ECOLOGICAL REMEDIATION

ECOLOGICAL REMEDIATION
An urban landscape strategy for Guanajuato

COLOPHON

Author |
David Aldana Trujillo
5095018

First Mentor |
dr. ir. Nico Tillie

Second Mentor |
Prof.ir. R.J. (Rients) Dijkstra

Department of Urbanism
Studio |
Urban Ecology and Eco-cities
MSc Urbanism
Faculty of Architecture and Built Environment
Delft University of Technology
Delft, The Netherlands

P5 Report
09/15/2021

TU Delft Department of Urbanism
BK Bouwkunde

Acknowledgments

Many characters played an important role during the process of this thesis project. They were the ones who helped me overcome the challenges, stress, long hours of work, while at the same time, they guided me, supported me and taught me how to move forward to the completion of the project.

Starting with my mentors:

To Nico, thank you for introducing me to the diverse landscape concepts and showing me how everything around us works as one system and the need to take care of it. You opened my eyes by showing through practice that no matter the scale, place or idea, it is worth fighting for nature and its integration with the urban context.

To Rients, I am incredibly grateful for the time and effort you spent with me and on this graduation project. Those long talks, design sessions and much-needed comments helped to develop this project. Thank you for pushing my limits to the max and giving me the tools, tips, and knowledge to complete the thesis.

To Carie and Adib for turning on that passion within me through example, teaching and experiences throughout the world. You have been vital in this process. Thank you.

To my friends:

Thanks to Jackson, Hadrian, Jort & Gab for the shared experience and long work hours, teaching moments and learning together.

A Nacho y Xime, gracias por todo el apoyo que me dieron durante mi tiempo en México ayudándome con la documentación del sitio y el material requerido. Gracias.

Rafa, por todas las horas de compañia en nuestras sesiones de trabajo, por todas esas largas platicas que me hacían distraerme de la tesis y por todo el apoyo que me brindaste en los momentos mas difíciles. Gracias.

Jorge and Damian, por todos esos kilómetros, platicas y vivencias que hicieron de esta experiencia una verdadera aventura. Gracias.

To my family:

A mis papas Alejandro and Hilda y mis hermanas Vanessa Y Stefania. No encuentro las palabras para agradecerles todo lo que me han brindado en todos estos años. Voy a estar siempre agradecido por todo el apoyo que me dan todos los días para que pueda seguir adelante con esta aventura, por constantemente darme el coraje, determinación y fuerza avanzar en los momentos más difíciles y por estar conmigo en los momentos mas felices. Esta tesis es tan suya como mía. Gracias.

TABLE OF CONTENTS

I / Prelude
- 1.1 The WHY
- 1.2 Argumentation

II / Problem Field
- 2.1 Global Trends
- 2.2 Problem Focus
- 2.3 Guanajuato
- 2.4 Central Region
  - 2.4.1 Anthropogenic
  - 2.4.2 Ecology
  - 2.4.3 Water
- 2.5 Spatial justice
- 2.6 One ecosystem

III / Methodology
- 3.1 Problem Statement
- 3.2 Research Aim
- 3.3 Research Question
- 3.4 Theoretical Framework
  - 3.4.1 Ecocities
  - 3.4.2 The human dimension
  - 3.4.3 Swarm Planning
  - 3.4.4 Framing
- 3.5 Research Framework
- 3.6 Methods
- 3.7 Relevance

IV / Analysis
- 4.1 Spatial Analysis
  - 4.1.1 Soil
  - 4.1.2 Water
  - 4.1.3 Infrastructure
  - 4.1.4 Landscape
  - 4.1.5 Urban
- 4.2 Site Documentation

V / Exploration
- 5.1 Scenarios 2060
- 5.2 Conceptual Vision
  - 5.2.1 Region
  - 5.2.2 Local
- 5.3 Challenges & Opportunities
  - 5.3.1 Urban
  - 5.3.2 Landscape
- 5.4 Framework
- 5.5 Toolbox

VI / Design
- 6.1Urban Strategy
  - 6.1.1 City Level
  - 6.1.2 Neighborhood Level
  - 6.1.3 Block Level
- 6.2 Landscape Strategy
  - 6.2.1 Forest
  - 6.2.2 Agriculture
  - 6.2.3 River Edge
  - 6.2.4 City Edge
- 6.3 Regional Strategy
  - 6.3.1 Soil
  - 6.3.2 Water
  - 6.3.3 Infrastructure
  - 6.3.4 Landscape
  - 6.3.5 Urban

VII / Conclusions & Reflections
- 7.1 Conclusions
- 7.2 Reflections

VIII / References

IX / Appendix

0 / FOREWORD

GUANAJUATO

URBANIZATION

The state of Guanajuato was founded in 1823. The importance of the state comes firstly from its ideal position, located in the central north region of Mexico, neighboring the stares of Queretaro and Michoacán to the south, Jalisco to the west, and to the north with Zacatecas and San Luis Potosi.
The historic relevance of the state rises from Guanajuato's strategic location as well a series of political and economic events that span from pre-Hispanic times to one of the largest industrial areas in the country. The state itself is divided into 4 regions: North East characterized by rural areas and ecological conservation, North being the historic, cultural and handcraft region, Center with the industry and service sector, and South with an agricultural and livestock economy.

Guanajuato's history starts with native settlements who in their majority focused on agriculture and cattle raising. It is believed that between the years of 800 – 1000 more than 1,400 settlements disappeared due to an intense drought. The settlements were abandoned leaving behind "abandonment offerings" and in some cases setting the settlement on fire. Some of these sites have been rediscovered by archeologists located in various areas of the state with a similar set of characteristics, mainly regarding the altitude of the places, architectural styles, agricultural terraces, and planning of cities.
- Arroyo Seco - Victoria – 1775m
- Canada de la Virgen – San Miguel de Allende – 2322m
- El Coporo – Ocampo - 2275m
- Peralta – Abasolo - 1730m
- Plazuelas – Penjamo – 1845m

19th century - Guanajuato became the cradle of Mexico's independence which was confirmed by some leaders native to the state. On the 16th of September of 1810, Miguel Hidalgo decided to initiate an armed rebellion against the viceroyalty of New Spain because of the social and economic issues in Mexico. The state held numerous battles against the Spanish crown to liberate cities such as Salamanca, Irapuato, Leon and finally Guanajuato, where one of the most important battles happened because of the mining importance of the city.

1877 - Porfirio Diaz established the politics of Order and Progress. He initiated the works to connect major cities of the state with Mexico City, Monterrey, Chihuahua, and Morelia. The state became, as called by Don Porfirio, the barn of Mexico and focused on the production of grains.
Another economical sector that resurged was the mining of precious metals and with this the economic reactivation of other service industries such as the textile.

1990 – The rapid industrialization in the state made apparent two main issues in the urbanization of the state. With most of the industries and agricultural areas located in the central and south region of the state, the wealth distribution was poorly balanced throughout the state resulting in high extreme poverty in the North region of the state followed by the North-east and the south regions.
Along with the industrialization and population growth came the urban sprawl of major cities with multiple suburban developments followed by a similar social housing strategy by the national government. These two phenomena caused a lot of stress in the cities by demanding de installation of basic services such as electricity, plumbing and security in relatively secluded areas or places located on the periphery of the cities.
As a result, many people decided to move outside of the city center for a higher standard of living, some others were forced to leave by the economic reaction of this suburban areas concluding in a systematic segregation of classes.

2020 – The results of bad planning and poor wealth distribution resulted in what our cities are today. Focusing only on private interest instead of social wellness the cities lack the basic infrastructure. Mobility within the city and statewide is inefficient and poorly managed. Green spaces around the city are reduced to minor interventions for the streetscape and parks remain scarce and belong to a private entity. Biodiversity within the cities is completely forgotten and native species are perceived as a negative factor. Water is becoming a big issue for the state due to the excessive extraction from the subsoil and the lack of bodies of water and water retention because of the semi-arid region. Finally, the stress of people in the cities pollutes the urban areas and increases the heat island effect day by day.

INDUSTRIALIZATION

Guanajuato's economy has gone through several changes since its foundation. Starting as a mining region and agricultural hub in the XIX century the state quickly adapted to the industrialized world and turned into a textile and manufacturing industries by the early XX century. The trading of goods and services throughout the region was constant, profitable and gave the state a financial advantage which boosted its growth. Guanajuato was a promising land of opportunity and prosperity, that is why starting in 1994 Guanajuato was the choice of many National and North American industries to develop factories.

NAFTA - The North American Free Trade Agreement (NAFTA) was signed by the Mexican President Carlos Salinas de Gortari, U.S. President George H. W. Bush and the Canadian Prime Minister Brian Mulroney. The trade took form as an idea from President Ronald Reagan to implement a free trade agreement with Mexico in the 1980s and facilitate the high-volume of trades between the two countries. "NAFTA was an episode of important Mexican economic development and the strategy that was followed to get involved in the new economic globalization stage in the decade of 1980s."(Guti, 2005). It was not until early 1990s that the deal began to formulate between Mexico, U.S. and Canada with the promise of a mutually beneficial deal that would bring prosperity and growth to all parties involved. Mexico, counting with an inexpensive work labor was the main target of large companies which eventually would move partly if not fully to Mexican territory.
The agreement fell short in many fields starting with the massive loss of jobs in the U.S. with the migration of companies and subsequently with the unfair salaries offered to Mexican workers. Secondly the agreement happens after the 1992 Rio earth summit where (countries) took part in a global initiative for sustainable development, poverty eradication and environmental protection but NAFTA felt short again and did not push for a more sustainable, ecological or fair infrastructure.

"The significance of the NAFTA signing was indeed historic, tragically so. Because if the environmental movement had not been so agreeable, NAFTA might have been blocked or renegotiated to set a different kind of precedent. A new trade architecture could have been built that did not actively sabotage the fragile global climate change consensus." (Klein, 2014)
Despite the various flaws on NAFTA the state benefited greatly from the injection of industry, in a matter of a decade the GDP grew from 1.2 to 3.5 with the contribution of 4.5 from the manufacturing industry.
Nowadays the industrial climate has expanded more than just to U.S. and Canadian companies, now Guanajuato houses automotive industry giants like Mazda, General Motors, Volkswagen, Honda, and Pirelli. These companies have attracted multiple manufacturing industries to serve the demands in the state. On the other hand, the agricultural industry is growing as well and developing green houses to produce broccoli

The constant manipulation and use of land has resulted with 68.4% of the land in the state has severe to extremely severe erosion – the restoring of agricultural land and forest is now a priority in the state but there is a misalignment between the ecological goals and the economic development that still need to be synced.

BIODIVERSITY

The definition by the Convention on Biological Diversity (CBD) of "Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
There are 17 countries around the world that are considered mega diverse because their biological diversity represents approximately 70% of the species known in the world, one of them being Mexico.

Mexico counts with 10% - 12% of the most known species and 60% of those are believed to be native species, therefore only found in this country.

Guanajuato has an area of 30,600 km2, 16% of the total surface of the country and shelters more than 4,065 species from which 112 are native and 149 reside in a category of the NOM-059-SEMARNAT-2010. (Manuel et al., 2018)
Guanajuato has done multiple efforts to get a better understanding and positive impact on the biodiversity of the state and has invested in research and documentation as well as being one of seven states to implement a state strategy to improve the future of biodiversity. In 2012 there was a collaboration between the Commission for Knowledge and Use of Biodiversity (Conabio by its Spanish initials) and the Institute of Ecology of the State of Guanajuato (IEE by its Spanish initials) to create a document that serves as a diagnostic regarding the contemporary biodiversity capital.

WATER

Guanajuato belongs to two administrative hydrological regions (i) Hydrologic Region of Panuco (RH-26). and (ii) the Lerma-Santiago Region (RH-12) which has a flow towards the Pacific Ocean.
The principal waterways and rivers are:

- -Lerma
- -Turbio
- -Laja
- -Silao
- -Guanajuato
- -Santa Maria

A large infrastructural development in the state that started in the decade of 1950's resulted in the construction of multiple dams, an oil refinery and a thermoelectric plant. This development resulted in a large demographic concentration in the state and consequently created more stress in the water system.
The distribution of water is focused mainly on the public use, the industry and agriculture in this setting the industrial sector has the most efficient water use followed by the residential and agricultural.
Currently the state ran into a problem, more and more the unsustainable ways of water extraction are becoming more expensive and scarcer, on a ground level the bodies of water contain less water every year and the waterways lack a constant flow.
The precipitation has also started to be more unpredictable and scarcer. With a reduction of -5% - -12% throughout the whole state of Guanajuato and is more prevalent in the periods from April to August (Manuel et al., 2018). The regions that are having a major impact in scarcity are the north, north east and south as well as the settlements gathered around the Lerma river.

CLIMATE CHANGE

The current practices and development strategies in the state have been constructed with an anthropogenic state of mind. The capitalist engine has been running for a long time now and we can see clear spatial and environmental repercussions.

Starting with the climate the state has seen a constant increment of temperature mostly perceived during the summer months with a forecast of a raise of 2 – 4 degrees in the coming 50 years. This translates in issues to the existing water system, Guanajuato is a semi-arid area which regularly does not enjoy vast quantities of water but as expressed previously, the state has managed to provide water for various sectors. The rains come usually during the summer in the months of July, August, and September. The latest forecasts show a reduction of rain of -1 to -99 in the coming years through these months.

With the lack of water, the agricultural sector of the state will be heavily affected and will create food scarcity as well as the reduction of crops.
Finally, the biodiversity of the state will slowly disappear due to the destruction of ecosystems, the lack of water, clean air and heavy changes in temperatures.

"How sad to think that nature speaks and mankind doesn't listen."

Victor Hugo
1840

Abstract

Key words: Ecocities, Anthropogenic, Guanajuato, Ecology, Environment

Anthropogenic development is the main actor in the destruction of our planet.

Urbanization, industrialization, and agriculture have been expanding exponentially at a global scale in an attempt to create prosperity and progress. Still, in the process of this never-ending pursuit of betterment for the human race, we are killing native biodiversity and entire ecosystems.
This graduation project in Urbanism and Landscape architecture will portray the current issues resulting from anthropogenic development, taking the Guanajuato, Mx, central region as a case study and reflecting on the challenges, scenarios, and possibilities for the future.

This thesis project aims to reflect and understand the current environmental, ecological, and social issues generated as a result of anthropogenic practices in the central region of Guanajuato, Mexico. Through research and resources such as literature, governmental projections, urban and geomorphological analysis; the thesis gives an understanding of the current conditions of the state of Guanajuato, MX focusing mainly on the central region of the state and in cities of Irapuato, Salamanca and Pueblo Nuevo as well as highlighting the disconnection between the built environment and the native biodiversity and nature.

The urban, industrial, and agricultural expansion in the region has completely neglected the state's ecological elements and the role they play in our ecological cycles. As of now, the central region has annihilated most of the native biodiversity. The constant exploitation of the soil has resulted in erosion and compaction throughout the region, and the existing aquifers, lakes, ponds, and rivers have been extracted until their last drop.

Therefore, to react to a symbiotic change, the goal is to create a regional proposal that focuses on mitigating ecological and environmental problems in the region as well as enhancing the biodiversity in the landscape and the development of sustainable agriculture that supports native ecosystems as well as integration and balance in the urban areas through the halt of large cities expansions transitioning into a network of ecocities through sustainable compact towns redevelopments.

The aim is to find a regional strategy that enhances the native species through their ecological territory and designs and intervention for towns to develop and grow sustainably by creating a balance between people, animals, and plants.

I / PRELUDE



1.1



1.2



1.3

1.1 The WHY

The world is changing more than ever. Every day more people are conglomerating in big cities, pollution is tangible in our day-to-day lives, and even viruses are rising and affecting the way we live. As a result of the activities of ever-changing humanity, we are facing one of the biggest challenges in our existence, which seems to be unstoppable; global warming.

The constant manipulation by humans to earth is taxing the essential things that make this planet habitable, and the forecast for the future is not so promising. We are already facing consistent droughts in cities all over the world, the increase in temperature and lack of humidity is resulting in massive fires that exterminate complete ecosystems, the way we harvest and process food is deteriorating the soil and eliminating its capacity to provide life, and the use of water has diminished the amount of clean water for all species.

This moment is a breaking point for humanity but also for the planet we live on. If we want humanity to prosper, there is the immediate need for radical changes in the anthropogenic practices that build towards a balance in our ecosystem and attempt to salvage what we have.

On the bright side, many driven people want to make a positive change in the world, either through volunteering, innovation, or expertise. I have been drawn into this world of possibilities by various inspiring characters worldwide, from professors at TU Delft to urbanists, landscape architects, and researchers and activists.
As a designer, architect, and future urbanist, it is my turn to bring ideas and proposals to the table to be able to find strategies and solutions for our world, not only because I'm passionate about this subject but because it is part of moral and ethical responsibility to leave a better planet for future generations by being part of the solution rather than the problem.

In this thesis, I will focus on many topics that look unrelated, but by looking closer, we can see that they all belong to one system. I will attempt to bring alternatives that enrich the environment and promote growth in biodiversity; at the same time, I will showcase a possible approach for urbanization that is developed sustainably and in balance with nature while creating a better quality of life for people.

Figures
1.1 Photo by: Mike Marrah
1.2 Photo by: Justus Menke
1.3 Photo by: Joshua Brown

Figures
1.4 Photo by: Francois Savigny
1.5 Photo by: Alfie Photography
1.6 Photo by: Doug Perrine
1.7 Photo by: Anup Shah
1.8 Photo by: Martin Harvey
1.9 Photo by: Antonio Busiello
1.10 Photo by: Juan Carlos Munoz
1.11 Photo by: Richard Barrett
1.12 Photo by: Zig Koch
1.13 Photo by: Pablo Corral
1.14 Photo by: David Lawson
1.15 Photo by: William Burrad-Lucas
1.16 Photo by: Edwin Giesbers
1.17 Photo by: David Lawson





1.2 Argumentation

Humankind has modified and altered its surroundings ever since the first settlements as means of protection and shelter. With time, humans realized that with the use of technology, they could take advantage of the natural characteristics of our planet, developing more significant structures and optimized systems to extract resources. The development of cities came to place and a better quality of life because of the security they provided, the food availability it secured and finally, the consolidation of a community.

With every technological advance, we have altered our immediate surroundings more and taken more than we need from nature. The constant expansion of cities, the industrialized monoculture, and the industry increase are the main actors in the extraction, consumption, and pollution of the earth's resources.

Our actions are the main reason why ⅓ of the world's forests are gone, and they have been replaced with industrial agriculture fields. Our actions are the reason why up to 1 million species are facing extinction due to the deforestation caused by the constant expansion of cities, industry, and agriculture. Our actions are the reason each year our drinking water runs scarcer, our soils erode, and our air is polluted, ending the earth's capability to give life.

In terms of the built environment and specifically large urban areas, the quality of life is perceived as higher because of the services and security it provides. Today, more people live in cities than rural areas because of the opportunities and living standards. But if we look closely, we can see that there are many unresolved issues in cities both at a societal level and an ecological level.

The exponential increase in population has put cities under a lot of stress, facing multiple issues. Because of the lack of planning, the high demand for services in short periods has resulted in quick solutions that solve the immediate problem in the shortest time with little to no regard to ecology and quality of life. Take Manhattan, for example, where there is a housing shortage that has lasted for the past 50 years and resulted in small and costly living spaces. Another example of a failed urban area is Mexico City, which has tripled its size in the past 50 years and has grown with mobility issues, extreme pollution, and water scarcity. Finally, we can see the lack of spatial justice in cities like Rio de Janeiro with the favelas or Buenos Aires with the infamous villa 31, where segregation becomes the norm and a way of living.

So, I ask myself:

Why do we put human progress on top of the health and wellbeing of all species?

Why do we continue exploiting resources if we can see today that they are running out?

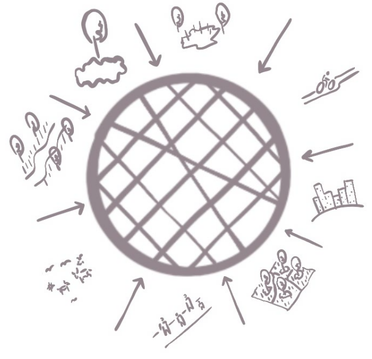
Why do we keep developing quick solutions for today's problems if we know they are creating more issues in the future?

We are past the breaking point, and we need to act radically by making extreme changes in our archaic way of developing, how we grow food, how we extract and use natural resources, and how we build and live our cities.

What if we created a balance with nature to allow other species to thrive and heal the soil and water systems?

What if we made it a regional imperative to fix the landscape to promote biodiversity while improving the relationship between humans and nature?

What if we parted away from the idea of living in a large city and instead, reduce our carbon footprint, living in a small town that has been developed in a sustainable way thinking on the human scale and incorporating ecology as part of the urban landscape instead of an addition to the city?



II / PROBLEM FIELD



2.1


2.2


2.3

2.1 Global Trends

Anthropogenic

In humanity's pursuit for progress and prosperity, we have developed a system that only sees for the interest of people. In this constant battle to make us safer, healthier, and more comfortable we have taken and exploited everything we could from our earth's resources without thinking of how this would affect us in the end. Humankind has modified and altered its surroundings ever since the first settlements as means of protection and shelter. With time humans realized that with the use of technology, they could take advantage of the natural resources of our planet. With every technological advance we have altered more our immediate surroundings and we have taken more than we need from nature. The repercussions of this anthropogenic system are visible today.

Urban

Urbanization has been developed as an anthropogenic practice for the human race to progress and prosper. Through time, improvements have been made to cities to transform them into more efficient, cleaner, and healthier environments.

Today, more than half of the world's population lives in urban areas with increasing numbers every day. It is expected that more than two-thirds of the world's population will live in urban areas by 2050 (Ritchie, 2018). The increase of population comes with multiple issues that are interrelated with how people decide to live now a days.

One of the main issues is the constant increase of the world's carbon emissions from which cities are responsible of roughly 75%, and are derived from urbanization, industrialization and from consumption-based economies (United Nations, 2011). Other equally affecting factors are the use of natura resources and the demand for more exploitation of the planet in order for cities to work and provide for its population. Finally, with the constant increase of population, cities expand to accommodate for that growth. In the process, the cities annihilate forests, species, and even entire ecosystems.

Agriculture

"Shortly after the end of the last great ice age – 10,000 years ago – 57% of the world's habitable land was covered by forest. In the millennia since then a growing demand for agricultural land means we've lost one-third of global forests – an area twice the size of the United States." (Ritchie, 2021)

Industrialized agriculture has been a solution to feed large amounts of people in a highly effective and control way. It has been so effective that now is one of the most used way of agriculture worldwide. This form of agriculture while beneficial for humans, it is detrimental for nature. With the use of monoculture fields, heavy chemicals for plague control, and chemical fertilizers, this specific practice has been the main actor in the world's deforestation as well as the one responsible for water pollution and soil erosion.

Water

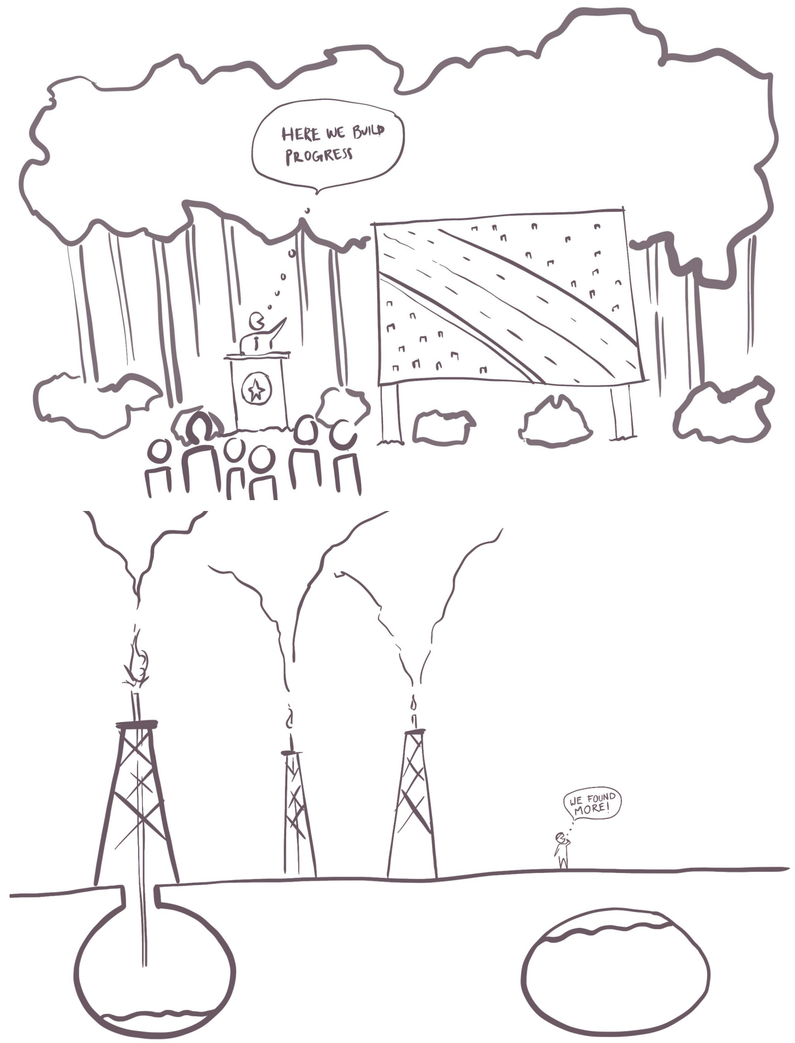
Humanity relationship with water has been reckless, we have used this resource in huge amounts for things as important as watering crops as well as irrelevant things as washing a car. This issue grows more everyday because people believe that this resource is unlimited and cant perceive or imagine a world without it.

"Freshwater makes up a very small fraction of all water on the planet. While nearly 70 percent of the world is covered by water, only 2.5 percent of it is fresh. The rest is saline and ocean-based. Even then, just 1 percent of our freshwater is easily accessible, with much of it trapped in glaciers and snowfields. In essence, only 0.007 percent of the planet's water is available to fuel and feed its 6.8 billion people."(National Geographic, 2021)

Keeping this in mind, the current amount we have is not only alarming but through our actions, this number is being reduced rapidly.

"By 2025, an estimated 1.8 billion people will live in areas plagued by water scarcity, with two-thirds of the world's population living in water-stressed regions as a result of use, growth, and climate change."(National Geographic, 2021)

The realization that we cannot live without water should be enough for humanity to make a radical change in consumption but also the retention, filtration, infiltration, and reincorporation to a very harmed system.



anthropogenic

an·thro·po·gen·ic | \ an(t)-thr -p - je-nik

of, relating to, or resulting from the influence of human beings on nature

Source: https://www.merriam-webster.com/dictionary/anthropogenic

urban strawl

also called sprawl or suburban sprawl

the rapid expansion of the geographic extent of cities and towns

Source: https://www.britannica.com/topic/urban-sprawl

industrialization

in·dus·tri·al·i·za·tion | \ in- d -str - -l - z -sh n

the widespread development of industries in a region, country, culture...

Source: https://www.merriam-webster.com/dictionary/industrialization

agriculture

ag·ri·cul·ture | \ a-gri- k l-ch r

the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products

Source: https://www.merriam-webster.com/dictionary/anthropogenic

2.2 Problem Focus

As human development expands, the lack of nature-based or ecologically focused interventions is reflected in the urban landscape throughout the asphalt cities, agricultural landscapes, and lack of diversity in species.

Guanajuato exemplifies this very accurately with a noble desire for expansion and wellbeing for its human population. At the same time, in a modernized world, flora and fauna are viewed as a commodity or an accessory rather than what it is, a living being. As our societal system is set today, the individualistic mindset overpowers the community, negatively impacting everything that is not profitable. In this constant pursuit of betterment, we need to stop and question ourselves, for whom are we doing this?

The idea of a synthetic, clean, and the perfectly organized world is taking shape but not without destroying everything on its way, leaving the human race in despair.

This thesis's problem focus investigation scope falls on the areas of Anthropogenic development in the central Guanajuato region and its manifestation in biodiversity, water system, and soil quality.

Analyzing these elements will bring to light the disconnections between urban areas and nature, along with an understanding of the damage and stress caused to the local environment from human-related activities.

In addition, it will explain the current urban challenges spanning from the big picture topics such as population increase, industrial expansion, and urban sprawl to the localized issues within cities, ecology, and mobility.

Finally, this thesis attempts to find alternatives and proposals that can work in a multi-scalar level of implementation, being optimistic as an individual intervention and strengthen as a network of systems.

Figures
2.1 Photo by: Randy Olson
2.2 Source: www.permaculturenews.org
2.3 Photo by: Karsten Winegear



Figures
2.4 Global Location, adaptation by author

2.4

2.3 Guanajuato

Guanajuato is a state located in the center of Mexico. The semi-arid plateau in the central region of Guanajuato lies in between the Sierra Madre Oriental to the east and the Sierra Madre Occidental to the west. The climatic characteristics are quite gentile and controlled with a primary summer rain season and comfortable temperatures through the year.

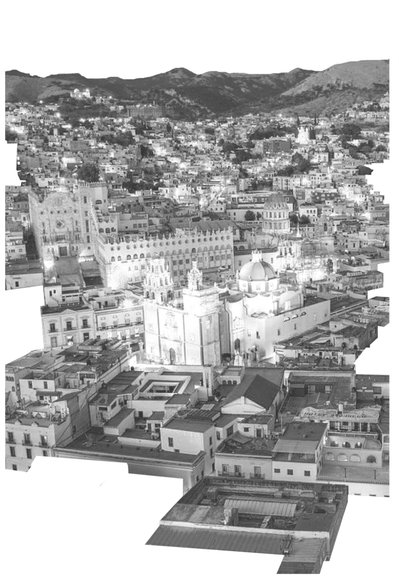
Surface area - 30,608 km2

Population - 6,167,000

Industry – 31,508

Agricultural Land – 1/3 of total area

World Heritage – Guanajuato and San Miguel de Allende













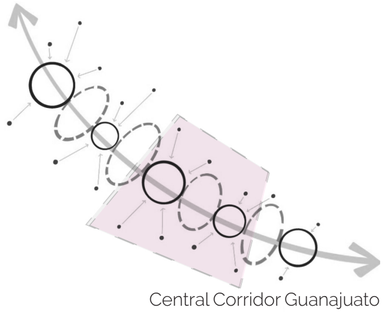




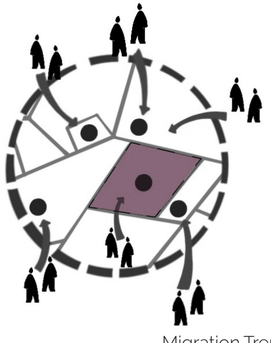




2.4 Central Region



Central Corridor Guanajuato



Migration Trends

Because of its prime location and geomorphological conditions in the state's central region, the industry is expanding through a central corridor that crosses from east to west. There are five cities located along the corridor benefiting from the industrial development: Leon, Silao, Irapuato, Salamanca, and Celaya. Along with the industry comes a series of positive socio-economic aspects such as economic growth and job opportunities, creating an image of well-being and progress in the state.

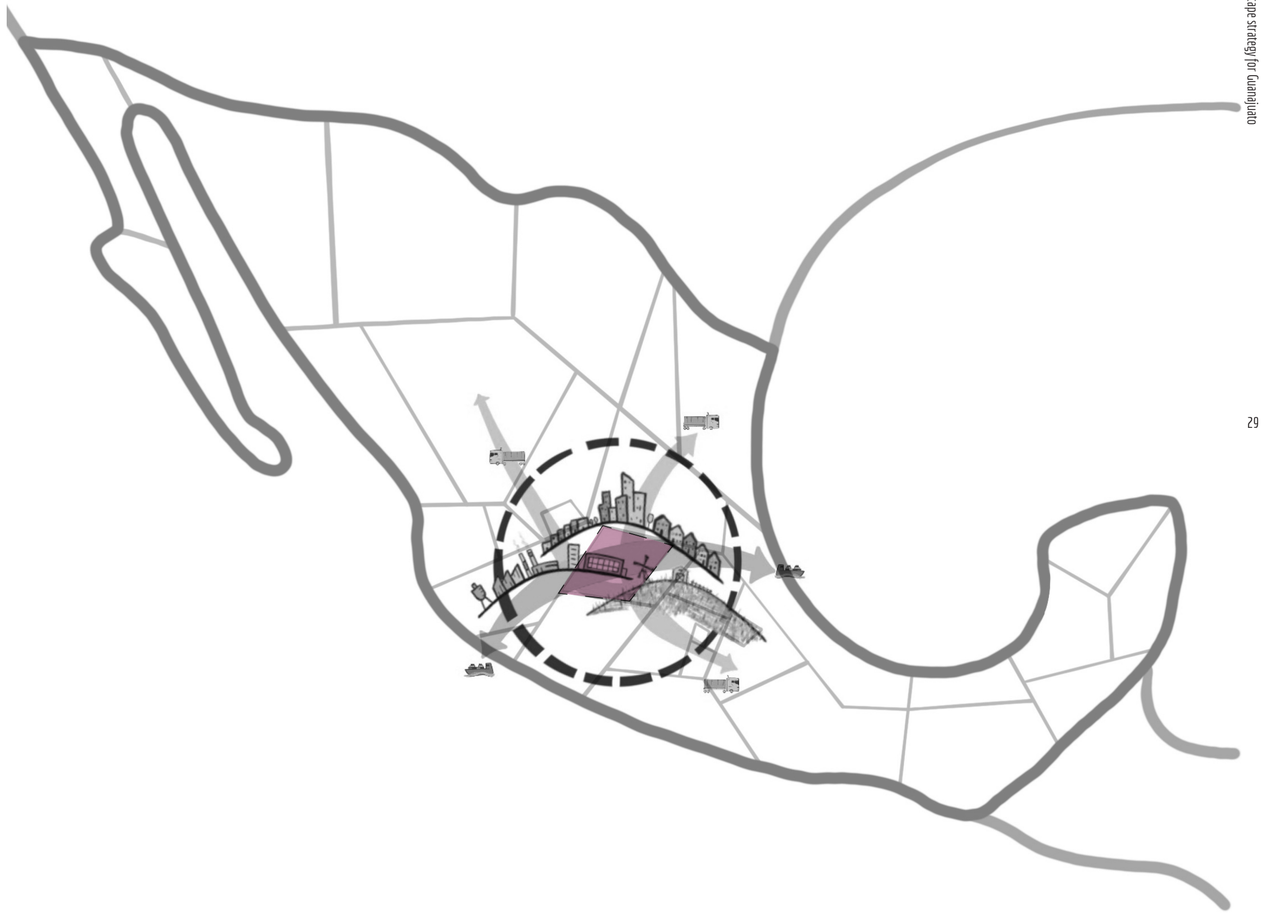
Most of the stress is falling only on five cities, and the issue now is the lack of planning in the urban areas to deal with this increase in population. Along with this growth, a new problem arises. Because the cities have been developed in an anthropogenic way, the ecology has suffered the consequences. Currently, the central region is the most deforested area of the state; it houses the most significant urban areas, most of the industry, and the most considerable amount of agricultural land in the state. There is a visible lack of biodiversity in this region and an appreciable amount of air, water, and soil pollution.

The urban dependence on lands outside the city borders has become irresponsible. It will eventually lead to the city's demise, as many predecessors from the past have experienced (Dobbelsteen et al., 2010), and so far, this is the path our cities are following.

Looking into one of the most precious resources, the over exploitation of the water systems in the region has put an immense amount of stress in the water basins that are being pumped dry. There is no short- or long-term solution for this issue. The constant extraction and poor-quality control have polluted and dried most of the wells, surface water bodies and rivers; the projection of water availability is negative with an expectancy of insufficiency in the next decade.



Figures
2.5 Central Region, adaptation from Google Earth



Relevance of Central Region

2.4.1 Anthropogenic

Urbanization

The state of Guanajuato is characterized by its colonial cities developed by the Spanish crown following the indies laws as a social and urban structure. Cities such as Guanajuato, San Miguel de Allende, and Dolores Hidalgo date back to the colony and remain in a very similar condition regarding the urban fabric and the compactness of the city. In contrast, cities located in the central region such as Leon, Silao, Irapuato, Salamanca, and Celaya have developed resembling the modernized city while keeping some historical essence in the downtown areas. In the early 1900 most the previously mentioned cities had a compact urban fabric with space for the pedestrian and mass transit systems. They held a close relationship with nature as is the case of Irapuato with the River Silao crossing through the city and Leon neighboring Sierra de Lobos. With the introduction of the car the cities changed and adapted to the new mobility system and the new suburban way of living, soon enough the public transport was reduced to the inefficient system that exists today. Furthermore, in order for greater urban development the addition of roads was vital turning the once slow traffic and green streets into an asphalt landscape, in some cases rivers were deviated and filled to create more space for the car. Since then the cities in the state keep sprawling to the outskirts with low density dwellings and monofunctional buildings, taking over the land that once belonged to native ecosystems. Without a clear urban planification the cities continue these development practices creating a vicious habit of expansion with disregard to other species.



2.6



2.7



2.8

Figures
2.6 Source: https://www.mexicoenfotos.com/
2.7 Source: https://www.life.com
2.8 Source: http://kioscodelahistoria.mx
2.9 Source: https://www.milenio.com

Agriculture

Agricultural activities provide approximately 6.6% of the GDP in Guanajuato and it expands on an area of 1,370,307 hectares. The area is divided in two types of agriculture, (i) Temporal agriculture which encompasses 49% of the total area and (ii) Irrigation occupying 51% of the territory and being predominant in the central region.
Currently agriculture has the highest usage of water in the state with an extraction level usage of 84%, it also has the lowest use efficiency utilizing only 50% of water, the rest of the water evaporates or is disposed of.
The agricultural system in the central region of Guanajuato represents a major actor in the land use restricting the biodiversity in a large portion of the state and with the increment in population the demand for this sector increases as well. The inadequate use of soil, deforestation and erosion are aggravating the infiltration capacity of the soil, at the same time contaminated water is discharged into the rivers lowering the quality of the water and leaving traces of pollution in the water system.
So far, the traditional agricultural system is the predominant practice of food production in the region and a shift in the system would represent a major impact in the state economy as well as the impact on the population since 25% of the population benefit from these practices. It is urgent that new systems are implemented to the food production sector which are more sustainable, efficient with the use of land and water and not disruptive to the current economic system of the region.

Industrialization

Over the past 30 years Guanajuato has developed a large infrastructure to support the growth and expansion of industry. With the introduction of the North American Free Trade Agreement Guanajuato became a particularly important player in the housing of foreign industry, counting with an inexpensive work labor. Ever since, the central region has consolidated its economic importance at a national level with the development of industry and the financial growth that this brings. The state invested in a larger freeway system called “Industrial Corridor”, an international airport and created an internal port, all of the aforementioned connects the state and the industry to some of the largest cities in the country as well as some of the most important ports of Mexico. Nowadays

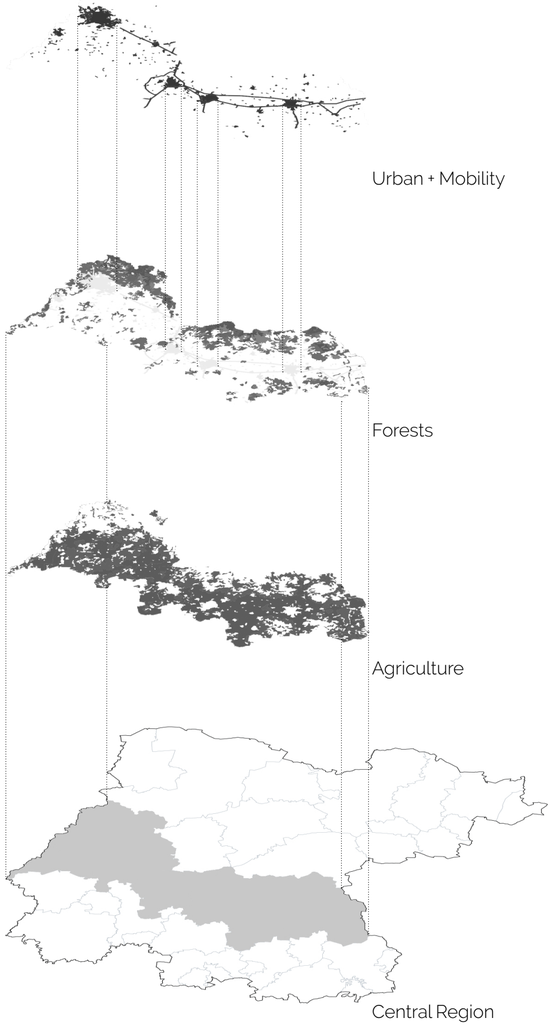


2.9

Water eficiency per sector

Sector	Eficiency
Urban	58%
Agriculture	50%
Industry	84%

Source: Uso público-urbano, Comisión Estatal del Agua de Guanajuato, con datos de 2016; uso agrícola e industrial, Comisión Nacional del Agua y Secretaría de Desarrollo Agroalimentario y Rural, con datos de 2015.



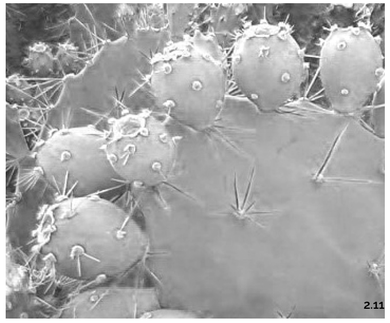
Figures:
2.10 Image by Tom Reichner
2.11 Source: https://www.frozenseeds.com
2.12 Image by Phil Bendle

Guanajuato is constantly expanding its industrial capacity and is expecting steady growth for the near future. The constant expansion, of the industry is bringing new challenges for which the state is not prepared. There is an exponential growth in population for which the 5 largest urban areas in the region do not have the infrastructure to take in. By the centralization of the industry, satellite cities have experience a degrowth in economy and population. The development of new industrial parks throughout the corridor lack an ecological incorporation and they disrupt the existing ecosystems. Finally, the pollution resulting from logistic based activities from the industry are damaging our entourage and our health.

2.4.2 Ecology

Guanajuato has an area of 30,600 km2, 16% of the total surface of the country and shelters more than 4,065 species from which 112 are native and 149 reside in a category of the NOM-059-SEMARNAT-2010. (Manuel et al., 2018)
In between the years 1940 and 2014 the state's vegetation has suffered as a result of the industrial and urban expansion. Human sediments have had an increase in area of 4.5 times its size from 1970's occupying areas of former forests. It is calculated that in the past 50 years more than 45% of the native forests have been lost.
The state has made efforts in the past 10 years to remedy the harm caused to biodiversity. Starting with a comprehensive document documenting all the existing native biodiversity located in the state with its representing characteristics, qualities and needs. The state has also labeled an approximate of 20% of the total state territory to the natural protected areas program with the hope that these areas remain untouched by human developments. Lastly, the state expanded its capacity to track and map other species connectivity through ecological corridors.
These efforts are a step in the right direction to help preserve and rehabilitate the state's biodiversity but there is still a lot to be done. The implementation of ecological standards in human developments is currently reduced to small aesthetic little yards. There is no repercussion or tradeoff punishing the ecological impact the new developments cause. On a city level the lack of natural open spaces diminishes by the day and there are no plans to add more while the global community is calling for environmentally friendly solutions.
Today, the central region of Guanajuato uses the vast majority of its territory for agriculture. Due to this, the environment is not prevalent to host a diverse biodiversity, therefore the region displays the major ecological disconnect and cuts the biological corridors in two parts. We need to start thinking of biodiversity as the multi scalar system that it is and coordinate efforts at a neighborhood, city, and regional level. It is imperative to reach a balance between anthropogenic practices and nature in order to rehabilitate a larger ecological system.


2.10


2.11


2.12
Photo by Pi

2.4.3 Water



Rivers and water bodies



Aquifer



Basin

Guanajuato belongs to two administrative hydrological regions (i) Hydrologic Region of Panuco (RH-26), and (ii) the Lerma-Santiago Region (RH-12). The principal waterways and rivers are Lerma, Turbio, Laja, Silao, Guanajuato and Santa Maria.
A large infrastructural development in the state that started in the decade of 1950's resulted in the construction of multiple dams, an oil refinery and a thermoelectric plant. This development resulted in a large demographic concentration in the state and consequently created more stress in the water system.
The distribution of water is focused mainly on the public use, the industry and agriculture in this setting the industrial sector has the most efficient water use followed by the residential and agricultural.
Currently the state ran into a problem, more and more the unsustainable ways of water extraction are becoming more expensive and scarcer, the surface water runs scarcer every year and the waterways carry only an intermittent flow that aligns with the summer rain season.
As a result of climate change, the precipitation has become more unpredictable and scarcer. With a reduction of -5% - -12% throughout the whole state of Guanajuato and is more prevalent in the periods from April to August (Manuel et al., 2018). The regions that are having a major impact in scarcity are the north, north east and south as well as the settlements gathered around the Lerma river in the central region.
The water demand grows in parallel with the population and the existing relationship we have with water, how we extract it and dispose it has proven to be unsustainable and harmful to the whole water system. If these practices continue the state will not have enough water to supply to the industry, agriculture, and urban areas, collapsing the economic system. The state is in desperate need to develop a sustainable water management program that rehabilitates the surface and subsoil water system bringing an equilibrium to its aquifers that at the same time is gentile with the ecosystem and without truncating industrial and urban development.
Finally, the central region houses 4 of the most intensively extracted aquifers today but instead of a decrease in extraction, the numbers are going up. It is projected that by 2030 the demand will increase, 10 – 20% for subsurface water, 5 – 8% in agriculture and 4.5% for drinking water.

2.5 Spatial Justice

At an ecological level, the state is currently being overpowered by anthropogenic development; there is an apparent disconnection between the space for humans and what is dedicated to nature.

Currently, there is extraordinarily little space for biodiversity to thrive, and with the current practices, the area is being reduced. Native species slowly disappear as the population grows, and if this continues, the state will soon find that most non-human species are extinct.

Within the cities, spatial justice is missing due to the disorganized city expansions. This lack of spatial justice has to do mainly because of the lack of planning from the government officials and the private development sector that does not adhere to a set of zoning codes. Nowadays, we have cities that have grown with a suburban inspiration prioritizing privacy and security for the residents. These developments have proven inefficient, unsustainable, land-intensive, and economically expensive; and have caused segregation creating social classes based on location, economy, and social circles. This is not only perceived as a societal issue but it can be spatially represented in cities and neighbourhoods.



2.6 One Ecosystem

At some point in time, the daily urban lives of humans evolved and developed with the idea that the ecology around them was an enemy to their existence. Some of it had to do with plagues, diseases carried by animals, and unhealthy environments due to a lack of maintenance.

Today, most of the cities around the world have been developed with this idea, including the cities in the state of Guanajuato.

Multiple challenges have risen since, starting with the lack of biodiversity within cities to the point of endangering whole species as a result of deforestation, the quality of the soil and the water retention capability has also been damaged, and as a result, we have less flora and more heat in the cities. If we pay attention to the problems we have now, we can link all of them to the lack of natural cycles of a living ecosystem, these cycles provide life, variety, controlled climate between others.

The theory proposed in the article "Cities as organisms: using biomimetic principles to become energetically self-supporting and climate proof" proposes the reincorporation of ecology and nature into the city and the daily lives of humans and develop around it to regenerate natural cycles including the human cycle. 'The Origin of Life', not only as an individual entity but also as a collective entity. (Dobbelsteen et al., 2010)

The one ecosystem idea is born from the mix of the ecocities concept and the need to create a single ecosystem that lives within urban areas opening spaces for all species.

Human beings need to be put back into the mix when we talk about nature and ecosystems because the anthropogenic actions affect the ecosystems we displaced. "Since life is never constant, also cities need to evolve into better, more efficient, more resilient organisms."(Dobbelsteen et al., 2010)

And so cities and its population should evolve to improve life for all and understand the important role that they play in the bigger picture to know how little we are when talking about the world's biodiversity.

Figures
2.13 Photo by: Emma Gossett



2.13

"Humans, like all organisms, don't inhabit the world alone or immune from the effects of the environment. When organisms interact they form communities; the combination of communities and physical processes are ecosystems, which in turn combine to biomes and eventually Gaia."

Narraway et al.
2020

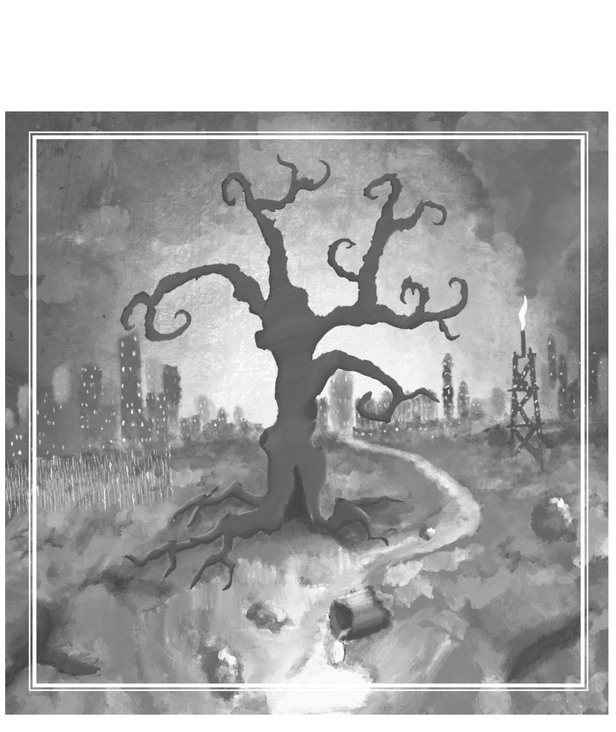
III / METHODOLOGY

"We need to remember that the work of our time is bigger than climate change. We need to be setting our sights higher and deeper. What we're really talking about, if we're honest with ourselves, is transforming everything about the way we live on this planet."

Rebecca Tarbotton, Executive Director of the Rainforest Action Network, 1973-2012

3.1 Problem Statement

The central region of Guanajuato has constantly been developing and modifying its geomorphological landscape, transforming it into an anthropogenic system. Urbanization, Industrialization and Agriculture are the practices driving the economic progress of a modernized society for the past 50 years; on the other hand, it can be argued the state indirectly financed the destruction of biodiversity and the overexploitation of natural resources. The equivocate land use has resulted in massive deforestation, large amounts of eroded soil, and the destruction of native ecosystems. The problems are present in the water system as well with scarce amounts of surface water, overexploitation of the aquifers and the pollution of rivers; the region has exhausted the water reserves and will not have access to clean water by the end of the decade. On an urban scale, the constant growth in population and the lack of urban planning have resulted in cities that constantly expand. The use of motorized vehicles is the only mobility method. There is a lack of nature and green spaces in the city, diminishing biodiversity. With the absence of a human focus, the quality of life decreases in the cities, and the gaps in social and spatial justice are more noticeable. Finally, climate change is more evident, and the forecast for the ecological impact and lack of natural resources in the region is alarming.



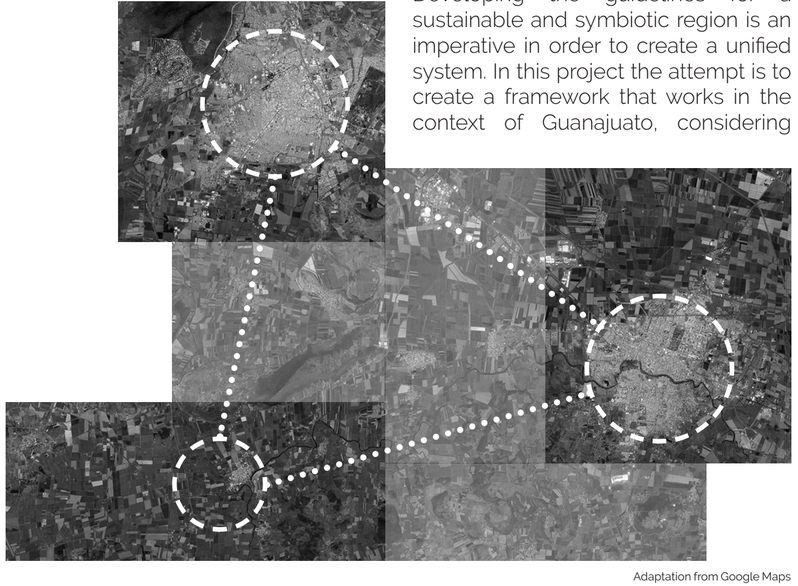
3.2 Research Aim

This thesis research seeks to understand the consequential challenges caused by anthropogenic practices to nature through a series of spatial analysis, documentation, and design explorations. Although the main research is done on the influencing forces, the attempt is to showcase the importance of a balance between all living things, implementing this ecological culture through a regional strategy framework, designing for natural elements in synthetic structures, and creating a toolbox of solutions to enhance the biodiversity and wellbeing of the ecosystem for the whole region.

State

_Framework

Developing the guidelines for a sustainable and symbiotic region is an imperative in order to create a unified system. In this project the attempt is to create a framework that works in the context of Guanajuato, considering the infrastructural, economical, and societal challenges to develop a system where the anthropogenic development and nature reach a balance.



Adaptation from Google Maps

Region

_Soil

Development of remediation strategies for agricultural landscapes with eroded and polluted soil through increase of microorganisms and bacteria to allow for new ecosystems.

_Water

Strategy to increase retention of stormwater at the surface and to allow for slow infiltration as well as filtration systems to incorporate stormwater to the system.

_Infrastructure

Develop a mobility system that opens space for other types of human mobility as well as strengthening the biological connections for other species.

_Landscape

Reforestation of existing forests, incorporate sustainable agriculture with a spatial strategy by designing gradients with multiple species. Allow for intact landscapes to allow for an increase in biodiversity.

_Urban

Develop an alternative to the current overflow of population and constant expansion in larger cities through a network of sustainable towns and villages in the proximity of larger urban areas and industry.

3.2.1 Irapuato - Valle

A case study for the central region

As the central region of Guanajuato is too extensive, this thesis research will focus mainly on a specific area that encompasses the aforementioned urban and ecological challenges to use it as a case study for the whole region. The area is selected from 4 of the aquifers along the central region, taking into consideration the amount of industry, population, and agricultural land as well as the geomorphological relevance at a state level as well as the national.

Irapuato - Valle Aquifer

A decay in the static level for the Irapuato – Valle aquifer has been constant in the last 20 years. In between 2006 and 2013 drops of 5 to 15m were registered with a constant increment of 1 – 1.5m annually. The aquifer is in extreme stress, currently having a deficit of -71 m3 annually and they are being extracted from its nonrenewable storage.

Two areas with major state level drops are located in the agricultural areas west of Irapuato, and south east of Salamanca. This particular region is also characterized for its semi-arid climate, large planes, agricultural landscapes, growing industry and sprawling cities. The region is also crossed by the Lerma river, one of the largest rivers in Mexico as well as the Sialo river which is of great importance in the state of Guanajuato.

In the area of Irapuato – Valle Aquifer we have a representation that encompasses the anthropogenic system of the whole central region. The city is facing an increase in population not only from nationals but also internationals due to the increase in job opportunities in the manufacturing sector. The lack of urban planning and design is resulting in constant expansion of gated communities often located in the periphery of the city creating segregation and not being able to provide basic services, mass transportation and an ecological balance. Another important factor that makes Irapuato relevant in an ecological perspective is the crossing of the Silao river which has been deviated from its original path and represents the perfect example of the disconnection between cities and the water system.

Salamanca is within the largest urban areas of the state. The city houses the Pemex oil refinery, one of the most important in the country, at the same time the city is a major actor in air and water pollution in the region. The proximity to Lerma River is especially important, being the second largest river in Mexico and crossing through 5 states: Estado de Mexico, Queretaro, Michoacán, Guanajuato, and Jalisco. The impact of a city with this type of industry affects the health of the ecology and natural resources at a local level as well as in a national one which is why tackling the challenges produced by this city are so relevant.

Pueblo Nuevo is one of the smallest towns in the region (approx. 1sq km). The town is surrounded mainly by agricultural land which falls under the intensive irrigation category and it is located within a short distance (15km) from Irapuato and Salamanca as well as the industrial areas. This town also has an ecological importance since it is located in the confluence of River Lerma and Silao and could become an area of opportunity to improve soil quality and the water system. The area around Pueblo Nuevo is currently a disconnector of the neighboring tropical forests and biological corridors that used to cross from north to south of the state. The enhancement of the later could result in an increase of biodiversity and the strengthening of native ecosystems in the region.

3.3 Research Questions

Considering there is no planned degrowth for the industrial sector and the urban areas in the state of Guanajuato, this thesis focuses more on a systemic balance between the built environment and nature. Therefore, this way of thinking shapes the following research questions.

MRQ
What is an urban and ecological regeneration strategy to restore social and environmental issues caused by anthropogenic practices in order to transition into a biodiverse and sustainable urban landscape?

1 / SRQ
How are the anthropogenic practices affecting the social and ecological aspects in Guanajuato?

2 / SRQ
How does a regional strategy framework incorporate local and regional problems and opportunities that are specific to the region?

3 / SRQ
How can a damaged regional landscape turn into a biodiverse ecosystem that supports soil remediation and water quality and quantity while implementing a balance with anthropogenic practices?

4 / SRQ
What are regional and local urban principles & interventions to create a balanced urban landscape to increase the quality of life for all species?

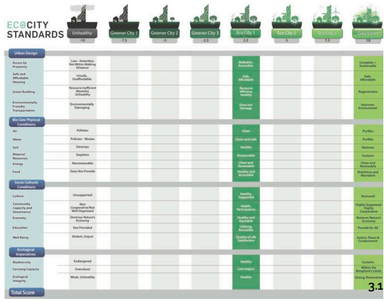
Problem Field	Sub-Research Questions	Methods	Outcome
Anthropogenic _Urbanization _Agriculture _Industrialization	**How are the anthropogenic practices affecting the social and ecological aspects in Guanajuato?**	Literature review, mapping, spatial analysis, site visit, interviews	Site documentation with a deep undertanding of the regions geomorphology and challenges
			Maps of a multiscalar urban and ecological analysis
	How does a regional strategy framework incorporate local and regional problems and opportunities that are specific to the region?	Ecocities Framework, literature review, existing project analysis	An adapted ecological framework that is specific for the conditions of the central region.
Ecology			Utilize the adapted framework standards to layout a strategy for regional landscape design
	How can a damaged regional landscape turn into a biodiverse ecosystem that supports soil remediation and water quality and quantity while implementing a balance with anthropogenic practices?	Water system analysis, landuse , topography, soil analysis, literature review, existing project analysis, data analysis, multiscalar mapping	Enhancement of water ways with native species Strategy for land use shift Design explorations to create a biodiverse landscape
			Incorporation of framework standards
Water	**What are regional and local urban principles & interventions to create a balanced urban landscape to increase the quality of life for all species?**	Literature review, existing project analysis, local mapping and analysis, design explorations, incorporation of framework standards, sustainable and affordable approach, generic solutions for region application	Compact, dense city Enhance relationship with water Addition of green areas Increase diverse flora Depaving of roads and parks Shift in mobility system Increase of evapotranspiration Green buildings Water retention infrastructure

3.4 Theoretical Framework

34.1 Ecocities

ecocities

"An Ecocity is a human settlement modeled on the self-sustaining resilient structure and function of natural ecosystems. The ecocity provides healthy abundance to its inhabitants without consuming more (renewable) resources than it produces, without producing more waste than it can assimilate, and without being toxic to itself or neighboring ecosystems. Its inhabitants' ecological impact reflects planetary supportive lifestyles; its social order reflects fundamental principles of fairness, justice and reasonable equity."



3.1

Richard Register, founder of "Ecocity Builders" and author of "Ecocities: Rebuilding Cities in Balance with Nature", proposes a new approach to the development of cities in order to mitigate the current unsustainable urban practices. Through an ecological framework and standards, he calls for a radical reshaping of cities into a balanced and sustainable urban landscape. "As we build, so shall we live" (Register, 2006)

The anthropogenic practices in the central region of Guanajuato have been disrupting the native biodiversity for decades, the constant expansion of industry and urban areas are adding up to the deforestation, soil health and stress in the water system. An ecological shift needs to happen in order to promote sustainable developing standards and to restore and regenerate the biodiversity and natural resources.

The framework is divided in four pillars: Urban Design, Bio-Geo Physical Features, Socio Cultural Features and Ecological Imperatives Within these pillars there is an array of standards and requirements that touch upon different types of elements, species, and development goals for cities which are aiming to become an Ecocity.

_Urban Design

Designing cities through the principle of proximity allowing for walkable access, green open spaces, sustainable basic services, and affordable green housing.

_ Bio-Geo Physical Features

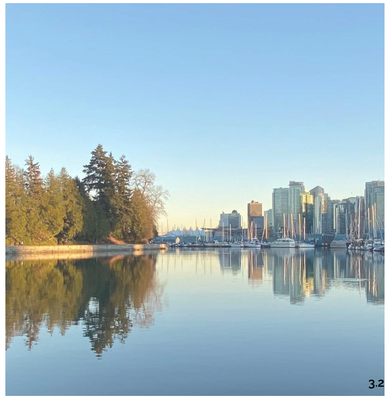
The cities should commit to a responsible management of resources as well as the local production food and generation of clean energy. They should have a biodiverse landscape that provides clean air and ensures healthy soil and water.

_ Socio Cultural Features

By education, the population on ecological and sustainable practices the community participation will improve. Cities need to incorporate an economy that benefits all species, it should be committed to have a positive impact on the planet.

_ Ecological Imperatives

Cities need to be committed in sustaining and restoring biodiversity as well as incrementing the variety of species into the ecosystem through ecological enhancement. The demand on resources extraction should be limited to the planet's carrying capacity to not disturb the environment further.


3.2

3.4.2 The human dimension

Everyone should have the right to easily accessible open spaces, just as they have a right to clean water. Everyone should be able to see a tree from their window, or to sit on a bench close to their home with a play space for children, or to walk to a park within ten minutes. Well-designed neighborhoods inspire the people who live in them, whilst poorly designed cities brutalize their citizens. As Jan says: "We shape cities, and they shape us." (Gehl, 2010)

Jan Gehl argues in his book "Cities for People" that the human dimension has been neglected since the incorporation of the automobile through a modern approach for the mechanization of the city.

For the particular case of the central region of Guanajuato this motorized urban development has been the standard for the past 60 years. Nowadays the streets of cities barely have sidewalks, all the new constructions have to accommodate space for parking. Because most of the population move by car the public transportation has been neglected, resulting in an outdated and inefficient mass transit system. As for intercity mobility the only affordable options are cars and buses, giving no alternatives for other means of mobility.

He comes with the rhetoric idea for cities to reinforce pedestrianism rather than motorized mobility in order to create a shift in human habits. Through bringing back the human dimension, Gehl proposes four goals the cities should aim for and incorporate: lively cities, safe cities, sustainable cities, a healthy city.

_lively cities

The capacity for a city to create public social gathering spaces for constant human interaction through a shift into a slow mobility system.

_safe cities

By having more eyes on the street and movement there is a greater incentive to pay attention to your surroundings and events, therefore the cities tend to feel more secure.

_sustainable cities

The cities can be sustainable through green mobility. This will reduce the emissions, noise levels, as well as relieving the stress from natural resources extraction.

_healthy cities

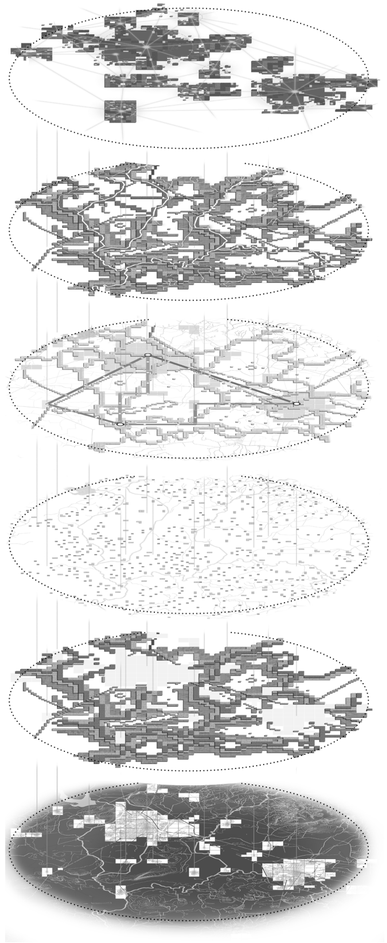
By increasing human mobility by physical activities, the habits and health conditions of people will change as well, giving the opportunity for a healthy and active lifestyle.


3.3



3.4

'we co-evolve with the environment we create'
(Kropf, 2017)



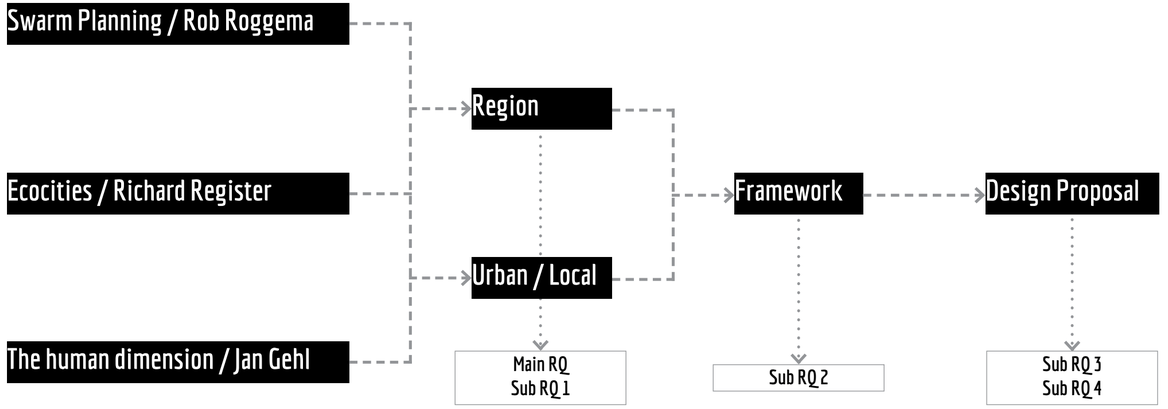
3.4.3 Swarm Planning

Swarm planning is a theory developed by Rob Roggema as a tool for analysis and understanding of a complex urban and landscape. Very much as a layer system used in software's such as Photoshop or Illustrator, the swarm planning looks to identify individual layers or topics to isolate the spatial data and to understand on an organized and clear manner the information. This method also opens the opportunity for proposals that work on multiple layers and tackle the issues in an immersed system.
[Swarm Planning of those areas, i.e., spatial systems with increased adaptive capacity and resilience, requires three activities:
1. Increase the collective capacity to manage resilience (Walker et al., 2004). This requires a collective future view on what a resilient equilibrium, under threat of climate change and hazards, looks like. In this step the simple rules are defined that govern the behaviour of the swarm;
2. Define the spatial elements, as described in the previous paragraph, to be able to use the properties of complex adaptive systems in design and spatial processes. In this step the design parameters to work with (or the spatial elements
the swarm consists of) are defined;
3. Start the process of increasing resilience. The jump to a higher level of resilience or complexity often requires an impulse. In this step the crucial intervention,
which will start developments is defined. The swarm (the collective of spatial elements) responds to, prepares for or anticipates external changes and reshapes accordingly.
Swarm planning, implemented following these three steps is capable of increasing the adaptive capacity and resilience in spatial systems, and improving the capacity of regions and areas to anticipate (extreme) climate events.] (Roggema, 2014)

In the case of this thesis swarm planning is applied on the stages of spatial analysis, exploration, and design development with the areas of focus being Soil, Water, Infrastructure, Landscape and Urban. The goal is to identify the challenges at the individual level on the isolated topic, compare them and find the connections that all layers have. At the later stages of exploration and design the approach is to design on individual levels to tackle the isolated problems while at the same time developing a resilient symbiotic system that can mitigate the current ecological and urban challenges of the region as well as to create a regional ecological remediation strategy that acts at multiple scales.

'we co-evolve with the environment we create'
(Kropf, 2017)

3.4.4 Framing

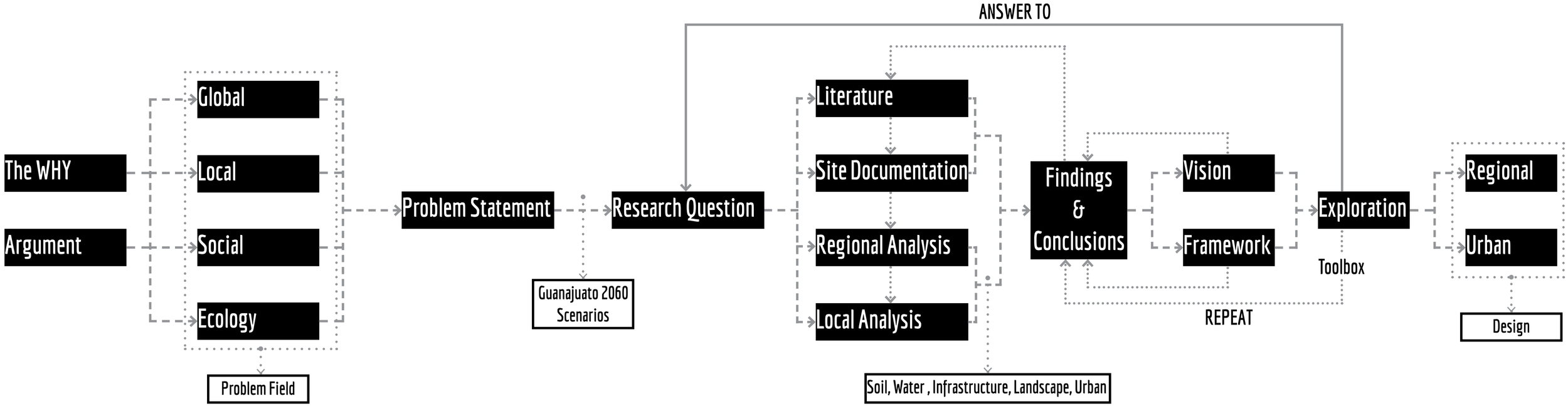


The framing of this thesis is built up and guided by a set of existing theories, this process allows for a step-by-step exploration and resolution for the research question and sub research questions on the different scales and proposals of this project.

The theories in use are "Swarm Planning" by Rob Roggema, "Ecocities" by Richard Register and "The human dimension" by Jahn Gehl. With the use of this theories and its principles the thesis gains a scientific and academic background that can be used as a strategy for the main aim of the project. In the case of this thesis, the belief is that with a mix of theories, principles and frameworks, a cohesive and balanced proposal could be achieved.
At the regional and urban/local scale the design should be able to answer the main research question (What is an urban and ecological regeneration strategy to restore social and environmental issues caused by anthropogenic practices in order to transition into a biodiverse and sustainable urban landscape?), as well as the first sub research question (How are the anthropogenic practices affecting the social and ecological aspects in Guanajuato?).
With the development of a new framework for the state of Guanajuato inspired by the existing "Ecocity Builders" framework, a standard and workflow of future urban planning, landscape design and redevelopments will be proposed, answering the second research sub question (How does a regional strategy framework incorporate local and regional problems and opportunities that are specific to the region?)
Finally, the design proposal focuses on the spatial qualities and requirements in order to achieve a balance between nature and anthropogenic development. The design proposal should be able to answer research sub question three (How can a damaged regional landscape turn into a biodiverse ecosystem that supports soil remediation and water quality and quantity while implementing a balance with anthropogenic practices?) and four (What are regional and local urban principles & interventions to create a balanced urban landscape to increase the quality of life for all species?)

Figures
3.1 Source: https://ecocitybuilders.org
3.2 Photo by : Alf Palacios
3.3 Source: https://bikedenton.wordpress.com/2010/08/08/what-is-str%C3%B8get-and-who-is-jan-gehl/
3.4 Photo by New York City Department of Transportation

3.5 Research Framework



The research is divided into seven sections: Prelude, Problem Field, Methodology, Analysis, Exploration, Design and Conclusion.
Each of these sections is an attempt to understand with as much detail as possible the challenges at various scales while focusing most of the attention on a specific location. This understanding drives the contextualization, the problem field, and the research into a set of proposals by exploring the opportunities and turning them into a spatial and strategical design encompassing the landscape and urban aspects.

Prelude	Problem Field	Methodology	Analysis	Exploration	Design	Conclusions
ARGUMENT	CONTEXT	STRUCTURE	RESEARCH	DEVELOPMENT	PROPOSAL	EXPERIENCE
The WHY	Global Trends	Problem Statement	Spatial Analysis	Scenarios 2060	Master Plan	Conclusions
Argumentation	Problem Focus	Research Aim	Site Documentation	Conseptual Vision	Landscape Strategy	Reflection
	Guanajuato	Research Question	Conclusions & Findings	Framework	Urban - Local Strategy	Evaluation
	Central Region	Theoretical Framework		Toolbox		Relevance
	Spatial Justice	Research Framework				Recomendations
	One Ecosystem	Methods				
		Relevance				

3.6 Methods

The research of the thesis attempts to bring clarity to the current problems caused by anthropogenic practices in nature.
Through a series of analysis, literature review, documentation, and design explorations the thesis will compose an extensive understanding of the challenges the region is experiencing along with strategies and design proposals for a sustainable urban landscape. The thesis develops through five sections.

Prelude
_Agument
The first section focuses on the reason why I decided to pursue this specific topic and area based on personal motivation in combination with global challenges.

Problem Field
_Context
The problem field dives into an introduction of the current issues at a global scale, how this is reflected in the state of Guanajuato as well as providing general information of the state to get familiarized with the region location, its current ecological condition, and its challenges. And it touches upon larger issues that should become of great importance to the state.

Methodology
_Structure
The methods section is formed by a deeper analysis and research arising from the thesis methodology and defining the problem, research questions, research aims and outcomes. This structure guides the whole development of the thesis and is of great importance for every section of the thesis.

Analysis
_Research
On the analysis section the thesis focuses on the existing conditions of a specific site starting with the spatial qualities and challenges of the region, it is followed by an onsite documentation section which will portray the current conditions of the region and lastly a set of conclusions and findings that bring a smaller focus in order to start with explorations.

Exploration
_Development
The exploration section looks into the possible strategies for the region considering what the future of this region could become as well as providing a general vision derived from the analysis conclusions. This section will also provide a layered framework for the region based on existing examples and finally a set of design tools that can be incorporated in the region to support the expected change.

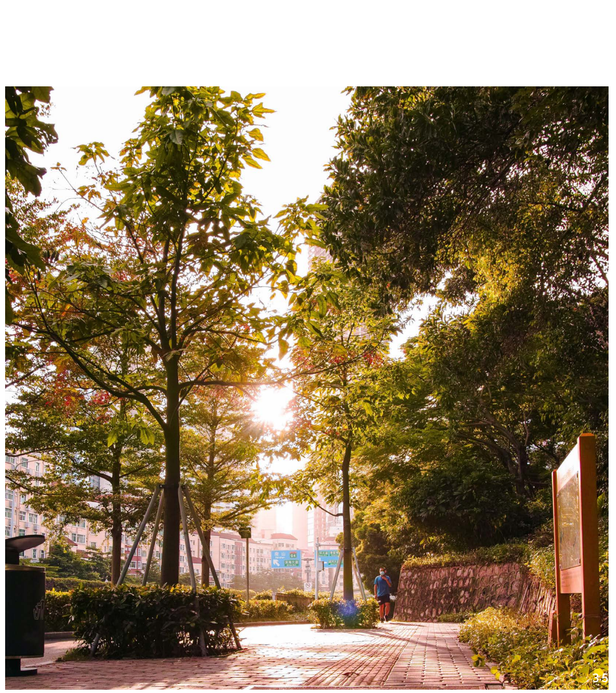
Design
_Proposal
Diving into the design section, a master plan for the region will be developed to understand the gesture that is expected as a result. Certain areas of the regions will be selected, and a multiscale design will be proposed focusing on areas as the rural landscape, and sustainable urban redevelopments.

Conclusions & Considerations
_Experience
Finally, the conclusion and considerations refer to the gained experience and knowledge throughout the thesis providing reflections, design evaluations and recommendations.

3.7 Relevance

The thesis research, strategies and design proposal will have societal relevance because of the sustainable approach to create a society that lives in balance with the flora and fauna with the hope that people will be able to create a more resilient way of living in the state of Guanajuato. This proposed way of living, building, moving, and experiencing the world around you should improve the relation humans have with nature and ideally shift the principles of anthropogenic development to fall under a one ecosystem mindset.

The scientific relevance is found through the experimentation of natural remediation through spatial interventions; finally, the work developed through the thesis will contribute to the disciplines of urbanism and landscape through the research, exploration and designs for Guanajuato.

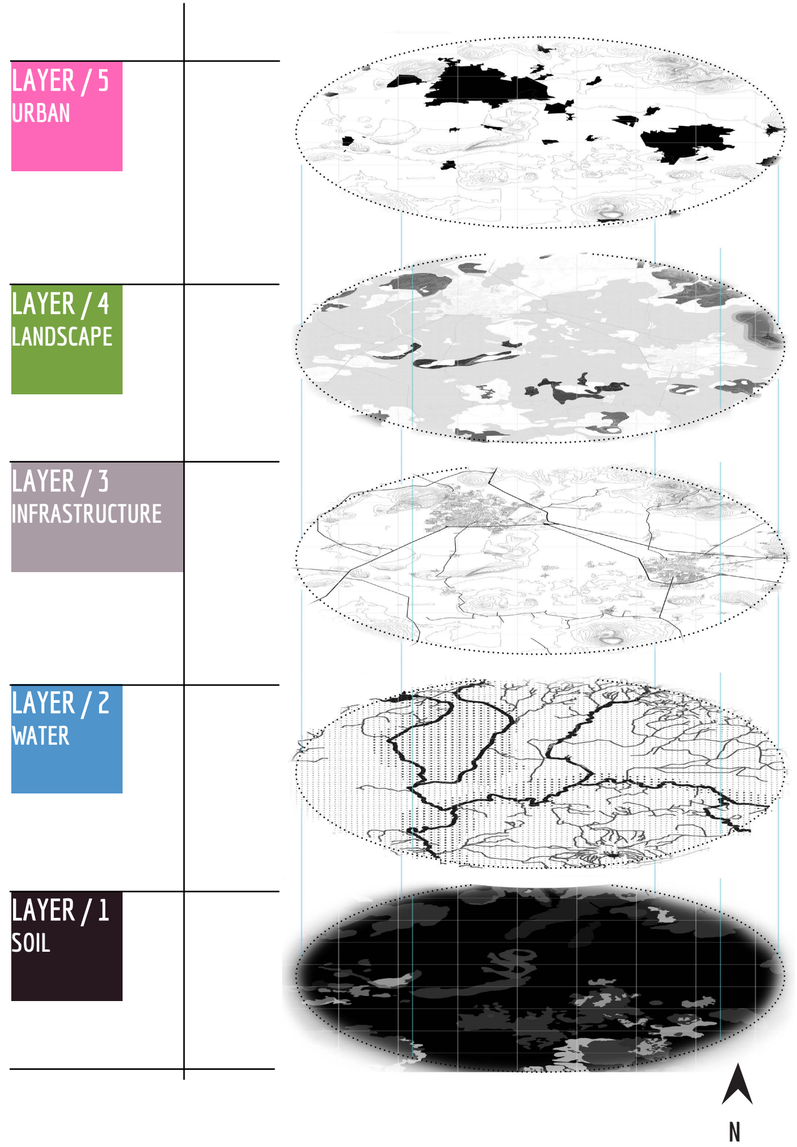


Figures
3.5 Photo by: Joshua Fernandez

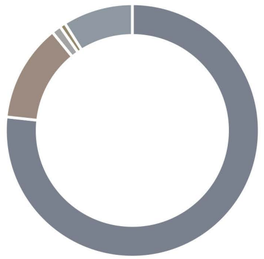
IV / ANALYSIS

4.1 Spatial Analysis

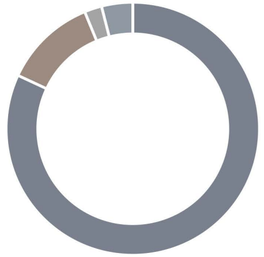
In order to better understand the current challenges of Guanajuato's Central Region a spatial analysis is required. The attempt of this analysis is to locate the problems caused by anthropogenic practices both on the built environment as well as the ecological aspects.
The analysis follows the swarm planning technic and layers the main areas of focus of this thesis: Soil, Water, Infrastructure, Landscape and Urban.
The expected outcome for each of these areas is a conclusion highlighting the main issues and its correlation with the other layers.
Finally, the goal is to understand how each one of the analyzed layers affects the other and how that is translated into one systemic problem for the whole region and even its extension at a national level.



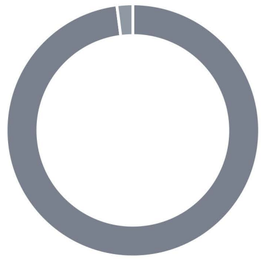
4.1.1 Soil



Irapuato



Salamanca



Pueblo Nuevo

Agriculture Grasslands Forest Shrubland Urban

Land Use (Manuel et al., 2018)

The land use in the area between the cities of Irapuato, Salamanca and Pueblo Nuevo are dedicated mainly to three main uses: urban, industrial, and agricultural. In terms of land use the agricultural lands are predominant in the region because of its proximity to the Lerma River and the vast plains, secondly, we find the urban areas, villages and human settlements, and finally the industrial sector which is constantly growing.

_Agriculture
The land in this region has been used for agriculture since the early 1600 due to the large plains, average weather, and temporal precipitation, as well as the proximity to rivers such as the Lerma River and Silao River. It is important to emphasize the amount of land that is dedicated to the production of food which utilizes a low-tech irrigation system where the fields are flooded with water extracted from the aquifers and around 50% is wasted and polluted. Another important factor that needs to be highlighted is the overexploitation of the soil, currently the area has a remarkably high compaction risk caused by the overextraction of water, the intensive monoculture, and the lack of biodiversity.



_Urban
In the past 30 years the population of Guanajuato has doubled, and the urban areas have expanded up to 10 time its size. Due to a lack of urban planning, sustainable mobility strategies and an ecological focus, the cities have taken a toll in the environment and the ecosystem of the area as well as the increment of heat island effect within them. There is a lack of compact densification in cities, such is the case of Irapuato where the average height of buildings as 2 stories and urban sprawl is the trend for new developers. On the other hand, there are small compact towns that even though they are within the same region and in proximity of industry and agriculture they remain underdeveloped, opening opportunity for a new type of redevelopment in the state.

_Industry
The cities of Irapuato and Salamanca have been industrial cities since the late 1960's and have developed accordingly. The focus for large industrial areas and aesthetic has left the landscape behind while taking advantage of the natural resources to develop. In Salamanca we find one of the most important refineries

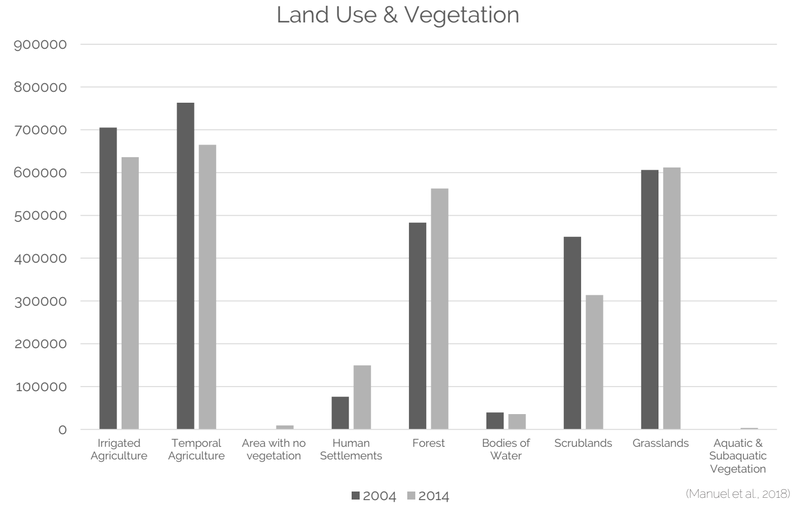
Irapuato

Salamanc

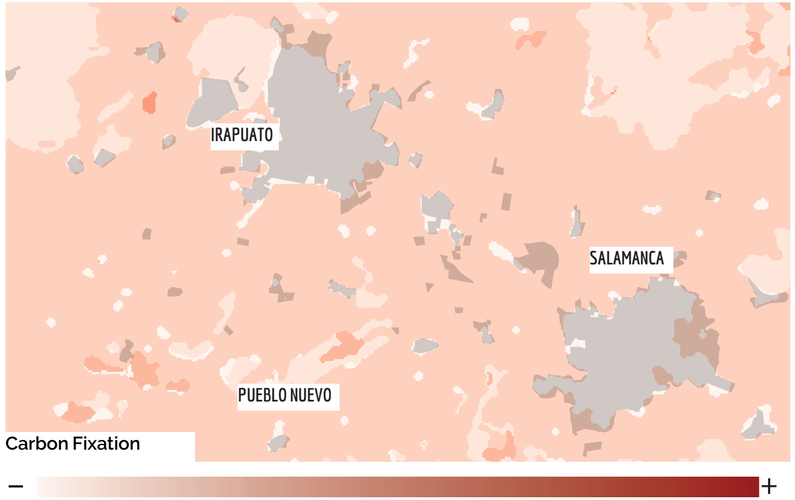
Pueblo Nuevo

Urban Areas
Industry
Roads
Water System

0 1000 km



(Manuel et al., 2018)



in the country that provides jobs for a large amount of the population of that city. At the same time, the refinery is one of the main actors in pollution of water, soil and air which spreads through a regional level. Furthermore, the industrial areas located in the industrial corridor have been growing exponentially in the past years turning what once was open fields and agricultural lands into agglomerates of large highways and warehouses. The state is pushing for more industry to settle in this area and have high hopes for the coming years in terms of economic growth, job offers and a better quality of life, but this cannot be achieved without thinking how this growth is affecting the biodiversity of the plains and forest, the quality and availability of water and finally the housing and climate effects within the cities.

Height Difference

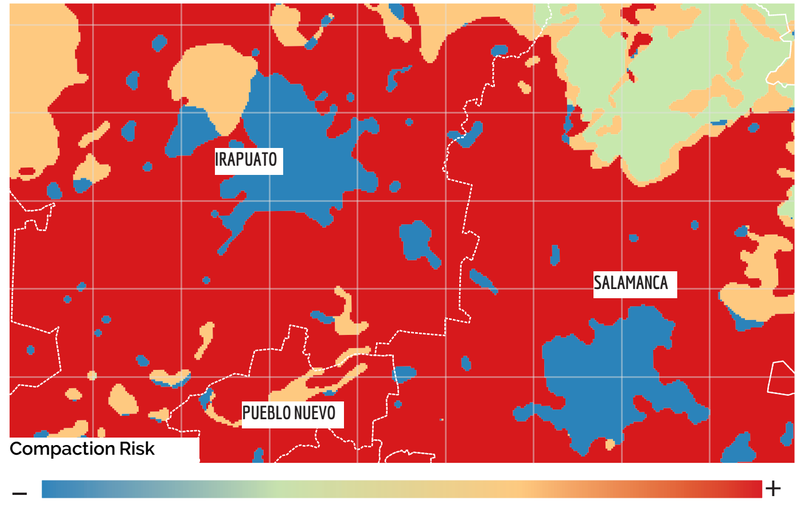
The large plains of the central region of Guanajuato have been ideal for agricultural practices. Currently 64% of the central region total area is conformed by temporal or traditional agriculture. The agricultural land serves not only the urban areas in the proximity, but it also provides for other neighboring states. Lately the harvesting of avocado, berries and agave have been predominant in this particular region. At the same time these crops require a high amount of nutrients from the soil and in the case of avocados large amounts of water.

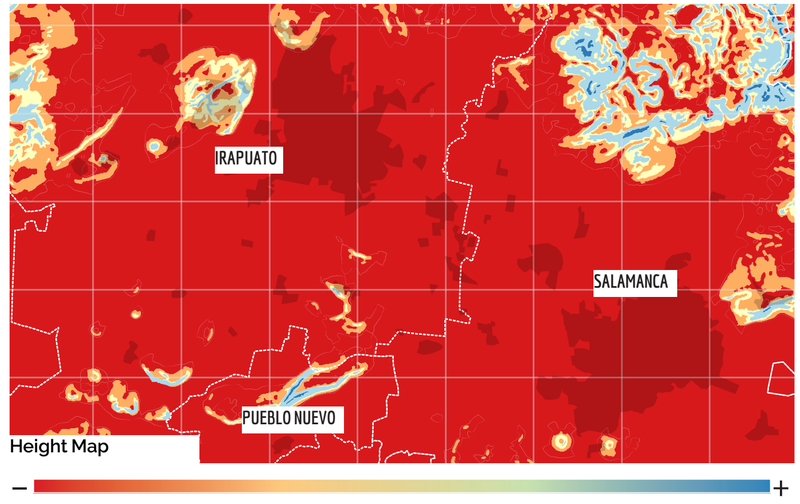
Carbon Fixation

Due to the extensive monoculture land use, there is a lack of biodiversity in the region reducing the soil nutrients, retention capacity and filtration. In parallel the result of this lack of carbon fixation is the increase of green house effect, erosion of soil and lack of humidity.

Compaction Risk

The intensive agricultural activities have taken a toll on the soil quality. Every year the poor agricultural practices including the flood irrigation system, the burning of crops at the end of seasons and the use of chemicals and pesticides have increased the soil's compaction risk. The compaction of the soil means the solidification of the top surface, as a result the hard shell of soil prevents water to infiltrate as well as roots to penetrate the soil. In short Soil Compaction = No life.





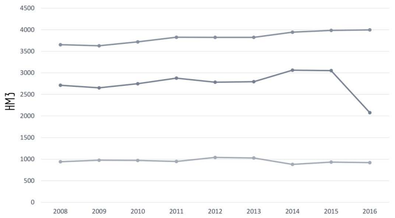


Findings

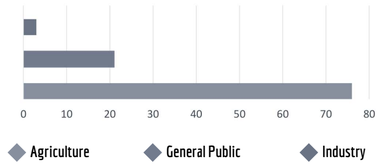
As the landscape stands today there is a clear lack of zoning both at the urban level and the landscape level.
The lack of control on the agricultural land has resulted in many problems with the soil such as compaction, lack of carbon fixation and erosion. The archaic agricultural practices in the region are the main actor to blame, the soil has been exploited to its maximum by extracting all its nutrients for food production. Since the cycles of soil recuperation have not been respected, the addition of chemical fertilizers has been used to increase production but not without harming further the quality of the soil.
Another important damaging factor is the practice of monocultures. The lack of biodiversity in the agricultural areas is reflected in the restricted capacity bay soil to capture carbon and develop a healthier layering.
In addition, with the deforestation from the agricultural land and urban areas, the soil lacks the capacity to heal.

In order to start remedying the damage done to the soil there needs to be a reincorporation of biodiversity through out the whole region that promote self-sustaining ecosystems that not only increase the quality of the soil but manages a balance between the demand by humans and a healthy environment.

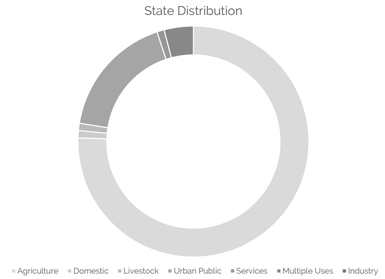
4.1.2 Water



Hydric Balance 2008-2016



Water usage



Water usage

(Manuel et al., 2018)

Figures
4.1 Image adapted from Google Earth

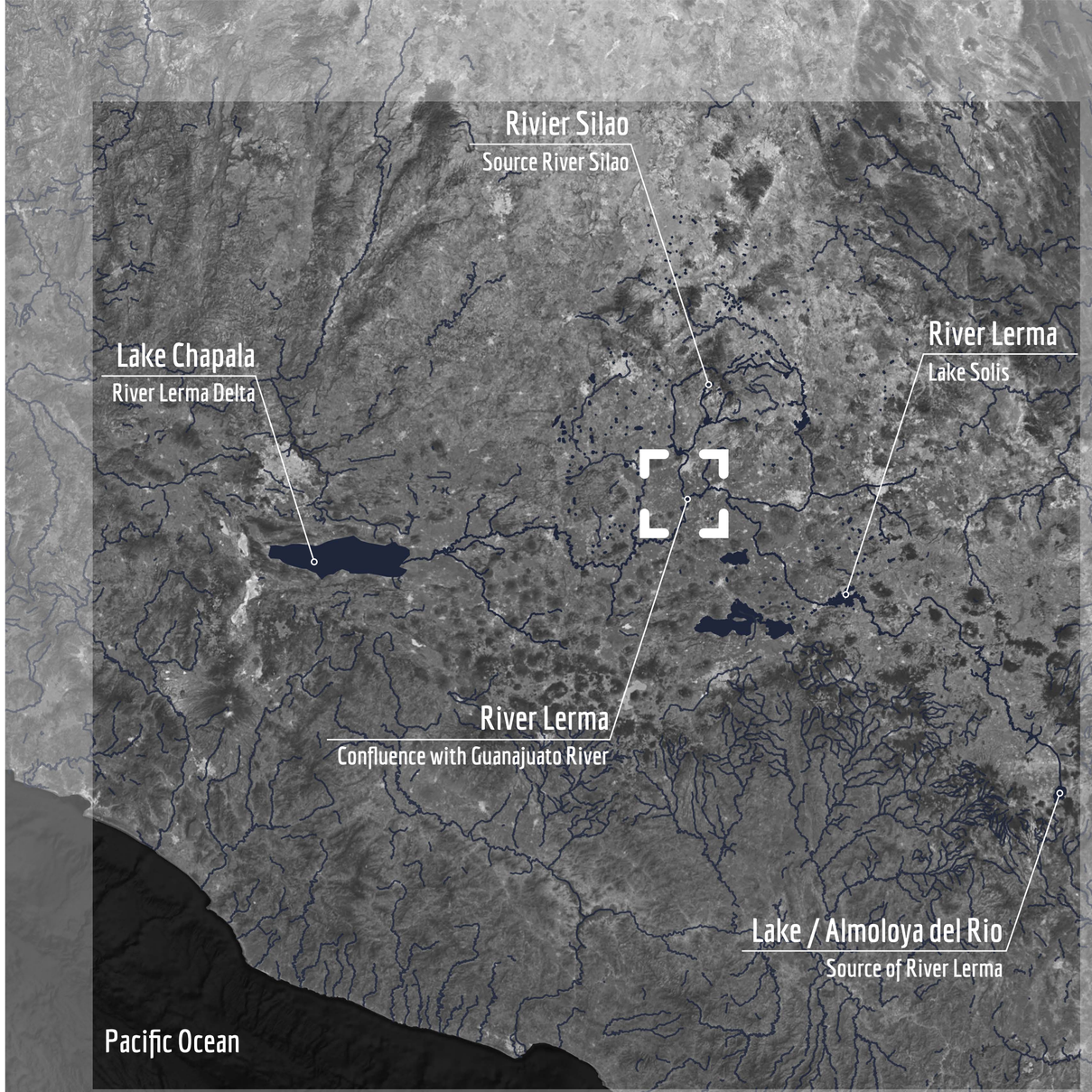
To understand the water system, an analysis at a large scale is required with a focus on the Lerma river, its source, the situation in the Irapuato-Salamanca-Pueblo Nuevo area and its delta.
The source of the Lerma starts in Almoloya del Rio, 2600 meters above sea level. The water gathers at the foot of the Holotepec Volcano in the form of a lake and evolving into a river in the north side of it, the Lerma River. In its path the river crosses five different states, one of them being Guanajuato. In the vicinity of the river, it is common to find agricultural land that takes advantage of the terrain and water flows for irrigation, it also provides water for cities and industries extracting water with wells from the aquifers. Finally, the river's delta is located in Lake Chapala, Jalisco and it contains all the water that has passed through this system, not excluding the polluted and low-quality water.

A comparison between the past and the present is done with the intention to grasp in a visual way the changes that these areas have gone through and to understand the causes for this shift.

There is a challenge at a National and Statal level. Water systems are being over extracted by the population to allocate it to anthropogenic practices, mainly in the agricultural sector. The usage of the water while being an issue is not the end problem, the problem lays in how people utilize, manipulate, and dispose water. The current process of water usage in Mexico and the state of Guanajuato are diverse, while there is a push for treating the used water and returning it to the system in a clean way, there is still a lot to be done in terms of water culture. The majority of the water that goes into the urban areas and agricultural areas end up highly polluted with heavy metals and human waste, this water is the one that then is put back into the national water system and is reused to water crops, for industry and in some cases as drinking water.

Another challenge in the region is the fact that the flat terrain makes this area propense to flooding. Now a days the state has done little to no efforts in terms of water management and water retention. While along the rivers there is now the existence of dikes, the rest of the land still has no strategy when it comes to flooding prevention and mitigation. The only solution as of today is to dispose of the water as soon as possible.

When it comes to the overextraction of wells, the state is currently in big trouble. Currently there are higher amounts of extraction than there is of entry, this is a pattern that has been true for the past decade and is more present than ever in the past few years. It is expected that in the next decade the state water reserves will run out.



Water System - Central Region of Mexico
4.1



2003



2003



1984



2020



2020

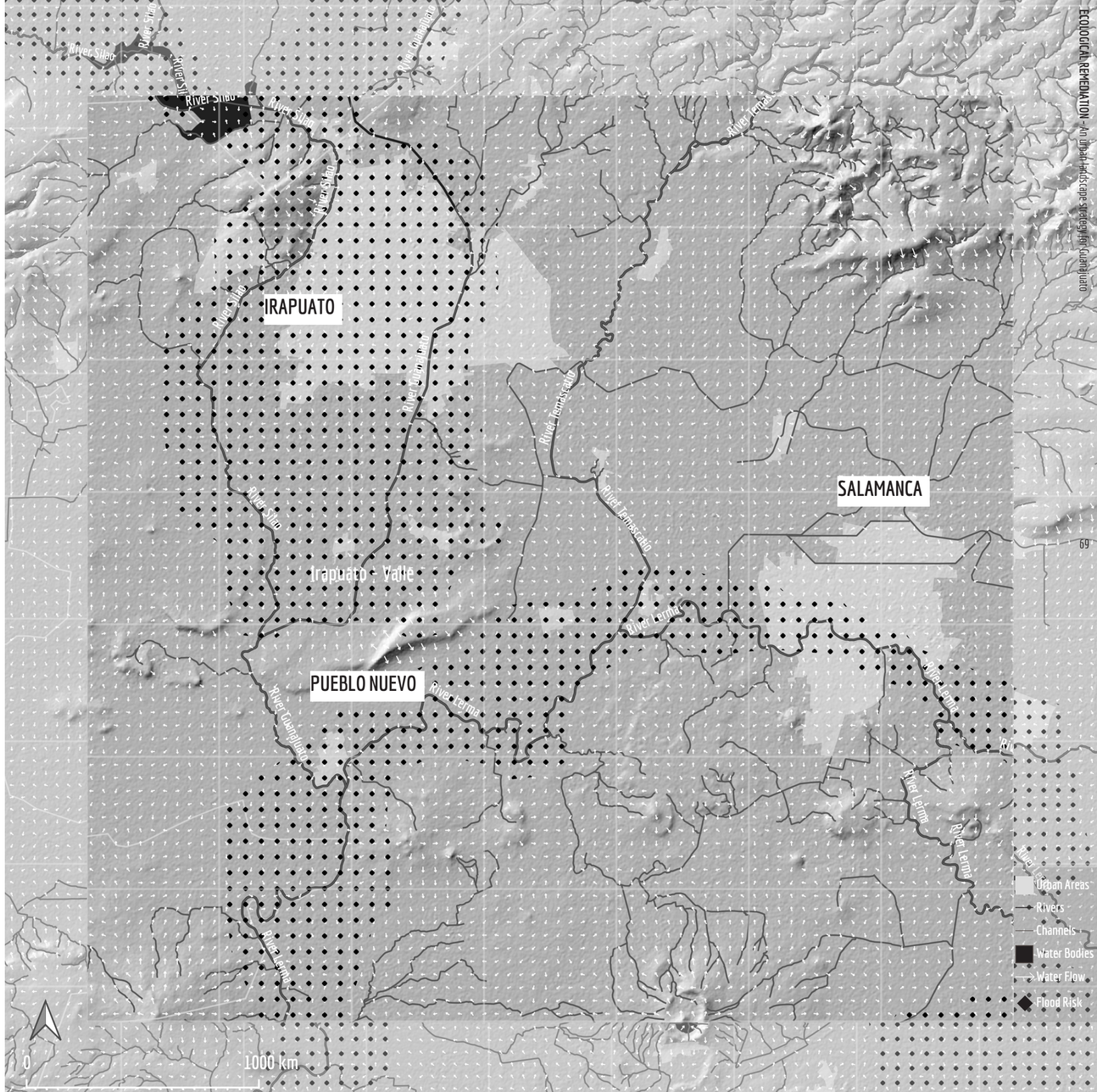


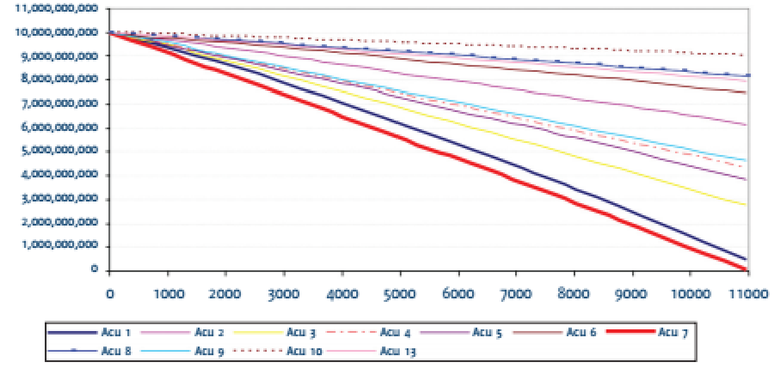
2016

_Almoloya del Rio
Looking at an image of the source, Almoloya del Rio, from 2003 there is a vast amount of water in the lake and the area is perceived as fertile and healthy. In comparison with the image of the same area in 2020 the lake has been reduced to a seventh of its size, the urban areas have expanded around it and the land appears dry and eroded.

_Pueblo Nuevo
The crossing of the Lerma river through Pueblo Nuevo in the year 2003 looks like a small water way with a linear forest along it and it is surrounded by healthy agricultural land. In 2020 the river has increased in width to almost tree times its original size, the linear forest has disappeared and the land on the north side seems eroded.

_Chapala
In Chapala there is nor much difference that can be grasped visually, only the surroundings have change where cities like Guadalajara, Ocotlan and Sahuayo have expanded and the greenery in the landscape seems to be decreasing.


River Silao
River Silao
River Silao



State's Aquifer Reserves Tendency towards 2030 (Manuel et al., 2018)

_Irapuato-Salamanca-Pueblo Nuevo

According to studies done by the National Institute of Statistics and Geography (INEGI), the central region of Guanajuato has high hydrological vulnerability as a result of the overextraction of the aquifers and are soon to be dry. A projection to the year 2036 is alarming with 6 of the 13 hydrological regions in the state are in a high vulnerability status.
Today, the region extracts more water from the aquifers than the amount that enters it and there has been a deficit since the early 2000's. At the rate of urban, agricultural, and industrial growth it is expected that in the near future the state dries up its aquifers turning the central region of the state into a desert.
The changes in precipitation in combination of the flat terrain are also alarming, with more unexpected rain out of the regular seasons entire crops are lost creating an economic distress as well as a food production reduction and cities are constantly flooding damaging the infrastructure.

Figures
4.2 Image adapted from Google Earth
4.3 Image adapted from Google Earth
4.4 Image adapted from Google Earth
4.5 Image adapted from Google Earth
4.6 Image adapted from Google Earth





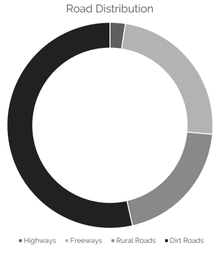
Figure2
42 CEAG del Plan Estatal Hidráulico 2008- 2030, Centro de Ciencias Atmosféricas de la Universidad de Guanajuato, 2010

Findings

The water system in the region is heavily extracted and the projections suggest that there will be not enough water for the needs of the state, industry, people, and nature.
There is a lack of water retention capacity at multiple levels in the landscape as well as in the urban areas, the current practices focus mainly on redirecting the stormwater to pipes, sewage and finally the rivers. This practices not only reduce the quality of water but also prevents the lakes, aquifers, and basins to refill. The result is statewide scarcity of the most precious resources.

There is a need for a large-scale system taking care of the water quality and quantity throughout all the cycles it goes through in order to use, retain, filter, and reincorporate into the system as well as to create a shift in the relationship between humans and water and develop strategies where we take advantage of challenges such as the flood areas which can be used as an opportunity for designated wetlands and retention areas rather than a safety and infrastructural problem.

4.1.3 Infrastructure

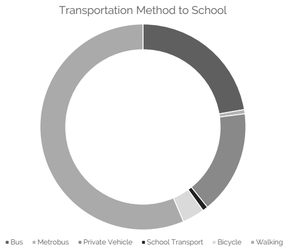


(Manuel et al., 2018)

State Road Length

Highway	**347 km**
Freeway	**3,494 km**
Rural Roads	**2915 km**
Dirt Roads	**7766**

(Manuel et al., 2018)



(Manuel et al., 2018)

In the state of Guanajuato for the past decades the development of infrastructure was a key component in urbanization as well as the means to develop a thriving industry. As part of the analysis is worth to highlight the number of connections throughout the state's territory which at the same time, they generate disconnections for people as well as other species.

The state is interconnected by 3 main types of roads, Federal, Municipal and Rural. All of the aforementioned were developed for motorized vehicles, principally the car. As an alternative for those who don't own a car they can take buses from central stations in every city, a service that is expensive, inefficient, and timely. Within the cities the structure is very similar to the American city, grand boulevards, avenues, and local streets. Within them the mobility options remain the same as in the interstate.

Since the state is located in the center of Mexico there is an interior port that processes all the imports and exports for the industrial corridor. The state counts with one international airport located in between Leon, Silao and Guanajuato and is conveniently placed next to the interior port.

The railway system while being well connected is only used by Ferromex for the transport of products across the country, each city counts with a station dedicated to loading and unloading goods and products.

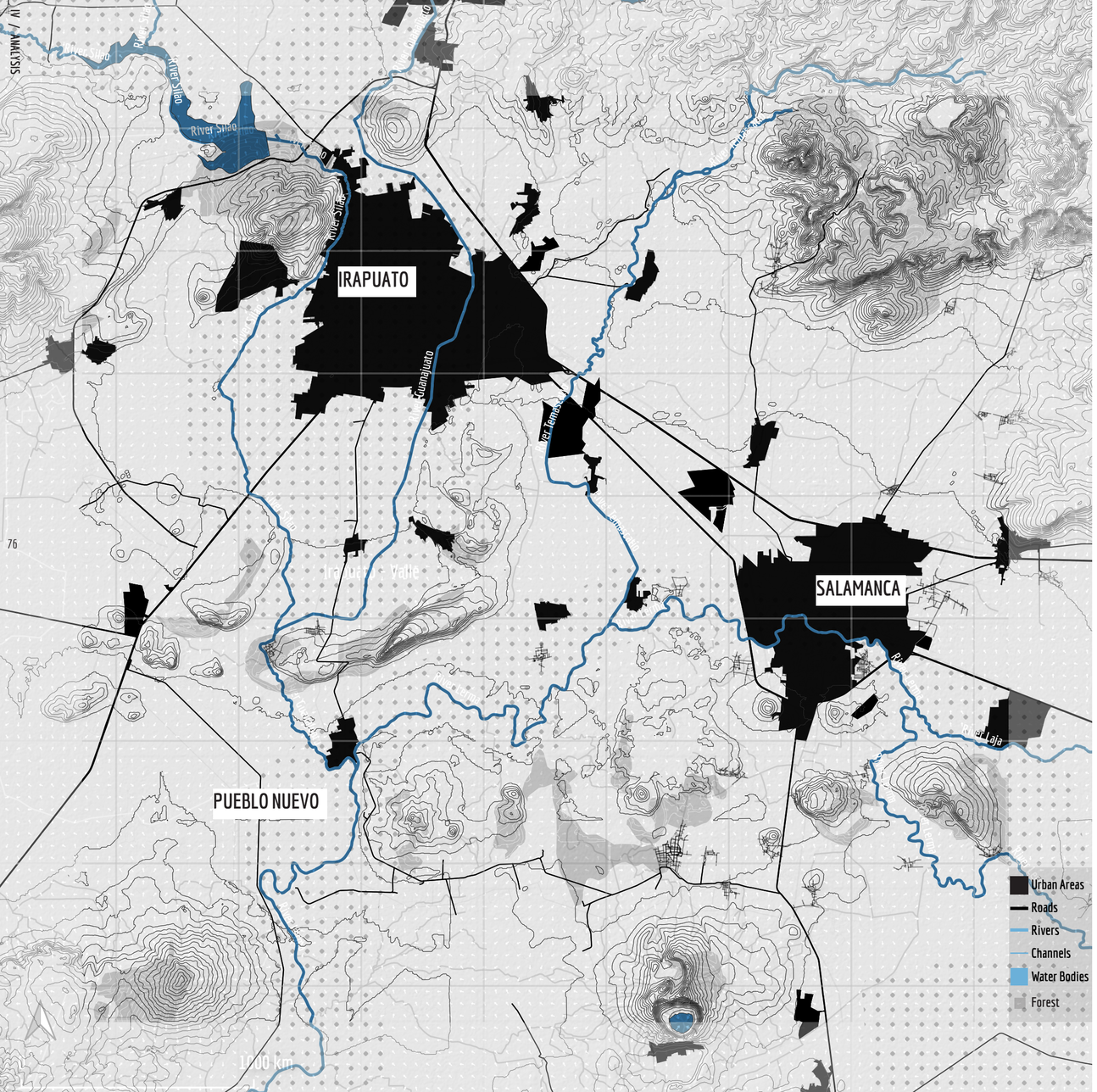
Since the majority of the mobility infrastructure has been developed for motorized vehicles, those who don't have one are left to rely on the inefficient public transport. The lack of space for the pedestrian is also a sensitive topic, since the cities don't have enough connections for pedestrians there are less people on the streets, supporting the lack of community, gathering spaces, eyes on the street and even health related issues. In the state there are only 2 cities that have infrastructure dedicated only for cycling and soft mobility methods, only one of those cities has a full network throughout the whole metropolitan area (Leon).

Leon - This city in Guanajuato is also the largest city in the state and one of the few leaders for urban developments in Latin America. Much like the city of Curitiba in Brazil, Leon counts with an efficient metrobús (Optibus) system that connects a large area of the city. It also has one of the largest cycling networks in Latin America.

As for the animal aspect of the disconnections generated by infrastructure it happens both at a state level as well as an urban level.

At the state level, the development of high-speed highways has generated a break in the biological corridors that existed in the past. There is a lack of access mainly in the central corridor for other species creating a central boundary that divides north and south ecology.





At the urban scale the disconnection exists through the deforestation for urban expansion where the destruction of native ecosystems take place as well as pushing species further away into the mountains where the last existing forests are located. On a neighborhood and street level the lack of spaces dedicated for landscape and biodiversity makes it impossible for species to roam around freely, gather food and seek shelter.


4.8


4.9



4.10

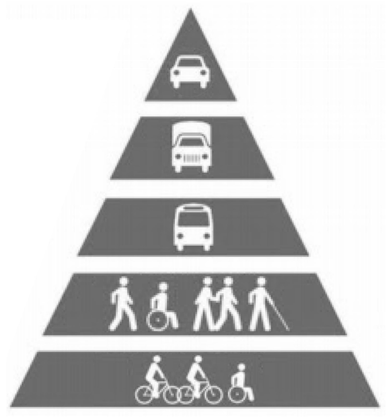


4.11


4.12



4.13



Mobility Hierarchy



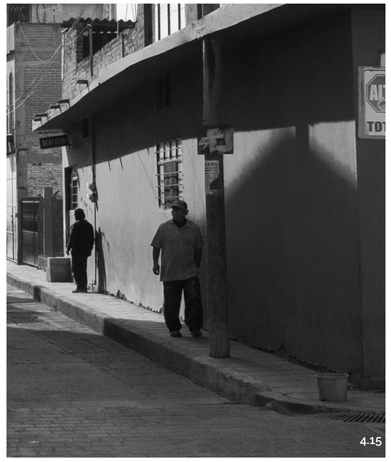
4.14



4.17



4.18



4.15



4.16



4.19

Bike Lanes / Length per City

Leon	**103 km**
Celaya	**29.9 km**
Silao	**23.2 km**
Salamanca	**16.4**
San Francisco	**14.5**
Irapuato	**7.3**
Purisima del R.	**5.6**
Uriangato	**3.4**

(Manuel et al., 2018)



Findings

There is a need for the state to provide a wider variety of sustainable, efficient, and affordable mobility methods for people both within the urban areas as well as a statewide network. This mobility methods have to comply with the ecological needs for the state to give a place and safe passage to species throughout the biological corridors and to generate the connections throughout the whole state.

The implementation of bike lanes and larger pedestrian paths and gathering spaces could be a positive addition to the urban areas that give people the accessibility and health support that they need.

Mass transit needs to be improved providing smarter and innovative technologies into the city that connect larger numbers of people in an efficient and economical way.

City and intercity infrastructure need to provide specific protected spaces where other species can transit safely as well as to provide continuous biological corridors from city to city and into protected natural areas in the state.

Figures
4.8 Photo by Author
4.9 Photo by Author
4.10 Image adapted from Google Earth
4.11 Image adapted from Google Earth
4.12 Source: https://ocvirapuato.com.mx/afiliados/parque-irekua/
4.13 Source: www.elsoldeleon.com.mx
4.14 Source: https://centrourbano.com/
4.15 Photo by Author
4.16 Source: www.elsoldeirapuato.com.mx
4.17 https://www.fundesa.org.gt
4.18 Source: https://heraldodemexico.com.mx/
4.19 Source: https://carmania.mx/

4.1.4 Landscape

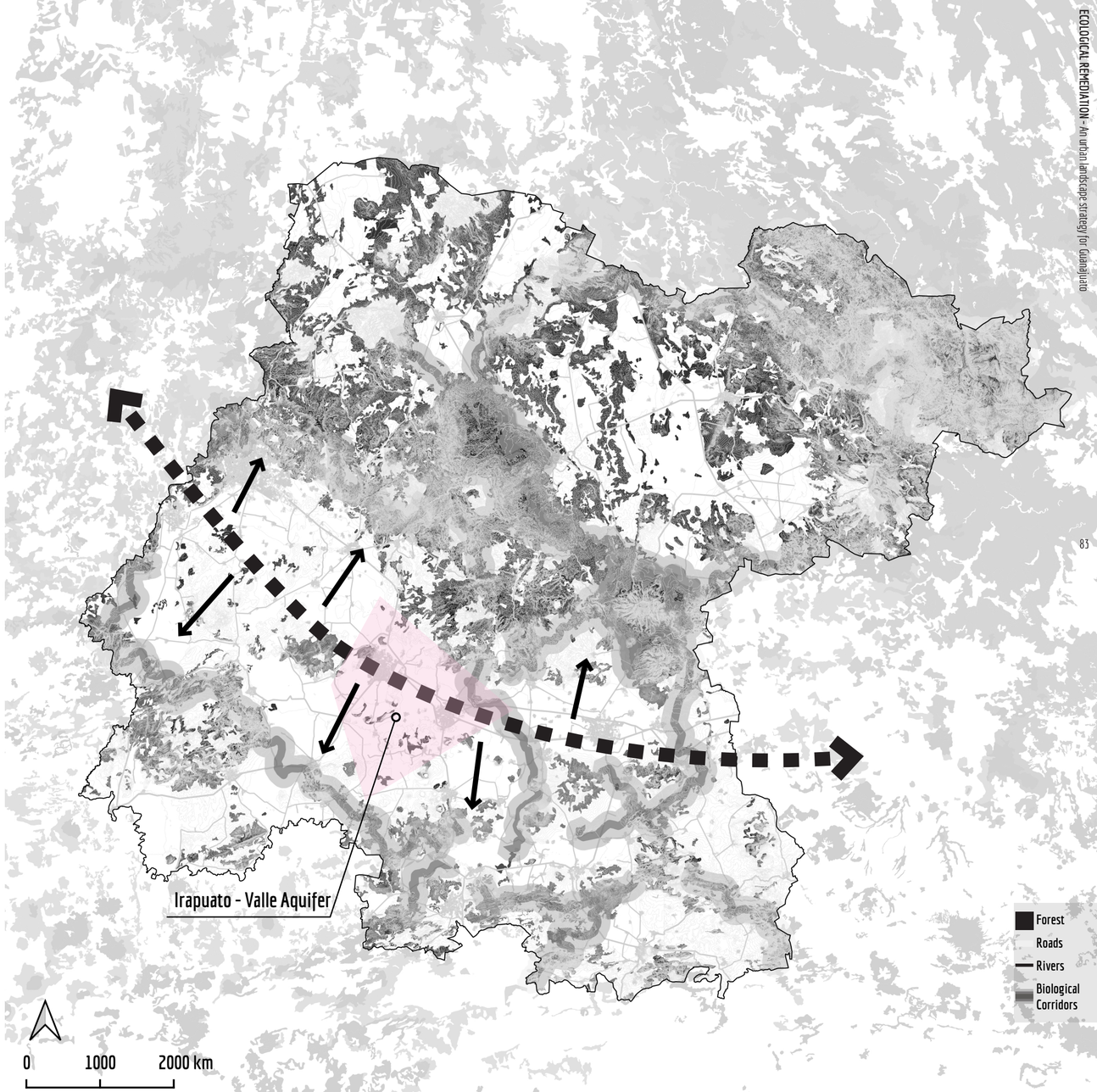
With the continuous urban expansion, industry development and enourmous amount of agricultural land the biodiversity in the central region has been disapearing at a regional level but it has also created a disconection with the statal and national ecosystems.

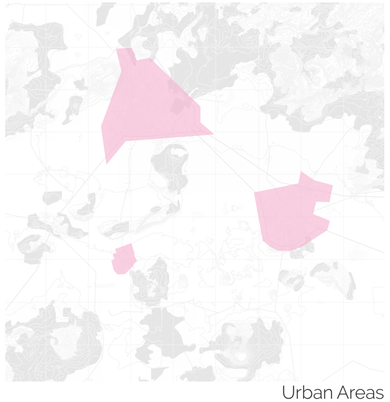
On figure XX there is a white shade crossing from south-east to north-west right in central region of the state of Guanajuato, these are the planes of the state. In this region agriculture, urban areas and industry have succeeded because of the flat terrain, the connectivity to most of the country, and the gentle weather. Since colonial times until today, this region has been one of the agricultural hubs for the state with constant crops of corn, grains, and strawberries to mention a few. As the cities grew so did the food demand, increasing the size of the agricultural land and taking over the native ecology of the state. Today we can see only a few areas that remain native forests throughout the state, and only because the land they are on its not ideal for agriculture. Ecology appears in patches as constant as the hills in the area and it is in an extremely high risk of disappearing in the near future.
To better understand this phenomenon an analysis is done separating the different types of landscapes, their relation to water and the challenges brought upon by anthropogenic development in the area.

_Temporal Agriculture
The temporal agriculture can be found usually at the foot of the hills where it takes advantage of the rain and water channels during only the precipitation season on the months of July & August. Because of its natural restrictions, this type of agriculture is not predominant in the state.

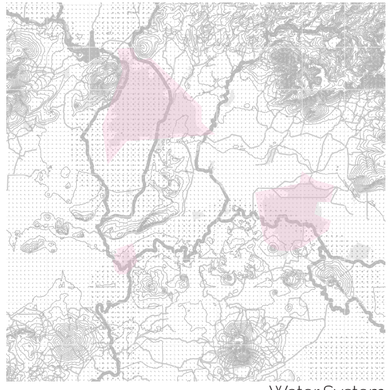
_Irrigation Agriculture
Irrigation agriculture covers most of the area in the Irapuato-Salamanca-Pueblo Nuevo vicinity. The crops are usually located in flat terrains and in proximity of rivers taking advantage of the basins to extract water all year round to irrigate the crops. This type of agriculture is irrigated in an unsustainable manner where the farmer floods the fields along with chemicals and lets the crops absorb however much they can. With this method the efficiency of the water used is lower that 50%, losing a large amount in evaporation and runoff water merging again with the rivers. As the crops have added chemicals, most of the water that us not utilized joins the system with heavy chemical pollutants lowering the water quality as well as eroding the soil.

_Forests
The forest areas in the region fall under four categories: (i)oak forest, (ii)xeric shrublands, (iii)grasslands & (iv)deciduous forests. These native ecosystems used to spread throughout the whole state. Today with the increase of urban areas and agricultural lands the space of these forest has been reduced to an alarming size. The negative effects of losing these environments span from

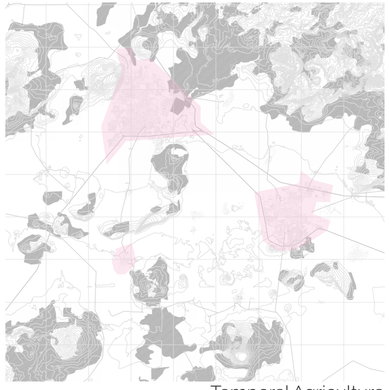




Urban Areas

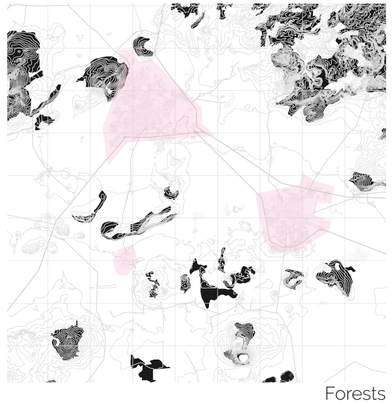


Water System

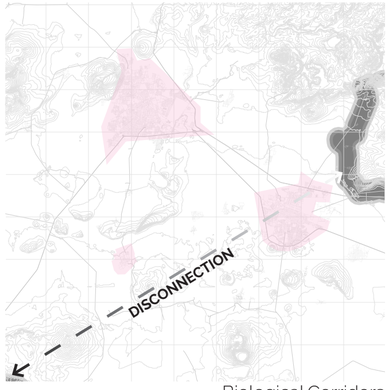


Temporal Agriculture

Irrigation Agriculture

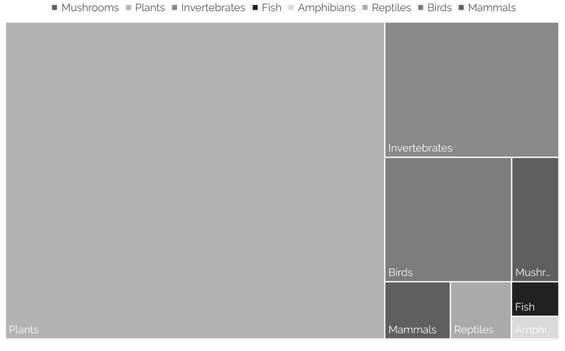


Forests



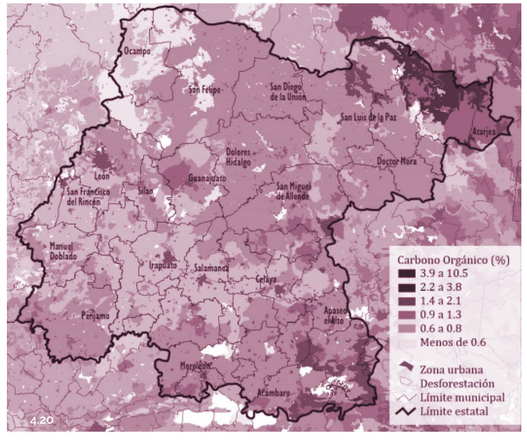
Biological Corridors

State's Native Biodiversity



(Manuel et al., 2018)

Deforested Areas 2017



the loss of species to soil erosion and a disturbance on the water cycles. The lack of forests also affects the climate throughout the region, showing the harshest effects in urban areas with the increase in temperatures and air pollution.

_Biological Corridors

The biological corridors can be thought as highways for the animal realm. They use this corridor to move through space in search of food, shelter, and comfort. At a state level there is a clear division between the north and the south corridors along the plains, agricultural areas and ironically enough, our own highways. The before mentioned industrial corridor runs from north-west to south-east providing a large fast automotive mobility highway to the whole country. This piece of infrastructure has been one of the most important infrastructure projects developed in the state and has changed the economic and political relevance of the state. At the same time, it has broken in two a larger mobility system for thousands of species, harming their ecosystem, their freedom, and their way of living. Now a days the Irapuato-Salamanca-Pueblo Nuevo region has one of the lowest biodiversity rates of the whole state and with the increase of industry and urban areas this issue will be continuously getting worst.

In the vicinity of Pueblo Nuevo, we see only a small portion of a deciduous forests on the south-east and patches of a biological corridor along the Lerma river, leaving the rest of the landscape for agriculture.

the loss of species to soil erosion and a disturbance on the water cycles. The lack of forests also affects the climate throughout the region, showing the harshest effects in urban areas with the increase in temperatures and air pollution.

Land Use Change since 1970

Shrub Lands	**- 66% ha**
Primary Forest	**- 30% ha**
Oak Forest	**- 56% ha**
Thorn Forest	**- 30% ha**

(Manuel et al., 2018)



Findings

Due to the constant urban, industrial, and agricultural expansion, the landscape of the central region has disappeared almost to its totality. There are some areas that remain mainly on the foot of hills or in proximity with rivers, besides that, most of the land belongs to anthropogenic practices.

This lack of biodiversity in the land in combination with the disconnection of biological corridors from north to south, has affected the native species of the region which in its majority have disappeared.

Along with soil recuperation strategies there is a need for heavy reforestation, enhancing the existing remaining forest areas and native biodiversity as well as extending the ecological elements through out the whole state. The protection of species is an imperative, there is a need to provide for safe and consistent passage for them to thrive in the state.

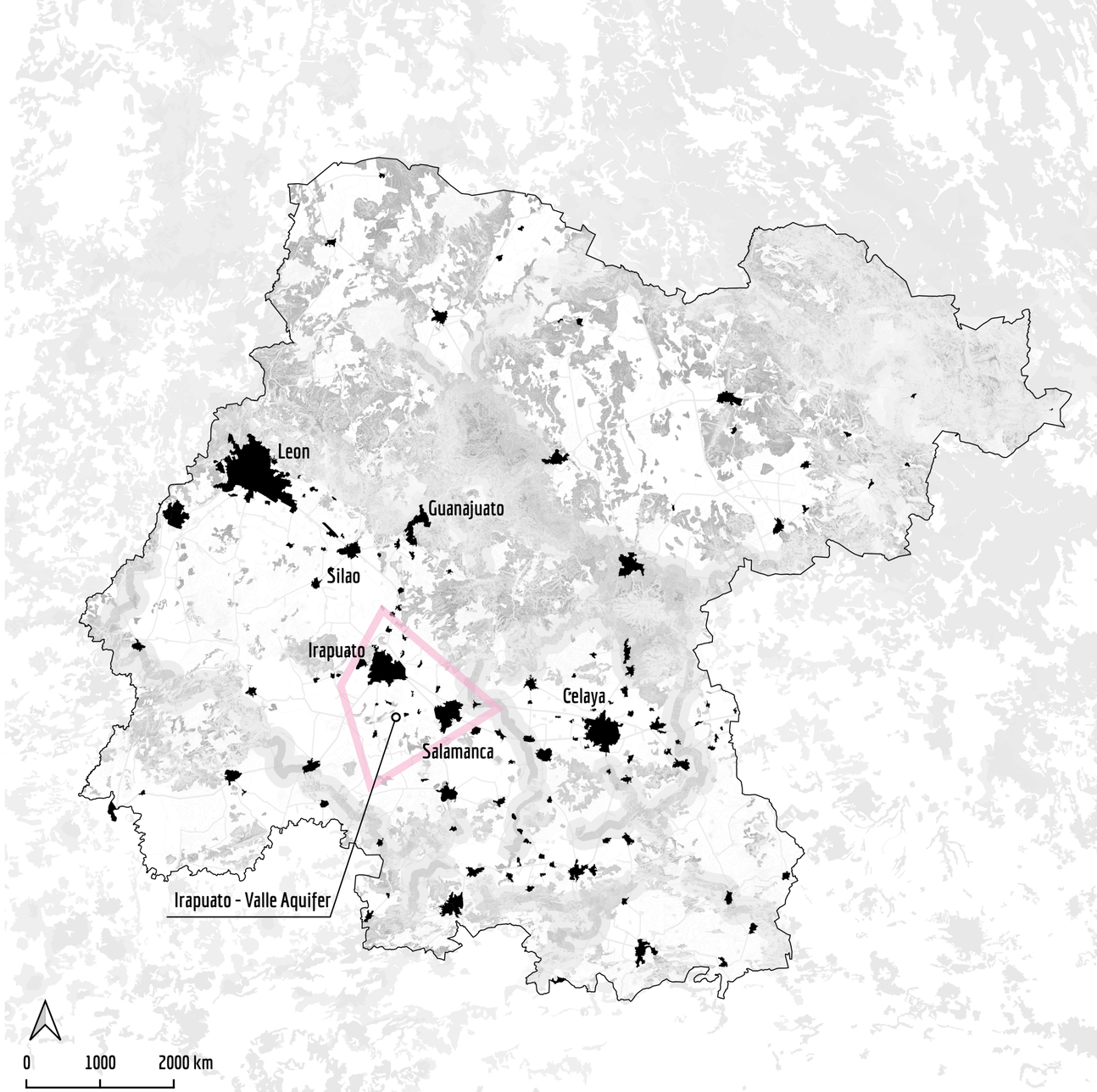
Finally, some areas should remain as intact ecosystems on an attempt to give native species a fighting chance. At the same time, these areas will enhance the biodiversity, the health of soil and the variety and quantity of species.

Figures
4.20 Image adapted from Dimension Medio Ambiente y Territorio (Manuel et al., 2018)

4.1.5 Urban

The central region of Guanajuato has an industrial corridor that connects the state to the whole country and acts as a mobility hub. 5 are the cities that are directly connected through infrastructure and industry as well as being the ones that increase in size, population and economically.
This thesis will focus on the town of Pueblo Nuevo characterized by being a small compact town with an agricultural economy, it also has the condition of being in the confluence of the Lerma and the Silao river and finally is within a 30km radius of the industrial cities of Irapuato and Salamanca and the industry between them.
It is worth understanding the relevance of the cities of Irapuato and Salamanca to get a general idea of how the large cities in the state have grown due to the industry and how they have been developed. The city of Irapuato has been in constant growth since the development of the textile factories in the early 80 as well as the agricultural sector. The city of Salamanca houses one of the most important refineries in the country constructed in 1950 and has been the booster of the economy of the city since.

Due to the increase in population and lack of urban planning, the cities are expanding without measure and they are destroying more and more the native biodiversity.
The housing demand has driven the market into a fast and low quality housing. The cost, location and typology are directly linked to social inequality.
Because the cities are developed for motorized vehicles, mobility infrastructure requires more space and increases the city footprint
Biodiversity is not the priority in city development. There is a limited amount of species and biodiverse land in the cities.







1989



1990



1992



2020



2020

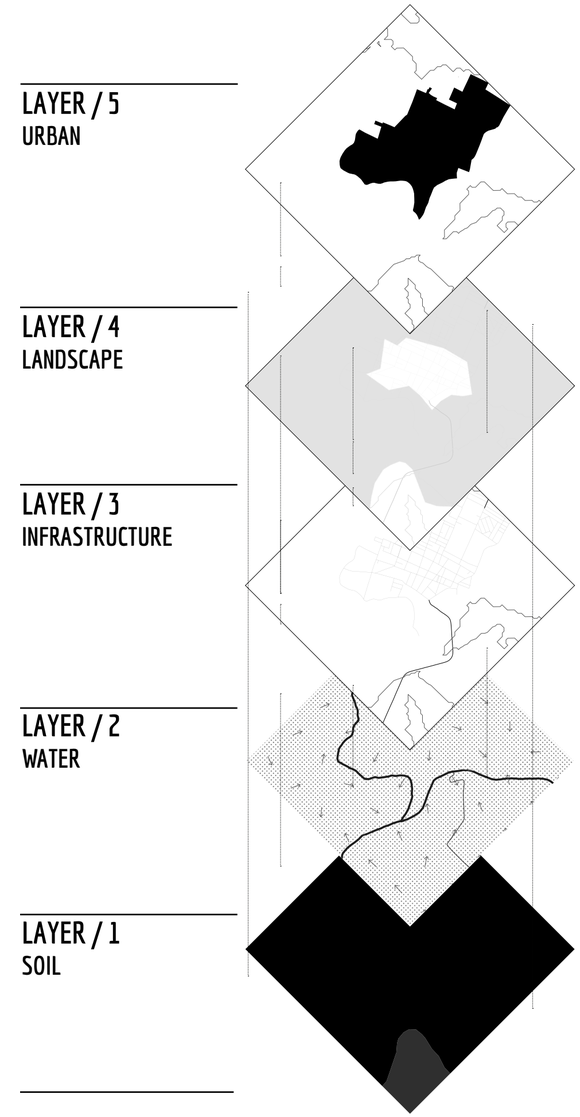


2020

_Irapuato
The urban footprint of Irapuato has changed a lot since 1989. The city has been expanding in order to meet the housing demand from the exponential population increase.

_Salamanca
The city of Salamanca has increased in size and population expanding to the north-east and the south-west.

_Pueblo Nuevo
The town of Pueblo Nuevo has remained compact with a slight extension to the north and the population has been increasing at a slow pace since 1992



Figures
4.21 Image adapted from Google Earth

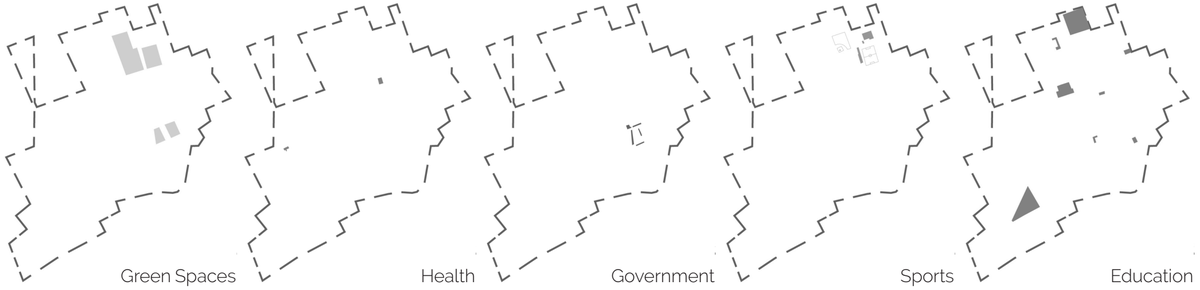
Pueblo Nuevo

The town of pueblo nuevo has an area of 0.8 square kilometers, the urban fabric follows a grid structure with a variation of block sizes. It has a central square with some added vegetation, in this same area there is the church and the municipality. There are 3 different access to the city 2 large highways in the south of the town and one smaller road on the north-east following the river.

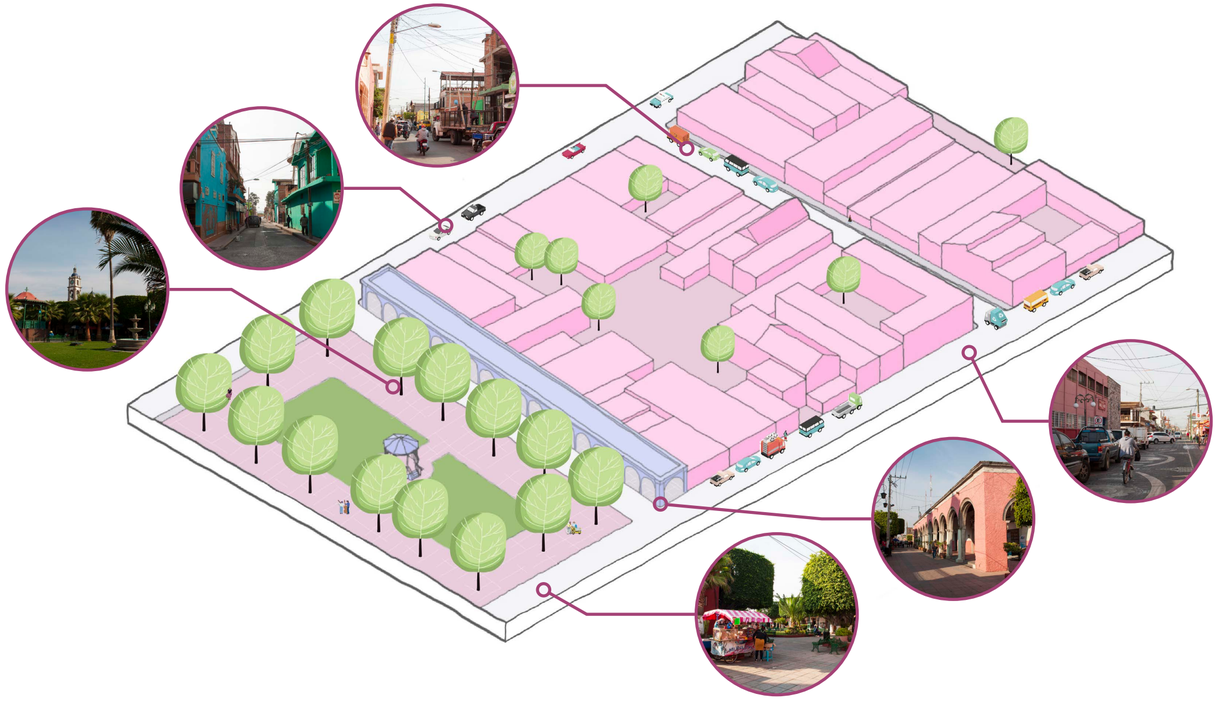
There is no clear hierarchy of a commercial street and the services are spread around town with no clear structure, considering that the town is in its majority residential it suggests that most of the business are family owned and are located on the ground level of their residences.

The streets are paved with concrete and count with sidewalks with an average width of 1.2m. There is a clear predominance of the car on the streets, in most cases half of the streets are used as parking lots and the rest as a road. There is little greenery on the streets and sidewalks, the greenery that can be found is located mainly in the central square and in some back yards of houses.

As for the building structure the church is one of the tallest buildings on town, the rest of the buildings span from 1 to 2 floors with the majority hosting only one function.







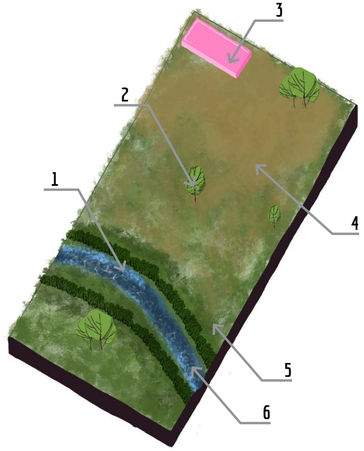
1. BLOCK

1. Lack of biodiversity
2. Large percentage of streets for parking
3. Streets for motorized vehicles
4. Lack of human scale
5. Small sideways
6. Low density blocks
7. Non porous surfaces

The relation with nature is not evident, along the river Silao there is little to no interaction from the city, the areas that are occupied are used as agricultural land and the rest are empty lots. On the Lerma river the situation changes, there is more greenery and a variety of species and the city edge is closer to the river, this does not mean that the relationship it has is something positive, just that is more evident through nature. Lastly in the main square there are several trees planted which appear to be the same species, two large gardens with grass, the rest of the city is shows mainly hard surfaces.

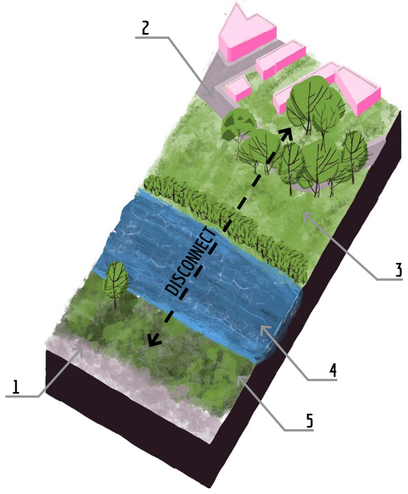
2. CITY - AGRICULTURE

1. Lack of vegetation on river's edge
2. Lack of trees and variety in species
3. Single use/low density buildings
4. Lack of vegetation / eroded soil
5. Lack of human and animal mobility paths
6. Polluted water / chemicals / garbage



3. CITY - RIVER

1. Eroded agricultural soil
2. Paved streets with no greenery
3. Discontinuation of trees
4. Polluted water
5. Lack of / greenery / human & animal interaction





Findings

At the large urban areas of the central region there has been a constant expansion throughout the years, this urban sprawl has been the result of increase in population attracted by the growing industry. Because of the lack of planning there is an uneven distribution of services, amenities, green areas, and spaces for leisure between others. This lack of spatial justice has been increasing the segregation of people and division of classes in these cities.

The mobility factor is another big issue, cities are developed for motorized mobility and create a disconnection between other alternatives. Cities cannot be walked, cities cannot be biked, the people and the infrastructure limit this possibility.

The lack of greenery in the cities and open green areas is harming the biodiversity at a regional level but it also has localized issues such as the increasing temperature of the cities.

Finally, the quality of life that cities currently offer is on decay and falling rapidly. Housing, education, health, jobs need to start providing for people and at the same time be a positive impact on social and ecological aspects.



4.2 Site Documentation

Region

As part of an understanding of the selected location, a site documentation was incorporated as to reinforce the gathered data, at the same time this documentation shows the discrepancies and differences between the latest online information and the current reality of the site.

This documentation has been done at two scales and with two different focuses. The first section focuses on the landscape qualities, mostly along the Silao river. The contrasting landscapes portray an area that on its majority is agricultural land with the exceptions of a few villages on the edge of the river. The river lacks a constant flow, and the available water is heavily polluted, scarce and emits a rotten smell. On the agricultural land the lack of quality of the soil is visible, most of the soil is eroded, compacted, or just turned into dust. The infrastructure next to the river consists of a dike that is risen approximately 1m above the agricultural land, on the river side there are some patches of greenery, but it is inconsistent through out the path taken. The path is a dirt road wide enough to fit a car but the quality of the road is comparable to open terrain. The overall landscape shows the vast plains covered crops with some existing forests on the foot of the hills.

Figures
4.22 Image adapted from Google Earth













Figures
4.14 Image adapted from Google Earth
4.15 Image adapted from Google Earth













Figures
4.14 Image adapted from Google Earth
4.15 Image adapted from Google Earth



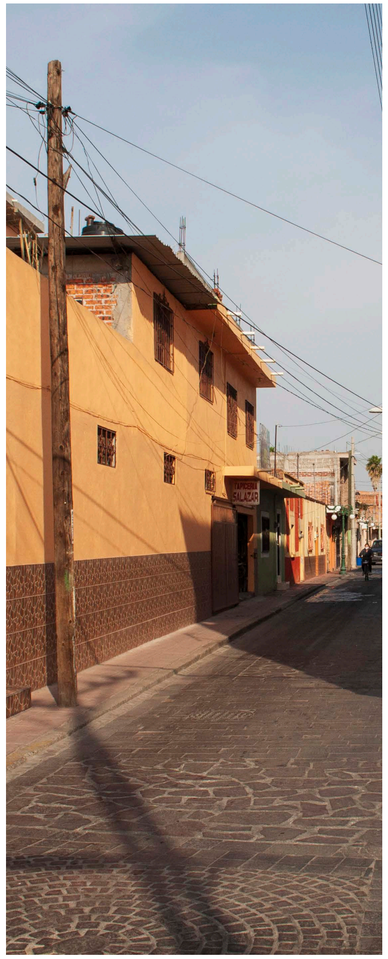
Pueblo Nuevo

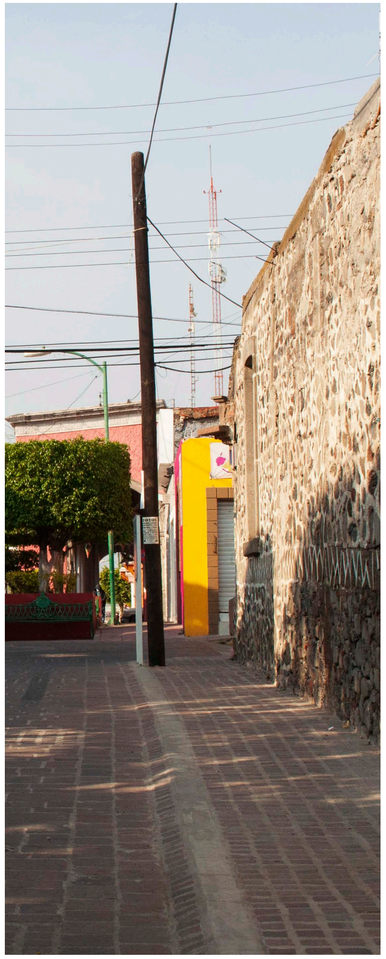
The town of Pueblo Nuevo is of quite a small scale both in extension as well as the vertical density. The feel of the city is quiet, slow and belongs into a more neighborhood feel rather than a city. The streets are wide, buildings are low, the sidewalks are shy of 1m wide and are constantly interrupted by an electrical pole. The central area has two churches and a main square where people can be found sitting on benches, eating in small restaurants, or shopping for miscellaneous items. Even though the streets are made for motorized vehicles, there is slow traffic in the central area and most people use bikes and walk as other means of mobility.

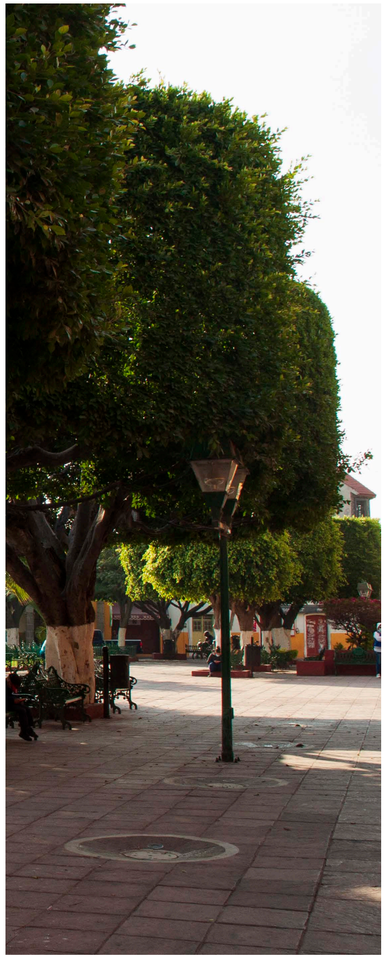
In terms of architecture, the town is eclectic with a few buildings with some historical or aesthetic relevance. The buildings in this category fall under the realm of governmental and religious functions. As for the rest of the city it consists mainly on mixed use buildings or dwellings with an average of two storeys tall.

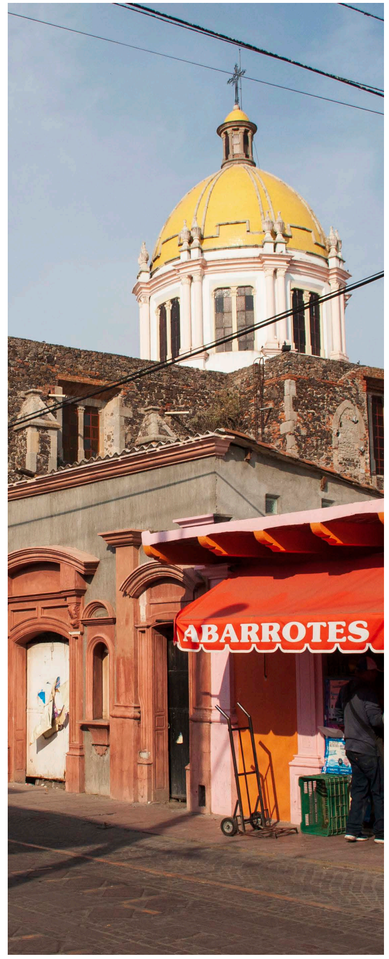
Figures
4.23 Image adapted from Google Earth

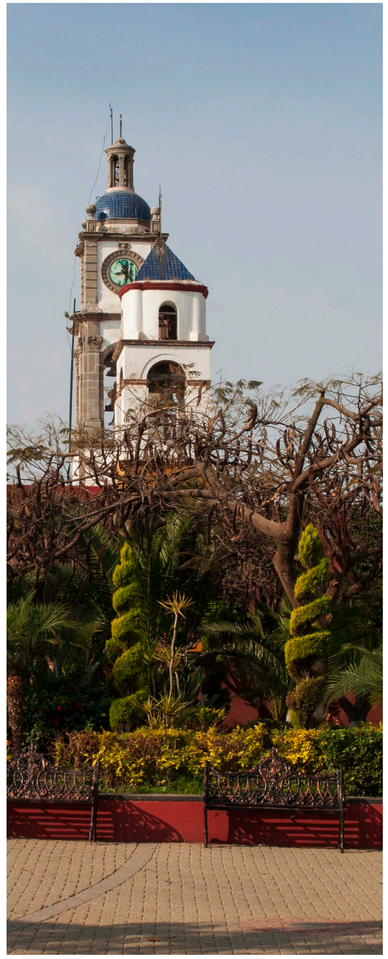


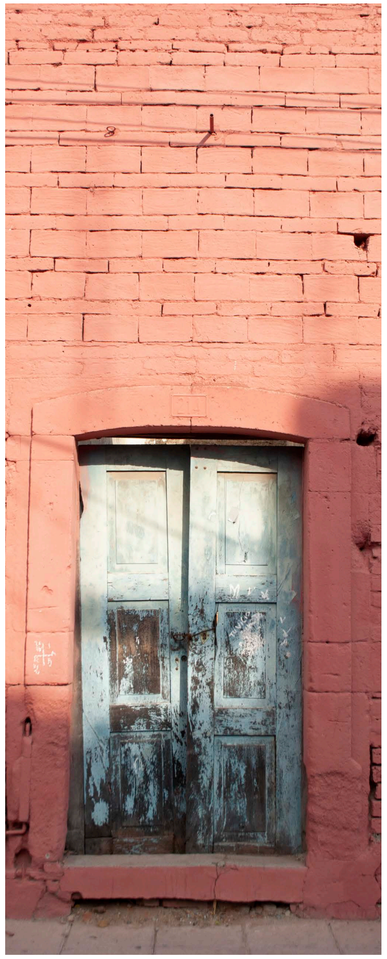




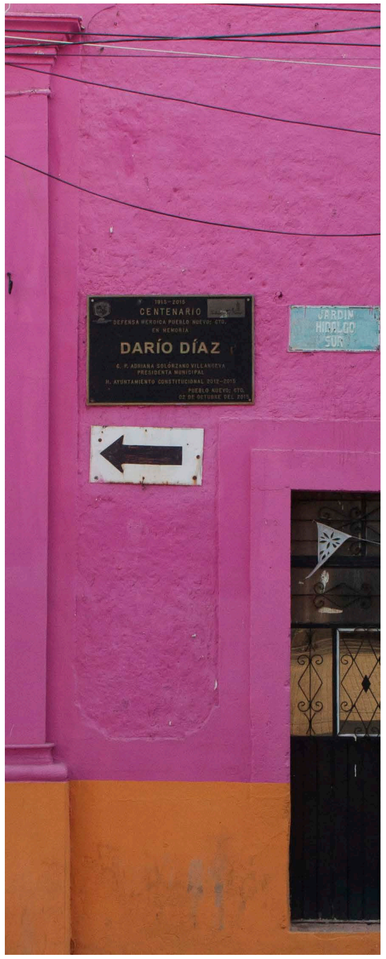


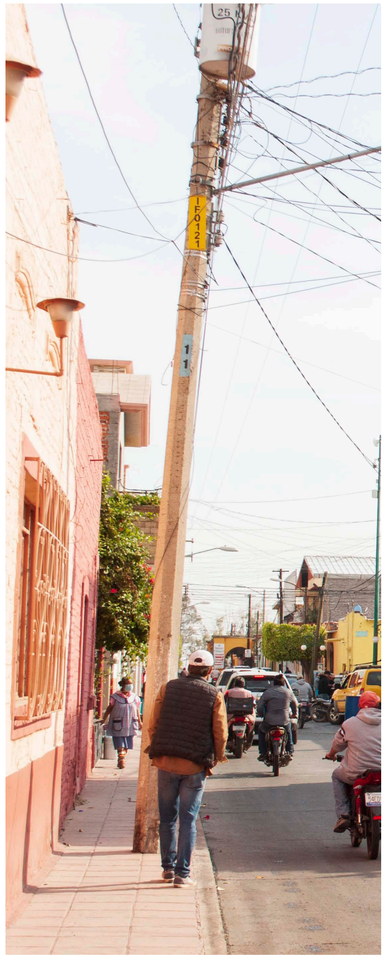

ABARROTES

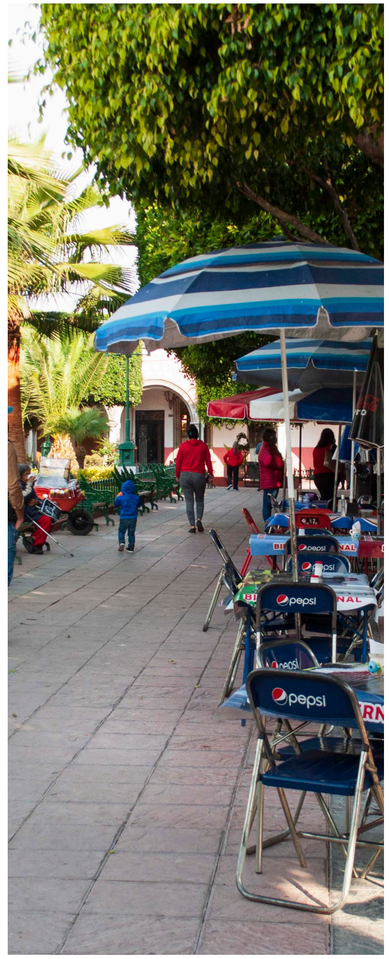


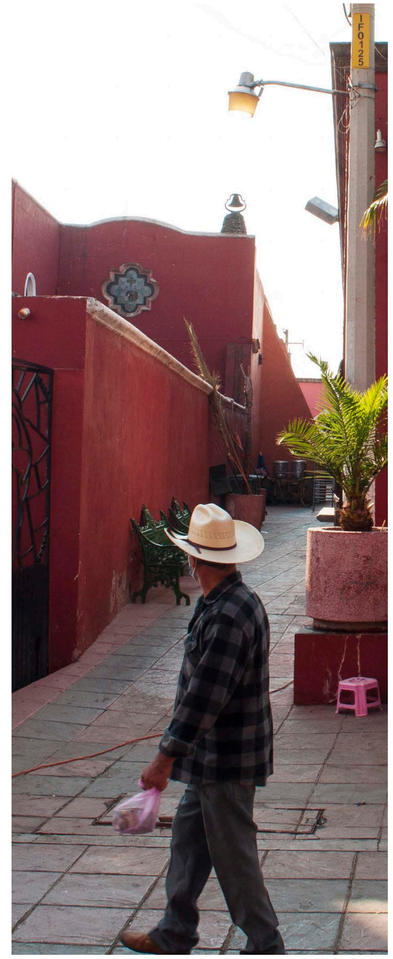





CENTENARIO
DARÍO DÍAZ
JARDIN
HIDALGO
SUR



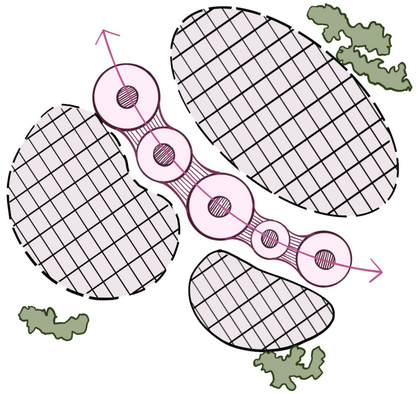

pepsi



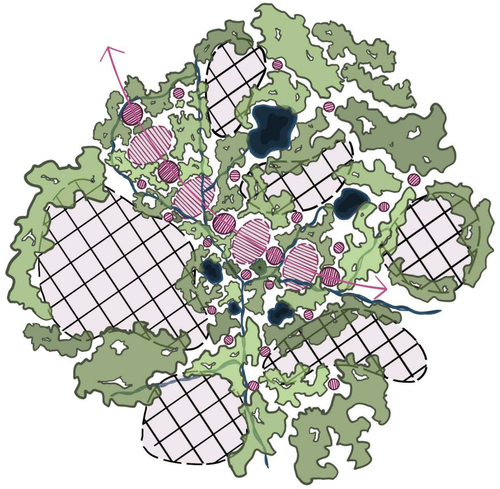
V / EXPLORATION

5.1 Scenarios 2060

To imagine the future and extrapolate the realities that we are facing as a society, as a region and even as a planet might become the only way for humans to understand the negative or the positive outcome that ourselves can bring.
The projections and visions in this thesis look into 40 years in the future and compares a region that continues its current anthropogenic practices with no consideration to biodiversity and the environment and a scenario where drastic measures are taken in order to be able to have a planet where humankind and other species can thrive on.
The visions are speculative but are based on the analysis previously done as well as taking into account the theories and examples of landscape projects an urban design. The goal is to develop a vision that people understand and feel convinced by it so to incorporate it in all the focus levels of this thesis as well as on their daily lives.
The rendering of the visions is merely a collection of ambitions for the region illustrated in a conceptual manner.



2060 if nothing changes

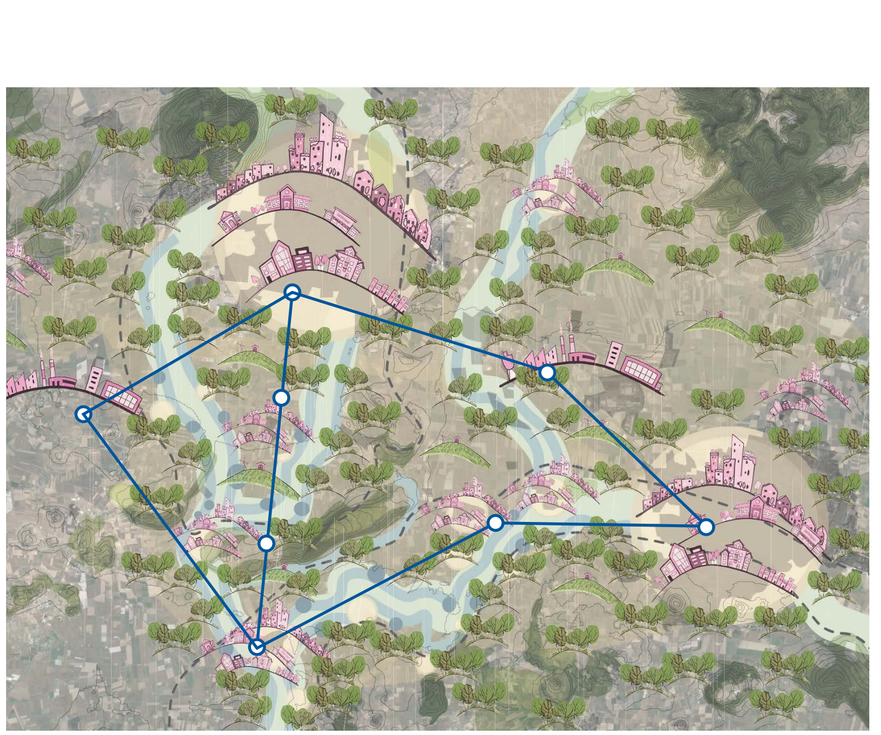


2060 if a symbiotic urban landscape is achieved

5.2 Conceptual Vision

5.2.1 Region

The regional vision is structured in a layer network of systems that when used together act as one. Starting from the soil remediation the attempt is to increase the capacity of the land to host native biodiversity. The enhancement of water ways, water collection and filtration should reinforce the system as well as providing clean water to all species. The infrastructure has two focuses, a human and an animal one. Both systems should incorporate continuous corridors with multiple options of paths and in the case of the humans, different mobility options. At the landscape level the introduction of agroforestry, intact ecosystems and gradients attempt to provide for a more diverse and lively landscape and ecology while at the same time creates a healthy ecosystem for native species as well as humans. Finally, the urban areas should be spread evenly throughout the territory to balance the population as well as the quality of life that they should provide. The cities should be redevelop sustainably to meet the needs of the increasing population and to achieve a balance with nature.

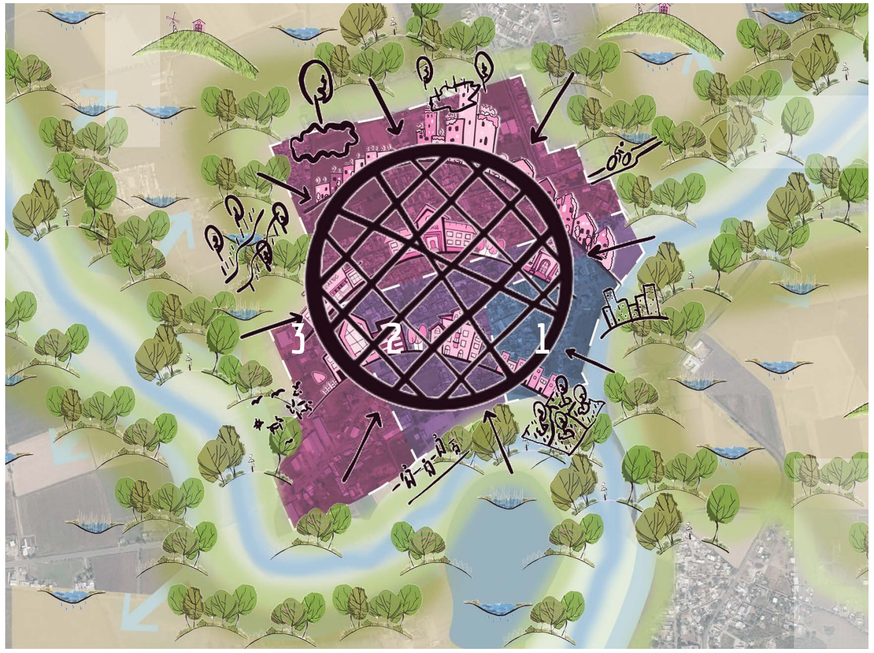


5.2.2 Local

The urban strategy for the region considers a vast number of changes throughout the state, the town of Pueblo Nuevo is used as a case study that represents any of the small towns located in the state while at the same time it will propose the new identity, sustainability, and social goals all within a one vision.

The vision for Pueblo Nuevo and its surroundings is in line with the ecocity standards and the human scale goals proposed by Jan Gehl. The goal is to achieve a symbiotic environment both in the city as well as the surrounding landscape and ecosystems reflected through acupunctural generic interventions that adapt to the specific site needs as well as the economic viability.

There will be two projections or visions in this thesis. Firstly, the development of a regional scale vision with suggestions for interventions as a result of the geomorphological analysis and the need of a healthier and biodiverse ecosystem. Secondly, a localized urban plan for the town of Pueblo Nuevo to improve its spatial and ecological qualities as well as to aid the stress created in larger cities throughout the state, this second vision will be a case study for the rest of towns in Guanajuato with the intention that the applied strategies could be replicated in all the others that share the same ecological territory.



5.3 Challenges & Opportunities

5.3.1 Urban

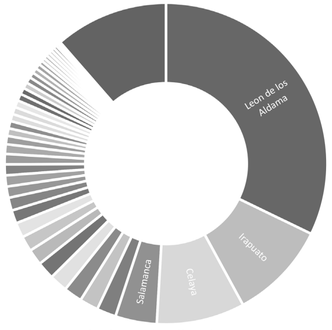
Current population distribution is focused only on a few urban areas in the state. The urban development in these cities has focused on quick design solutions derived from the suburban development typologies.

As shown in the analysis, the footprint of 5 cities has been in constant expansion while some other urban areas have remained the same size. This case illustrates the current unbalanced distribution of population throughout the state and highlights the future problem as well.

The centralized economies, urban sprawl and intercity industry, will end with the vegetation and biodiversity of the central region.

The challenges only expand when a projection of population increase in 2060 is made; the extrapolation considers the average of population growth from the past 80 years. As a result, there will be an increase in the population of 3,000,000 people. This projection is an increase of 50% that needs to be incorporated into the cities, which most likely will be in the current large urban areas.

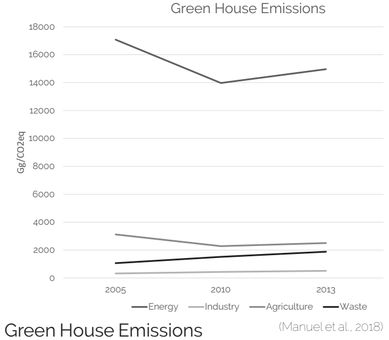
Considering that the urban development of the cities will continue with the same practices, in 40 years, these five cities will have doubled in size, increasing the use of motorized vehicles, greenhouse effects, water scarcity and spatial injustice. On an ecological level, the native species will continue to suffer and eventually disappear from the region due to the poor conditions of the state.



Current Population Distribution

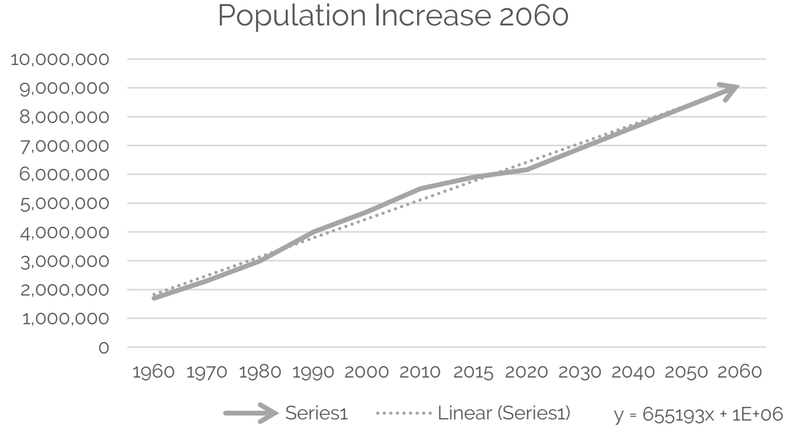
(Manuel et al., 2018)

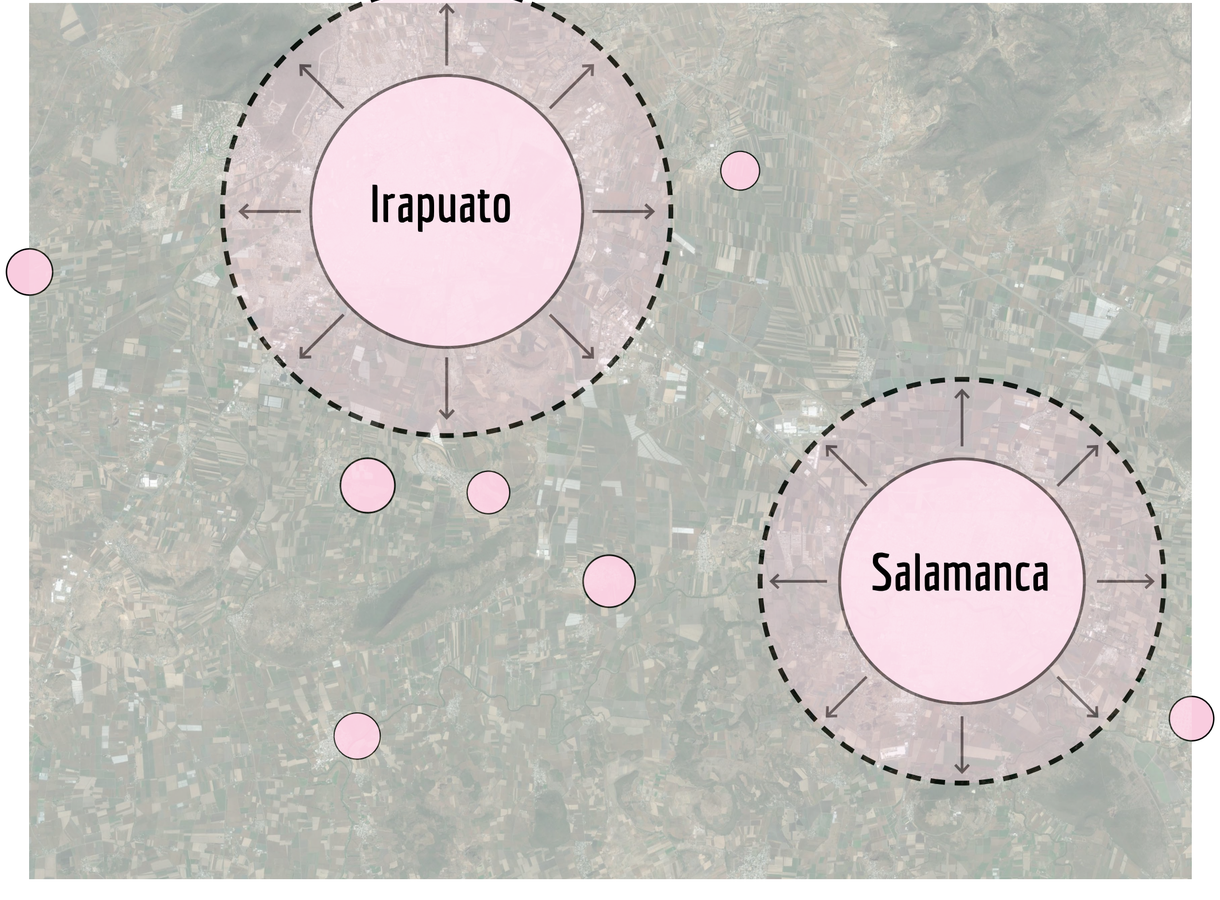
153 *urban areas*



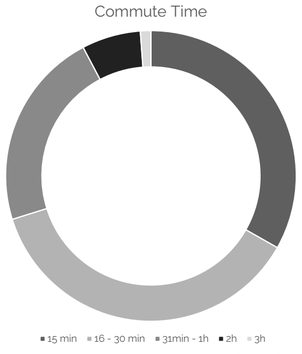
Green House Emissions

(Manuel et al., 2018)

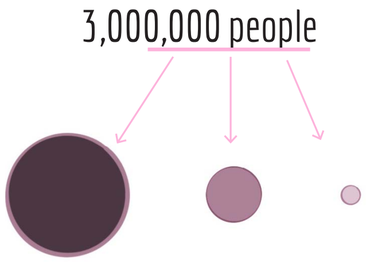




Current growth trend along large urban areas



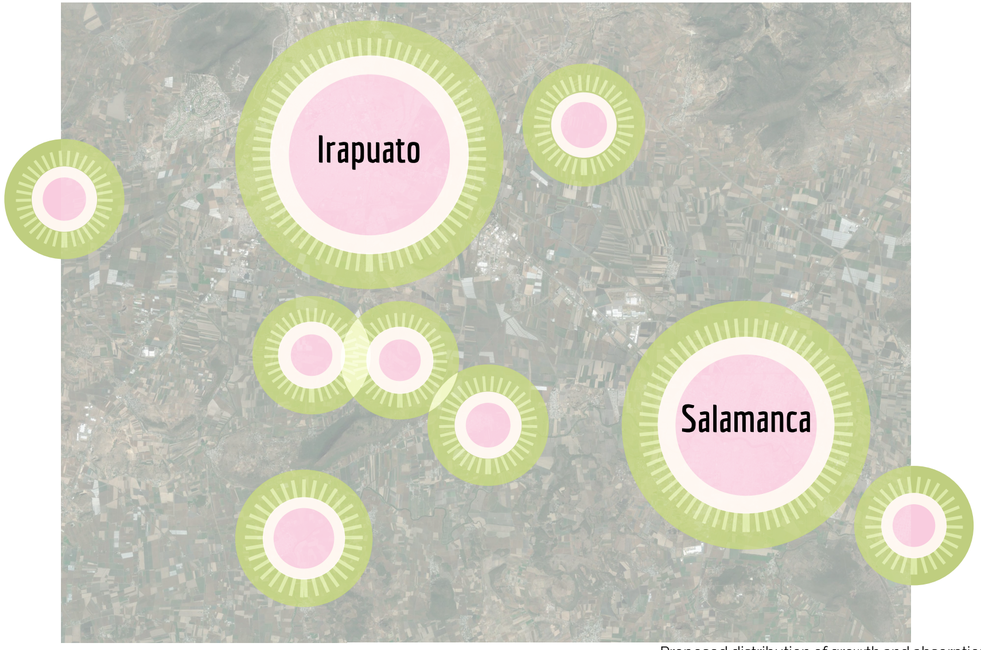
(Manuel et al., 2018)



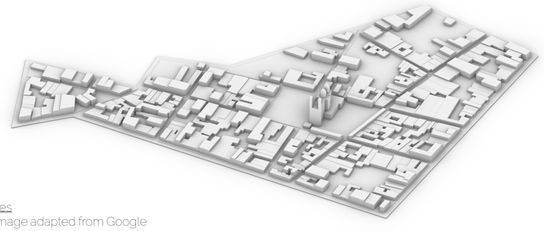
All urban areas absorb population

There is also an opportunity at this moment in time to change the path we are on and improve the urban landscape for all. Even though the developing practices and the urban growth tendencies are similar at a global scale, the state of Guanajuato has a slight difference that opens the opportunity for a shift in the migration of people into large urban areas. Since most industries are not located within cities but rather in between them, there is no need for people to inhabit the current five large urban areas. Instead, we have the chance to distribute the projected 3,000,000 increase in population between all urban areas in the state.

Even though the change is substantial, there are multiple benefits for this shift in growth at a regional and local scale.
This proposal mitigates the need for rapid expansion and development for large urban areas, and instead, they could focus on other internal urban and social challenges. Large urban areas should therefore remain the same size, limiting the expansion with green belts and vertical densification within the existing urban footprint.
As for the small cities and towns, they will absorb an amount that doubles their current population, limiting their footprint to 2km2. Vertical densification should be used to develop the towns in a compact and sustainable manner.
For the small cities and towns, this change would mean a higher population density and a long period of redevelopment. Still, in the end, the city would benefit from an established local economy, increased pedestrianism, local safety through eyes on the street, more and better public spaces and higher quality of life and health, among others.

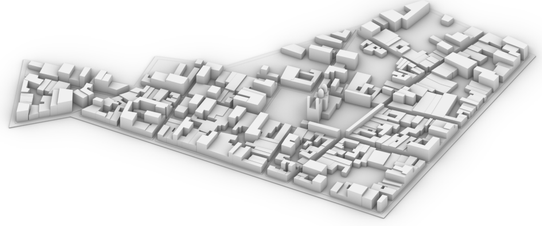


Proposed distribution of growth and absorption of population

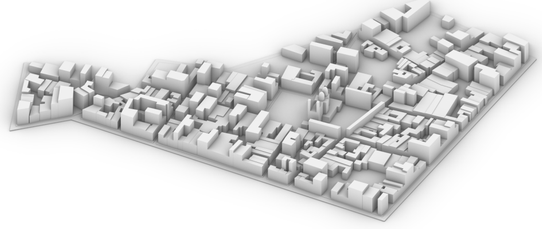


Figures
4.14 Image adapted from Google Earth
4.15 Image adapted from Google Earth

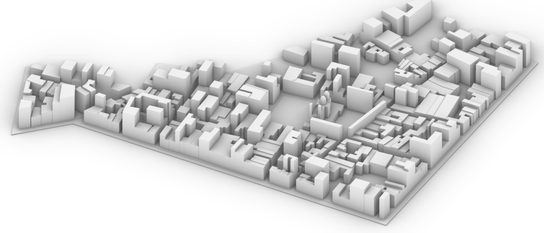
Current Neighborhood Density



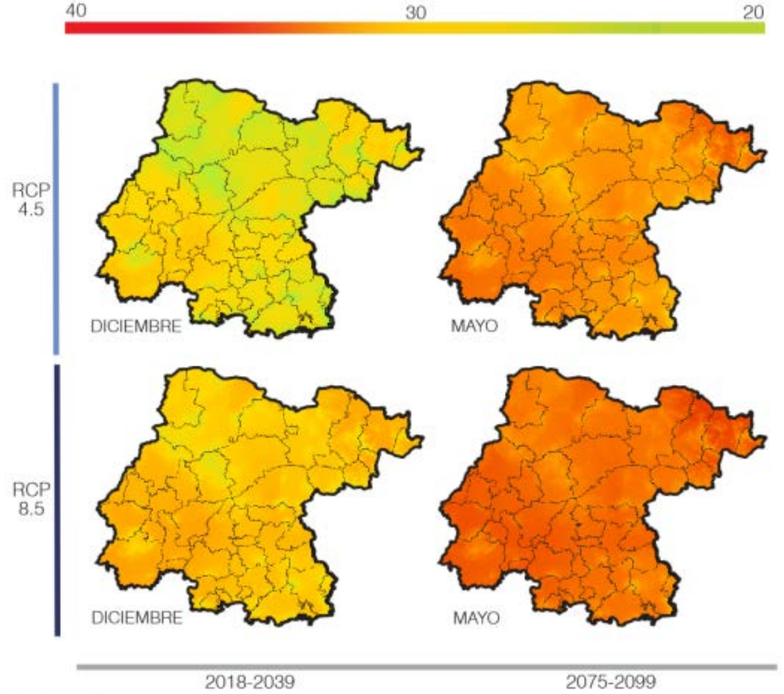
Double Vertical Increase



Triple Vertical Increase



Quadruple Vertical Increase



Maximum Temperature

(Manuel et al., 2018)

5.3.2 Landscape

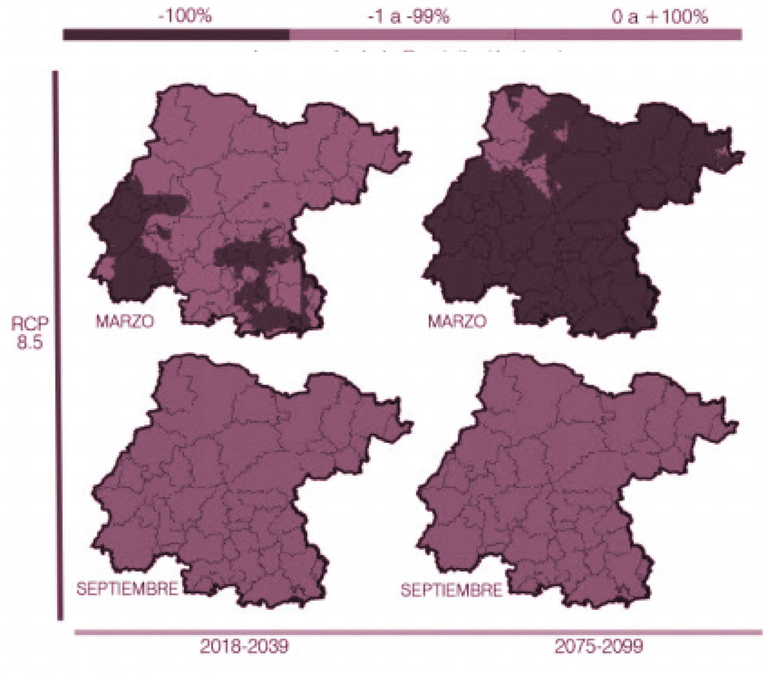
As anthropogenic development expands in the central region of Guanajuato, the landscape is being damaged and reduced, nearing the point of extinction.

The lack of biodiversity is now visible throughout the region; some forests, scrublands and shrublands can be appreciated intermittently and in isolated areas.

The reduction of the native vegetation has resulted in a constant increase in temperature in the state, lack of water, migration of species, and soil erosion. Other unexpected events develop due to climate change, such as off-season precipitation, floodings, forest fires and even hailing.

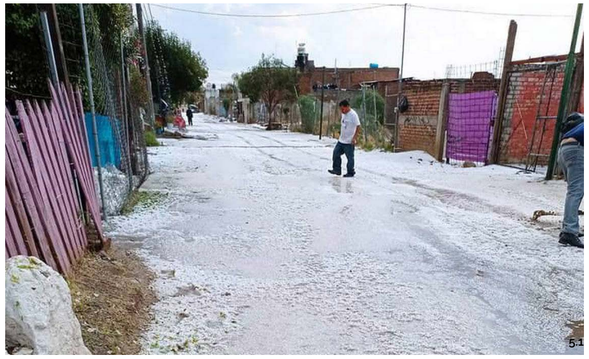
Today we face an increase of 1.1 degrees in the state, and the challenges are just getting worst and more complicated.

The biggest challenge the state is facing is the scarcity of water and the loss of the resource in the coming decade due to the lack of water retention and the way people use it.



Monthly Precipitation 2018-2099

(Manuel et al., 2018)



5.1



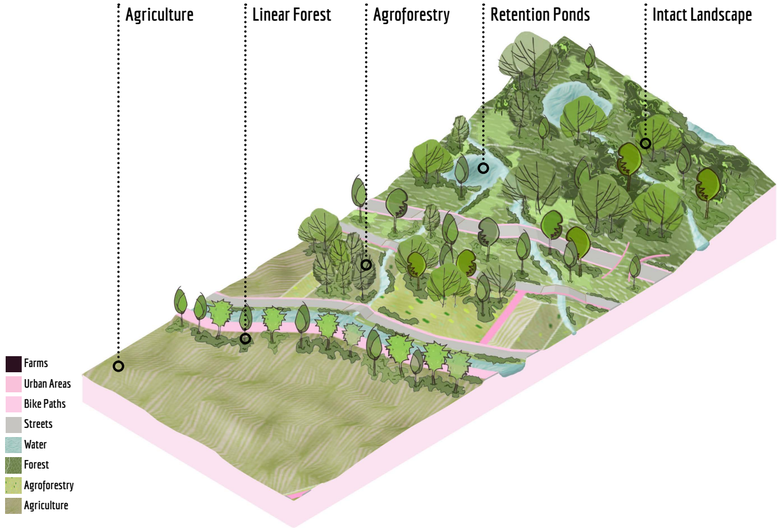
5.2



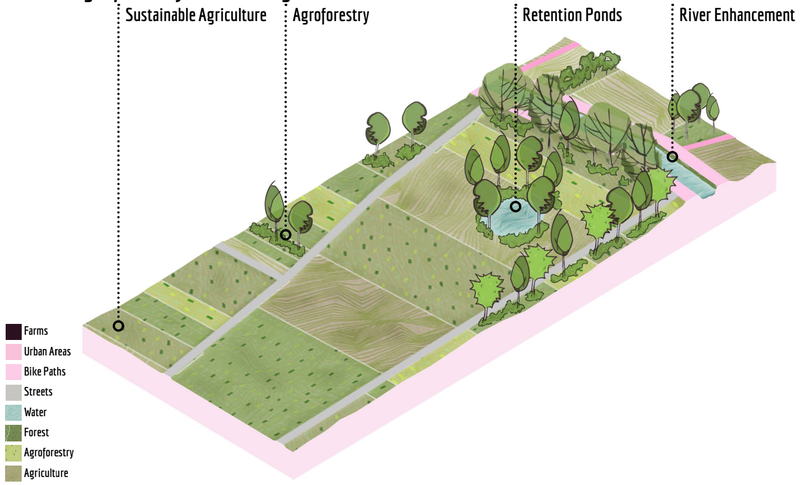
5.3



5.4



Forest - Agroforestry - River - Agriculture

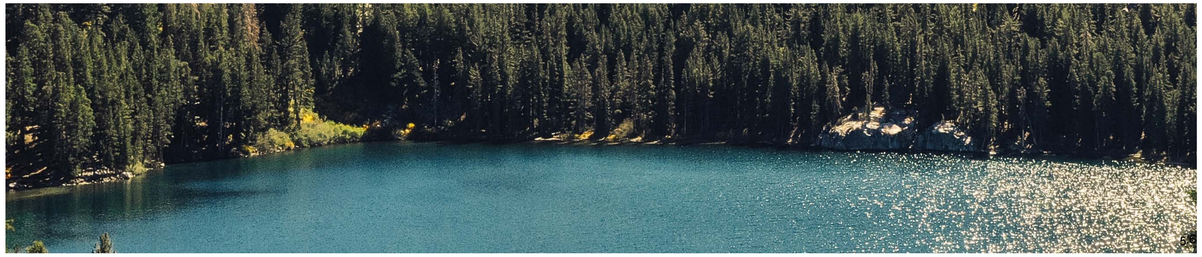


River - Agroforestry - Water Retention - Agriculture

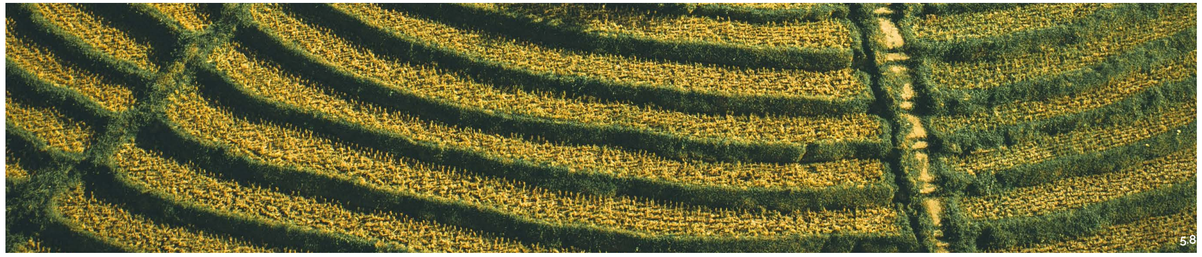
There is still a chance to regain the native biodiversity and empower species with a series of interventions done on the local and regional scale.

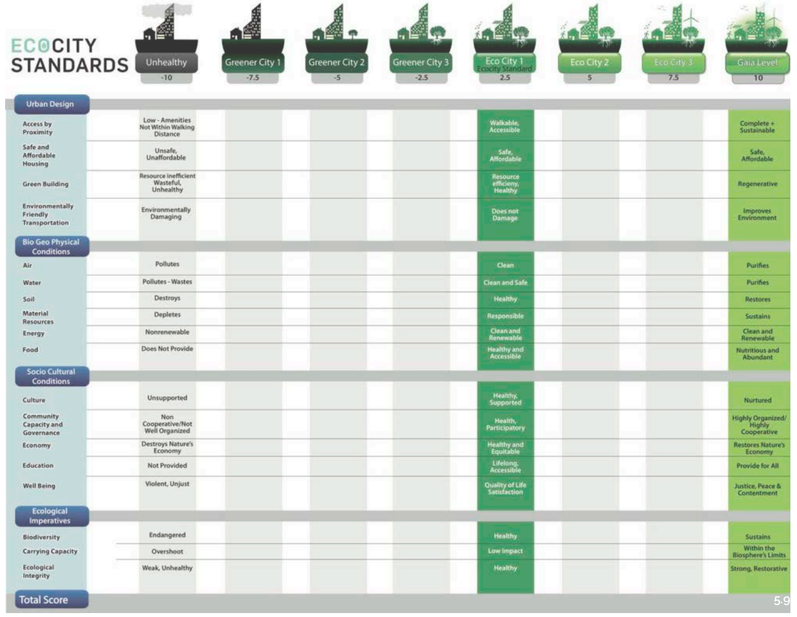
Starting with water, there needs to be an increase in the retention of water on hills to mitigate the runoff stormwater, retaining water at agricultural areas to increase the quantity both at surface and substrate levels, developing better practices for agriculture and shifting to agroforestry and permaculture to improve the biodiversity, ecosystems and soil quality. For vegetation, there need to be designated spaces for protected forests, scrublands and lakes to save native species.


5.5

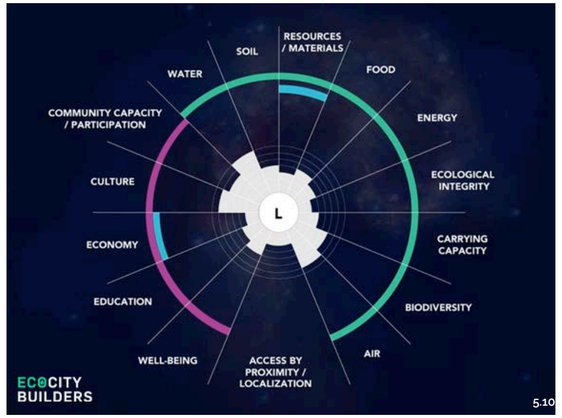

5.6


5.7


5.8



Figures
5.1 Source: www.elsoldeirapuato.com.mx
5.2 Source:www.elsoldeirapuato.com.mx/
5.3 Source: http://periodicotiempouriangato.com/irapuato-fuertes-inundaciones-causan-estragos-reportan-arboles-caidos-y-cierre-de-vialidades/
5.4 Source: https://www.elespanol.com/ciencia/medio-ambiente/20210721/descubren-ingredientes-clave-incendios-arrasan-ecosistemas/597690799_0.html
5.5 Photo by: https://unsplash.com
5.6 Photo by: https://unsplash.com
5.7 Photo by: https://unsplash.com
5.8 Photo by: https://unsplash.com
5.9 Source: https://ecocitybuilders.org/
5.10 Source: https://ecocitybuilders.org/



5.4 Framework

The development of an urban ecology framework comes from the idea of a regional implementation of certain standards and to guide the individual efforts in a collective force of change.
Inspired by the Ecocities framework and standards (Ecocity Builders, 2020), this framework dives into 5 areas of focus as layered previously with the swarm planning method: Soil, Water, Infrastructure, Landscape & Urban. Each area has a subdivision of ambitions that can be tackled individually at multiple scales based on the needs of Guanajuato Central Region.
At the same time the framework has a grading scale where a short explanation of the situation places the ambitions in a better or worst grade.
Annihilation is considered the lower grade on this framework and encompasses all the things that the region is developing poorly.
Restoration can be taken as a mid-point of improvement towards a symbiotic urban landscape and means that steps are being taken to improve the current situation in all the areas.
Symbiosis is the maximum grade which is accomplished when every area has not only changed but when they work as one ecosystem.
Applying changes to align with the framework should be a statewide attempt and the implementation of this ambitions, even though they are meant to be spatial interventions, should find its place in policy, education, lifestyles and governability.

ECOLOGICAL REMEDIATION - An urban landscape strategy for Guanajuato

URBAN
LANDSCAPE
INFRASTRUCTURE
WATER
SOIL

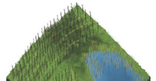
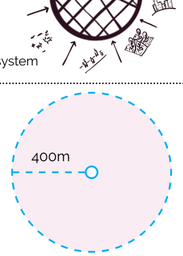
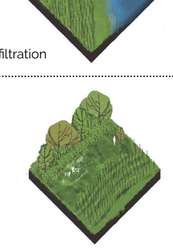
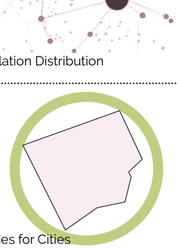
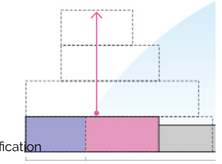
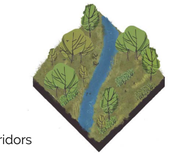
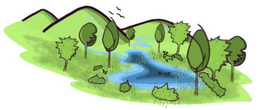
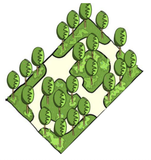
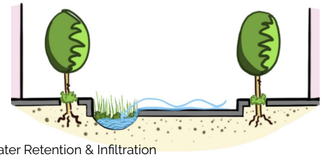
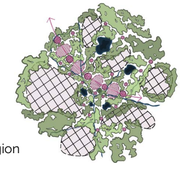
		ANNIHILATION	UNHEALTHY	REMEDIATION	RESTORATION	HEALTHY	BALANCE	SYMBIOSIS
URBAN	COMPACT CITY	Urban Sprawl - Constant Expansion			Contained cities			Compact cities
	MOBILITY	Unsustainable, Individual, Lack of Variety			Sustainable Transport - Increase of soft mobility			Sustainable mass transport - Soft mobility as the main option for mobility
	LIVING	Segregation, Lack of services, Low Quality			Integration, Some services, Good quality			Unified city, All services, Premium quality
	LANDSCAPE	Lack of greenery & Biodiversity			Incorporation of greenery			City as a living ecosystem
LANDSCAPE	REFORESTATION	Increase in Deforestation			Reforestation			Vast forests
	BIO CORRIDORS	Elimination of biological corridors			Continuation of biological corridors			Free mobility for all species
	GRADIENTS	Monoculture			Varied species			Diverse and balanced landscape
	BIODIVERSITY	Annihilation of species			Reappearance of native species			Strong biodiversity
INFRASTRUCTURE	MOBILITY OPTIONS	No options in mobility			Options in mobility			Sustainable and varied mobility
	CONNECTIONS	Increase in human and animal disconnections			Increase in human and animal connections			Network of integrated connections
	ECO INTEGRATION	Elimination of ecology			Restoration			Integrated ecological infrastructure
WATER	QUALITY	Low quality - Polluted			Higher quality - Somewhat clean			Best quality - Clean
	QUANTITY	Scarce			Availability			Vast
	FLOOD AREAS	Problematic			Opportunity			Wetlands & Ponds
	REINCORPORATION	Polluted or inexistent			Reincorporation strategies			Natural filtration - reincorporation system
SOIL	CARBON FIXATION	No fixation			Mid fixation			High fixation
	SOIL QUALITY	Infertile , Eroded, Compacted			Restoration strategy			Best quality
	LAND USE	Monocultures, Uneven			Variety of land uses			Highly diverse land use

5.5 Toolbox

As part of a regional strategy there needs to be goals but also tools to make this transformation happen. Through the analysis and context of this ecological territory there is clarity in the current challenges as well as the opportunities that can take shape. By bringing in knowledge of strategies as well as simple principles and interventions that could be applied at a diverse variety of scales, budgets and focus; this toolbox is formulated to assist the individual to become a part of this vision.

The proposed toolbox of interventions should work as an aid in design and spatial solutions. The options shown are generic, individual strategies that could be applied at multiple scales from a region to a city and even in a neighborhood scale.

These proposed tools are existing strategies applied all over the world and have been selected specifically for the central region because of the specific needs of ecological, landscape and urban areas.

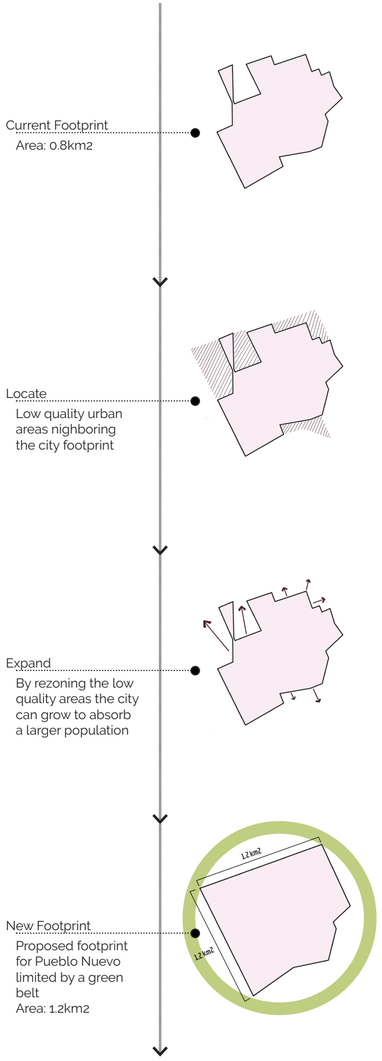
URBAN	LANDSCAPE	REGION
 City as an Ecosystem	 Retention & Infiltration	 Balanced Population Distribution
 5 Minute City	 Agroforestry	 Green Boundaries for Cities
 Vertical Densification	 Biological Corridors	 Anthropogenic and Ecological Justice
 Green and Blue Features	 Species Variety	 Independent Economies
 Streets for All	 Intact Nature	 Public Spaces
 Water Retention & Infiltration	 Immersion in Nature	 Symbiotic Region

VI / DESIGN



1. Urban Intervention Area
2. Lanscape Intervention Area

6.1 Urban Strategy



The urban strategy uses the town of Pueblo Nuevo as a case study for the proposed sustainable redevelopment that cities around the region could undergo if the change is desired and agreed upon between all the stakeholders focusing on the existing problems and future projections in an attempt to solve the challenges of the area. The redevelopment is a city-wide intervention that involves the local government and the population. Size, mobility structure, zoning and spatial distribution are some of the elements that are modified in order to improve the quality of life of the current and incoming population as well as incorporation sustainable and ecological interventions to mitigate the issues related to climate change and enhance the life of native species.

The case of Pueblo Nuevo opens endless possibilities for sustainable redevelopment and to become one of the first ecological cities in Mexico and in the proposed network of ecocities along the whole state.

The first step taken within this redevelopment proposal after finding a suitable location was to understand the amount of people the town will absorb as the balance distribution plan states. For the case of Pueblo Nuevo, the population will double over the period of 40 years. Counting only with an area of 0.8km2 and a population of 15,000 people Pueblo Nuevo remains a small town in the context of the state, with no economic or cultural relevance the town is forgotten as many others in the state.

The issue now falls upon the "How will the town absorb an extra 15,000 people?". If we followed the current practices of development in the state, the town would expand towards the exterior of its current footprint to create more dwellings having motorized vehicles as the main mobility method and with no regard for ecology.

In order to avoid that there is a need to determine what are the design principals that the redevelopment should follow certain design principles developed by Richard Register and Jan Gehl.

As one of the principals aims, having a compact city us vital to prevent urban sprawl from happening in the future as well to avoid and protect natural areas, the redevelop cities need to have a structure that allows for the upcoming growth but that is also friendly to the human scale and the environment. Towns like Pueblo Nuevo could be redesign and expanded up to a 2km2 area. This should be the size limit and any attempt of expansion of the city should be forbidden. To help with this size limit, the implementation of a green belt around the city should take place. The green areas should be protected by deeming it a public park, state forest or a sanctuary.

With the new footprint there are multiple ways of restructuring the town, services, mobility, and distribution. As of today, the town has one central area located in the southeast quadrant. With an average walk of 10 minutes, the access to this area is inconvenient for the majority of the town.

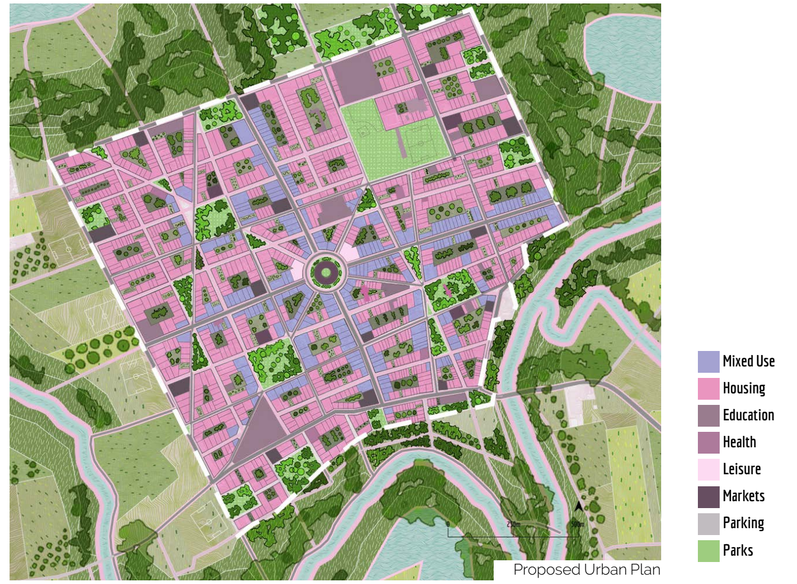
Touching upon the aspects of spatial and social justice as well as the idea of a compact 5-minute city, the idea of developing multiple economical cores across the town comes to play. The town is divided in five quadrants, each of these quadrants will consist of a green public space providing a gathering place for the population within a 5-minute walk, the areas surrounding the park will house a variety of functions and services to provide all a person needs on daily basis.

In order to make a 5-minute city there is the need for spaces tailored for the pedestrian and other soft mobility methods. Now a days the streets of Pueblo Nuevo Now a day the streets of Pueblo Nuevo are design for a motorized mobility with a couple exemptions on the main square area. In order to achieve a shift in mobility the usage of motorized vehicles needs to drop within the city. As part of the proposal, the development of peripheral parking lots has to take place. This opens the possibility of changing the format of the streets from ultra-paved spaces into pedestrianized garden walkways. Accomplishing this will allow to make a shift in the transportation methods turning into a more sustainable option such as pedestrianizing the city and giving more space to bike paths and other soft mobility methods.

Bringing back the human scale into the city by designing it for the user should become a given when redeveloping cities and towns. The character and program available on the street should be available for all providing a social equality as well as democratizing the space we inhabit. These changes promote positive outcomes in the long term. Society tends to live the city in a different way, they are more active, sociable, healthier both mentally and physically. Bringing people together also creates a stronger community that cares about the neighbor, looks after them in order make a safer environment for everybody.

The relation with nature should be improved as well, starting with depaving the hard surfaces to have a healthier soil and water filtration, the addition of greenery on the streets, walls and roofs of buildings will provide space for more species to inhabit the town. The greenery will also help regulate of temperature in the town. Maximizing the evapotranspiration, the heat island effect will be reduced and the comfort for people will increase.

Finally, in order to tackle the water issues in the area the city needs to be more conscious of how water is treated. The addition of street canals will help to retain the rainwater in rain seasons while at the same time allowing it to slowly infiltrate into the soil within the urban areas. The depaving of surfaces will also allow for an increase in infiltration allowing for a healthier soil, and rich biodiversity.



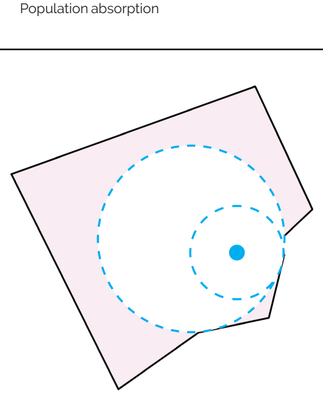
Proposed Urban Plan

6.1.1 City Level

5 MINUTE NEIGHBORHOODS WITH CENTRAL NODES

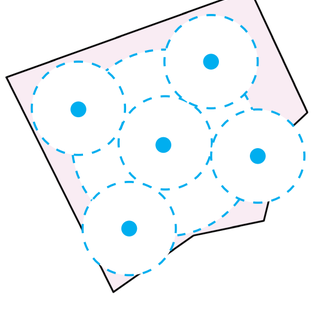
Why?
- Lack of space for pedestrians
- Lack of green public spaces
- Accessibility
- Low density town
- Population absorption

CURRENT



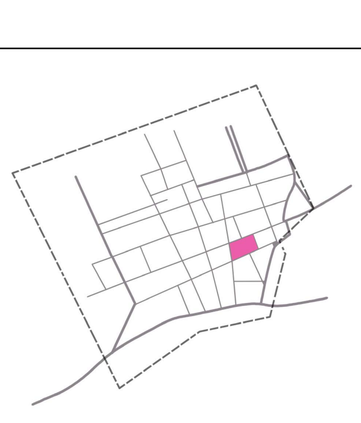
How?
- Comunity through public spaces
- Compact city through self sustaining quadrants/ neighborhoods
- Increased pedestrianism
- Accessibility to services

PROPOSED

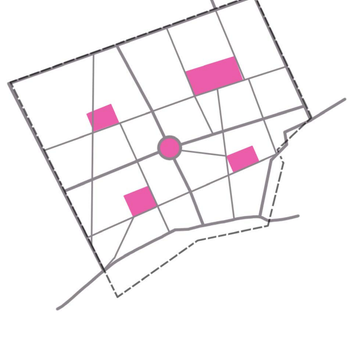


INCREASE OF PUBLIC SPACES

Why?
- Lack of space for pedestrians
- Excess of non porous surfaces
- Lack of green public spaces
- Lack of water infiltration

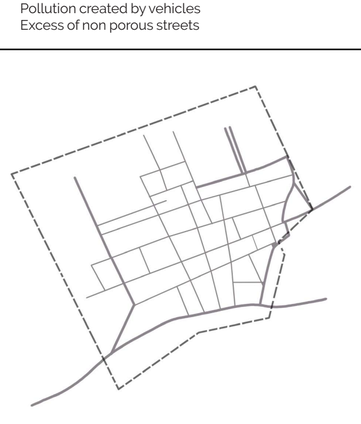


How?
- Increase of public spaces by 500%
- Increase of permeable areas and water retention
- Spaces distributed throughout the whole city

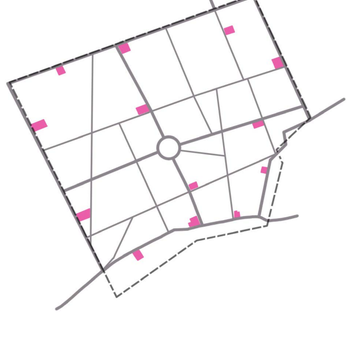


REDUCTION OF MOTORIZED STREETS

Why?
- Lack of space for pedestrians
- Car parking on streets account for a 40% of the street
- Lack of biodiversity on the streets
- Lack of connectivity
- Pollution created by vehicles
- Excess of non porous streets

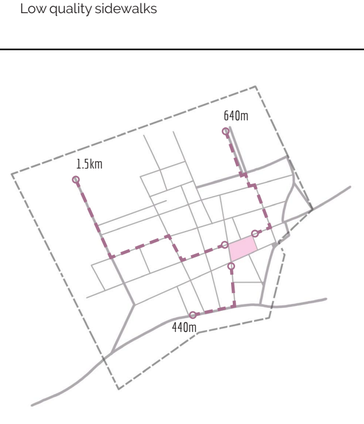


How?
- Increase of vegetation on streets
- Increase of areas for pedestrianism
- Reduction of pollution and noise



INCREASE OF SOFT MOBILITY STREETS

Why?
- Lack of space for pedestrians
- Lack of biodiversity on the streets
- Lack of connectivity
- Excess of non porous streets
- Low quality sidewalks



How?
- Increase of areas for pedestrianism
- Reduction of pollution and noise
- Increase of vegetation on streets
- Shorter distances



INCREASE OF GREENERY

Why?
- Lack of space for pedestrians
- Lack of biodiversity on the streets
- Lack of connectivity
- Excess of non porous streets
- Low quality sidewalks



How?
- Increase of areas for pedestrianism
- Reduction of pollution and noise
- Increase of vegetation on streets

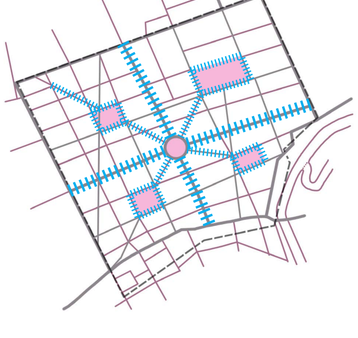


INCREASE OF MIXED USE BUILDINGS &FUNCTIONS

Why?
- Mixed use and commercial spaces are located only along one part of the city



How?
- Increase of mixed use, office and commercial space
- Quadrants as independent economic hubs
- Proximity to all services



6.1.2 Neighborhood Level



Area: 0.2 km2
Population: 5,000
Density: 2,500 persons per km2

GATHERING AND ECONOMIC CENTER OF CITY
Public Spaces & Services

Diving deeper in the transformation of Pueblo Nuevo we look at the block level taking the southeast quadrant of the town. Currently this is the main economic and social space counting with two churches, two schools, governmental buildings, commercial areas, and formalized public spaces. Here the goal is to completely shift the mobility within this quadrant where the pedestrian and soft mobility methods are the most common means. The motorized vehicles will only transit within the quadrant for deliveries, drop offs or extraordinary circumstances.

Currently the area houses an approximate of 5,000 persons which by the year 2060 is expected to double. Since the area should not extend the solution is vertical densification. While some areas can be bought and developed by a private company or the government, it is considered and expected that the main actor responsible for this densification are the current residents. The benefits of the redevelopment by the inhabitants not only guarantees that this project does not become a typical gentrification project, but it also gives the opportunity for the current residents to shape their own town while benefiting from economical growth and financial stability.

In terms of density a new zoning will be proposed and adapted to the new street configuration and the availability of public spaces with the understanding that where there is more open space on the street the FAR is higher, on the cases where the opposite happens the FAR is reduced.

Providing all the services within a 5-minute walk is challenging, that is why an increase of functions on the plinth is incorporated along main avenues, streets, and public spaces. With the doubling of population there is also the need for more schools, clinics, leisure, markets, and parking. The proposed plan allocates all within the neighborhood level.

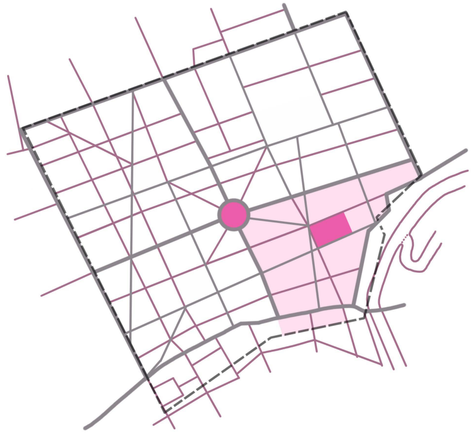
The addition of greenery and green areas within the neighborhood is vital to promote a healthier and sustainable city that enhances the natural cycles.



Current Urban Landscape of Selected Quadrant



Current Urban Landscape



Selected Quadrant for Intervention



Current Urban Landscape

compact

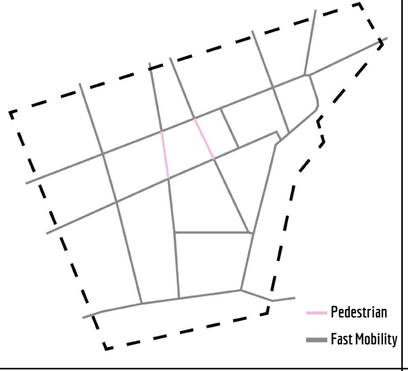
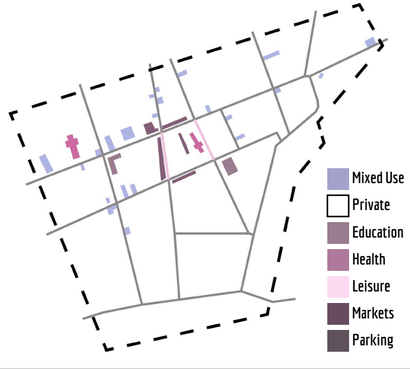
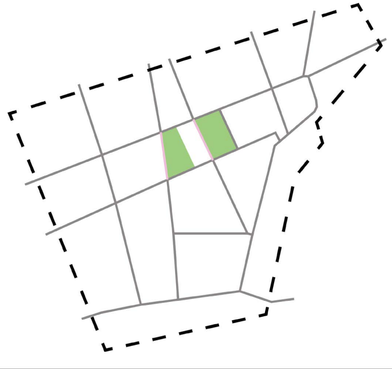
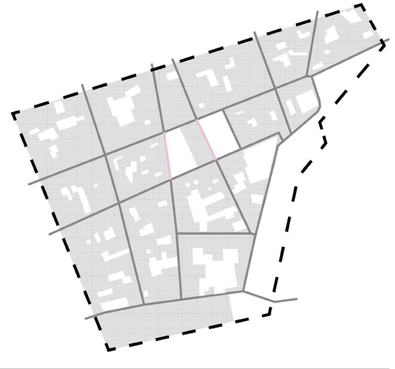
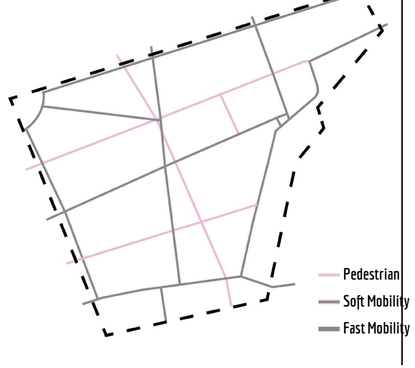
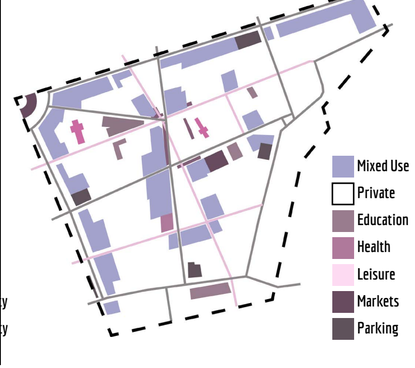
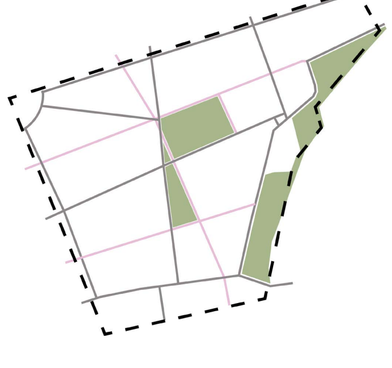
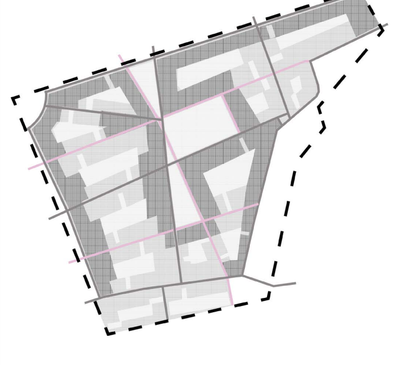
lively

safe

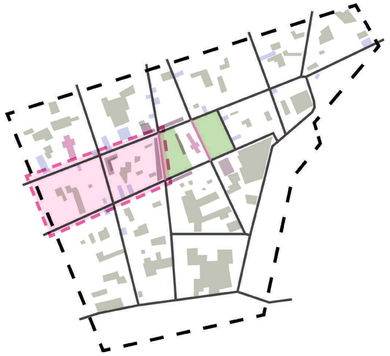
sustainable

healthy

pedestrianize

	INCREASE OF MOBILITY VARIETY	REDUCTION OF FUNCTIONS IN QUADRANTS	INCREASE OF GREEN PUBLIC SPACES	INCREASE OF INBLOCK COMMUNAL AREAS	FAR ZONING
	Why? 40,200 m2 of fast mobility - non porous 1090 m2 of pedestrian only streets **STREET USE** 31.25% for motorized vehicles 31.25% on street parking 37.5% for sidewalks	**Why?** • Lack of services • Informal commercial spaces • Low education availability • Lack of markets • Lack of health centers	**Why?** • Lack of public spaces • Lack of greenery • Low interaction with nature • Excess non porous surfaces	**Why?** • Small private courtyards • Lack of green connections	**Why?** • Low density buildings • Poor quality of open spaces • Lack of zoning
CURRENT					
	How? 23,300 m2 of fast mobility - permable surfaces 11,000 m2 of soft mobility 14,770 m2 of pedestrian only streets **STREET USE** 37.5% for motorized vehicles 50% for sidewalks 12.5% for greenery	**How?** • Increase of mixed use, office and commercial space • Quadrants as independent economic hubs • Proximity to all services • Addition of schools, health centers and markets	**How?** • Increase public spaces • Depave existing green public spaces • Incorporate squares for continuous green corridors • Green belt as a boundary for expansion control	**How?** • Increase size of courtyards • Additional semi-private space • Green Network	**How?** • Vertical densification • Population absorption • Zoning for priority areas
PROPOSED					

6.1.3 Block Level



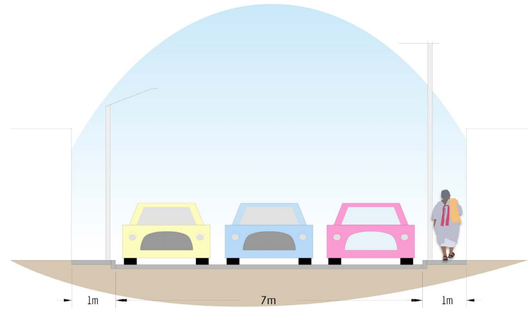
The next level of analysis and design is at the block scale. The intention of zooming into a smaller area it to develop the previous ideas, design principles and vision within a scale that is better understood.
The area was selected because of its current qualities both environmental and urban. On the environmental perspective the location has within a green public area with the largest amount of unpaved surface in the town of Pueblo Nuevo. On the urban level this area contains most of the functions and services that the city provides such as religious buildings, commercial spaces, educational facilities, governmental buildings, and a mix of single and multi-family residential.
The goal for the block is for it to become a series of buildings immersed in nature. These buildings should have the capacity to house multiple functions within them, in the case of schools & governmental buildings they should be allowed to perform only one task. On the street level the currently paved streets filled with cars and no greenery will change to become the complete opposite to serve the pedestrian first. Some areas of the street will be transformed into small canals and meadows where a gradient of flora can be found as well as a place where large trees will provide shade and a cooling effect. At the same time the hope is that these spaces benefit native species, and it is expected that they too take to the streets and become part of the city once again.
Within the block there are a series of private gardens that are not well maintained or do not have ecological qualities to promote a larger biodiversity.



Current Urban Landscape of Selected Block



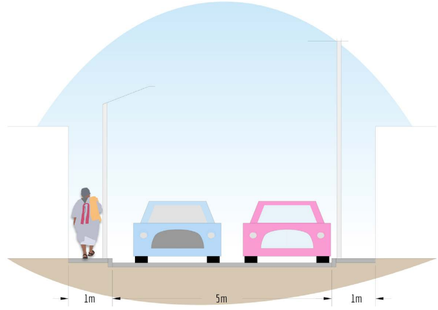
1



Current Urban Qualities Wide Street



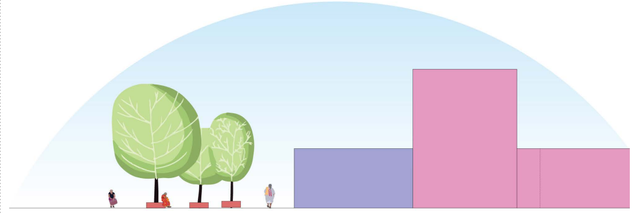
2



Current Urban Qualities of Narrow Street



3



Current Urban Qualities of Public Space

infiltration

porosity

permeability

evapotranspiration

retention

densification

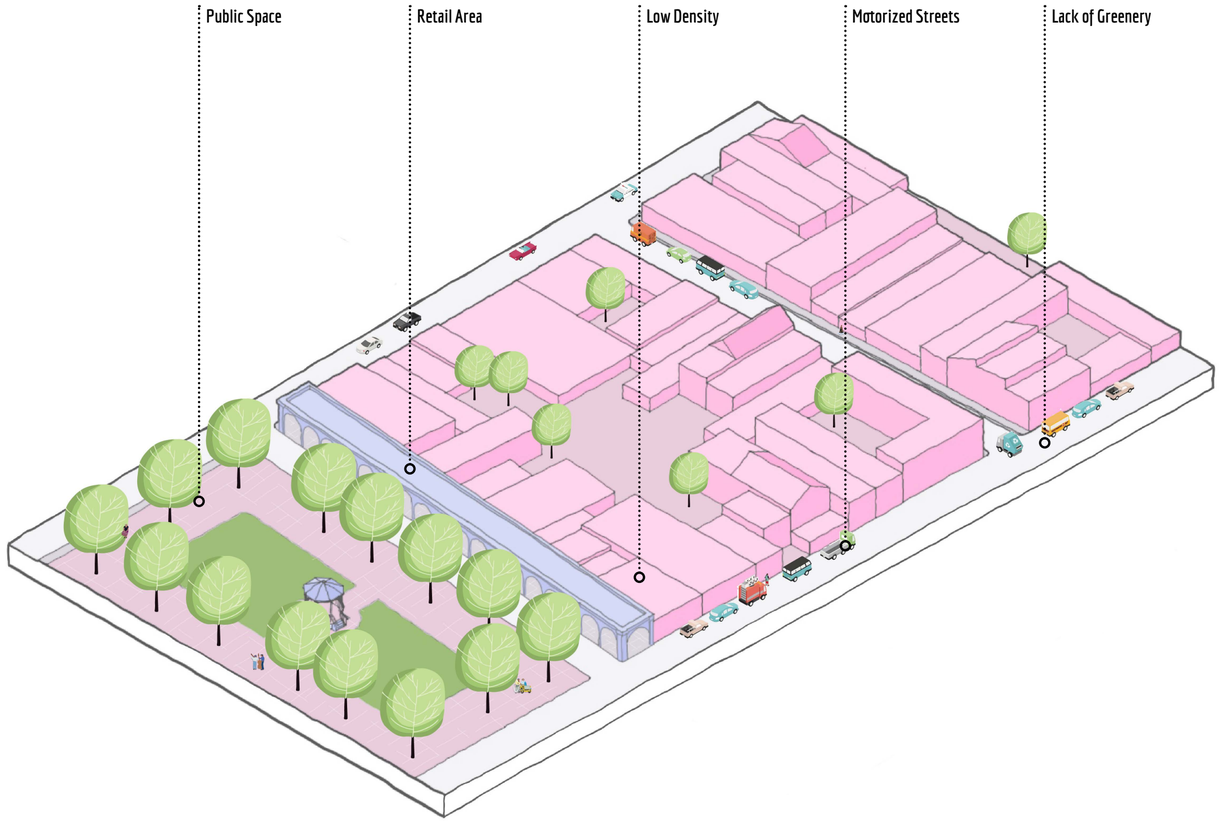
walkability

spatial justice

community

biodiversity

The proposal is to create a depth limit of 24 meters within the existing lots for the future redevelopment, this space will allow for a large communal courtyard that will be supported by the city and the residents of the block. The goal is to give people a semiprivate place where they can be in contact with nature and can have constant human contact, creating a more solid community.
Finally, a set of public neighborhood gardens should replace some buildings in the block. They will work as a community garden to strengthen the community while at the same time it will become a space to share knowledge and to understand and help ecology. They will also be the access and connector of the greater green courtyard network along the city developing another way to transit and experience your surroundings.



Current Urban Qualities of Block

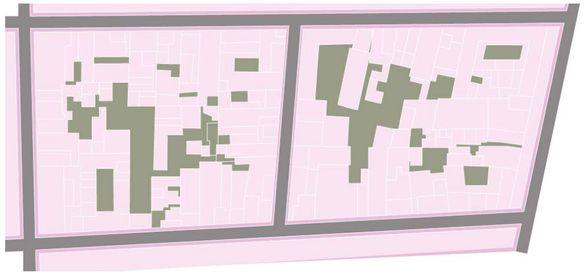
Phasing Landscape Strategy

CURRENT BLOCK STRUCTURE

Why?

- Low Density Buildings
- Streets for cars
- Lack of biodiveristy
- Lack of community spaces
- Non Porous Surfaces

1.

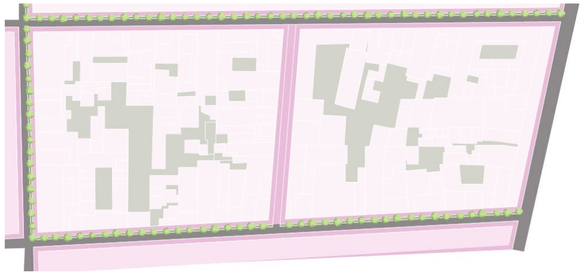


STREETSCAPE ENHANCEMENT

Why?

- Non porous surfaces
- Small sidewals
- Lack of vegetation
- Lack of soft mobility

2.



How?

Increase sidewalk to 2m
Addition of greenery and trees on street

COURTYARD EXPANSION

Why?

- Lack of lot control
- Lack of vegetation
- Non porous surfaces
- Lack of biodiversity

3.



How?

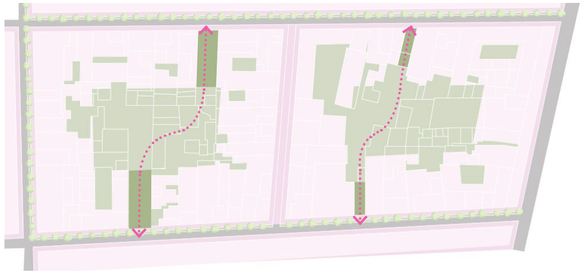
Limit lot depth to 24 meters to increase ventilation, natural light and biodiverse permeable surfaces

COMMUNITY GARDENS

Why?

- Buildings extend throughout the whole lot
- Lack of Functions
- Informal commercial areas
- Street fo motorized vehicles
- Lack of pedestrian space
- Lack of biodiversity and permeability

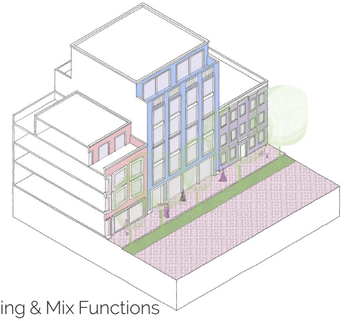
4.



How?

Addition of community gardens on block to increase biodiversity, green connections as well as a city courtyard network

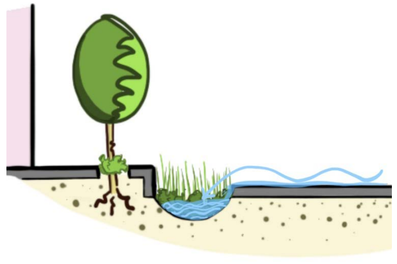
Principles & Aspirations



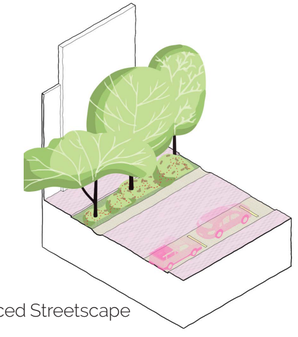
Zoning & Mix Functions



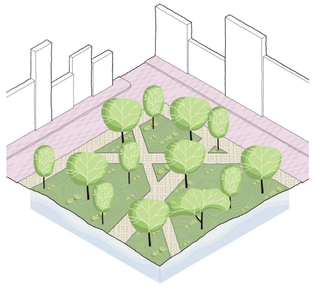
Vertical Densification



Retention & Infiltration Capaciy



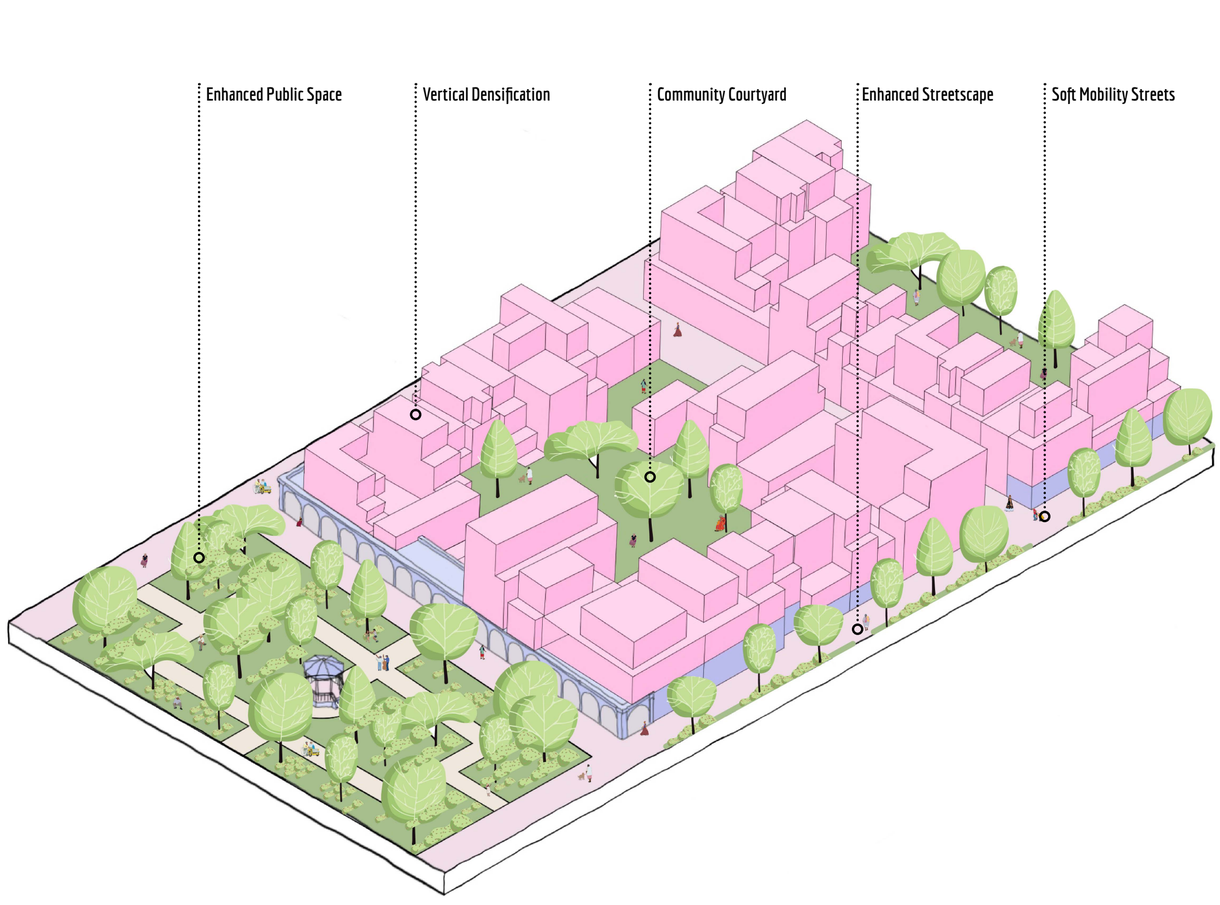
Enhanced Streetscape



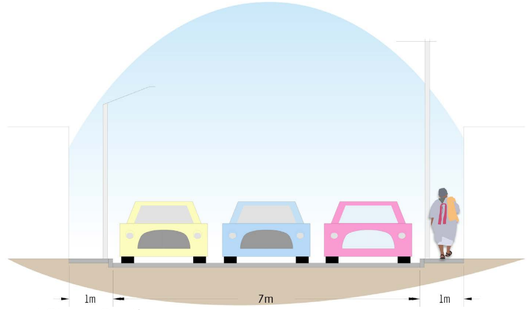
Biodiverse Public Spaces & Water Retention



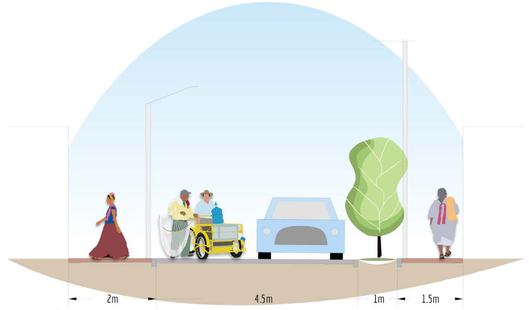
Green & Blue Features







Current Street Section



Proposed Street Section





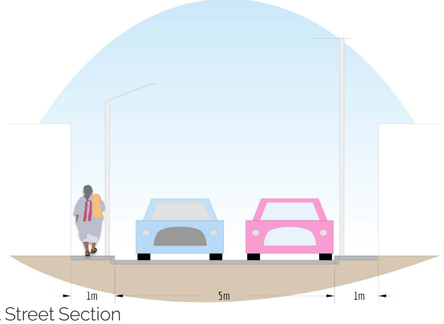




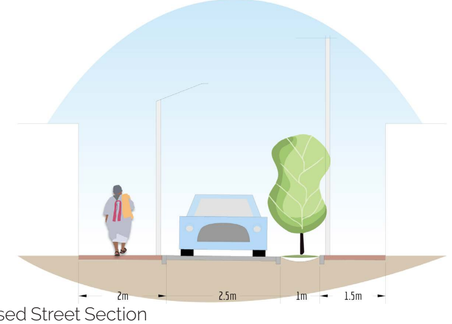








Current Street Section



Proposed Street Section

Quality Dwellings

Soft Mobility Streets

Water Retention &
Diverse Vegetation

Increase in Vegetation




1

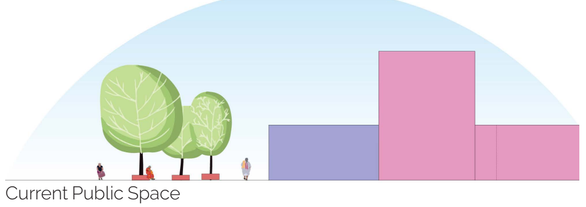

2

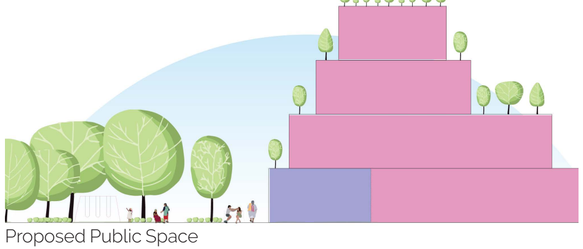

3


4


5

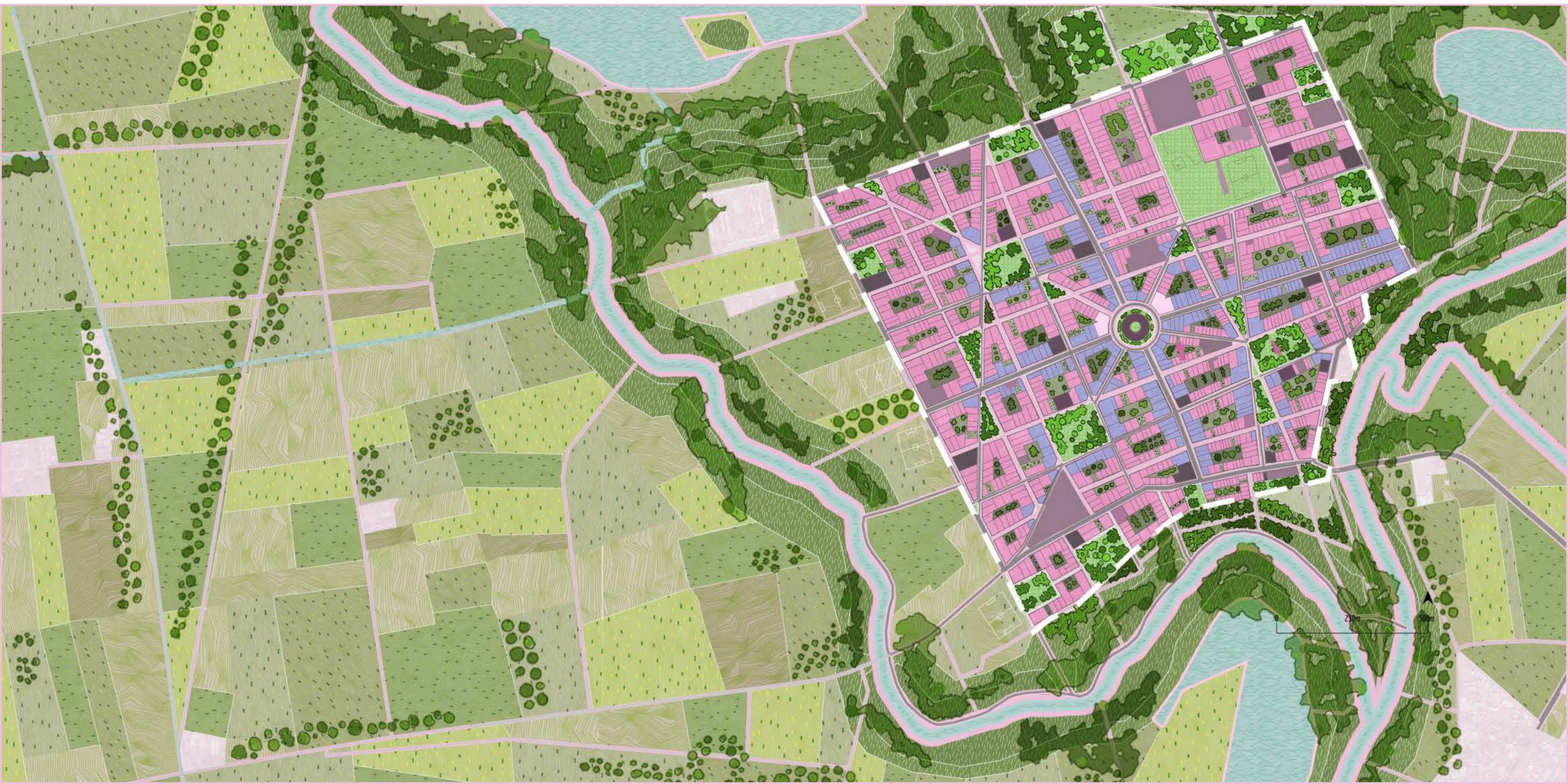

6


Current Public Space


Proposed Public Space

Pop-up Retail | Increased Permeability | Gathering Spaces | Outdoor Seating Areas | Biodiverse Landscape | Recreation Spaces




0
250m
500m

6.2 Landscape Strategy

The current landscape in the region as found in the analysis has a series of problems arising from the current anthropogenic practices. The soil in most of the region has been overused and polluted mainly by the agricultural practices. Because of the constant expansion of urban areas, industry, and agriculture the native vegetation has been highly reduced. The demand and over extraction of water has endangered the aquifers with the prediction of scarcity in the near future. Finally, the existing infrastructure has divided the area where species other than humans can transit freely.

To find a solution for all this issues we need to find transition from the current landscape that has been extremely manipulated and modified and turn it again into a resilient ecosystem. Taking the area around the intervened town of Pueblo Nuevo as a case study for this design proposal, the aim is to expand on the urban goals while shifting the focus now more towards the native ecology and find solutions for the complex problems the region.

The design interventions are known as generic tools for ecological improvement, some of them have been added to the toolbox. But in this specific design proposal the place and the geomorphology play a very important role, this is the moment where the generic becomes specific to a site, weather, and conditions.

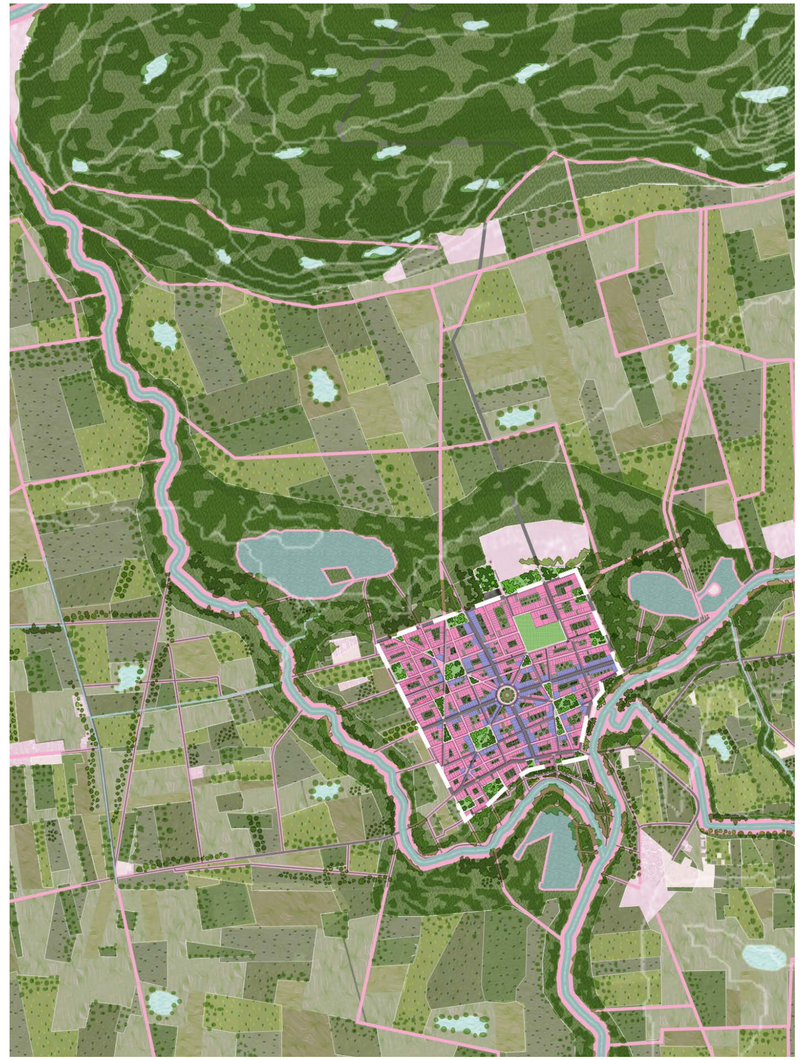
To formulate the transition there needs to be a phasing of how these changes should happen. In the proposal the start is to gather, retain, infiltrate and filtrate water. The reason for this is the basic rule of thumb “where there is water there is life”, in order for soil, vegetation and species to thrive there needs to be sources of water.

Second, threating the soil to regain quality, nutrients, and water retention capacity among others. The goal is that the soil becomes again part of the natural cycles and supports the cycles of vegetation and animals as well as taking advantage of them.

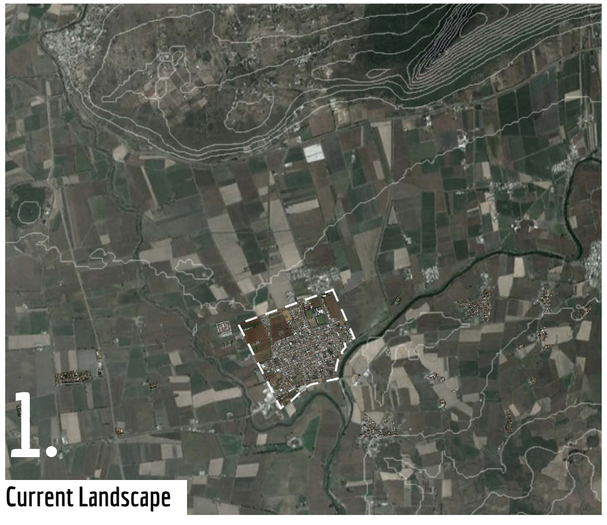
Having a better quality of soil opens the opportunity for reforestation. Since most of the existing biological corridors run along the rivers it makes sense to make a continuation of those corridors. The reforestation along the rivers will provide safe passage, food, and shelter to species. A linear forest will become the main traveling path for animal species.

Traditional practices in agriculture within this region have damaged all levels of the ecological territory it occupies. That is why other agricultural methods need to be introduced in the region. Agroforestry, sustainable agriculture, permaculture, and food forests are a few of the methods that can help mitigate a lot of the current problems in the state while supporting the natural cycles by creating an ecosystem through biodiversity.

The last part of the proposal lays on the immersion of the common person with nature. Currently, people have very little connection to the existing landscape or species in the area. To make a change and to push this contact the proposal of soft mobility methods along the agricultural areas, forest and rivers takes place. With this infrastructure people will have more options for mobility that are sustainable and healthy while at the same time they create a bonding experience with all their surroundings.



Phasing Landscape Strategy



Current Landscape



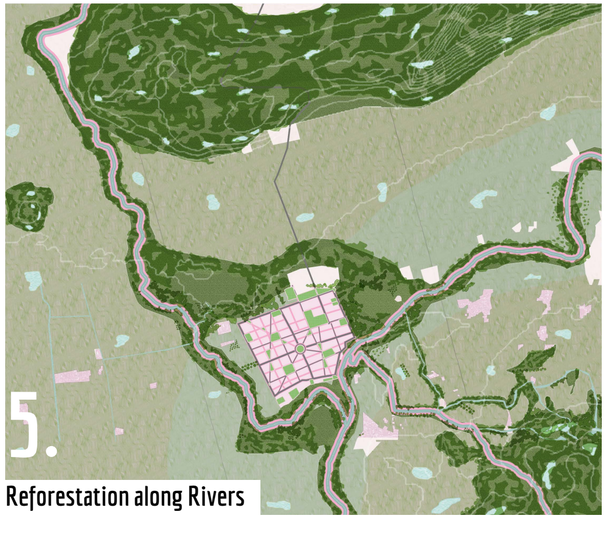
Current Ecology, Soil Erosion & Flood Areas



Retention Ponds



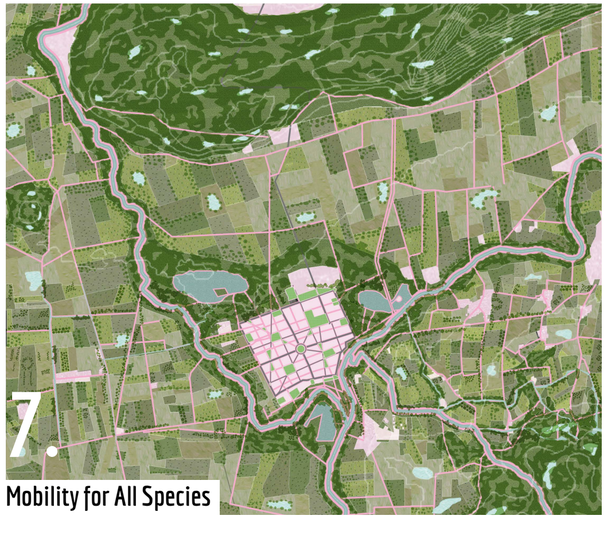
Soil Remediation



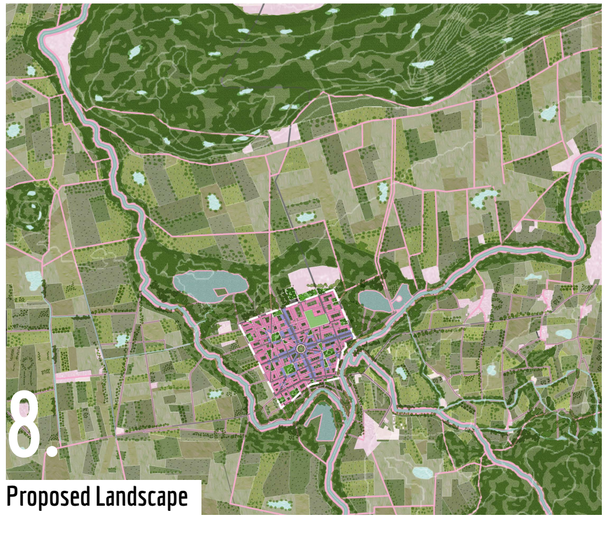
Reforestation along Rivers



Agroforestry & Sustainable Agriculture



Mobility for All Species

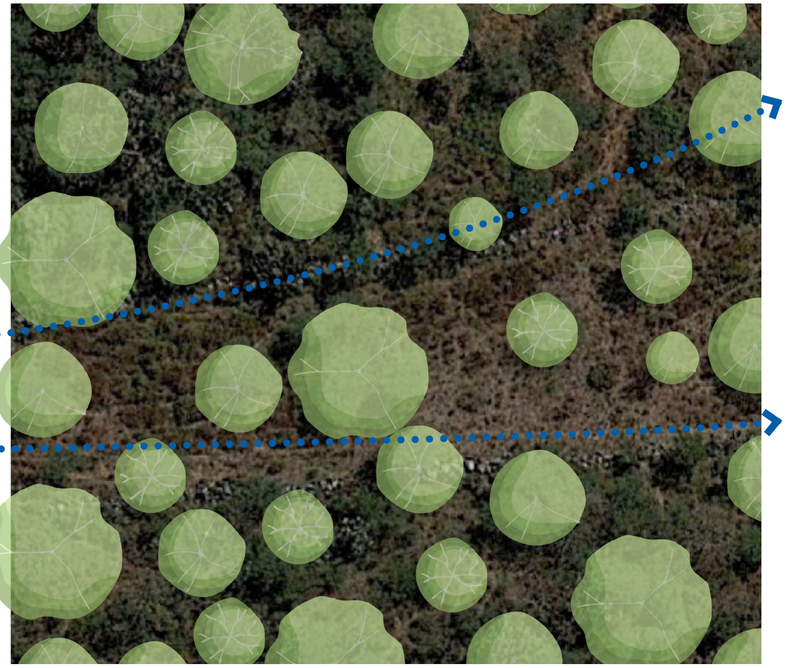


Proposed Landscape


1
2
3
4
PUEBLO NUEVO
1. FOREST
2. AGRICUTURE
3. RIVER EDGE
4. CITY EDGE

6.2.1 Forest

Current

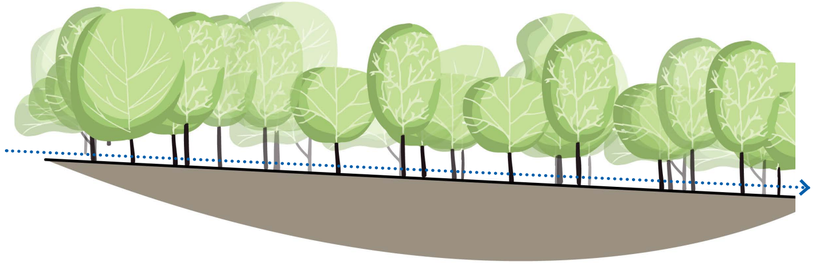


The existing forests in the region are mainly located at the foot of the hills which are not many because of the topography of the region.

The hills could benefit from contouring to create several steps along the hill to help stop the speed of storm water runoff. The addition of retention ponds in key locations can maintain water in a specific area for longer while increasing infiltration and attracting species. Through the addition of varied vegetation the water can also be absorbed and retained in the area while at the same time serving as a booster for the reforestation strategy.

The aim here is to retain the stormwater runoff in the forest areas and along the hills with multiple goals:

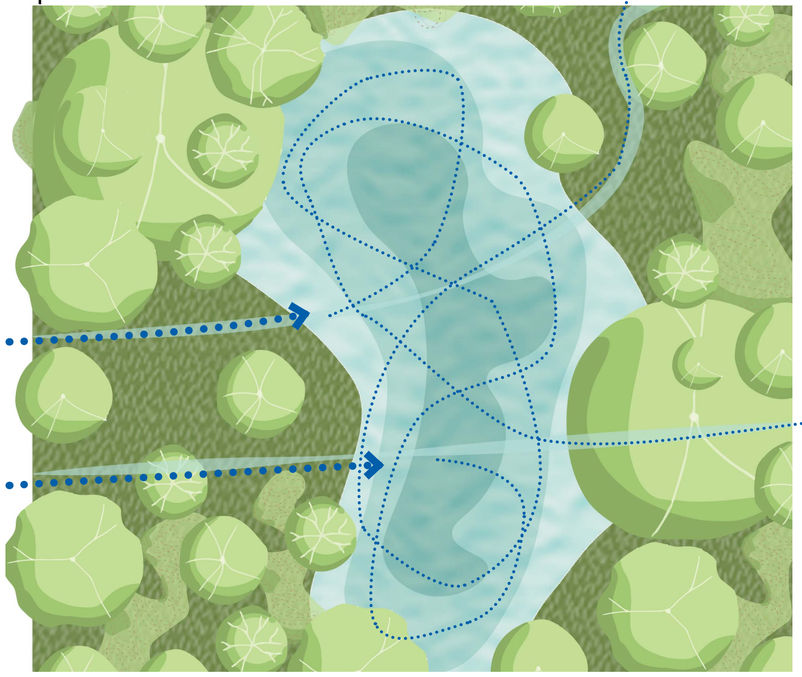
1. Increase evapotranspiration
2. Increase water infiltration
3. Increasing surface water to support species
4. Support basins quantity

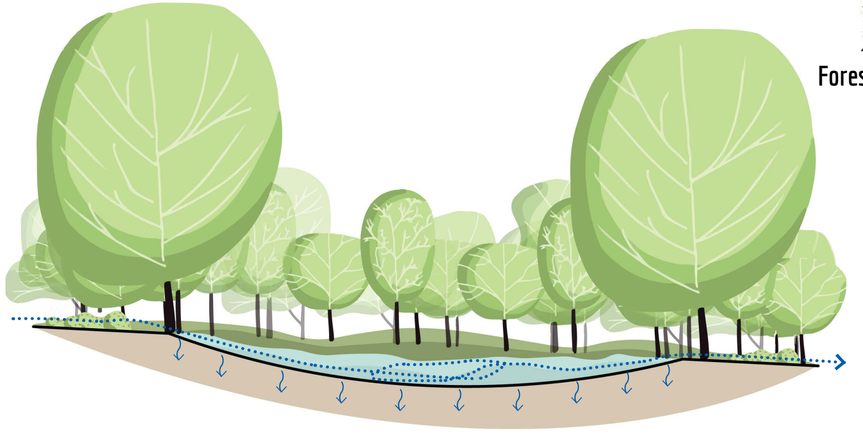


Why?

- Biodiversity only located on hills
- Lack of water retention
- Soil water retention capacity

Proposed

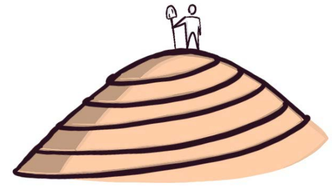




Design Principles



Retention Ponds



Erosion & Runoff Control

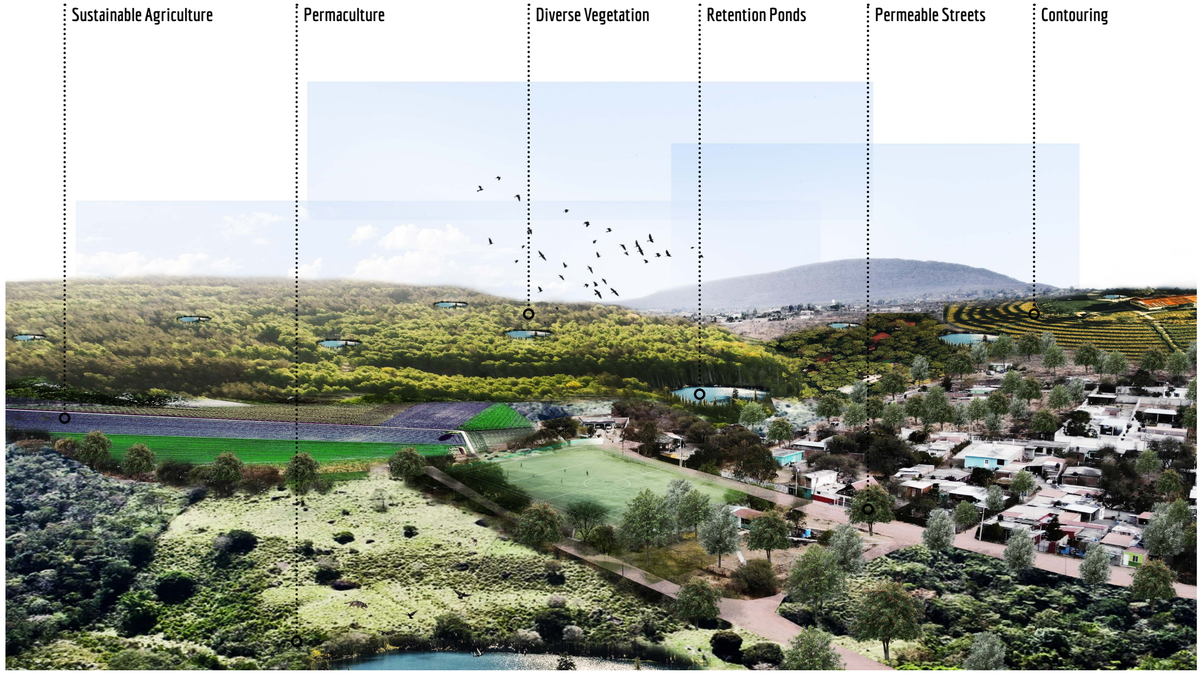


Forest Species Variation

Current



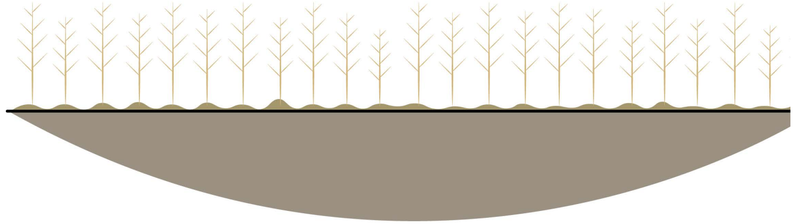
Vision 2060



6.2.2 Agriculture

Current





Even though the region's land is mainly occupied by agricultural crops there is nothing positive these current practices are giving to the water system, soil or biodiversity.
In the selected area all the crops are currently:

1. monoculture
2. dependent on irrigation
3. use chemical pesticides and fertilizers
4. eroded

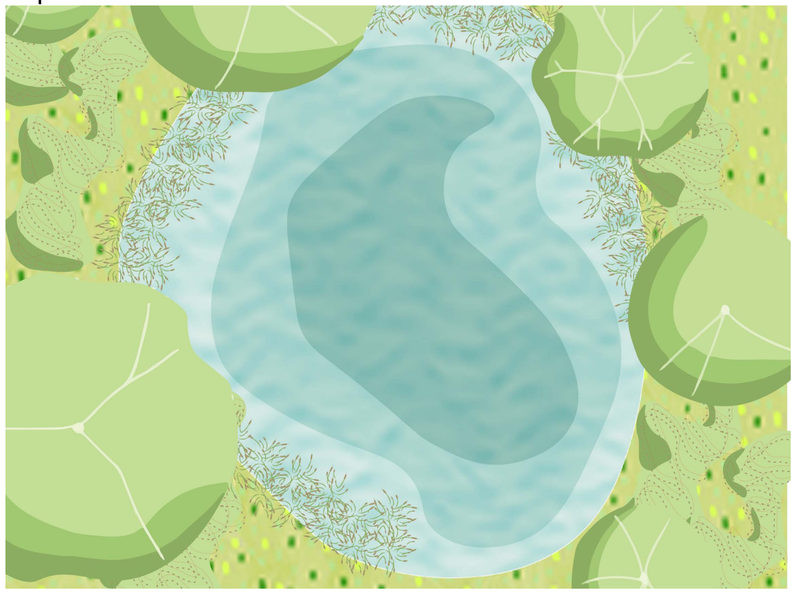
The current practices have, as shown in the analysis, taken most of the nutrients out of the soil increasing the risk of compaction. Once the soil is compacted it is dead and it cannot provide any life. This is the risk of the state if there is no change, the region will lose its capacity to produce food.

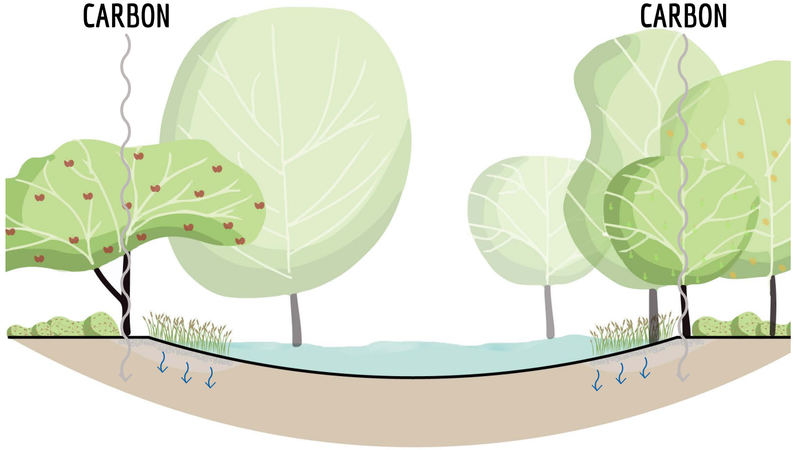
As a strategy we need to start with the retention of water so farmers can utilize this resource in a more sustainable way. Having a pond for a certain number of fields will reduce the amount of water extracted from the aquifers while at the same time it will increase the infiltration to the soil maximizing its retention capacity. Second, the existing soil needs to go through a restoration phase where the fields regain nutrients, water retention capacity and the ability

Why?

- Soil compaction
- Water availability
- Evaporation & Run off control

Proposed

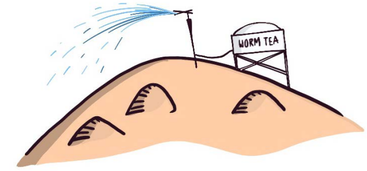




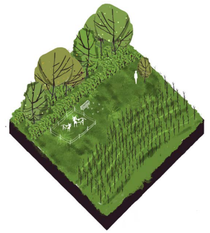
Design Principles



Retention Ponds



Soil Restoration



Agroforestry

to become productive.
There needs to be a shift in the traditional agriculture. By providing sustainable solutions that will help the earth and at the same time it will support the farmers the region will have a working ecosystem where the human is brought back along all other species.

Current



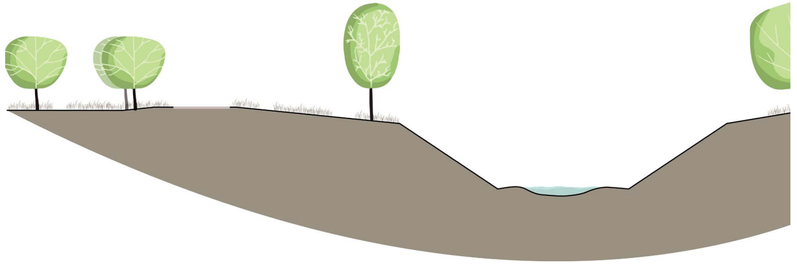
Vision 2060



6.2.3 River Edge

Current



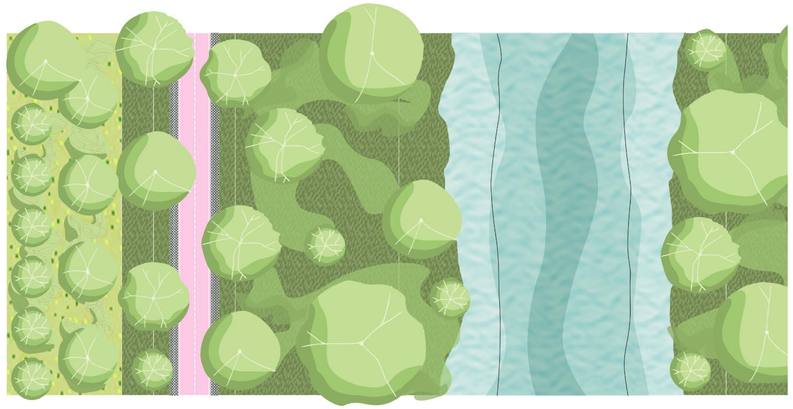


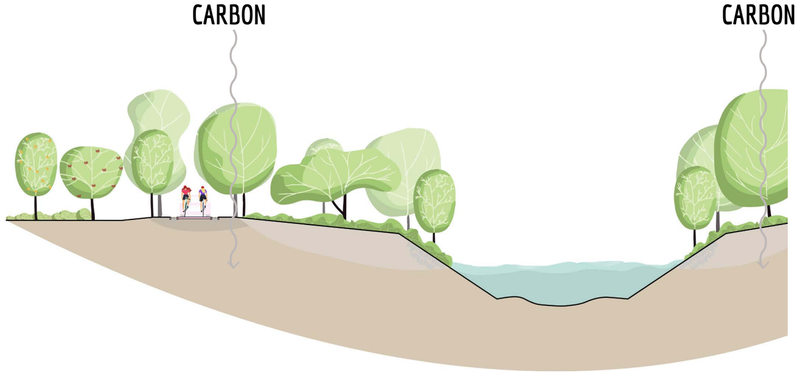
The current water system has been exploited to dangerous levels both at a national and a regional level. The over extraction of this resource is not the main problem, the real problem lays in how it is used and sent back into the system. At the same time the existing rivers that once hosted a biodiverse landscape is now reshaped and manipulated to serve only for the anthropogenic practices.
As mentioned before, the rivers were the main biological connection of the region connecting the north and south areas of the state. Currently because of the modification done to the rivers most of the vegetation is gone and as a result the migration between north and south has been reduced.
The strategy envisions these rivers as what they once were, a corridor for all species, in this case as part of the one ecosystem theory the human is also considered.
The enhancement of the water system and the river edge starts with contouring the rivers to be able to retain water for longer and to have a natural system that filters it, getting rid of heavy chemicals and pollutants. The next step is to enhance the biological corridors with the addition of a varied vegetation along the river, creating a linear forest. Finally, some bike lanes and walking

Why?

- Lack of biodiversity
- Disconnection of biological corridors
- Potential for slow mobility

Proposed





Design Principles



Enhancement of water system



Bike Paths



Walking Paths



Biological Corridors

paths will be developed for humas to be able to immerse themselves in nature and to become in some way a part of this new ecosystem.

Current

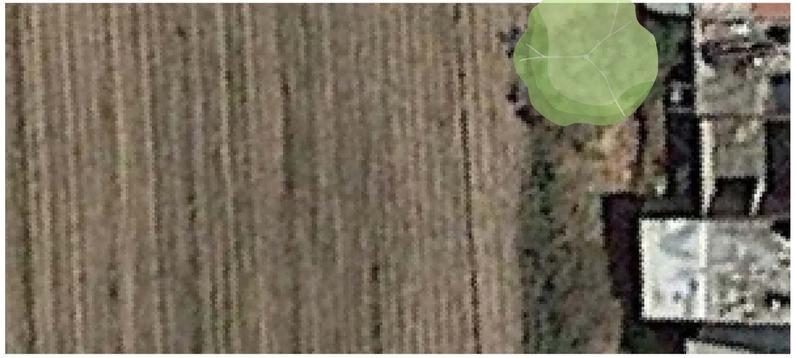


Vision 2060



6.2.4 City Edge

Current



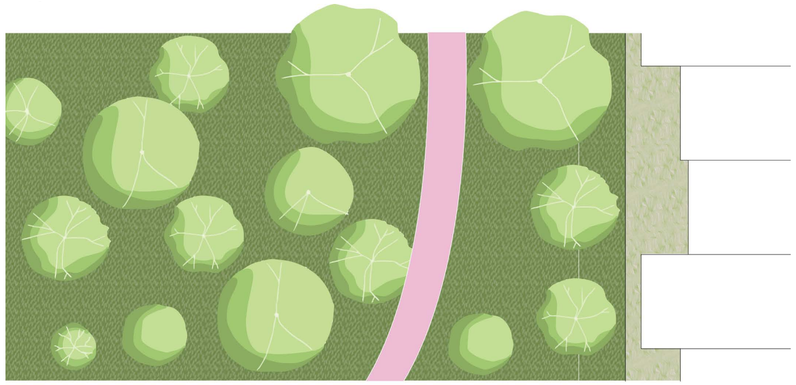


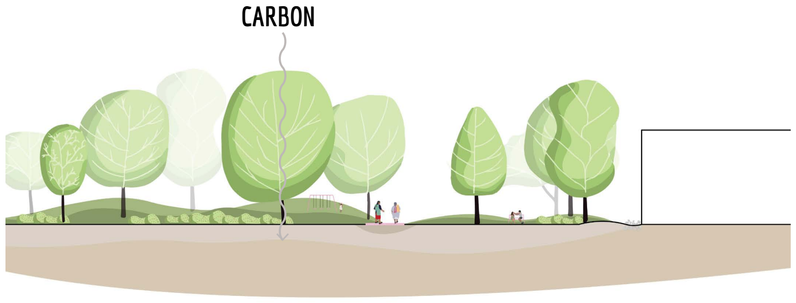
Perhaps the most important element of the landscape strategy is located in the edge of cities.
Currently these areas have a difficult transition from urban or suburban into agricultural land. Most of these areas are not only dangerous but also lack a certain aesthetic and ecological quality for humans as well as a lack of living space for animals.
These areas are also a big challenge, because of the urban sprawl in the cities the agricultural areas turn into new urban developments, most of them gated communities that have a lack of services and that are far from the city.
In order to comply with the compact city theory and the desire for a city's footprint size limit there needs to be a barrier that helps with the containment of the city. Within the proposal the development of green belts around the cities the expansion is expected to stop while providing a biodiverse landscape that houses other species in the proximity of urban areas and improves the aesthetic, environmental and health qualities of the cities.
These green belts could become parks for the cities for people to gather, experience and enjoy. They could also become forest where wilderness finds a home supporting the reforestation of the region. It could become truly a place for all.

Why?

- Lack of biodiversity
- Disconnection of biological corridors
- Potential for slow mobility

Proposed

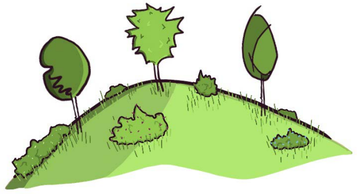




Design Principles



Intact Landscapes



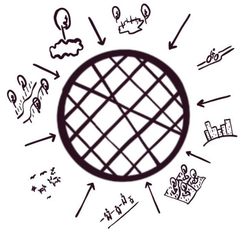
Reforestation



Bike Paths



Walking Paths

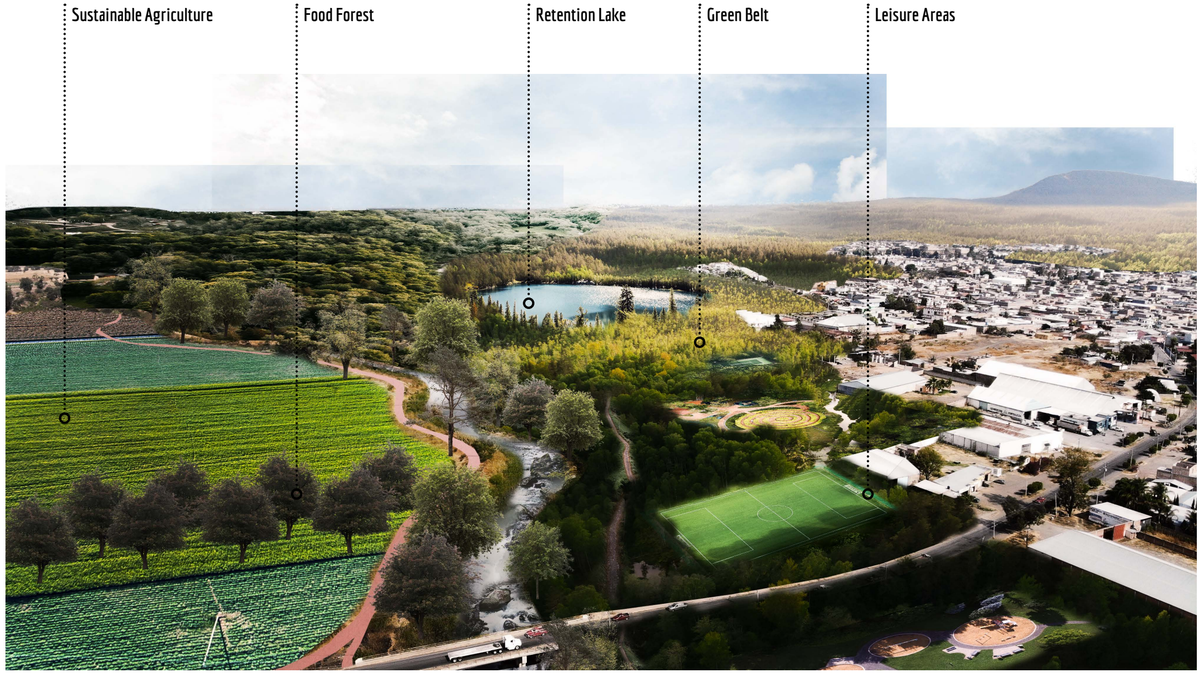


Inclusive Cities

Current



Vision 2060















6.3 Regional Strategy

A spatial strategy was designed to develop the region in an organized and beneficial manner considering the current characteristics of the space, its topography, water system, agricultural, industrial and urban areas.

Using the swarm planning system, the design starts with isolating the soil, water, infrastructure, landscape and urban in the combination of a grid traced along the whole region to facilitate the isolation of functions and challenges.

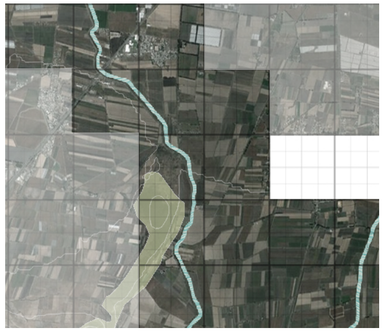
The design started with setting up a grid of 500m X 500m to grasp the scale of the space and understand the subdivisions of functions in the territory.

The grid provides a smaller scope to propose and design on by isolating the existing characteristics of the selected areas and challenges it contains while at the same time understanding the relevance and the role the area play at a larger scale.

Once the area with its challenges, actors and disconnectors are found, there is a selection of interventions and principles chosen from the proposed toolbox concerning the urban and landscape design proposals to be applied at a larger scale. All of these elements placed in the area have been studied and throughout through the analysis and knowledge acquired of the area during this thesis.



6.3.1 Soil





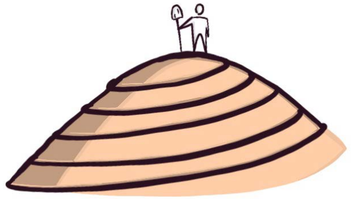
In the soil layer, there is a focus on a restoration strategy and phasing that aims to improve the quality of the soil, mainly on the existing agricultural areas and along with the water system.

The intention is to identify monoculture crops in the region, which, as seen in the analysis, most of them are near the water system. The second step was to understand the relationship between agriculture and these areas and how they can be improved through natural methods and ecological cycles. Step three was to use the analysis, toolbox, and design proposals as guidelines to remediate the soil's current conditions and develop a phasing strategy.

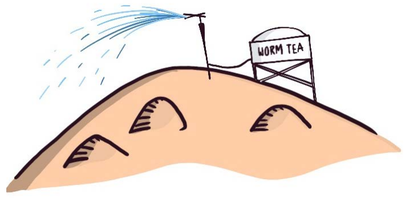
Phase 1 - Erosion & Runoff Control
By implementing a crop rotation, the water on the fields will stay in the area for more prolonged periods improving the infiltration
Contour building along the hills can also help control the runoff water from storms and help with water retention in a broader area.
Terracing can be an agricultural technic to be implemented on the hills, continuing with water retention.

Phase 2 - Soil Restoration
Increase microbe activities by using natural fertilizers on the soil and with the help of other species by increasing their droppings in agricultural areas.
Composting all biodegradable resources and feeding them to damaged areas in the region will improve the quality of the soil as well as increasing the water holding capacity

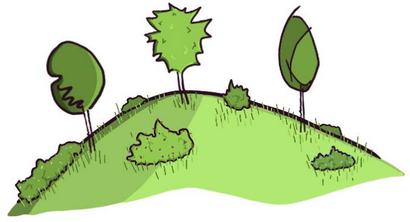
Phase 3 - Replanting
To aid with the soil's carbon fixation, there is a need to combat deforestation in the region. By replanting native species throughout the crops, an increase of carbon will be fed to the soil, increasing its quality and life-giving capacity.



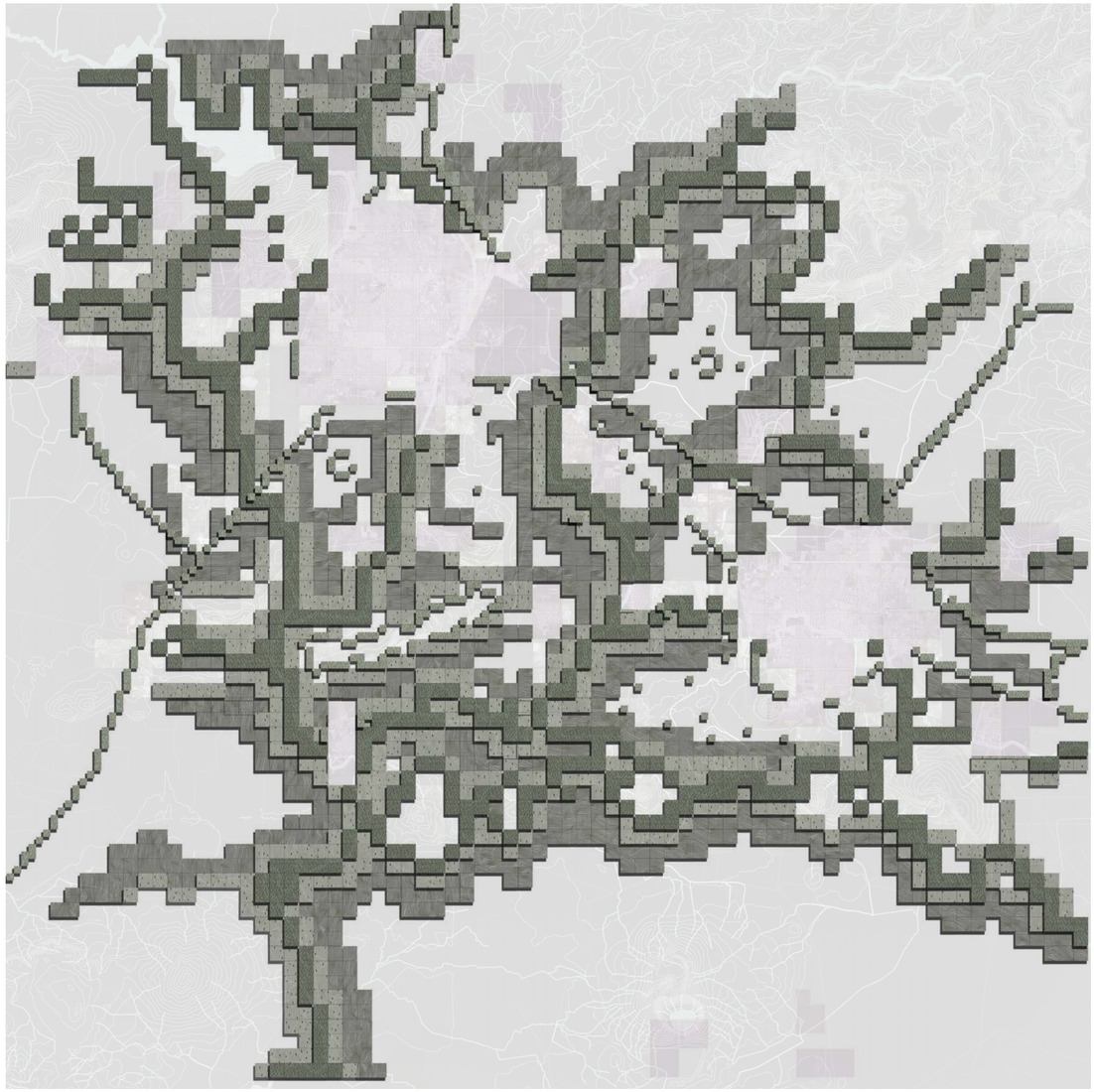
Phase 1 - Erosion & Runoff Control



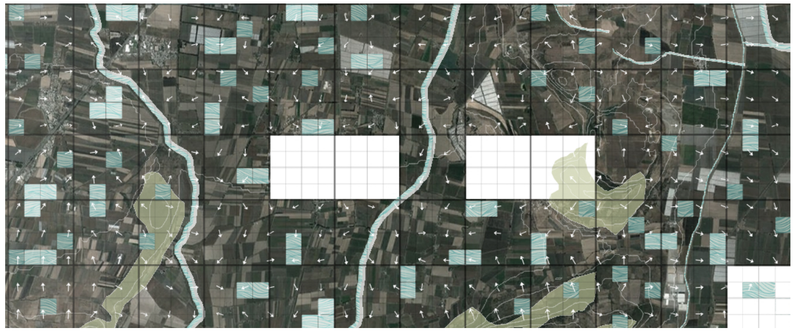
Phase 2 - Soil Restoration



Phase 3 - Replanting



6.3.2 Water

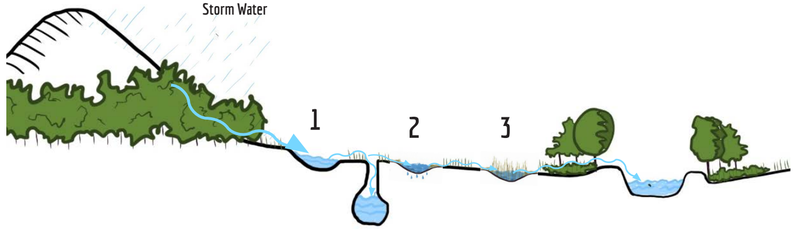


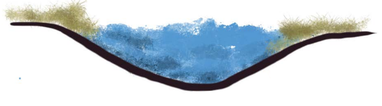
The regional water strategy uses the topography, and current water flows as an opportunity for natural interventions that increase this resource's reserves, quality, and availability.

The proposal focuses on the following:

Retain Water
Infiltrate Water
Filtrate Water
Reincorporate to System

Starting with the area with the most potential, hills in the region can be contoured and dug out to place retention ponds on the higher regions. These interventions would increase the quantity of water on the hills improving the biodiversity capacity, and the infiltration would promote the growth of native vegetation. As the water follows its natural cycle, the addition of retention and infiltration ponds are proposed on agricultural lands to increase the availability for food production and increase the quality of the water once used. Through these proposals, the water would be reincorporated into the river system & basins in larger quantities and better quality.

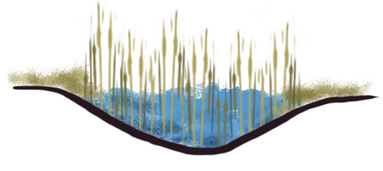




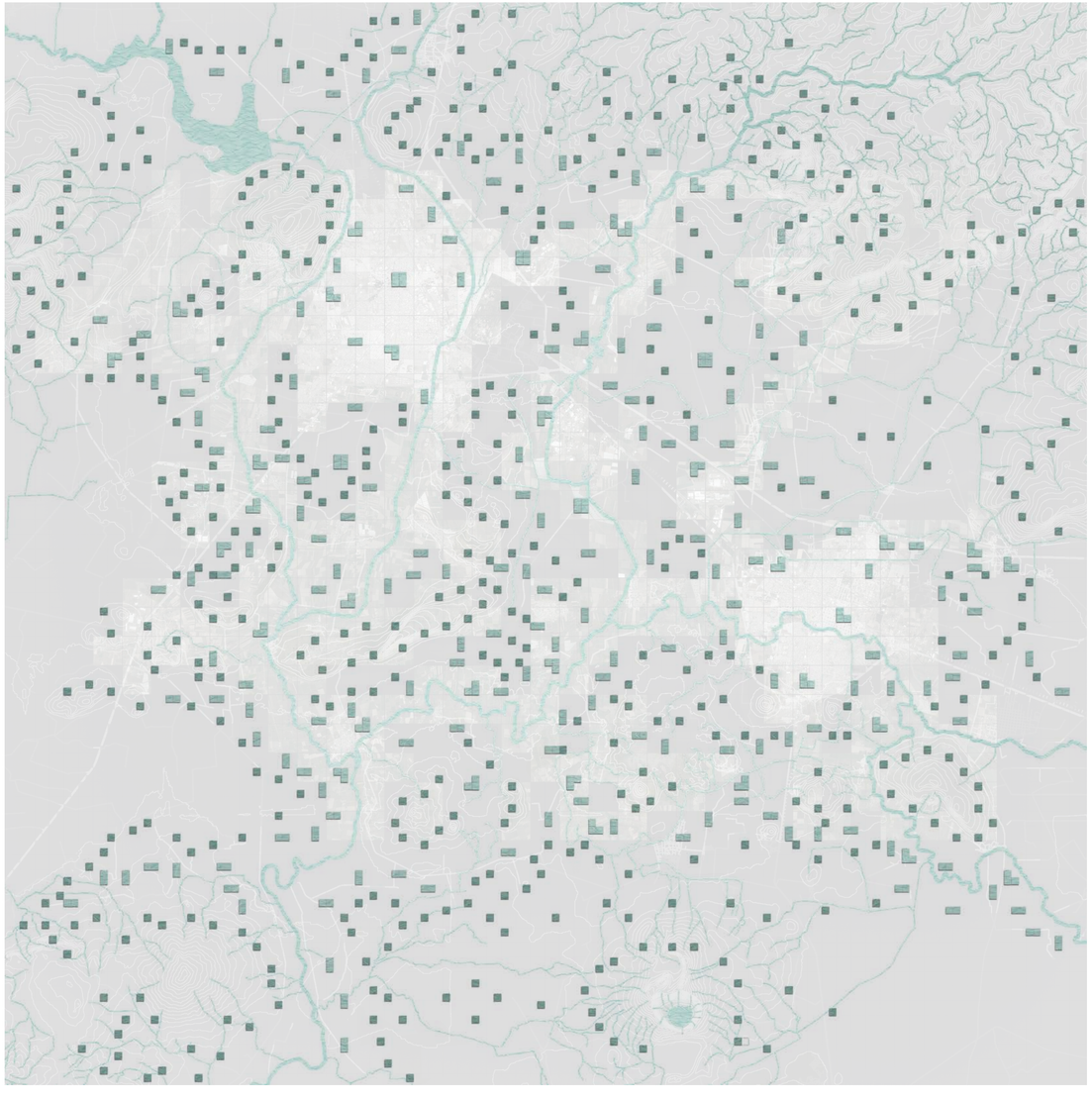
1. Retention Ponds



2. Infiltration Ponds



3. Filtration Ponds



6.3.3 Infrastructure



To connect the region with a human and animal focus, the proposal closes the gaps that the current disconnectors have created.

On the human side, incorporating a regional mass transportation system is proposed as a sustainable mobility system. In addition, a bike and walking path system is added throughout the multiple levels of existing mobility infrastructure to add the option of soft mobility methods that connect people with numerous cities and within them.

On the animal side, the development of biological corridors along the river edge and hills will improve the migration of species and the reincorporation of species in the region. As a more significant infrastructure proposal, the development of wildlife bridges and eco ducts should be implemented on the current infrastructure that is acting as a disconnector and any other infrastructure project in the future.



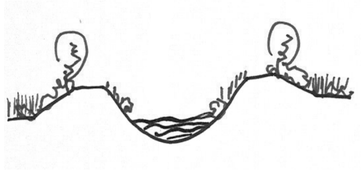
Mass Transport



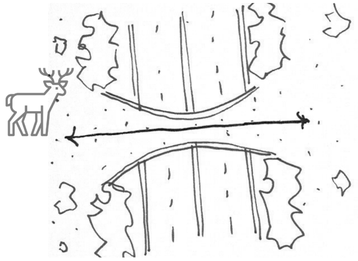
Bike Paths



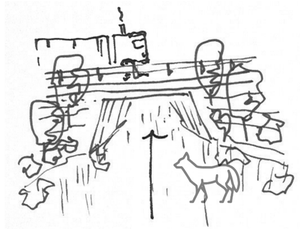
Walking Paths



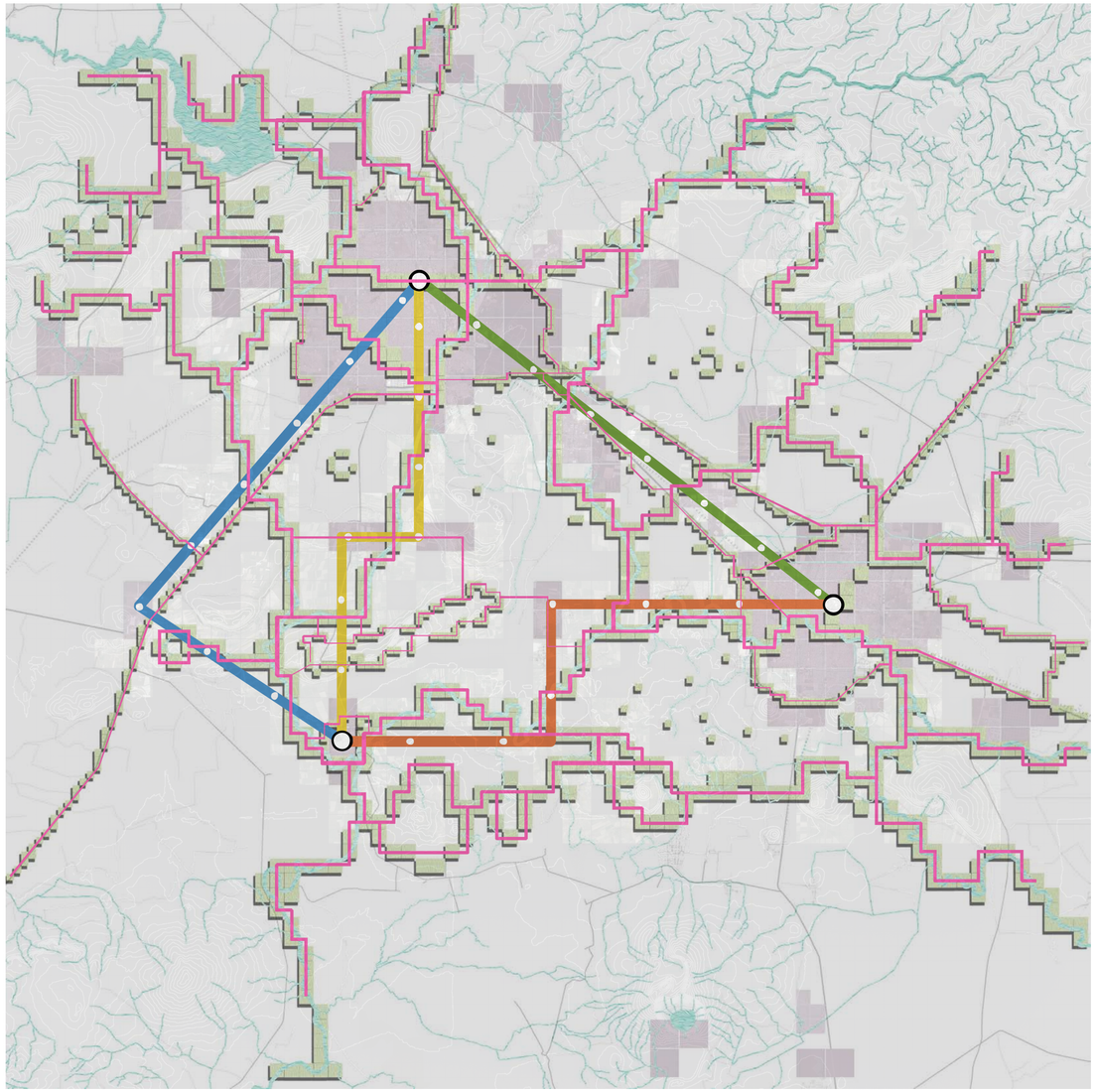
Corridors



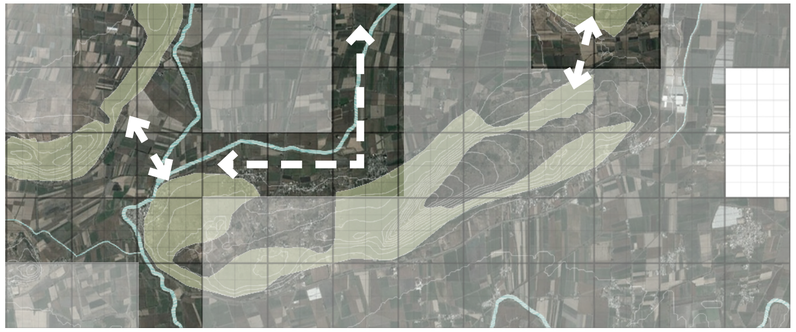
Wildlife Bridges



Eco ducts



6.3.4 Landscape

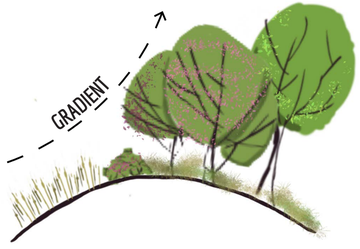


Following the current landscape design proposals, the regional strategy expands only on the proposed interventions' scale.

The desire is to be able to generate a biodiverse landscape through the reforestation of damaged forests, scrublands and shrublands in the region as to regain the native species that once inhabited the region while at the same time opening the opportunity for new species to coexist.

Secondly, the enhancement of vegetation in agricultural areas with the introduction of sustainable farming practices, the addition of gradients and the development of agriculture as a natural cycle where an ecosystem is created and sustains life for all.

Third, the consolidation of the biological corridors along rivers and connecting existing forests for free and safe mobility for all species and to help enhance soil and water systems.



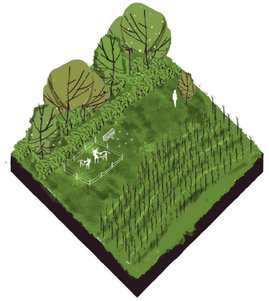
Species Variety



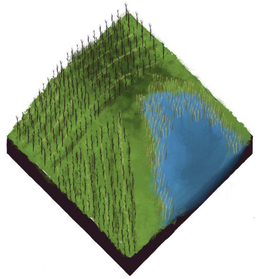
Food Forest



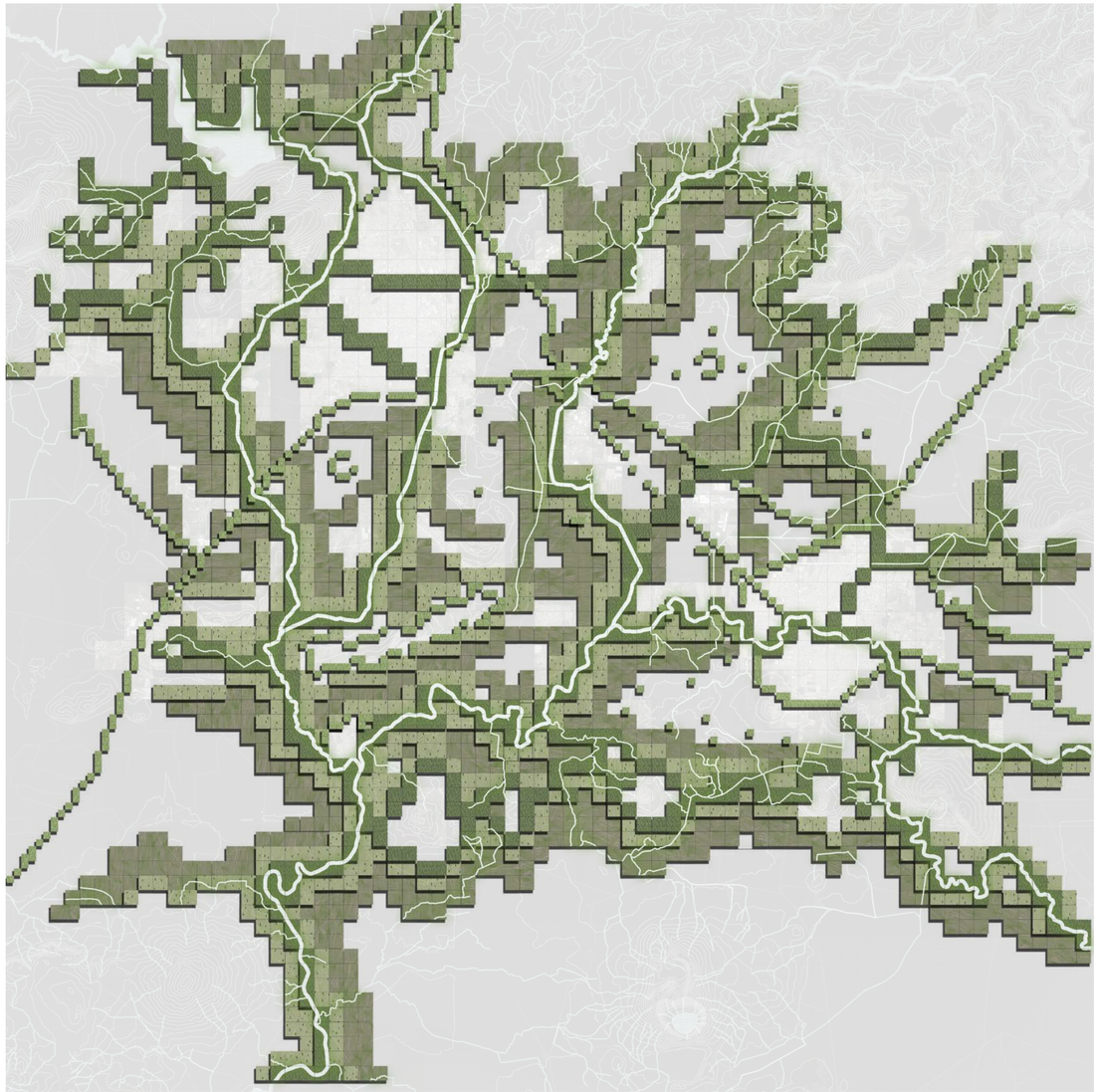
Biological Corridors



Agroforestry



Retention & Infiltration



6.3.5 Urban

The regional strategy for the urban design follows the localized strategies utilized in the case study of Pueblo Nuevo.

The aim of urban design is to create cities that are developed sustainably and that incorporate ecological imperatives to achieve a balance between the Anthropocene and other species.

The redevelopment of towns and cities should be replicated to absorb the projected population growth while maintaining cities compact; they should promote a high quality of life and contain a wide variety of functions that enable a local economy and communal living.

This model is intended to be replicated and expand through the region to create a network of ecocities in Guanajuato.



Balanced Population Distribution



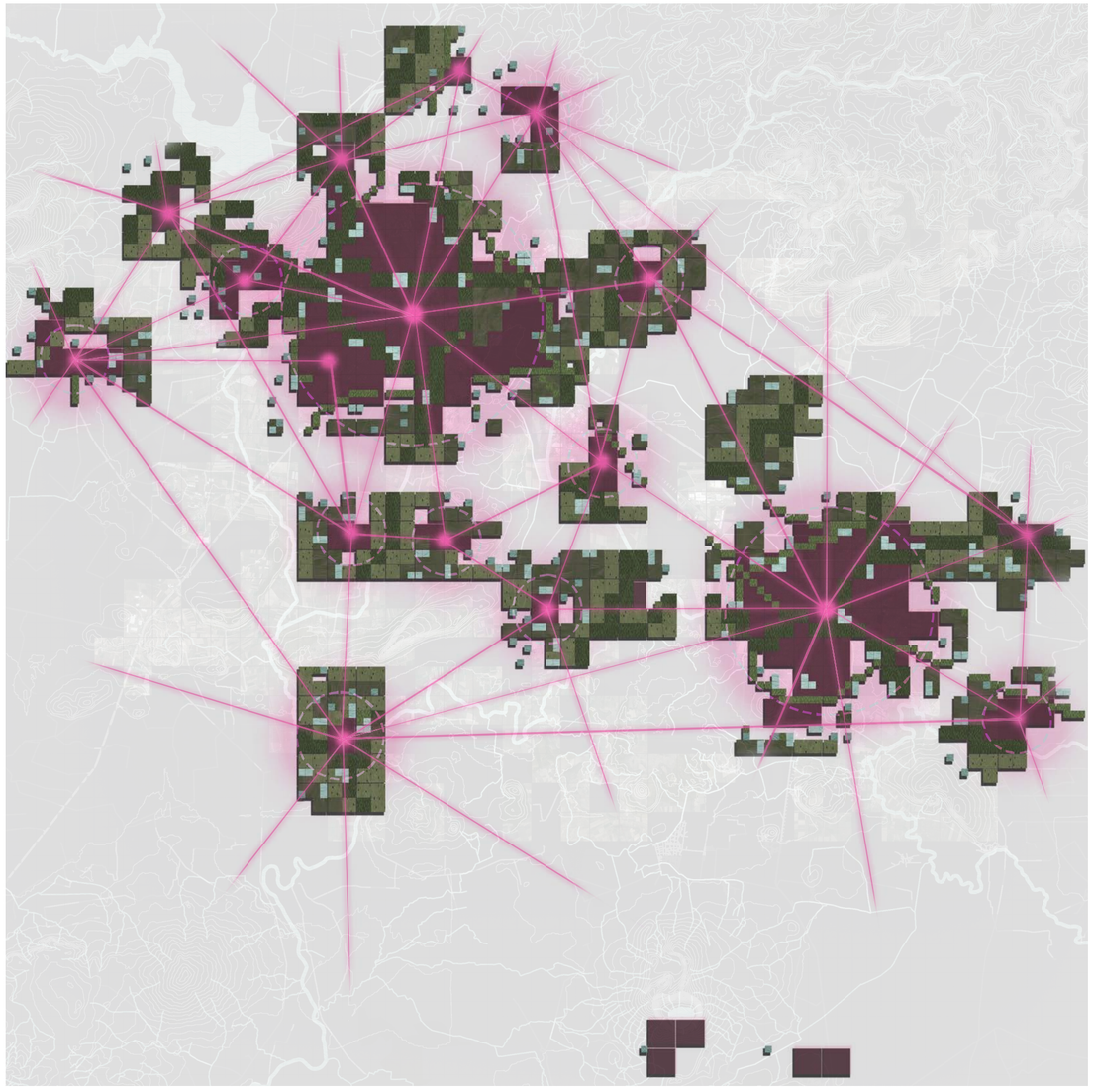
Ecocities



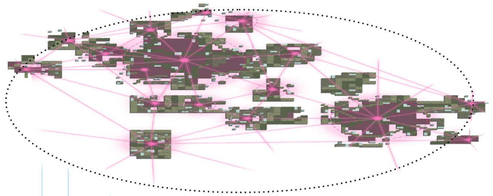
High Quality of Life



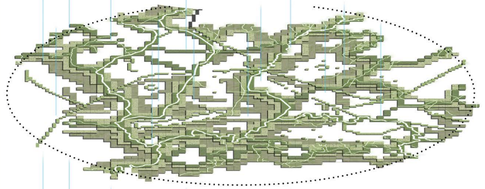
Variety of Programs & Functions



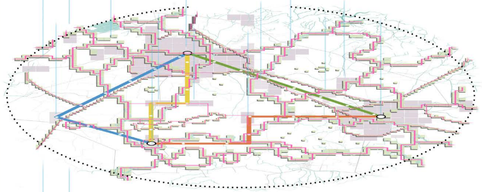
LAYER / 5
URBAN



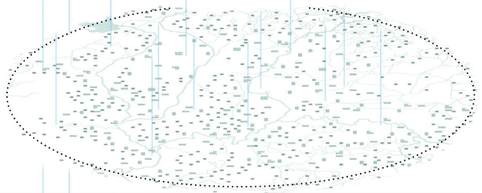
LAYER / 4
LANDSCAPE



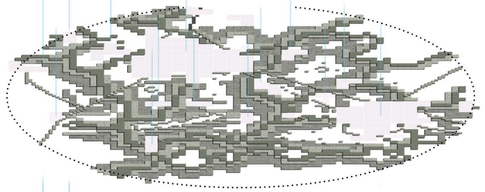
LAYER / 3
INFRASTRUCTURE



LAYER / 2
WATER



LAYER / 1
SOIL



VII / CONCLUSIONS & REFLECTIONS

7.1 Conclusions

This graduation project, “Ecological Rehabilitation – An urban landscape strategy for Guanajuato”, has been developed in an unusual way for an urban design project as well as a landscape architecture project.

The aim was to explore the ecological and environmental challenges to understand at a deep level what is really going on in Guanajuato. Taking the time to analyze the different ecological levels has given me a vast knowledge of general information about the state but also those things that people who are developing our cities don’t want to see.

Taking this knowledge of the current landscape challenges and finding its causes has been one of the great learning processes in this project. By understanding how anthropogenic pracitces affect the environment, we can then begin to fix it.

Through this period, I also realised the scary reality of where we stand as individuals, cities, and states. The thought of knowing that our future is compromised in the next decade is something that scares me but knowing that people had an opportunity to do something and did nothing to fix it saddens me.

Hope is the reason why I started this project focusing on the importance of thinking of an urban design that increases the quality of life for people but at the same time enhances the life of nature by designing for the benefit of what we cannot or don’t want to see.

I genuinely believe that on both an urban and a landscape scale, the proposals will enhance the current life quality of all species. In the cities, by creating a healthy biodiverse environment where there is the human scale, and that enhances the community by day to day interaction, discussions and joyful moments. At a landscape level, the initiatives of retaining water will start developing one working ecosystem, first at a local level. Still, the intention is that it is replicated at a regional level. This will allow animal species and vegetation to recover the territory it was taken through anthropogenic practices. The reforestation of forests and the introduction of sustainable agricultural methods will increase the biodiversity throughout the whole region. They will provide a chance for other species to thrive and coexist with humans and create a relationship between both of them.

I realize that these proposals are not the only solution for the current challenges in Guanajuato. Many other designers, ecologists, landscape architects and activists may have different views and approaches to try to fix urban areas and landscapes. These proposals are only my take on the issue and my vision of what could happen in the near future.

One lesson to be learned from this project is that we are past the breaking point. We need to act in a radical way by making extreme changes in our archaic way of developing, how we grow food, how we extract and use natural resources, and how we build and live our cities. If we neglect our planet for longer, we might be the ones who see it disappear, leaving nothing for future generations.

I hope that this project serves for a change in perception, boosts people’s imagination, and portrays a different vision of the future.

7.2 Reflection

Societal Relevance

Given the Mexican political and societal context as well as the regional scope of this graduation project the societal relevance lays more on the “What if?” field rather than in a proven scientific workflow and policy. The thesis, while it implements various theories from the Ecocities from Richard Register and the human dimension by Jan Gehl, it belongs in a place of further research and contextual application. The final intention is to trigger the imagination of the reader and try to create a consciousness in the way we are living today.

It is true that in order for this project to become a reality there needs to be an immense amount of molding in the cultural aspects of how people from Mexico and specifically Guanajuato live, work, harvest as well as how they develop a better relationship with nature. The process can take decades to be implemented just because every level of the anthropogenic practices is exclusively developed for human progress, and in the process, we destroy the land, species and ecosystems that give us life.
Nevertheless, in an attempt to provoke, this thesis gives a general understanding of the several issues we face today in the state expecting to slowly bring change from the individual to the collective. Every single intervention, no matter how small, will take us a step closer to living in a balanced ecosystem once again creating a healthy world to prosper.

Methodology

As the thesis developed the generic urban methodology was adapted to have a product with proper information and experimentation for this specific project, context, and scope. Here I will present some areas that were a breaking point in some part of my project.

Motivation and Argumentation - As being the first two areas of the project they present the relevance of the project as well as the reason WHY you are doing what you are doing. Personally, this phase was extremely demanding and changed on every stage of the thesis. The problem is that the expectation of this chapter is to hook the audience and translate the problems that you are thinking of in a relatable way for everyone. As my project was in Mexico and in a specific region of a state this was very difficult at first until the moment that I understood that what I was doing was in fact a global issue that happened to be placed in this region based on my personal motivation. Through this way of thinking I was able to come up with a concrete argument at a global scale that then scaled down into a specific area.

Analysis, Conclusions & Vision - With a great amount of data from the area linked with the aspirations for change from my side it was a very heavy task to correlate the information and to conclude into a non-biased result. At the same time the analysis brought

me lots of possibilities to move forward and forcing me to decide and focus on a few issues while leaving many more behind. The literature review helped form these decisions but at the same time it opened the door to more items that could be tackled in the project turning into a never-ending loop. Here I had to take a step back and really think about what my vision for this place was, at this point I already have more information that I needed so I was able to develop a vision that came from a place of science, data, and theory. I only wish this vision part would have come before in a more conceptual way so that the analysis and conclusions were more grounded from the beginning.

Data Collection

Having a project in a different country is always going to be a challenge, not to mention that specifically this year the pandemic gave us less freedom to travel, document and interact in the space we are trying to transform. On the plus side and to my surprise, Mexico counts with a very broad range of data spanning from the country scale to states and even municipalities. I was able to extract information from INEGI (Instituto Nacional de Estadistica y Geografia) as well as from various state dependencies.
An issue that I had very often was that the information would not always be up to date, studies from dates prior to 2015 could not be taken as a reliable source. On this particular occasion I would have to make a correlation

me lots of possibilities to move forward and forcing me to decide and focus on a few issues while leaving many more behind. The literature review helped form these decisions but at the same time it opened the door to more items that could be tackled in the project turning into a never-ending loop. Here I had to take a step back and really think about what my vision for this place was, at this point I already have more information that I needed so I was able to develop a vision that came from a place of science, data, and theory. I only wish this vision part would have come before in a more conceptual way so that the analysis and conclusions were more grounded from the beginning.

Data Collection

Having a project in a different country is always going to be a challenge, not to mention that specifically this year the pandemic gave us less freedom to travel, document and interact in the space we are trying to transform. On the plus side and to my surprise, Mexico counts with a very broad range of data spanning from the country scale to states and even municipalities. I was able to extract information from INEGI (Instituto Nacional de Estadistica y Geografia) as well as from various state dependencies.
An issue that I had very often was that the information would not always be up to date, studies from dates prior to 2015 could not be taken as a reliable source. On this particular occasion I would have to make a correlation from that data with literature review so I could understand how things have changed, only then I could move on to an educated conclusion.

Ethical Dilemmas

When doing an ecological rehabilitation there are many factors that you have to consider, ethics being one of them. In this project I tend to put that aside because I do not know where to place it concretely, is it ethical to destroy a forest and get rid of species? Is it ethical to remove the people that are living in those former forests when they were not the ones destroying it? Is it ethical to expropriate land from farmers to reforest large areas?
I see it more in a way of what has done it has done and how do we improve it. To grow as a society with empathy and push for spatial justice for all living things.

Application

Since the project is done by the analysis of a specific region the interventions are meant to be applied throughout the whole region both at local and individual as well as regional and collective. The expansion of this plan would in theory be applicable to any area that fits within the same ecological territory and the attempt is that the whole regional plan expands to the neighboring areas.
This does not mean that the tools provided would not work on other around the world and have proven effective. Instead, what I believe should have another look before applying the proposed network of interventions in another site is to have a deep understanding of the area and the many factors researched in the analysis chapter.

VIII / REFERENCES

Alberti, M. (2008). Advances in Urban Ecology. In Advances in Urban Ecology. https://doi.org/10.1007/978-0-387-75510-6

Alexander, C. (1965). A City is not a Tree, Parts 1 & 2. Architectural Forum, 122(1, 2), 58–62, 58–61. http://www.rudi.net/pages/8755 http://www.rudi.net/books/201

Alvarado, R. (2021). Deforestan área protegida en Cuerámaro. https://www.elsoldeirapuato.com.mx/local/deforestan-area-protegida-en-cueramaro-4978801.html

Ben-Zadok, E. (2008). Green Cities: Urban Growth and the Environment by Matthew E. Kahn . In Journal of Urban Affairs (Vol. 30, Issue 4). https://doi.org/10.1111/j.1467-9906.2008.00409_1.x

Beurden, J. B. van, Doepel, D., & Tillie, N. (2013). Sustainable densification and greenification in the inner city of rotterdam. Proceedings of CUPUM 2013: 13th International Conference on Computers in Urban Planning and Urban Management - Planning Support Systems for Sustainable Urban Development, July 2013, 1–17.

Burnett, E. (n.d.). Is this the greenest city in the world? https://edition.cnn.com/videos/tech/2014/06/26/cot-masdar.cnn/video/playlists/city-of-tomorrow/

Camarena Pozos, D. A. (2015). Microorganismos presentes en agua y suelos afectados por contaminantes provenientes de actividades industriales en Guanajuato. July, 1–5. https://doi.org/10.13140/RG.2.1.2786.4163

Caprotti, F. (2014). Critical research on eco-cities? A walk through the Sino-Singapore Tianjin Eco-City, China. Cities, 36, 10–17. https://doi.org/10.1016/j.cities.2013.08.005

Chapman, E. H., & Lynch, K. (1962). The Image of the City. The Journal of Aesthetics and Art Criticism, 21(1), 91. https://doi.org/10.2307/427643

CONACULTA. (n.d.). Ciudad de Guanajuato. https://www.cultura.gob.mx/turismocultural/destino_mes/guanajuato/guanajuato.html#:~:text=GUANAJUATO&text=Su nombre deriva de Quanaxhuato,importante de la Nueva España.

CONAGUA. (2018). Actualizacion de la disponibilidad media anual de agua en el acuifero Irapuato-Valle (1119) Estado de Guanajuato. In Aguas Subterraneas / Acuiferos.

Consejo de desarrollo Regional. (2002). Programa de desarollo regional, Region III Centro-Oeste. https://transparencia.guanajuato.gob.mx/biblioteca_digital/docart10/201302181442300.ProgramadeDesarrolloRegional_RegionIII_2000-2006.pdf

Cruz Angon, A., Melgarejo, E. D., Contreras Ruiz Esparza, A. V., Gonzalez Gutierrez, M. A., Becerril Patlen, R., Guzman Gonzales, D., & Baez Montes, O. (2012a). Biodiversidad en Guanajuato - Estudio del Estado Vol. 1 (CONABIO (Ed.); First).

Cruz Angon, A., Melgarejo, E. D., Contreras Ruiz Esparza, A. V., Gonzalez Gutierrez, M. A., Becerril Patlen, R., Guzman Gonzales, D., & Baez Montes, O. (2012b). Biodiversidad en Guanajuato - Estudio del Estado Vol. 2 (CONABIO (Ed.); First).

Defries, R. S., Foley, J. A., & Asner, G. P. (2009). Balancing human needs and ecosystem function. Frontiers in Ecology and the Environment, 2(5), 249–257.

Delegacion SADER Guanajuato. (2018). Evolucion de la produccion agricola en Guanajuato. SADER. https://www.gob.mx/agricultura/guanajuato/articulos/evolucion-de-la-produccion-agricola-en-guanajuato?idiom=es

Dillon, S. (1998, June 24). INTERNATIONAL BUSINESS; A 20-Year G.M. Parts Migration To Mexico. https://www.nytimes.com/1998/06/24/business/international-business-a-20-year-gm-parts-migration-to-mexico.html

Dobbelsteen, A. van den, Keeffe, G., Tillie, N., & Roggema, R. E. (2010). Cities As Organisms: Using Biomimetic Principles To Become Energetically Self-Supporting and Climate Proof. January. https://pure.tudelft.nl/portal/en/publications/cities-as-organisms-using-biomimetic-principles-to-become-energetically-selfsupporting-and-climate-proof(d57cdef2-8ac0-4856-b00a-3be806ba49c3).html

Ecocitiy Buildiers. (2019). Ecocity Standards. https://ecocitystandards.org/standards/

Ecocity Builders. (2020). https://ecocitybuilders.org

El Español. (2021). Descubren los cuatro ingredientes clave de los incendios que arrasan los ecosistemas. https://www.elespanol.com/ciencia/medio-ambiente/20210721/descubren-ingredientes-clave-incendios-arrasan-ecosistemas/597690799_0.html

El Sol de León. (2021). Se divierten con granizada de 10 minutos en León. https://www.elsoldeirapuato.com.mx/local/se-divierten-con-granizada-de-10-minutos-en-leon-teporada-de-lluvias-granizo-leon-guanajuato-6223566.html

Elmqvist, T., Goodness, J., Marcotullio, P. J., Parnell, S., Sendstad, M., Wilkinson, C., Fragkias, M., Güneralp, B., McDonald, R. I., Schewenius, M., & Seto, K. C. (2013). Urbanization, biodiversity and ecosystem services: Challenges and opportunities: A global assessment. In Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment (Issue January). https://doi.org/10.1007/978-94-007-7088-1

EPA. (2020). United States Environmental Protection Agency. Heat Island Effect. https://www.epa.gov/heatislands#:~:text=Heat islands are urbanized areas that experience higher temperatures than outlying areas.&text=Daytime temperatures in urban areas,Learn About Heat Islands page.

Etingoff, K. (2015). URBAN ECOLOGY Strategies for Green Infrastructure and Land Use. Forman, R. T. T. (2008). Urban Regions - Ecology and Planning Beyond the City. Cambridge University Press.

Francis, R. A. (2013). Urban Ecosystems. In Urban Ecosystems. https://doi.org/10.4324/9780203133644

Fully Charged. (2012). No Masdar: The City of the Future. https://www.youtube.com/watch?v=Nlaz61zpLfs&ab_channel=fullychargedshow

Galicia, A., Arenas, J., & Villoro, J. (2012). El Cóporo, Plazuelas y Peralta, Caminos de Guanajuato. https://mediateca.inah.gob.mx/repositorio/islandora/object/documental%3A79

Gehl, J. (2010). Cities for People. Island Press.

Gehl, J., & Svarre, B. (2013). Jan Gehl & Birgitte Svarre. In How to Study Public Life. https://tudelft.on.worldcat.org/oclc/865475474

Girardet, H. (2012). Surviving the Century. In Surviving the Century. https://doi.org/10.4324/9781849772709

Guanajuato, D. E. L. M. D. E., Lona, M., Itzel, D., Cota, M., & Eugenia, G. (n.d.). Actualización del conocimiento de anfibios y reptiles del municipio de guanajuato, guanajuato, méxico. 1, 7–11.

Guti, E. (2005). Impacto del Tratado de Libre Comercio de América del Norte en las relaciones de trabajo en México. Papeles de Población, 11(46), 9–44.

Higgins-Dunn, N., Feuer, W., & Kim, J. (2020, May 1). New York City to open city streets to pedestrians as the weather warms, Mayor de Blasio says. CNBC. https://www.cnbc.com/2020/05/01/coronavirus-new-york-city-to-open-streets-to-pedestrians-as-the-weather-warms.html

Instituto de Ecologia del Estado de Guanajuato, Centro de Ciencias Atmosfericas de la Universidad de Guanajuato, Instituto Nacional de Ecologia, S. del M. y R. N. (2011). Diagnostico Climatologico y Prospectiva sobre Vulnerabilidad al Cambio Climatico en el Estado de Guanajuato. 63.

Jacobs, J. (1961). Jane Jacobs The Death and Life Cities of Great American Cities.

Joss, S. (2015). INITIATIVE TOMORROW ' S CITY TODAY ECO-CITY INDICATORS , STANDARDS & FRAMEWORKS. January 2012.

Khaledian, Y., Ebrahimi, S., Natesan, U., & Basatnia, N. (2018). Urban Ecology, Water Quality and Climate Change. In Assessment of Water Quality using Multivariate Analysis (Vol. 84, Issue March). http://link.springer.com/10.1007/978-3-319-74494-0

Klein, N. (2014). This Changes Everything. Capitalism vs. The Climate. Penguin Random House.

Lerner, Jaime. (2014). Creative Leisure vs. Industrious Mediocrity. Urban Acupuncture, 65–68. https://doi.org/10.5822/978-1-61091-584-7_19

Lerner, Jamie. (2007). A song of the City. https://www.ted.com/talks/jaime_lerner_a_song_of_the_city?language=en#t-543821

Manuel, M. C. J., Garza, P., Indicadores, L. O. S., & Biodiversidad, Y. L. A. (2018). Plan Estatal de Desarollo Guanajuato 2040 - Dimension Medio Amiente y Territorio.

Masdar City. (2020). Masdar City. https://masdar.ae/

McHarg, I. L. (n.d.). Design with nature.

Merriam Webster. (n.d.). https://www.merriam-webster.com/

Mersal, A. (2017). Eco City Challenge and Opportunities in Transferring a City in to Green City. Procedia Environmental Sciences, 37, 22–33. https://doi.org/10.1016/j.proenv.2017.03.010

Monitoreo, R. De, Calidad, D., Guanajuato, E. De, & Ecología, I. De. (2006). " La Calidad del Aire en Guanajuato " Informe 2006 de estado y de tendencias.

Narraway, C. L., Davis, O. S. P., Lowell, S., Lythgoe, K. A., Turner, J. S., & Marshall, S. (2020). Biotic analogies for self-organising cities. Environment and Planning B: Urban Analytics and City Science, 47(2), 268–286. https://doi.org/10.1177/2399808319882730

National Geographic. (2021). Freshwater Crisis. Freshwater Crisis. https://www.nationalgeographic.com/environment/article/freshwater-crisis#:~:text=Freshwater makes up a very,trapped in glaciers and snowfields.

Pac, S.-, & Norte, G. (2010). El agua en Guanajuato.

Pace, R., De Fino, F., Rahman, M. A., Pauleit, S., Nowak, D. J., & Grote, R. (2020). A single tree model to consistently simulate cooling, shading, and pollution uptake of urban trees. International Journal of Biometeorology, October. https://doi.org/10.1007/s00484-020-02030-8

Paredes Melesio, A., Mandujano Bueno, A., Games Vazquez, A. J., & Garcia Nieto, H. (2011, January). Updating the agricultural soil use map in the state of Guanajuato. Revista Mexicana de Ciencias Agricolas. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2007-09342011000100007

Pickett, S., Cadenasso, M., & McGrath, B. (2013). Resilience in Ecology and Urban Design. In Springer. http://link.springer.com/content/pdf/10.1007/978-94-007-5341-9.pdf

Pickett, S. T. A., Cadenasso, M. L., Childers, D. L., Mcdonnell, M. J., & Zhou, W. (2016). Evolution and future of urban ecological science: ecology in, of, and for the city. Ecosystem Health and Sustainability, 2(7). https://doi.org/10.1002/ehs2.1229

Rao, M. (2018). Seen the photos of deer eating garbage in Chennai? Here's the story behind it. https://www.thenewsminute.com/article/seen-photos-deer-eating-garbage-chennai-heres-story-behind-it-77380

Redaccion. (2018). Irapuato: Fuertes inundaciones causan estragos; reportan árboles caídos y cierre de vialidades. http://periodicotiempouriangato.com/irapuato-fuertes-inundaciones-causan-estragos-reportan-arboles-caidos-y-cierre-de-vialidades/

Register, R. (2006). Ecocities - Rebuilding Cities in Balance with nature (Second). New Society Publishers'.

Reid, C. (2020, April). Paris To Create 650 Kilometers Of Post-Lockdown Cycleways. Forbes. https://www.forbes.com/sites/carltonreid/2020/04/22/paris-to-create-650-kilometers-of-pop-up-corona-cycleways-for-post-lockdown-travel/

Ritchie, H. (2018). Urbanization. OurWorldInData.Org. https://ourworldindata.org/urbanization

Ritchie, H. (2021). The world has lost one-third of its forest, but an end of deforestation is possible. The World Has Lost One-Third of Its Forest, but an End of Deforestation Is Possible. https://ourworldindata.org/world-lost-one-third-forests

Roggema, R. (2014). Swarm Planning. Springer.
Rotterdam, G., Iabr, —, Fabric, —, & Tno, J. —. (2018). Urban Metabolism. July 2014. http://iabr.nl/media/document/original/urban_metabolism_rotterdam.pdf

Sauvé, S., Bernard, S., & Sloan, P. (2016). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. Environmental Development, 17, 48–56. https://doi.org/10.1016/j.envdev.2015.09.002

Secretaría de Cultura/INAH. (2020). Arroyo seco. https://sic.cultura.gob.mx/ficha.php?table=zona_arqueologica&table_id=219
Secretaria de Economia. (2021). Data Mexico. https://datamexico.org/es/profile/geo/guanajuato-gt

Speck, J. (2012). Walkable City - How downtown can save america, one step at a time (First pape). Farrar, Straus and Giroux.

Turner, T. (1995). Greenways, blueways, skyways and other ways to a better London. Landscape and Urban Planning, 33(1–3), 269–282. https://doi.org/10.1016/0169-2046(94)02022-8

Turner, T. (1996). City As Landscape - A post-postmodern view of design and planning (First). E & FN Spon.

United Nations. (n.d.). United Nations Conference on Environment and Development (Earth Summit),(3-14 June 1992, Rio de Janeiro, Brazil). https://www.un.org/en/events/pastevents/UNCED_1992.shtml

United Nations. (2011). Climate Neutral Cities: How to make cities less energy and carbon intensive and more resilient to climate challenges. In United Nations.

Urban Ecologist. (2000). Curitiba: A Visit to an Ecological City. Urban Ecologist. http://www.urbanecology.org/curitiba-visit-ecological-city/

Villalba Bustamante, M. (2013). El trabajo en las minas de Guanajuato durante la segunda mitad del siglo XVIII The labor in Guanajuato mines during the second half of eighteenth century. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0185-25232013000100002

Wang, X., & Mell, I. (2019). Evaluating the challenges of eco-city development in China: A comparison of Tianjin and Dongtan eco-cities. International Development Planning Review, 41(2), 215–242. https://doi.org/10.3828/idpr.2019.8

Waxman, O. B. (2018, November). 4 Things to Know About the History of NAFTA, as Trump Takes Another Step Toward Replacing It. Time. https://time.com/5468175/nafta-history/

Villalba Bustamante, M. (2013). El trabajo en las minas de Guanajuato durante la segunda mitad del siglo XVIII The labor in Guanajuato mines during the second half of eighteenth century. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0185-25232013000100002

Wang, X., & Mell, I. (2019). Evaluating the challenges of eco-city development in China: A comparison of Tianjin and Dongtan eco-cities. International Development Planning Review, 41(2), 215–242. https://doi.org/10.3828/idpr.2019.8

Waxman, O. B. (2018, November). 4 Things to Know About the History of NAFTA, as Trump Takes Another Step Toward Replacing It. Time. https://time.com/5468175/nafta-history/

IX / APENDIX

ECOCITIES:
REDEFINING CITIES THROUGH NATURE

Abstract
Urbanization has been developed as an anthropogenic practice for the human race to progress and prosper. Through time, improvements have been made to cities to transform them into more efficient, cleaner, and healthier environments; but often at the peril of harming the native landscape and biodiversity. The concept of the Ecocities comes to light as an alternative to a sustainable and inclusive approach to develop the urban landscape. The ecocities framework is built up with a series of strategies and standards spanning from urban design to physical conditions, and it suggests that the more elements you comply with the more ecological the city will be. As of now there are only a few examples of newly developed Ecocities and there is still too much to analyze and consider before we can agree that the Ecocities is the way forward. This paper highlights the characteristics of cities and the current relationship they hold with ecology and biodiversity, as this will help to develop nature inclusive solutions. Secondly, the paper analyzes the Ecocities concept as well as existing projects to assess the challenges and improvements they need to undergo. Finally, the paper compares existing cities and Ecocities to provide a better understanding of the differences, benefits, and disadvantages between them. The paper concludes with suggestions and considerations for improvements in the Ecocities framework and standards as well as a deeper understanding of what an Ecocities entails.
Keywords
Urban ecology, Ecocities, urbanization, cities, biodiversity

Introduction

From the beginning of the world's first settlements, the human built environment has been designed and constructed as to meet with the requirements of the user. As humans have evolved so have our cities, and the developments within them have been becoming increasingly complex and technical. Ever since the introduction of the car as a personal mobility device, the human mindset regarding their entourage has changed. What once was a place of interaction, commerce and livability has now been transformed into a landscape of asphalt and concrete. Now the cities are the catalysts of societal, and ecological problems creating segregation, lack of social justice, and disconnecting nature from the built environment.
Today, more than half of the world's population lives in urban areas (Ritchie, 2018) and the exponential growth of the cities calls for more drastic and quick solutions that adapt to the human needs as well as those of the environments.
In the last century, the world went through an outstanding change; because of the human drive and ingenuity people developed better ways of doing things during the industrial revolution. It evolved again with the modern movement that welcomed the introduction of the car into the daily life and redesign cities to accommodate space for the new technologies. The world is in need of another revolution with a different scope. Rather than a focus in technological advances for the industry the new revolution needs to have the wellness of our planet as a priority. Only this way can we remediate the damage done by humankind to the earth, its resources, and species. The platform in which we will project this change has to be in cities since they are principal actors in this issue, and in the end, they shall become a place of symbiosis.

"May the city of tomorrow shine as a feast of landscapes" (Turner, 1996).

The cities through time to today

Ever since the Roman Empire, there has been a set of laid out rules for the design and making of cities. These guidelines were expected to develop firstly a safe place for its inhabitants, secondly to create an entourage that would become a place for communion and commerce, and finally a place for people to live comfortably and with dignity. These rules have passed through many iterations driven by ideologies and concepts which were meant to bring prosperity, although not perfect, the rules helped set up the basis for the built environment.
With every problem, disease or natural disaster, the city also changed to mitigate these problems and that added to the complexity of these urban areas as well as a better quality of life for humans. "As we build, so shall we live" (Register, 2006), and live we did. Through time the cities became bigger, taller, and more hectic, resulting in the cities of today.
Up until 1960, cities were designed by experience to enhance the livelihood of its citizens until, urban design and city planning fell into the hands of actors interested in turning cities into a machine, focusing most of its attention into the development of car based infrastructure rather than facilities for people. (Gehl, 2010)
Since then, city planners have overlooked the dimension of humans, plants, and animals. They were quickly overpowered by modernist ideologies, and through their vision for the built environment shifted the traditional city into a set of isolated monoliths, which because their scale create a disconnection in the urban fabric. Open spaces of low quality were developed as an embellishing element that lacked a variety of landscapes and species. Noise and air pollution and the lack of greenery make them inhabitable both for humans as well as for other species. In this case humans had the opportunity to continue living in their new urban areas with no immediate repercussion, on the other hand other animal and plant species were not so lucky and started to slowly disappear from our urban landscape. Finally the rise in the car culture has reduced the pedestrianism as well as informal human interaction (Gehl, 2010) creating a new standard of living in which humans live, work and procrastinate in specific enclosed spaces and the space in between them belongs to the motor vehicles.
Today more than half of the world's population lives in urban areas with increasing numbers every day. It is expected that more than two-thirds of the world's population will live in urban areas by 2050 (Ritchie, 2018). The increase of population comes with multiple issues that are interrelated with how people decide to live now a days. One of the main issues is the constant increase of the worlds carbon emissions from which cities are responsible of roughly 75%, and are derived from urbanization, industrialization and from consumption-based economies (United Nations, 2011). Another big issue in cities is the consumption of energy which is estimated to be 85% of the world's energy. This is a big issue not only because of the ever-increasing human demand but because of the means of energy production. While now a days a lot of countries are slowly shifting into sustainable energies, the main sources of energy are still fossil fuels like coal and oil, which are at the same time the cause of unprecedented climate change.

There is an immediate urgency that demands a shift in the urbanization practices. The call for change is being promoted by many organizations like Ecocity builders, the UN as well as treaties for countries such as the 1992 Rio Declaration, and more recently the Paris Agreement. The addition of multiple actors of change is bringing new waves of design and development, focusing on specific elements like nature, energy, and artificial intelligence, portraying various speculative futures and lifestyles that would emerge as a consequence of change.

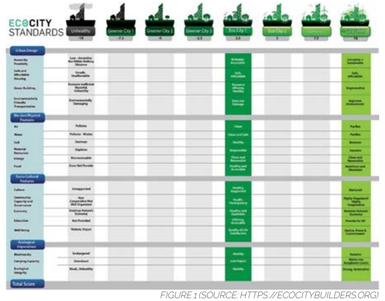


FIGURE 1 (SOURCE: HTTPS://ECOCITYBUILDERS.ORG)



FIGURE 2 (SOURCE: HTTPS://ECOCITYSTANDARDS.ORG/STANDARDS/)

Ecocities

As a part of the new waves of development and a response to the multiple problems our cities have produced, a relatively recent concept has been born – the ecocities. Richard Register has been the developer of this concept and has written a book: "Ecocities: Rebuilding Cities in Balance with Nature", where he expands on the topic. He has also founded a nonprofit organization called "Ecocity Builders" along with an online platform and both a framework and standards for cities to follow when looking into ecological redevelopment.
In order to be able to apply these strategies we need to understand and know what an ecocity is, and how it changes and improves the built environment? As stated in the Ecocity Builders website, the definition of an ecocity is the following:

"An Ecocity is a human settlement modeled on the self-sustaining resilient structure and function of natural ecosystems. The ecocity provides healthy abundance to its inhabitants without consuming more (renewable) resources than it produces, without producing more waste than it can assimilate, and without being toxic to itself or neighboring ecosystems. Its inhabitants' ecological impact reflects planetary supportive lifestyles; its social order reflects fundamental principles of fairness, justice and reasonable equity." (SOURCE: HTTPS://ECOCITYBUILDERS.ORG/)

The framework of the ecocities (Figure 1), is divided in four pillars and classifies the degree of compliance, by means of points the grade of compliance. The four pillars are: (i) Urban Design – Built form and Accessibility, (ii) Bio-Geo Physical Conditions, (iii) Socio-Cultural Conditions and (iv) Ecological Imperatives. Within these pillars there is an array of standards and requirements that touch upon different types of elements, species, and development goals (Figure 2), for detail framework refer to the appendix. It attempts to enlist all the elements that conform a city that can have a positive impact on the ecology if treated properly.

Ecocities, while radical in nature, are a step towards a sustainable and symbiotic world, and while the framework and standards might seem overwhelming we need to keep in mind that it is a process of adaptive transition, and not of imposition and disposal of existing lifestyles. "As the first step, we need to establish the principle of restoration and regeneration" (Register, 2006). There are some areas that need to be tackled fast and hard like the motorized mobility (gasoline based) as well as the permeability of the cities which stresses the water system and consequently the water supply. Starting with the motorized vehicles, the excessive usage of this tool has not only changed the city scape, but it has also shaped our lifestyle and our composition as humans. Cities that once were a place for pedestrians now house extensive road networks in contrast with the limited offer of pedestrian paths. The pollution created by motorized vehicles is already part of the air we breath and its affecting not only the health the planet but also that of all the living things within it. Affiliated traffic and noise pollution are also a big problem in cities, now there are very few places within a city where you are not exposed to the sound of a motor.

"We shape cities, and they shape us" (Gehl, 2010), and as it stands today we are the unhealthy result of our poor decisions. The ecocities standards insists that transportation needs to be sustainable and efficient. For a more passive way of transportation it calls for more pedestrian streets and infrastructure destined for bicycles. In terms of more technologically advanced means of transportation there is still a lot of work to be done. "The sustainable city is strengthened generally if a large part of the trans- port system can take place as 'green mobility,' that is travel by foot, bike or public transport" (Gehl, 2010). These days technology is finally moving into that direction, but it will take some time to incorporate it at such a large scale. Soon people will move around in shared autonomous electric vehicles and electric mass transportation alternatives like the hyperloop.

The permeability of the cities is also imperative when it comes to fast change within the cities. Cities have the tendency to erode the soil on which they stand. Due to the increase of motorized vehicles, asphalt roads and antiquated sewage systems, the cites have now, more than ever, extremely limited space for water infiltration. This affects the soil by eroding it, it also limits the amount of water that is reincorporated on the basins. This has an impact at the city level in the form of the heat island effect, raising the temperatures of cities during the day by approximately 4° (EPA, 2020). It is important to point out that when temperature rises it doesn't just affects human being, the heat disrupts and in some cases kills other species, meaning that if the city as it is counts with few species to begin with soon it will have close to zero. In summary, the least amount of water we have in the city the more species will suffer, including us. The porosity of cities can be improved by strategies like de-paving the solid surfaces, opening spaces for infiltration, adding a variety of vegetation, and creating collection areas for slow release, among others.

There are more things to be done in our cities in order to regain the harmony with ecology that they once had. The ecocities framework serves as a tool for change which needs to be explored, developed, and applied in cities all over the world in order to generate a positive change for the climate.

Existing Ecocities

The ecocities concept became immensely popular after its conception and started a trend around the world. Now a days there are many cities that have implemented a redevelopment plan following the ecocities framework such as Vancouver in Canada, Portland in the USA, and Curitiba in Brazil (Register, 2006). There are also new developments all over the world that brand themselves as ecocities and that have remarkably high expectations such as Tianjin, China and Masdar City, UAE.

As an exploration of the existing ecocities and to better understand its characteristics, strategies and challenges, we will talk about one city that is considered one of the most successful ecocity redevelopments, one about a newly developed ecocity with a challenging present and an additional reflection of a eco-city developed in China.

Curitiba

The city of Curitiba in Brazil is considered one of the most successful ecocities in the world. The redevelopment project started in 1965 with a plan to enhance the quality of urban life and established priorities as well as the Curitiba Research and Urban Planning Institute (Urban Ecologist, 2000). In 1975 the plan was reinforced when the city tried to develop a car overpass in the center of the city. Instead, the then mayor of the city, Jaime Lerner decided to build a

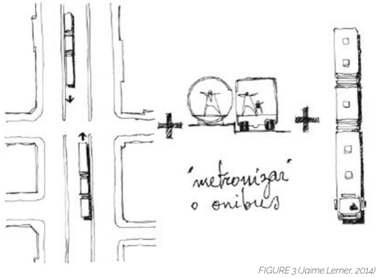


FIGURE 3 (Jaime Lerner, 2014)

pedestrian only street against the will of the shop owners of the area. In only 72 hours the street was finished and stopped the development of more automobile infrastructure.
As Lerner puts it, "the car is like your mother in law, you need to have a good relationship with her but she cannot command your life" (Jamie Lerner, 2007) , instead there needs to be a sustainable and more efficient way to transport people. In 1974 as the population of Curitiba reached 600,000 the public transport consisted only of one bus line for the whole city. As the demand increased the development of a new mass transit solution came to life, Bus Rapid Transit (BRT) an efficient and economic transportation system, and in 1991 imitating the subway system it evolved with the addition of above ground tube stations (Figure 3). Today more than two thirds of the citizens in Curitiba use this system.

Finally, the most important factor for the shift of Curitiba to an ecocity has been its people. Lerner dedicated resources to educate the people in ecological related topics making an emphasis on educating the children. It takes them six months to educate their children in sustainability and then the children educate their parents (Jamie Lerner, 2007). The city has also created multiple programs to incorporate people to society and make them active actors of the ecocity.

The second example is Masdar City in the UEA, but before we analyze the city, it is worth explaining the difference between ecocities and an eco-city. As mentioned before, the ecocities concept was developed by Richard Register along with standards and frameworks. On the other hand, the eco-city is a marketing term that has been adopted by many countries for their new developments and though the term doesn't have a strict structure it derives and follows the principles of the ecocities. For example, it is debated that the "branding" of the eco-cities in China has a misalignment and lacks the application of ecological principles from the ecocities standards (Wang & Mell, 2019), and some of this also applies to this next eco-city.

Masdar City

Masdar City is located next to the Abu Dhabi is said to be one of the most sustainable cities in the world. The project started in 2008, was built with sustainable and recycled materials with a special focus on sustainable energy producing the energy for the city with its more than 87,000 solar panels and water management which reduces consumption up to 40% (Burnett, n.d.); the final goal was to build a carbon neutral city that generated zero-waste.
Masdar was planned as a compact city, its pedestrian streets are designed to be narrow and in the proximity of buildings to create shaded spaces , with the aid of a central ventilation system the city's temperature is 10 degrees cooler than that of Abu Dhabi and allowing for comfortable pedestrian mobility. The city was built above the ground to create a thermal gap and it opened the opportunity to create underground connectivity. Using electric autonomous vehicles, people can move through longer distances in a sustainable and efficient way (Masdar City, 2020). Although the city is currently as big as 600,000 square meters and houses a shy 1,300 residents and around 4,000 office workers it is projected to expand both in size and in the amount of building functions (Fully Charged, 2012). As impressive as this new development is, there is still too much to be incorporated in the city. Besides the technological advances in construction as well as those embedded in the system of the city there is a lack of nature-based solutions as well as biodiversity. On the social aspect we cannot perceive yet how this development will influence people's behavior and attitude towards a sustainable way of living.

Tianjin

Tianjin Ecocity is also another example of the challenges that newly developed ecocities are facing. The city was developed for 350,000 habitants but currently only 12,000 live there. The main issue being the top down development process was imposed by the Chinese government and has left little to no room for the influence of local communities in decision making (Wang & Mell, 2019). This has made it harder for people to identify with the city and to be able to call it home.
"It is more and more widely recognized today that there is some essential ingredient missing from artificial cities. When compared with ancient cities that have acquired the patina of life, our modern attempts to create cities artificially are, from a human point of view, entirely unsuccessful" (Alexander, 1965)

Successes & Challenges

There is a clear contrast between both of the presented ecocity and eco-city examples. On one hand we have a low budget redevelopment of a city that since a very early stage they implemented a planning that focused on sustainability and the people living there while on the other we have a state of the art new development that is not only a platform for innovation but is a living experiment of what the future of cities should be like. Something similar is seen in the case of Tianjin except in this case the city was developed on top of a wasteland and was regenerated with nature.
For the positives we have so far, many factors to celebrate in these cities, the fact that they exist and set an example is already outstanding. But there is still a lot of work to be done in order to start imagining a future for humans, animals, and plants in these cities. Starting with the biodiversity factor cities need not only to stop polluting, but also need to enhance the natural aspect within the city to house a variety of species and create a natural system in their ecosystem. Strategies to remediate natural resources should be incorporated in their cities in order to have healthier soil and water systems. Finally, much like Curitiba is doing, the social aspect is really important. Programs need to be developed to incorporate people in the design, development, and planning process as well as to educate the citizens about the importance of being sustainable, and how they can contribute to saving the planet.

Recent urban trends

Through the COVID-19 pandemic we have seen many cases of cities all around the world that are making changes to become more friendly both with the environment as well as with the human dimension. Such is the case for New York City where mayor Bill de Blasio is turning over 100 miles of streets into pedestrian ways and bike lanes to encourage social distancing (Higgins-Dunn et al., 2020). Another city that made changes to its mobility infrastructure was Paris, converting more than 650 km of streets into bike lanes as a response to the pandemic. The idea of Mayor Anne Hidalgo the to keep the newly implemented bike lanes to reinforce

her existing “Plan Velo” and to turn Paris into a cycle-friendly city by 2024 City streets being transformed into pedestrian areas, more spaces are being dedicated to cycling mobility and the incorporation of green and porous spaces are becoming more common. With these changes in the cities also comes a change in how people are behaving, more than ever people are choosing bicycles as their main means of transport and walking is not far behind, reducing dramatically the use of motorized vehicles. Finally buying organic products from local vendors has become more common as well as the reduction in consumption of animal-based protein. Every small attempt to improve the relationship with nature is worth doing, because through selfless acts only good things can come our way.

Conclusion

As this essay has stated, there are many issues that a current city needs to solve in order to create a positive change towards a sustainable way of living. The ecocities framework has the potential to helps restore the damage humans and cities has cause in our planet. The evidence is shown by the examples of existing ecocities around the world, not excluding the lessons to learn from them which as a consequence might be the cause of a slow adaptation of cities.
As most experiments and transformations, Ecocities developments will too take its fair amount of time to be incorporated and adapted to the emerging ways of living. The Ecocities reality remains a dream that, in a not so distant future, will mature and with good luck establish itself as the way to design cities. We already have good examples that are developing not only the cities but also knowledge, soon enough this knowledge will be shared throughout the world and every city will be able to apply it into their own context.
This paper is the first step in the analysis of the ecocities framework and its application continued by a framework development for the state of Guanajuato in Mexico as well as design strategies to apply ecocities in its region.

Bibliography

Alexander, C. (1965). A City is not a Tree, Parts 1 & 2. Architectural Forum, 122(1, 2), 58–62, 58–61. http://www.rudi.net/pages/8755 http://www.rudi.net/books/201

Burnett, E. (n.d.). Is this the greenest city in the world? https://edition.cnn.com/videos/tech/2014/06/26/cot-masdar.cnn/video/playlists/city-of-tomorrow/

EPA. (2020). United States Environmental Protection Agency. Heat Island Effect. https://www.epa.gov/heatislands#:~:text=Heat islands are urbanized areas that experience higher temperatures than outlying areas.&text=Daytime temperatures in urban areas,Learn About Heat Islands page.

Fully Charged. (2012). No Masdar: The City of the Future. https://www.youtube.com/watch?v=Nlaz61zpLfs&ab_channel=fullychargedshow

Gehl, J. (2010). Cities for People. Island Press.
Higgins-Dunn, N., Feuer, W., & Kim, J. (2020, May 1). New York City to open city streets to pedestrians as the weather warms, Mayor de Blasio says. CNBC. https://www.cnbc.com/2020/05/01/coronavirus-new-york-city-to-open-streets-to-pedestrians-as-the-weather-warms.html

Lerner, Jaime. (2014). Creative Leisure vs. Industrious Mediocrity. Urban Acupuncture, 65–68. https://doi.org/10.5822/978-1-61091-584-7_19
Lerner, Jamie. (2007). A song of the City. https://www.ted.com/talks/jaime_lerner_a_song_of_the_city?language=en#t-543821

Masdar City. (2020). Masdar City. https://masdar.ae/
Register, R. (2006). Ecocities - Rebuilding Cities in Balance with nature (Second). New Society Publishers'.

Ritchie, H. (2018). Urbanization. OurWorldInData.Org. https://ourworldindata.org/urbanization

Turner, T. (1996). City As Landscape - A post-postmodern view of design and planning (First). E & FN Spon.

United Nations. (2011). Climate Neutral Cities: How to make cities less energy and carbon intensive and more resilient to climate challenges. In United Nations.

Urban Ecologist. (2000). Curitiba: A Visit to an Ecological City. Urban Ecologist. http://www.urbanecology.org/curitiba-visit-ecological-city/

Wang, X., & Mell, I. (2019). Evaluating the challenges of eco-city development in China: A comparison of Tianjin and Dongtan eco-cities. International Development Planning Review, 41(2), 215–242. https://doi.org/10.3828/idpr.2019.8



ECOLOGICAL REMEDIATION

An urban landscape strategy for Guanajuato