Modelling Transport-based Land-use Scenarios in Bogota

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1. Context

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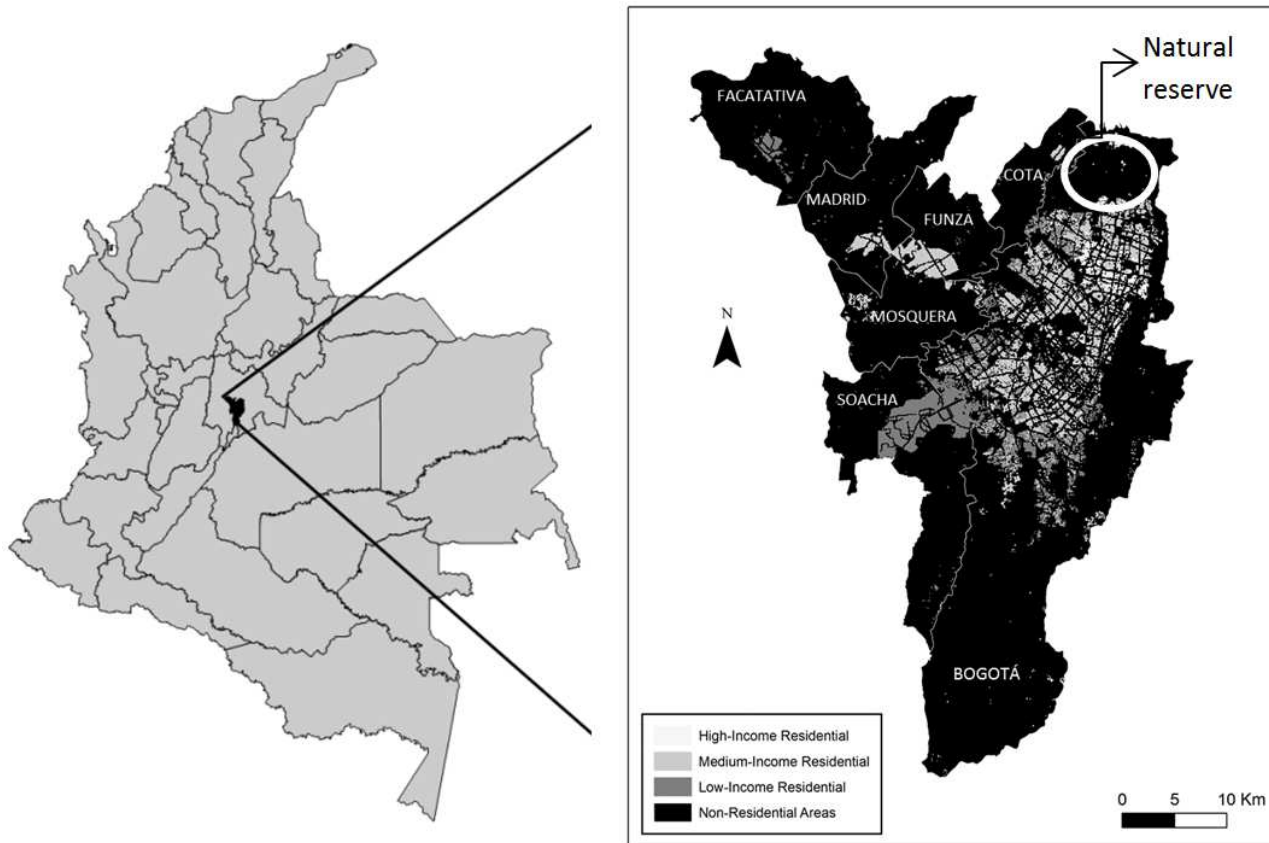
- Traffic congestion - Bogota in the top five

Foto: Lina Rozo/ Kienyke.com

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

- Pollution

- Public Health issues

- AFD (France AID) project

- 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

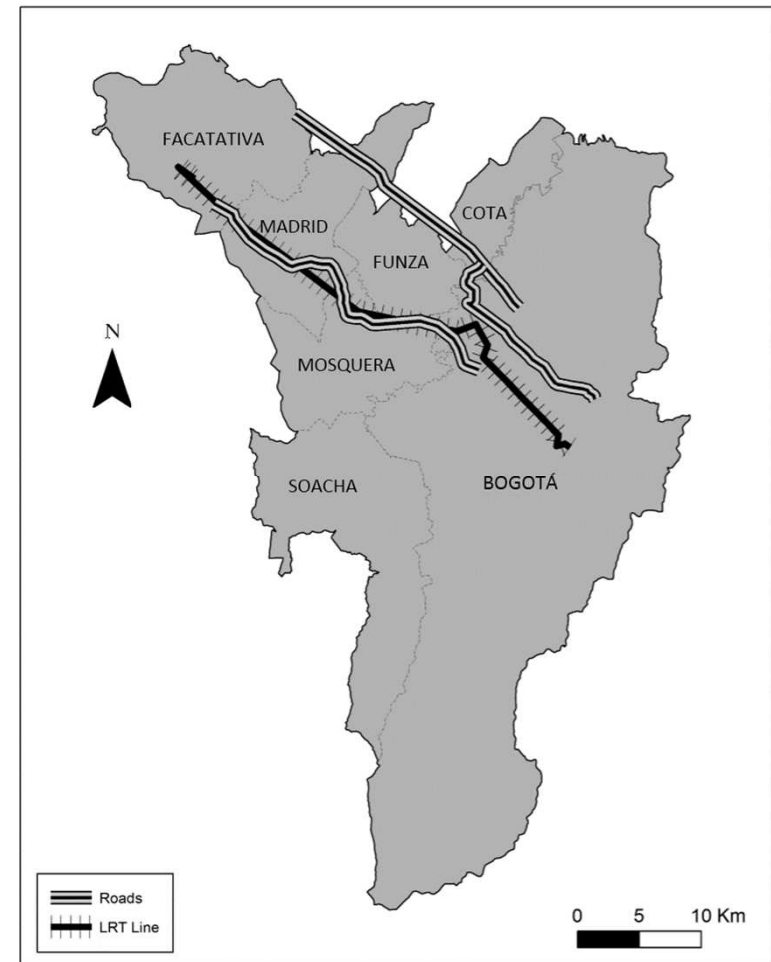| Dataset	Description	Application in BoLD
2014 cadastral dataset for Bogota	Parcel-based cadaster dataset for Bogota that includes land-use coverage for every land parcel and the fiscal land value of them	Calibration of land-use coverage areas in Bogota
2005 to 2011 planning zones	Planning zones for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

3. Methods

- ## Scenarios

  - Stakeholders workshop and interviews with administration officials

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

- ## Scenarios

  - ### New road and train alternatives

- ## Transmilenio

  - ### Current Bus Rapid Transit (BRT) system in Bogota

Guillermo Torres (Revista Semana). Available at
http://www.semana.com/tecnologia/novedades/articulo/transmilenio-estas-son-las-estaciones-con-wifi-gratis/380288-3

3. Methods

- Van der Hammen reserve

El Tiempo (http://www.eltiempo.com/bogota/voy-y-vuelvo-reserva-thomas-van-der-hammen-41019)

3. Methods

- Estimating future land demands (*Business as usual*)

  - Forecast population growth (DANE, National Agency for Statistics)

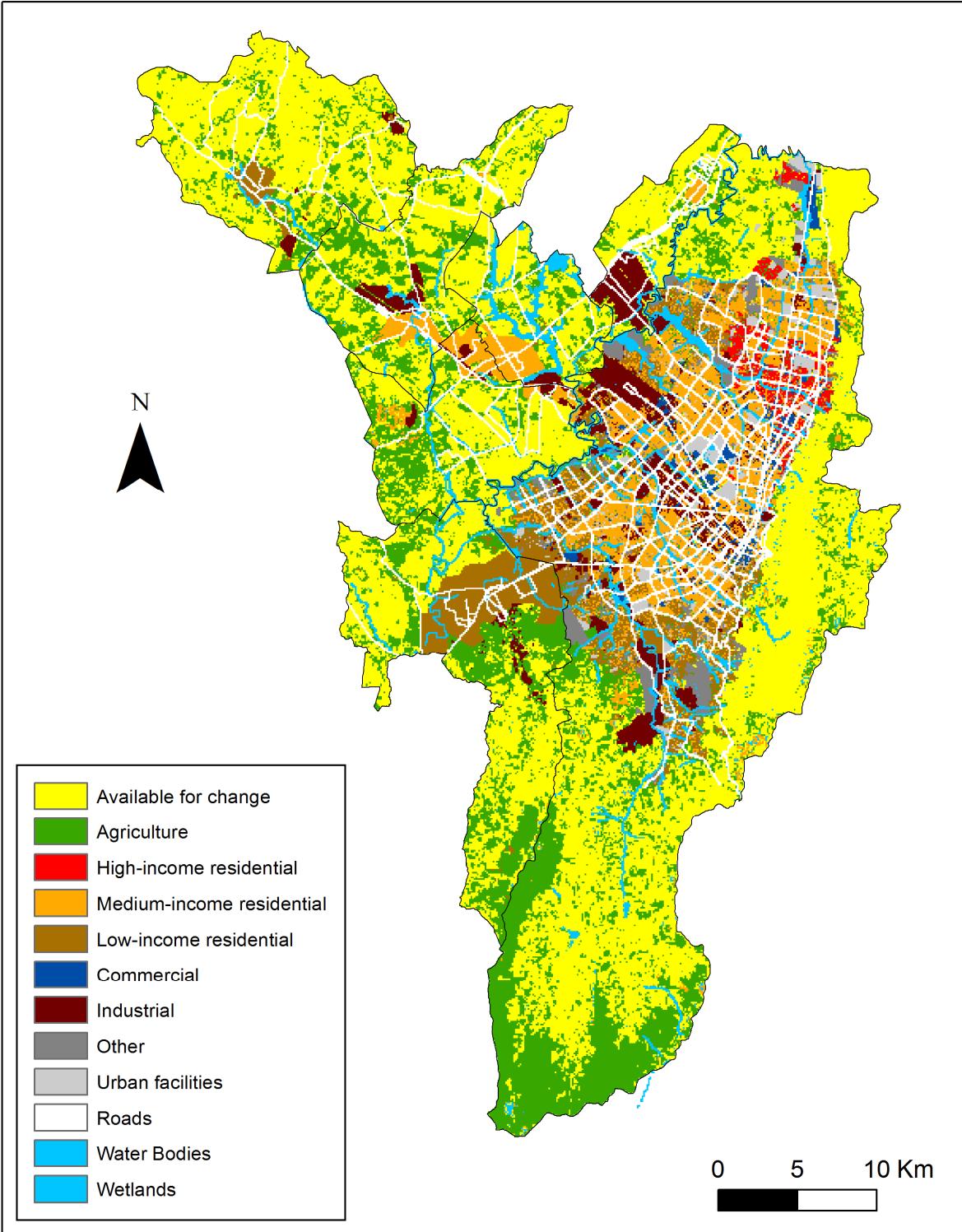 - Forecast economic growth (Bank of the Republic and FENALCO)

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

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

2014

Available for change
Agriculture
High-income residential
Medium-income residential
Low-income residential
Commercial
Industrial
Other
Urban facilities
Roads
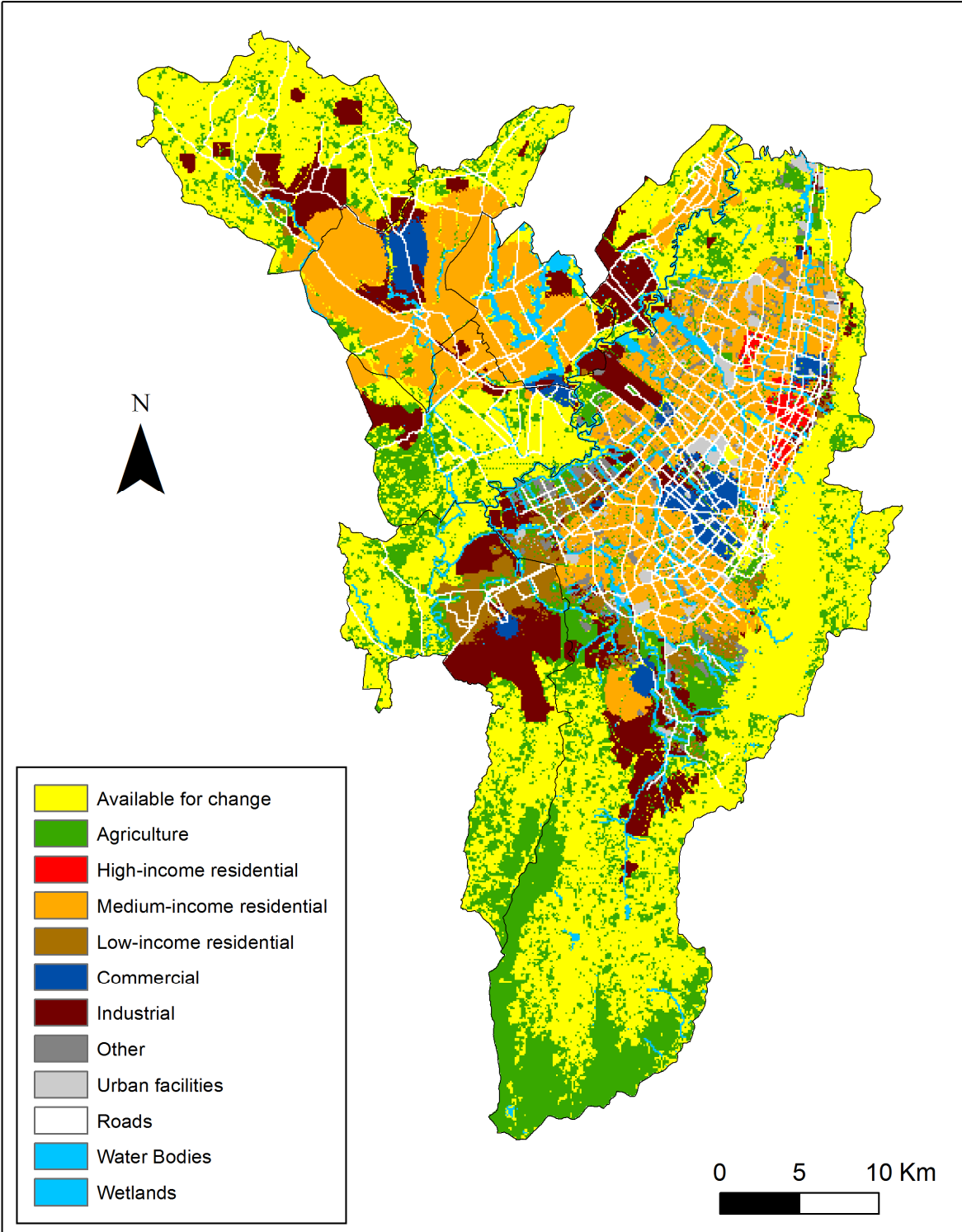Water Bodies
Wetlands

N

0   5   10 Km

Scenario 1

Road development and reserve maintained

- Increased commercial development along the proposed road

- Additional industry in their surrounding areas

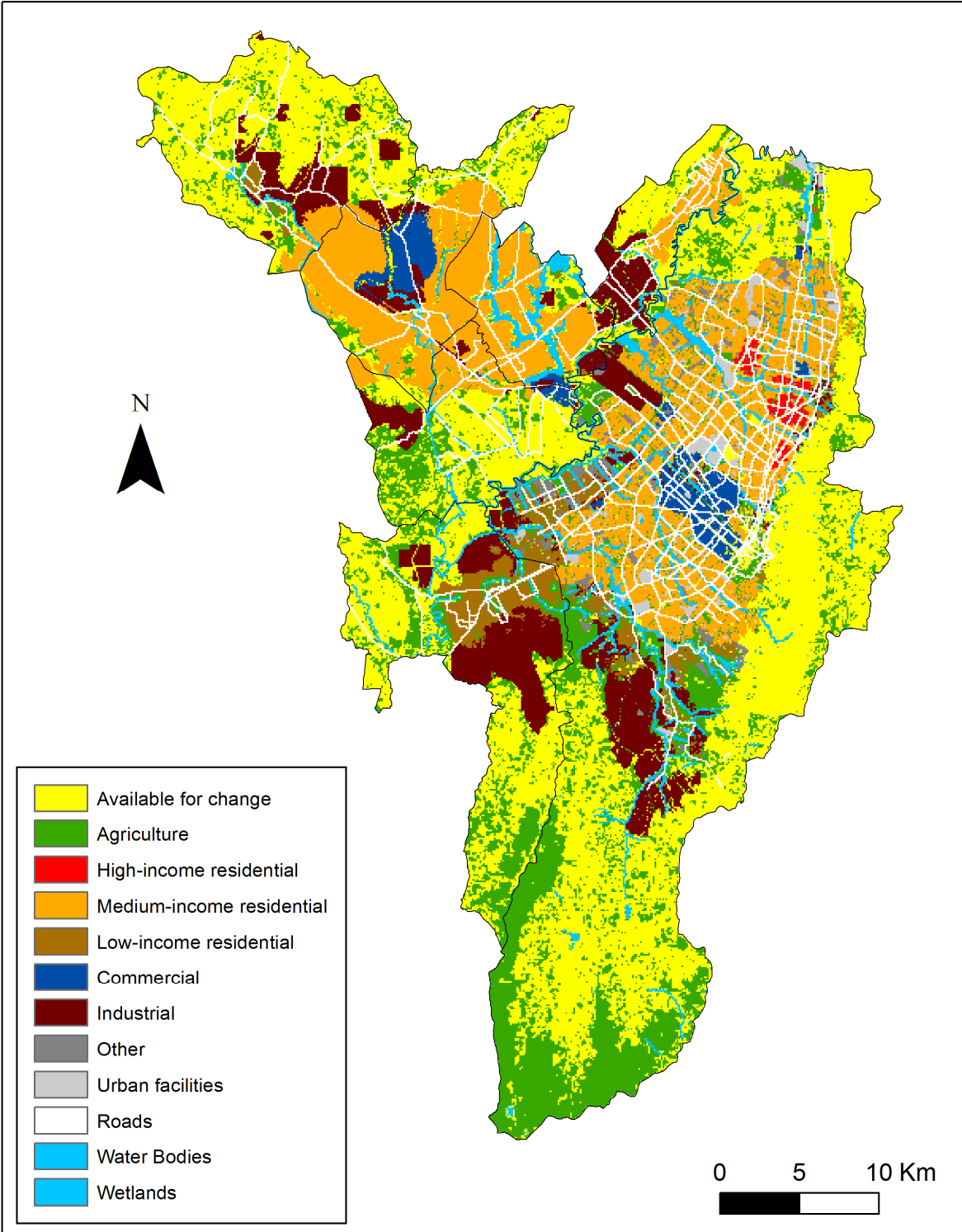- Industrial areas appear in the far West among farming zones

Legend:
- Available for change
- Agriculture
- High-income residential
- Medium-income residential
- Low-income residential
- Commercial
- Industrial
- Other
- Urban facilities
- Roads
- Water Bodies
- Wetlands

N

0   5   10 Km

Scenario 2

Train development and reserve maintained

- Residential and commercial development concentrates along proposed stations

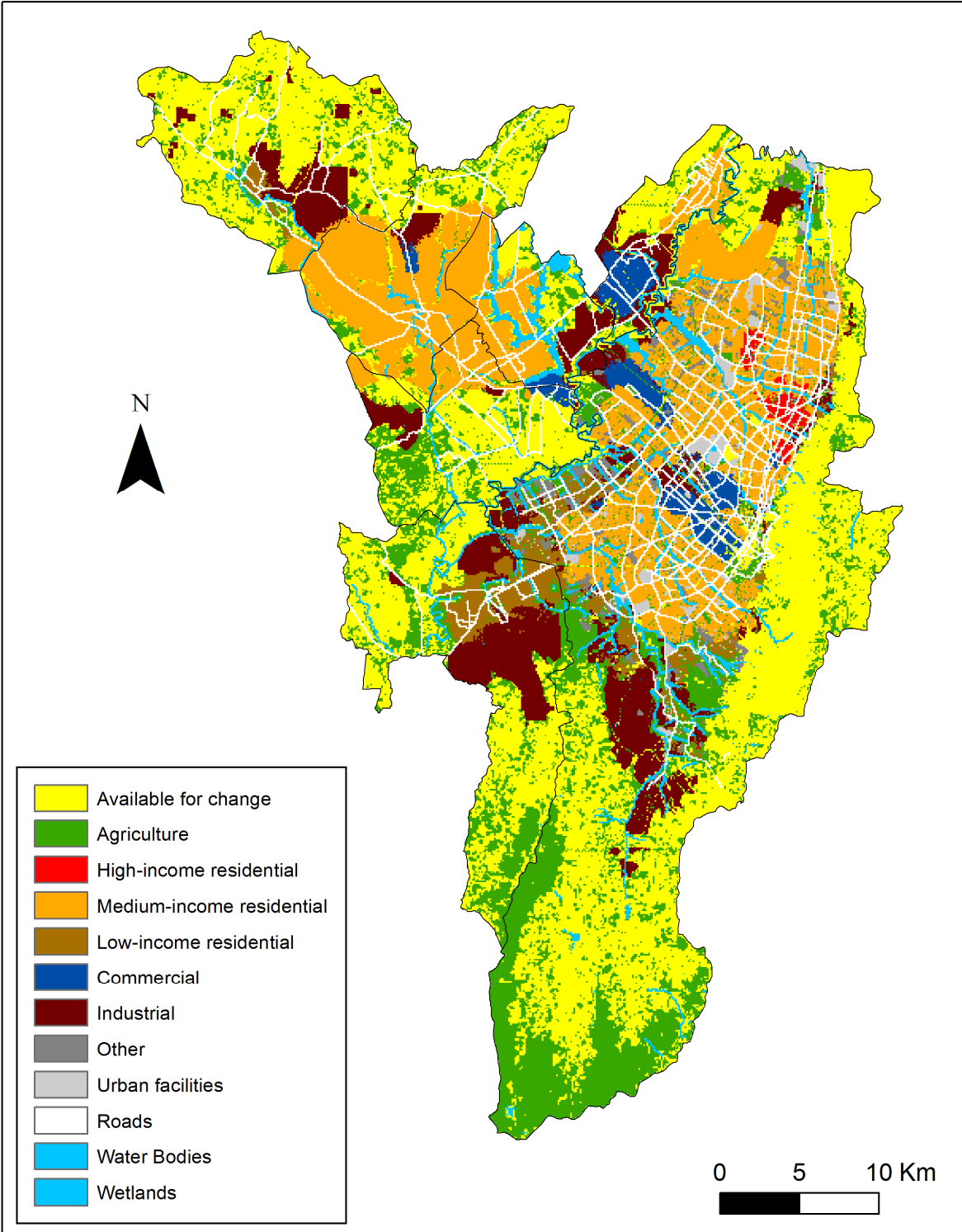- This is particularly notorious in bordering areas between Bogota and the municipalities.

Legend:
- Available for change
- Agriculture
- High-income residential
- Medium-income residential
- Low-income residential
- Commercial
- Industrial
- Other
- Urban facilities
- Roads
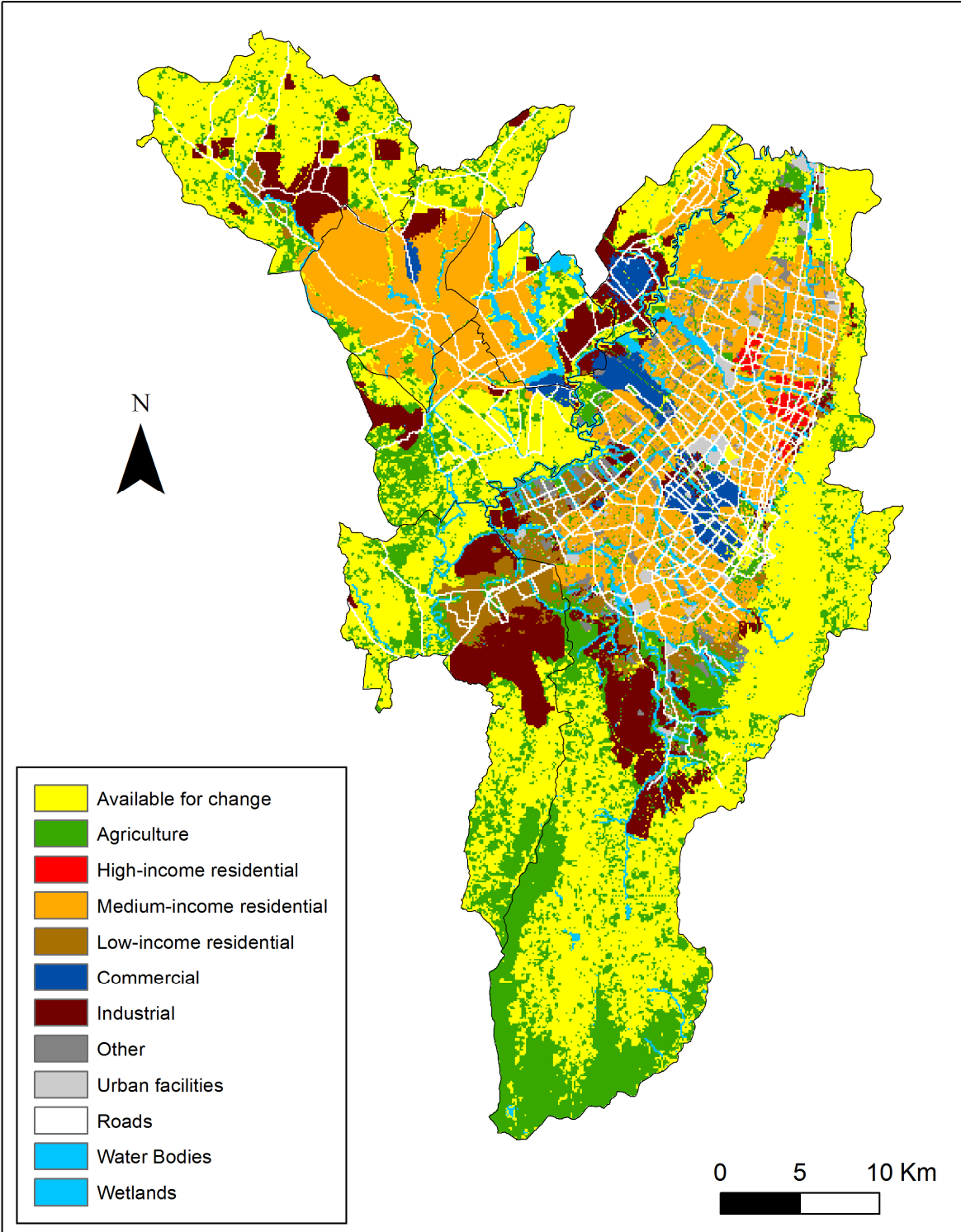- Water Bodies
- Wetlands

0   5   10 Km

Scenario 3

Road development and reserve urbanized

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

Legend:
- Available for change
- Agriculture
- High-income residential
- Medium-income residential
- Low-income residential
- Commercial
- Industrial
- Other
- Urban facilities
- Roads
- Water Bodies
- Wetlands

0   5   10 Km

Scenario 4

Rail development and reserve urbanized

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

Legend:
- Available for change
- Agriculture
- High-income residential
- Medium-income residential
- Low-income residential
- Commercial
- Industrial
- Other
- Urban facilities
- Roads
- Water Bodies
- Wetlands

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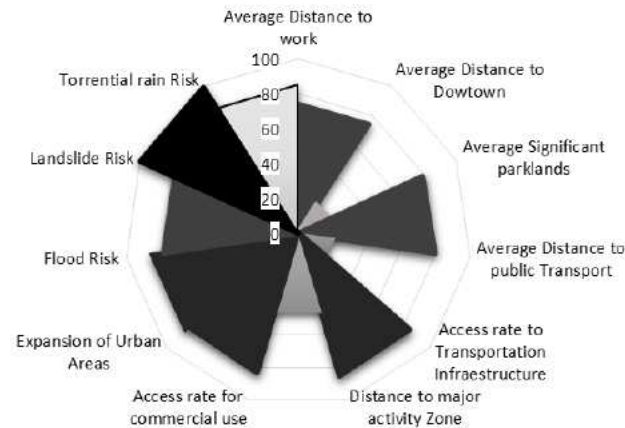
0   5   10 Km

- Circles of mobility

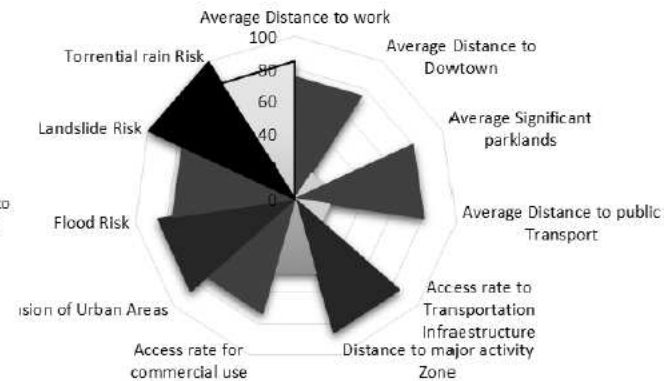Scenario No.1 - Highway development & VDHR Restricted
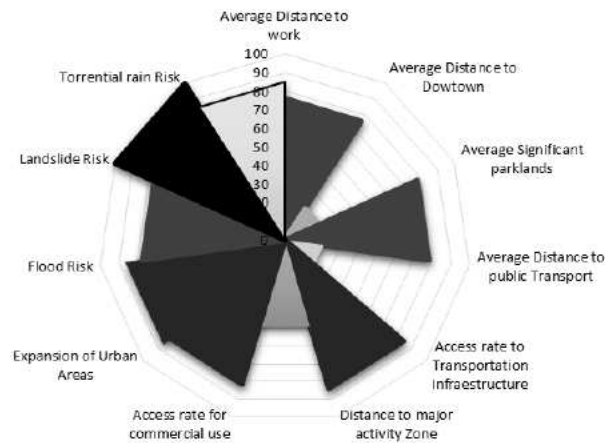
Scenario No.2 - Train & VDHR Restricted
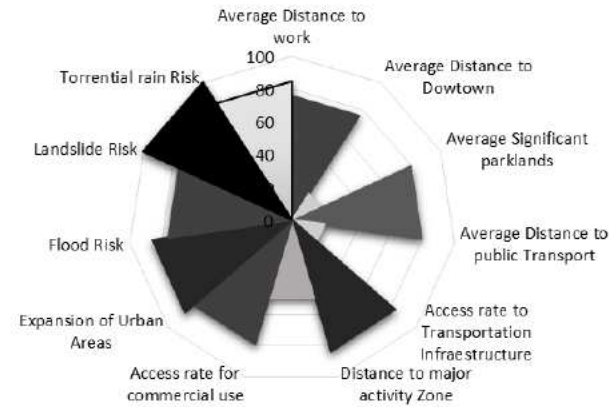
Scenario No.3 - Highway development & VDHR Unrestricted

Scenario No.4 - Train & VDHR Unrestricted

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: