

Future [Arch]Ecologies | Territory, Identity and Heritage

Landscape as infrastructure for a new socio-cultural co-production in the Yucatan Peninsula, Mexico

COLOPHON

Future [Arch]Ecologies | Territory, identity and heritage. Landscape as infrastructure for a new socio-cultural co-production in the Yucatan Peninsula, Mexico.

P5 Report

5221595

Transitional Territories 21'-22'
Inland, Seaward:
The form of time and the politics of space

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Urbanism and Building Sciences
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TU Delft Department of Urbanism
BK Bouwkunde

DELTA URBANISM

"We are fated to optimism. However, we need to be more responsibly optimistic, more attentive to the impact of our proposed futures on the planet and on the aspirations of the future generations.

There is a need for a new spatial contract"

- Hashim Sarkis, 2021

As the final days of these amazing two years of master's come to an end, I would like to say thank you...

Gracias Diego, por tu apoyo durante todo el proceso, por compartir toda tu experiencia y sabiduría conmigo y por creer en el proyecto desde el inicio.

Thank you Inge, for your support, insights and knowledge. I would love to complement my professional journey studying the art of landscape.

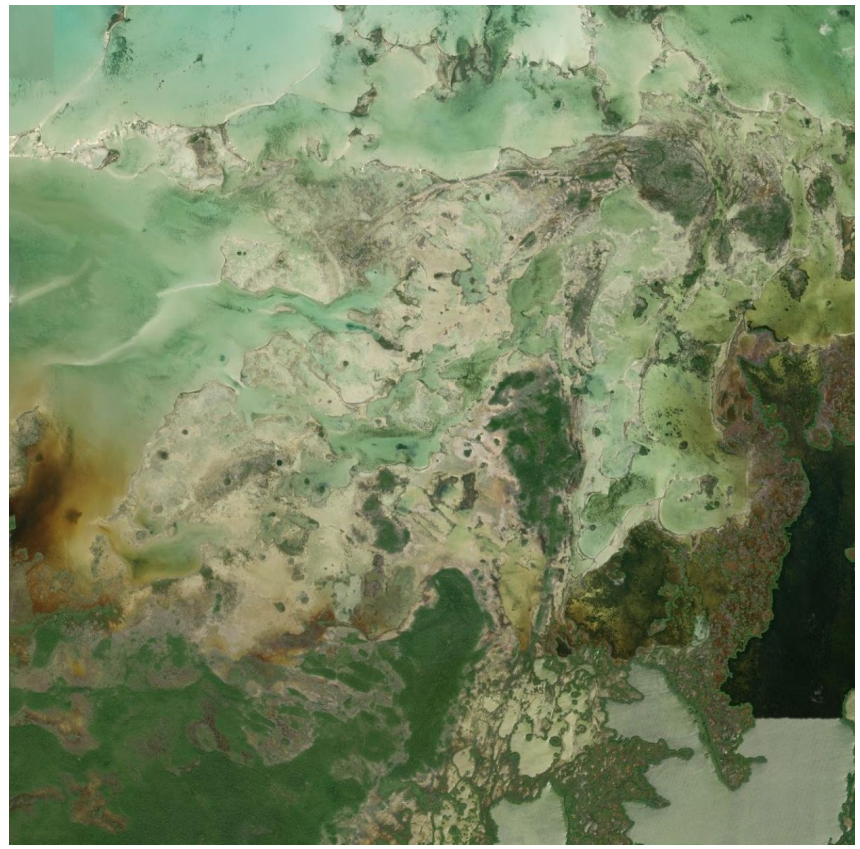
To my roommates and friends with whom I shared laughs, ups and downs, and lots of international food. Thank you for your support and love: Daphne, Luiz, Anagha, Nikhil, Rutu, Oviya. I want to continue seeing you shine.

A mi familia, mi madre y mi hermano por seguir perseverando. Para ustedes mi amor incondicional y toda mi admiración.

Y finalmente, gracias a ti Jorge...
Sin ti nada de esto hubiera sido posible. Gracias por seguir creyendo en mi y apoyar todos mis sueños.

Hemos alcanzado una meta más.

Lu’um



No one ownes the land,
but everyone cares for it...

IMG.1 ESRI Satellite Image (2022) Mangroves in Quintana Roo, Mexico

Motivation

Throughout my formative process, I have always gravitated towards cases of social injustice and natural imbalance. My curiosity makes me go deep under the surface, looking for knowledge and evidence in every layer to be able to understand the full scope in order to offer a possibility of change through design that takes into account the plurality of worldviews, needs and voices.

My country is rich in resources but also has many shortcomings. I have observed various degrees of marginalization, I have witnessed many injustices towards the citizens and the environment, the lack of real leadership in the political sector have continue to push me in search for alternatives to help my homeland. My motivation then comes from a deep desire to cast a light to these realities and to obtain the knowledge and tools necessary to empower the lower sectors who, with political corruption and climate change, are the first and most affected.

In the words of Hashim Sarkis, we have to design a new spatial contract and be responsibly optimistic about the future. That touched me deeply and is how I look upon graduation. How do we want to live together? Rampaging or Coexisting?

My goal then with my thesis project is to design scenarios that promote social and ecological sustainability and resilience among indigenous communities with a higher degree of marginalization, not only in the face of climate change but also in the face of the current political and economic trends in the Yucatan Peninsula of Mexico. My goal is to preserve our heritage, empower locals and achieve a dynamic equilibrium between all actors, human and non-human, towards a more cared for and regenerated landscape for a resilient future for all.



IMG.2 Shino. (2020) Sinkhole "Cenote", Quinatana Roo, Mexico [Photo]Unsplash

ABSTRACT

The Yucatán Peninsula in Mexico, known by the name of Mayapán by the Mayan civilization, remained an enclosed and remote area during every major historical transition of the country (Colonization, Independence from Spain, Internal Civil War). Located between the Gulf of Mexico and the Caribbean Sea, this rich landscape remained forever in the sight of powerful individuals and colonizers who never truly managed to rule the Mayan warriors.

Today, the region is composed of three different states with a complex mosaic of rich biodiversity, fascinating landscapes and important coral reef systems competing for survival against the effects of nature and human actions. For decades, the focus remained mainly on the economic development of the coastal areas without considering the ecological stress and social uncertainty as a result of urban expansion. In the span of merely twenty years, the region was completely transformed following capitalist intentions and we can see the fragile state of the land as a direct result of this. Sadly, the region's mostly mono-cultural economic practices focusing on tourism services have pushed the locals, from mostly indigenous background to leave their communities and seek job opportunities in the cities created for the new Mayan Riviera.

This set of political, social, economic and natural elements have had enormous repercussions on the physical and social integrity of the landscape, which nowadays is threatened not only by the over-exploitation of resources and climate change, but also by the homogenization and simplification of an ancestral culture.

However, it is in this richness of landscapes, biodiversity and cultural heritage where I see a possibility to think of new ways of co-existing and to imagine new ways of living in sync with our environment. What would be the long durée in this region where everything is the result of a process of legitimization and Disneyfication of the landscape and its culture? The aim of this thesis is to expose the critical issues, assess the damage and recover together with nature with the guiding principle that resources should be managed to reflect the relationships among all ecosystem components, including humans and nonhuman species, the environment in which they live, and physical, biological and socioeconomic interrelationships.

Keywords

Traditional knowledge, Nature-based solutions, natural capital, productive equilibrium, maintenance of prosperity, socio-ecological resilience, heritage.

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IMG.3 Cima, N. (2021). Tulum, Quintana Roo, Mexico [Photo]. Unsplash

I. INTRODUCTION

WHERE ARE WE STANDING?

1.1 Planetary outgrowth
1.2 Nation expropiation
1.3 Landscape fragmentation

WHERE ARE WE STANDING

Planetary outgrowth

The point of no return

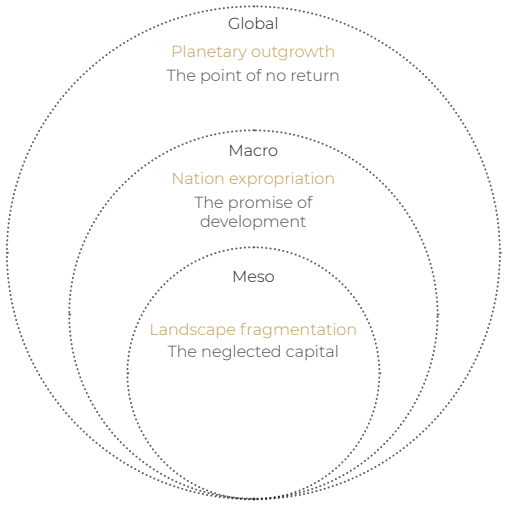


FIG. 1 Positioning of the thesis through the scales, diagram made by author

Our planet has reached its limits. From now on, the only possible way of action is to adapt to the new global stage.

Four decades have passed since the first call for action on the global environmental crisis and over this period of time, numerous scientific studies have been trying to get our attention showcasing the magnitude of the problem. Since the Industrial Revolution, the consequences of human activities on biodiversity and ecosystem processes have continue to increase their effect up to the point of pushing the earth system boundaries outside a stable environmental state (Rockström et al., 2009).

We are living in the era of the Anthropocene, marked by a worldview of progress and development at the expense of the Earth. The way in which humans have colonized, extracted and use the earth's resources has also led to social inequalities, mass migrations, and unequal economic growth between nations. These actions form a complicated network that redistributes its effects in a non linear and transboundary way, where the space of violation is separated to the space of its repercussion (Lahoud, 2014)

According to the latest IPCC Report (2021), "many of the changes observed in the climate are unprecedented in thousands of years, and some of the changes already set in motion, such as continued sea level rise, are irreversible over hundreds to thousands of years." Current estimations show that global mean sea level has increased by 0.20 m since 1901.

Moreover, the report provides new estimates of the chances of crossing the global warming level of 1.5°C in the next decades, and finds that unless there are immediate, rapid and large-scale reductions in greenhouse gas emissions, limiting global warming close to 1.5°C or even 2°C will be beyond reach.

In the light of this new stage of the planet, I begin to wonder what would be our role as designers?

Since climate negotiations are economic negotiations (Lahoud, 2014), the role of urbanists has to be one that resembles a compass, to reguide urban development and our relationship with the environment that surrounds it for a more positive engagement, from superior to symbiosis.

"The idea of growth is quite literally outgrowing the planet itself. How do practices of care counter this expansionary ideology and how does giving critical attention to care shift our planetary imagination?"

- Krasny & Fitz, 2019

IMG.4 Baumeister, M. (2019). Etzweiler mine, Germany [Photo]. Unsplash



WHERE ARE WE STANDING

"Every culture is by definition a vital branch of our family tree, a repository of knowledge and experience, and, if given the opportunity, a source of inspiration and promise for the future."

- Wade Davis, The Wayfinders

Nation expropiation

The promise of development

About two-thirds of the world's biodiversity is located in just over a dozen countries known as megadiverse countries. Mexico is one of these countries and it stands out among the rest since it is the fourth nation in terms of species richness, in addition to combining a high biological diversity with great cultural wealth (Sarukhán et al., 2017). And as it turns out, cultural diversity is closely related to biological diversity since different local communities depend on the natural environment for the goods and services it provides them (Pretty et al., 2009).

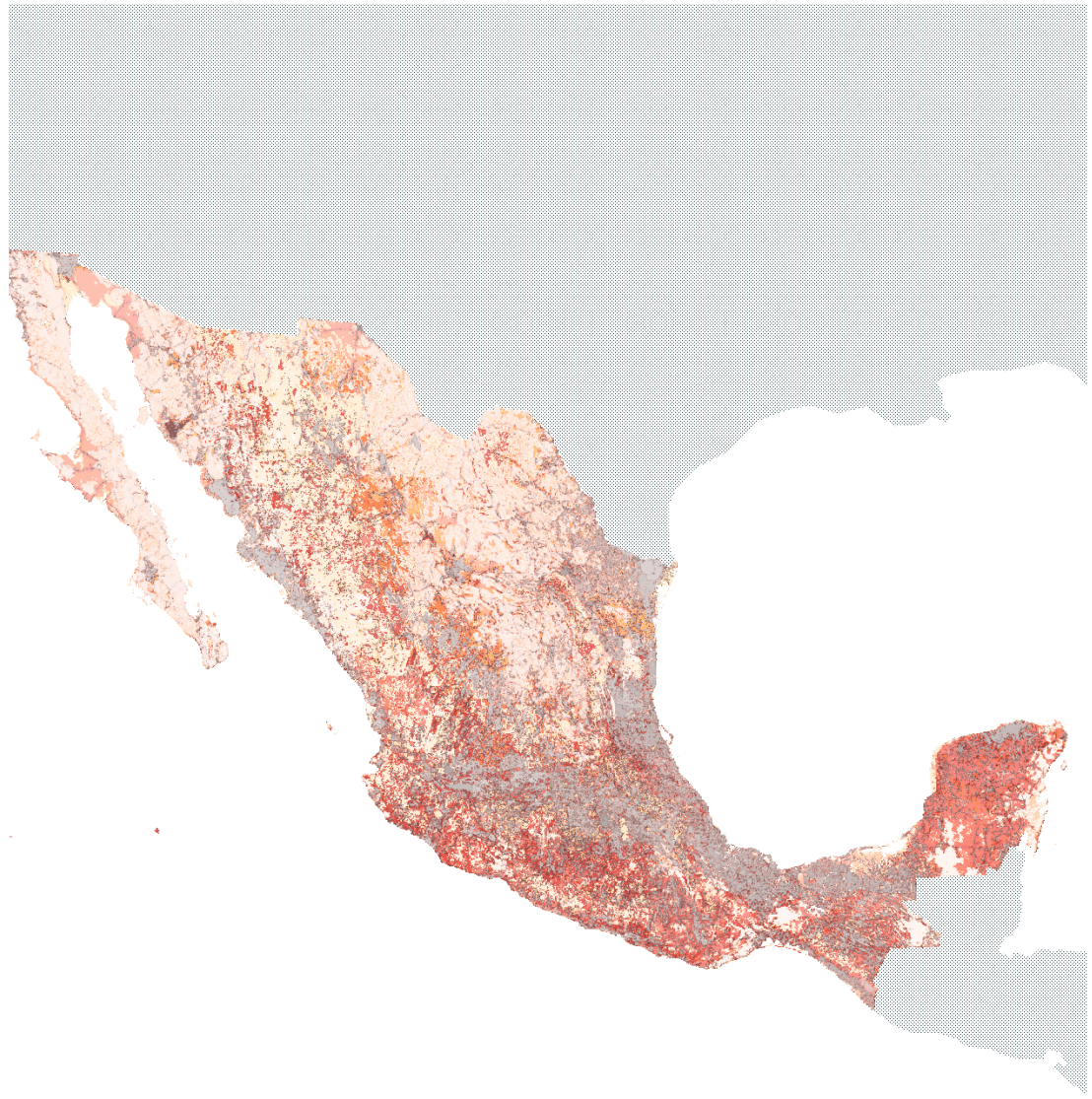
Sadly, in the last two centuries, but especially in the last four or five decades, in Mexico, as in the rest of the world, human activity has become a factor of profound modification of natural and ecological processes. The greatest impact has been felt in the loss of ecosystems due to deforestation for food production. Already by 1876, the original vegetation cover of the country was estimated at 56%, and by 2011 it fell to 32% of its original extension, with the greatest losses located in the tropical zones.

A significant proportion of the remaining vegetation is fragmented and in different states of disturbance, with a great abundance of secondary vegetation, that is, vegetation that is undergoing different processes of recovery or deterioration (Sarukhán et al., 2017).

The development of humanity depends entirely on ecosystems and the environmental services that they provide, but despite this, little to no value has been given to them, ethically and economically. Moreover, there is still no recognition in the relationship between biological and cultural diversity as an inherent, consubstantial part of the country's richness. Mexico not only stands out for the high number of species it houses, but also for its wealth of endemic species (Sarukhán et al., 2017) and the great diversity of indigenous cultures that have survived for centuries to different eras of colonization and banishment from their land.

The indigenous communities that inhabit the territory have developed a close relationship with the biological diversity of their environment, both in their worldview and in the way in which they have taken advantage of the available natural resources. More than 15% of the species consumed for food in the world had their origin in Mexico and at least 118 species were total or partially domesticated by pre-Hispanic farmers (Sarukhán et al., 2017).

There is no doubt of the richness and potentialities the country gathers, but there is also no doubt of the many challenges it faces.



With federal government plans that still look into the past for solutions like opening more coal factories to produce energy and weak political interest to pursue the UN's global sustainable goals, the country is falling behind it the care for the planet agenda. With metropolitan areas of millions of people scattered around the country, the challenge of a sustainable urban development has increased with the effects of climate change and the rising social inequalities, for which the most marginalized sector of the population is the first to suffer the consequences.

MAP.1 Antrophogenic impact in Mexico, made by author with data from CONABIO, 2015

WHERE AM I
STANDING

Landscape fragmentation

Commodification

For my graduation project, I decided to focus in the south region of Mexico, specifically in the territory known as the Yucatan Peninsula. Known by the name of Mayapan by the maya civilization, the region remained an enclosed and remote area during every major historical transition of the country - Colonization, Independence from Spain, and Civil War.

Located between the Gulf of Mexico and the Caribbean Sea, this rich landscape remained forever in twhe sight of powerful individuals and colonizers who never truly managed to rule the Mayan warriors. First, were the archaeologists who 'rediscovered' Pre-Hispanic-Built heritage, then, the new bourgeois class that exploited its natural resources by cultivating Henequen fields and exporting chewing gum thanks to the endemic Chicozapote tree and finally, the 'pioneers' who 'discovered' paradise on earth, put a price on it and started to capitalize it.

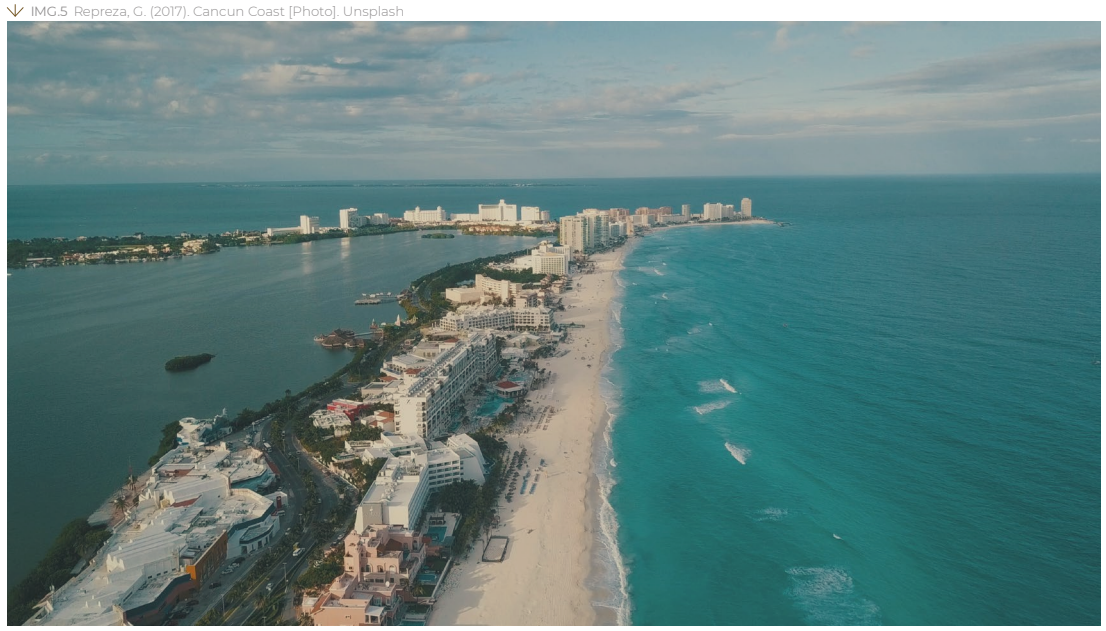
Today the region is composed of three different states – Campeche, Yucatan and Quintana Roo - with a complex mosaic of different biodiversity, rich landscapes and important coral reef systems competing for survival against the effects of nature and human actions.

The seas and the coastal zone of Mexico are one of the pillars of national development. Unfortunately, environmental deterioration, with the consequent loss of natural habitats of marine biodiversity and many socioeconomic resources, continues to increase every day. Mexico is currently one of the countries with the most fragile and vulnerable marine ecosystems to the impacts of natural and anthropogenic phenomena, including climate change (Sarukhán et al., 2017).

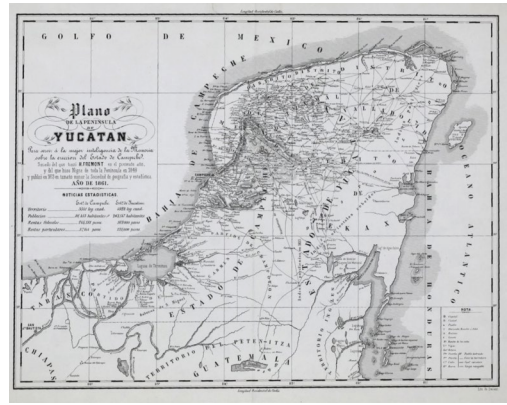
In recent decades, the focus on the Peninsula remained mainly on the economic development of the coastal areas without considering the ecological stress and social uncertainty as a result of urban expansion. In the span of merely twenty years, the region was completely transformed following capitalist intentions and we can see the fragile state of the land as a direct result of this.

Such commodification transforms the urban landscape into an economic good, that is subject to market exchange and exploitation. Furthermore, it has had an impact in the culture and heritage in the area as well.

IMG.5 Repreza, G. (2017). Cancun Coast [Photo]. Unsplash



1861



IMG.6 Fremont, H. (1861) Map of the Yucatan Peninsula [Map] INAH

1985



IMG.7 NASA (2022) Images of change, satellite image of Cancun, Qroo.

2019



IMG.8 NASA (2022) Images of change, satellite image of Cancun, Qroo.

WHERE AM I STANDING

Landscape fragmentation

Conservation

Traditions and symbolism are being transformed into saleable products. It has been developing a process of legitimization for local representations to be both comprehensible and acceptable to international tourists and on the other hand, a process of Disneyfication or standardization to homogenize historic urban landscapes, hence erasing all signs of place distinctiveness (Khirfan, 2014).

Legitimization and Disneyfication also alienate the local inhabitants of these historic urban landscapes especially when the socio-economic and cultural realities differ significantly from the objectives of development. Local inhabitants and tourists experience the landscape differently. The commodification jeopardizes the very essence of the landscape, the same essence the market is trying to sell.

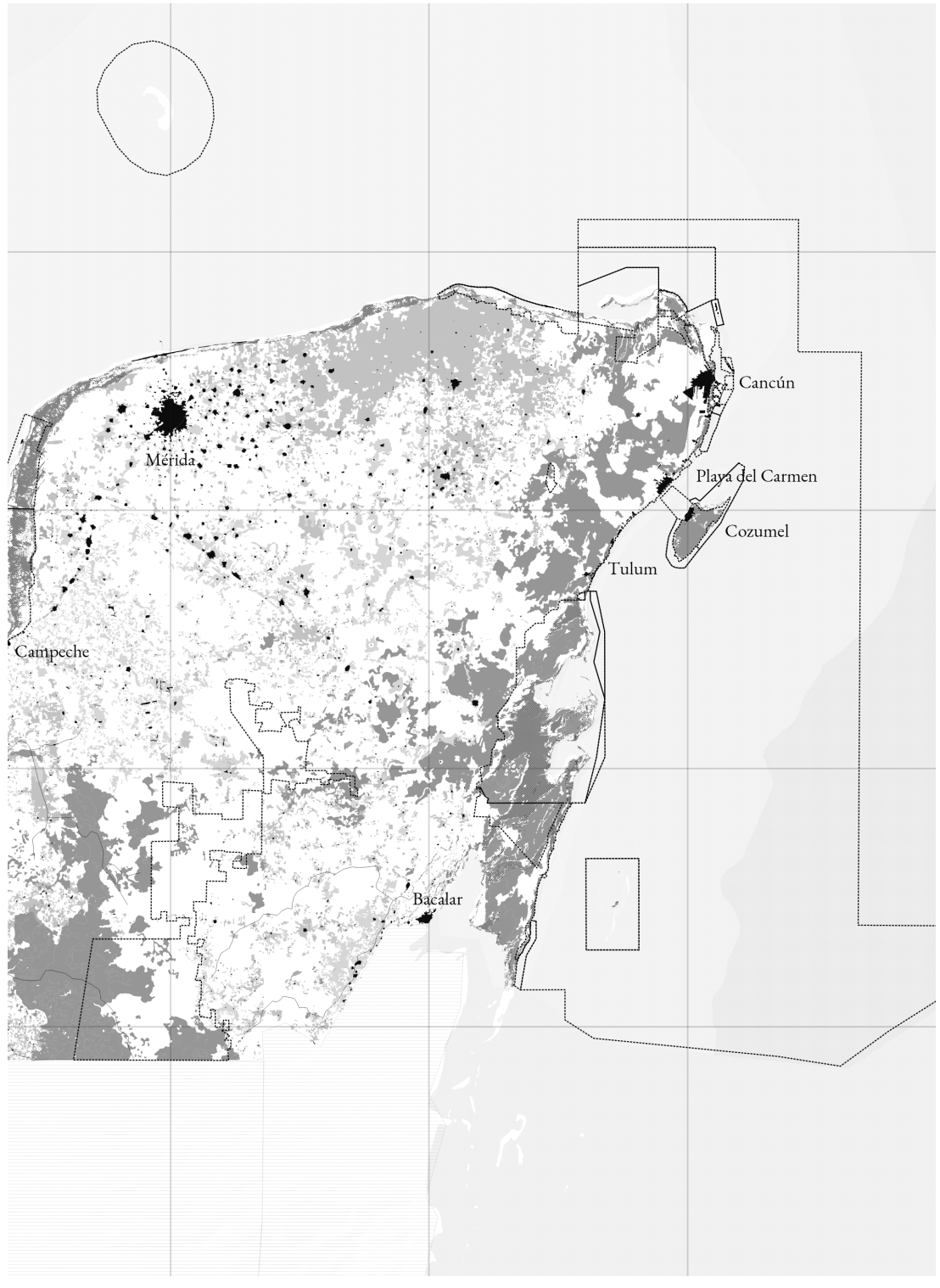
The development of northern Quintana Roo as a tourist destination produced a generalized social longing for the presumed benefits of mass tourism, which caused some ejidatarios (the inhabitants of the ejido, a collectively owned land) to sell more than a thousand small lots near the coastal areas. This subdivision created a massive division of the land, lending to ecological imbalance and a disconnection between the natural corridors, leaving species stranded on small pieces of land, unable to move or migrate (Ibarra-Madrigal et al., 2020).

The loss of habitat in intertidal zones, change in land cover, port and tourist developments, mining or the extraction of materials used as fill in construction and the disappearance or reduction of wetlands are some of the most tragic losses the landscape has endured. However, the most critial pressure the territory is facing today is the deforestation of the tropical forest, the Selva Maya, that for centuries has sustained life in the Peninsula.

The Selva Maya extends through 35 million hectares throughout Mexico, Guatemala and Belize. This area constitutes the largest tropical rain forest in Mexico and the second forest of its kind in Latin America, after the Amazon. Furthermore, the region holds important archaeological sites that are now important tourist attractions and is home for several endemic species. Every year the Selva Maya is losing more than 80,000 hectares of tree cover, largely as a result of ranching, expanding rangelands, small-scale and commercial agriculture, and forest fires. The two main groups responsible for this landscape fragmentation are large corporations but also, poor farmers that depend on this conversion of the land to feed their families. These farmers typically use the land for a couple of years before the nutrients in the soil are depleted and then farmers migrate and repeat the cycle by opening up new land (CONABIO, 2020).

But there is still hope because in Mexico. About half of the forested areas are owned by communities (ejidos). In the Selva Maya of the Yucatan Peninsula, the ratio grows to 61 percent, which means that rural communities whose livelihoods deeply depend on this diverse ecosystem have the ability to make decisions to define its fate. However, they face numerous challenges like lack of knowledge of good sustainable practices or not enough help from the government and even within the community.

It is in this richness of landscapes, biodiversity and cultural heritage where I see a possibility to think of new ways of co-existing and to imagine new ways of living in sync with our environment. What would be the long durée in this region where everything is the result of a process of legitimization and Disneyfication of the landscape and its culture? The answer for me is the socio-cultural heritage. The long durée that looks into the future would have to go back, to re-learn protocols of care from the Mayans and their relationship with Lu'um, Earth.

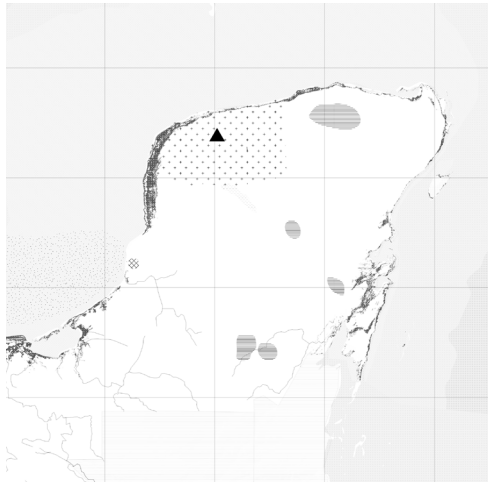
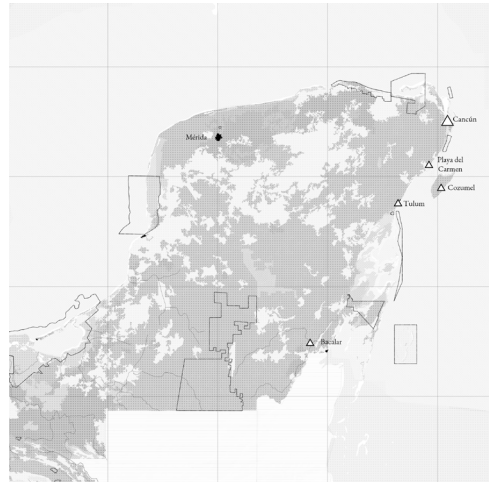
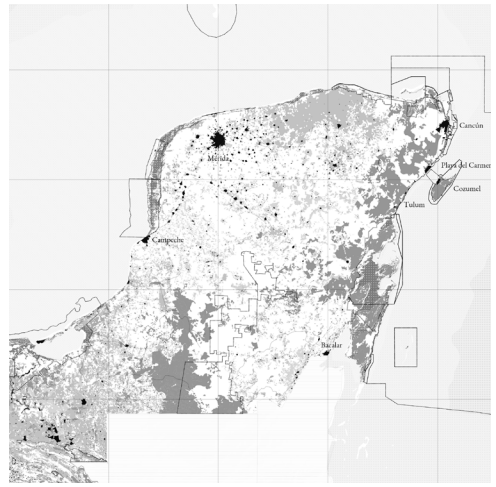
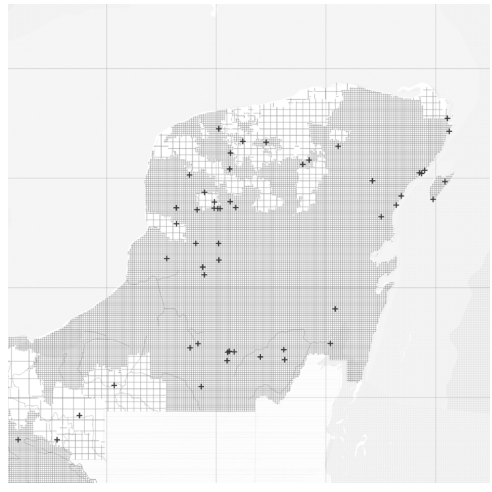
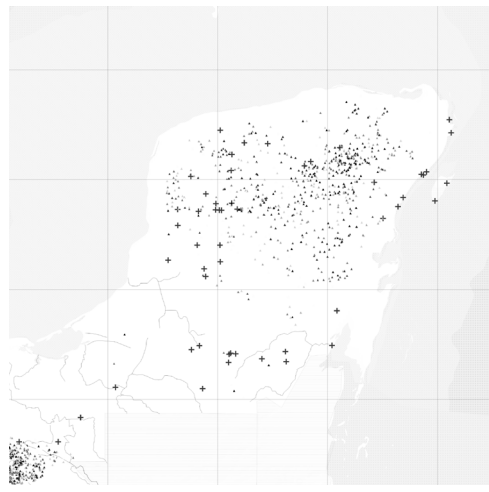


MAP.2 Made by author with data from CONABIO, 2015

Landscape fragmentation

Key moments of change

MAP.3 Made by author with data from CONABIO and INGEI, 2015

	1970	1990's	2000's
Land Cover and Natural Resources			
Infrastructure and Political Borders			
Archeological sites and Indigenous Communities			



II. PROBLEMATIZATION

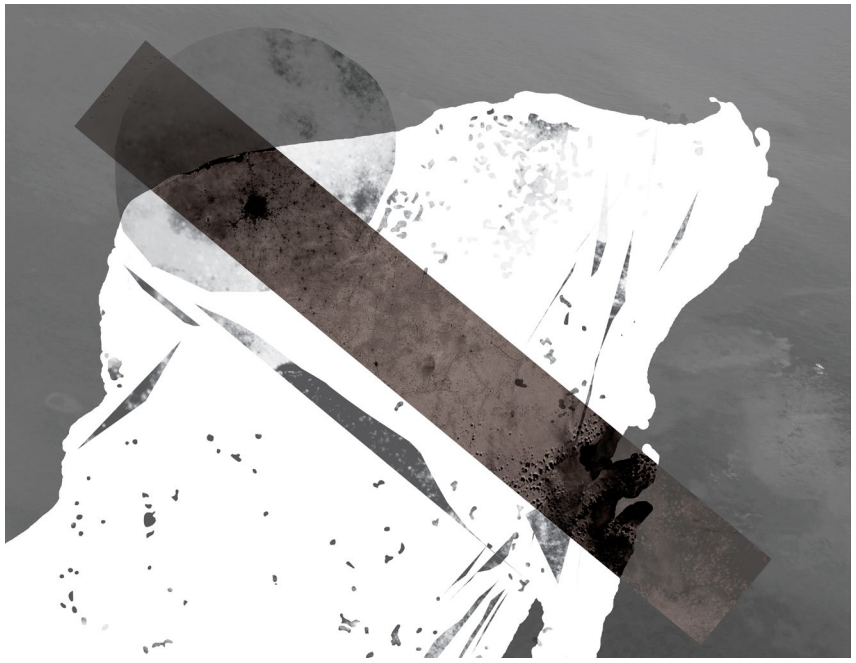
ACCUMULATION

2.1 Lines of inquiry
- Matter
- Topos
- Habitat
- Geopolitics

2.2 Problem focus
- Critique
- Problem statement

ACCUMULATION

2.1 LINES OF INQUIRY



Interconnected territory

Every action done in one part of the region can be felt as well thousands of kilometers away

FIG.2 Illustration made by author

+ Matter
Earth, water, air

+ Topos
Terraforming, erasure, translations, flux

+ Habitat
Mutualism, competition, diversity, entropy

+ Geopolitics
Climate regime, ethics, ownership, displacement

The Capitalocene is at war with many forms of life on earth, including human life (Klein, 2014). Today's hyper-capitalist accumulation has measure development and growth in terms of the level of colonized nature and exploitation of natural resources. This crisis asks for us to rethink our planetary inhabitation if we like to continue living on earth and to care about the right things.

The Transitional Territories studio proposes a new lens from which to look at the project. By looking at processes of accumulation and opportunities for clearance, I started to shape my own research, following these lines of inquiry studying aspects of Matter, Topos, Habitat and Geopolitics within my area of study.

Through a methodology of composition, alteration and limits, the aim of the monographs for accumulation, is to dive deep into the current processes of the interconnected systems in the region, trying to expose their boundaries, limits and level of influence in the environment.

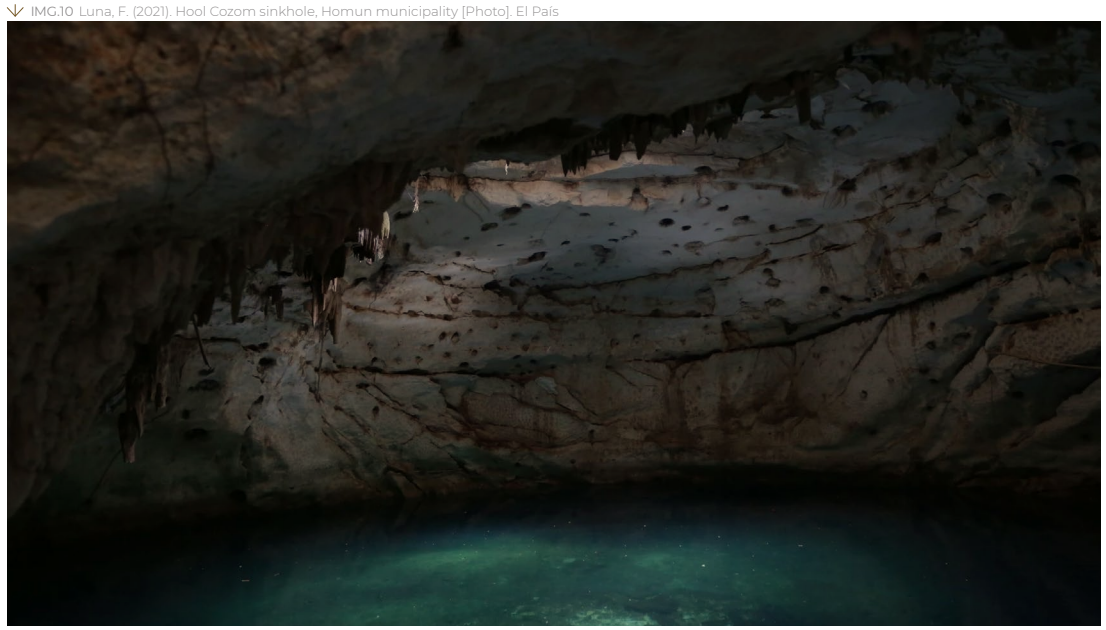
Composition

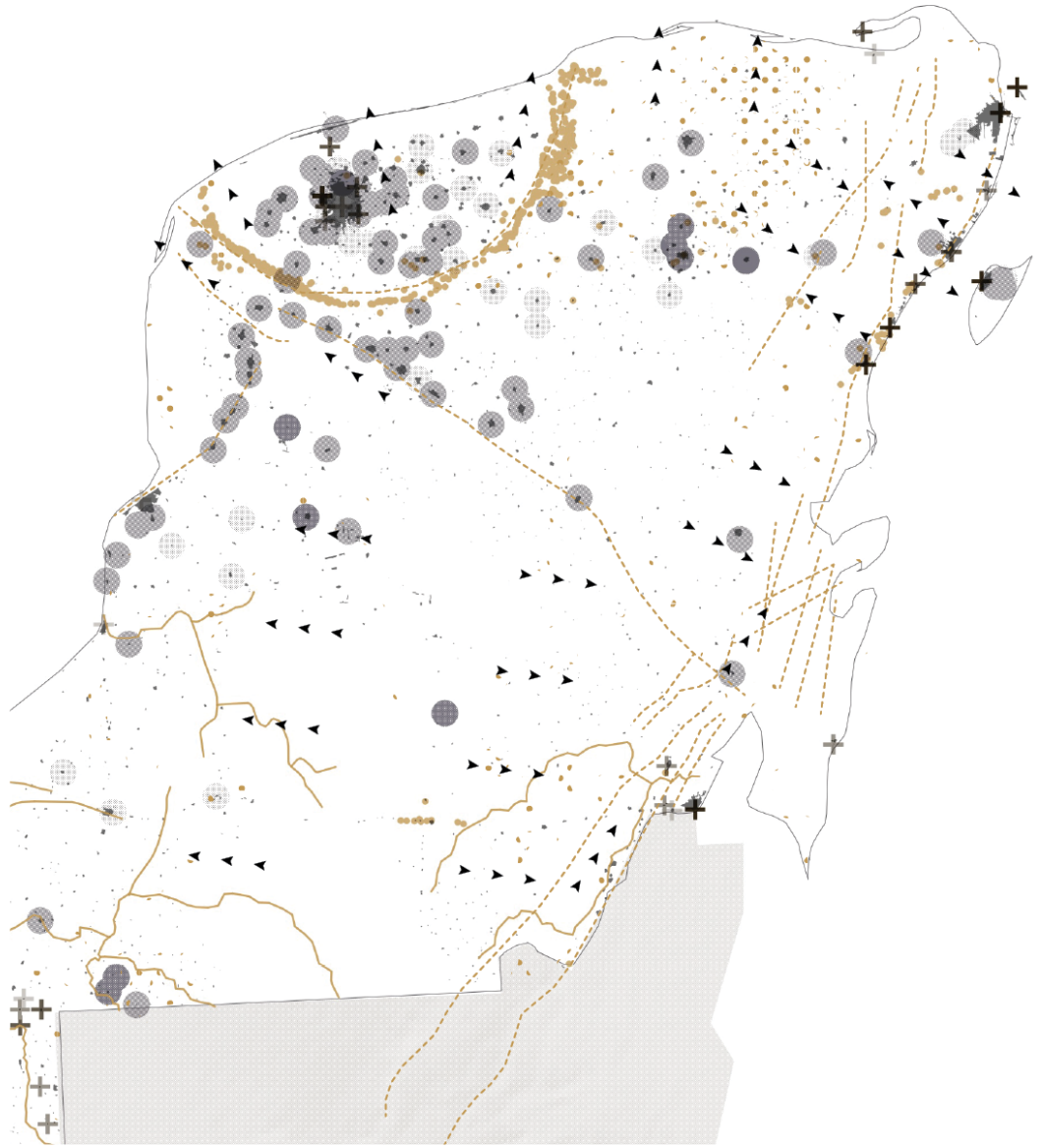
The only available water resource on the Yucatan Peninsula is groundwater.

Due to its geological and topographic characteristics, surface-water runoff and drainage are practically nonexistent, except in the southern parts. Therefore, the supply of drinking water for the different activities of society is the groundwater that in turn receives the wastewater that is generated in the region. Groundwater storage and flow occur in a regional Karst aquifer with major cave systems and turbulent currents.

The groundwater moves from the areas with the highest rainfall, in the south of the state, towards the north coast where it is discharged in the form of rivers and flows into the mangroves and coral reefs. This transboundary aquifer system extends over an area of 165,000 km2 approximately, reaching neighbor countries Guatemala and Belize and hosts large amounts of groundwater resources which maintain highly diverse groundwater-dependent ecosystems (Bauer-Gottwein et al., 2011).

IMG.10 Luna, F. (2021). Hool Cozom sinkhole, Homun municipality [Photo]. El País





MAP.3 Made by author with data from CONABIO, 2020

Alteration

The key groundwater management problem in the Yucatan Peninsula is trading off groundwater for human use against groundwater for ecosystems. The high-speed development of the tourism economy and infrastructure, farming lands and overall population growth threaten the groundwater resources, leading to exponentially increasing amounts of wastewater and soil waste. The vulnerability of the aquifer to contamination is due to the characteristics of the karstic subsoil, which determines that the rain infiltrates quickly and drags away any substance found on the surface of the land.

In most of the state, domestic effluent or wastewater is discharged underground through abandoned septic tanks and shallow wells due to the lack of a sanitary drainage system. Rainwater is discharged into the aquifer through absorption wells 15-18 m deep, which slowly increases contamination rates.

The region lacks comprehensive regulation of wastewater treatment and landfills as well as farming lands are particularly critical in this high-permeability karstic area. Moreover, sea water intrusion in the karst aquifer is extensive and reaches tens of kilometers inland. Groundwater use is thus restricted to a relatively thin freshwater lens (40 – 100 m thick).

IMG.11 Garnica, T. (2021). Aerial view of pig farms [Photo]. Greenpeace



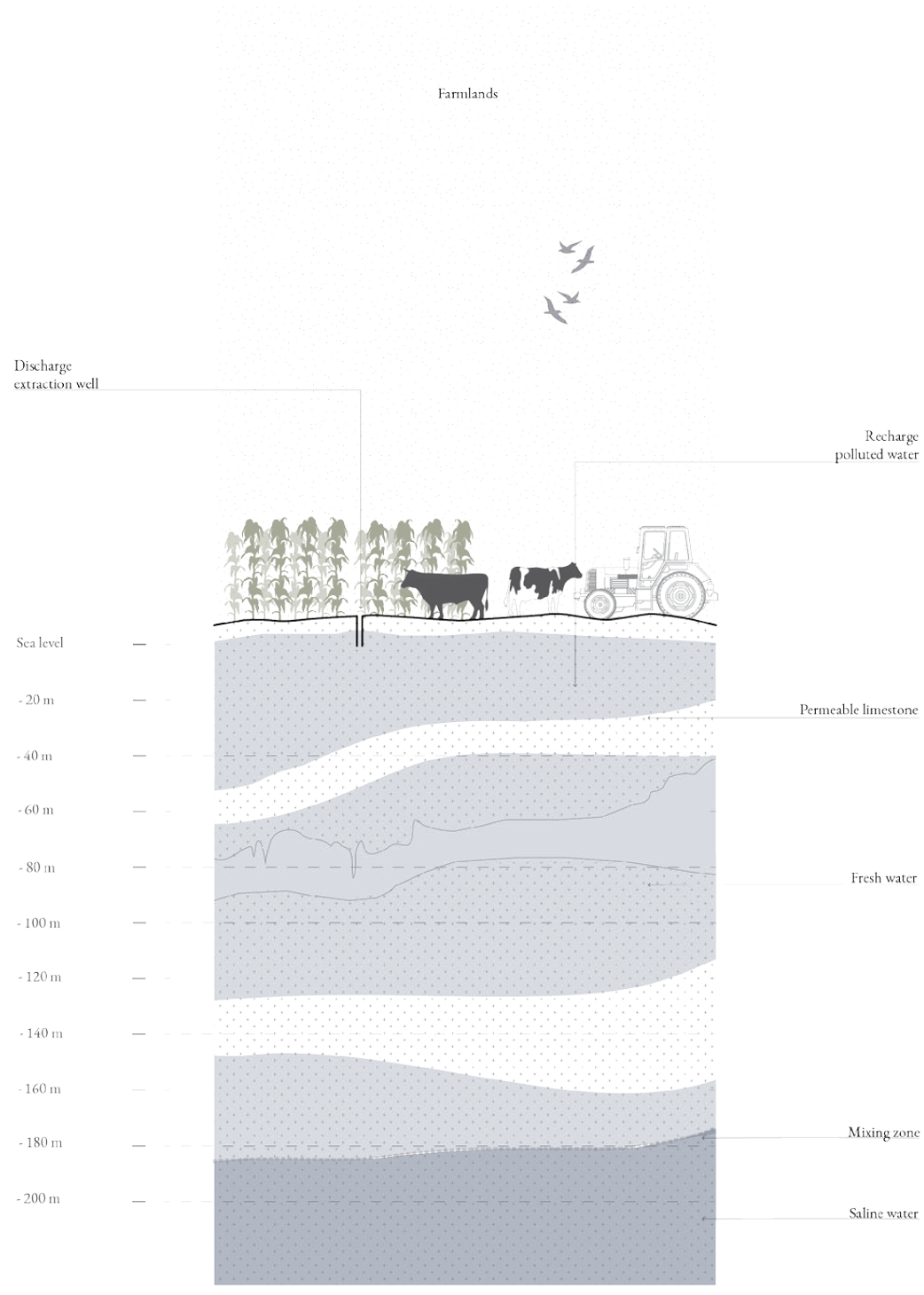


FIG.3 Made by author with data from USGS (2017)

MATTER

WATER

Limits

Stress on groundwater resources is thus continuously increasing and threatens both water supply assets and groundwater dependent ecosystems like cenotes (sinkholes), wetlands, rainforest, coral reef and urban areas.

Since the 1990's it is believed that land-based sources of pollution such as discharge of untreated sewage and wastewater, along with overfishing, coral disease, and climate change, may have contributed to the loss of up to 50% of corals in the reef along the region's coast.

With a ten-fold increase in population expected by 2030, the problems are likely to worsen (Harvell et al., 2007). Researchers warn that a combination of sea-level rise and over extraction of fresh water contributes to saltwater intrusion into the aquifers, thereby posing an immediate threat to the region's fresh water quality and availability.

IMG.12 Greenpeace (2020). Plastics found on Sian Ka'an Nature Reserve [Photo]



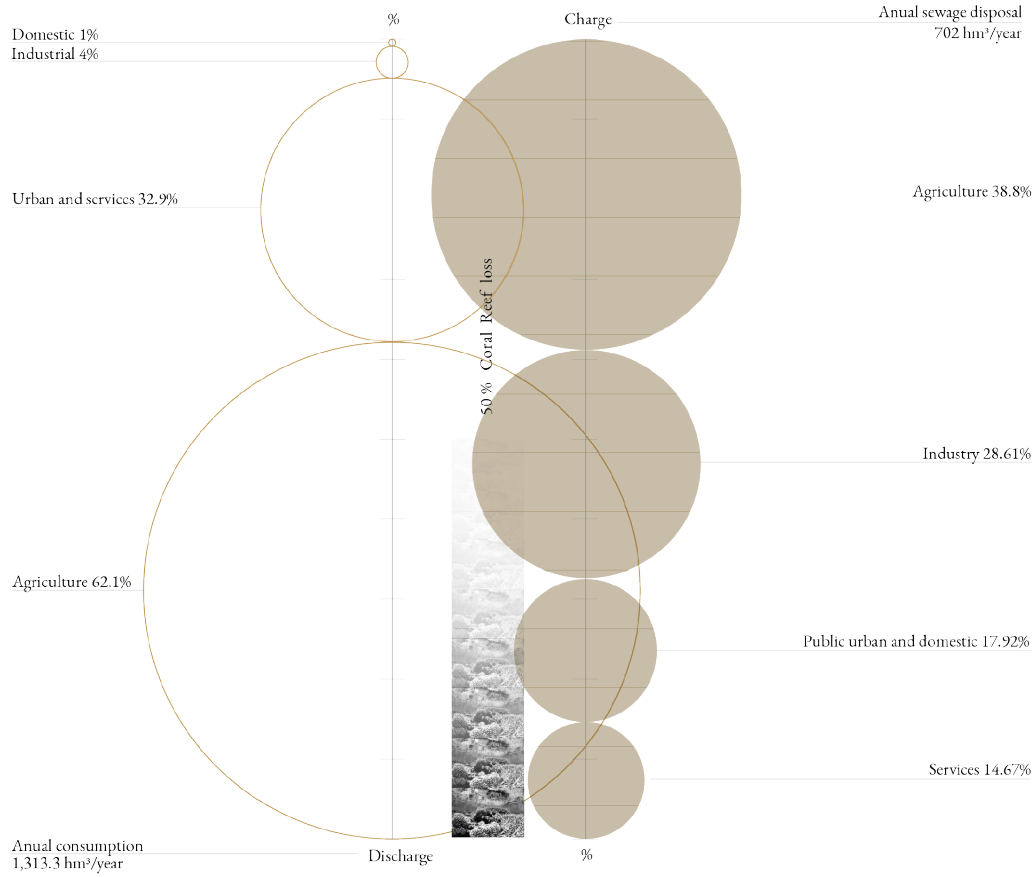


FIG.4 Illustration made by author with data from INEGI, 2020

TOPOS
ERASURE

Composition

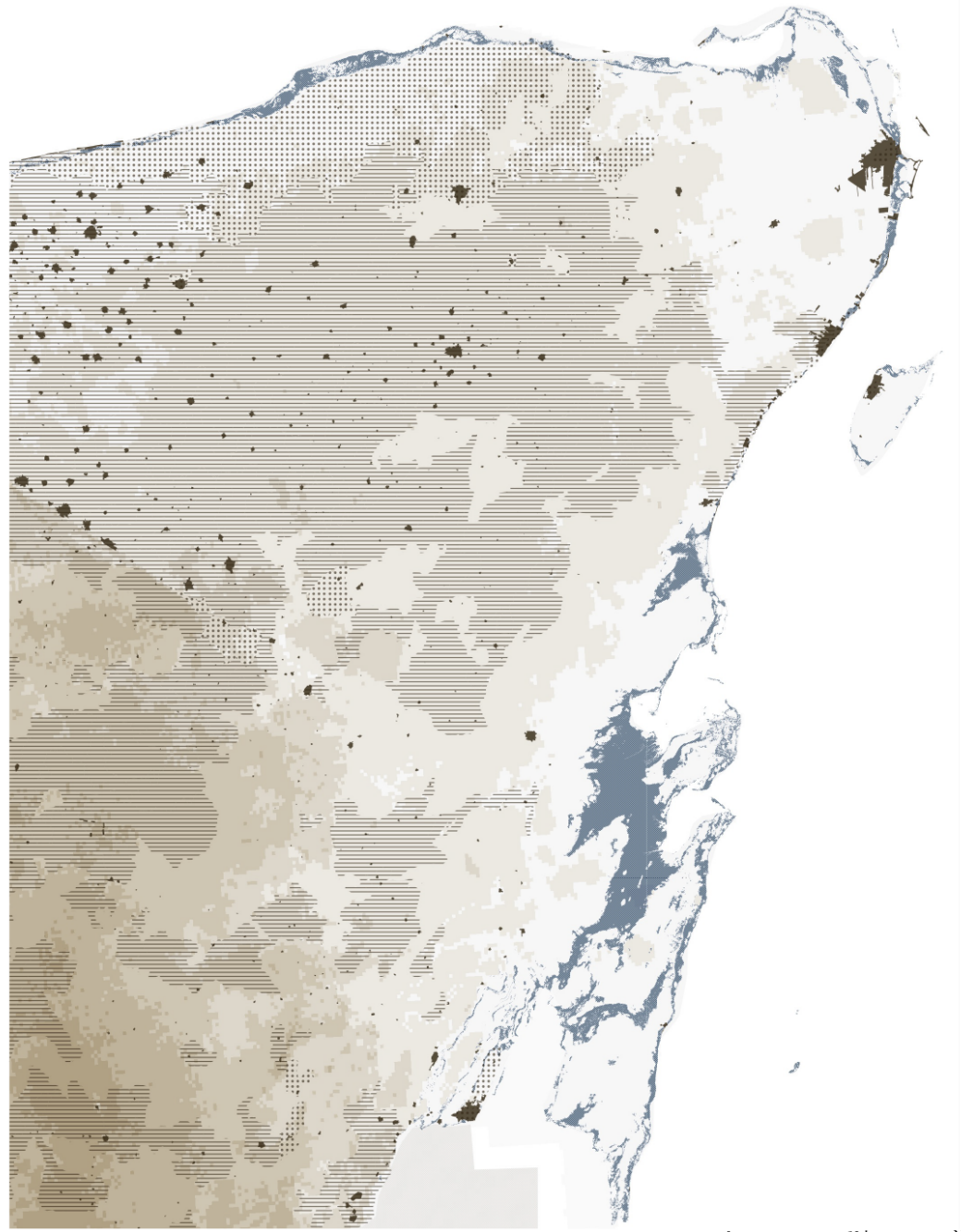
The topography of the region presents elevations generally below 50m a.s.l. The highest area lies in the center of the peninsula and from there elevation decreases eastward and westward by abrupt steps. In the southern part of the Yucatan state are the hills of Ticul and Sayil, with altitudes of up to 250m a.s.l. (Bautista et al., 2011).

The subsoil of the Yucatan Peninsula is formed by limestone rock of different porosities and an average thickness of 150m. In karstic aquifers such as this, there is high hydraulic conductivity as a result of the permeability of the rock, its fracturing, and high rainfall in the region.

Therefore, the cases of saline intrusion observed in the aquifer are the result of excessive extractions of fresh water that cause an ascent of underlying salt water. As a result, there are areas in the region suffering from chemical erosion on the soil, putting even more at risk the threatened ecosystems and land cover in these areas.

IMG.13 Levit, G. (2012). Sinkhole, *Cenote*, Quintana Roo [Photo] Flickr





MAP.4 Made by author with data from CONABIO, INEGI, 2020

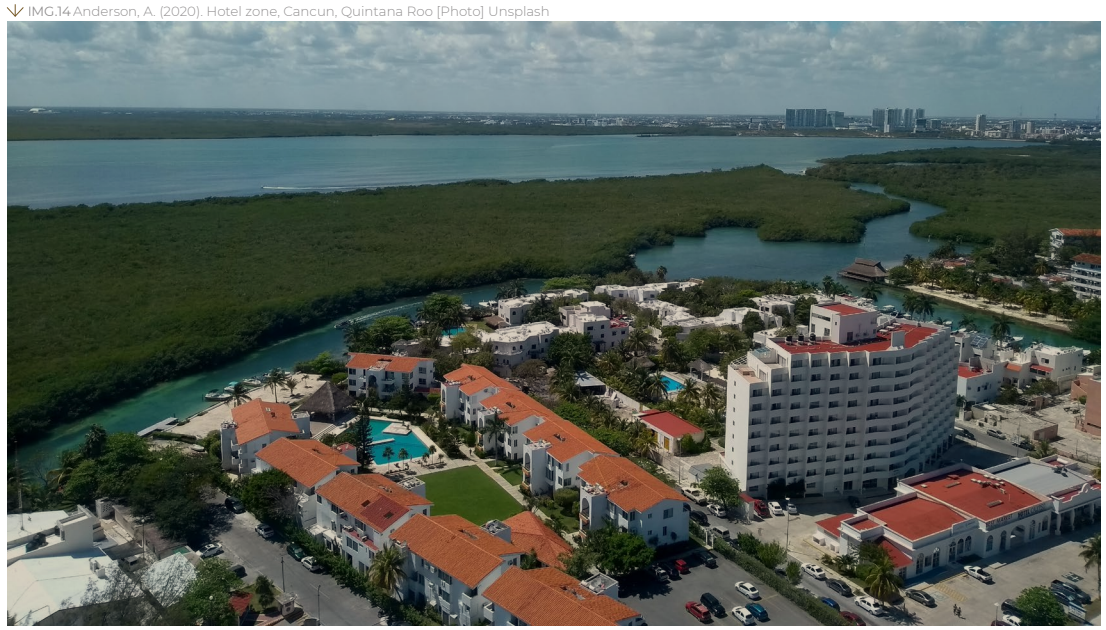
ERASURE

Alteration

Saltwater intrusion is a major hazard to coastal communities as it causes degradation of fresh water resources. The impact of rising sea level on the saltwater intrusion into coastal aquifers has been studied for decades and human activities are known to influence groundwater availability indirectly by affecting precipitation patterns and directly by extracting groundwater and reducing recharge.

According to researchers (Deng et al., 2017), the groundwater recharge in the Peninsula will decrease to 32.6mm a year if human activities increase by 50% more. Therefore, in this aquifer, the response to human activities is greatly exceeded by natural hydrogeological conditions.

IMG.14 Anderson, A. (2020). Hotel zone, Cancun, Quintana Roo [Photo] Unsplash



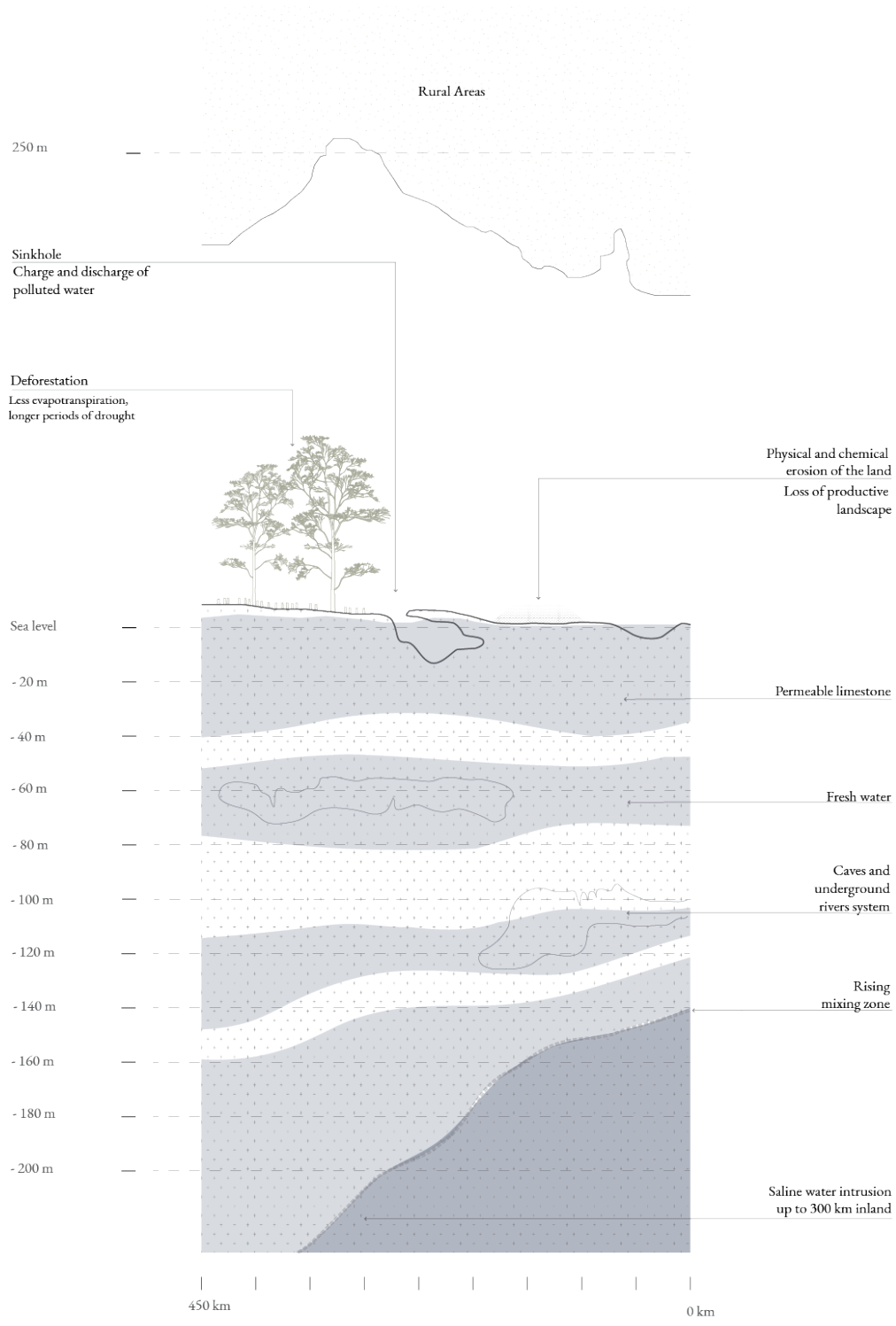


FIG.5 Illustration made by author with data from CONABIO, 2020

Limits

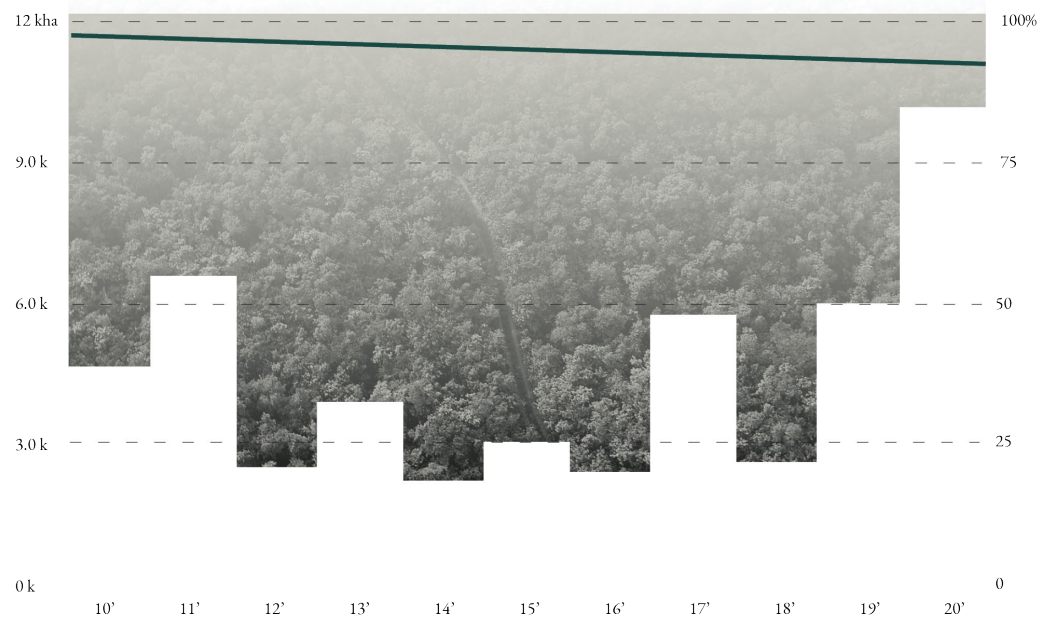
It is important to highlight that although the recharge far exceeds the extraction of the aquifer, even so there are problems that continue to increase gradually with respect to the quality of the groundwater.

First, we have to consider the level of water contamination as opposed to the water treatment, that will cause an increase in the erosion of thousands of hectares a year, representing more loss of land cover which up to this day has lost 75% of its tropical forest.

With the climate change scenario of 1m sea level rise, thousands of square meters of coastline will likely be affected, including urban development, dunes and mangroves and on top of it all, inland saltwater intrusion distance is estimated to be up to 300km.

IMG.15 Cuervo Vega, S. (2018). Deforestation panorama, Quintana Roo [Photo] CCMSS





Deforestation rate from 2010 - 2020,
Quintana Roo, Mexico.

FIG. 6 Illustration made by author with data from CONAFOR, 2020

HABITAT
COMPETITION

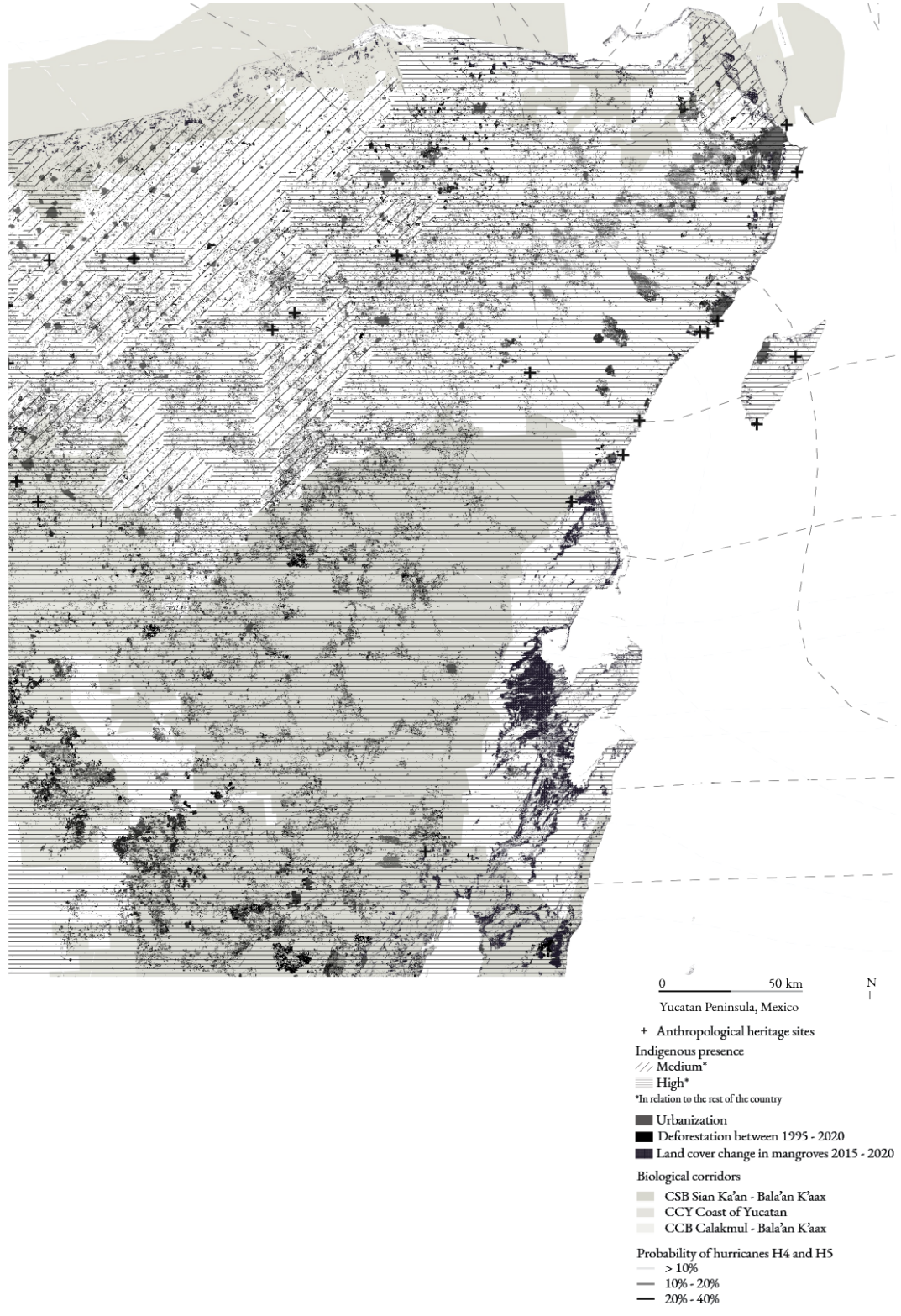
Composition

The peninsular vegetation, especially that concentrated in the southern part, plays a very important role in conserving water both at a microclimatic level and in its area of influence. Unfortunately, the deforestation that has taken place in the region, more pronounced since the early 1990s, has accelerated the processes of climate change.

Analysis of deforestation rates in Mexico, estimated during the period 1970 - 1990, indicate that the forests changed land use at an average rate of 206,000 ha per year, this being the type of vegetation cover with the fastest rate 0.5% annual loss (CONAFOR, 2020). The anthropogenic impact it's not only hurting the ecosystems but also human life, especially indigenous communities living in the depth of the tropical forest, whose livelihoods depend on this ecosystem to meet their basic needs.

IMG.16 ESRI (2012). Satellite image, Amish soy fields south of Quintana Roo [Photo]





MAP.5 Illustration made by author with data from CONABIO, INEGI, 2020

Alteration

The loss of natural barriers due to land fragmentation and urban sprawl in the coastal line such as dunes and mangroves, leave the metropolitan areas unprotected against natural disturbances like tropical storms and hurricanes that every year between the months of June and September make their way through the region. Because of climate change, the frequency of high magnitude hurricanes is increasing.

Between 1950 and 2004, 29 hurricanes of categories between 3 and 5 arrived in our territory, affecting 25% of the territory, with the coastal areas receiving the greatest damage. More concerning is that between 2005 and 2015 eight hurricanes of these categories have passed through the region increasing beach erosion in the highly touristic coasts (CONAGUA, 2017).

IMG.17 Cortes, M. (2020). Cancun beach erosion, Quintana Roo [Photo] Author



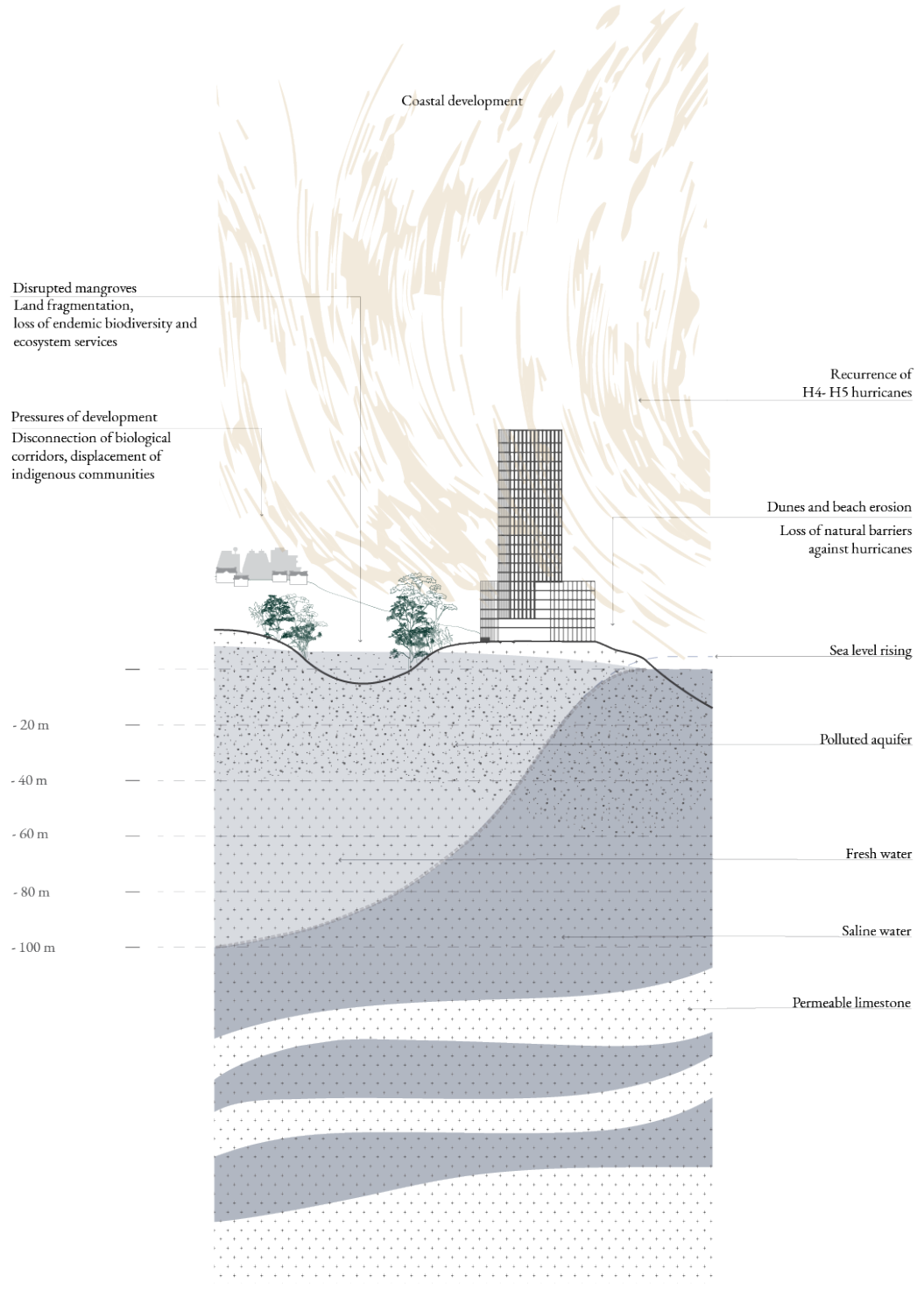


FIG.7 Illustration made by author

HABITAT
COMPETITION

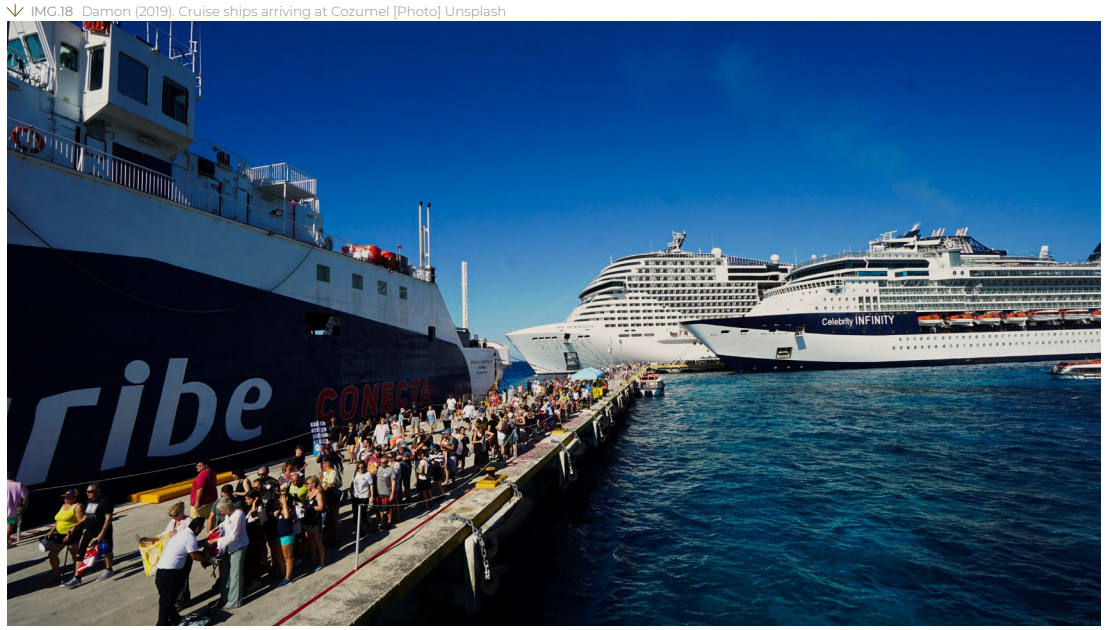
Limits

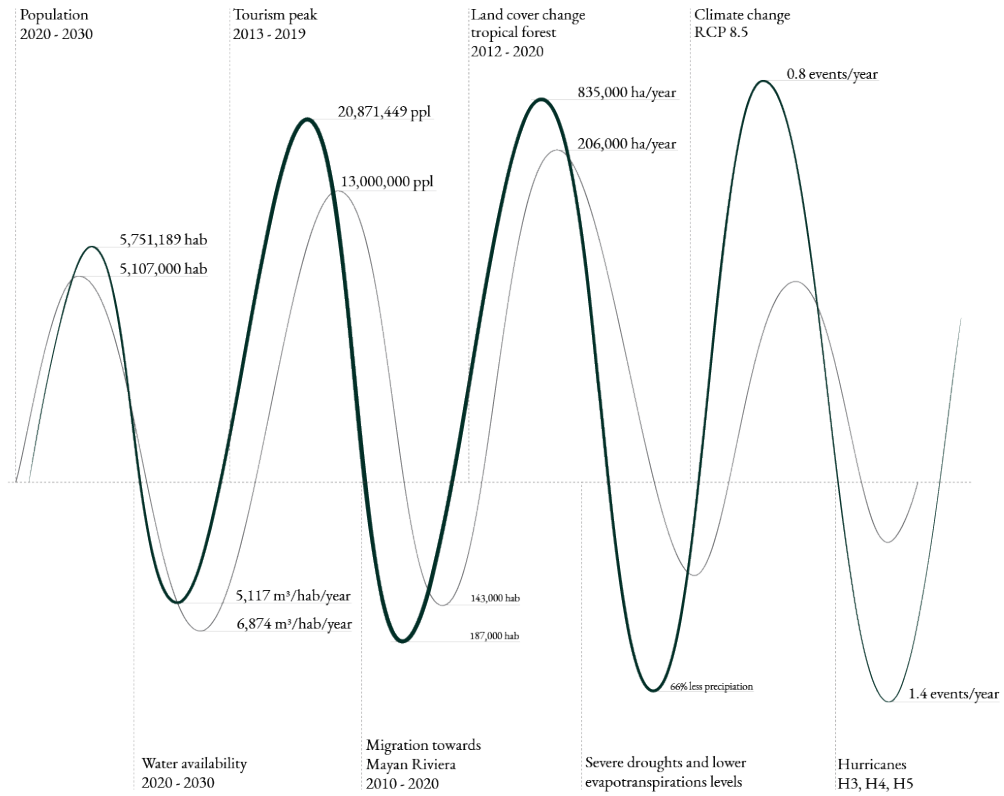
The limits of the habitat are represented by a chain of events. First, as the population keeps growing in addition to the high fluctuation of yearly tourists that arrive to the region, the consequences of these pressures hit the water availability and treatment.

On the other hand, as the promise of development and growth are concentrated in the coastal areas with a monopoly tourist economy, migration from rural areas towards these urban centers leave the landscape uncared for, and expose to bad practices and deforestation, that in turn accelerate the effects of climate change with larger seasons of drought and lower evapotranspiration levels.

Finally, in the future, the natural disturbances are likely to be more severe, with stronger hurricanes concentrated in a shorter period of time.

IMG.18 Damon (2019). Cruise ships arriving at Cozumel [Photo] Unsplash





IMG.8 Illustration made by author with data from INEGI, 2020

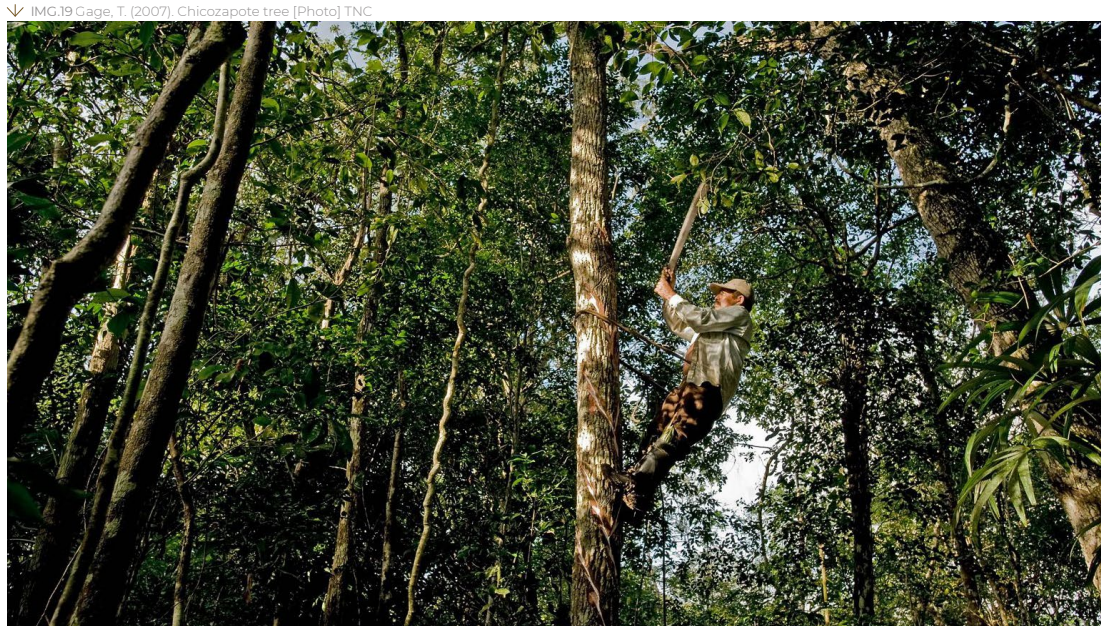
GEOPOLITICS
OPPOSITIONS

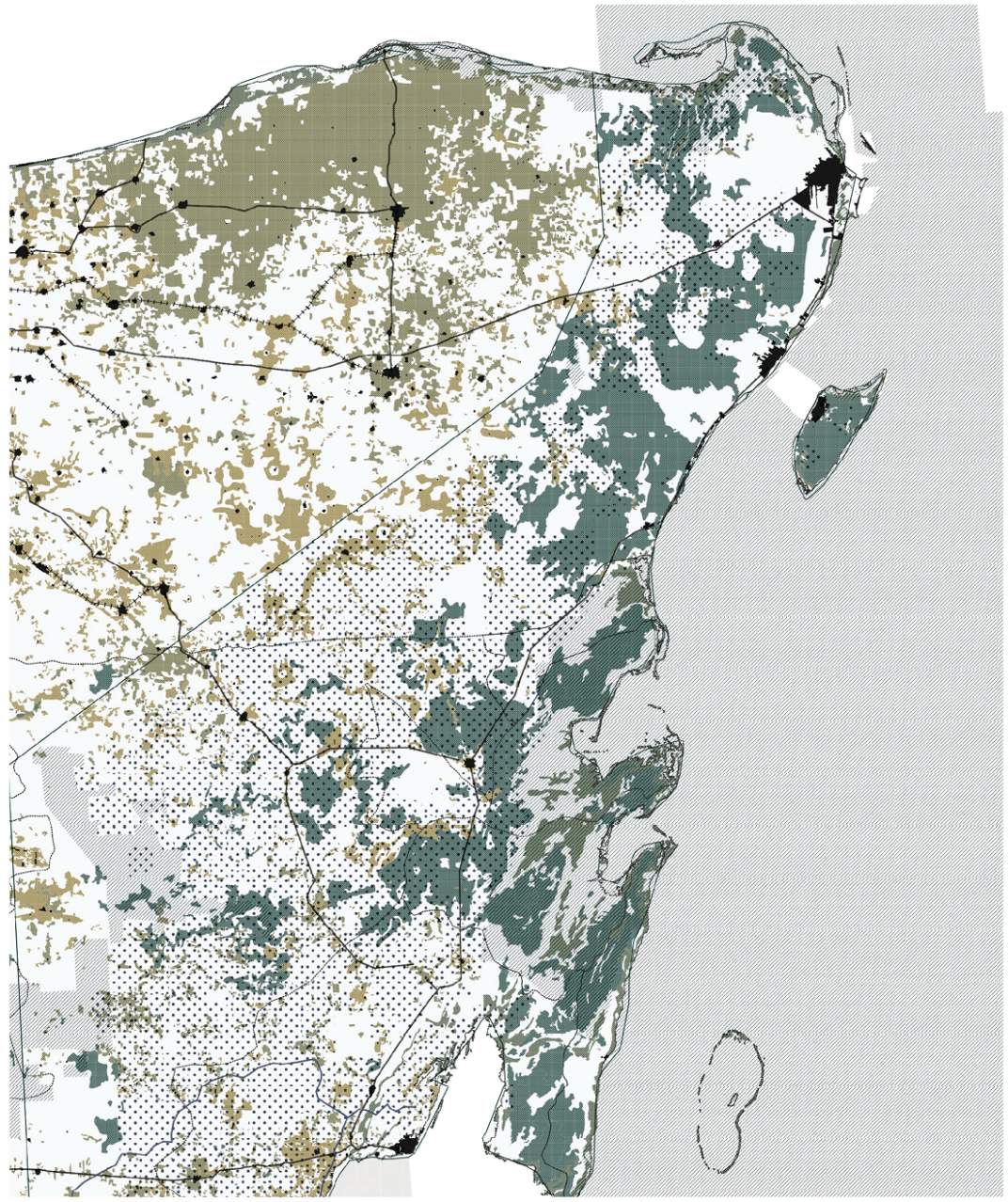
Composition

Indigenous and rural communities with natural capital management practices originated in Mesoamerica intervene both in Protected Natural Areas (PNA) and outside of them, transforming natural spaces into managed landscapes. The territories of the indigenous communities as a whole represent 14.3% of the country's surface and almost all of the types of vegetation existing in Mexico are represented in them.

Most of the dry and humid forest, which together include a very high biodiversity, are under the custody of indigenous communities. A third of the country's federal PNAs and 28.9% of their area include indigenous territories, and about 21% of their population is indigenous, therefore, the conservation of a significant portion of biodiversity and ecosystems and the services that they provide depends on the conservation of said territories (Sarukhán et al., 2017)

IMG.19 Gage, T. (2007). Chicozapote tree [Photo] TNC





MAP.6 Made by author with data from CONABIO, 2020

Alteration

About 50% of the most important aquifers of the country's hydrographic basins are occupied by indigenous people, which translates to a quarter of the country's total rainwater catchment. Half of the regions where the greatest rainfall occurs on a national scale correspond to the territories of indigenous communities.

Unfortunately, almost 80% of the population of the NPAs is classified in marginalization indexes between medium and very high, a situation largely determined by the high representation of indigenous groups in these zones (Sarukhán et al., 2017). The management of the water basin in the Yucatan Peninsula, is a complex hierarchy of federal instances, subdivisions and interests of private sectors that continue pushing the limits of the NPAs in order to gain ownership on groundwater resources.

IMG.20 Jimenez, A. (2016). Mayan priest [Photo] Wikimedia Commons



Inclusive
oppositions

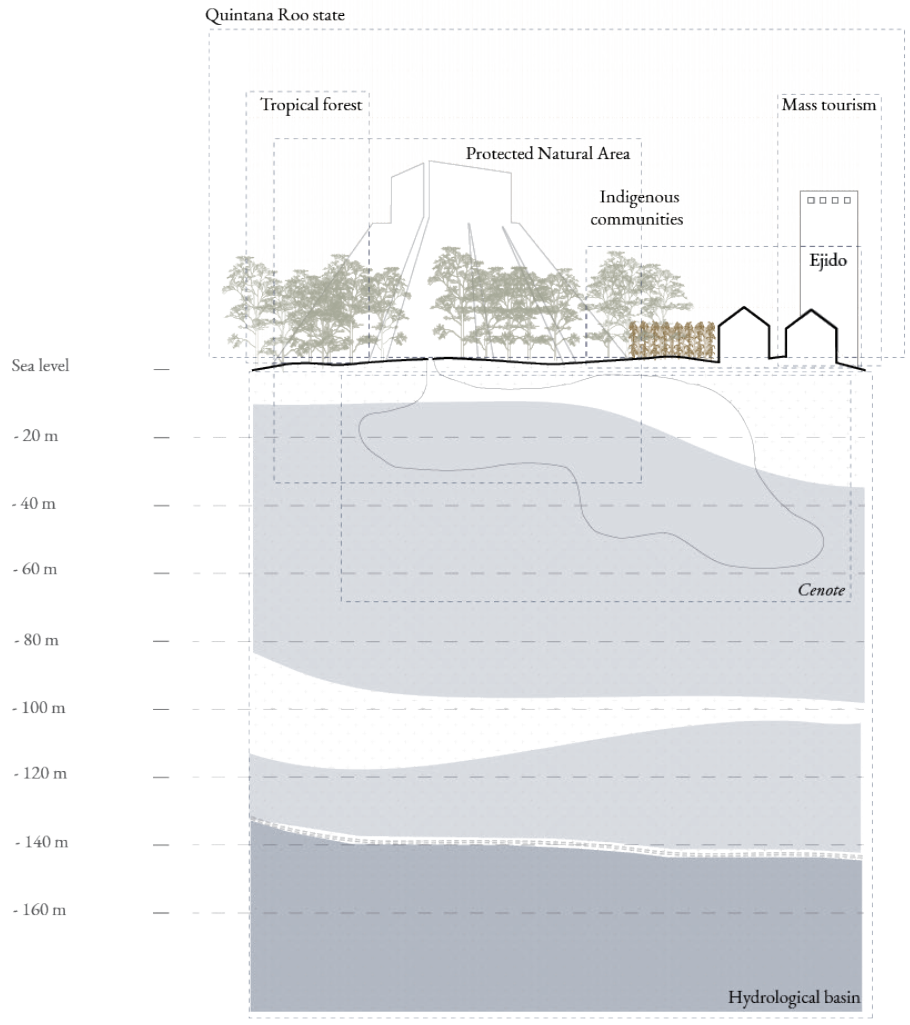


FIG.7 Illustration made by author with data from INEGI, 2020

GEOPOLITICS
OPPOSITIONS

Limits

After the phase of research, it became evident that the region is one where the different worldviews and management of the territory have caused a large fragmentation in the landscape but also in the socio-cultural fabric.

These three inclusive oppositions cut through the territory, making it lose its fragile equilibrium and leaving it exposed to natural and human threats. In the current climate crisis, now is the time for nations to develop a well-rounded strategy of socio-ecological development that takes into account the different voices and knowledge of the territory.

IMG.21 Varial* (2016). I am Mayan [Still from video] TNC



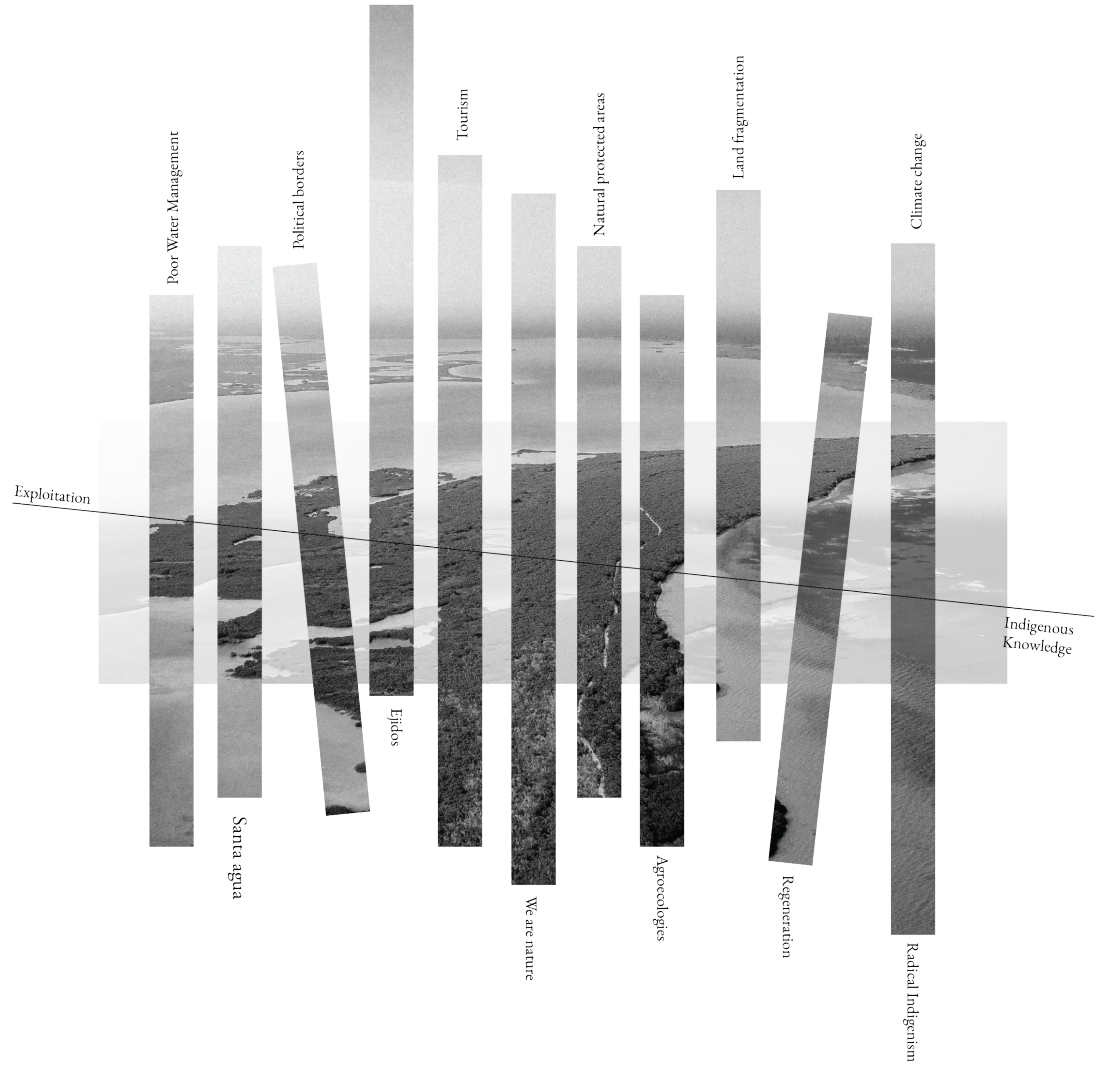


FIG. 8 Illustration made by author

2.2 PROBLEM FOCUS

CRITIQUE

The Eastern Yucatán Peninsula is a complex mosaic of different biodiversity rich landscapes, home of endemic species and territory of the cultural history of an ancient civilization. For decades, the focus remained mainly on the economic development of the coastal areas without considering the ecological stress and social uncertainty as a result of urban expansion. Today, the area is struggling from freshwater shortages, pollution, habitat modification, wetland loss, and weak political interest.

Although the natural environment and socio-cultural heritage, are linked inseparably through complex interrelationships, they are still approached as individual units. There is a total disconnection between economic thinking and the environmental aspects of economic activity and the social repercussions. This results from the failure to communicate to society and decision makers about the interconnections of natural and human systems and to decouple economic growth and urban development from the loss of natural and social capital.

The lack of a local and metropolitan well rounded vision for the area and the failed administration of landscape resources and the irregular information on them causes a permanent loss of opportunities for the socioeconomic development of these areas and of those that depend on their proper functioning, the indigenous communities that take care of the ecosystems in rural areas.

Despite numerous historical disruptions and steady iterations of colonialism that continue through today, indigenous communities have resisted and continue to care for their land. The cultures that exist and have existed in the territory have developed a close relationship with the biological diversity of their environment, both in their worldview and in the way in which they have taken advantage of the available natural resources. The most important negative effect is the growing loss of control over the use of the land and occupation of the ejido territory, where markets for renting and selling land arise that lead to a greater fragmentation of the social fabric and clear risks of environmental impact, which in turn closes possibilities of regulating the conservation and usufruct of collective resources. This results in mayor degradation of the culture, the collective visions and practices, and the relationship with natural resources.

IMG.22 Mayan Riviera 1970 vs. 2005, images by FONATUR



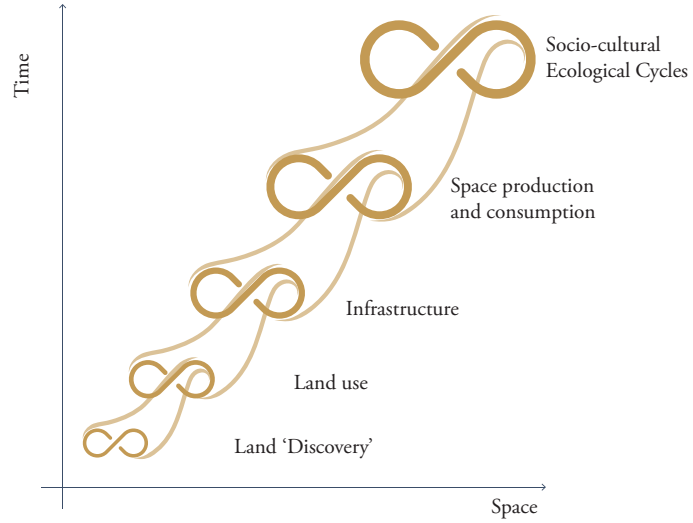


FIG. 9 Adaptative cycles of the Yucatan Peninsula, made by author

With the acceleration of modernization and globalization, intangible cultural heritage is more and more difficult to get the same attention as material cultural heritage. Its living environment is deteriorating, and the degree of damage is accelerating. The inheritance of traditional indigenous knowledge needs not only the careful protection of generations, but also the courage to innovate in accordance with the change of the times.

Tourism development without long-term plans currently represent one of the most serious threats to the region and the lack of a proper coastal administration of its resources and the irregular information that there is about them causes a permanent loss of opportunities for the socioeconomic development of the area and of those that depend on their good state of to survive.

The value of water has been lost due to its easy access and the invisibility of aquifer recharge and since there is no proper water treatment and management system in place, the quality of the fresh water that the population consumes is severely affected by the recharge of polluted water towards the karst aquifer. In addition, increased discharges aid saline intrusion along with climate change. As of today, there are no protected or conservation areas in favor of the aquifer.

The rapid urbanization and land use change along with the area's natural subsoil type contribute to rapid soil erosion. The main accelerators of this process are the agricultural industry and saline intrusion. With eroded soils, land cover is also shifting and natural barriers like dunes and mangroves have been lost, leaving the coastal urbanization at risk and unprotected every hurricane season.

As tourism grows, the landscape decreases. There is no real attachment to land and the values of the indigenous communities and their relationship with the environment are overlooked. Even though the archeological sites are one of the main tourist attractions in the region, the value is placed on the object and not on the subject, the indigenous communities from Mayan descent and their immense traditional ecological knowledge.

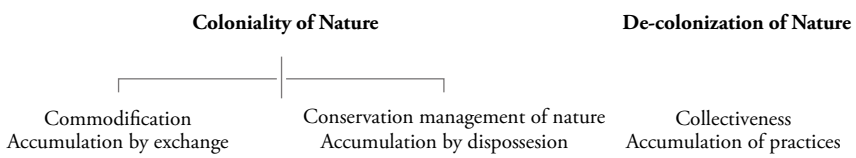
Finally, the government's development plans speak of progress through industry and capital. They are separate from the plans for conservation, regeneration, and environmental health.

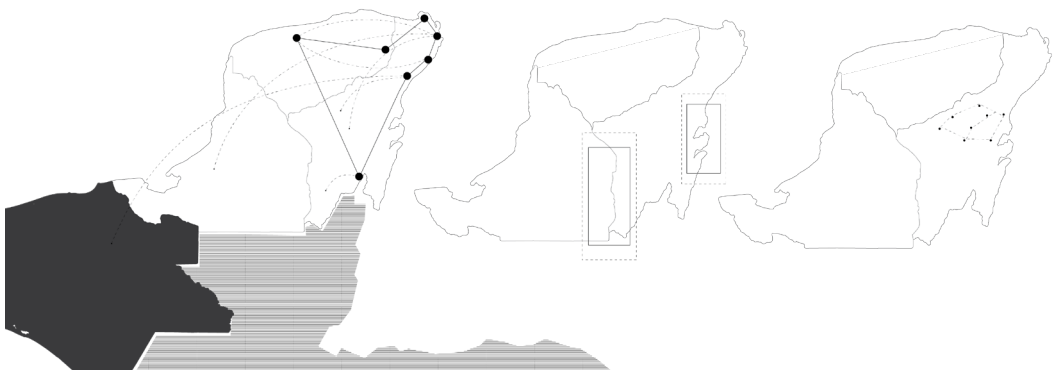
PROBLEM STATEMENT

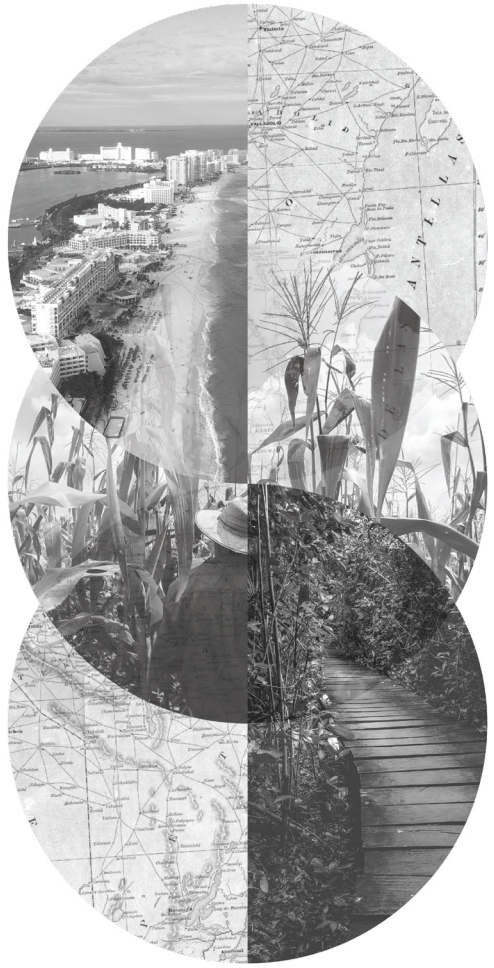
The region's mostly mono-cultural economic practices focusing on tourism services have pushed the locals, from mostly indigenous background to leave their communities and seek job opportunities in the cities created for the new Mayan Riviera. The extensive knowledge about the natural capital of the territory that the indigenous communities have reached, for millennia and through complex processes of nature-society interaction, is being diminished by situations of extreme poverty and massive migrations of rural communities.

This set of political, social, economic and natural elements have had enormous repercussions on the physical and social integrity of the landscape, which nowadays is threatened not only by the over-exploitation of resources and unplanned urban sprawl, but also by the homogenization and simplification of an ancestral culture.

Going forward, these factors, together with climate change, are likely to continue the deterioration of ecosystems and the fragile social fabric on the local communities unless effective action is taken immediately. There is an urgency to understand the interactive effects of these drivers, which will most likely reinforce themselves and which have the potential to generate tipping points, with potentially irreversible changes in the region and its fragile interconnected systems.







Co-existing but not co-habitating

FIG.10 Illustration made by author
FIG. 11 Illustration made by author



IMG.23 Mendoza, L. (2019). Offering [Photo]. Unsplash

III. PROPOSITION

CLEARANCE

3.1 Care-full design

3.2 Hypothesis

CLEARANCE

What could be a new socio-cultural contract with the territory for a careful engagement with the landscape that could provide a new pathway for bio-socio-cultural spatial justice?



FIG.12 *Elevating TEK*, Illustration made by author

3.1 CARE-FULL DESIGN

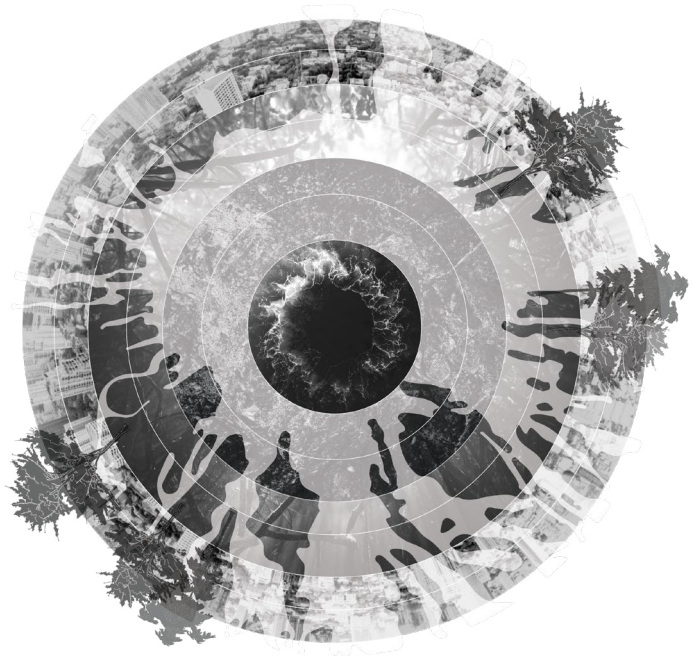
As globalization keeps pressuring the local socio-cultural fabric in the Peninsula, the affective relationship between human and landscape continues to deteriorate. There needs to be a recognition of the bio-physic and socio-cultural dynamics in order to better understand the limits of the array of complex systems at play, their different gradients of use and impact in the equilibrium of the ecosystem, and the stakeholders and actors that are the most important drivers of change.

Traditional knowledge occupies a pivotal place in the range of actions needed to mitigate climate change. A new cultural construction of the territory that explores its the elements and qualities that contribute to its transformation, adaptivity and durability overtime may shift the focus from an economy of extraction and conservation to an investment in the regeneration of natural capital, ecosystem services, heritage and most importantly to be able to sustain future ways of occupying and using the land.

With my thesis, my goal is to explore the possibility of a more diverse use and production of space, to counter act the processes of urban sprawl, abandonment of critical land as result of migration, and habitat modification. By reading the landscape as tabula scripta, I propose to bring forward the natural capital, ecosystems services and traditional local knowledge for a new territorial socio-ecological planning framework that uses as unit of measure the ejido, a piece of land community owned by locals from mostly indigenous background that are the most affected by the current urban and economic development in the coastal areas. By examining the critical zones for urgent action and exposing the potential of the landscape as infrastructure, I can start to imagine a possible transformative pathway that through the project will be able to re-valuate and re-evaluate the way in which we can achieve a coexistence between the different systems, scales and actors that come from different worldviews and have had a different relationship with the environment.

I propose a planning framework strategy that will guide the local and metropolitan development in a functional ecological and socio-economical way. As a starting point, the first area of focus includes but transcends NPA (Natural Protected Areas), ejido communities and the ecosystems surrounding them. After assessing the current situation and interconnections withing the systems, to propose a plan to transform neglected landscape into productively managed landscape with the added value of the productive heritage in mind. Taking into account ecological criteria at the appropriate scale and by involving all actors, my goal is to reassess vernacular strategies and traditional indigenous knowledge in order to integrate them in the current system to finally form a network of bio-cultural corridors that will expand and strengthened the development of the territory, making it more resilient to future disturbances, social or natural. With social participation and the convergence of actions between the different sectors and government orders and NGOs, the goal is to allow for the functional connectivity of ecosystems and the socio-cultural integration in the development of the metropolitan area of Quintana Roo.

Känan K'aax



Care-
Full
Design

FIG.13 Illustration made by author

WEAVING THE PLURIVERSE



Interdependency
Stewardship
Fallow

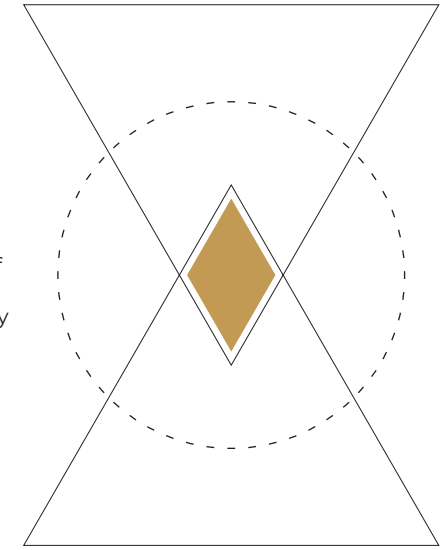
By re-valuating the natural and social capital and the ecosystem services the landscape provides, we can redefine our relationship with it, shifting its role from passive, exploited and damaged, to an active agent able to sustain life and adaptable to the current urban development taking place in the Peninsula of Yucatan.

In addition, by incorporating the traditional knowledge of indigenous communities in an innovative way as the front runners of a re-connection to place and a co-production of space, we can achieve a new dynamic equilibrium of knowledge, actors and systems through nature-based solutions. Elevating the landscape as the new flexible backbone of the territory as functional cultural-ecological region.

Finally, the interweaving of the new bio-cultural landscape fabric could spark new productive heritage. By doing so, the regeneration and care for the territory will be the new longue durée.

Values

Revised policies, re-guided land use, engaged stakeholders, diversification of productive practices and re-valorization of natural capital



Identity

Preservation of heritage and territory identity resignification

Sectorial practices

Continuous adaptation, regeneration, creativity with nature

Elevate the vernacular knowledge of indigenous communities and involve them in the co-production of space by taking advantage of land use of the ejido

Governance

↑ FIG.14 Diagram made by author
← FIG.15 Cover from the book Braiding sweetgrass by Kimmerer (2015)



IMG.24 Guerrero, H. (2021). Laguna de Bacalar, Quintana Roo [Photo]. El País.

IV. METHODOLOGY

4.1 Theoretical framework
4.2 Theoretical foundations
4.3 Research quesitons
4.4 Aims, methods, limitations and expected outcomes
4.5 Conceptual vision
4.6 Project framing
4.7 Project taxonomy
4.8 Relevance

4.1 THEORETICAL FRAMEWORK

The theoretical framework shows the theories and concepts that have helped me understand on the one hand how the different systems, ways of thinking and actors interact, and on the other hand, what theories and concepts could be a possible way forward.

Starting with the premise that I am working with Complex Systems (SFI, 1993) that in turn behave under different cosmovisions, I decided to analyze the different power relations, different types of capital and pressures that act in the Peninsula. On one hand, there are the constant processes of Globalization, Development and their spatial form in Geo-politics (Kjellén, 1916). On the other hand, there is the local cultural Heritage of the area, the value of the Natural Capital (UN) and the Indigenous knowledge Systems (Kawagley, 2005). It is in this intersection of Inclusive Oppositions (Beck, 2002) where the thesis finds an opportunity and challenge.

The area of opportunity reveals the potentials for a new construction of the Territory (Raffestin, 2011) with a revised Governance of the commons (Ostrom, 1990), active Collective agency into the social–ecological system-oriented resilience-thinking (Brown and Westaway 2011), Socio-spatial justice (Marcuse, 2009; Soja, 2010) and the incorporation of the Ejido as the smallest and starting scale of approach to provoke the first steps of action.

The way in which I propose to approach the project is first to map and asses the Critical Zones (Latour,2020) where the pressures of urban development, landscape fragmentation, exploitation of natural resources and higher levels of social marginalization intersect to then cross referenced these zones with the mapping of the Ecosystem services (Costanza et al., 1997) that help preserve the natural capital and to sustain life and productive activities. Then, I will design a framework and guidelines that aim to re-organized the space, re-connect the bio-cultural corridors and diversify the economic activities taking into account the sustainable use of resources and regeneration of the territory, socially and naturally. By means of Nature-based solutions (IUCN), Traditional Ecological Knowledge (Berkes, 1998), Productive protection of heritage (Wenzhang, 2006) and Protocols of care (de la Bellacasa, 2017), the goal of the project is to explore the possibility of a different ecological citizenship.

Finally, I am proposing a design and planning framework that thinks about its Strategic Capacity (Giezen, 2013) considering a Redundancy (Giezen, 2013) of knowledge and actors that will help the project to adapt to any future disturbance and to achieve an Evolutionary resilience (Simin Davoudi, 2013). In conclusion, the success of the project could be measured in the level that the territory adopts these new values that will be considered in the future development of the Peninsula.

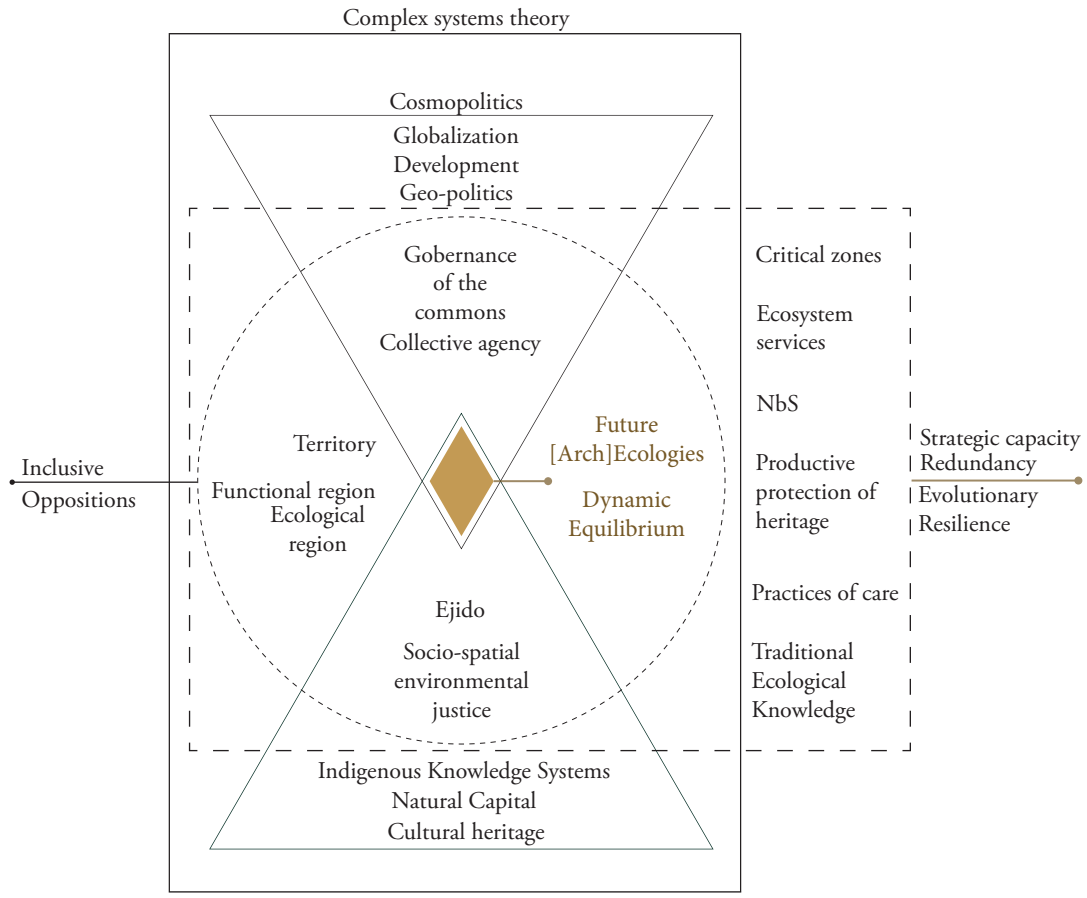


FIG.16 Diagram made by author

4.2 THEORETICAL FOUNDATIONS

Complex systems theory (Waldrop, 1993)

The study of the multiple independent, adaptative, and self-organized agents interacting with each other in many ways. The whole is greater than the sum of its parts but at the same time, by studying how the parts of a system relate to each other, we can reveal hidden patterns and connections that help us understand in turn the whole system.

Cosmovision (Dilthey et al., 2019)

Cosmovision or worldview is the way in which society or a person perceives the world, interprets and gives meaning to it. A cosmovision helps define common notions that can be applied in every aspect of life from politics, economy and science to religion, morals and philosophy. It is influenced by the time and place from which the subject gives meaning to its surroundings.

Globalization

Globalization is the term most used to describe how economy and technology have connected the world. Also, it implies a homogenization of social practices and movement of people as well as a dissemination of knowledge. For the purpose of this thesis, the term implies the external pressures that the Peninsula has been submitted to historically and now how its infrastructure serves the mass global tourism as a result of its marketing of welcoming vacation spot internationally.

Development

When learning about the history of the Peninsula, the many "pioneering" periods presented different views of growth, development and capitalization of the resources. In the last two centuries, but especially in the last decades in Mexico, as in the rest of the world, human activity has become a factor of profound modification of nature and ecological processes.

There are social, economic and political factors that are considered root factors, which in turn induce other proximate or direct factors such as changes in plant cover for food production, overexploitation of components of biodiversity or the introduction of invasive alien species. In most recent times, the development has mainly focus on the economic growth through tourism economy and has paid little to no attention to the locals loosing the performative, environmental and cultural aspects of the landscape.

Furthermore, the hight resource exploitation and the unification of the natural support towards one sector is the cause of little to no investment in other productive activities that could diversify the economy.

Geo-politics

To be able to understand the power relationships in the Peninsula, I need to study the geopolitics of it. How the projection of power (ideological, cultural, economic or military) is projected in the landscape and in turn how is affected by the landscape itself in which it operates.

Governance of the commons (Ostrom, 1990)

Commons are the public goods and resources, natural and cultural, shared by a group of individuals. By the term governance of the commons, my goal is to look for different views, management and care for the commons in the Peninsula that contribute to its sustainability and with the participation of the public, private and political actors.

Territory (Raffestin & Klauser, 2012)

The concept of territory is a human construct that includes the physical geographic space and an imaginary that materializes individually and collectively through expropriation and valorization. My goal with the thesis is to propose a new cultural construct and re-signification of the territory in the Peninsula, to diversify the narrative associated to it, now monopolized by tourism hot spot to one that also appreciates the living heritage of the country and its rich biodiversity.

Collective Agency (Anscombe, 1957)

Collective agency is important for the purpose of the thesis as I want to look into the intentional actions a group performs in accordance to their ethic and values. I would like to shift the agency perform from an individual subject and instead look at the possibilities of the collective action of a community, that strengthen the social fabric and strive for a common beneficial goal for everyone and everything involved, human and non-human.

Cultural Heritage (UNESCO, 1994)

The term Heritage has changed many times through times. For the purpose of this thesis, I refer as cultural heritage is not the object but the subject. In other words, while the monument may be the biggest tangible representation of an ancient culture like the Mayans, what I would like to focus on is in the intangible heritage, the one including traditions, beliefs, social practices, rituals, relationship with nature and skills and crafts that a community passes on to their descendants and has immense value now more than ever as an important factor in maintaining cultural diversity in the face of growing globalization.

Natural Capital (UNCED, 1992) and Ecosystem services (Costanza et al., 1997)

Natural capital comprises Earth's natural assets like soil, air, water, flora and fauna, and the ecosystem services resulting from them, which make human life possible. Ecosystem goods and services represent the benefits human populations derive, directly or indirectly, from ecosystem functions.

Sadly, natural capital is continued to be undervalued as well as the ecosystem services it provides like food, climate regulation, and health. Despite being fundamental to our wellbeing, their daily use remains almost undetected within our economic system. An important assessment for my project is to map the natural capital and the ecosystem services in the state that are being neglected and to expose the importance of reaching an equilibrium again in other to continue living in the area.

Socio-spatial justice (Marcuce, 2009; Soja, 2009)

With Socio-Spatial justice I refer to the way spatial justice theory presented by Soja (2009) argues that all social justice has a spatial element. Also, the way in which spatial justice is a derivate of, and a cause of, social justice (Marcuse, 2009). When referred to in this thesis, I want to look into socio-spatial justice as the way to re-guide the development of the territory, looking for equilibrium and designing for the plural. Giving back the surplus not only to nature but also the economic benefits to the lower marginalized communities that have lost their land due to urban sprawl, lack of job opportunities and land cover change.

Ejido – Collective Property (Ruiz-Massieu, 1987)

In 1979, the Mexican government presented in the Second Global Conference of Rural Agrarian Reform, before the FAO Assembly, the official document that defines the term "Ejido". The Ejido is as a society of social interest; made up of Mexican countrymen by birth, with an initial social patrimony constituted by the lands, forests and waters that the State gives them free of charge as inalienable, non-transferable, indefeasible and imprescriptible property.

Likewise, the community is the nucleus of the population with legal personality and is entitled to agrarian rights, over its lands, pastures, forests and waters, and as a production unit it has decision-making, execution and control, which function according to the principles of internal democracy, cooperation and self-management in accordance with their traditions and customs. The very collective nature of the use of the land can be the way in which the narrative of the relationship we have with the environment changes from something at our service to something that everyone cares for and maintains.

Nature-based solutions (IUCN)

Nature-based Solutions (NbS) are defined by IUCN as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”. NbS support society’s development goals but in a way that reflect its cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services.

Critical Zones (Latour, 2014)

Defined by Bruno Latour as specific zones within a territory under stress and pressures that need to be study in a layered approach, taking into account the vertical as well as the horizontal axis in order to understand its political, social, natural and cultural processes. The notion entails an attention, to know what is happening and the necessity to be cautious, careful and informed. The critical zone engages all inhabitants in the same narrative of interconnected entities in which the human multiform actions are everywhere intertwined.

Matters of care (de la Bellacasa, 2017)

In her book, Maria Puig de la Bellacasa discusses ecological ethics and the concept of care as a way to maintain, repair or regenerate the world we live in so that we can continue to do so as well as possible. Furthermore, it proposes permaculture as a way to work within bios with an ethics of collective empowerment that positions care at the center and parting with the understanding that we are embedded in a complex network of relationships in which every action has consequences, on us and others, humas and non-humans.

Traditional Ecological Knowledge - TEK (Berkes, 1998)

It is the term used to describe the cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings, with one another and with their environment. It is an attribute of societies with historical continuity in resource use on a particular land. For this thesis, I refer to the TEK that to this day, the descendants of Mayan culture hold in respect of the use of resources, their cosmovision, relationship to nature and harnessing of land.

Indigenous knowledge Systems – IKS (Kawagley, 2005)

Indigenous Knowledge Systems refers to the core values, beliefs, and practices associated with indigenous communities whose worldviews have survived continuous threats from colonialism, globalization and displacement from their land. The depth of their knowledge rooted in the long inhabitation of a particular place offers lessons that can benefit us as we strive to co-exit with every creature of this planet in a sustainable way. Indigenous communities have a strong link to surrounding natural resources and part of their cosmovision is their attachment to the land and the use of it in way that future generations also will be able to do it. Enjoy the usufruct of the land and return the surplus.

Productive Protection of Heritage (Gong, 2020)

Productive protection refers to the protection method of transforming intangible cultural heritage and its resources into cultural products by means of production, circulation, sales and other means, with the core of maintaining the authenticity, integrity and inheritance of intangible cultural heritage, and the premise of effectively inheriting intangible cultural heritage technology.

Productive protection is an active way to create economic effects for intangible cultural heritage. Its main purpose is to promote the living inheritance of intangible cultural heritage and ensure the vitality of intangible cultural heritage. With my thesis I would like to start a different conversation in the way we appreciate the cultural heritage. In the Yucatan Peninsula, Archeological sites are highly visited tourist attractions and the craftmanship of indigenous communities is highly appreciated. Nonetheless, I believe the focus has been more on the physical object than in the subject that holds the values, knowledge from whom there is much to learn, understand and validate.

Strategic Capacity (Giezen, 2015)

The Strategic Capacity of a project is the set of decision-making processes that look at complexity and uncertainty not by a set-in stone proposal but from a perspective of adapting and responding to changing situations. In other words, is the ability to open and close the process, avoiding the narrowing of decision-making processes while at the same time allowing designers to advance and close phases of the project, allowing it to keep moving forward. The Strategic Capacity takes into account three important aspects: strategic ambiguity, redundancy and resilience.

First, strategic ambiguity helps the process to open and close at times when needed. Secondly, there needs to be a redundancy of knowledge and actors to be able to innovate and options to choose from when facing uncertainties, tensions or external disturbances. It is essential for the project to survive over a long period of time.

Finally, a balance needs to be found between proactive and reactive resilience. Taking into account this way of planning the project for my thesis, I see the project as a concept with a constellation of actors, designing with flexibility, able to adapt while keeping a sense of direction. The resilience of the project will rely on the availability of a redundancy of options, alternatives, and directions to recombine different pathways.

4.3 RESEARCH QUESTIONS

Starting with the Ejido as fundamental design unit of systemic dynamic equilibrium, how to reposition the landscape as new resilient backbone of the territory, by integrating the traditional indigenous knowledge for a new socio-cultural co-production of regional space?

Sub-questions

Assessment research questions

AR1: Which are the systems at play and where are the critical zones where they connect, have their limits been reached?

AR2: Which are the processes and national plans developing in the territory that sustain, disrupt or project new values?

AR3: What is the hierarchy of stakeholders and the power relations and economic drivers that take place in the territory?

AR4: How to find common ground in the different cosmovisions within the territory that will enable the different actors, environmental systems and land uses to coexist?

AR5: How to re-map the natural capital of the territory in order to provide a new lens with which the value of the landscape can be assed?

Design and planning research questions

DR1: If awareness of an issue is not enough then what could be the first steps towards a disruption of the system?

DR2: How to diversify the narratives of the territory that could provide new productive economic activities to benefit marginalized groups of society without further deteriorating the natural capital?

DR3: How to transcend Natural Protected Areas for a new way of managing the lands that does not remove the local inhabitants from their territory?

DR4: What can we learn from traditional indigenous knowledge and how to potentiate it in order to incorporate in future territorial ecological planning frameworks?

DR5: How different relationships and attachment to land can render different ways of uses within regulation, conservation or regeneration?

DR6: What could be a better way to present and preserve our cultural tangible and intangible heritage?

Projection research questions

PR1: What are the flexible and adaptative pathways needed for a resilient future where new models of occupation can take place?

PR2: How to continue the participation and involvement in the process in the long term?

PR3: How to continue strengthen the system in order to overcome future natural and social disturbances?

THEORETICAL UNDERPINNING

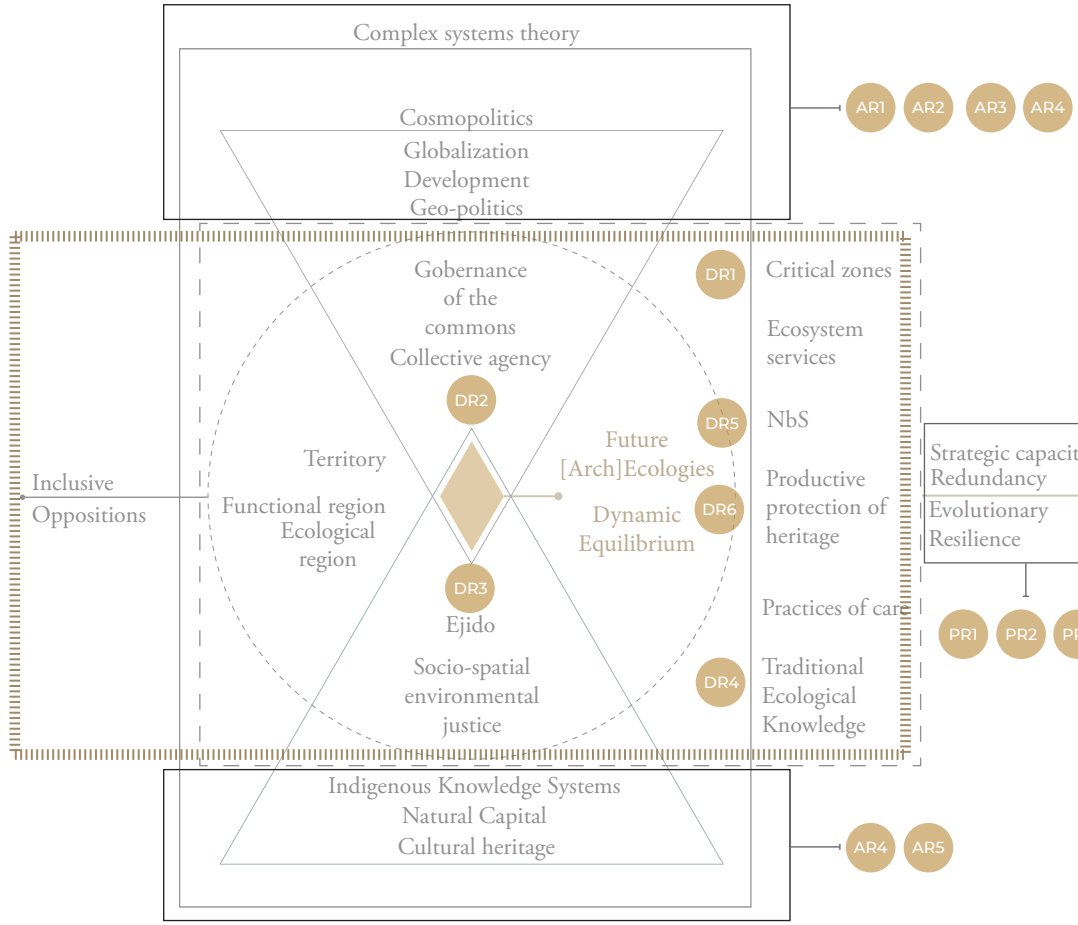


FIG.17 Diagram made by author

4.4 RESEARCH
AIMS, METHODS, LIMITATIONS AND OUTCOMES

Research aims

To propose a new cultural construction of the territory by exploring the elements and qualities of the territory that contribute to its transformation, adaptivity and durability overtime. Shifting the focus from an economy of extraction and conservation to an investment in the regeneration of natural and social capital, ecosystem services and productive heritage.

To research and understand the limits of the different systems working in the territory and their gradients of influence within the complex network of relationships

To explore the possibility of diversifying the productive activities to counter act the current monopoly economic practices and use nature in a creative way.

To remap the natural capital in order to shed light on the crucial processes the ecosystem services perform in the area in order to sustain life, human and non-human. Then to reconnect bio-cultural corridors.

To collect enough data to have a redundancy of knowledge and actors that could enable the project to adapt and evolve in the face of tensions and pressures.

To find common ground between the indigenous knowledge systems and ecological practices.

To redefine the federal, state and local plans for developing a complex region, its form and functionality.

Research methods

Assesment

a. Literature review to know the current state of the region, its challenges and potentialities.

b. Theoretical and conceptual framework that gives direction to the project.

c. Consulting National Mexican Databases and National Universites research papers (INEGI, CONABIO, CONAGUA, UNAM).

d. Cartography on Accumulation, mapping of the variables (ecosystems, indigenous communities location, land parcellation and land cover, priority areas, natural protected areas, infrastructure, metropolitan areas, Heritage zones)

Design, planning and projection

a. Cartography on Clearance, mapping natural capital, social capital, ecosystem services, indigenous knowledge systems, projecting mapping.

b. Photos, videos, interviews with local NGOs and researchers.

c. Selection of case studies and critical zones.

d. Scenario building and projection of possibilities in their spatial form as initiators of the new interconnected network.

Limitations

Assesment

a. Limited access to databases due to permissions and restricted area codes (Mexico vs. The Netherlands), not enough information of the current state of the region as some databases and research papers date back ten years.

b. The need to first test the concepts and theories in the Latin American context.

c. Limited access to databases or not up to date research and cartographies.

d. No available information on current social and natural processes of habitat modification and migration.

Design, planning and projection

a. Not enough information available to be able to project mapping.

b. Copyright issues and difficulties having contact with local universities and NGOs.

c. Not enough and current information about the critical zones.

d. Difficulties connecting the systems, actors and future plans for the region.

Expected outcomes

Design possible scenarios and possibilities for the region through natured based solutions, taking into account theory of complex systems and system thinking in order to achieve a dynamic equilibrium that acknowledges the landscape eco-services, socio-cultural value, local identity and collective agency.

Following the studio's lines of inquiry (Matter, Topos, Habitat and geopolitics), and the processes of accumulation and possibilities for clearance in the area, the expected outcomes can be divided as follow:

Assesment

1. Atlas of Accumulation of the natural and social systems interacting in the region.

2. Documentation of the history and practices of local indigenous communities.

3. Alignment with national and international sustainable development goals.

4. Hierarchy of stakeholders and actions each perform.

5. Revision of the critical zones and potentialities.

Design, planning and projection

1. Atlas of Clearance for the possibilites of the territory

2. Proposal of specific case scenarios

3. Planning framework and guidelines for the future local and metropolitan development

4. Discussion on our role as urbanists and designers in the face of climate change and reaching our planet's limits and human limits.

4.5 CONCEPTUAL VISION

The design and project framing come as result after a careful first evaluation and research of the whole Yucatan Peninsula. With my research approach, I decided to have first a panoramic view of the context of the region, roughly the same size as The Netherlands. After a first phase of literature review on aspects such as history, development, migration, water cycles and underground rivers, ecosystems, indigenous communities, endemic species and future government plans for the region (infrastructure and development), I determined critical zones where there is a convergence of economic and development pressures coming from the touristic areas in the coast, the location of Ejidos and indigenous communities losing their land due to land fragmentation, the closeness to natural protected areas, priority work areas designated by the government and finally, where future federal development plans will have a deep impact.

The different productive activities that the indigenous communities perform need to be conducted under diversified-use mosaic landscapes with management schemes that integrate the use of multiple species; that are associated with the maintenance of multiple ecosystem services; and that engage local cultures, respecting their traditional knowledge regarding the use of resources and their cultural values.



FIG.18 Illustration made by author

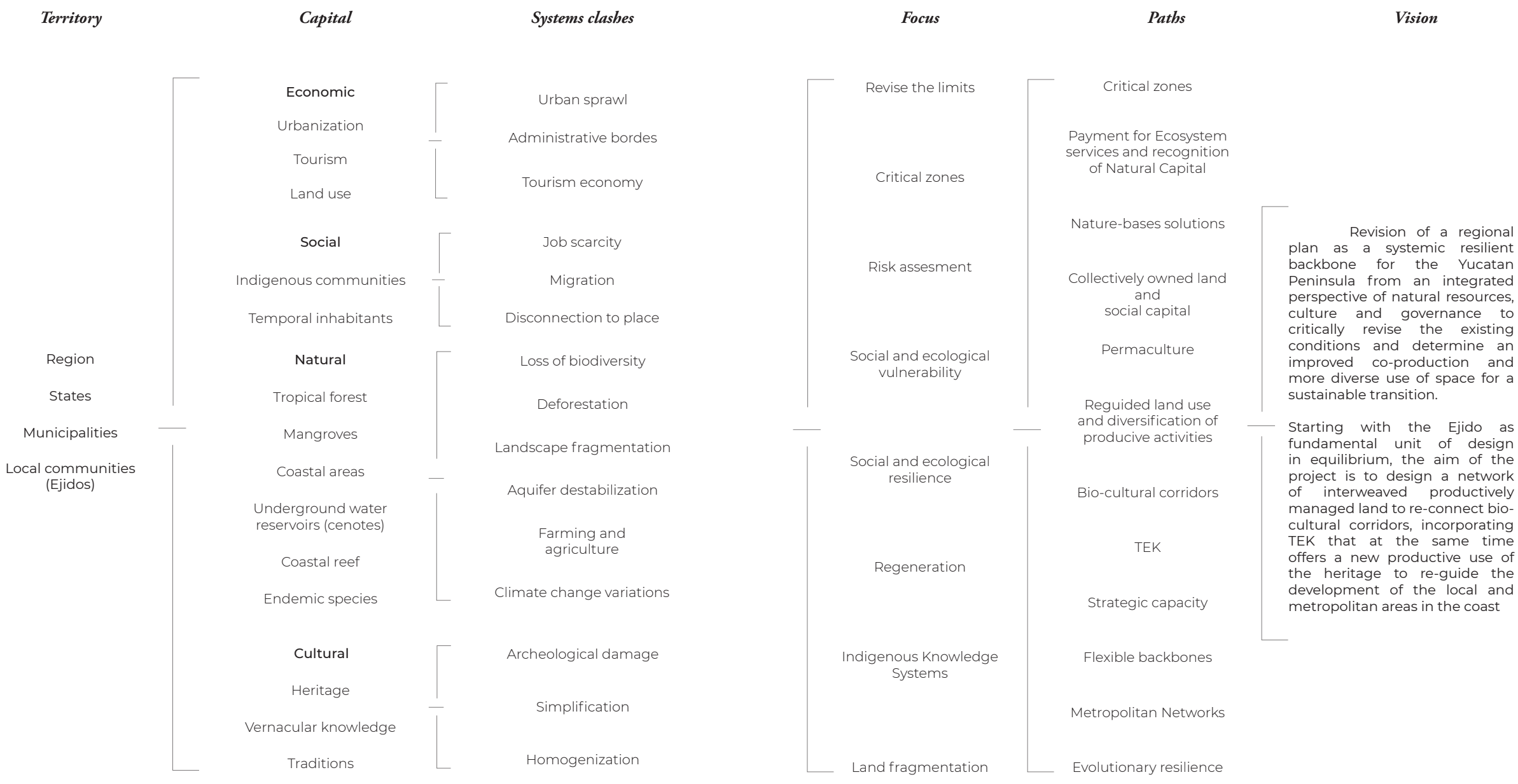
First, after studying the connections of the systems in the Peninsula with its three states, then, I selected the area of intervention in the state of Quintana Roo, at its heart, close to the biggest biosphere reserve of the country and the priority work areas designated by the government, to finally propose the *Ejido* as starting point, as basic design unit to start the transformative pathway towards a dynamic systemic equilibrium.

Going through the layers, from macro to micro scales during the whole process, and considering the vertical as well as the horizontal axis of governance, my proposal is to spark the change and adaptation from within, to begin a reconnection of the bio-cultural corridors, and reguide the local and metropolitan development with a diversification of productive activities.



FIG.19 Illustration made by author

4.7 PROJECT TAXONOMY



4.8 RELEVANCE

EXPECTED OUTCOMES

Scientific

There is a gap in knowledge and recognition of the different systems at stake, their interdependency, their vulnerability and their limits or points of no return. On the other hand, by exposing the negative trends the region has experienced recently and intensely due to mono-political practices and weak institutionality, the aim is to think for new ways of co-habitation and re-guided land use.

Social

The goal through this research is to benefit locals and not only to preserve but regenerate the landscape and our relationship with it. Through a process of progressive and adaptive plan towards a new relationship between the different complex systems, the aim is to increase the economic activities, thus increasing the possible income sources, reduce vulnerabilities and strengthen the backbone of the territory by recognizing the interdependency between every complex socio-ecological system.

Ethical

To design for the plural in care-full design. Not fall in generalizations and respect the heritage and ancient culture of the area as well as the natural capital and the potentials of learn from the vernacular knowledge. The goal is to revised objectively the responsibility and degree of impact of every stakeholder, system and resource and my responsibility as guide and planner.

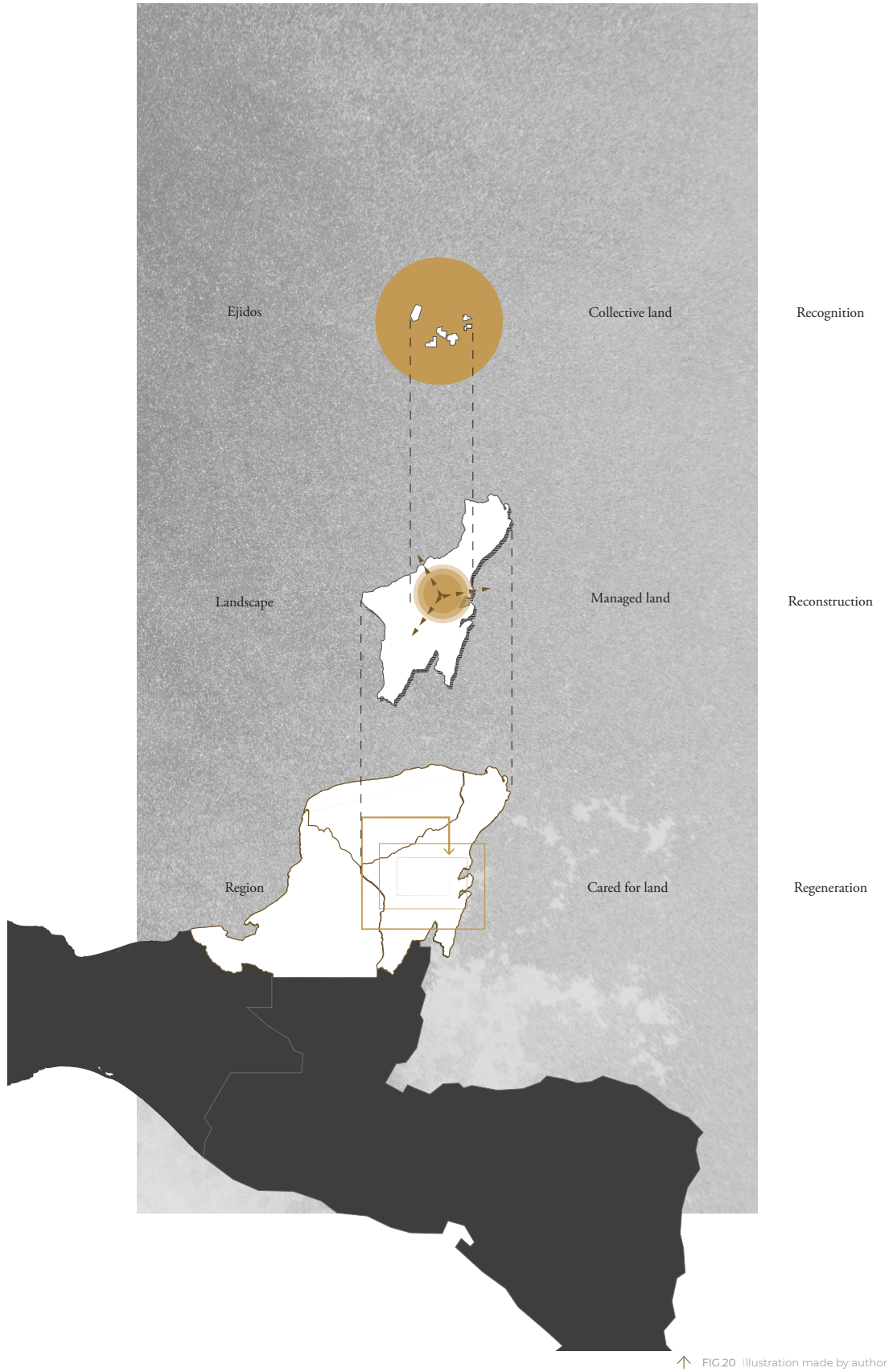


FIG.20 Illustration made by author

IMG.25 Robak, T. (2019). Laguna de Bacalar, Quintana Roo [Photo]. Unsplash

V. PROJECT PROPOSAL

THE FUTURE RESERVE

5.1 What are we valuing

5.2 Design proposal

- Values
- Bridge
- Principles and goals
- Framework

5.3 Systemic section

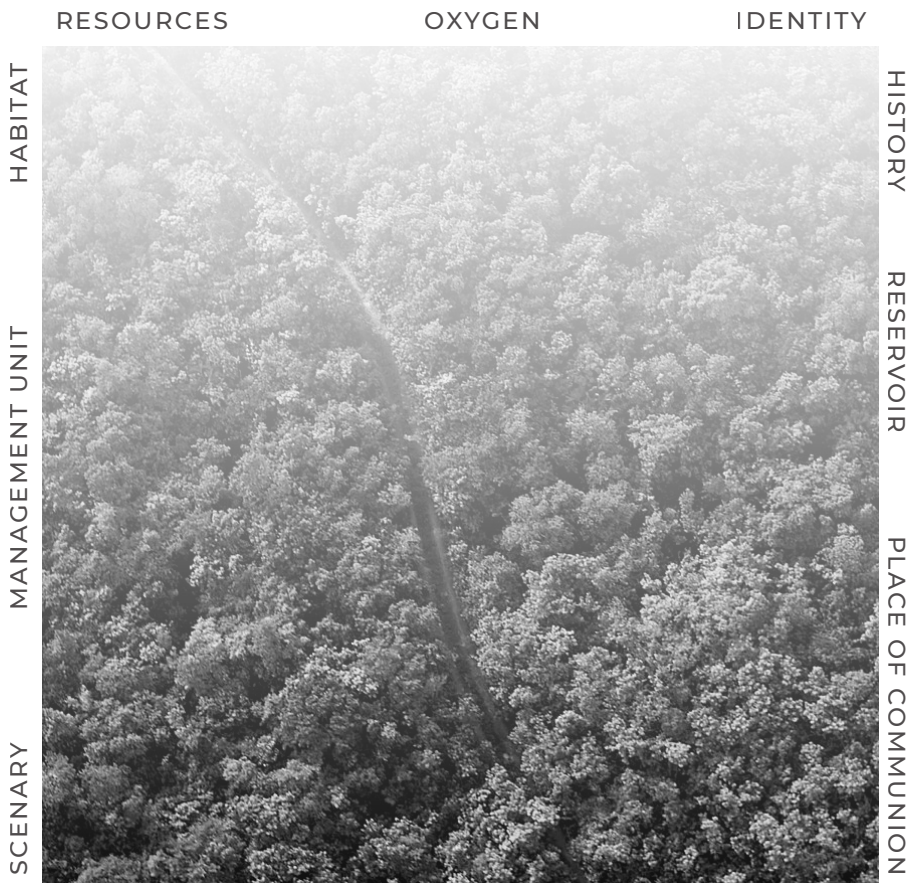
5.4 Area of intervention

5.5 Practices of care

5.6 Productive heritage

5.7 Units of engagement

5.1 WHAT ARE WE VALUING



What is a forest?

FIG.20 Illustration made by author

The legal vacuums (obsolete DUP and EOP never published), are propitiating these exponential developments.

It is important that the communities are informed and defend their territory with a productive economic activity.

- Liliana Garcia,
Director of programs, Amigos de Sian Ka'an

There is a need for a terriorial reconfiguration that incorporates the communities into the value chain.

Riviera Maya has an expiration date, culture does not.

- Yesenia Maraí Tello Leyva
Sustainable Tourism Program Coordinator,
Amigos de Sian Ka'an

The Mayan jungle has never been pristine nature. This jungle has been a managed landscape for centuries and it responds to the needs of the culture.

These communities have the knowledge, we support them in terms of governance and better policies.

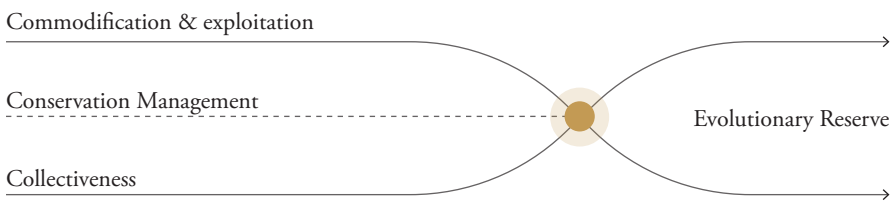
- Hugo Cardenas Rodriguez,
Coordinator of the Yucatan Peninsula
for the Sustainable Territories Program, TNC Mexico

Economic growth in developing countries is often paralleled by a gradual but constant decrease in resources and fragmentation of the landscape. By redefining development from the perspective of the system, developing countries can grow their infrastructure and building stock, and meet the needs of their society, while moving away from the linear economic model which is putting long-term development ambitions at risk.

There is an urgency to step away from focusing on a single sector or industry. Rather, we should ask ourselves what is essential and what will be the longue durée. There is an opportunity to define collaborative strategies to develop a circular economy in line with national objectives, make more efficient use of resources and giving back the surplus. The desirable institutional change is one that recognizes the plurality of voices, practices and knowledge systems.

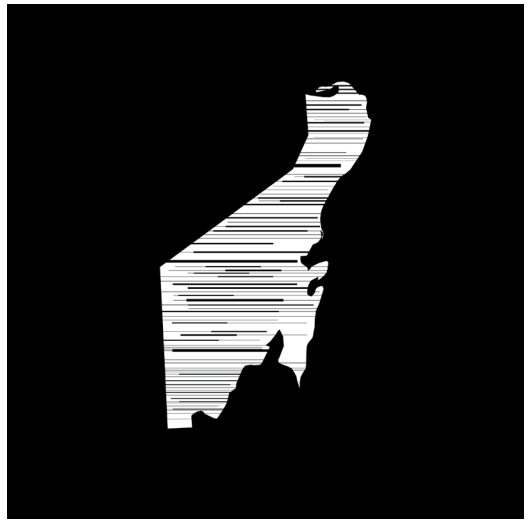
EVOLUTIONARY RESERVE





The current disruption of cycles imposed by paradigms of modernity and different cultural constructions and management of nature have pushed the local indigenous communities to live in a world of in betweenness.

With Evolutionary Reserve, the intention is to move away from the dichotomy of man and nature and propose a new spatio-temporal relationship with the place by the functional connectivity of ecosystems and the socio-cultural integration in the development of the territory. The project starts from the recognition of natural and social capital and proposes a new territorial management post-conservation. Not harmony with nature but working with nature through bio-cultural restoration, restoring not only ecosystems, but human and cultural relationships to place.



"Indigenous communities have survived previous climate challenges but not today's displacement"
– Julia Watson.

FIG.21 Illustration made by author

5.2.1 DESING VALUES

TRADITIONAL
ECOLOGICAL
KNOWLEDGE

We are borrowing from the future.

Indigenous knowledge and resource management systems are not mere traditions but adaptative responses that have evolved over time. Local and traditional knowledge is about practice, and that is why it can be protected by protecting practice, not by collecting “best practice” cases in a museum sense. It can serve economic development and livelihoods and appropriate, land-based economic opportunities, can serve knowledge development.

The remaining pockets of traditional systems can transform themselves into diverse and creative hybrid systems that build on traditional ways of knowing, and take advantage of windows of opportunity during times of crisis. They can also inspire new approaches to environmental stewardship, and suggest more participatory and locally grounded alternatives to top-down, centralized environmental management (Berkes, 2018).



FIG.22 Illustration made by author

5.2.2 DESING BRIDGE

NATURE BASED SOLUTIONS

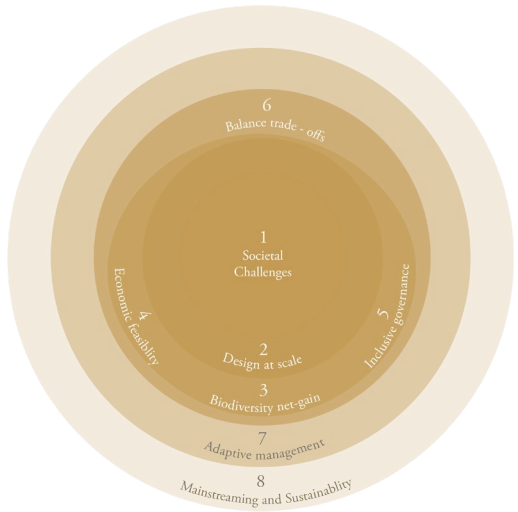


FIG.23 |UCN Global Standard for NBs

It is essential to bridge the gap between western versus indigenous forms of conservation and management of nature and to recognize indigenous people as participants and co-managers in this process. However, this asks us for a cross-cultural concept of conservation. The conservationist belief holds that there is an inverse relationship between human presence and the well-being of the natural environment. For many indigenous peoples and for much of the rest of the non-western world, the distinction between nature and culture is meaningless (Berkes, 2018).

One common goal between western and indigenous conservation approach is sustainability and one way to weave these worldviews is in the way of the transformation the system taking into account not only biological processes but also economical and cultural ones. The project found that Nature Based Solutions could provide this bridge and bring forward the potential to forge new ethical principles for ecology and resource management.

Traditional systems inspire a new resource management science open to the participation of resource users in management, one that uses locally grounded alternatives to top-down centralized resource management (Berkes, 2018).

Both tranditional systems and NBs work from an Adaptative management. They acknowledge that environmental conditions will always change, thus requiring management institutions to respond to feedbacks by adjusting and evolving. It takes a dynamic view of ecosystems, emphasizes processes and cycles and stresses the importance of resilience.



FIG.24 Illustration made by author

5.2.3 DESIGN PRINCIPLES

ALIGNING PRACTICES STRATEGIES AND GOALS



Recognition

By recognizing the systems' interactions and redefining the local paradigm of development from its perspective. Define collaborative strategies to develop a circular economy, in line with national objectives and international goals against climate change and to achieve social and natural justice.

Reconfiguration

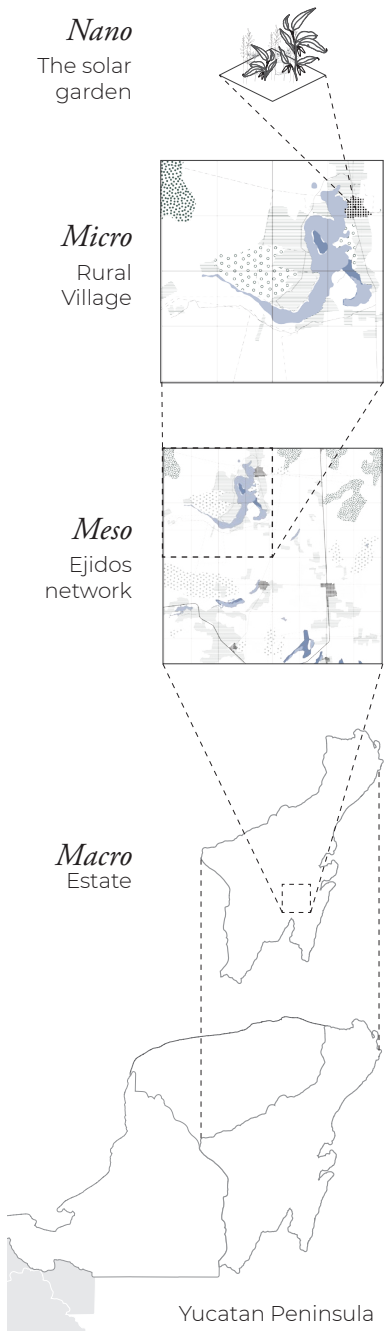
Design for slowing down in order to multiply the benefits. Smart re-interpretations of ancient practices, integrating modern technology and bold contemporary interventions through nature based solutions that recognize a bottom-up approach.

Reconciliation

Convergences between public, private and the local communities.

5.2.4 DESING FRAMEWORK

SCALES OF ENGAGEMENT

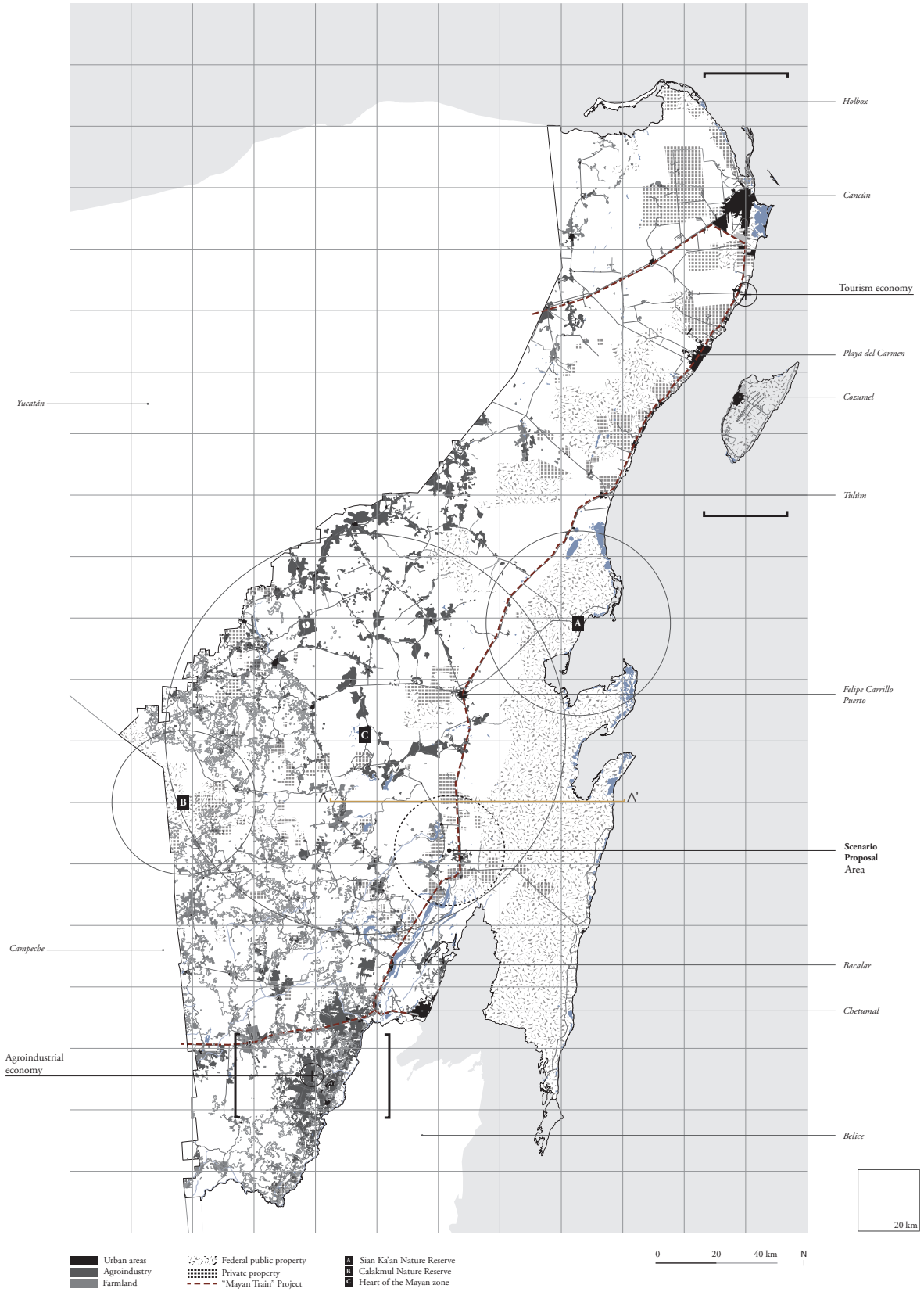


The Mayan forest is losing more than 12,000 ha per of tree cover a year since 2003, largely to cattle ranching, mechanized agriculture, subsistence farming and wildfires and Federal government's plans for a proposed rail project would lead to more clear-cutting (CONABIO, 2018).

In contrast to the production system based on the milpa, today in Quintana Roo agro-industrial and mechanized production systems are advancing, which have severely damaged and destroyed the territories covered by jungle. In the last 20 years, the cultivation of sugar cane, soybeans, lemon, papaya, pineapple and watermelon has advanced remarkably (CONAFOR, 2018).

On average, 1,882 ha per year are lost of forest and mangrove vegetation due to tourist infrastructure, 5,904 ha per year lost due to the advance of agribusiness and 4,900 ha per year due to livestock activity. In total, 4.4 million ha covered by highly biodiverse forest ecosystems are threatened which represent 83% of state coverage (CONAFOR, 2018).

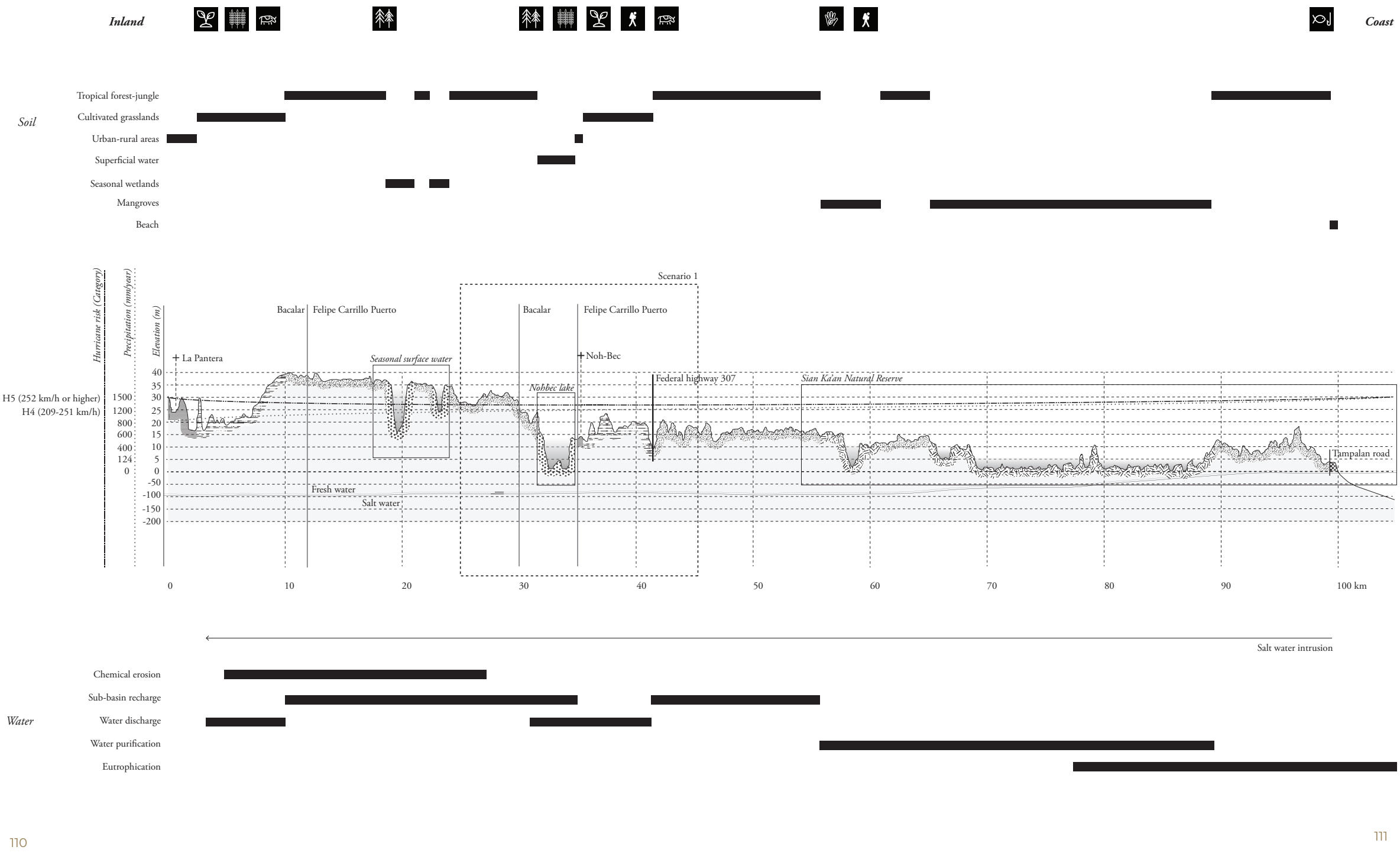
By recognizing the systems' interactions and redefining the local paradigm of development from its perspective there is an opportunity to define collaborative strategies to develop a circular economy, in line with national objectives and international goals against climate change and to achieve social and natural justice.



5.3 SYSTEMIC SECTION

HUMAN AND NON-HUMAN COMPLEX INTERACTIONS

The systemic section shows the current dynamics between atmosphere, surface and subsurface and how land cover and economic actitivites are affecting and accelerating the erosion of the land and the contamination of the aquifer.

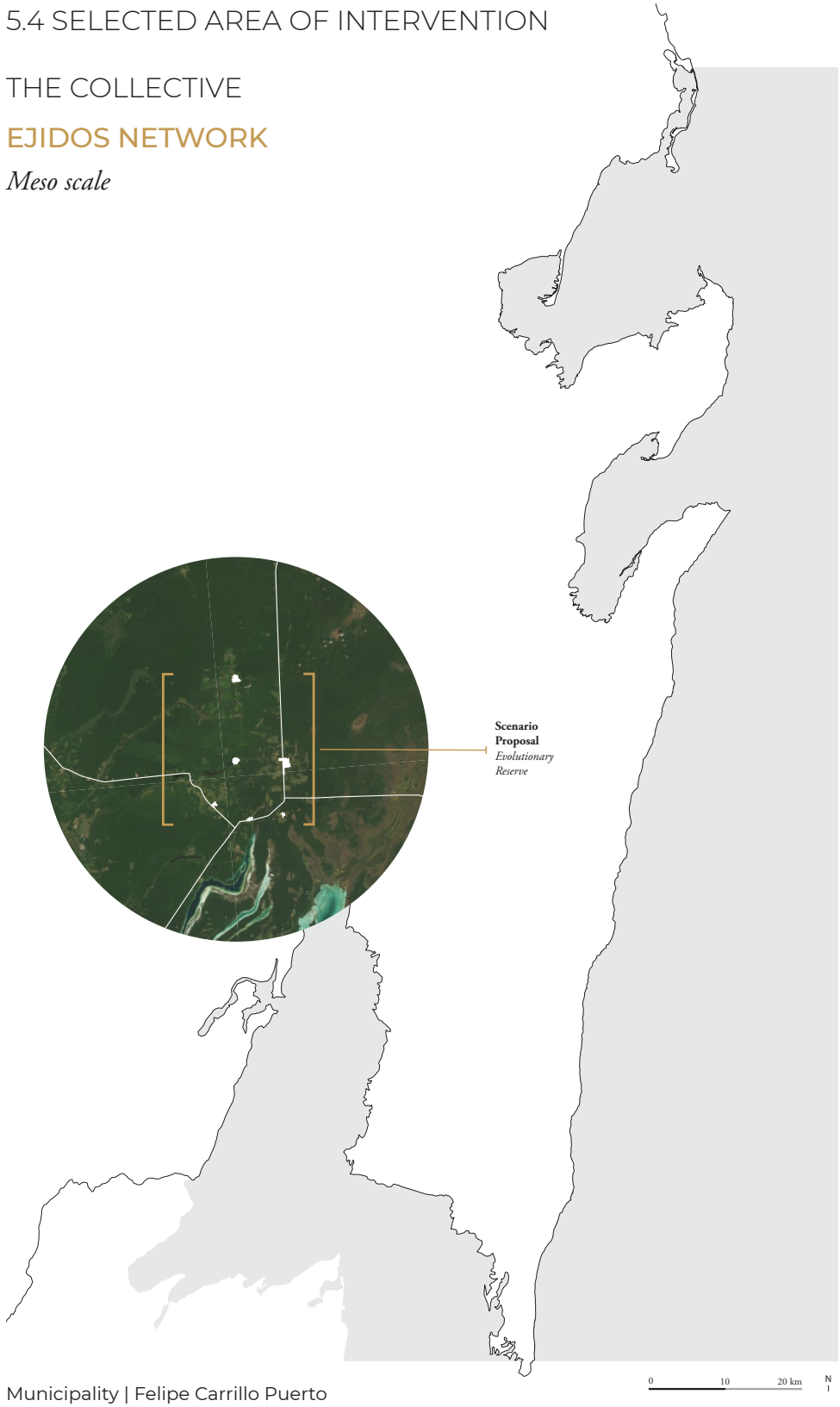


5.4 SELECTED AREA OF INTERVENTION

THE COLLECTIVE

EJIDOS NETWORK

Meso scale



Municipality | Felipe Carrillo Puerto
Population density | 6.5 hab/km2
Presence of indigenous communities | 59.48%

The proposed area of intervention is located at the heart of the Mayan zone, which is threaten from touristic development advancing from the north and the agroindustry coming from the south of the state. Located in the Municipality of Felipe Carrillo Puerto, the communities of Noh-Bec, Limones and Lazaro Cardenas would be the testing ground for the project.





Noh-bec

Population: 2,052 people



Limones

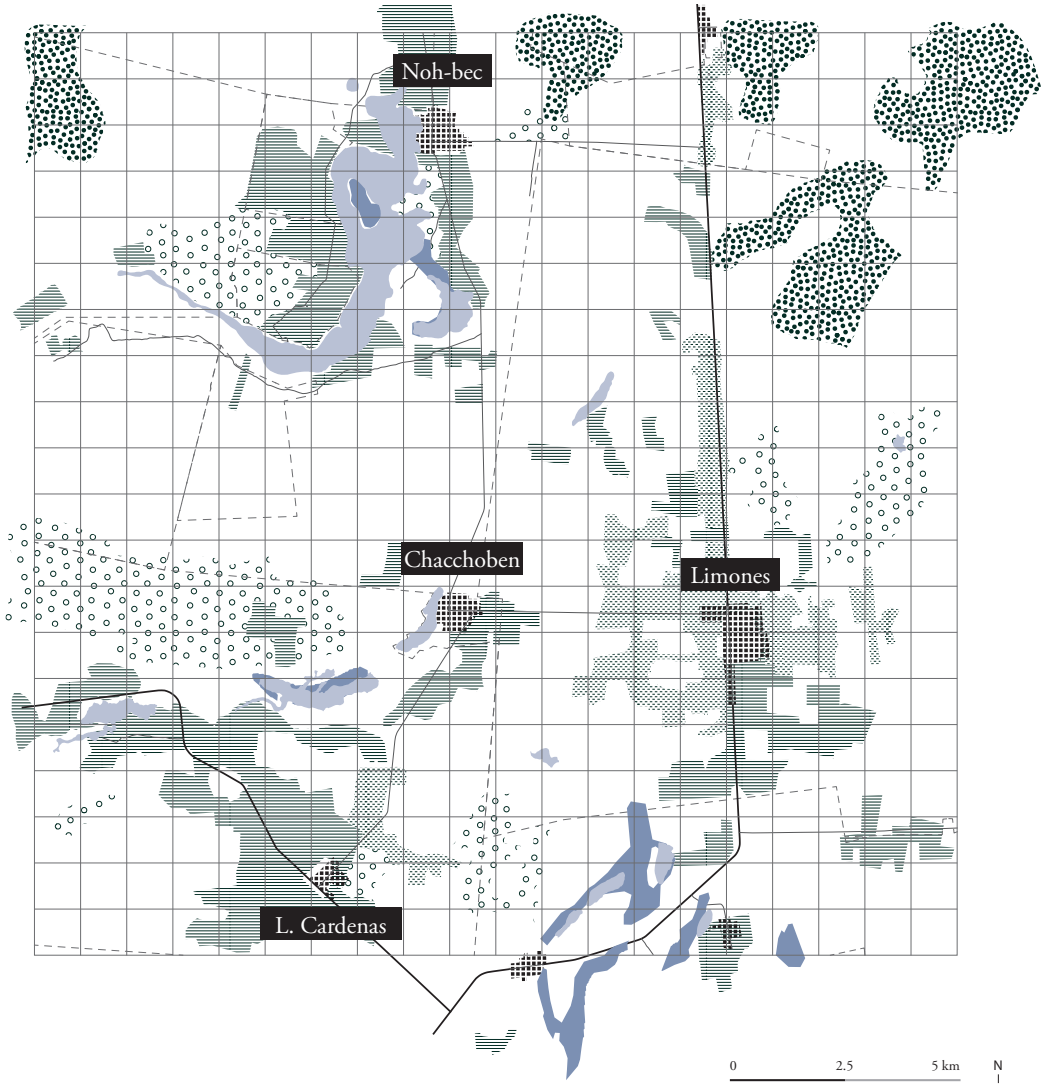
Population: 2,739 people



L. Cardenas

Population: 421 people

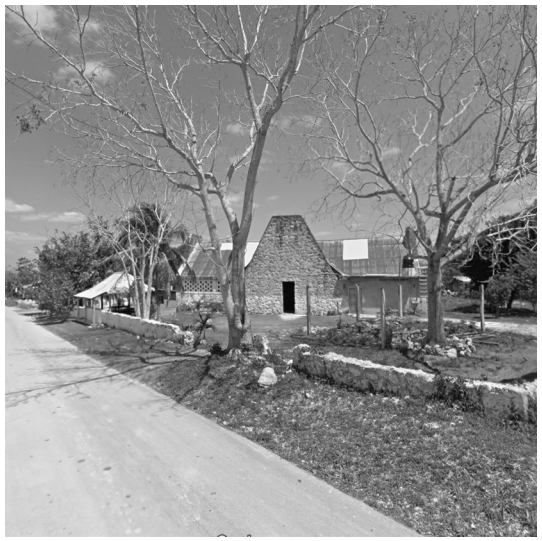
Current land use



AUTONOMY AND
COOPERATION

THE VILLAGE

Micro scale



The extensive knowledge about the natural capital of the territory reached by the ancient cultures for millennia and through complex nature-society interaction processes, is being reduced by situations of extreme poverty and massive migrations of rural and indigenous communities, due to the disintegration of their community organizations, which has its origin in erroneous agricultural, economic and commercial development policies.

All this entails the loss of important traditional wisdom to achieve sustainability and the conservation of natural resources (CONABIO, 2017).

THE ESSENTIAL

THE SOLAR GARDEN

Nano scale



The solares are smaller gardens located near the household predominantly managed by women.

This small mosais include a variety of plants that could be ornamental, medicinal, and gastronomic for household consumption and possibly for sale when they have surplus. They plant root vegetables, tomatoes, peppers, leafy greens, and fruit trees (especially papaya, orange, lime, and mango) (Martinez-Reyes, 2016).

THE MILPA



The Selva Maya has been under transformation for thousands of years.

The milpa is the most widely known agroecological system of the ancient maya civilization that to this day, remains central to traditional agricultural practices in the Yucatan Peninsula (Watson, 2020).

From the Nahuatl “mil-pa”, meaning “cultivated field”, this process encompasses much more than just the polyculture of the parcel with what is known as the Mesoamerican triad or “the three sisters”, involving maize, pumpkin and beans, but it is also the way through which local indigenous communities relate to nature, physically and spiritually (Martinez-Reyes, 2016).

Centered mainly on maize production, traditional Mayan milpa farmers support forest ecosystem services by planting and protecting trees that accelerate post-agricultural succession. This rotating cultivation system with a cycle of ten to twenty-five years, is the main productive activity and represents the daily livelihood in rural areas.

Milpa shapes woodland ecosystems without the use of fertilizers and pesticides. This contemporary swidden cultivation system is activated by fire and involves the regeneration of woody vegetation after a period of annual cropping and reduces weed infestation by taking the space weeds would need to grow (Watson, 2020).

The swiden, also refered to as “slash-and-burn” has been criticized and misunderstood for its potentially negative effect on soils and forests but the reality is that the use of fire reduces weeds and pests, releases soil nutrients, replenishes nitrogen, and adds phosphorous, potassium, magnesium, and manganese contained in the ash to the soil. In this specific region with karstic soils, burning releases calcium, which is essential for crop production. When properly managed, the milpa swidden cycle results in enriched anthropogenic soil (Watson, 2020).

The Mayan ritual calendar is interwoven with the annual agricultural cycle and ceremonies which are performed at each stage of maize growth, beginning with the planting and concluding with the harvesting (Martinez-Reyes, 2016).

Mayan milpa is valuable today as we face the urgent need for ecological restoration, preservation of genetic biodiversity, and the renewal of rural livelihoods. With this agroecological system, indigenous communities have managed complex ancient agroforestry ecosystems to meet their physical, economic, cultural, and spiritual needs (Watson, 2020).







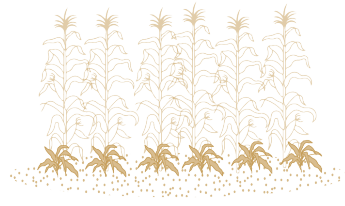
MILPA LIFE CYCLE



Solar garden
Pach Pakal



Clearance
Kol



Milpa
Kool
1 - 5 years



Sak'abb
3-5 years



Sak'abb-hubche'
3-5 years



Hubche'
< 10 years



Ka'anal - hubche'
10-15 years



Kelenche'
15-30 years



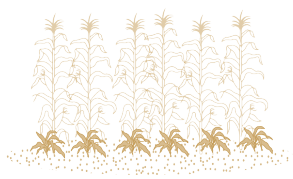
Ka'anal k'aax
> 50 years



Mature forest
Suhuy k'aax



Solar garden



Milpa

5.6 PRODUCTIVE HERITAGE

SPATIO-TEMPORAL ENGAGEMENTS

But the milpa is not the only practice with which the indigenous communities engage with nature.

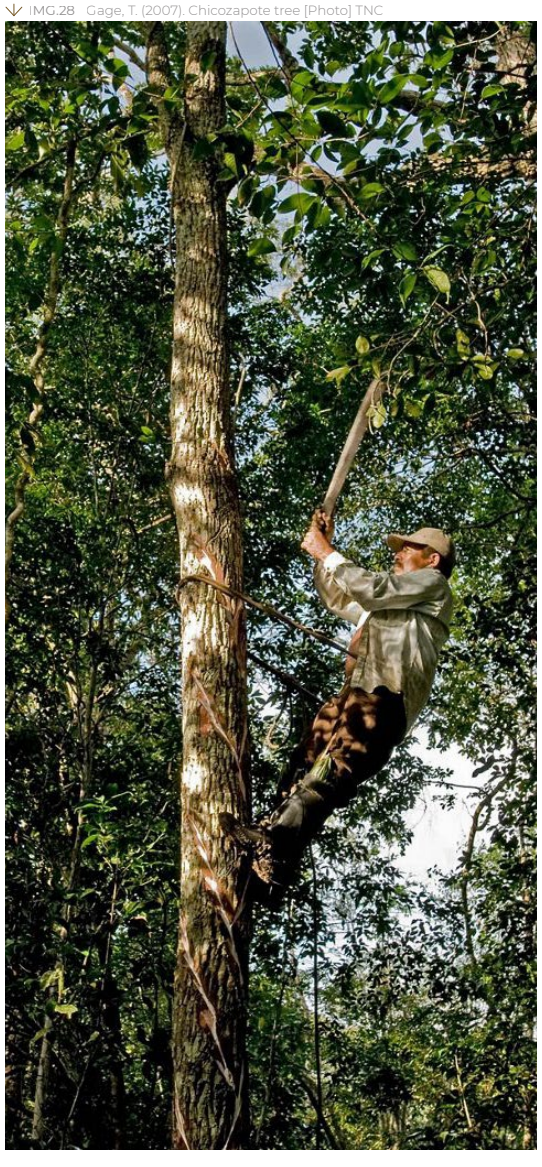
Throughout the region, responsible and sustainable stewardship of the landscape can be seen and understood from other productive heritage practices such as beekeeping, gum extraction from the endemic tree of Chico Zapote, forest community management, silvopastoral livestock, and finally by bio-cultural reserves where TEK is shared with visitors and younger generations.

These practices, not only help the environment through reforestation, natural pest control, carbon sequestration, soil creation or aquifer recharge among other ecosystem services, but also they further strengthen the local's connection to place and in exchange, the landscape provides food security, health, scenery, cover and an increase in biodiversity.

IMG.26 Godfrey, M. (n.d.). Extracting gum from tree [Photo] TNC



IMG.28 Gage, T. (2007). Chicozapote tree [Photo] TNC



IMG.29 Schlegel, E. (n.d.). Silvopastoril activity [Photo] TNC



IMG.27 CCMSS (n.d.). Beekeepers [Photo]



IMG.30 Schlegel, E. (n.d.). Milpa [Photo] TNC



IMG.31 Keller, P. (2017). Jungle Road [Photo] TNC



5.6 PRODUCTIVE HERITAGE

NATURAL AND SOCIAL CAPITAL



Solar garden

Medicinal plants

Food security

Beekeeping

Pollination

Milpa

Soil improvement

Water filtration

Food security

Biological pest control

Spiritual connection to place

Agroforestry

Soil fertility

Reduce erosion

Carbon sequestration

Increase biodiversity

Biological pest control

Water filtration

Provide habitat

Community Forest Management

Soil fertility

Carbon sequestration

Increase biodiversity

Provide habitat

Recreation

Evapotranspiration

Aquifer recharge

Natural Reserve

Protect biodiversity

Provide habitat

Recreation

Evapotranspiration

Aquifer recharge

BIO-CULTURAL UNITS

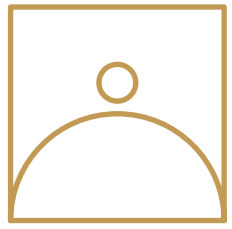
After the extensive research on critical zones, TEK and productive heritage and delimitation of the area of intervention, I tried to answer my research question with various possibilities that interconnected, would offer a wide arrange of scenarios and pathways.

Due to the complexity of the systemic relations and in order to better understand the processes, cycles and dynamics of the management of the land, the project proposes the use of bio-cultural units.

Each bio-cultural unit was inspired and based on the practices of care and productive heritage of the region, with the goal of creating bridges between scales and practices.

Furthermore each unit correspond to a scale of engagement and the connection between units will determine the mosaic rhythm of the new co-produce landscape.

More detailed explanation of each unit and their characteristics will follow in the next pages.



The seed

Nano

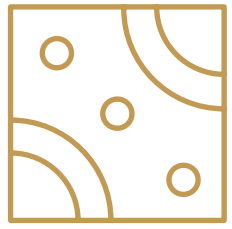
Community center



The harvest

Micro

Village



The network

Meso

Ejido



The next reserve

Meso - Macro

Ejido network



The seed

Scale | Nano

Community center

Solar gardens - *Ka'anches*

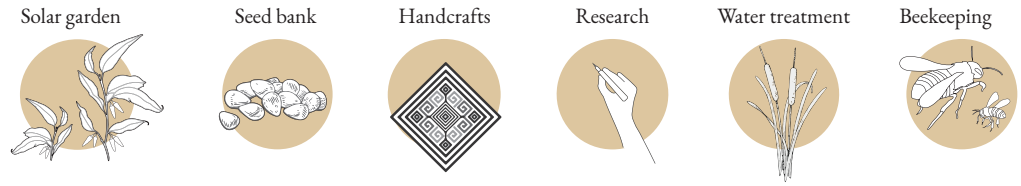
Time cycle | Year round

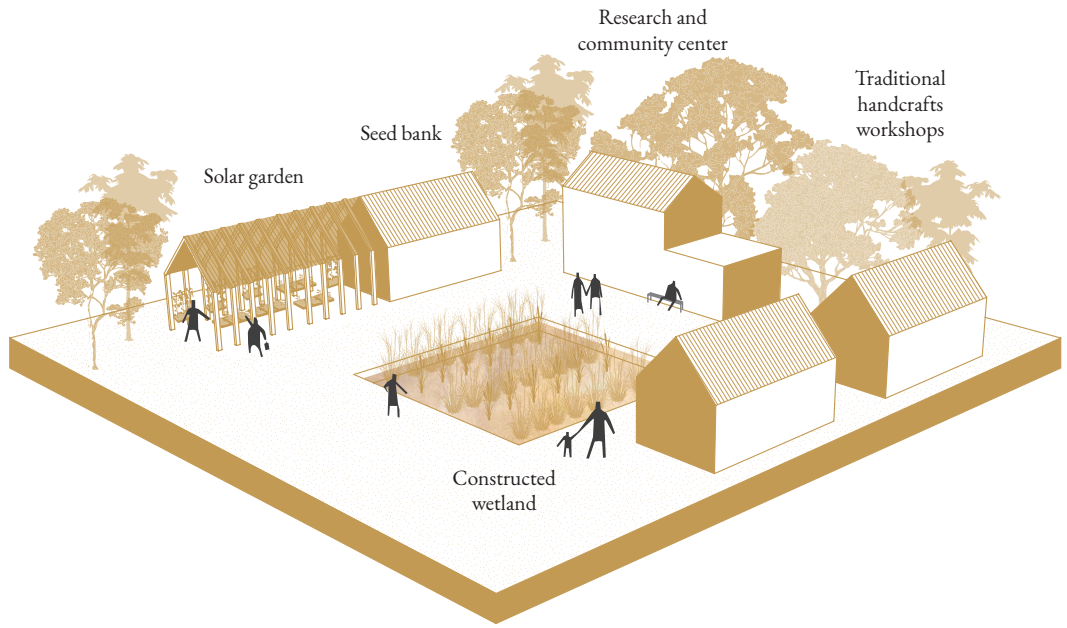
Ecosystem Services | Food security, pollination, water filtration, medicinal.





↑ IMG.32 HG, R. (2018). Solar garden [Photo] Mexicodesconocido
← IMG.33 Rebolled, P. (2018). Indigenous women [Photo] Unsplash





The first unit corresponds to the smallest scale: the solar gardens and the seeds.

The seed represents the most essential part of the cycle where the milpa, the forest and the reserve find its beginning and end. This part of the landscape mosaic offers as program a seed bank where the "milperos" (men of the milpa) and women of the community can select and store the best seeds for upcoming farming seasons. Next, the possibility of a community center, where the locals can share their traditional handcrafts, have workshops for the design of the solar gardens or simply as a public forum, for future governance meetings. The addition of a research center offers the possibility of a partnership with academia, to test new biological pesticides, different crop rotation and soil regeneration and to study wildlife and biodiversity in the surrounding biological corridors.

But nothing could be possible without water. As already described in the first part of the research, water charge and discharge present a difficult challenge for these remote communities. At this scale, the necessary infrastructure to treat waste water is nonexistent as many rural communities do not have a drainage and sewage system in place. As a consequence, waste waters go directly to the aquifer without treatment. For this reason, this unit proposes the construction of an artificial wetland with the purpose of water treatment.

BIO-CULTURAL UNITS



The harvest

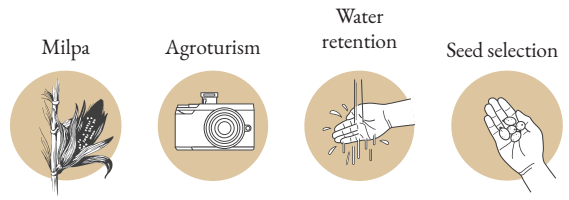
Scale | Micro
Milpa

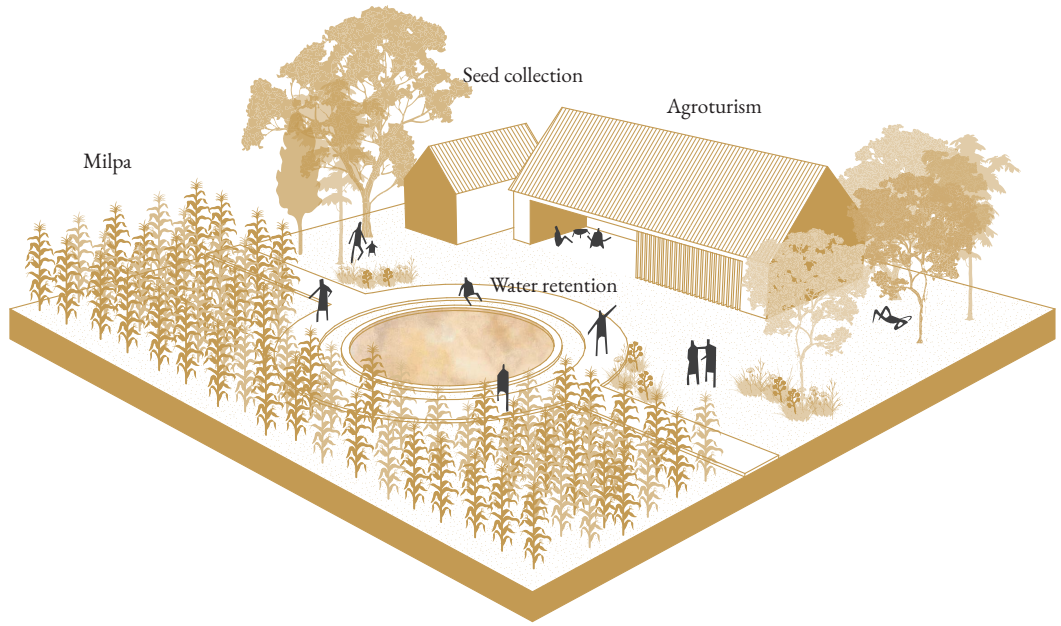
Time cycle | 0-15 years

Ecosystem Services | Food security, soil creation, water retention, scenery, education, recreation.



IMG.34 Schlegel, E. (2017). Milpa harvest [Photo] TNC





The second unit corresponds to the milpa and its harvest.

The harvest offers a new lens with which to showcase the Milpa process, value its wisdom and share it with visitors how like to partake in activities such as agrotourism. By offering the possibility to walk around the milpa to tourists, we could finally take the first steps to elevate the indigenous knowledge and focus on the intangible heritage instead of the physical one. Paying attention to the person and not the object. Furthermore, the addition of storage huts for the harvest and the seeds will help the cycle and its continuity.

But again, nothing could be possible without “santa agua” (holy water). This part of the mosaic presents the proposal of the use of a locally known chultun or Mayan cistern. A chultun is a bottle-shaped underground storage chamber built by the pre-Columbian Maya in southern Mesoamerica. Their entrances were surrounded by plastered aprons which guided rainwater into them during the rainy seasons. These cisterns offer the possibility of collecting water during rain season and use it for the harvest during dry season. Moreover, when dry the function as an excellent storage for food that could make it last longer.



The network

Scale | Meso
Village

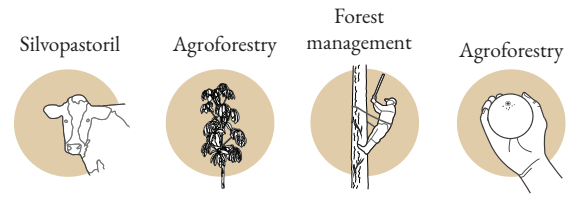
Time cycle | 0-25 years

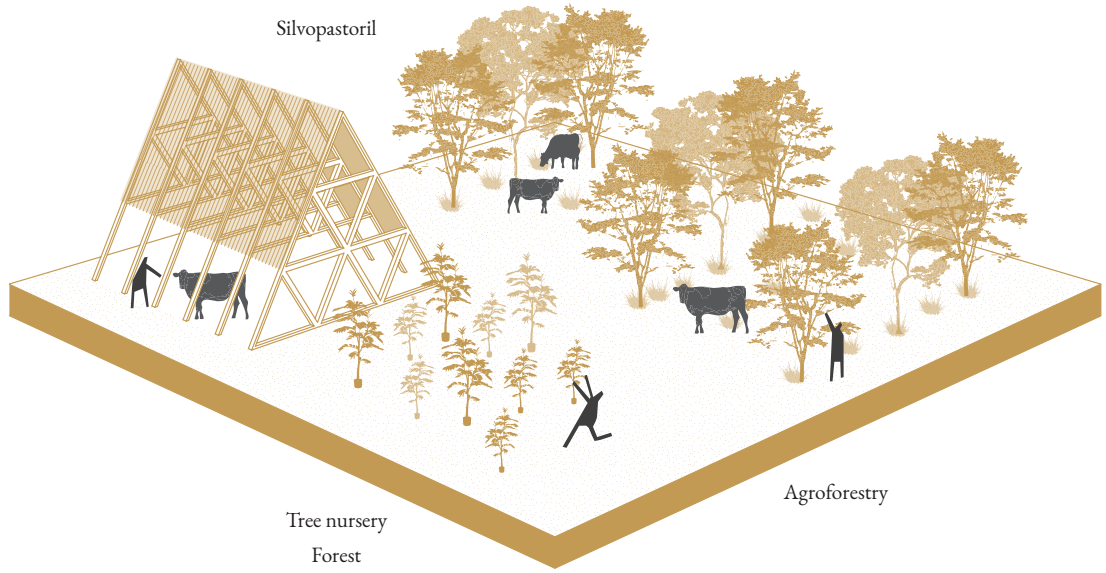
Ecosystem services | Soil improvement, water filtration, water recharge, carbon sequestration, evapotranspiration.





↑ IMG.35 Schlegel, E. (2017). Silvopastoril practices [Photo] TNC
← IMG.36 Schlegel, E. (2017). Ejidos Forest Producers of the Maya Zone S.C. [Photo] TNC





The third unit corresponds to the bigger scale of the Ejido and its possibilities to form partnerships with surrounding Ejidos in order to form a network.

The network represents the regeneration of the system. With tree nurseries, agroforestry and silvopastoral practices, this mosaic helps with the goal of thoughtful reforestation while adding economic value to the process. The raising of cattle, the harvest of fruit trees and the selling of wood and gum represent an important source of food and income for these rural communities. The network could empower the communities to form collectives, where the green economy could flourish.

Furthermore, this unit is in charge of the more extensive recharge of the aquifer while at the same time, providing more stock for evapotranspiration and carbon sequestration.

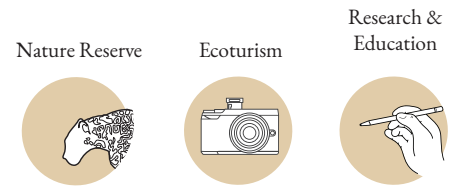
BIO-CULTURAL UNITS

The next reserve

Scale | Meso - Macro
Bio-cultural corridors

Time cycle | 25-50 years

Ecosystem services: Water recharge, evapotranspiration, increase biodiversity, carbon sequestration, recreation, scenery.







IMG.37 Schlegel, E. (2017). Kaxil Kiuic Biocultural Reserve Zone S.C. [Photo] TNC

The fourth and final unit corresponds to the next reserve. Like the seed, this mosaic represents the beginning and end of the cycle, first by the reconnection of biological corridors and later, by the possibility of providing the fertile grounds for a new community to develop and start again with the solar gardens and the milpas.

During its own cycle, the next reserve is managed by the communities with the network of ejidos alliance providing the possibility to access to international green funds, water bonds, and payment for ecosystem services, increasing the building capacity and the economic security of the communities. With the next reserve, my goal is to stop further parcellation and the wrong idea that if the environment is not exploited is not valuable.

Furthermore, this unit offers the possibility of a research and education center to share with locals and tourists important knowledge about the better care of the environment, our duty as stewards and to further study biodiversity.



↑IMG.38 Nortemann, E. (2020). Mayan woman [Photo]. TNC

VI. PROJECTION

6.1 The art of designing with nature

6.2 Operability

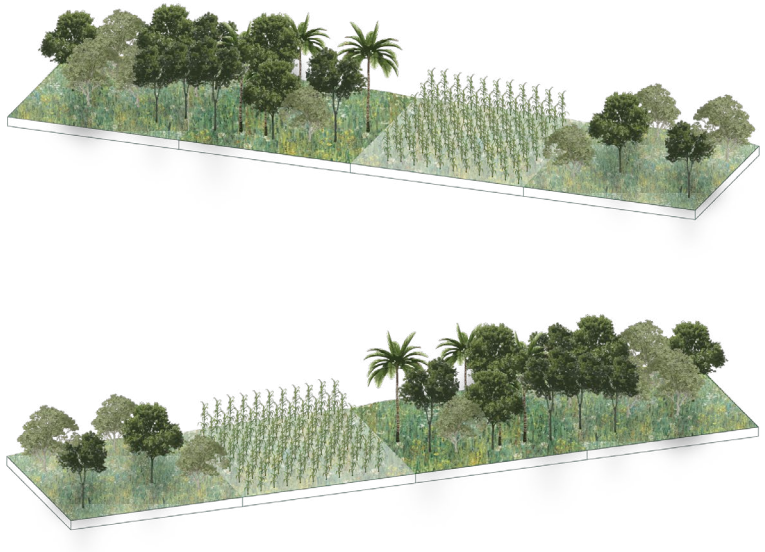
6.3 Unfolding Reserve

6.4 New systemic section

6.5 Systemic resilience

6.6 Partnerships

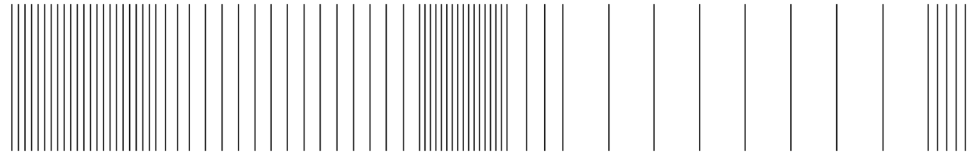
6. 1 THE ART OF
DESIGNING NATURE



Milpa | Agroforestry | Forest management | The next Reserve

Succesion

Adaptability



Evolutonary Resilience

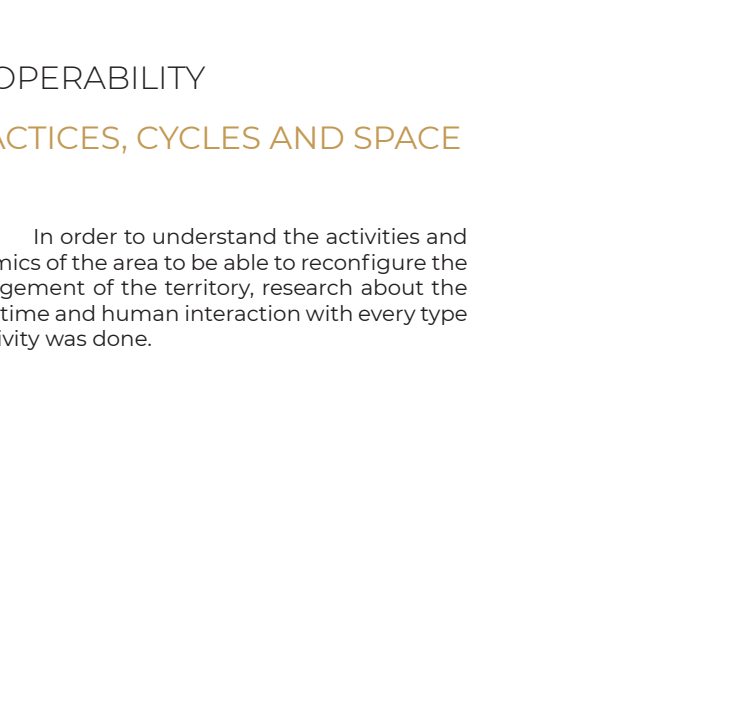
The key to managing the tropical rainforest is to focus on its resilience, rather than on its supposed fragility and unmanageability (Berkes, 2018).

The implementation of the different practices of care could return an infinite number of combinations. That is why, the project proposes the following approach, taking into account the current situation and how it could transition to achieve the goal of a co-managed cultural landscape.

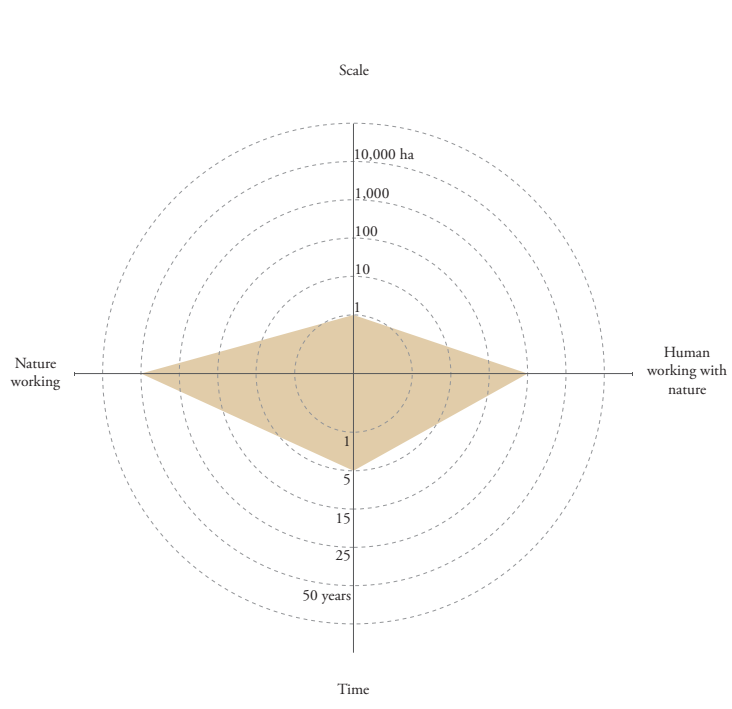
6.2 OPERABILITY

PRACTICES, CYCLES AND SPACE

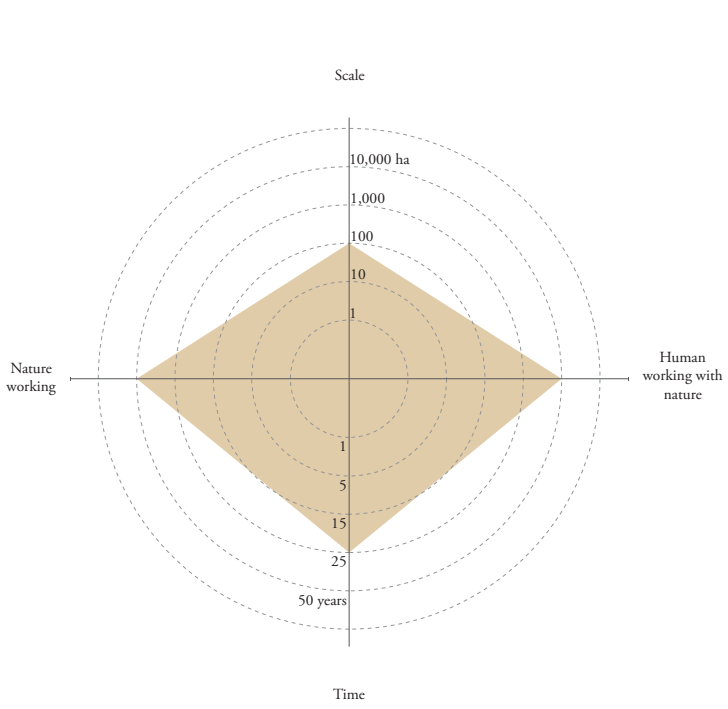
In order to understand the activities and dynamics of the area to be able to reconfigure the management of the territory, research about the scale, time and human interaction with every type of activity was done.



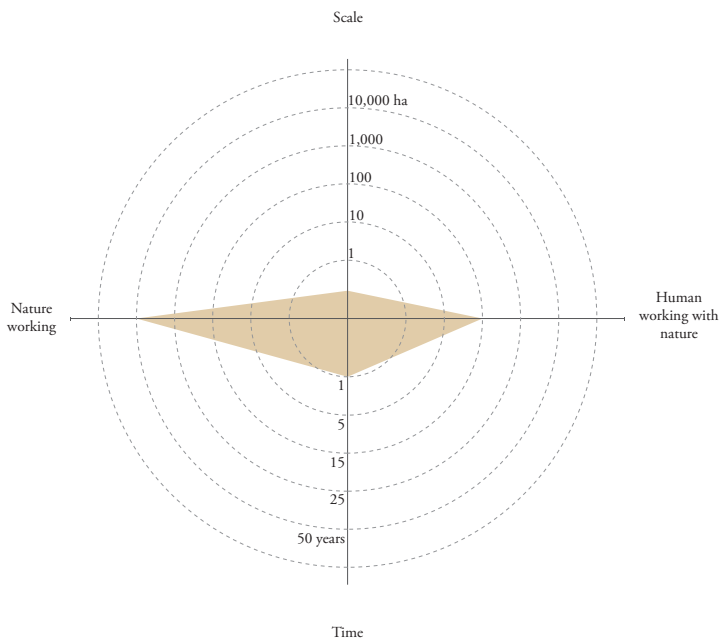
Solar gardens



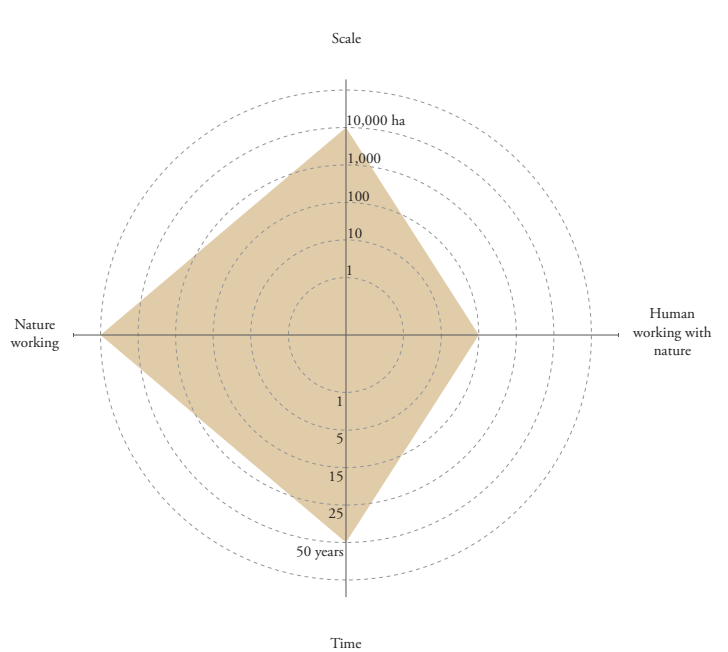
Milpa



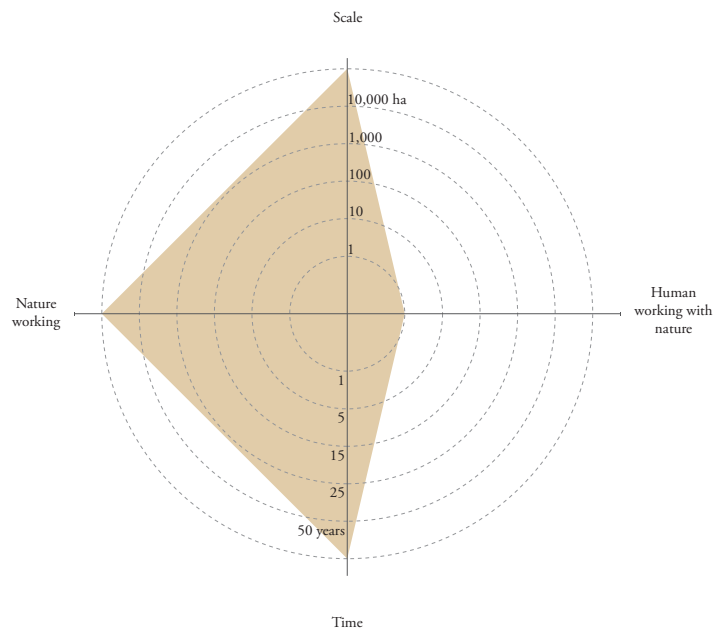
Agroforestry



Community Forest



An Unfolding Reserve

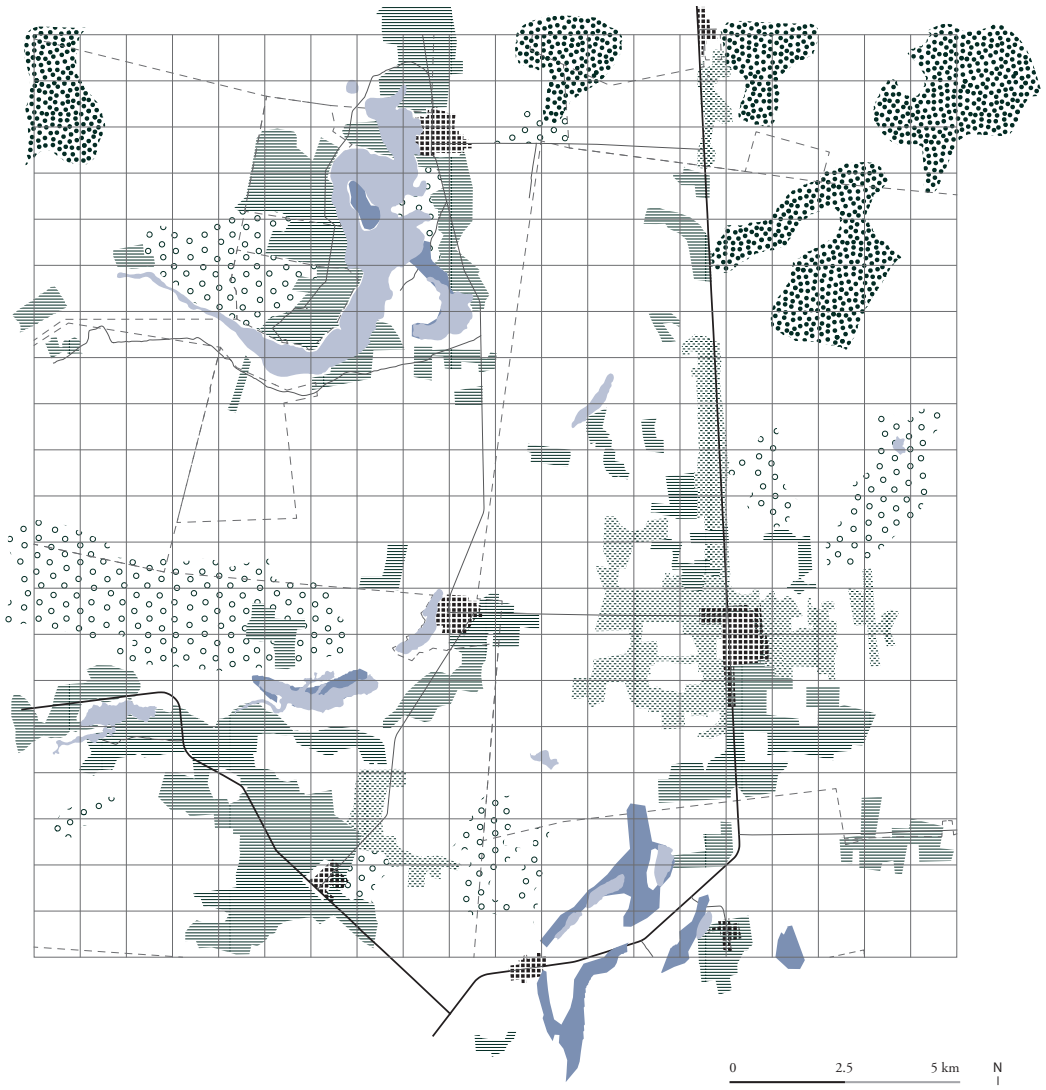


6.3 UNFOLDING RESERVE

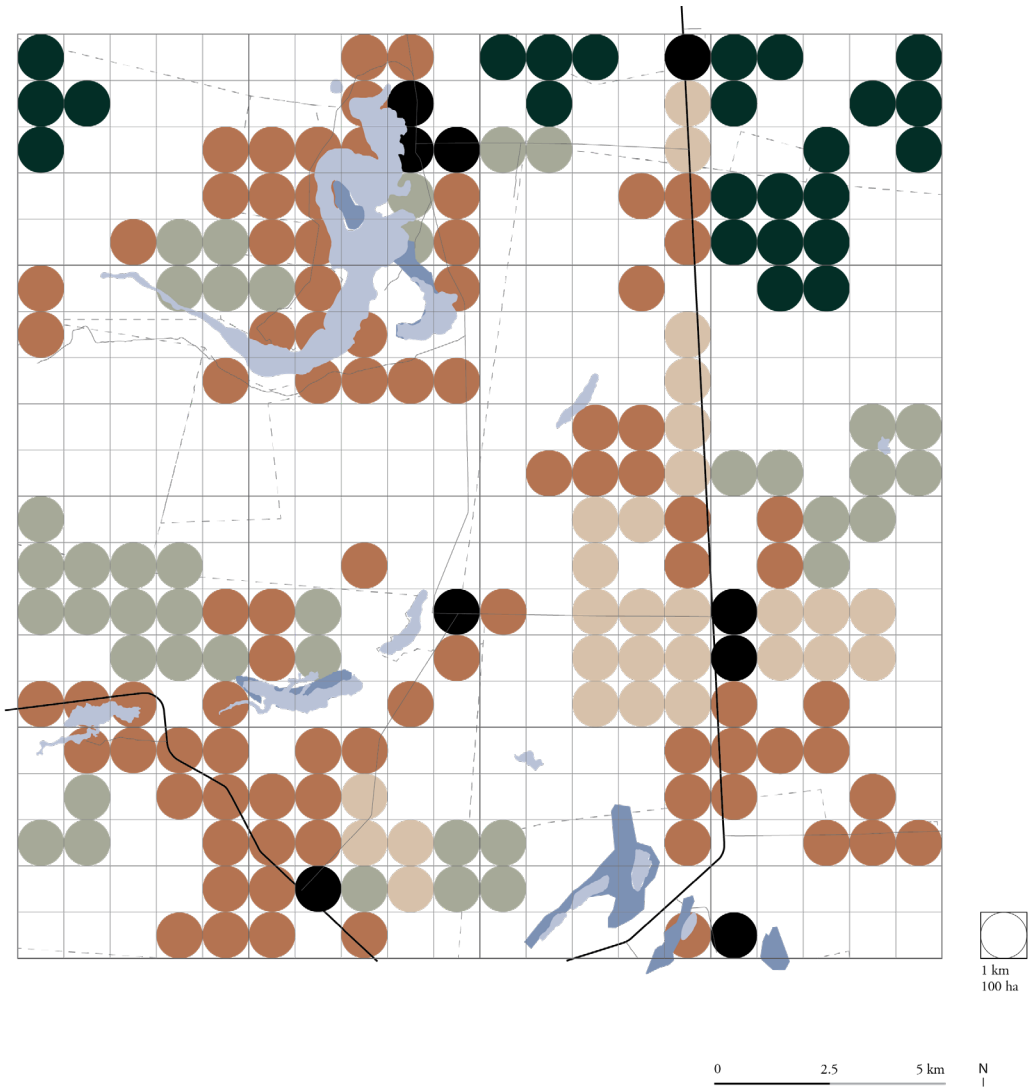
LANDSCAPE PHASING

The current situation presents a fragmented landscape where big parcels close to superficial waters are used for agroindustrial activities. On the other hand, there are a few patches of mature and medium forest and the rest (white space) are unmanaged secondary vegeation, such as bushes and low lying trees.

Current situation
Year 0



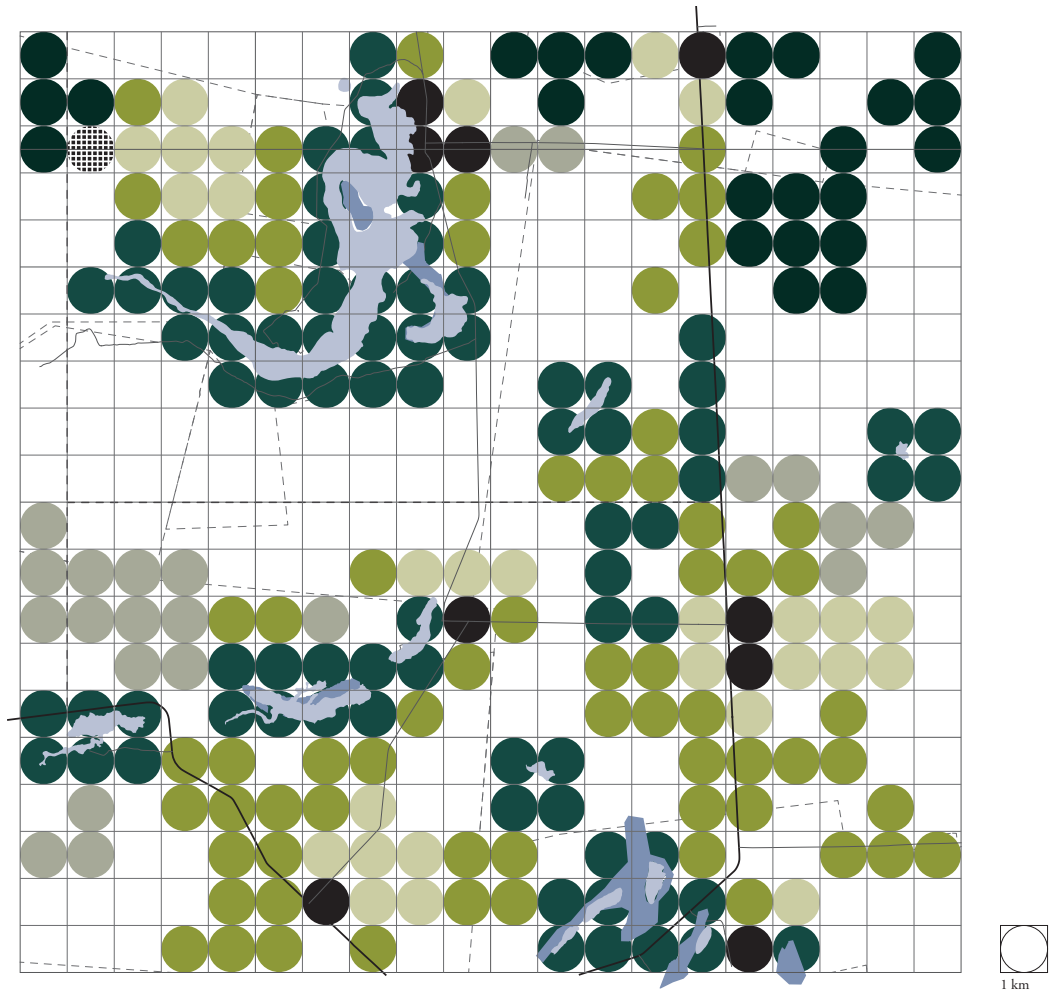
Current situation
Year 0
Translation to mosaics



The first step in the transition is to regenerate the areas surrounding superficial waters by creating a riparian buffer that will allow for water filtration before it contaminates the lagoons, lakes and sinkholes.

New proposed areas for milpa and agroforestry and forest management around current villages and cities are proposed.

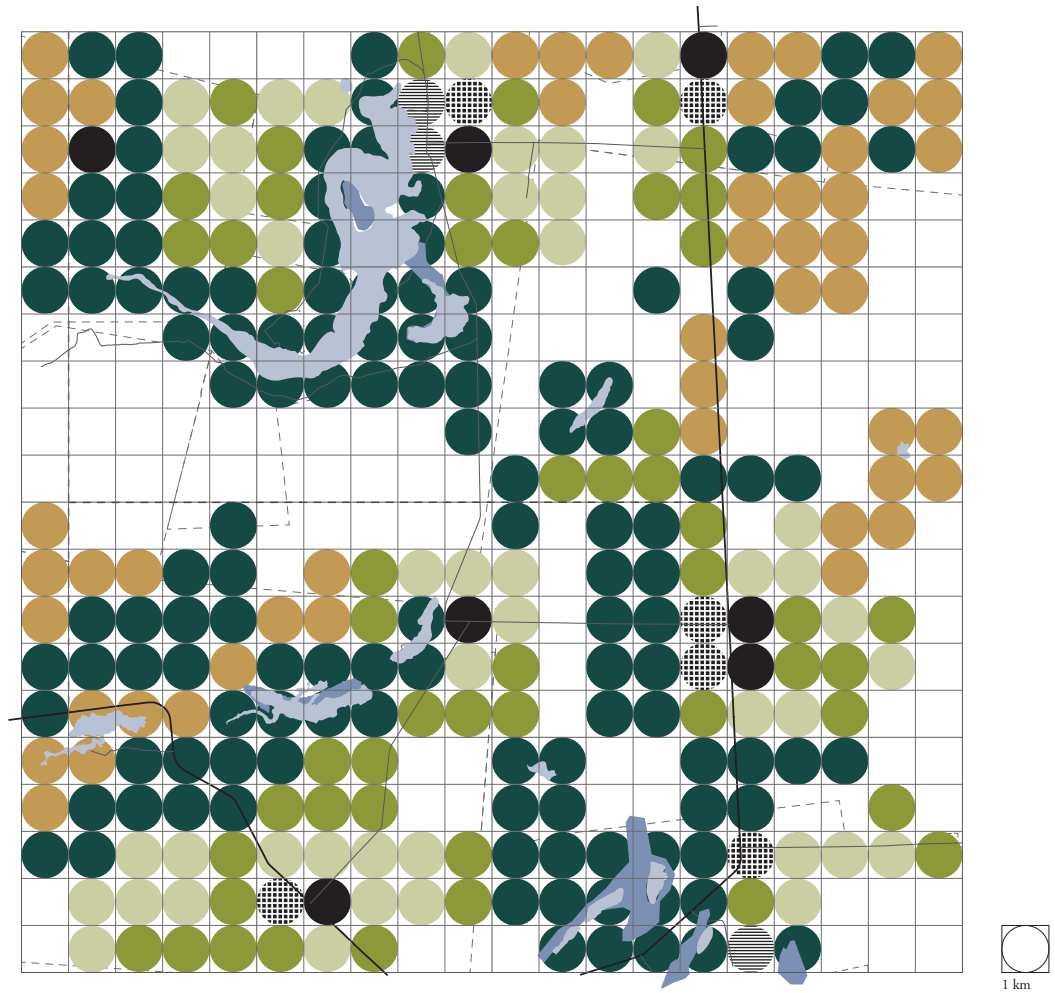
Years 0 - 5



Next, current mature forests are designated as reserve areas and a gradual reforestation process surrounding said areas starts in order to reconnect biological corridors following the principles of Forman (1996) in the creation of patch-corridor matrix.

Furthermore, the expansion, movement and creation of new management sub-cores is implemented.

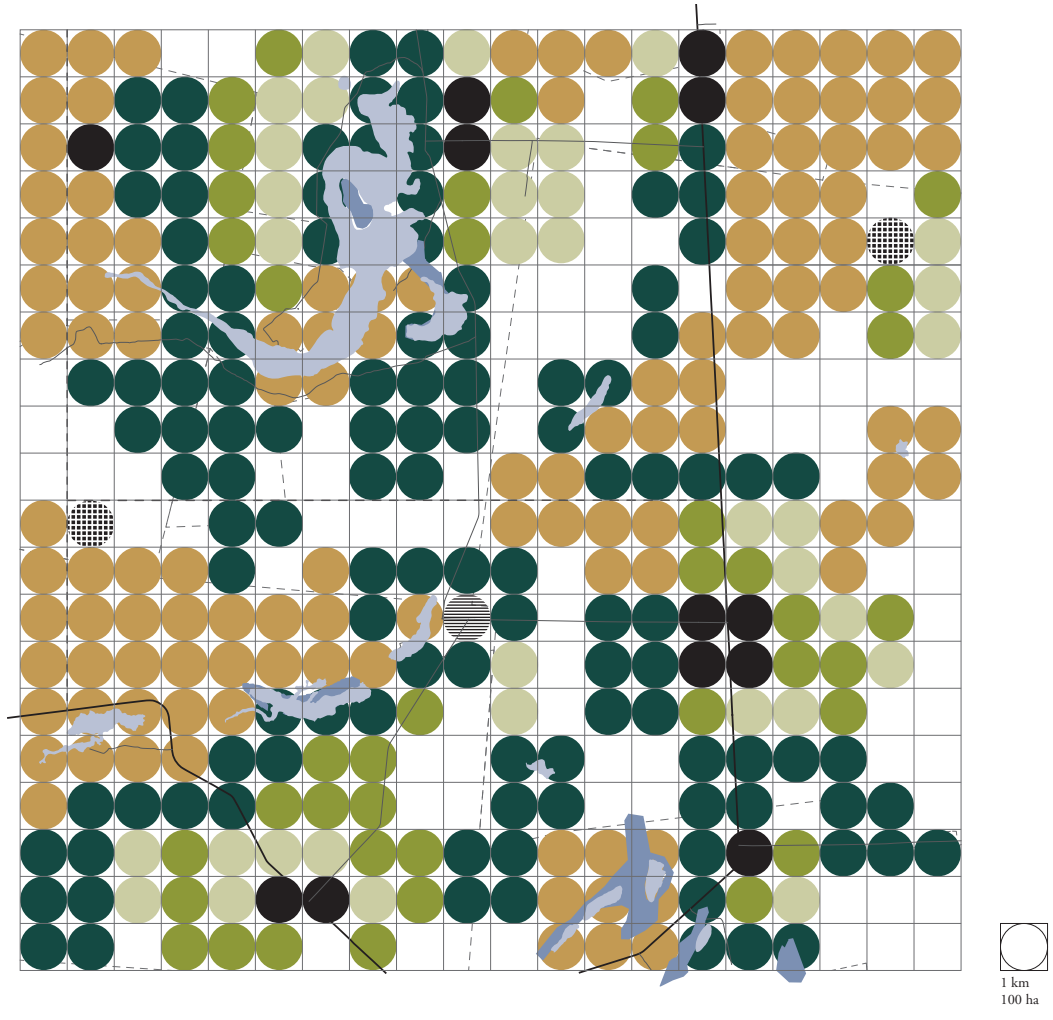
Years 5 -15



During this phase, the recognition of a bio-cultural corridor is more evident moving creating a connection between the current Federal Nature Reserve and the rest of the ejido network. The new reserve areas are managed my the community, offering ecoturism activities while at the same time being benefited by the payment of ecosystem services and water funds.

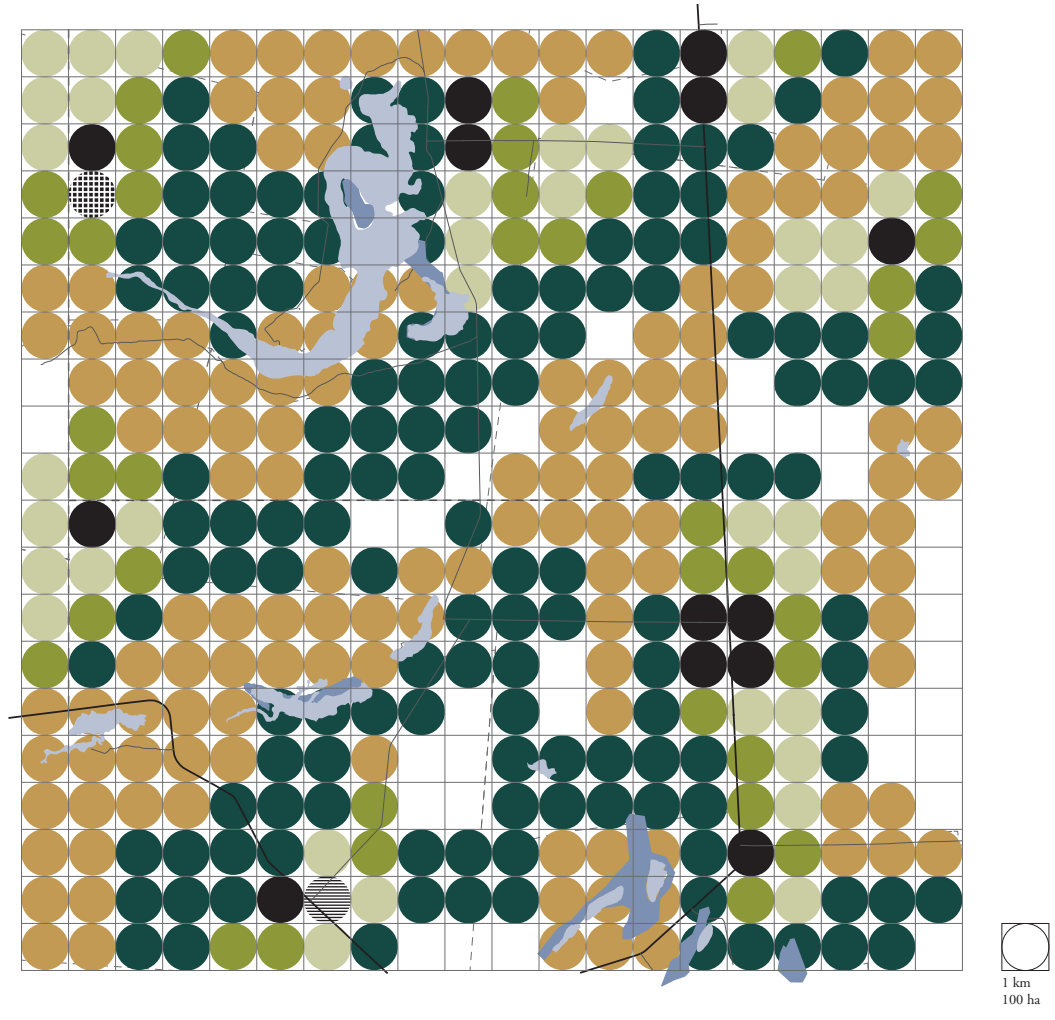
Milpa and agroforestry activites continue to exchange parcels while some mosaics transtion organically towards a community forest management.

Years 15 - 25



Next, the mosaic rhythm continues to connect patches and corridors. Practices of care continue to shft in a gradual way, respecting their cycles and the next reserve also starts to shift to an agroecology activity again.

Years 25 - 50



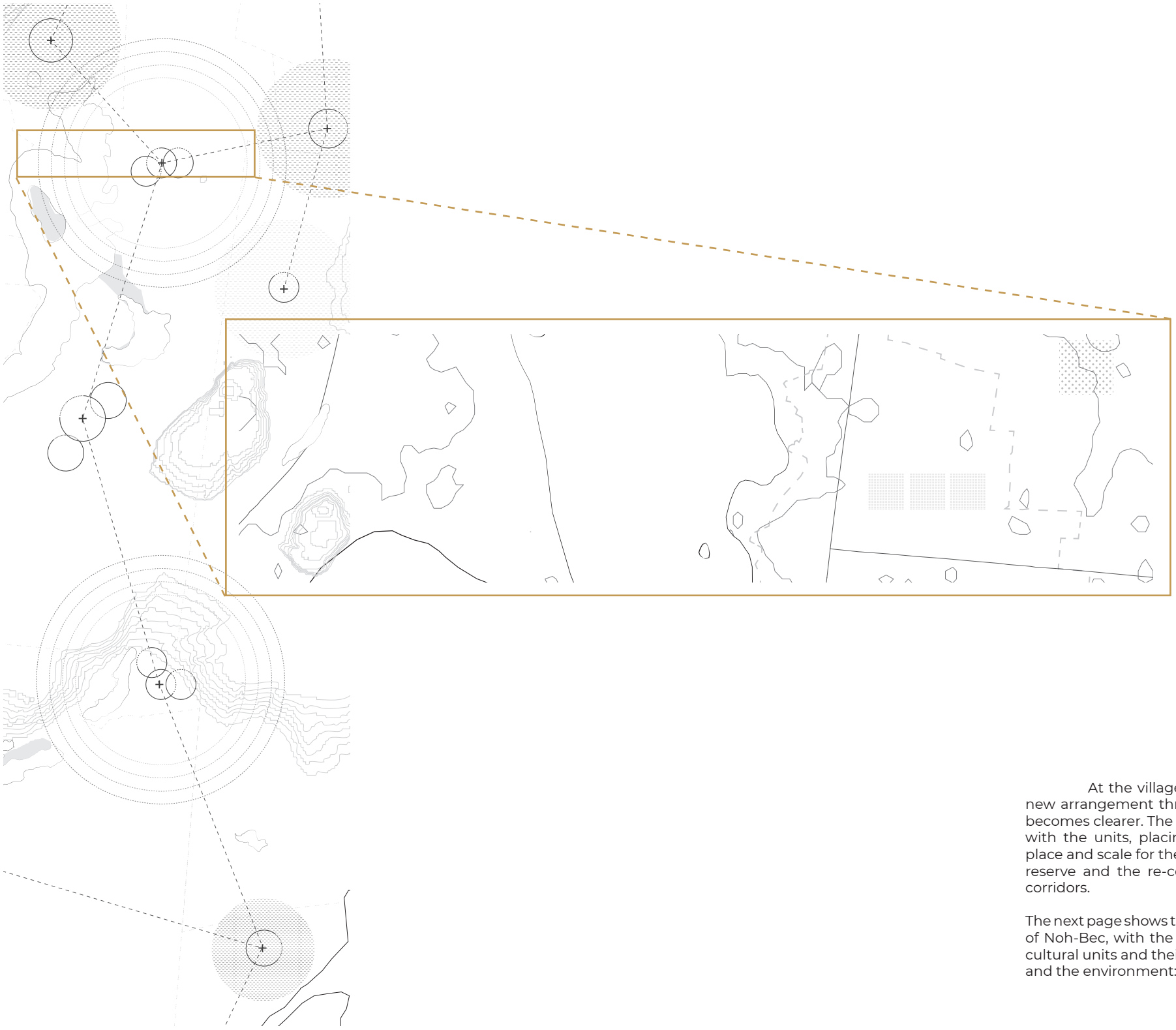
Years 50 - 75



Finally, during this phase it becomes clear the shift of the next reserve, now again performing as milpa or agroforestry systems. As it continues to move, it continues to reconnect bio-cultural corridors, providing the possibility for the communities to access to other ways of income.

The once fragmented landscape is now a performative one, not untoched but steward by humans. The benefits of this green infrastructure would be seen through the regeneration of the land, the protection of the aquifer and the recognition of the ecosystem services it performs as well as the practices of care performed by the indigenous communities.

6.4 NEW SYSTEMIC SECTION
ALL THE SHADES OF BLUE



At the village scale, the possibilities of a new arrangement through the bio-cultural units becomes clearer. The new systemic sections plays with the units, placing them at the necesseray place and scale for the continuity of the unfolding reserve and the re-connection of the biological corridors.

The next page shows the section of the community of Noh-Bec, with the implementation of the bio-cultural units and their relationship with practices and the environment: atmosphere, soil and water.

Practices of care



Reserve



Constructed wetland



Solar garden



Beekeeping



Milpa



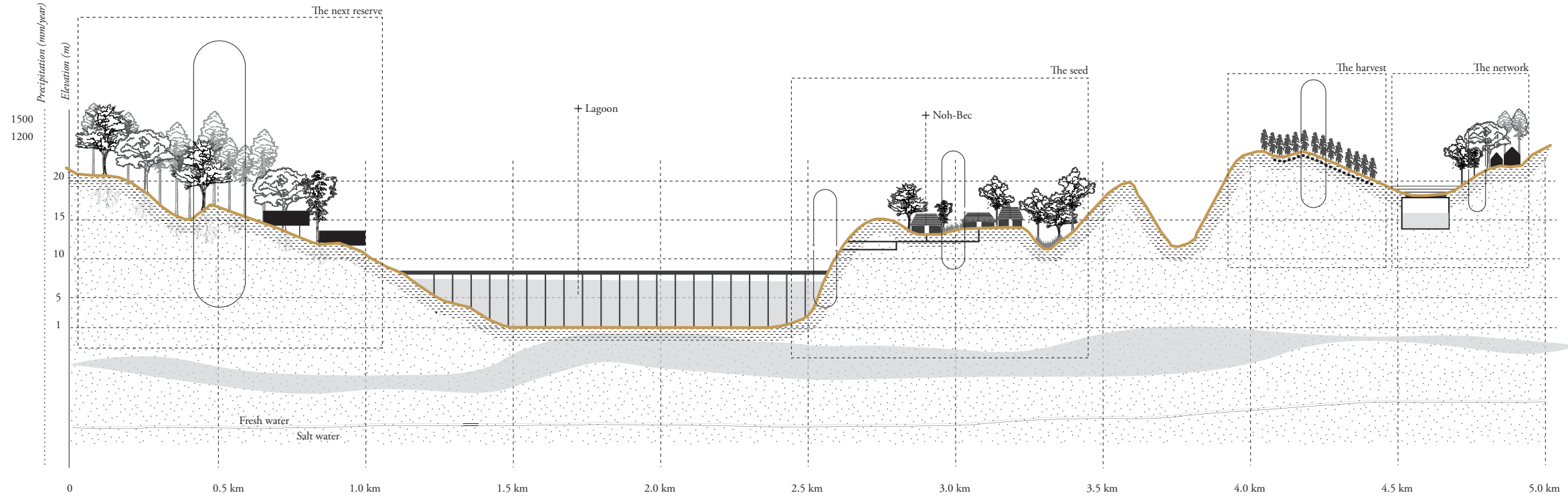
Water retention



Agroforestry

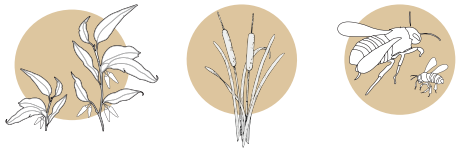


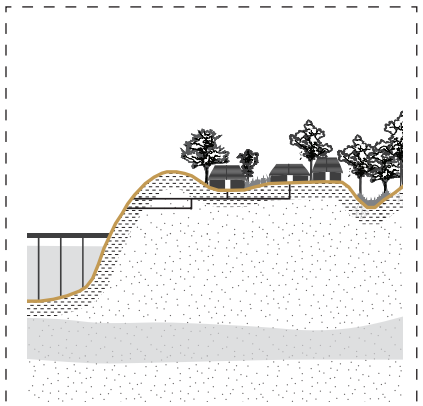
Forest Management





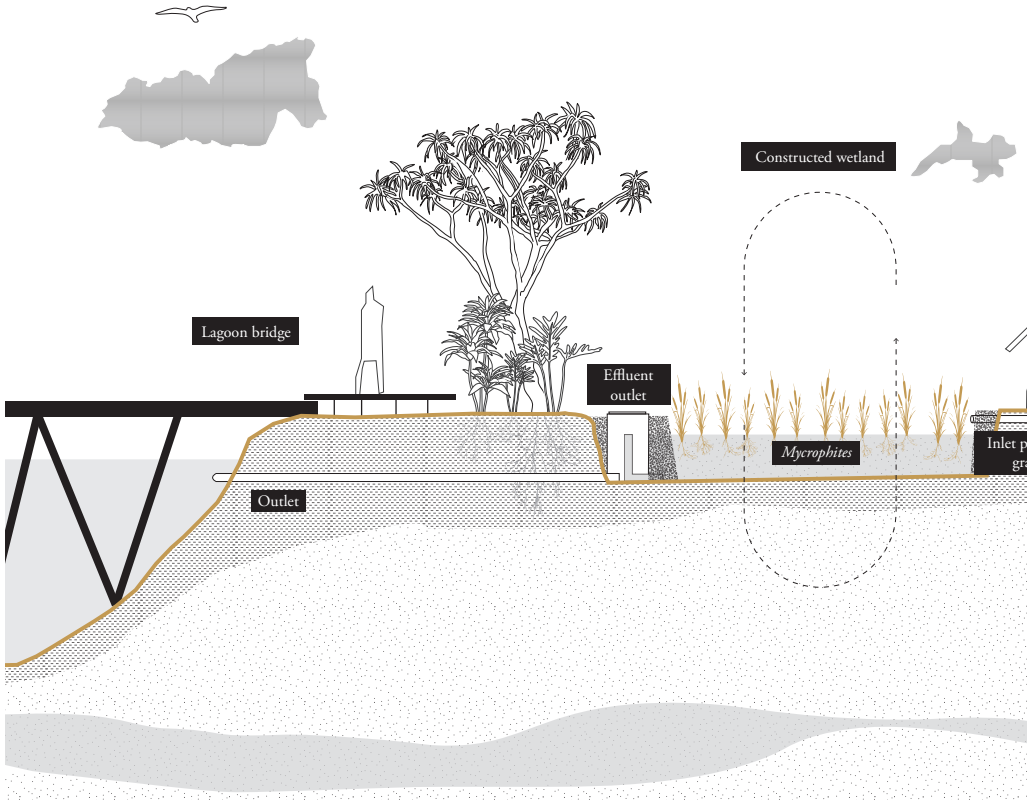
THE SEED





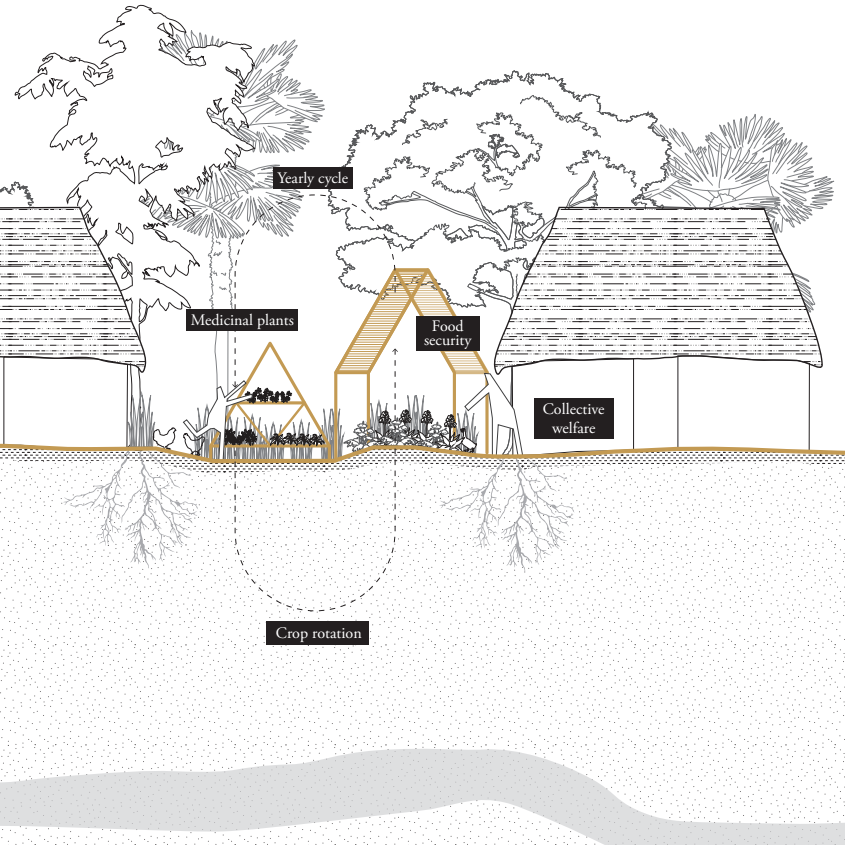
For the community of Noh-Bec, the new systemic sections shows all the shades of blue, meaning, the important relationship with water throughout the system and its relationship with the practices and land use.

First, the constructed wetlands that will filtrate waste water are located close to the lagoon. Housing sewage will be directed to the artificial ponds which after finishing the process will release the now clean water to the lagoon.

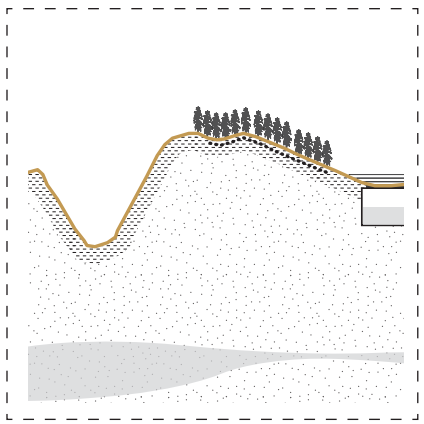


	Desing characteristics			Operating characteristics		Cleansing efficiency	
Type of wetland	Depth (m)	Unit Areas (m2/P.E)	Size ratio	Hydraulic retention time (TRH) (d)	Applied hydraulic load (mm/d)	Organic matter	Nitrogen, phosphorus, pathogens
Horizontal subsurface flow	0.3 - 1.0	1.2 - 12	4 : 1	2 - 10	23 - 50	65 - 95%	20-75%, 15-78%, 98-99%

On the other hand, at the heart of each block of the community, the solar gardens can be found. The project proposes to connect these hearts in order to create green corridors along the community, providing medicinal plants, ornament flowers, and food security.

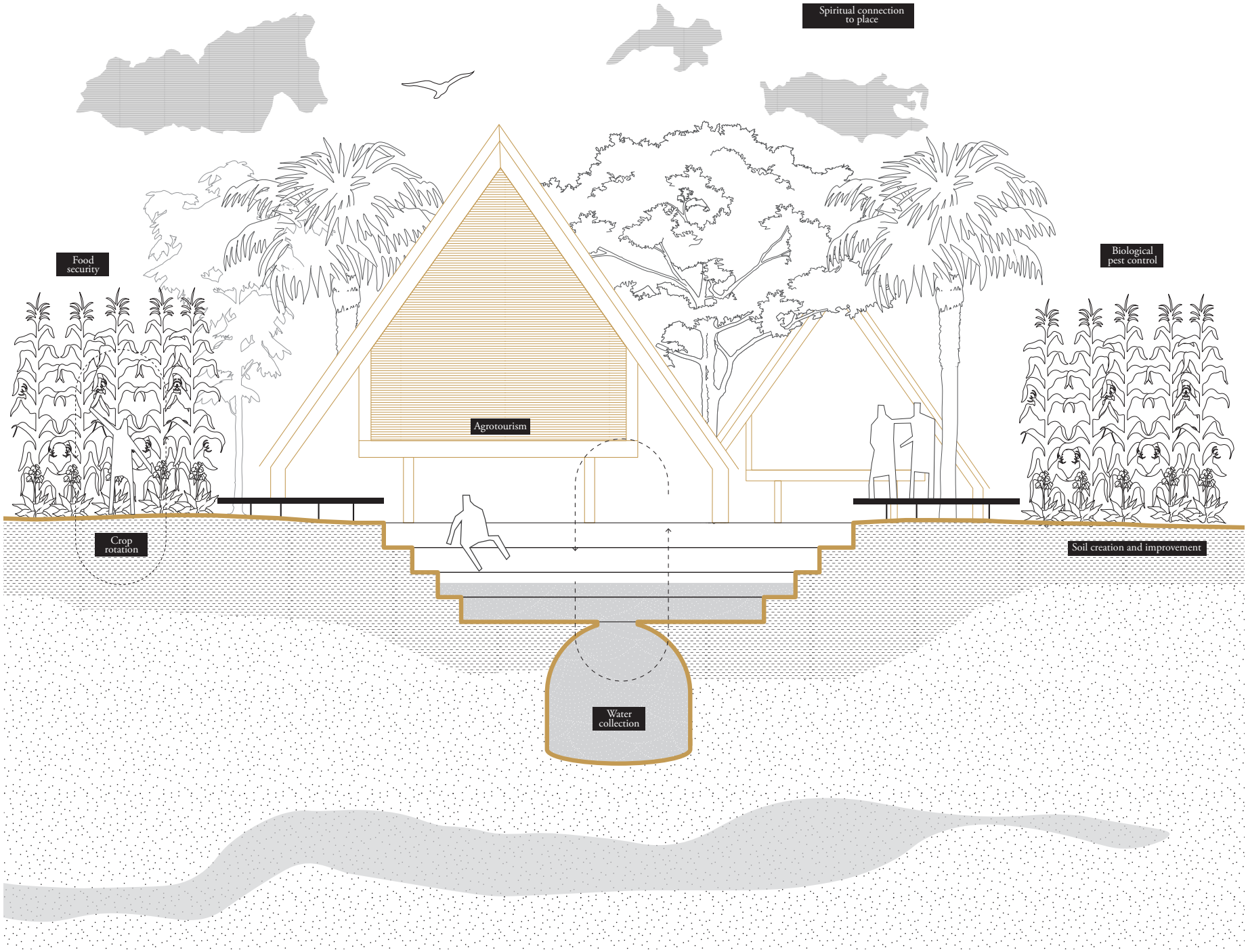


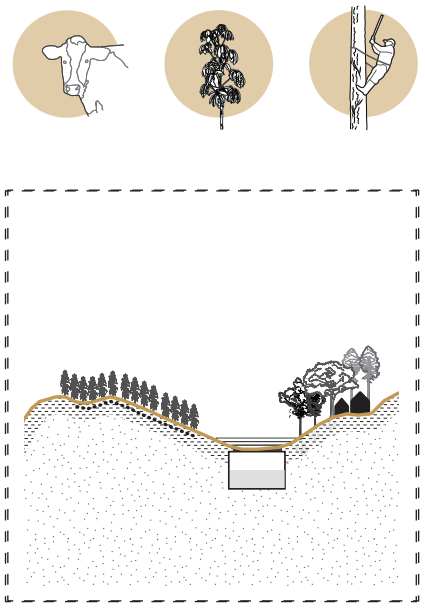


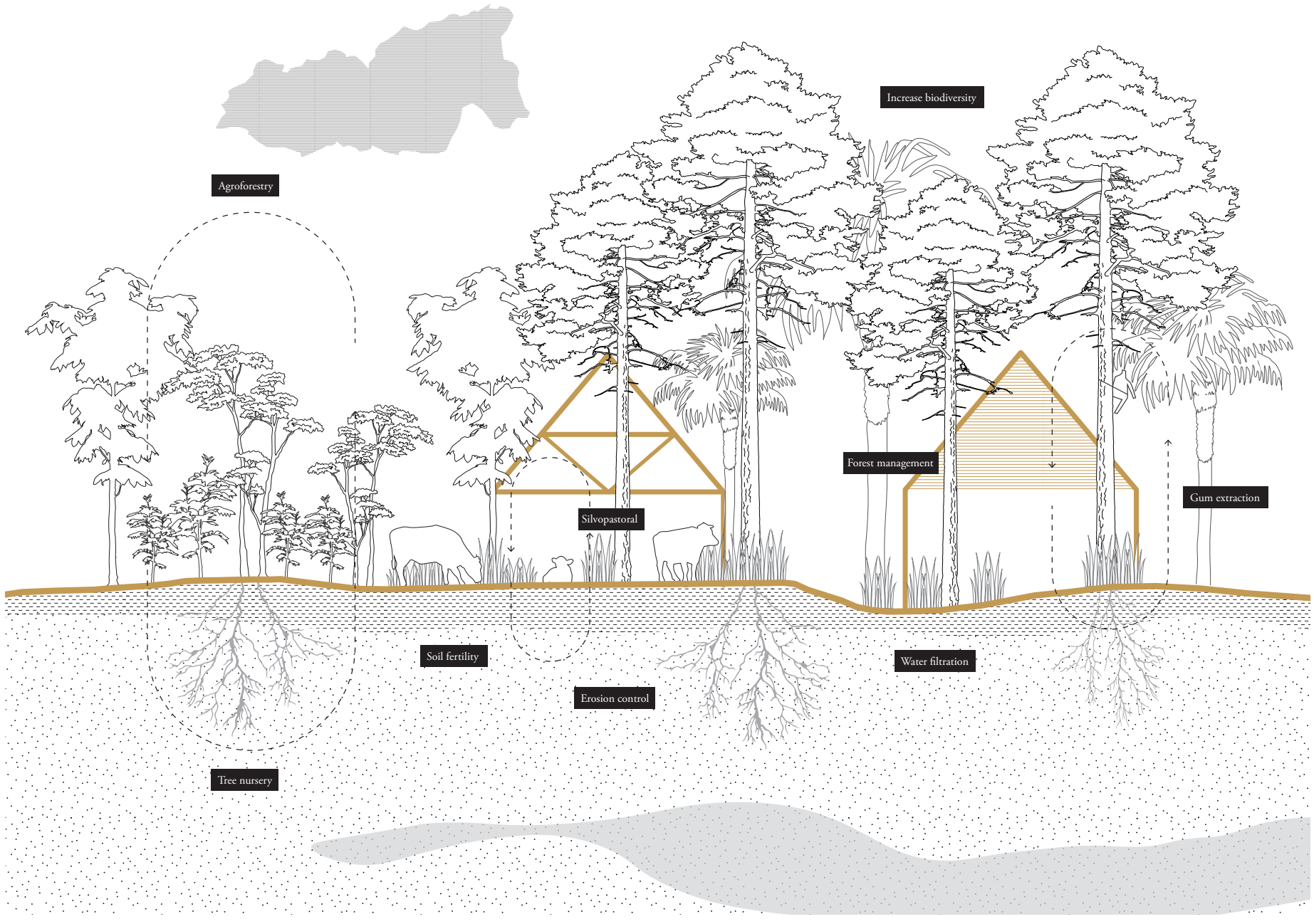


Next, the bio-cultural unit of the harvest is located just outside the community since the milpas are managed by approximately two to four ha per family. As seen on this section, the milpas could be complemented with storage houses for the harvest and seeds and also offer the possibility for agrotourism, so that this millenial practice can be recognized at the same level as the physical heritage of the area.

Furthermore, the water retention wells help the farmer in times of dry season and also as a direct way of showing the important relationship with water that now is mainly underground.



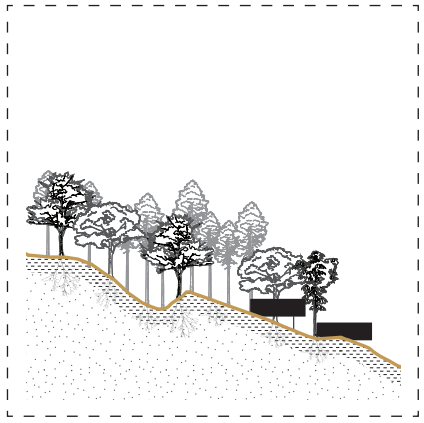




Next, the network shows the first steps towards reforestation of the area, which have the possibility of becoming a new patch of forest and in the future part of the next reserve or go back to a milpa cycle again. The tree nursery coupled with silvopastoral farming and agroforestry are constantly removating the soil, making it more fertile and removing harming species by natural pest control.

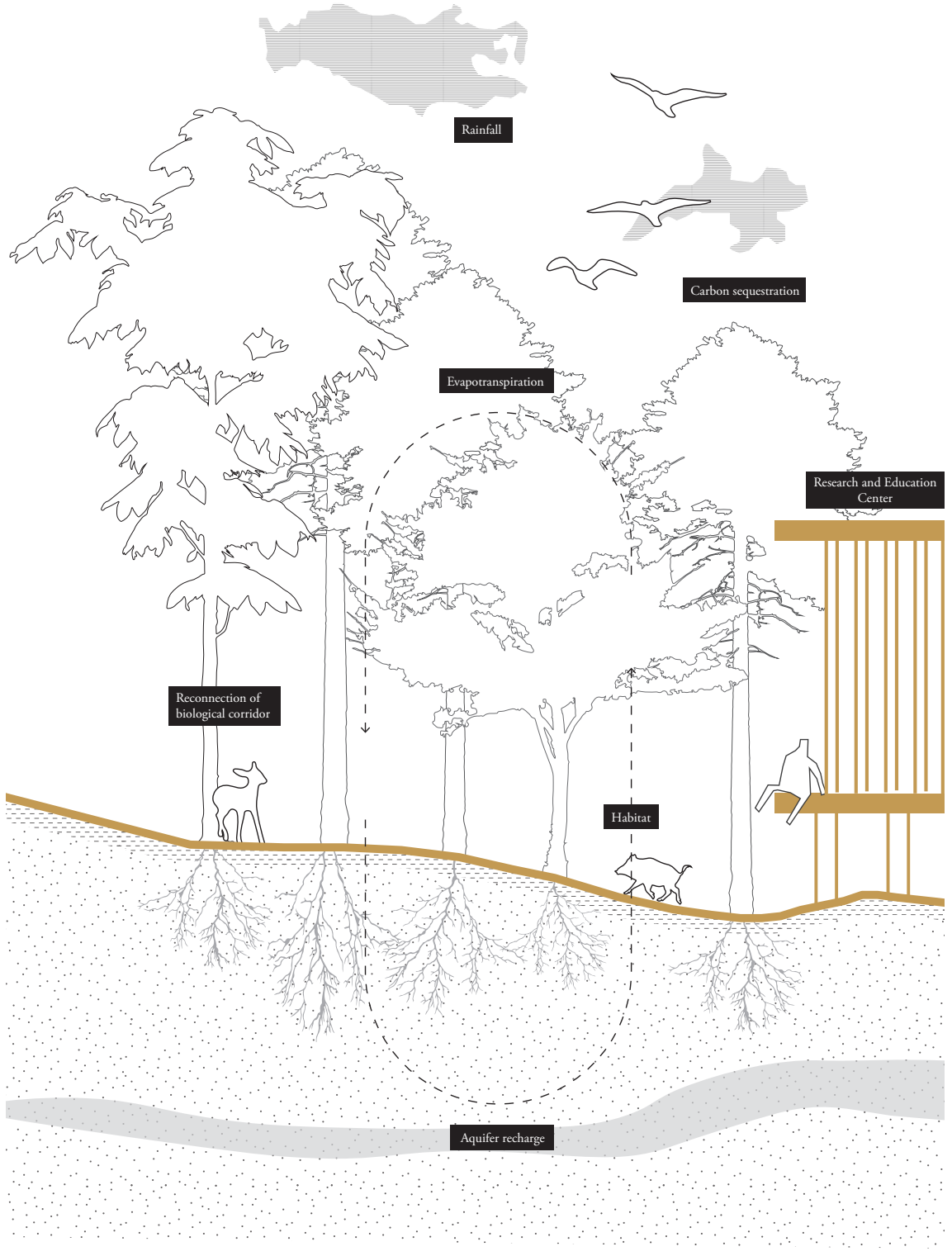
Forest management can increase its wood stuck by the selective farming of endemic species, like the Chico zapote tree, or with fine woods like Cedar and Mahogany which are highly demanded by american and european markets.





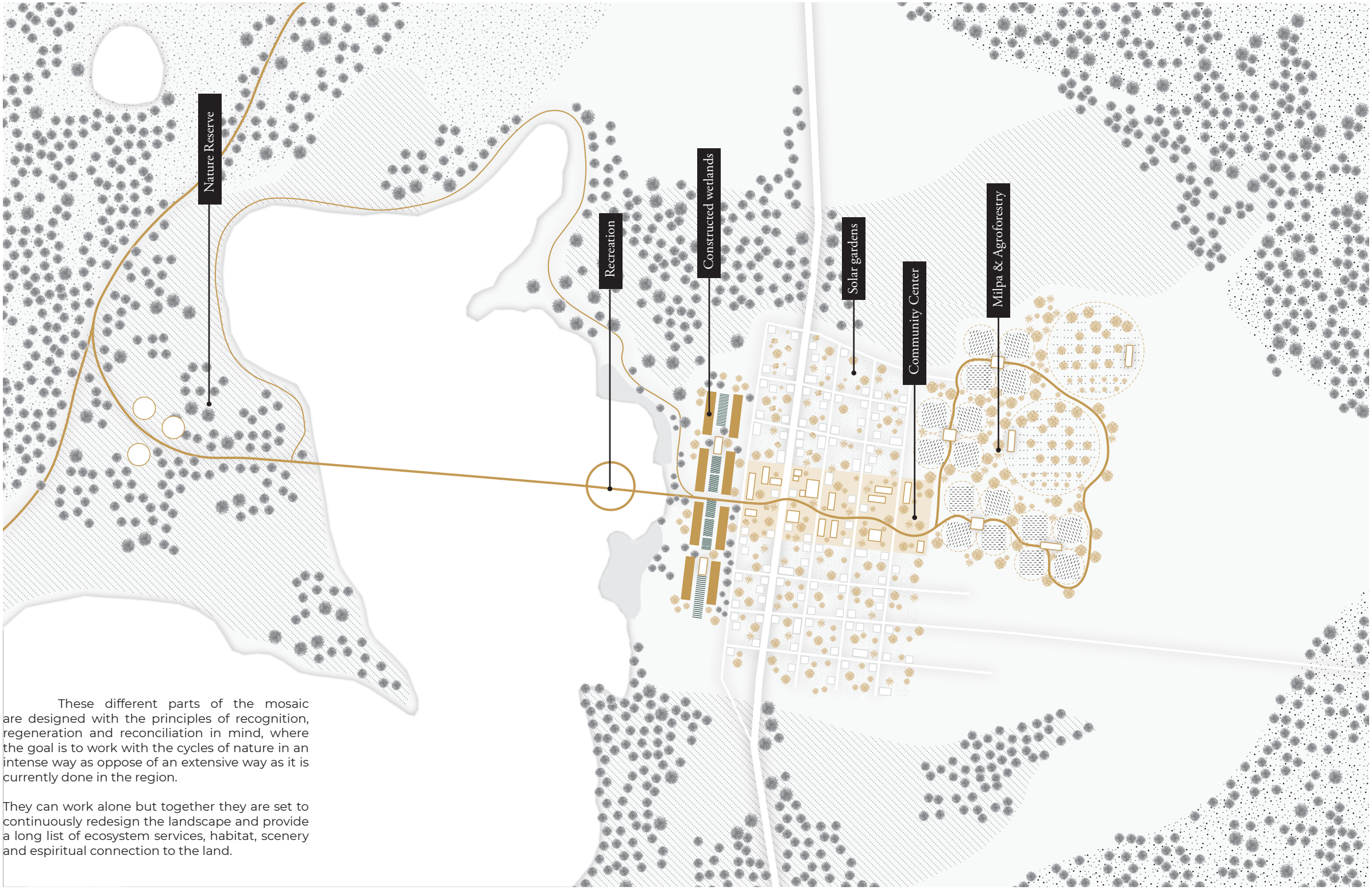
Finally, the next reserve is located at the other side of the lagoon where the tropical forest is already mature. In this area, the community will benefit from a partnership with local acamedia as well, with the presence of a research and education center that could do more in-situ research about environmental concerns that in turn can inform future direction and steps of the biological corridors.

Furthermore, it will also serve as an ecotourism route, that will teach the tourist about the mayan gold: its traditional ecological knowledge, its relationship with nature and their respect towards water.



6.5 SYSTEMIC RESILIENCE

MICRO AND MESO SCALE

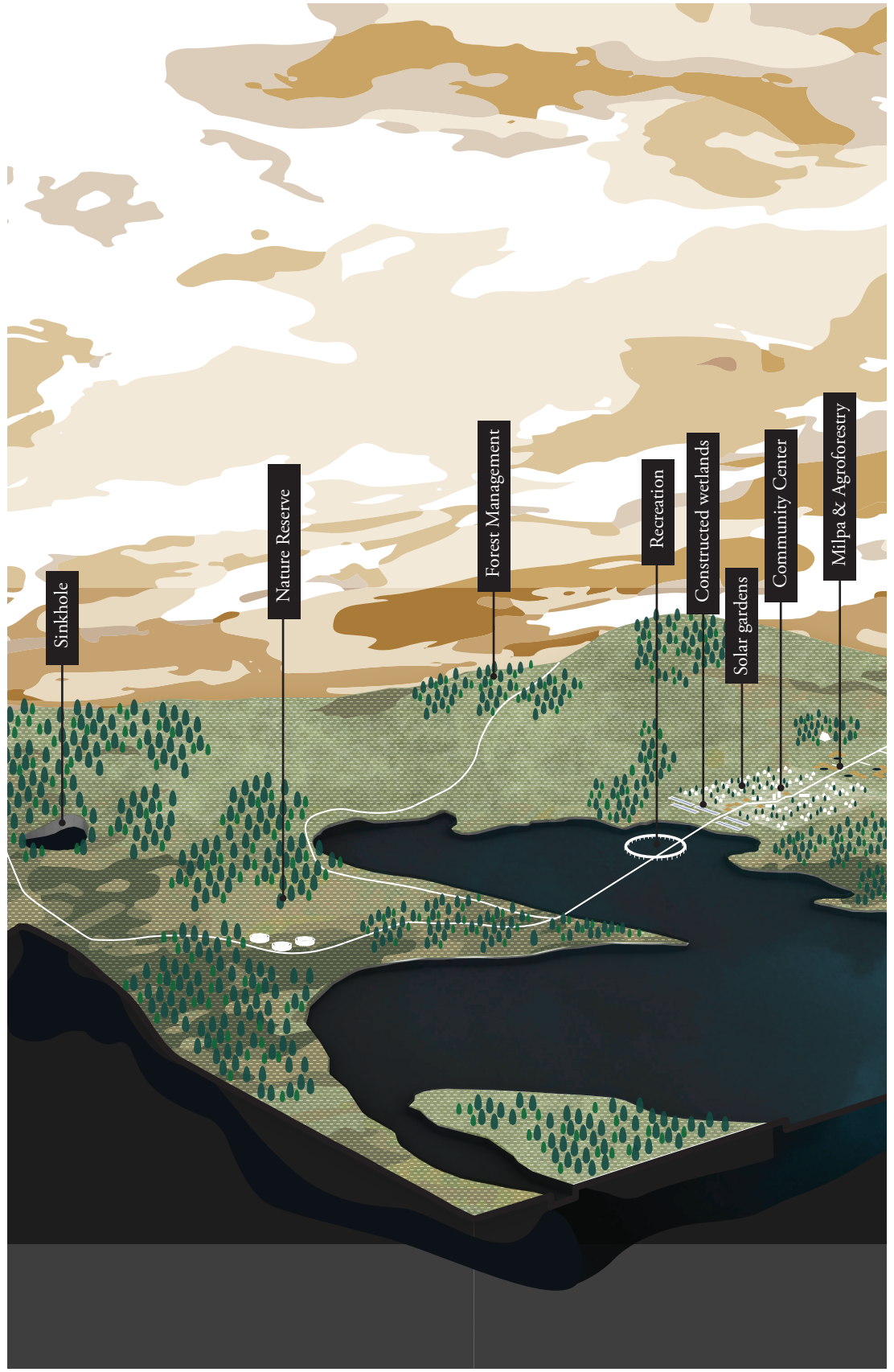


These different parts of the mosaic are designed with the principles of recognition, regeneration and reconciliation in mind, where the goal is to work with the cycles of nature in an intense way as oppose of an extensive way as it is currently done in the region.

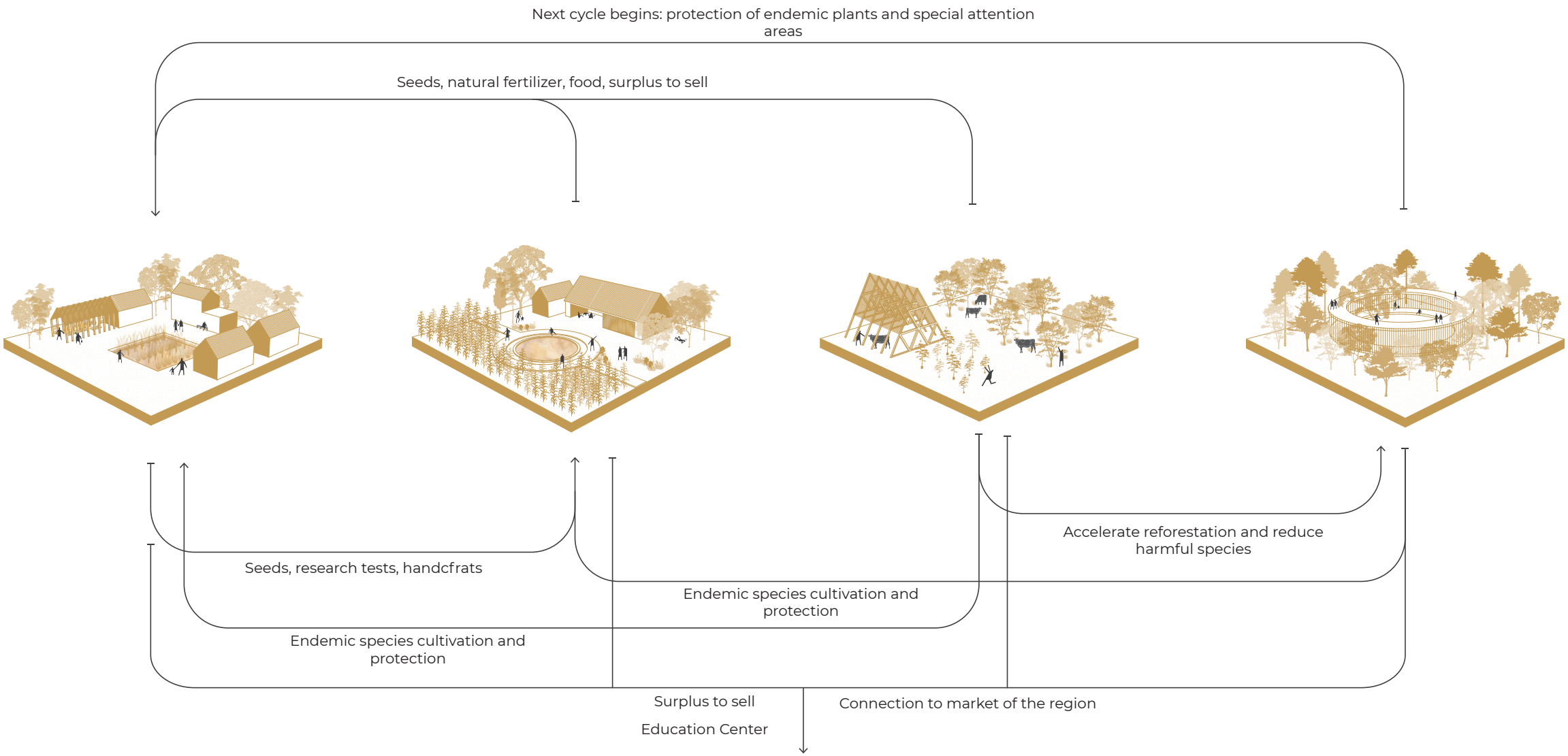
They can work alone but together they are set to continuously redesign the landscape and provide a long list of ecosystem services, habitat, scenery and espiritual connection to the land.

The systemic resilience lies in its ability to adapt and rebounce forward. By carefully designing for the plural, the human and non-human, will be the way in which the complex relationships within the different systems can re-connect and perform in a new rhythm.

Designig for rest in order to speed up the benefits and regeneration of the environment.

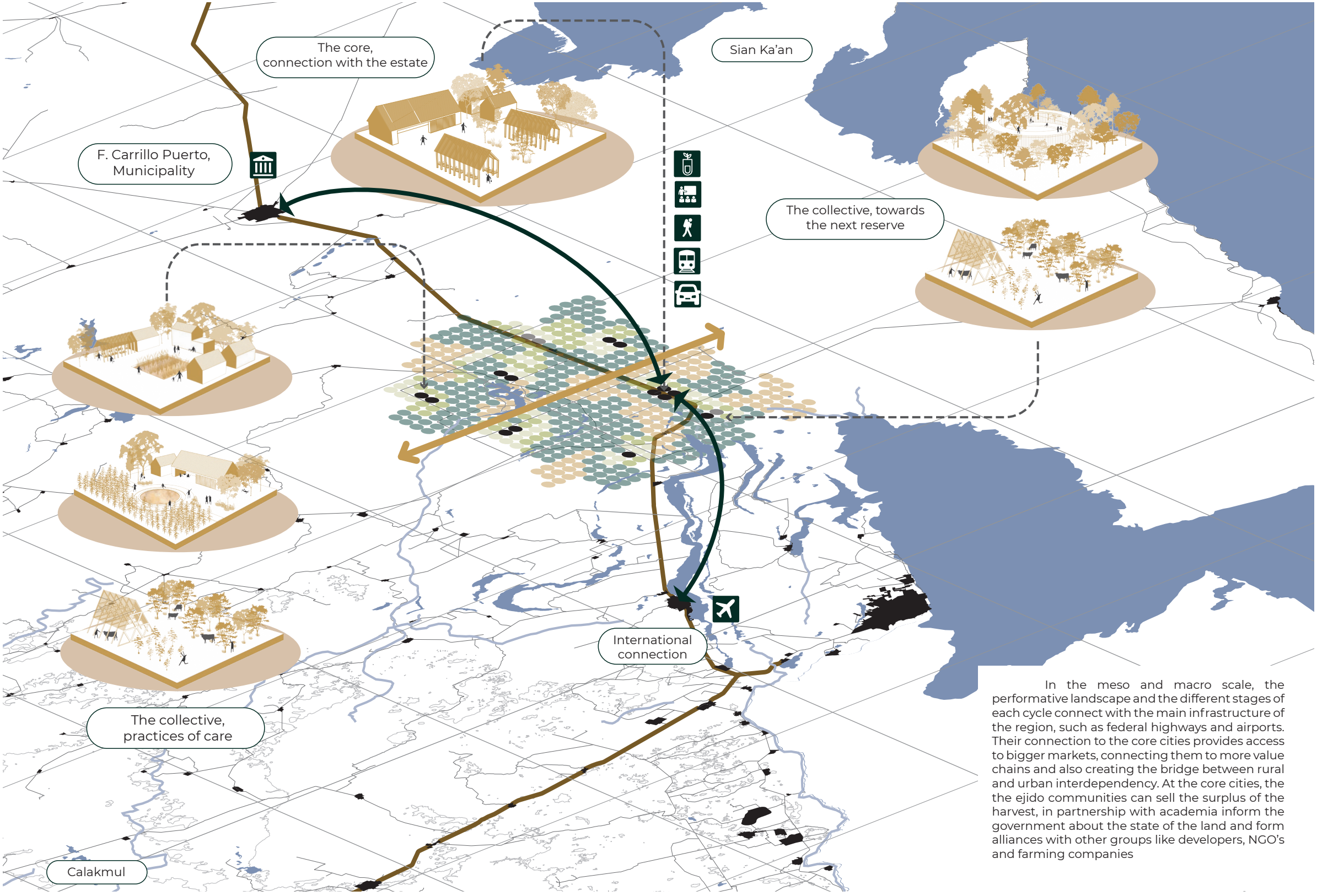


6.6 PARTNERSHIPS & COOPERATION





MESO AND MACRO SCALE



In the meso and macro scale, the performative landscape and the different stages of each cycle connect with the main infrastructure of the region, such as federal highways and airports. Their connection to the core cities provides access to bigger markets, connecting them to more value chains and also creating the bridge between rural and urban interdependency. At the core cities, the the ejido communities can sell the surplus of the harvest, in partnership with academia inform the government about the state of the land and form alliances with other groups like developers, NGO's and farming companies


IMG39 Mystic (2020), God of rain, mayan cosmology, [Photo], Unsplash

VII. GOVERNANCE

7.1 Stakeholders analysis

7.2 Ministries, Institutes and local leaders

7.3 Governance analysis

7.4 Towards a new governance

7.5 Project phasing

7.1 STAKEHOLDERS ANALYSIS

DIFFERENT READINGS OF THE LAND

Starting from the local scale and going all the way to the global scale, different readings of the land present a wide arrange of stakeholders.

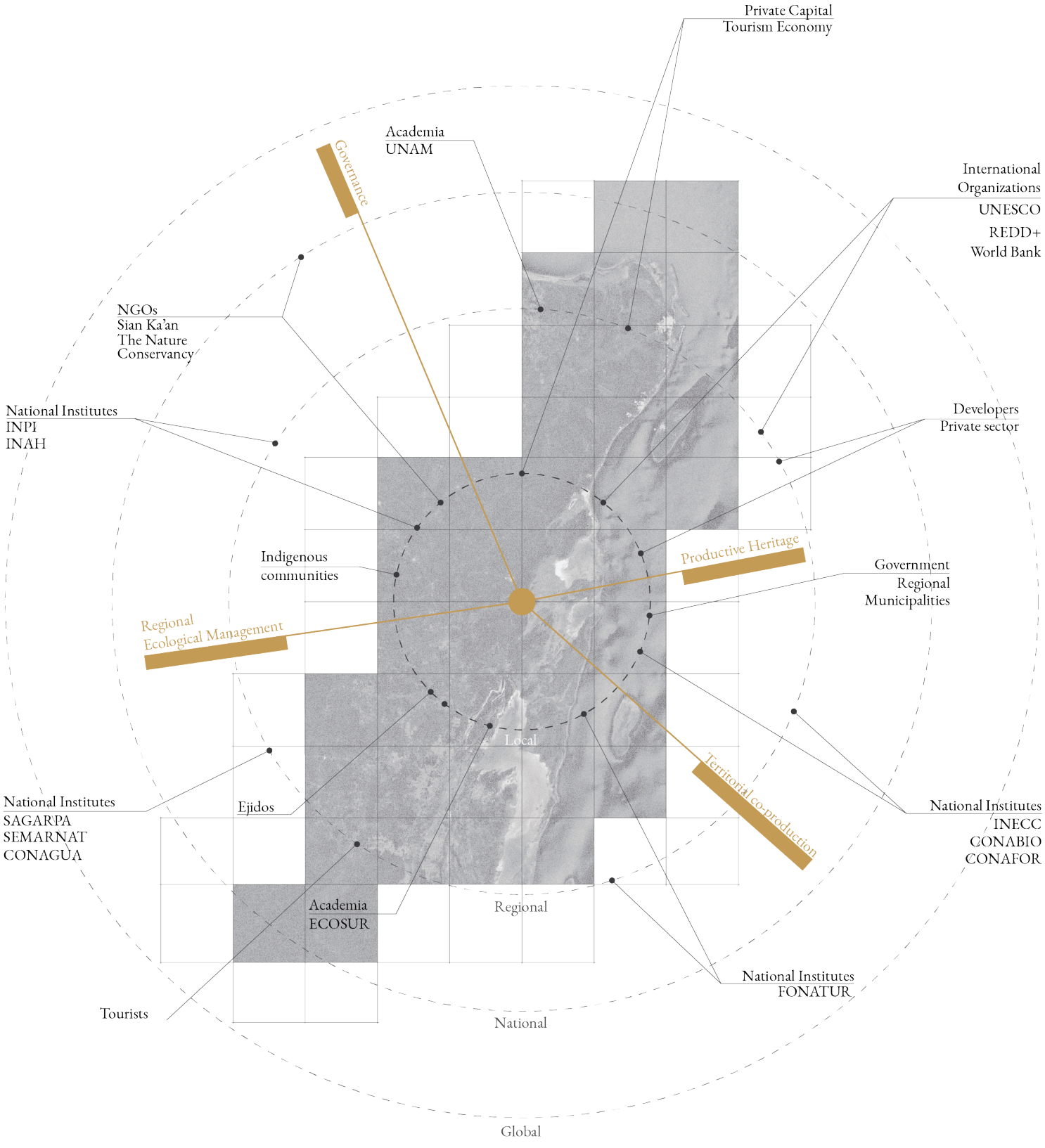
Without a doubt, the most influential one would be the tourism industry, with its representatives in national and international private capital developers, with the help of the National Ministry of Tourism (SECTUR). Moreover, the level of power that the National Fund of Tourism (FONATUR) has over the economic interests of the region leaves local communities and indigenous communities without a voice in the planning of the regional development.

On the other hand, the most prominent NGOs working in the area are the Sian Ka'an Reserve managers and global environmental non profit like the Nature Conservancy. The first one has previously stated in the report, continues in the line of coloniality of nature, focusing mainly on conservation and ecotourism. Meanwhile the second one engages more closely with local communities in ordert to empower them and elevate their productive practies connecting them to new markets and accesing green bonds.

Furthermore, the National Institutes represent different areas of the government that are responsible among other issues for research and protection of the environment, the indigenous communities, the national heritage and the use and management of water resources. Environmental ministries focus mainly on research and education, specifically the Environment and Natural Resources Ministry (SEMARNAT) with its sub-ministries: National Forest Comission (CONAFOR), National Commission for the Knowledge and Use of Biodiversity (CONABIO), Ministry of Agriculture and Rural Development (SAGARPA), and the National Institute of Ecology and Climate Change. The National Water Comission is in charge of national waters management (aquifers, potable water, infrastructure and water treatment plants).

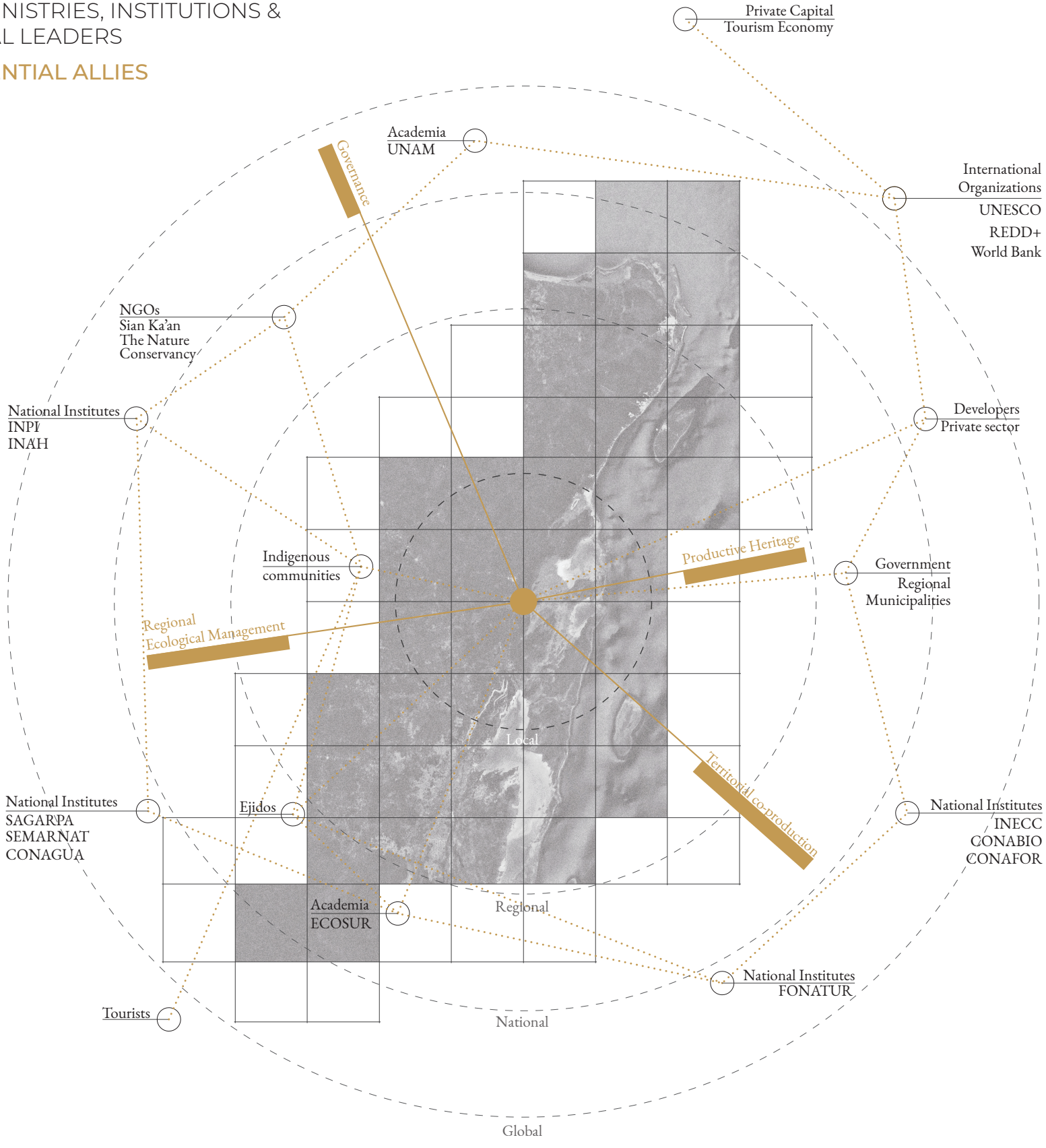
Next is academia, with the National Autonomous University of Mexico (UNAM) and the South Border College (ECOSUR). These universities conduct important research mainly on critical issues such as the karst aquifer and water pollution.

Finally, the Ejidos. Their leaders, which are the eldest of the population, guide their communities' development and seek balance with their surrounding environment. Sadly, these communities lack a lot of basic services and more often than not, are not considered in the regional development plans.



7.2 MINISTRIES, INSTITUTIONS & LOCAL LEADERS

POTENTIAL ALLIES



A different approach to governance could come from strenthening alliances between local leaders, academia, National Institutes and Ministries to balance the power and interest that the private sector and agrarian companies have over the region.

In order to achieve a more just and balanced regional ecological management, the way presented through practices of care and productive heritage is not enough without the support and convergences of common goals between municipalities, regional governments and federal plans and ambitions.

The hierarchy needs to re-arrange and seek a more balanced representation of voices at the table, human and non-human.

7.2 GOVERNANCE ANALYSIS

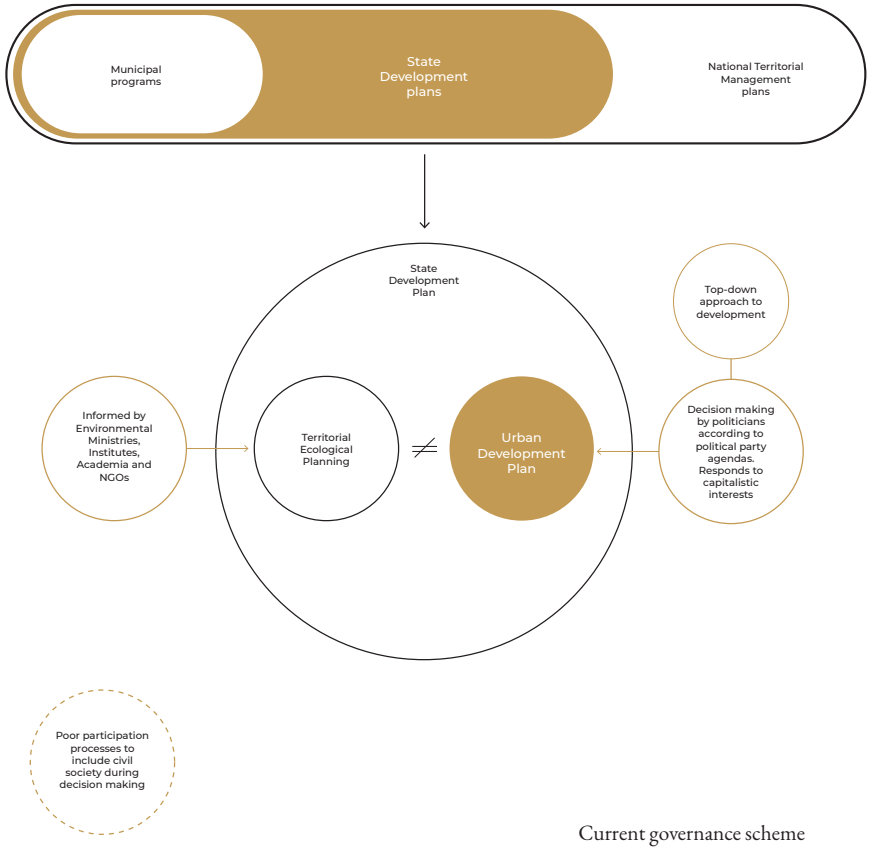
Stakeholders
- (PR) Private sector
- (PU) Public sector
- (RD) Research and design
- (CS) Civil society
- (NG) NGO

Political administrations and structure
- (M) Ministries
- (NI) National Institution
- (PL) Federal Plans
- (LW) Laws

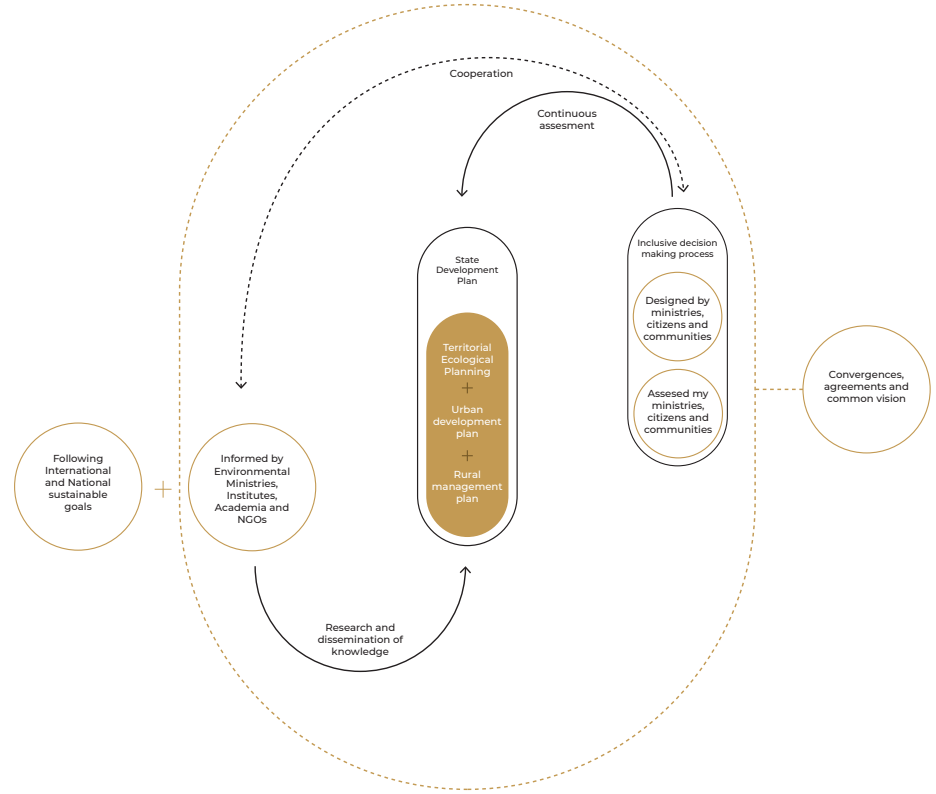
	Socio-Cultural	Environmental	Territorial planning	Economy
International	(UN) Declaration on the rights of indigenous peoples (UN) Sustainable development goals	(AICHI) Biodiversity targets (UN) Sustainable development goals	(UN-HABITAT) Urban planning (UN) Sustainable development goals	(PR) Developers — Tourism economy World Bank — Sustainable development (UN) Sustainable development goals
National/Federal *Mexican Republic*	(M)(PU) CULTURA (LW) Federal Law on archeological zones, artistic and historical monuments. (LW) Law of the National Institute of Indigenous People. (NI) **INAH** Protection of archeological sites and intagible cultural patrimony. (NI) **INPI** Program for the Comprehensive Well-being of Indigenous Peoples. (RD) Academia — **UNAM** National Autonomous University of Mexico	(M)(PU) SEMARNAT (LW) General Law of Ecological Balance and Environmental Protection (LW) General Law of Climate change (LW) National Waters Law (NI) **CONABIO** Implement and operate the National Information System on Biodiversity (SNIB). (NI) **CONANP** Management and administration of the Mexican system of Natural Protected Areas. (NI) **INECC** Technical and scientific research on ecology and climate change. (NI) **CONAFOR** Promote productive, conservation and restoration activities in forestry. (NI) **PROFEPA** Seek environmental justice through the application and enforcement of current federal environmental legislation. (NI) **CONAGUA** Protect national waters and provide potable water to every citizen. (PU) NATIONAL GOVERNMENT (PL) **National Strategy on Biodiversity in Mexico 2016 - 2030** Knowledge, conservation and regeneration, sustainable stewardship, attention to pressure factors, education, communication and environmental culture, integration and governance.	(PU) NATIONAL GOVERNMENT (PL) **National Plan of development 2019-2024** Sustainable development Food self-sufficiency and rural sector rescue Technology and science (M)(PU) SEDATU (LW) General Law of Human Settlements, Territorial Planning and Urban Development Recognize the role of the rural population, indigenous and Afro-Mexican peoples in inclusive and sustainable territorial development for the proper use and exploitation of the land.	(M)(PU) SADER (LW) Law of Sustainable rural development Sustainable rural development and incorporation to the market. Program for the Promotion of Agriculture, Livestock, Fisheries and Aquaculture. (M)(PU) SECTUR (LW) General Law of Tourism (PL) Sustainable Tourism Planning (NI) **FONATUR** Promotes tourism investment in the country and the sale of land to investors.
Regional *Yucatan Peninsula*	(RD) Academia — **ECOSUR** South Border College	(NG) TNC - Mexico Mexico REDD+ Mayan Forest sustainable development (PU) REGIONAL ADMINISTRATION (PL) **Territorial ecological planning programs** According to water basins and sub-basins, biological corridors, coast lines, natural reserves.		
Estate *Quintana Roo*		(NG) Amigos de Sian Ka'an — Conservation of the Natural Reserve of Sian Ka'an (PU) STATE GOVERNMENT (PL) **Territorial ecological planning programs** According to water basins and sub-basins, biological corridors, coast lines, natural reserves.	(PU) STATE ADMINISTRATION (PL) **State urban development plan** Technical and local management instrument through which urban planning and regulation actions are promoted and developed in order to achieve sustainable urban development.	(M)(PU) SEDETUR — Tourism in Quintana Roo. (PR) Developers (PR) Agrarian/cattle companies
Municipal *Felipe Carrillo Puerto*	(NG) Indigenous NGO's	(PU) MUNICIPAL GOVERNMENT (PL) **Territorial ecological planning programs** According to water basins and sub-basins, biological corridors, coast lines, natural reserves.	(PU) MUNICIPAL ADMINISTRATION (PL) **State urban development plan** Technical and local management instrument through which urban planning and regulation actions are promoted and developed in order to achieve sustainable urban development.	
Ultra local / Ejido *Noh-Bec*	(CS) Local handcrafters	(CS) Community forest management	(CS) Ejido leaders	(CS) Local cooperatives (CS) Local farmers

7.4 TOWARDS A NEW GOVERNANCE

CONVERGENCES AND COMMON GOALS



Current governance scheme



Governance proposal

As showed in the previous page, the governance analysis presents the different stakeholders through scales and domains. Even though there seems to be many institutions and ministries responsible for the social and environmental aspect, they do not have power over the regional planning decisions, much less the local leaders.

Moreover, according to our Constitution, each state has sovereignty, which means that state governments have their own set of laws and plans which makes it even more difficult to find common ground if what is at stake is a region composed by three different political borders.

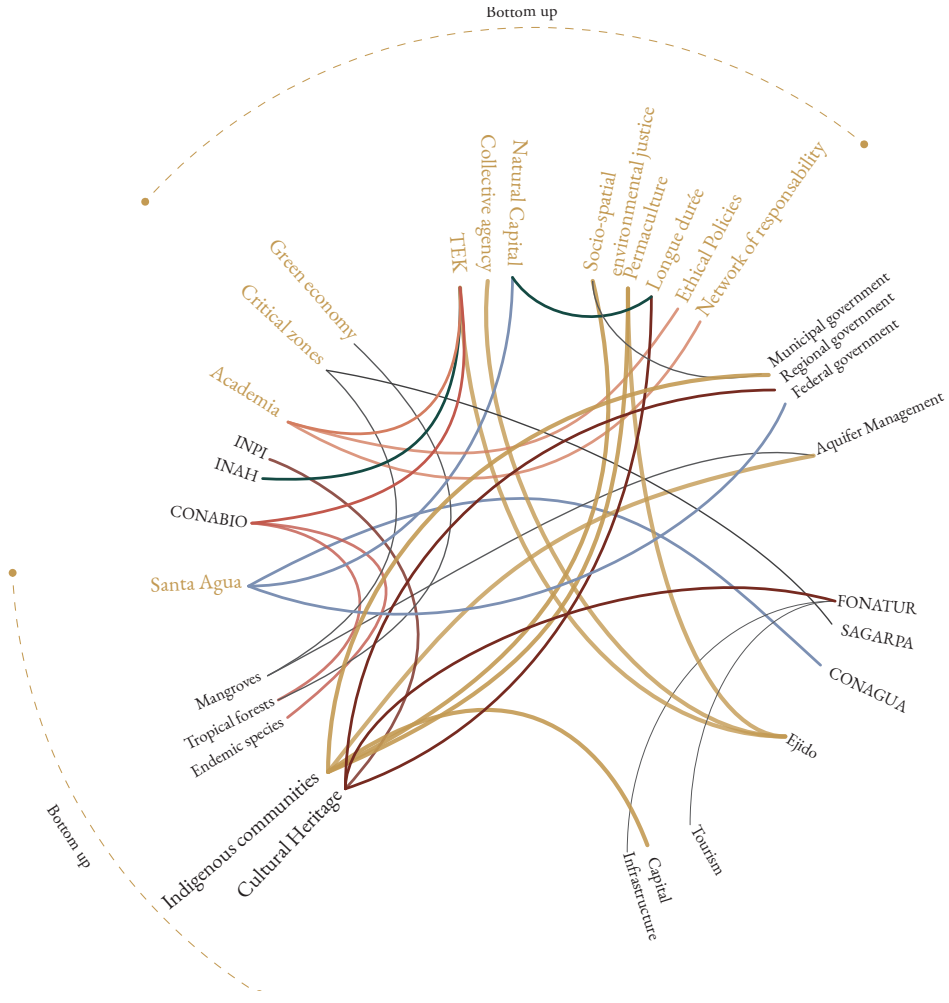
Territorial Ecological planning has been seen as a guide but not considered as a rule for National, regional or municipal urban development plans.

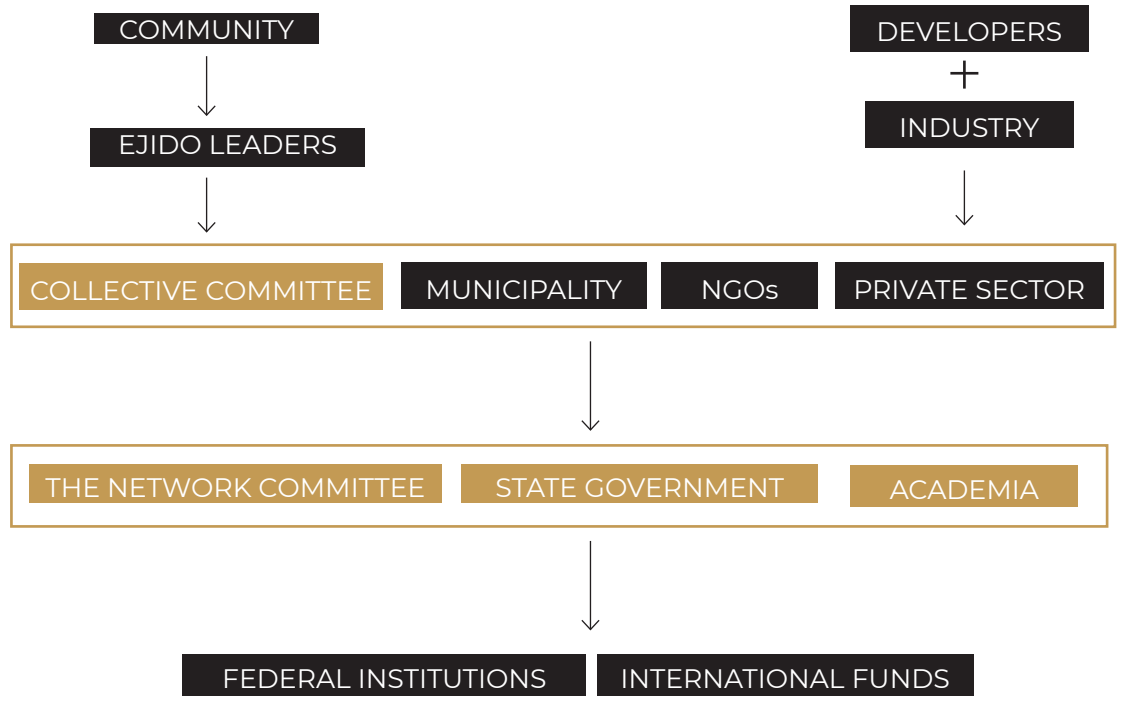
A more just and research based approach to territorial plannig needs not only to be informed by locals, environmental and social ministries as well as NGOs but at the same time it needs to be designed and assessed by the same actors in a process of constant revision, modification, learning and expansion.

Regional development plans should consider of equal importance the ecological sustainability and the urban development since both depend on each other to thrive.

7.4 TOWARDS A NEW GOVERNANCE

FURTHER ALLIANCES





Finally, in order to balance the decision making process and to move away from a top-down approach, the project proposes the creation of collectives and committees that their goal is to amplify the voices of the indigenous communities.

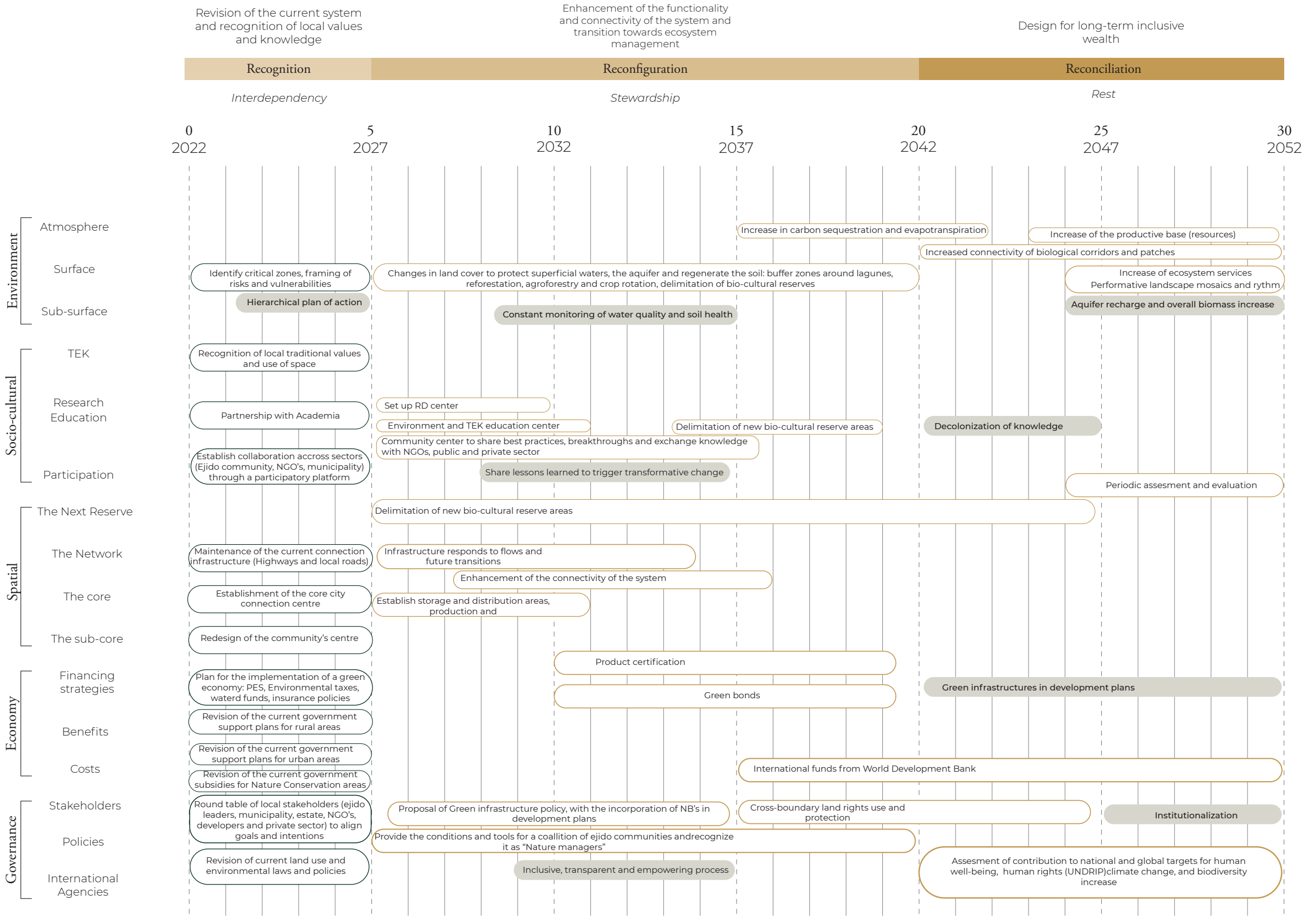
The diagram on the right shows first, the creation of the “collective commitee” which is formed by the network of ejido leaders. This would amplify their voices with the municipal government and in partnership with local NGOs and private sector that would form the “network committee.”

In doing so, the network committee would then be at the same level of the state government and backed by science with academia.

Lastly, this partnership would enable the communities to access the green economy of water bonds, payment for ecosystem services, environmental taxes among others.

In conclusion, the alignment of the stakeholders, with the national and international sustainable goals would paved the way towards a resilient future, where no one owns the land but everyone cares for it...

7.5 PROJECT PHASING



VIII. FINAL CONSIDERATIONS

8.1 Conclusion
8.2 Final reflection

8.1 CONCLUSION



IMG.40 Rice, J. (2018). Sinkhole, Yucatan, Mexico [Photo]. Unsplash

There is an enormous diversity of terrestrial ecosystems in the country but unfortunately, there are no quantitative details about the environmental services they provide us. Poorly understood by metropolitan development plans, the value of ecosystems services remains a crucial topic to explore if society wants to continue living in these coastal areas. If the understanding and appreciation of nature is changing, then what is meant by conservation is also subject to variation.

Why is co-production with indigenous communities important?

An important part of Mexico's natural capital is owned by indigenous and rural communities, who have mastered the transformation of natural spaces into productive landscapes. Given their crucial ecological knowledge, they should be included in the development of a national strategy for a new territorial ecological planning. Furthermore, a large part of the country's Natural Protected Areas are inhabited by said communities, so the conservation of a significant portion of biodiversity and ecosystems and the services they provide depends on the conservation of their territories.

Territorial planning designed with ecological criteria on an adequate scale and adopted by all sectors would help to reduce the impact of natural disasters on biodiversity, as well as the socio-economic consequences of these phenomena, and also to better quantify and value the services of key ecosystems for the regulation of these natural disturbances. It is a powerful instrument at the regional level to take advantage of development opportunities and stop processes of ecological deterioration, however, it must be expanded and strengthened with social participation and the convergence of actions between the different levels of government, considering the conservation, regulation, regeneration and economic interests.

Starting from the premise that environmental services are the most important interaction between the rural and the urban, I see potential with the implementation of socio-environmental policies that could support the role of the ejido as an entity of social cohesion and of regional interaction.

What is nature?

That was one of the questions from my studio mentors after my P1 presentation. At that moment, I did not know how to answer. Now, I realize how valuable that question was for my graduation project and how it led me through a path of discovering different paradigms associated to human relationships with “the other”, the non-human, and therefore the different spatial configurations embedded in the territory that have resulted from these processes.

This final reflection will first describe the “how” of my process and methodology to then support the argumentation, the “why”, which results in the reflection of the relationship between research and design. An important aspect that I will discuss through the reflection of my methodology will be to assess the advantages and limitations of it as well as the difficulties I encountered during the research phase and how I overcome those problems.

Secondly, I will reflect on the relationship between my graduation project with my master’s track and the graduation studio I chose, the feedback I have received from my mentors and how I have incorporated those comments in my work. Finally, I will describe the relationship and relevance of my work with the social, professional and scientific framework and potential applications and transferability of my work in practice. As a conclusion, I will discuss the necessary final steps and considerations I need to pay attention to in order to successfully move towards P5, the final presentation.

On the method

The chosen area of study for my graduation project is a complex mosaic of biodiversity rich landscapes competing for survival against the effects of natural pulses and different iterations and forms of coloniality of nature throughout the territory. After studying the key moments of time that have contributed to the current socio-ecological state of the region, and the different cosmopolitics associated with the sometimes opposed uses and configurations of space, my main methodology approach relied first on the premise that I was working with complex systems, whose balance was lost.

From general to specific, my first phase of research focused on literature review, the construction of a theoretical framework and the mapping of risks and vulnerabilities throughout the entire region, following the lines of inquiry proposed by the studio (matter, topos, habitat and geo-politics). This approach was useful because it helped me understand the interdependency of the different systems at stake and how each action, coming from within or outside the region, in terms of use, management or paradigm in relation of the use of resources, has had consequences not only in the surface but also in the sub-surface and atmosphere. This first phase of the research where I looked at the interconnections and power relations was important because it gave me a clear panoramic vision of the current context, and subsequently by zooming-in on the most critical zones I was able to define the area of intervention and the opportunities that I could highlight through my design proposal.

On the other hand, from P1 to P3 I focused mainly on the political, cultural and sociological aspect and its consequences on the environment which for some time limited me to move forward with my design proposal. Since my project focuses on the co-production of the territory with indigenous communities, I specifically struggled to take the first steps towards my design proposal because I had to make sure that I was being respectful with the beliefs and practices of the locals but at the same time, that my design proposal could bring these ancestral ways of working with nature to the 21st century.

Moreover, the scale of the region, its low population density and at the same time the high fluctuation of tourism population around the year were some issues that I also struggled with which I overcome by studying different adaptation pathways that could find common ground with the different cosmopolitics within the territory and at the same time, to study the different cycles of nature that perform in the landscape. Moreover, by conducting interviews with local NGOs that have been working closely with the indigenous communities for more than twenty years, I was able to understand the current systemic processes and stakeholders, the strengths and weaknesses.

Moving towards design, I switched the approach now from specific to general. Through research by design, I proposed a reconfiguration of the territory, with varying spatio-temporal relations with the environment that would render a new co-production of the territory and an arrange of cultural performative landscapes. Working with scenario projection gave me direction towards the main goal and it help me set the phases, actors, milestones and necessary steps to reach my vision. During this process, I had to pay attention to the strategic capacity, redundancy and evolutionary resilience of the system, thus by testing my design with desirable and extreme scenarios.

On the connections

The goal with my graduation project is to cast light on the diversity and plurality of voices, human and nonhuman, to propose resilient possible scenarios for the future, to provide a compass instead of a set of rules or to simply expose critical narratives to start a conversation. This has been relevant for my graduate project in Urbanism master's track since my aim is to expose the critical issues, assess the damage and recover together with nature with the guiding principle that resources should be managed to reflect the relationships among all ecosystem components, including humans and nonhuman species, the environment in which they live, and physical, biological and socioeconomic interrelationships.

The connection between my graduation project and the studio of Transitional Territories can be seen in the way my approach seeks to unveil, expose and trace the different layers that compose the landscape and at the same time, to look into the different moments of change, transitions and moments in time that have shape the territory between land and sea. From this perspective, my aim was to study and observe the consequences of the design and planning decisions in the surface layer, but also how it also affects the subsurface and atmosphere. In other words, how every choice has a direct or indirect impact through every layer and across every axis. Politics, social structures, cultures and landscape and time are complex systems interrelated and any disturbance in the fragile equilibrium that they interact could disrupt their continuous cycle of life.

I have received a lot of valuable feedback from my studio mentors throughout the entire graduation project which can be seen in my work, specifically through practices of care and the designing for the plural, human and non-human. I aimed to proposed a territorial planning and reconfiguration with ecological criteria on an adequate scale and adopted by all sectors that could take advantage of development opportunities and stop processes of ecological deterioration. However, the design must be expanded and strengthened with social participation and the convergence of actions between the different levels of government, considering the conservation, regulation, regeneration and economic interests.

On the relevance and transferability

In the Yucatan Peninsula there is a gap in knowledge and recognition of the different systems at stake, their interdependency, their vulnerability and their limits or points of no return. On the other hand, by exposing the negative trends the region has experienced recently and intensely due to mono-political practices and weak institutionality, the aim was to think for new ways of cohabitation and re-guided land use.

The goal through this research is to benefit locals and not only to preserve but regenerate the landscape and our relationship with it. Through a process of progressive and adaptive plan towards a new relationship between the different complex systems, the aim is to increase the economic activities, thus increasing the possible income sources, reduce vulnerabilities and strengthen the backbone of the territory by recognizing the interdependency between every complex socioecological system.

Furthermore, to design for the plural in care-full design by not falling in generalizations and respect the heritage and ancient culture of the area as well as the natural capital and the potentials of learning from the vernacular knowledge. The goal is to revised objectively the responsibility and degree of impact of every stakeholder, system and resource and my responsibility as guide and planner.

My graduation project could be use in practice in the way urban planning and design could contribute to make visible the invisible. In other words, poorly understood by metropolitan development plans, the quantitative value of ecosystem services remains a crucial topic to explore. If Nature is a cultural construct, we can move forward towards a new paradigm where conservation is also subject to variation. I found through nature-based solutions a bridge that could bring forward the value of the environment and at the same time, a strategy that takes into account socio-cultural and economic aspects for a successful proposal that could continue bringing benefits in the long-term.

Subsequently, why is co-production with indigenous communities important? An important part of the world's natural capital is managed by indigenous and rural communities, who have mastered the transformation of natural spaces into productive landscapes. Given their crucial ecological knowledge, they should be included in the development of a national strategy for a new territorial ecological planning. Furthermore, a large part of the Natural Protected Areas of the planet are
inhabited by said communities, so the conservation of a significant portion of biodiversity and ecosystems and the services they provide depends on the conservation of their territories.

Starting from the premise that environmental services are the most important interaction between the rural and the urban, I see potential with the implementation of socio-environmental policies that could support the role of the ejido as an entity of social cohesion and of regional interaction.

IX. BIBLIOGRAPHY

Ambrosie, L. M. (2015). Myths of tourism institutionalization and Cancún. Annals of Tourism Research, 54, 65–83. https://doi.org/10.1016/J.ANNALS.2015.06.002

Anscombe, G.E.M. (1957). Intention. Oxford University Press.

Ardren, T., & Miller, S. (2020). Household garden plant agency in the creation of Classic Maya social identities. Journal of Anthropological Archaeology, 60, 101212. https://doi.org/10.1016/J.JAA.2020.101212

Arteaga Aguilar, M. A., Ayala Arcipestre, M. E., & Márquez, R. I. (2016). Ordenamiento territorial comunitario, participación social y uso del suelo: experiencias en el sureste de México. Perspectiva Geográfica, 19(2), 289. https://doi.org/10.19053/01233769.4100

Atzyl, S., Reyes, P., & Miranda, H. B. (n.d.). Soluciones basadas en la naturaleza para enfrentar los riesgos hidrometereológicos y el cambio climático en la Sistema Urbano Lagunar de Coyuca.

BARNHARDT, R., & OSCAR KAWAGLEY, A. (2005). Indigenous Knowledge Systems and Alaska Native Ways of Knowing. Anthropology & Education Quarterly, 36(1), 8–23. https://doi.org/10.1525/AEQ.2005.36.1.008

Barrera-Bassols, N., & Zinck, J. A. (2003). Ethnopedology: a worldwide view on the soil knowledge of local people. Geoderma, 111(3–4), 171–195. https://doi.org/10.1016/S0016-7061(02)00263-X

Bautista, F., Palacio-Aponte, G., Quintana, P., & Zinck, J. A. (2011). Spatial distribution and development of soils in tropical karst areas from the Peninsula of Yucatan, Mexico. Geomorphology, 135(3–4), 308–321. https://doi.org/10.1016/J.GEOMORPH.2011.02.014

Bauer-Gottwein, P., Gondwe, B. R. N., Charvet, G., Marín, L. E., Rebolledo-Vieyra, M., & Merediz-Alonso, G. (2011). Review: The Yucatán Peninsula karst aquifer, Mexico. Hydrogeology Journal, 19(3), 507–524. https://doi.org/10.1007/S10040-010-0699-5

Brankovits, D., Pohlman, J.W., Niemann, H. et al. Methane- and dissolved organic carbon-fueled microbial loop supports a tropical subterranean estuary ecosystem. Nat Commun 8, 1835 (2017). https://doi.org/10.1038/s41467-017-01776-x

Coral disease, environmental drivers, and the balance between coral and microbial associates. (2007). Oceanography, 20(SPL.ISS. 1), 172–195. https://doi.org/10.5670/OCEANOG.2007.91

Berkes, F. (2018). Sacred ecology (Fourth). Routledge.

Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of Traditional Ecological Knowledge as Adaptive Management. Source: Ecological Applications, 10(5), 1251–1262.

Bermingham, A., Whitney, B. S., Loughlin, N. J. D., & Hoggarth, J. A. (2021). Island resource exploitation by the ancient Maya during periods of climate stress, Ambergris Caye, Belize. Journal of Archaeological Science: Reports, 37, 103000. https://doi.org/10.1016/J.JASREP.2021.103000

Buzinde, C. N., & Manuel-Navarrete, D. (2013). The social production of space in tourism enclaves: mayan children's perceptions of tourism boundaries. Annals of Tourism Research, 43, 482–505. https://doi.org/10.1016/J.ANNALS.2013.06.003

Calliari, E., Staccione, A., & Mysiak, J. (2019). An assessment framework for climate-proof nature-based solutions. Science of The Total Environment, 656, 691–700. https://doi.org/10.1016/J.SCITOTENV.2018.11.341

Cinco-Castro, S., & Herrera-Silveira, J. (2020). Vulnerability of mangrove ecosystems to climate change effects: The case of the Yucatan Peninsula. Ocean & Coastal Management, 192, 105196. https://doi.org/10.1016/J.OCECOAMAN.2020.105196

Condorelli, R. (2016). Complex Systems Theory: Some Considerations for Sociology. Open Journal of Applied Sciences, 06(07), 422–448. https://doi.org/10.4236/OJAPPS.2016.67044

Corazziere, C. (2019). Re-signification processes of the productive heritage for a renewed urban quality. Smart Innovation, Systems and Technologies, 100, 547–554. https://doi.org/10.1007/978-3-319-92099-3_61

Coscieme, L., da Silva Hyldmo, H., Fernández-Llamazares, Á., Palomo, I., Mwampamba, T. H., Selomane, O., Sitas, N., Jaureguiberry, P., Takahashi, Y., Lim, M., Barral, M. P., Farinaci, J. S., Diaz-José, J., Ghosh, S., Ojino, J., Alassaf, A., Baatuuwie, B. N., Balint, L., Basher, Z., … Valle, M. (2020). Multiple conceptualizations of nature are key to inclusivity and legitimacy in global environmental governance. Environmental Science & Policy, 104, 36–42. https://doi.org/10.1016/J.ENVSCI.2019.10.018

Costall, A. R., Harris, B. D., Teo, B., Schaa, R., Wagner, F. M., & Pigois, J. P. (2020). Groundwater Throughflow and Seawater Intrusion in High Quality Coastal Aquifers. Scientific Reports 2020 10:1, 10(1), 1–33. https://doi.org/10.1038/s41598-020-66516-6

Costanza, R. (2020). Valuing natural capital and ecosystem services toward the goals of efficiency, fairness, and sustainability. Ecosystem Services, 43, 101096. https://doi.org/10.1016/J.ECOSER.2020.101096

Davoudi, S., Brooks, E., & Mehmood, A. (2013). Evolutionary Resilience and Strategies for Climate Adaptation. Planning Practice and Research, 28(3), 307–322. https://doi.org/10.1080/02697459.2013.787695

Dedrick, M., Webb, E. A., McAnany, P. A., Kanxoc Kumul, J. M., Jones, J. G., Batún Alpuche, A. I., Pope, C., & Russell, M. (2020). Influential landscapes: Temporal trends in the agricultural use of rejolladas at Tahcabo, Yucatán, Mexico. Journal of Anthropological Archaeology, 59, 101175. https://doi.org/10.1016/J.JAA.2020.101175

Deng, Y., Young, C., Fu, X., Song, J., & Peng, Z. R. (2017). The integrated impacts of human activities and rising sea level on the saltwater intrusion in the east coast of the Yucatan Peninsula, Mexico. Natural Hazards, 85(2), 1063–1088. https://doi.org/10.1007/S11069-016-2621-5/FIGURES/12

Ruiz-Massieu, M. (1987). Derecho Agrario Revolucionario. UNAM.

Diemont, S. A., Bohn, J. L., Rayome, D. D., Kelsen, S. J., Cheng, K., & Belize Lacandon Maya Yucatec Maya Mopan Maya Tsotsil Maya, M. (2010). Comparisons of Mayan Forest management, restoration, and conservation. Forest Ecology and Management, 261, 1696–1705. https://doi.org/10.1016/j.foreco.2010.11.006

Dilthey, W., Makkreel, R. A., & Rodi, F. (2019). Wilhelm Dilthey: Selected Works, Volume VI : Ethical and World-View Philosophy. Volume VI, Ethical and world-view philosophy. https://press.princeton.edu/books/hardcover/9780691195575/wilhelm-dilthey-selected-works-volume-vi

DOF - Diario Oficial de la Federación. (n.d.). Retrieved December 15, 2021, from http://www.dof.gob.mx/nota_detalle.php?codigo=5565599&fecha=12/07/2019

Dramstad, W. E., Olson, J. D., & Forman, R. T. T. (1996). Landscape ecology principles in landscape architecture and land-use planning. Harvard University, Graduate School of Design etc.

Ellis, E. A., Montero, S. A., Hernández Gómez, I. U., Romero Montero, J. A., Ellis, P. W., Rodríguez-Ward, D., Blanco Reyes, P., & Putz, F. E. (2019). Reduced-impact logging practices reduce forest disturbance and carbon emissions in community managed forests on the Yucatán Peninsula, Mexico. Forest Ecology and Management, 437, 396–410. https://doi.org/10.1016/J.FORECO.2019.01.040

Elke Krasny and Angelika Fitz, Critical Care: Architecture and Urbanism for a Broken Planet (Cambridge, Mass.: MIT Press, 2019): 13.

Estrada-Medina, H., Jiménez-Osornio, J. J., Álvarez-Rivera, O., & Barrientos-Medina, R. C. (2019). El karst de Yucatán: su origen, morfología y biología. Acta Universitaria, 29, 2292. http://doi.org/10.15174.au.2019.2292

Evans, D. L., Vis, B. N., Dunning, N. P., Graham, E., & Isendahl, C. (2021). Buried solutions: How Maya urban life substantiates soil connectivity. Geoderma, 387, 114925. https://doi.org/10.1016/J.GEODERMA.2020.114925

Franklin, G. L., Medellín, G., Appendini, C. M., Gómez, J. A., Torres-Freyermuth, A., López González, J., & Ruiz-Salcines, P. (2021). Impact of port development on the northern Yucatan Peninsula coastline. Regional Studies in Marine Science, 45, 101835. https://doi.org/10.1016/J.RSMA.2021.101835

García de Fuentes, A., Jouault, S., Romero, D., García de Fuentes, A., Jouault, S., & Romero, D. (2019). Representaciones cartográficas de la turistificación de la península de Yucatán

a medio siglo de la creación de Cancún. Investigaciones Geográficas, 100. https://doi.org/10.14350/RIG.60023

Giezen, M., Salet, W., & Bertolini, L. (2015). Adding value to the decision-making process of mega projects: Fostering strategic ambiguity, redundancy, and resilience. Transport Policy, 44, 169–178. https://doi.org/10.1016/J.TRANPOL.2015.08.006

Goldscheider, N. (2019). A holistic approach to groundwater protection and ecosystem services in karst terrains. Carbonates and Evaporites, 34(4), 1241–1249. https://doi.org/10.1007/S13146-019-00492-5/FIGURES/5

Gong, C. (2020). A Study on the Productive Protection of Intangible Cultural Heritage Against the Background of "the Belt and Road." 429–432. https://doi.org/10.2991/ASSEHR.K.200316.095

Graniel, C. E., Morris, L. B., & Carrillo-Rivera, J. J. (1999). Effects of urbanization on groundwater resources of Merida, Yucatan, Mexico. Environmental Geology 1999 37:4, 37(4), 303–312. https://doi.org/10.1007/S002540050388

Harvell, Catherine & E, Jordan & Merkel, Susan & Raymundo, Laurie & Rosenberg, Eugene & Smith, Garriet & Weil, Ernesto & Willis, Bette. (2007). Coral Disease, Environmental Drivers, and the Balance Between Coral and Microbial Associates. Oceanography (Washington D.C.). 20. 58-81. 10.5670/oceanog.2007.91.

Huaman, E. S., & Sriraman, B. (2015). Indigenous innovation: Universalities and peculiarities. Indigenous Innovation: Universalities and Peculiarities, 1–213. https://doi.org/10.1007/978-94-6300-226-4

Iglesias, E. (2014). Travesías del desarrollo en Yucatán. Problemas Del Desarrollo, 45(177), 169–192. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0301-70362014000200008&lng=es&nrm=iso&tlng=es

IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press

Iveson, K. (2011). Social or spatial justice? Marcuse and Soja on the right to the city. City, 15(2), 250–259. https://doi.org/10.1080/13604813.2011.568723

Keesstra, S., Nunes, J., Novara, A., Finger, D., Avelar, D., Kalantari, Z., & Cerdà, A. (2018). The superior effect of nature based solutions in land management for enhancing ecosystem services. Science of The Total Environment, 610–611, 997–1009. https://doi.org/10.1016/J.SCITOTENV.2017.08.077

Khirfan, L. (2014). World heritage, urban design and tourism: three cities in the middle east. Ashgate.

Kimmerer, R. W. (2015). Braiding sweetgrass. Milkweed Editions.

Krause, S., Beach, T., Luzzadder-Beach, S., Guderjan, T. H., Valdez, F., Eshleman, S., Doyle, C., & Bozarth, S. R. (2019). Ancient Maya wetland management in two watersheds in Belize: Soils, water, and paleoenvironmental change. Quaternary International, 502, 280–295. https://doi.org/10.1016/J.QUAINT.2018.10.029

Krause, S., Beach, T. P., Luzzadder-Beach, S., Cook, D., Bozarth, S. R., Valdez, F., & Guderjan, T. H. (2021). Tropical wetland persistence through the Anthropocene: Multiproxy reconstruction of environmental change in a Maya agroecosystem. Anthropocene, 34, 100284. https://doi.org/10.1016/J.ANCENE.2021.100284

Kurnick, S. (2019). Navigating the past in the aftermath of dramatic social transformations: Postclassic engagement with the Classic period past in the northeast Yucatan peninsula. Journal of Anthropological Archaeology, 53, 51–65. https://doi.org/10.1016/J.JAA.2018.11.003

Latour, B. (2014). Some Advantages of the Notion of "Critical Zone" for Geopolitics. Procedia Earth and Planetary Science, 10, 3–6. https://doi.org/10.1016/J.PROEPS.2014.08.002

Latour, B., Weibel, P., & Zentrum für Kunst und Medientechnologie Karlsruhe. (2021). Critical zones: the science and politics of landing on earth. 472. Retrieved January 16, 2022, from https://mitpress.mit.edu/books/critical-zones

Lawrence, A. K. (2015). Risk Sensitivity and Value among Andean Pastoralists: Measures, Models, and Empirical Tests1. Https://Doi.Org/10.1086/320483, 42(3), 432–440. https://doi.org/10.1086/320483

Lebedeva, E. v., Mikhalev, D. v., & Nekrasova, L. A. (2017). Evolutionary stages of the karst-anthropogenic system of the Yucatán Peninsula. Geography and Natural Resources 2017 38:3, 38(3), 303–311. https://doi.org/10.1134/S187537281703012X

Leija, M. G., & Lomas, S. F. (2018). Assessment of a nature-based structure to manage coastal dune erosion in Yucatan, Mexico. Coastal Engineering Proceedings, 36, 57–57. https://doi.org/10.9753/ICCE.V36.STRUCTURES.57

Long, D. T., Pearson, A. L., Voice, T. C., Polanco-Rodríguez, A. G., Sanchez-Rodríguez, E. C., Xagoraraki, I., Concha-Valdez, F. G., Puc-Franco, M., Lopez-Cetz, R., & Rzotkiewicz, A. T. (2018). Influence of rainy season and land use on drinking water quality in a karst landscape, State of Yucatán, Mexico. Applied Geochemistry, 98, 265–277. https://doi.org/10.1016/J.APGEOCHEM.2018.09.020

Lopez-Maldonado, Y., & Berkes, F. (2017). Restoring the environment, revitalizing the culture: cenote conservation in Yucatan, Mexico. Ecology and Society, Published Online: Oct 11, 2017. Doi:10.5751/ES-09648-220407, 22(4), 7. https://doi.org/10.5751/ES-09648-220407

Manuel-Navarrete, D., & Pelling, M. (2015). Subjectivity and the politics of transformation in response to development and environmental change. Global Environmental Change, 35, 558–569. https://doi.org/10.1016/J.GLOENVCHA.2015.08.012

Martínez-Reyes, J. E. (2016). Moral Ecology of a Forest. University of Arizona Press. https://openresearchlibrary.org/content/b6a915de-e0f8-46c7-ae7e-5ab9354c68d1

Medina, L. K. (2003). Commoditizing culture: Tourism and Maya Identity. Annals of Tourism Research, 30(2), 353–368. https://doi.org/10.1016/S0160-7383(02)00099-3

Melo Zurita, M. de L. (2019). Holes, subterranean exploration and affect in the Yucatan Peninsula. Emotion, Space and Society, 32, 100584. https://doi.org/10.1016/J.EMOSPA.2019.100584

Melo Zurita, M. de L., & Munro, P. G. (2019). Voluminous territorialization: Historical contestations over the Yucatan Peninsula's subterranean waterscape. Geoforum, 102, 38–47. https://doi.org/10.1016/J.GEOFORUM.2019.03.019

Metcalfe, S. E., Schmook, B., Boyd, D. S., de la Barreda-Bautista, B., Endfield, G. E., Mardero, S., Manzón Che, M., Medina González, R., Munguia Gil, M. T., Navarro Olmedo, S., & Perea, A. (2020). Community perception, adaptation and resilience to extreme weather in the Yucatan Peninsula, Mexico. Regional Environmental Change, 20(1), 1–15. https://doi.org/10.1007/S10113-020-01586-W/FIGURES/2

Montagnini, F. (Ed.). (2017). Integrating Landscapes: Agroforestry for Biodiversity Conservation and Food Sovereignty. 12. https://doi.org/10.1007/978-3-319-69371-2

Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action. Governing the Commons. https://doi.org/10.1017/CBO9780511807763

Pretty, J., Adams, B., Berkes, F., de Athayde, S. F., Dudley, N., Hunn, E., Maffi, L., Milton, K., Rapport, D., Robbins, P., Sterling, E., Stolton, S., Tsing, A., Vintinner, E., & Pilgrim, S. (2009). The Intersections of Biological Diversity and Cultural Diversity: Towards Integration. Conservation and Society, 7(2), 100–112. http://www.jstor.org/stable/26392968

Puc-Alcocer, M., Arce-Ibarra, A. M., Cortina-Villar, S., & Estrada-Lugo, E. I. J. (2019). Rainforest conservation in Mexico's lowland Maya area: Integrating local meanings of conservation and land-use dynamics. Forest Ecology and Management, 448, 300–311. https://doi.org/10.1016/J.FORECO.2019.06.016

de La Bellacasa, M. P. (2017). Matters of care: Speculative ethics in more than human worlds (Vol. 41). U of Minnesota Press.

Klauser, F. R. (2012). Thinking through territoriality: Introducing Claude Raffestin to Anglophone sociospatial theory. Environment and Planning D: Society and Space, 30(1), 106–120. https://doi.org/10.1068/D20711

Ramírez, K. D. I., & Ibarra, A. M. A. (2015). Percepción local de los servicios ecológicos y de bienestar de la selva de la zona maya en Quintana Roo, México. Investigaciones Geográficas, Boletín Del Instituto de Geografía, 2015(86), 67–81. https://doi.org/10.14350/RIG.36593

Ramirez-Reyes, C., Sims, K. R. E., Potapov, P., & Radeloff, V. C. (2018). Payments for ecosystem services in Mexico reduce forest fragmentation. Ecological Applications, 28(8), 1982–1997. https://doi.org/10.1002/EAP.1753

Recubenis Sanchis, I. (2020). Restoring Systemic Proximities: Towards the re-territorialization of the Dutch Rivierenland. https://repository.tudelft.nl/islandora/object/uuid%3A2d79ab24-9ac8-4b1f-8bca-ed4eeb999e71

Redclift, M. (2001). “Changing Nature’”: The Consumption of Space and the Construction of Nature on the ‘Mayan Riviera.’”

Roo, Q., Ka, M., Yesenia Maraí Tello-Leyva, an, en Des, M., Merediz-Alonso, G., & en Amigos de Sian Ka, M. C. (2017). Acciones, Logros Y Retos Del Destino De Bajo Impacto Ambiental En Quintana Roo, México: Maya Ka’an. European Scientific Journal, ESJ, 13(27), 77–77. https://doi.org/10.19044/ESJ.2017.V13N27P77

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., de Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., … Foley, J. A. (2009). A safe operating space for humanity. Nature 2009 461:7263, 461(7263), 472–475. https://doi.org/10.1038/461472a

Rosete-Vergés, F., & Negrete-Fernández, G. (2012). Planeación territorial en el sureste de México: revisión histórica del ordenamiento ecológico. Universidad y Ciencia, 28(3), 301–311. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0186-29792012000300009&lng=es&nrm=iso&tlng=es

Sarukhán, J., & Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (México). (2017). Capital natural de México síntesis: evaluación del conocimiento y tendencias de cambio, perspectivas de sustentabilidad, capacidad humanas e institucionales.

Sarukhan, J., Urquiza-Haas, T., Koleff, P., Carabias, J., Dirzo, R., Ezcurra, E., Cerdeira-Estrada, S., & Soberon, J. (2015). Strategic actions to value, conserve, and restore the natural capital of megadi versity countries: The case of Mexico. BioScience, 65(2), 164–173. https://doi.org/10.1093/BIOSCI/BIU195

Shimamoto, C. Y., Padial, A. A., da Rosa, C. M., & Marques, M. C. M. (2018). Restoration of ecosystem services in tropical forests: A global meta-analysis. PLOS ONE, 13(12), e0208523. https://doi.org/10.1371/JOURNAL.PONE.0208523

Sioui, M. P. S. (2019). Drought in the Yucatan: Maya perspectives on tradition, change, and adaptation. 2, 67–75. https://doi.org/10.1016/B978-0-12-814820-4.00005-5

Slunge, D., & Loayza, F. (2012). GREENING GROWTH THROUGH STRATEGIC ENVIRONMENTAL ASSESSMENT OF SECTOR REFORMS. Public Administration and Development, 32(3), 245–261. https://doi.org/10.1002/PAD.1623

“The city and spatial justice” [« La ville et la justice spatiale », traduction : Sophie Didier, Frédéric Dufaux], justice spatiale | spatial justice | n° 01 septembre | september 2009

Šprajc, I., Dunning, N. P., Štajdohar, J., Hernández Gómez, Q., López, I. C., Marsetič, A., Ball, J. W., Dzul Góngora, S., Esparza Olguín, O. Q., Flores Esquivel, A., & Kokalj, Ž. (2021). Ancient Maya water management, agriculture, and society in the area of Chactún, Campeche, Mexico. Journal of Anthropological Archaeology, 61, 101261. https://doi.org/10.1016/J.JAA.2020.101261

Stevanović, Z. (2015). Managing Karst Aquifers—Conceptualizations, Solutions, Impacts. 403–419. https://doi.org/10.1007/978-3-319-12850-4_14

T., T., A.M., L., A., L. A., & A., R. (2018). Análisis de la gobernanza multinivel en México: Lecciones para REDD+ de un estudio sobre cambio de uso del suelo y distribución de beneficios en Chiapas y Yucatán. AnáLisis de La Gobernanza Multinivel En MéXico: Lecciones Para REDD+ de Un Estudio Sobre Cambio de Uso Del Suelo y Distribución de Beneficios En Chiapas y Yucatán. https://doi.org/10.17528/CIFOR/006292

Valencia, M. F. L., & Fuentes, A. G. de. (2019). Economía social y turismo alternativo: el caso de la Península de Yucatán. Dimensiones Turísticas, 3(5), 79–95. https://doi.org/10.47557/IKVX1907

Waldrop, M. (1993). Complexity: The emerging science at the Edge of order and chaos. Simon and Schuster.

Watson, J., & Davis, W. (2020). Lo-TEK: Design by radical indigenism.

Xuhong, K., & Jingjing, H. (n.d.). Productive Protection of Intangible Cultural Heritage Based on the Theory of Involvement: A Case Study on the Farmers’ Paintings of Xin-Ji County, Hebei Province, China. https://doi.org/10.1051/shsconf/20208601031

Zahedi, S. (2008). Tourism impact on coastal environment. https://doi.org/10.2495/CENV080051

Zamudio-Sánchez, F. J., Soriano-Montero, M., & Ibarra-Contreras, P. (2012). Análisis sobre la evolución del desarrollo humano en la peninsula de Yucatán. Economía Sociedad y Territorio. https://doi.org/10.22136/EST00201262



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