Remote sensing and geospatial databases for the Brazilian agriculture sustainable development

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Brazil Land Use and Cover - 2017

Area: 8.5 million km²

Population: 211.4 million

- 62.6% Tropical Forest and Savannas
- 28.6% Crops, Fruits, Pastures
- 6.3% Natural Pastures
- 2% Lakes, Rivers
- 0.5% Urban, Indus
Brazilian Agriculture: Global Importance

+ 100 products for + 100 Countries in 2017

30 Million Tonnes

45 Million Tonnes

240 Million Tonnes
Brazilian Agriculture: Global Importance

Factors contributing to results include:

- Natural resources availability
- Favorable climate conditions
- Agricultural research
- Farmers and agroindustry
- Governmental policies towards the agricultural sector
Brazilian Agriculture: Opportunities

Landscape planning and public policy through economic, ecological and cultural integration.

Remote sensing and geospatial databases in the planning of Brazilian agriculture.

http://www.turismo.gov.br
Brazilian Agriculture: Opportunities

Brazilian Agriculture: Opportunities

1. Advances in sustainability in agriculture
2. Strategic insertion in the bioeconomy
3. Contribution to public policies
4. Productive insertion and poverty reduction
5. Positioning at the frontier of knowledge
Brazilian Agriculture: Opportunities

www.embrapa.br/group/rede-agropensa
Remote Sensing: Multiscale (Global for Local)
Brazilian Agricultural Expansion: The Importance of Strategic Planning

Diversity of Production Systems
Regional Socioeconomic Contrasts
Spatial-Temporal Dynamics of Land Use
Expansion / Contraction
Intensification / Degradation
Diversification
Challenge:
Brazilian Agricultural Mapping and Monitoring

Crops
70 Million hectares
Agriculture and Fruits
Bagé - RS

Fonte: imagem do satélite GeoEye-1
Data: 27 de maio de 2011
Sistema de projeção UTM, zona 21S
Datum: WGS84
Área de Soja
Município: Londrina-PR
Imagem do satélite Quick Bird
26/02/2008
Ponta Grossa - PR

Soybean and Corn

Fonte: imagem do satélite GeoEye-1
Data: 4 de abril de 2012
Sistema de projeção UTM, zona 22S
Datum: WGS84
Sugarcane and Forest
Cosmópolis - SP

Sugarcane and Fruits
Área de Pastagem
Município: Campo Grande-MS
Imagem do satélite GeoEye-1
09/10/2011
Petrolina - PE

Tropical Fruits
Soybean, corn and cotton
Imagens de Satélite de região de agropecuária no município de Luiz Eduardo Magalhães (BA) - 2011.

- Terra/Modis - 250m
- Landsat 5 - 30m
- GeoEye 1 - 1,5m

Irrigation System: corn, soybean and cotton

Luiz Eduardo Magalhães - BA
Is one of the world’s biodiversity hotspot and hosts some of the most intensive agricultural for food production in the world.

Land-use and land-cover (LULC) map is based on Landsat-8 Operational Land Imager (OLI) 121 scenes.
Land-use and land-cover mapping of the Brazilian Savanna based mainly on satellite images

- The results showed:
  - **54.6%** (111 Mh) were still natural areas
  - **43.4%** (88.5 Mh) were already converted
  - **0.7%** Water
  - **1.2%** Non-Observed
- The accuracy of the final map was **80.2%**
Land-use and land-cover mapping of the Brazilian Savanna based mainly on satellite images

- The results showed:
  - 43.4% Converted
  - 29.5% Cultivated pasture
  - 8.5% Annual croplands
  - 3.1% Perennial croplands
Assessment of the pastures conditions in the Brazilian Savanna by means geotechnologies


- This study aimed to evaluate pastures conditions by Normalized Difference Vegetation Index (NDVI) timeseries, derived from Spot-Vegetation sensor.

- Analyzes based on NDVI time-series (10 years) indicated that 173 municipalities have more than 50% of their pastures under some degradation process.
Assessment of the pastures conditions in the Brazilian Savanna by means geotechnologies

In general, NDVI were relevant to methodologic application to evaluate the cultivated pastures conditions and the planning of public and private actions to pastures productive potential.
Agroforestry has large potential for carbon (C) sequestration while providing many economical, social, and ecological benefits via its diversified products.

Airborne lidar is considered as the most accurate technology for mapping aboveground biomass (AGB) over landscape levels.
Modeling and mapping agroforestry aboveground biomass in the Brazilian Amazon using airborne lidar data

Airborne lidar. Color (from red to blue) represents the elevation of the laser points.

Examples (a–d) of agroforestry (left) and forests (right) fields shown in airborne lidar. Color (from red to blue) represents the elevation of the laser points.

Maps of vegetation type (a); and AGB predicted with mixed-effects model (b); and fixed-effects model (c); and the difference between AGB predicted with fixed- and mixed-effects models (d). Black color indicates the area masked for analysis.

Teak plantations shown in the field (a); aerial photo (b); and lidar data (c); American oil palm sample tree (d); and plantation shown in aerial photos (e); and lidar data (f).
Rural development: the importance of geographical indications

To increasing spatially explicit agri-food data and information digital access.
Rural development: the importance of geographical indications
Several public organizations provide data and alphanumeric information on Brazilian agriculture.

Critical to understand the content of information, data visualization is an indispensable tool to examine and validate analysis and upholds people making decisions.

Data visualization is the action, delivered often by digital tools, of clarifying the information with in a collection of data through different graphic shapes.
Brazilian agricultural geodatabase: strategic planning and development

Agriculture Area, Location and Production (1990–2018)
- corn, soybean, sugarcane, rice, beans, coffee, cotton, orange, + 100

Animals Quantity and Location (1990–2018)
- Cattle, Pork, Chicken, Horse, Fish, + 10…

Cross Reports

Quadro Comparativo Lavoura: Café (em grão) Total
- Quantidade Produzida (Em Mil Toneladas)
- Área Colhida (Em Milhares de Hectares)
- Rendimento Médio (Em kg / ha)
- Valor Produção (Em Milhares de R$)

Fonte: IBGE
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Final Considerations

The results of these actions support public and private decision-making in rural planning and collaborate with the 17 Sustainable Development Goals. Highlighting:

- Knowledge of technology & innovation about the adoption of techniques and technologies with adequate agriculture and ecosystem management.

- Integrated applications of remote sensing and geodatabase providing solutions and information for planning and implementation of agricultural projects to public and private.

- Use and applications of the emerging space technologies like LiDAR, WebGIS, BigData for agriculture planning and natural resources monitoring towards more sustainable rural practices.
Thank You.

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