

From a FRAGMENTED TERRITORY to a CONNECTED NETWORK

System of inter-connected functions along the Bogotá River and basin

REPORT P4

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Section 1

Context

Introduction

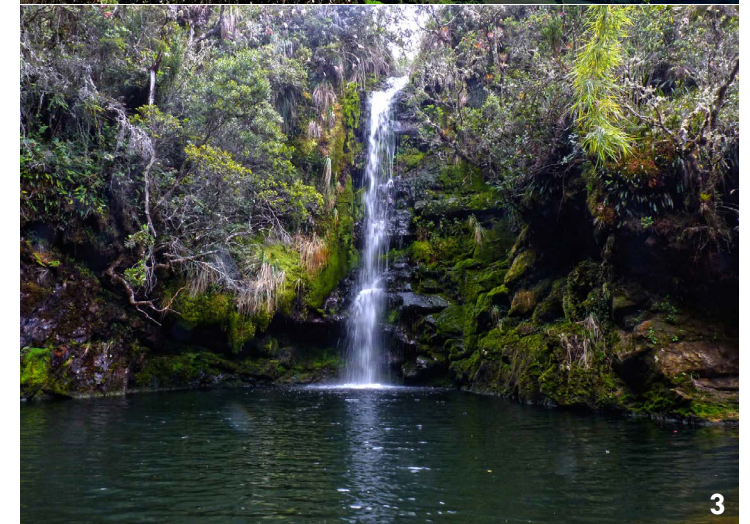
Colombia is recognized worldwide for its vast natural resources in forests, deserts, water and biodiversity. This heritage is one of its greatest strategic possessions, which has not been considered in all its dimensions as the large added value for economic, social and environmental sustainability of the country.

The Bogotá River rises about 3.300 meters above sea level in the Guacheneque Paramo ecosystem and natural reserve. It flows 380 kilometers down to a height of 208 meters above sea level in the Magdalena River. It is the main water source of the Savannah of Bogotá. The river constitutes the essential axis of the capital city - Bogotá - and the general region's water structure.

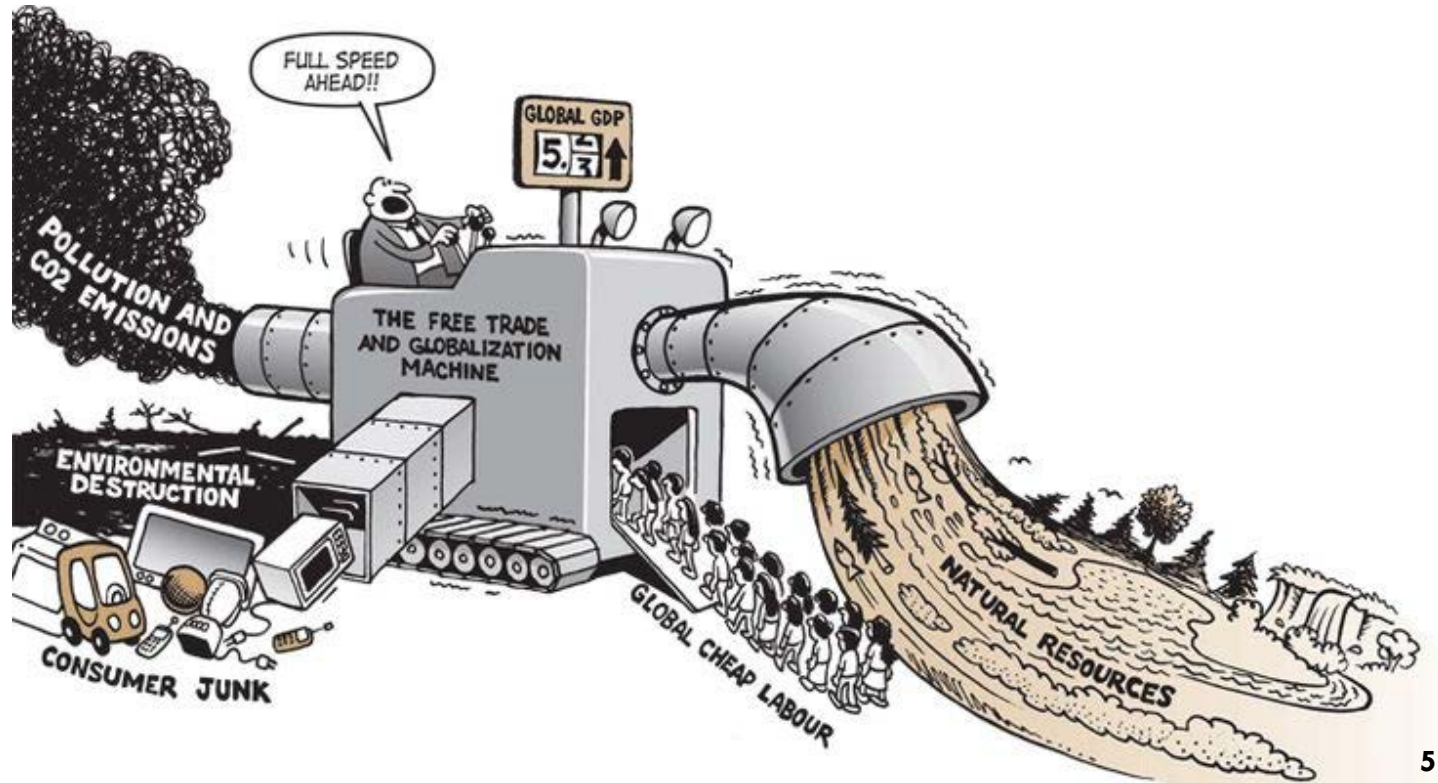
The Bogotá River Basin drains and has an area of approximately 590,000 hectares, corresponding to about 32% of the region surface. In the basin, 75% of the population lives in urban areas and only 25% lives in rural areas.

The water accommodates according to the relief of the terrain, it can drain or infiltrate, accumulate in the mountains as snow or in depressions as lakes. Over the years it has not only generated the orography but also the political divisions: rivers and lakes provide natural boundaries between regions inside the country.

The interest in the Bogotá River involves as principal elements water and soil. They have powerful properties of self-regulation and interaction among human activities. These physical factors and the interaction with human activities, have urgent priority and are of higher relevance for the population over the economic factors. For this reason, the graduation project started with the analysis of the natural system structure.



Problem



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The Bogotá River in Cundinamarca, Colombia, has had for some a forgotten and for others an unknown story through the years. In the 20th century the wood was extracted from the surrounding forests for energy input and in the 21st century the water is the protagonist for the hydroelectric power plants. The food is produced and the drinking water comes from the longest fertile and varied river basin in the region. The natural structure became relevant in the past centuries due to the constant use of the resources that are provided for human activities and urban development. However, it was only a matter of time for us to realize, that the allegedly renewable resources were any longer renewable. Moreover, the consequences arisen over the water and the soil bring dramatic impacts for the population and the environment.

The picture above illustrates the irony in which human activities need more raw materials and consume the natural resources to produce additional outcomes that should supply the demands over the population growth. It exemplifies in one image the enormous problem that Colombia is struggling with, not only in the Bogotá River basin but in many other river basins throughout the country.

How is it happening? The crisis incurred by the deterioration of the natural system structure occurs together

with three significant and arising issues: contamination, sewages and waste amounts. These three matters bring vast concern in the future and durable life and stability of the natural resources.

The contamination is generated by several productive activities that bring economic inputs to the region. The sewers come primarily from housing and industrial areas. Finally the waste amounts are a gigantic situation that is threatening the health and the ecological presence in the river basin.

It is a fact, that the most productive areas in the country host the highest amount of population, providing (these fertile areas) with ecological services. Although the current situation shows, they have substantial environmental threats. Therefore, it is why is essential to create sustainable environments.

I want to tackle in this project, and I will present in detail, the necessity of an improved model of governance that can accomplish the requirements for future developments while in balance and in a sustainable way with the environment contained in the area. For this reason, the main goal of this project is to generate a sustainable (liveable and renewable) system between water + soil + human activities along the Bogotá River and basin.

How? It is divided in ...



Contamination



6

Sewage



7

Waste amounts

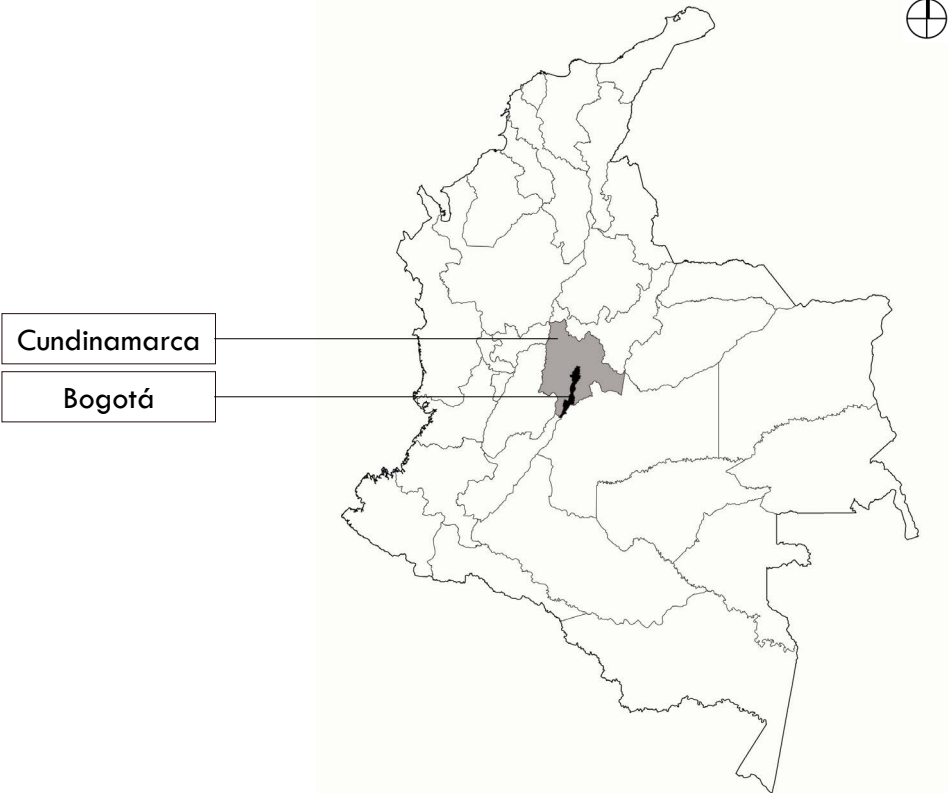


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The excessive and unquantifiable use of the resources have produced three principal issues shown above: contamination, sewers and waste amounts. In this research, the Bogotá River and basin will be the prin-

cipal area analyzed in the project. It is located in Colombia, in the department of Cundinamarca, where the capital city Bogotá is located too.

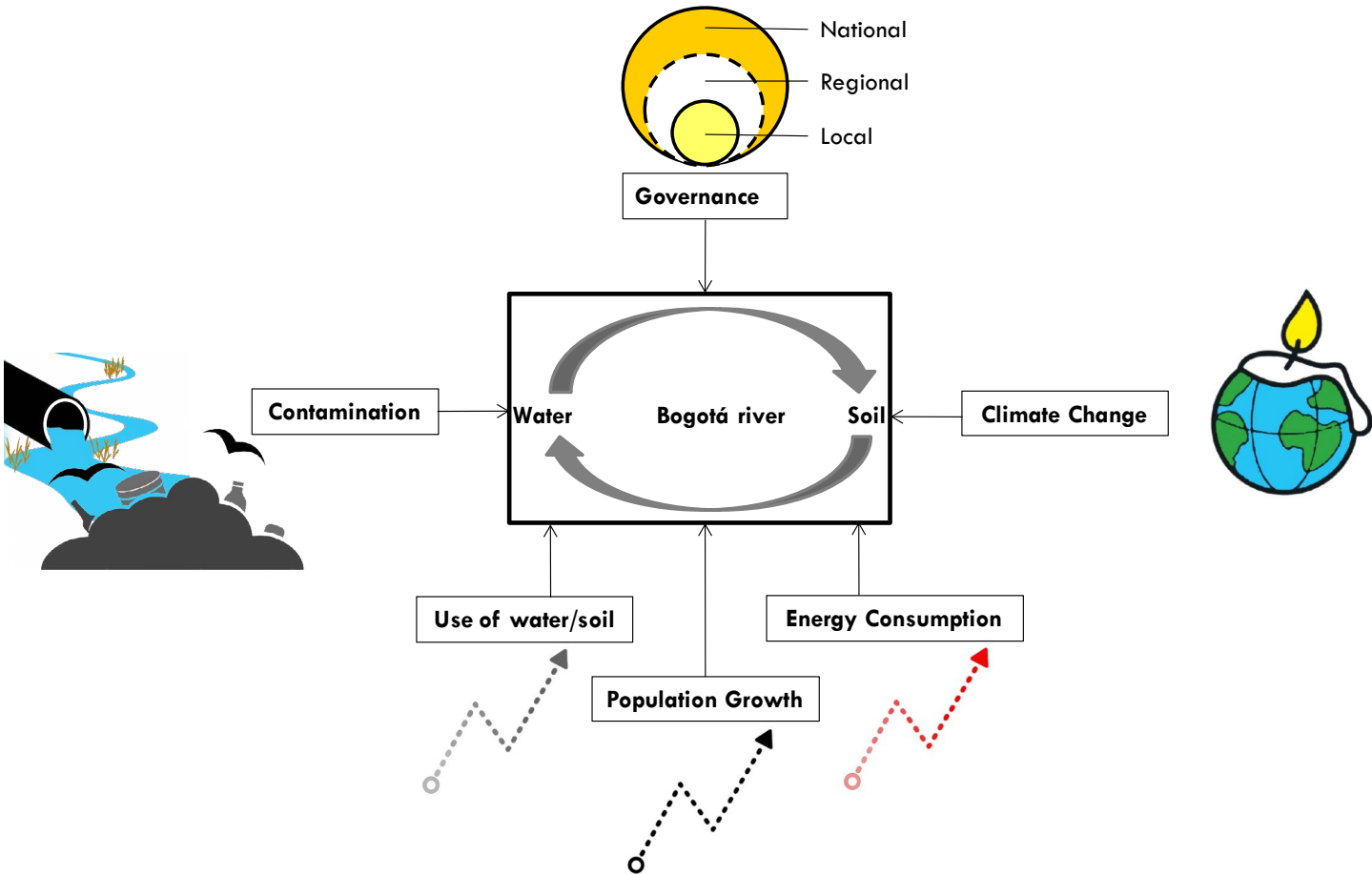
Where?



Why the Bogotá River basin is been pushed to an environmental threat? The answer is provided through six different factors that influence in the deterioration of the river basin. The problem produced by the behaviour of the population include use of the water/soil,

energy consumption, contamination and the model of governance (internal factors). On the other hand, climate change (external factor) weakens the already exploited ecosystem.

Why?



Problem Statement

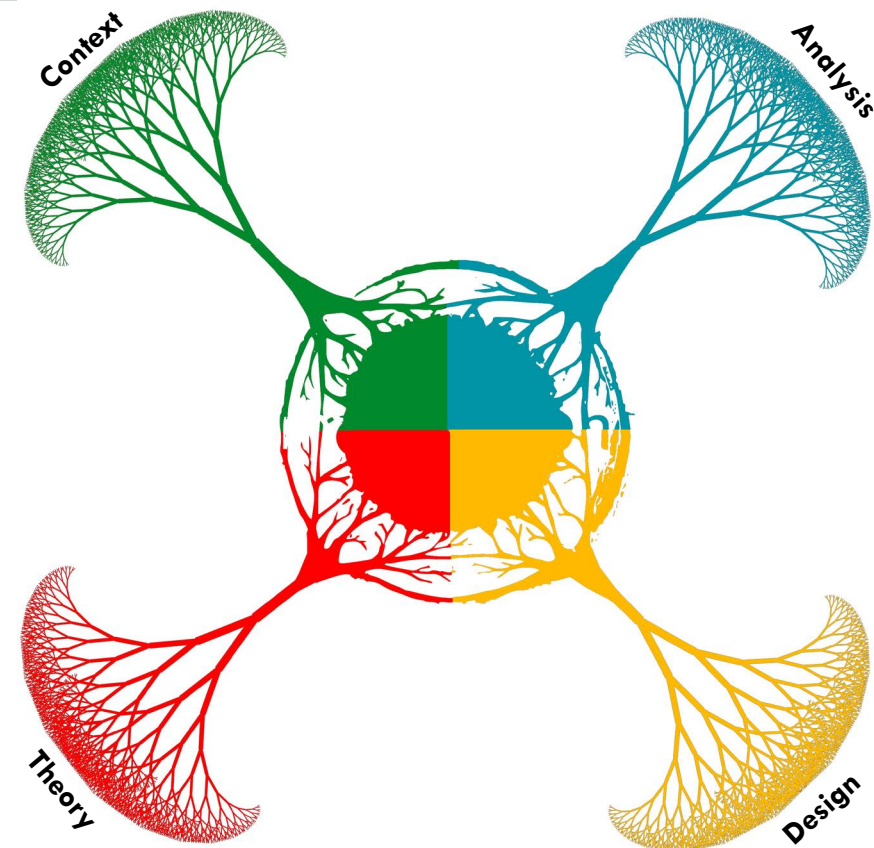
The difficulties mentioned before bring the following conclusion:

The Bogotá river has an extension of about 380 km; its basin surface has around 6.000 km² 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 factors that threaten the environmental system** of the river and its basin: contamination, urban development and rural activities such as agriculture and cattle.

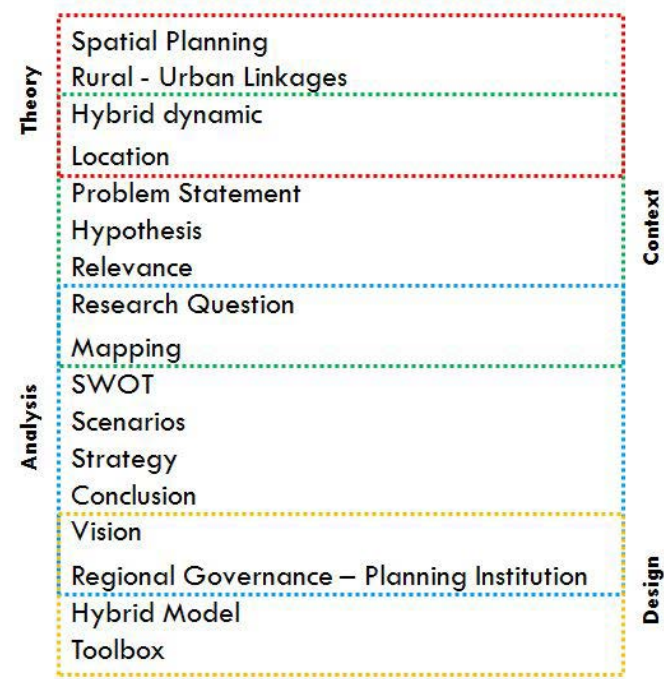
The **absence of a regional law**, the **constant lose of ecological biodiversity** given to the consequences over the water and the soil, and finally the **permanent pollution** received through discharges of tanneries, sewages and industry have provoked environmental **degradation** over the river and the basin.

Methodology



The **methodology** of the project is divided in four branches: theory, context, analysis and design. These branches are going to work together along each other to develop a balanced proposal, which not only involves the Colombian context but also it takes into

account the applied concepts and theories in other referents analyzed before which could be relevant for the intervention. The four branches are identified with different colors to highlight every theme included in each one. They are explained below:



The overlapping of these four branches consequently, makes it possible to go from one theme to another taking into account its connections and backgrounds with one another. The result in the end will create the fusion of the four bases established into an innovative model of governance (planning institution) applied through

the hybrid model dynamic. This is going to upgrade some economic activities in the region in balance with the natural system structure for a sustainable system between water, soil and human activities.

Theory

The theory involves applied strategy concepts as:

Regional Planning

(MacLean Lewsi, Wiley, and sons, 1949: 116).

Spatial Strategies

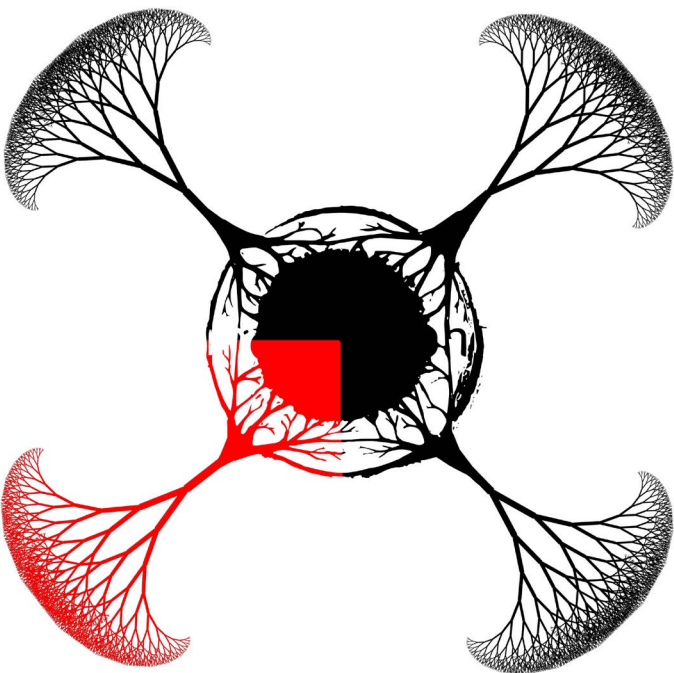
(Albrechts, et al., 2003: 128).

Rural - Urban Linkages

(Habitat III, et al., 2015: 1).

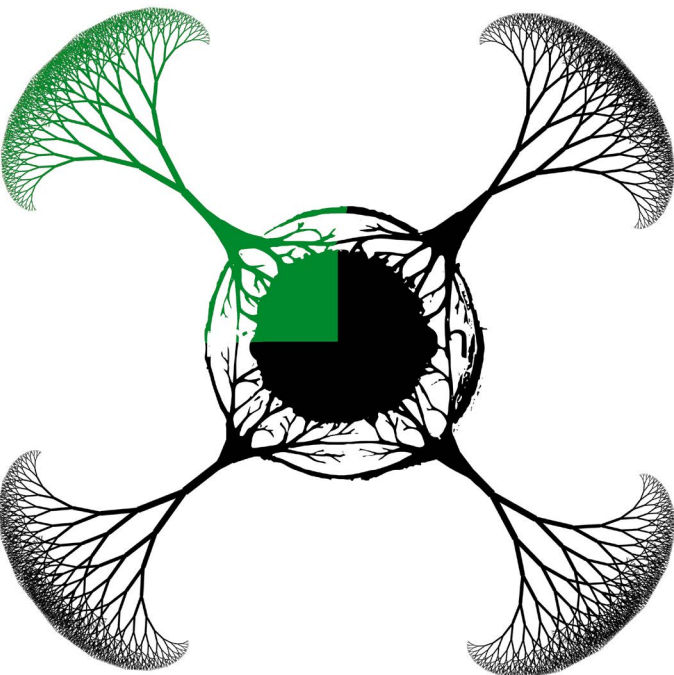
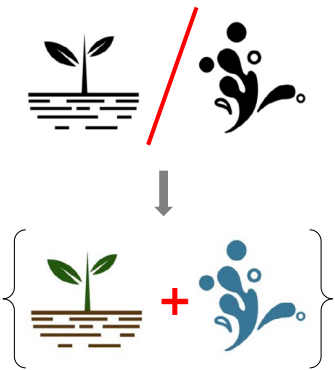
Hybrid Dynamic

(Funnell, 1988: 270).



Context

The **context** will not only involve knowledge about the location but also about the ecosystem. This is going to reinforce and highlight the importance of the elements such as water and soil and the future use of these resources.



Analysis

The **analysis** involves different methods such as SWOT, Scenarios, Vision and Strategy through mapping. Includes the goal in the environmental field and the objectives over human activities to achieve in the further development of the project.

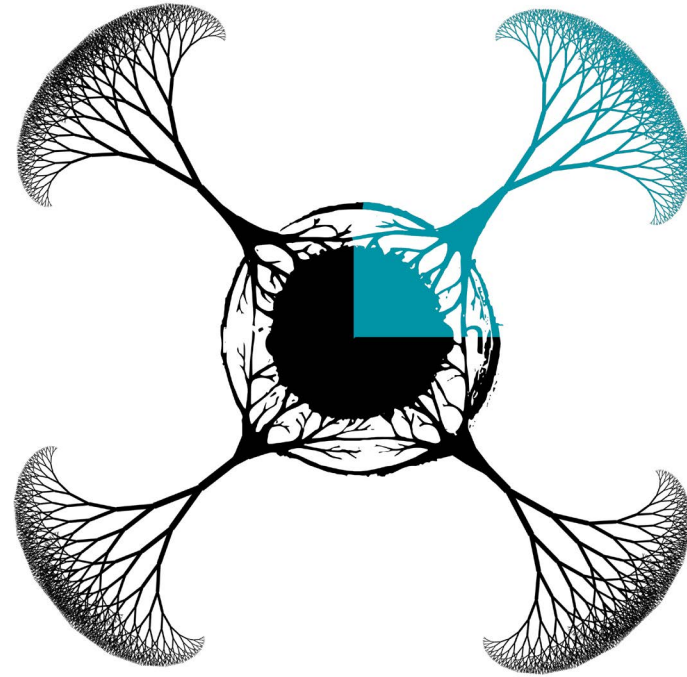
GOAL

Recover the natural system structure.



Objectives

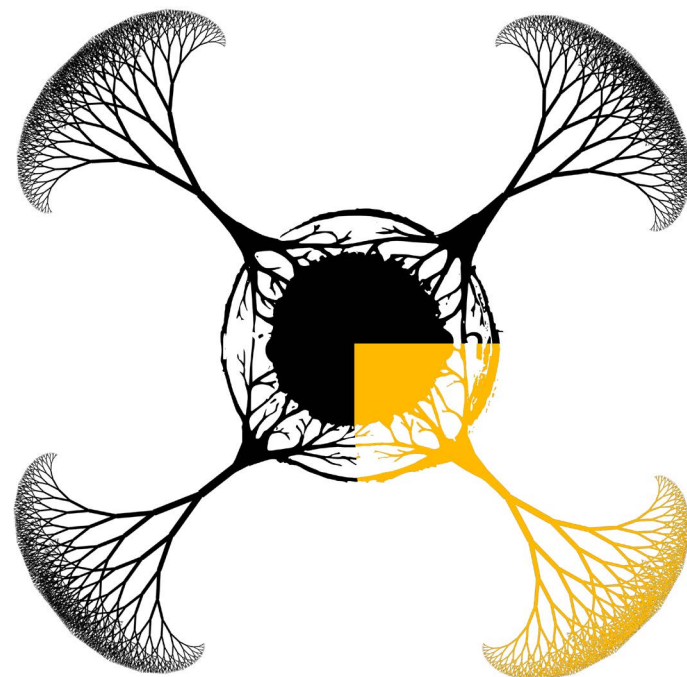
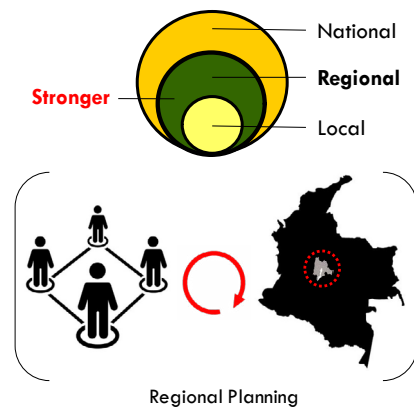
- a)
- b)
- c)
- d)



Design

Finally, the **design** is going to be concluded in a spatial regional strategy applied in a proposed model of governance. That way planning in this region will become stronger and more sustainable.

The development of a new model of governance (planning institution) and the implementation of **urban - rural linkages (hybrid dynamic)** strategies along the river basin for the improvement and protection of the ecosystem. A innovative way of governance that is going to attract a variety of stakeholders that would want to get involved.





Section 2

Research

Theoretical Framework

The theoretical framework involves concepts such as: Regional Planning, Spatial Strategies and Rural - Urban Linkages, highlighted in the previous section. Also the research made by Professor Thomas Elmqvist from the Stockholm Resilience Centre, addressed the conflicting role between ecosystems, human activity and the role of governance.

In his work Cities and Biodiversity Outlook, he talks about the world's first assessment of biodiversity in cities and highlights the importance of biodiversity contained in cities. He illustrates how innovation in the transition to sustainable processes is fundamental and essential in environments life expectation (Elmqvist, 2013: 635). All of them were taking into account in the spatial strategy in the Bogotá River Basin. Some of the most relevant references are:

Regional Planning

- The regional planning scale allows to focus in the ecosystem structure, taking care of the conservation of natural resources, flood control, and broad economic and governmental problems (MacLean Lewsi, Wiley, and sons, 1949: 116).

Spatial Strategies

- The shift in governance cultures is a long-term process. The implementation of the new planning institution, can achieve a transition to creative and flexible spatial strategies. The ambition is realising an open, innovative, and collaborative governance practice,

which will translate into a sustainable environment and an improved quality of life (Albrechts, et al., 2003: 128).

Rural - Urban Linkages

- This refers to complementary and cooperative functions in flows of people, natural resources, capital, goods, employment, ecosystem services, information and technology between rural and urban areas (Habitat III, et al., 2015: 1).

- Nolan and White (1984) suggest that the urban-rural relations should be structured to reflect one principle: "Urban-rural relationships should change from being exploitative to mutually beneficial" (Funnell, 1988: 270).

All of these concepts studied were an important element to conclude that the region needed an improved model of governance. It also leads for spatial creative and innovative programs, that can increase the stability and unity in the region.

In this case, the Bogotá River basin, the implementation of a sustainable model of development and governance, brings with it the opportunity for innovation, authority influence and support. As Thomas Elmqvist stated, the innovation lays not so much in developing new infrastructural technologies but to work with what we already have. The results are often far cheaper and more sustainable as well (Elmqvist. 2012).

Section 3

Analysis

Hypothesis

The interest in the river which involves as principal elements water and soil with the human activities and their interactions caught my attention given that, in my personal opinion, the physical factors in this specific case have urgent priority and are of higher relevance for the population over the economic factors. They have more influence on the daily life needs rather than the economic structure.

There are two ways for human activities to interact inside the natural system structure: the actual situation is the one represented in the model of the right (above), the irresponsible, selfish and short sighted approach; whilst the ideal model (right middle) the responsible, cooperative and foresighted.

For this reason, the research started with the analysis of the natural system structure where the hydrological cycle takes place and is relevant for the analysis and research. Although the interactions in the natural system are not rigid, in the sense that when it comes to the hydrological cycle the interactions create different associations and incorporate a variety of exchange processes. It is shown how it actually occurs in the scheme (right below):

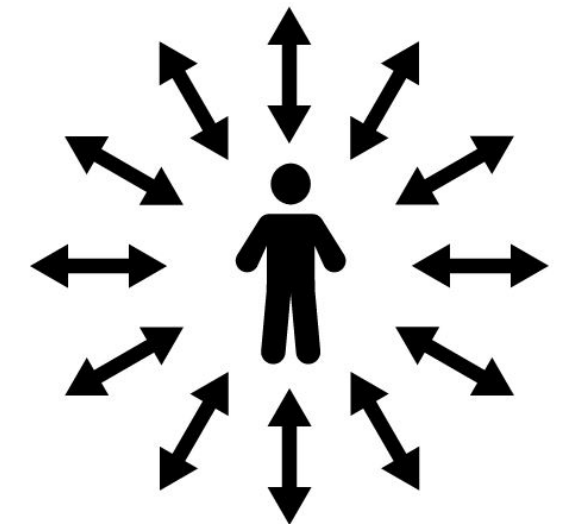
By means of the illustrations given before, the natural system has the following system structure with the principal two elements mention along the project water and soil. There is a constant interaction between water and soil as depicted above. However a conflict exists when human activities become part of the system. Where they use natural resources without renovation, reuse them. This interacting cycle is not helping because is not a sustainable system structure.

This is how the model has been working generating different kinds of problematic issues. Principally it has been influenced by human developments which include contamination, governance, food demands and energy generation. Then the hypothesis and ideal model for the future condition (goal system) of the river is shown in the image above.

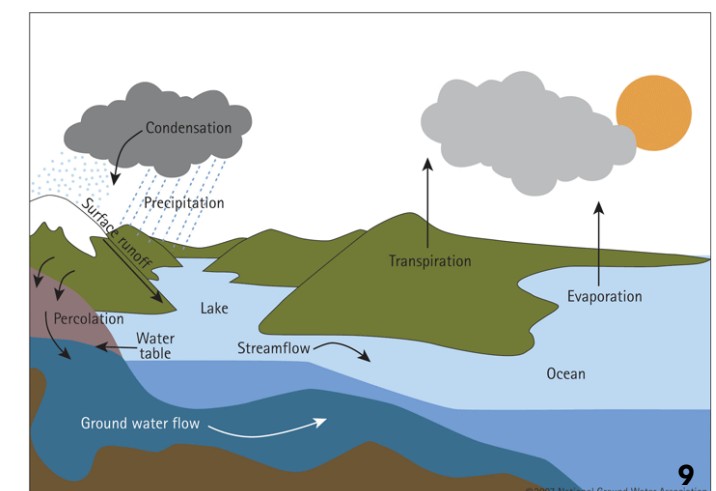
This is the system in which it should work and is useful for the present and future conditions. It is a model in which water, soil and human activities interact with each other but also **work together in a sustainable way**: social, economic and environmental sustainability. It would be a self regenerating system that fulfils needs of the population in the region.

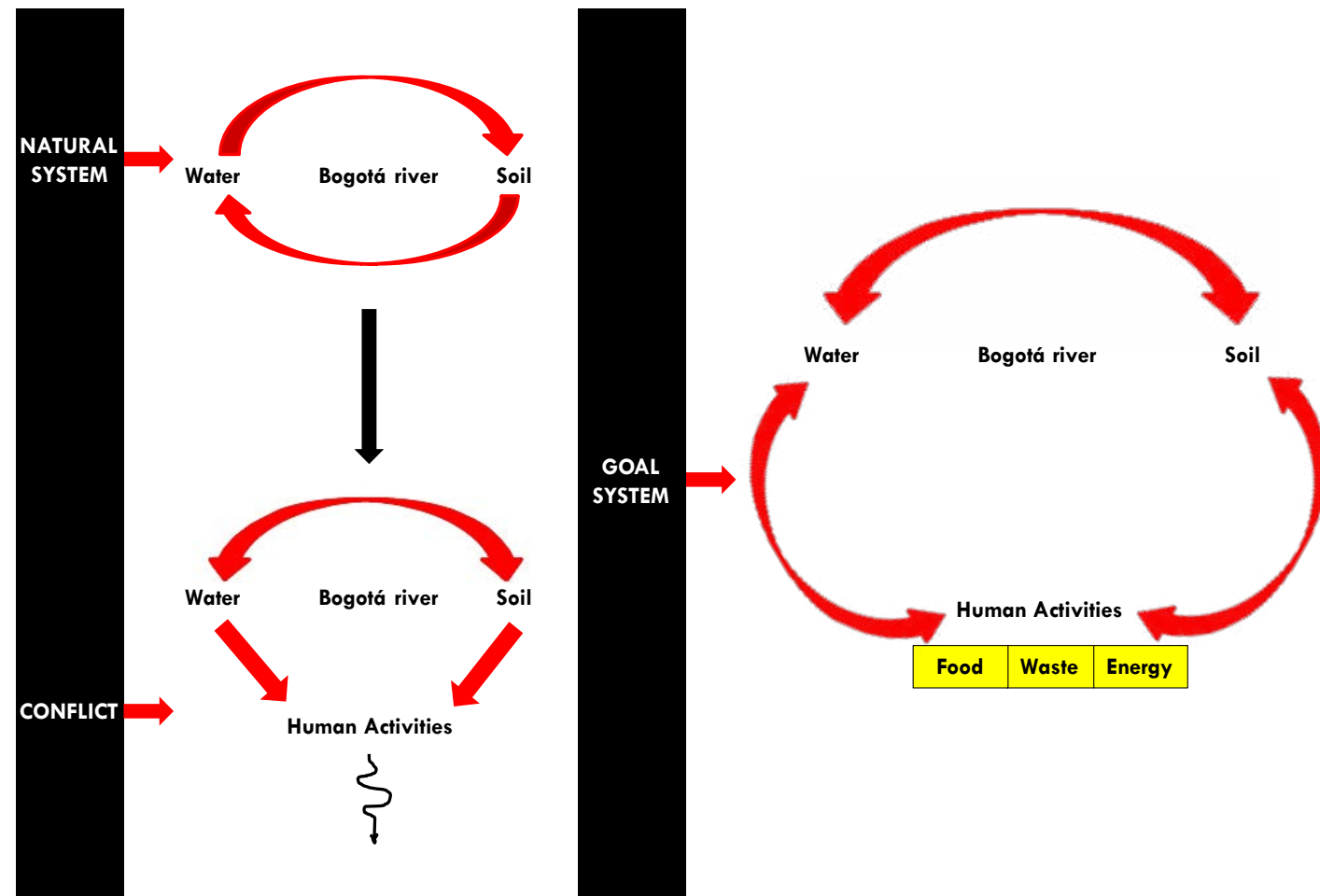


Irresponsible Consumption



Responsible Consumption
Sustainable system





Problem Field

The context of the territory in which the study area is located is shown below. The Colombian territory covers **1.7%** of the global surface, which hosts **14%** of the global biological heritage. It also has more than three hundred ecosystems in its characteristic geography.

On the other hand, the water structure of the country is large and bio-diverse, which is one of the most important qualities. It shelters the variety of ecosystems around the territory.

It is important to understand the natural structure of the country because few have been able to coexist with it in a sustainable manner.

The images aside show the water and soil landscape structures in the country. The department Cundinamarca is located in the most populated and economically productive region in the country called Andina region; it has **116 municipalities**.

The Bogotá River provides considerable input to the productivity and economy of the region and the country. In the west border of Cundinamarca, the Magdalena River becomes part of the Andina Region sharing the ecosystems involved in it.

In this context, the Magdalena River is relevant given that the Bogotá River in the end of its riverbed flows into and contaminates it.





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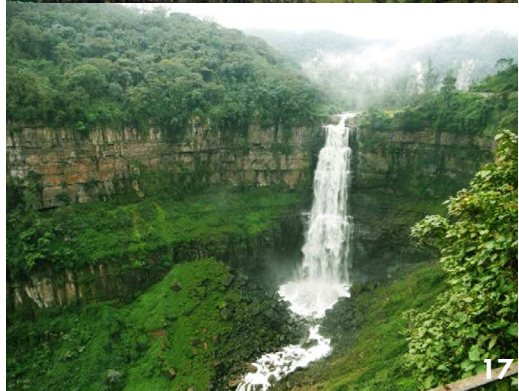
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16



17

Caño Cristales River

Amazon River

Magdalena River

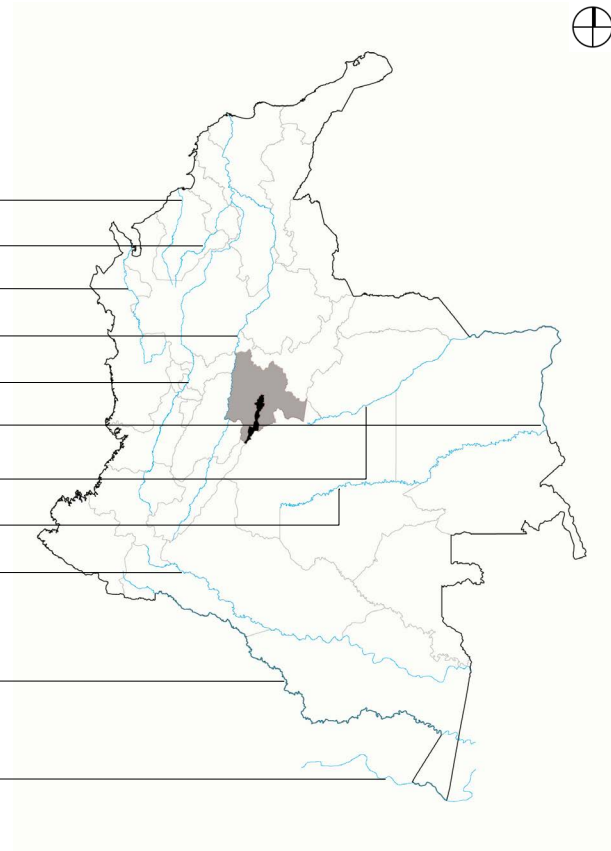
River born

River basin

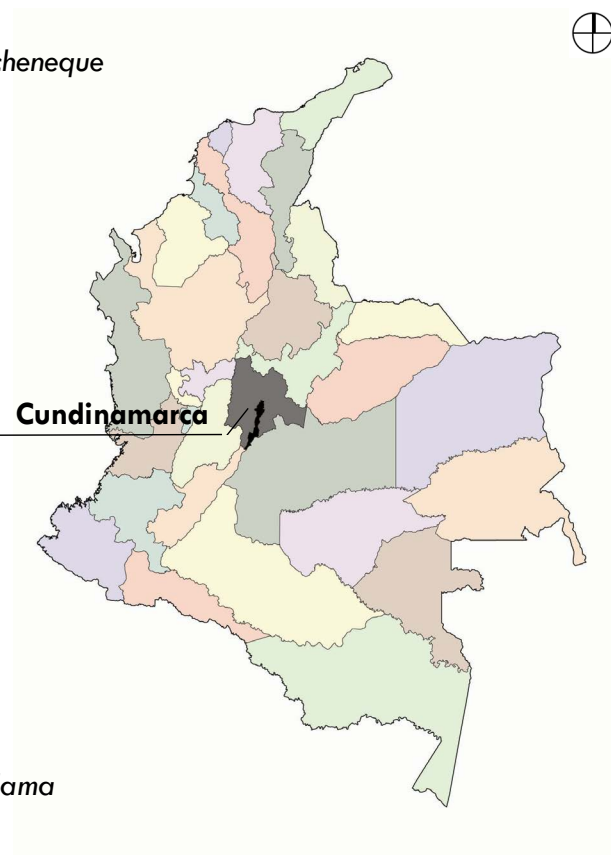
Change of topography

- Sinú River
- San Jorge River
- Atrato River
- Magdalena River
- Cauca River
- Orinoco River
- Meta River
- Guaviare River
- Caquetá River

- Putumayo River
- Amazonas River



Páramo de Guacheneque



Landscape

Crops

Salto del Tequendama

Cundinamarca

The map in the right shows the River Basins Administrative Division:

Given by administrative boundaries of the different municipalities in the department and also topographic and geographic features.

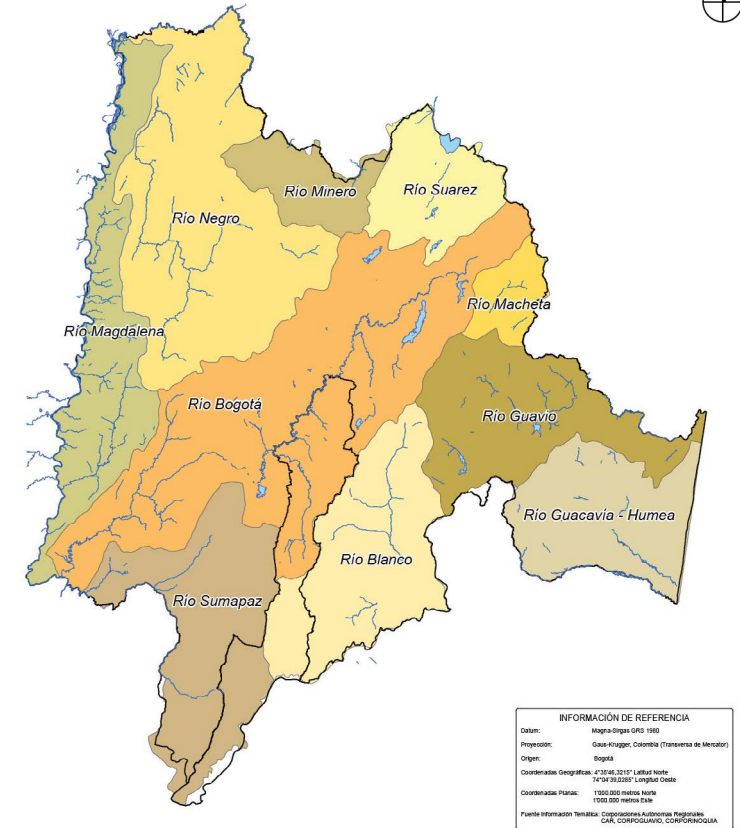
The Bogotá River basin is the orange area. It has **46 municipalities** which correspond to **1/3 of the department**.

The Basin has an area approximately of around 590,000 Ha. Which is **33% of territory**.

- | | |
|----------------------|---------------|
| Río Blanco | Río Magdalena |
| Río Bogotá | Río Minero |
| Río Guacavía - Humea | Río Negro |
| Río Guavio | Río Suárez |
| Río Machetá | Río Sumapaz |

Some of the principal qualities of the region are shown in the next pictures. Flower fields, live-stock and agriculture are the activities with the main incomes in the GDP.

All these values together shape the prosperous and abundant river basin that the country has. The rich natural resources that are present show

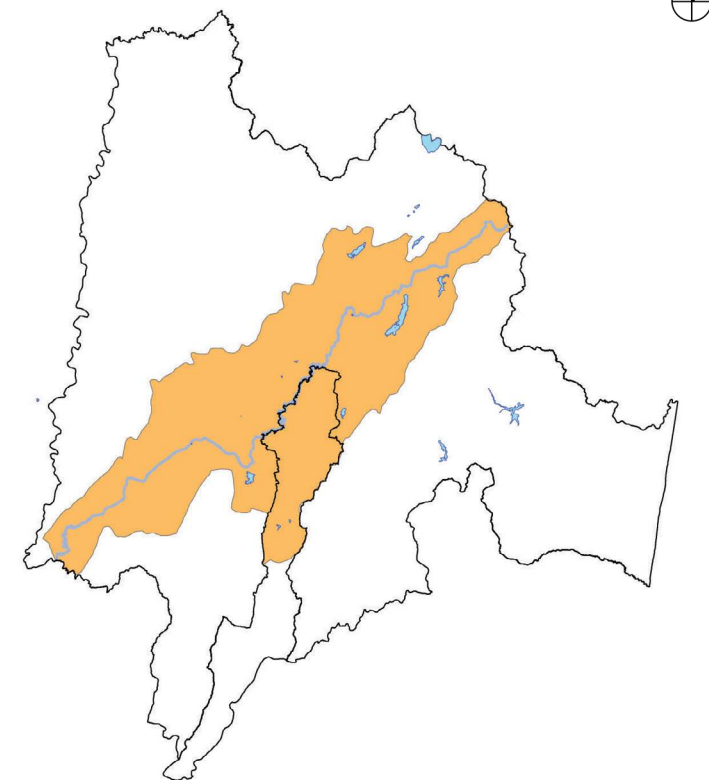
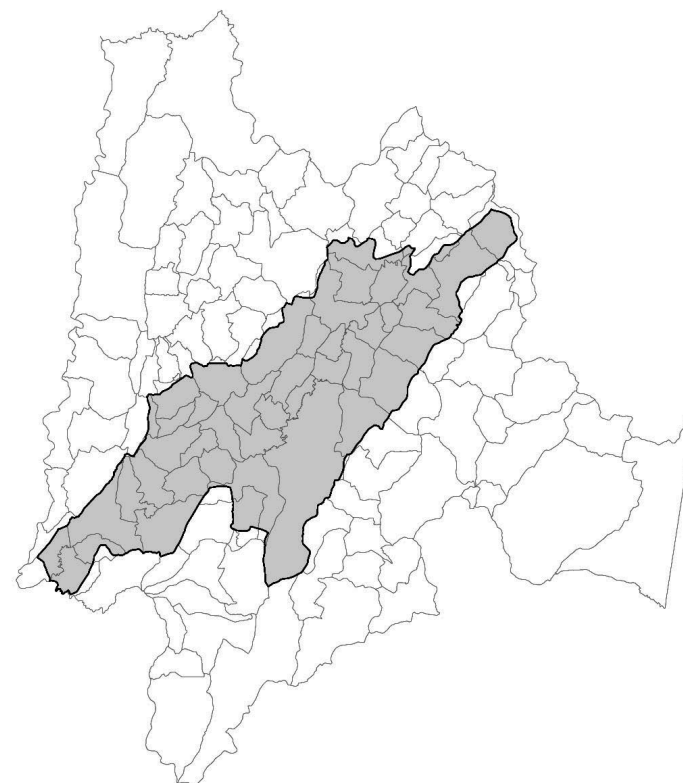


18

the majestic landscape of the surroundings.

The largest areas in the river basin are covered with nature; on top of that the agriculture, cattle and flower fields also benefit from the river basin.

In terms of numbers, the structure of the population has the following dimension:





Flower fields

19



Livestock

20



Natural Resources

21



Agriculture

22



23

Population Department: **10.600.000 people** approx.

Bogotá: **7.800.000 people** approx.

115 municipalities: **2.800.000 people** approx.

Then, in the river basin the proportions are the following:

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.

In the majority of the cases, the most populated and developed urban areas settled closer to the water structure are the ones that contaminate the river the most. In other words, the amount of people mentioned before that live in the river basin are not the only ones that contaminate the area, also the ones in the surroundings. The river receives waste from about 9,410,000 inhabitants. This includes Bogotá (capital city) and the surrounding municipalities of the Bogotá River basin.

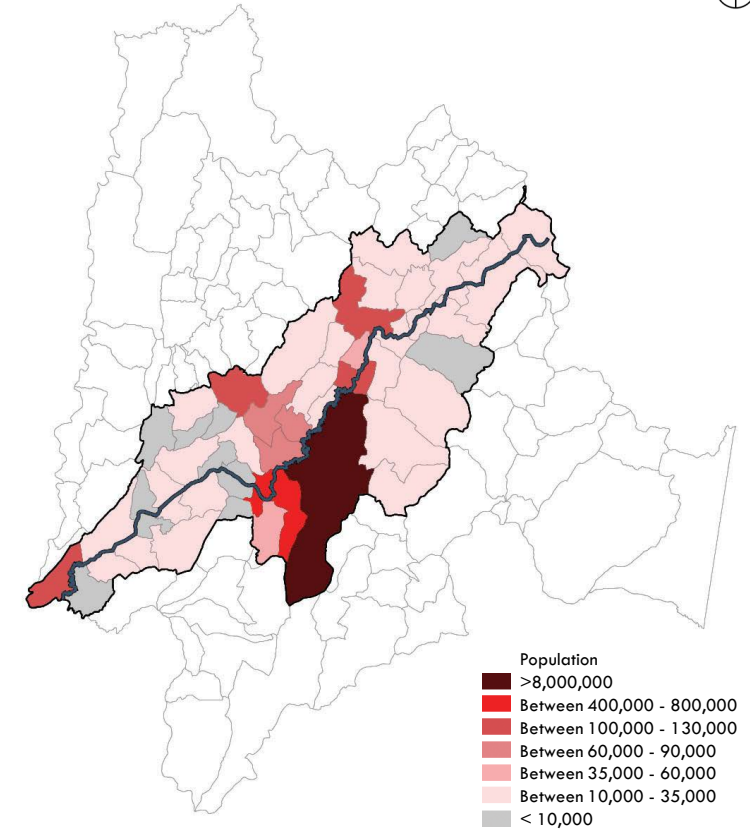
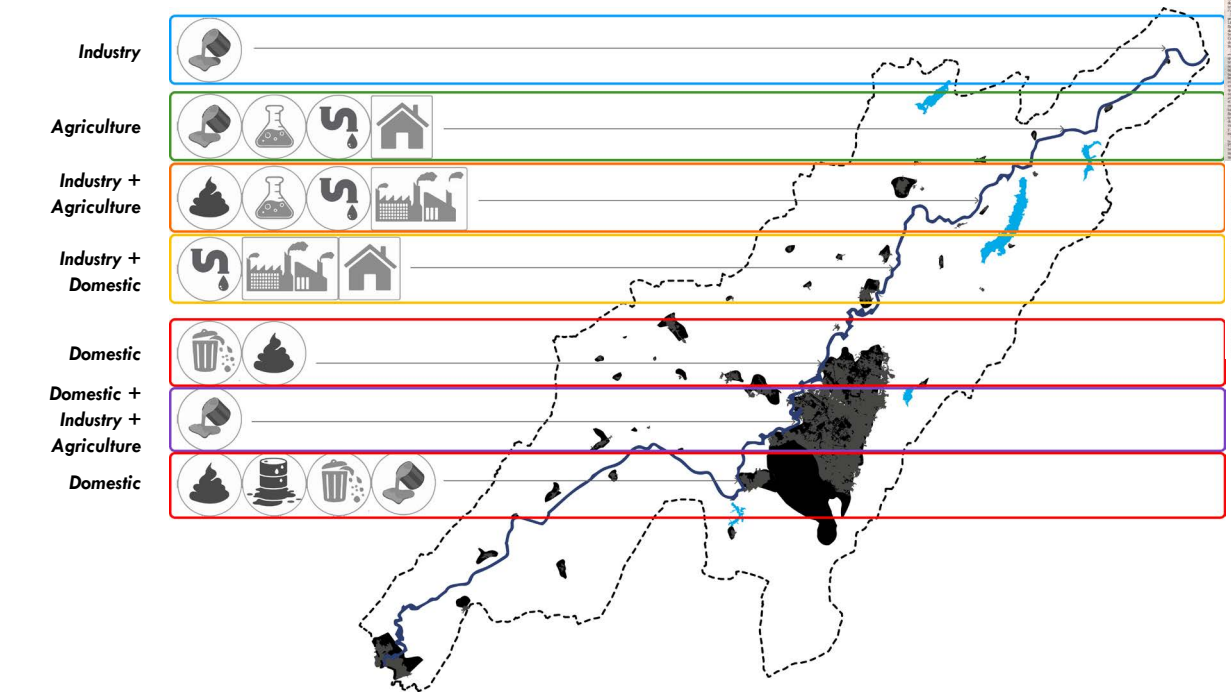
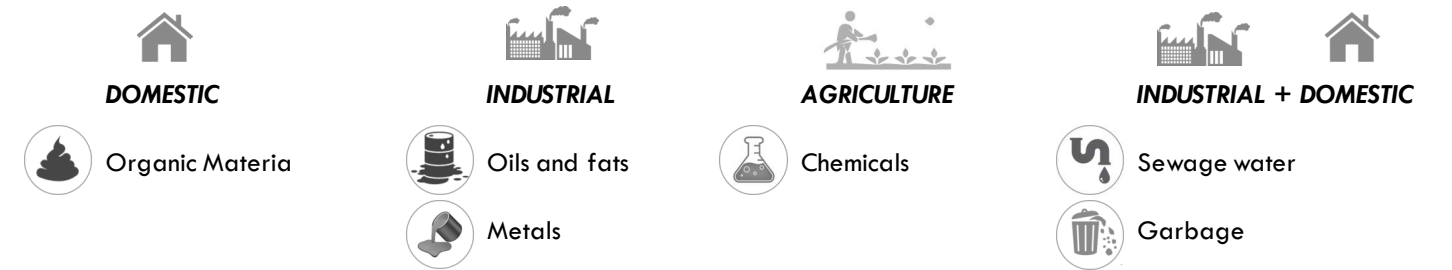
In the map with the total population shows, the larger amount of people that live in the river basin are located in the middle part of the Bogotá River. It includes municipalities such as Zipaquirá, Chía, Cajicá, Soacha, Girardot, Madrid, Mosquera, Funza and the capital city Bogotá.

For a more illustrative example of the problem studied in the river basin area, the next maps show the interpretation on the data table studies from the Bogotá watershed, made by the public entity CAR (Regional Autonomous Corporation) about the contamination in the water structure overlapped with the urban growth of the municipalities along the basin territory.

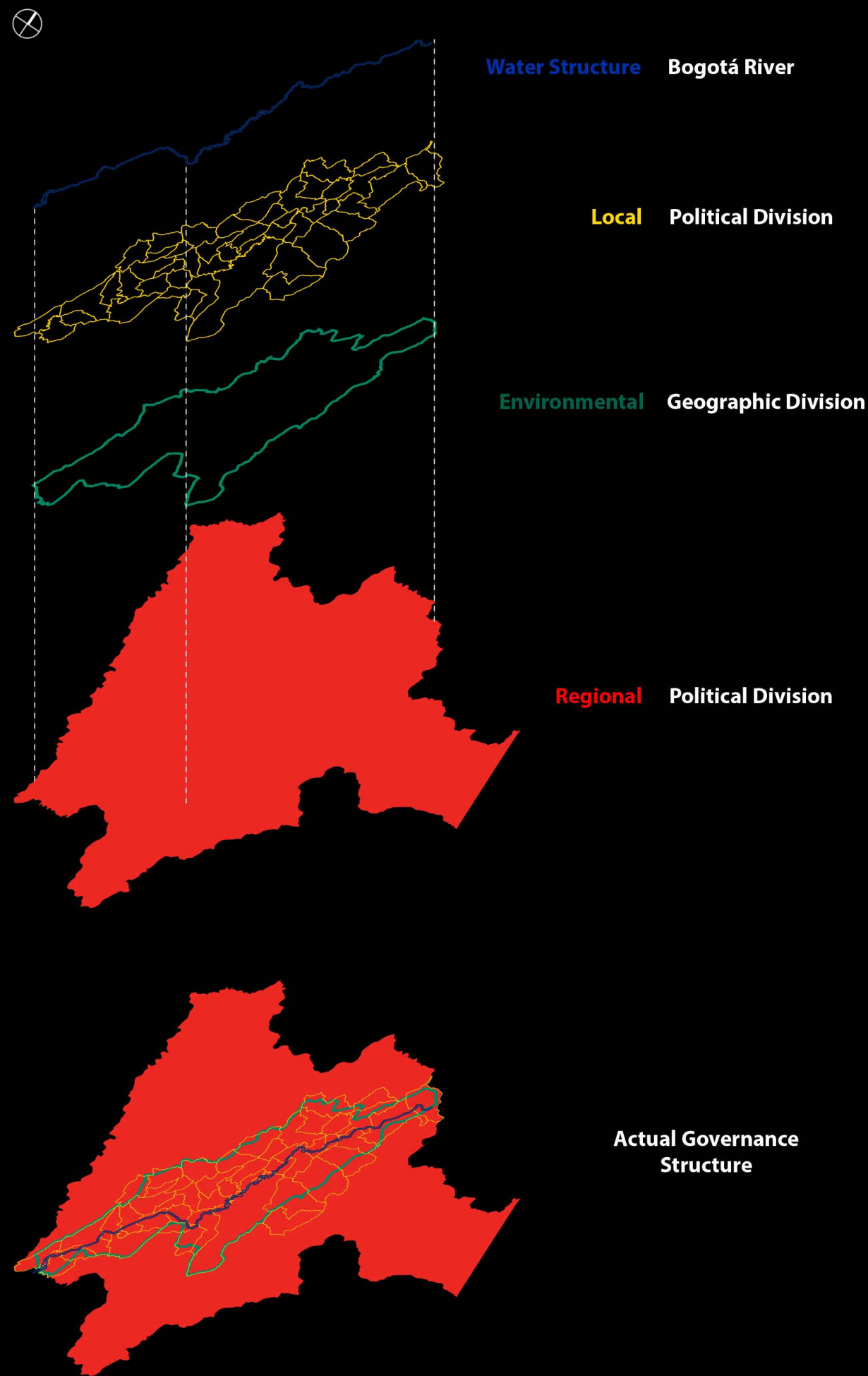
It compares the urban development, understood as human activity, with the quality and the water status. This concludes that: by one hand, the river presents high amounts of contamination along the whole natural structure; and by the other hand, the urban development's keep growing near the water structure.

The contamination is given by four principal sources: domestic, industrial, agriculture and the mixture between industrial and domestic. All of them have threaten the purity and usefulness of the water structure. All of them are located near the territory that surrounds the river. It is really important to highlight the organization of this issue because it is going to be explained further in one of the strategies that involve waste management.

As a conclusion, there are seven areas delimited with different kinds of contamination. The most harmful areas are the ones near the capital city that are defined as domestic, domestic + industry + agriculture and domestic. With huge amounts of garbage, metals, oils and organic materials.



Governance Structure



The map in the left and the organization chart in the right, have the government structure of the department of Cundinamarca, alined and overlapped. The water structure is the Bogotá River, the local and regional governance is represented by the political division (governor + mayors). Finally, the environmental structure is the geographic division defined by the Autonomous Regional Corporation that is the first regional environmental authority.

The map in the bottom illustrates the result in the overlap of all these layers. Conclusion: even though the Bogotá River is inside a regional delimitation, the environmental or political division don't plan and protect in an integrated way the territory as it should be done.

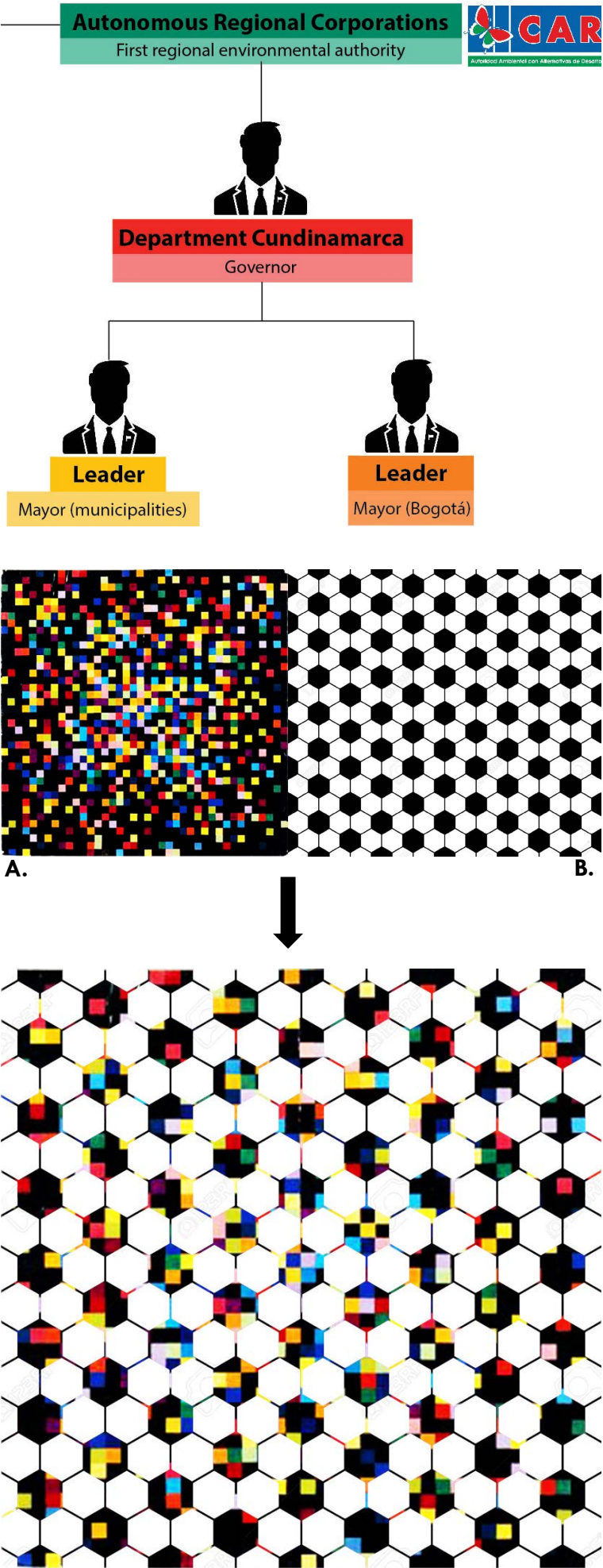
The schemes in the right, represent the conceptual vision of what is happening and what could be done.

A. Current planning = Sprawl

B. Ideal planning = System



In the next section, it will be explained how to structure this ideal scheme into a realistic one.



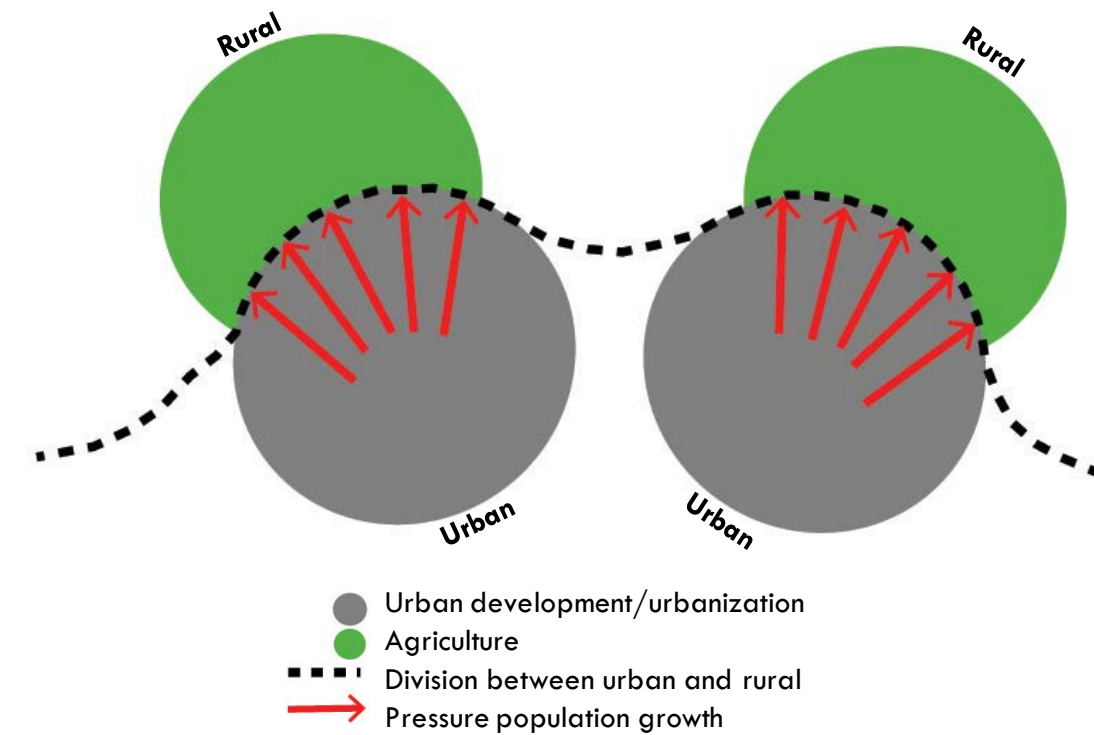
Section 4 Strategy

Dynamic

The actual dynamic in the region is given by the scheme below. The urban development has absorbed the rural areas along time and lately has been more often. The existing boundaries between rural and urban areas have changed dramatically during the last 20 years. Without any territorial planning rural areas

become urban areas given to population growth, as it can be seen in the images in the next page. Any improvement in infrastructure or services has been done producing impressive expansion of urbanized areas. This dynamic generates fragmentation, which is a driving force that is enlarging along the department.

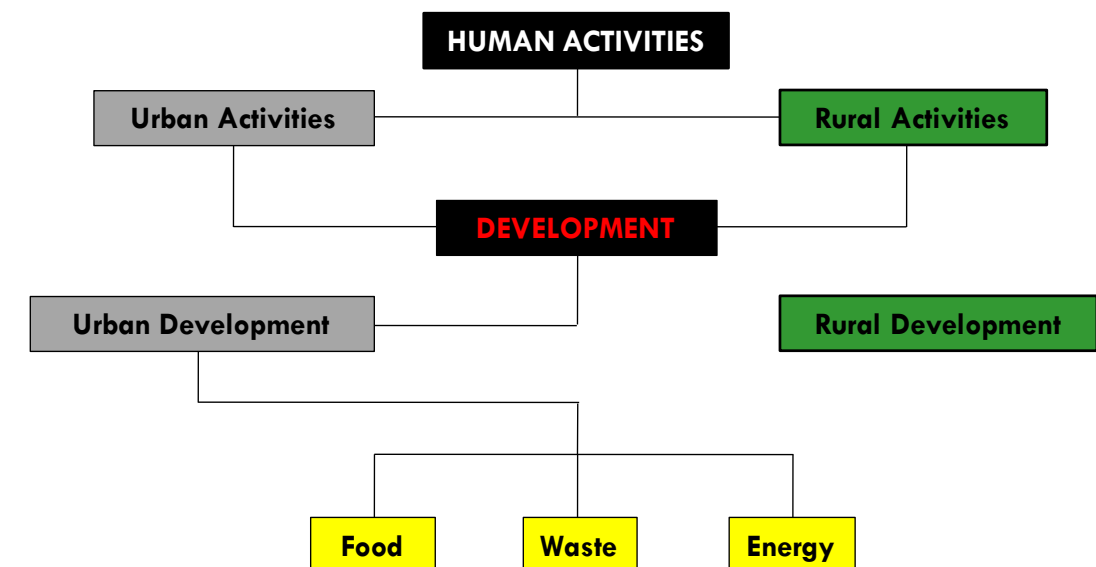
Driving forces = Economic + population growth



The result is an unbalanced and unsustainable dynamic between the human activities in rural and urban areas. There is a failure in the structure of the system and it is really necessary to intervene. The scheme below points out the themes that are going to become part of the research, analysis and finally the strategy

and design of the regional plan. The development is the main theme because is the main issue involved with the planning and governance of the region. The other three (food, energy and waste) are complementary themes that are going to become part of the possible strategic projects.

Dynamic = unbalanced = non sustainable





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GermanRu
PHOTOGRAPHY

Research Question / Specific Research Questions

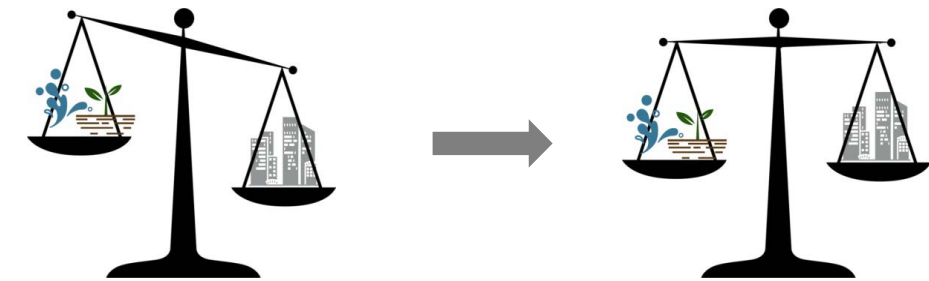
The research questions are defined based on the consequences given over the natural system structure, named: water and soil and on the description of the problem statement. The principal factors provoking a change are human activities divided in rural and urban activities. Development generates certain flows that are applicable and significant to highlight in de-

termined areas along the river basin. These three flows are: food, energy and waste.

Therefore the general research question covers these themes previously mentioned and specifically emphasized on the creation of a sustainable system structure in the region.

GENERAL

How to generate an **integrated system** between **urban development, food production and waste management** and **energy generation**, due to the increasing pressure of urbanization and the **need to protect the environment** contained in the Bogotá River and its basin?



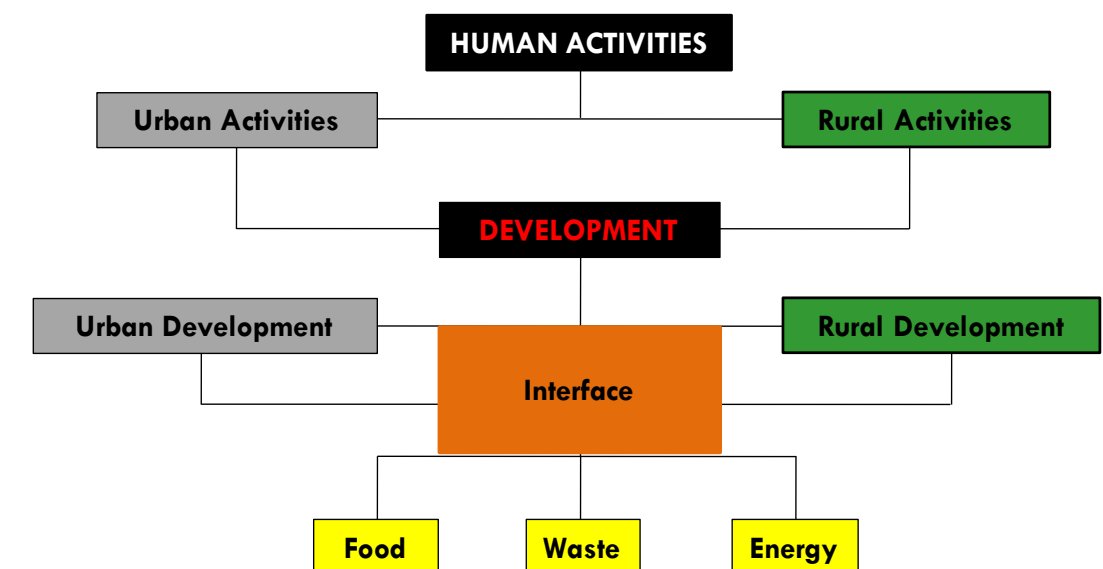
Then the specific research questions will work with the central human activities and its three respective flows:

SPECIFIC

1. **DEVELOPMENT** - How to generate land for urban development without harming the river system?
2. **FOOD** - How to create a balance between the natural structure and food production in cattle and agriculture activities?
3. **ENERGY** - How to improve water and soil utilization for energy generation?
4. **WASTE** - How to adequate areas for waste management and treatment along the Bogotá river and basin?

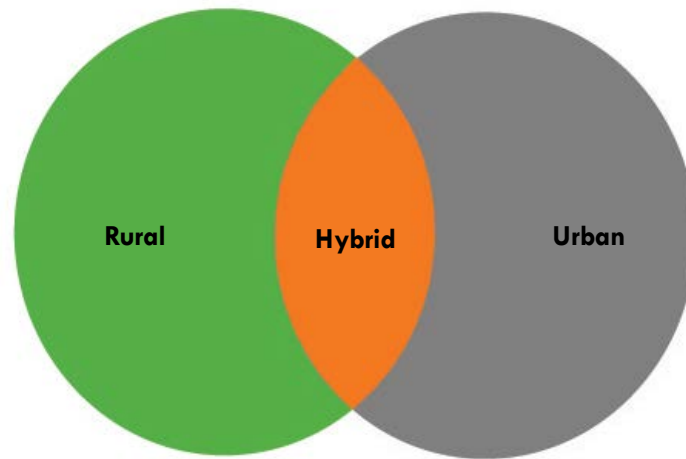
As it was shown in the scheme before, there is a breakdown in the system. So the idea is to generate an interface as a solution in the strategy based on decentralization to improve the structure of the regional system.

Dynamic = balanced = sustainable





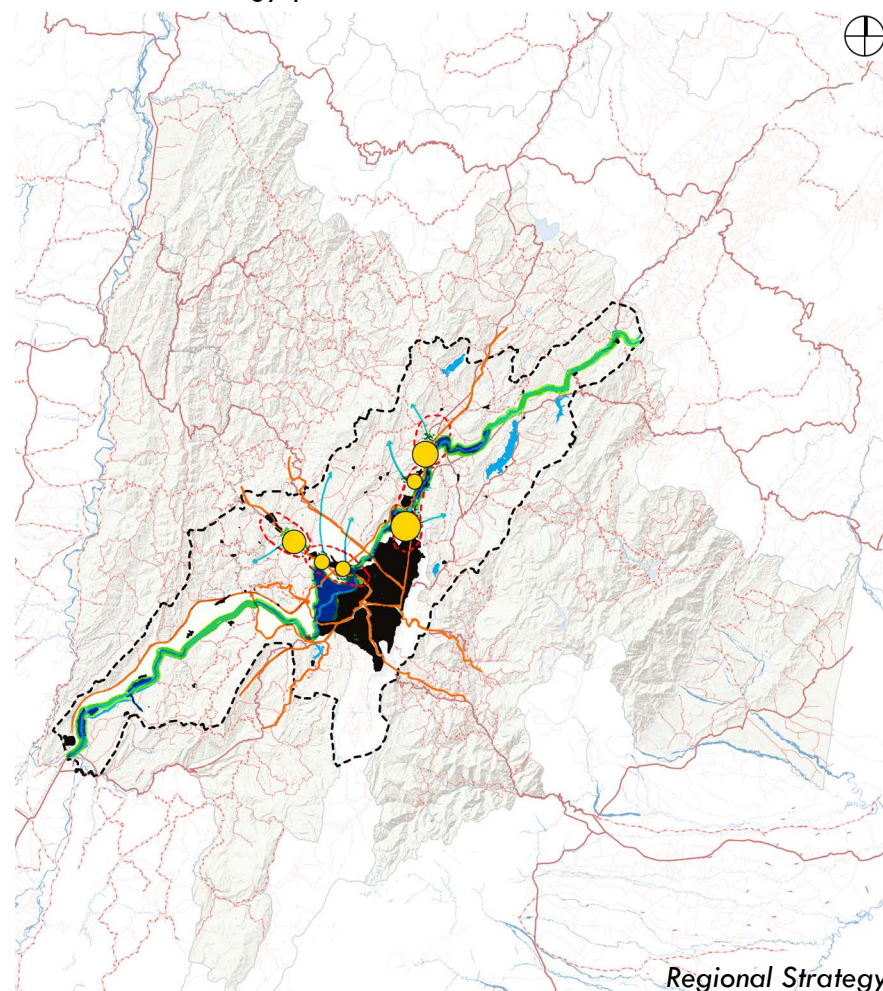
Driving force = Overlap union → Interface



- Urban development/urbanization
- Agriculture
- Hybrid spatial structure: Mixed components

The challenge of the country and the regions is: Colombia's 75% of the population live in urban areas. It has been projected that in 2050 its population will increase to 85% in urban areas. Cities around the world consume around 67% of the energy produced

and are responsible of almost 80% of the greenhouse gases. The increasingly demographic growth in urban areas and specifically in Colombia has put more demand and pressure over the natural resources.



Regional Strategy

The strategy is going to be given by the generation of an interface (a mixed shared area) that I denominated "hybrid model". The objectives mention before about the different flows, food, waste and energy and the development could be seen as strategic projects involucrated and developed in this hybrid areas.

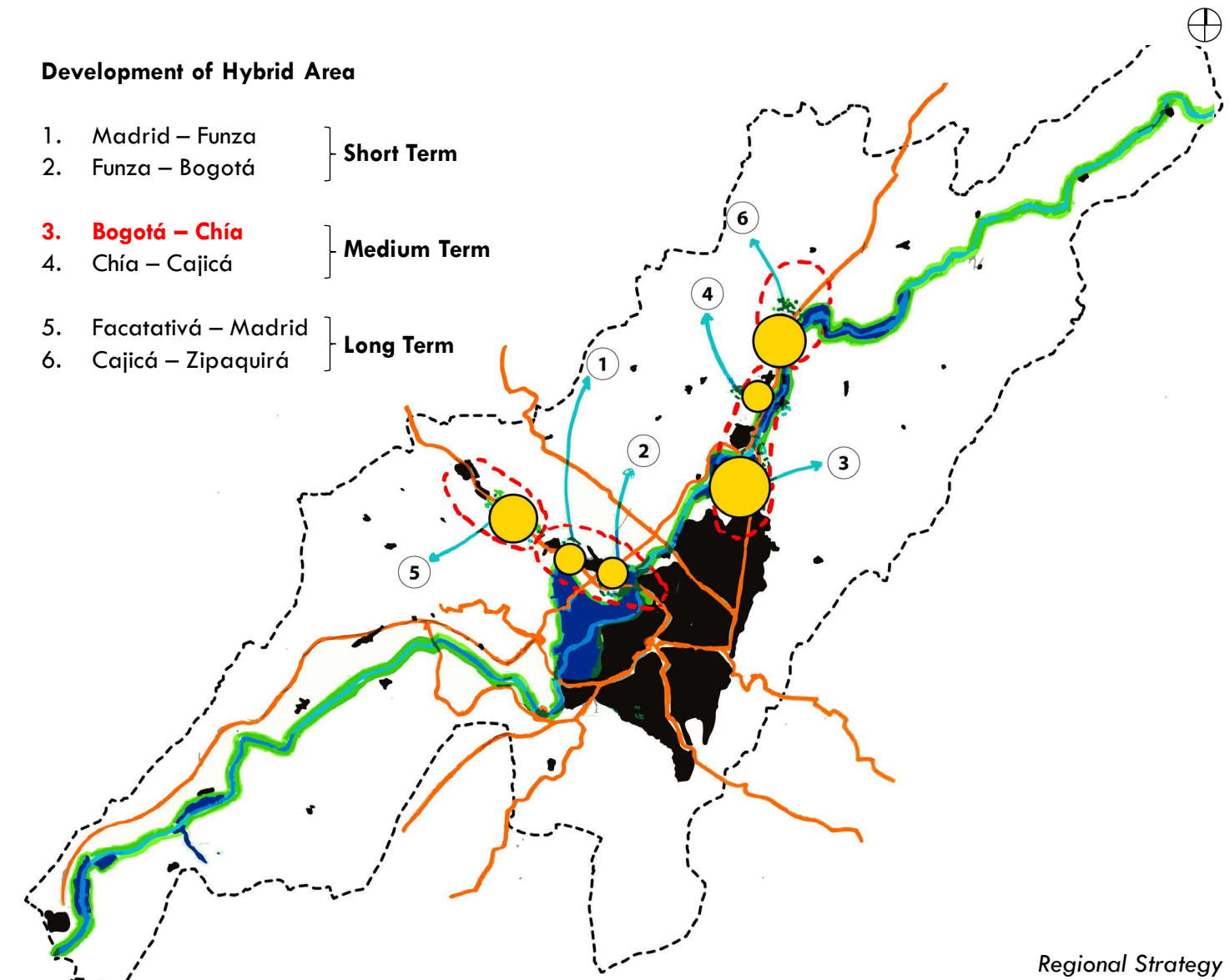
The map in the left (bottom), shows the location of the

strategy in the whole territory of the department of Cundinamarca.

The hybrid region strategy has six areas defined in short, middle and long term developments. With their conurbations between urban areas and absorption of rural areas will threaten more the water structure and the planning of the territory. From these six areas, I

Development of Hybrid Area

- | | |
|------------------------|---------------|
| 1. Madrid – Funza | } Short Term |
| 2. Funza – Bogotá | |
| 3. Bogotá – Chía | } Medium Term |
| 4. Chía – Cajicá | |
| 5. Facatativá – Madrid | } Long Term |
| 6. Cajicá – Zipaquirá | |



Regional Strategy

will design and develop the one between the capital and the north municipality: #3. The objective of it is to show and example of the possible replied interventions in the other five areas.

The recent tradition of understanding and behaviour

has been done in a local scale. This has brought pollution to the river and is seen as a constant weakness. But, if the tradition of understanding is upgraded to a regional scale for the generation of a self sustaining system it would bring an opportunity to create an integrated system of the water structure and the territory.

Bogotá River Basin Development, Planning and Protection Authority

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

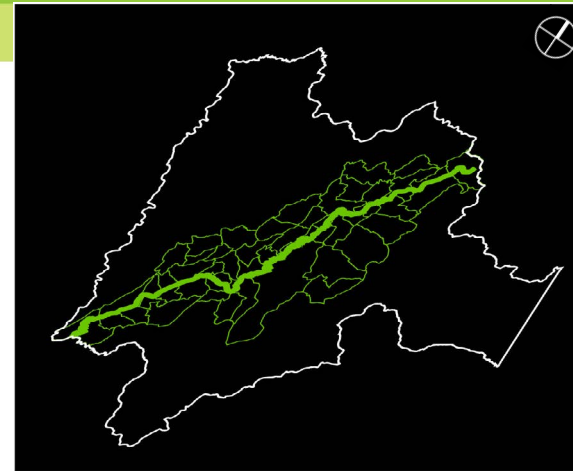
Mision: Hybrid Region

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

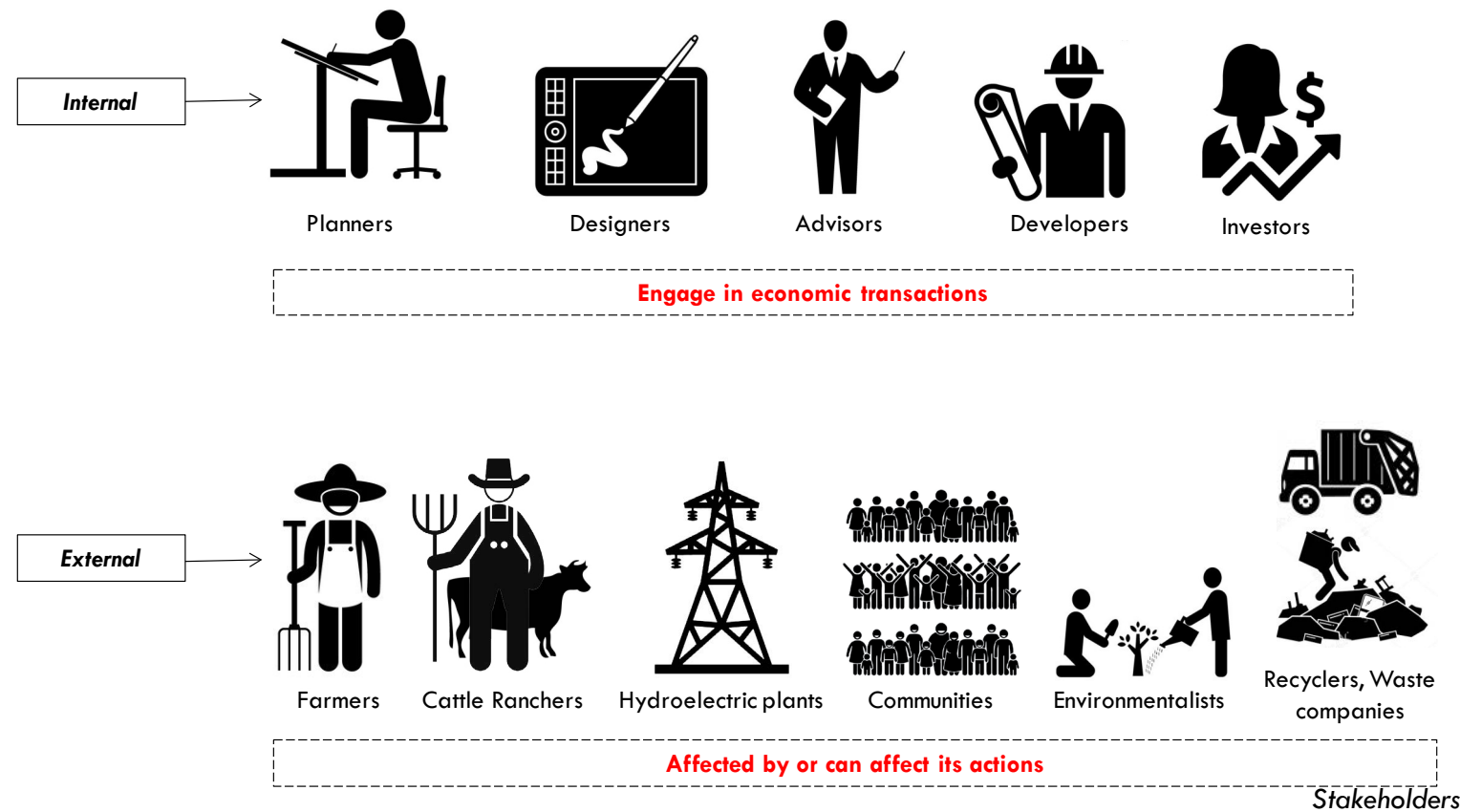


The river basin:
doesn't respond to an administrative system

Although the
river works as a natural system structure

How to structure this ideal scheme into a realistic one? Through the development and implementation of a planning institution. The organization concept is based on a hybrid region mision (as the regional strategy proposed). Transformation of the river basin into a productive landscape ecosystem, sustainable and self-sufficient.

This concept was based on the fact that the river doesn't respond to an administrative system. Although the river works as a natural system structure. The institution will be responsible of restoring the river system structure, binding social, agriculture, waste, energy



and environment issues. The group of stakeholders involved is as follows:

The internal stakeholders will involve from planners to investors and the external will include the people involved in all the flows mentioned before. The internal are engaged in economic transactions, while the external stakeholders are the ones that will be principally affected by or can affect the actions taken in the project.

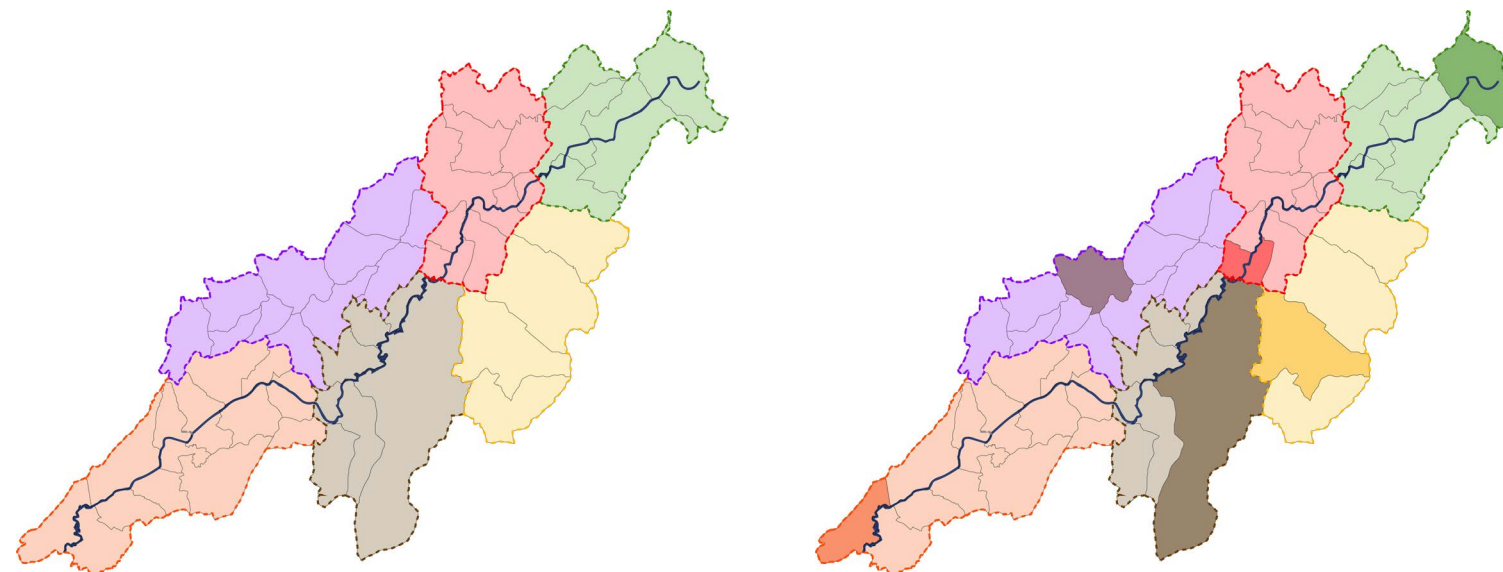
The framework in the map distribution (for the planning institution) is given in six groups between the 46 municipalities involved with the Bogotá River. There are two types of members: core and peripheral. The core member groups are the ones that have physical direct contact with the river. The peripheral member groups don't. Every group and the municipality has one representative in the internal structure of the planning institution.

Core Members

- Group 1
- Group 2
- Group 3
- Group 4

Peripheral Members

- Group 5
- Group 6



River Basin Map Distribution

Core Members

- 1. Girardot
- 2. Bogotá
- 3. Chía
- 4. Villapinzón

Peripheral Members

- 5. Facatativá
- 6. La Calera

Bogotá River Basin Development, Planning and Protection Authority

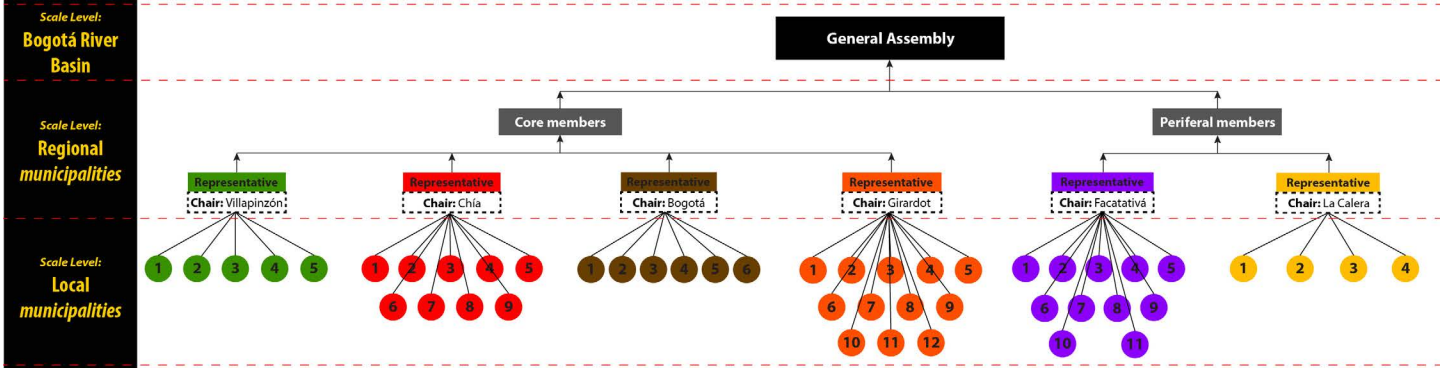
The first image below, is the internal structure of the spatial distribution shown before. There are three scale levels interconnected. Local with the municipalities, regional with the six groups representatives and River Basin scale level for the general assembly where internal and external stakeholders make the final decision making.

The next image has the relations/tasks structure: bottom up, from the local scale to the River Basin scale. The scheme goes from the bottom to the top. The representatives of the municipalities come from parctical

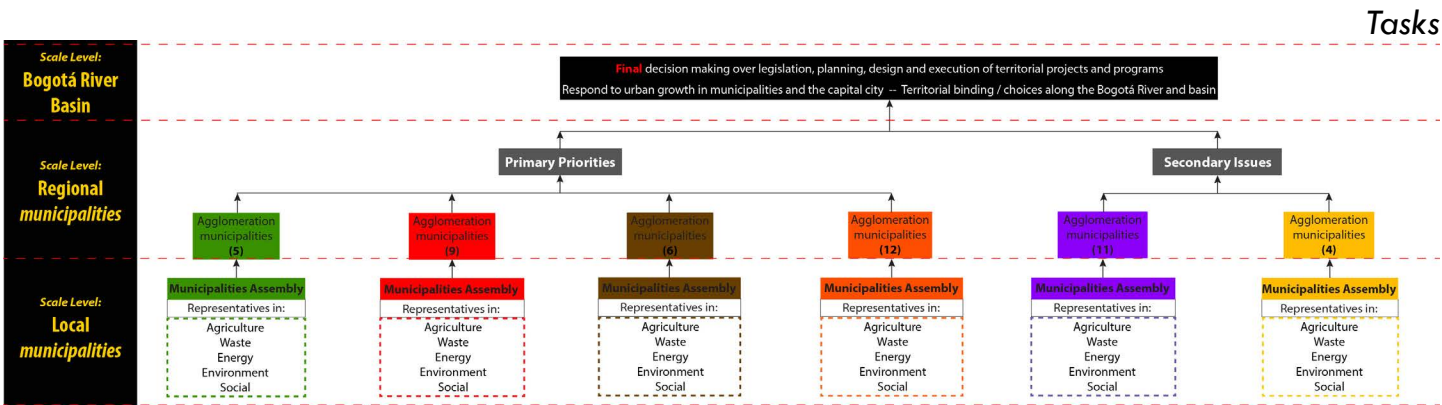
fields such as: agriculture, waste, energy, environment and local communities. There is a local assembly to then move to the regional assembly and finally the general assembly.

The socialization map is the last scheme in this page. It has the same structure that the relations/tasks structure. The difference is that the scheme flows from the River Basin scale (top) to the local one (bottom). After the final decision making in the general assembly the projects develop are going to be socialized in this way.

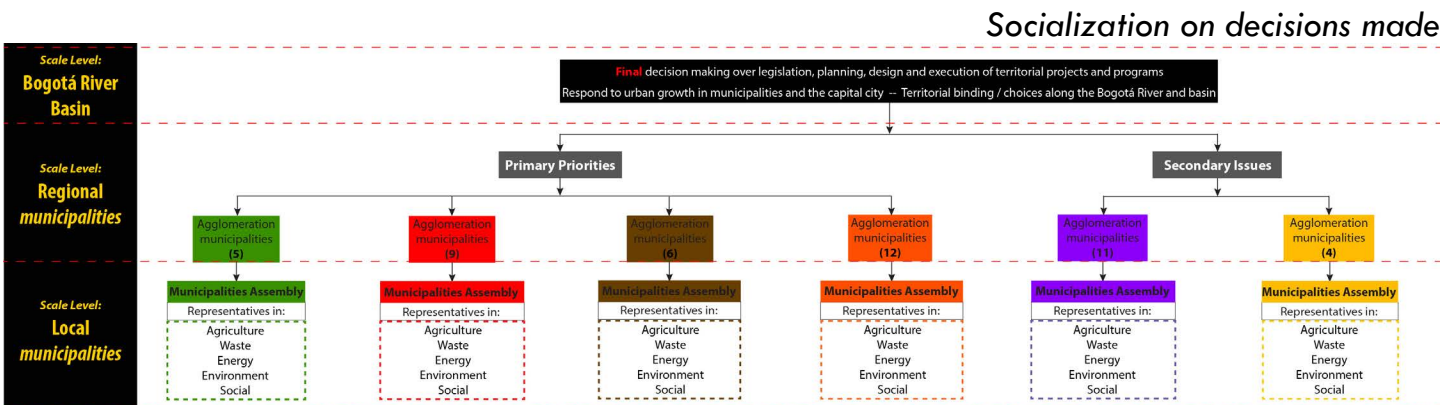
Internal Structure



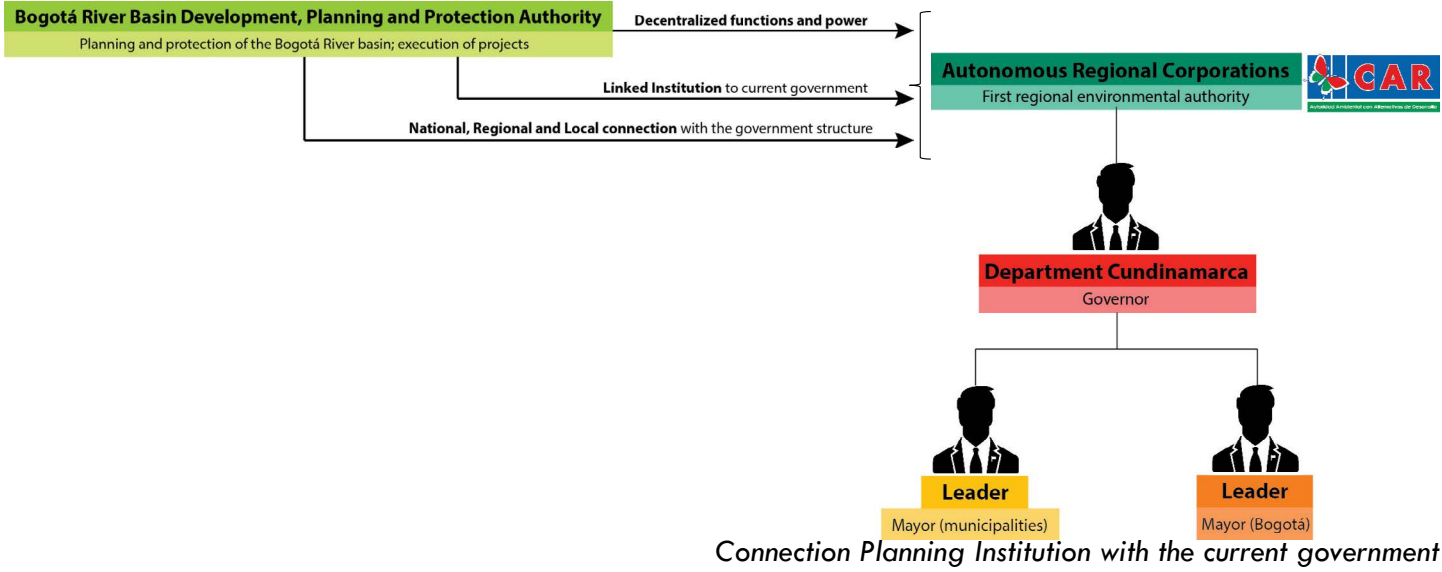
Relations



Tasks



Socialization on decisions made



The experts/advisors responsibilities are shown in the table (below). It is divided in 4 sections: Legislation, Planning, Design and Documentation Centre.

Each one works in its respective theme although they all work with the improvement and focus in: food, waste, energy, recreation and the natural structure of the general ecosystem in the territory.

The ideal interaction between the institution and the government structure is shown in the scheme above. It will work in three different scales.

It will be a linked institution with the urrent government, however it will have decentralized functions and power.

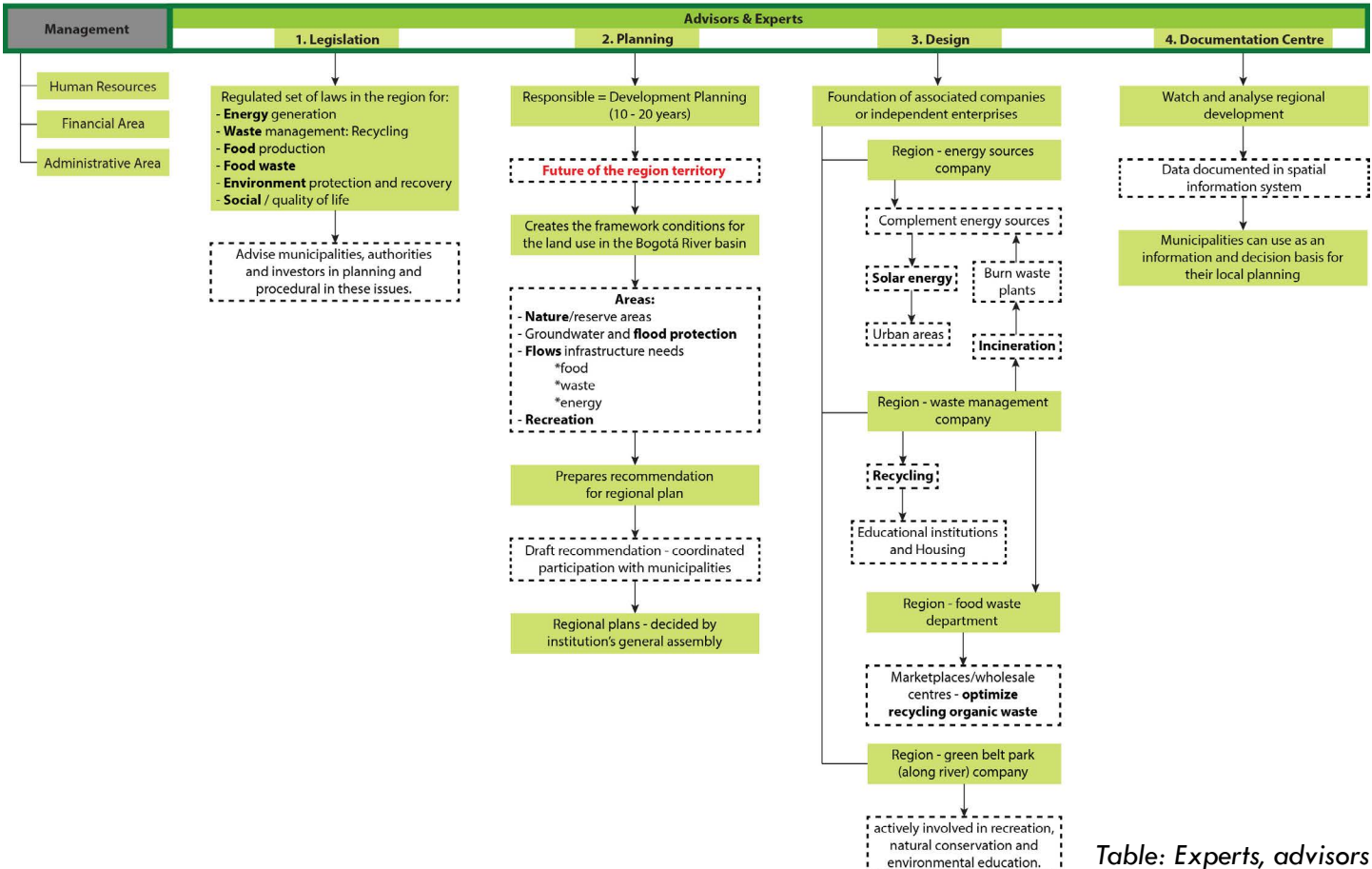
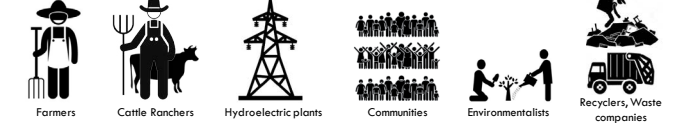
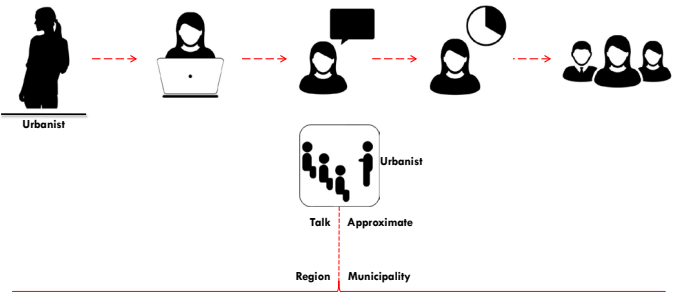
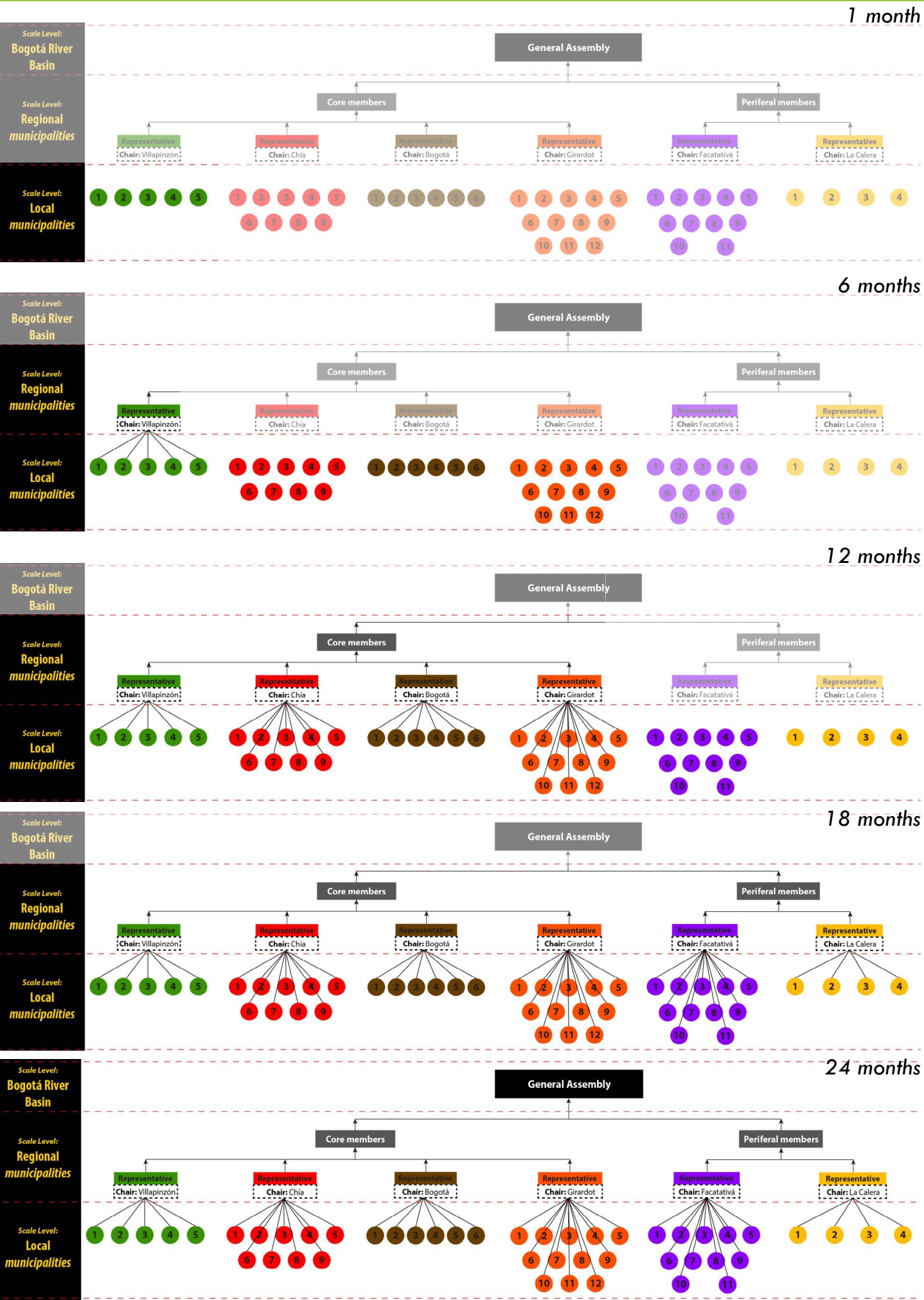


Table: Experts, advisors

Bogotá River Basin Development, Planning and Protection Authority



How is it going to work this planning institution in the short, medium and long term? The starting initiative is to contact and approximate the external stakeholders, then introduce them to the plan project.

The conformation of the institution will be done in approximately two years. The phasing of the planning institution is shown in the scheme of the left.

First the local scale is develop in different stages until is complete to consolidate the regional assembly. After the local municipalities representatives is complete, the Chairs are selected to become an active part of the general assembly and the final decision making.

After the first two years, the phasing of the development and improvement of the territory will be given in 30 years, through the spatial interventions shown in the maps. For the first 15 years, the ecosystem will recover completely and for the next 15 years the social interventions will consolidate completely.

30 years



20 years



15 years



10 years



5 years



2 years



Phasing: planning of the territory

Section 5 Design

Ideal Vision

The ideal vision, in the development and design of the hybrid area, is shown in the map below. Spatial planning in line and accomplishing the main goal in the environmental field and the objectives in agriculture, waste, energy and urban development.

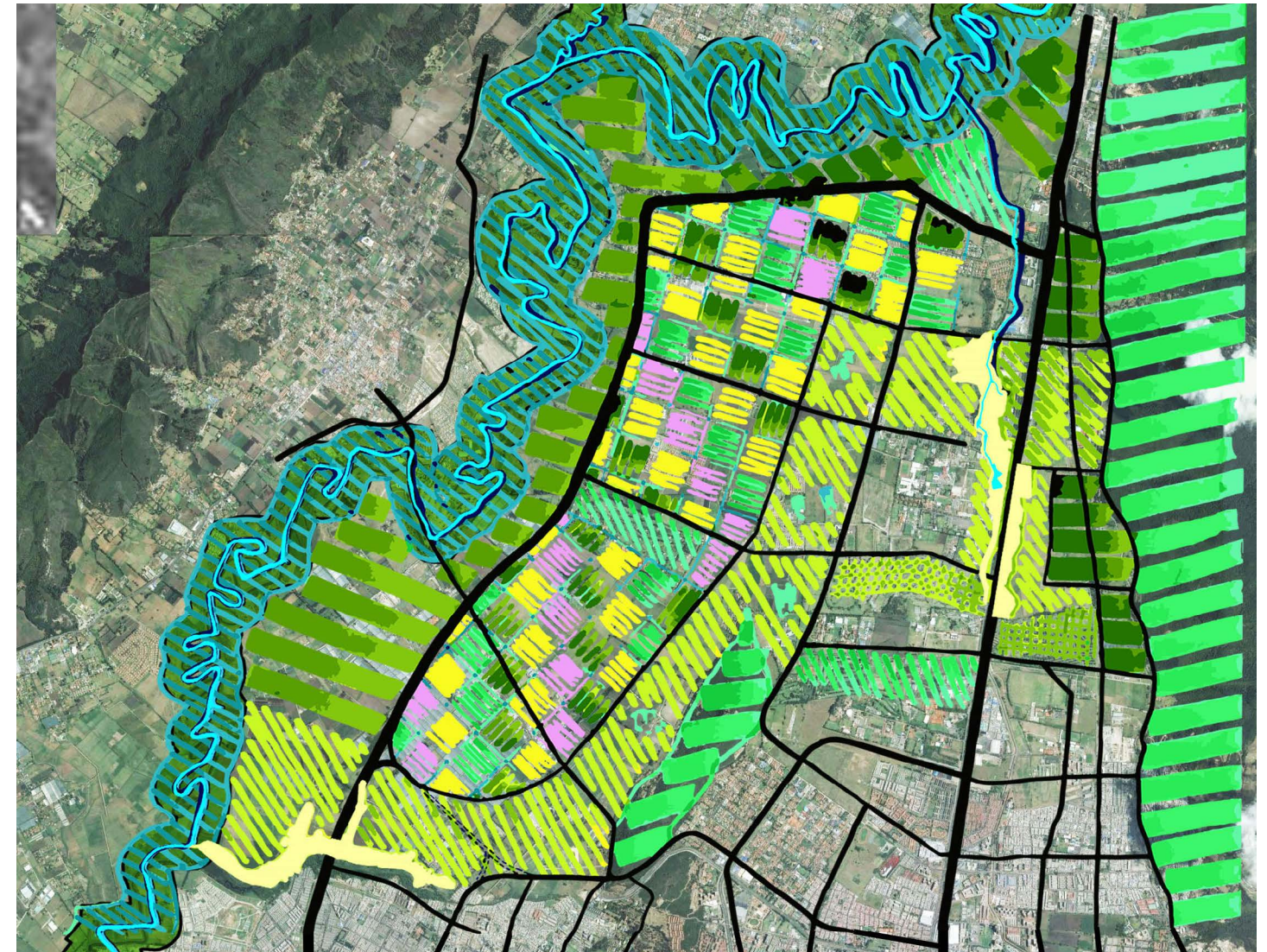
To accomplish in a realistic way the goal and objectives, it is important to optimize three systems and their flows: food, waste and energy; including the so-

cial and environmental factors. The systems have certain demands:

Food: Feed **55%** more population with the same amount of land.

Waste: Manage and locate **141%** more waste
Reduce traffic 50%

Energy: Energy generation **4 times more** for 42%



Urban Forest

Wetlands

Hills

Rivers

Flood Area

Sustainable Agriculture

Private to public green areas

Predominant Use in the area

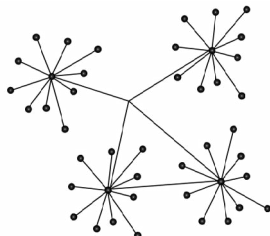
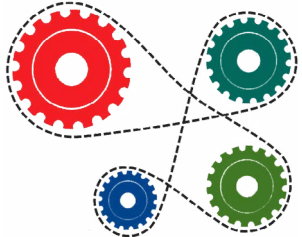
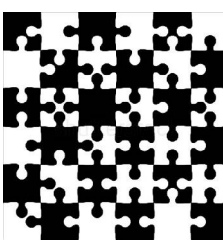
Facilities

Housing

Urban Agriculture

Flower Fields

Realistic Vision

	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

Regional Toolbox

To improve the demands it was developed a regional/ local toolbox that will help tackle these issues. The toolbox will allow to reach the hypothesis established since the beginning. The goal system where the conflict between human activities and natural resources is enhanced. The toolbox is shown in the left page:

It includes the three flows (food, waste, energy), governance, contamination and infrastructure as the principal key elements for the framework in the design.

To classify, validate and adjust these information, the previous highlighted elements demonstrate in the following information, that they are the starting point for the proposal to succeed.

As a result, they will achieve the necessary support to

**Wetlands** – 500 Ha approx.

**Eastern Hills Reserve** – 13.200 Ha

**Bogotá River** – 90 km approx.
Passes through the city

**Thomas Van der Hammen Reserve** – 1395 Ha

transform the region into a hybrid model and potentiate sustainability.

The design shown in the beginning of the section, illustrates the development of the hybrid model in the area # 3 of the regional strategy. It is located in the northern part of the capital city (Bogotá).

Bogotá has a population of **7.800.000** people (2015). In 2065, the population is expected to have **12.900.000**. In this 50 years, the population of the capital will grow 5.000.000 approximately.

In the areas and quantities shown below, it can be seen that the area has a great ecological structure, plus opportunities in food (urban agriculture) and waste fields principally, for the improvement and sustainability of the ecosystem and the population.

**Consumes** – 1 kg per day
365 kg per year

**City Generates** – 800.000 kg of recycling material

**Produces** - 0.28 kg recycling material per day

**Usage of** – 1.300.000 Ton per year



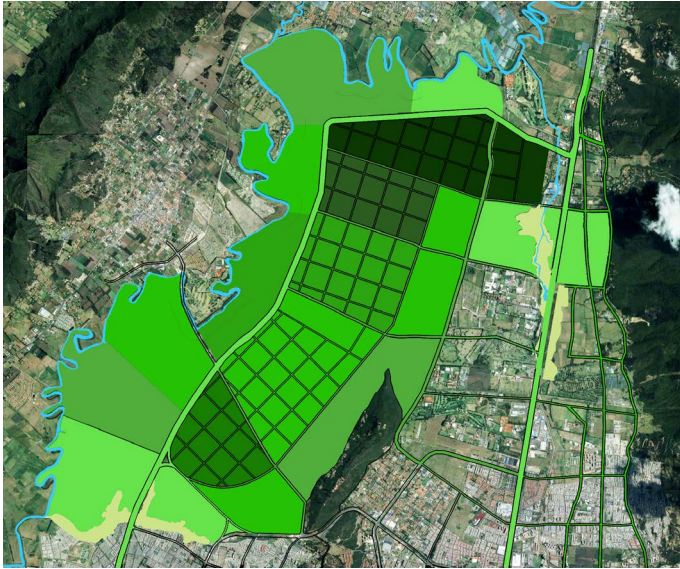
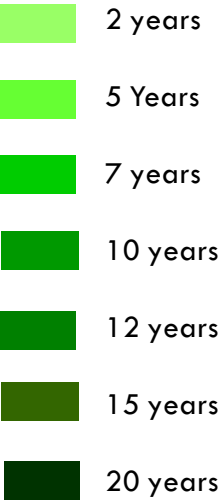
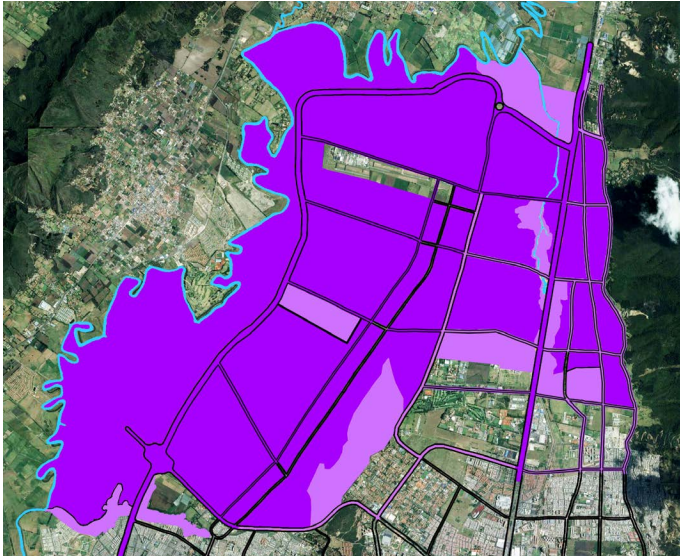
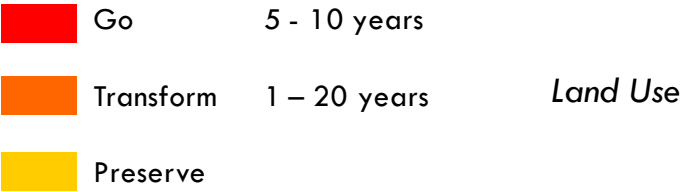
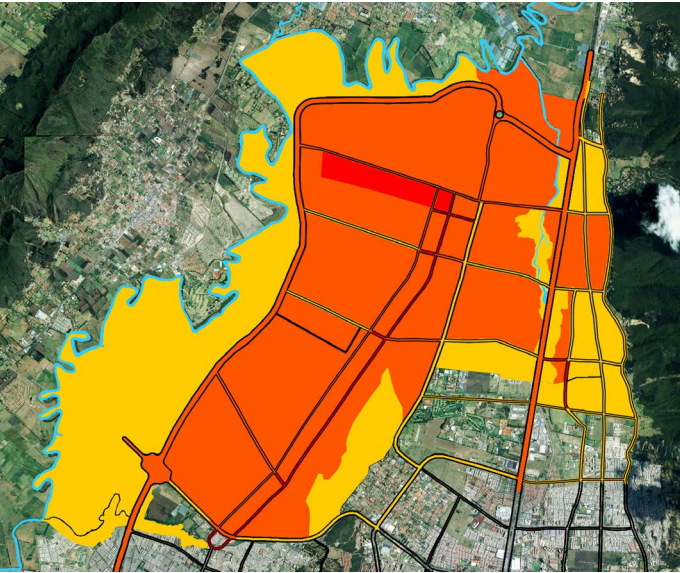
The regional toolbox will be explained through the planning and design of the northern area of the capital.

Governance

In the right column, there are two maps that illustrate in different categories what will go, transform or pre-serve.

In the top: land use. The majority of the preserved areas in the map are ecological structure. In the middle: Spatial Planning. Around 85% of the area will be transform in its planning distribution.

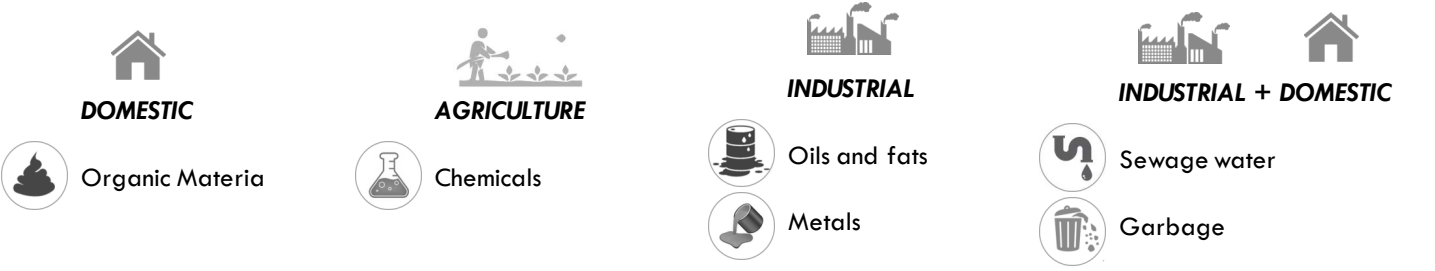
Finally in the bottom, the timeline where the territory will be transform by the intervention of the new planning institution during approximately 20 years. The area is divided into seven periods. The priority is given to the areas closer to the water structure and the urban forest in the plan.



Timeline



Sources that contaminate



Contamination of the river

The objective is to prevent the contamination and control the amounts thrown to the river. It is possible by identifying the sources that contaminate in higher quantities:

- Domestic
- Agriculture
- Industrial
- Mixed: Industrial + Domestic

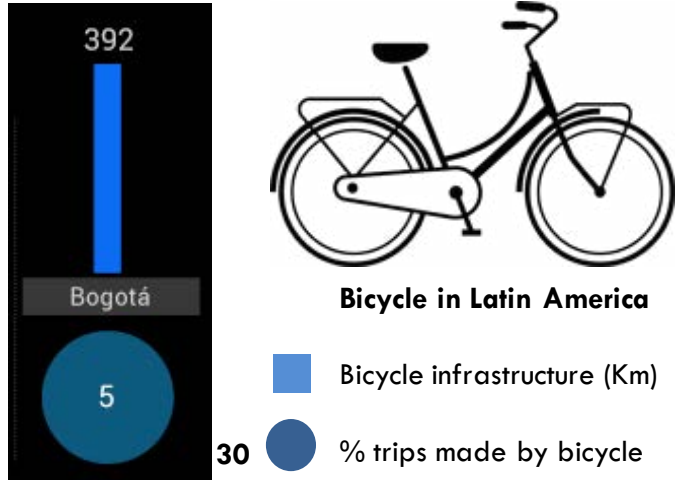
These four principal sources have the opportunity to change the current situation over the river, through the optimization in recycling processes and other solutions such as:

- Domestic
- Agriculture
- Industrial
- Mixed: Industrial + Domestic

RECYCLE
COMPOST
RECYCLE
BURN WASTE

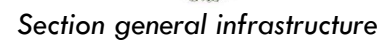
Infrastructure

The element highlighted in infrastructure is the bicycle. In Bogotá and other cities around the department, has great reception and potential of improvement. It has around 392 km of bicycle paths. It could be increased in the planning of the hybrid model.



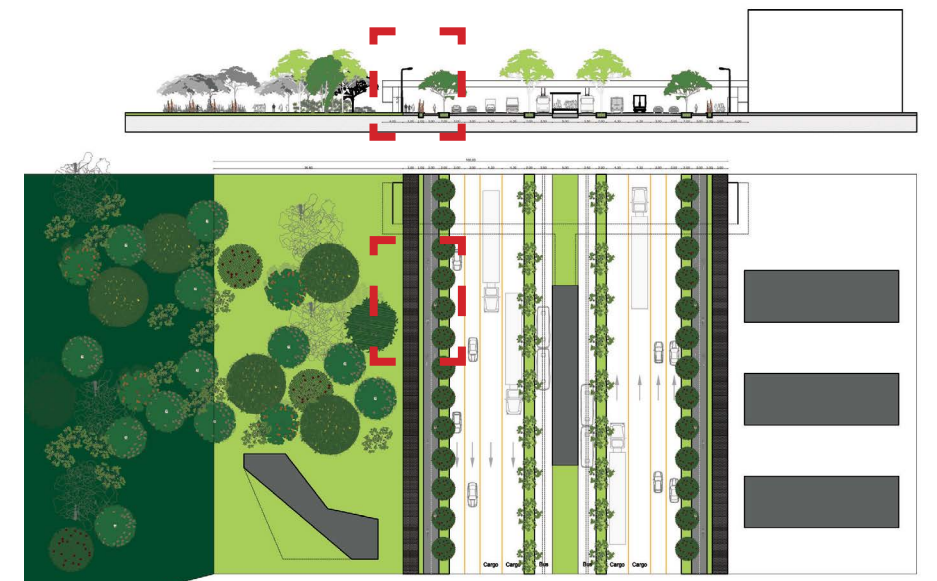
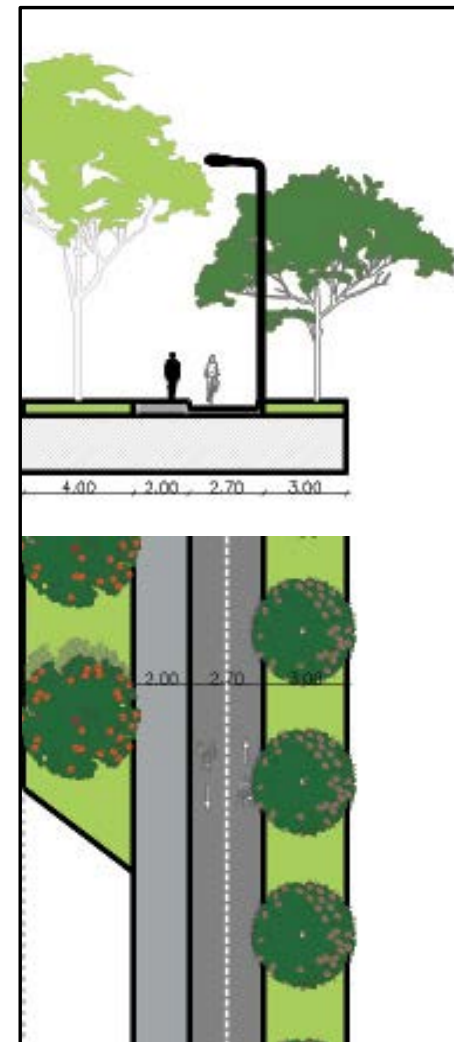
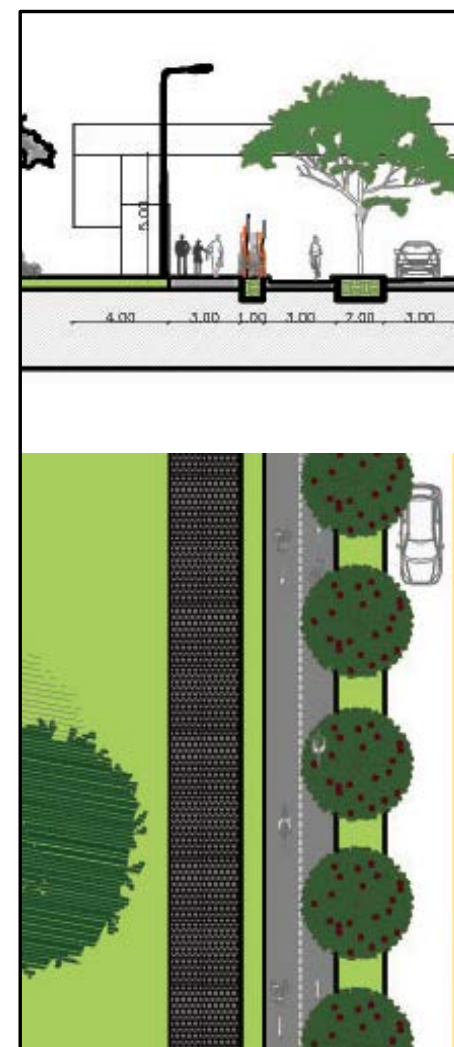
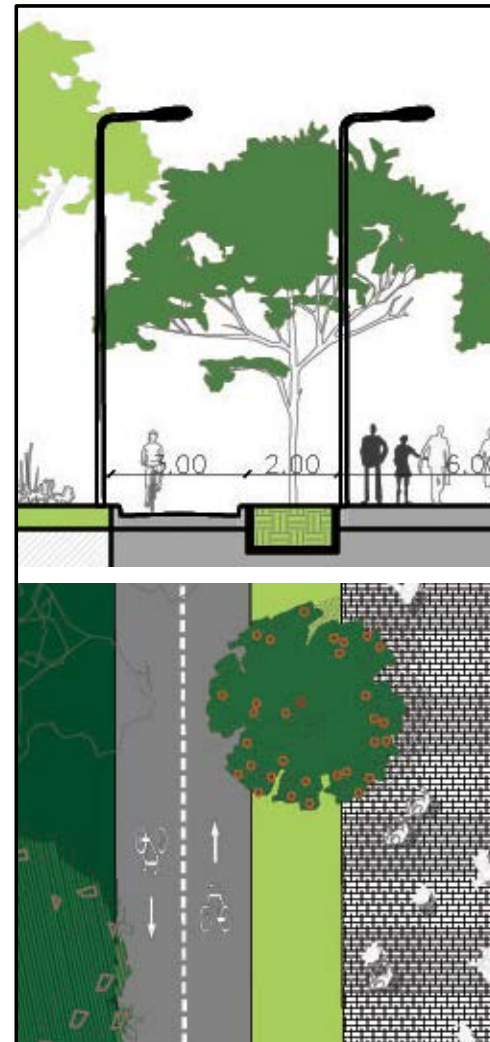
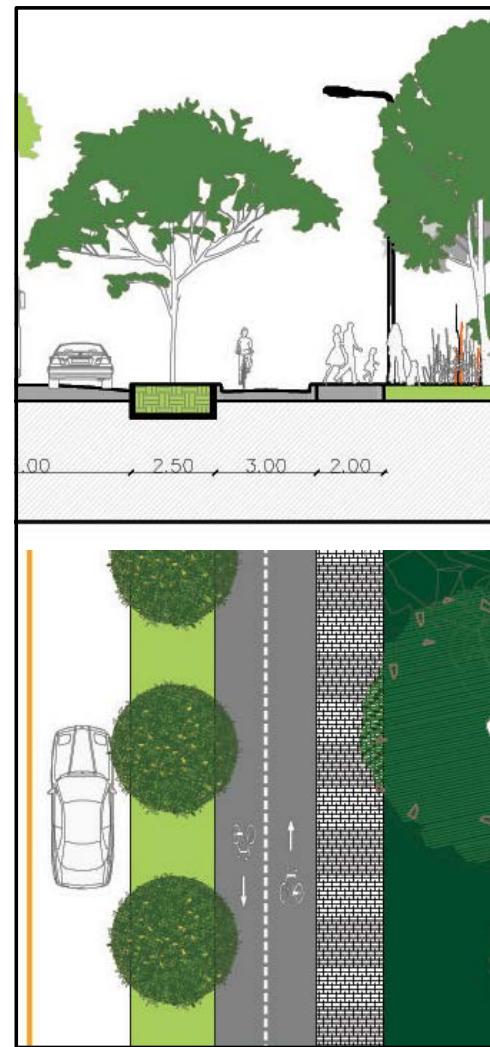
The same sources that can help de-contaminate





The figure consists of two architectural drawings. The top drawing is a section view showing a cross-section of a landscape. It features a road with a sidewalk, a building, and trees. Dimensions are provided for various elements: a sidewalk width of 0.80, a road width of 0.80, a building width of 0.80, and a total width of 2.40. A black rectangular box highlights a specific area on the sidewalk. The bottom drawing is a plan view showing a top-down view of the same landscape. It features a road with a sidewalk, a building, and trees. Dimensions are provided for various elements: a sidewalk width of 0.80, a road width of 0.80, a building width of 0.80, and a total width of 2.40. A black rectangular box highlights a specific area on the sidewalk.

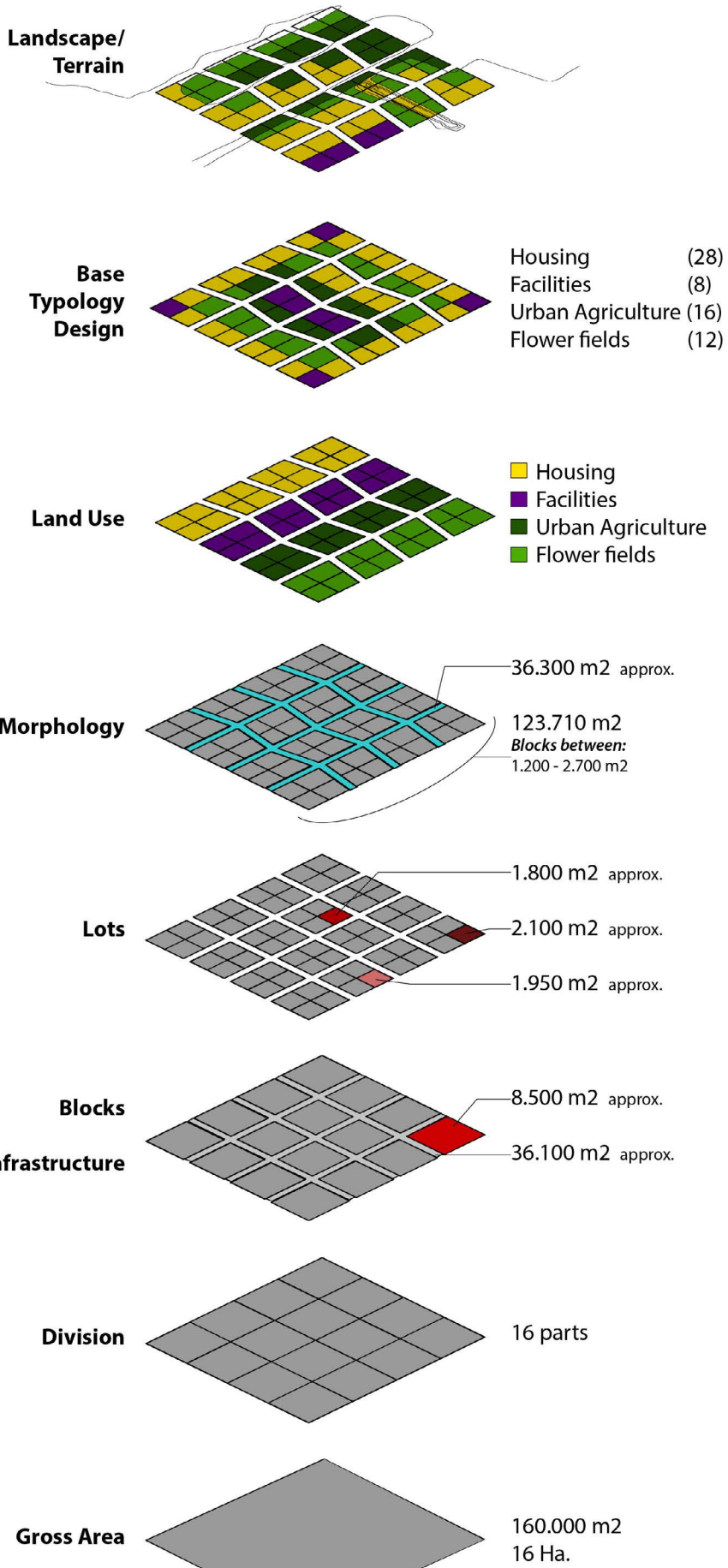
Section general infrastructure



Section arterial infrastructure

Section arterial infrastructure

Design Block Framework



Structure and morphology square system

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

Housing
Facilities
Urban Agriculture
Flower fields

In the next section, it will be explained the remaining three key elements of the regional toolbox: food, waste and energy, related with the connection local/regional scale of the hybrid model.

During the design process a square system is developed. It has the framework for the planning of the territory that corresponds to the areas assigned for this specific spatial structure.

The main square system starts with a gross area of 16 Hectares (see image in the left). Along the distribution, the infrastructure, blocks and finally lots are defined, which give shape to the morphology of the square. In the end the main typology square has 64 lots divided into 16 smaller blocks with an area between 1.200 and 2.700 m².

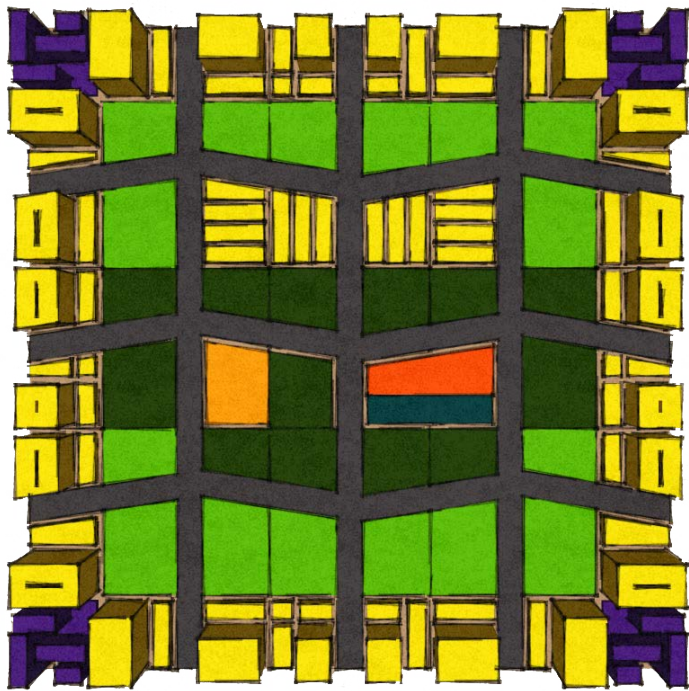
The land use is distributed in four main functions:

- Housing
- Facilities
- Urban Agriculture
- Flower Fields

As a result, the system square has its functions located responding to the infrastructure and landscape.

The square system distribution is shown in the image below:

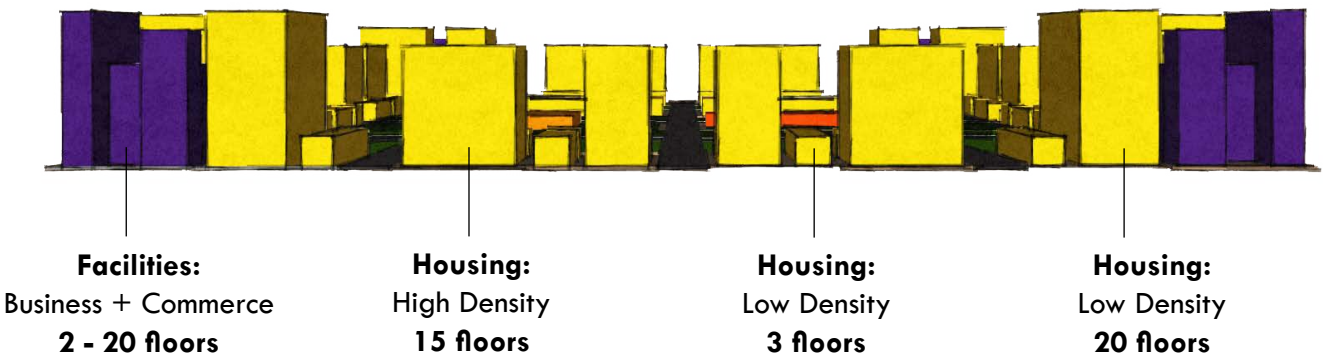
- Housing
- Commerce and business
- School (pre-school)
- Recycling Collection Point
- Urban Agriculture
- Flower Fields



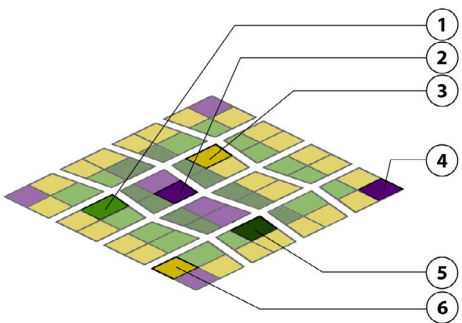
Square System Distribution

To begin, the buildings have a height of floors depending on the function. The standard is shown in the section below:

The design criteria is focused to reduce demands over urban development, food (agriculture), waste and energy. The qualities and opportunities present in the previous fields brought the densities inside the square system, that are shown in the image on the bottom.



Section Square System Distribution



Flower Fields	12 Lots	1.98 Ha
Facilities: Education, Waste	4 Lots	0.36 Ha
Housing – Low Density	24 Lots	0.85 Ha
Facilities: Business, Commerce	4 Lots	0.58 Ha
Urban Agriculture	16 Lots	3.16 Ha
Housing – High Density	4 Lots	0.66 Ha
TOTAL		7.60 Ha

Areas and functions

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
Total Block Area	16	Ha
Density	138.5	People per Ha

In the following table, there are the calculations (one square system), how many people are going to be located, how many families, the density of people per Hectare and how much is the total floor space and construction index in housing units.

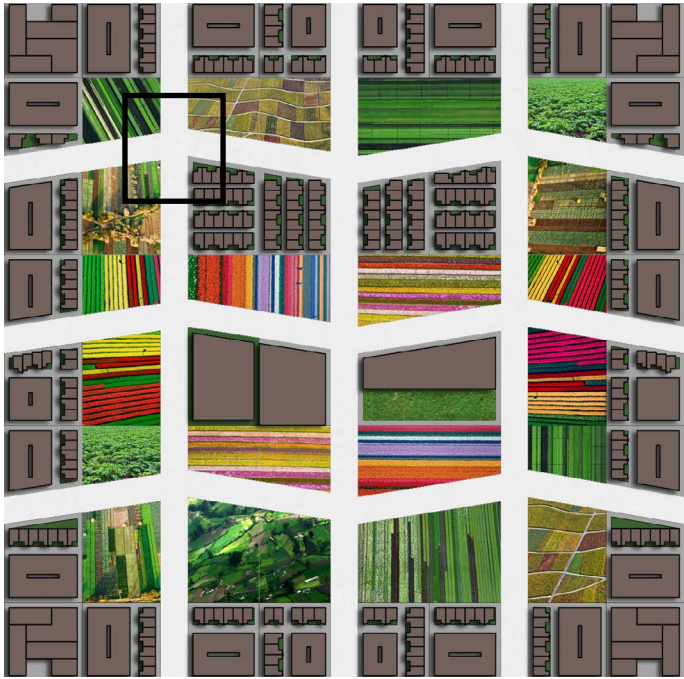
Bogotá has an actual average density of:
197 inhabitants/Ha

The proposed in the square system will have:
138.5 inhabitants/Ha

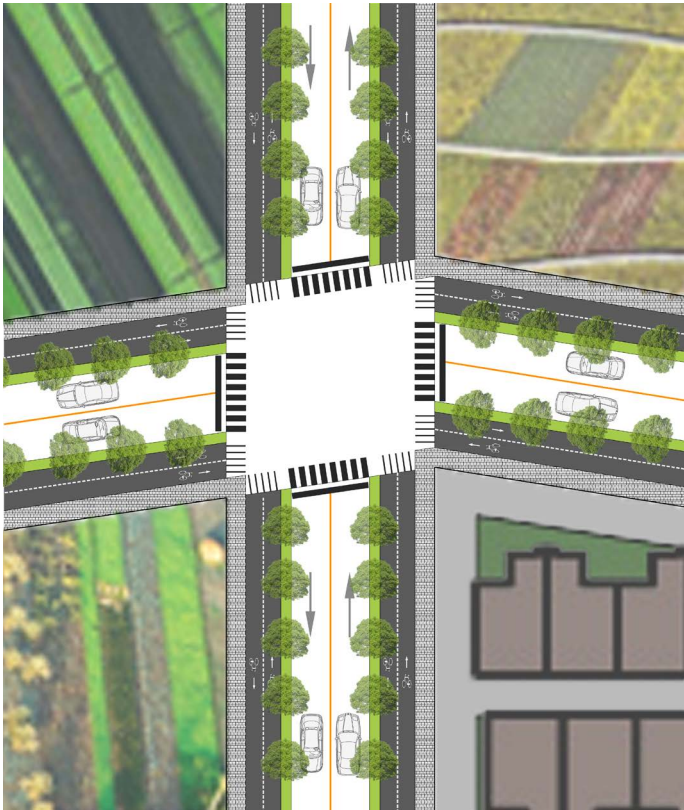
It has a reduction of 60 people per Hectare. The purpose of this is to have other functions such as urban agriculture and flower fields for a more sustainable model of planning in the territory. Also to use the advantages that the land has in its ecological and water structure.

The plant (right) shows how the block is going to look like and the image details one of the key elements - infrastructure - contained in the square system.

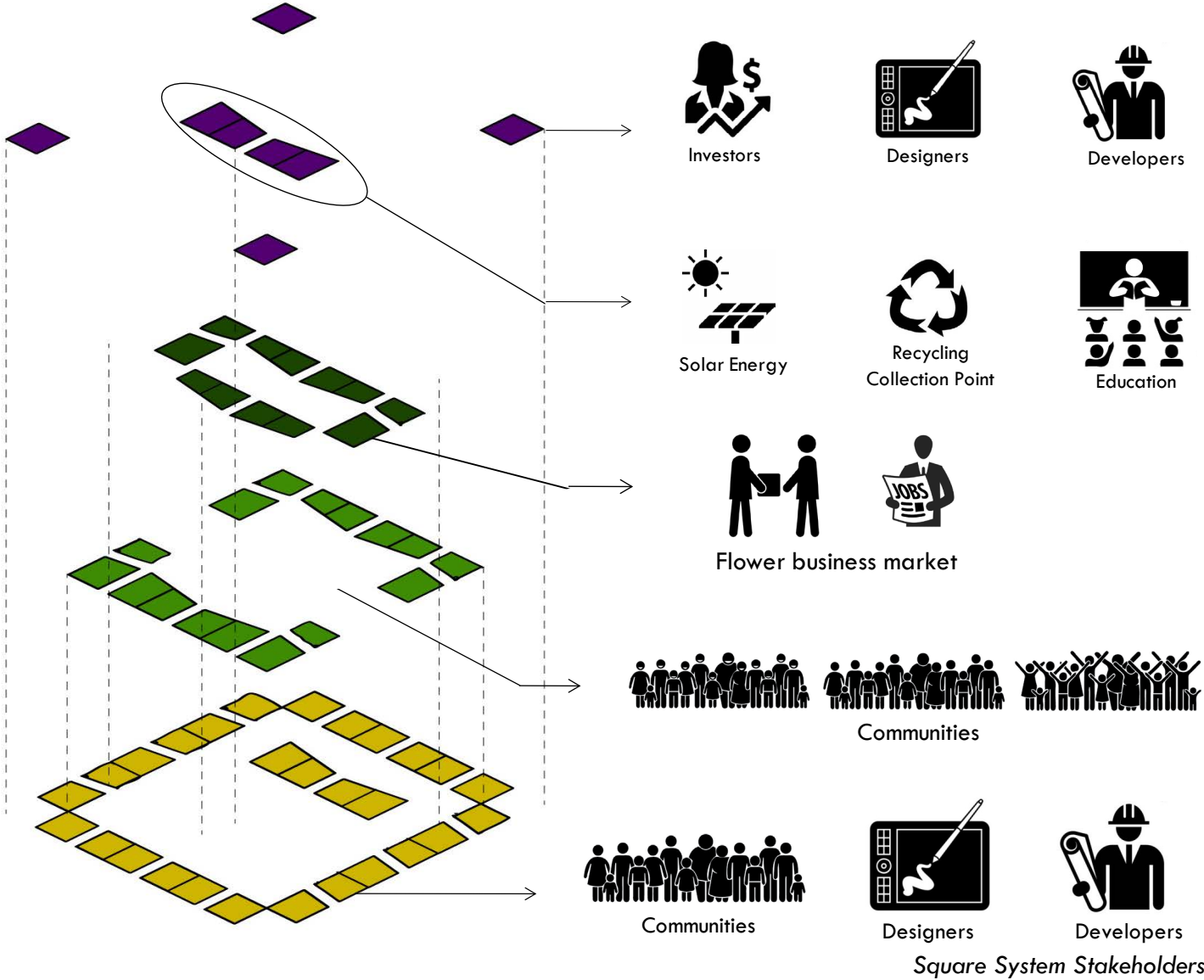
The design previously mentioned, will be developed through the strong support of the internal and external stakeholders (planning institution). The facilities and housing will be potentiated principally by the private sector. Following the strong guidelines described before:



Square System Design



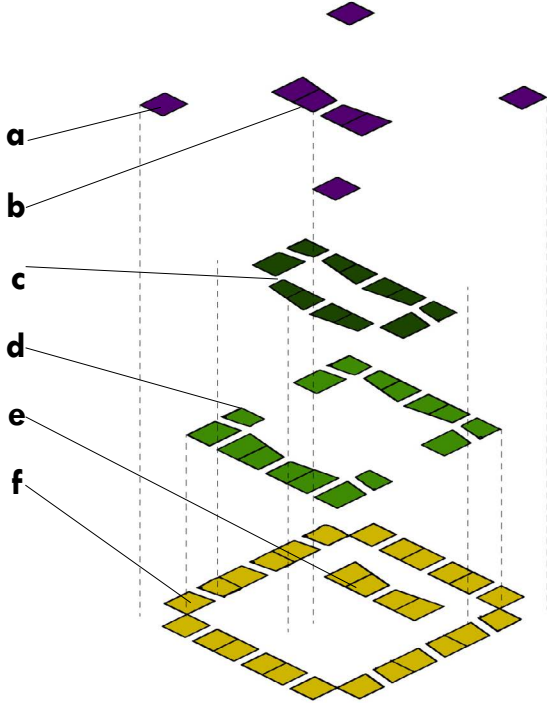
Square System Design - infrastructure detail



- Densities - people
- Heights - buildings
- Public Space
- Insulations
- Functions

Likewise, the phasing of the square system will be completed in approximately five years. In order:

- a. Facilities - commerce and business **3 years**
- b. Facilities - education, waste, food(compost)**2 year**
- c. Flower Fields **1 year**
- d. Urban Agriculture **1 year**
- e. Housing - Low density **3 years**
- f. Housing - High density **5 years**



Square System Phasing

Hybrid Model

On the other hand, the relation between the square system (one block) and its surrounding blocks is really important. The interaction in the area between the blocks, taking into account landscape, infrastructure and flows, is the key element to coordinate the planning and design in the same way.

The first map (top), highlights the ecosystem structure inside this specific part of the hybrid area. Elements such as the Bogotá River and its green belt, hills, urban forest park, green areas and sustainable agriculture conform the adaptative capacity of this territory.

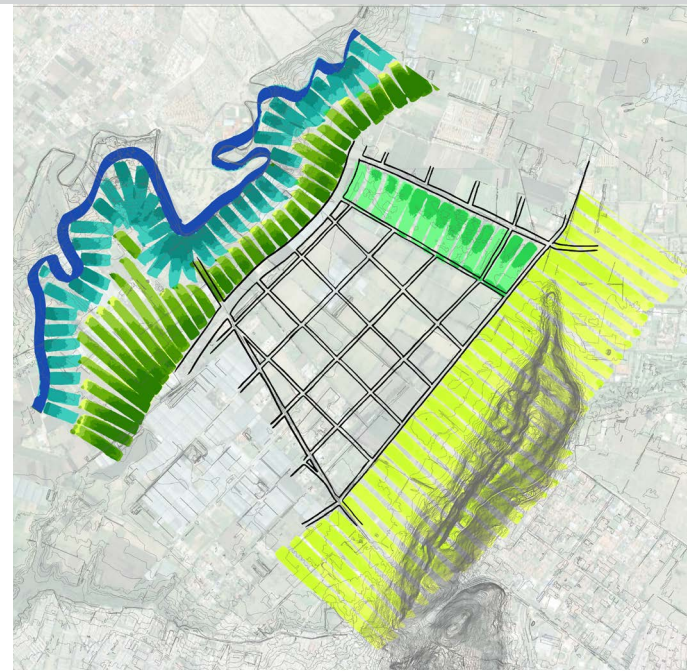
The urban forest park and the green belt will be shown later with its further design and planning of the areas that needed to be improved.

The second map (middle), shows the infrastructure that will be important for the flows in the map below. The map shows a principal artery road and its connections with the secondary and finally local roads.

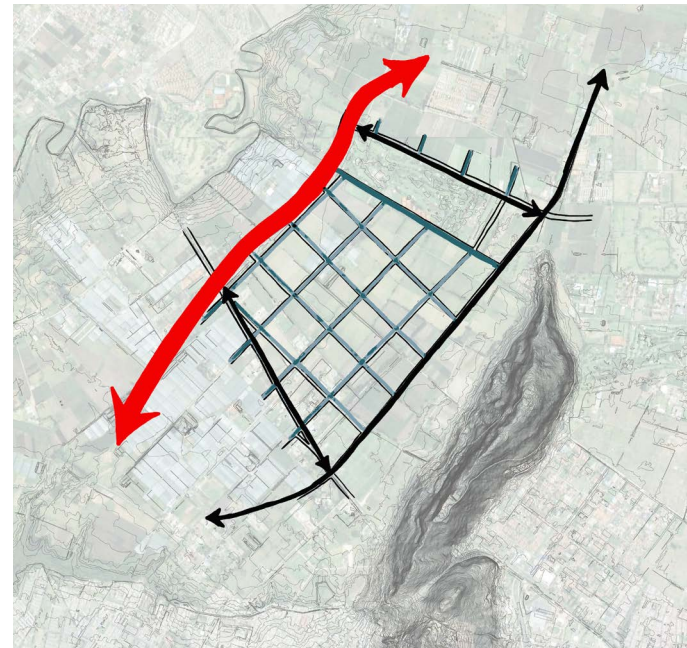
Finally, the flows map will have the logistic park in the southern part of the map. It is going to have direct connection with the main road infrastructure and will have areas for: recycling collection point, non-recyclable garbage and flower meeting point and distribution. In the west park of the logistic park, due to the topography, it will be located a water storage area for future needs.

The light blue, orange and purple, show the routes that the garbage, recycling and flower trucks will use to optimize the transport and the collection of the sources.

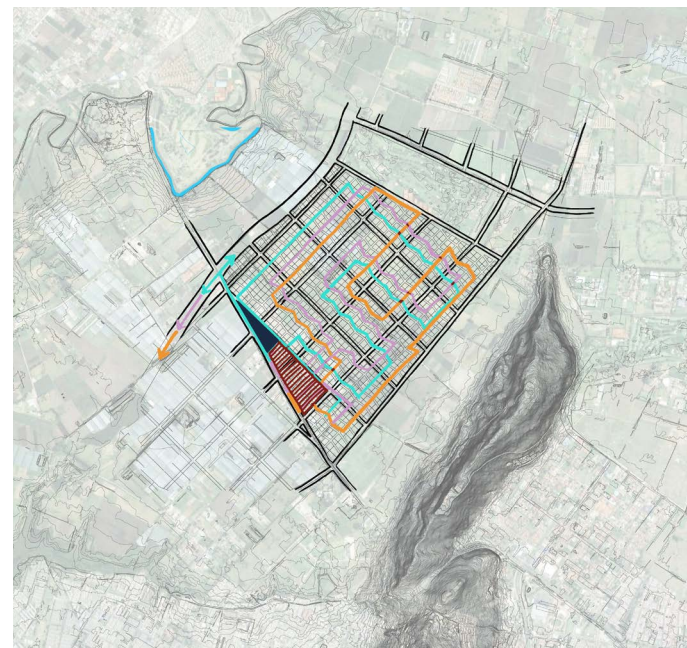
The overlap of these three layers, give as a result the optimum profile of the hybrid model. I will work further on the planning and final design of this specific area.



Adaptive Capacity - Landscape



Infrastructure



Flows - Logistic Park



System Square of Blocks

Urban Forest Park

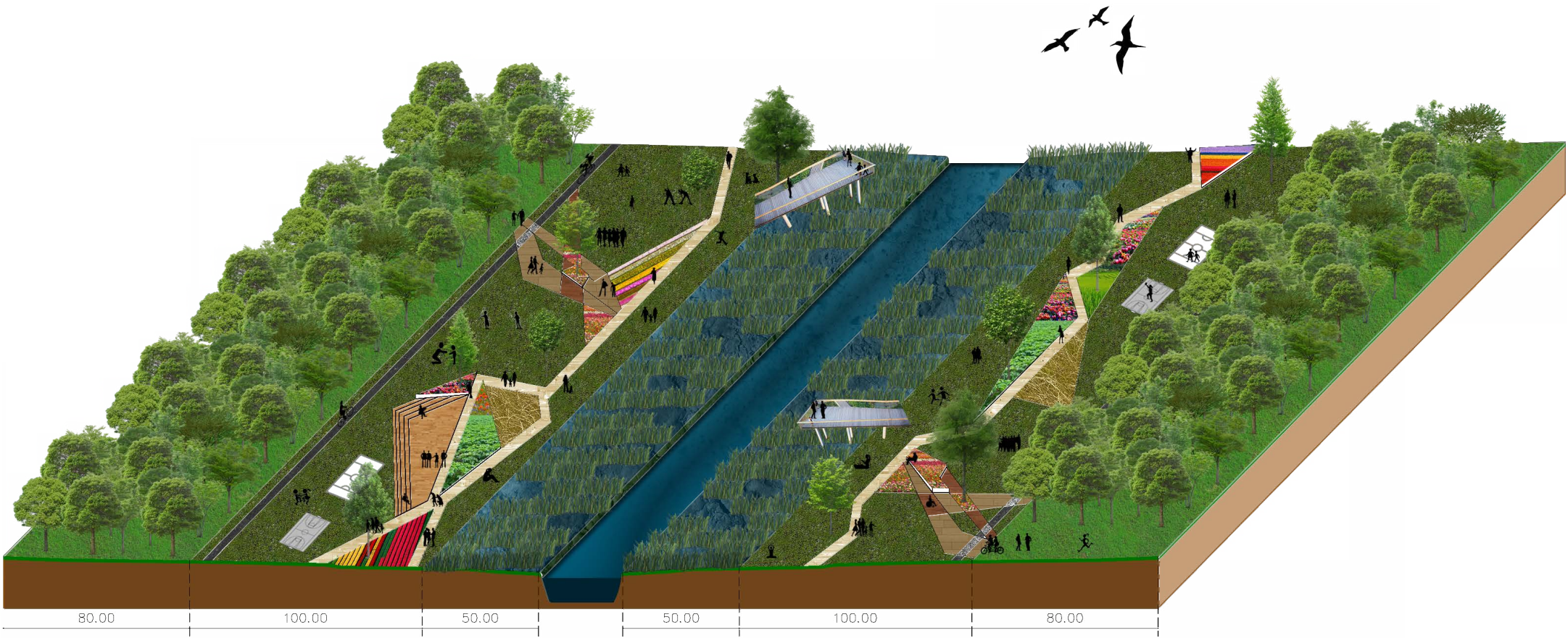


As it was mentioned before, the ecological structure of the hybrid model is relevant in the planning and design. For this reason, the Urban Forest Park and the Green Belt contained in the area are shown in the following images.

The recovery and protection of these areas, allow the territory to restore its natural structure with the surroundings in the local and the regional scale.

These two specific areas, are also connected with the system of squares that interact with each other. As a result, the structure of the territory becomes more sustainable; with the improvement of the flows, the restoration of the ecosystem and as a consequences the quality of life of the population.

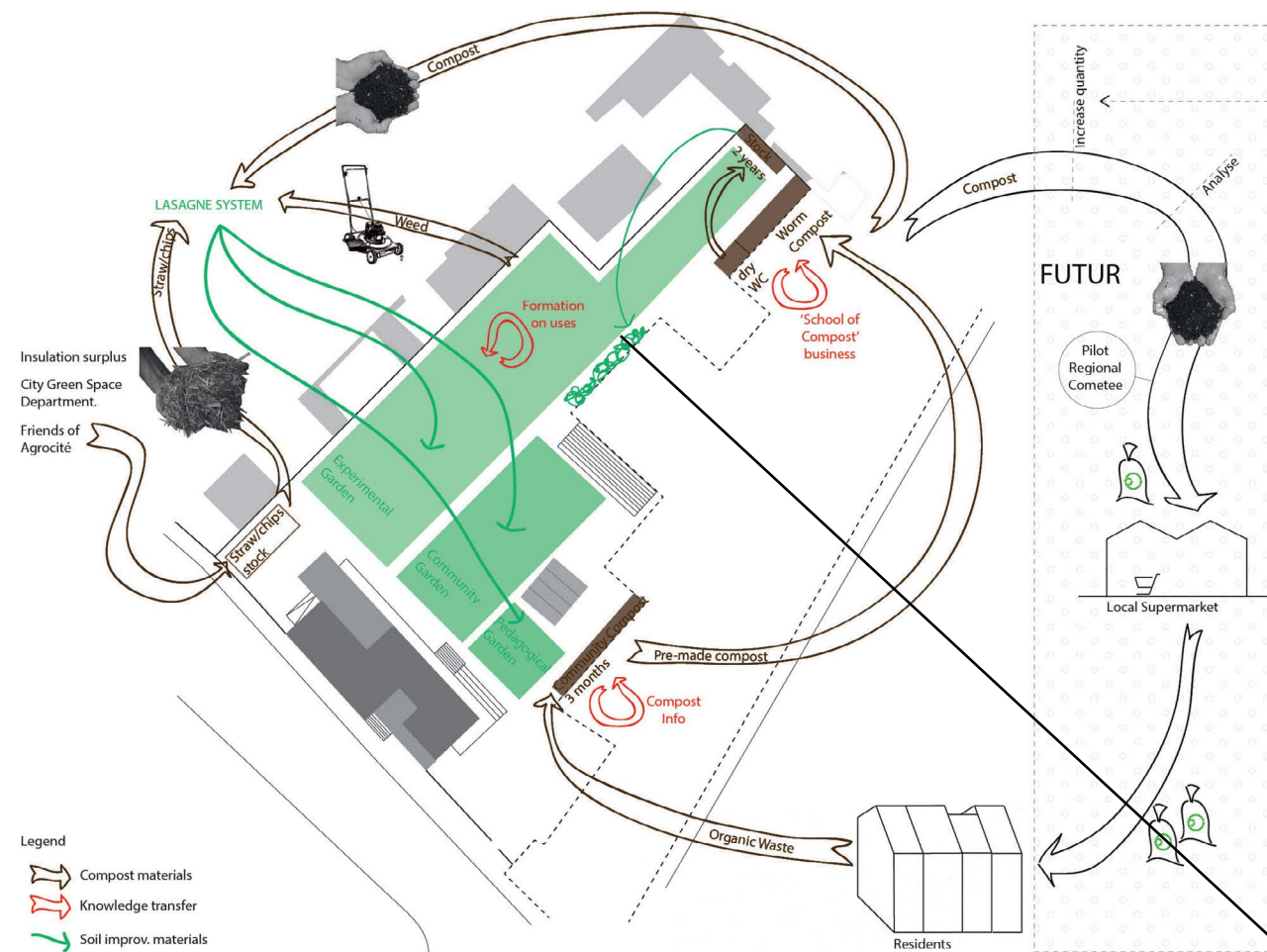
Green Belt - Bogotá River



The Urban Forest Park has an extension of 1.600 Hectares approximately in the complete hybrid model of Bogotá. It will have recreational areas and also preservation of the ecosystem, its Fauna and Flora.

The Green Belt along the Bogotá River, has an offset of 230 metres in all its extension. The first 50 metres area established as flood area. The next 100 metres are a recreational park with nodes along the river, that identify areas with higher and lower density of visitors.

Finally, the insulation between the green belt and the other functions is given by a length of 80 metres that has been recovered through reforestation.



The square block system has the following components that integrate a sustainable use of the land and the resources. The images show the corresponding function and where it is located. This page has all the themes concerning in productive and re-use areas:

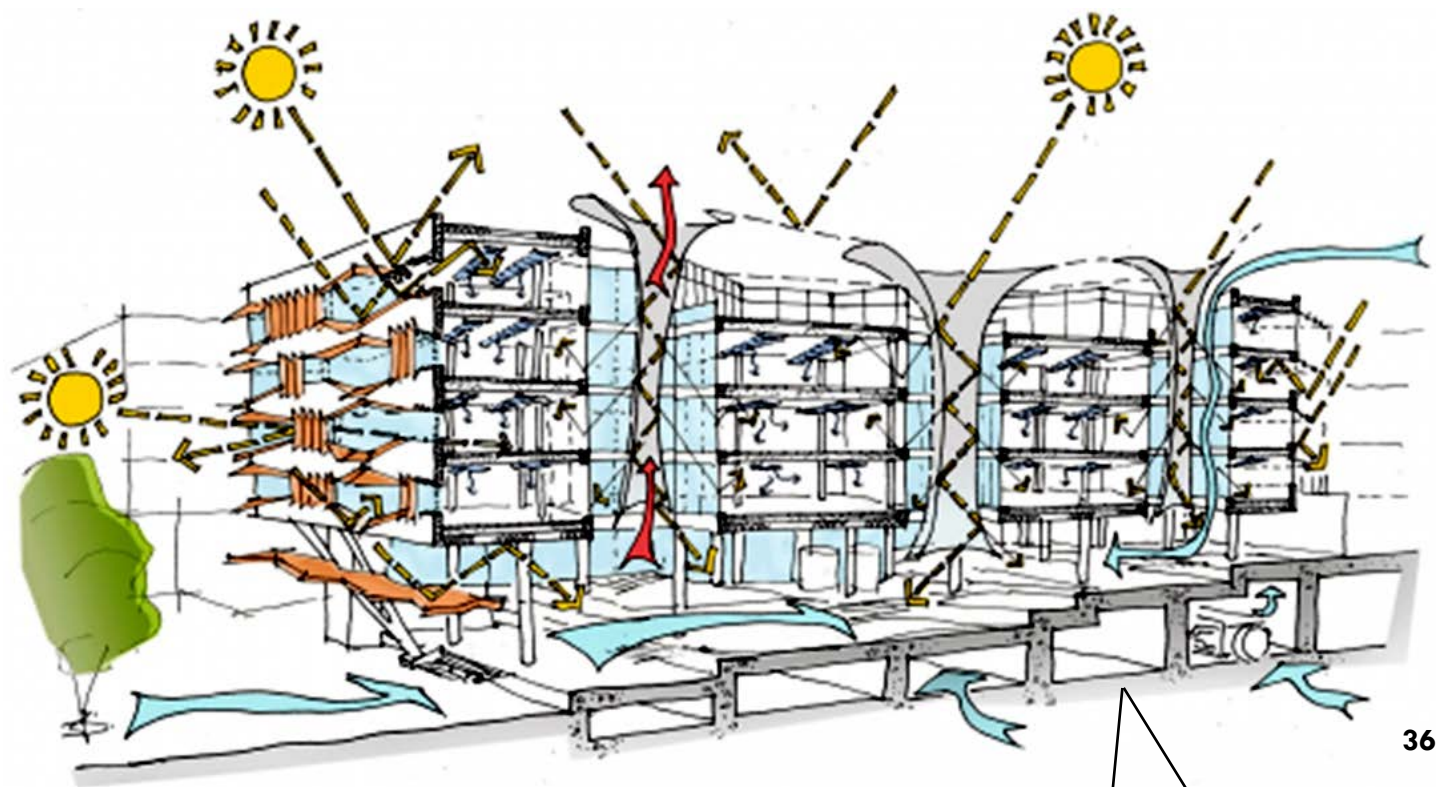
- Urban agriculture
- Flower Fields
- Compost Centre

Image 31, illustrates the distribution of the compost centre. It will be central to the urban agriculture areas to facilitate the transport and logistics.

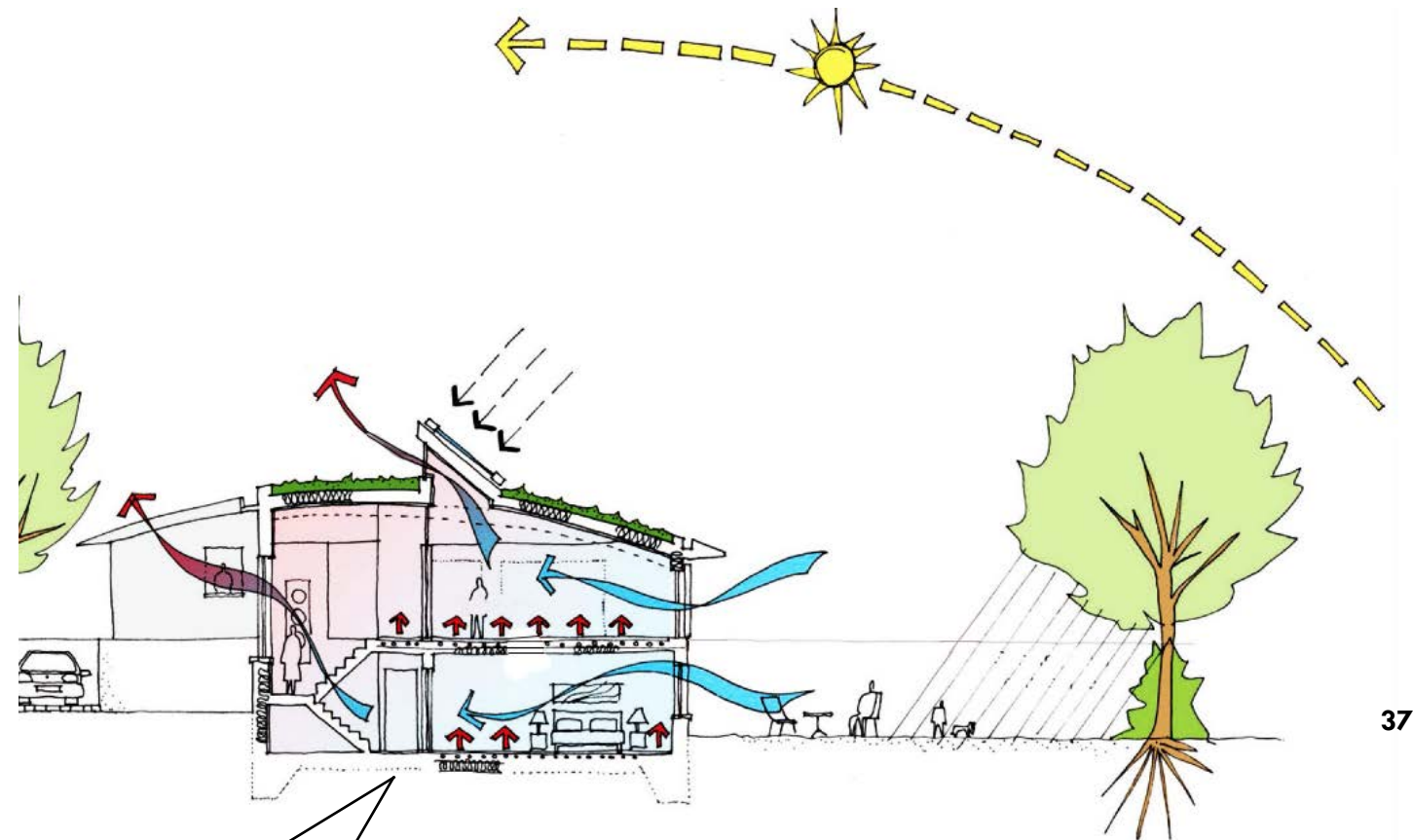
Image 32, shows how the urban agriculture will look like in the neighborhood scale. The connections and the coverage. With the food produce in one block (16 Ha), approximately **22%** of the people living in it (8.864) will have food. In total, will be around **1.900 people**.

Finally, the flower fields (image 33, 34 and 35) will keep the traditional recollection and distribution structure that Colombia has. The fields will have an area of 1.98 Ha in total and could have the production of two crops in one year. The flower fields not only will bring a landscape touch to the block but it will also generate a considerable amount of jobs.



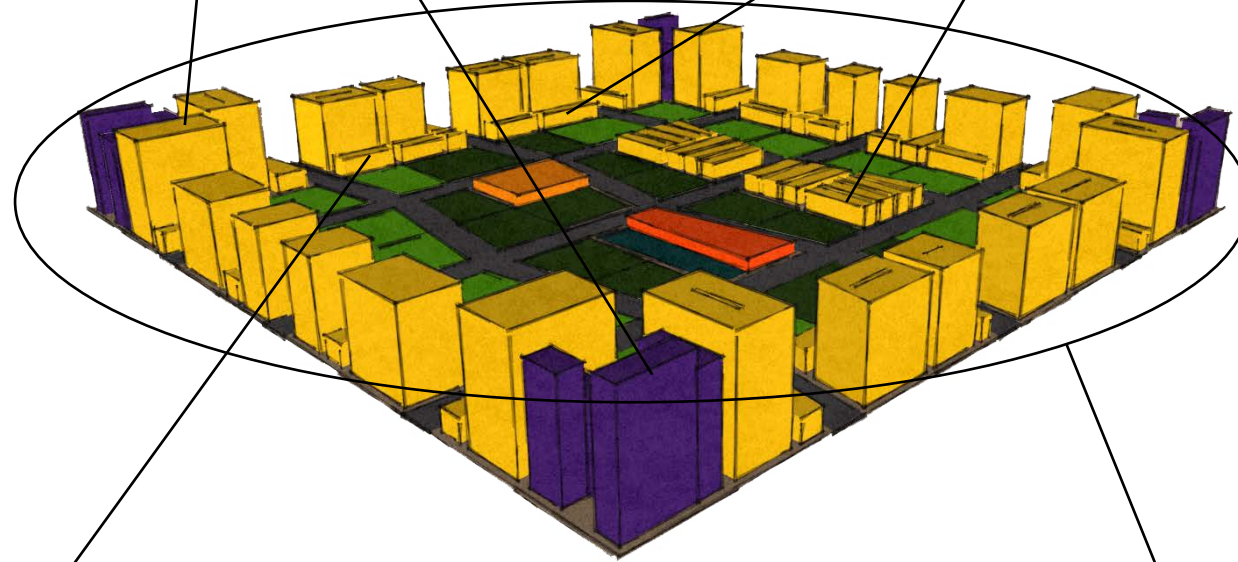


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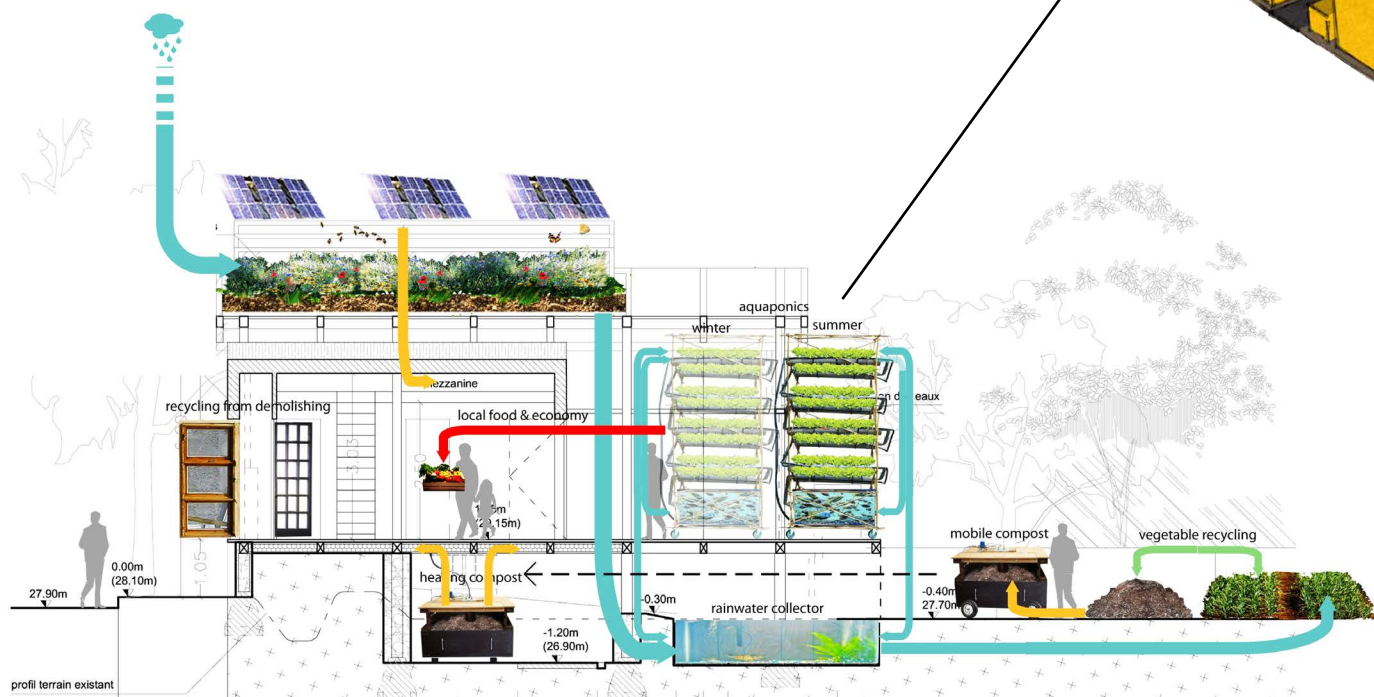
This page illustrates the technology implemented general in all the constructions, but especially in housing and facilities. In terms of recycling, solar energy, sustainable buildings in relation with the functions of compost production and urban agriculture.



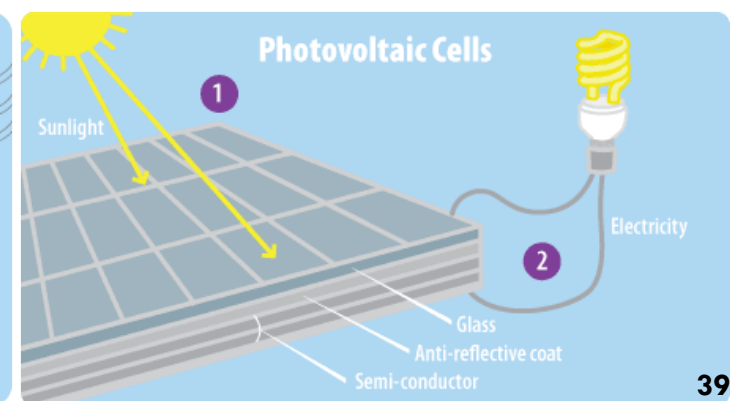
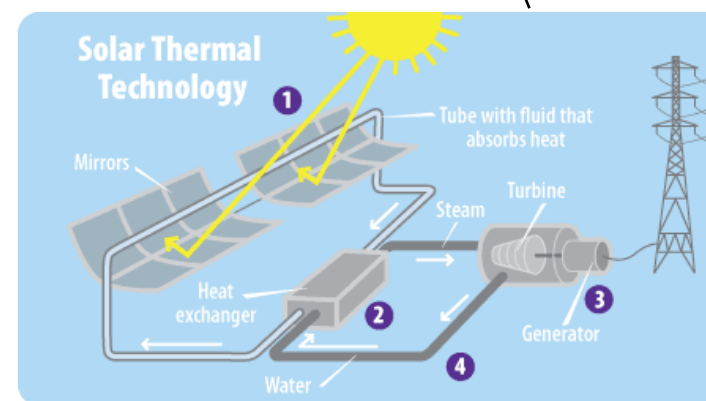
38

Image 36 and 37, show the possibilities present for the private sector (developers, investors and constructors) to build sustainable friendly in housing and business centres with wind and sun considerations.

Image 38 and 39, show the opportunities in housing and in general for the whole block to develop infrastructure for solar electricity and water storage. The calculations made for these issues will be worked further to create the optimum profile for the hybrid model in the region.



39



To conclude the hybrid model concept and the design contained in the square block system, it is important to highlight and don't forget the regional connection and improvement with this theory.

The development of a new model of governance based on examples, allow the development of the hybrid model in the Bogotá River Basin.

On the other hand, the planning innovation of the proposed authority for the river and the basin in general, gave considerable input for the final product. The validation of the gathered information let me prove or demolish certain issues involved in the planning of the territory and its future direction.

The territorial binding between social, economic,

recreational and environmental fields was a success in the design and its future sustainability.

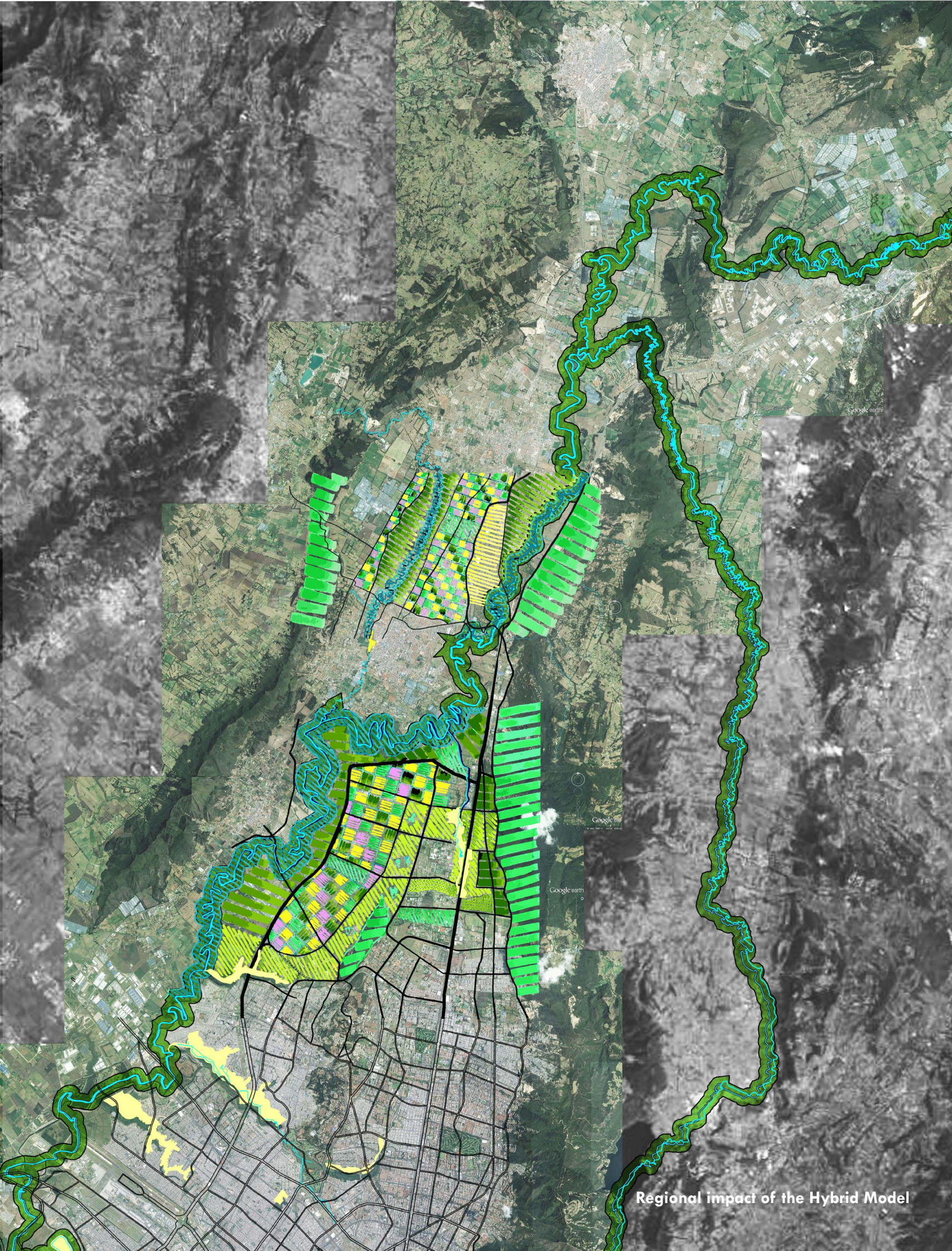
The map in the right shows the development of the Bogotá hybrid area in a regional level. The impact it could have and the connection with another hybrid area in the north between the municipalities of Chía and Cajicá.

The future interaction of these models will improve the ecosystem structure and the use of the natural resources. Transforming as well the river basin into a polycentric region.

The last scheme shows the improvement of the region with the river basin applying a sustainable model of governance, from this day to the year 2065.



Sustainable Hybrid Model



30 years

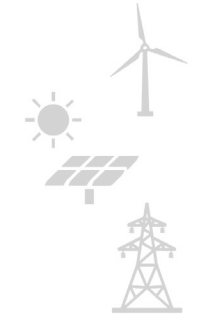
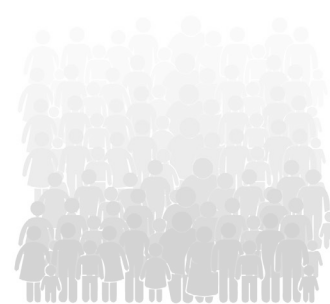
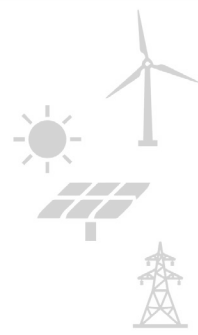
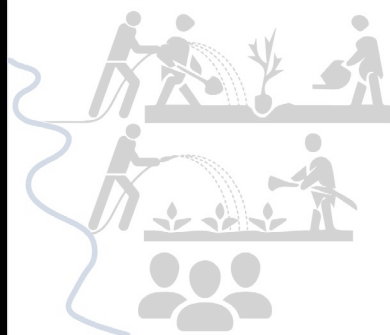
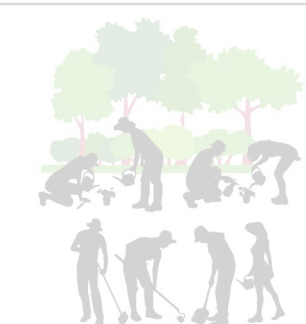
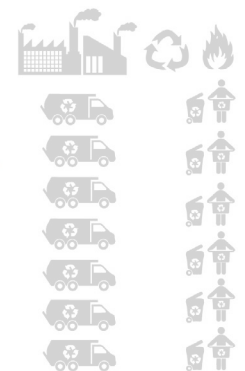
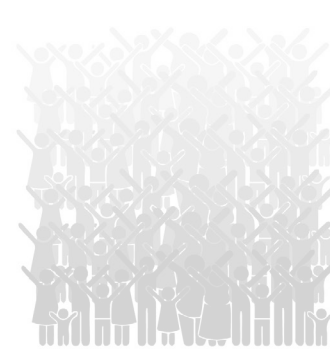
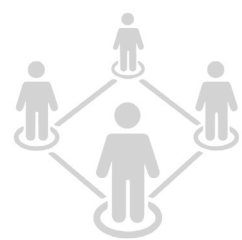
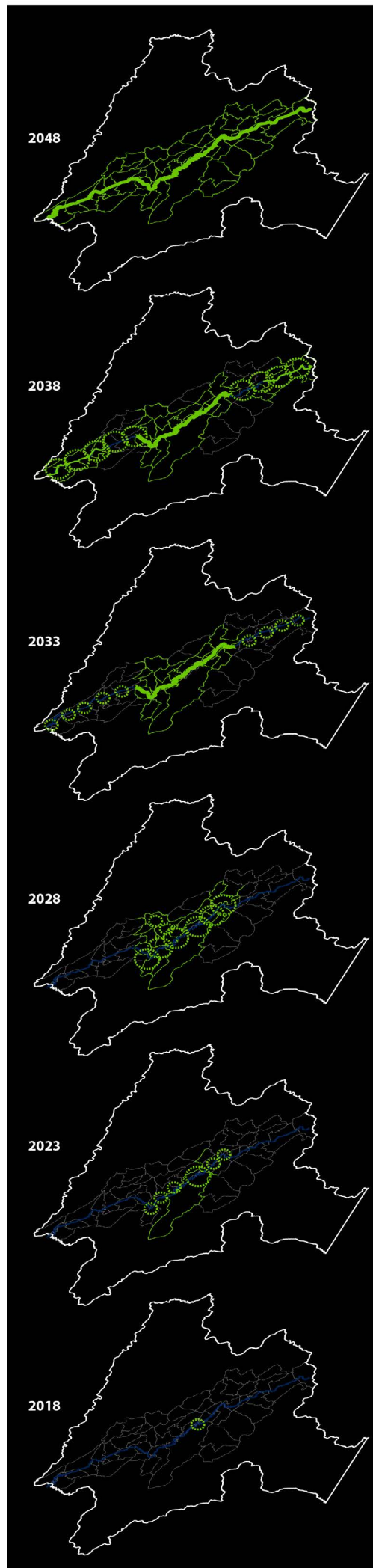
20 years

15 years

10 years

5 years

2 years



Farmers



Cattle Rancher



Hydroelectric
Company



Community



Environmentalists



Companies
and recyclers

Agriculture

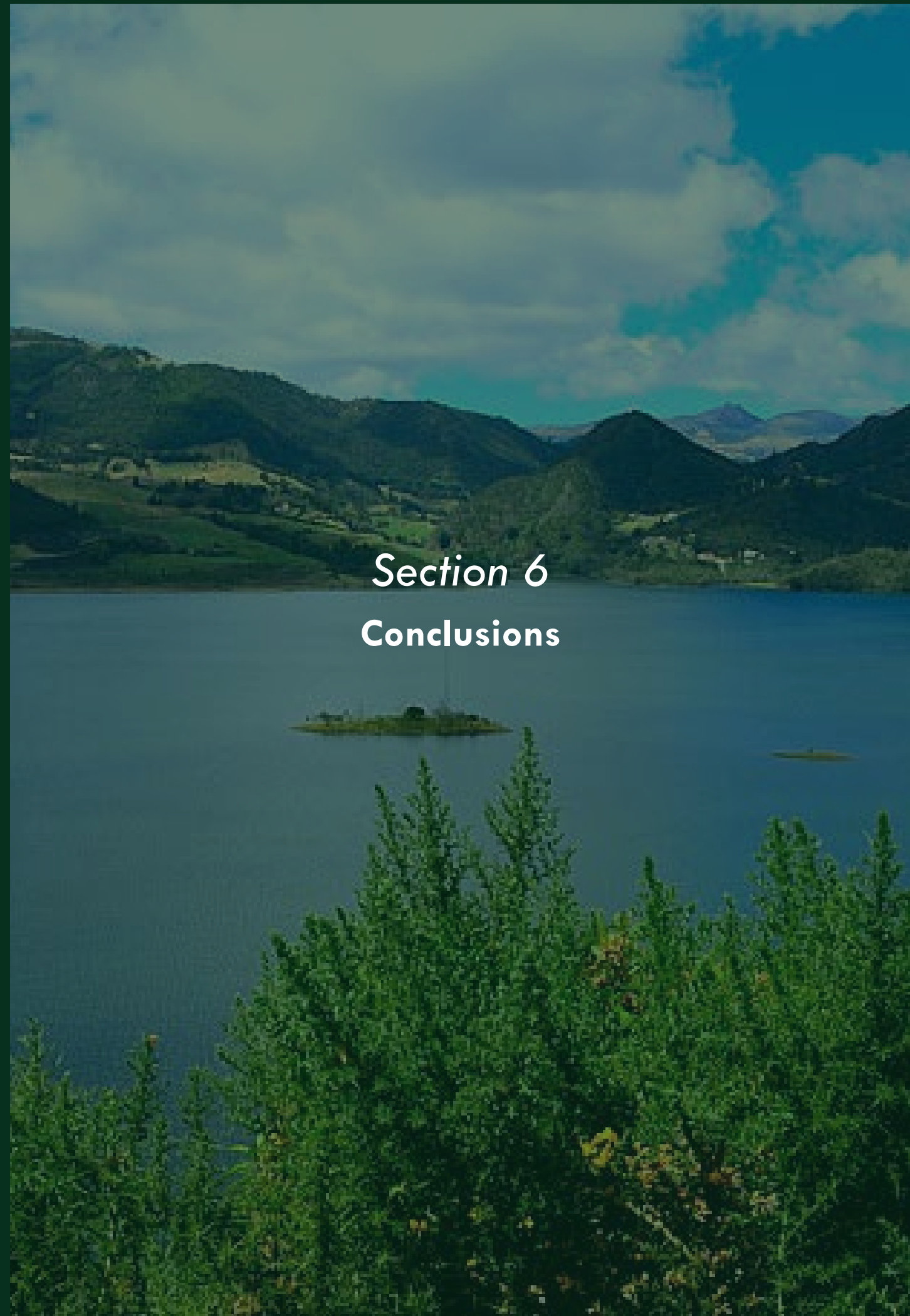
Livestock

Energy

Social

Environment

Waste



Section 6

Conclusions

Motivation- Social and Scientific relevance

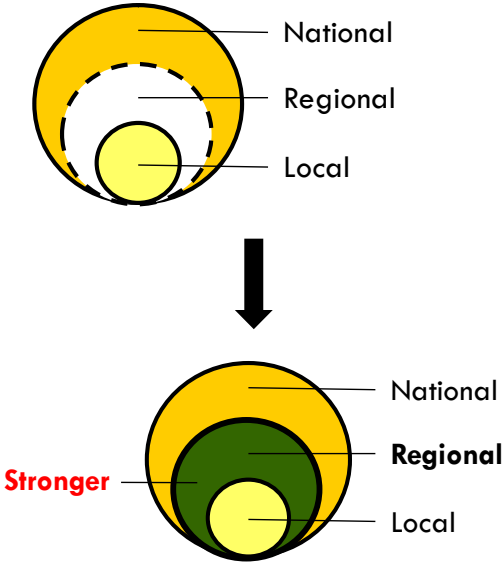
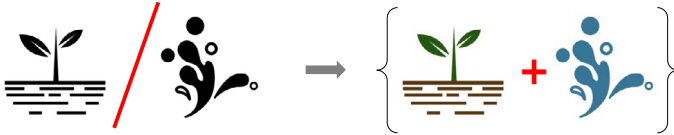
The principal motivation of this project in a **social perspective** is to stand out the importance of the Bogotá River and its basin for the people in the region. The magnitude of the explosion and contamination of the natural resources doesn't compensate the protection and balance in the recovery of the area. Contribute to the generation of a sustainable system structure for a healthier quality of life and improve habits for upcoming generations of people with the immediate context.

Prioritize and create interest in the generation of a sustainable system structure. **How?** Through the three activities that are highlighted in the right image (top).

On the other hand, for a **scientific relevance**, it is known that the Bogotá River has had a considerable number of studies and programs written for the protection and recovery of its structure, although none of them have been implemented. The quantity of those papers, essays or plans are not directly proportional to the efforts done in the defence of this environmental structure and its natural resources.

These documents have principally emphasized on the study of the water resource or the soil quality, but not in the joined natural system structure that includes both and other physical elements in this specific case. Overall they constitute the cycle by which human activities are benefit from.

Also, the lack of a regional law that covers the entire area gives as a consequence the actual situation: a national law that is not valuable and a local law that is accomplished by some of the municipalities around the river.



NATIONAL; LAW 2811 – 1974: Article no. 1

“El ambiente es patrimonio común. El Estado y los particulares deben participar en su preservación y manejo, que son de utilidad pública e interés social.”

“The environment is common heritage. The State and individuals must be involved in its preservation and management, which are of public utility and social interest.”

“La preservación y manejo de los recursos naturales renovables también son de utilidad pública e interés social.”

“The preservation and management of renewable natural resources are also of public utility and social interest.”

Reflection

Theme and case study relationship

The graduation project: From a Fragmented Territory to a Connected Network explores the overlapping of urban and rural areas, into one hybrid model of planning and governance. The development of the Bogotá River water structure and basin, into a sustainable system of inter-connected functions; ensuring the protection and restoration of the ecosystem in the river basin. The world has been increasingly modified by human activities. For this reason, the conservation of biodiversity is essential as insurance to maintain resilient ecosystems and ensure a sustainable flow of ecosystem goods and services to society (Angelstam, Bengtsson, Elmqvist, Emanuelsson, Folke, Ihse, Moberg and Nyström, 2003: 389). The Studio Complex Cities has provided the directives and guidelines through spatial planning and strategy. The appliance of them to my graduation project, have allowed me to comprehend, recognize and value the processes needed to work in different scales at the same time.

The project shows interest and awareness in the improvement of the model of governance and planning subject; that involves not only political or administrative structures, but also the conflict between urban development and the ecosystem. The rapid transition of the land use from urban to rural areas, has threaten future sustainability of the region. The Studio Complex cities have given me a strong theoretical framework connecting spatial planning and strategy to The Bogotá River Basin in Colombia; which is in need to be recovered and planned. The result, the Studio opens a lot of opportunities in different situations and contexts to work and research.

The project is motivated by the increasing contamination and deterioration of the natural resources in the Bogotá River and the surrounding territory.

Research and design relationship

The research of the project is based on: 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?

To accomplish the planning of the territory and a balanced model of governance for a sustainable region, it was needed to optimize spatial issues and elements along with government dynamics. The project conceived the idea that this should be achieved through the improvement of the relation human activities (urban development) and natural resources. The goal of the research was focused to find how rural and urban areas could overlap in determined strategic projects and balance the misuse and waste of the resources apart from the contamination of the river. In other words, recover the environmental structure. This was accomplished through the definition of the general objectives (specific research questions) of the project, and the design improvements were established in a square system of blocks (hybrid model).

The specific search questions were:

- **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?
- **ENERGY** - How to improve water and soil for energy generation?
- **WASTE** - How to adequate areas for waste management and treatment along the Bogotá river and basin?

It can be concluded, that all the questions were accomplished. Although the quantities in each of them (food, waste, energy and development) varied; and depended on the demands that were required.

On the other hand, the design improvements (square system of blocks - hybrid model) were defined with a specific mission: it was given through the union of a variety of aligned research: contamination / flows / government structure / infrastructure / densities / and landscape that were organized in a framework. The result was a regional toolbox which allowed the establishment and settlement of priority issues and planning guidelines to apply in the designed hybrid model. The spatial opportunities for the future of the territory by upgrading these key ingredients would not only develop and outstanding new framework, but also involved a considerable number of stakeholders.

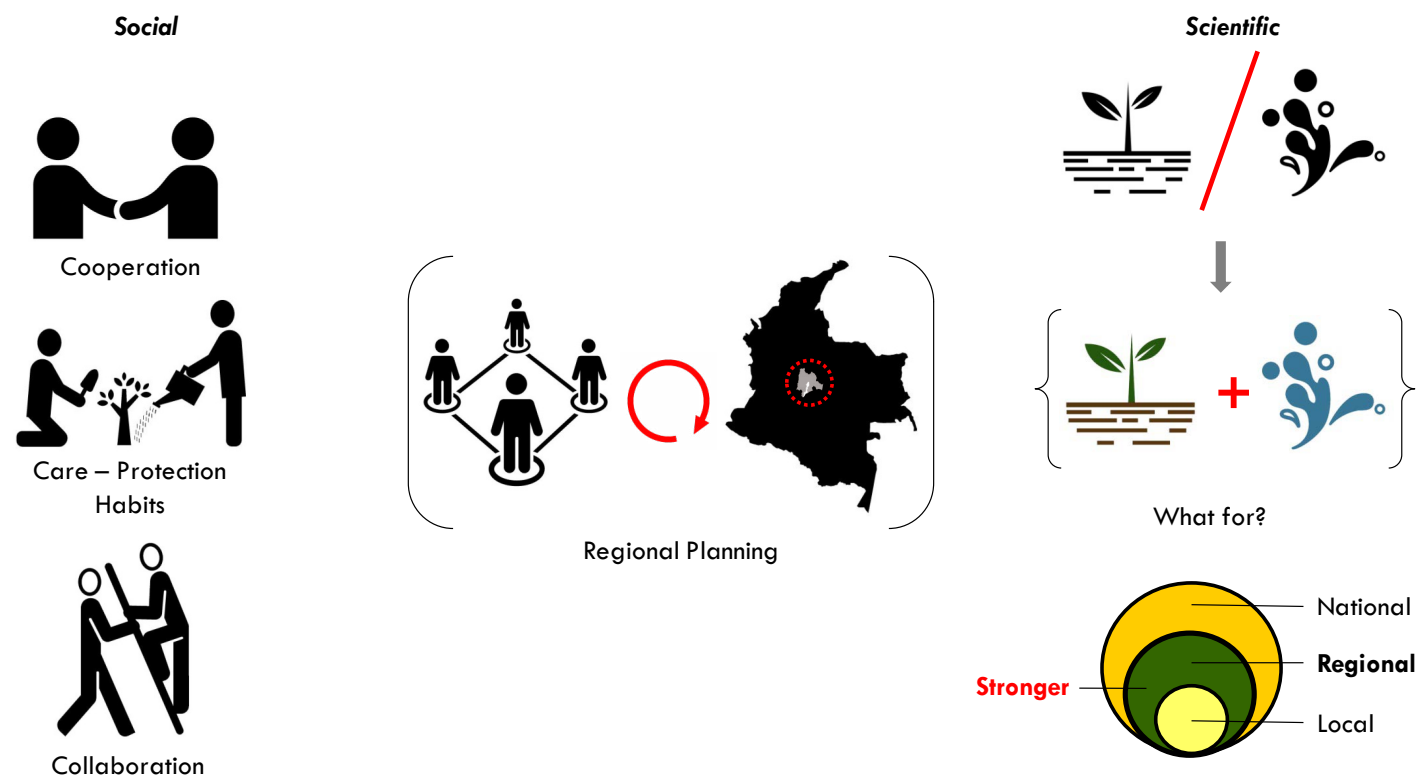
For this reason, it would be significant for the project to contribute to this body of knowledge in a more integral and sustainable way. In the research group - Complex Cities - it could give an approach of how thinking from the environmental field as starting point, could give another perspective in governance and strategic planning to apply different choices for the improvement of the Bogotá River.

The environmental field would be essential given that focuses on the needs of the population and damages

over the natural structure; instead of focusing only on economic problematics or urban growth.

Moreover, a more concrete connection with the research group - Complex Cities - could contribute with its planning methods in the regional strategy that I would like to approach.

What for? Well this will allow the generation of alternatives more in line with the planning of the territory. As a result, this is going to integrate the region with the Bogotá River and basin.

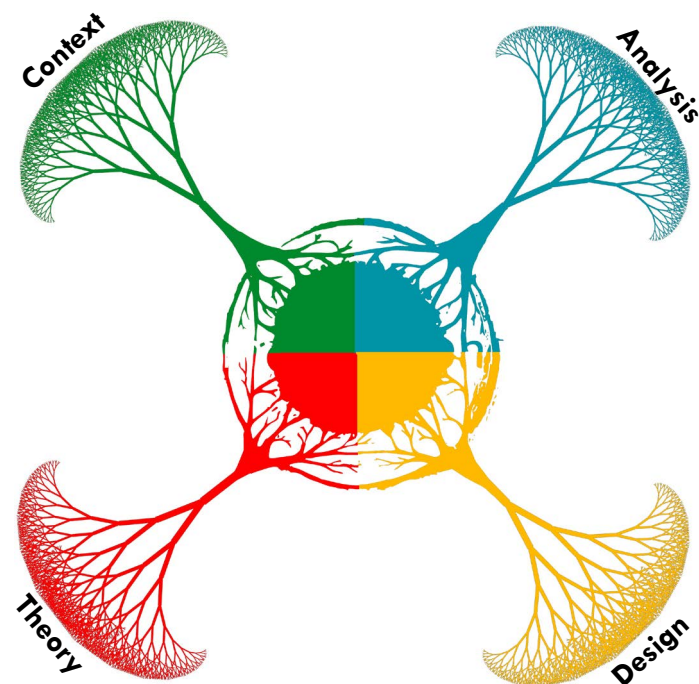


In the end, the optimum profile for the improved model of governance and planning was given to the result between the regional toolbox, the strengths of the territory and the design square system of blocks (hybrid model). This would be the best model to develop. The spatial strategy was applied in the land use and the result was that it reached the objectives established. It was due to the location between urban areas that had higher possibilities of conurbation which brought the perfect scenario to apply and develop the hybrid region concept.

Personal and Studio line of approach relationship

The methodology of the Studio approaches in the graduation project, through the exploration of regional and local scales. It gave a broader overview of the current situation in the researched field and the vision of the future scenarios at the same time. Understanding not only the social and economic context; but also the environmental field brought bigger possibilities of developing a more sustainable and self-sufficient productive landscape ecosystem.

The personal methodology was divided since the beginning in four branches: theory, context, analysis and design. These branches worked together overlapping along the complete process to develop a balanced



and coherent strategy and design product. Together, the personal and Studio's methodology, directed to the understanding of the environmental structure. Both of them worked simultaneously throughout the whole planning process. They helped to achieve the main goal, objectives, strategy and final design.

Graduation project and the wider social context relationship

The Bogotá River basin, both water and land, have been threaten by different factors such as: extensive food production, waste and energy generation. The biggest weakness confronted is involved with the government structure. The administrative division of the territory is only convenient for bureaucratic purposes; so the natural system structure is left aside in the black hole of consumption and destruction. However, the strengths and opportunities are contained in the wide biodiversity of the territory. The mountains and its topography help to provide enormous amounts of water to be consumed in populated areas. The fertile land and the variety of heights supply any possible need that the population could demand.

The preservation of the ecosystem and protection of biodiversity could not only improve the physical and mental health of the community, but also the planning and development as means to improve the territory.

The hybrid region is developed from a long-term perspective and the results will be evident in three principal achievements:

- Enhanced planning at the geographical regional scale.
- Recovery of the ecosystem structure.
- Involvement - Social inclusion and participation of the river basin population.

This is the reason why I propose with my project the opportunity and possibility of improving the existing situation. The distorted model could be upgraded in time with the development of a hybrid region; which would enhance the territory into a sustainable and self sufficient productive landscape ecosystem. The case study could be used as an example or showcase where the importance of the connection between consumption activities and the ecosystem is very important to avoid the fragmentation of the region.

Research Approach - Theory Paper

Governance and Development towards a sustainable exploitation of the Bogotá River Basin

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April 2016

Urbanism

Abstract- The Bogotá River in Colombia has the strongest economic potential and productive basin in the country (it represents around 5% of the GDP). The increasing necessity for food production, energy availability and urban development due to the demographic growth during the last two decades, has caused an excessive transformation of the regional ecosystem and contamination of the river.

The lack of commitment to protect the water and the environment, the abuse of natural resources for economic purposes and the absence of a solid governance model have caused a disconnection between law, planning and development. There is a lack of territorial planning in terms of environmental, social and economic integration.

The question that arises from this problematic is how to generate an integrated system between urban development, food production, waste management and energy generation, given the increasing pressure of urbanization and the need to protect the environment contained in the Bogotá River and its basin.

This paper will tackle the need for an improved model of development and governance for the river basin with its built and natural environment. It discusses the necessity to redefine and restructure the human activities (interventions on the territory such as agriculture and urban development), in order to improve the quality of the environment and the social life of the region.

Key words – environment, sustainability, river basin, urban development regional governance, model of development, strategic spatial planning

1. Introduction

For the last two decades, urban development has transformed the ecosystem in the Bogotá River basin. The industrial revolution increased natural resource exploitation, urban growth and pollution (Botequilha Leitão, and Sousa Ferreira, 2006: 150). The development of new technologies has intensified the use of resources without considering their exhaustion.

"In a world increasingly modified by human activities, the conservation of biodiversity is essential as insurance to maintain resilient ecosystems and ensure a sustainable flow of ecosystem goods and services to society" (Angelstam, Bengtsson,

Elmqvist, Emanuelsson, Folke, Ihse, Moberg and Nyström, 2003: 389). As it is stated in the previous quote, from the article of the Royal Swedish Academy of Sciences, it is crucial for the wellbeing of society that a sustainable management of the ecosystem's natural resources is carried out.

Many sources point out the same conclusion, as visualised in Figure 1, for instance in the article Biodiversity concepts and urban ecosystems, it is stated that "more people live in cities; restoration, preservation and enhancement of biodiversity in urban areas become important" (Clergeau, Mennechez, & Savard, 2000: 131).

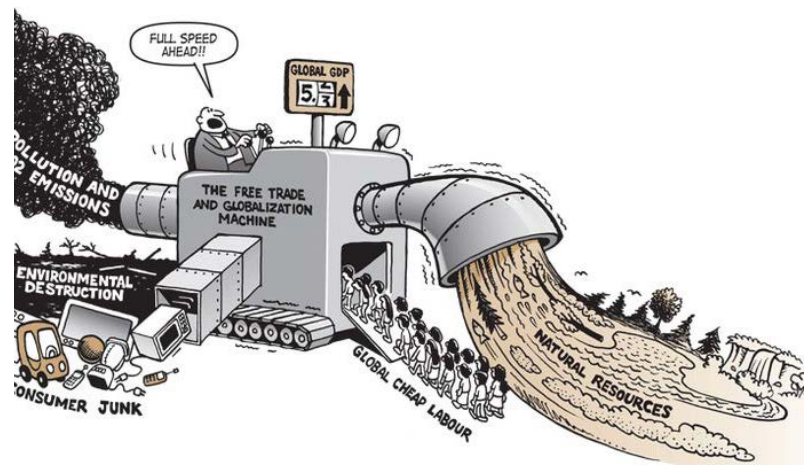


Figure 1: The picture shows the general concept of the degradation of the natural resources and the contamination progression.

Source: <https://www.pinterest.com/ateamb/globalisation-and-the-environment/>

My research is inspired by the work of Professor Thomas Elmqvist. As researcher at Stockholm Resilience Centre, he addresses the conflicting role between ecosystems, human activity and the role of governance. In his work *Cities and Biodiversity Outlook*, he talks about the world's first assessment of biodiversity in cities and highlights the importance of biodiversity contained in cities. He illustrates how innovation in the transition to sustainable processes is fundamental and essential in environments life expectation (Elmqvist, 2013: 635).

In Colombia, like in other countries, the main cause of excessive use of natural resources is human activities, related to economic production. The current situation shows that rivers near cities are being channelled and contaminated due to the pressure of urban development, and as a consequence, the pressure over the rural landscape is putting the territory and the ecological structure of the country in a dangerous position. In the case of the Bogotá River basin, both water and land have been threatened by different factors such as extensive food production, waste and energy generation. For example, in the year 2009, food production (agriculture) used 49% of hectares of the total area in the river basin.

Moreover, the administrative system of the territory has not applied strong policies, with the objective to articulate a coherent spatial logic for land use regulation and resource protection. The eroding influence of national party politics in the local political organisation (functional/sectoral) has broken governance relations (Albrechts, Healey and Kunzmann, 2003: 113-114). This has disabled programs and actions to take over the sustainability of the ecosystem's future.

In this context, the issue I want to tackle in this paper is the indispensable need for an improved model of development and governance. It can be

translated spatially into a strategic vision for the territorial development and the capacity of creating strategic interventions at the urban and regional levels. As stated in the theory of Albrechts, Healey and Kunzmann, the focus on the spatial relations of territories embraces the guarantee of a more effective way of integrating economic, environmental, cultural and social fields (2003). In other words, a sustainable and self-sufficient productive landscape ecosystem, that is planned by considering short, medium and long-term development for the future.

At this point, there are four questions that arise from the context of the current government: 1. How is it possible to generate an integrated system between urban development, food production, waste management and energy generation? 2. How to do it without damaging the environment contained in the Bogotá River basin? 3. In what way could it respond to the increasing demographic growth? 4. How could this proposal build a realistic scenario which is linked with the governance configuration?

In order to address all these issues, this paper is divided into four sections. Section 2 presents the current situation in the Bogota River basin. Section 3 examines some examples of successful new forms of regional governance. Section 4 discusses how these examples can be applied in the river basin in an innovative proposal. And finally, the conclusions give recommendations for a planned transformation and implementation.

2. The problematic in the Bogotá River Basin: law, pollution and exploitation.

In the following section, I will introduce the main problem that the Bogotá River basin and the natural resources in Colombia are facing. Colombia has

a National Law to ensure and protect the ecological biodiversity of the country which includes ecosystems with their natural resources and water structures. This act number 2811 in existence since 1974 claims in its article #1: *"The environment is common heritage. The State and individuals must be involved in its preservation and management, which are of public utility and social interest. The preservation and management of renewable natural resources are also of public utility and social interest."*¹

As will be explained below, the complex structure of the government renders this law useless. And even though it is present in the management of the Bogotá River basin, it is not implemented due to the economic benefits derived from the land use. There is a need to build strong spatial organising concepts and persuasive institutional alliances to carry a strategy across a diffused power context (Albrechts, et al., 2003: 127). Strategic spatial planning is a key component of political and administrative efforts in city regions to guide their development processes (Albrechts, et al., 2003: 116). Therefore, the spatial structure plan that is proposed, aims to provide structuring principles capable of imposing some order on the currently perceived chaos (Albrechts, et al., 2003: 121). There is an urgent need for the transition from a traditional regulatory land use planning system to the provision of a strategic framework. This would mean a shift from the practice of allowing dispersed development to the concept of managing growth according to sustainable development principles; and from rather closed processes to more open processes involving larger numbers of stakeholders (Albrechts, et al., 2003: 116)

On the contrary of what is stated in this national law, the impulse of demographic growth constantly requires the provision of supplies, which translates into the transformation of natural ecosystems into productive areas. Because of this, the conflict between human activities and the use of natural resources is growing every day. According to Guerrero Legarreta (2010: 121) the rivers become sewers; wetlands are drained and filled with urban development; marshes turn into output fields establishing livestock and agriculture. The impacts are so disastrous in the Bogotá River basin that human activities are defined as "the destructive hand" (Guerrero Legarreta, 2010: 123).

As it is stated in the national law previously mentioned, the preservation and management of renewable natural resources are of public utility and social interest. This means that natural resources should provide benefits to all inhabitants equally,

and for this, a balanced use of them is needed. In the case of the Bogotá River Basin, which has the most fertile and productive soil of the country as well as a large biodiversity, it is seen that there is a high exploitation of the land only for economic purposes, which is not taking into account the sustainability of the natural system.

Cities have grown immensely without planning, which has created not only problems for the natural resources but also with respect to the social dimension in every populated area in the Bogotá River basin. It is essential to maintain and protect the biodiversity of the river basin for a sustainable future of its surroundings, including the populated areas. The results of my research show the need for the water and environmental structure of the Bogotá River basin, to recover.

3. Best practises in Regional Governance

The following section highlights three European projects of regional governance that will be exposed as potential examples of how to pass from a long-term successful planning to a sustainable structure and recovery of the ecosystem. The reason because these examples were chosen, was because they applied spatial strategies in order to improve social, environmental and economic aspects.

The first example deals with the regeneration of the Emscher River, also known as Ruhr Region Basin in Germany. It was one of the most polluted and environmentally devastated regions of the world. There was a conflict between environmental and development goals. The main objective was to encourage the ecological, economic and urban revitalization of the Ruhr Valley and the Emscher River. This aimed to re-establish connectivity between green spaces creating a robust ecological system, converting a post-industrial district and housing sewer into a recreational area.

The main idea was the conception of a green connector with a cohesive green infrastructure. So the new model of governance was changed, transforming the region into a polycentric urban development which was more sustainable: known as sustainable - oriented regeneration.

The second example, the Zuidvleugel or "south wing" is the group of cities and towns in the south-west of the Randstad in the province of South Holland in the Netherlands. They have one principle: co-govern-

1. Secretaria General de la Alcaldia Mayor de Bogotá D.C., (1974). Decreto 2811 de 1974 Nivel Nacional. Retrieved August 31, 2015, from <http://www.alcaldia-bogota.gov.co/sisjur/normas/Norma1.jsp?i=1551>

ment. “The central government involves the provinces, the municipalities, or both in the formulation and implementation of its policies.”(Spaans and Stead, 2013: 8).

In this model of governance, the city regions are called Joint Arrangements Act Plus. These areas are characterized by having one large city surrounded by municipalities that share or become part of a single urban system. These city regions have responsibilities over fields that cover environment, transport, housing and regional economy.

The third example, the community of communes of Val de Drôme brings together thirty municipalities of the Drôme Valley located in the region Auvergne-Rhône-Alpes in France. The community has three missions: sustainable & distributed development, enhanced solidarity and environment quality. It also involves spatial planning, protection of the environment, economic development, sports facilities, social & cultural activities and social housing policies, among others. The model of governance focuses on development, maintenance and management of the priorities and needs of the province.

The three examples and the statements previously mentioned, contribute to the structure plan of the new planning institution proposed in this paper, the Bogotá River Basin Development, Planning, and Protection Authority through strategic spatial planning.

The takeaway from the Emscher River project is the recovery of the environmental ruin and the ecological structure through a sustainable green infrastructure connector and the incorporation of the future scenarios in their model of governance. Ecological principles began to be included into planning as a result of an increased environmental awareness motivated by general environmental degradation and increasing urban sprawl and industrial development (Roberts and Roberts 1984; Ndubisi, 1997; Botequilha Leitão, and Sousa Ferreira, 2006: 151).

From Zuidvleugel project, the lesson learnt is the principle of co-government to achieve a balanced and coherent coordination in spatial planning, as well as its economic, social and environmental responsibilities. The article Strategic Spatial Planning and Regional Governance in Europe stated, that the spatial concept balanced development offered a development focus across the regions of the EU. This general approach is developed through concepts of polycentric development, redefining urban-rural relations, securing access to infrastructure and knowledge and at the same time promoting more compact

development and resource conservation (Albrechts, et al., 2003: 115).

From Val de Drôme, the priority was focused on the community and environmental value for the improvement of the quality of life. The potential is to produce principles of spatial development through strategic spatial planning. It is evident in the production of the European Spatial Development Perspective (ESPD). The document articulated the sustainable development ideal in a way that combined the EU’s objectives of economic competitiveness, environmental sustainability, and social cohesion (Committee for Spatial Development [CSD], 1999; Faludi & Waterhout, 2002; Albrechts, Healey, and Kunzmann, 2003).

For this reason, the ideal model of development and governance, balancing natural resources, human activities, and government structure, is a spatial strategy applied through the implementation of a “hybrid dynamic”, a term created in my research and that I will explain in the next section through the theory urban-rural linkages. It will be based on a measured and more sustainable use of the resources, by developing a framework that will transform the region from a fragmented unsustainable dynamic into an incorporated sustainable system. This will generate employment that will result in economic development for the region and in a good quality of life for the people living there. The three examples and regional governance statements built the necessary arguments to develop the hybrid model on a regional scale in the Bogotá River basin. In the following section, I will explain how the framework mentioned before, as I call hybrid region, could be developed.

4. A new planning institution: Bogotá River Basin Development, Planning, and Protection Authority

I will explain how the proposal of the planning institution could work, based on the theory of urban-rural linkages.

The overlap between rural and urban areas, generating a third area called hybrid, which can be seen in Figure 2. The United Nations Conference on Housing and Sustainable Urban Development stated that urban and rural areas depend on each other. Urban areas depend on rural areas due to a range of goods and services: food, clean water, environmental services, and raw materials, among others (Habitat III Issues Papers, 10 Urban-Rural Linkages, 2015:

3). The explanation of the hybrid dynamic could be linked to the theory “urban-rural linkages”. This refers to complementary and cooperative functions in flows of people, natural resources, capital, goods, employment, ecosystem services, information and technology between rural and urban areas (Habitat III, et al., 2015: 1).

As an example of how this mutual relation can work, the hybrid region will be represented in a planning institution and a spatial framework, which will show the new model of governance and development of the Bogota River Basin. This spatial regional structure plan is shown in Figure 3. The framework of the hybrid spatial strategy is located in the areas more

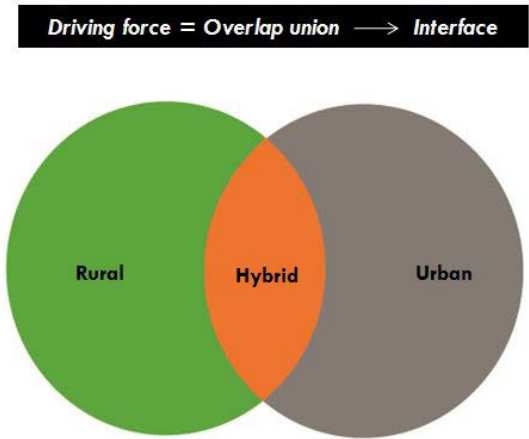


Figure 2: Scheme hybrid dynamic. Source: Scheme by author.

Nolan and White (1984) suggest that the urban-rural relations (hybrid dynamic) should be structured to reflect one principle: “Urban-rural relationships should change from being exploitative to mutually beneficial” (Funnell, 1988: 270). The partnership between urban and rural areas develops the cooperation to reach common and sustainable goals (Habitat III, et al., 2015: 1).

likely to present future conurbation between rural and urban areas (yellow circles).This principle will be applied in strategic projects along the river basin, implementing the hybrid mission concept protecting the ecosystem of the Bogotá River and land. Also, it will generate a more sustainable dynamic between the use of natural resources and human activities.

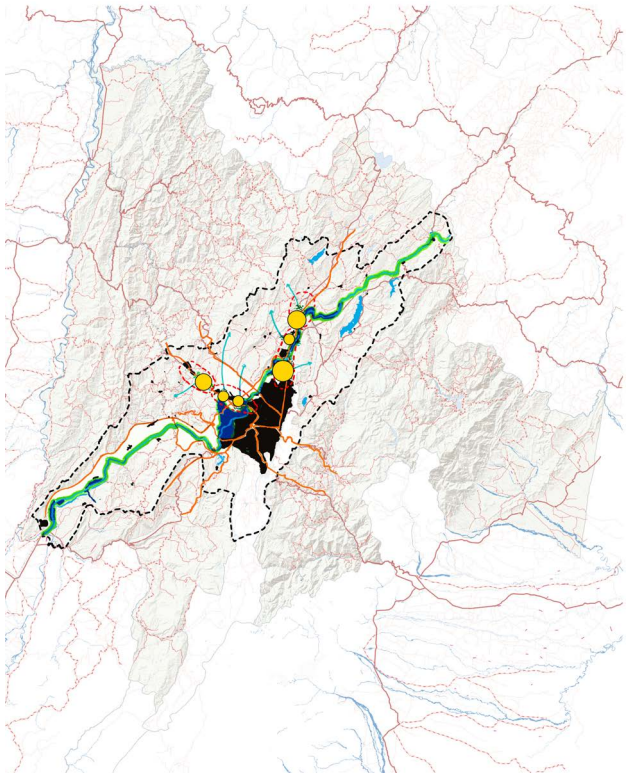


Figure 3: Map hybrid spatial strategy on the Bogotá River basin territory. Source: Map by author.

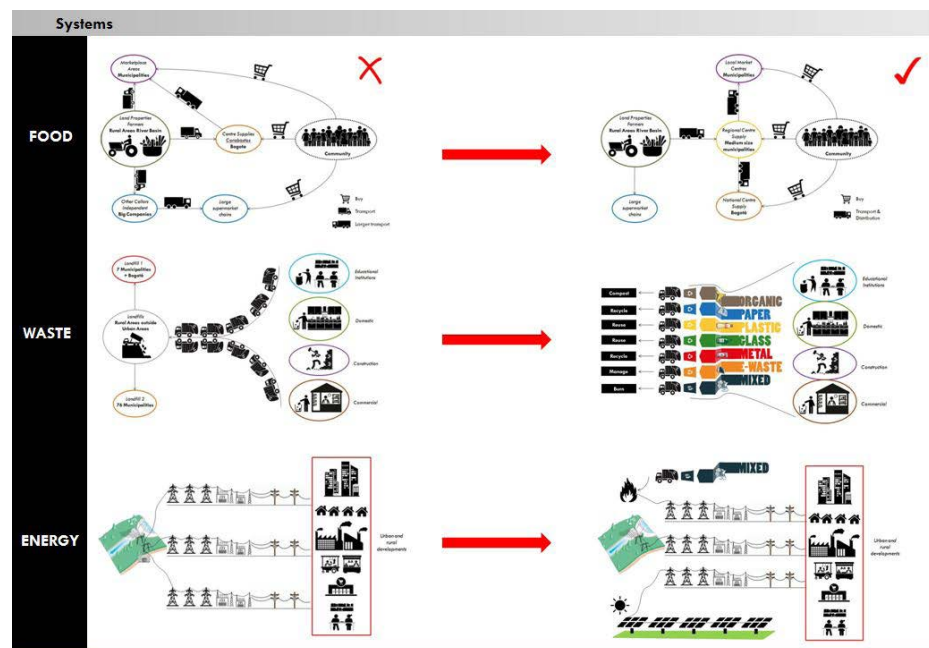


Figure 4: The hybrid mission outcome: inclusion of three flows: food, waste, and energy.
Source: Image by author.

Ecosystems are needed for the production of food, the generation of energy and the significant quality of life of the population. They are beneficial to humans and all living things, and they provide services, which need to be used in a conscious manner. The hybrid mission will be developed with the inclusion and overlapping of three flows: food, waste, and energy. In Figure 4, the illustration shows how it could work, enhancing the regional network and the outcome to generate sustainability with the increasing population growth.

Through the development and implementation of a new planning institution, a spatial framework can be built in relation to the existing governance structure. The proposal of the organization concept of the river authority (see Figure 5) will be based on the hybrid mission (spatial regional strategy). The transforma-

tion of the river basin into a productive landscape ecosystem: sustainable and self-sufficient.

The concept is based on the fact that the river does not respond to an administrative system in the current situation; although the river works as a natural system structure. This way, the institution would be responsible for restoring the river system structure, binding social, agriculture, waste, energy and environmental issues. Furthermore, the actual lack of government contribution over the regional scale in this issue; presents the opportunity to widen governance relations and incorporate new local community stakeholders (Albrechts, et al., 2003: 114). The community participation is highly valuable for the foundation of the planning institution.

The stakeholders (see Figure 6) involved in the creation of the planning institution are the peo-

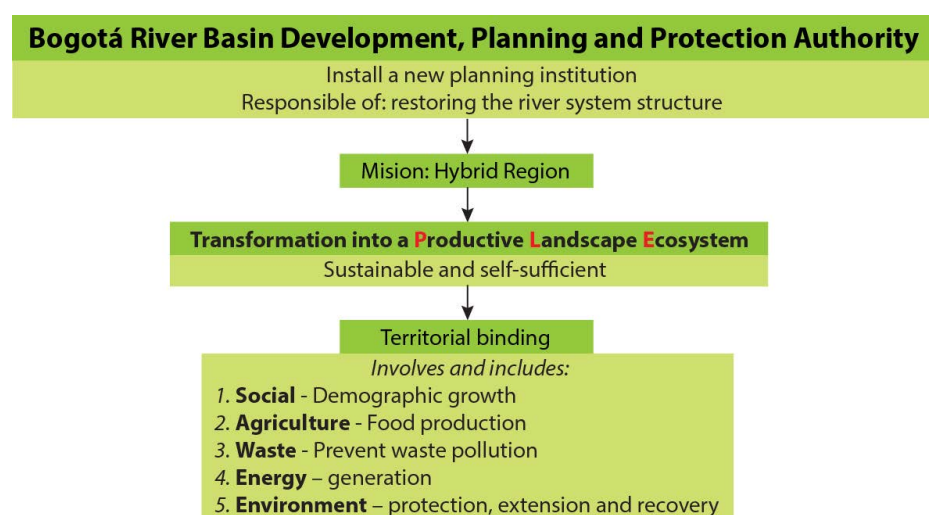


Figure 5: Development and location of the planning institution.
Source: Image by author.

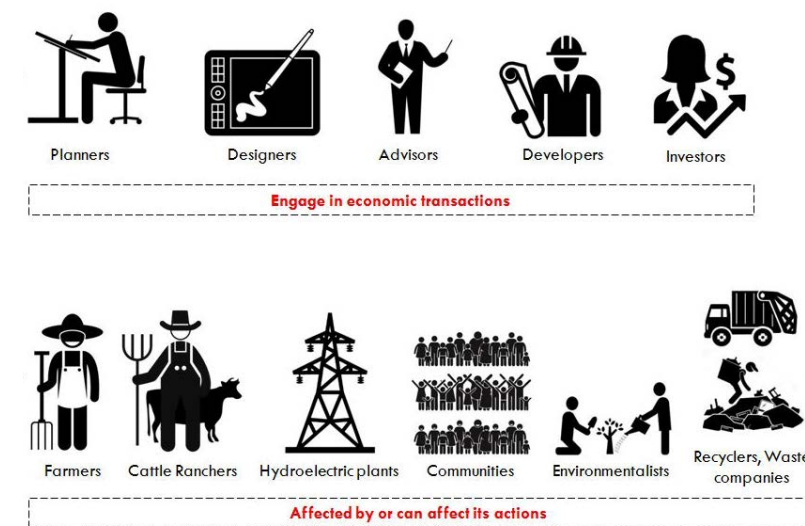


Figure 6: Stakeholders.
Source: Image by author.

ple involved in the flows previously mentioned; and will range from planners to investors.

There are two types of members: core and peripheral. The core member groups have physical con-

proximately two years. First, local scale, then organization of assemblies on the regional scale and finally the establishment of the general assembly in the river basin scale. After the initial two years, the development of the territory will be planned to take

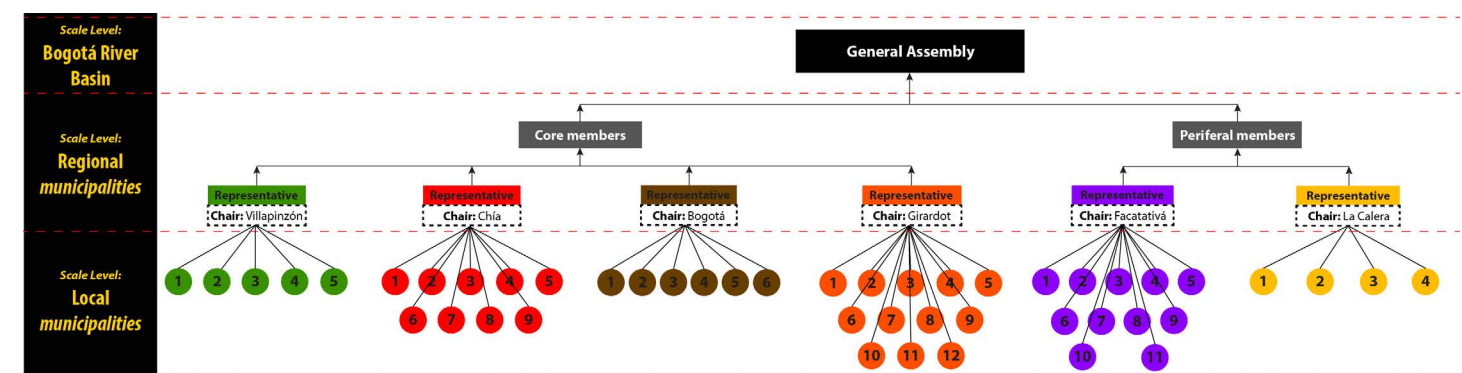


Figure 7: Planning institution internal distribution.
Source: Image by author.

tact with the river, whereas the peripheral member groups don't. In figure 7 is shown, that every group and the municipality has one representative in the internal structure of the planning institution. There are three scale levels interconnected. Local with municipality representatives; regional with the six groups representatives and River basin scale level for the general assembly where internal and external stakeholders make the final decision making. How is the planning institution going to work in short, medium and long term? The first initiative is to contact external stakeholders such as farmers, cattle ranchers, hydroelectric plants, communities, recyclers, waste companies and environmentalists and introduce them to the planned project.

The following step is related to the foundation of the institution, which will be done in ap-

place over a span of thirty years. For the first fifteen years, the focus will be the complete recovery of the ecosystem and for the next fifteen years, the social interventions will complete the whole vision.

As it was stated in the article Strategic Spatial Planning and Regional Governance in Europe, the spatial strategies are not only long-term orientation scenarios. The shift in governance cultures is itself a long-term process. But the hope is that the areas of the river basin, through the implementation of the new planning institution, are going to be able to achieve a transition to creative and flexible spatial strategies. The ambition is realising an open, innovative, and collaborative governance practice, which will translate into a sustainable environment and an improved quality of life (Albrechts, et al., 2003: 128).

5. Conclusions

Innovation and coexistence

Every day more water is needed for consumption, for agriculture and generation of energy; more land is needed for production and cultivation of food, but also for landfills and storage of waste in an unsustainable way.

In populated areas, in this case, the Bogotá River basin, the implementation of a sustainable model of development and governance, brings with it the opportunity for innovation, authority influence and support. As Thomas Elmqvist stated, the innovation lays not so much in developing new infrastructural technologies but to work with what we already have. The results are often far cheaper and more sustainable as well (Elmqvist. 2012).

Also, he stated that ecosystems, biodiversity, and urbanization are related and need to coexist. Cities have enormous potential in taking better advantage of the biodiversity located in, around and flowing through them (Elmqvist. 2012). He suggests that urbanization should be managed in a more sustainable way to protect the environment.

Hybrid region planning and development principle: river ally and ecosystem's conservation

The preservation of the ecosystem and protection of biodiversity could not only improve the physical and mental health of the community, but also the planning and development as means to improve the territory. The hybrid region is developed from a long-term perspective and the results will be evident in four principal achievements:

- Enhanced planning at the geographical regional scale.
- Recovery of the ecosystem structure.
- Food production, waste generation and energy consumption improvements.
- Involvement - Social inclusion and participation of the river basin population.

The product of this essay helped me understand the dimension of the problem and the different scales that are involved. The water system should be taken as an ally of planning and development, not as an enemy that is disturbed across the territory. It is part of the ecological structure. The regional planning scale allows to focus in the ecosystem structure, taking care of the conservation of natural resources, flood control, and broad economic and governmental problems (MacLean Lewsi, Wiley, and sons, 1949: 116).

Planning Institution goal

With the establishment and empowerment of the planning institution in the territory, the goal shown in figure 8 will be accomplished, leading to a progressive future and conscious use of the natural resources.

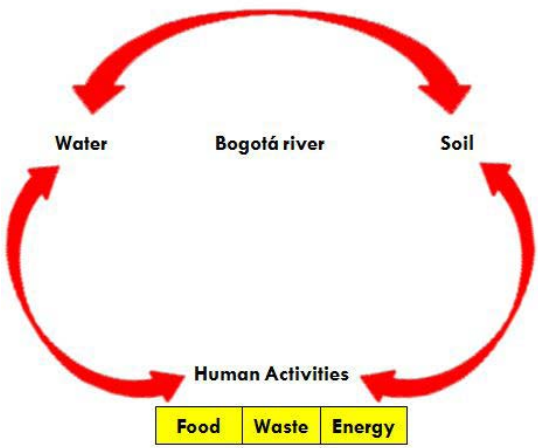


Figure 8: Hypothesis: responsible consumption/sustainable.

Source: Image by author.

Future Vision

Finally, my vision of the Bogotá River basin is focused on creating a positive potential of the region, combining environmental, social and economic objectives in the spatial structure of the territory as well as develop investment programs and more participation of stakeholders. The first defined by Albrechts, Healey and Kunzmann (2003: 114) as sustainable development; and the second territorial development.

The two concepts aim to:

- Stop the deterioration of the environment
- Change the existing attitude of influential stakeholders towards planning, by establishing a new planning culture and shifting from passive planning towards a more action-oriented form (Albrechts, et al., 2003: 121).
- Introduce sustainability principles
- Integrate more actors in the planning process
- Give an alternative to the spatial demands in recreation, agriculture, infrastructure, and housing, among others.

The encouragement of stabilizing and improving the previous five points above, in the hybrid mission, will be a fundamental point to be examined in the future design and planning of the territory.

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