Remote sensing and geospatial databases for the Brazilian agriculture sustainable development

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Brazilian Agricultural Research Corporation – Embrapa

UNITED NATIONS
Office for Outer Space Affairs

International Conference on Space Solutions for Sustainable Agriculture and Precision Farming

Romania, 06-10 May 2019.

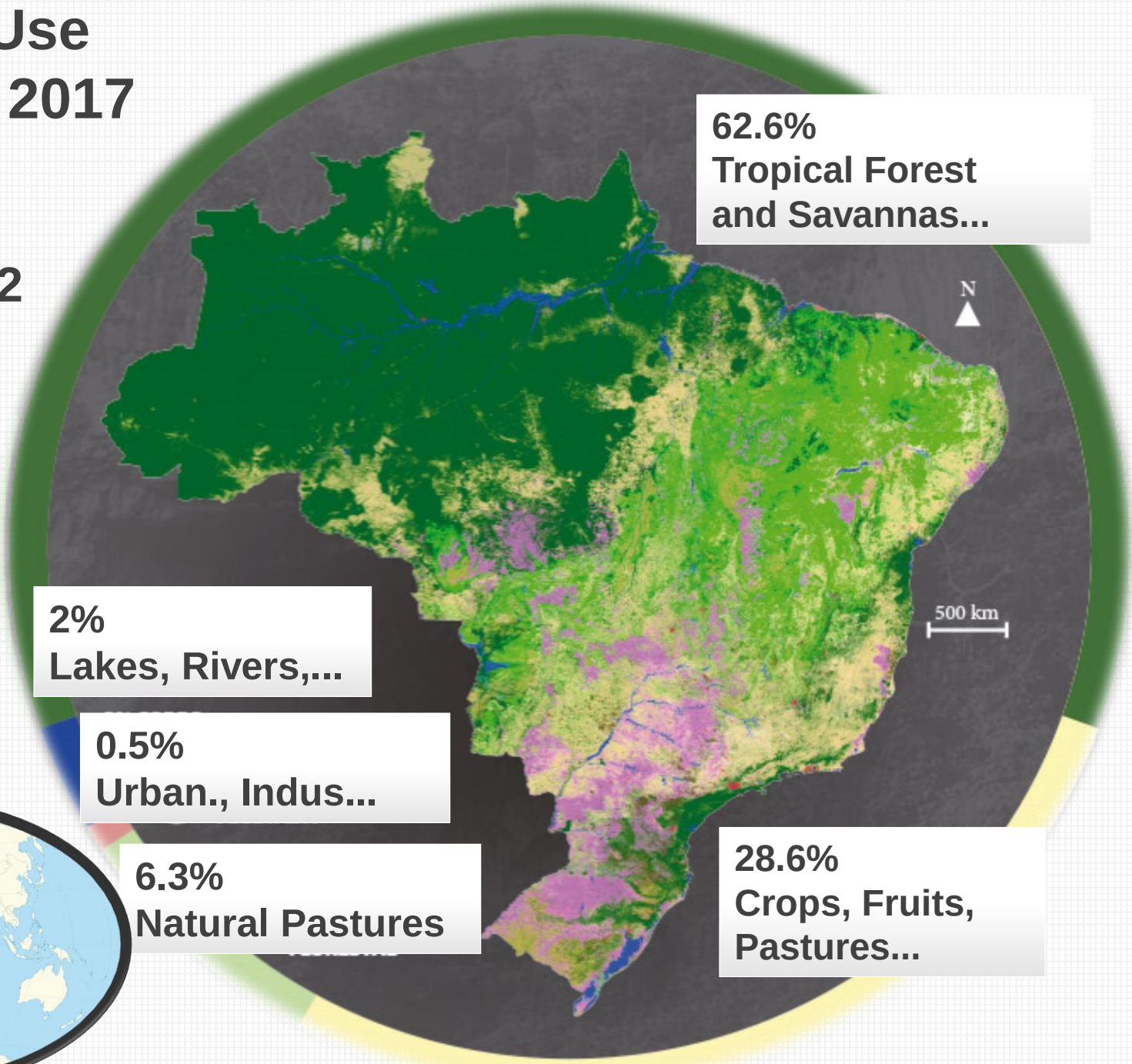
MINISTÉRIO DA AGRICULTURA, PECUÁRIA E ABASTECIMENTO

PÁTRIA AMADA BRASIL GOVERNO FEDERAL

Brazil Land Use and Cover - 2017

Area:
8.5 million km2

Population:
211.4 million



http://mapbiomas.org

Brazilian Agriculture: Global Importance

+ 100 products for + 100 Countries in 2017

45

Million Tonnes

30

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

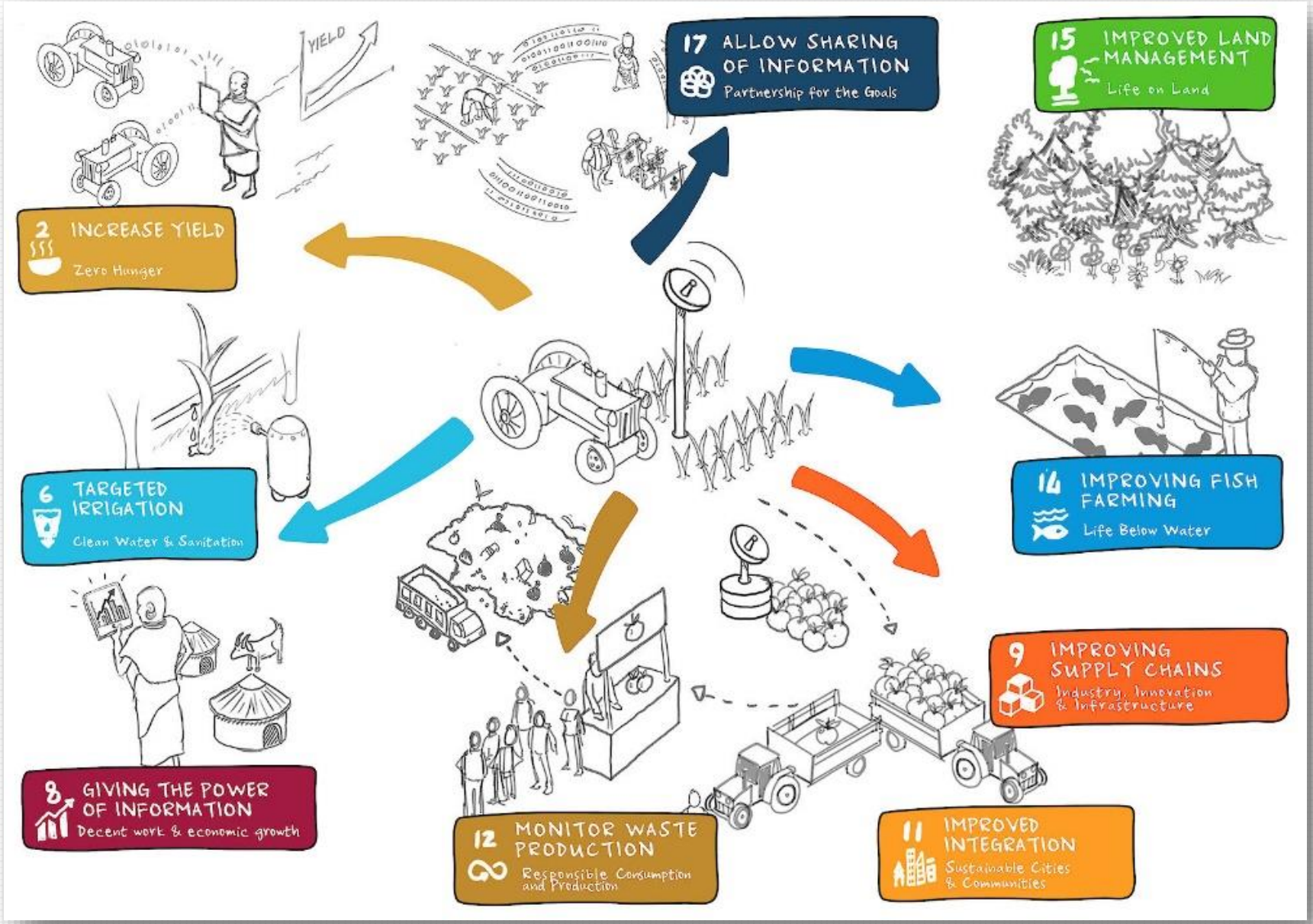
Brazilian Agriculture: Opportunities

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



United Nations Global Compact. Digital Agriculture. 2017.

Brazilian Agriculture: Opportunities

Embrapa

NAÇÕES UNIDAS BRASIL

OBJETIVOS DE DESENVOLVIMENTO SUSTENTÁVEL

17 OBJETIVOS PARA TRANSFORMAR NOSSO MUNDO

Acesse aqui a Agenda 2030 na íntegra, com o documento final adotado na Cúpula das Nações Unidas sobre o Desenvolvimento Sustentável, em setembro de 2015.

Plataforma Agenda 2030

Acessa a Plataforma Agenda 2030 clicando na imagem ou em agenda2030.org.br

Advances in sustainability in agriculture

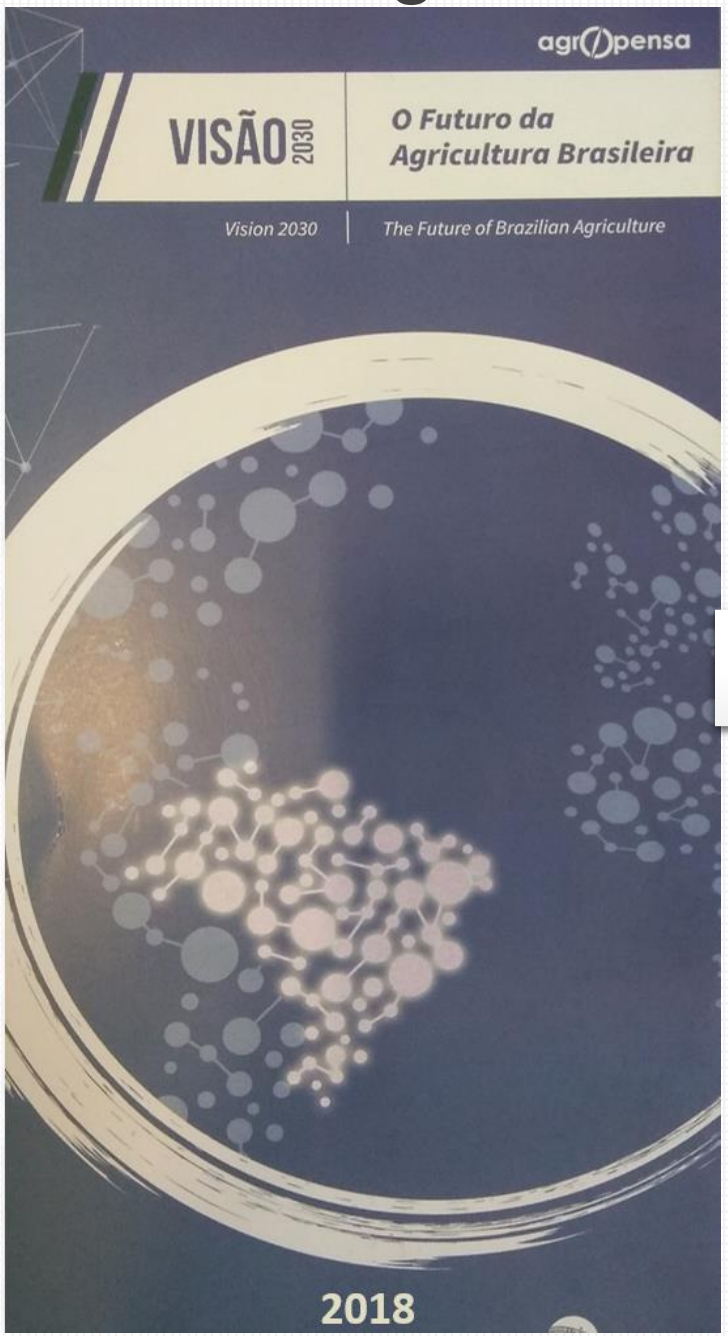
Strategic insertion in the bioeconomy

Contribution to public policies

Productive insertion and poverty reduction

Positioning at the frontier of knowledge

Brazilian Agriculture: Opportunities

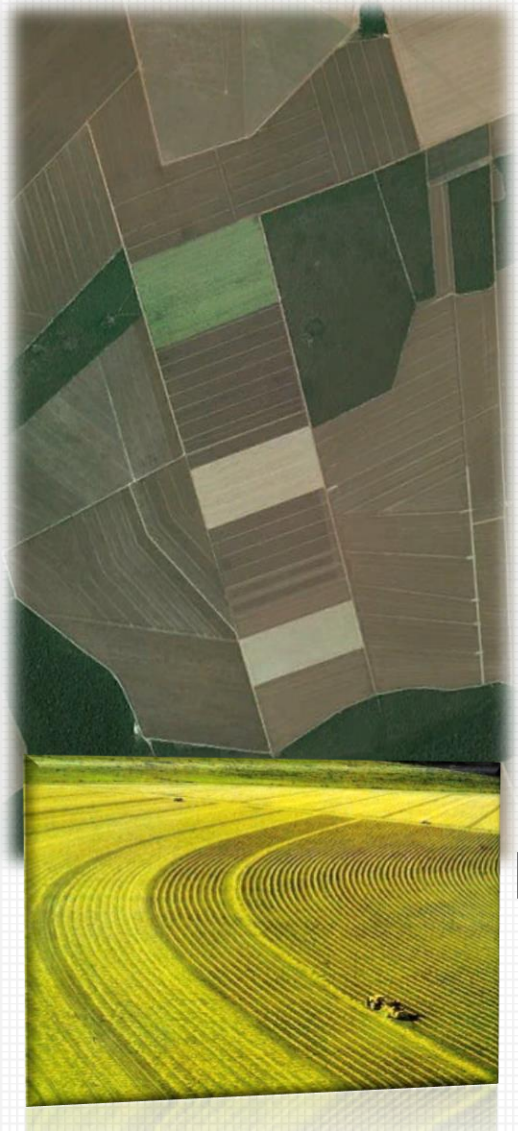


www.embrapa.br/group/rede-agropensa

Remote Sensing: Multiscale (Global for Local)

Brazilian Agricultural Expansion: The Importance of Strategic Planning

Bolfe, E.; Contini, E. Victória, D. **Agroanalysis. v. 7, p. 6-8, 2016.**
http://www.agroanalysis.com.br/storage/2016/7/index.html

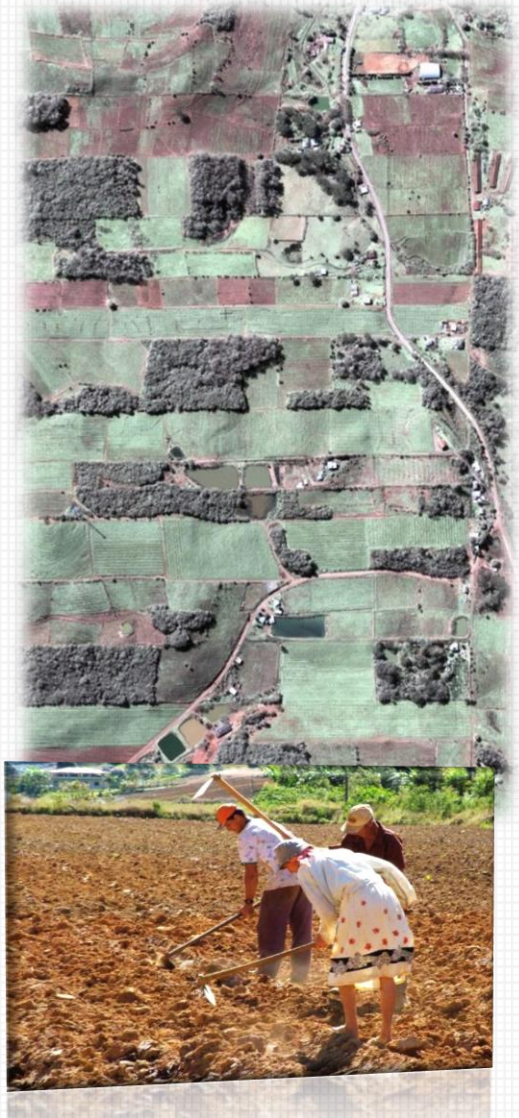


Diversity of Production Systems

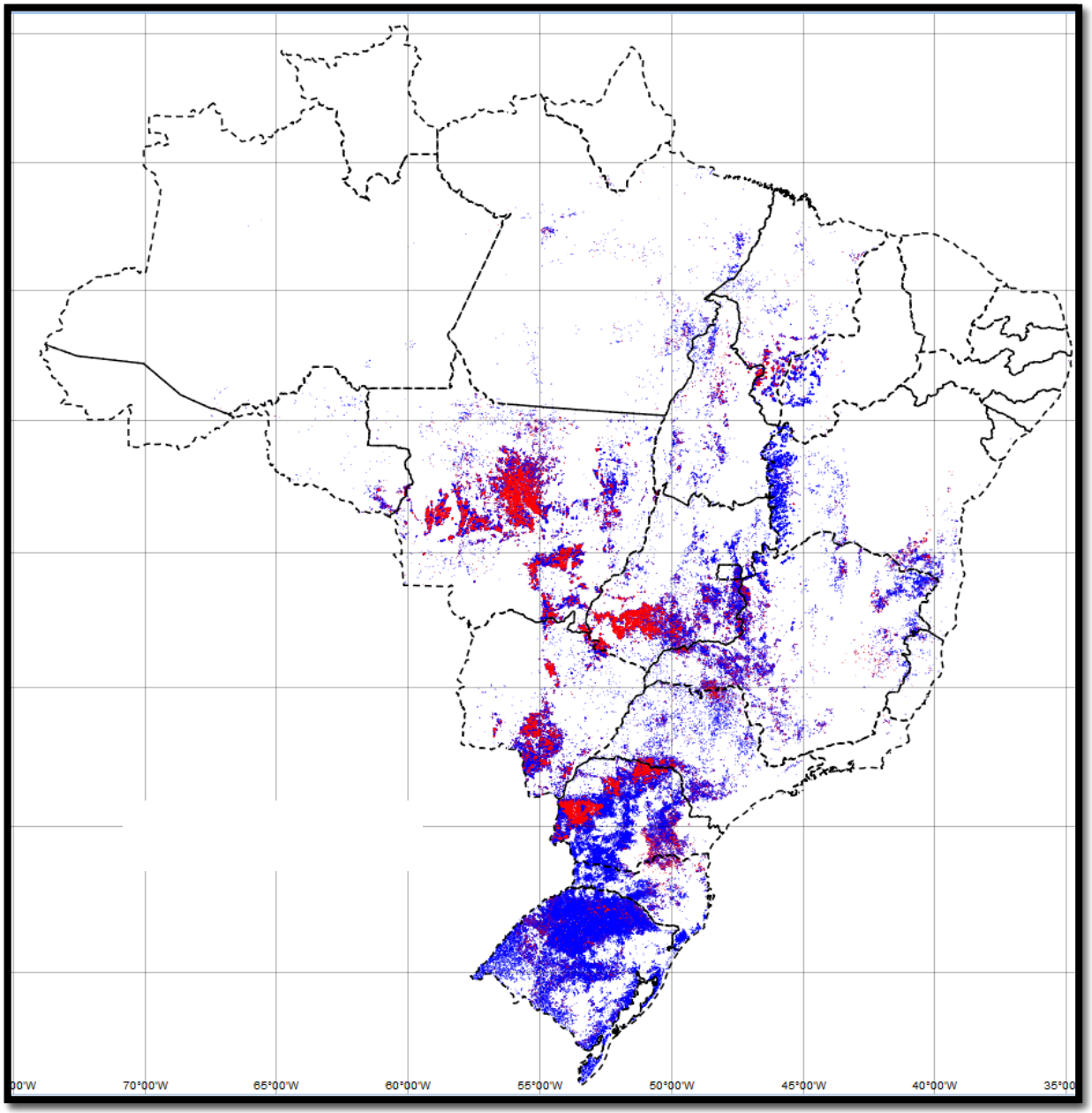
Regional Socioeconomic Contrasts

Spatial-Temporal Dynamics of Land Use

Expansion / Contraction
Intensification / Degradation
Diversification



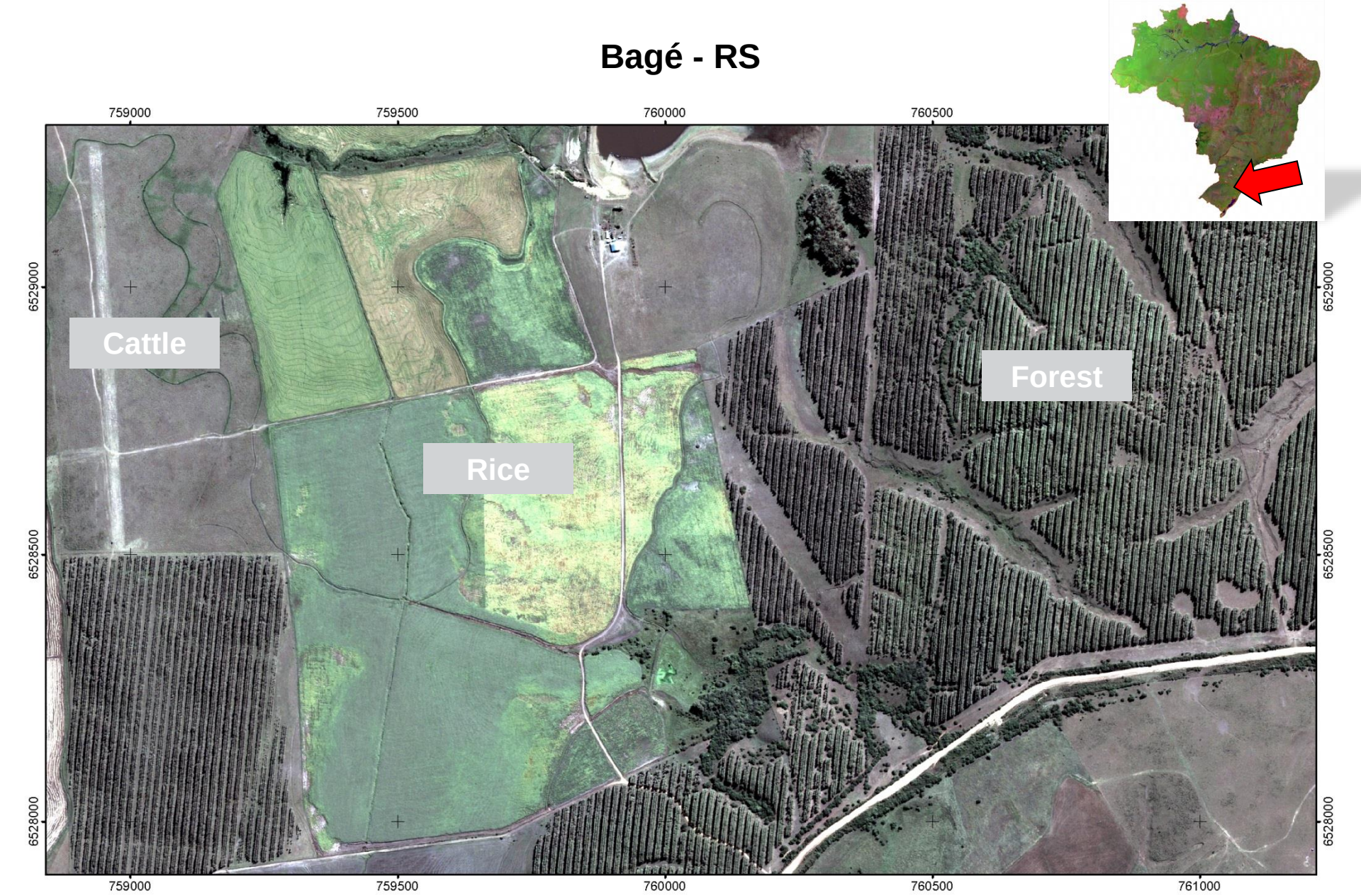
Challenge:
Brazilian Agricultural Mapping and Monitoring



Other institutions

Crops
70 Million
hectares

Bagé - RS



Fonte: imagem do satélite GeoEye-1
Data: 22 de março de 2011

Sistema de projeção UTM, zona 22S
Datum: WGS84

N

0 62.5 125 250 375 500
m

Bento Gonçalves - RS

Fonte: imagem do satélite GeoEye-1
Data: 31 de agosto de 2011

Sistema de projeção UTM, zona 22S
Datum: WGS84

N

0 62.5 125 250 375 500
m

Bagé - RS

Fonte: imagem do satélite GeoEye-1
Data: 27 de maio de 2011

Sistema de projeção UTM, zona 21S
Datum: WGS84

N

0 125 250 500 750 1 000
m

Londrina- PR

soybean

Área de Soja
Município: Londrina-PR
Imagem do satélite Quick Bird
26/02/2008

Ponta Grossa - PR

596000 596500 597000 597500

7218000

7217500

7217000

Soybean and Corn

596000 596500 597000 597500 598000

Fonte: imagem do satélite GeoEye-1
Data: 4 de abril de 2012

Sistema de projeção UTM, zona 22S
Datum: WGS84

N

0 62.5 125 250 375 500
m

SÃO LUIS DO PARAITINGA - SP

Fonte: Imagem de Satélite GeoEye-1
Data: 21/05/2011

Sistema de Projeção UTM, zona 23S
Datum: SAD69

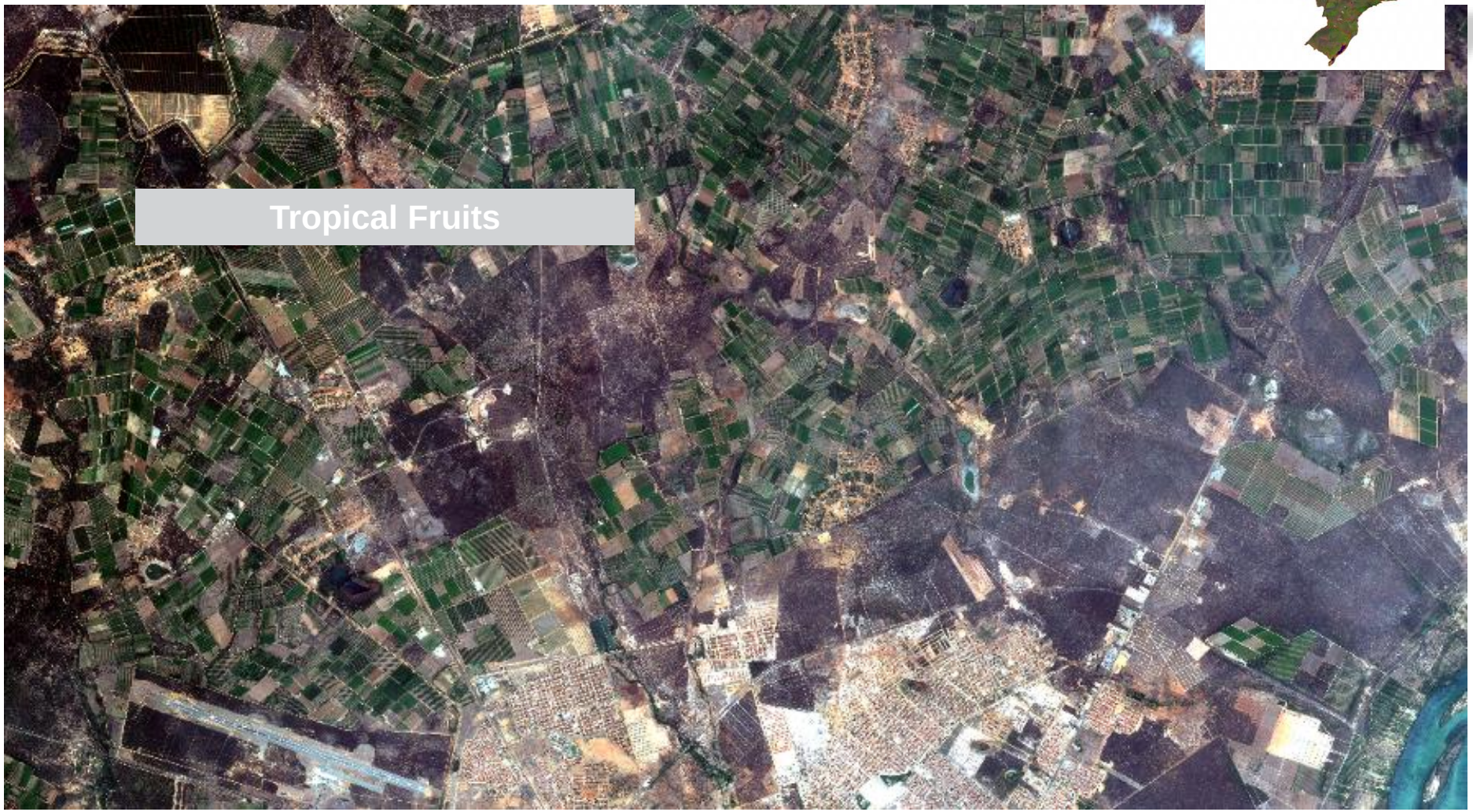
N

Cosmópolis - SP

Adolfo - SP

Campo Grande - MS

Petrolina - PE



Luiz Eduardo Magalhães - BA

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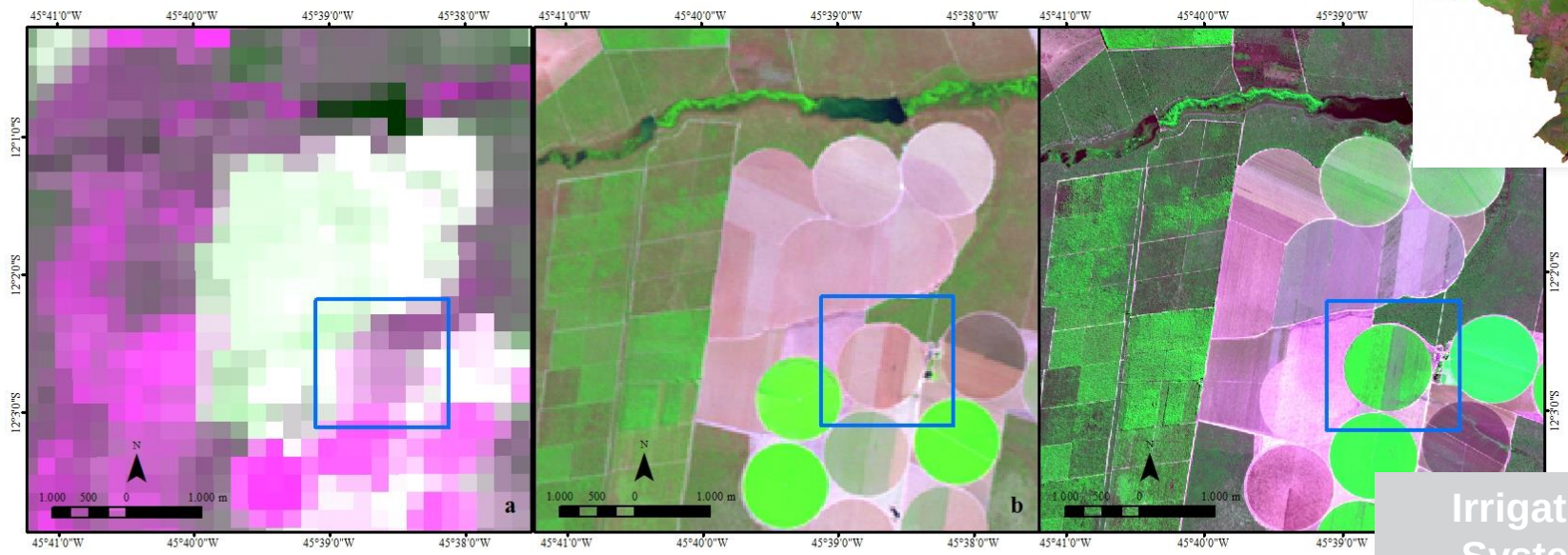
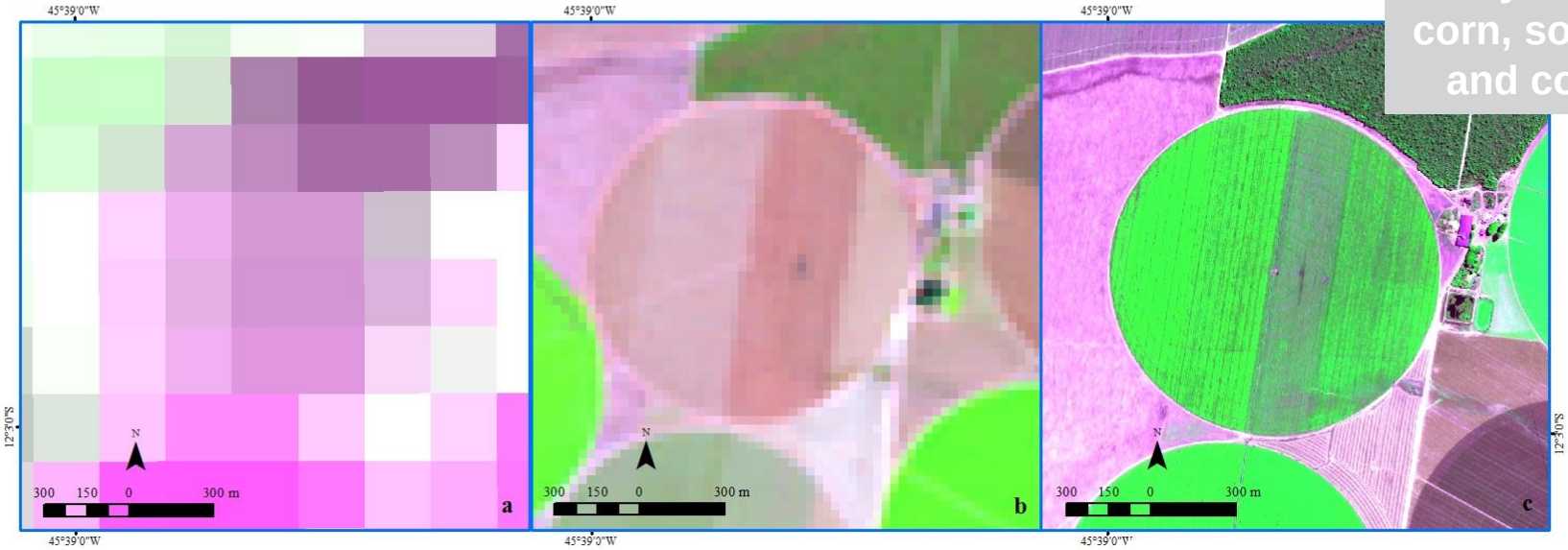




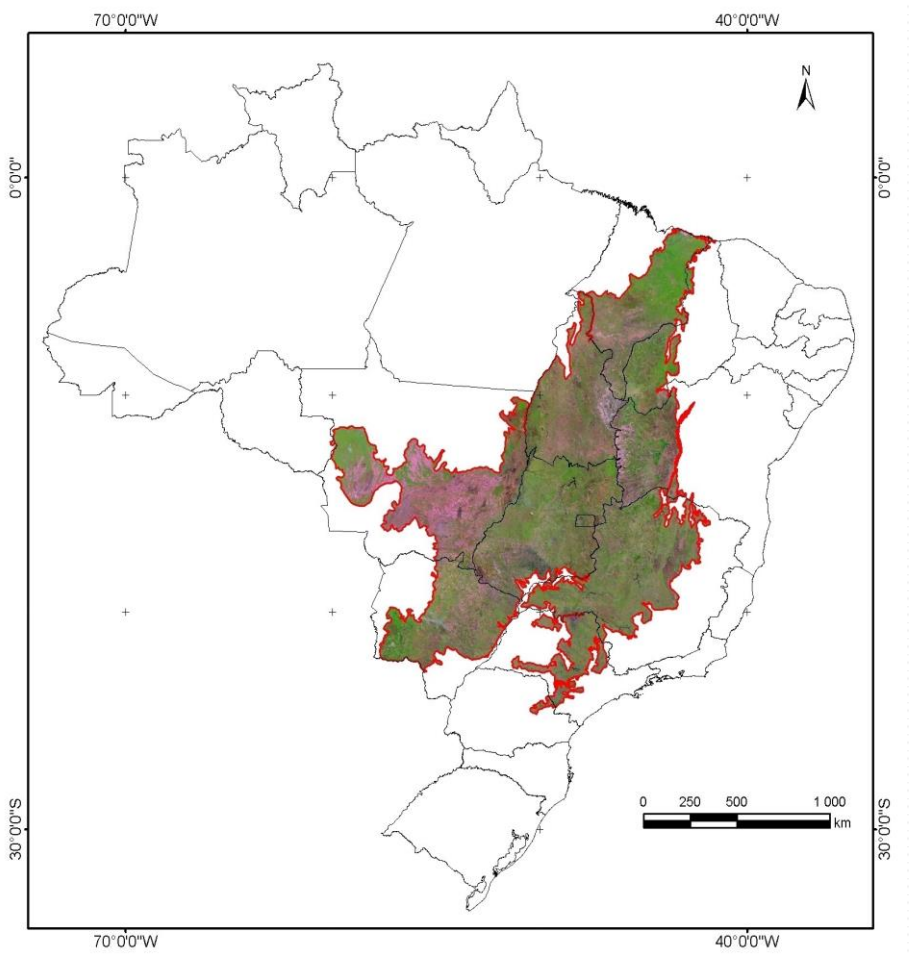
Irrigation System: corn, soybean and cotton

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

Land-use and land-cover mapping of the Brazilian Savanna based mainly on satellite images

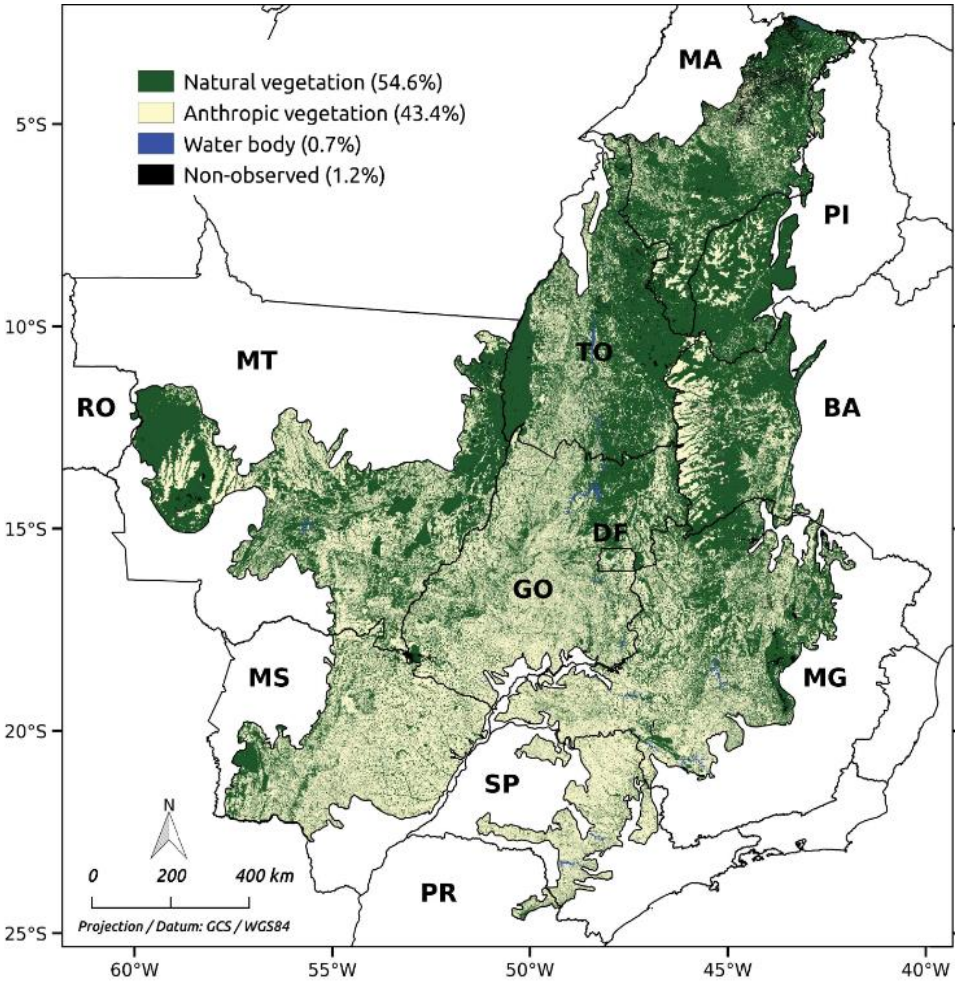
Scaramuzza, C.; Sano, E.; Adami; M.; Bolfe, E.; Coutinho; A. **Brazilian Journal of Cartography. v. 69, p. 1041-1051, 2017.** http://www.seer.ufu.br/index.php/revistabrasileiracartografia/article/view/44309/23391

- 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%



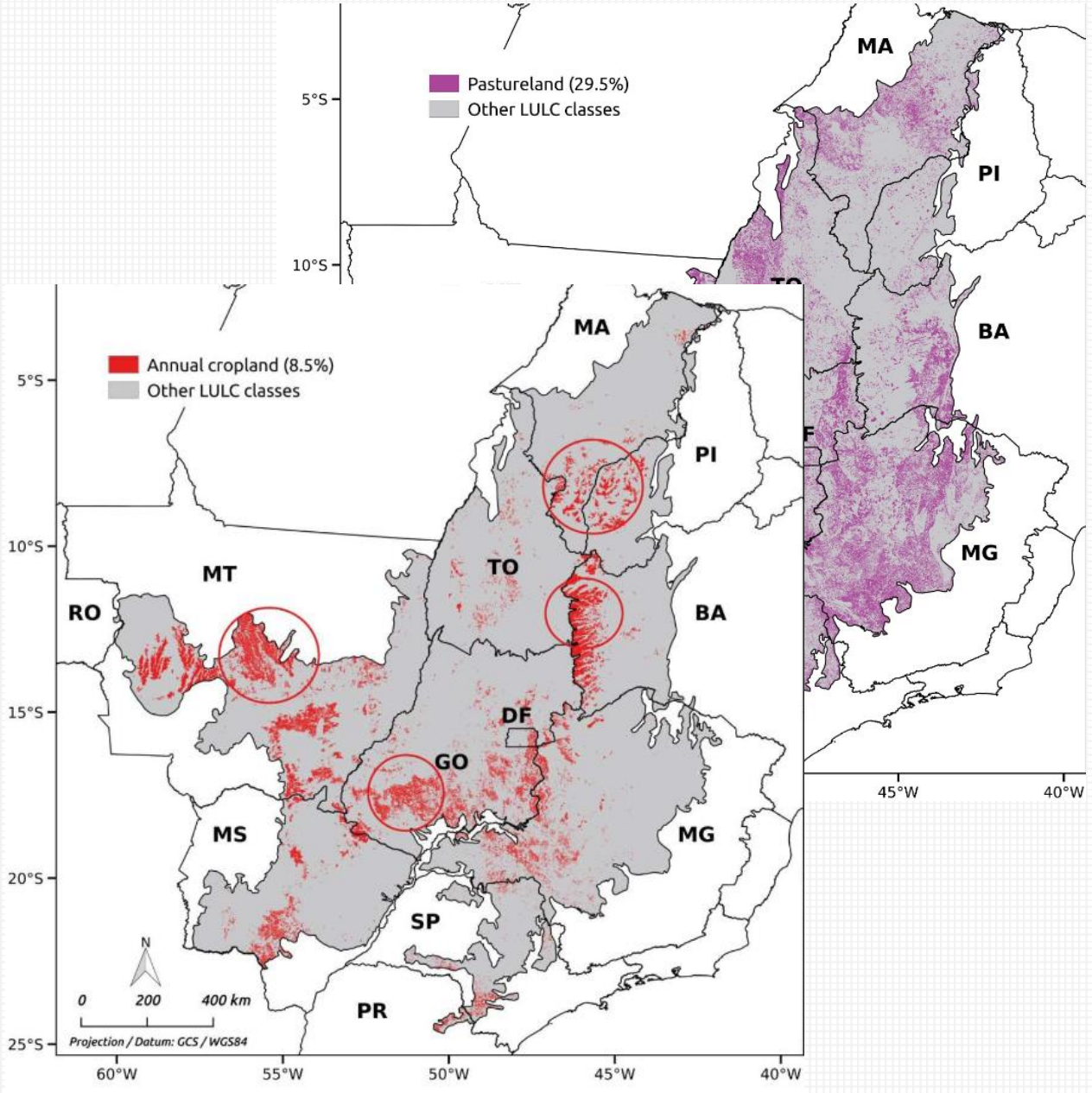
Land-use and land-cover mapping of the Brazilian Savanna based mainly on satellite images

- 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

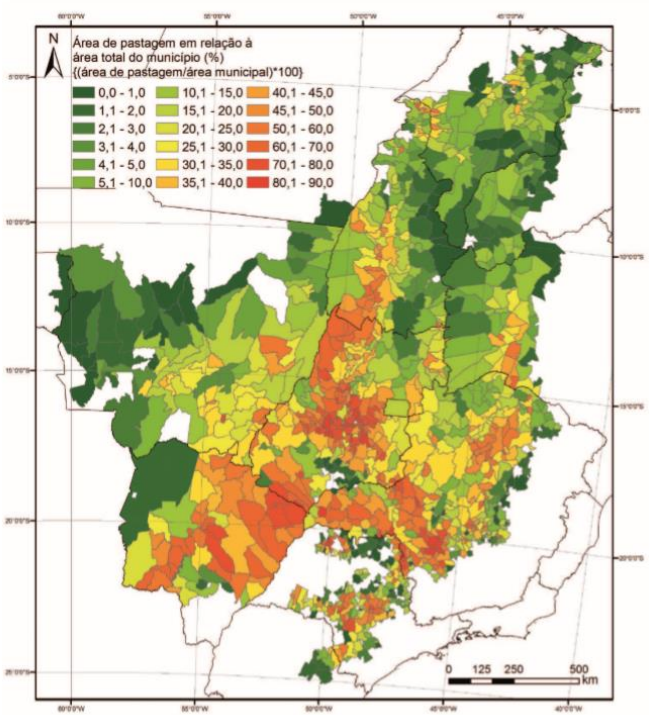
Andrade, R.; Bolfe, E.; Victoria, D.; Nogueira, S. **Brazilian Journal of Sustainable Agriculture**. v. 7, p. 34-41, 2017.

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

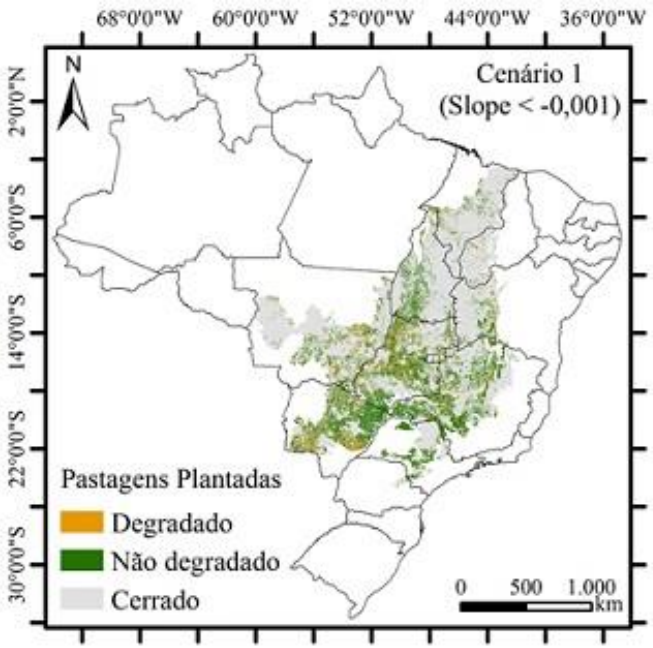
- Analyzes based on NDVI time-series(10 years) indicated that 173 municipalities have more than 50% of their pastures under some degradation process.

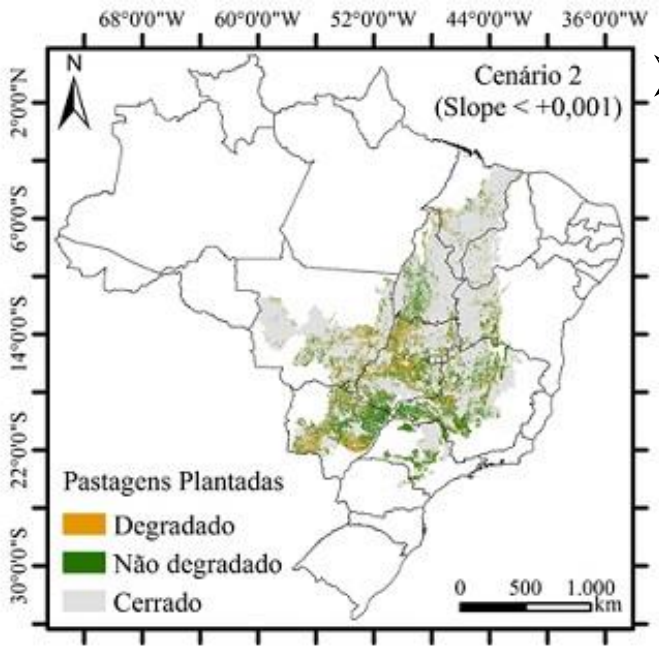
Degradation

No Degradation



Assessment of the pastures conditions in the Brazilian Savanna by means geotechnologies





	Pastagem degradada	
UF	Milhões de hectares	Porcentagem (%)
BA	0,55	25
DF	0,03	26
GO	3,46	27
MA	0,36	21
MG	2,05	18
MS	2,86	25
MT	2,04	32
PI	0,18	38
PR	0,02	19
SP	0,40	16
TO	0,53	13
Total	**12,49**	**24**

	Pastagem degradada	
UF	Milhões de hectares	Porcentagem (%)
BA	0,85	39
DF	0,04	37
GO	5,25	42
MA	0,66	37
MG	3,05	26
MS	3,98	35
MT	2,77	44
PI	0,24	48
PR	0,03	28
SP	0,58	23
TO	0,94	22
Total	**18,37**	**35**

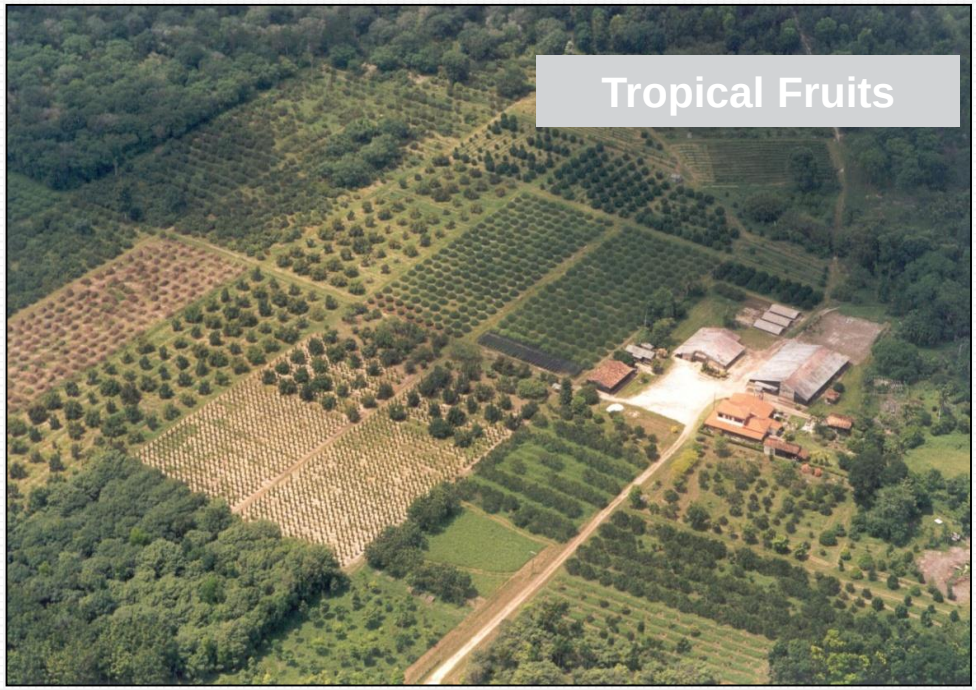
- In general, NDVI were relevant to methodologic application to evaluate the cultivated pastures conditions and the planning of public and private actions to pastures productive potential.

Modeling and mapping agroforestry aboveground biomass in the Brazilian Amazon using airborne lidar data

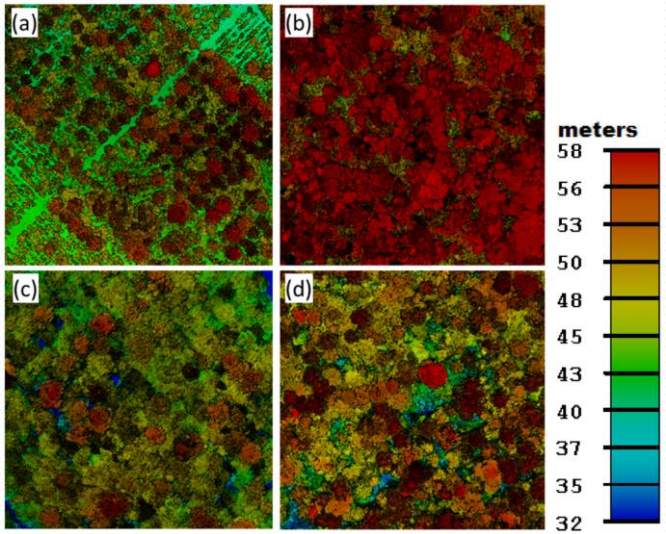
Chen, Q.; Lu, D.; Keller, M.; dos-Santos, M.; Bolfe, E.; Feng, Y.; Wang , C. **Remote Sensing**. v. 8, p. 21-36, 2016.
https://doi.org/10.3390/rs8010021

- 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.

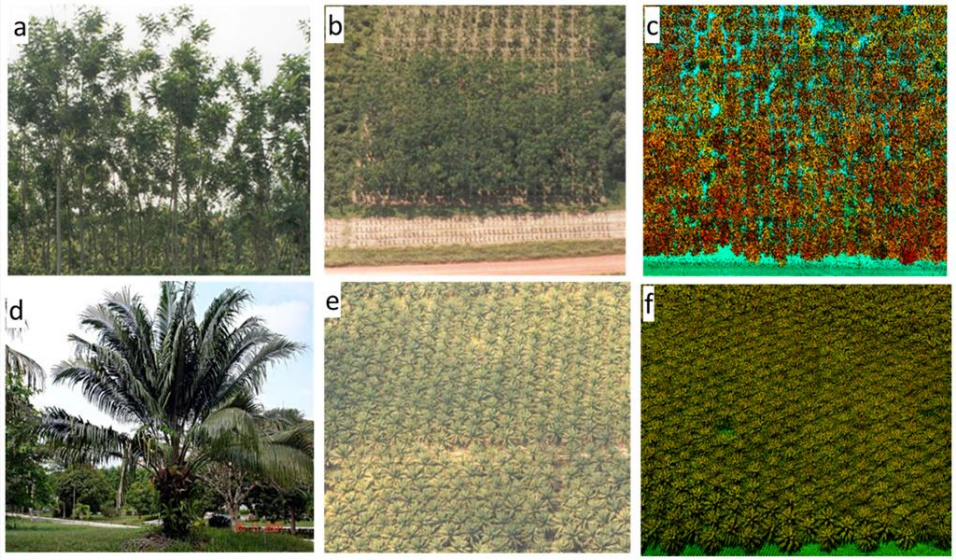


Modeling and mapping agroforestry aboveground biomass in the Brazilian Amazon using airborne lidar data

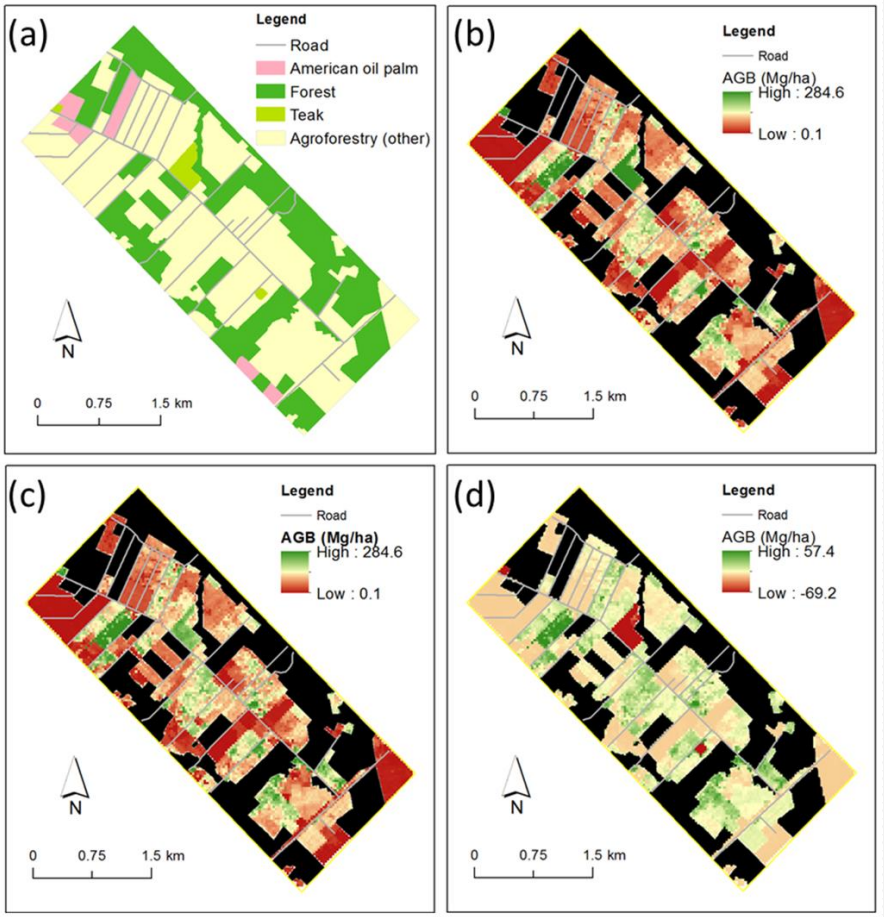


Airborne lidar. Color (from red to blue) represents the elevation of the laser points.

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 p



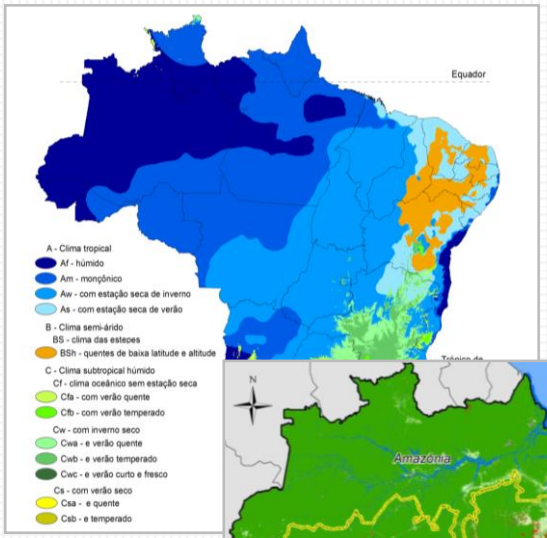
Teak plantations shown in the field (a); aerial photo (b); and lidar data (c); American oil palm sample tree (d); and plantation shown in aerial photos (e); and lidar data (f).

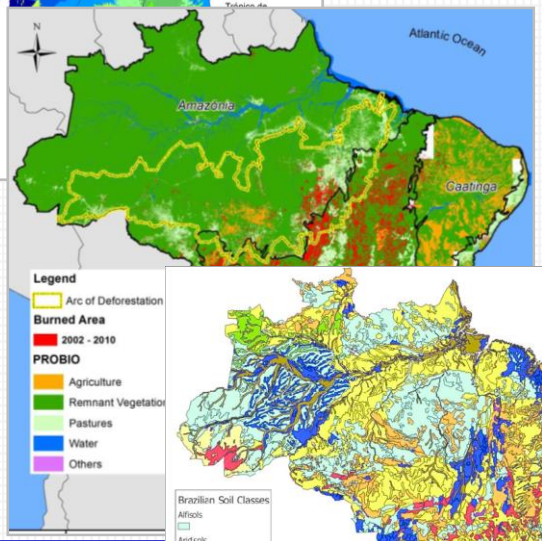


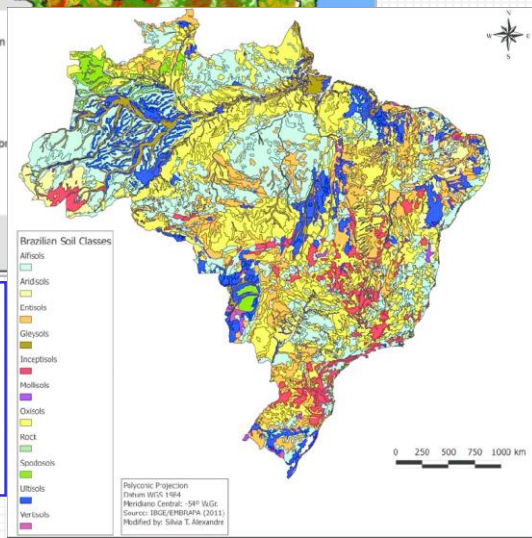
Maps of vegetation type (a); and AGB predicted with mixed-effects model (b); and fixed-effects model (c); and the difference between AGB predicted with fixed- and mixed-effects models (d). Black color indicates the area masked for analysis.

Rural development: the importance of geographical indications

Bolfe, E. & Sautier, D. **Agroanalysis**. v. 11, p. 32-34, 2018.
http://www.agroanalysis.com.br/storage/2018/11/index.html

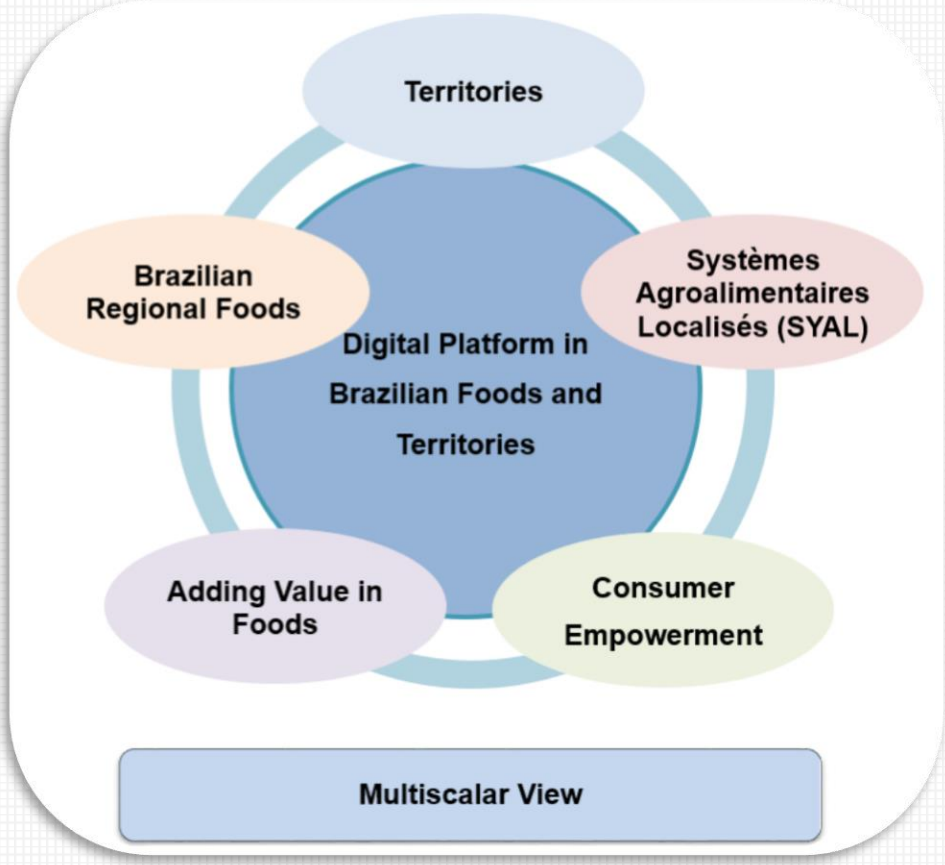


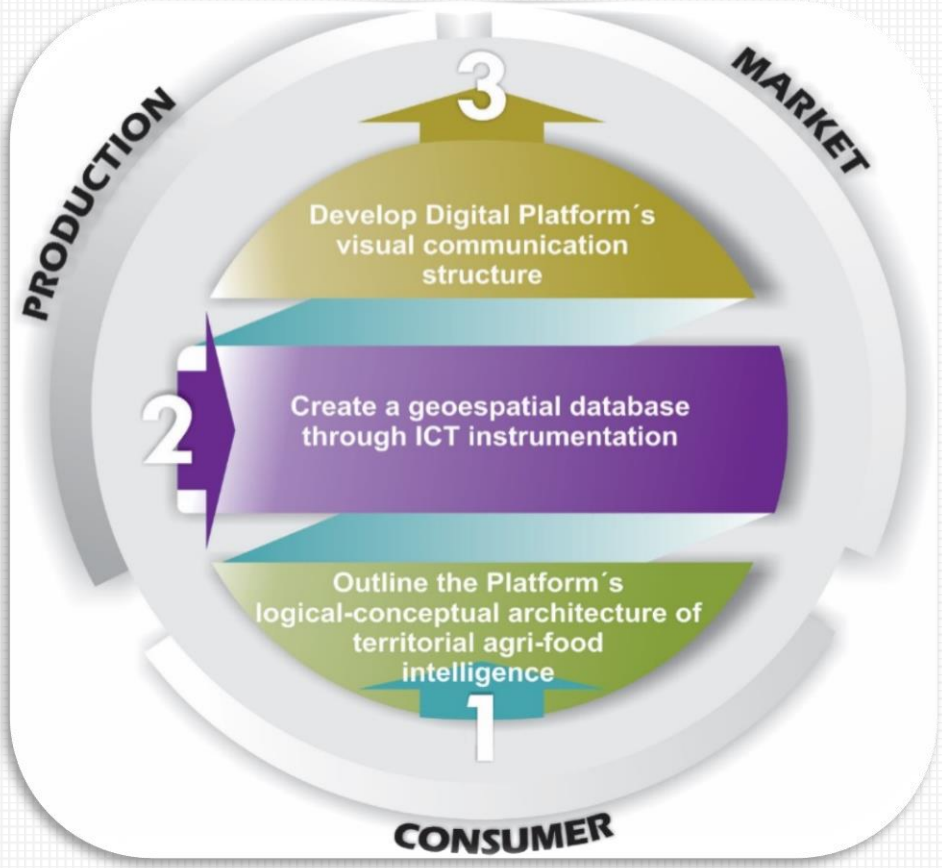




To increasing spatially explicit agri-food data and information digital access.

Rural development: the importance of geographical indications





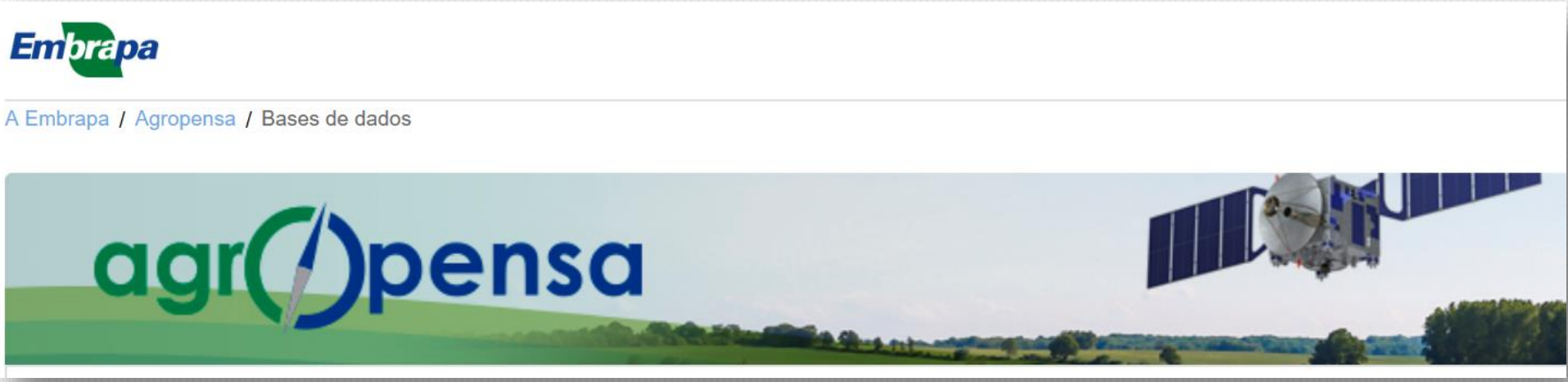
cirad
AGRICULTURAL RESEARCH FOR DEVELOPMENT

Embrapa

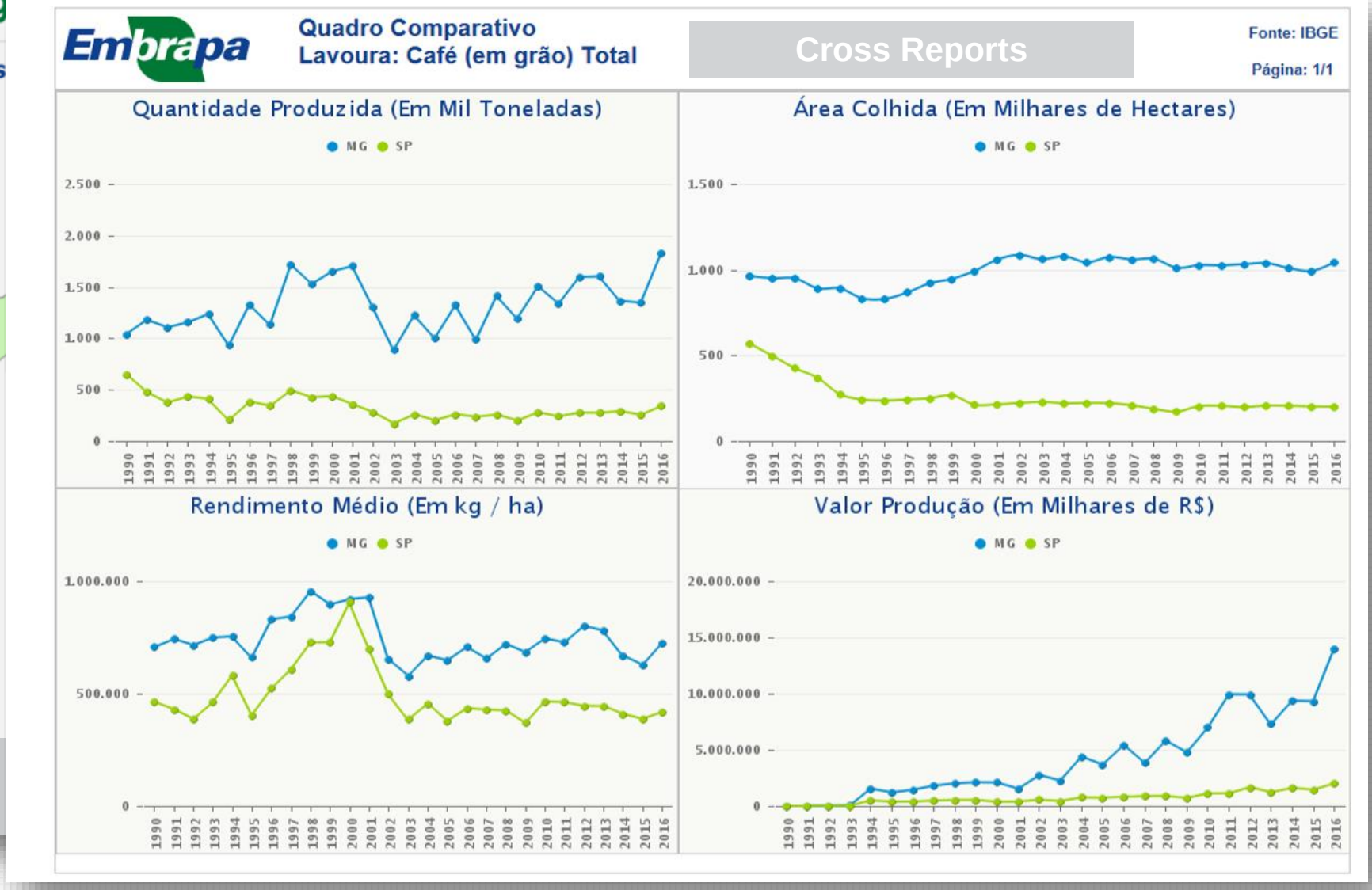
Brazilian agricultural geodatabase: strategic planning and development

Bolfe, E.; Pena Jr. M.; Contini, E;... **Brazilian Journal of Development**. v. 5, p. 201-214, 2019. http://brazilianjournals.com/index.php/BRJD/article/view/893

- 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



Final Consideratios

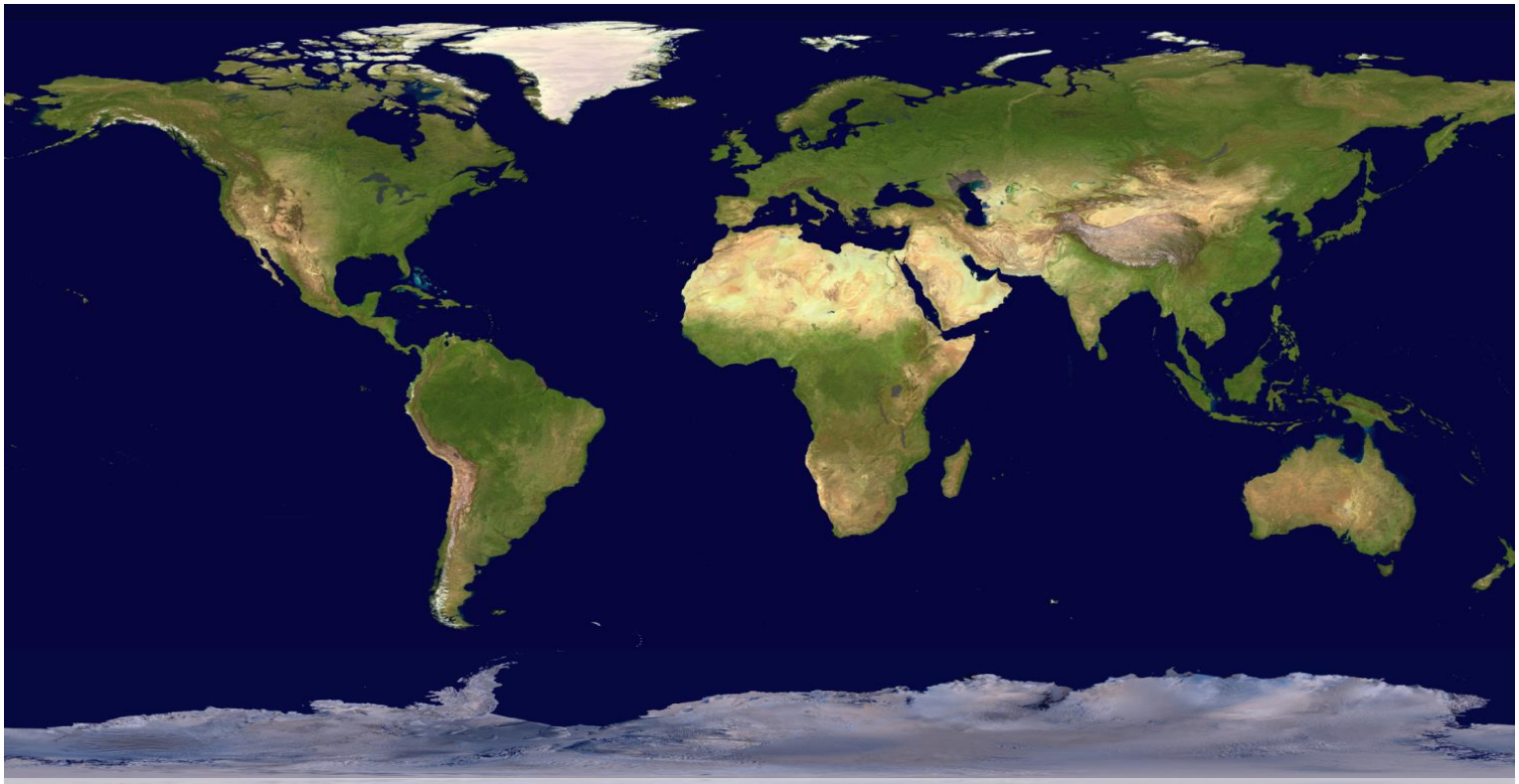
The results of these actions support public and private decision-making in rural planning and collaborate with the 17 Sustainable Development Goals. Highlighting:

- 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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