DigitalWorld 2017 International Expert Panel:

Contemporary Views: What are the Essences of Geospatial/Sensing Knowledge and Application Scenarios?

March 21, 2017, Nice, France

DigitalWorld / Ninth International Conference on Advanced Geographic Information Systems, Applications, and Services (GEOProcessing 2017)

GEOProcessing, ALLSENSORS, ICDS / DigitalWorld
March 19–23, 2017 - Nice, France

Digitalworld Expert Panel: . . . Contemporary Views . . .

Panelists

- *Claus-Peter Rückemann* (Moderator),
  Westfälische Wilhelms-Universität Münster (WWU) /
  Leibniz Universität Hannover /
  North-German Supercomputing Alliance (HLRN), Germany
- *Yerach Doytsher,*
  Technion - Israel Institute of Technology, Israel
- *Alexandre Corrêa da Silva,*
  HEX - Tecnologias Geoespaciais, Brazil
- *Hoyong Park,*
  Oracle, USA
- *Paulo E. Cruvinel,*
  Embrapa Instrumentation, Brazil
- *Claus-Peter Rückemann,*
  WWU Münster / Leibniz Universität Hannover / HLRN, Germany

DigitalWorld / GEOProcessing 2017:
`http://www.iaria.org/conferences2017/GEOProcessing17.html`
Program: `http://www.iaria.org/conferences2017/ProgramGEOProcessing17.html`

DigitalWorld Expert Panel: . . . Contemporary Views . . .

Panel Statements and Preview:

- **Scenario knowledge computing:**
  - **Essence:** Knowledge documentation and computation, long-term aspects, value of data.
  - **Long-term:** Data and knowledge should be preserved for long-term, > project intervals.
  - **Value of data:** A model of a currency will be beneficial.
- **Scenario crowdsourced data:**
  - New trend in spatial information: Crowdsourcing.
- **Scenario monitoring territory by Remote Sensing:**
  - Importance in monitoring territory.
  - Challenges encountered in monitoring territory.
  - Main technological solutions used so far.
- **Scenario smart city:**
  - Reduce volume of data appropriately for geostreaming in edge analytics.
  - Condense the data for some application.
  - Have processing/computing support for complex usecases.
- **Scenario agricultural information and food security:**
  - **Better** information and security.
  - **Institutionalise** interdisciplinary environment dedicated to analysis, research, innovation.
  - **Concept of value chain:** Improve productivity and sustainability.
  - Diverse levels of technology, heterogeneous production.
  - Either open-access policies for sharing geospatial information and technologies or even using those which are commercially available.

DigitalWorld Expert Panel: . . . Contemporary Views . . .

Pre-Discussion-Wrapup:

- **Scenarios:** From fundamental research, natural sciences, geosciences, spatial sciences, . . . to smart cities, crowd mobility, urban services, monitoring entities.
- **Values:** Knowledge, data, transfer, workflows, algorithms, procedures.
- **Essences:** Everything preserving values/potential (for new insights, applications, . . .).
- **Focus:** What are the essences/common most important aspects/. . .?
- **Context:** Who is involved in geosciences/sensing/society?
- **Special conditions:** Different academia/industry applications/views?
- **What:** . . . (sources, workflows, results, . . .) to preserve persistently?
- **Means:** Which means (data, knowledge resources, algorithms, hardware, . . .) are available/required?
- **Value:** What is the relation between essences and values?
- **Recommendations:** Which general and special recommendations?
- **Networking:** Discussion! Open Questions?

  Suggestions for next Expert Panel?

DigitalWorld Expert Panel: Conclusions / Post-Panel-Discussion Summary

Post-Panel-Discussion Summary (2017-03-22):

Resulting from the discussed topics, the essences of geospatial and sensing knowledge and application scenarios are focussing on data, information, knowledge, advanced documentation and deployment, especially:

- **Crowdsourced data:** Data and information are becoming increasingly important. One of the most significant paradigms today is crowdsourcing, e.g., OpenStreetMap. (Doytsher)
- **Edge analytics:** As crowdsourced data becomes a popular choice for many application scenarios, the role of edge analytics becomes important not just for data processing but also for the privacy and security perspective. (Park)
- **Integration:** Stakeholder integration is needed in the form of active participation, citizens, customers, companies, governments, ... to ensure the development of better solutions with higher impact on social and environmental issues. (da Silva)
- **Security and data:** Data, security, and safety are essential, e.g., food security, safety, risk control. (Cruvinel)
- **Knowledge documentation / computation:** Essential are knowledge (factual, conceptual, metacognitive, procedural), education on integration of precise sciences and data science, documentation (manual, automated, audited, ...), e.g., long-term and multi-disciplinary knowledge resources. (Rückemann)

DigitalWorld Expert Panel: Table of Presentations, Attached

Panelist Presentations: (presentation order, following pages)

- **Precise Sciences and Data Science: Application and Knowledge** (*Rückemann*)
- **New Trends in Spatial Information: The Era of Geo-Spatial Crowdsourcing** (*Doytsher*)
- **Challenges in Monitoring Brazilian Territory by Remote Sensing** (*Corrêa da Silva*)
- **Geostreaming in Edge Analytics in the context of Smart City** (*Park*)
- **Importance and Essences of Geospatial/Sensing Knowledge for Global Food Security** (*Cruvinel*)

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Contemporary Views: What are the Essences of Geospatial/Sensing Knowledge and Application Scenarios?

Precise Sciences and Data Science: Application and Knowledge

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Westfälische Wilhelms-Universität Münster

GEXI

ACT MAP

Knowledge computing and application

- **Value of applications is in focus. Data is ‘Big’.**
- **Contributions:** Client and producer.
- **Consequence:** Applications are developed, data is a stepchild.
- **Complexity:** . . . something no contributor wants.
- **Value:** . . . something, which made economic benefit.
- **Essences:** Commonly little thought about.
- **Scenario range:** Fundamental research, natural sciences – geosciences, spatial sciences, to smart cities, crowd mobility, urban services, monitoring entities . . .

Knowledge and applications and how they manifest:

- **Knowledge and applications:** ...
  factual knowledge, conceptual knowledge, procedural knowledge, metacognitive knowledge and **implementations**.

Vision of understanding:

- **Contributions:** Scientific research, natural sciences, knowledge resources, ...
- **Contributors/roles:** Fundamental researchers, infrastructure providers, service providers, long-term documentation, research data management, ...
- **Consequence:** Integration of precise sciences and data science.
- **Complexity:** ... is potential value.
- **Values:** Knowledge, data, transfer, workflows, algorithms, and procedures:
- **Essences:** Everything preserving values/potential (for insights, applications, ...).
- **Scenario knowledge computing, essence:** Knowledge documentation and computation, long-term aspects, and value of data.

Vision ... regarding essences of knowledge computing and application

- **Understanding:** The complementary nature of precise sciences and data science.
- **Defining:** Data, knowledge, ...
- **Implementing:** Applications based on appropriate means and measures.
- **Preserving:** Essential data, knowledge, and value (for long-term).

Defining knowledge (Summit delegates and contributors)

- "**Knowledge** is created from a subjective combination of different attainments as there are intuition, experience, information, education, decision, power of persuasion and so on, which are selected, compared and balanced against each other, which are transformed, interpreted, and used in reasoning, also to infer further knowledge. Therefore, not all the knowledge can be explicitly formalised. Knowledge and content are multi- and inter-disciplinary long-term targets and values. In practice, powerful and secure information technology can support knowledge-based works and values."

Citation: *Rückemann, C.-P., Gersbeck-Schierholz, B., and Hülsmann, F., Przemysław Skurowski, Michał Staniszewski (2015): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Knowledge and Computing; September 23, 2015, The Fifth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 13th International Conference of Numerical Analysis and Applied Mathematics (ICNAAM), September 23–29, 2015, Rhodes, Greece.*

Delegates and contributors: *Claus-Peter Rückemann, Friedrich Hülsmann, Birgit Gersbeck-Schierholz, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany;Przemysław Skurowski, Michał Staniszewski, Silesian University of Technology, Gliwice, Poland; International EULISP post-graduate participants, ISSC, European Legal Informatics Study Programme, Leibniz Universität Hannover, Germany*

Defining data-centric and Big Data (Summit delegates and contributors)

- **"The term data-centric refers to a focus, in which data is most relevant in context with a purpose. Data structuring, data shaping, and long-term aspects are important concerns. Data-centricity concentrates on data-based content and is beneficial for information and knowledge and for emphasizing their value. Technical implementations need to consider distributed data, non-distributed data, and data locality and enable advanced data handling and analysis. Implementations should support separating data from technical implementations as far as possible."**
- **"The term Big Data refers to data of size and/or complexity at the upper limit of what is currently feasible to be handled with storage and computing installations. Big Data can be structured and unstructured. Data use with associated application scenarios can be categorised by volume, velocity, variability, vitality, veracity, value, etc. Driving forces in context with Big Data are advanced data analysis and insight. Disciplines have to define their 'currency' when advancing from Big Data to Value Data."**

Citation: *Rückemann, C.-P., Kovacheva, Z., Schubert, L., Lishchuk, I., Gersbeck-Schierholz, B., and Hülsmann, F. (2016): Post-Summit Results, Delegates' Summit: Best Practice and Definitions of Data-centric and Big Data – Science, Society, Law, Industry, and Engineering; Sep. 19, 2016, The Sixth Symposium on Advanced Computation and Information in Natural and Applied Sciences (SACINAS), The 14th Internat. Conf. of Numerical Analysis and Applied Mathematics (ICNAAM), Sep. 19–25, 2016, Rhodes, Greece.*

Delegates and contributors: *Claus-Peter Rückemann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany;Zlatinka Kovacheva, Middle East College, Department of Mathematics and Applied Sciences, Muscat, Oman; Lutz Schubert, University of Ulm, Germany; Iryna Lishchuk, Leibniz Universität Hannover, Institut für Rechtsinformatik, Germany; Birgit Gersbeck-Schierholz, Friedrich Hülsmann, Knowledge in Motion / Unabhängiges Deutsches Institut für Multi-disziplinäre Forschung (DIMF), Germany*

Implementing and keeping: Which data to keep, by which means?

- Publication and dissemination (Golden Open Access, ...),
- Knowledge resources (knowledge, collections, containers, references, classification, ...) including
- media sources,
- program sources,
- publications,
- realia, ...,
- via long-term means, Universal Decimal Classification (UDC), Unified Modeling Language (UML), Knowledge discovery, High End Computing, ...

Who?

- Project funding organisations, organisations affiliated with partnership/research/collaboration, organisations specialised on knowledge preservation, researchers, creators, ...

Conclusions:

- **Knowledge, data, transfer, workflows, and procedures should be understood and defined.**
- **Data and knowledge should be preserved for long-term, longer than project intervals.**
- **Implementations should consider knowledge-appropriate means and measures.**
- **Education on "integration" of precise sciences and data science is required.**
- **A currency model is beneficial for data / knowledge and application.**

Thank you for your attention!

Wish you an inspiring conference and a pleasant stay in Nice!

New Trends in Spatial Information: The Era of Geo-Spatial Crowdsourcing

Prof. Dr. Yerach Doytsher

Mapping and Geo-Information Engineering,
Technion, Israel

Crowdsourcing

Different definitions of the term:

- ✓ "***Taking a job traditionally performed by a designated <u>agent</u> and outsourcing it to an undefined, generally large group of people***" **(Howe, 2006)**

- ✓ "***The practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers***" **(Merriam-Webster online dictionary, 2014)**

Crowdsourcing

More definitions:

- ✓ "*Can be explained through a theory of crowd wisdom, an exercise of collective intelligence… It is a model capable of aggregating talent, leveraging ingenuity… crowdsourcing is enabled only through the technology of the web*" **(Brabham, 2008).**

- ✓ "*A type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge…*" **(Estelles-Arolas and Gonzalez-Ladron-de-Guevara, 2012).**

Crowdsourcing

Areas of Crowdsourcing

- Crowdsourcing range across fields as diverse as popular as:
  - Culture,
  - Psychology,
  - Biology,
  - Behavioral economics,
  - Artificial intelligence,
  - Social sciences,
  - Military,
  - History,
  - Politics,
  - Computing
- It is one of the most significant paradigms exists today

Geo-Spatial Crowdsourcing

- **In the mapping and geo-information disciplines:**
  - Crowdsourcing refers to a large group of people that can substitute surveying experts and professional cartographers in their mapping tasks by contributing user-generated geographic content, e.g., location data and information
  - Replacing an expert by the layman (the non-professional people)
- **Replacing the existing top-down system with a bottom-up one**
- **Leads to increasing numbers of location based projects, applications and services**

OpenStreetMap (OSM)

- One of the most promising Volunteered Geographic Information (VGI) projects
- Contributing groups or volunteers update the geo-spatial database of this on-line open-source map with new and updated geographic content
- Data is easily edited and downloaded, whereas open-source codes are provided to process and analyze the existing mapping data

OpenStreetMap (OSM)

Numbers:

- No. of registered OSM members is more than 3.5 million
- No. of active members last month – close to 41,300
- No. of OSM Nodes in the database – near 3.8 billion
- Nodes created daily – more than 1.5 million
- No. of OSM Ways in the database – 0.4 billion
- Ways created daily – approximately 200,000

* Statistics from http://osmstats.neis-one.org

Thank You

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Challenges in monitoring Brazilian territory by remote sensing

Alexandre Corrêa da Silva

Introduction

Importance

- National security
- Decision making assistance for actions of environmental control and protection
- Ensure sustainable use of the natural resources

Technological

- Data complexity for automated processes (bioma – seasonality - flooding)
- Low internet capacity (Images acquisition)
- High indcidence of clouds in the Brazilian Amazônia Legal

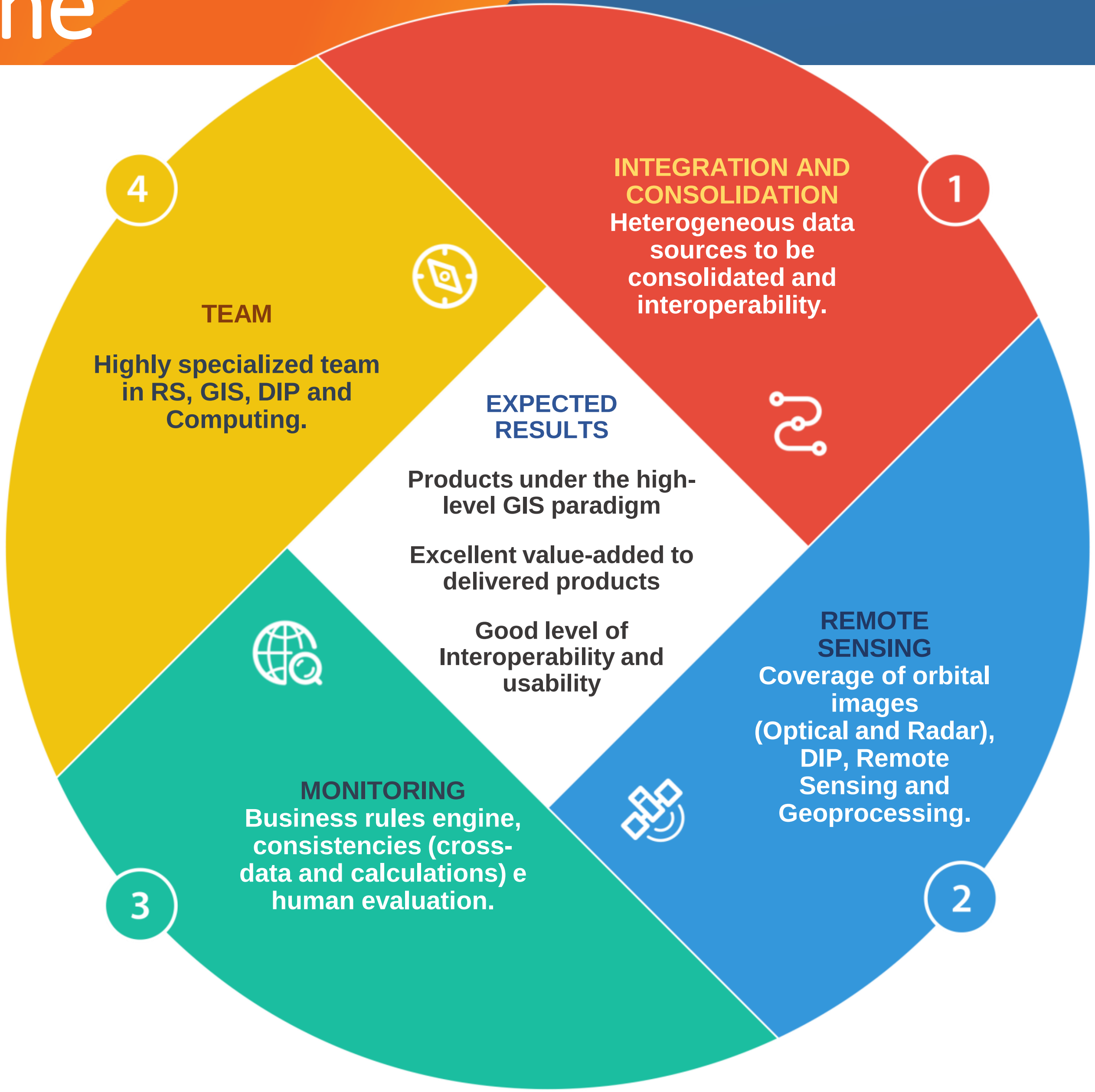
Physical

- Brazilian territorial Area 8.515.767,049 km² (IBGE)
- 603 Indigenous lands in Brazil

Solutions

- Geoserver
- Spatial Database
- Digital image processing (DIP) – Harpia
- Fusion of images by subdivision
- Collaborative Open-Source Technologies in GIS
- Landsat and Sentinel image Catalog
- Correlation between data from different sources

HEX Baseline



IBAMA

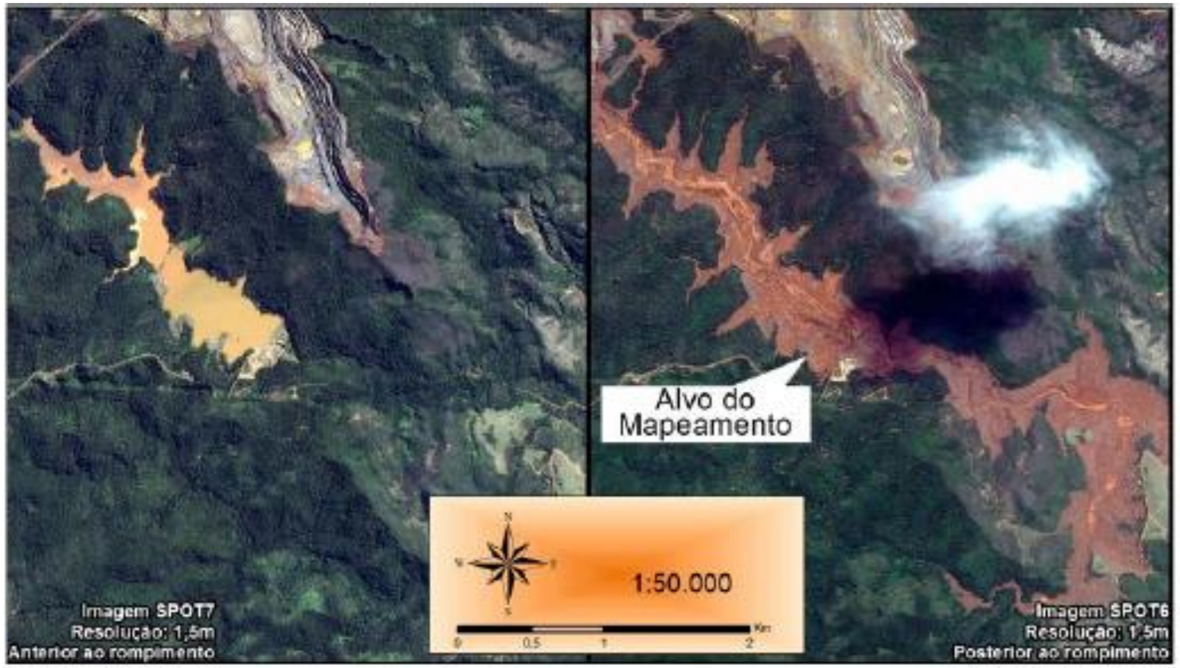


Figura 7 – Comparação entre os dois tempos de análise, antes e após o evento. Na imagem à direita: resíduos da mineração - alvo do mapeamento

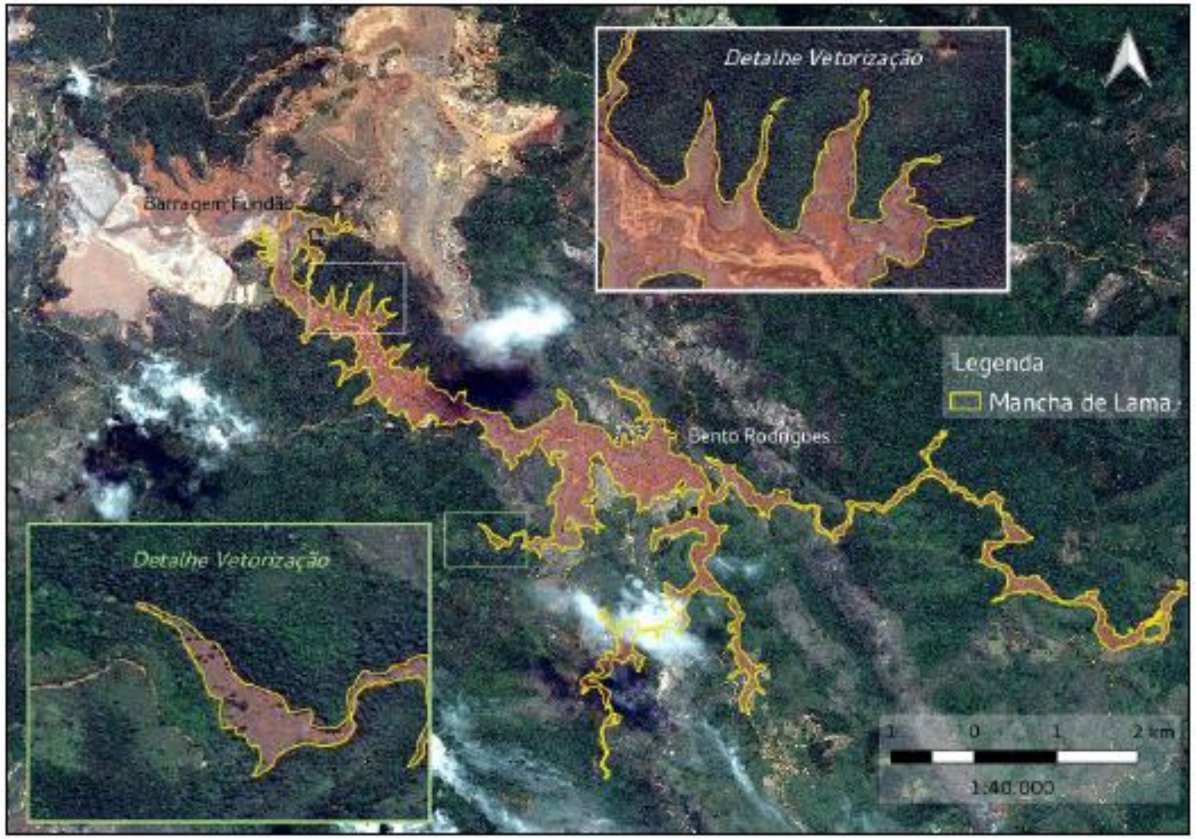
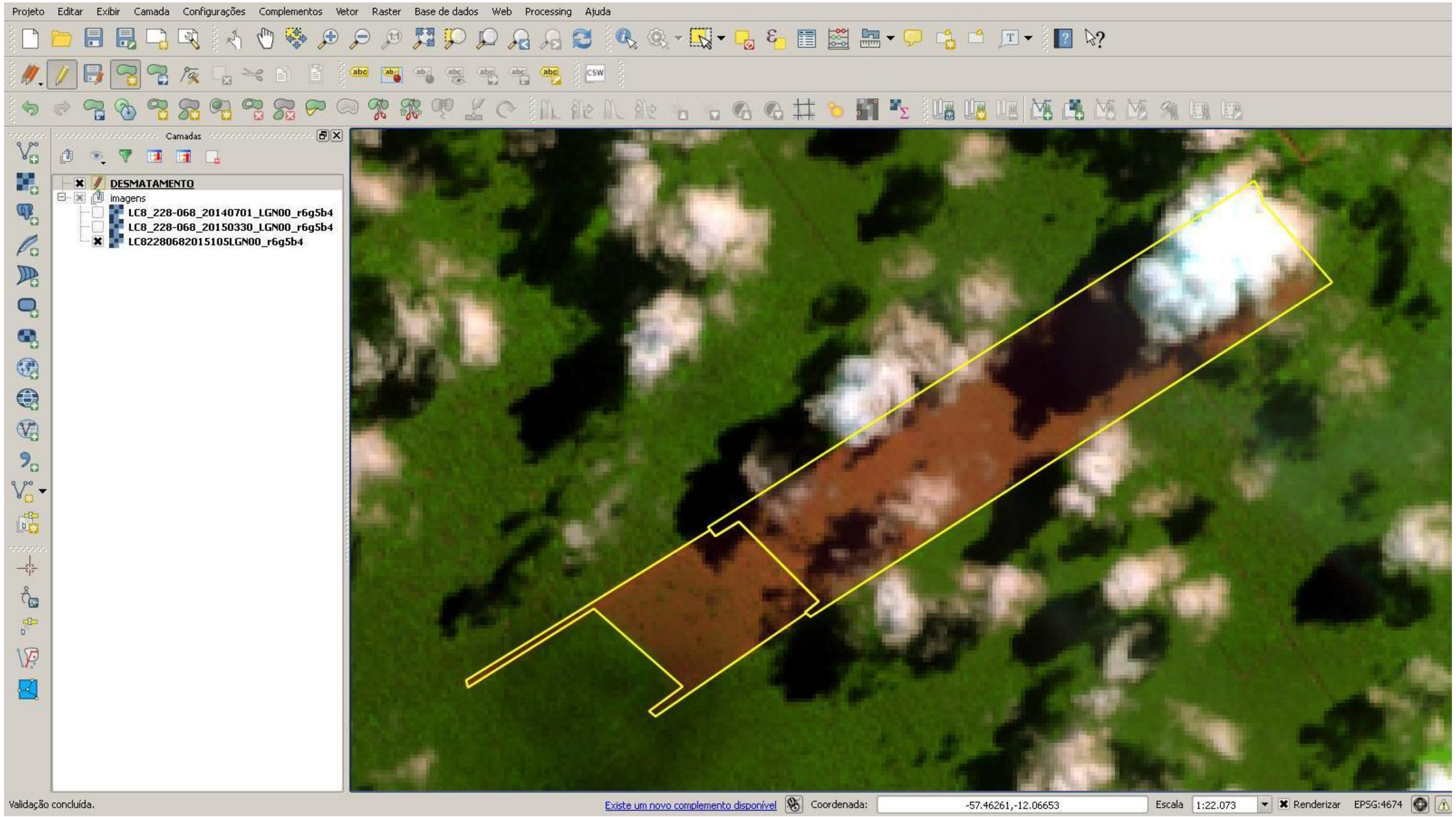


Imagem Spot-6 composição RGB cor natural - 06/11/2015.

Figura 9 - Trecho afetado pela massa de rejeitos de mineração, destacando a precisão da vetorização. Ao centro, encontra-se o povoado de Bento Rodrigues quase totalmente encoberto pela lama.

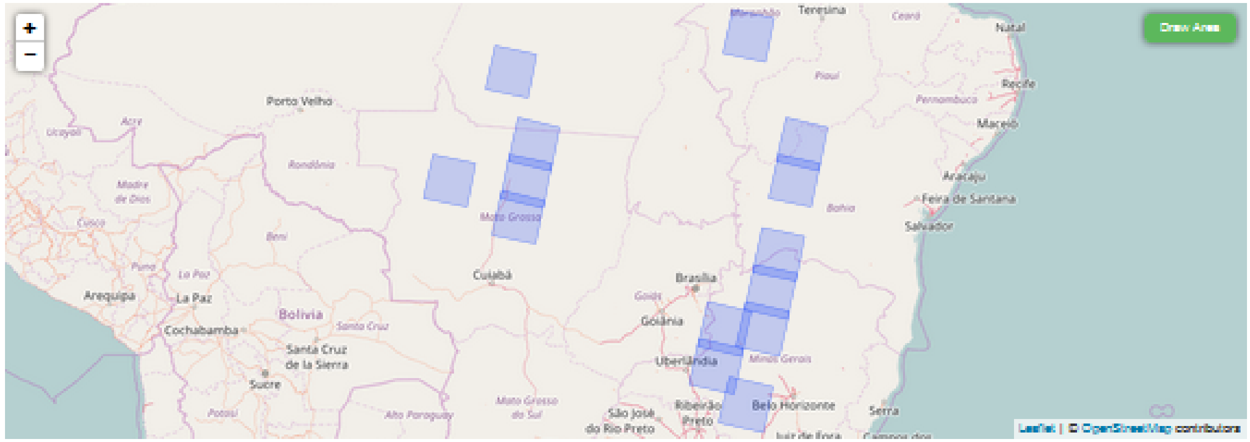
IBAMA – Indicar Landsat



Automated processes

harpia | Catálogo Landsat | Catálogo Sentinel | Recursos | Entrar

Catálogo Landsat



Filtrar Cenas | Pesquisar

Cena	Satélite	Taxa de Nuvens	Data	Status
LC80010632017072LGN00	Landsat 8	92,27%	13/03/2017	Processada
LC80010642017072LGN00	Landsat 8	90,69%	13/03/2017	Processada
LC80010652017072LGN00	Landsat 8	83,81%	13/03/2017	Processada
LC80010662017072LGN00	Landsat 8	69,79%	13/03/2017	Processada
LC80010672017072LGN00	Landsat 8	65,62%	13/03/2017	Processada
LC80010682017072LGN00	Landsat 8	67,6%	13/03/2017	Processada
LC82200722017070LGN00	Landsat 8	0,43%	11/03/2017	Processada
LC82190682017063LGN00	Landsat 8	0,07%	04/03/2017	Processada

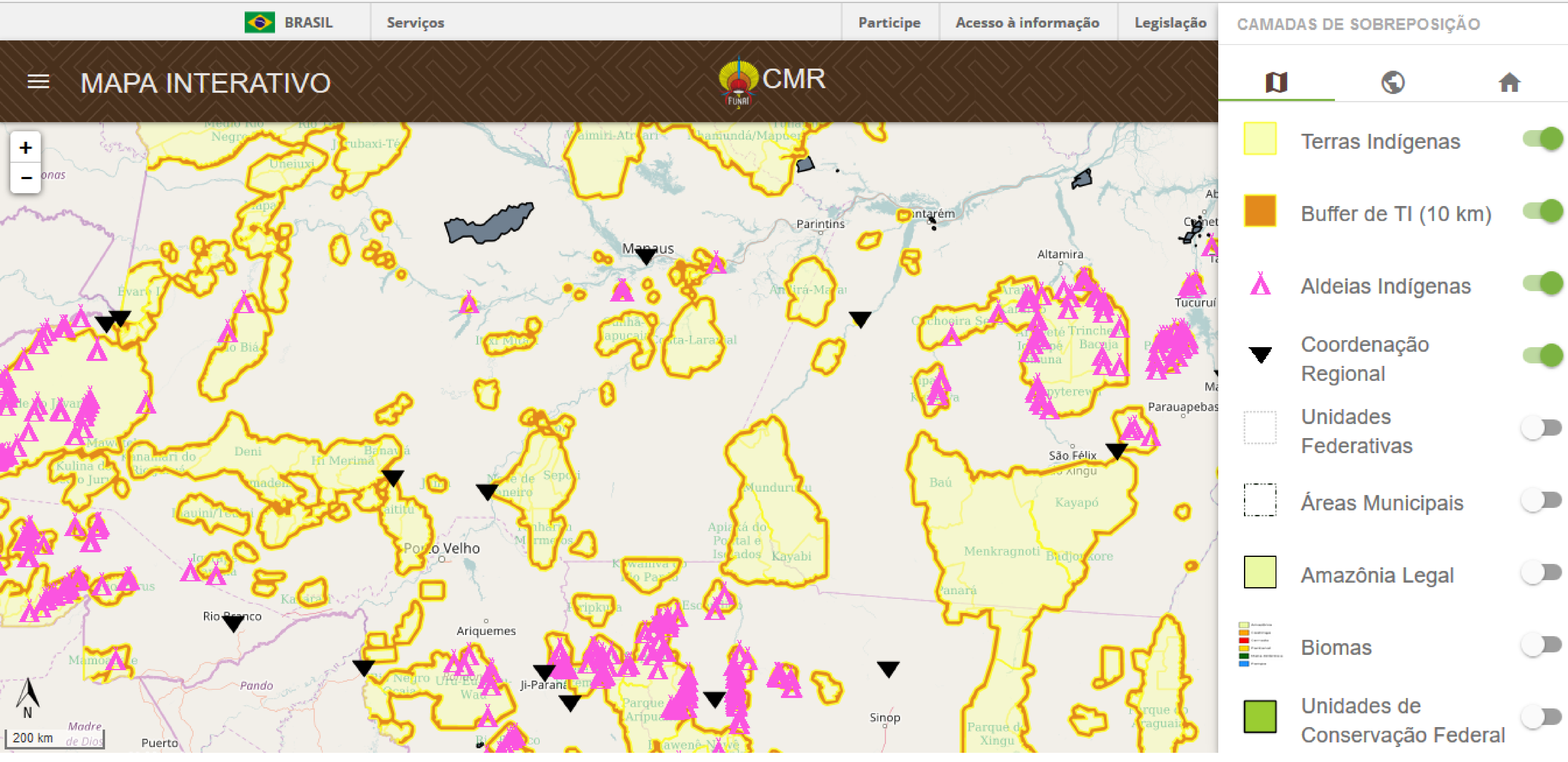
harpia | Catálogo Landsat | Entrar

Catálogo Landsat

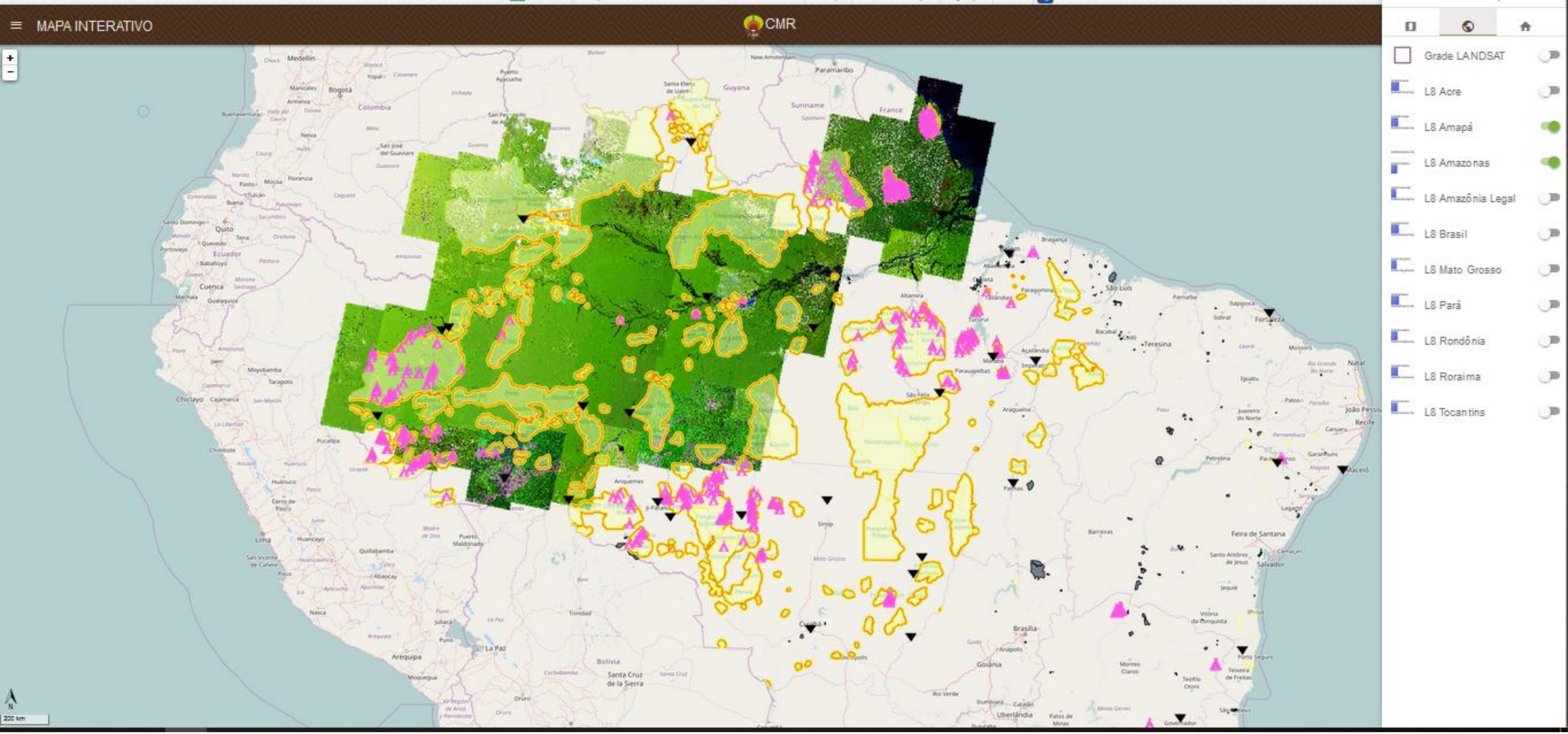
Filtrar Cenas | Buscar

Cena	Satélite	Taxa de Nuvens	Data	Status
LC82230632017075LGN00	Landsat 8	81,44%	16/03/2017	Processada
LC82230642017075LGN00	Landsat 8	82,04%	16/03/2017	Processada
LC82230652017075LGN00	Landsat 8	55,65%	16/03/2017	Processada
LC82230662017075LGN00	Landsat 8	34,32%	16/03/2017	Processada
LC82250622017073LGN00	Landsat 8	90,6%	14/03/2017	Processada
LC82250632017073LGN00	Landsat 8	92,05%	14/03/2017	Processada
LC82250642017073LGN00	Landsat 8	72,34%	14/03/2017	Processada
LC82250652017073LGN00	Landsat 8	72,86%	14/03/2017	Processada

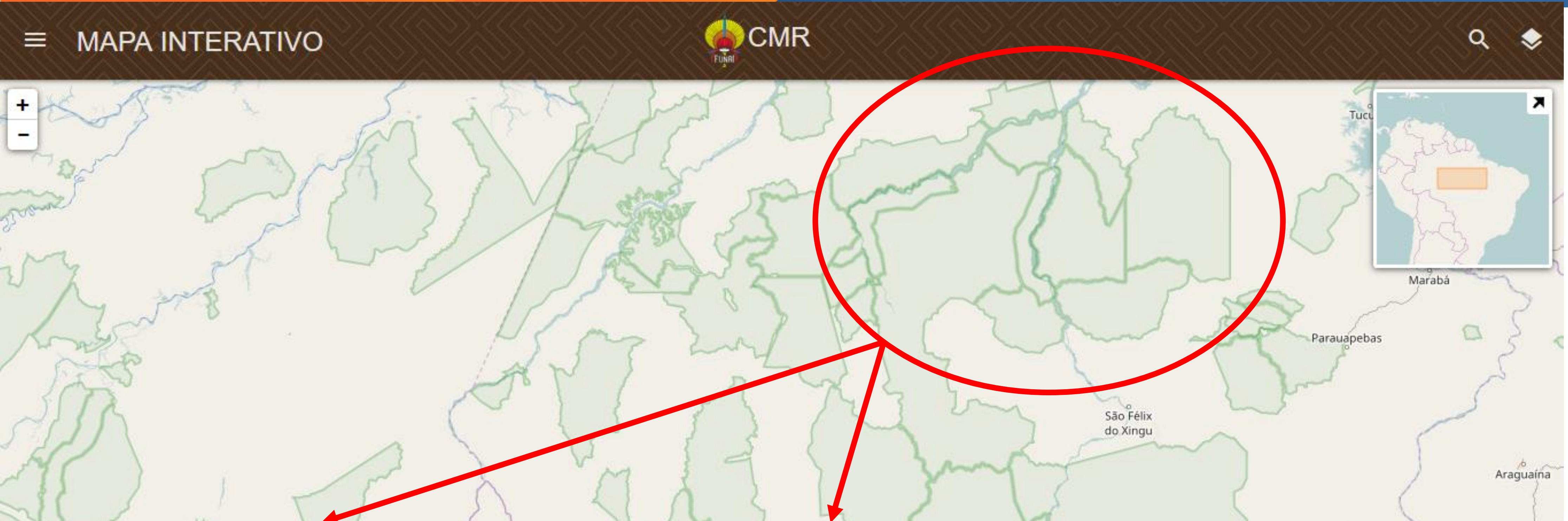
Funai – CMR (cmr.funai.gov.br)



Funai – CMR


MAPA INTERATIVO
CMR
Grade LANDSAT
L8 Acre
L8 Amapá
L8 Amazonas
L8 Amazônia Legal
L8 Brasil
L8 Mato Grosso
L8 Pará
L8 Rondônia
L8 Roraima
L8 Tocantins
Colombia
Guyana
Suriname
France
Ecuador
Bolivia
Medellín
Bogotá
Quito
Paramaribo
Teresina
Feira de Santana
Salvador
Brasília
Goiânia
La Paz
Arequipa
Santa Cruz de la Sierra
Cuenca
200 km

Funai – CMR


MAPA INTERATIVO
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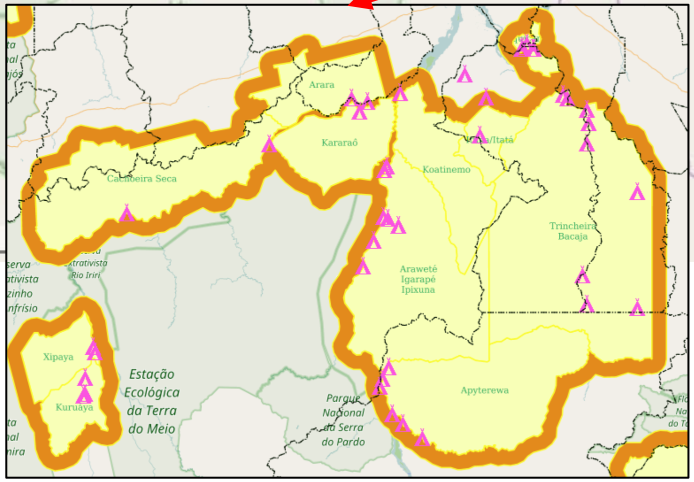
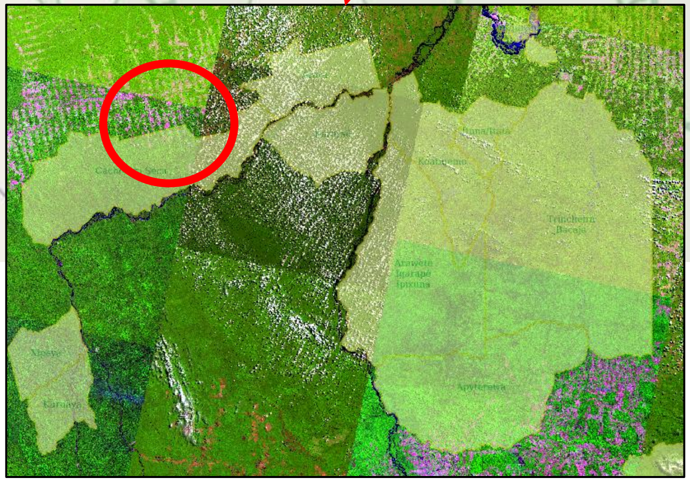
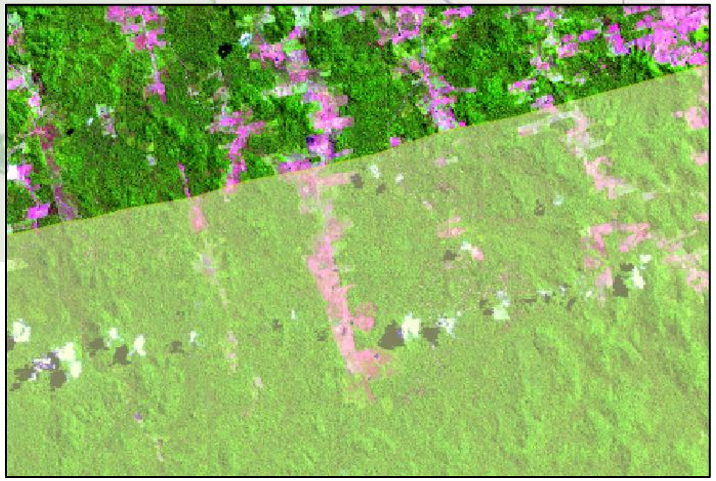
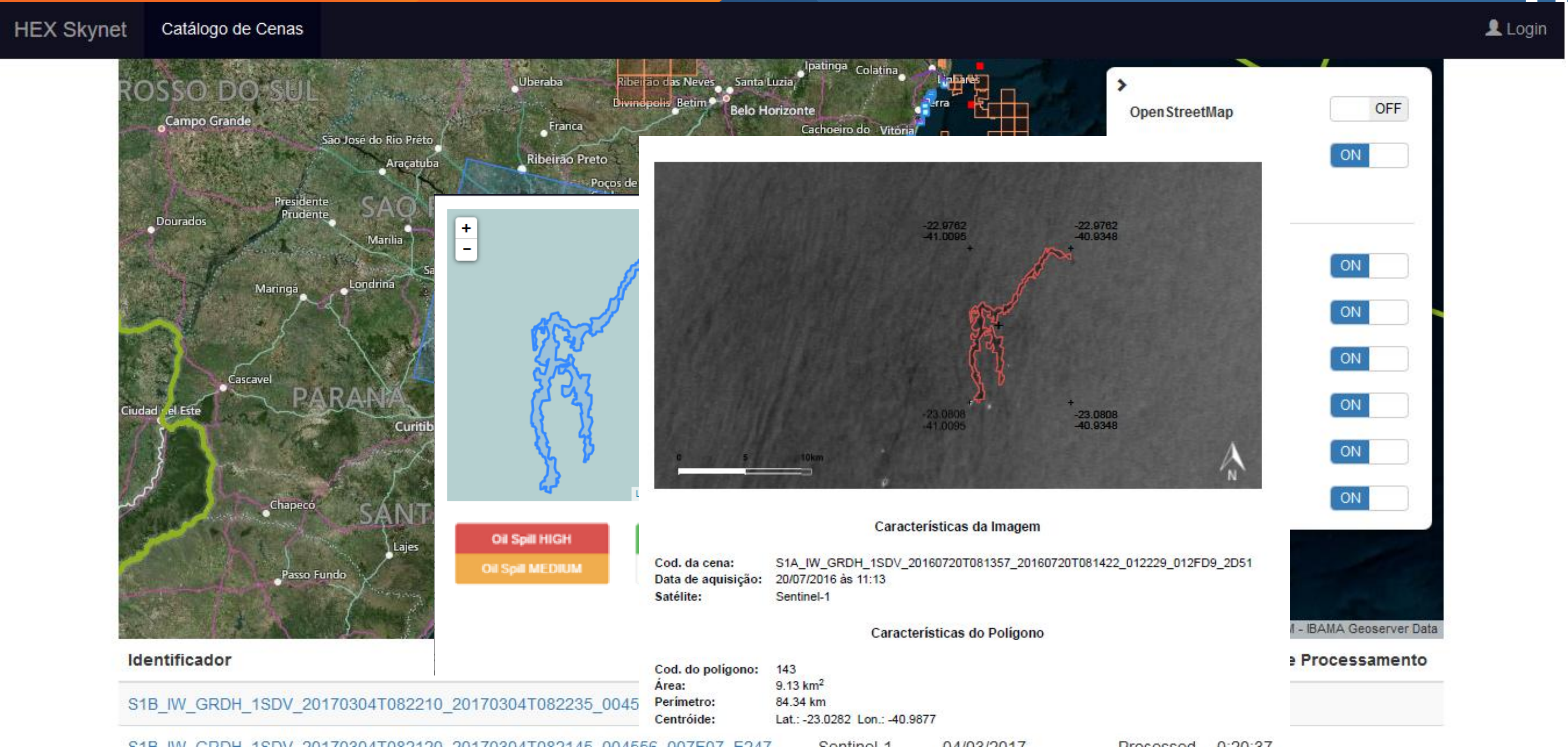
FUNAI
Tucuruí
Marabá
Parauapebas
São Félix do Xingu
Araguaína
100 km
N


Arara
Kararaô
Koatinemo
Cachoeira Seca
Trincheira Bacajá
Araweté Igarapé Ipixuna
Apyterewa
Xipaya
Kuruaya
Estação Ecológica da Terra do Meio
Parque Nacional da Serra do Pardo





Skynet – Oil spill detection



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Thank You!

Geostreaming in Edge Analytics in the context of Smart City

Hoyong Park, Architect
Oracle Stream Analytics Platform
March, 2017

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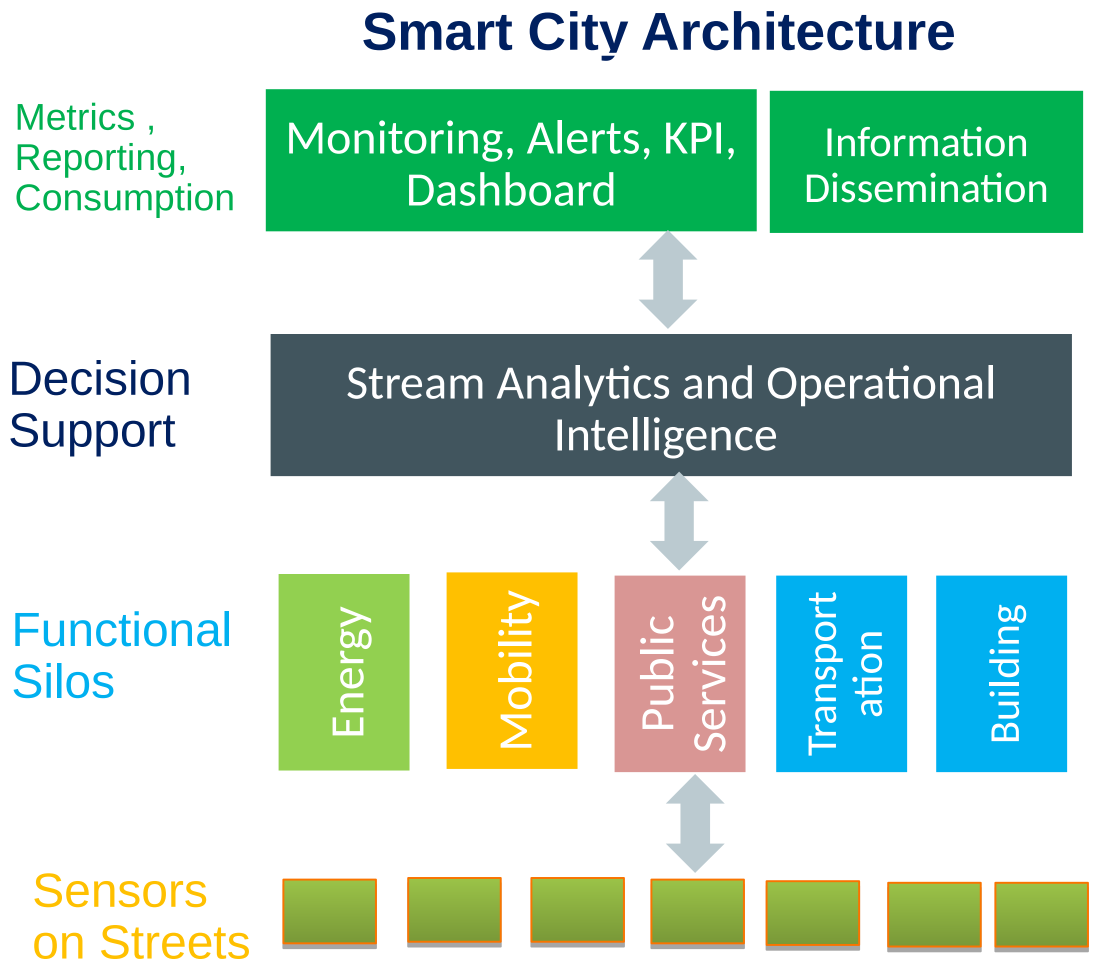
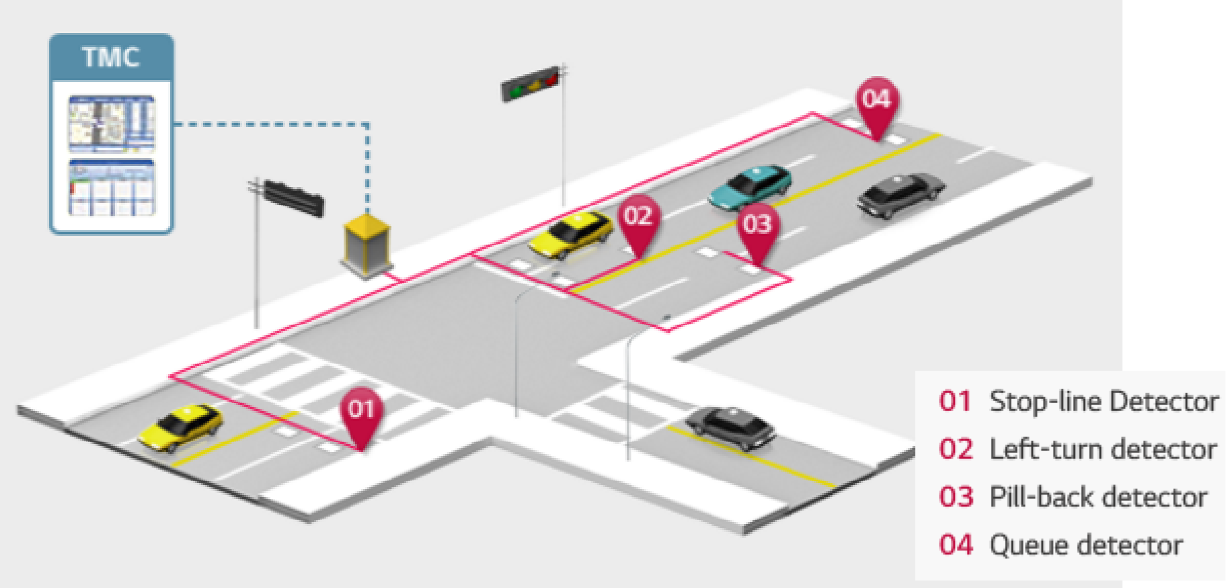
Geostreaming and Edge Analytics



- Edge Analytics
  - Too many sensor data to send?
- Crowdsourced Sensors
  - Use Cellphone as the sensor (Geostreaming)

Geostreaming usecases in Edge Analytics

- Smart Traffic Light and Control
- Smart Parking
- Smart urban lighting



- Realtime Traffic Flow and Congestion
  - Highway Capacity Manual (HCM)
  - Volume/Capacity (V/C)
  - Average Travel Time per Road Segment
  - Average Speed per Road Segment
  - Density
  - Stops
  - Accident detection
- Automatic Intelligent People Counting
- Geofencing based switch

Edge Device - Expected Runtime Behavior
Measuring metrics from traffic light(simple case)

- Assumption
  - Maximum number of vehicle at a time = 40 cars (4 way signal, 2 lanes, 5 cars per lane)
  - One location reading per second
- Operations
  - Distance Calculation with geodetic coordination
  - Geofencing
  - Window operation

- Geofencing implementation
  - Full Geometry Operation (contain)
  - Approximation (Geohash)
- Expected runtime behavior
  - 40 location events per second
  - One geofence per traffic light
  - Distance Calculation (haversine formula - four sin, two cos, one atan2, two sqrt)
  - Geohash based Geofencing (string matching)
  - Possible to implement with embedded mc

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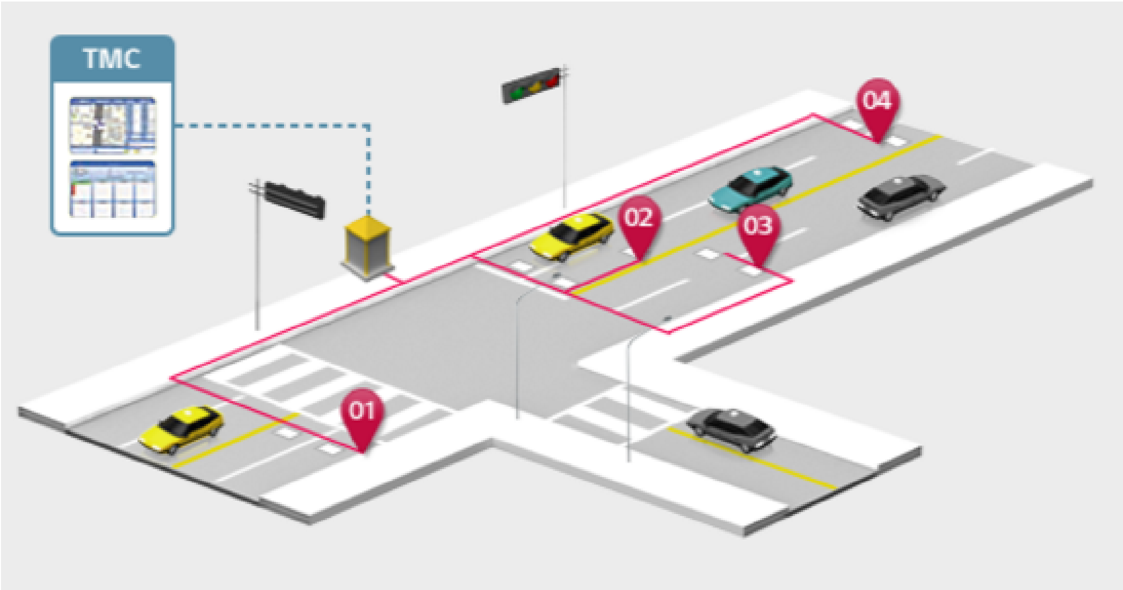
Traffic Signals in New York City

- 12,460 intersection with traffic signals as of June 30, 2011
- Need to process 498,400 events per second

- Pre-computation from Edge Device
- Base Event Detections



- High-level Complex Event Detections

Edge Device - Expected Runtime Behavior
Highway Monitoring for 10 miles (complex case)

- Assumption
  - Maximum number of vehicle at a time = 18,400 cars (8 lanes, 2300 cars per lane)
  - One location reading per second
- Operations
  - Distance Calculation with geodetic coordination
  - Geofencing
  - Window operation

- Geofencing implementation
  - Full Geometry Operation (contain)
- Expected runtime behavior
  - 18,400 location events per second
  - One geofence per segment
    - About 3200 geofences (10m segment)
  - Full laptop with Intel Core2 Duo with 2G Memory

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Conclusions

- Geostreaming in Edge Analytics would reduce the volume of data to process significantly
- Direct Geostreaming processing from Edge Device is possible for
  - Simple usecases (such as Intelligent Traffic Light, Intelligent Light)
    - Small number of Geofences
    - Small number of tracking objects
    - Some usecases do not need Point_In_Polygon operations and can be simplified using Geohashing based approximations
- Complex usecases requires server processing
  - Tracking large number of moving objects
  - OpenStreetMap, Waze, GoogleMap, and AppleMap

- Essences of Geostreaming in Edge Analytics
  - Estimate the volume of data
  - Reduce the volume of data
  - Avoid point in polygon operation
    - Geohashing based Approximation
  - Apply Hierarchical Complex Event Processing
    - Edge Analytics : Base Events
    - Server Processing : Complex Events

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Hardware and Software
Engineered to Work Together

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ACHI 2017 / eKNOW 2017 / eLmL 2017/ ICDS 2017 / GEOProcessing 2017 / ALLSENSORS 2017 / eTELEMED 2016 / SMART ACCESSIBILITY 2017 / MATH 2017 / EVIDEM 2017

March 19 - 23, 2017 - Nice, France

Embrapa Instrumentation

Pannel on GEOProcessing/ALLSENSORS/ICDS Topic: Contemporary Views – What are the Essences of Geospatial/Sensing Knowledge and Application Scenarios?

Importance and essences of geospatial/sensing knowledge for global food security

Paulo E. Cruvinel, Ph.D.

paulo.cruvinel@embrapa.br

What is food security?

As defined by the Food and Agriculture Organization (FAO) of the United Nations:

- Food security "exists when all people at all times have both physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs for an active and healthy life."

Food and Agricultural Organization of the United Nations (2013). Hunger Portal: FAO. Date retrieved: June 11, 2013. Retrieved from: http://www.fao.org/hunger/en/

Challenges

- An increasing global population, in combination with climate change, poses a threat to food security as arable land becomes less available;
- **Global population**: Projected to be approaching 12 Billion People in the 2050s;
- **Food production**: needs to increase more than 60% in food production;
- **Degradation, Water use, Resilience of natural resources, Pest Control**: needs for sustainability;
- **Risk Control**: Biggest challenge….

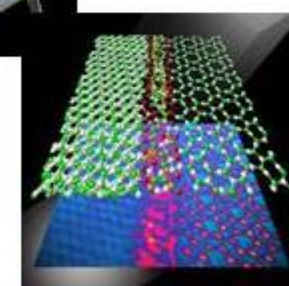
Needs for knowledge, science & innovation

Competitiveness & Sustainability

Small farmers & productive capacity

Food Security & Food Safety

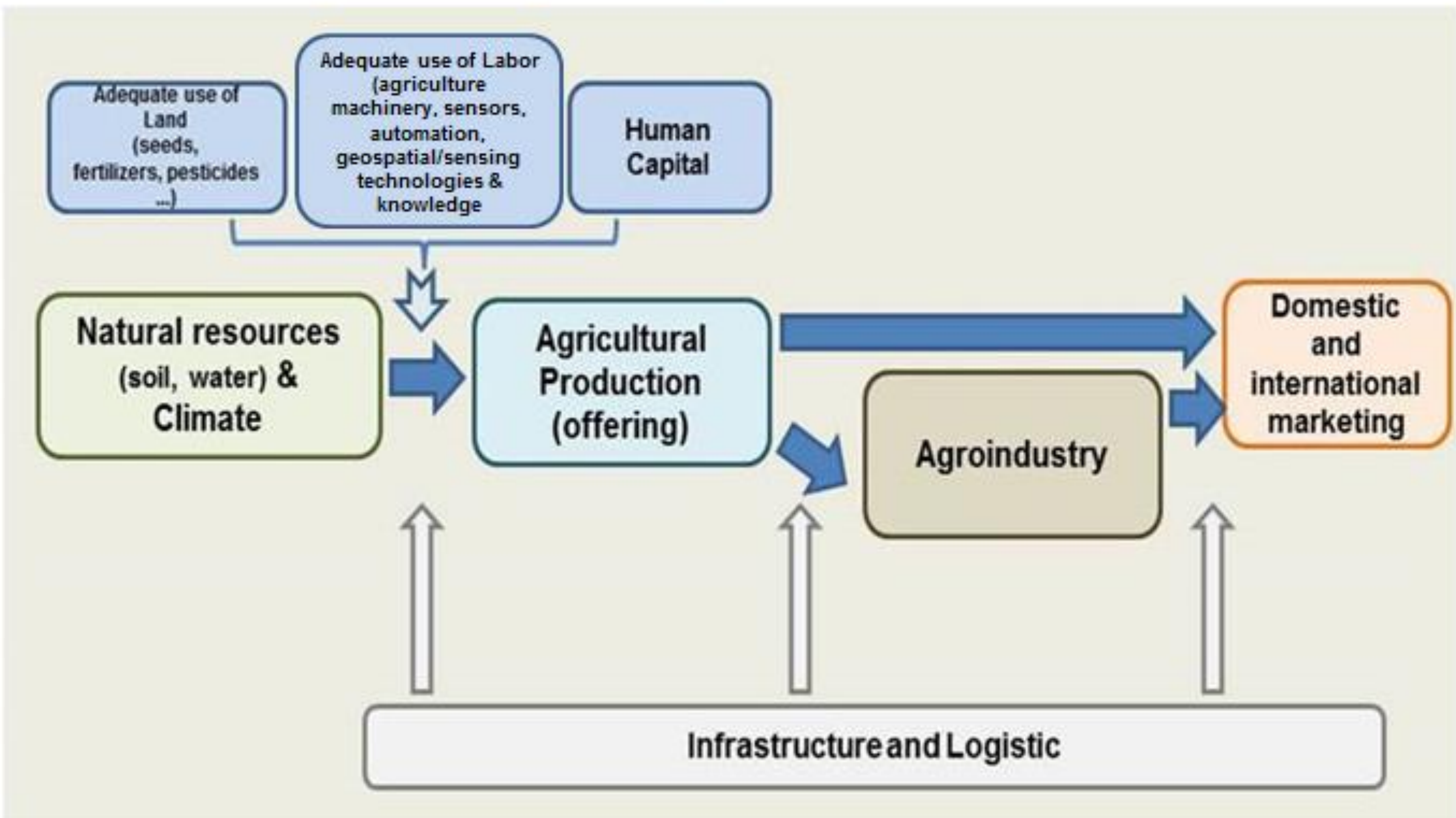
Environmental Diversity



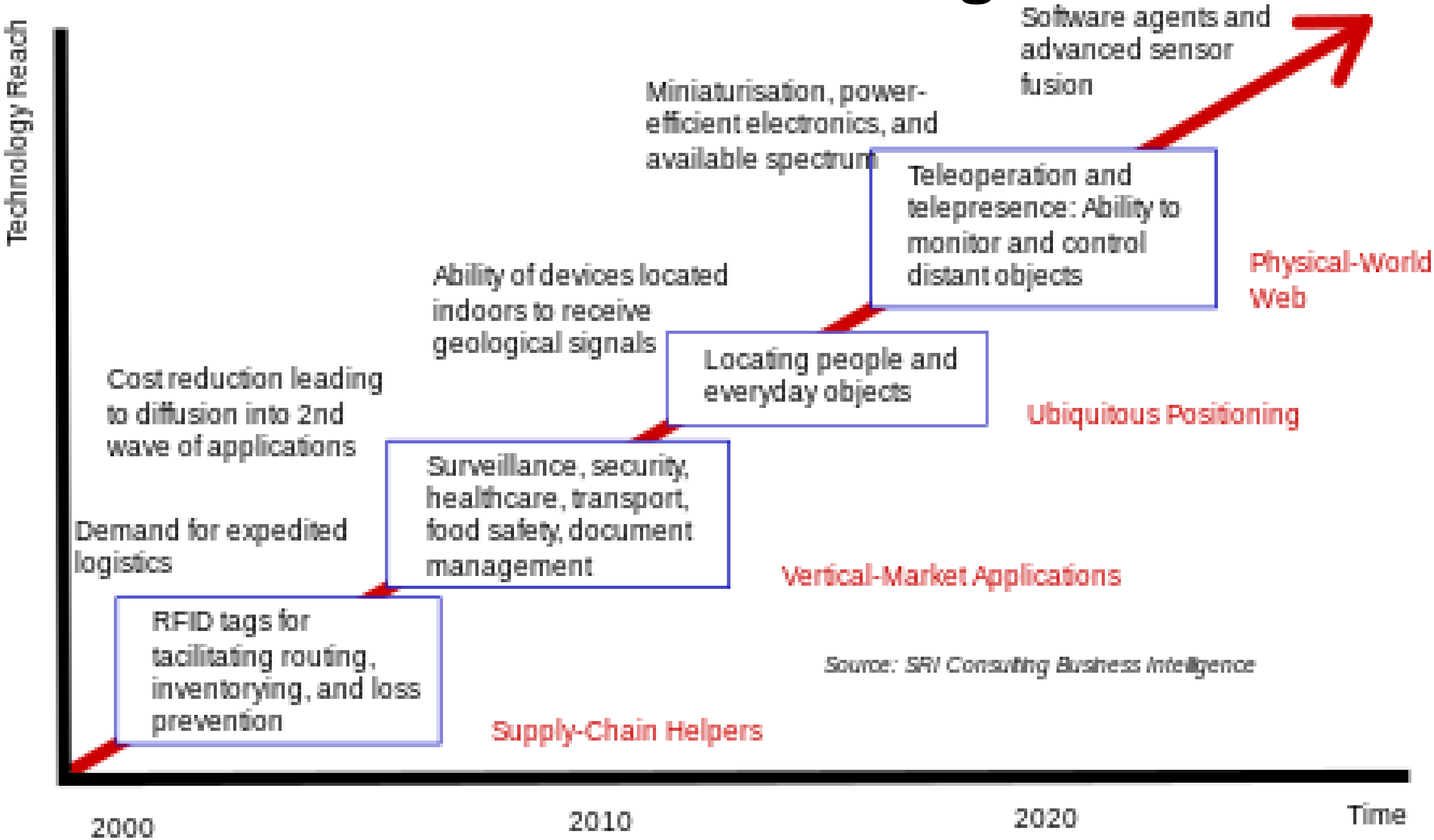
Science & Knowledge

Sustainability

Systemic view and use of the Value Chain concept

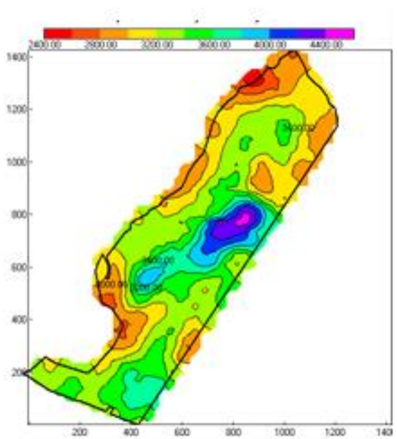


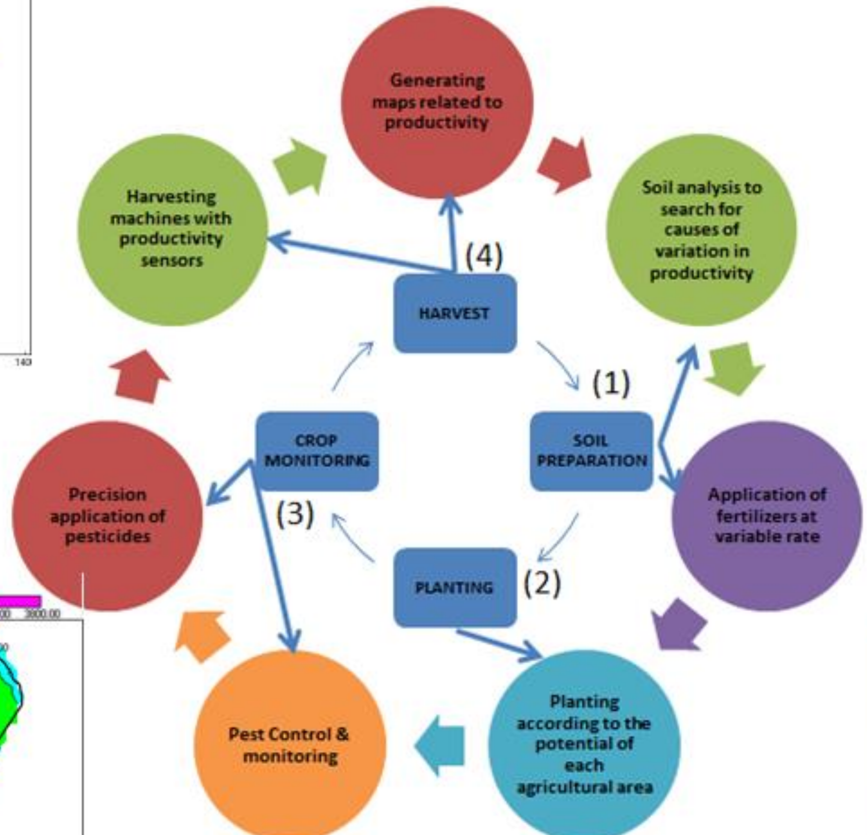
Technology roadmap:
The Internet of Things

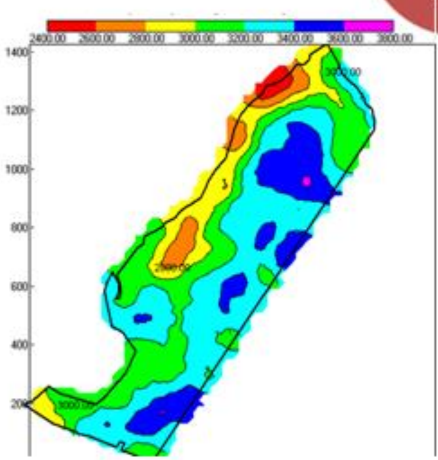


Source: SRI Consulting Business Intelligence, In: 3rd International Conference on Networks, Applications, protocols and Service (NetAPPS), Sept, 2012.

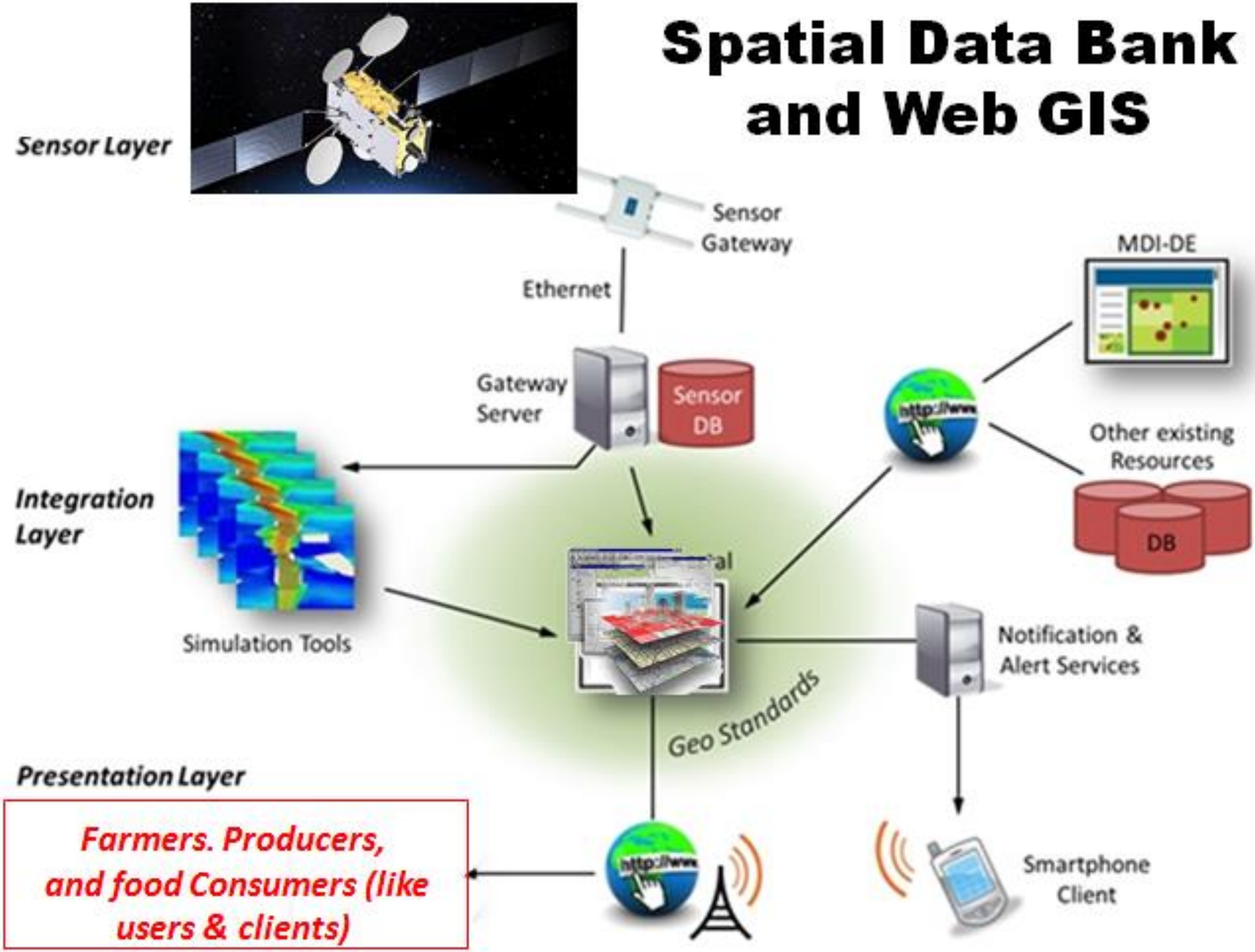
Sensors, Real-Time Critical Embedded Systems & Agricultural Automation







Spatial Data Bank and Web GIS



Food Security…But also Food Safety

RESEARCH ARTICLE OPEN ACCESS

Complexity of the International Agro-Food Trade Network and Its Impact on Food Safety

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Abstract Top

With the world's population now in excess of 7 billion, it is vital to ensure the chemical and microbiological safety of our food, while maintaining the sustainability of its production, distribution and trade. Using UN databases, here we show that the international agro-food trade network (IFTN), with nodes and edges representing countries and import-export fluxes, respectively, has evolved into a highly heterogeneous, complex supply-chain network. Seven countries form the core of the IFTN, with high values of betweenness centrality and each trading with over 77% of all the countries in the world. Graph theoretical analysis and a dynamic food flux model show that the IFTN provides a vehicle suitable for the fast distribution of potential contaminants but unsuitable for tracing their origin. In particular, we show that high values of node betweenness and vulnerability correlate well with recorded large food poisoning outbreaks.

http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.phone.0037810

Analysis of the international food-trade network shows great vulnerability to the fast spread of contaminants.

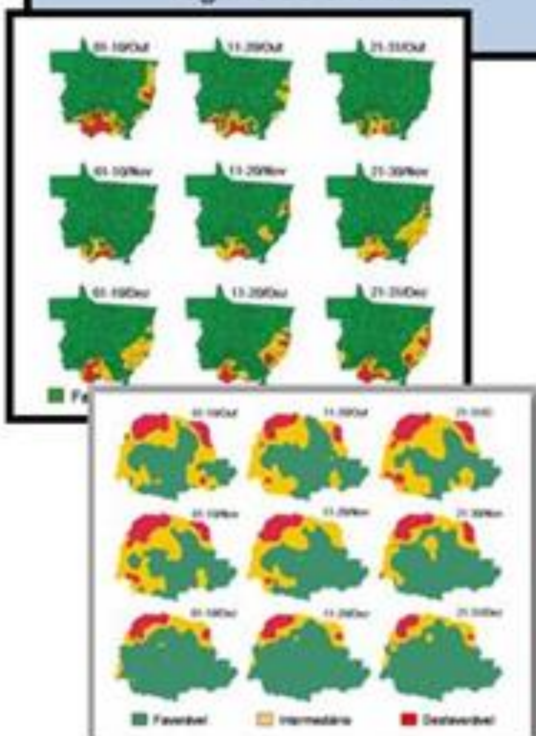
Source: Ercsey-Ravasz M, Toroczkai Z, Lakner Z, Baranyi J (2012) Complexity of the International Agro-Food Trade Network and Its Impact on Food Safety. PLoS ONE 7(5): e37810. doi:10.1371/journal.pone.0037810

Agricultural research based on geospatial/sensing knowledge to support Public Policies

Zoning of Climatic Risks

Regionalization of climatic claims to minimize losses in agricultural production, risks reducing from the rainfall regimes

regime de chuva.



Agroecological Zoning of Sugarcane

It defines suitable areas and exclusion zones for the cultivation of sugar cane in Brazil. Directs the policy of expansion and bioethanol production

Low Carbon Agriculture ABC Plan

Decarbonization of the agriculture processes by the incorporation of practices of low emission of greenhouse gases

Recommendations and final remarks

a) Creating the conditions that facilitate the development, of production, distribution, marketing and accessibility of knowledge related to technologies for food security, based on the value chain to improve productivity and sustainability, in socially just processes:

1. **Diagnosis**: roadmap for technology in automation & assessment to improve agricultural productivity and sustainability;
2. **Design**: interaction through stakeholders, national and international scenarios of emerging technologies for the S,T&I, future opportunities, threats, strengths and weaknesses related to geospatial/sensing & knowledge;
3. **Analysis**: trace alternative paths for the development of emerging technologies and innovation to improve agricultural productivity and sustainability;
4. **Correction**: make new adjustments, if necessary. Good traceability systems based on remote sensing to minimize the production and distribution of unsafe or less-quality products, thereby minimizing the potential for liability, recalls, and other aspects;
5. **Incisive innovation**: bringing and also thinking with the younger generation.

b) Implementation of strategies to ensure the competitiveness of agriculture based on engineering and technology innovation to minimize vulnerability of the international agro-food trade network:

(i) by contributing to a new body of innovation knowledge to be shared with academic institutes, educators, enterprises, government agencies, and nonprofit organizations;
(ii) by structuring in each country a permanent working group for the continuous monitoring (observatory model) of reality and the cases involving aid decision making to facilitate the organization of strategies for global food security;
(iii) by creating a spatial open database related to agriculture, climate changes and its relation with global food security at both global and regional level, i.e., including recommendation for nutrient and crop protection, pest control and crop quality, engineering technology, management of water, geospatial data, logistics, among others.

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Thank you all for listening

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