

GREEN SKILLS FOR CITIES

LTP

Shared lessons

Intro to Urban ecology,
ecological connectivity
& data driven design

IAAC

Mathilde Marengo & Iacopo Neri



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SECTION ONE

Context

Planetary Urbanization

A threat to fine ecological balances

GLOBAL HUMAN FOOTPRINT INDEX V2.

Cartography by Nikos Katsikis, based on data from the Wildlife Conservation Society - WCS, and Center for International Earth Science Information Network - CIESIN - Columbia University, 2005. Last of the Wild Project, Version 2, 2005 (LWP-2): Global Human Footprint Dataset (Geographic). Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC).



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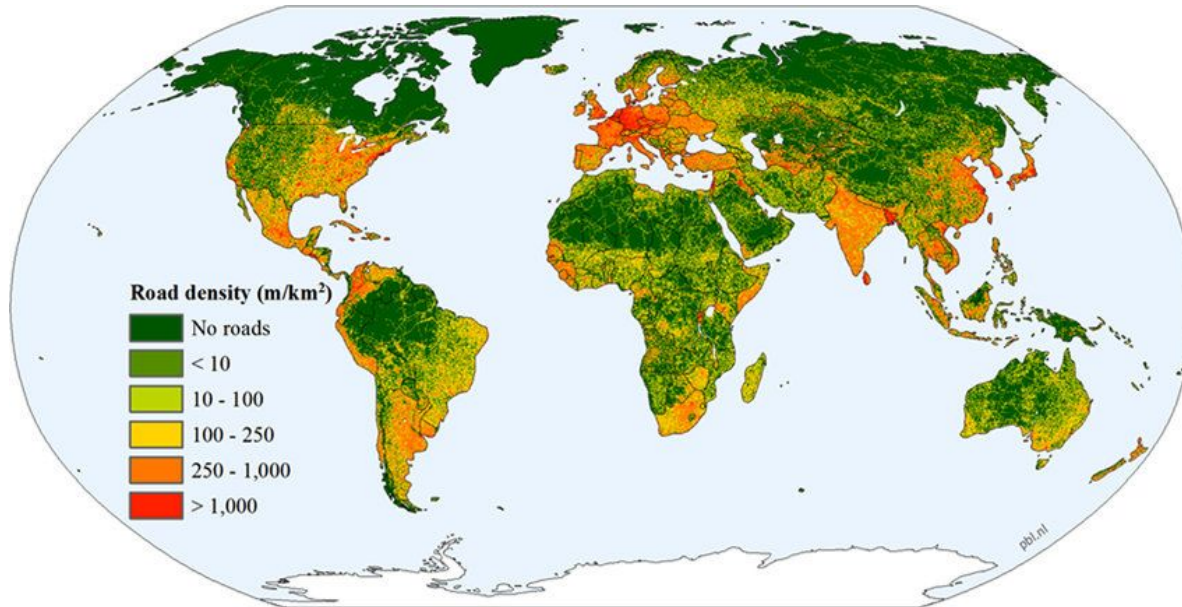
SECTION ONE

Questioning

Landscape

Fragmentation

Urbanities as a drivers for Landscape Fragmentation



For further reading: https://www.researchgate.net/publication/274389394_Habitat_fragmentation_and_its_lasting_impact_on_Earth_ecosystems

WHO ARE WE DESIGNING CITIES FOR TODAY?

The great majority of **today's legal systems only protect the rights of humans**, often considering nature as one of the **resources to be exploited** “for the exclusive benefit of our own species.”

Although this legal condition has began to shift with the emergence of several national and international conventions, [...] the modus operandi applied until this shift has created a condition whereby **land and ecology, through property laws, have been fragmented.**

A condition that is in **profound “contradiction to ecological principles of wholeness and interconnection.”**

LET'S DESIGN CITIES IN SYMBIOSIS BETWEEN HUMAN AND ECOLOGICAL FORCES.

John Thackara (2015), How to Thrive in the Next Economy: Designing Tomorrow's World Today, Thames & Hudson, London, pp. 151-156.

From: Mathilde Marengo, Iacopo Neri, Eduardo Rico-Carranza (2022), Enabling design with nature through data driven processes. A methodology for the integration of nature as an active partner in design towards living cities, Joelho-Journal of Architectural culture, Issue 14, Digital Culture: What's next? in press.

WHO ARE WE DESIGNING CITIES FOR TODAY?
LET'S DESIGN CITIES IN SYMBIOSIS BETWEEN HUMAN AND ECOLOGICAL FORCES.

Concepts such as **renaturing and rewilding** - both intended to not only restore nature, but **allow it to thrive independently** - offer an unprecedented challenge for designers: to approach landscape under a **dynamic, collective, multidisciplinary and multiscalar perspective**.

From: Mathilde Marengo, Iacopo Neri, Eduardo Rico-Carranza (2022), Enabling design with nature through data driven processes. A methodology for the integration of nature as an active partner in design towards living cities, Joelho-Journal of Architectural culture, Issue 14, Digital Culture: What's next? in press.

SECTION ONE

Frameworks

Designing cities in symbiosis

Renaturing and Rewilding as more-than-human design strategies



Tempelhofer Feld, Berlin



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Frameworks

→ Renaturing

From Renature:

re- + nature, coined as an opposite to denature.

<https://en.wiktionary.org/wiki/renature>

From Renaturation, which can mean can mean:

> the inverse process of denaturation

> ecological restoration, also sometimes called renaturization.

<https://en.wikipedia.org/wiki/Renaturation>



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SECTION ONE

Frameworks

Renaturing

The importance of nature



<https://www.youtube.com/watch?v=wXJiHr8jWBs>

For further reading: <https://royalsociety.org/topics-policy/projects/biodiversity/human-impact-on-biodiversity/>

Frameworks

→ Rewilding

Rewilding is a progressive approach to conservation. It's about letting nature take care of itself, enabling natural processes to shape land and sea, repair damaged ecosystems and restore degraded landscapes. Through rewilding, wildlife's natural rhythms create wilder, more biodiverse habitats.

Rewilding is about:

Nature's own ways - Nature knows best when it comes to survival and self-governance.

Bringing back wildlife - Rewilding works to restore lost species guilds by giving them space to thrive.

Ensuring wellbeing - When nature is healthy, we are healthier too.

Delivering for the future - There is no defined end point for rewilding.

<https://rewildingeurope.com/what-is-rewilding/>

SECTION ONE

Frameworks

Rewilding

Initiatives



<https://rewilding europe.com/>

SECTION ONE

Frameworks

Rewilding Initiatives

Mission

Our fundamental mission is to carry out multidisciplinary research of the highest standard directed to understanding the way in which biodiversity is generated, maintained and deteriorates, as well as the consequences of its loss...

[Más información](#)

[RSS \(Opens New Window\)](#)

ICTS de la Reserva Biológica de Doñana

Observatorio de Biodiversidad y Cambio Global de Doñana

Assessments of alien species impacts are reliable to prioritize resources

The Doñana Biological Station - CSIC has shown the reliability of assessments of alien species impacts, which help prioritize resources against one of the current and future challenges of humankind.

These assessments based on responses by experts are susceptible of high subjectivity and it was essential to test their utility in assisting in the management of alien invasive species.

[View »](#)

[actualidad](#) [biological invasions](#) [socio-economic impact](#) [alien species](#) [ecological impacts](#) 03/10/22

<http://www.ebd.csic.es/inicio>

SECTION ONE

Frameworks

Rewilding

Initiatives



<https://www.theguardian.com/environment/blog/video/2013/may/30/rewilding-animation-george-monbiot-video>

For further reading: <https://rewildingeurope.com/rewilding-in-action/>



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SECTION TWO

Renaturing cities

Steering territorial dynamics

Case studies

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Students: Naseer A.N.H., Qatanany H., Guimaraes L., Gonzalez M.J., Coskun S., Re(naturing) BCN, Barcelona, 2021. (IAAC)



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SECTION TWO

Renaturing cities

Integrating territorial
forces into urban design

Simulation and digital models can enable designers to understand, foresee, and drive territorial dynamics in order to **emphasise natural forces rather than limit them.**

Renaturing cities

Integrating territorial
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Simulation and digital models can enable designers to understand, foresee, and drive territorial dynamics in order to **emphasise natural forces rather than limit them.**

Alzette 2.0

Enhancing river natural state and functioning to tackle issues of floss and loss of habitat produced by human induced modifications in their river bed through a design that engages with the dynamics of river meandering.

SECTION TWO

Renaturing cities

Alzette

Simulating meandering dynamics

2.0



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Renaturing cities

Alzette

Simulating meandering dynamics

2.0



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Renaturing cities

Alzette

Simulating meandering dynamics

2.0



Meandering Pattern

- slowing down the river
- increasing riparian zone
- open undetermined channels for water flow



Bioremediation Forest

- reclaiming polluted soil and water
- improving local biodiversity
- improving air quality



Recreation Area

- reconnecting people to the river
- rehumanizing the river
- reviving

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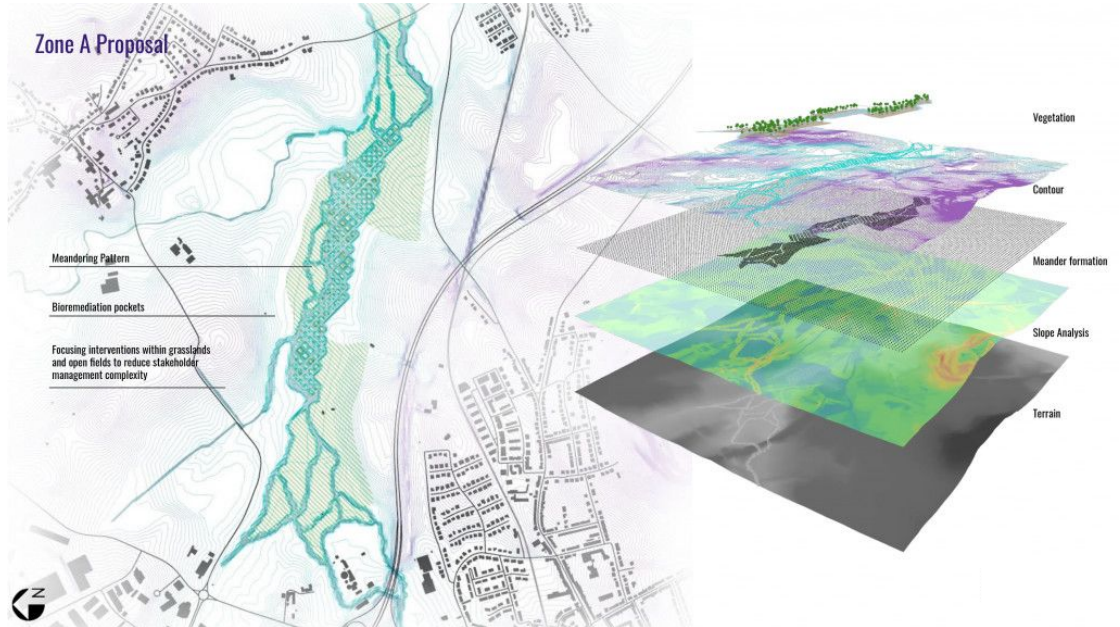
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Renaturing cities

Creating nature based
economies and social
values

Simulation and digital models can enable designers to understand, foresee, and drive territorial dynamics in order to **emphasise natural forces rather than limit them.**

Water we talking about

Reconnecting the link between the city, the citizens, and their water by creating natural, democratic flood risk management systems perpetuated by the inhabitants of Lagos, Nigeria.

SECTION TWO

Renaturing cities

Water we talking about

A city-citizens-water dialogue

MEANDERING OF RIVER : ABEOKUTA → RURAL AREA

Urbanization has lead to conformation of river to hard surfaces.

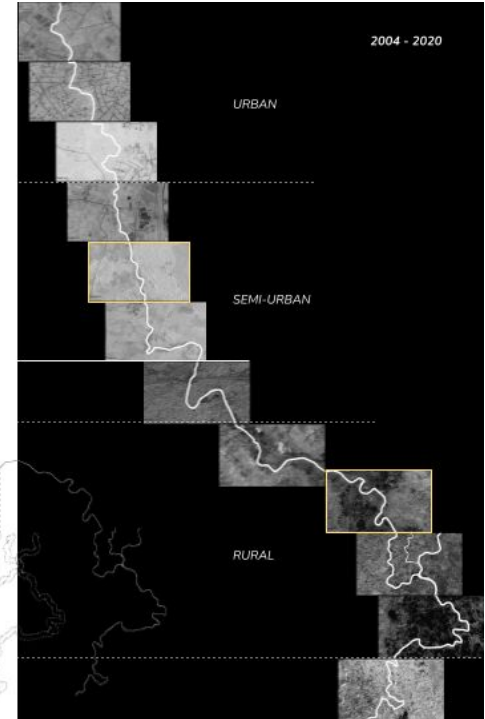
River deformation more noticable downstreet

Assumption: fixed velocity increasing from the flow of river, especially after release of Oyan Dam is transforming the river downstream at rapid rate

URBAN
increasing or decreasing flow rate
increase rainwater absorption

SEMI-URBAN
decreasing flow rate for farms
filter polluted urban runoff water

RURAL
decreasing flow rate to flood green areas



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Renaturing cities

Water we

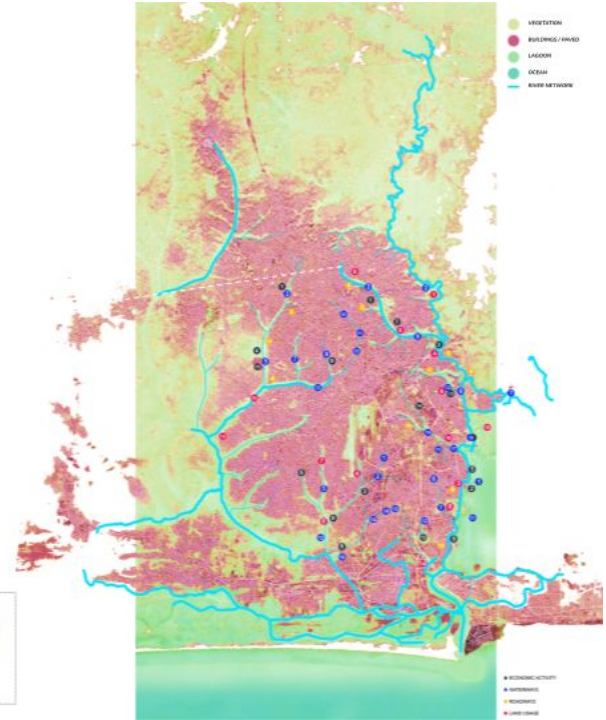
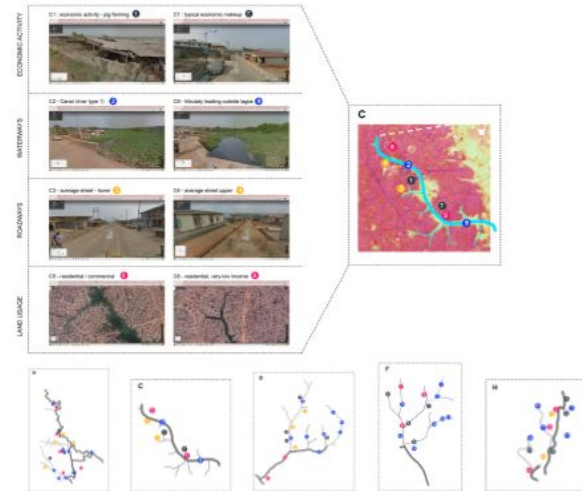
talking about

A city-citizens-water dialogue

How is the river being used, what is going on around it ?

CATEGORIES

- Economic activities
- Land type + usage
- Makeup of the waterway - size, vegetation, pollution, misc



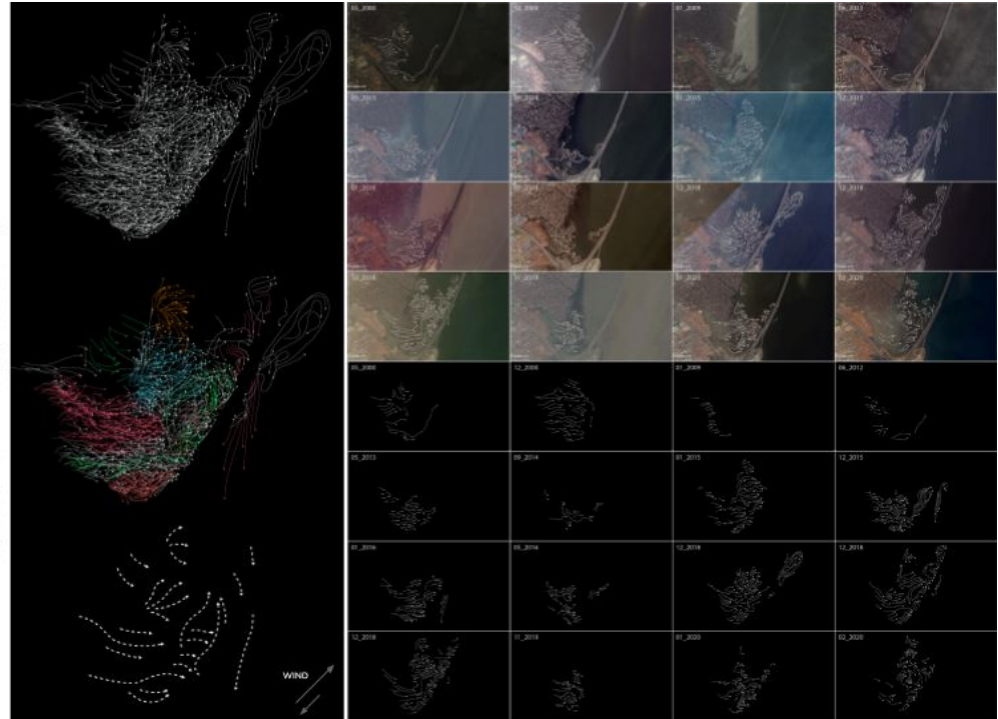
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Water we talking
A city-citizens-water dialogue

FLOW ANALYSIS	
Consistent flow pattern over 20 year span.	
Indications of north and south wind movements.	
PARAMETERS :	Indications of consistent water flow velocity according to season.
Flow direction	
Flow velocity	
River profile	
Vegetation	
Deposition	
CONCLUSION	
With this analysis, an assumption regarding sediment accumulation and deposit direction can be made by tracing the flow patterns.	



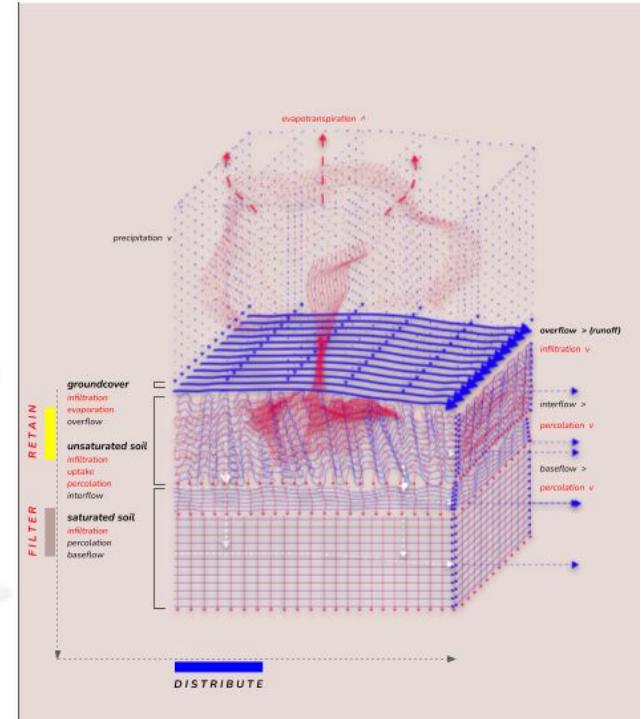
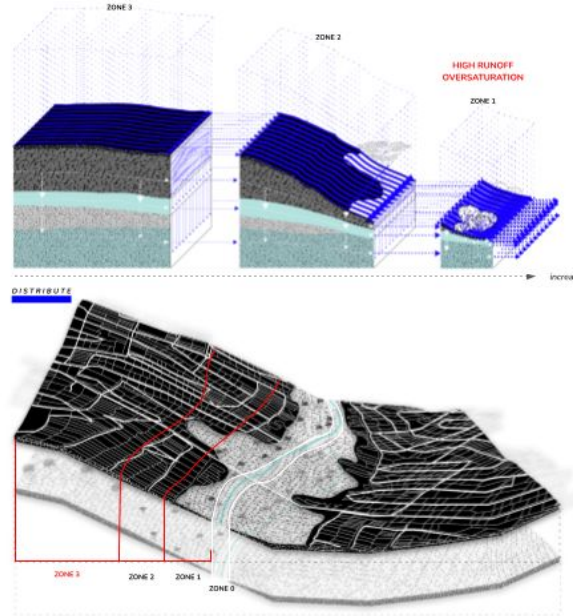
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Water we talking about

A city-citizens-water dialogue



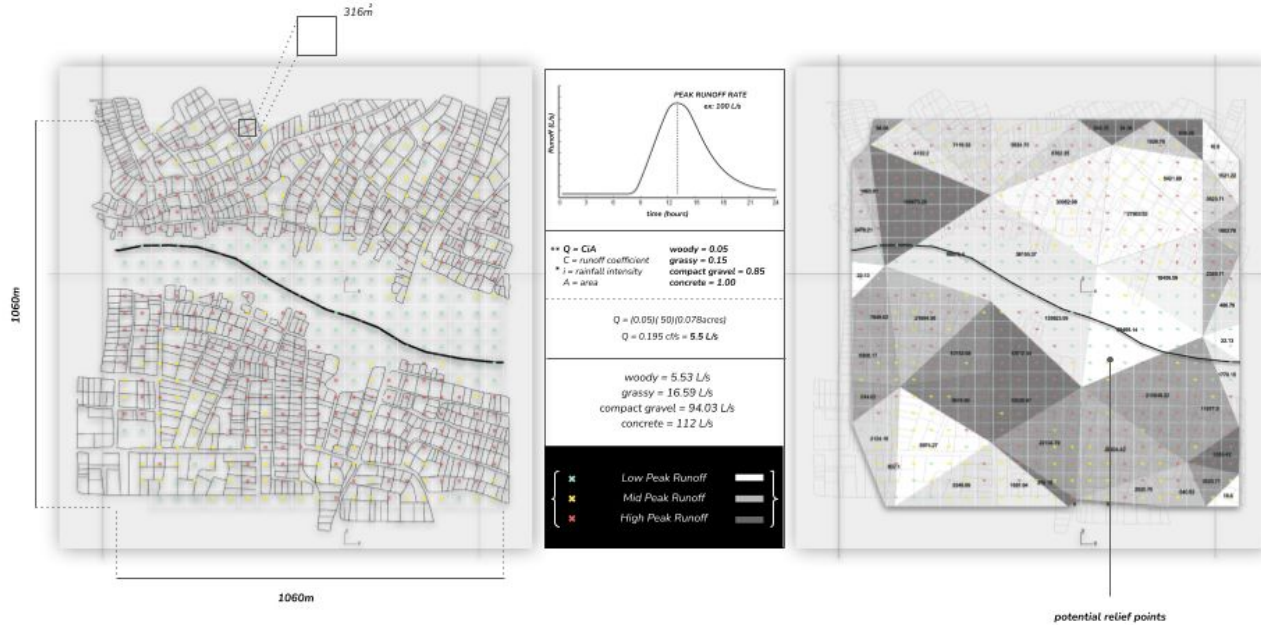
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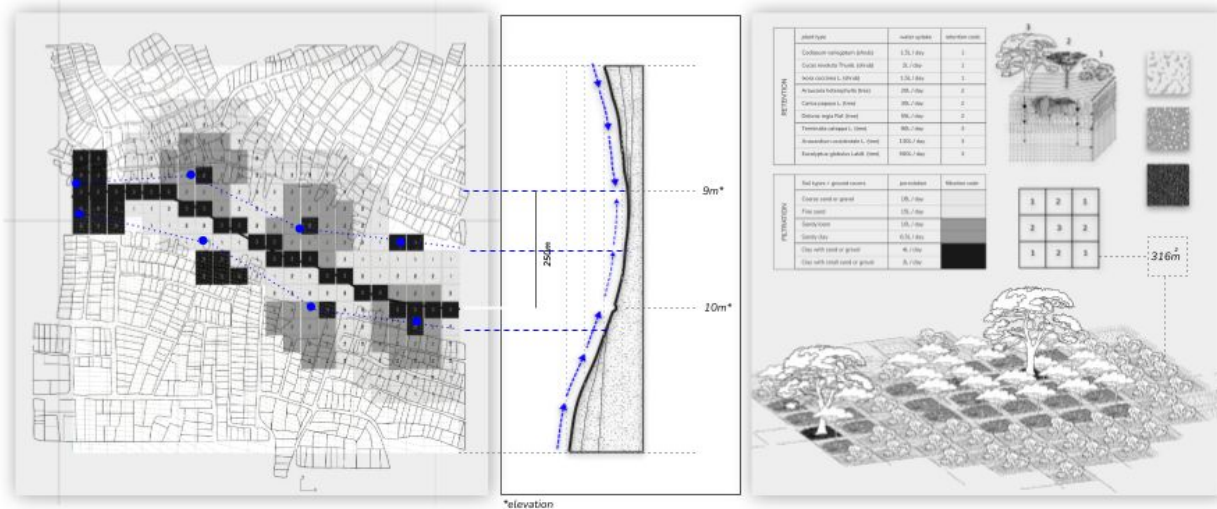
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Water we talking about

A city-citizens-water dialogue



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SECTION THREE

Rewilding cities

Ecosystem engineers and key-stone species

Case studies

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Students: Lampriadis D., Bou Saleh J., McGee J., Nirmal K., [Echo]nnect, Barcelona, 2022. (IAAC).



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Rewilding cities

Mending fragmented
landscapes through
ecological connectivity

Ecological connectivity is an essential part of nature. It is **necessary** for the **functionality of ecosystems**, is key for the survival of wild animals and plant species and is crucial to **ensuring genetic diversity and adapting to climate change across all biomes and spatial scales.**



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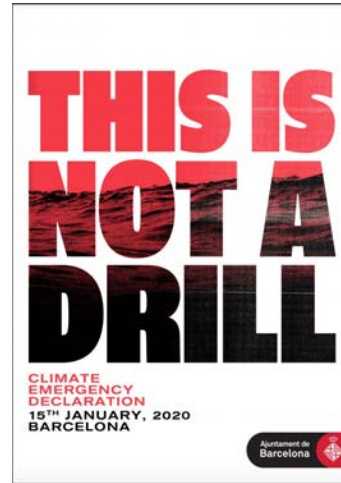
Ecological connectivity against landscape fragmentation



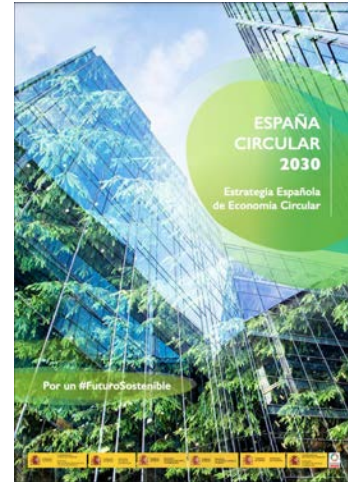
Agreement Towards a more inclusive and sustainable 22@ within Poblenou
<https://ajuntament.barcelona.cat/barcelonalibres/ca/publicacions/pacte-cap-un-poblenou-amb-un-22-mes-inclusiu-i-sostenible>



Barcelona Green Plan 2021 - 2030
https://ajbcn-decidim-barcelona.s3.amazonaws.com/decidim-barcelona/uploads/decidim/attachment/file/12162/Pla_Natura_Barcelona_2030_digital.pdf



Barcelona Climate Emergency Declaration - This is not a drill
<https://www.barcelona.cat/emergenciaclimatica/en>



España Circular 2030
<http://materplat.org/wp-content/uploads/Espa%C3%B1a-Circular-2030.pdf>

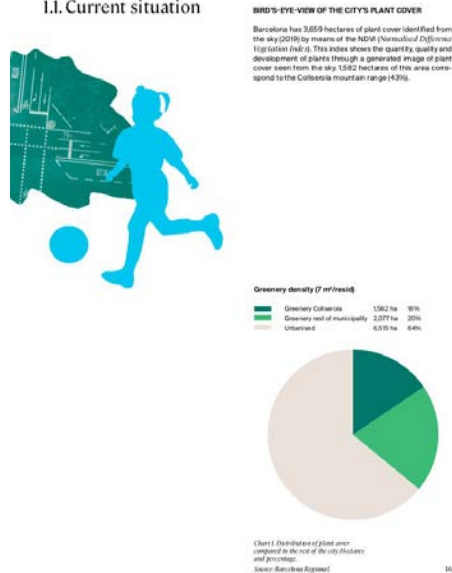
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Ecological connectivity against landscape fragmentation

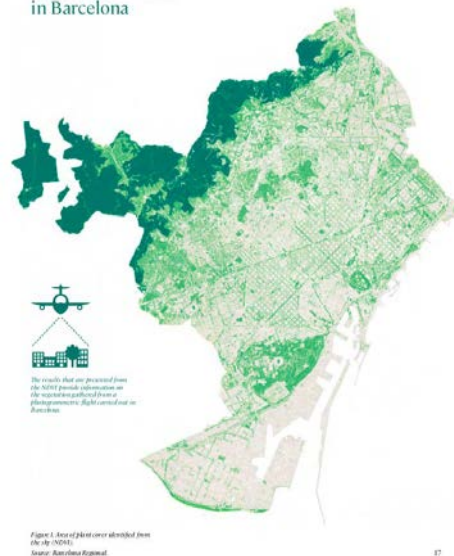
1. THE STATE OF GREENERY AND BIODIVERSITY AND THEIR DEVELOPMENT

1.1. Current situation



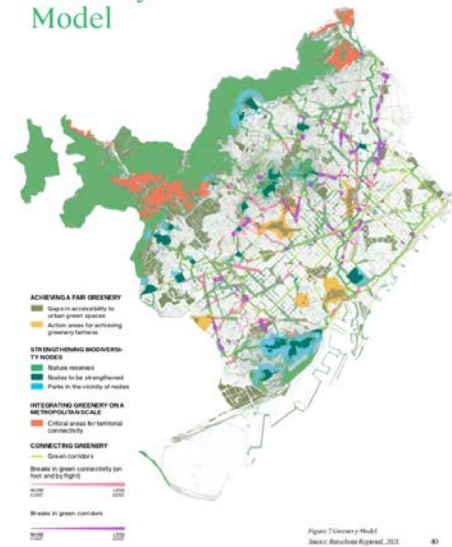
1. THE STATE OF GREENERY AND BIODIVERSITY AND THEIR DEVELOPMENT

Area of plant cover in Barcelona



2. ASSESSMENT OF THE GREEN INFRASTRUCTURE AND BIODIVERSITY PLAN 2021-2030

Greenery Model



To achieve a fair greenery

To connect greenery

To strengthen biodiversity nodes

To integrate greenery on a metropolitan level

Barcelona Nature Plan 2021-2030
<https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/123630/1/Barcelona%20Nature%20Plan%202020%20WEB.pdf>



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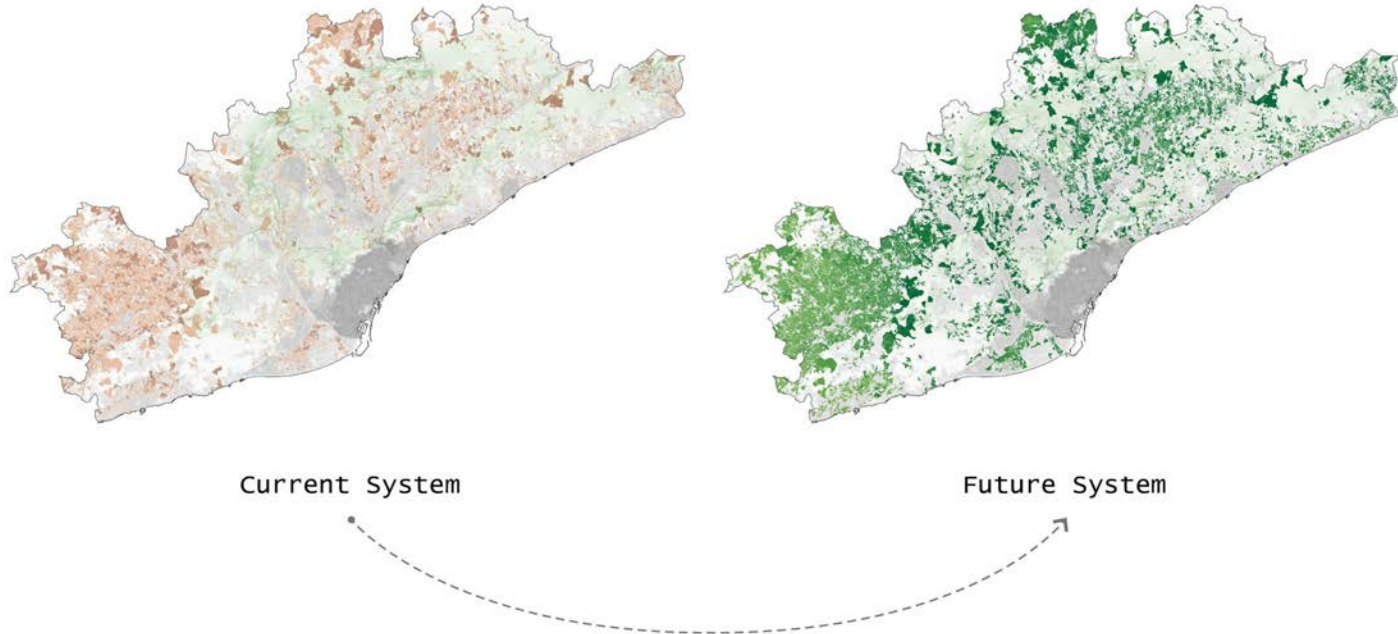
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Towards breathing cities



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Rewilding cities

Partnering with ecosystem engineers in design processes

Simulating the likelihood for **ecosystem engineers to thrive** in heterogeneous territory and foresee the consequences of their living in order **to drive their produced impact towards designated solutions.**

Rewilding cities

Partnering with ecosystem engineers in design processes

Simulating the likelihood for **ecosystem engineers to thrive** in heterogeneous territory and foresee the consequences of their living in order **to drive their produced impact towards designated solutions.**

FlowerPowder

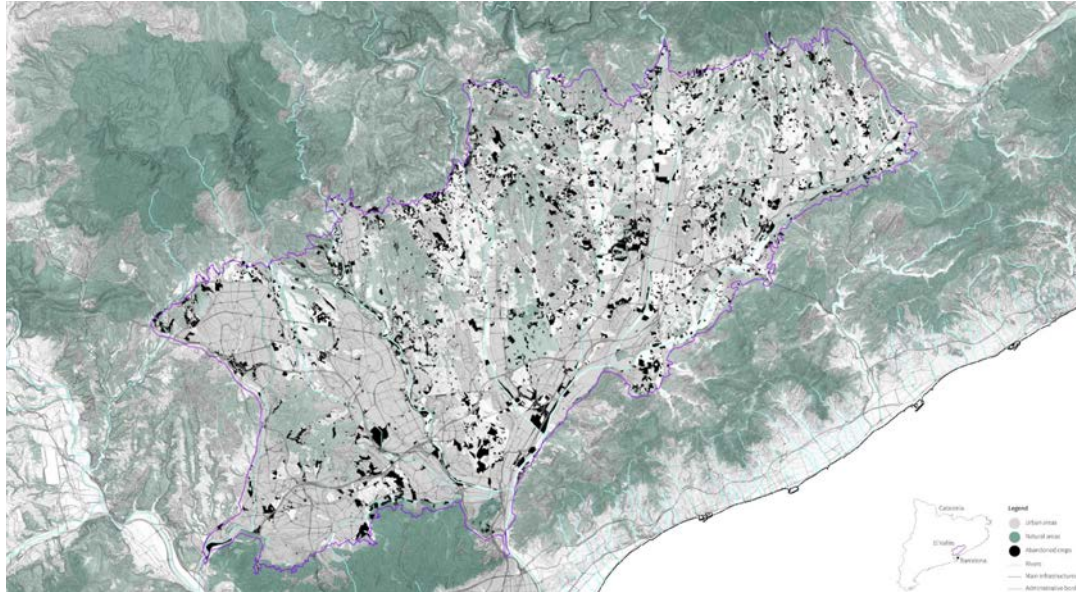
Acting on agriculture-induced landscape fragmentation with the support of pollinators and a data-driven methodology.

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Supporting local communities and pollinators



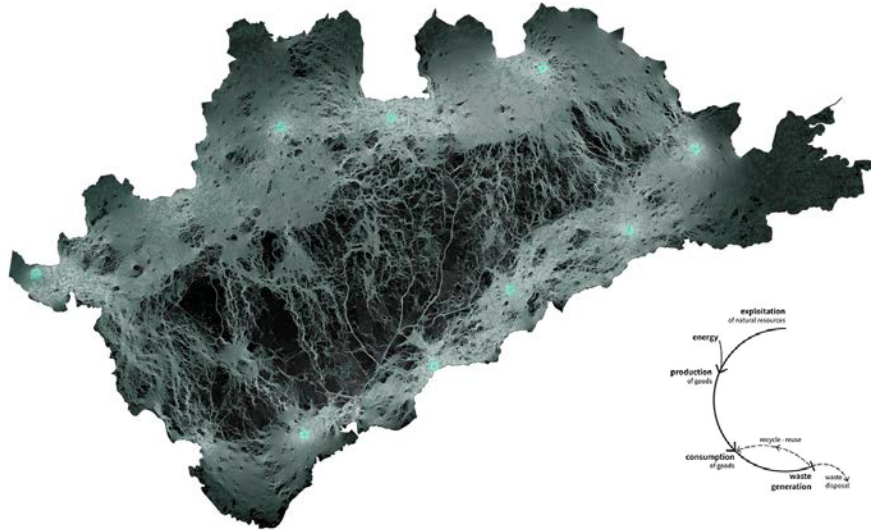
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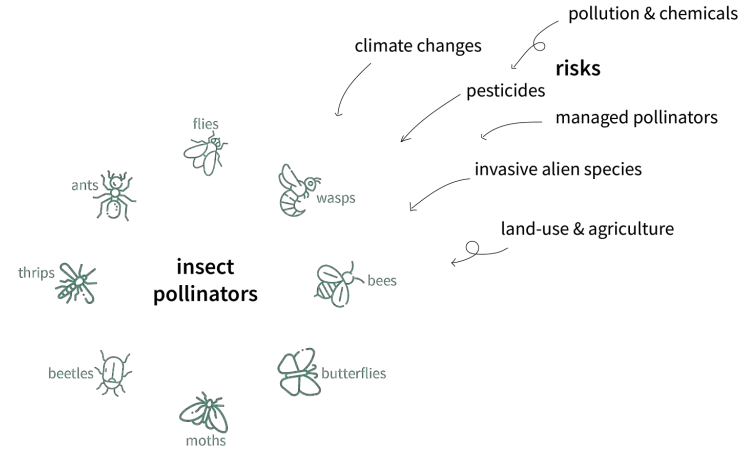
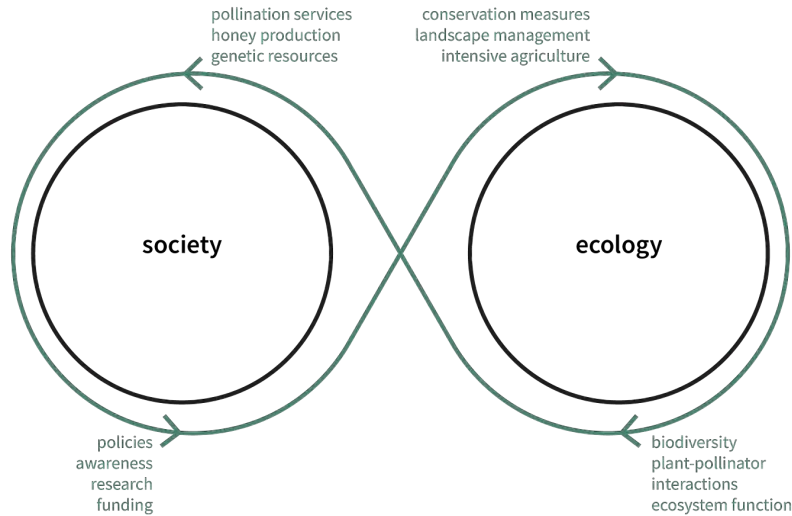
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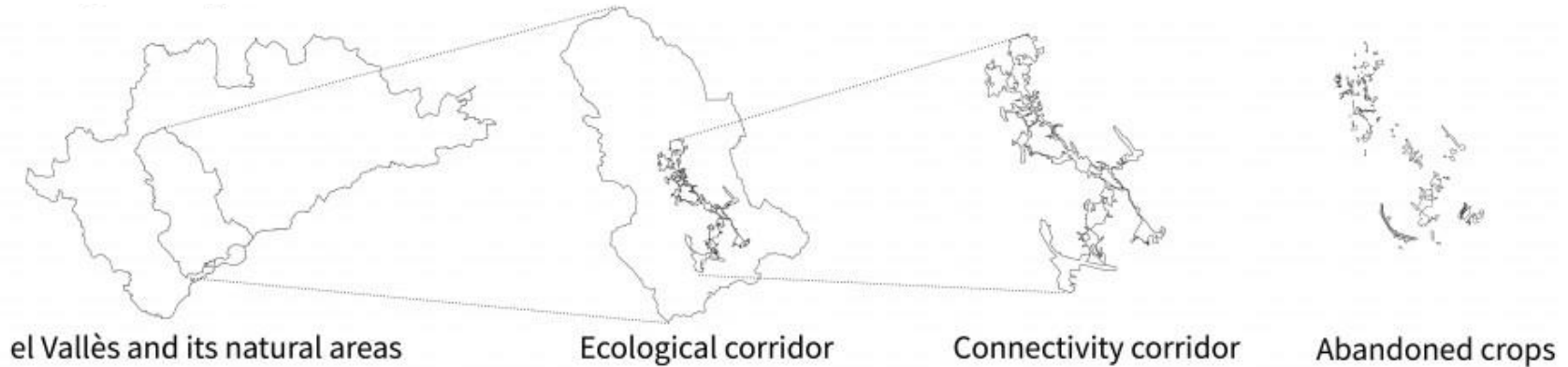
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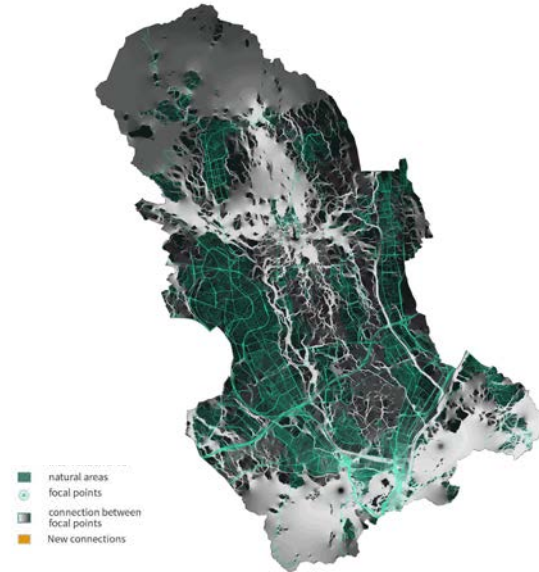
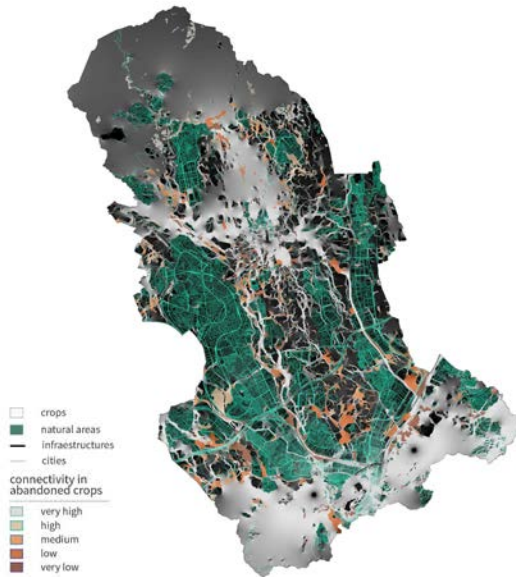
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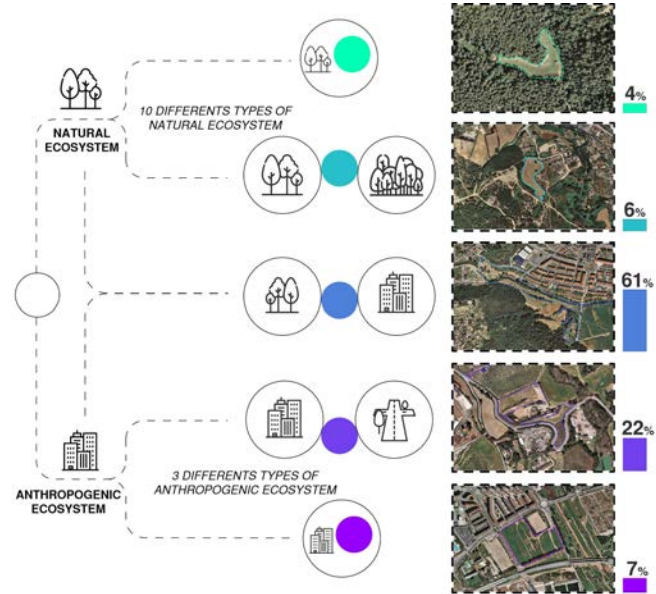
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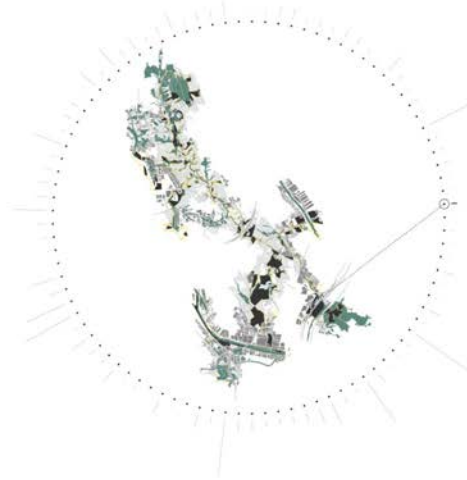
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Supporting local communities and pollinators



Adequation
of environment



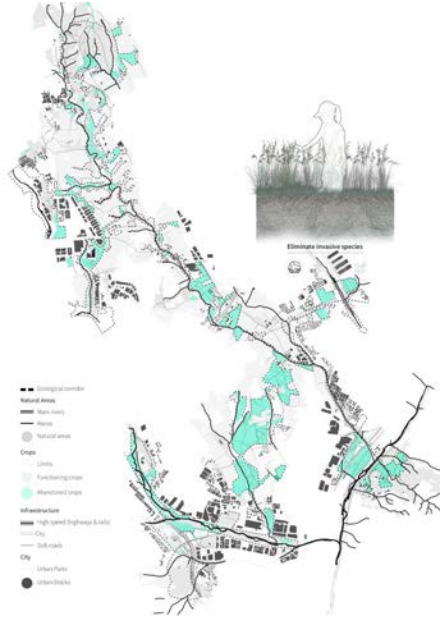
Nesting



Plantation



Beekeeping



Eliminate invasive species



Wildflower plantation



Flower tubes



Artificial Water Ponds



Beekeeping



Nesting



Nesting

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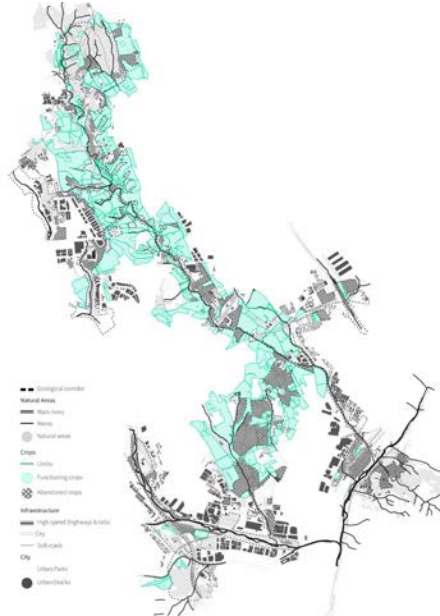
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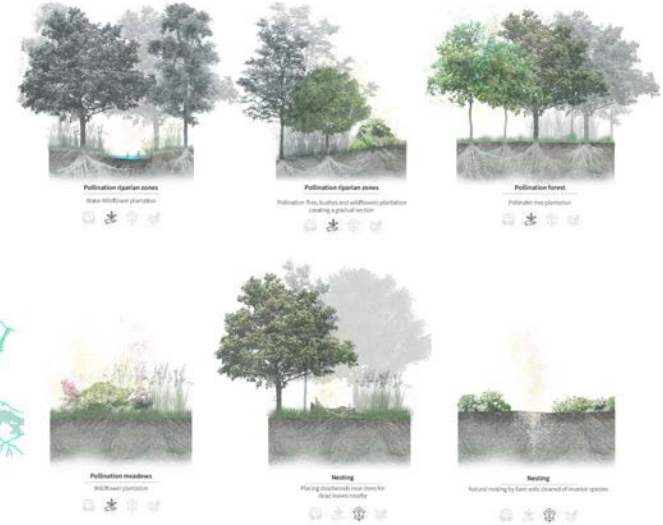
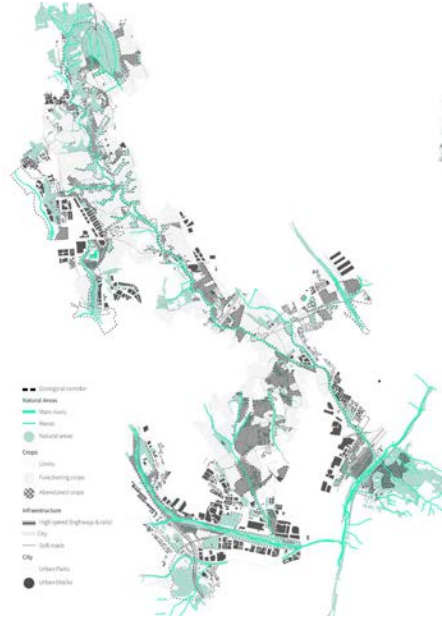
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Adequation
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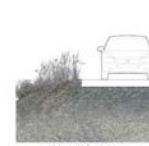
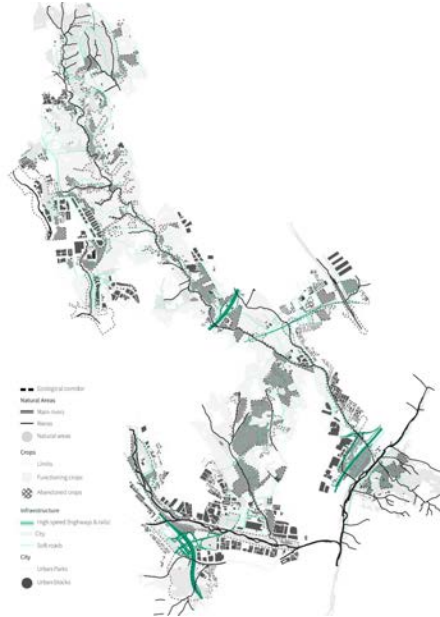
Nesting



Plantation



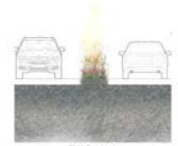
Beekeeping



Highspeed infrastructure
Taking out invasive species from the edges of infrastructure



Highspeed infrastructure
High facilities for protection from overpopulation. Road & air pollution, planning pollution friendly plants



City infrastructure
Urban furniture in the parking lots for pollution friendly flowers



City infrastructure
Urban furniture in the parking lots for pollution friendly flowers



City infrastructure
Abandoned buildings, Sensing overgrowth, Overgrowth with softpaths



Soft infrastructure
High facilities for protection from flood, Pollution plants plantation

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Rewilding cities

FlowerPowder

Supporting local communities and pollinators



Adequation
of environment



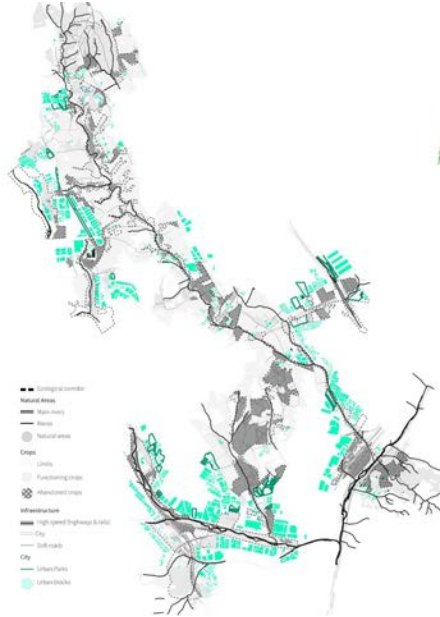
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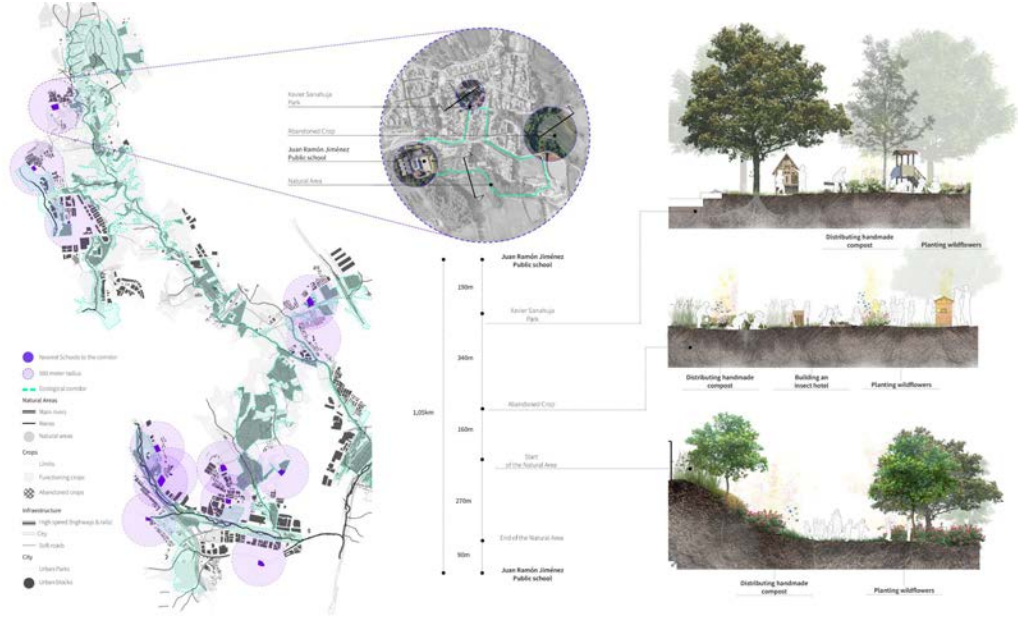
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SECTION THREE

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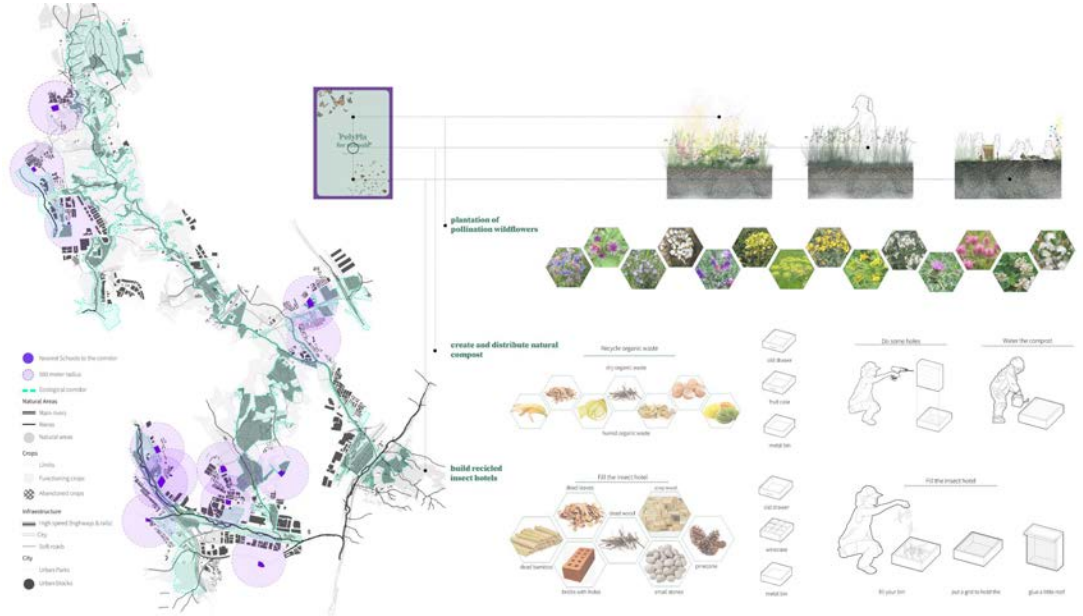
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Rewilding cities

Partnering with ecosystem engineers in design processes

Simulating the likelihood for **ecosystem engineers to thrive** in heterogeneous territory and foresee the consequences of their living in order **to drive their produced impact towards designated solutions.**

Rewilding Luxembourg

Mapping micro mobility pattern to support processes of community engagement in the deployment and monitoring of rewilding projects

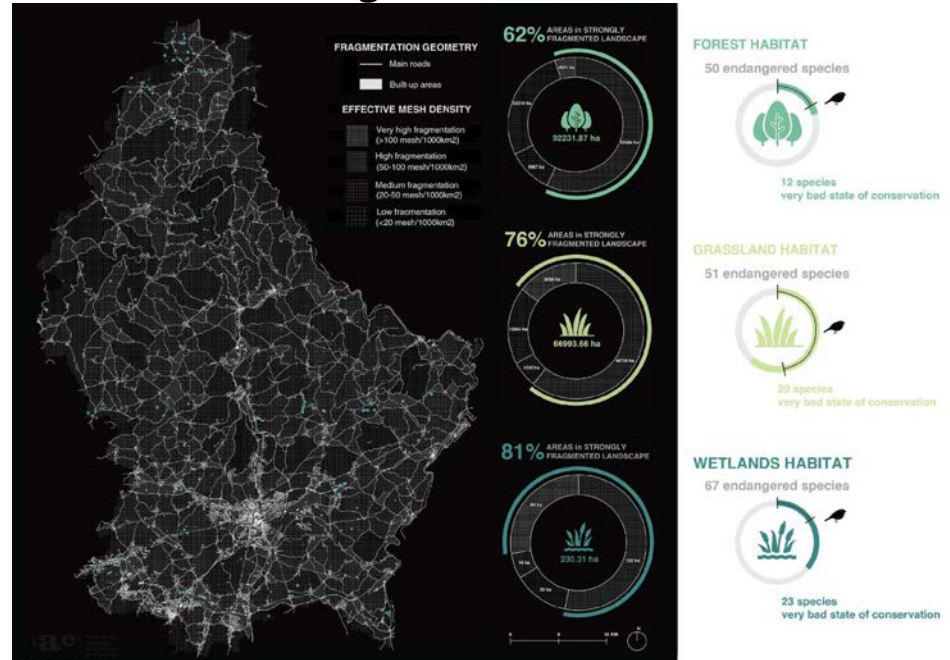
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Rewilding

Supporting local communities and pollinators

Luxembourg



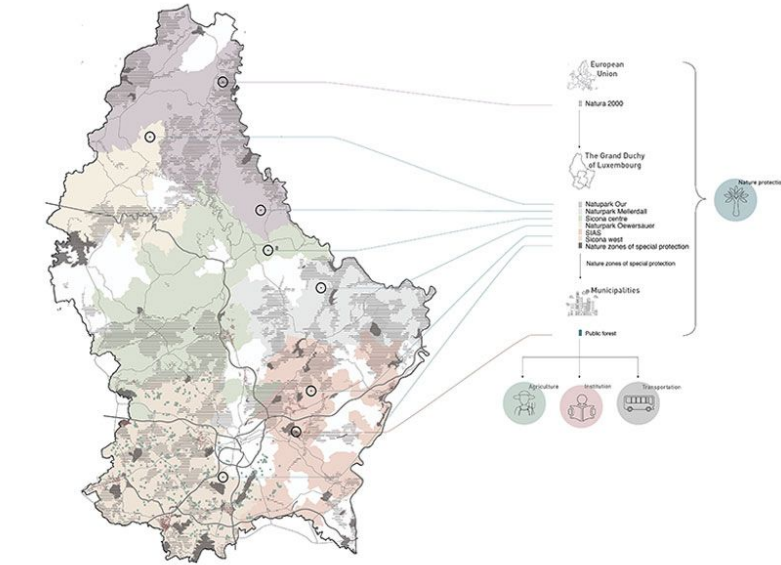
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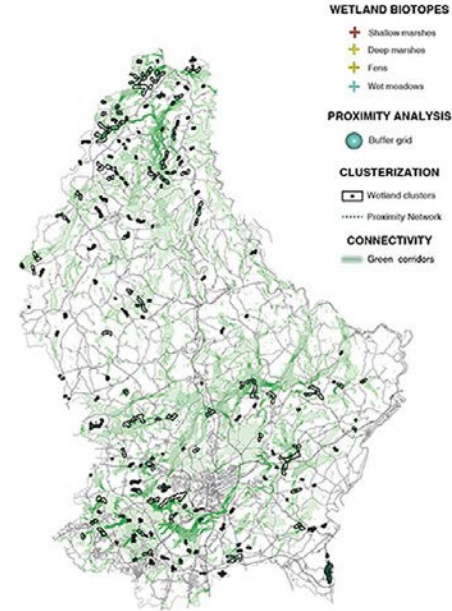
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Rewilding

Supporting local communities and pollinators



Luxembourg



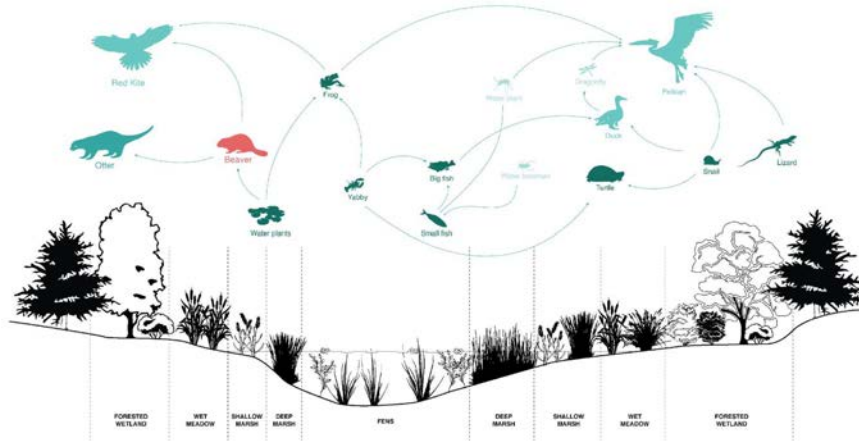
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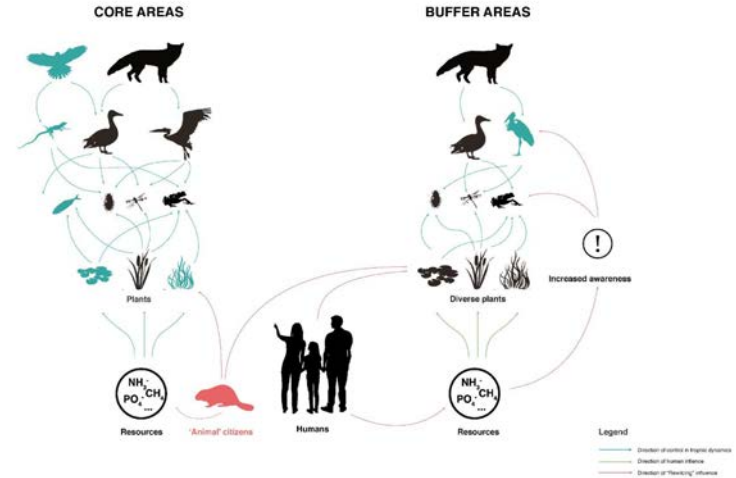
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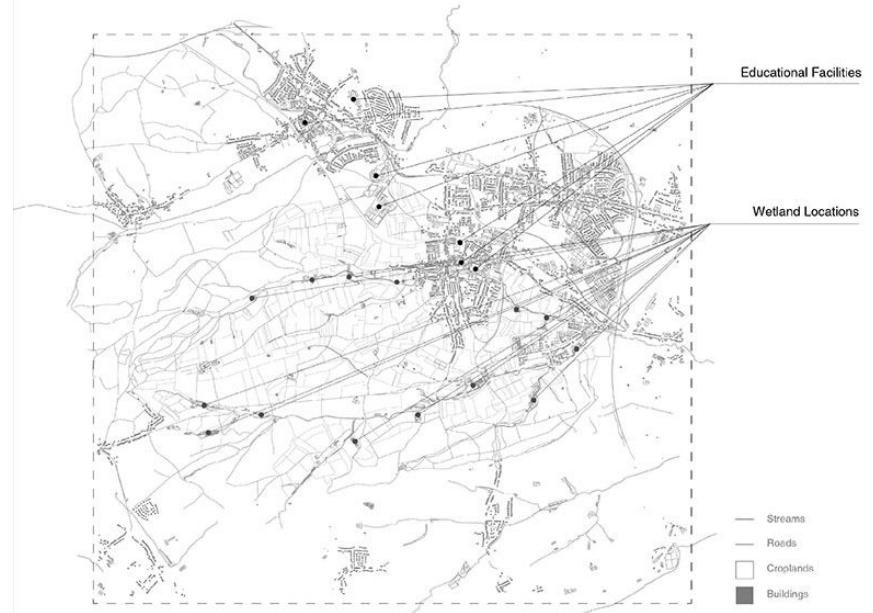
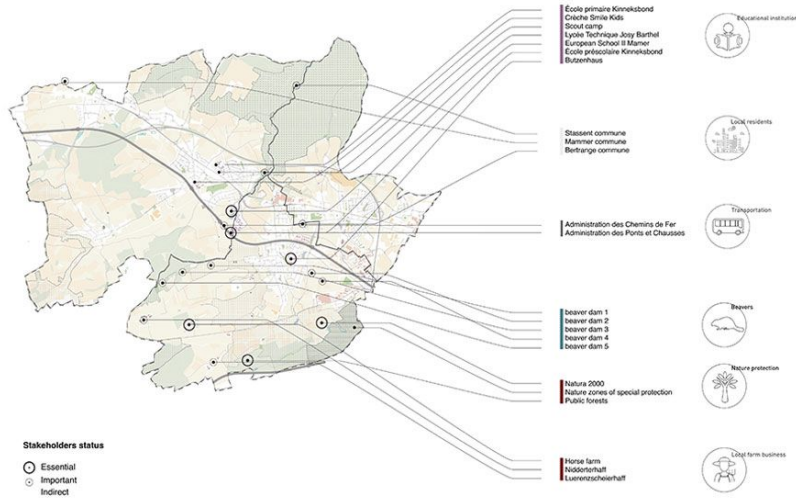
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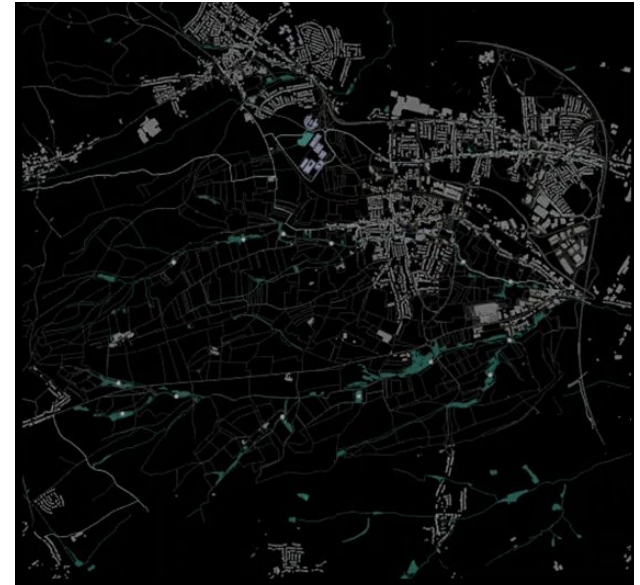
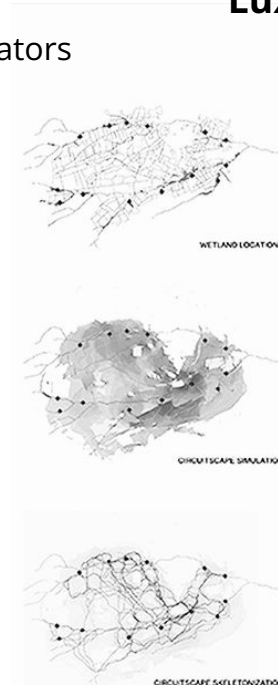
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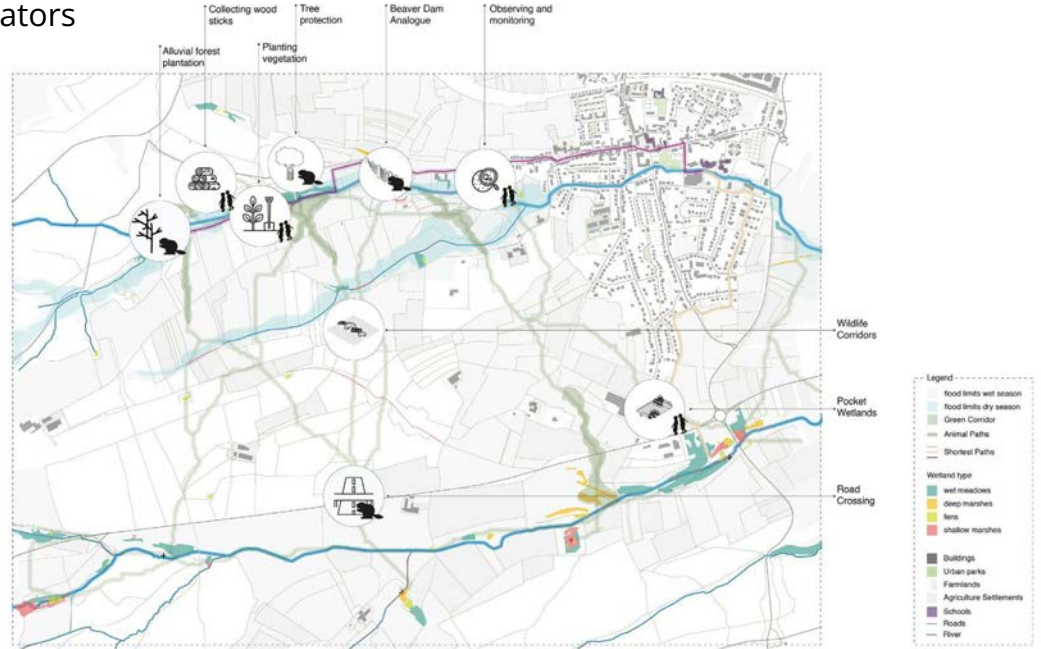
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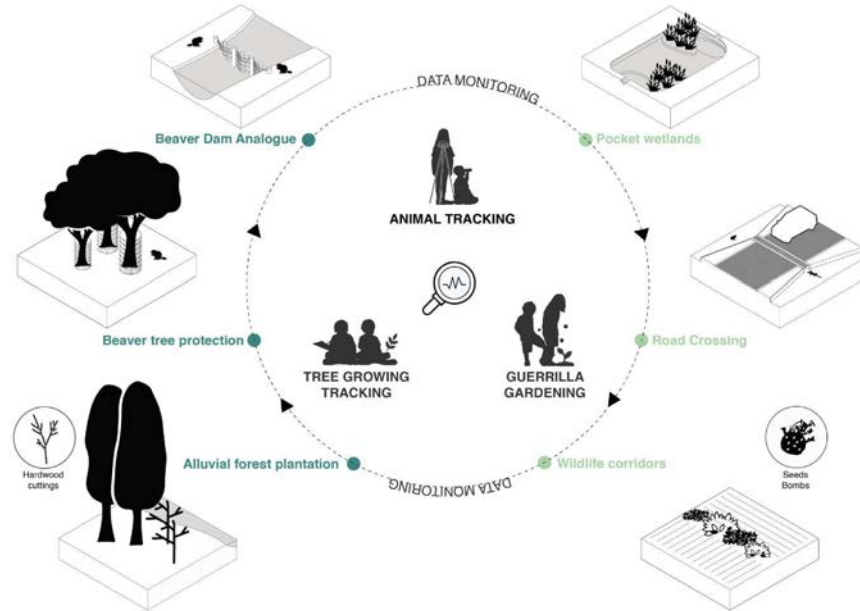
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Rewilding cities

Partnering with ecosystem engineers in design processes

Simulating the likelihood for **ecosystem engineers to thrive** in heterogeneous territory and foresee the consequences of their living in order **to drive their produced impact towards designated solutions.**

The Green Ally

Working together with red squirrels and fostering their behavioural traits and the role they play in ecosystems to reforest the Madrid area collaboratively.

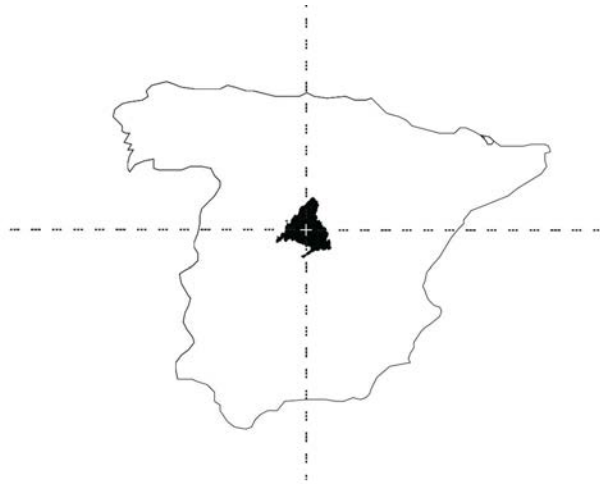
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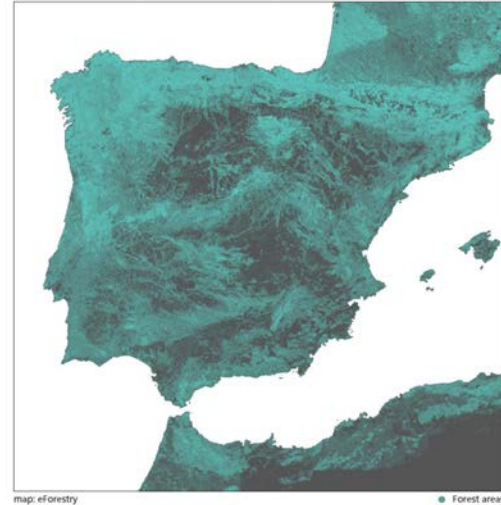
Rewilding urban centers

Green



Animal species: Red Squirrels

Ally



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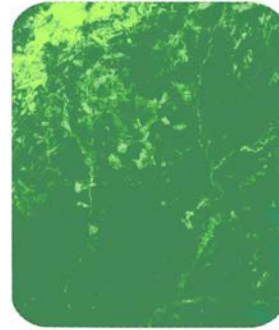
SECTION **THREE**

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The

Rewilding urban centers

Green

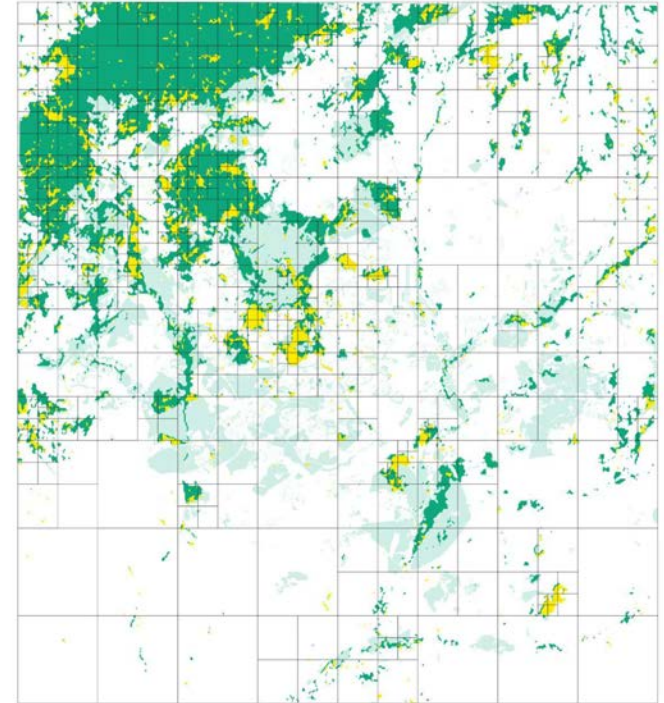


Hansen Global Forest Change 2000–2021

treecover2000: Tree canopy cover for year 2000, defined as canopy closure for all vegetation taller than 5m in height.

loss: Forest loss during the study period, defined as a stand-replacement disturbance (a change from a forest to non-forest state).

1 if loss ever happen during the study period



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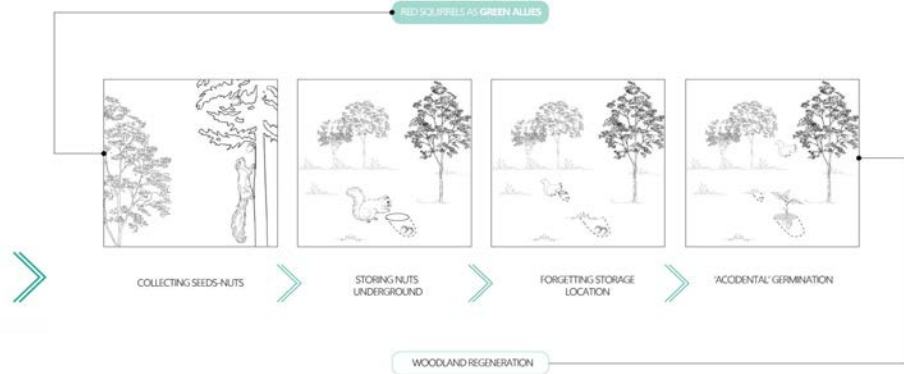
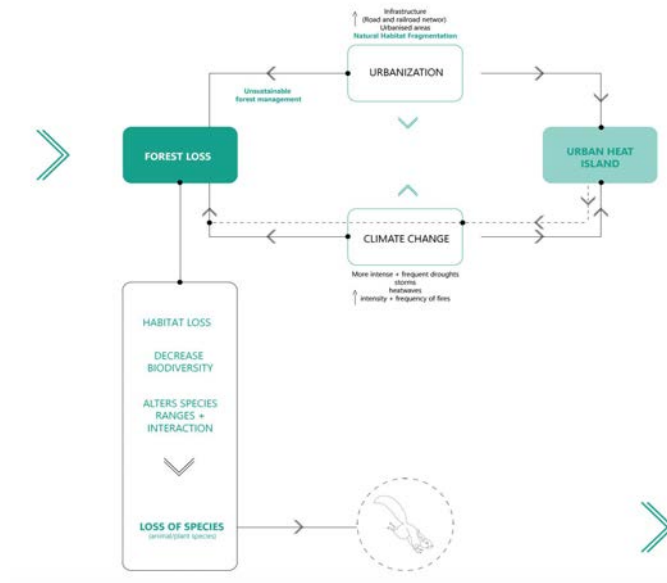
Rewilding cities

The

Green

Ally

Rewilding urban centers



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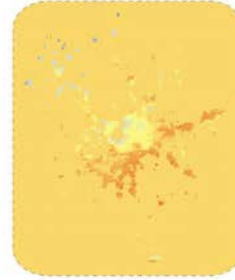
Rewilding urban centers

Urban Heat Island

An urban heat island occurs when a city experiences much warmer temperatures than nearby rural areas. The difference in temperature has to do with how well the surfaces in each environment absorb and hold heat.

UHI intensity has commonly been defined as the temperature difference between urban and rural places (or areas), $\Delta T_u - T_r = T_u - T_r$, where $\Delta T_u - T_r$ is UHI intensity.

UHI intensity (°C) color scale



UHI

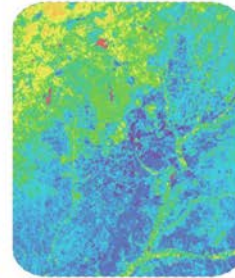
Normalized Difference Vegetation Index

NDVI quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs)."

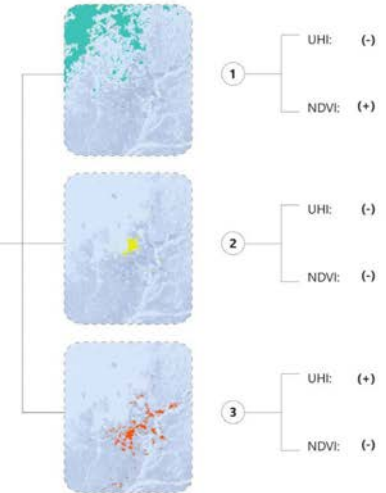
Range values: -1 to +1

negative values (-): clouds or water
positive values near 0 (+): bare soil
0.1 to 0.5: sparse vegetation
0.6 and above: dense vegetation

NDVI color scale



NDVI



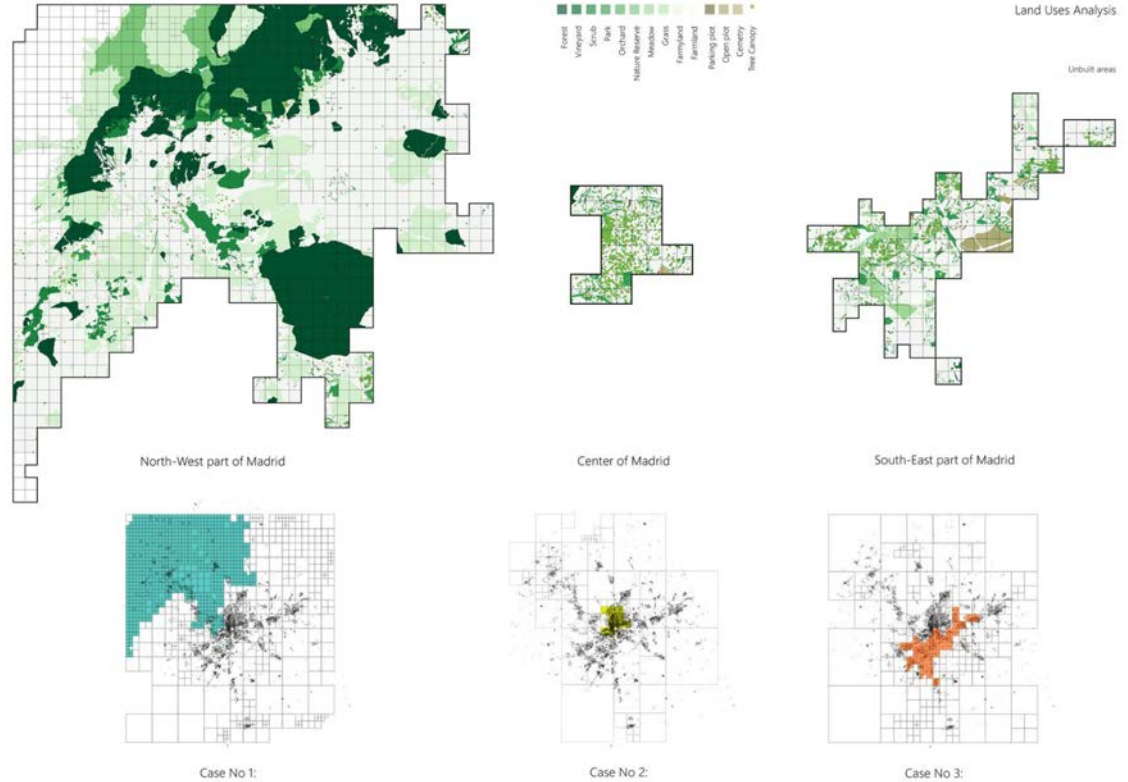
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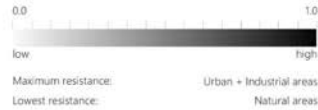
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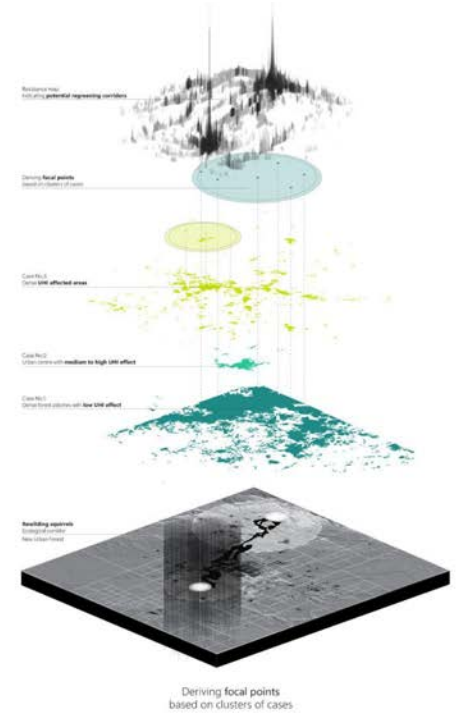
Circuitscape analysis: Connectivity of squirrels' movement corridor



Connectivity simulation: Large Scale



Ecological Corridor



Axonometric Conceptual Drawing

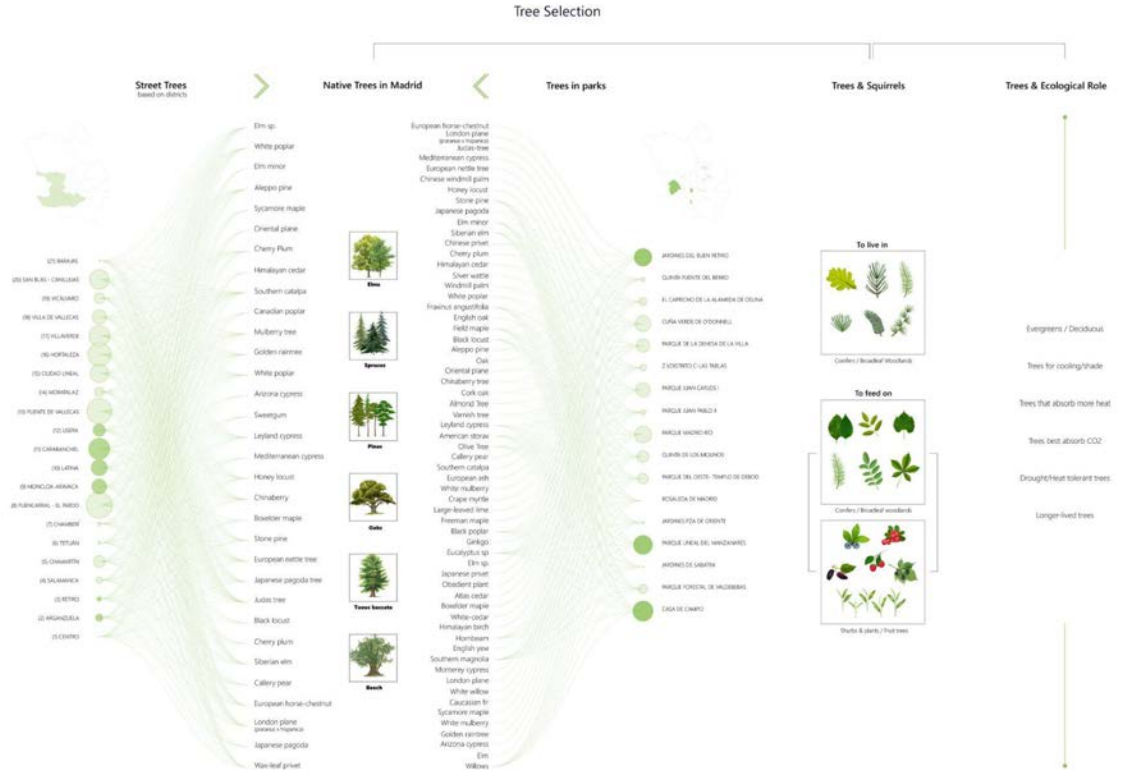
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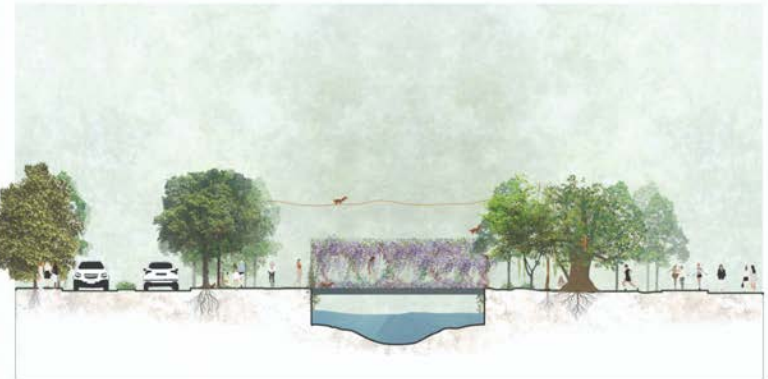
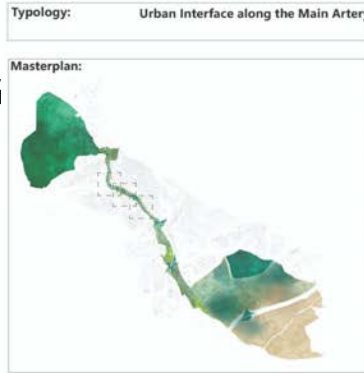
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SECTION FOUR

Productive ecologies

Co-designing green urban elements
that produce food and energy

Co-Mida

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Productive ecologies

CO-MIDA is an intelligent vertical modular system for the cultivation of edible plants, co-designed together with the citizens.

The system, thanks to the bacteria present in the earth, also produces the necessary electrical energy for its own operation and monitoring.

Funded by: BIT-Habitat, Ciutat Proactiva, Ajuntament de Barcelona

SECTION FOUR

Productive ecologies

Co-Mida

Green urban elements for the co-production of food and energy



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Productive ecologies

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Green urban elements for the co-production of food and energy



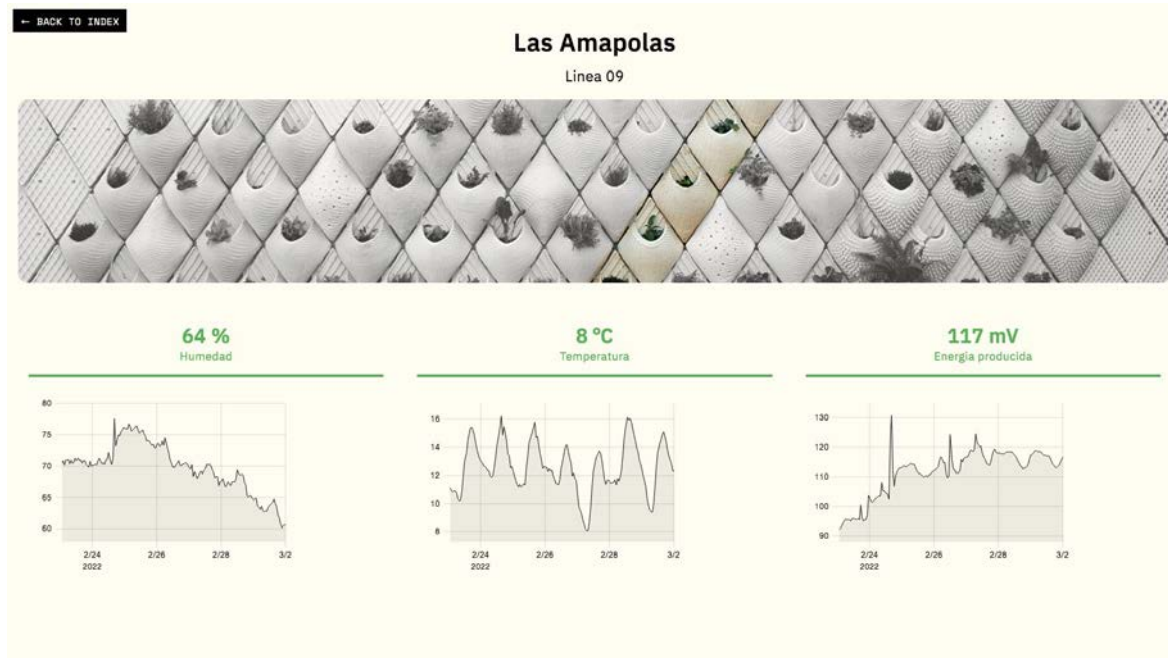
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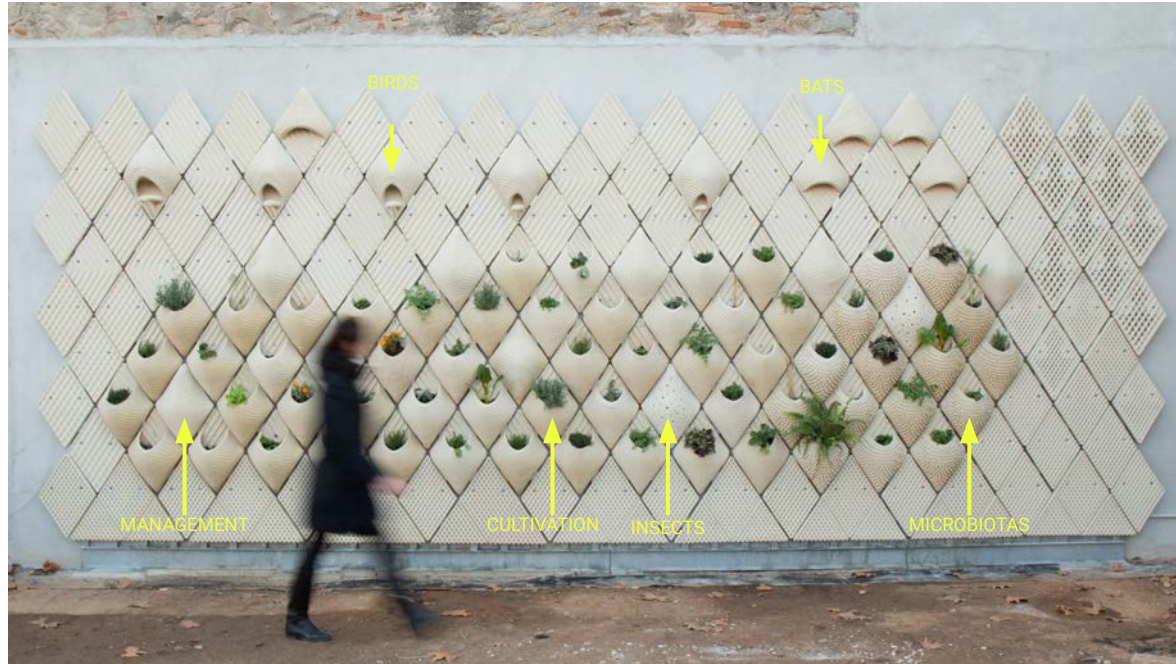
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Year 1

Year 2

Year 3

Year 4

Year 5

Year 6

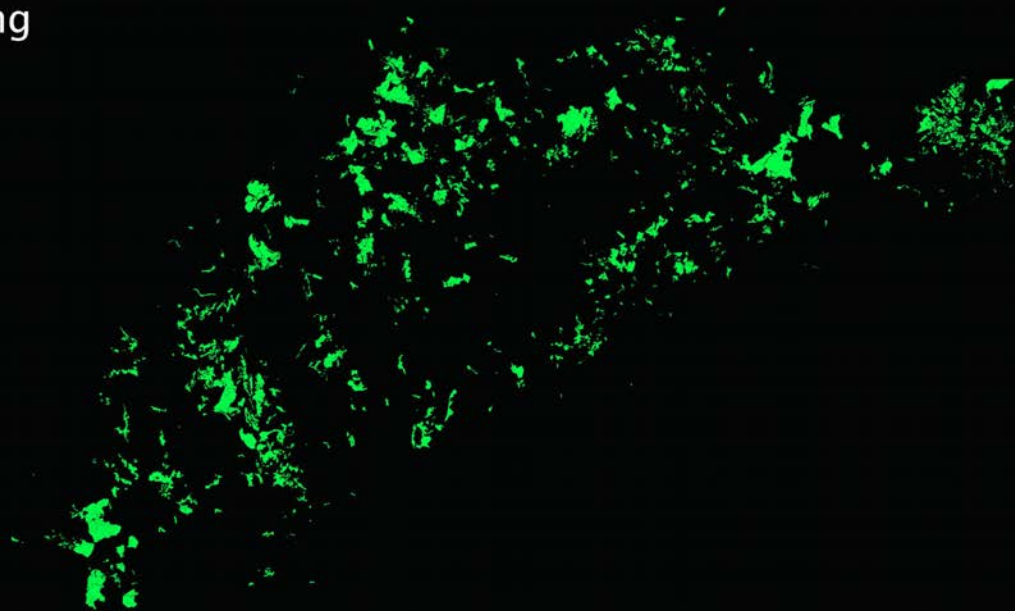
Year 7

Year 8

Year 9

Year 10

A Breathing Organism



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