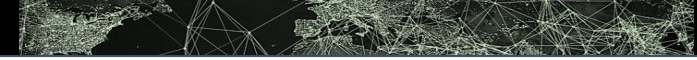




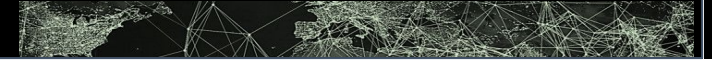
# Geographic Information Systems in NLA



## Summary

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1. GIS Conceptualization: meaning, structure and technology
  2. Why GIS in architecture?
  3. GIS implementation in NLA and its benefits
  4. Project: Municipal Spatial Planning in Timor-Leste
  - 5: Future of GIS
-



## Summary

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### **1. GIS Conceptualization: meaning, structure and technology**

2. Why GIS in architecture?

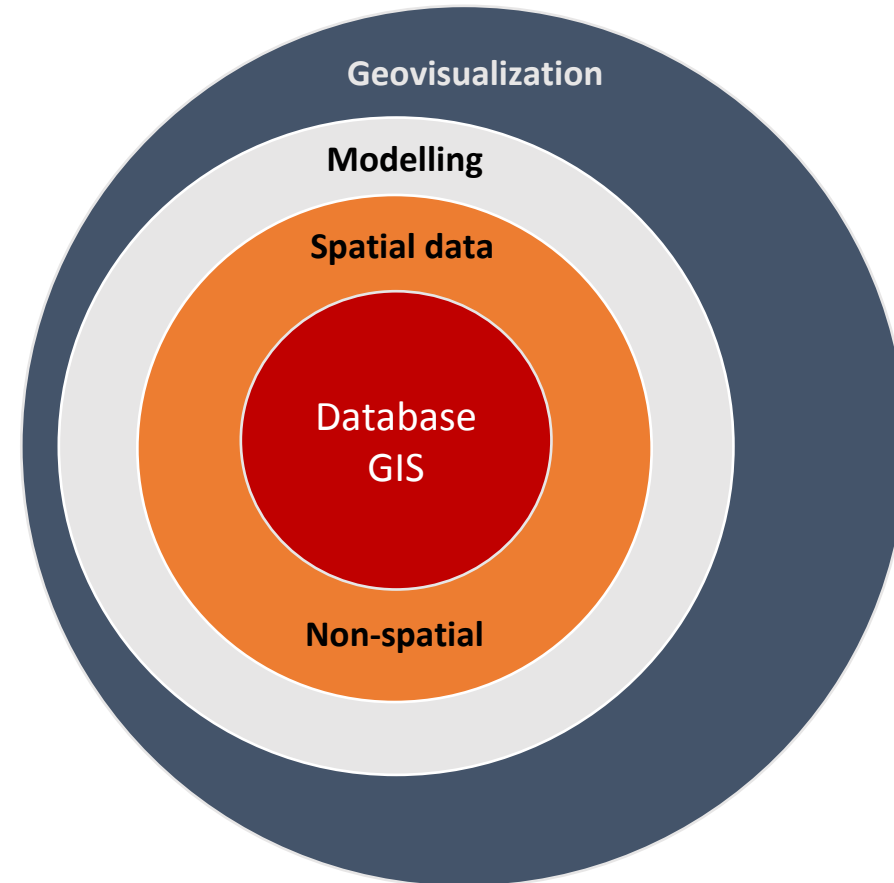
3. GIS implementation in NLA and its benefits

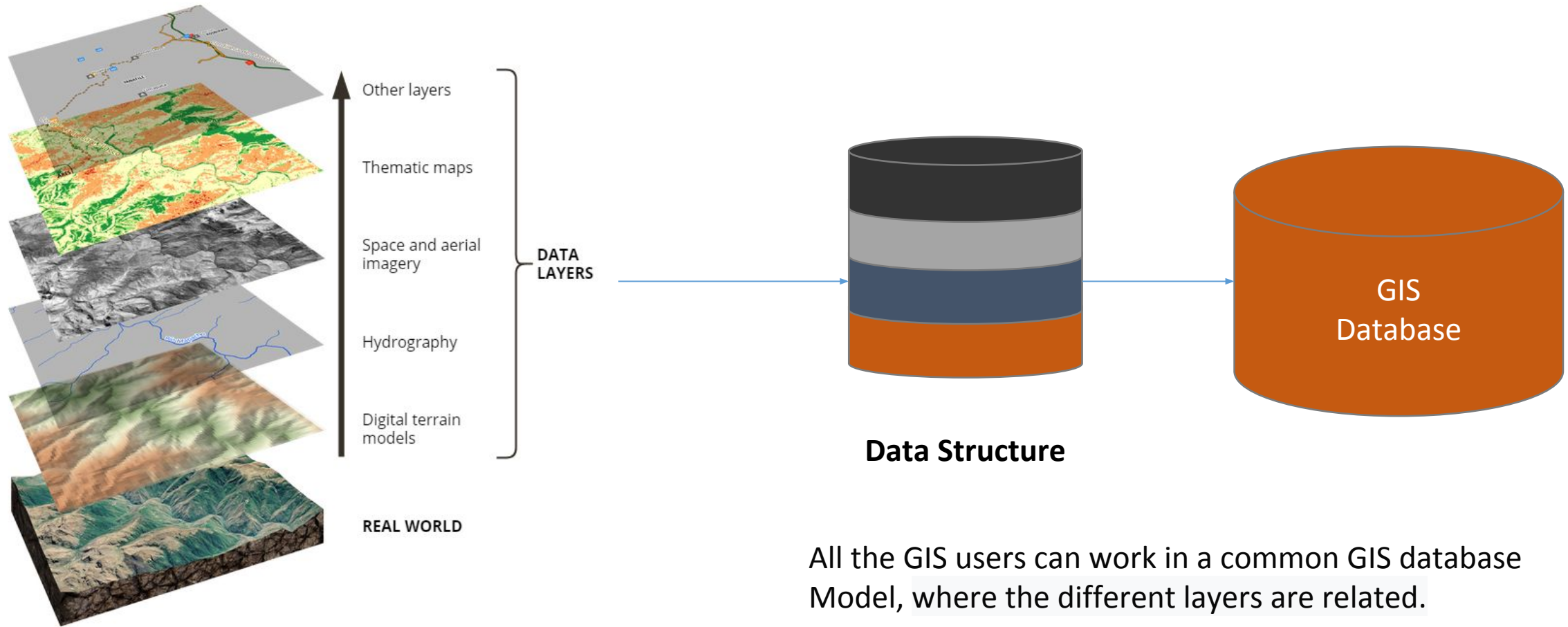
4. Project: Municipal Spatial Planning in Timor-Leste

5: Future of GIS

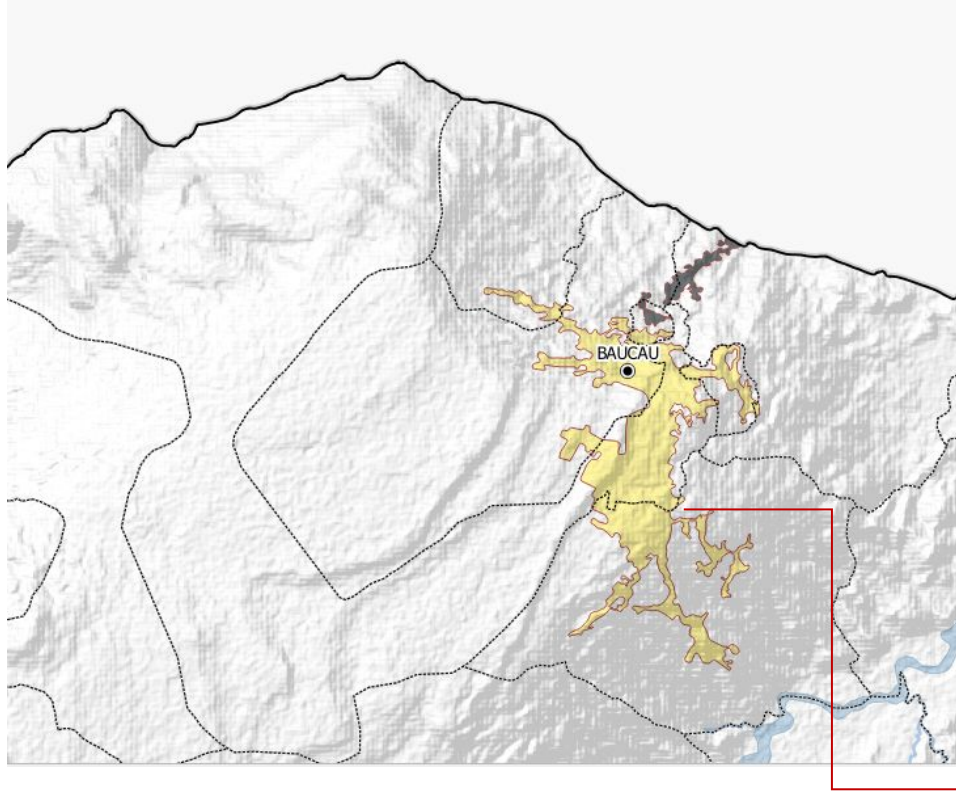
---

Spatial Analysis  
DataBase SOFTWARE  
Geographical geovisualization  
data HARDWARE geoprocessing  
Queries Maps  
Modelling Computer System





## GIS environment



Geometry ↔ Attributes

- coordinate system
- shape(point, line, polygon)

| fid | aurb_id | areasuco         | level_0 | level_1 | areapolurb        | areapoligo        | areaurbana        | propurbano     | est_total_        |
|-----|---------|------------------|---------|---------|-------------------|-------------------|-------------------|----------------|-------------------|
| 1   | 3793    | 141100621,522... | 0       | 22752   | 44283345,01618... | 7380557,50269827  | 12234173,62506... | 2,860806426... | 9200,071          |
| 2   | 3817    | 88118466,6210... | 0       | 7632    | 209542,4442650... | 104771,2221325... | 7445001,922204... | 0,028361289... | 119,97            |
| 3   | 3822    | 106565593,916... | 0       | 15284   | 1397254,811259... | 349313,7028148... | 8571108,928814... | 0,225119326... | 445,8470000000... |

# Geospatial Technologies



OpenStreetMap

**Opendata**

(OpenStreetMap, Urban Atlas from Copernicus Land Monitoring Service)

## Remote Sensing

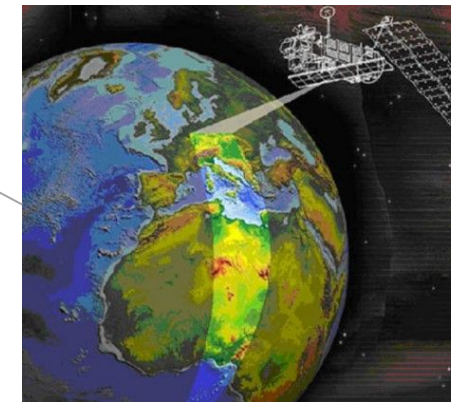
Extraction of 2D data based on satellite imagery

Products: Land cover mapping



## Remote Sensing

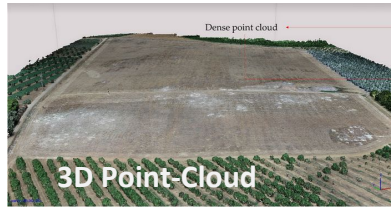
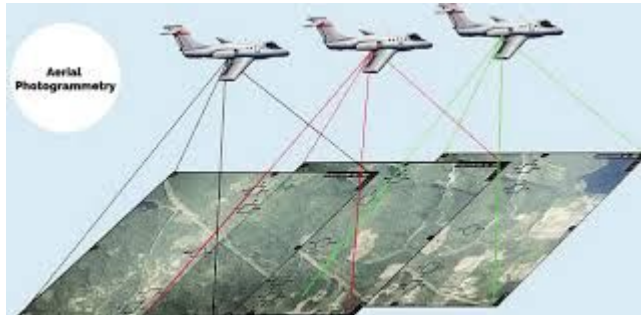
Extraction of 3D data based on radar imagery



Products: 3D models of Earth's surface

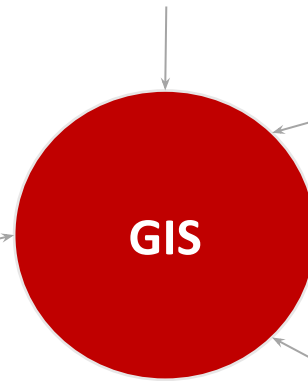
## Photogrammetry

Extraction of 2D/3D data based on aerial imagery or LiDAR data

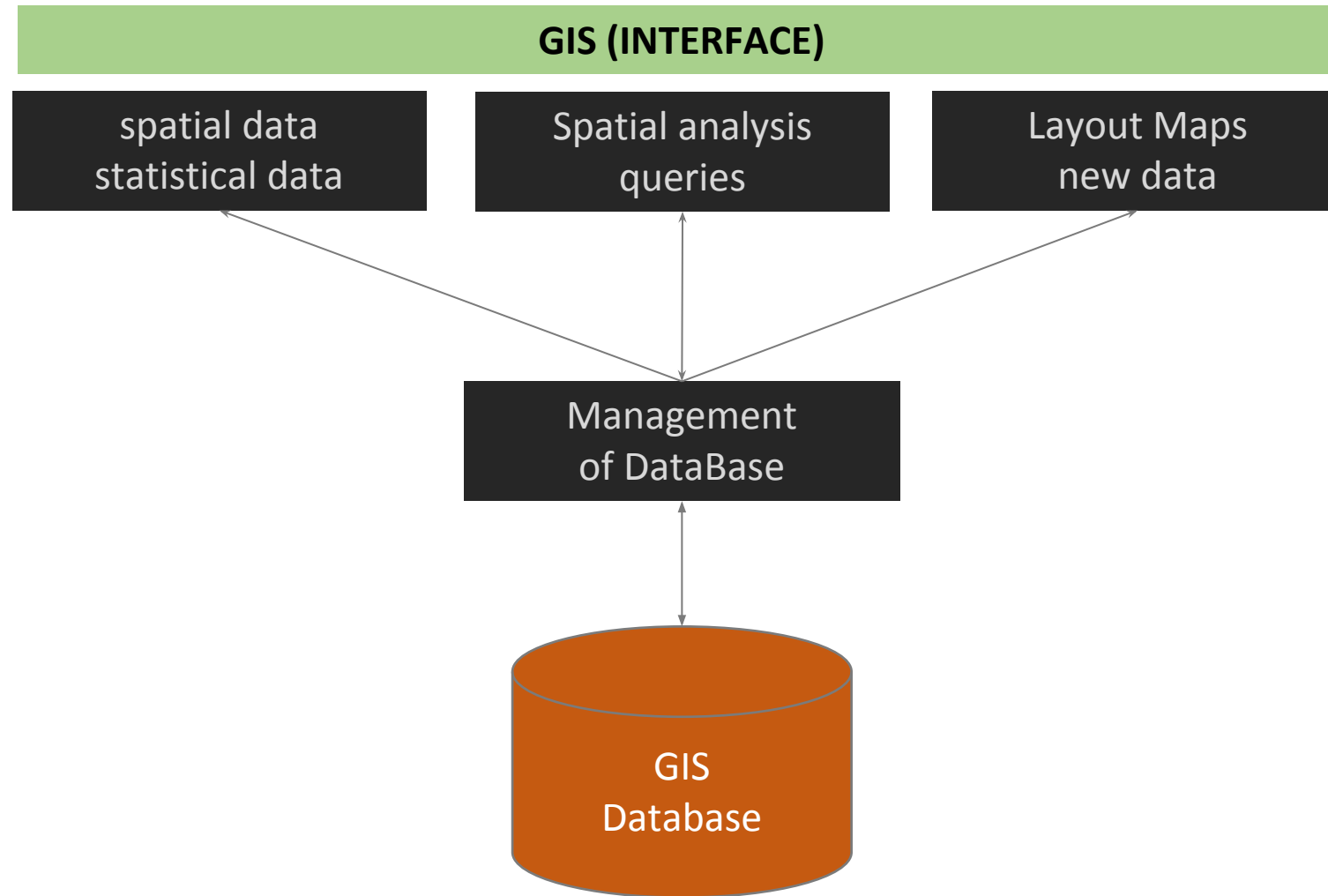
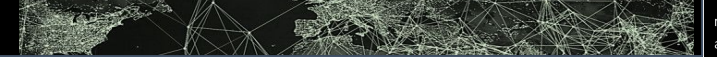


Products: Large scale topographic maps (2D) and 3D model surfaces

## GNSS and topography







## Summary

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-

## WHY GIS in ARCHITECTURE?

 Geographic Information Systems is a powerful tool ...

for **urban and regional planning - development and management** of plans; **analysis**; and **review** of environmental impacts.

in defining strategic plans for the management of **architectural heritage**, such as the identification of historic sites and their rehabilitation.

# What are the benefits of GIS tool for architects and spatial planners?

It can contribute to an efficient **decision and planning**

**explore** real-world spatial data within **database model**

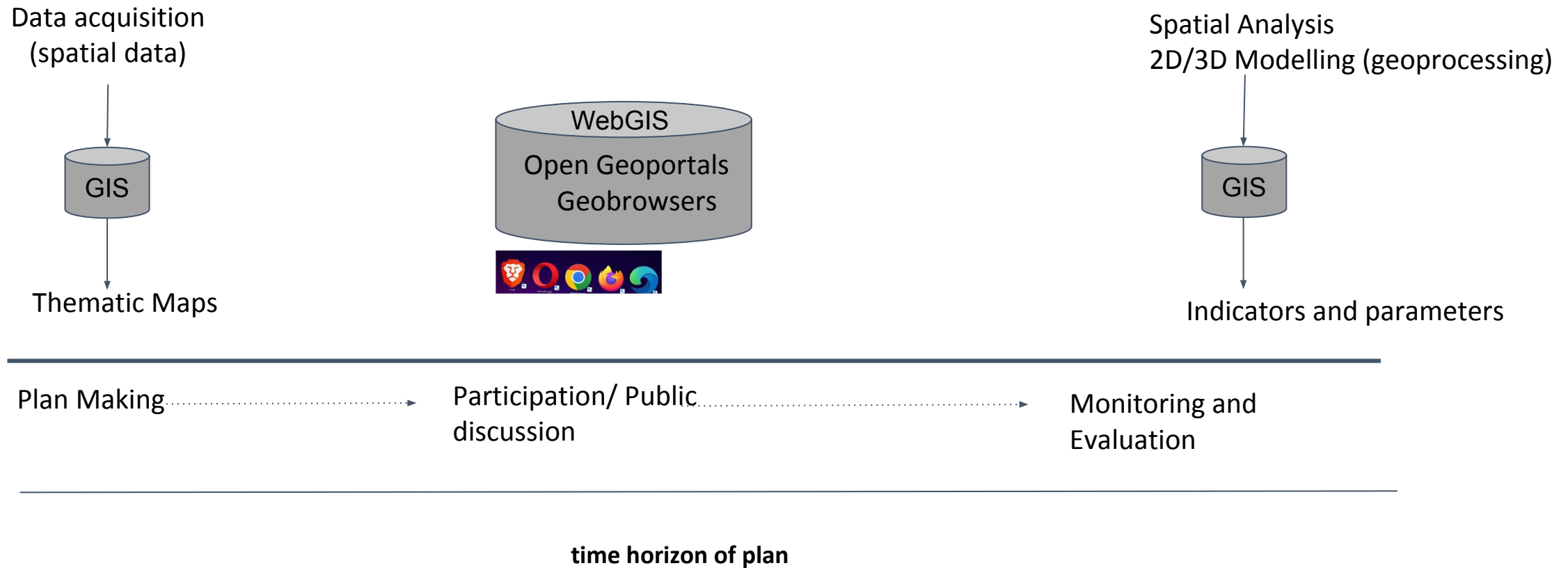
landscape **modelling** scenarios using **spatial analysis tools**

estimation of **indicators** or **urban parameters** of a plan through **GIS-based modelling**

- Inventory and catalogue of architectural heritage
- City management;
- mapping of utility networks and planning for service interruptions;
  
- Identify the best location for the construction of school/hospital
- compactness measurement of urban form at neighbourhood scale
- Network modelling for the management of public transport connection - Mobility
  
- measurement of population density per neighbourhood unit
- Estimation of energy efficiency buildings
- micro-spatial analysis for urban planning based on census tracts and building population (e.g. total volume building)

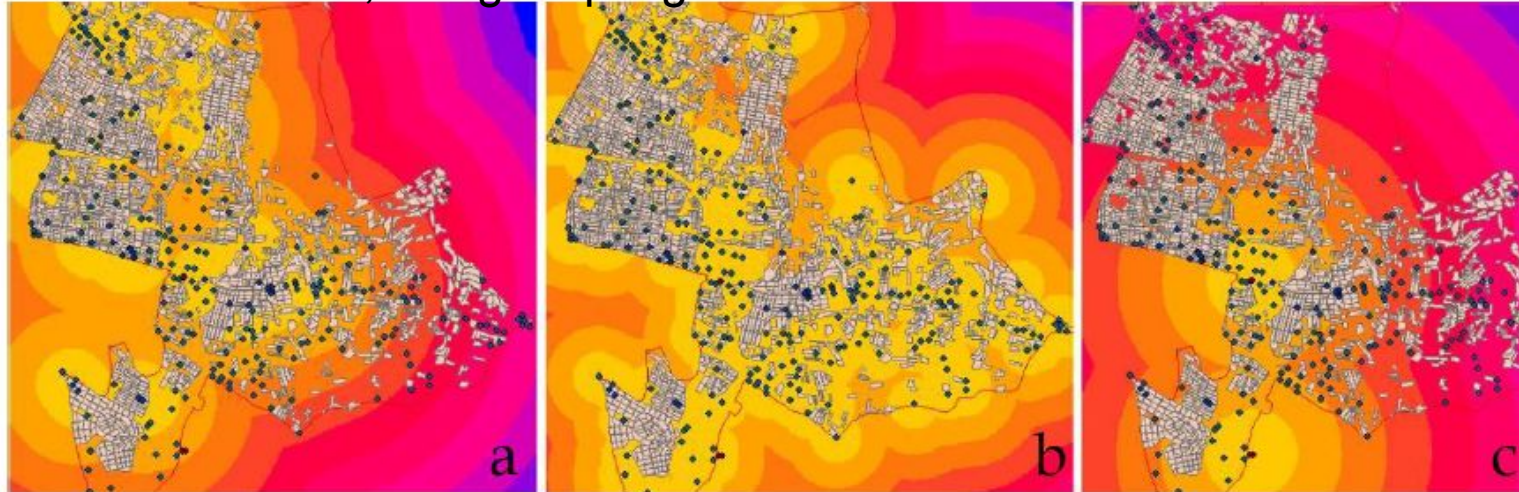
# Urban and Regional Planning

Stages of urban and regional planning process can be supported by GIS



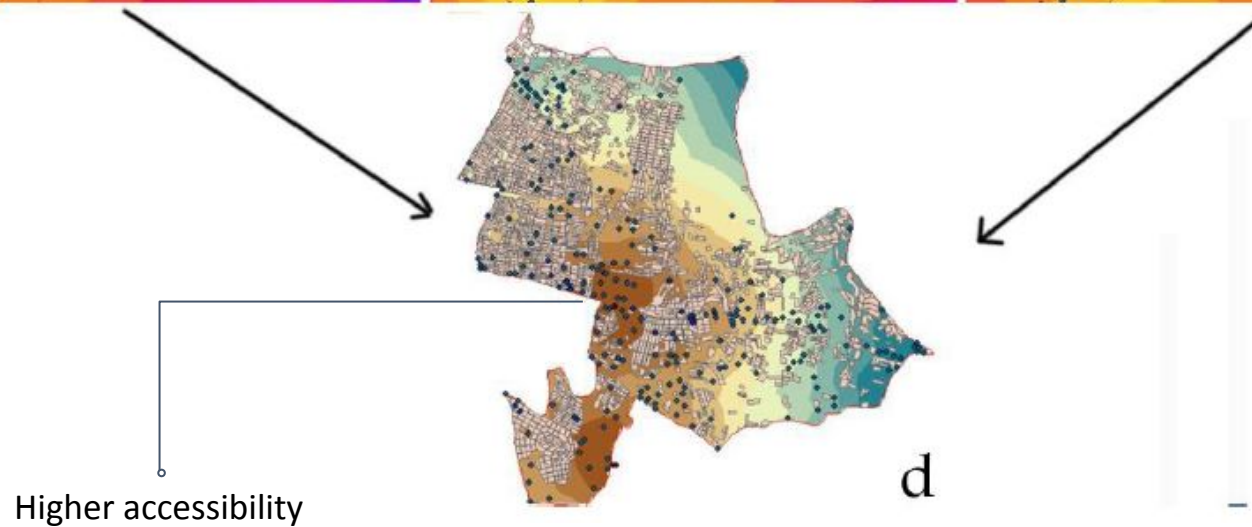
GIS can provide some of the data and techniques that are needed in different stages of the process.

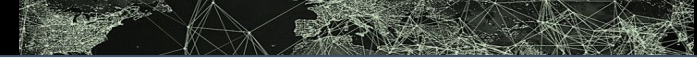
identify the accessibility of an urban areas, estimated at an urban block level, using map algebra



Combining data related to geometric

- (a) Distance from commercial facilities,
- (b) Distance from public buildings,
- (c) Distance from metro stations,
- (d) Combined accessibility.





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-



**GIS NLA (INTERFACE is based on FREE AND OPEN-SOURCE SOFTWARE)**

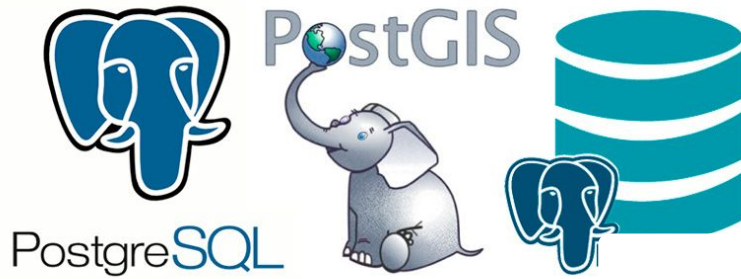
Vector, Raster  
Statistical data

Edition/Validation  
spatial data

Spatial Analysis  
Queries

Output data  
Maps

GIS Database  
Management



**Query Editor**    Query History

```

1
2
3 Alter table "Limites_Admin"."sucos_2022_DGE_448"
4 add column geom_cent geometry (point)
5 Alter table "Limites_Admin"."sucos_2022_DGE_448"
6 add column geom_cent_M geometry (multipoint)
7 --gestao 2022/Outubro
8
9 update "Limites_Admin"."sucos_2022_DGE_448"
10 set geom_cent=st_centroid(geom_32751)
11
12
13
14
15
    
```

**Data Output**    Explain    Messages    Notifications

| postgo                 | est_totalpop_posto | area_totalpovriskslope_posto |
|------------------------|--------------------|------------------------------|
| character varying (50) | double precision   | double precision             |
| 1 Hatulia B            | 18542.14467152729  | 2250840.9111431916           |
| 2 Atsabe               | 18715.47676749568  | 1203606.0760797614           |
| 3 Rallaco              | 11917.275036510573 | 1495339.7262129935           |
| 4 Ermera               | 36086.53295018155  | 3282330.790000868            |
| 5 Letefoho             | 21760.533473724423 | 1923221.3135338174           |





## GIS Project ENvironment

The screenshot displays the QGIS interface with the following components:

- Browser (2):** A tree view showing project layers such as 'pmtot\_base\_01', 'pmtot\_bo', and '044BO\_PO001'.
- Layers:** A list of loaded layers including 'Bobonaro\_grid\_25000', '044BO\_PO001', and 'Proteção de Infraestruturas e Equipamentos'.
- Map Canvas:** A topographic map showing roads, rivers, and administrative boundaries. A red line highlights a specific route.
- Processing Toolbox:** A panel on the right containing various processing algorithms like 'Export', 'Recently used', 'Cartography', and 'GDAL'.
- Identify Results:** A table showing the results of a query on the map.

| Feature   | Value                         |
|-----------|-------------------------------|
| name      | Parque Nacional Monte Loelako |
| (Derived) |                               |
| (Actions) |                               |
| id_0      | 5                             |
| id        | 4                             |
| fid       | 5                             |
| name      | Parque Nacional Monte Loelako |
| area_ha   | 5227                          |
| type      | Parque Nacional               |
| label     | E                             |
| CODE      | NULL                          |

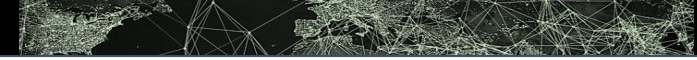
### GIS Benefits in NLA

efficiency in development, analysis, and management of the plan;

higher management control of data;

Centralisation of data in a Common GIS database;

Time Benefits;

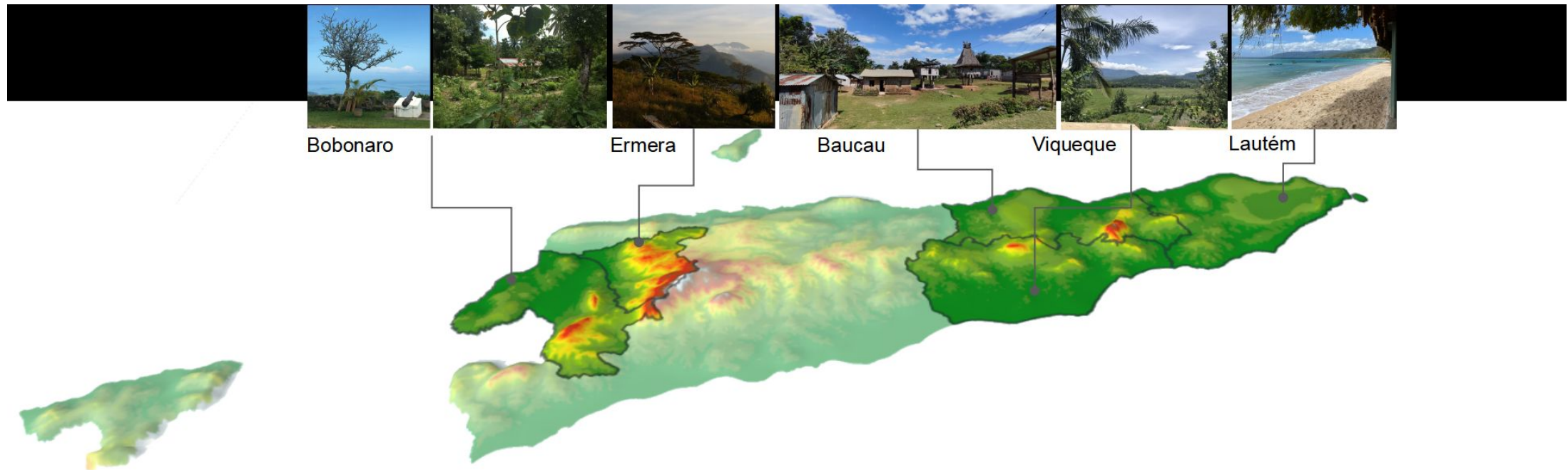


## Summary

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  - 5: Future of GIS
-

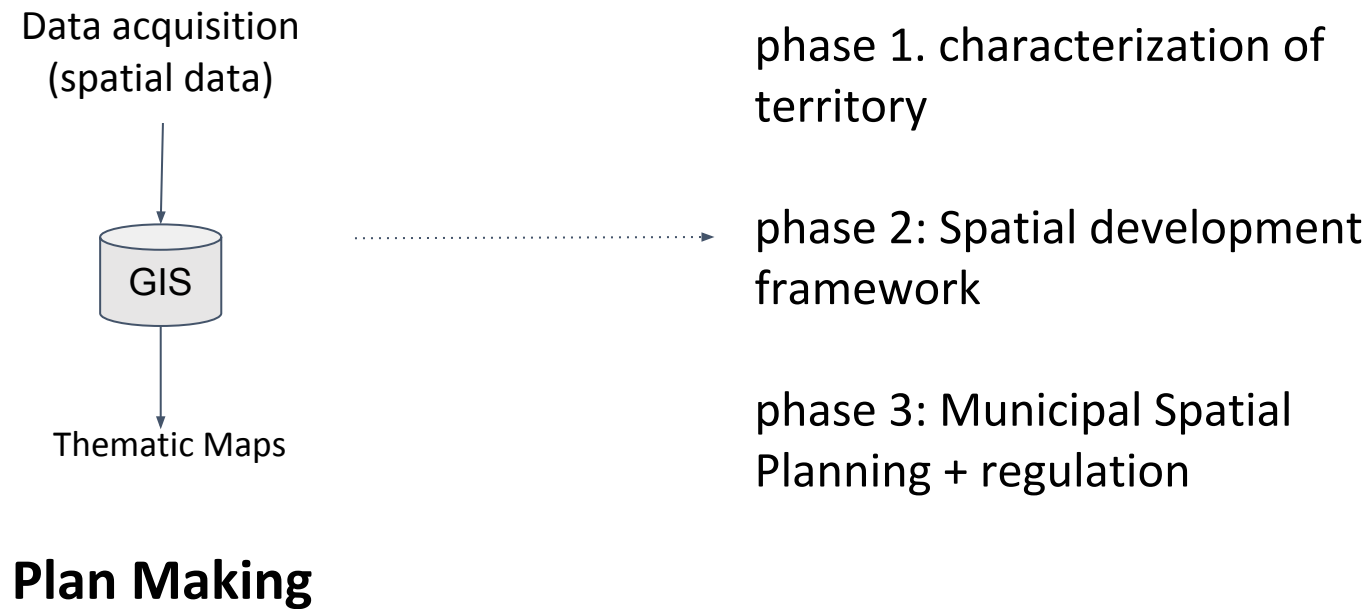
## Project - **Municipal Spatial Planning** for **FIVE municipalities**



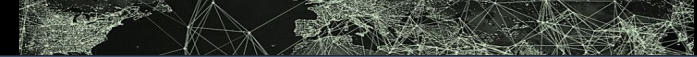
Area of Timor-Leste: 14.700Km<sup>2</sup> (aprox.)

## Project - **Municipal Spatial Planning**

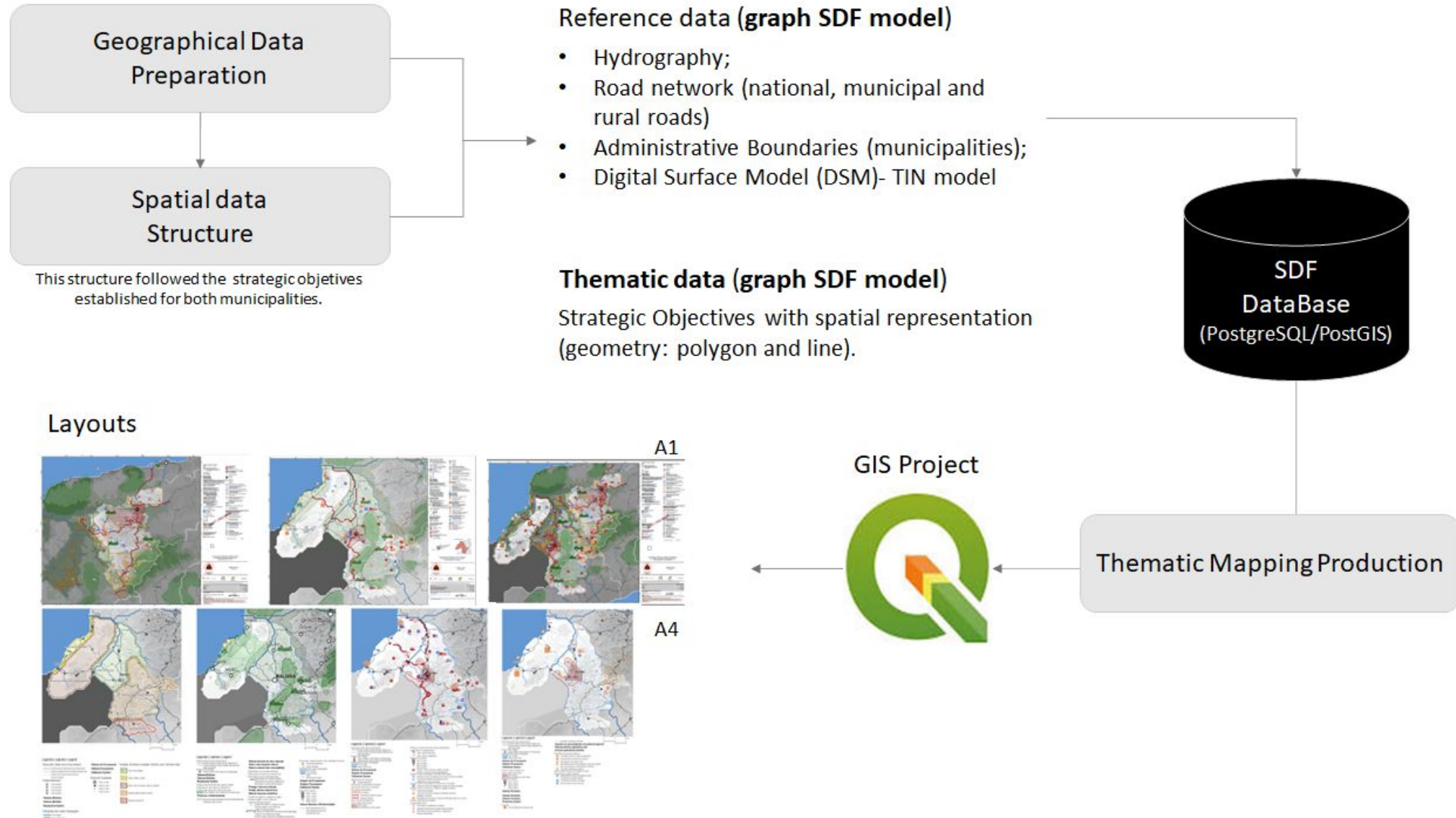
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# WORKFLOW

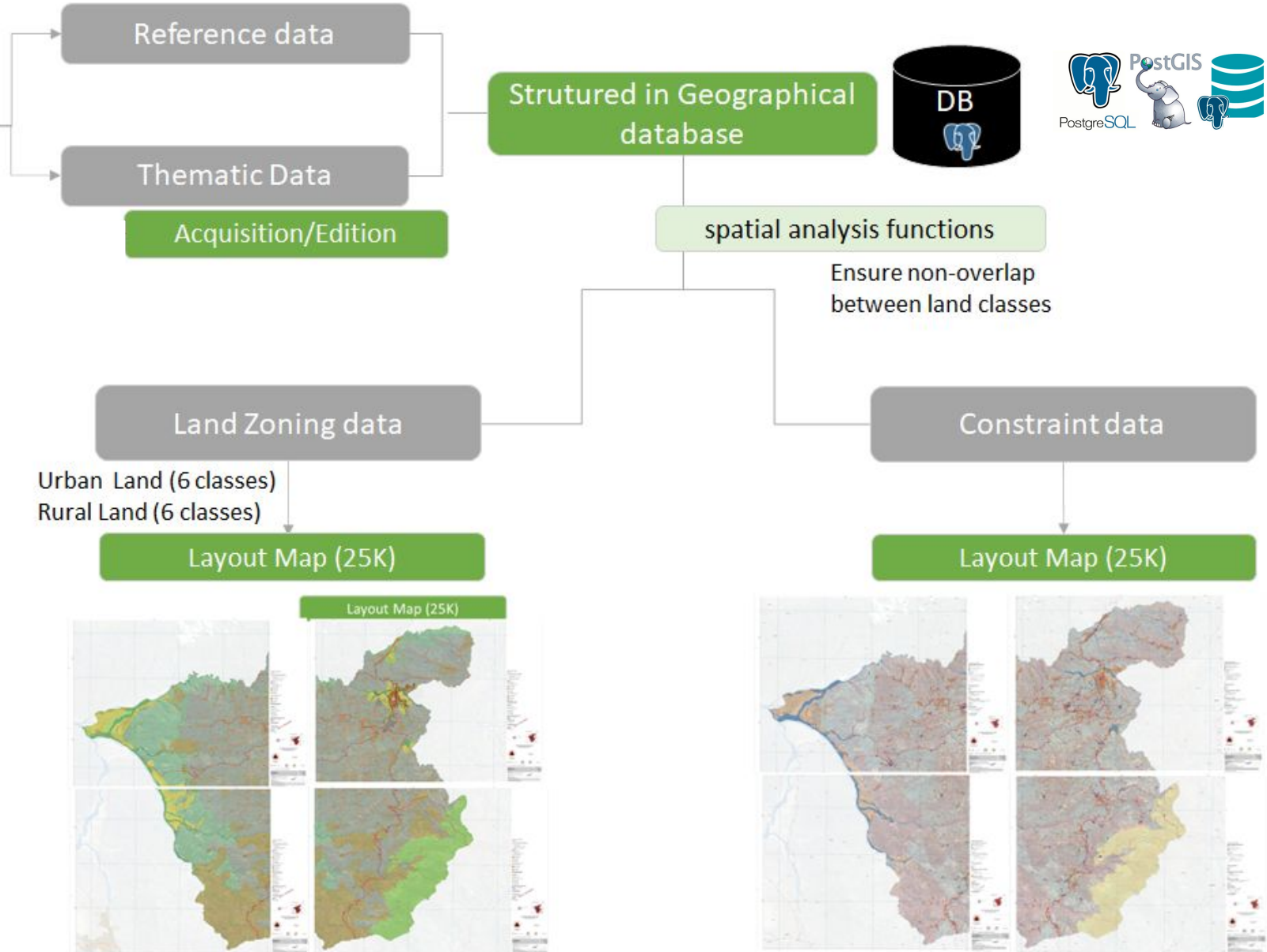


phase 2: **Spatial development Framework**

# GIS PROJECT



Municipal Spatial Planning  
Preparation of Spatial data

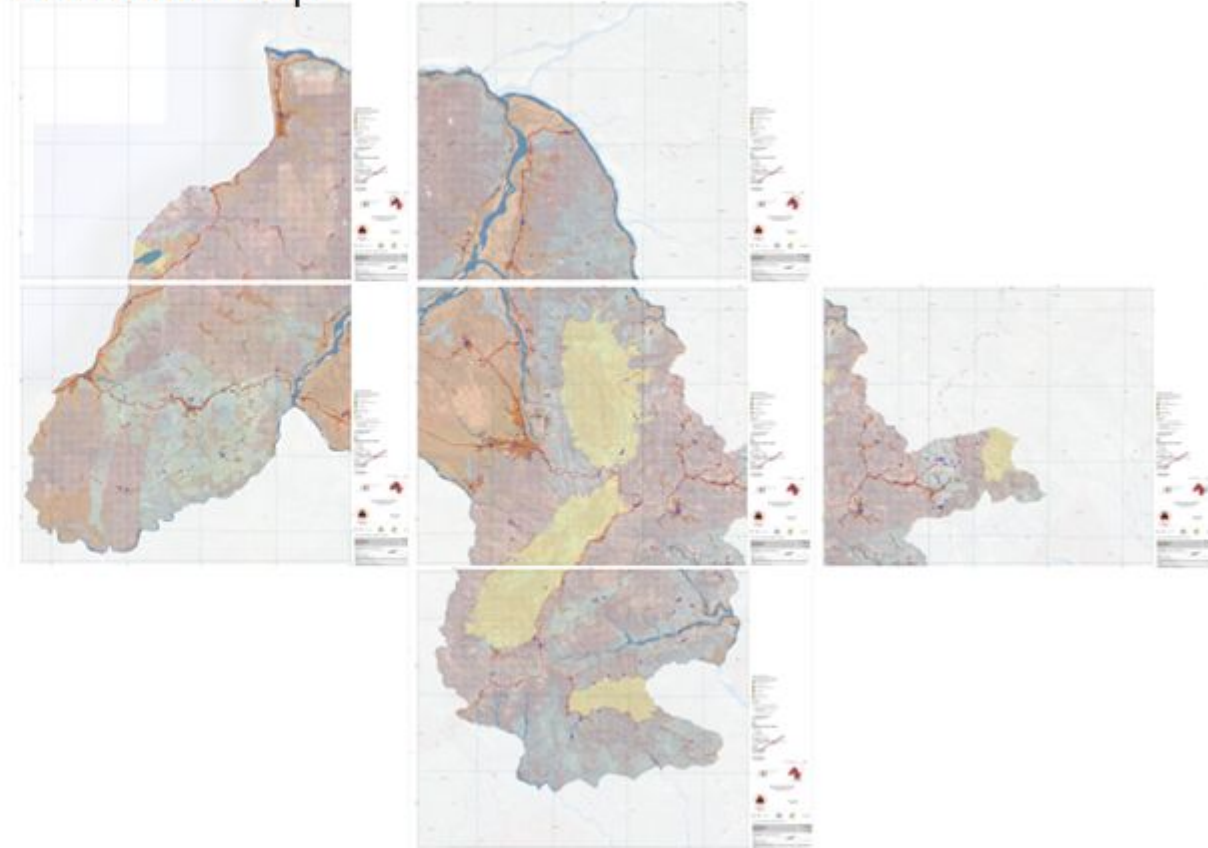


phase 3. **Municipal Spatial Planning**

Land Zoning Map



Constraint Map

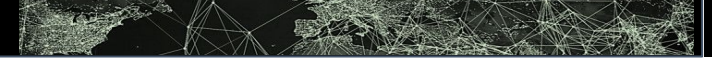


phase 3. **Municipal  
Spatial Planning**





# GIS Spatial Analysis in NLA

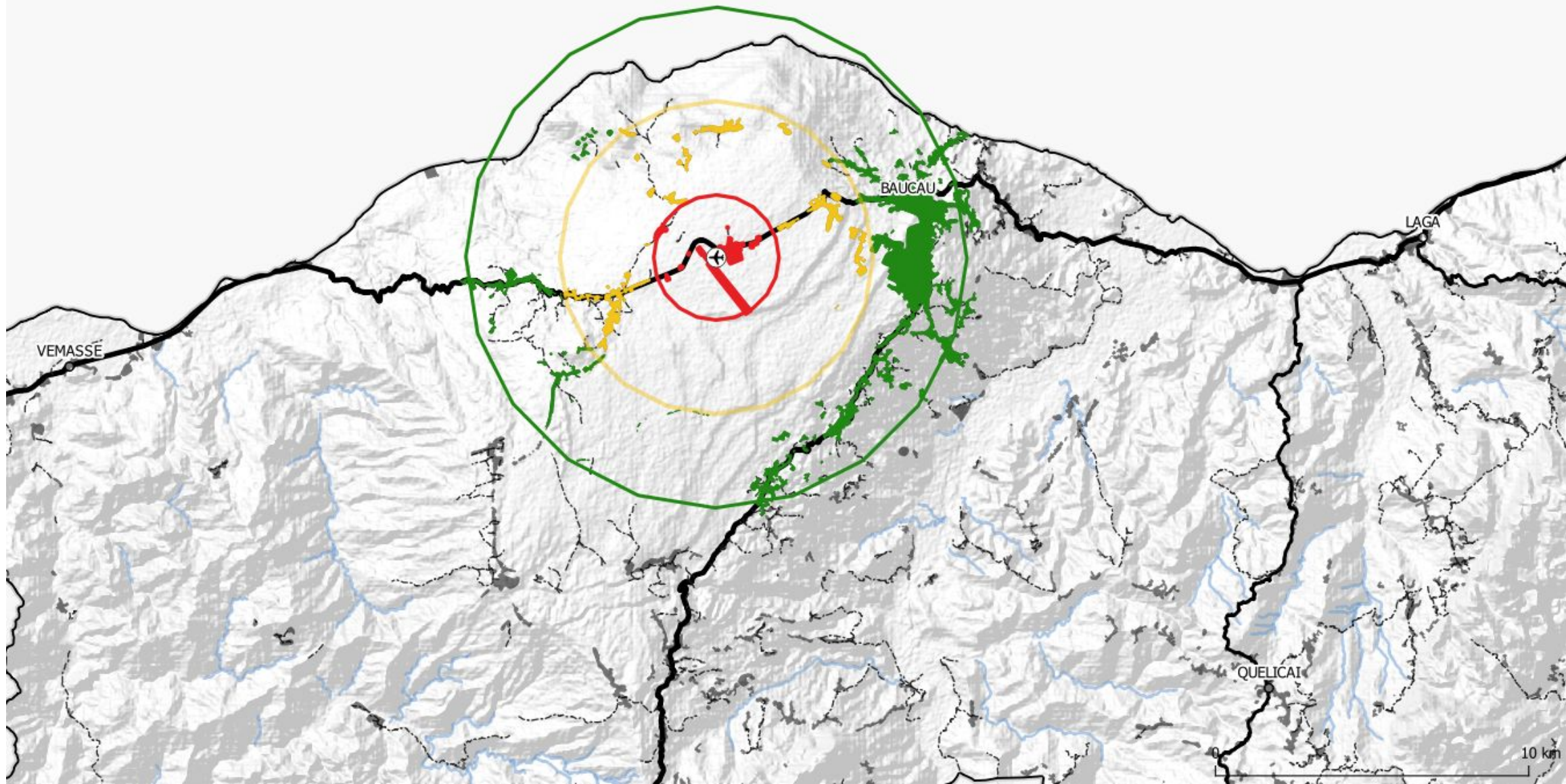


# GIS Spatial Analysis in NLA

1

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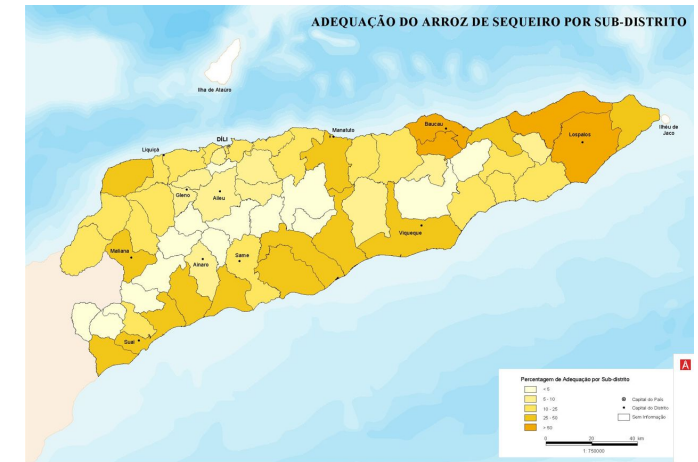
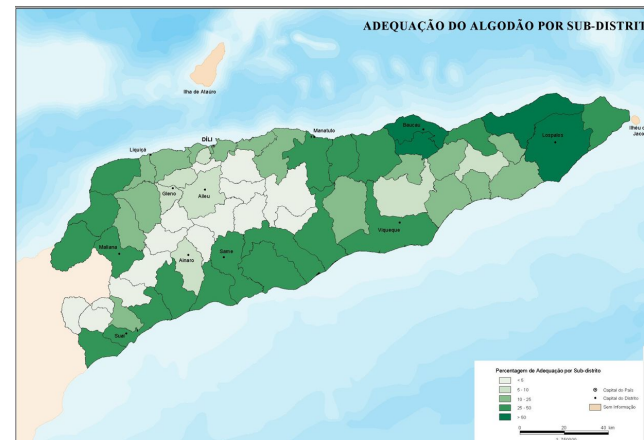
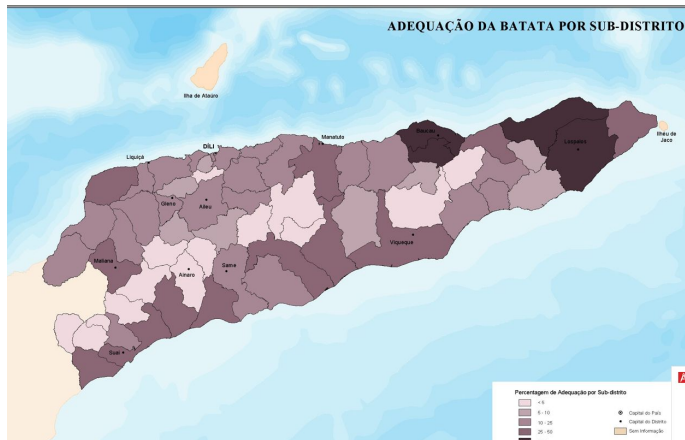
IDENTIFICATION OF POPULATED AREAS LOCATED AT A DISTANCE OF 2 KM, 5 KM  
AND 8 KM FROM BAUCAU AIRPORT



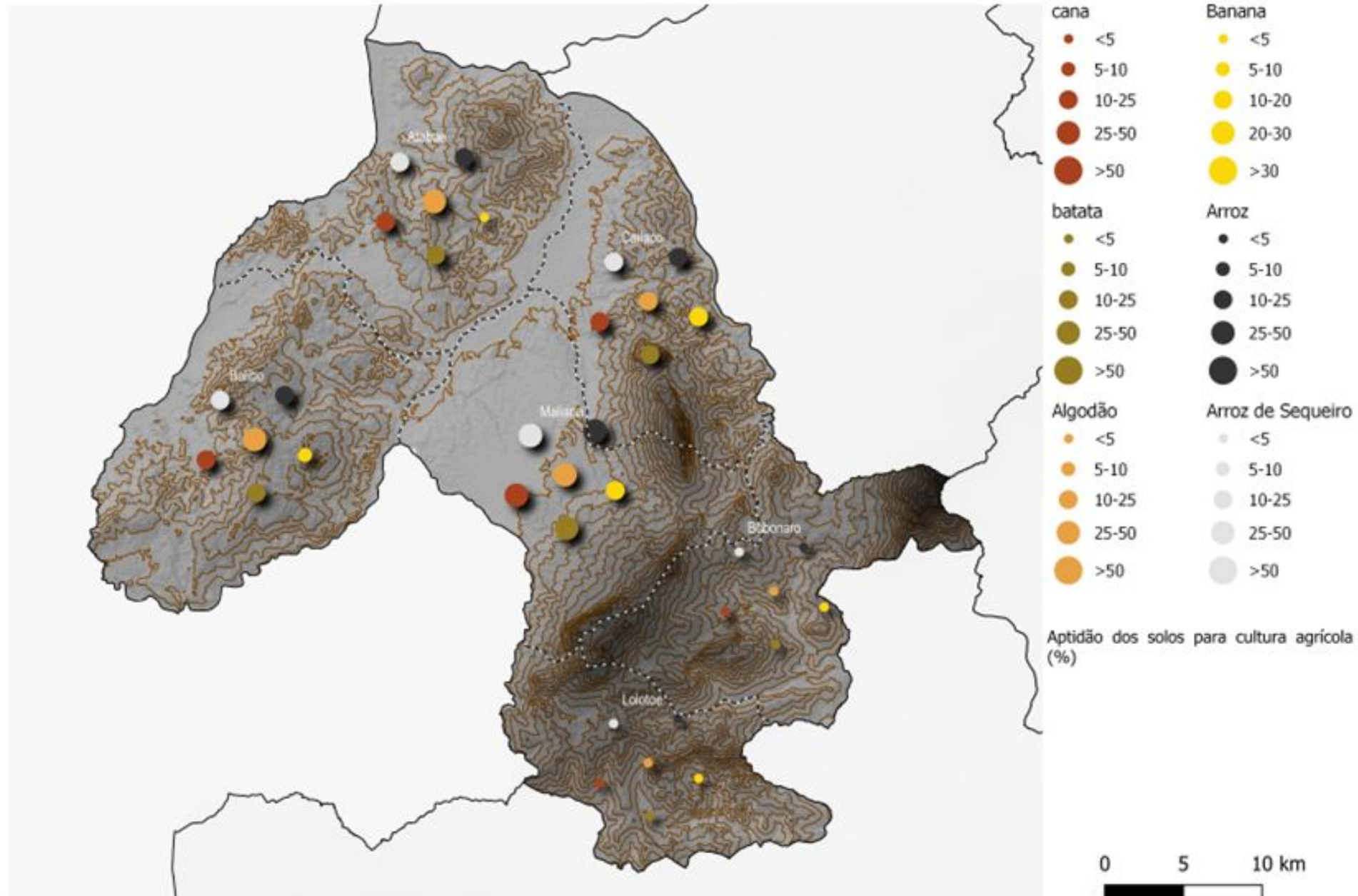
# GIS Spatial Analysis in NLA

2

How to represent on a single map all the different aptitudes of agricultural crops in each municipality?



Potential of all  
agricultural Crops in  
each administrative  
boundaries





## GIS Spatial Analysis in NLA



3

---

What's the percentage of "water" in each administrative boundary?

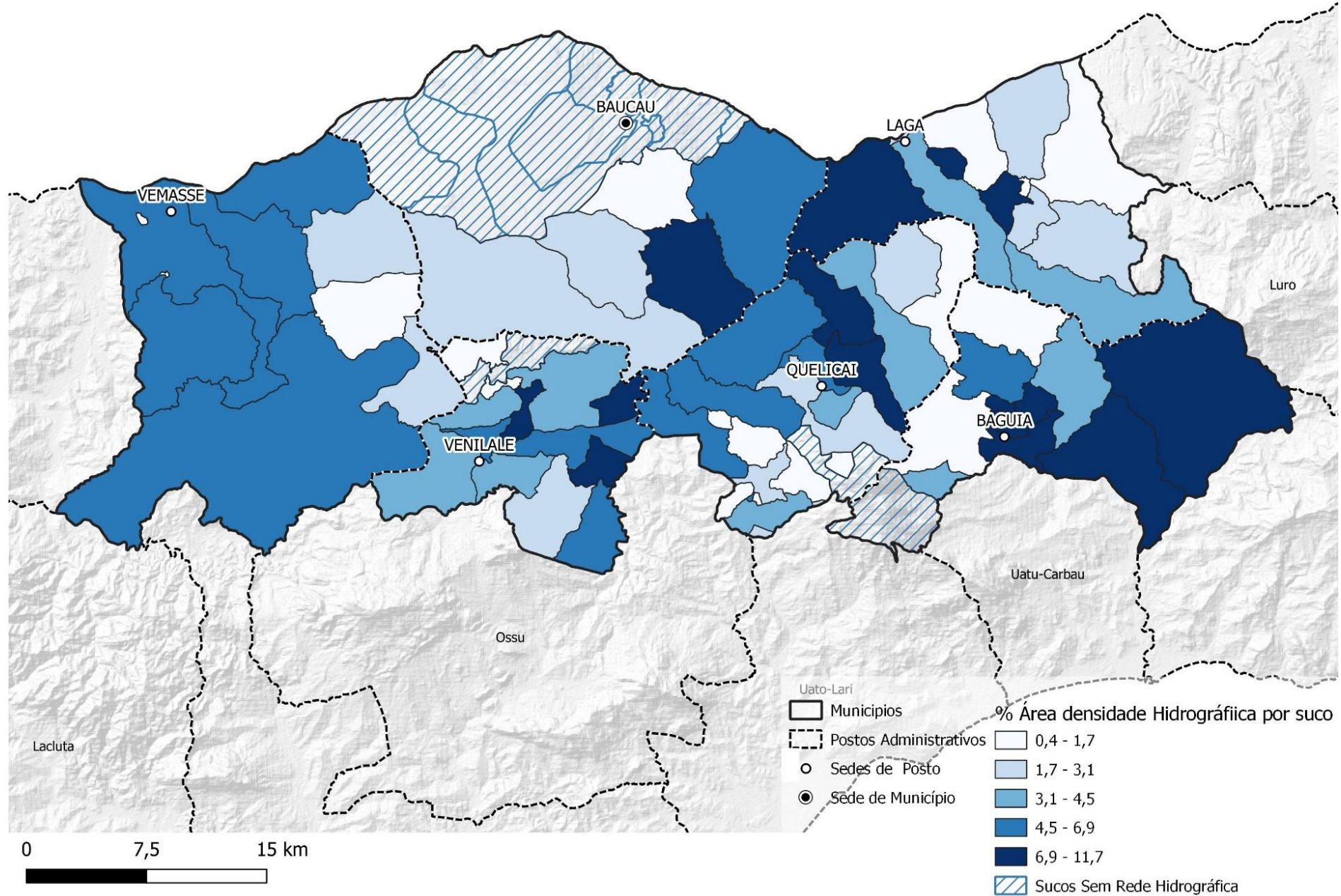
**Input data:**

network streams

Administrative boundaries



spatial function analysis was  
applied



# GIS Spatial Analysis in NLA

4

---

Represent the slope classes in each administrative boundary by diagram

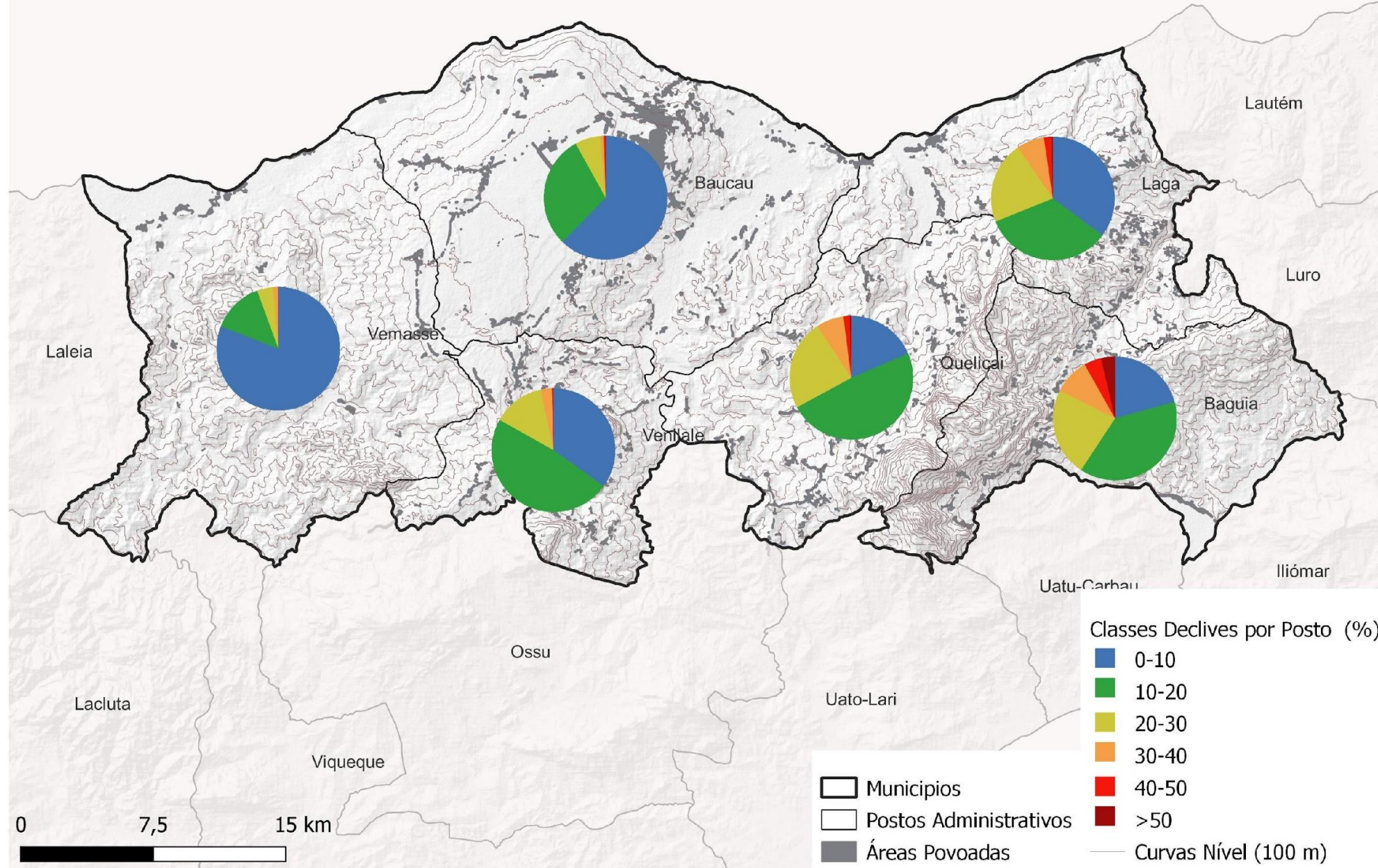
**Input data:**

Vector: Administrative  
boundaries

Raster: DTM (SRTM)



Identify the administrative boundary that have more percentage of higher slopes (> 30%).



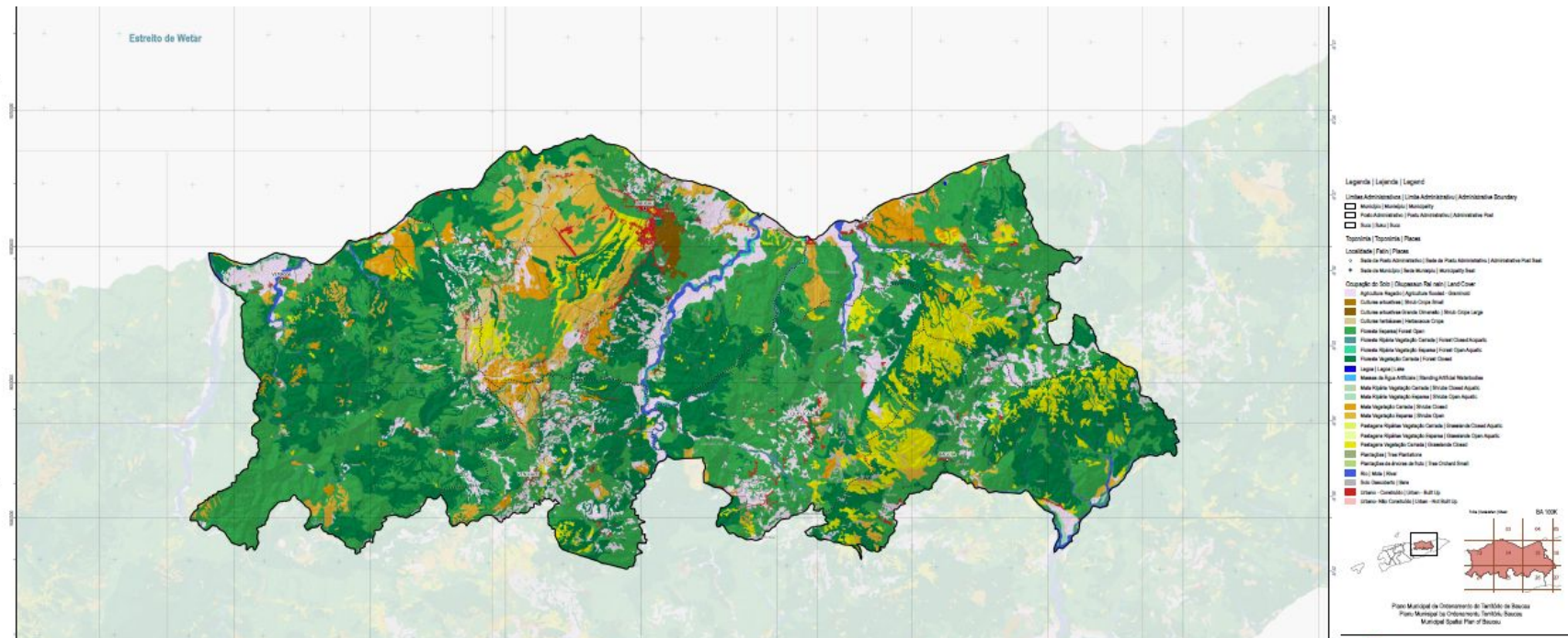
# GIS Spatial Analysis in NLA

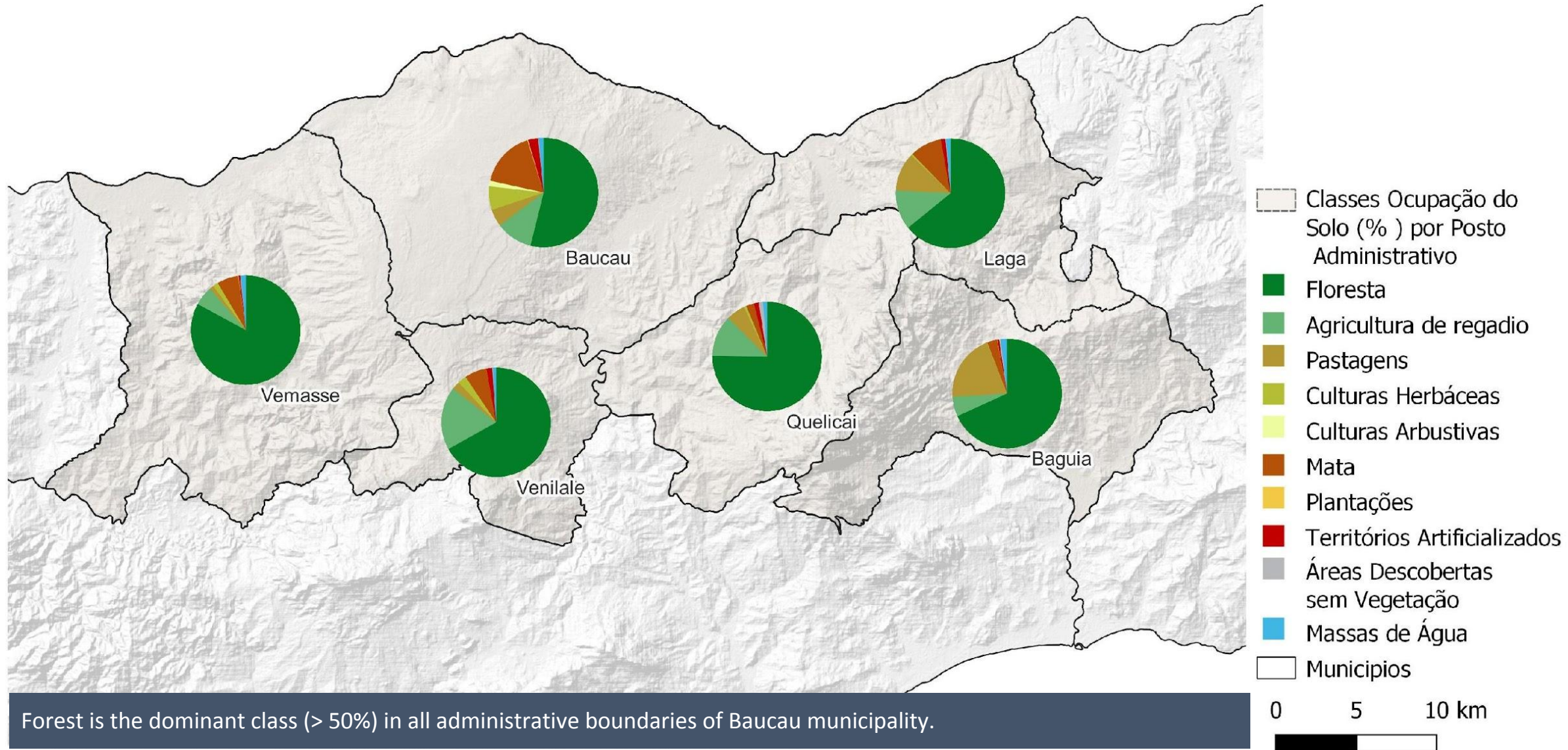
5

Represent the percentage value of land cover classes in each administrative boundary

**Input data:**

Vetor: Land Cover (open data); Administrative boundaries





Forest is the dominant class (> 50%) in all administrative boundaries of Baucau municipality.

# GIS Spatial Analysis in NLA

6

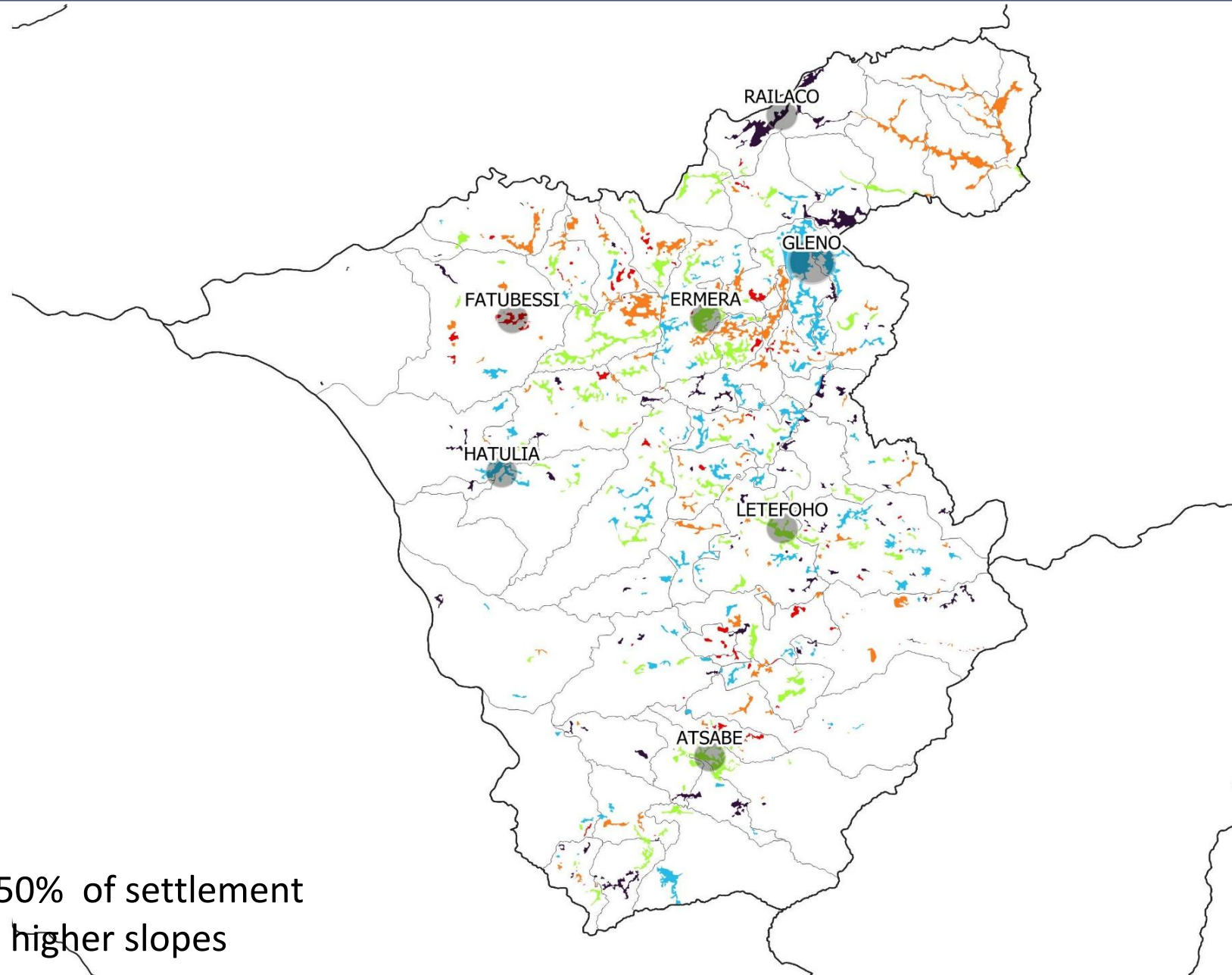
Identify the percentage area of rural settlements that Intersect Slopes Over 30%

## Input data:

Vector: Administrative  
boundaries ;  
raster: MDT SRTM; SLOPE  
MODEL



spatial function analysis was  
applied



Rede Povoamento

● Nível 1 | Level 1

● Nível 2 | Level 2

(%) Área do Povoamento  
exposta a declives > 30%

■ 0 - 5,7

■ 5,7 - 17,5

■ 17,5 - 33,1

■ 33,1 - 56,4

■ 56,4 - 100

□ Municipios

□ Sucos

0 5 10 km



FATUBESSI: more than 50% of settlement  
rural area is exposed to higher slopes

7

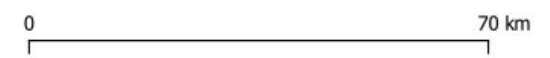
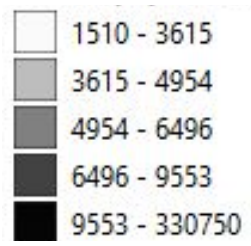
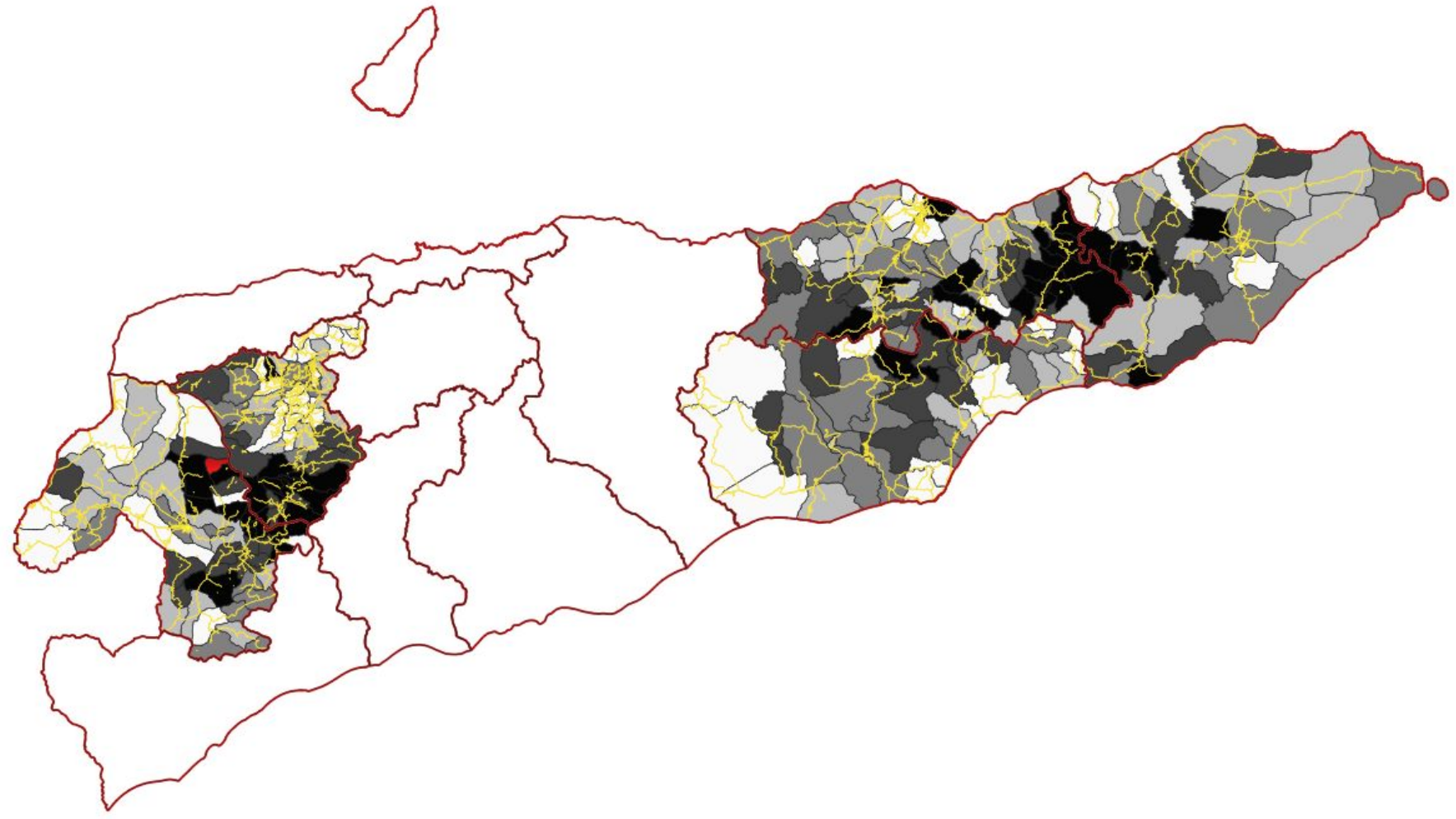
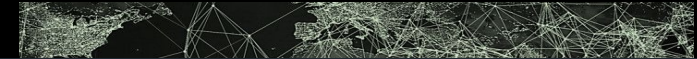
---

VISUALIZATION OF POPULATION DENSITY (HAB/KM2) in EACH ADMINISTRATIVE BOUNDARY.

**Input data:**

Census tracts: 2015

Vetor: Administrative  
boundaries ;

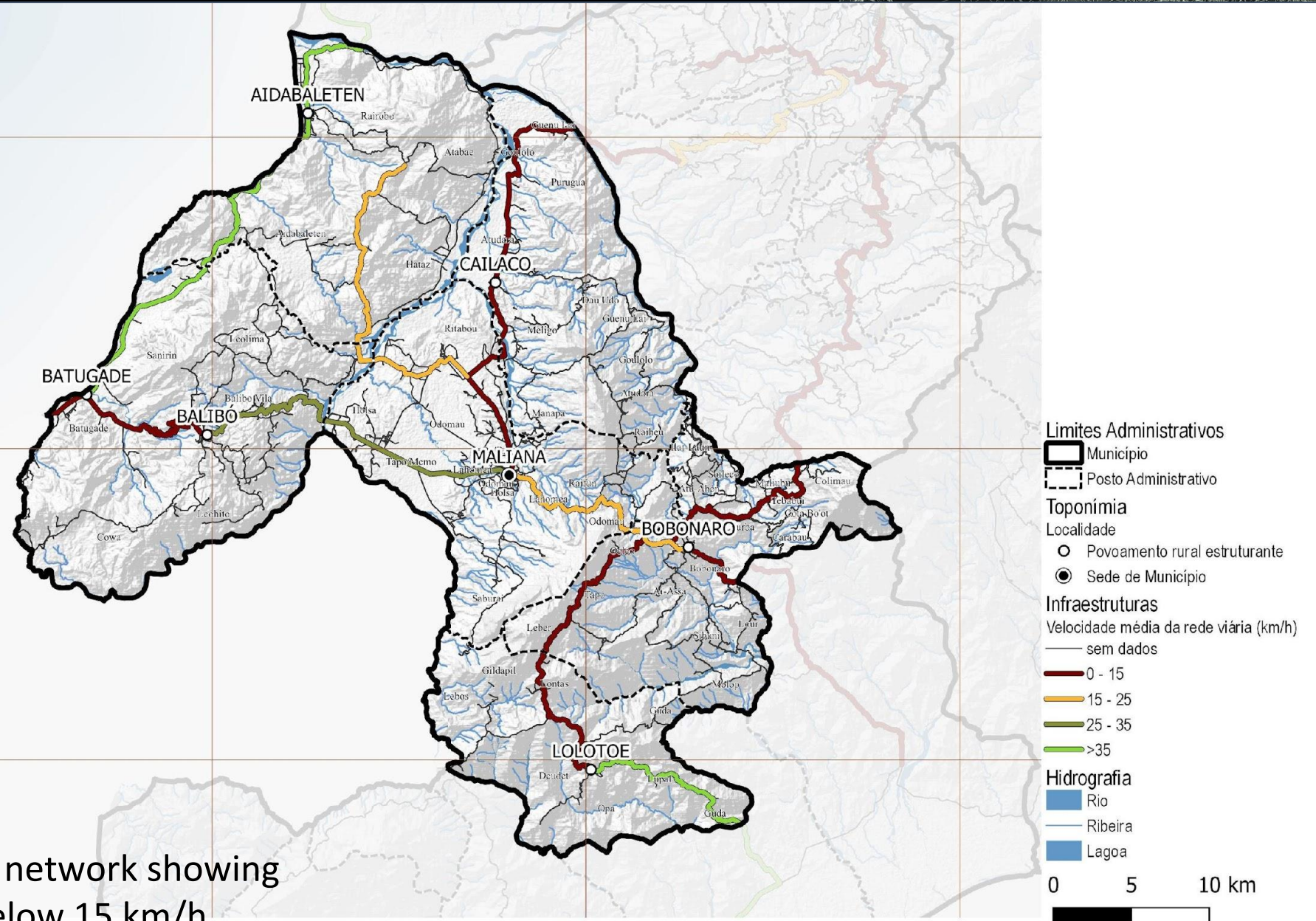


8

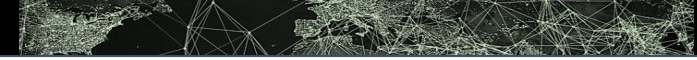
---

AVERAGE SPEED TRAVEL of NETWORK ROAD





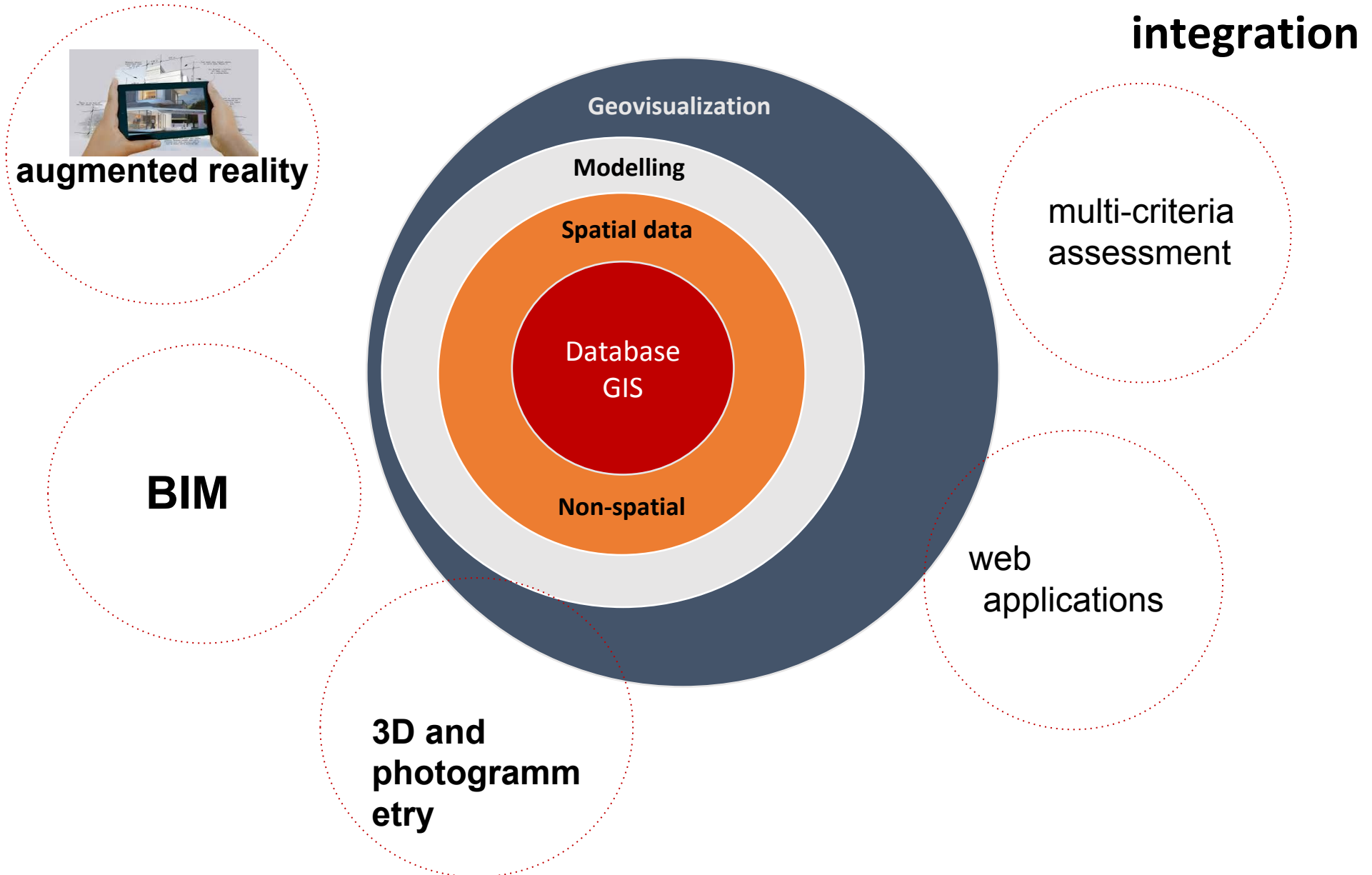
The **red colour** of the road network showing estimated travel speeds below 15 km/h.



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Thanks for your time!