# Latin America Geospatial Forum

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# Geotechnology, Agriculture, and Land Administration in Brazil: a Contribution from Embrapa Satellite Monitoring

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Embrapa

Monitoramento por Satélite

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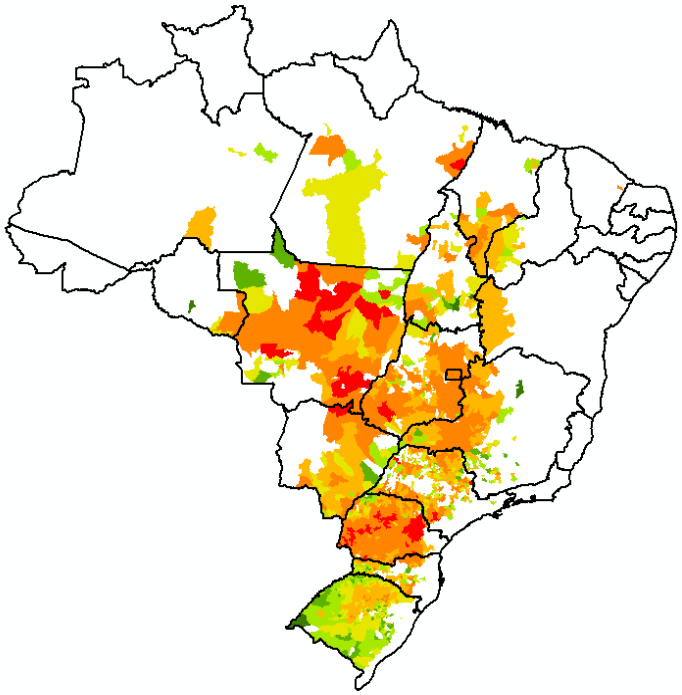
# *The challenge of land administration and agriculture monitoring In Brazil using geospatial information*

- Country's spatial dimension
- Biome diversity
- Diversity of agricultural products and techniques: from traditional to very intensive agriculture
- Spatial dynamics and temporal variability in land use and land cover
- Regional and local heterogeneity
- Lack of detailed information about Brazilian agriculture's territorial dimension



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## *Opportunities for agricultural satellite monitoring*

- Growing number of satellites and products
- Greater precision and availability, reduction of product costs (many are free)
- Growth of the Earth Observation market
- International satellite monitoring research programs
- Demands for the integration of orbital data and geotechnologies in management systems to support public policies

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| Satélite | Sensor | Resolução espectral | Resolução espacial | Resolução temporal |
|---|---|---|---|---|
| ALOS | AVNIR-2 | | | |
| | PALSAR | | | |
| | PRISM | | | |
| AQUA | MODIS | | | |
| CBERS-2 | CÂMERA CCD | | | |
| | IRMSS | | | |
| | WFI | | | |
| CBERS-2B | CÂMERA CCD | | | |
| | HRC | | | |
| | WFI | | | |
| EROS A1 | CÂMERA CCD | | | |
| EROS B1 | CÂMERA CCD-TDI | | | |
| GEOEYE-1 | PAN | | | |
| | MS | | | |
| IKONOS 2 | PAN | | | |
| | MULTI | | | |
| KOMPSAT-2 | MSC | | | |
| LANDSAT 5 | MSS | | | |
| | TM | | | |
| LANDSAT 7 | ETM+ | | | |
| NOAA 15, 16, 17 e 18 | AVHRR | | | |
| QUICKBIRD | PAN | | | |
| | MS | | | |
| RADARSAT-1 | SAR | | | |
| RADARSAT-2 | SAR | | | |
| RAPIDEYE | REIS | | | |
| SPOT 2 | HRV | | | |
| SPOT 4 | HRVIR | | | |
| | VEGETATION | | | |
| SPOT 5 | HRG | | | |
| | HRS | | | |
| | VEGETATION 2 | | | |
| TERRA | ASTER | | | |
| | MODIS | | | |

Legenda

| Resolução espectral (bandas) |
|---|
| 11 – 36 |
| 8 – 10 |
| 4 – 7 |
| 0 – 3 |

| Resolução espacial (m) |
|---|
| 0 - 2,9 |
| 3,0 - 10,9 |
| 11,0- 30,0 |
| 31,0 - 100,0 |
| Acima de 101,0 |

| Resolução temporal (dias) |
|---|
| 1 – 2 |
| 2 – 5 |
| 6 – 20 |
| Acima de 21 |

***BATISTELLA & MORAN, 2008. Geoinformação e Monitoramento Ambiental na América Latina. Editora Senac.***

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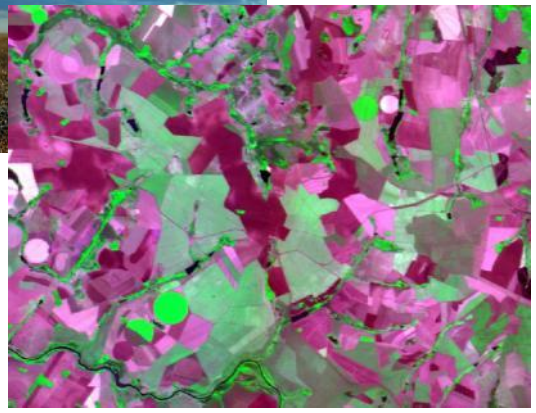
# Context

## World scenario

- Demand for food and energy
- Reduction in agriculturable area



## Brazil

Greatest amount of potentially arable land:
almost 400 mi hectares (FAO, 2009)

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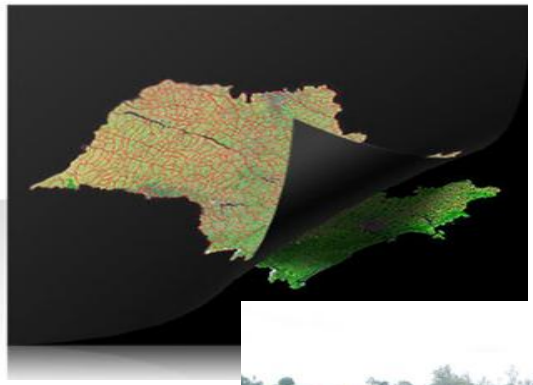
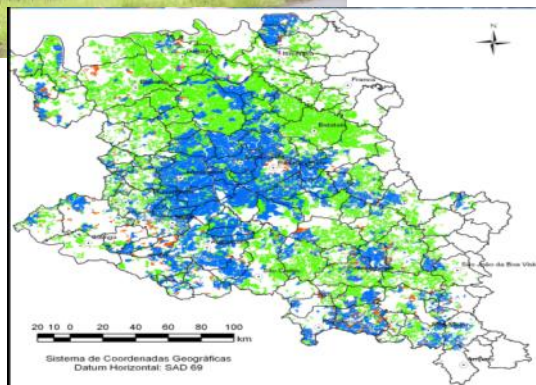
## Main research areas

- Land use and land cover dynamics
- Land zoning and planning
- Geospatial modeling
- Agriculture geospatial monitoring
- Sustainability indicators
- Geotracking / geotracing capability
- Dissemination of geotechnologies





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# Development in Brazil – New Horizons

Increasing agricultural modernization and food production capacity

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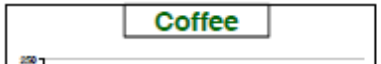
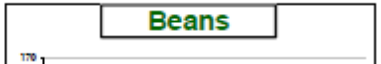
# Rising Agricultural Productivity

**Yield increase (1975 to 2009): from 60% to over 200%**
















**Poultry**

| | 1970 | 2009 |
|---|---|---|
| Days to slaughter | 50 | 39 |
| Weight kg | 1.8 | 2.2 |
| Food conversion (wtwt) | 1.4 | 1.7 |

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# Brazil Became an Important Food Exporter

2009 ranking: Brazilian Production and Exports

| Main Products | Production | Exports | Number of Markets | Exports US$ Billion |
|---|---|---|---|---|
| Sugar | 1st | 1st | 124 | 8.378 |
| Coffee | 1st | 1st | 81 | 3.762 |
| Orange Juice | 1st | 1st | 75 | 1.619 |
| Soybean | 2nd | 2nd | 46 | 11.413 |
| Beef | 2nd | 1st | 142 | 4.118 |
| Tobacco | 2nd | 1st | 100 | 2.992 |
| Ethanol | 2nd | 1st | 48 | 1.338 |
| Broiler | 3rd | 1st | 146 | 5.307 |
| Corn | 4th | 3rd | 49 | 1.259 |
| Pork | 4th | 4th | 81 | 1.225 |

Sources: USDA, Ministry of Agriculture

Around 79% of the Brazilian food production is consumed domestically and 21% is shipped to over 180 foreign markets

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# Conservation Agriculture in Brazil

## Massive conversion of intensive tillage systems to no-till systems

Harnessing ecosystem services on-farm and on large landscape level






Agriculture is becoming a "producer" of clean water

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# Conservation Agriculture in Brazil

## Key component of Brazil´s low carbon emission program for agriculture


**Public policies are in place to support CA-based production systems**

**Contributions of CA towards a low carbon agriculture:**

Facilitating carbon sequestration – Reducing green house gas emissions;
Minimizing soil degradation, including erosion and chemical pollution; and
Responding to constraints such as high energy, input costs and resource scarcity.

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# New Frontiers in Conservation Agriculture in Brazil

## Intensification of land use with integrated crop-livestock-forest systems

Supported by Brazil´s low carbon emission program for agriculture

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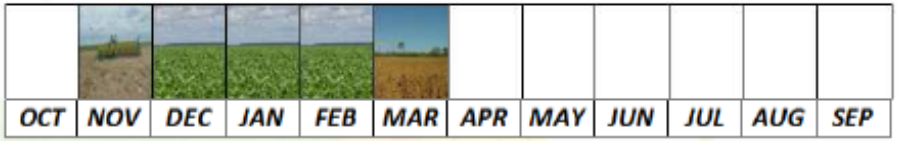
# New Frontiers in Conservation Agriculture in Brazil

**Soybean ± 42% of the time**




**Corn ± 50% of the time**


**Soybean + 2nd corn crop ± 80% of the time**


**Soybean + 2nd corn crop + livestock ± 92% of the time**


Intensification of land use with integrated crop-livestock-forest systems

iLPF

Target: 60+ million ha of degraded pastures – the new agricultural frontier

- System´s View and Complexity -

Combination of 90+ different technologies

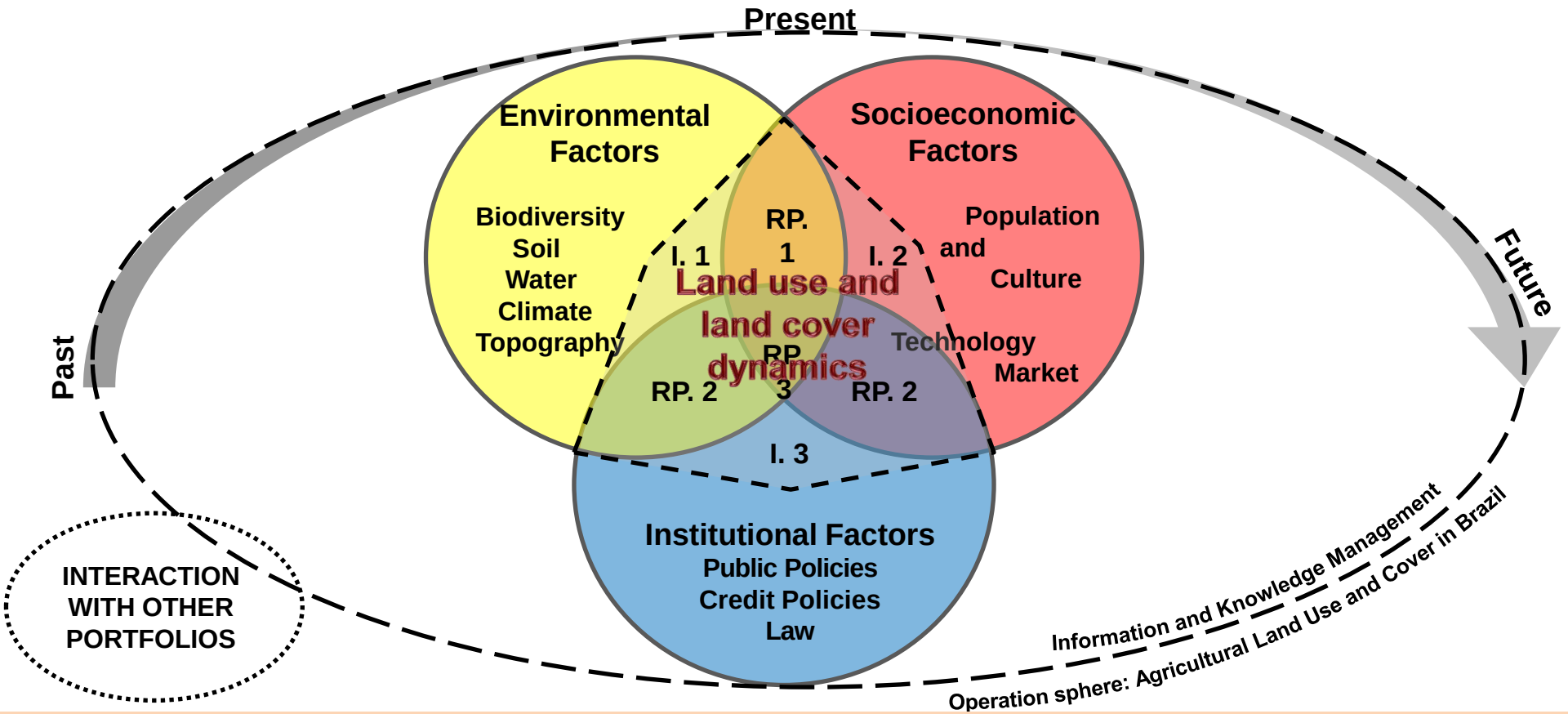
# CONCEPTUAL FRAMEWORK FOR THE LAND USE AND LAND COVER DYNAMICS PORTFOLIO

**INTERACTIONS - I.1**
Ecosystem Services
Land-Cover Changes
Carrying Capacity

**INTERACTIONS - I.3**
Land-Use Policy
International Protocols
Health Barriers - sanitary barriers

**INTERACTIONS - I.2**
Land Demand and Offer in Brazil
Land-Use Changes
Land secutiry

**DEMANDS, OFFER AND IMPACTS**




**PORTFOLIO - RD&I PROGRAMME (THEMES)**
**DECISION PROCESSES FOR CHANGES IN LAND USE AND COVER**

**RESULTS/PRODUCTS - RP.1**
Land Zonings: Environmental, Climate
Land-use aptitude
Sustainability and Risk Analysis
Impacts on Hydric Resources
Biosphere-Atmosphere Interactions

**RESULTS/PRODUCTS - RP.3**
Ecological-Economical Zoning
Land use and cover monitoring
Modeling of Land Use and Cover Dynamics
Production Estimation
Trend analyses and future scenarios

**RESULTS/PRODUCTS - RP.2**
Impacts caused by the "New Forest Code"
Geospatial Impacts by New Technologies
Social and Economical Vulnerability Analysis
Human Dimensions of Land Use and Cover

**PROJECTS AND MANAGEMENT ACTIONS**

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## *The future ahead*

**Agricultural production with economic sustainability, environmental quality and social justice**

**Ambition**

- Agricultural and environmental power

**How to face this challenge?**

- Geospatial data, information and knowledge
- Agricultural geospatial monitoring

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