Improving Land Administration in Brazil
Re-Engineering Cadastre Using LADM

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Challenge

Improve Land Administration in Brazil providing a basic (land) cadastre as reference to government and society in general.

Source: FIG, 2014. Cadastre 2014 and Beyond
In Brazil...

- There is no Cadastre for land, there are several

<table>
<thead>
<tr>
<th>Main Object</th>
<th>Name</th>
<th>Scope</th>
<th>Urban /Rural</th>
<th>Legal Act</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land tenure</td>
<td>National Cadastre of Rural Land - CNIR</td>
<td>Federal</td>
<td>Rural</td>
<td>Law 10.267/2011</td>
<td>INCRA, RFB (revenue federal agency), Registry</td>
</tr>
<tr>
<td>Land tenure</td>
<td>Land Cadastre and Registry System - SICART + Multipurpose Technical Cadastre - CTM</td>
<td>Municipal</td>
<td>Urban</td>
<td>Portaria 511/2009 - Ministry of Cities</td>
<td>Prefeitura, Registry</td>
</tr>
<tr>
<td>Land tribute</td>
<td>Cafir</td>
<td>Federal</td>
<td>Rural</td>
<td>Law 9.393/1996</td>
<td>RFB</td>
</tr>
<tr>
<td>Land tribute</td>
<td>Multipurpose Technical Cadastre - CTM</td>
<td>Municipal</td>
<td>Rural or Urban</td>
<td>Portaria 511/2009 - Ministério das Cidades</td>
<td>Prefeitura</td>
</tr>
<tr>
<td>Land use and occupation</td>
<td>Rural Cadastre National System - SNCR</td>
<td>Federal</td>
<td>Rural or Urban</td>
<td>Law 5.868/1972</td>
<td>INCRA</td>
</tr>
<tr>
<td>Land use</td>
<td>Environmental Rural Cadastre - CAR</td>
<td>Federal / State</td>
<td>Rural</td>
<td>Law 12.651/2012</td>
<td>Ministry of Environment MMA, Environmental State Agencies OEMAs</td>
</tr>
</tbody>
</table>
However...

In Brazil...

- They are not in integrated by law (or in practice), there is no cadastral system

- The “basic layer” (formal and informal domain) is divided in rural and urban cadastres
However...

In Brazil...

- The boundaries between rural and urban are not well known (and very dynamic)

- There is an NSDI (National Spatial Data Infrastructure), but it still does not have standards for cadastral data
Recent Advances

- Created in 2001 by law 10,267, the rural (territorial) cadastre was converted to digital in 2013

Certified areas from 2004 to 2016

Source: INCRA
Recent Advances

- **Legacy, since 2004:**
  - 73 thousand certified areas
  - 140 million hectares

- **Digital, since November 2013:**
  - 244 thousand certified parcels*
  - 138 million hectares
  - Total:
    - 415 thousand parcels**
    - 167 million hectares

* enabled to link with registry
** including untitled areas

Source: INCRA (https://sigef.incra.gov.br/consultar/estatisticas/ in 13/03/2017)
Recent Advances

**Past**
- Not standardized data production
- Lack of systematic
- Cadastre ↔ Registry → mismatches

**Today**
- Standardized methods
- Total coverage of cadastre data
- Cadastre ↔ Registry synchronized

**Future**
Still...

- The time to cover national territory following actual regulations and technical requisites is not reasonable
Still...

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Still...

- **Cost**
  - The process is too costly for the most of landholders

- **Staff**
  - The number of specialized professionals is low

- **Land Rights**
  - Millions of hectares have no formal domain
The needs of Land Administration are **URGENT**

- Land use control (environmental restrictions)
- Land regularization
- Conflict resolution
- Land Reform
- Public land management
- Infrastructure interventions
- Land use planning
- Economic development planning
Proposal

• From the experience with Rural Cadastre...

• Build a digital cadastre platform that could cover continuously the national territory
  – Considering all the continuum of land rights
  – Different geospatial data classes for different purposes
  – Add methods of data acquisition
  – Add data producers
  – Data precision upgradable over time
  – Could be used by rural and urban competent institutions
• Wider Range of **Land Rights**

![Continuum of land rights diagram](image)

As today  
To be added

*Source: UN-Habitat, 2008.*
Proposal

• More diversity of **Land Rights**
  
  – **Private** Law
    • Brazilian Civil Code
      – Real and Personal Rights
      – Possession
    • Traditional (informal social tenure) → “claims”
  
  – **Public** Law
    • Public Land Definitions: common use
    • State Intervention in Property
      – Expropriation Acts: social interest, public utility, public necessity
    • Public Land Concessions and Alienation Instruments
Proposal

- More diversity of **Rightholders**

As today  To be added

Proposal

• More diversity of **Spatial Units**

![Diagram showing representations of spatial units]

As today  
To be added

Proposal

- More diversity of Acquisition Methods

Acquisition methods

Inaccurate Reference

- Tape/Plane table
- Handheld GPS
- Satellite Imagery
- Total Station

Accurate Reference

- Legacy Maps
- Old Images
- Google Maps
- OpenStreetMap
- MS Visual Earth
- Aerial Camera
- UAV
- GPS/CORS


As today

To be added
Proposal

- More diversity of **Land Recordation**

As today

To be added
Proposal

Equalizer

Adapted from Lemmen et al, 2015.
Proposal

- **More**: tenure rights, agents, methods, purposes, coverage, security. **Less**: time and cost

<table>
<thead>
<tr>
<th>Class</th>
<th>Who (Agents)</th>
<th>How (Methods)</th>
<th>Level 1 Example: Registry / Formal Domain</th>
<th>Level 2 Example: Public Land Management</th>
<th>Level 3 Example: Social Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Credentialed professional with liability</td>
<td>Traditional Methods</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>B</td>
<td>Professional with liability</td>
<td>Handheld GPS and others</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>C</td>
<td>Citizen, NGOs, Unions...</td>
<td><em>Web interface</em> <em>OpenStreetMap</em> <em>Google Maps</em>...</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Proposal

Example
Based on LADM

Topography (All Classes)

Spatial Units in Topology Levels
Proposal

Sources and RRR´s

Sources
- Organization 1: Formal Domain (e.g., Registry)
- Organization 2: Governmental Land Management (Use Concession in Public Land) (e.g., Land Reform Institute)
- Organization 3: Social Tenure Institutions (e.g., Rural workers union)

Relationship
- Source 1: Target → BAUnit A2
  - Right: Ownership
  - Restriction: Mortgage
  - Responsibility: Keep vegetation along rivers

- Source 2: Target → BAUnit B3
  - Right: Use for agriculture
  - Restriction: Inalienability
  - Responsibility: Obey environmental regulations

- Source 3: Target → BAUnit C1
  - Right: Fishing
  - Restriction: Do not fish salmon
  - Responsibility: Keep vegetation along rivers

Interested Party
- Individual
- Family
- Community
Question!

What is the tenure situation at point •?
Proposal

Spatial units in different levels sharing topology elements
Coherent representation of RRR's to the same land portion

<table>
<thead>
<tr>
<th>Source 1</th>
<th>Target → BAUnit A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>Ownership</td>
</tr>
<tr>
<td>Restriction</td>
<td>Do not eliminate native vegetation</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Land Reform</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source 2</th>
<th>Target → BAUnit B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>Use for agriculture</td>
</tr>
<tr>
<td>Restriction</td>
<td>Do not lease</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Obey environmental regulations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source 3</th>
<th>Target → BAUnit C1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>Fishing</td>
</tr>
<tr>
<td>Restriction</td>
<td>Do not fish salmon</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Keep vegetation along rivers</td>
</tr>
</tbody>
</table>

Interested Party

- Public Institution (GOV)
- Family
- Community
Proposal

Representation of Land Rights in levels based on Brazilian Civil Code
Proposal

Representation of Land Rights in levels based on Brazilian Civil Code and the Rural Immovable of Brazilian Land Statute

**Rural Immovable / Land Statute**
- Taxation, Environmental Regularization, Land Use Control, Social Purpose Verification

**Possession Rights**
- Po1: Possession from property → José
- Po2: Possession from property → Maria
- Po3: Possession from lease → José
- Po4: Possession → José

**Personal Rights**
- P1: Lease: Maria → José

**Real Rights**
- R1: Property → José
- R2: Property → Maria
- R3: Property → Pedro
Proposal

Example using LADM Classes:
one possession (red dashed boundaries) set by the leasing of two properties (black)
LADM Classes

- Brazilian Quilombola traditional rights in recognition process
- Including expropriation of private parcel and titling of public areas
Conclusion

• **LADM** has been a very important reference
  - **Solid** conceptual framework
    • Covering **formal and informal** RRR’s
    • Spatial representation with **topology in levels**

• Project Status
  - Working on specialization → **LADM_BR profile**
  - More 6 months (data model and processes)
  - **We need help!**
    • **Effective IT support**: software development based on geospatial data
References

FAO - Food and Agriculture Organization (2012). Voluntary guidelines on the responsible governance of tenure of land, fisheries and forests in the context of national food security. FAO, Rome, Italy.


THANK YOU!

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