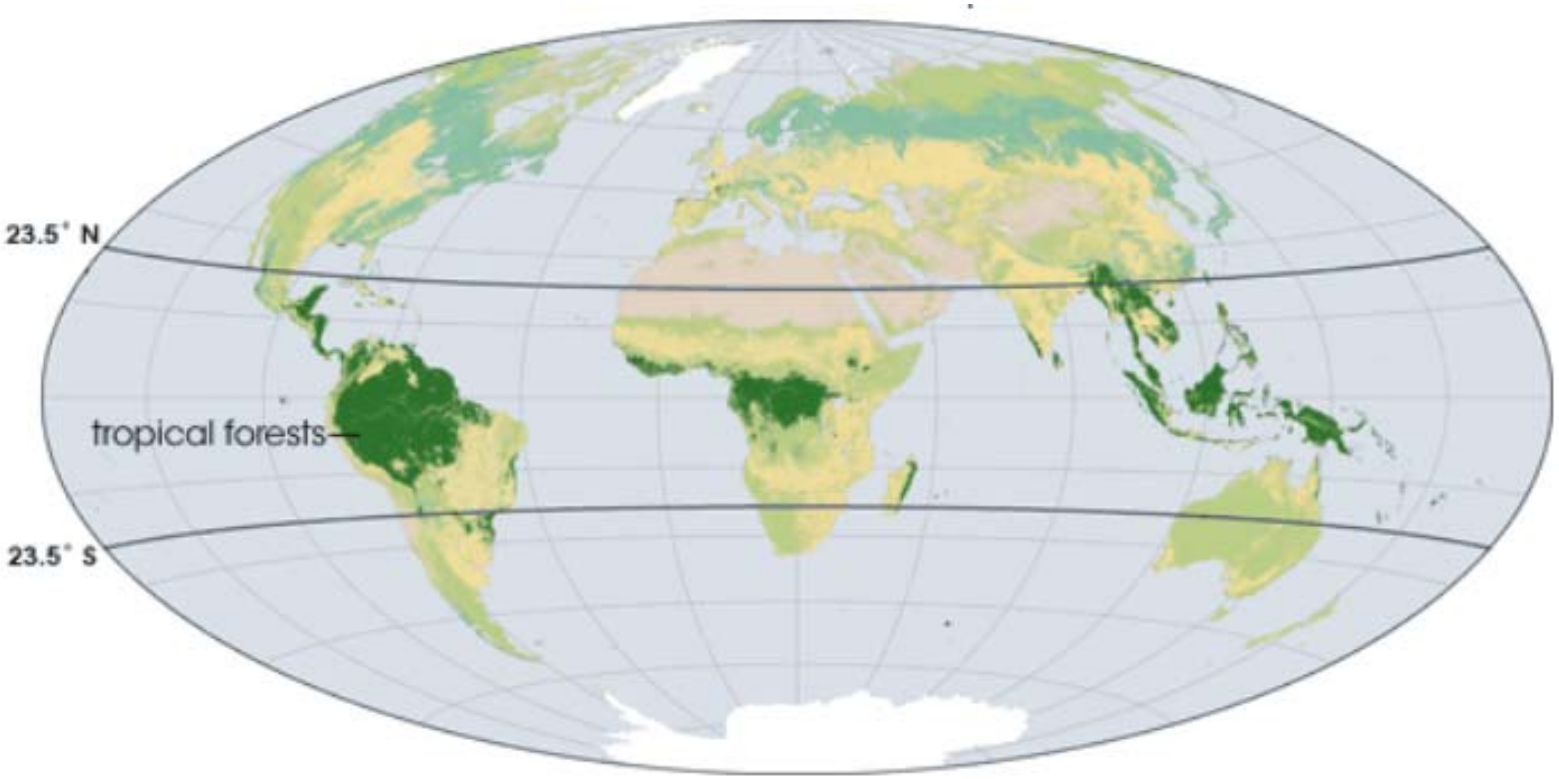
The Tropical Belt of the World

A Mega-diverse Region

Brazil – contains greater biodiversity than any other country on Earth.



Source: https://earthobservatory.nasa.gov/

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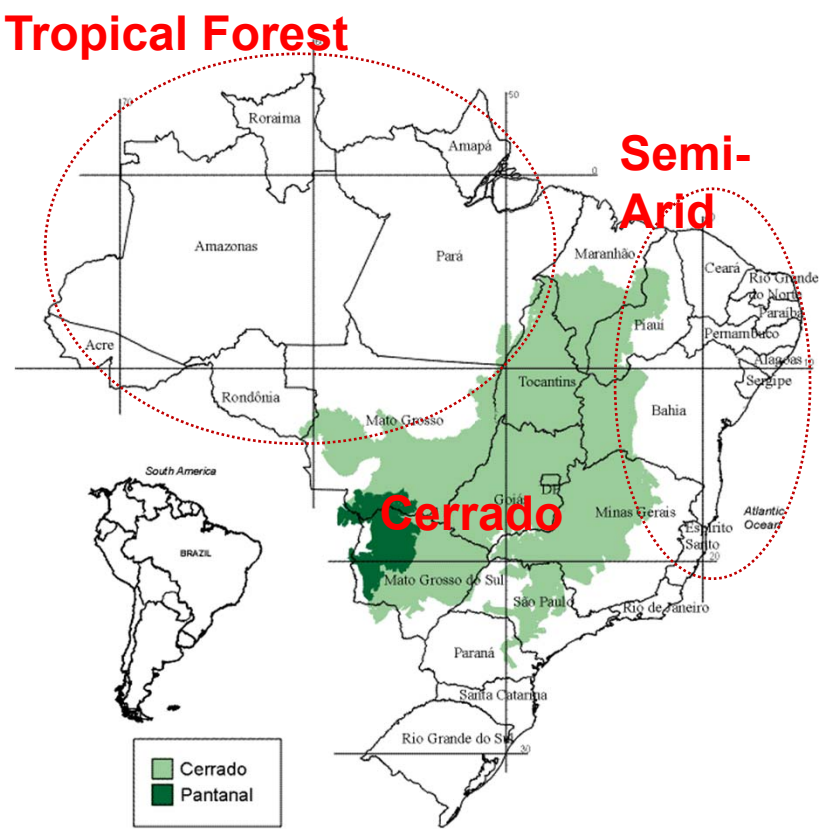
The Tropical Belt of the World

- Brazil -
A Mega-diverse Country

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

Embrapa

The Tropical Belt of the World



Before the 1970´s Brazil was not a food secure country.

Limited Understanding of our Biomes;

Low agricultural production and low yields;

Constant food supply crisis;

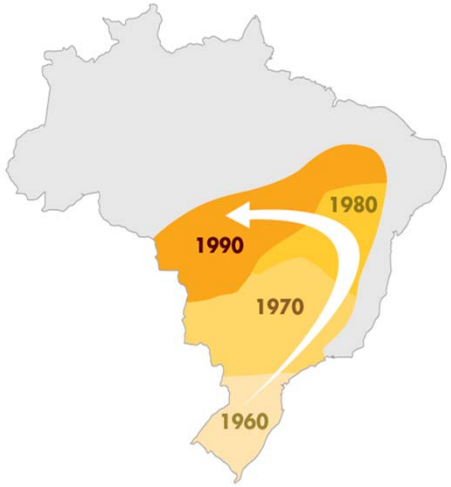
Widespread rural poverty;

Brazil known as coffee and sugar producer.

In 40 Years Brazil Developed a Science-based, Advanced Tropical Agriculture

Path of Agricultural Innovation in Brazil

EXPANSION



COMPETITIVITY

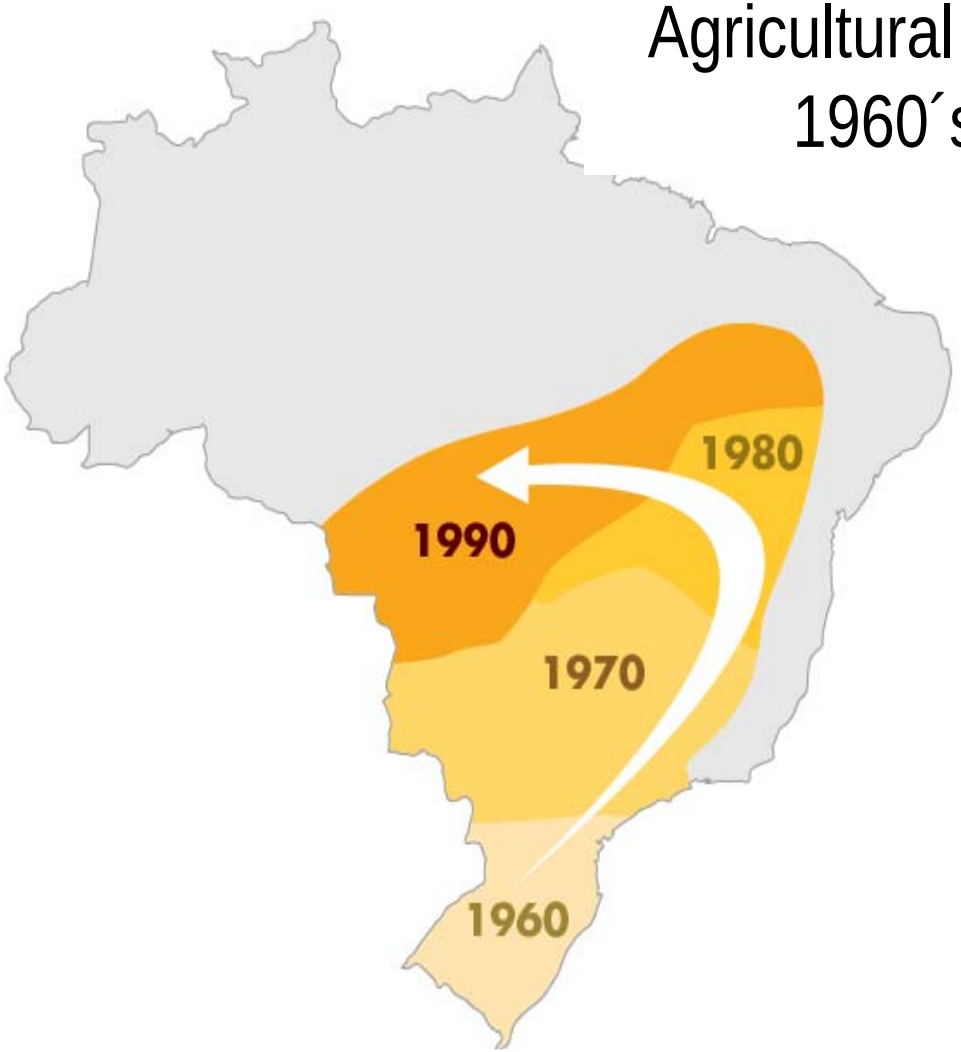
SUSTAINABILITY

MULTIFUNCTIONALITY

Embrapa

Path of Agricultural Innovation in Brazil

Agricultural Expansion from 1960´s to 1990´s

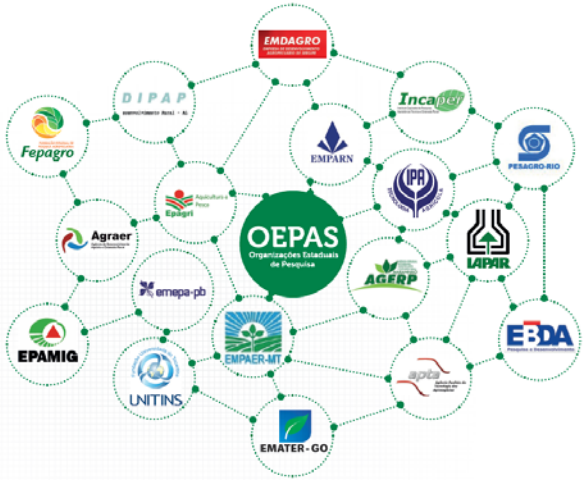


Education, Research and Innovation System

Federal Research
Embrapa

Universities

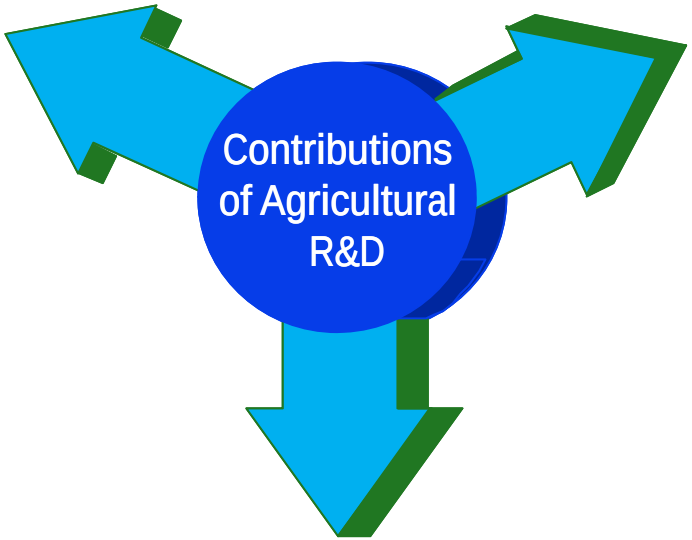
Regional, State Research



Private Sector

Basis for Agricultural Modernization in Brazil

Transformation of acidic, poor soils into fertile land

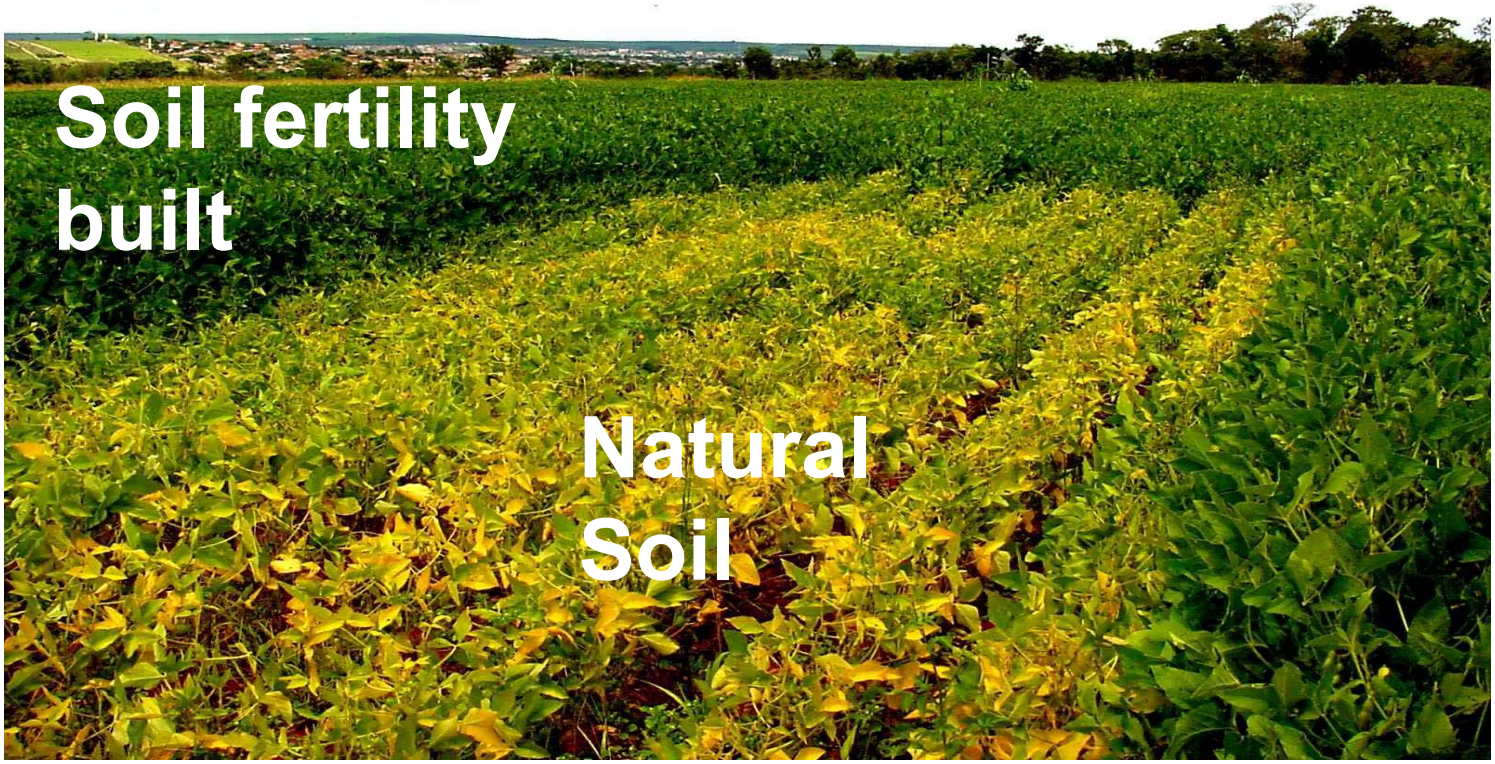


"Tropicalization" of crops and animal production systems

Conservation Practices
Zoning of Agricultural Risks

Basis for Agricultural Modernization in Brazil

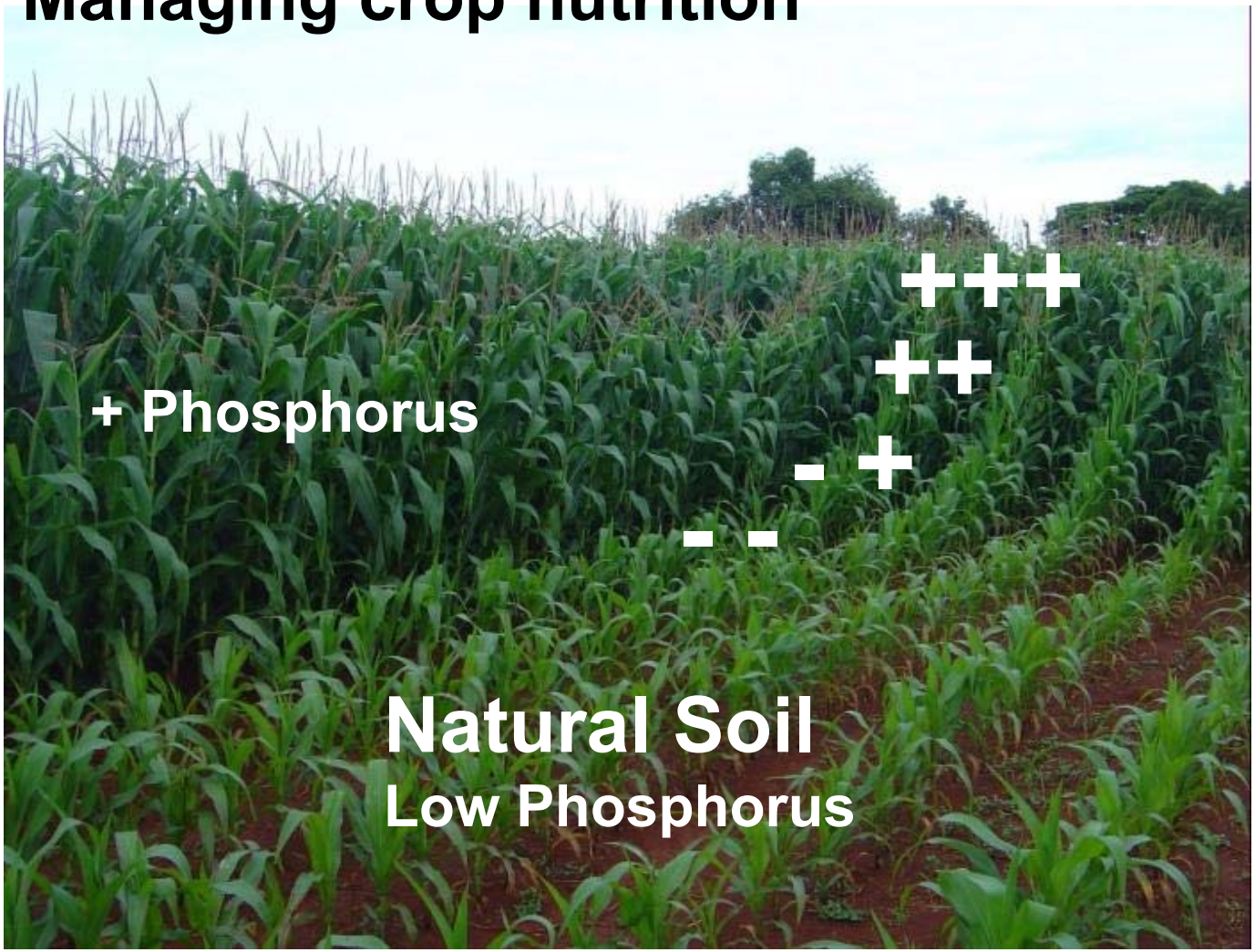
“Building” soil fertility



Source: Embrapa

Basis for Agricultural Modernization in Brazil

Managing crop nutrition



Source: Embrapa

Basis for Agricultural Modernization in Brazil

Source: Embrapa

Basis for Agricultural Modernization in Brazil

Biological fixation of nitrogen

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

The economy to farmers (and the country) is U$ 13 billion/year
+ 62 million ton of CO_2-equivalent/year

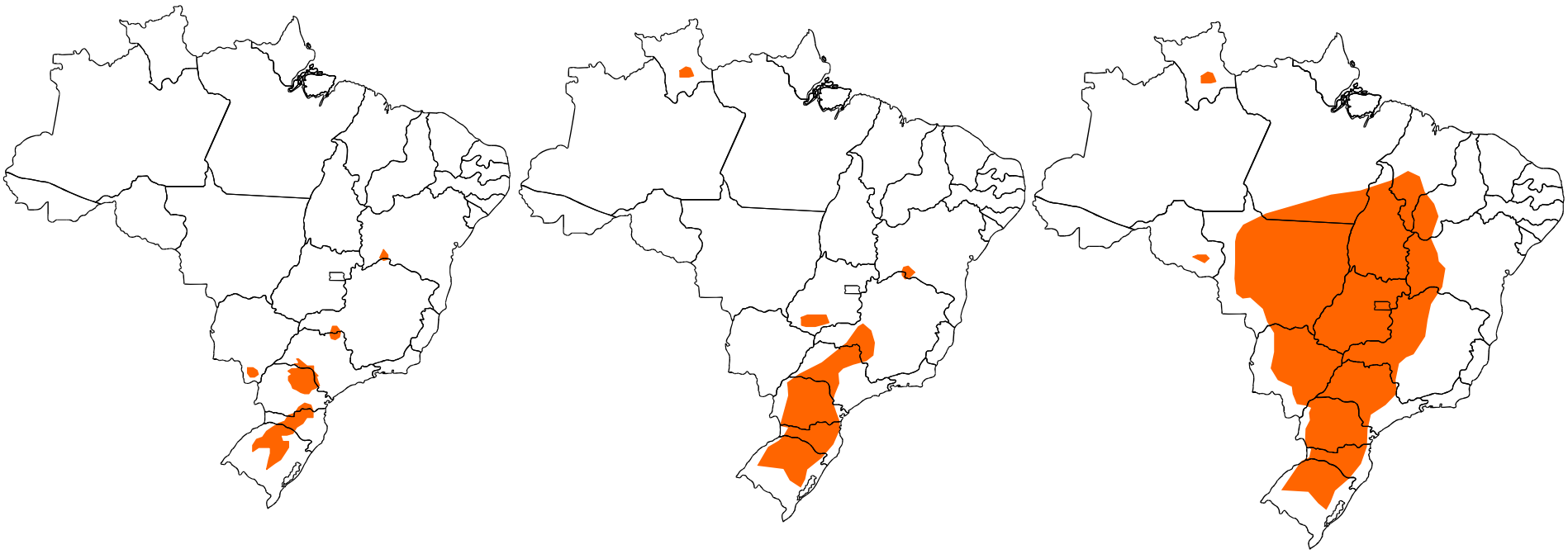
Source: Embrapa

A Platform of Conservation Practices

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

Source: Embrapa

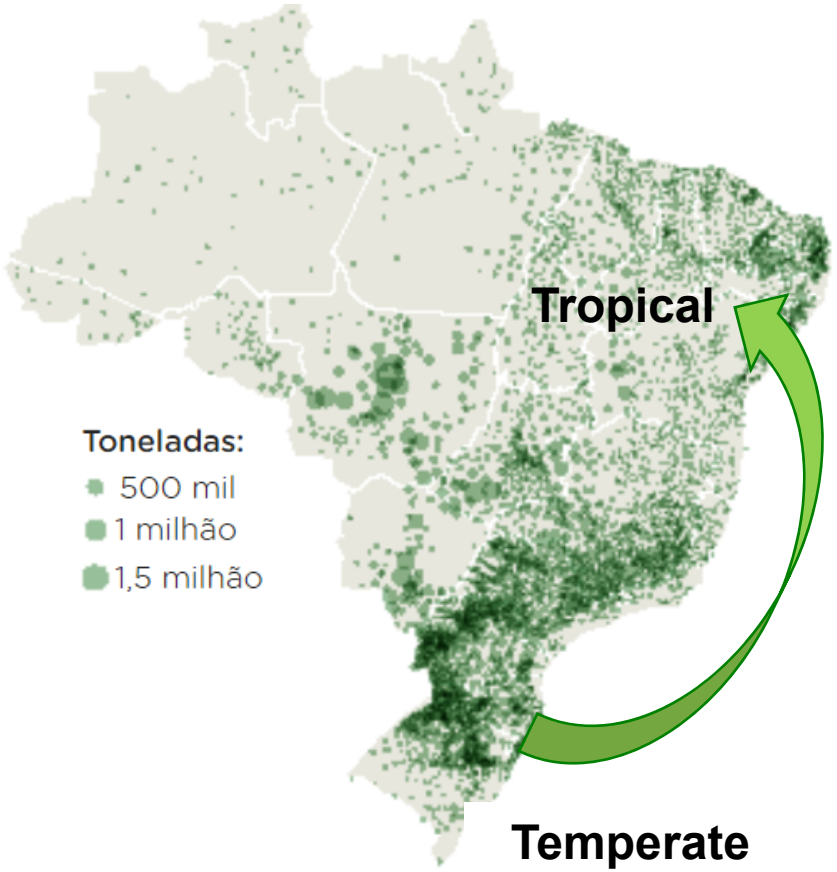
Tropicalization of Cropping Systems - Soybeans



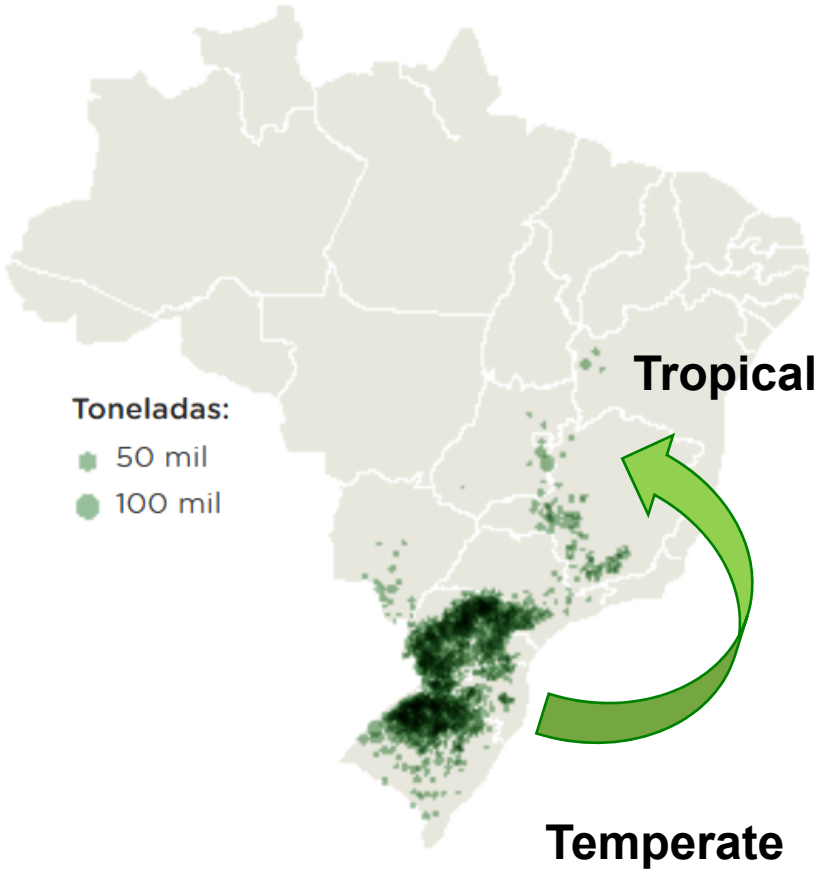
Source: Embrapa

Tropicalization of Cropping Systems

Corn

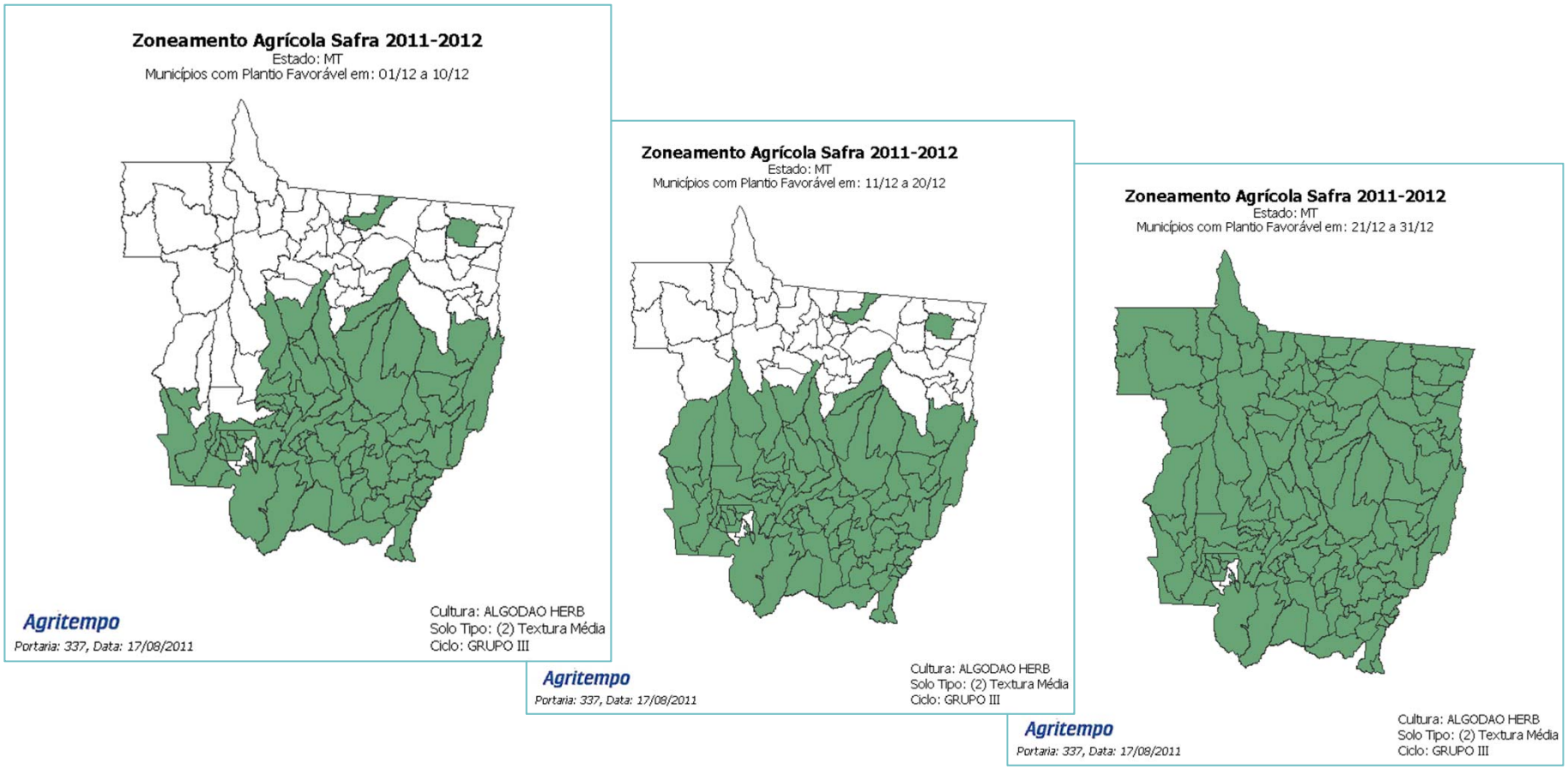


Wheat



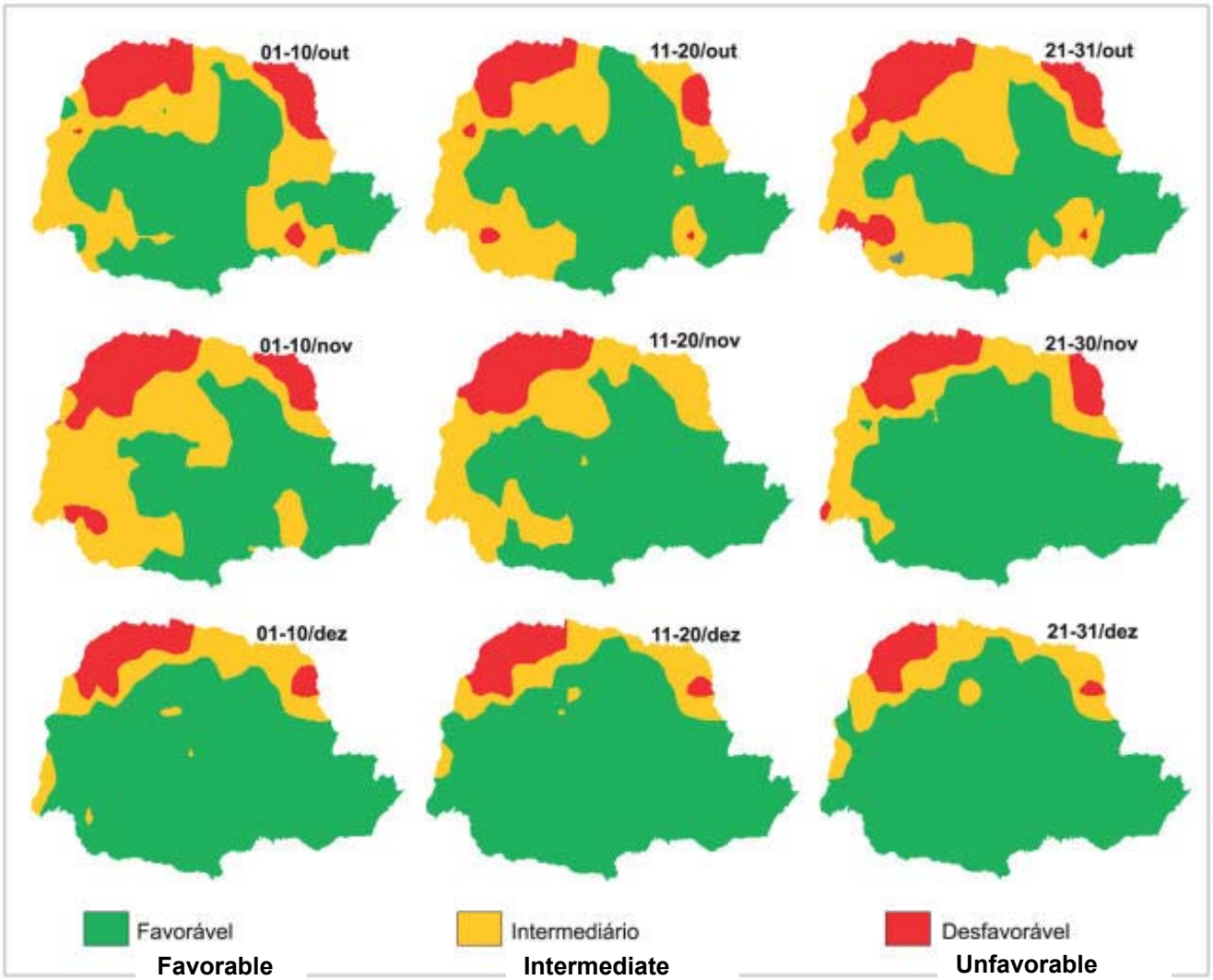
Source: IBGE/Nexo

Zoning of Agricultural Risks



Source: Embrapa

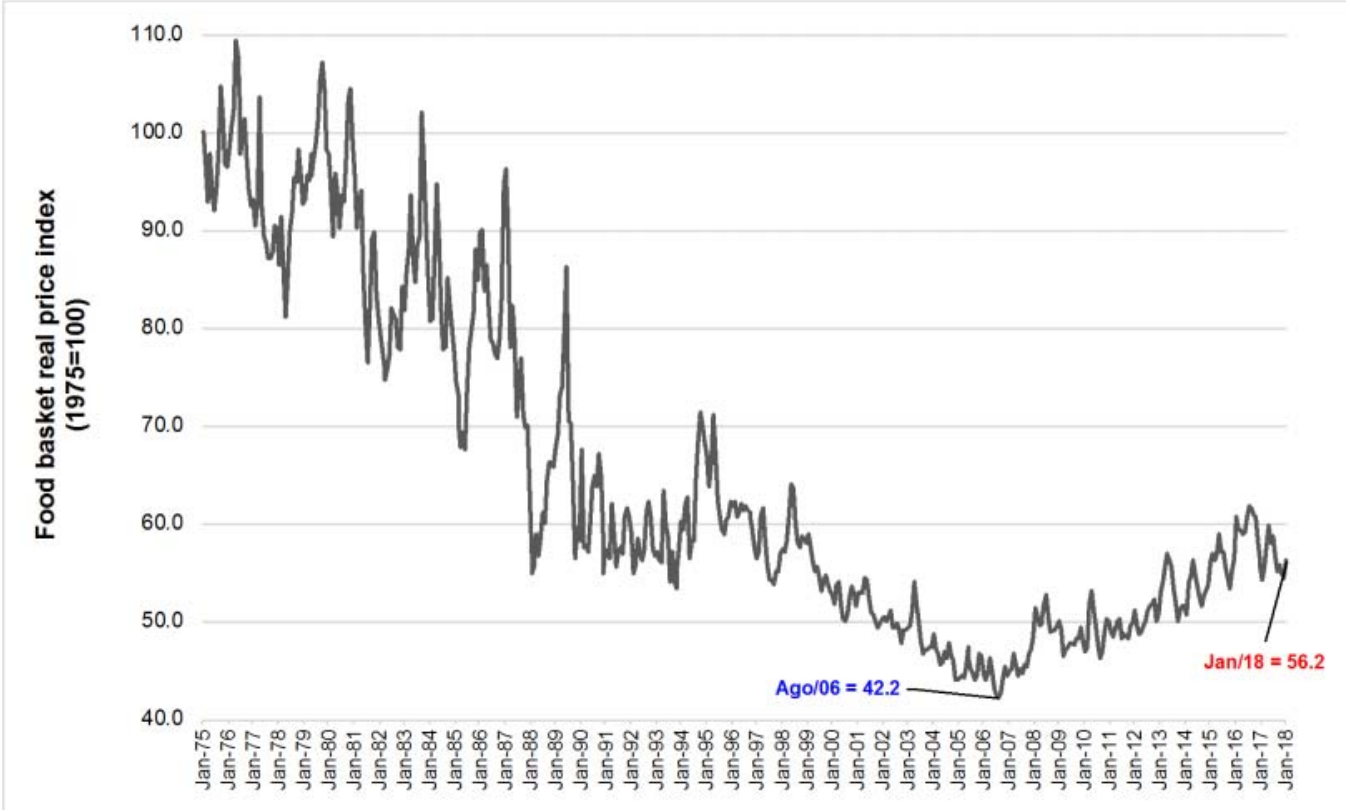
Zoning of Agricultural Risks



Source: Embrapa

Key Results and Impacts

Historical trends in food prices to Brazilian consumers
(1975=100, real prices, Jan 2018)



Source: Prices for SP-Brazil. Data from Dieese (2018), The inflation deflator is the IGP-DI (Jan.2018). Calculations and elaboration by G.Martha,

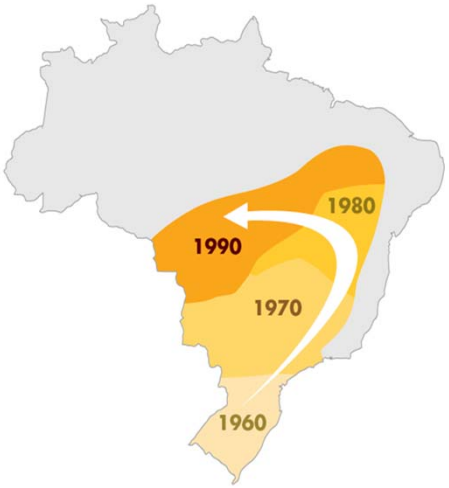
The huge growth in Brazilian agricultural production resulted in reduced prices to consumer. This alleviated inflationary pressures and generated an “income-effect” that benefited mostly the poor.

Path of Agricultural Innovation in Brazil

Food Security – Production of Surplus

1

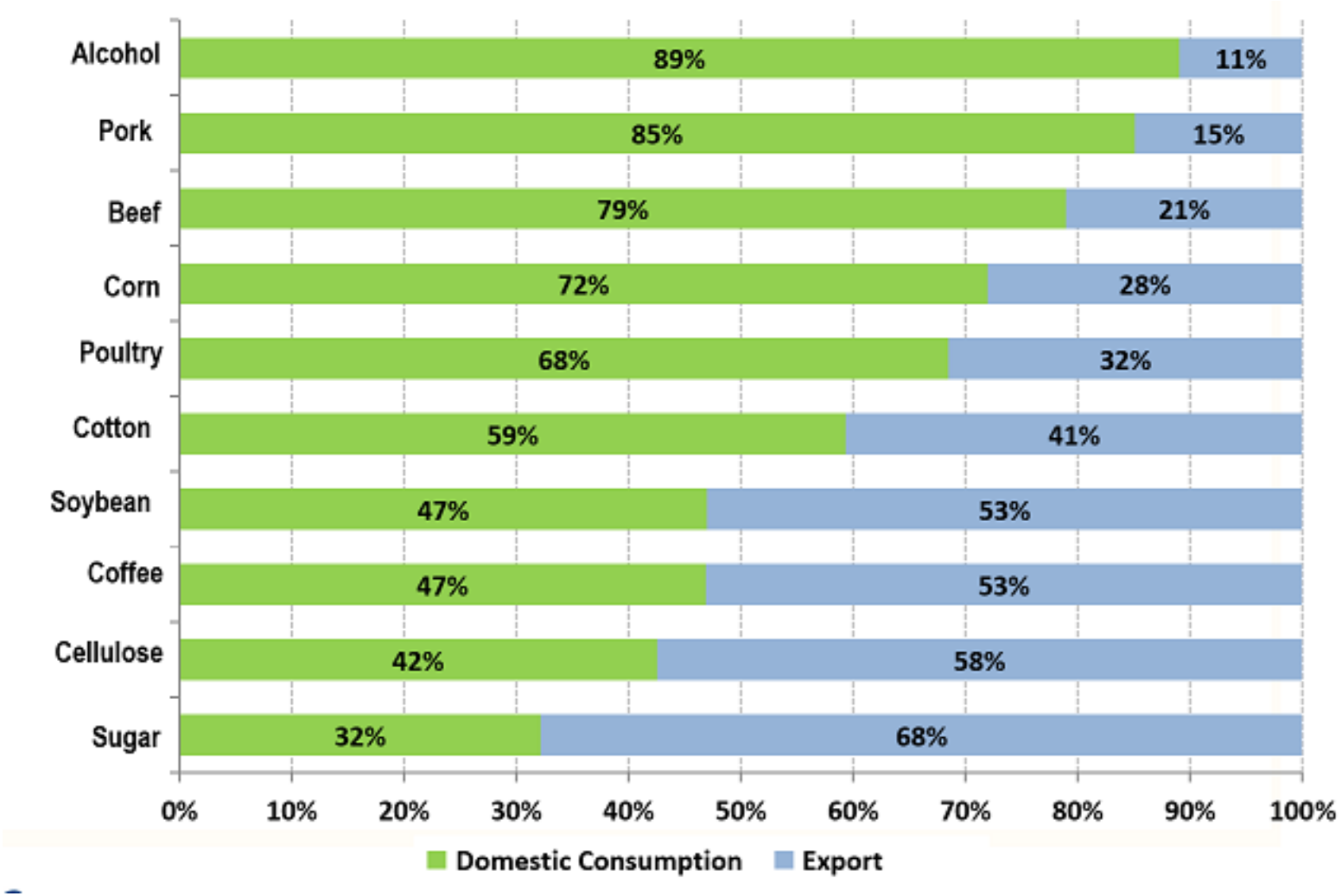
EXPANSION



2

COMPETITIVITY

Key Results and Impacts



Sources: MAPA, Conab and ÚNICA

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's 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-

Brazilian agriculture

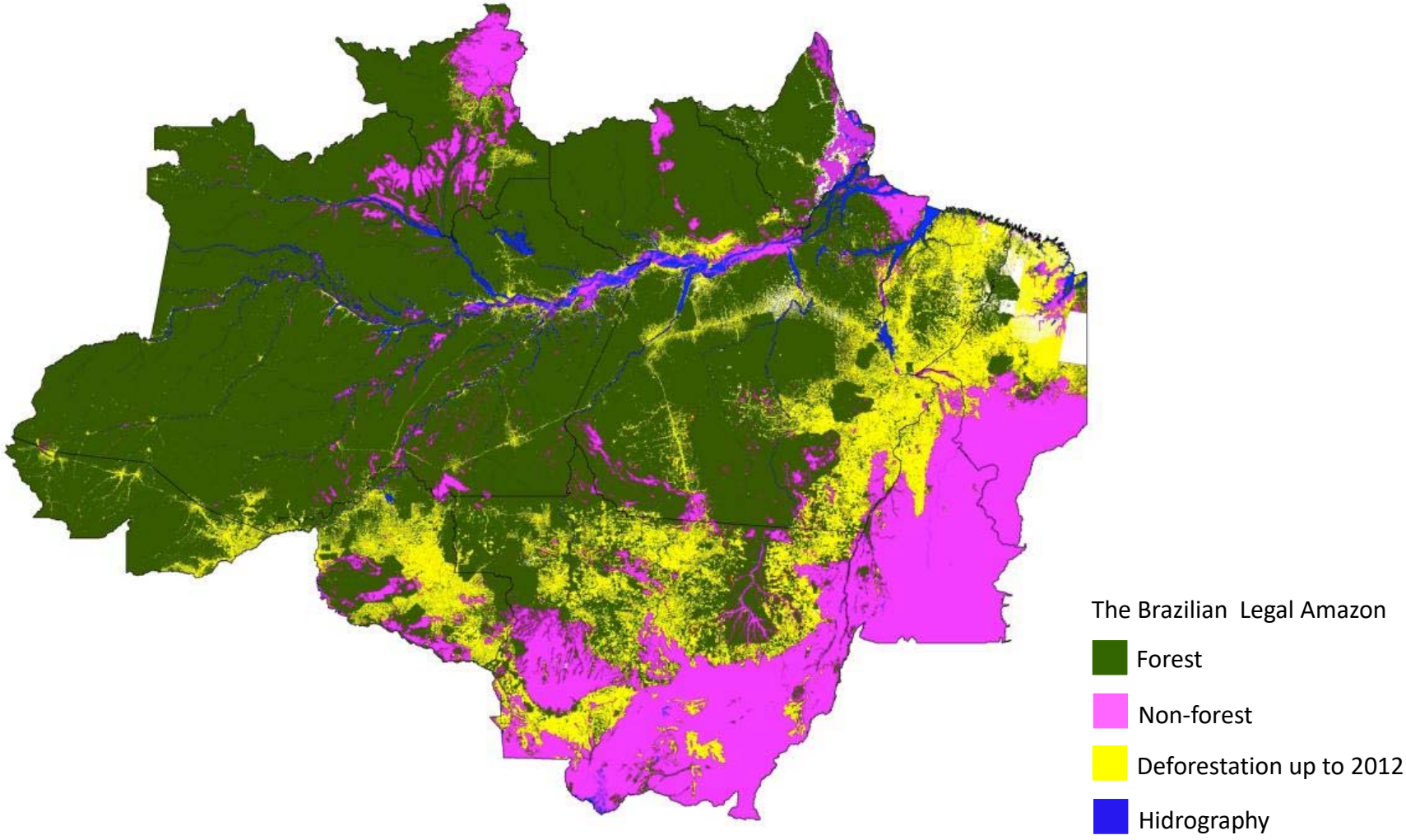
The miracle of the cerrado

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

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

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

Land Use – Biodiversity – Climate



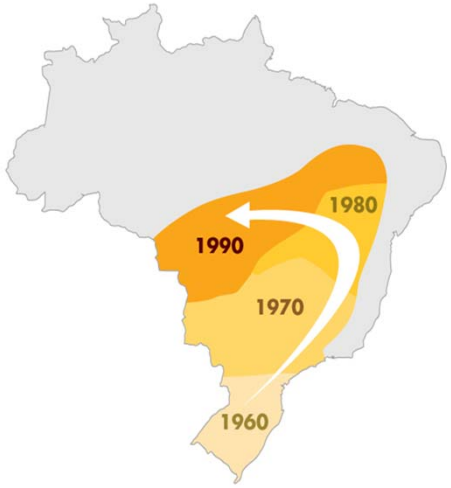
Source: Inpe/Embrapa

Water - Energy - Nature - Food

Path of Agricultural Innovation in Brazil

1

EXPANSION



2

COMPETITIVITY

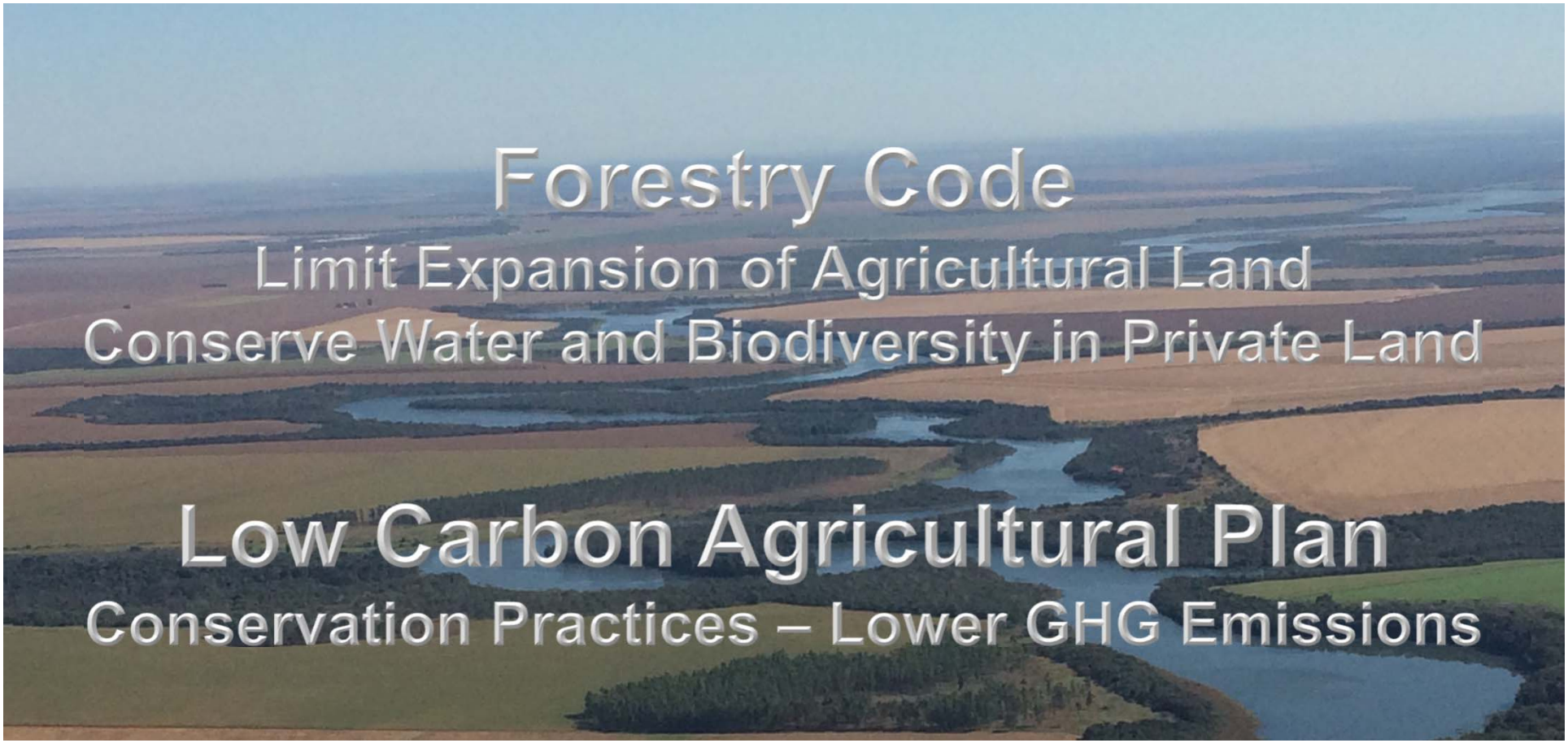
3

SUSTAINABILITY

Science and Public Policies Promoting the Sustainability of Agricultural Systems

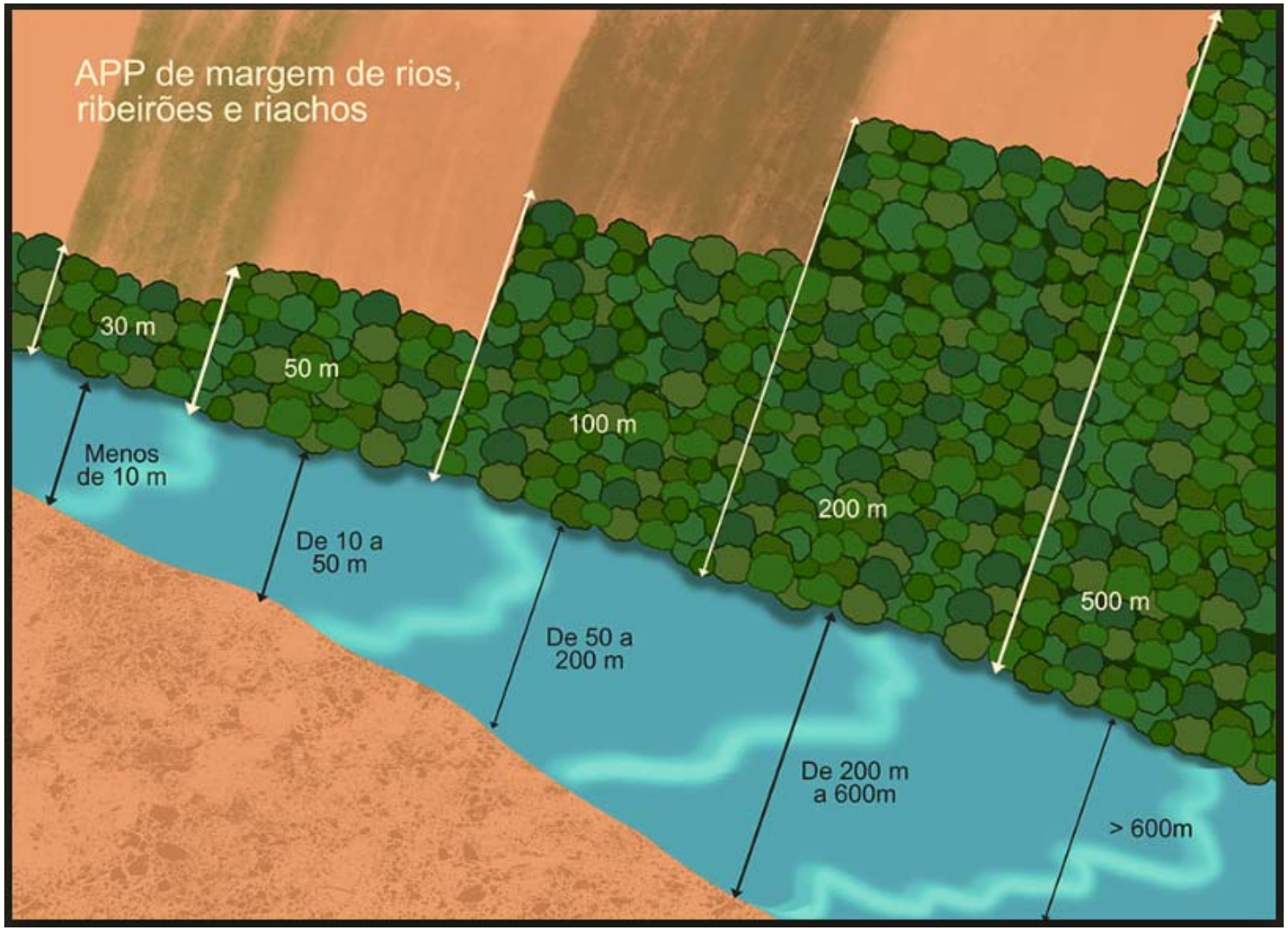
IAP-SPEC CONFERENCE

How Can Science and Technology Contribute to the Reduction of Poverty and Inequality


Forestry Code
Limit Expansion of Agricultural Land
Conserve Water and Biodiversity in Private Land
Low Carbon Agricultural Plan
Conservation Practices – Lower GHG Emissions

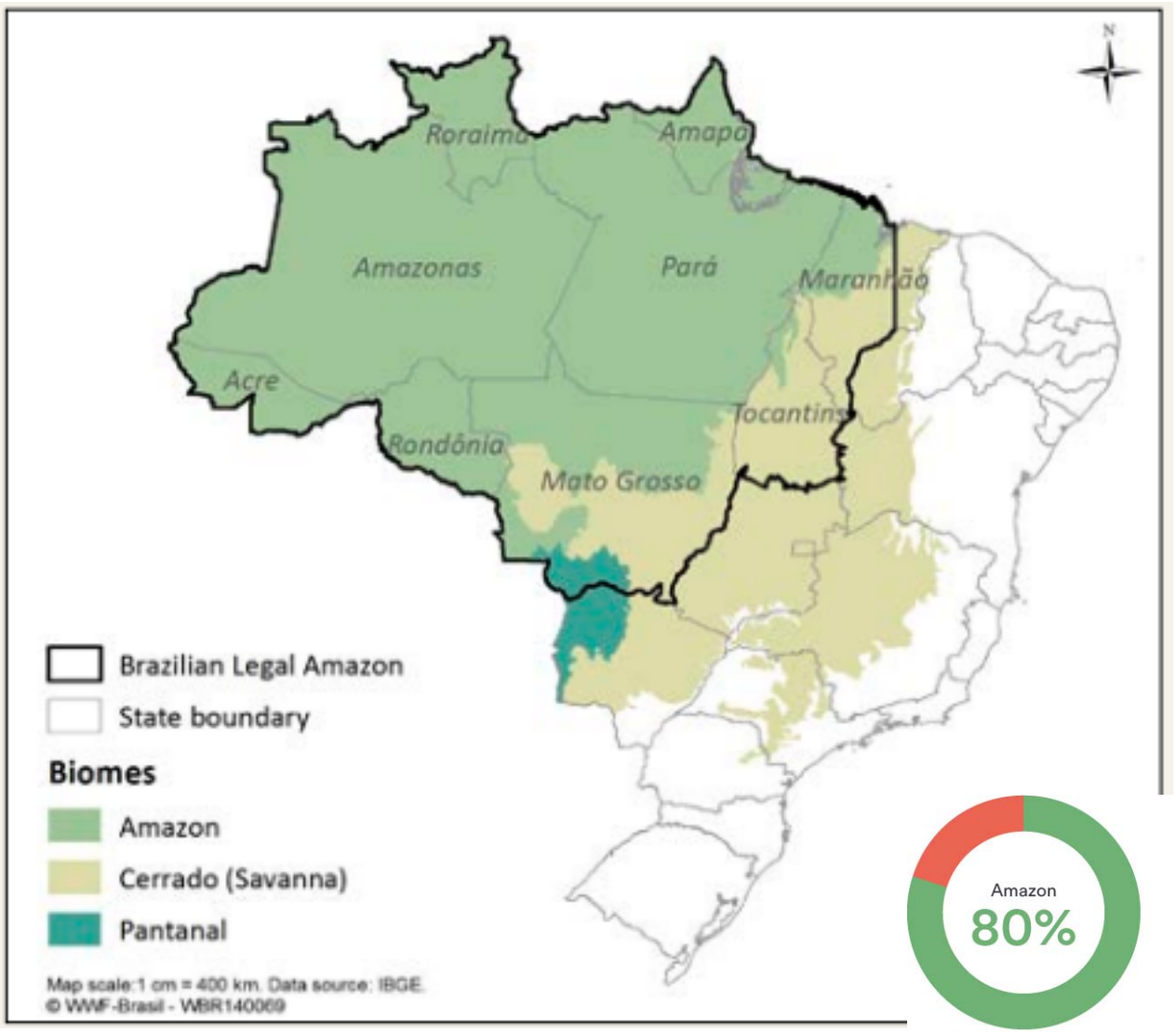
Forestry Code and Land Occupation in Brazil

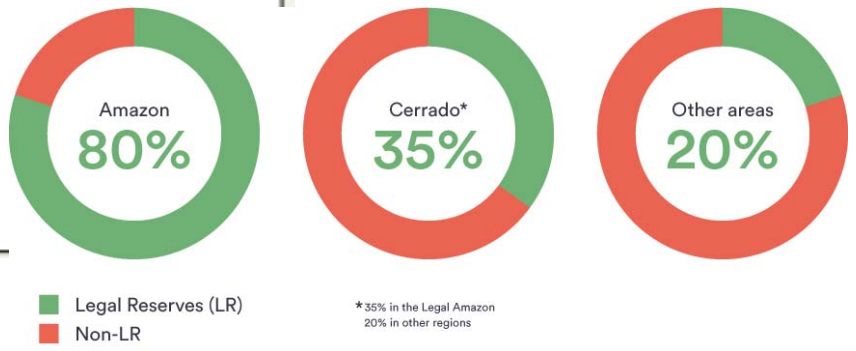
AREAS OF PERMANENT PROTECTION (APP)



Forestry Code and Land Occupation in Brazil

AREAS OF LEGAL RESERVATION (RL)

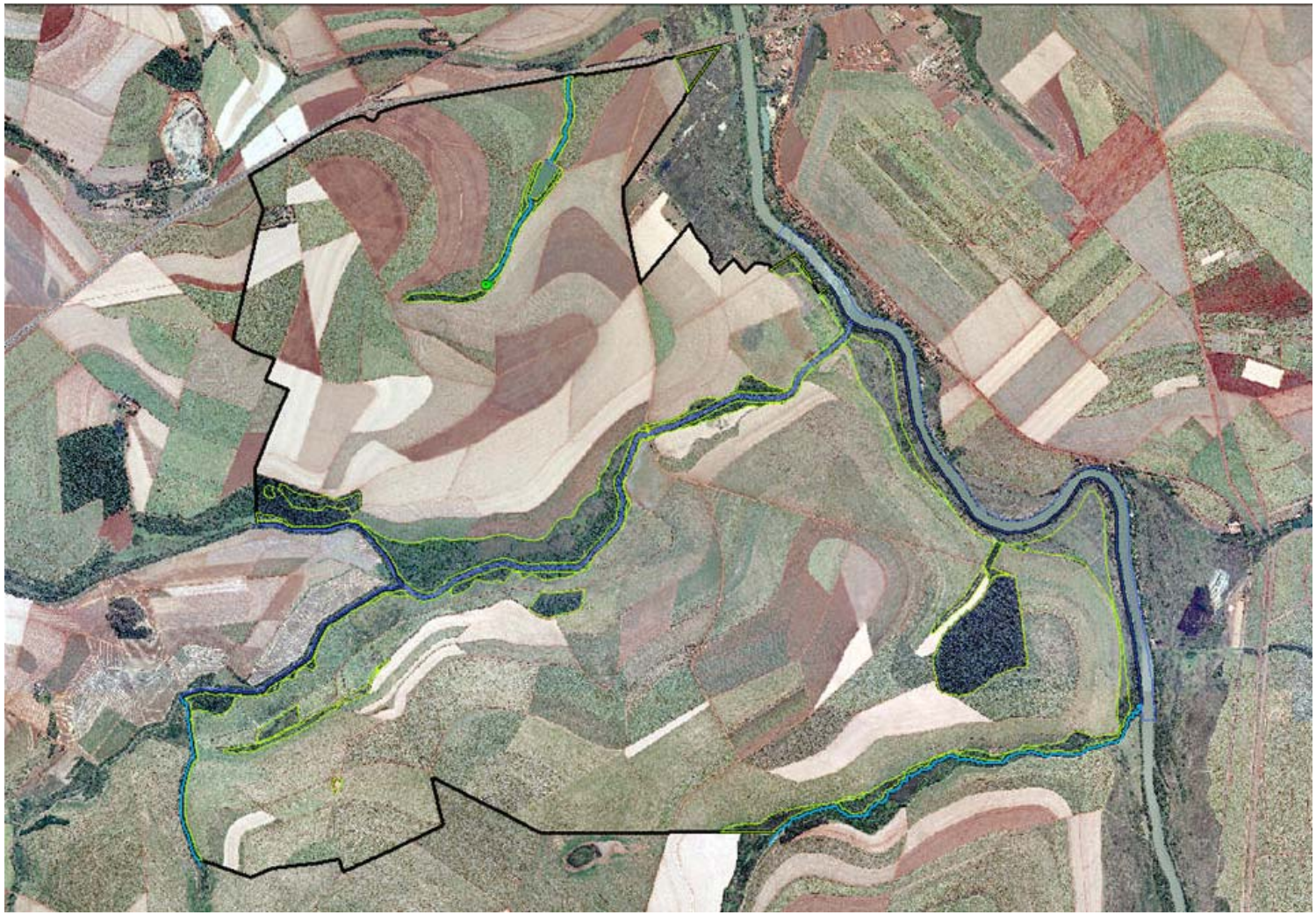




Source: WWF Brasil

Brazilian Forestry Code

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



Forestry Code and Land Occupation in Brazil

Source: Embrapa Territorial

Forestry Code and Land Occupation in Brazil

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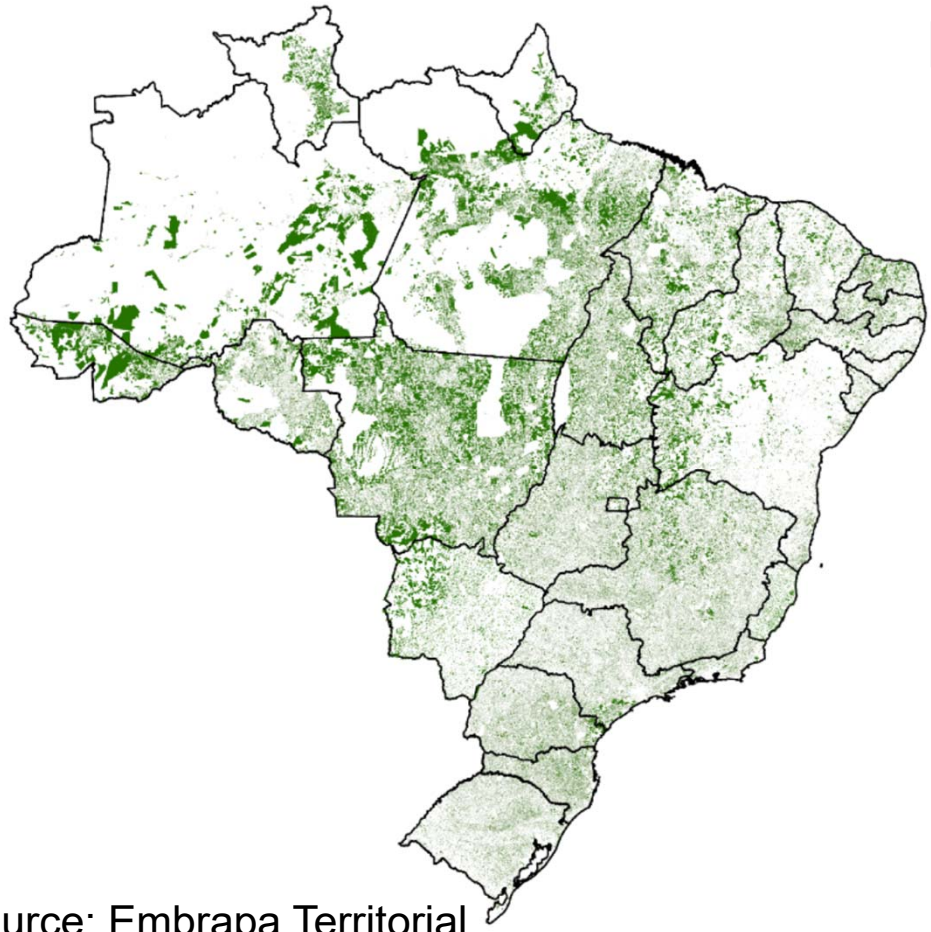
The Extent of Land Protection in Brazil



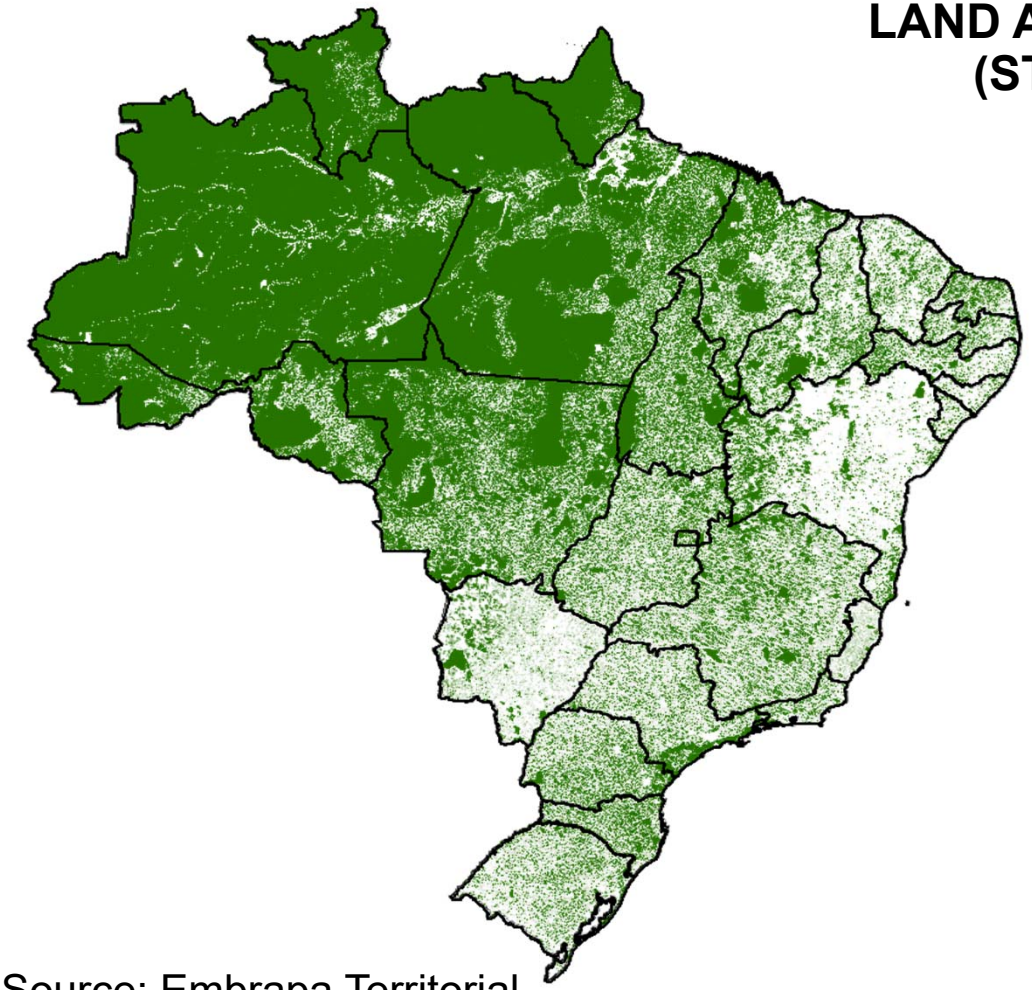
AREAS PRESERVED BY BRAZILIAN FARMERS

MORE THAN 20% OF BRAZIL

MORE THAN 200 M HA

Source: Embrapa Territorial

The Extent of Land Protection in Brazil



...PLUS INDIGENOUS AND PROTECTED LAND AND OTHER UNAVAILABLE AREAS (STATE OWNED, MILITARY ETC.)

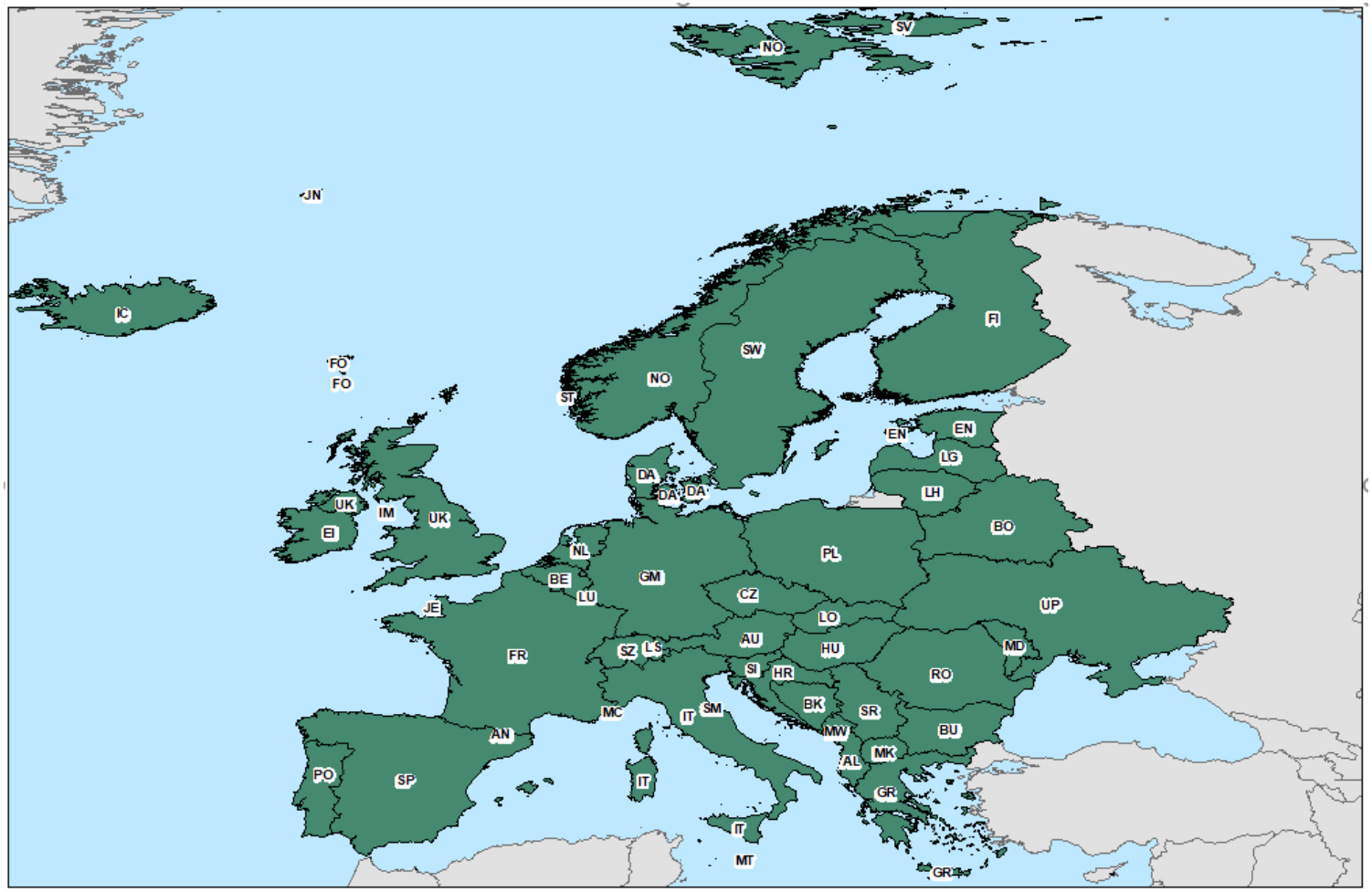
66,3% OF BRAZIL

563.736.030 HA

Source: Embrapa Territorial

The Extent of Land Protection in Brazil

THE TOTAL PROTECTED AREA OF BRAZIL IS THE EQUIVALENT OF THE ENTIRE TERRITORY OF 48 COUNTRIES IN EUROPE



Source: Embrapa Territorial


Forestry Code
Limit Expansion of Agricultural Land
Conserve Water and Biodiversity
Low Carbon Agricultural Plan
Conservation Practices – Lower GHG Emissions

Recovery of Degraded Pasture Land

The next frontier of agricultural expansion, 50 M ha

Source: Embrapa

Sustainable Intensification of Land Use

Double Cropping Systems – Early Cicle Soybean + Corn

Sustainable Intensification of Land Use

Cycling crops and livestock – and adding trees…

Source: Embrapa

Sustainable Intensification of Land Use

Cycling crops and livestock – and adding trees…

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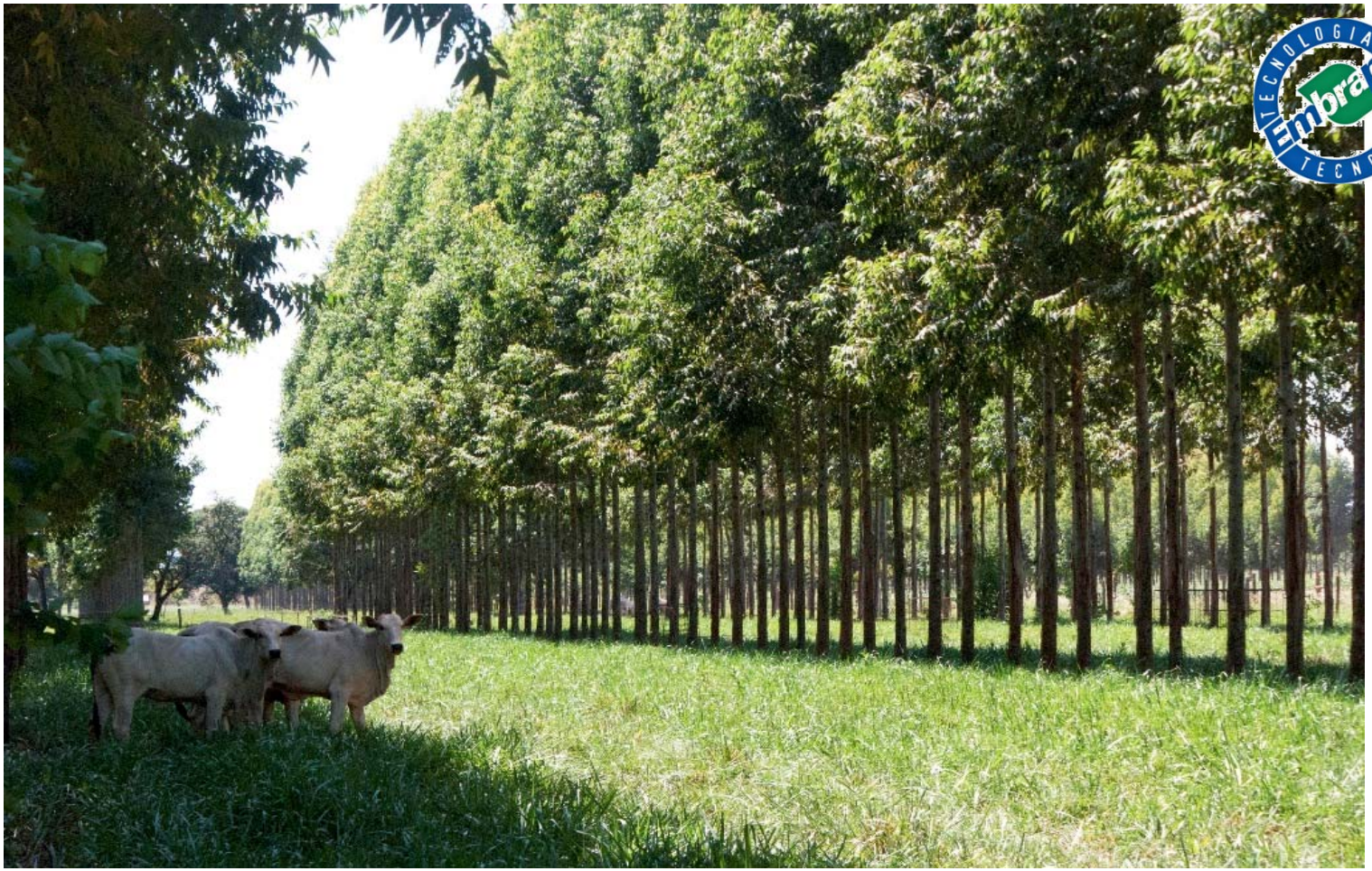
Sustainable Intensification of Land Use

Cycling crops and livestock – and adding trees…

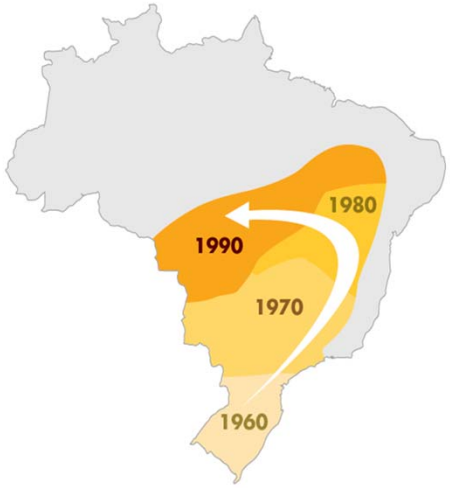


Source: Embrapa

Path of Agricultural Innovation in Brazil

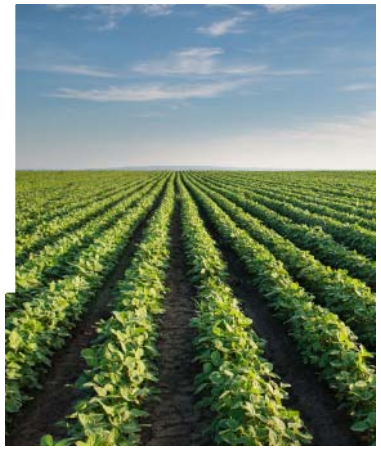
1

EXPANSION



2

COMPETITIVITY



3

SUSTAINABILITY

4

MULTIFUNCTIONALITY

Food and Agriculture in the UN 2030 Agenda

Embrapa

Food and Agriculture in the UN 2030 Agenda

- Pobreza
- Alimento
- Saúde
- Educação
- Mulheres
- Água
- Energia
- Economia
- Infraestrutura
- Desigualdade
- Cidades
- Produção Sustentável
- Clima
- Oceanos
- Biodiversidade
- Instituições
- Implementação

Source: FAO

Food and Agriculture in the Emerging Bioeconomy

Multifunctionality

Agriculture... Food – Fiber – Bioenergy ...

Agriculture... Food – Nutrition – Health ...

Agriculture... Environmental and Ecossystem Services

Agriculture... Biomass – Biomaterials – Green Chemistry...

Agriculture... Organic – Agroecology – Agroforestry ...

Agriculture... Food – Culture – Tradition – Gastronomy – Tourism

Embrapa

Food and Agriculture in the Emerging Bioeconomy

Multifunctionality

Agriculture... Food – Fiber – Bioenergy ...

Agriculture... Food – Nutrition – Health ...

Agriculture... Environmental and Ecossystem Services

Agriculture... Biomass – Biomaterials – Green Chemistry...

Agriculture... Organic – Agroecology – Agroforestry ...

Agriculture... Food – Culture – Tradition – Gastronomy – Tourism

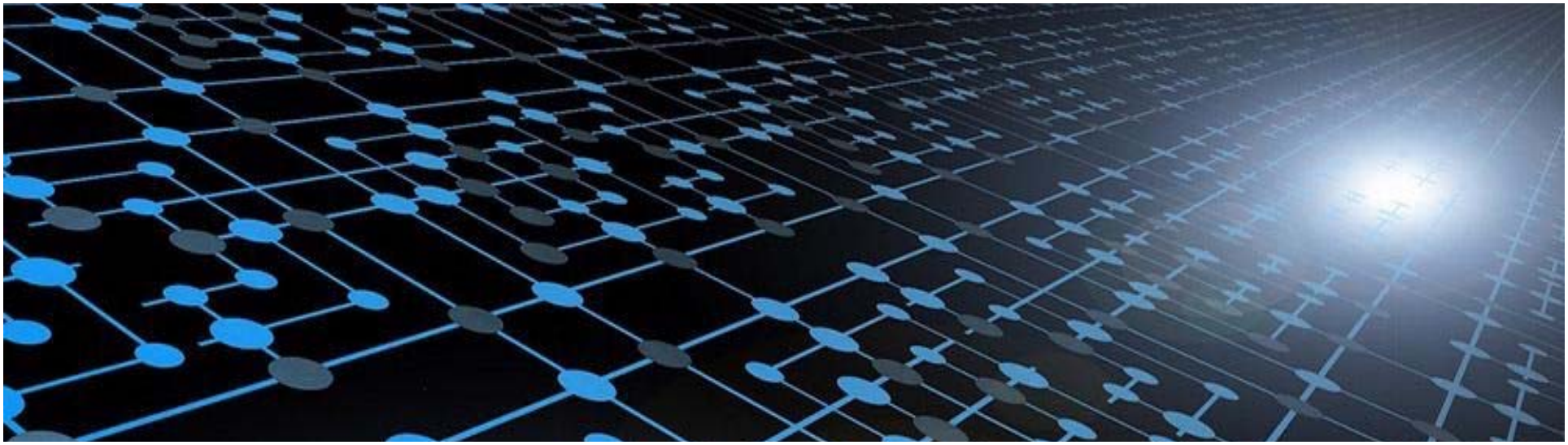
Food – Culture – Tradition – Gastronomy - Tourism

Image Source: Agronomie Environment & Sociétés, June 2017.

Growing demand for culturaly diverse foods

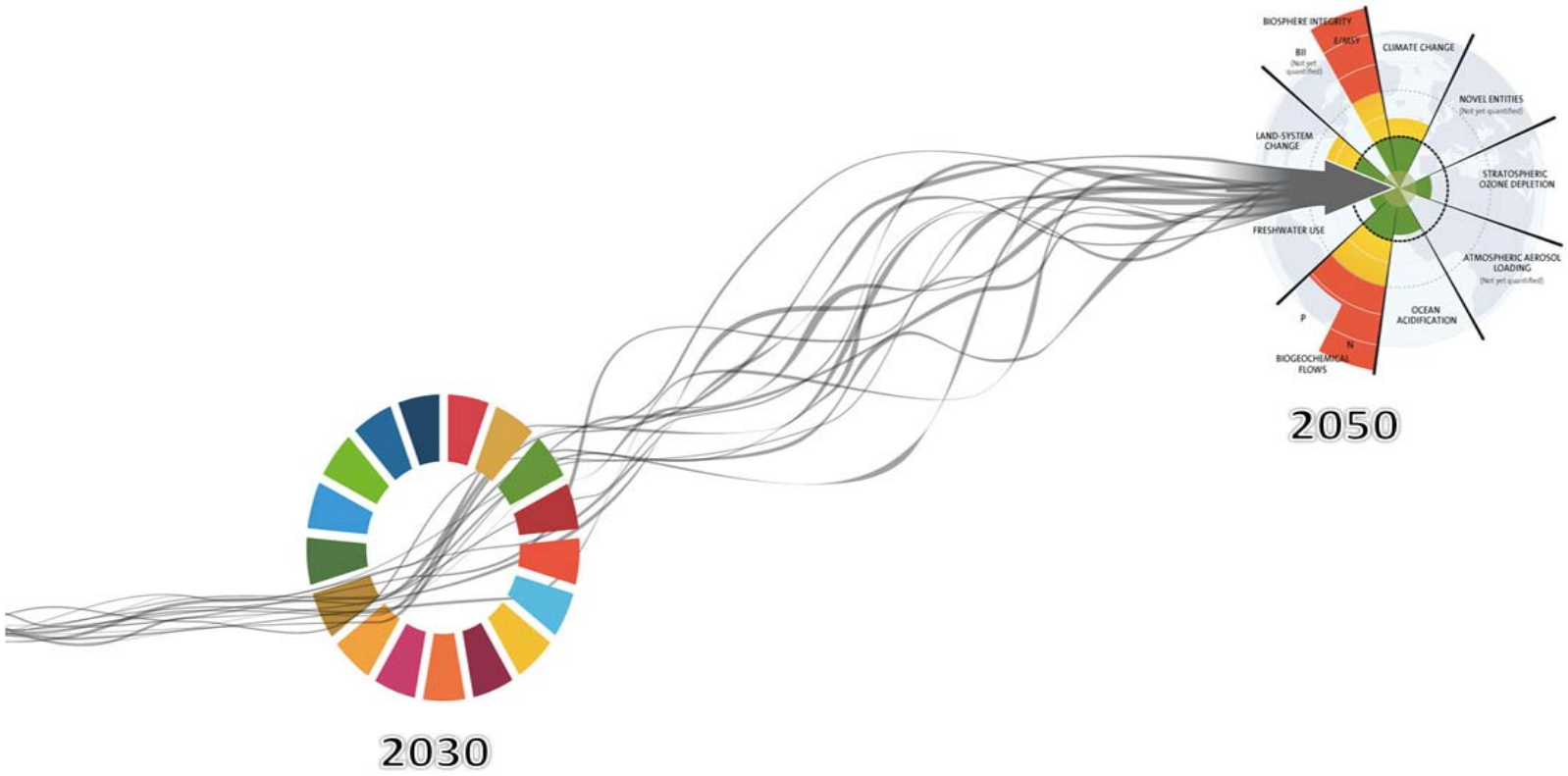
Food as an Experience

Flavors
Tastes
Textures
Sensations



Conclusion

Many Challenges in the 2050 Horizon...



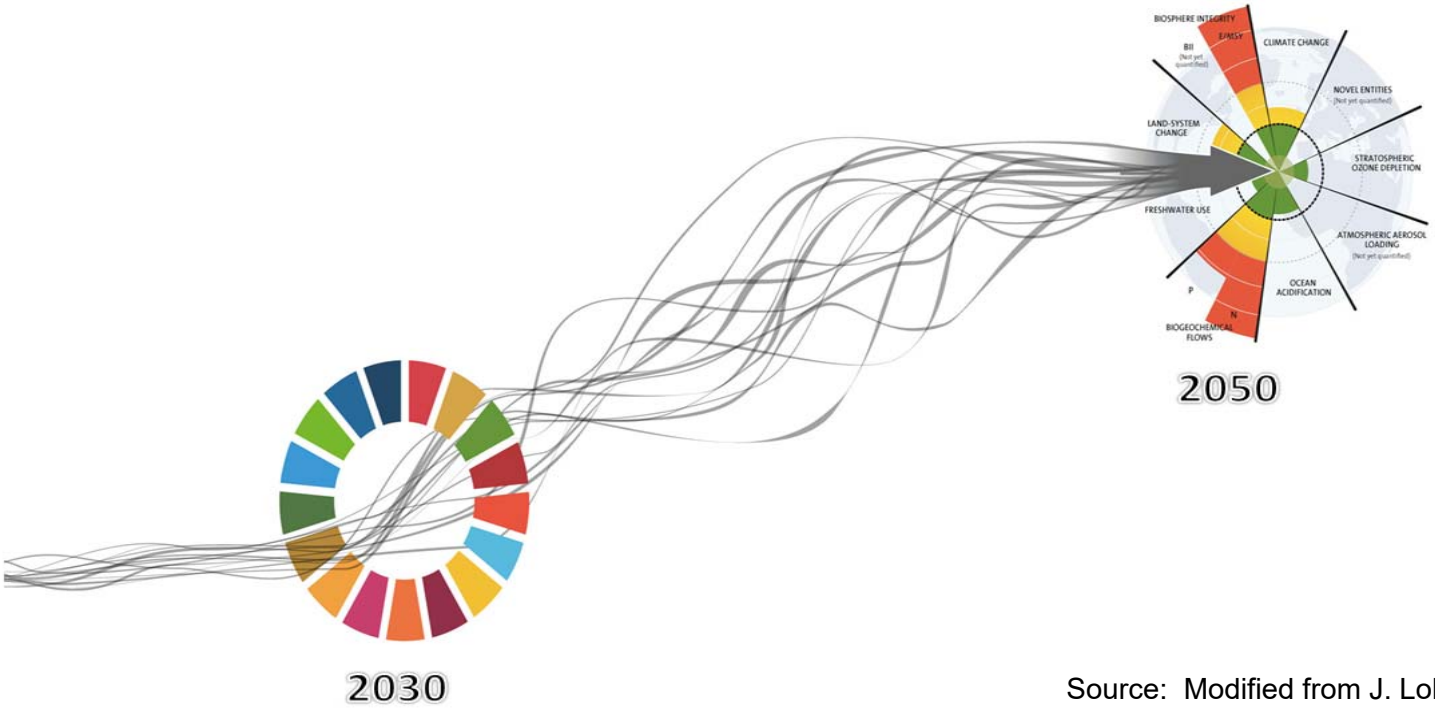
Source: Modified from J. Lokrantz/Azote

Brazil can help the world face the challenges ahead…

Enhancing its Capacity as Food Producer and Supplier

Consolidating Capacity in Conservation Agriculture and Sustainable Intensification

Sharing Knowledge and Experiences in Tropical Agricultural Systems



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Thank You!

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