HYBRID CITY

a Planning strategy for the Sustainable Development of the Bogotá River Basin

Angela María Moncaleano Novoa

Department of Urbanism **Faculty of Architecture** **TU Delft**

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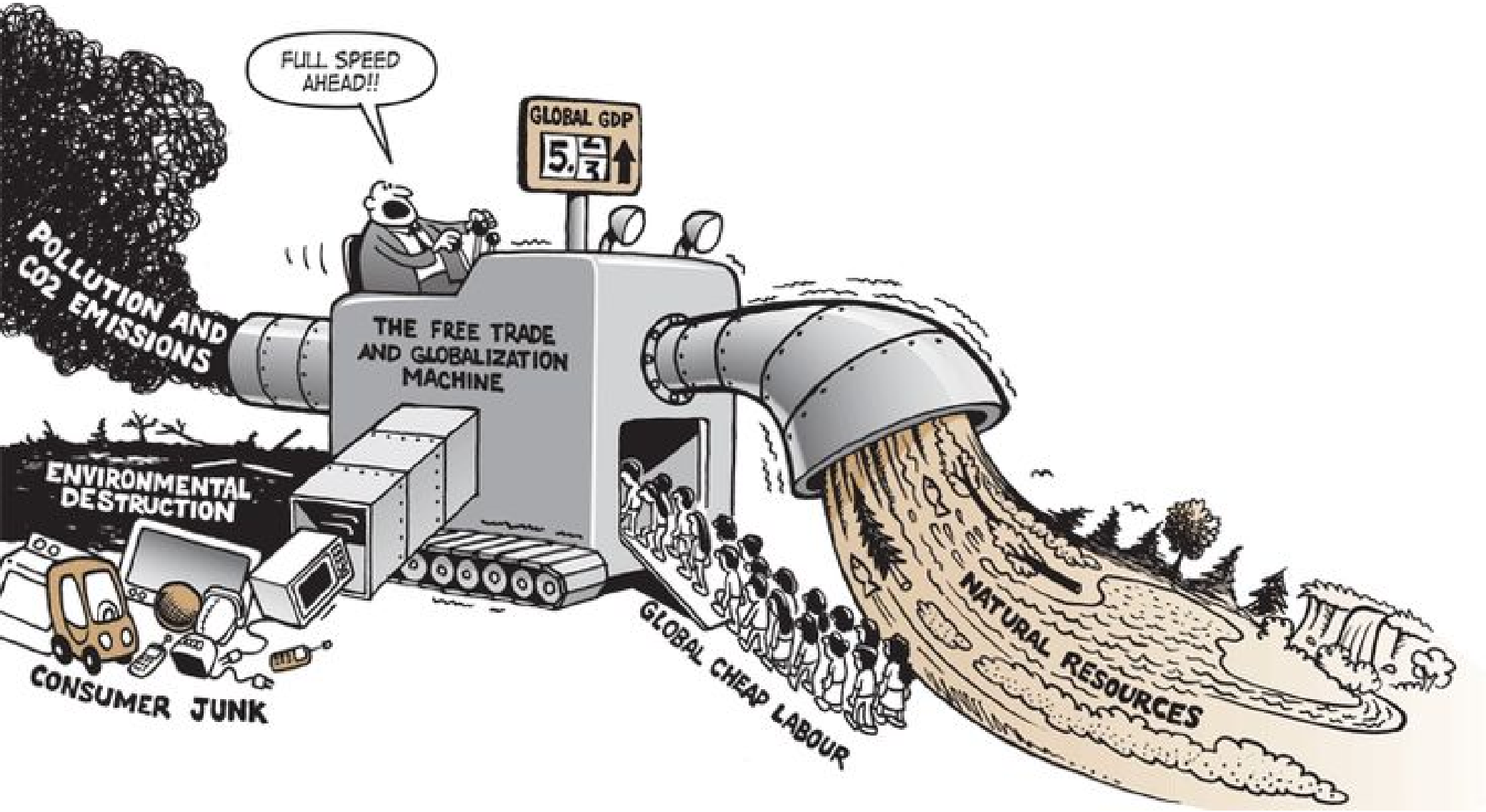
Characteristic ecological structure (Moorland in the Bogota River Basin).

Source: Páramo de Guacheneque, n.d. photograph, <http://www.colombiaoculta.org/Alrededores-de-Bogota/destinos-bogota-natural/nacimiento-del-rio-bogota---villapinzon>

Characteristic ecological structure (Waterfall in the Bogota River Basin).

Source: Cascada de la Nutria, n.d. photograph, <http://rutadeviajelion.blogspot.nl/2010/06/como-llegar-nacimiento-rio-bogota.html?view=flipcard>

PROBLEM



Free trade and Globalization machine.

Source: Globalization, n.d. photograph, <https://www.pinterest.com/ateamb/globalisation-and-the-environment/>

Contamination

Detail of pollution that afflicts the Bogota River.

Source: Sabana de Bogotá, Lizarazo, L. photograph, <http://images.et.eltiempo.digital/contenido/bogota/IMAGEN/IMAGEN-14057275-2.jpg>

Sewage

Detail of pollution that afflicts the Bogota River.

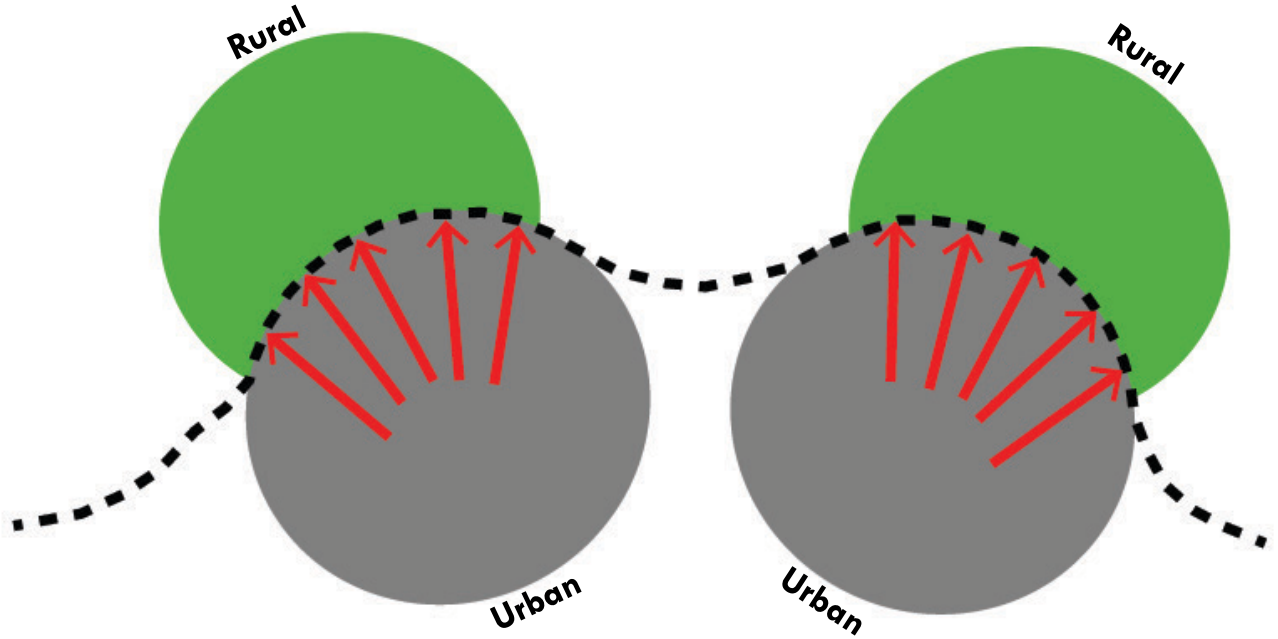
Source: Sabana de Bogotá, n.d. photograph, <http://sostenibilidad.semana.com/medio-ambiente/articulo/rio-bogota-contaminacion-tregua/32929>

Waste amounts

For over 60 years, the Bogota River has received waste water from the capital.

Source: Sabana de Bogotá, Lizarazo, L. photograph, <http://paularomeroe.blogspot.es/tags/rio-bogota/>

Driving forces = Economic + population growth

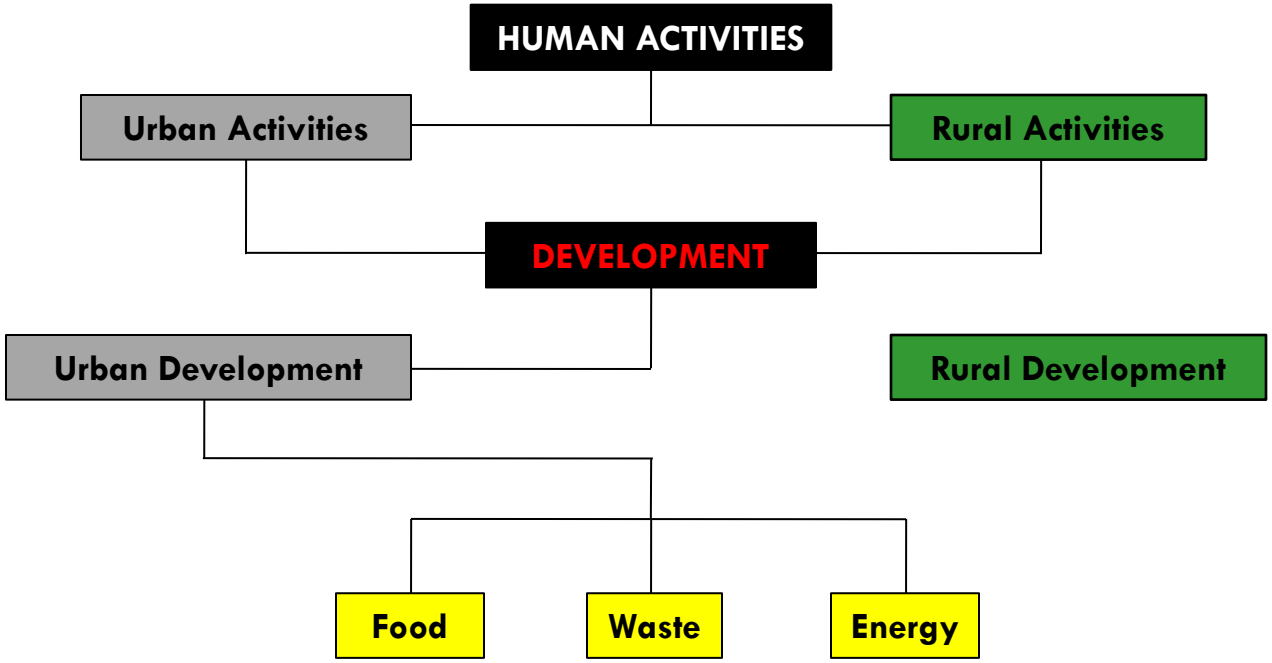


Rural Areas (Productive land).

Source: Newspaper cut, nd. photogragh, <\http://blogs.elespectador.com/el-rio/2014/08/11/cuales-son-los-municipios-que-contaminan-el-rio-bogota/>

Urban Areas (Consumer/user land).

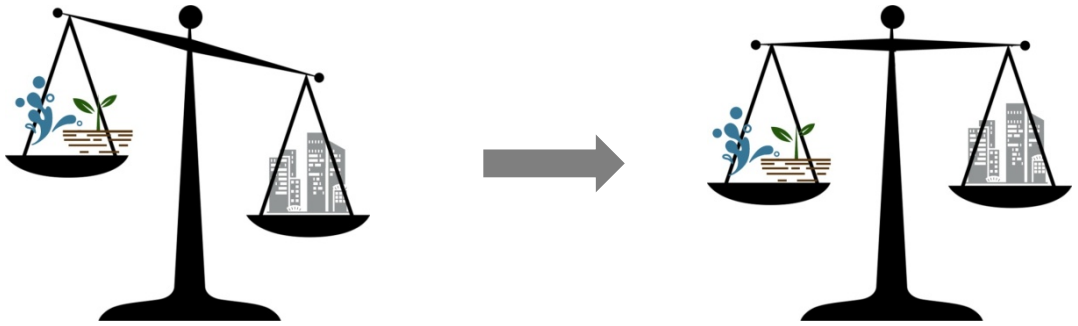
Source: Rural areas, nd. photoragh, <http://www.taringa.net/posts/imagenes/16234843/Bogota-una-capital-moderna-y-cultural.html>


HUMAN ACTIVITIES
Urban Activities
Rural Activities
DEVELOPMENT
Urban Development
Rural Development
Food
Waste
Energy

The Bogotá river length has an extension of about 380km; its basin surface has around 6.000km2 and passes through **different administrative boundaries**: 45 municipalities and the city of Bogotá. It is used as an **articulator between urban and rural areas;** and is the **main water source** of the Sabana de Bogotá.

However, there are **three principal aspects that threaten the environmental system** of the river and its basin: contamination, urban development and rural activities such as agriculture and cattle.

The **absence of a regional law**, the **constant lose of ecological biodiversity** as a consequence of the contamination of the water and the soil, and finally the **permanent pollution** received through discharges of tanneries, sewages and industry has provoked environment **degradation** over the river and the basin.



How to generate an **integrated system** between **urban development, food production, waste management and energy generation** given the increasing pressure of urbanization **without damaging the environment** contained in the Bogotá River and its basin?

DEVELOPMENT - How to generate land for urban development without harming the river system?

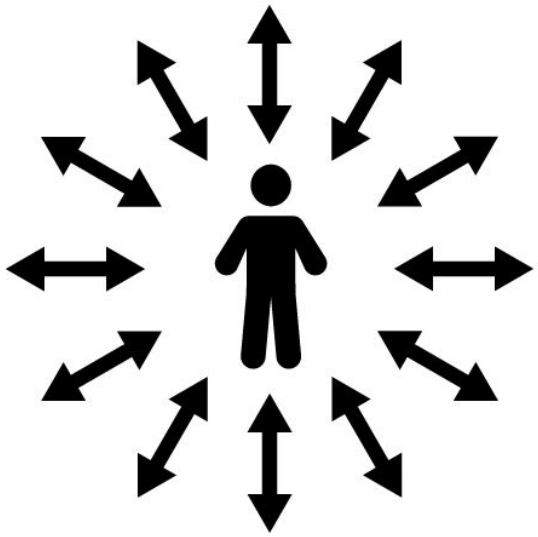
FOOD - How to create a balance between the natural structure and food production in cattle and agriculture activities?

WASTE - How to adequate areas for waste management and treatment along the Bogotá river and basin?

ENERGY - How to improve water and soil for energy generation?

RESEARCH & ANALYSIS

Irresponsible Consumption

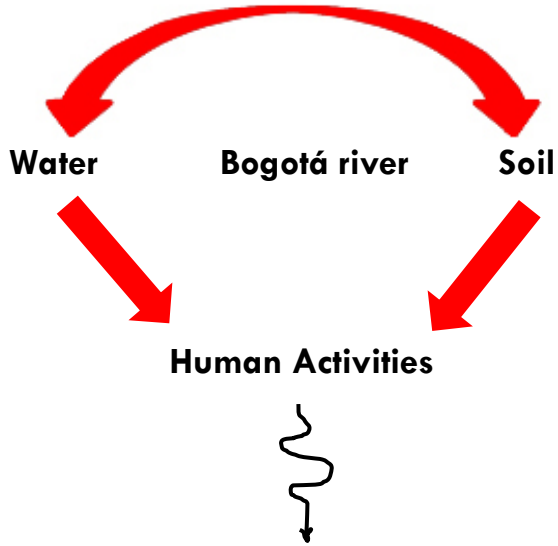


Responsible Consumption
Sustainable system

Two options for human activities with the Ecological Structure

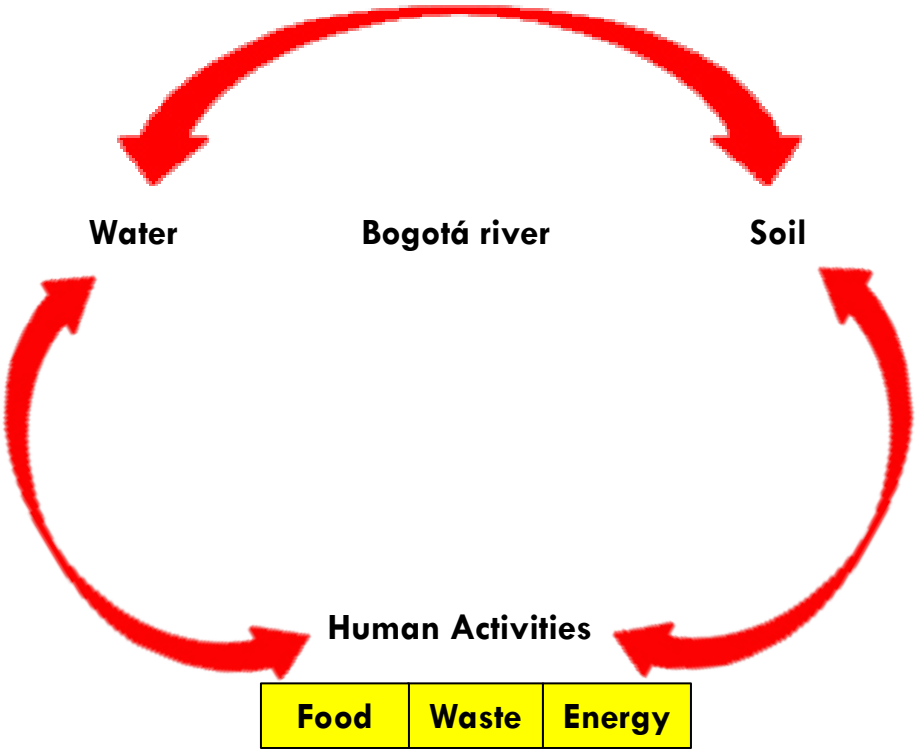
Hypothesis

NATURAL SYSTEM



CONFLICT

GOAL SYSTEM




Cundinamarca
Bogotá

Ecological and Water Structure

1. Quality ecological structure, Caño Cristales

2. Aerial view of the Amazon Rainforest.

3. View of the Magdalena River.

4. Characteristic ecological structure (Moorland in the Bogota River Basin).

5. Characteristic ecological structure in the Bogota River Basin.

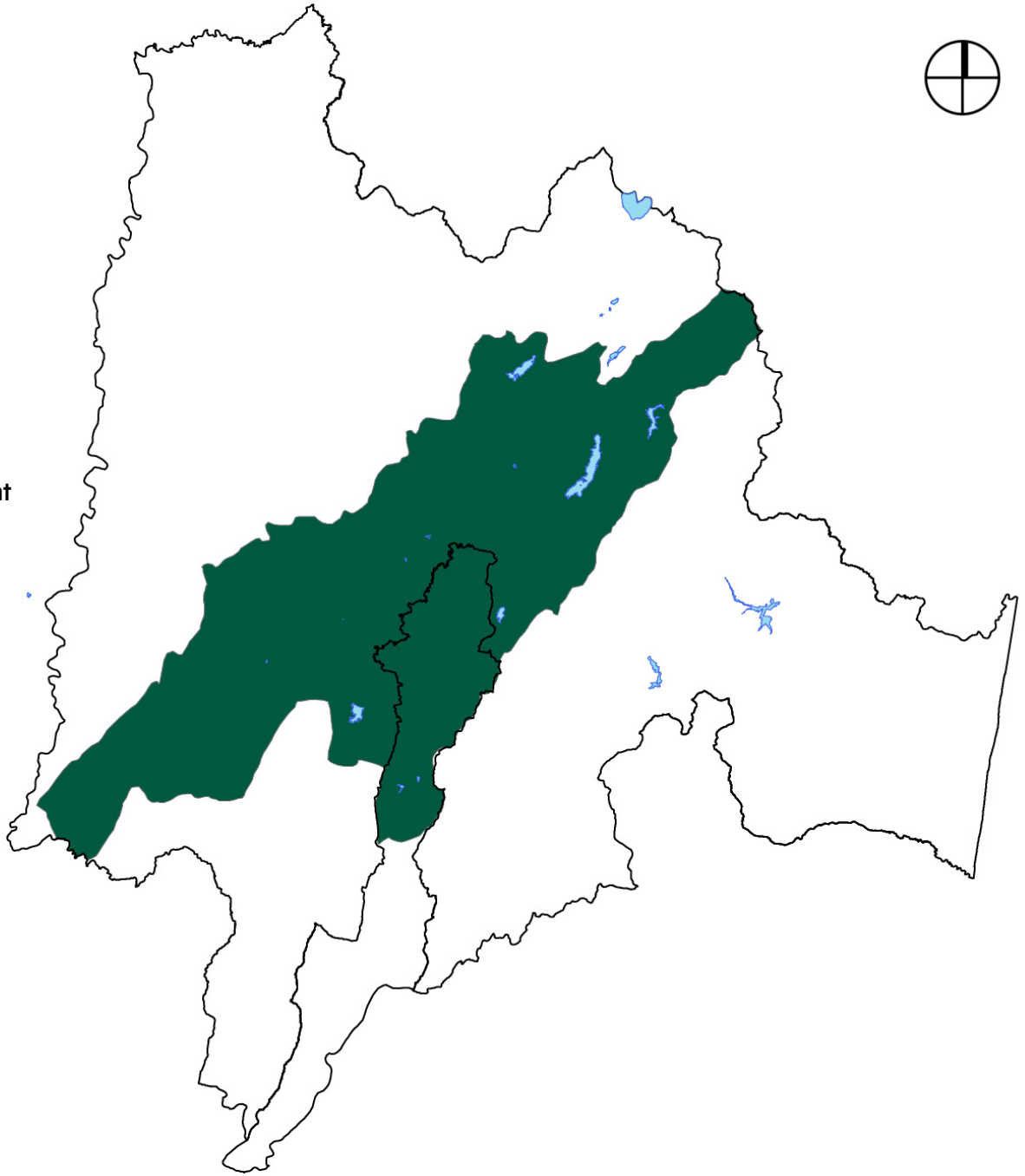
6. Characteristic ecological structure (Tequendama Waterfall in the Bogota River Basin).

Department: **116** Municipalities

River Basin: **46** Municipalities = **1/3** of the department

Basin Bogotá River - around **590,000 Ha.**

33% of territory

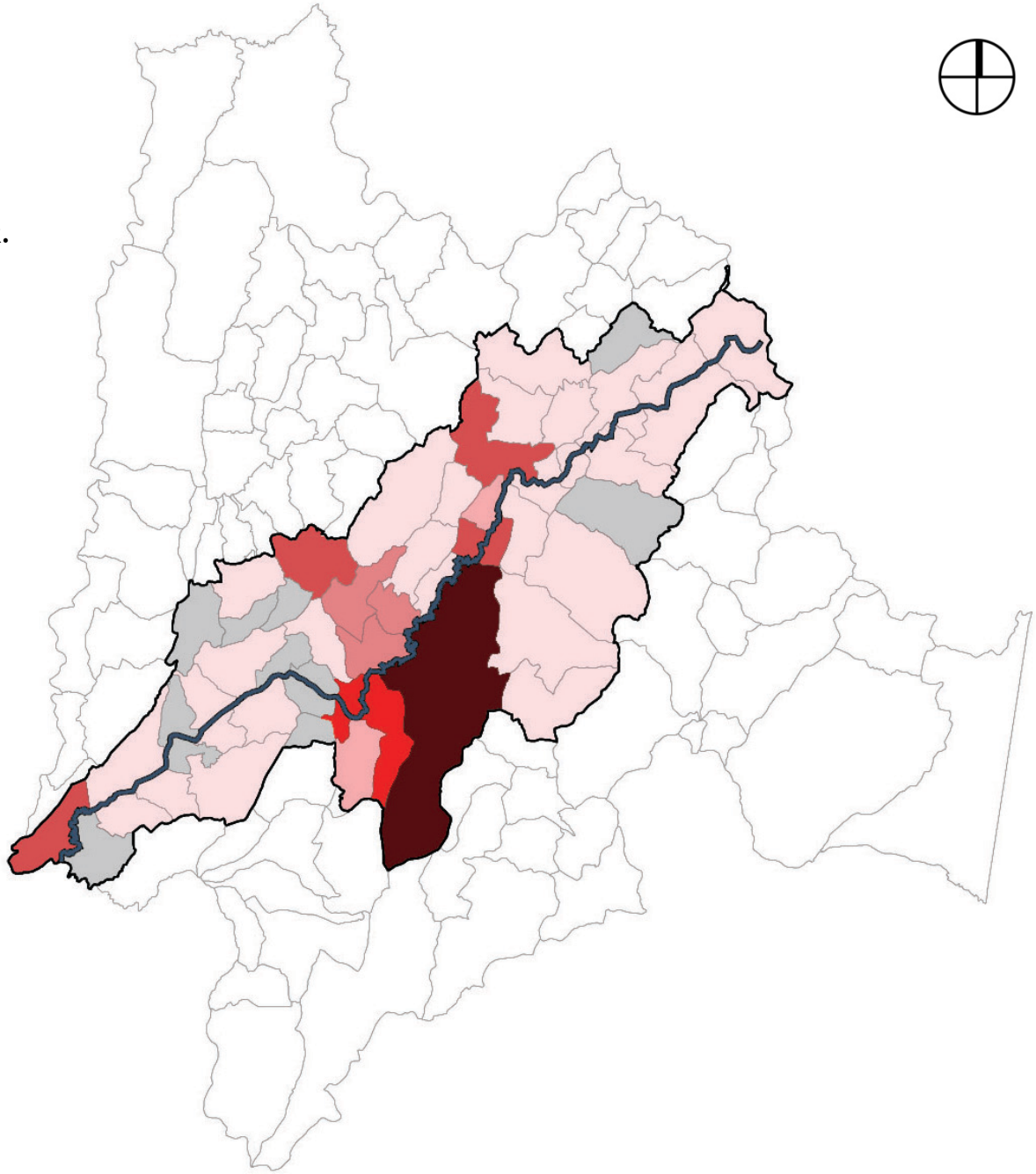


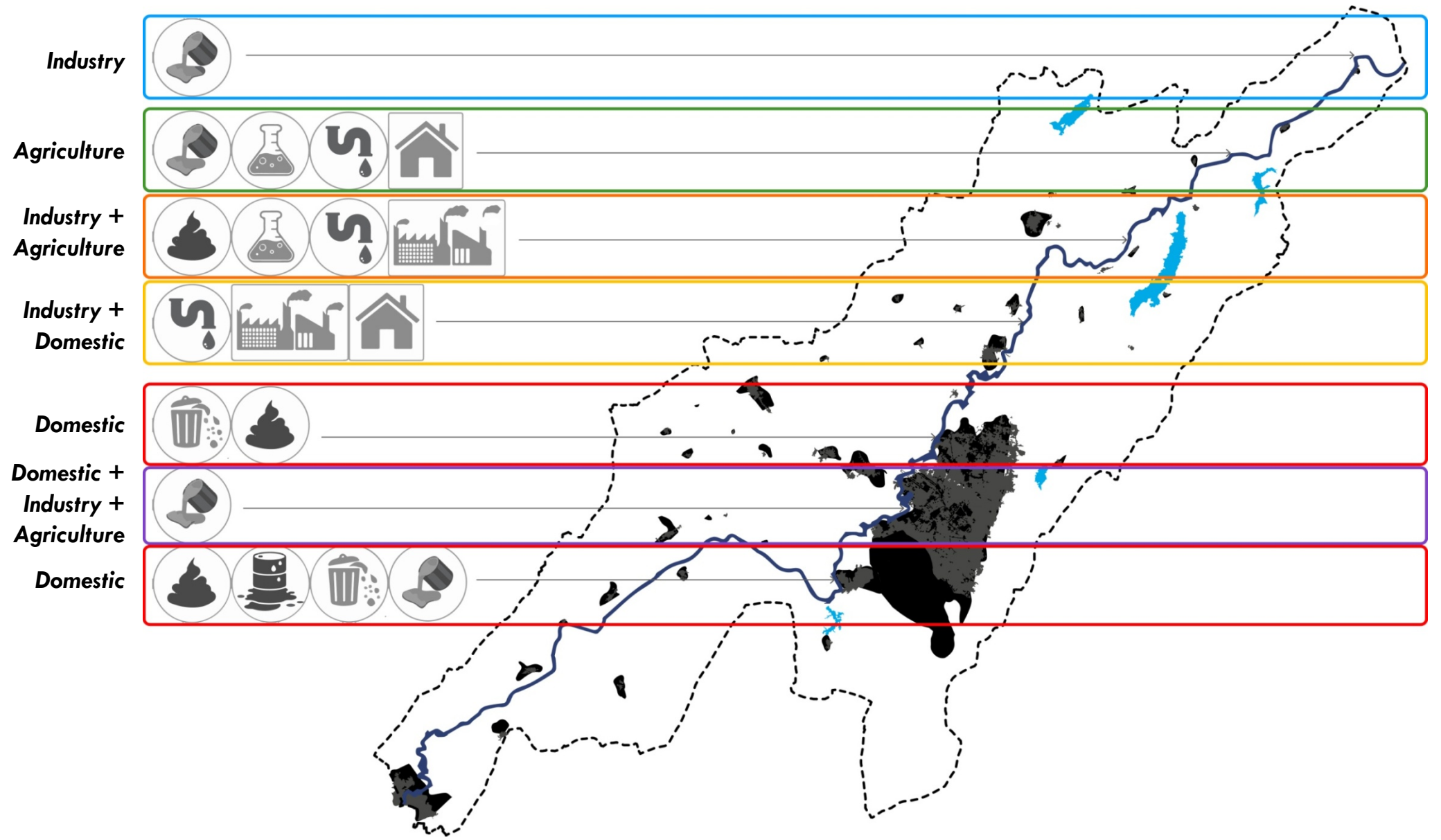
Characteristic ecological structure in the Bogota River Basin.

Source: Landscape, Ramirez, D. photograph

Population Department: **10.600.000** people approx.
Bogotá: **7.800.000** people approx.
115 municipalities: **2.800.000** people approx.

Population Bogotá River Basin: **9.650.000** people
= **92%** of the department
Bogotá: **7.800.000** people approx.
45 municipalities: **1.850.000** people approx.

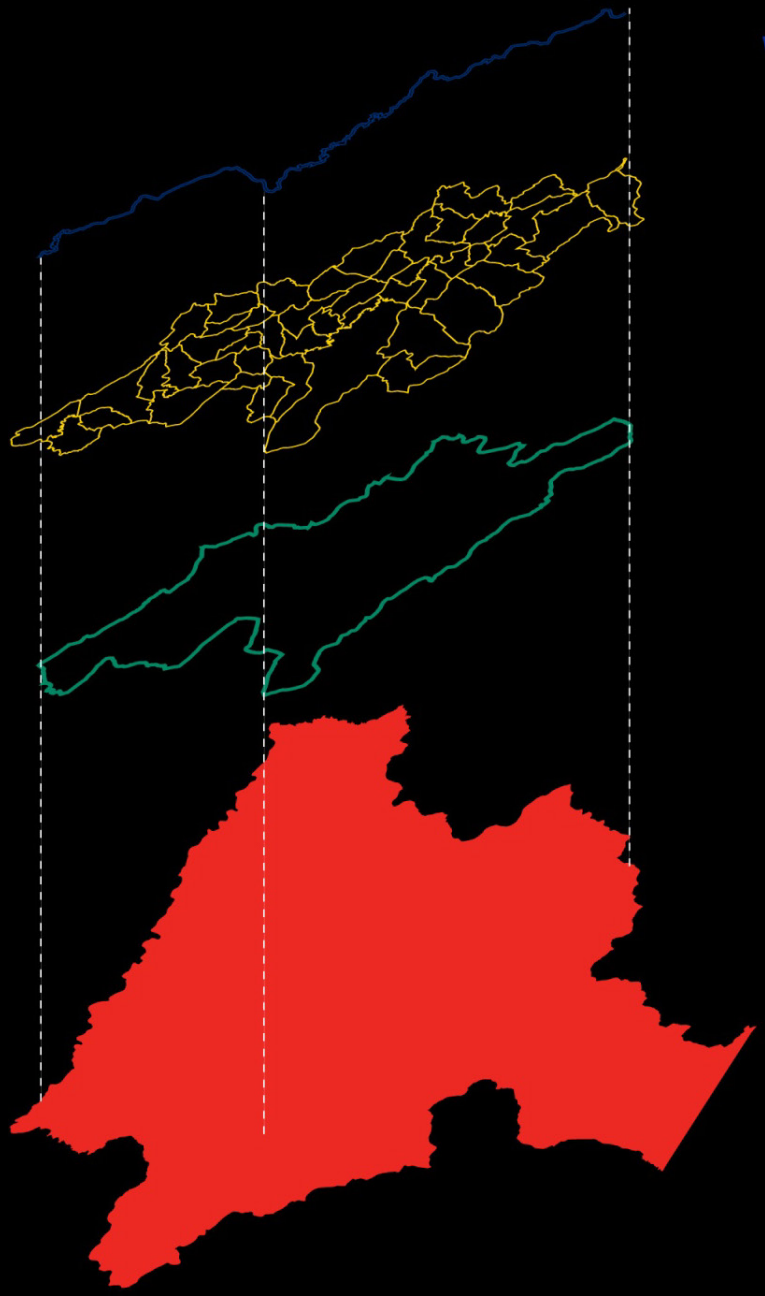



Industry
Agriculture
Industry +
Agriculture
Industry +
Domestic
Domestic
Domestic +
Industry +
Agriculture
Domestic

Overlap between contamination and demographic growth.

Source: Landscape, Ramirez, D. photograph

Current Governance Structure

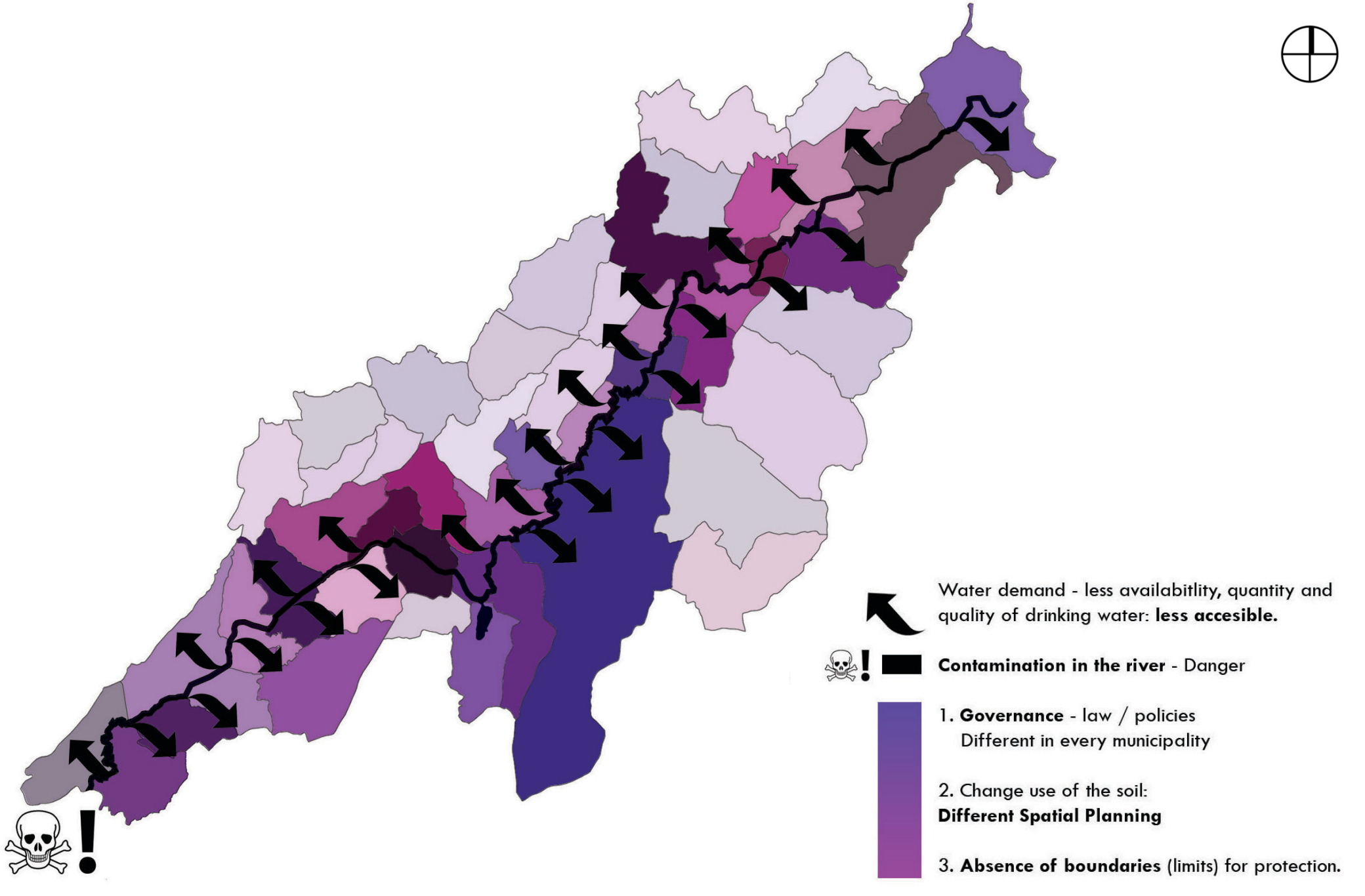


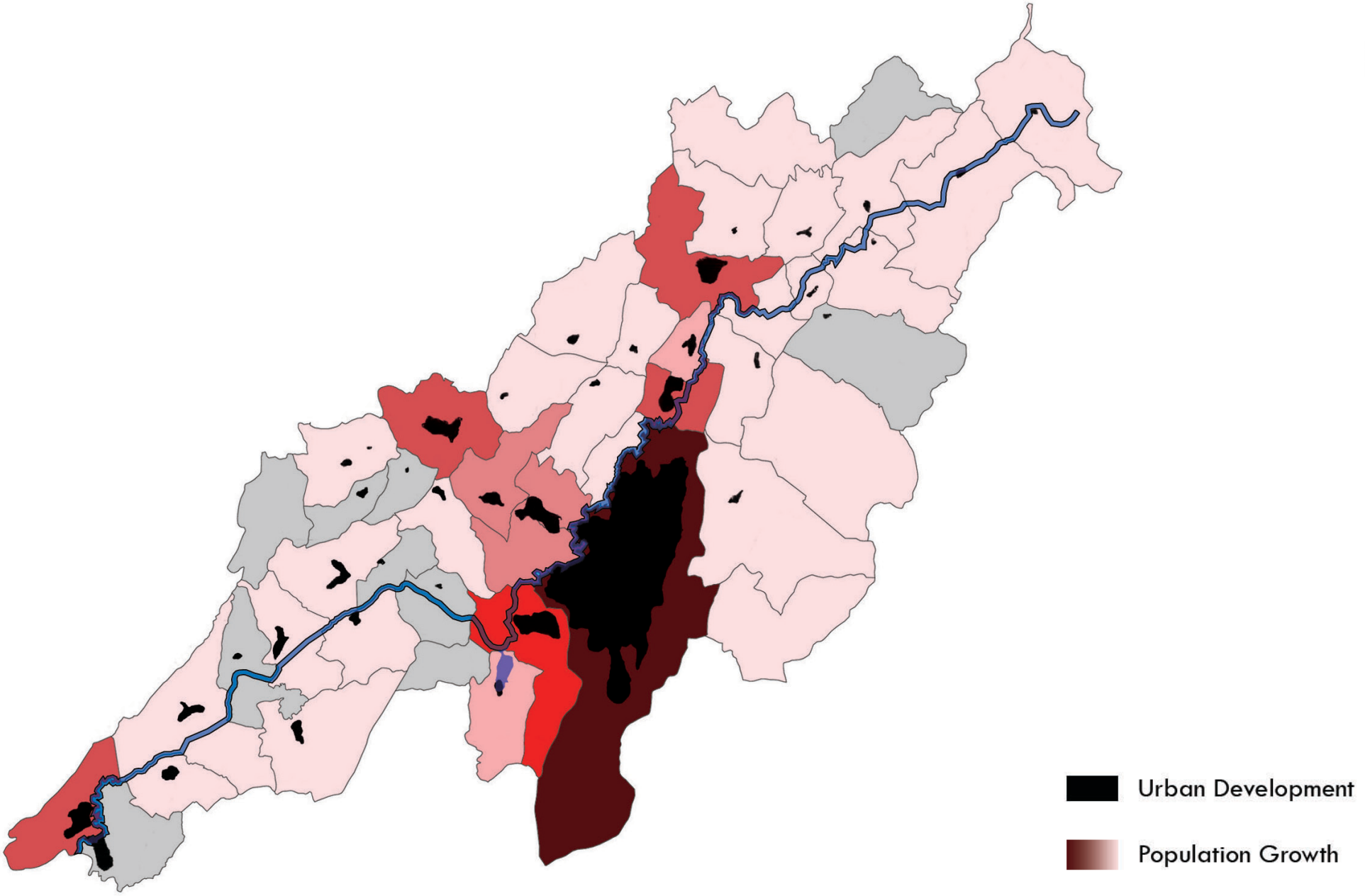
Water Structure Bogotá River

Local Political Division

Environmental Geographic Division

Regional Political Division


Water demand - less availabitlity, quantity and quality of drinking water: **less accesible.**
Contamination in the river - Danger
1. **Governance** - law / policies
Different in every municipality
2. Change use of the soil:
Different Spatial Planning
3. **Absence of boundaries** (limits) for protection.


Urban Development
Population Growth

Poverty

Starvation

Migration

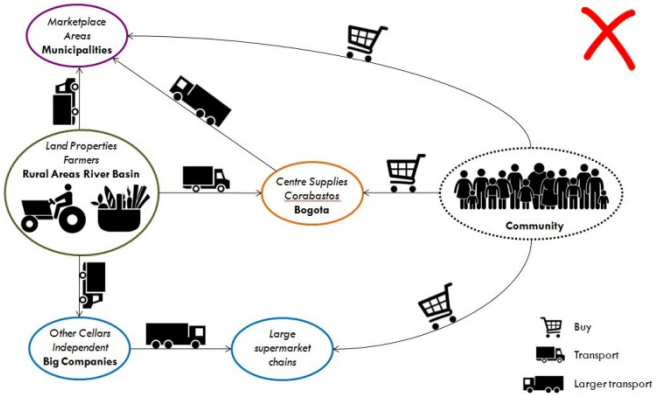
Contamination

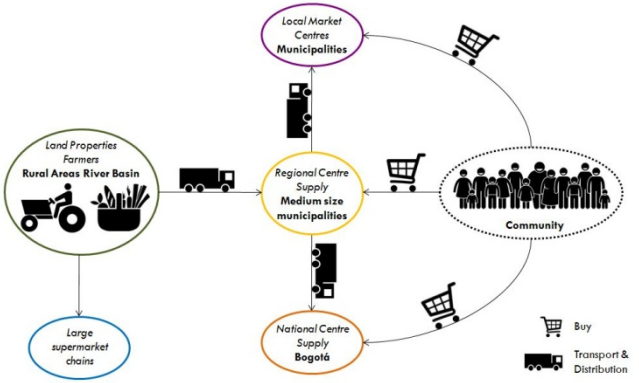
Ecological Catastrophe

How could it be improved?

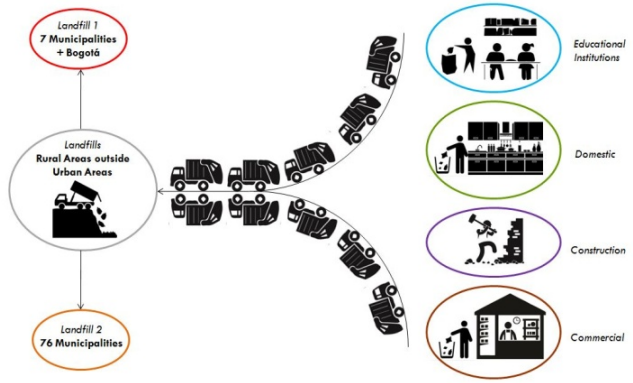
Flows Systems

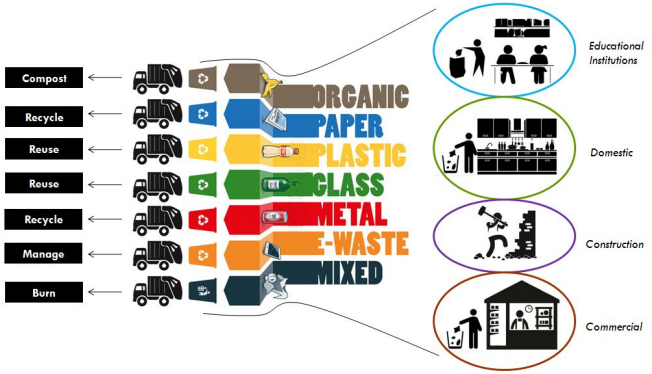
FOOD



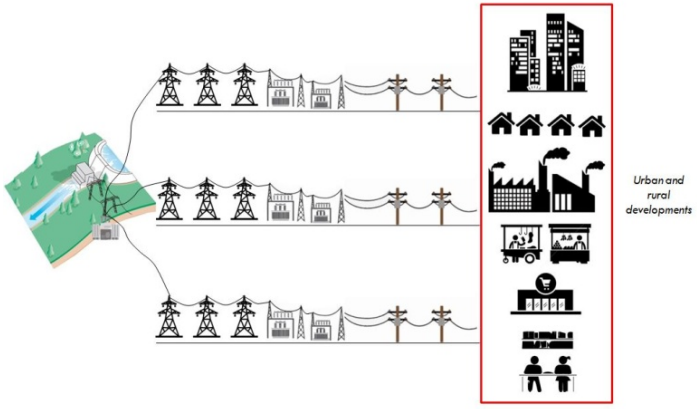


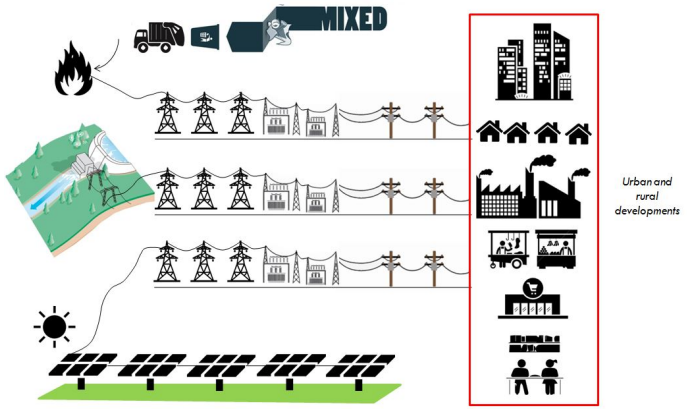
WASTE



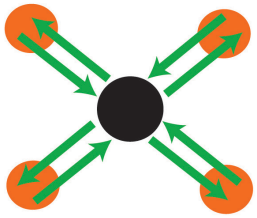
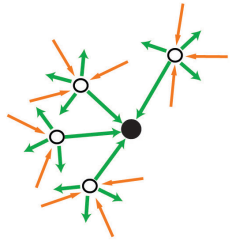
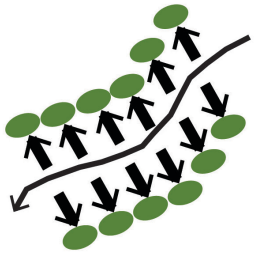
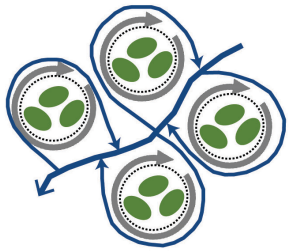
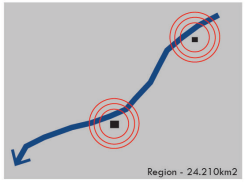
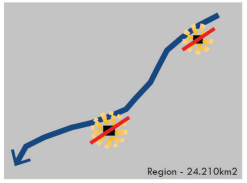
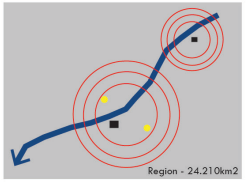
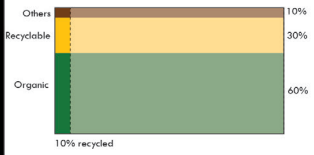
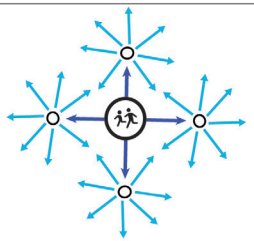
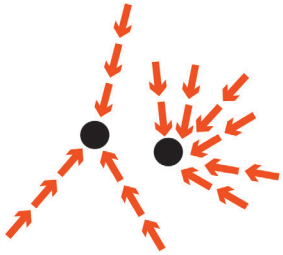
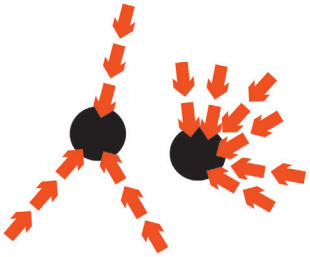
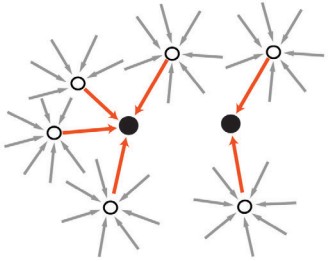
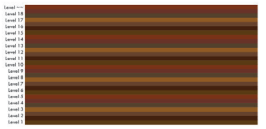


ENERGY



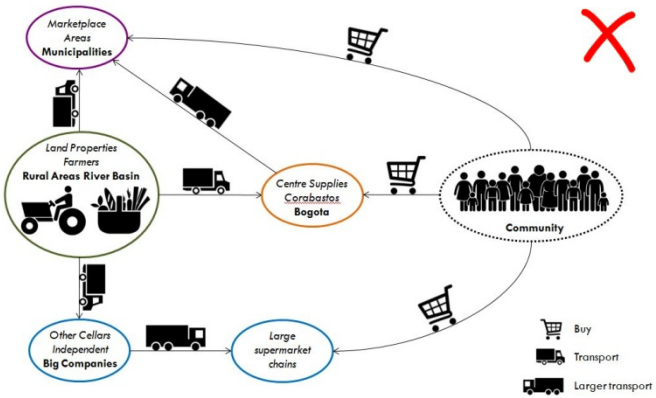


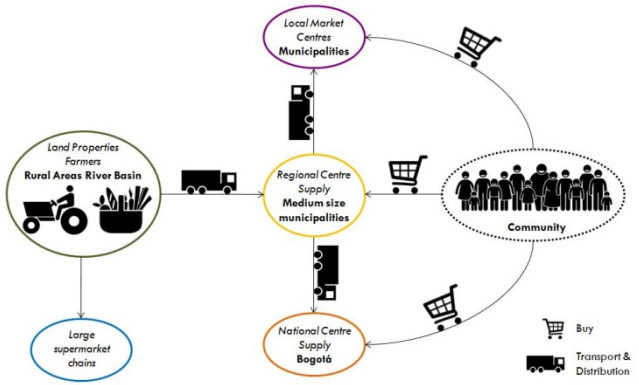
Regional Network – Key Elements

	PROBLEM		STRATEGY
FOOD			
Transport & Distribution			
Production			
ENERGY			
Sources			
WASTE			
Sources & Producers			
Transport			
Dumping			

Flows Systems

FOOD





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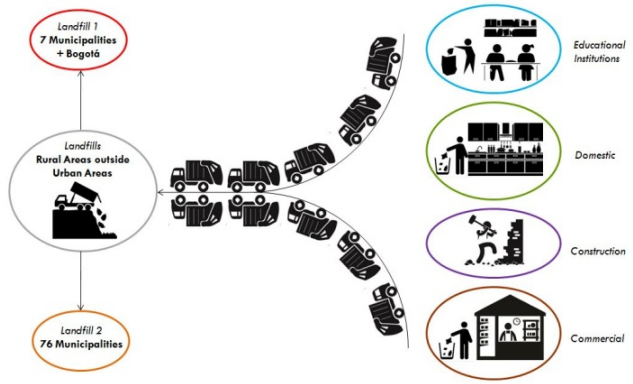
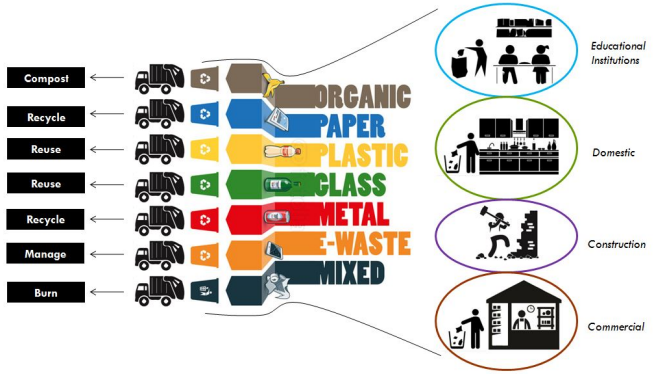
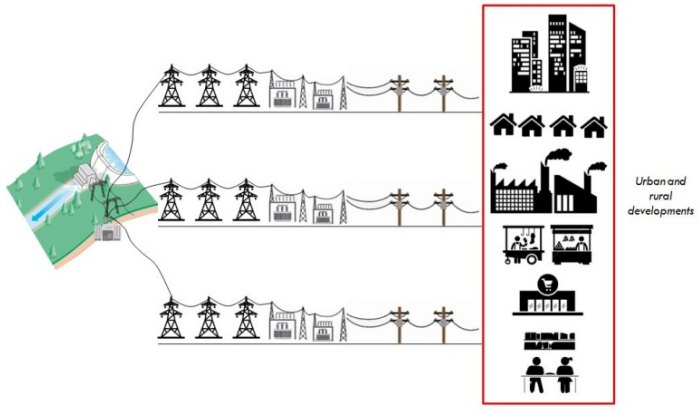
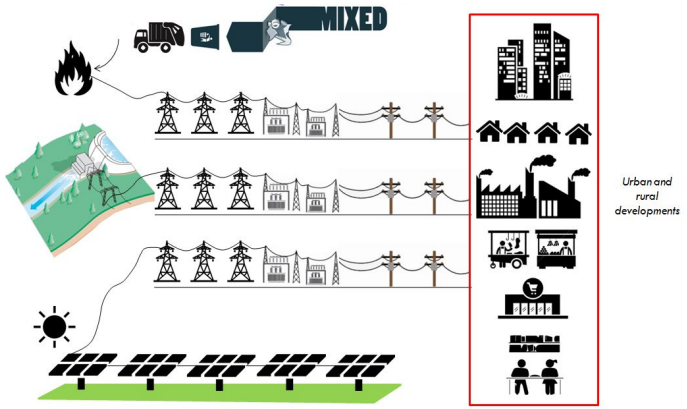
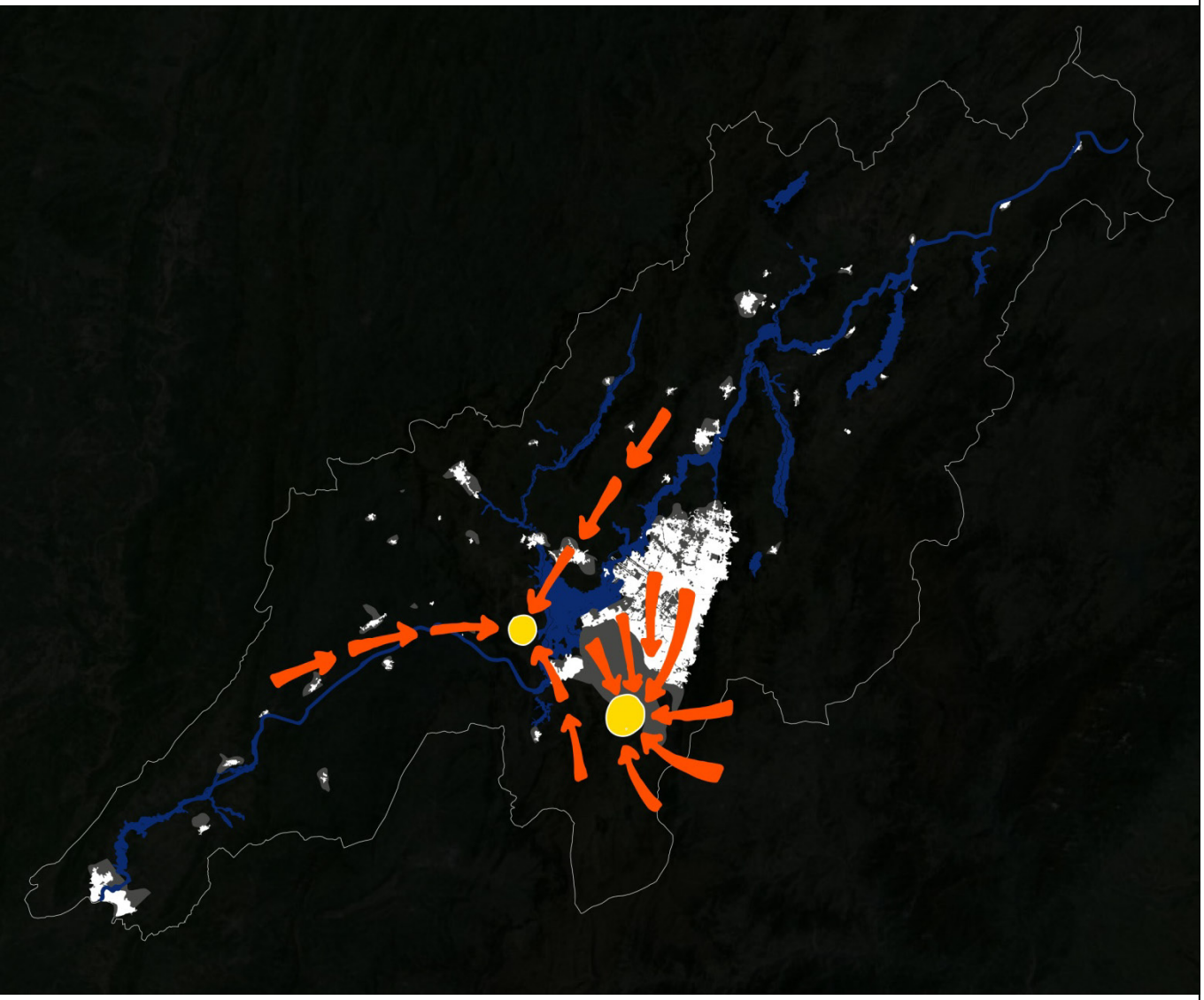


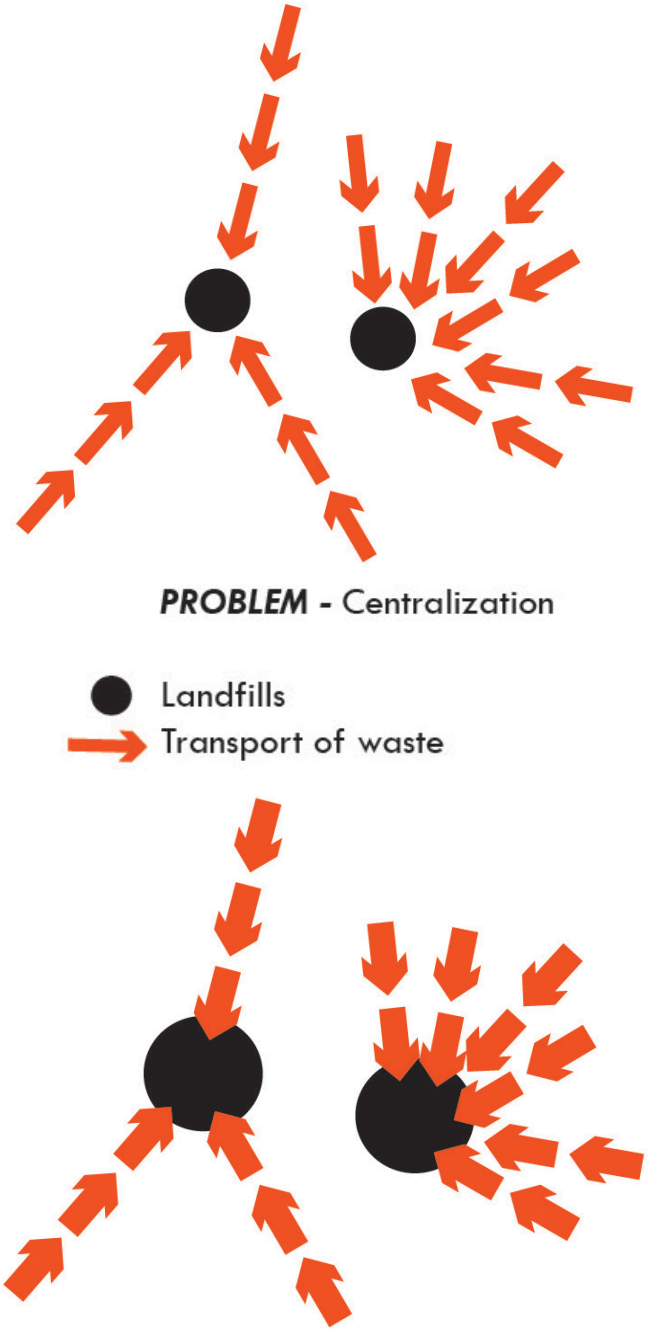


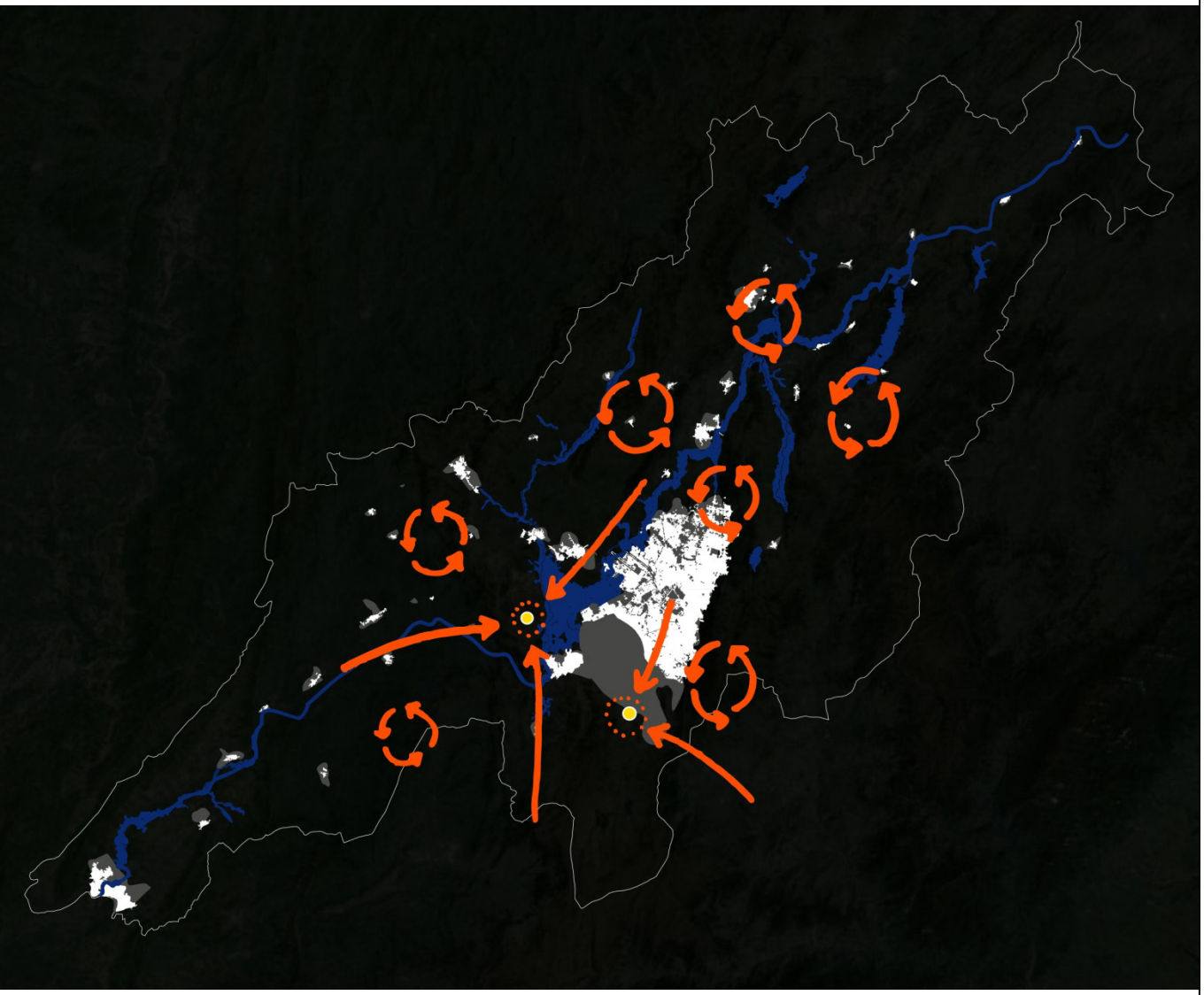
ENERGY

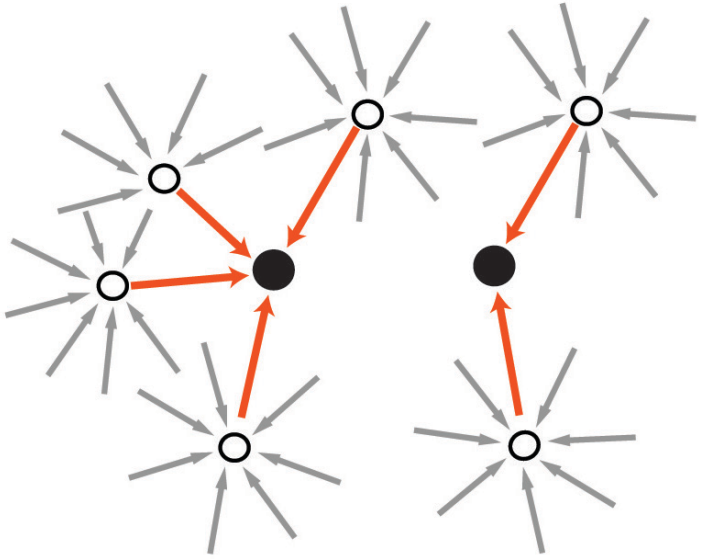







PROBLEM **-** Centralization
Landfills
Transport of waste



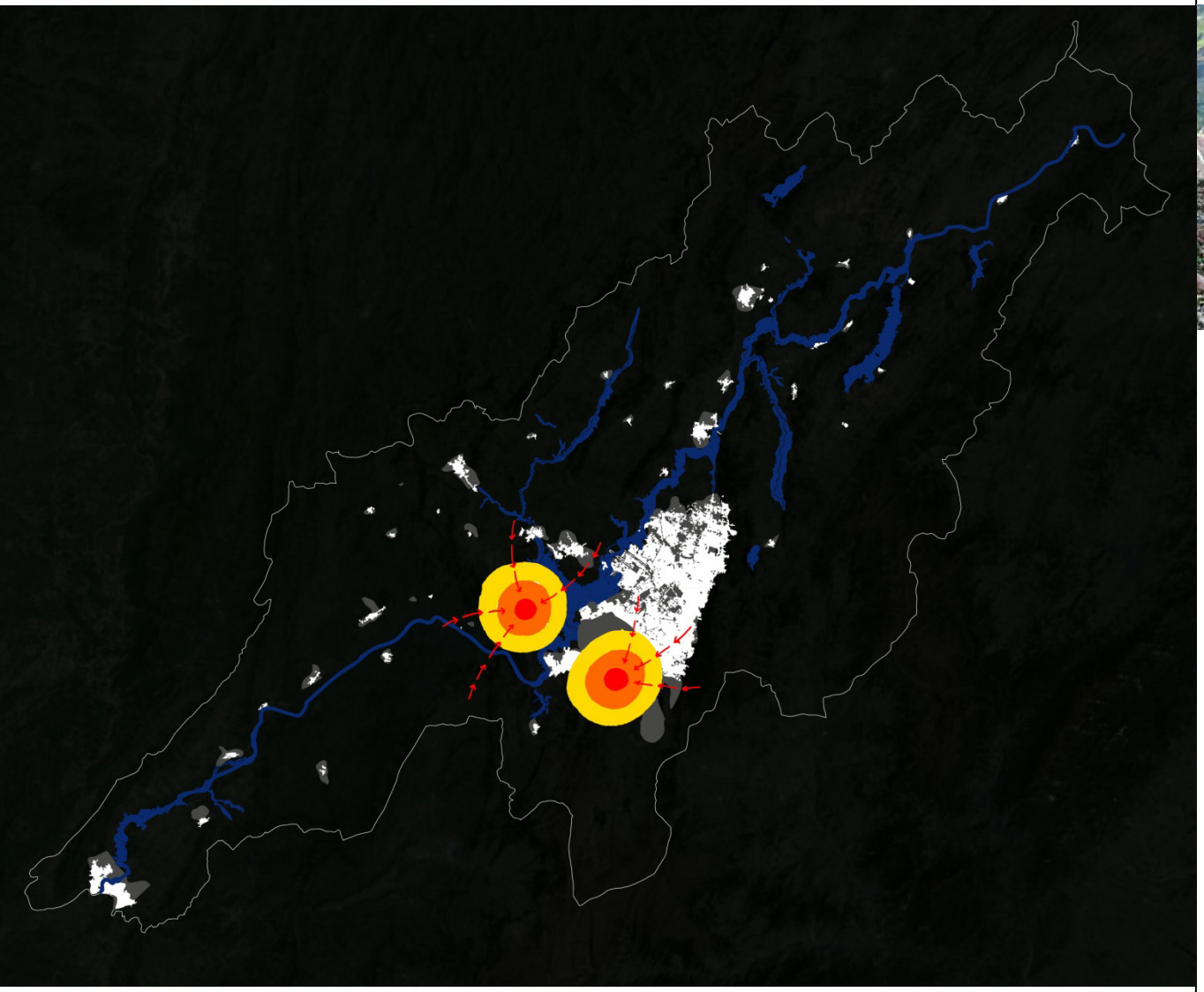


STRATEGY - Decentralization

Landfills

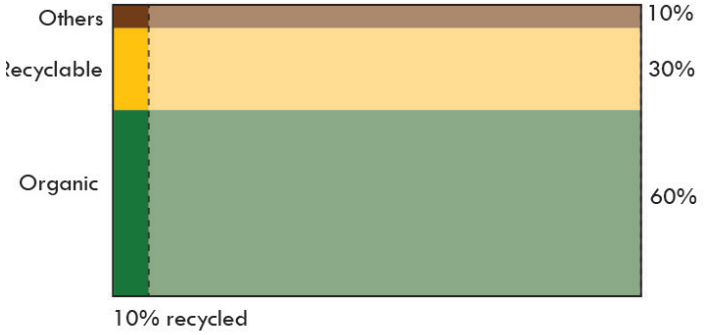
Management/treatment plants

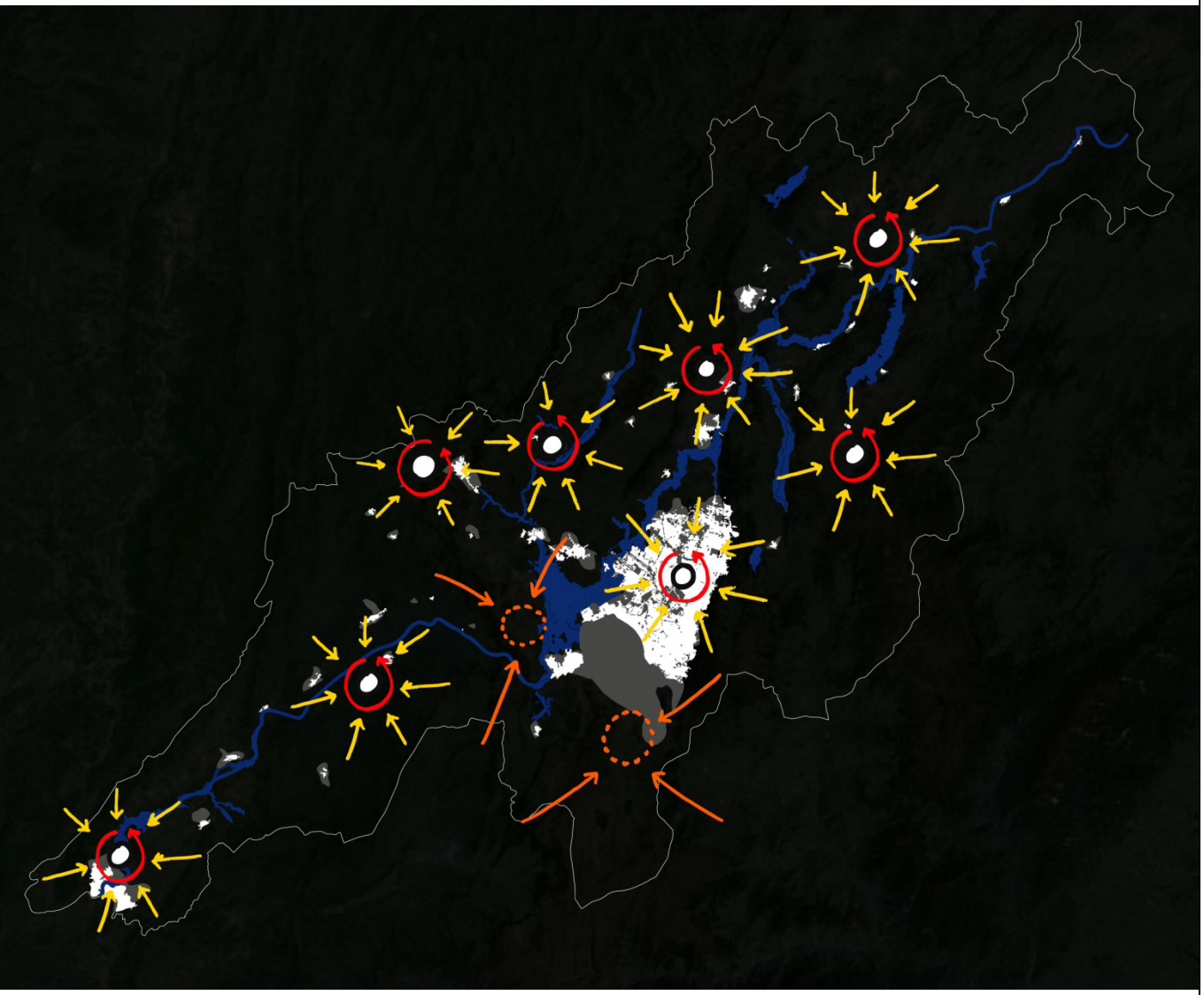
Transport of waste

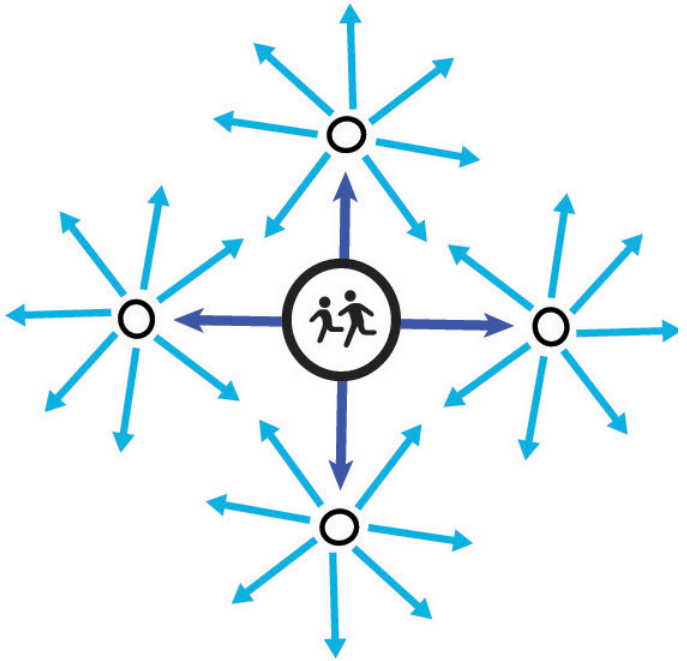


7. Waste disposal areas in Colombia Botadero "Doña Juana" in Bogotá.

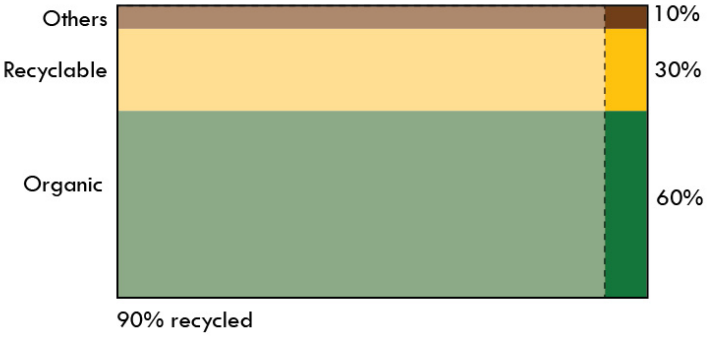
PROBLEM - Amount of waste

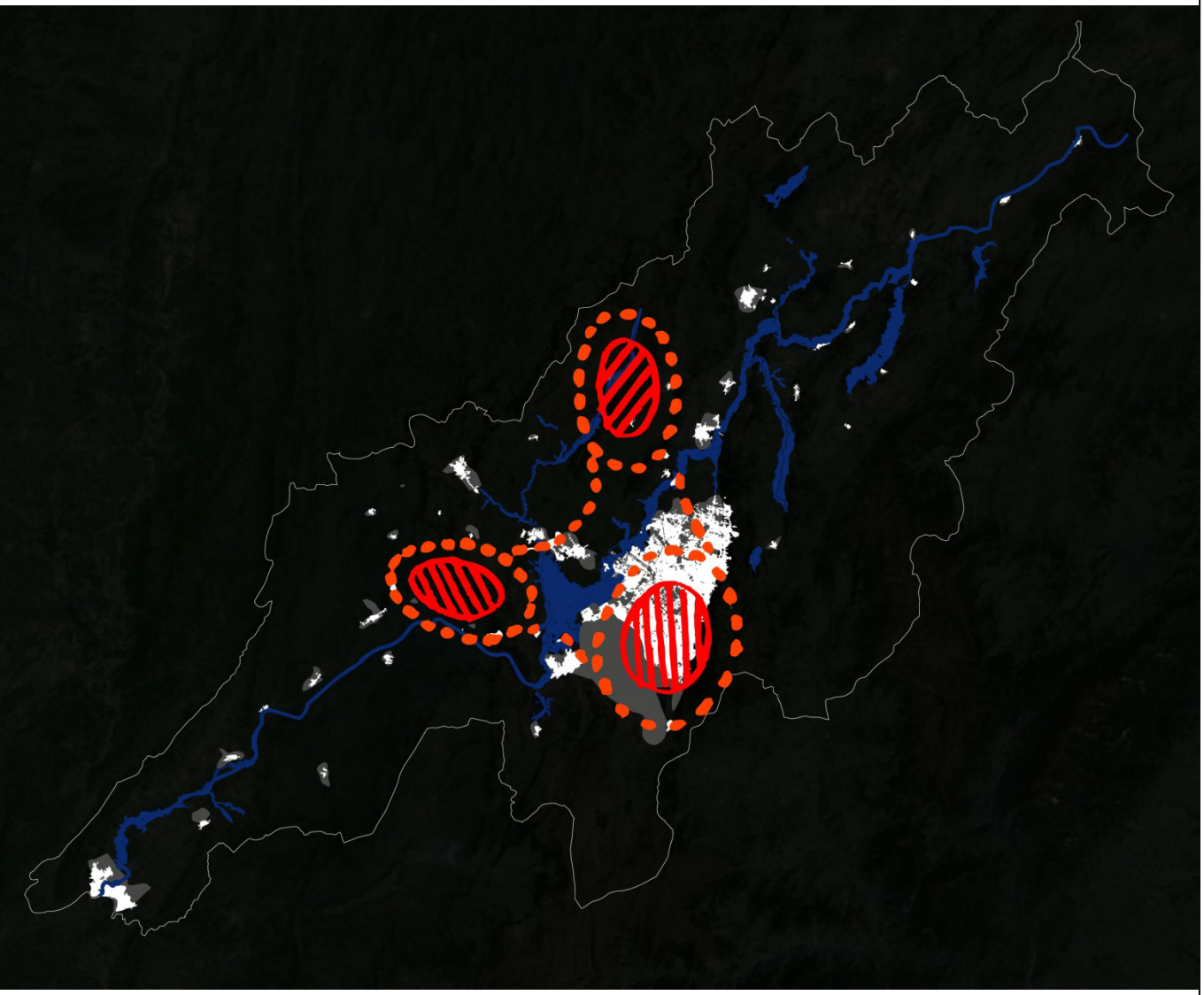




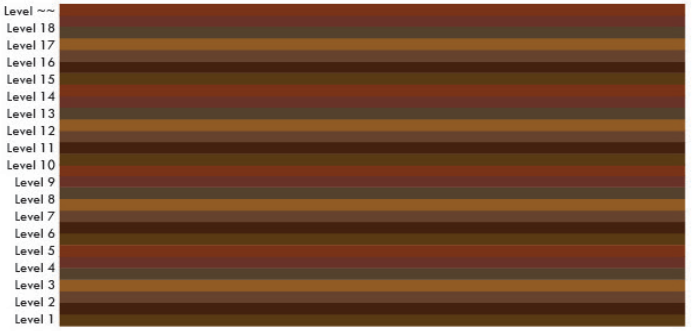


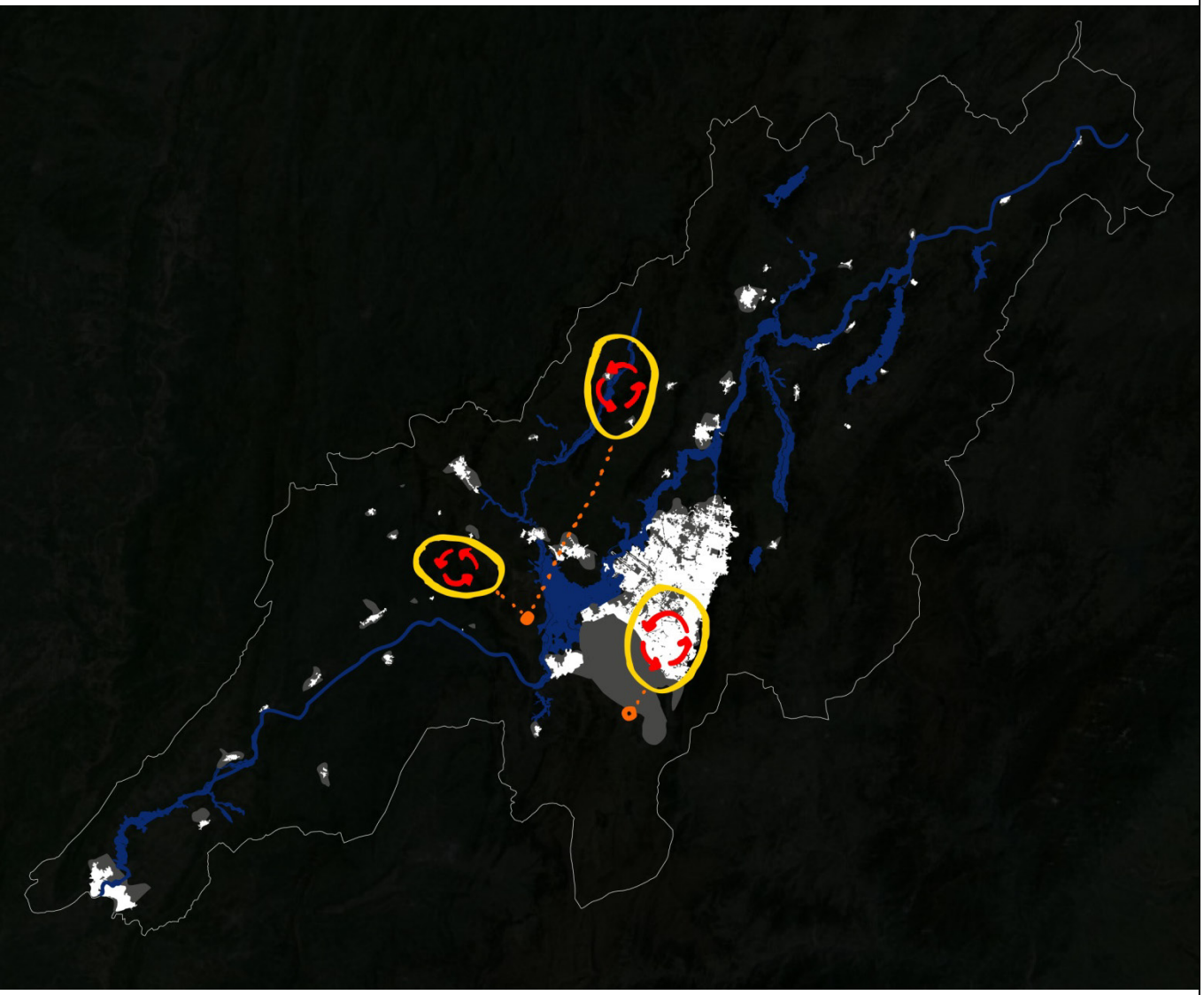
STRATEGY - Recycle





PROBLEM - Excess

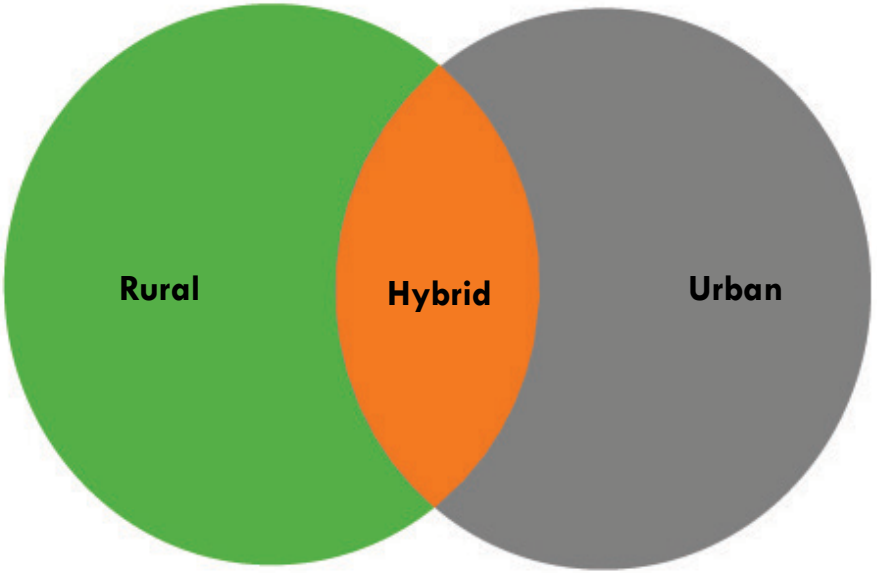




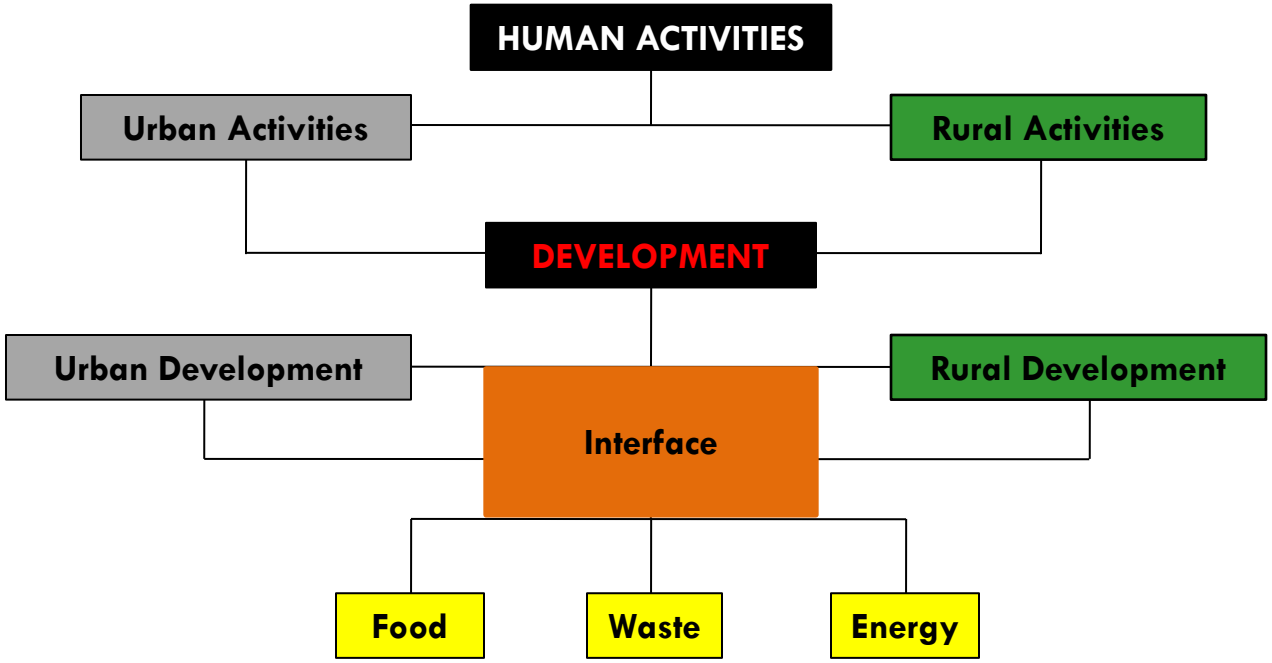
STRATEGY - Transform

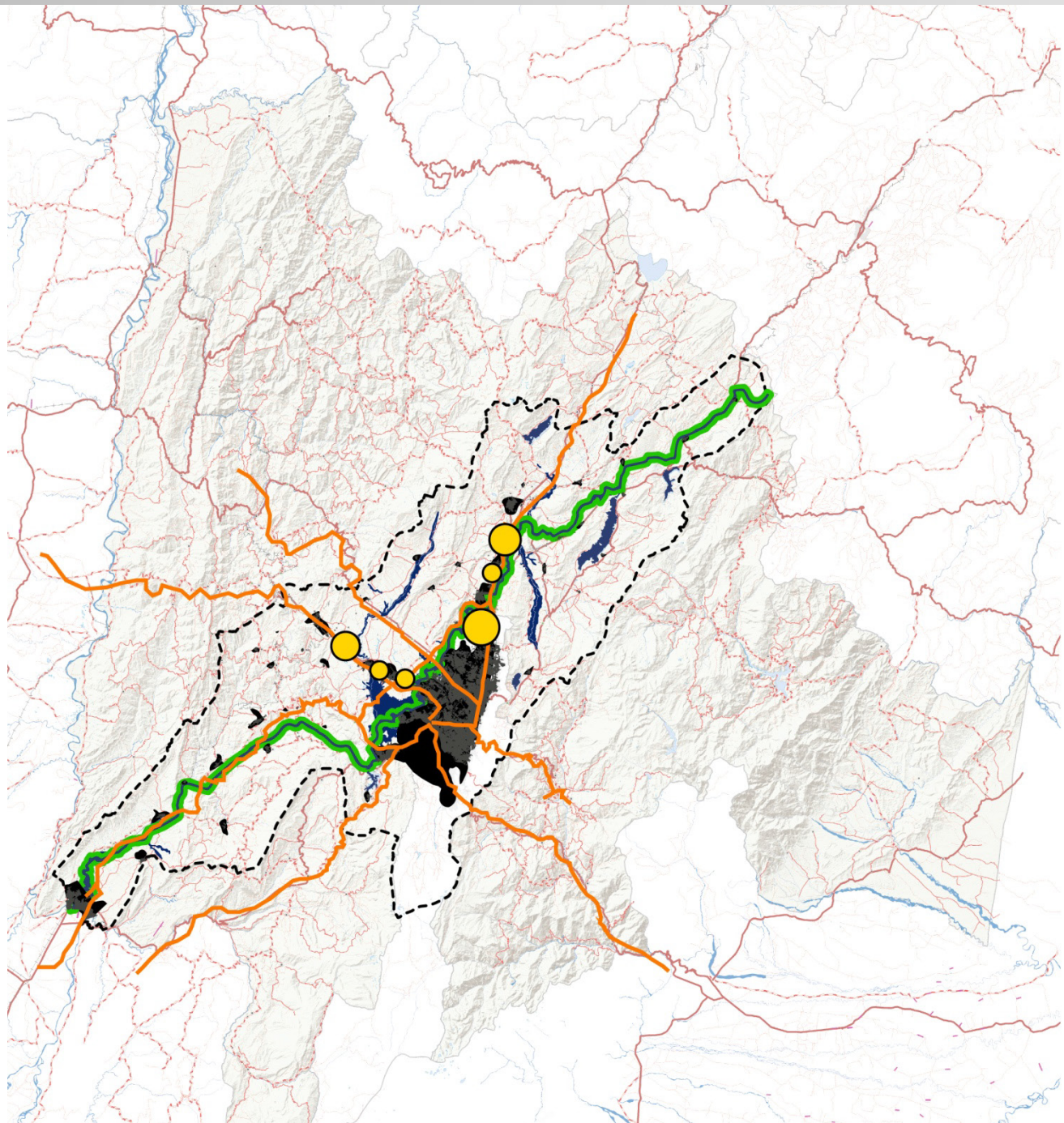
STRATEGY

Driving force = Overlap union ⟶ Interface



Urban development/urbanization
Agriculture
Hybrid spatial structure: Mixed components


HUMAN ACTIVITIES
Urban Activities
Rural Activities
DEVELOPMENT
Urban Development
Rural Development
Interface
Food
Waste
Energy



Development of Hybrid Model

1. Madrid – Funza
2. Funza – Bogotá

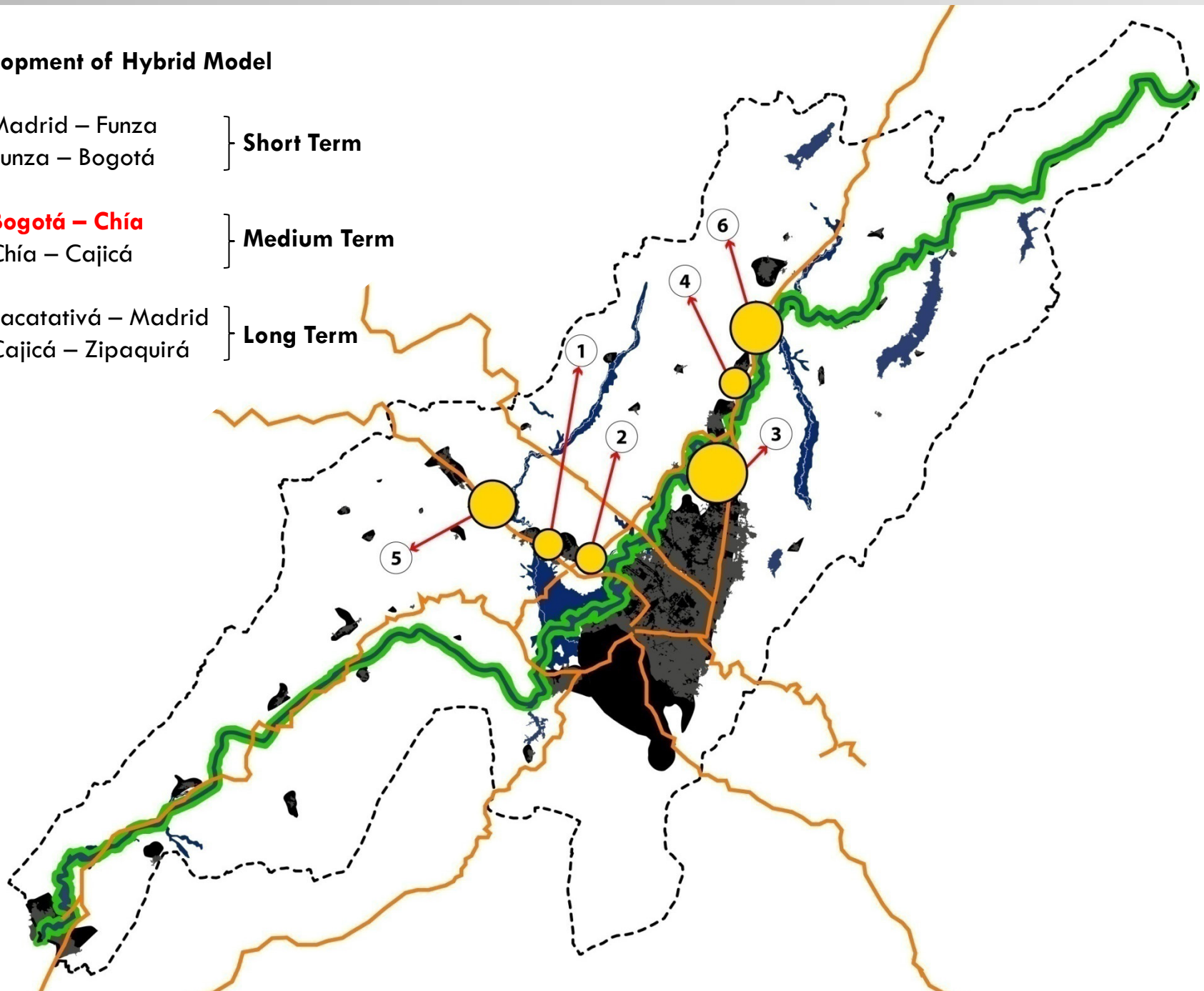
Short Term

3. Bogotá – Chía
4. Chía – Cajicá

Medium Term

5. Facatativá – Madrid
6. Cajicá – Zipaquirá

Long Term



- The river basin **doesn't respond to an administrative system**
- Although the **river works as a natural system structure**

Bogotá River Basin Development, Planning and Protection Authority

Install a new planning institution
Responsible of: restoring the river system structure

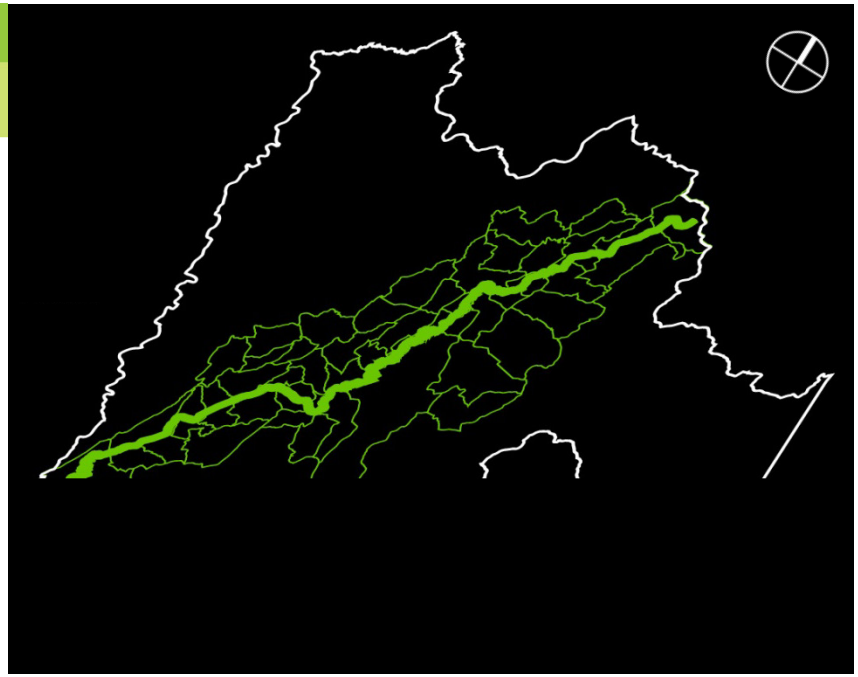
Mision: Hybrid Region

Transformation into a Productive Landscape Ecosystem
Sustainable and self-sufficient

Territorial binding

Involves and includes:

1. **Social** - Demographic growth
2. **Agriculture** - Food production
3. **Waste** - Prevent waste pollution
4. **Energy** – generation
5. **Environment** – protection, extension and recovery



Stakeholders

Internal

Planners

Designers

Advisors

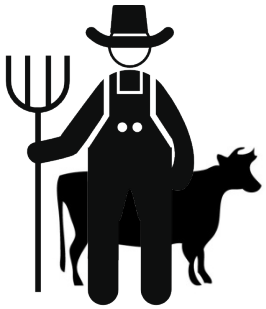
Developers

Investors

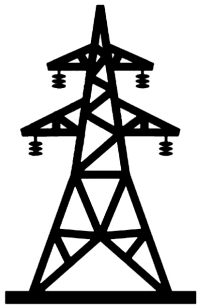
Engage in economic transactions

External

Farmers



Cattle Ranchers



Hydroelectric plants

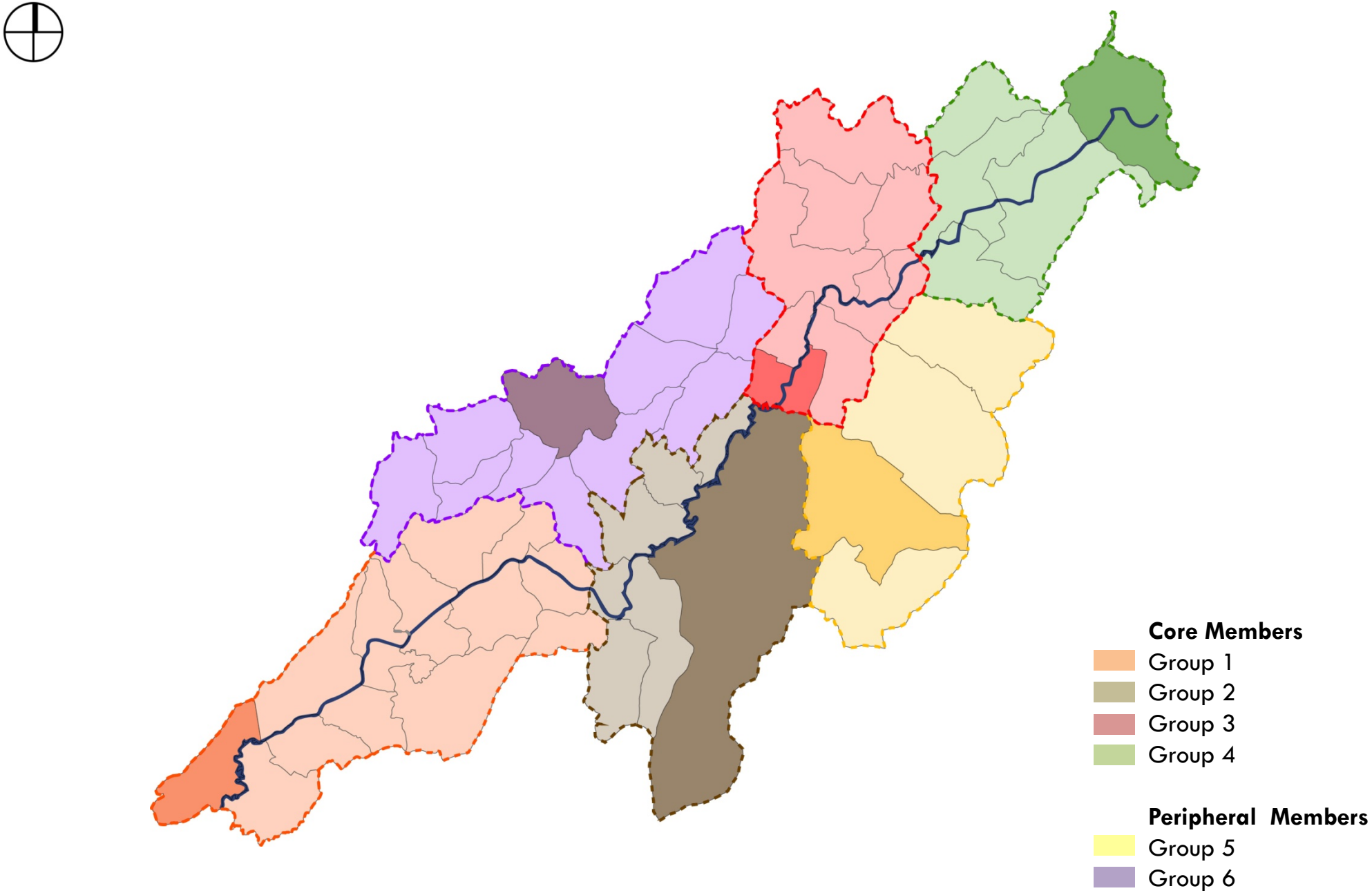
Communities

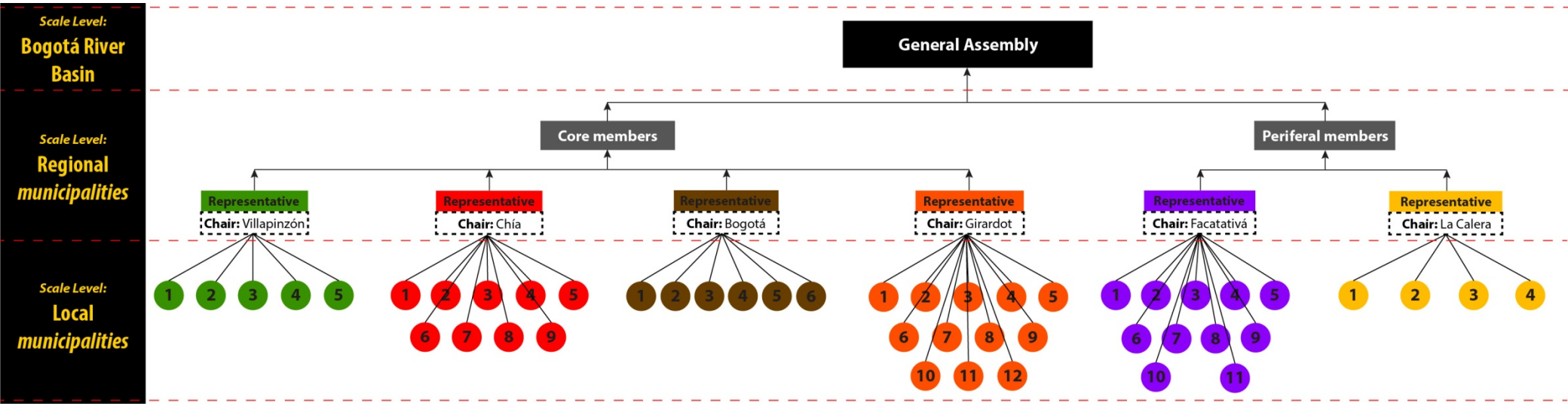
Environmentalists

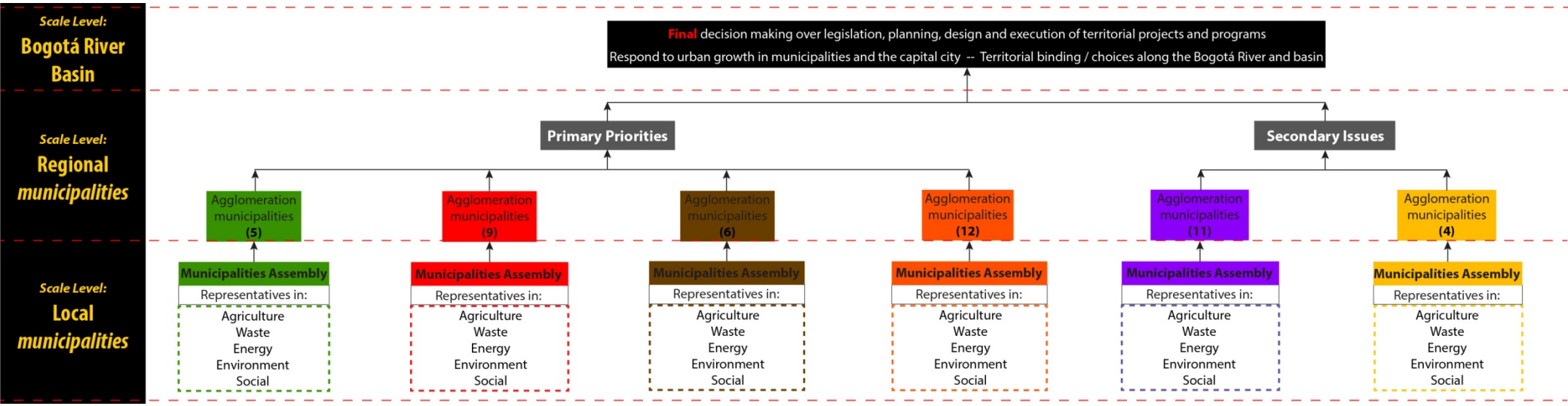
Recyclers, Waste companies

Affected by or can affect its actions

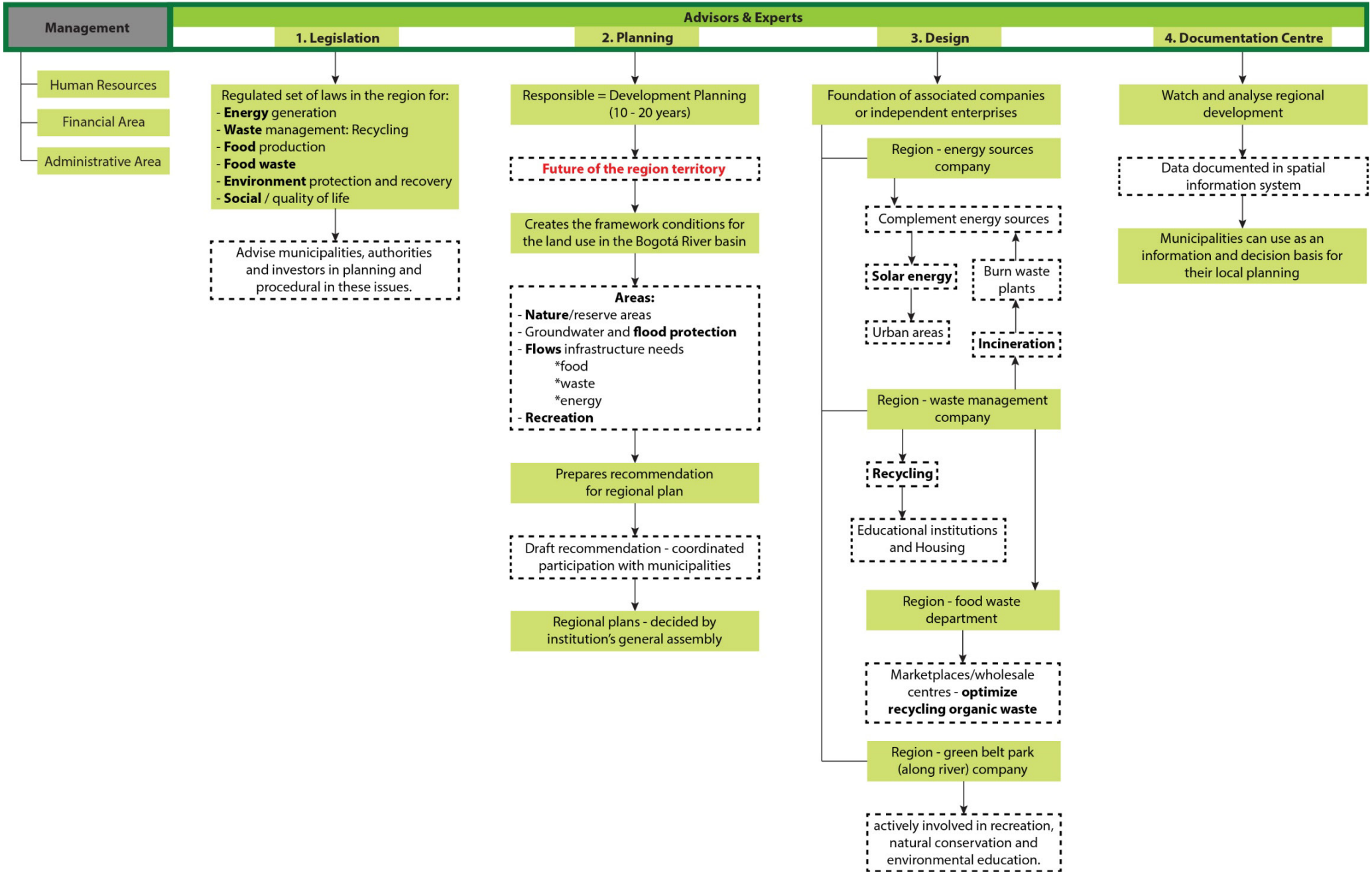
Map distribution

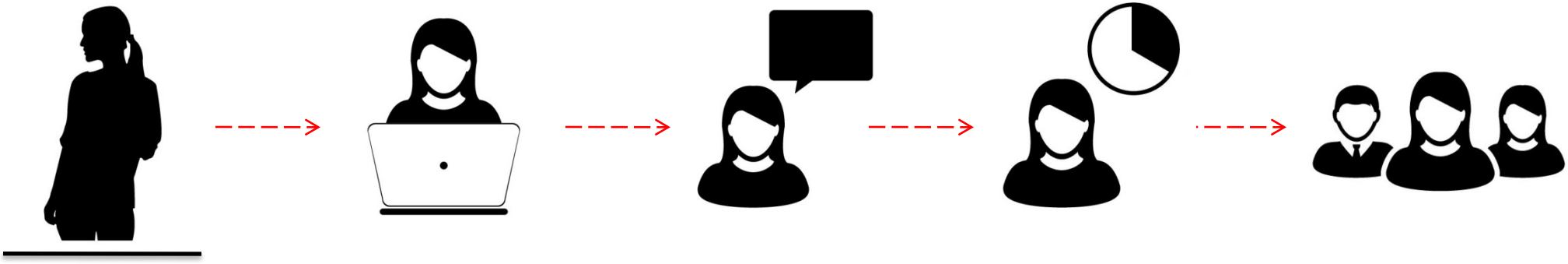


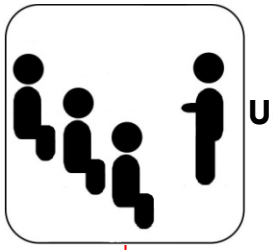

Scale Level:
Bogotá River Basin
Scale Level:
Regional municipalities
Scale Level:
Local municipalities
General Assembly
Core members
Periferal members
Representative
Chair: Villapinzón
Representative
Chair: Chía
Representative
Chair: Bogotá
Representative
Chair: Girardot
Representative
Chair: Facatativá
Representative
Chair: La Calera


Scale Level:
Bogotá River Basin
Scale Level:
Regional municipalities
Scale Level:
Local municipalities
Final decision making over legislation, planning, design and execution of territorial projects and programs
Respond to urban growth in municipalities and the capital city -- Territorial binding / choices along the Bogotá River and basin
Primary Priorities
Secondary Issues
Agglomeration municipalities (5)
Agglomeration municipalities (9)
Agglomeration municipalities (6)
Agglomeration municipalities (12)
Agglomeration municipalities (11)
Agglomeration municipalities (4)
Municipalities Assembly
Representatives in:
Agriculture
Waste
Energy
Environment
Social

Experts and Advisors Responsibilities



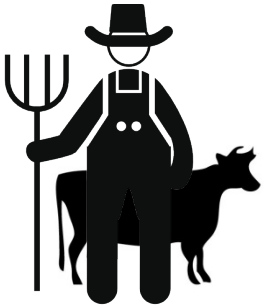




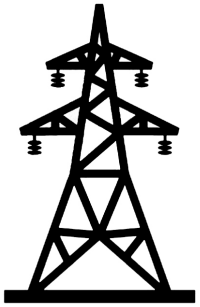
Talk | Approximate

Region | Municipality

Farmers



Cattle Ranchers



Hydroelectric plants

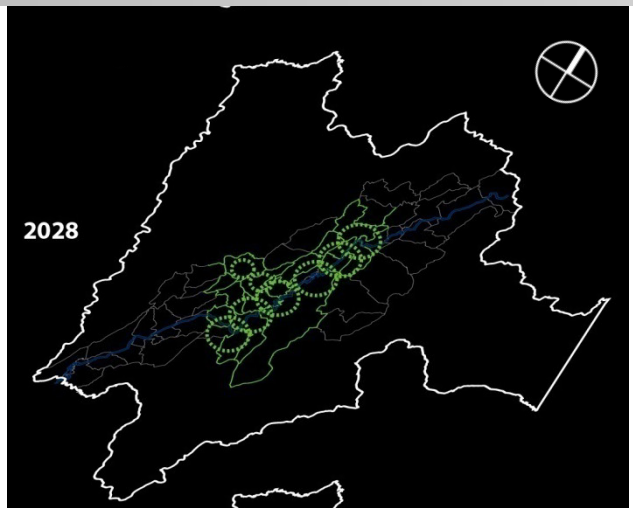
Communities

Environmentalists

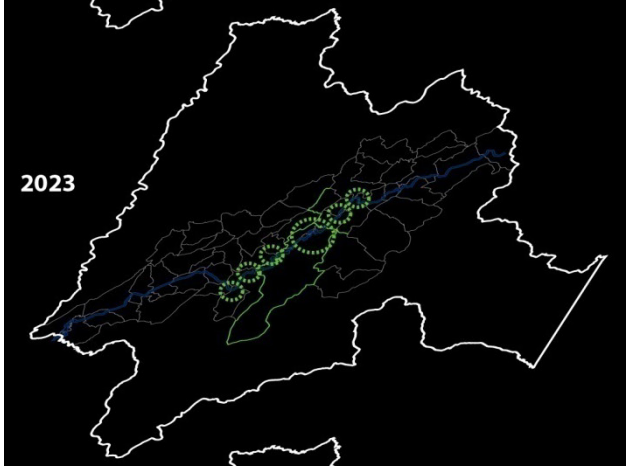
Recyclers, Waste companies

Phasing

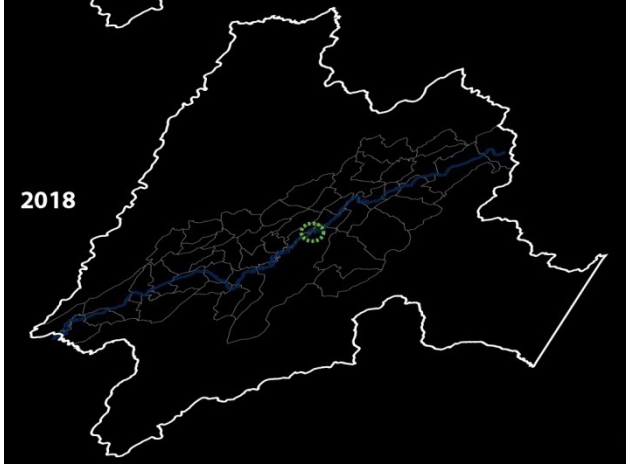
10 years



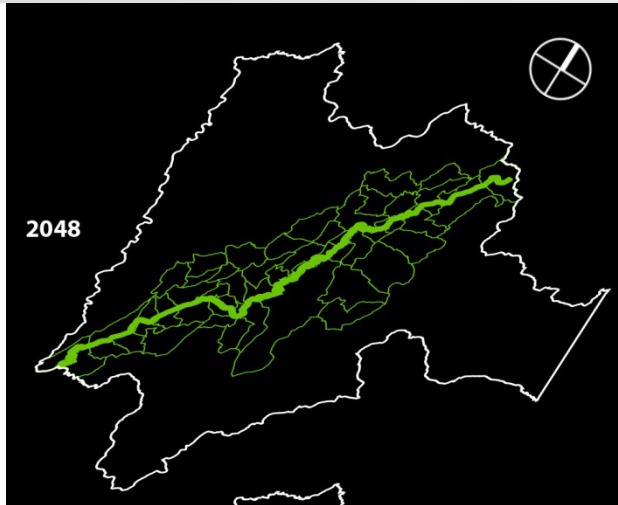
5 years



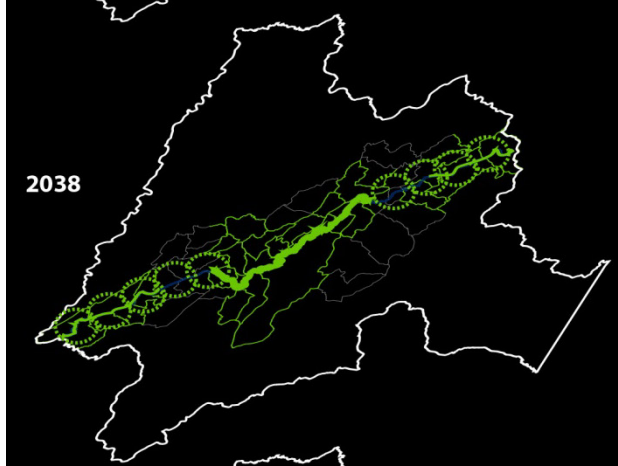
2 years



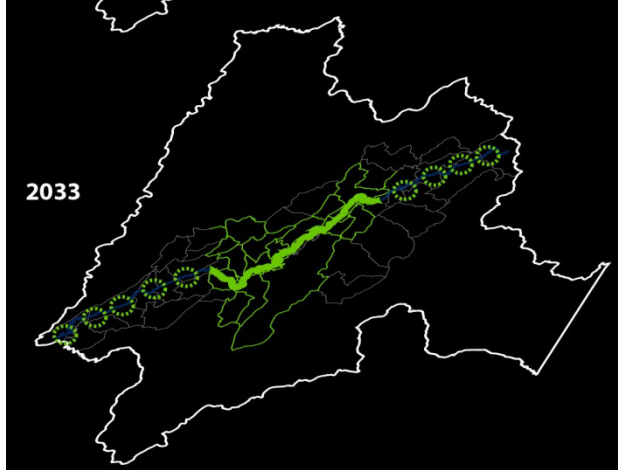
30 years



20 years



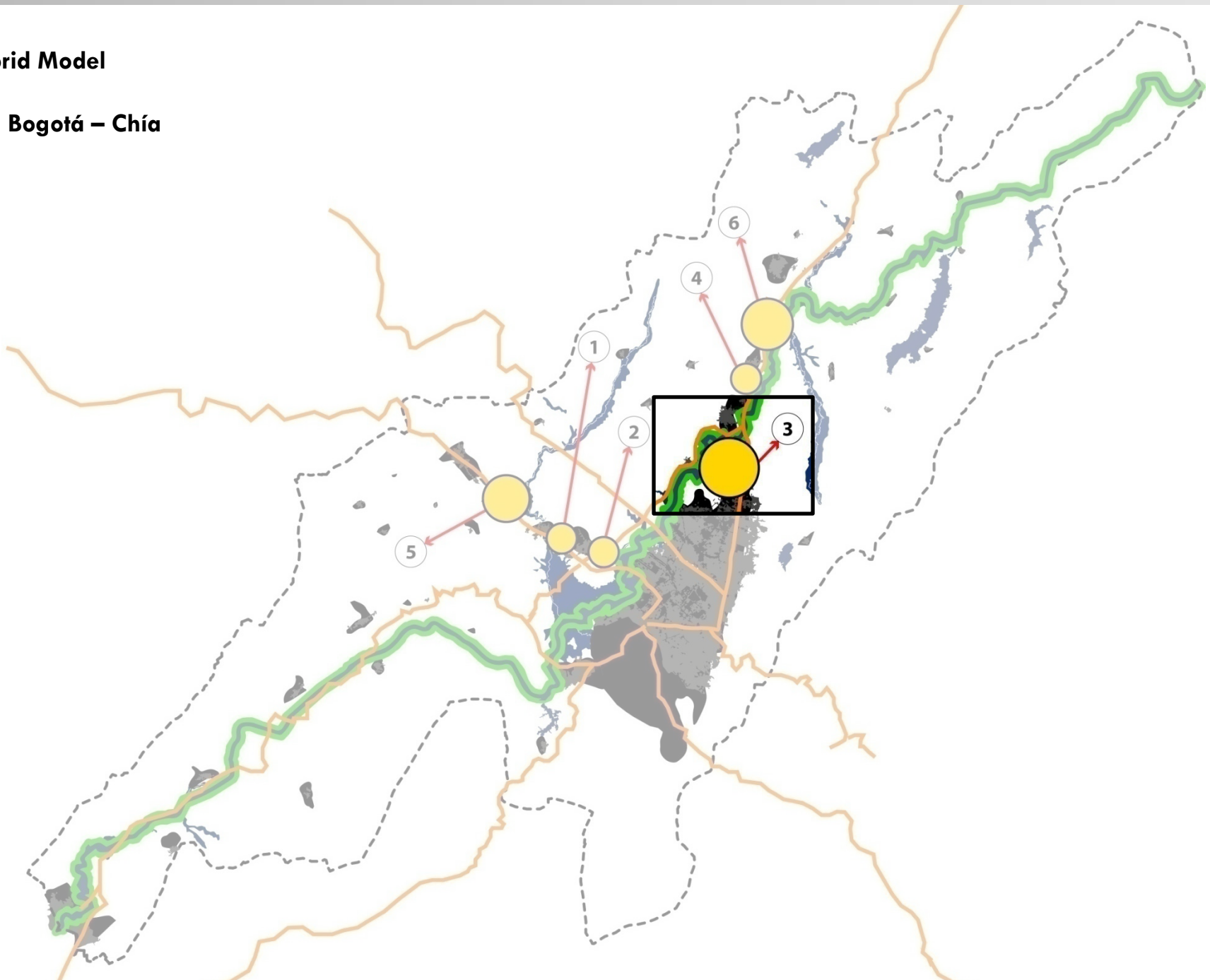
15 years



DESIGN

Hybrid Model

3. Bogotá – Chía



2015 **Population -** 7.800.000 people approx.

2065 **Population -** 12.900.000 people approx.

Overview capital city of Colombia: Bogota.

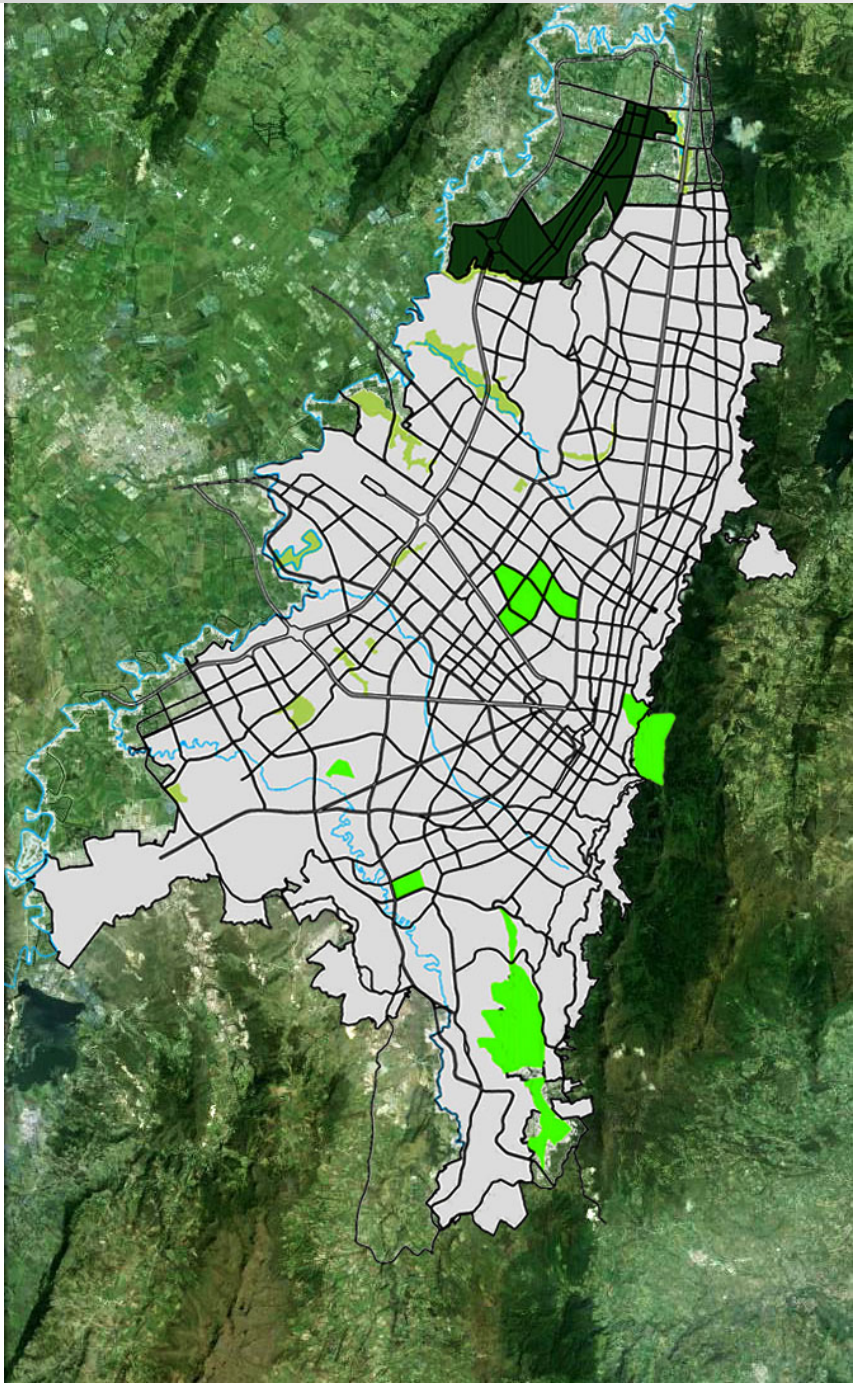
Source: Bogotá, nd. photogragh, <http://www.skyscrapercity.com/showthread.php?t=978478&page=116>

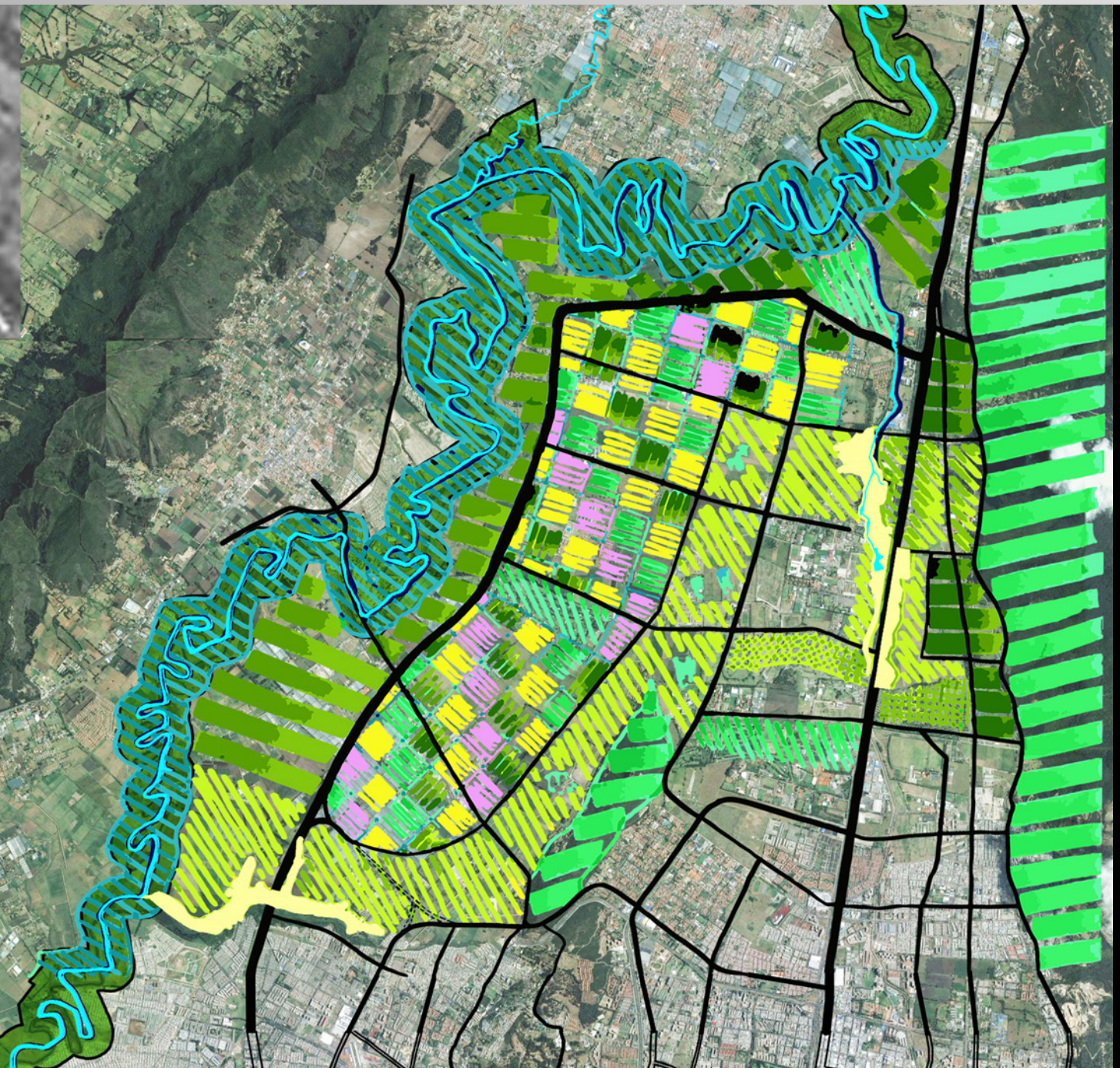
Wetlands – 500 Ha approx.

Eastern Hills Reserve – 13.200 Ha

Bogotá River – 90 km approx. Passes through the city

Thomas Van der Hammen Reserve – 1.395 Ha





Urban Forest

Wetlands

Hills

Rivers

Flood Area

Sustainable Agriculture

Private to public green areas

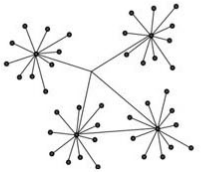
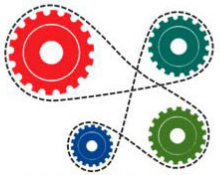
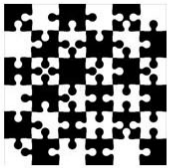
Predominant Use in the area

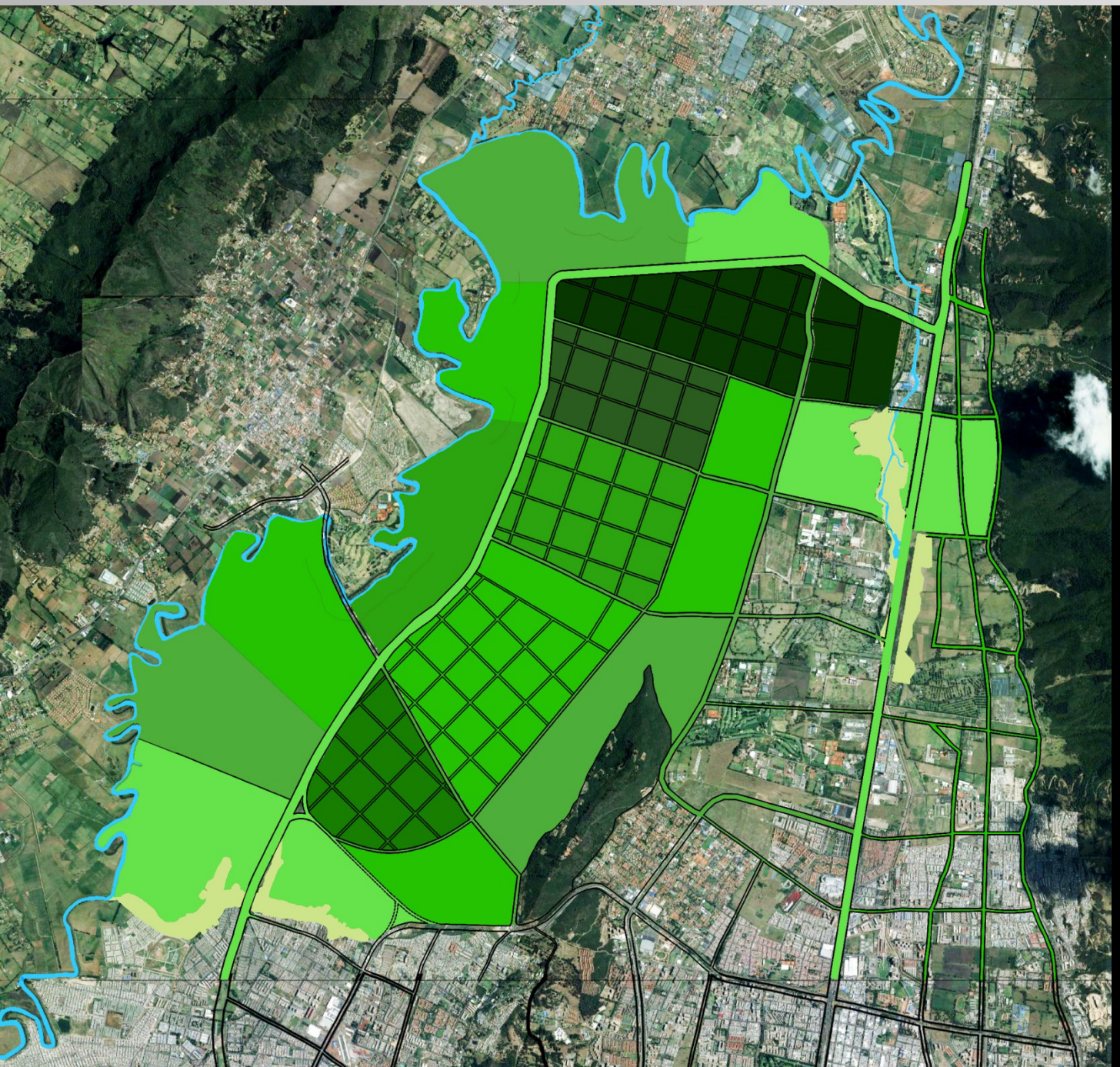
Facilities

Housing

Urban Agriculture

Flower Fields

	Method	Use / Implementation	Transform into: Regional network structure system
GOVERNANCE	*Inclusion*	 Landscape	 Balance
CONTAMINATION RIVER	*Recover*	 Sources that contaminate	 Sustainability
INFRASTRUCTURE	*Connecting Network*	 Bicycle	 Interconnected pedestrian Network
FOOD	*Supply system*	 Urban Agriculture/ Sustainable Agriculture	 Integrated Farming
WASTE	*Recycle*	 Recycling System	 Reuse Network
ENERGY	*Complement*	 Solar Energy/Burn Plant	 Renewable Energy Network



Timeline

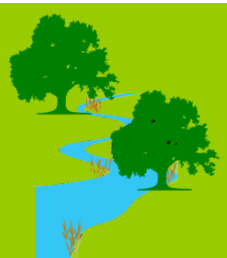
- 2 years
- 5 Years
- 7 years
- 10 years
- 12 years
- 15 years
- 20 years

DOMESTIC
Recycle

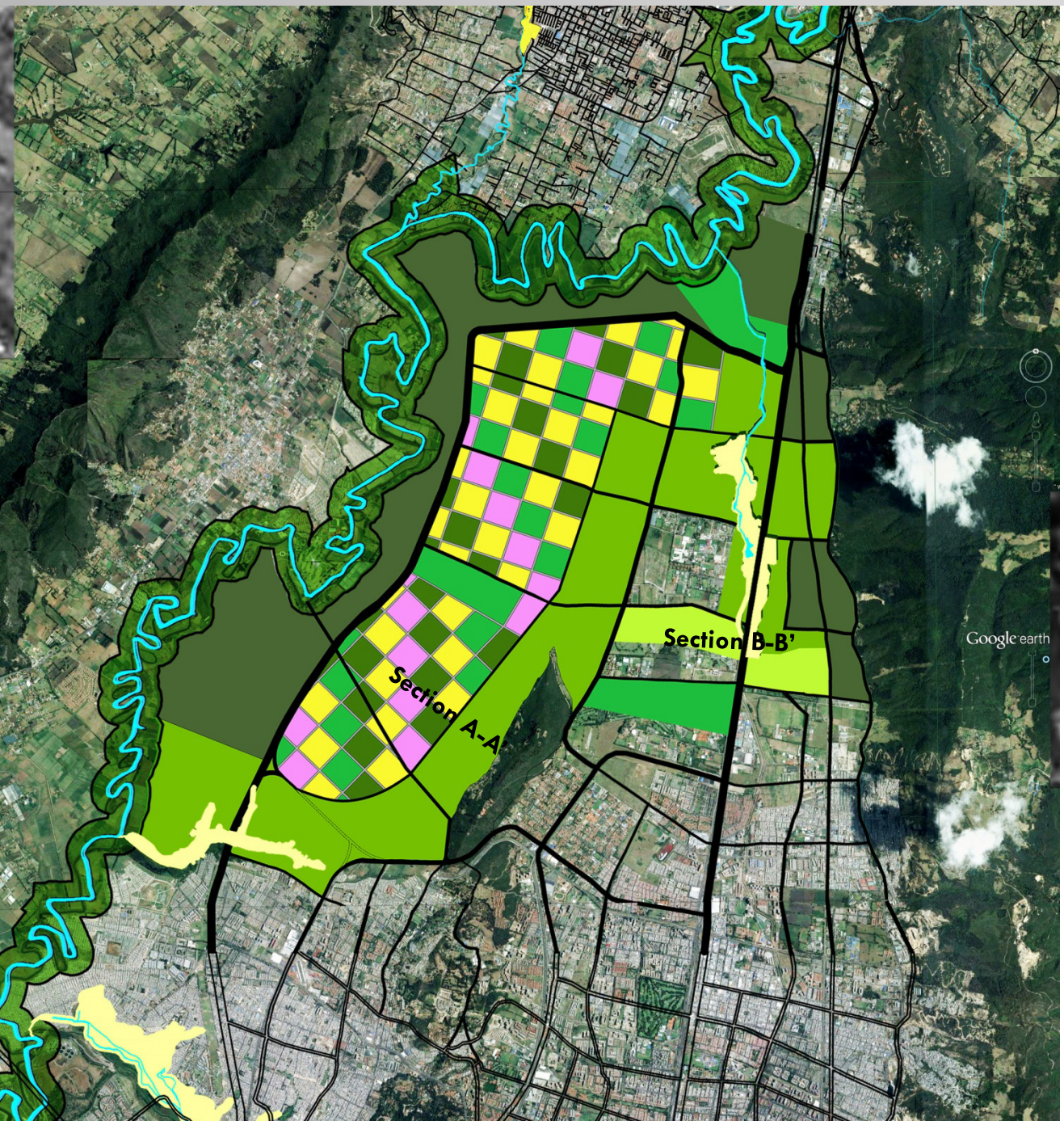
AGRICULTURE
Compost

INDUSTRIAL
Recycle

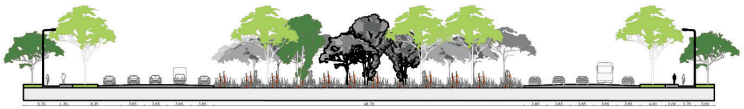
INDUSTRIAL + ***DOMESTIC***
Burn Waste Solar Energy

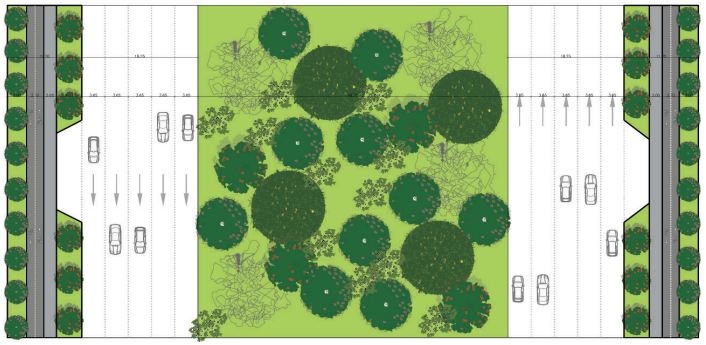


The same sources that can help de-contaminate

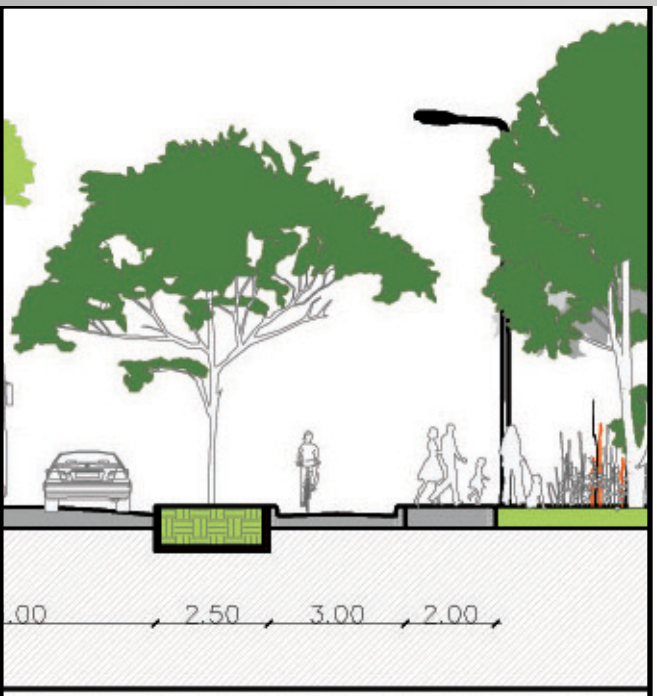


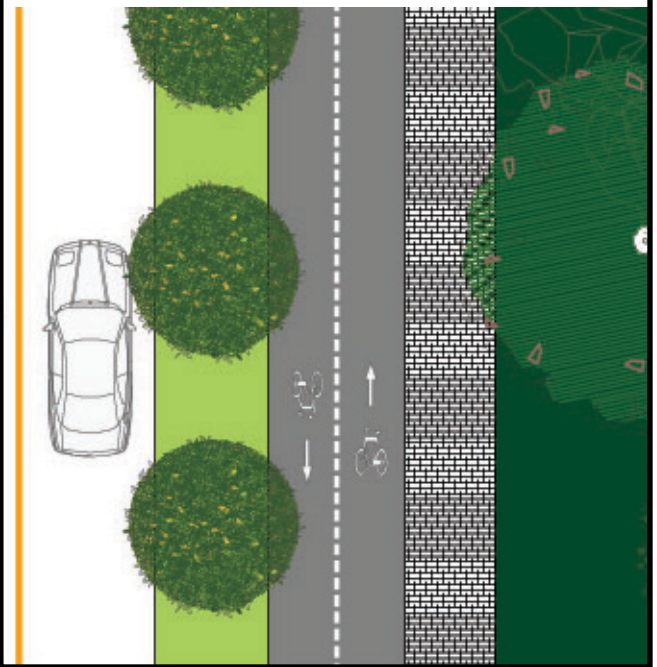
Section A-A'

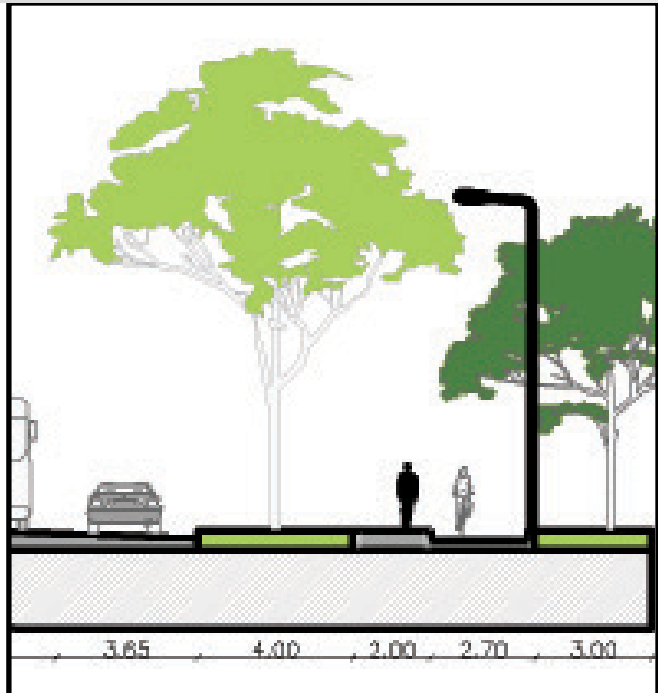


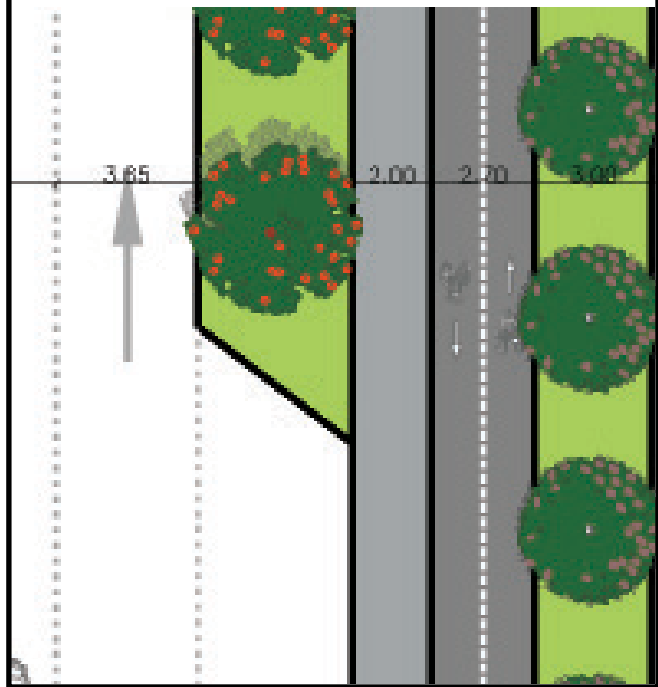


Section B-B'



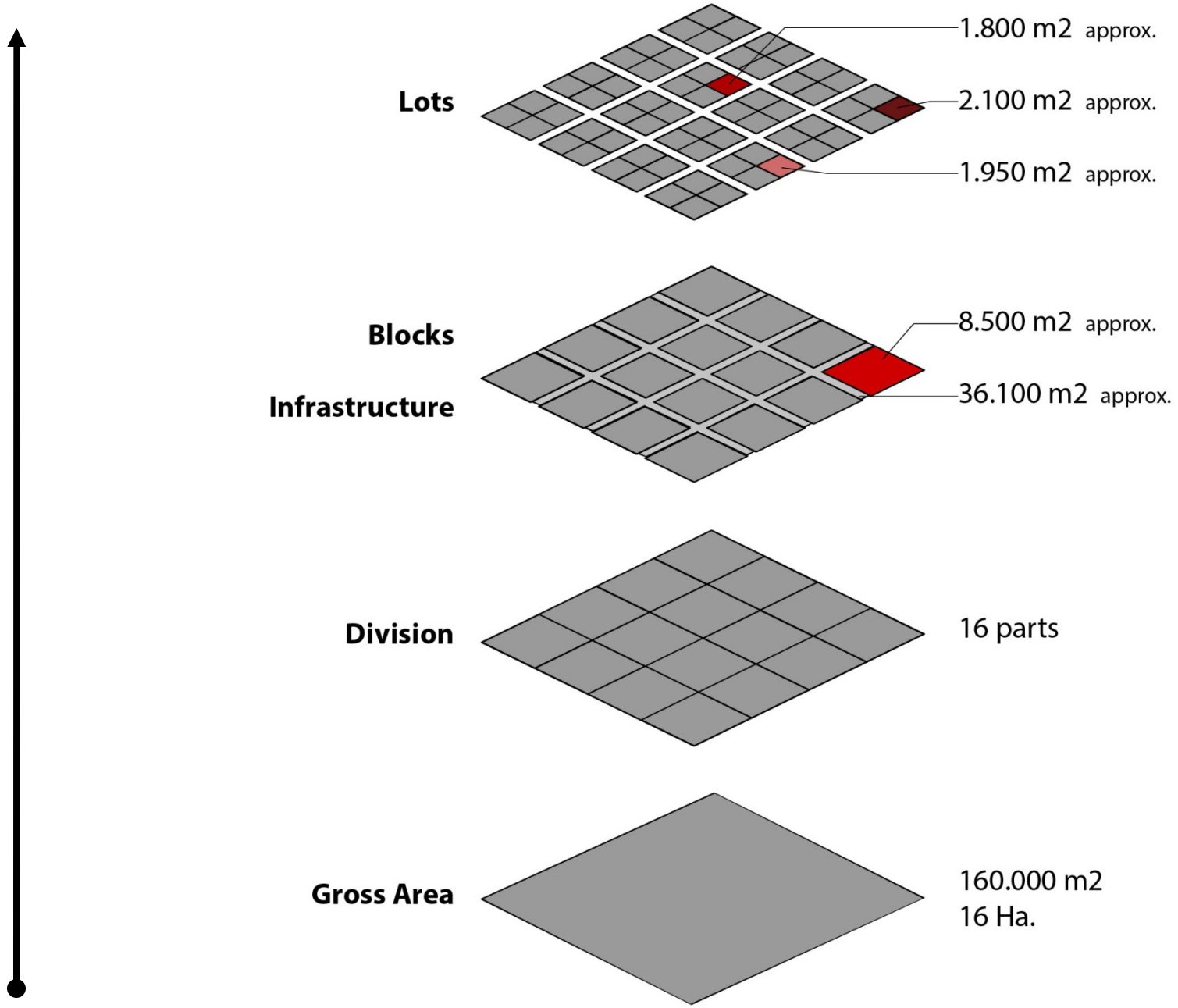




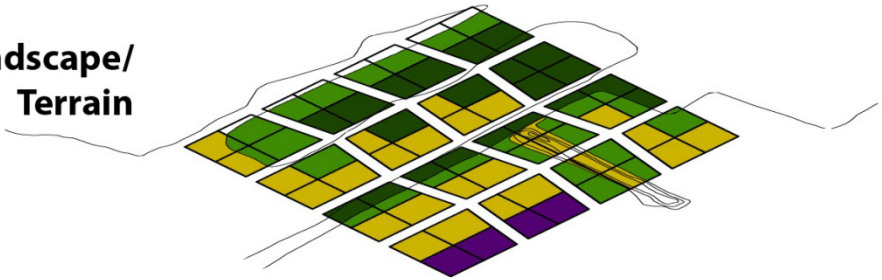


Section A-A'

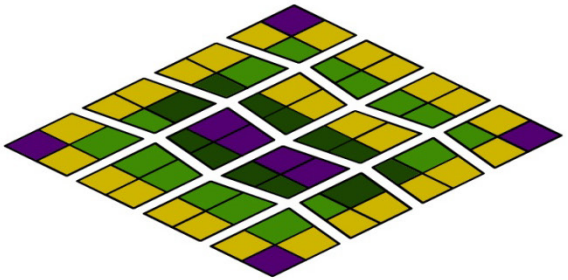
Section B-B'


Lots
1.800 m2 approx.
2.100 m2 approx.
1.950 m2 approx.
Blocks
Infrastructure
8.500 m2 approx.
36.100 m2 approx.
Division
16 parts
Gross Area
160.000 m2
16 Ha.

Landscape/ Terrain

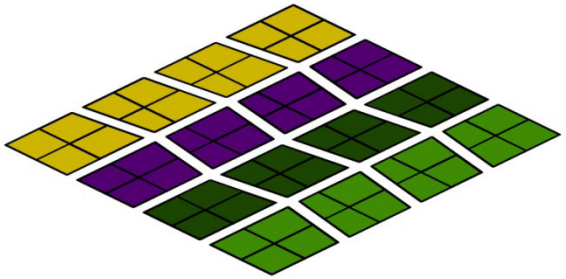


Base Typology Design



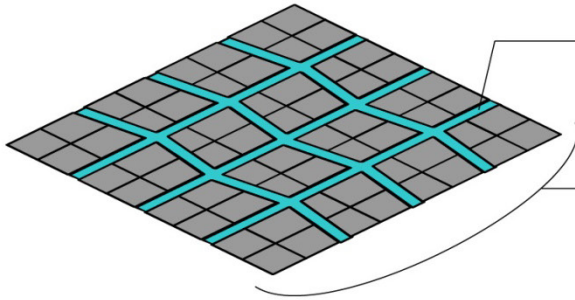
Housing (28)
Facilities (8)
Urban Agriculture (16)
Flower fields (12)

Land Use



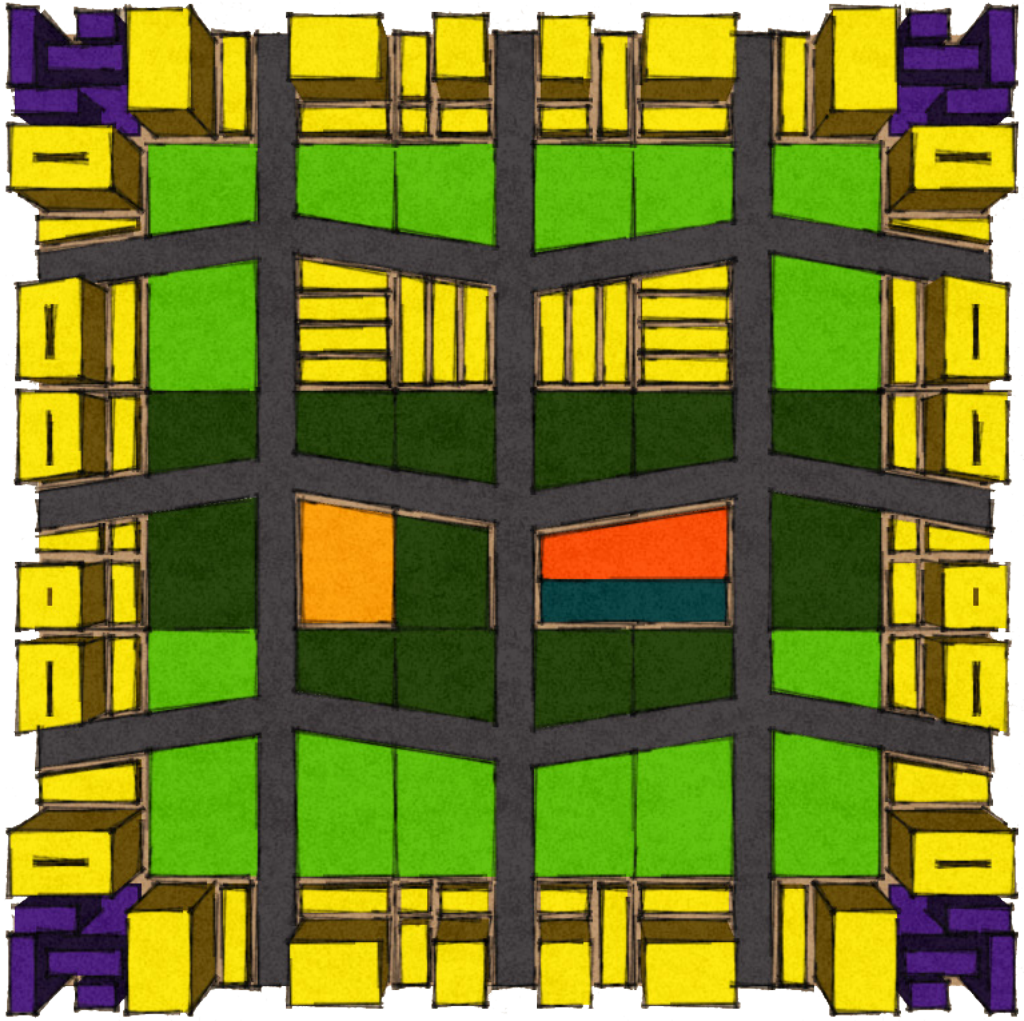
Housing
Facilities
Urban Agriculture
Flower fields

Morphology

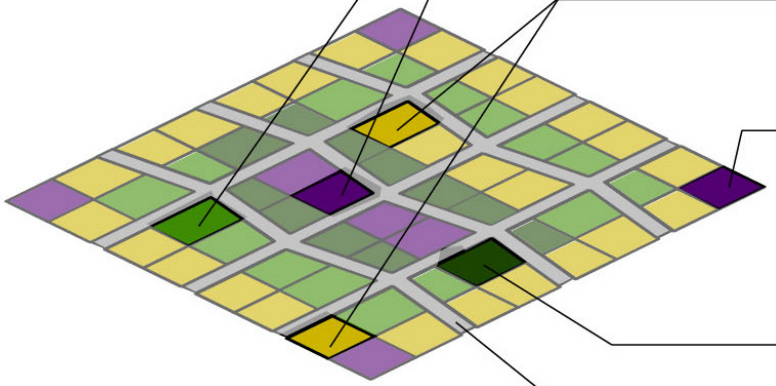


36.300 m2 approx.

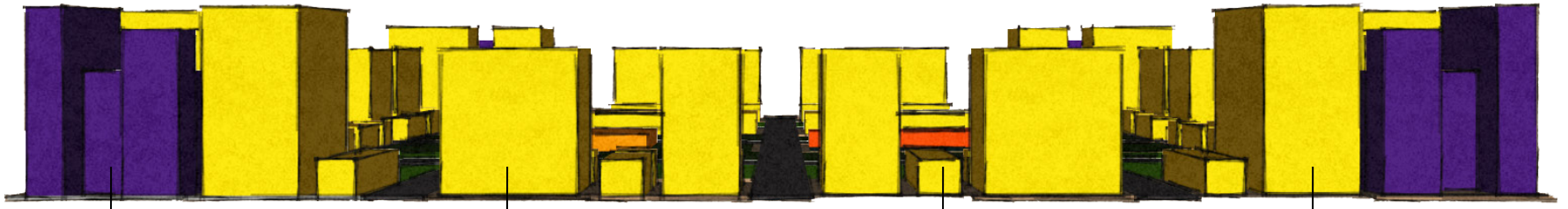
123.710 m2
Blocks between:
1.200 - 2.700 m2



- Housing
- Commerce and business
- School (pre-school)
- Recycling Collection Point
- Urban Agriculture
- Flower Fields



1 Urban Agriculture	16 Lots	3.16	Ha
2 Facilities: Education, Waste	4 Lots	0.46	Ha
3 Housing: High/Low Density	28 Lots	5.62	Ha
4 Facilities: Business, Commerce	4 Lots	0.85	Ha
5 Flower Fields	12 Lots	1.98	Ha
6 Road Infrastructure		3.63	Ha
TOTAL		**15.70**	**Ha**

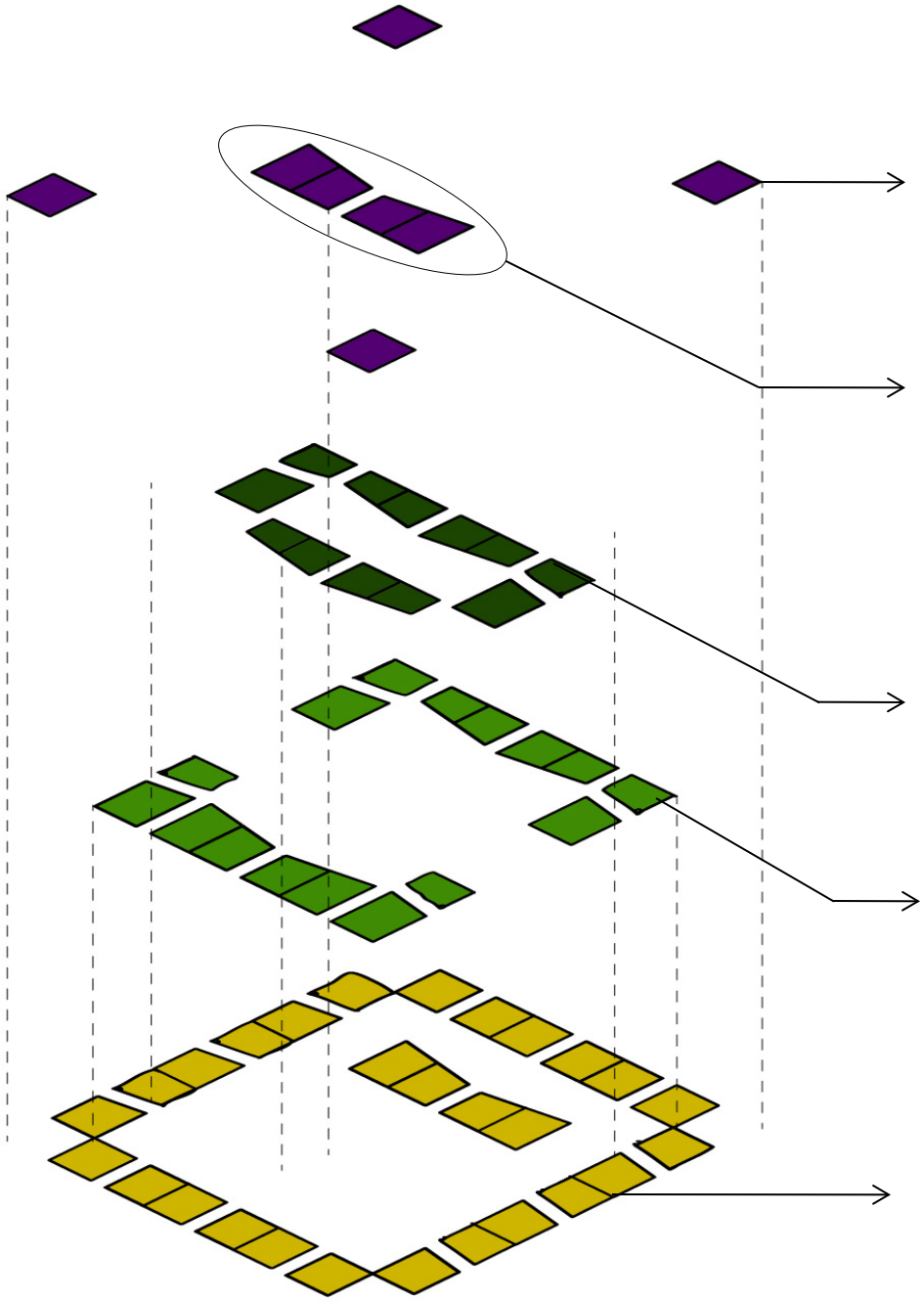


Facilities:
Business + Commerce
2 - 20 floors

Housing:
High Density
15 floors

Housing:
Low Density
3 floors

Housing:
High Density
20 floors



Investors

Designers

Developers

Solar Energy

Recycling
Collection Point

Education

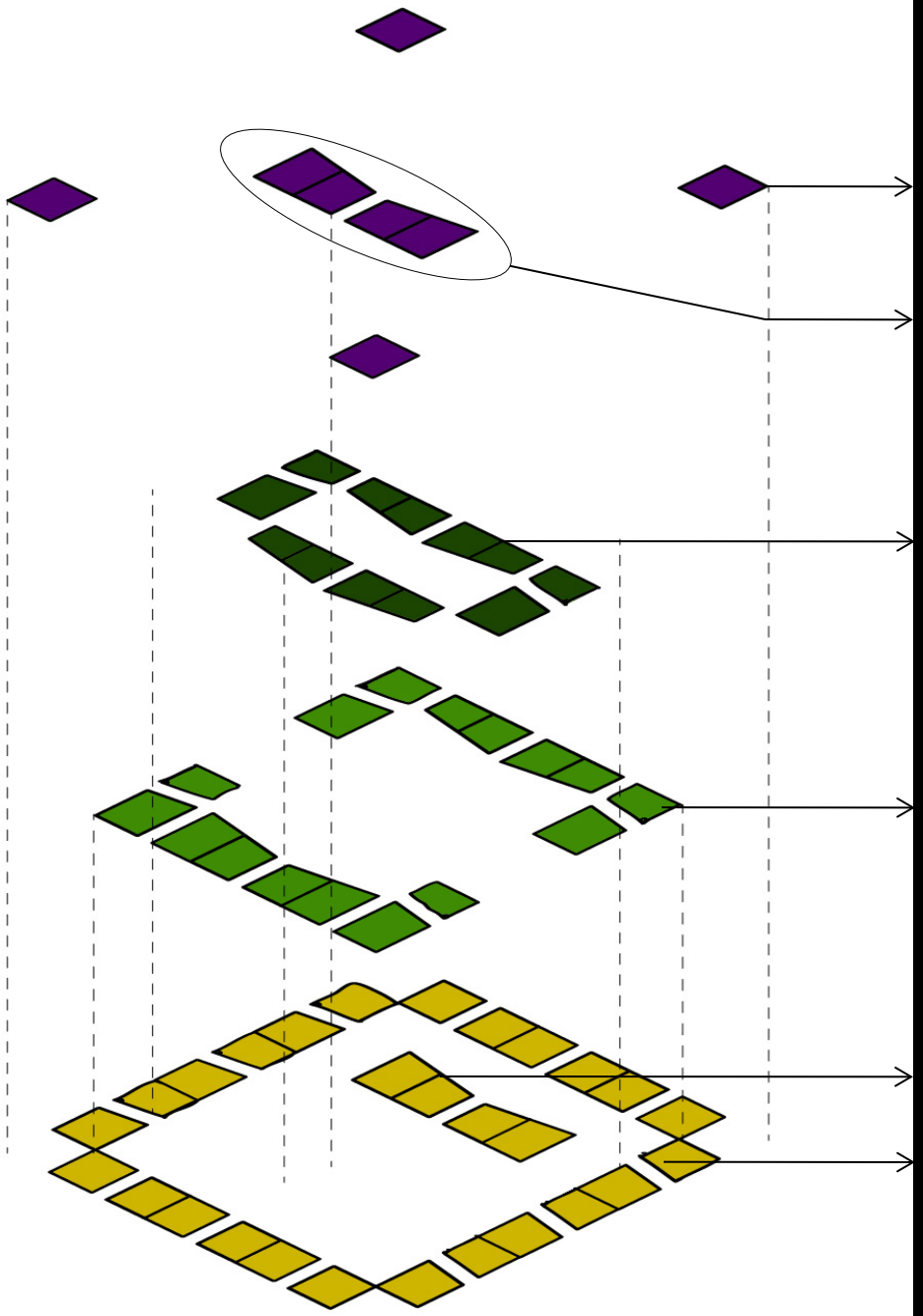
Flower business market

Communities

Communities

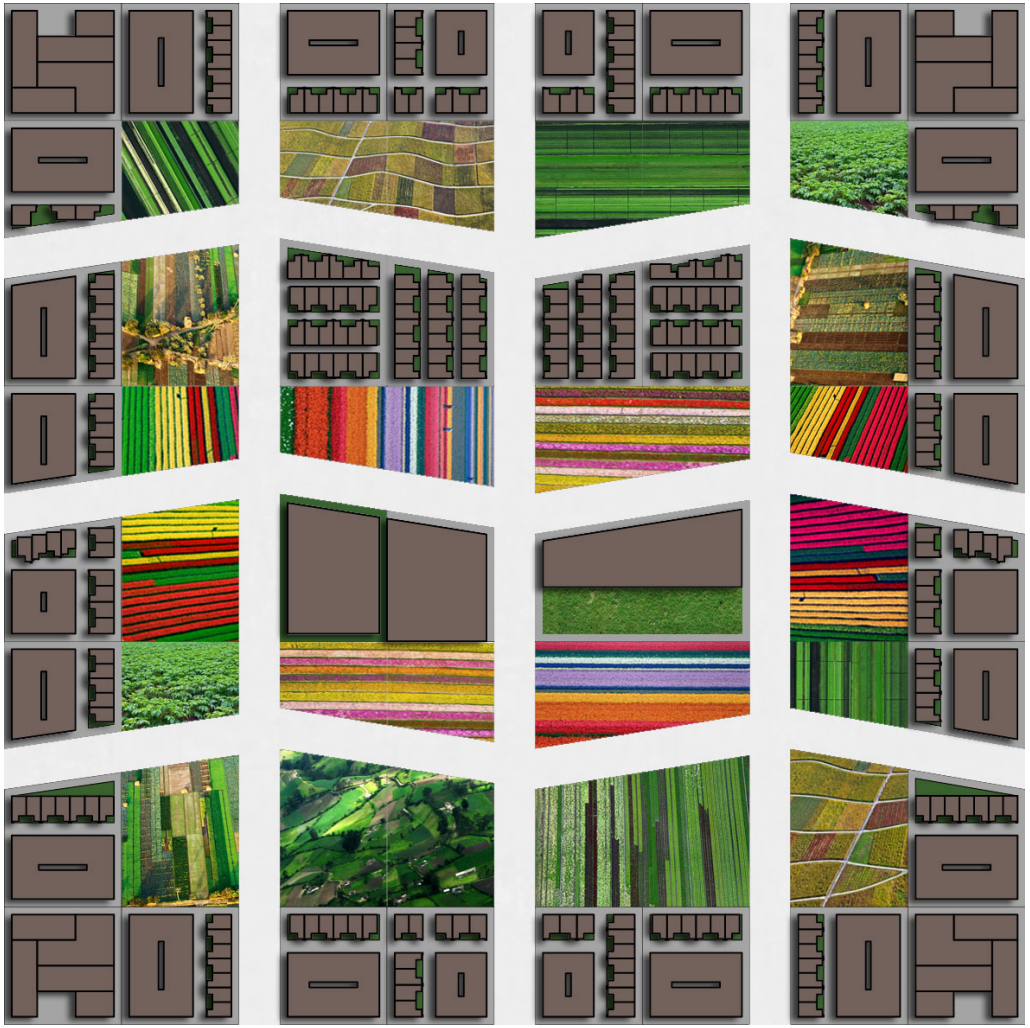
Designers

Developers



Phasing

Facilities: Business, Commerce	3 years
Facilities: Education, Waste, food (compost)	2 years
Flower Fields	1 year
Urban Agriculture	1 year
Housing: Low Density	3 years
Housing: High Density	5 years



TOTAL		
Floor Space Index	15,111.72	m2
Construction Index	74,805.88	m2
	782	Families
	2,216	Total Housing Units
	8,864	Total People

Bogotá

- **Actual** average density: **197 inhabitants/Ha**
- **Proposed** square system: **138.5 inhabitants/Ha**

Total Block Area	16	Ha
Density	138.5	People per Ha

- Urban Forest - Park
- Wetlands
- Hills
- Rivers
- Flood Area
- Sustainable Agriculture
- Green Areas
- Wetland's Green Areas
- Infrastructure
- Logistic Parks
- Water Storage
- Reforestation
- Green Belt Park
- Education Hubs
- Blocks

Urban Forest – Park
1.057 Ha

Wetlands
Wetland Guaymaral
y Torca
30 Ha

Wetland La Conejera
59 Ha

Rivers

Flood Area

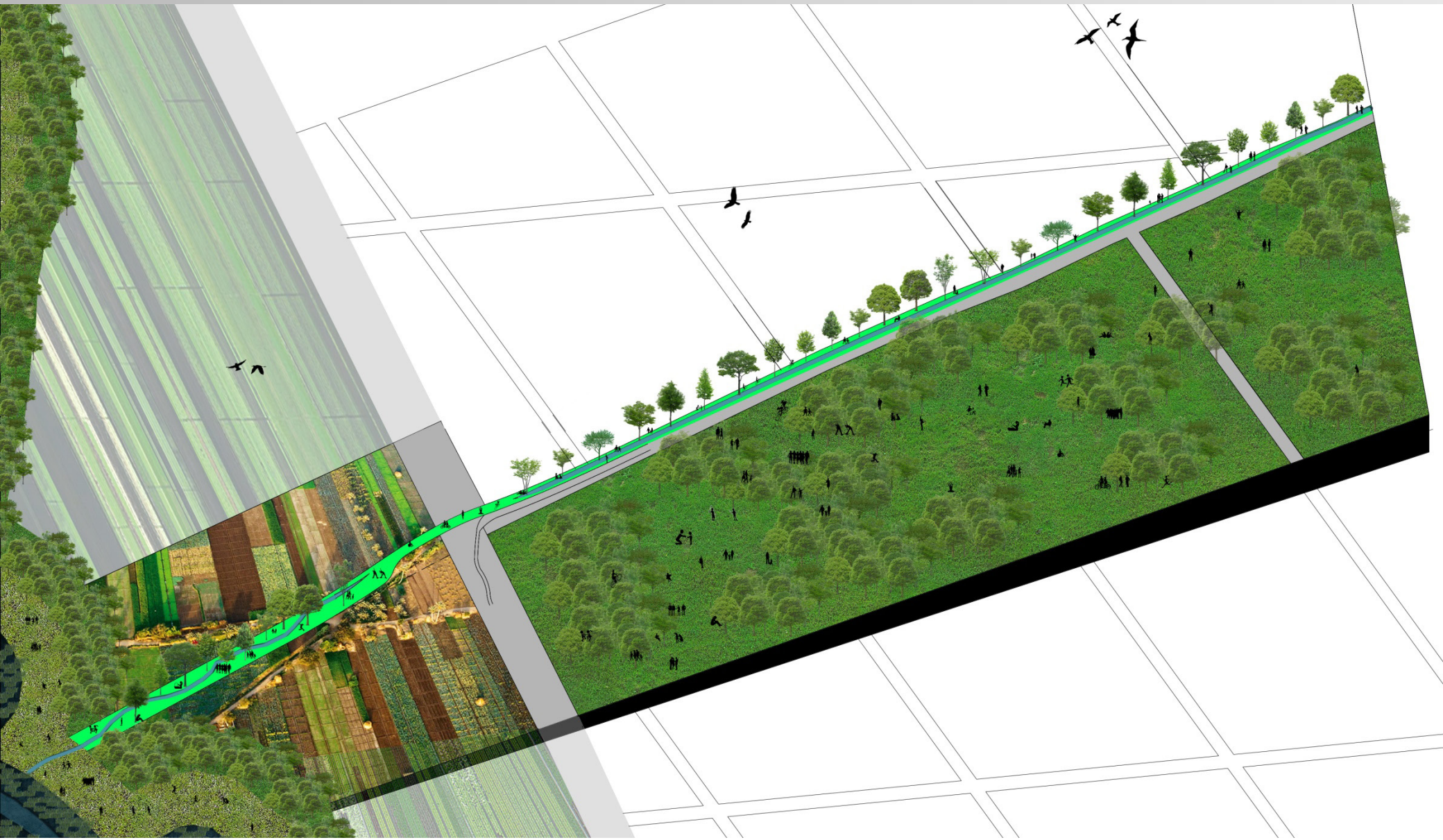
Reforestation

Green Belt Park

Green Corridors

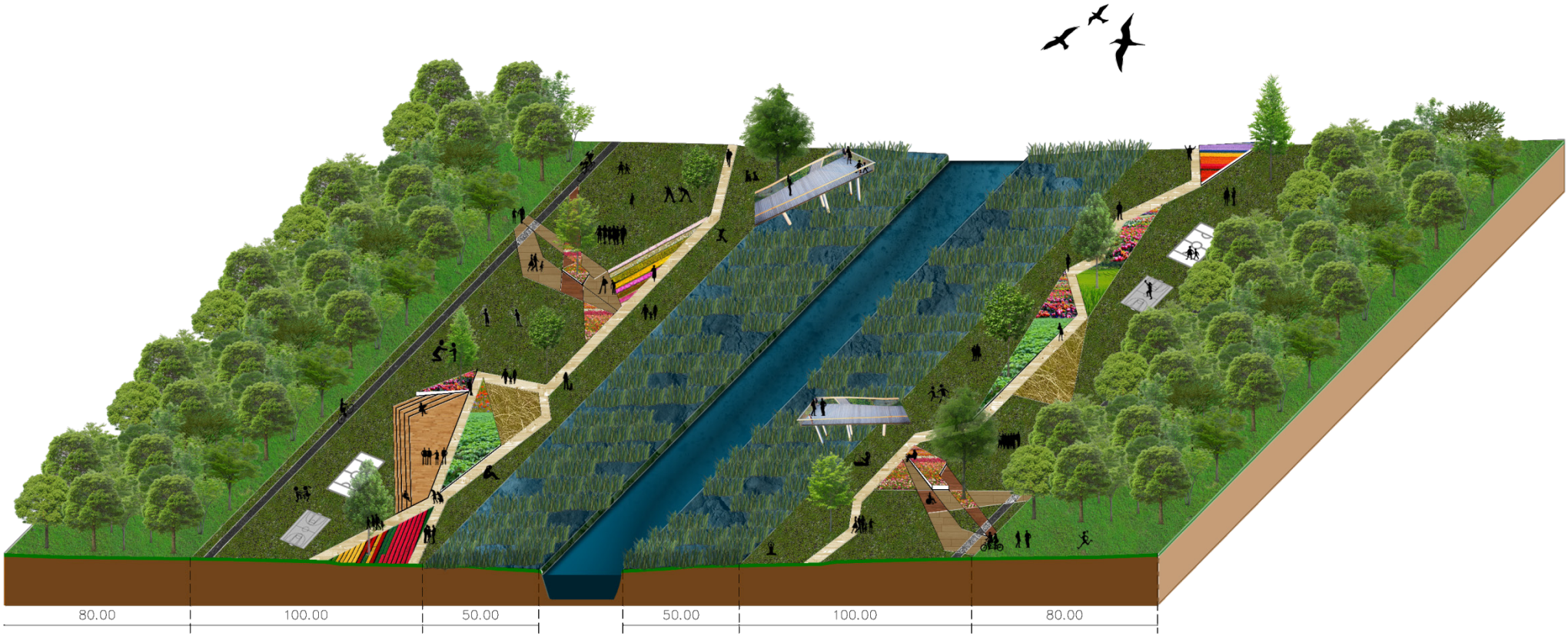
Nodes

Green Corridor # 1

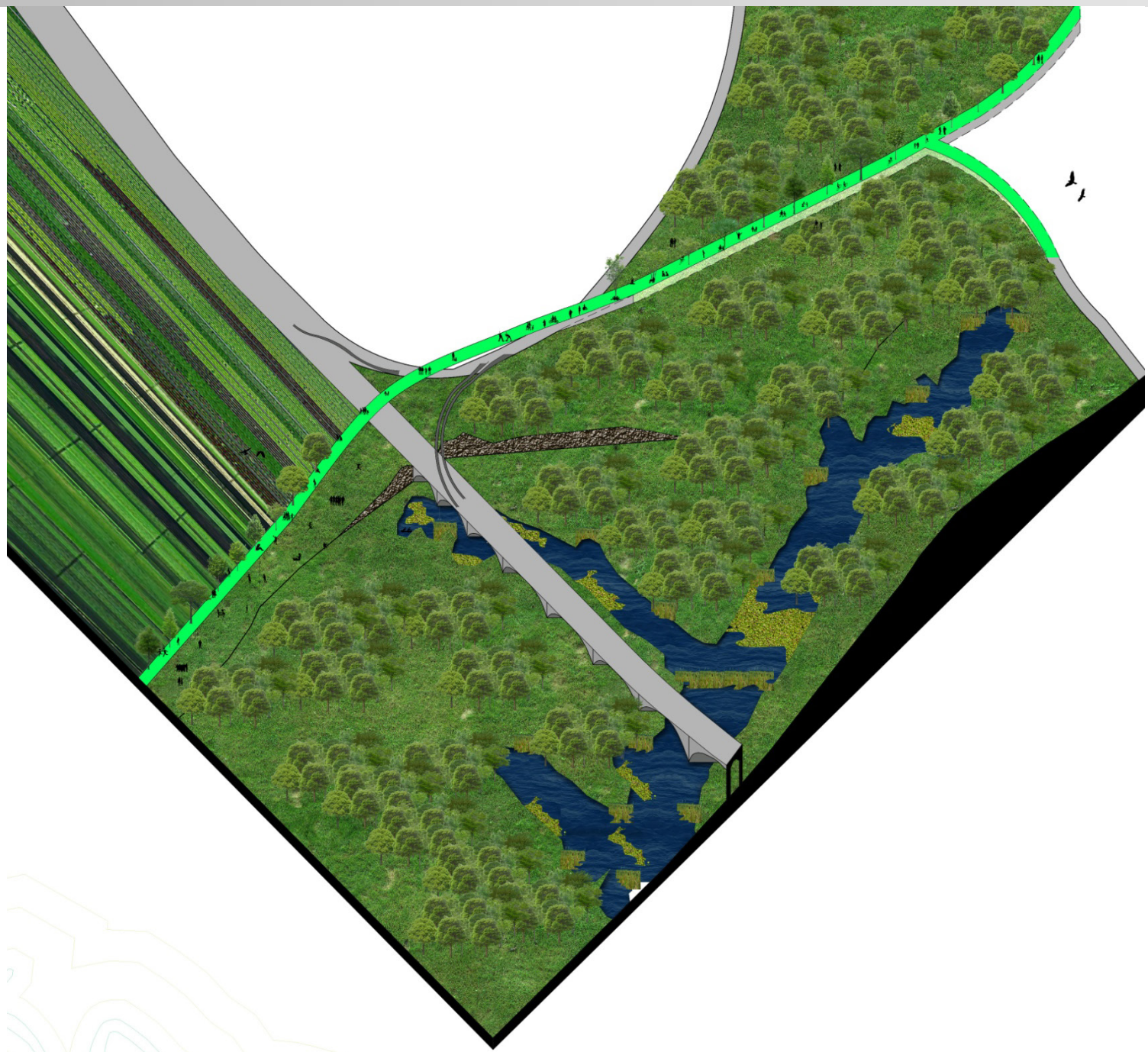


A

Green Belt – Bogotá River



B



C

Urban Forest Park

D

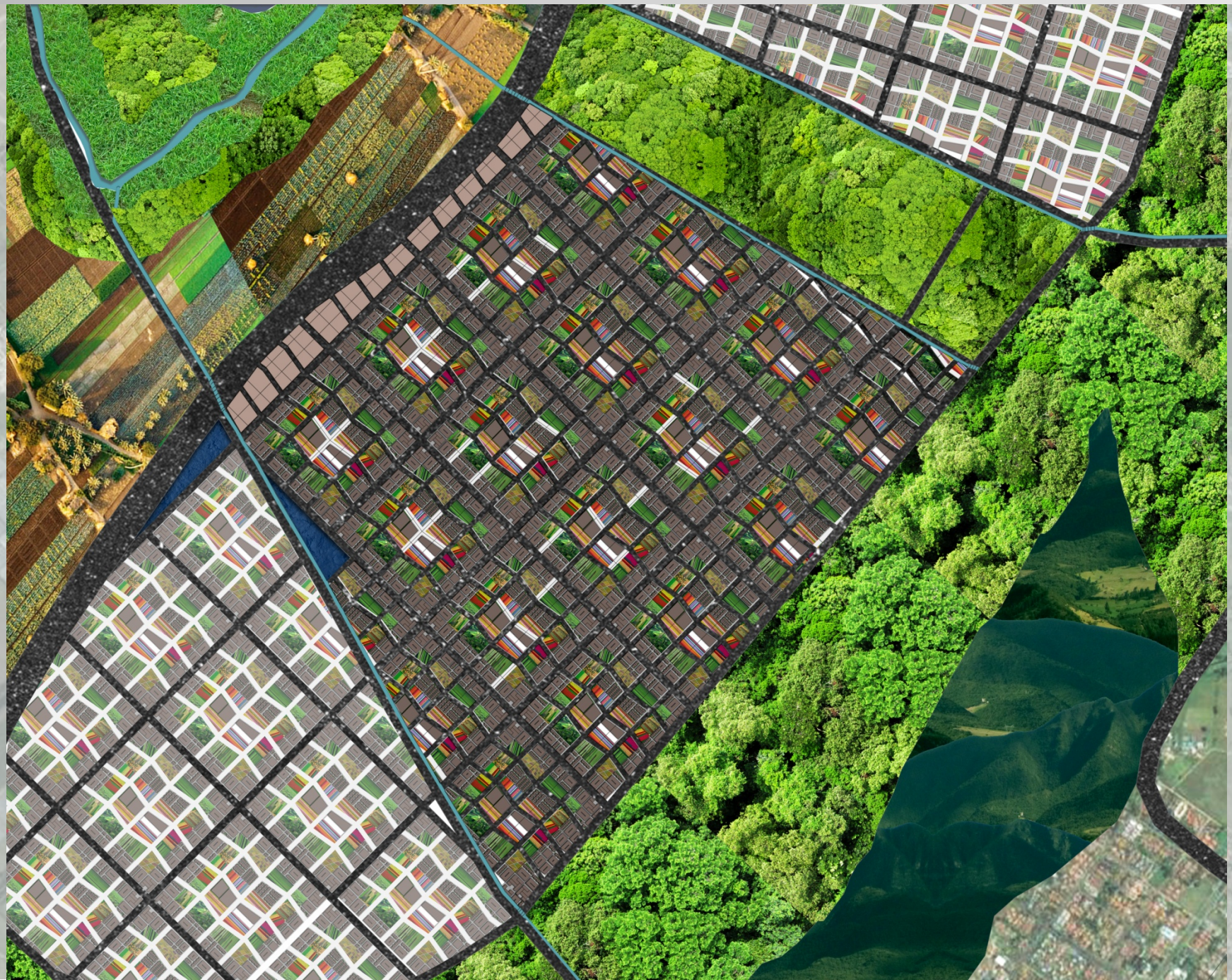
Vision La Conejera Wetland and arterial road infrastructure

E

Vision Urban Forest Park

F

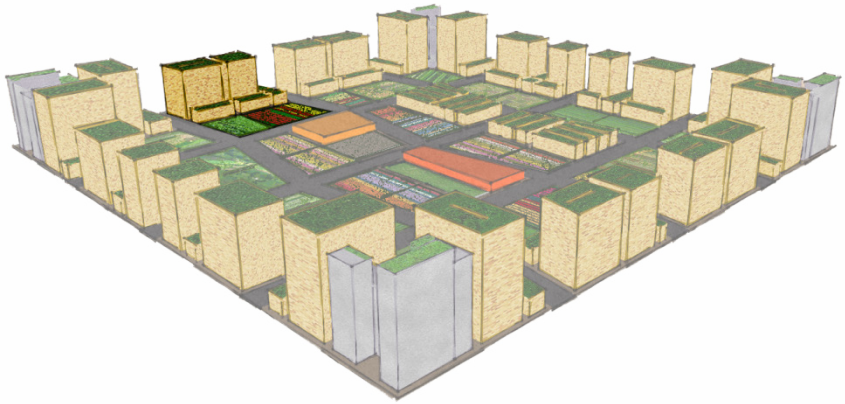
Hybrid Square Model



Urban Agriculture

Food Footprint	**Square System - 1 block (16 Ha)**	3,295.59	Tons per year
Ecological Footprint		2,841.03	Ha per year
Food Footprint	**Hybrid Model - 71 blocks (16 Ha)**	233,986.87	Tons per year
Ecological Footprint		201,712.82	Ha per year

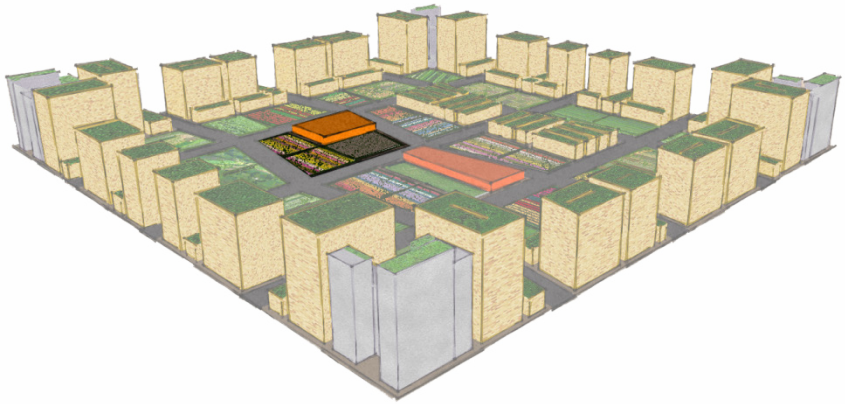
Population Feed - 1 block (16 Ha)	**1,950**	**People**
Population Feed - 71 block (16 Ha)	**138,456**	**People**



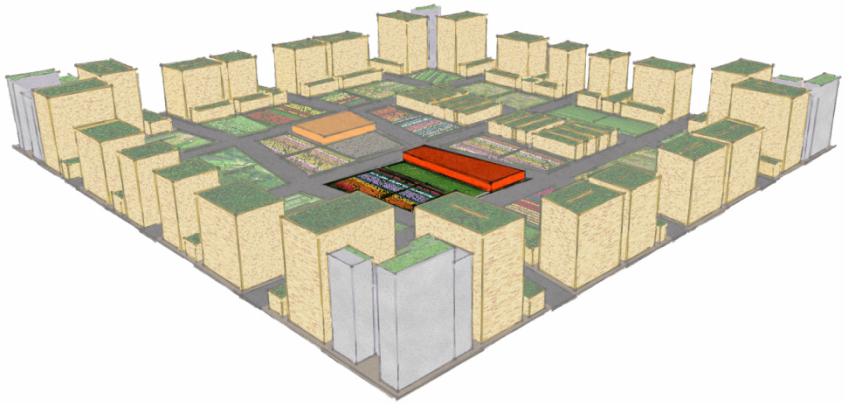
Flower Fields + Education

Square System - 1 block (16 Ha)	Area	1.98	Ha
	Harvest - 2 per year	3.96	Ha per year
Hybrid City Model - 71 blocks (16 Ha)	Total Area	140.55	Ha
	Total Harvest - 2 per year	281.11	Ha per year

Population employed in Hybrid City Model	**8,781**	**People**



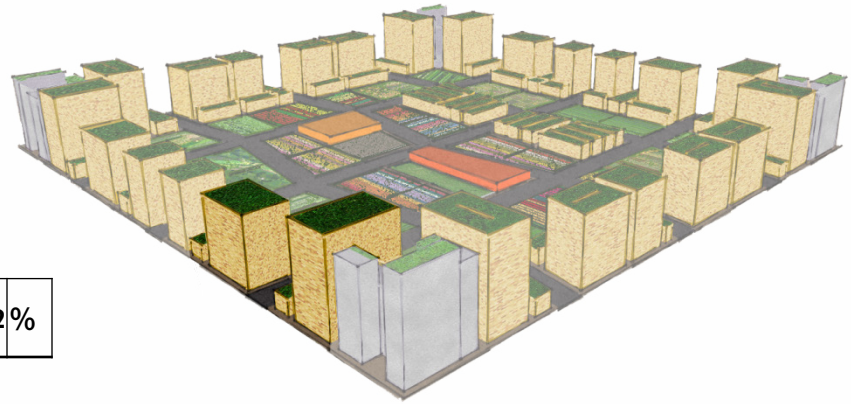
Compost Production Area + Waste and Recycling Collection Point



Compost Production Area	1,420	m2
Waste and Recycling Collection Point	1,900	m2

Housing

Square System - 1 block (16 Ha)	Total People	8,864	Population per block
	Density	139	People per Ha
	Total Housing Units	2,216	
Hybrid Model - 71 blocks (16 Ha)	Total People	629,344	Population Located in Hybrid System of Blocks
	Total Housing Units	157,336	



Bogotá Population	2015	7,800,000
Bogotá Population	2065	12,900,000
People to locate		5,100,000

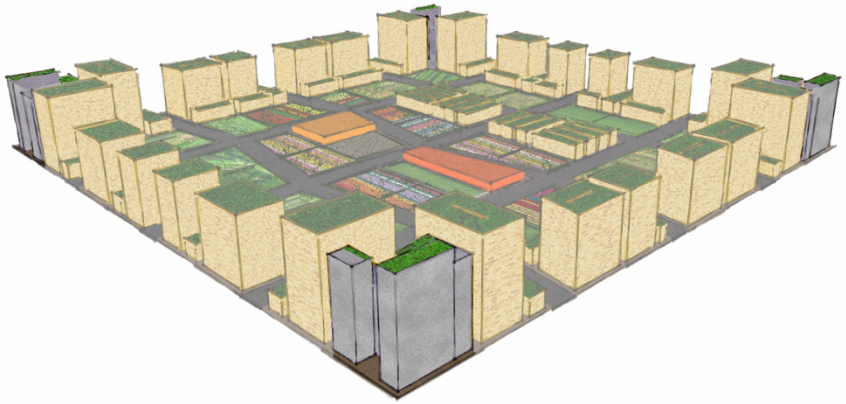
Percentage Population Located in Hybrid City Model	**12**	%

Facilities - Logistic Park + Sustainable Agriculture

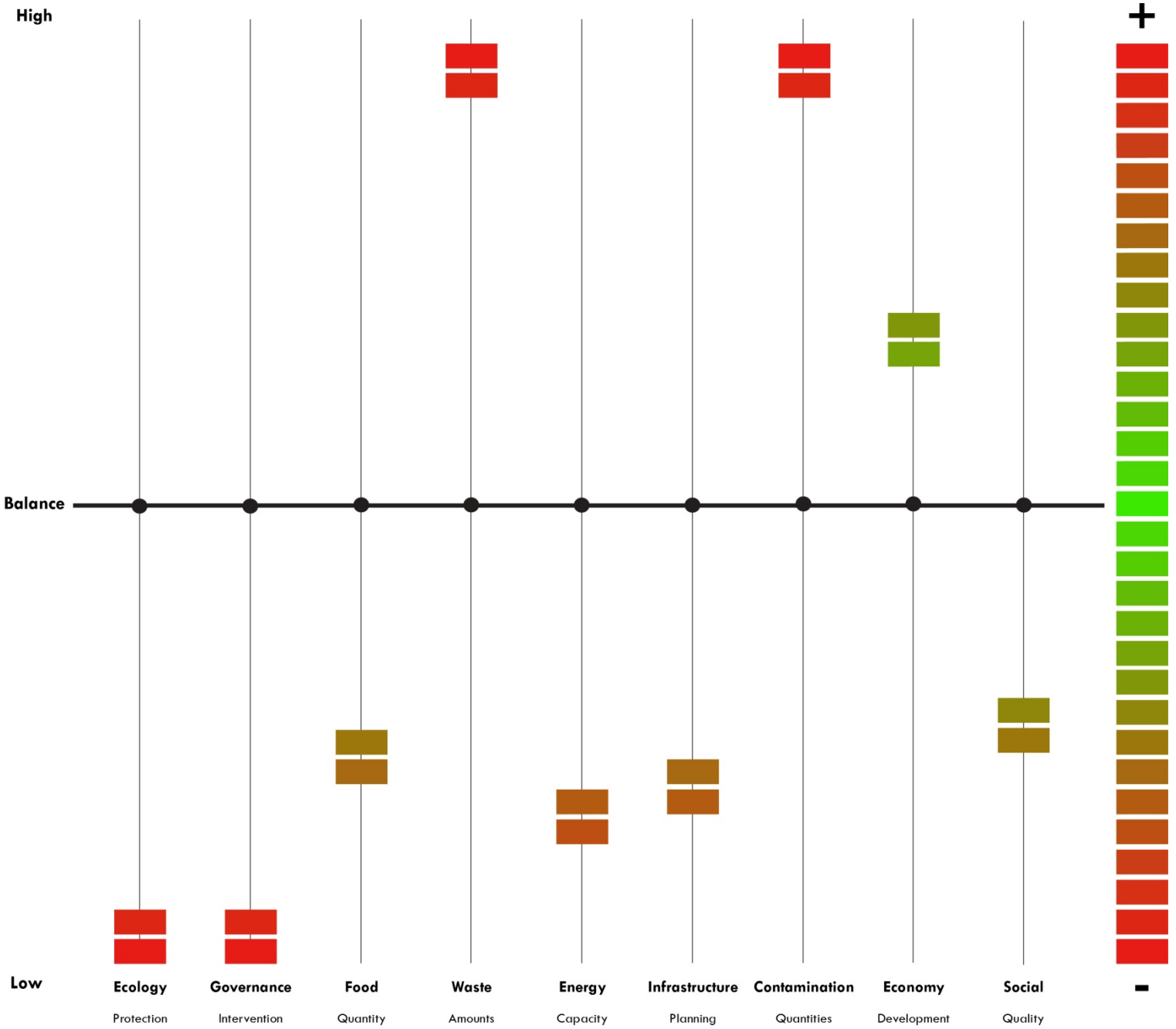
Hybrid City Model	Area for production	1,071.30	Ha
	Harvest - 2 per year	2,142.60	Ha per year
	Production	2,485.42	Ton per year

Percentage Population Feed in Hybrid City Model	**105.04**	**%**
	661,080	**People**

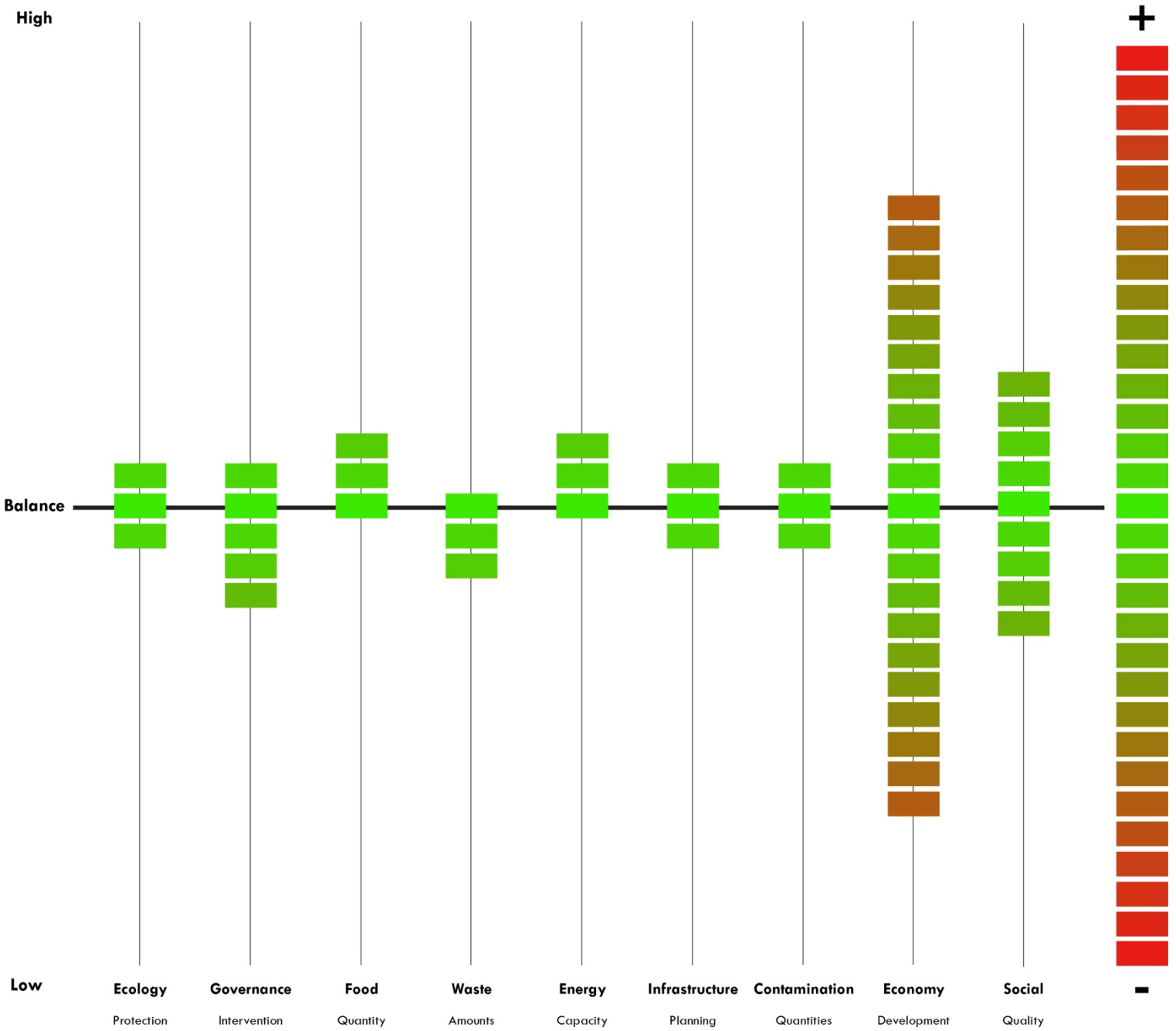
Total Area destiny to logistic parks in Hybrid City Model	**Area 1**	5.29	Ha
	Area 2	12.14	Ha
	Area 3	12.17	Ha
	Area 4	12.83	Ha
	Area 5	97.71	Ha
TOTAL		**140.15**	**Ha**



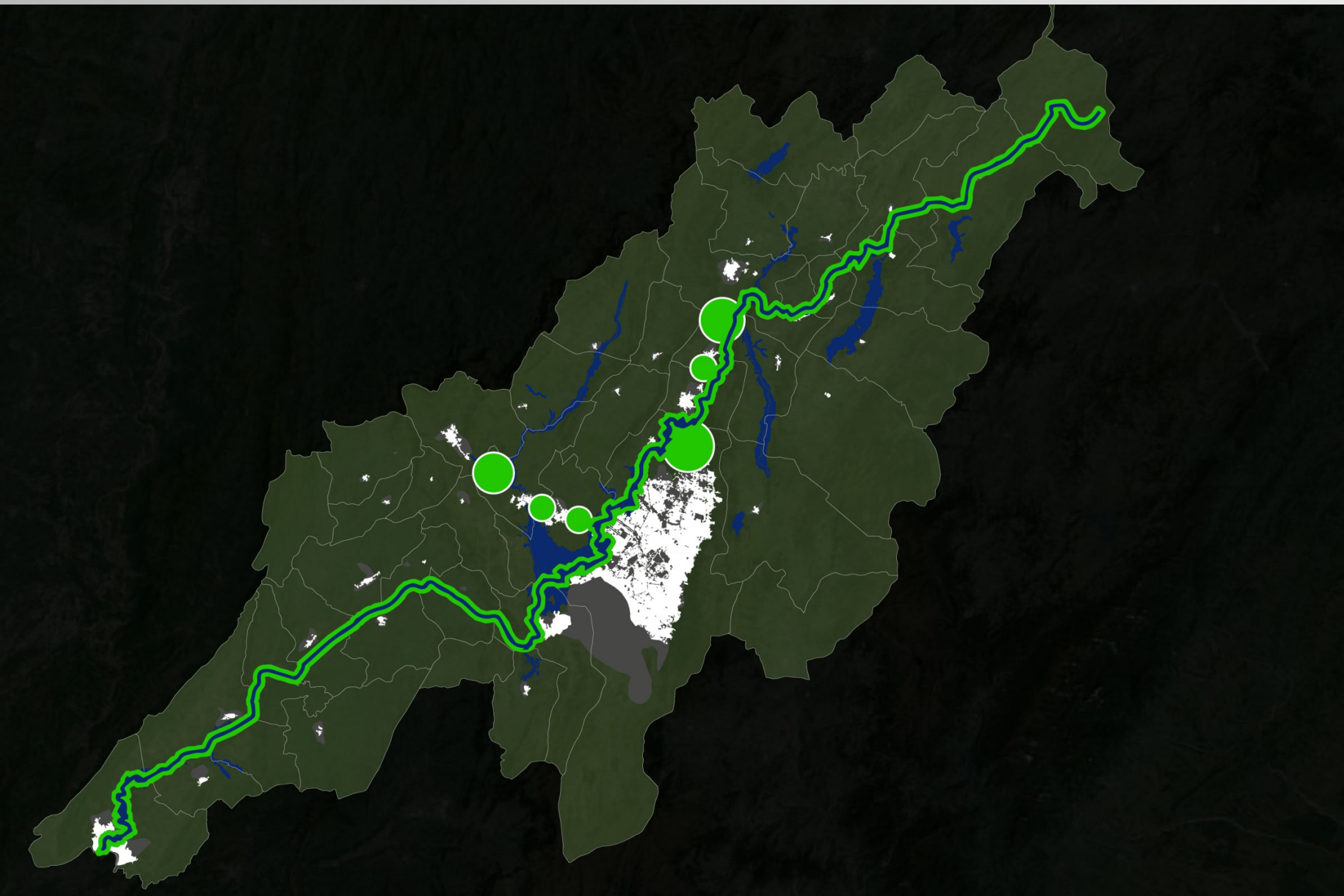
Current Profile

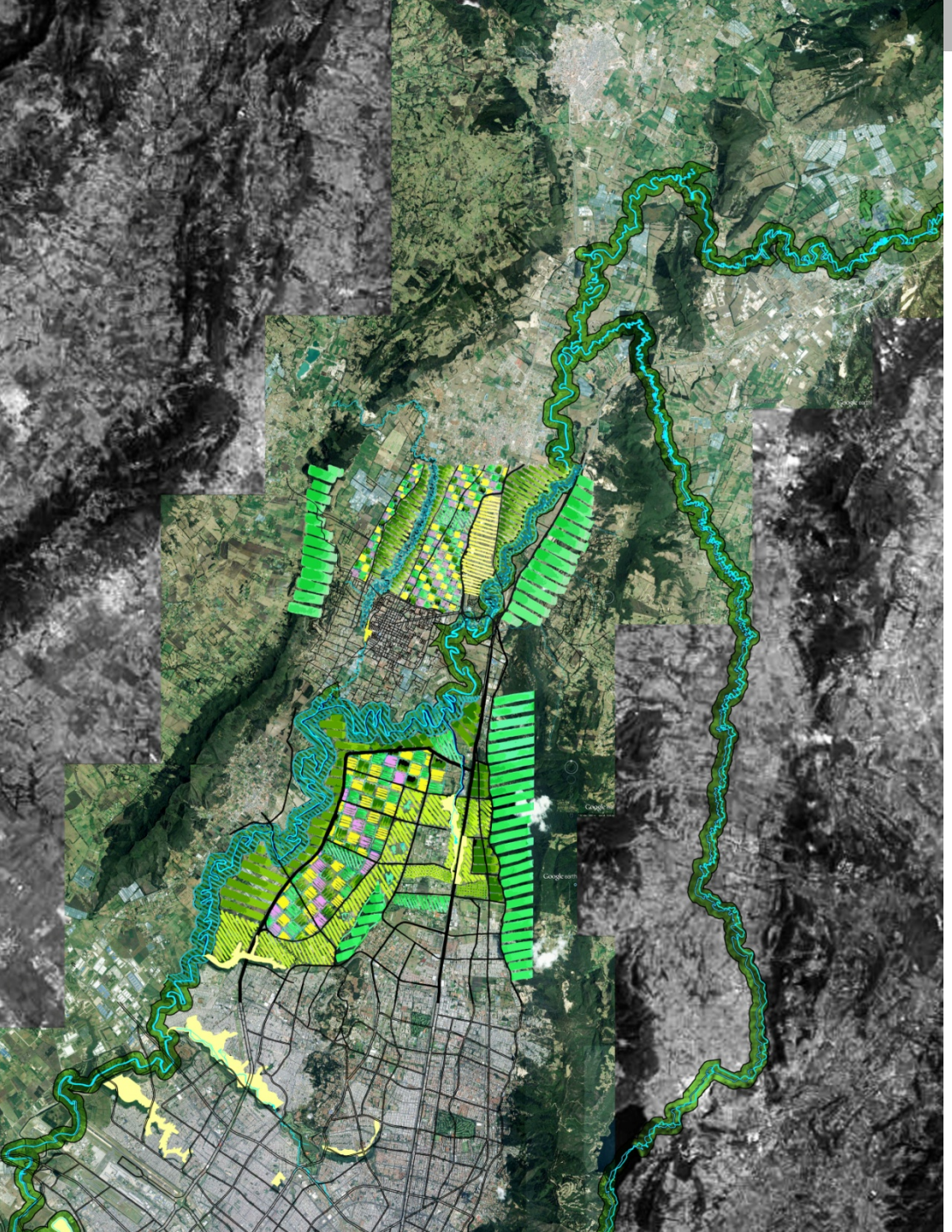


Optimum Profile



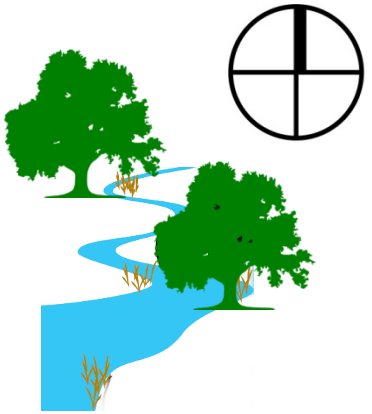
CONCLUSION





Regional Vision

GOAL



Recover the natural system structure.

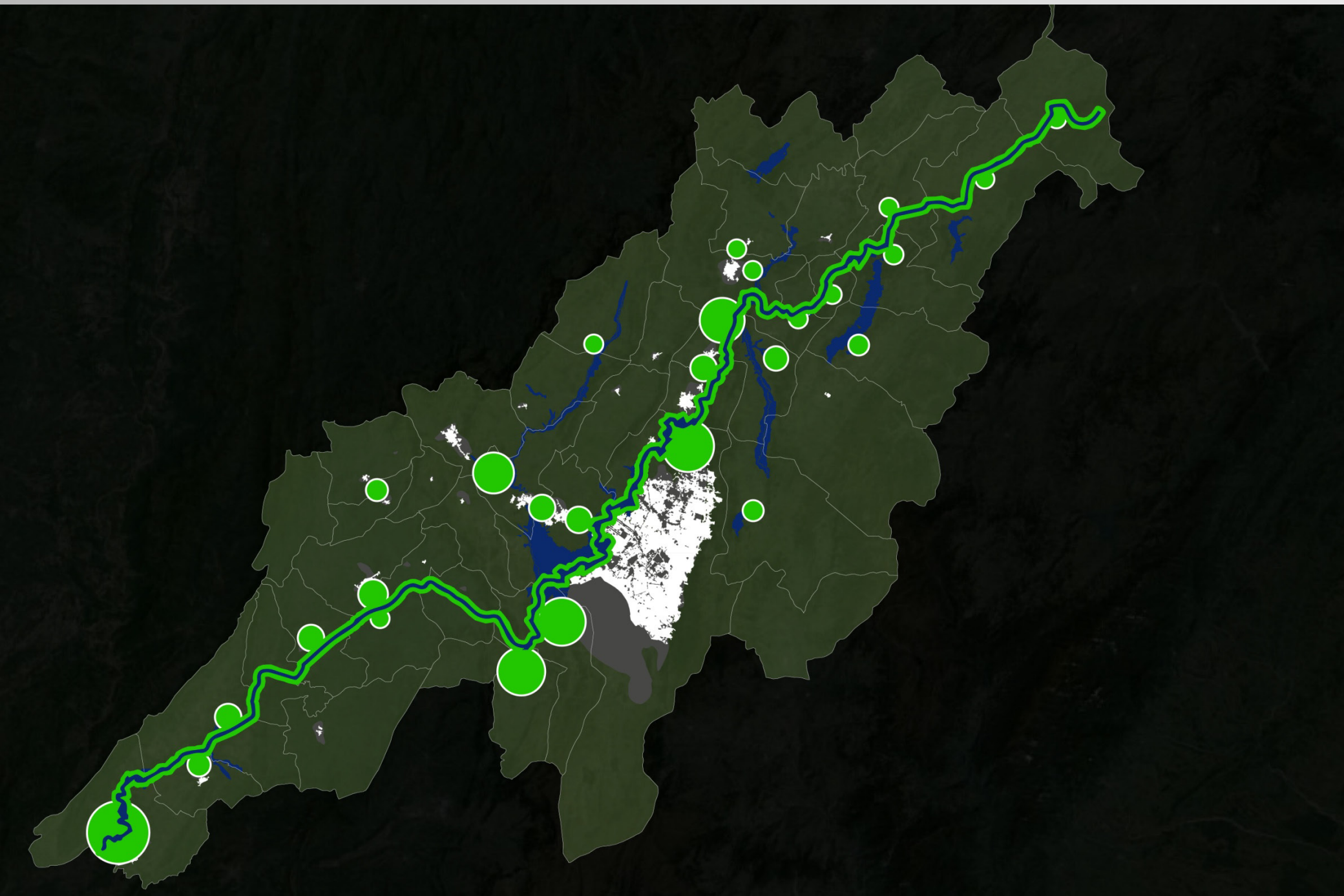
Objectives

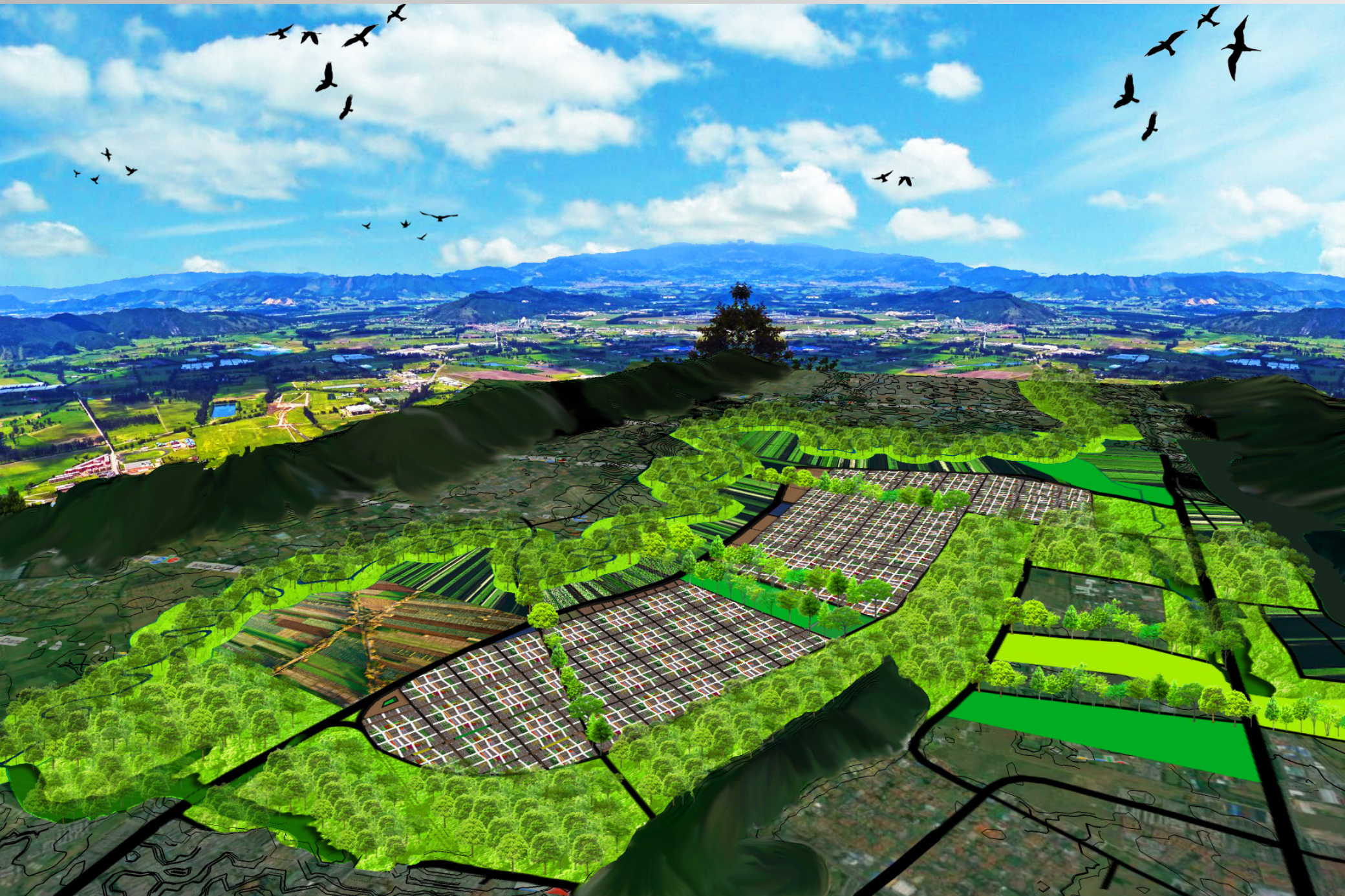
a) .

b) .

c) .

d) .





THANK YOU

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4. Characteristic ecological structure (Moorland in the Bogota River Basin). Source: Páramo de Guacheneque, n.d. photograph, <http://ridingcolombia.com/home/index.php/es/blog/1-blog/72-discover-the-paramo-an-exotic-mountain-destination-in-colombia>

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