Modelling Transport-based Land-use Scenarios in Bogota

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<td>Conclusion</td>
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1. Context

- Economic growth since 2001
- Traffic congestion - Bogota in the top five

Lina Rozo, https://www.kienyke.com/noticias/bogota-ciudades-con-peor-trafico-del-mundo

- Pollution
- Public Health issues
- AFD (France AID) project
2. Introduction

- Traffic congestion in the public and political debate
- 2015 Local elections – public transport proposals
- Objective
  - To develop a LUCC model to evaluate public transport alternatives
    – Bogota Land Development Model (BoLD)
3. Methods

- Study area
  - Bogota and the municipalities located to its West: Funza, Mosquera, Madrid, Focatativá, Cota and Soacha
  - 7.5 million inhabitants (Bogota holds 6.5 million)
## 3. Methods

### Data

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Description</th>
<th>Application in BoLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014 cadastral dataset for Bogota</td>
<td>Parcel-based cadaster dataset for Bogota that includes land-use coverage for every land parcel and the fiscal land value of them</td>
<td>Calibration of land-use coverage areas in Bogota</td>
</tr>
<tr>
<td>2005 to 2011 planning zones</td>
<td>Planning zones for areas outside Bogota municipality with their intended or authorized land-use coverage</td>
<td>Calibration of land-use coverage areas in Bogota by detecting vacant zones and more likely land-use based on regulatory restrictions</td>
</tr>
<tr>
<td>2005 and 2014 water body inventory</td>
<td>Official dataset of rivers, lakes and other water bodies in the area</td>
<td>Determination of areas covered by water not always identifiable by Landsat images</td>
</tr>
<tr>
<td>2005 and 2014 national and regional parts and reserves</td>
<td>Official dataset from national government describing legally environmentally protected land in the study area</td>
<td>Separation of parkland from agricultural lands as well as identification of forest reserves</td>
</tr>
</tbody>
</table>
3. Methods

- Scenarios
  - Stakeholders workshop and interviews with administration officials

<table>
<thead>
<tr>
<th></th>
<th>Road infrastructure</th>
<th>Suburban train infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural reserve</td>
<td>Scenario 1: Road infrastructure continues to be the main source of transport for</td>
<td>Scenario 2: Existing freight rail infrastructure upgraded to provide a suburban service for</td>
</tr>
<tr>
<td>maintained</td>
<td>growth areas in the West. New roads allow additional connections between</td>
<td>passengers in Bogota and municipalities in the West. New road constructions or upgrades are</td>
</tr>
<tr>
<td></td>
<td>municipalities and Bogota. No changes to existing restrictions to urbanization in the</td>
<td>limited to areas were no infrastructure currently exists.</td>
</tr>
<tr>
<td></td>
<td>VDH reserve.</td>
<td></td>
</tr>
<tr>
<td>Natural reserve</td>
<td>Scenario 3: As in scenario 1, roads are upgraded to provide accessibility in the</td>
<td>Scenario 4: As in scenario 2, a new train service is developed for the West. However, land</td>
</tr>
<tr>
<td>urbanized</td>
<td>West. However, land regulations are changed so VDH reserve is urbanized by</td>
<td>regulations are changed so the VDH reserve is urbanized.</td>
</tr>
<tr>
<td></td>
<td>providing additional road infrastructure as well as BTR services.</td>
<td></td>
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</tbody>
</table>
3. Methods

- Scenarios
  - New road and train alternatives
3. Methods

- **Transmilenio**
  - Current Bus Rapid Transit (BRT) system in Bogota
3. Methods

- Van der Hammen reserve

3. Methods

- Estimating future land demands (*Business as usual*)
  - Forecast population growth (DANE, National Agency for Statistics)
  - Forecast economic growth (Bank of the Republic and FENALCO)

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2023</th>
<th>2032</th>
<th>2040</th>
<th>% Cells per land-use for 2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential High Income</td>
<td>1359</td>
<td>1411</td>
<td>1566</td>
<td>1704</td>
<td>4,22</td>
</tr>
<tr>
<td>Residential Medium Income</td>
<td>11607</td>
<td>15519</td>
<td>18530</td>
<td>21582</td>
<td>53,41</td>
</tr>
<tr>
<td>Residential Low Income</td>
<td>7949</td>
<td>6584</td>
<td>6003</td>
<td>5112</td>
<td>12,65</td>
</tr>
<tr>
<td>Commercial</td>
<td>1146</td>
<td>1510</td>
<td>1970</td>
<td>2495</td>
<td>6,18</td>
</tr>
<tr>
<td>Industrial</td>
<td>5633</td>
<td>6798</td>
<td>8124</td>
<td>9519</td>
<td>23,55</td>
</tr>
<tr>
<td>Total Cells</td>
<td>27694</td>
<td>31821</td>
<td>36193</td>
<td>40412</td>
<td>100,00</td>
</tr>
<tr>
<td>Cells Increment (%)</td>
<td>13%</td>
<td>12%</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Methods

- Modelling software METRONAMICA (RIKS)
- Calibration
  - Future land demands
  - Current and future land zoning changes and suitability conditions (heritage, hydrology, environmental risks...)
  - Neighbouring relationships between land-uses
  - Accessibility analysis based on transport infrastructure.
4. Results
Scenario 1

*Road development and reserve maintained*

- Increased commercial development along the proposed road
- Additional industry in their surrounding areas
- Industrial areas appear in the far West among farming zones
Scenario 2

*Train development and reserve maintained*

- Residential and commercial development concentrates along proposed stations

- This is particularly notorious in bordering areas between Bogota and the municipalities.
Scenario 3

Road development and reserve urbanized

- Similar trends than scenario 1 + invasion of natural reserve by medium-income residential and industrial
Scenario 4

**Rail development and reserve urbanized**

- Similar trends than scenario 2 + invasion of natural reserve by medium-income residential and industrial.
4. Results

- Circles of mobility
5. Conclusion

- Supporting decision making; Objectives met
- Integration of land management and public transport policies
- Calibration issues and technical proposal (Accessibility Distance Decay Factor -ADDF- and Overtime Spatial Decay Determination -OSDD-)
- Limitations related to narrow view of scenarios
- Need to develop more efficient visualization and cartographic communication tools
Thanks to:

- Luis Alberto Rubio, UniAndes
- Agence Française de Développement
- SIGEOMOD20_20 (ref BIA2013-43462-P)