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8th International Architecture and Environment Symposium
Decision Support in Urban Social-Ecological Systems

Internet of Ecologies
Data driven design for inclusive + resilient cities

Dr Mathilde Marengo (she/her)
IAAC Head of Studies, PhD Supervisor, Faculty
Institute for Advanced Architecture of Catalonia
Advanced Architecture Group

2nd February 2023

More info: iaac.net/project/co-mida/

IAAC is a **Research, Education, Digital Fabrication & Promotion** centre based in **Barcelona**.

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IAAC is devoted to **shaping the future habitat** of our society, **building it in the present.**

Endesa Pavilion, Smart City Expo 2011, IAAC - photo by: Adrià Goula

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ARCHITECTURE
GROUP

An *interdisciplinary research group* investigating emerging technologies of *information, interaction and manufacturing* for the design and transformation of the *cities, buildings and public spaces.*

Musical Robotic Façade by Isern Associats, Ceramica Cumella & IAAC 2016, more at https://iaac.net/musical-robotic-facade-iaac/

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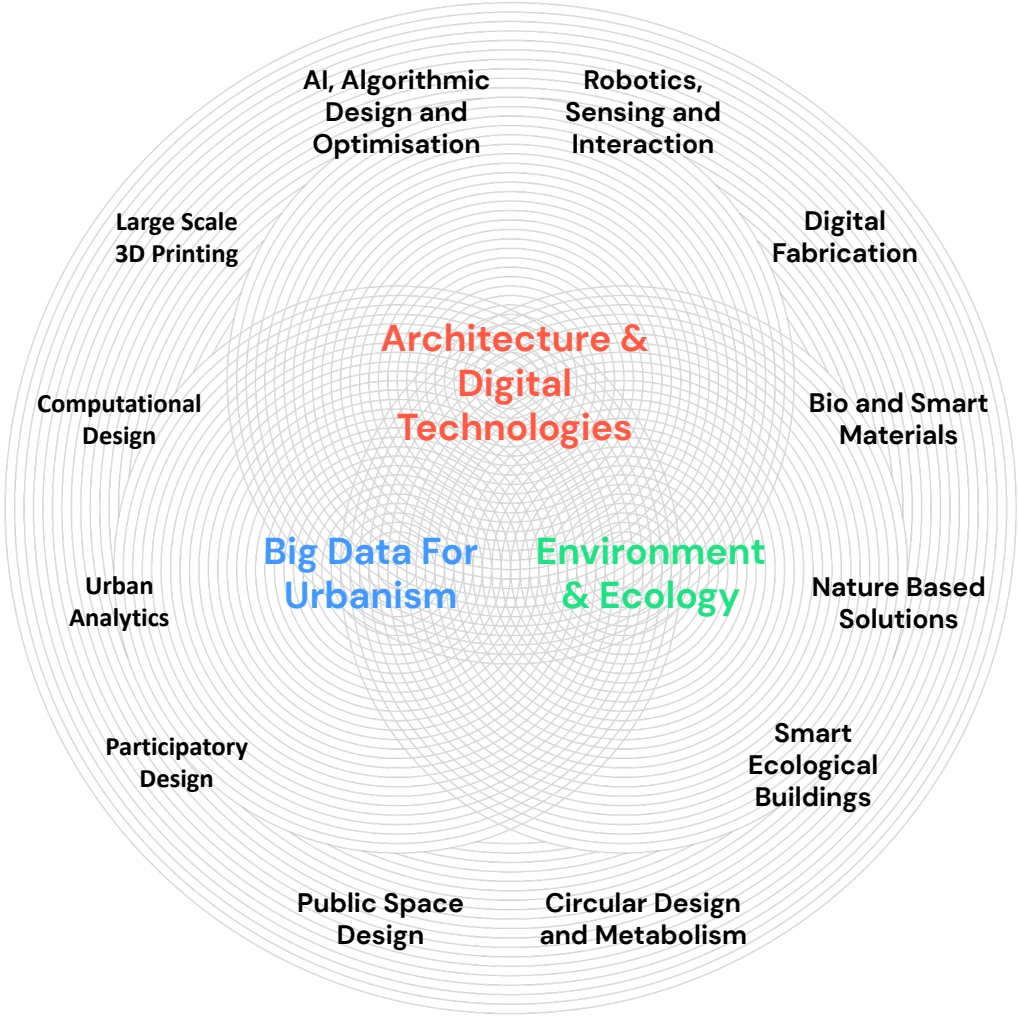

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Data driven design processes: enabling Inclusive + Resilient cities

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Collective intelligence for urbanism

Participatory design processes


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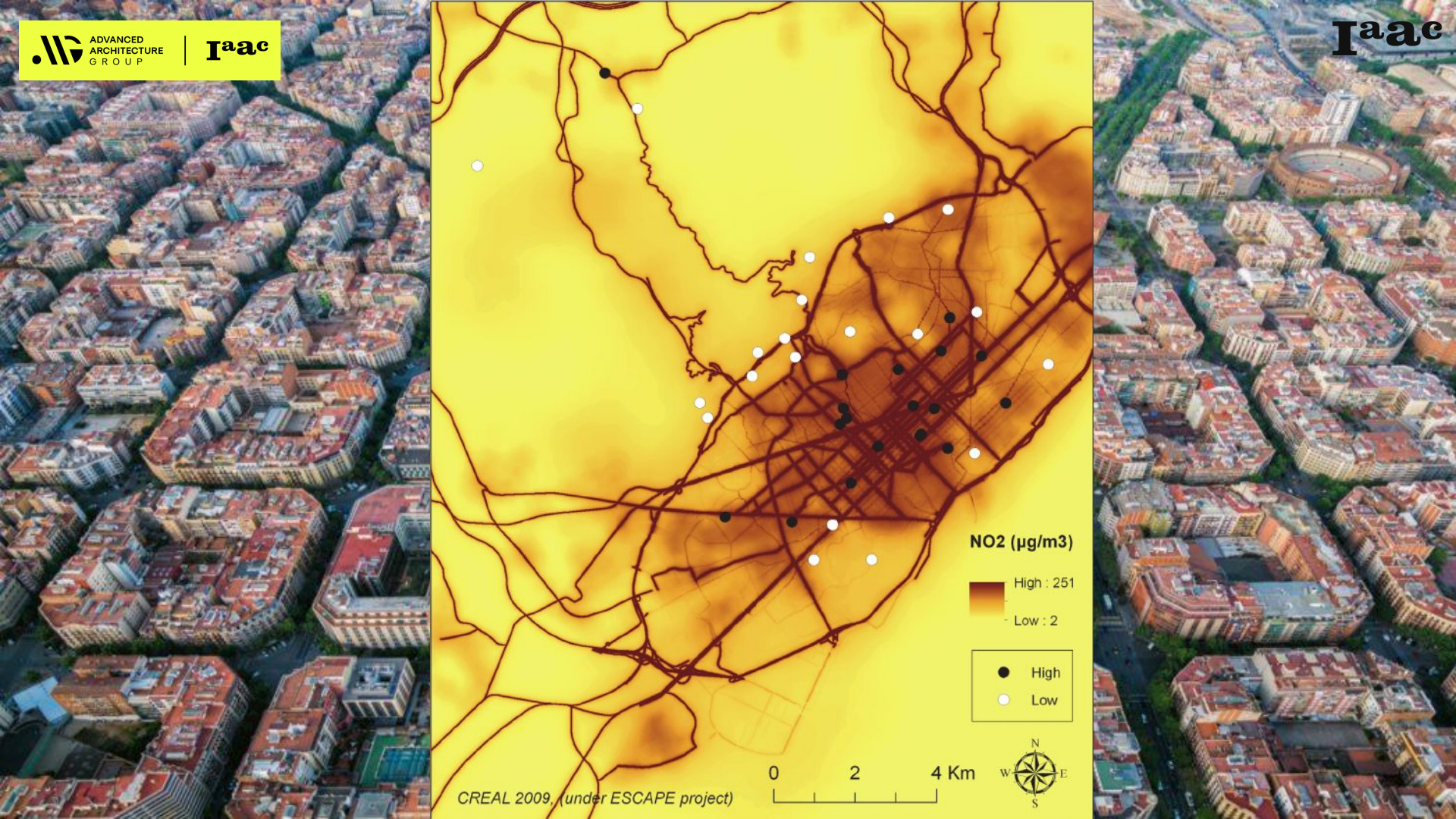
NO2 (µg/m3)
High : 251
Low : 2
High
Low
0
2
4 Km
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W
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CREAL 2009, (under ESCAPE project)

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Superblock of Sant Antoni, Studio Leku, copyright Del Rio Bani
www.archdaily.com/938244/superblock-of-sant-antoni-leku-studio/


SUPERILLA
Excepte
SUPERILLA

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Public Reception


LA VANGUARDIA

VIVO
GENTE SMART

ECOLOGÍA

¿El modelo de las supermanzanas disminuirá la contaminación atmosférica?

El Plan de Movilidad de Barcelona permitirá reducir un 21% la circulación de vehículos y aumentar espacios verdes

Lo + Visto

Matan a un transexual en Brasil tras darle una brutal paliza

Iker Casillas, roto de dolor

El Barça obra un milagro para la historia

La Duquesa de Cambridge y las mil y una versiones de su peinado favorito

Barcelona, Spain, Photo by: Enes

Citizen Inputs

How can we multiply the use of participatory inputs in the design of our urban habitat?

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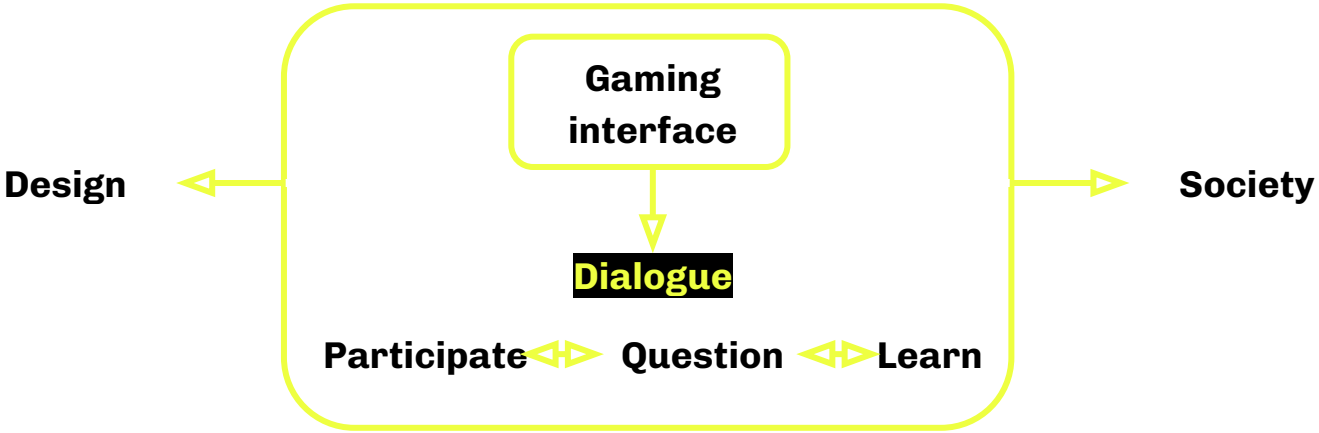
SuperBarrio - superbarrio.iaac.net/

SuperBarrio - superbarrio.iaac.net/

SuperBarrio - superbarrio.iaac.net/



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SuperBarrio - superbarrio.iaac.net/

SuperBARRIO


SUPERBARRIO
TU DISEÑO. TU BARRIO.
QUÉ DESEAS PARA TU BARRIO ?
QUIÉN DISEÑARÁ EL ESPACIO PÚBLICO DE TU CIUDAD ?
LOS VECINOS PODEMOS HACERLO !
ÚNETE, PARTICIPA Y DISEÑA TU BARRIO.

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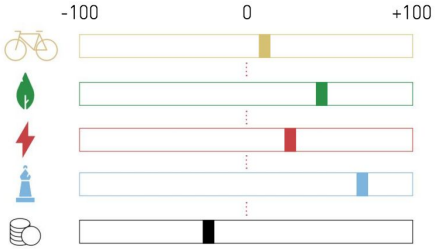
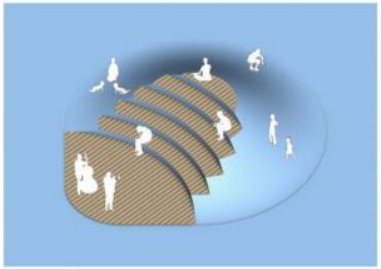
The counters measure the interaction between the modules to develop a balanced urban design



SuperBarrio - superbarrio.iaac.net/

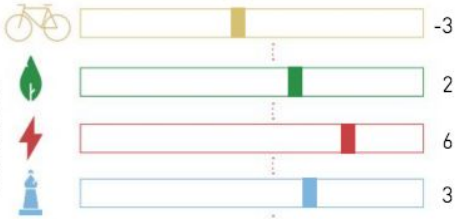


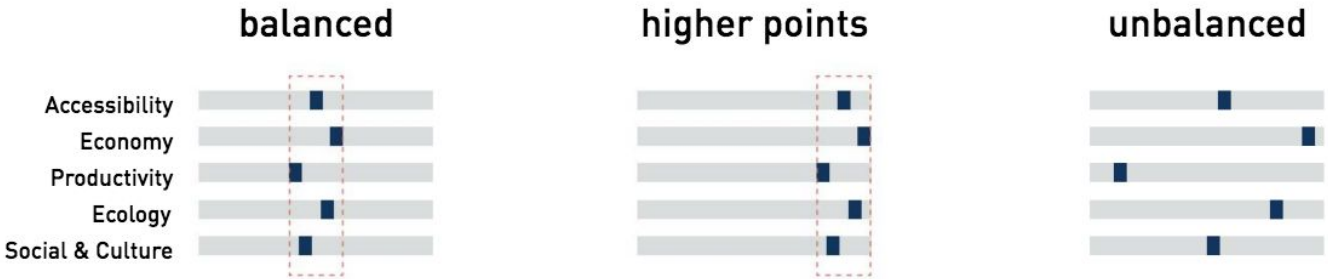
Amphiteatre

Accessibility:	-1
Economy:	0
Productivity:	2
Ecology:	1
Social & Culture:	5

Energy turbine

Accessibility:	-2
Economy:	3
Productivity:	4
Ecology:	1
Social & Culture:	-2





Learning

Each module placed affects the counters directly

The aim: get the highest & most balanced points

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Spatializing Citizen Inputs

Boosting participatory practices for the design of nature driven inclusive cities

urbinat.eu

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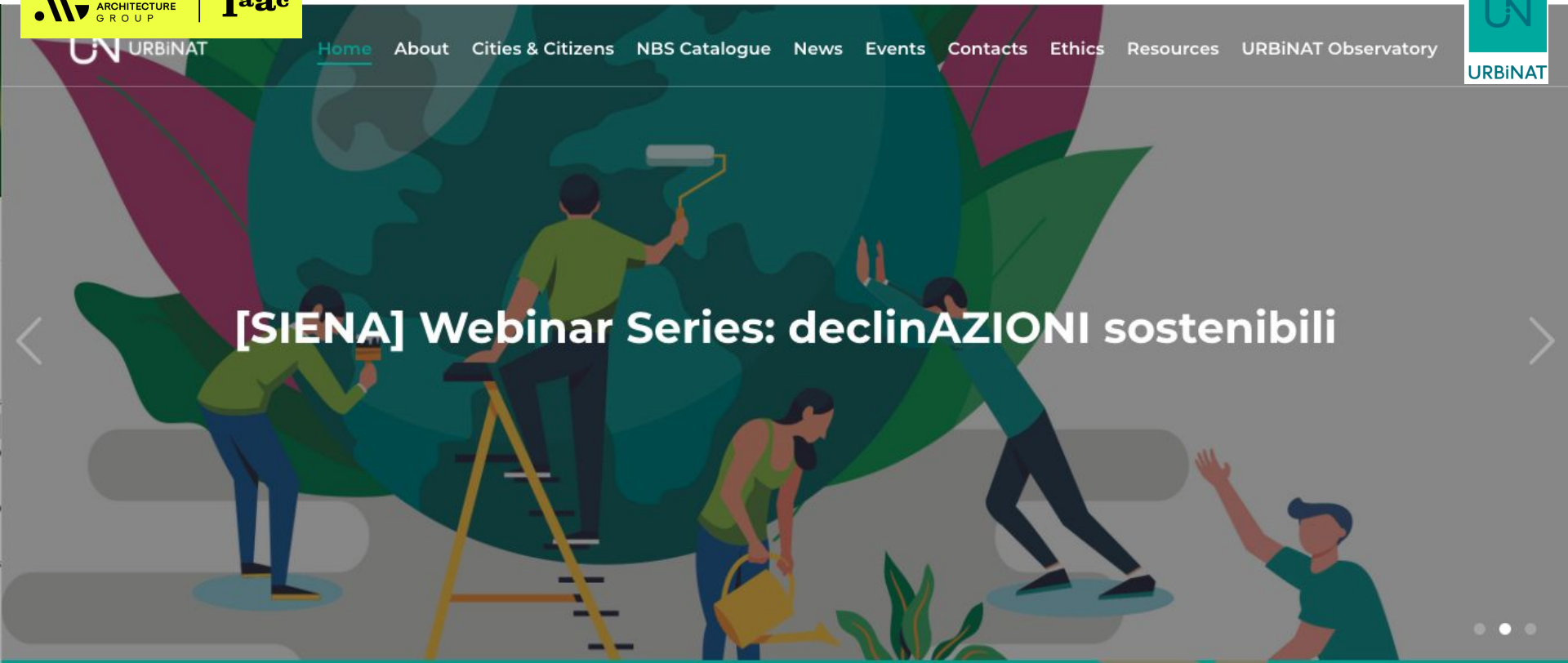
URBiNAT

Home About Cities & Citizens NBS Catalogue News Events Contacts Ethics Resources URBiNAT Observatory

URBiNAT



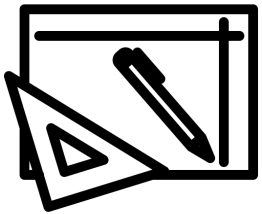
URBiNAT: Urban Innovative & Inclusive Nature URBiNAT Cities URBiNAT NBS Catalogue URBiNAT News

URBiNAT: Urban Innovative & Inclusive Nature

Urbinat - urbinat.eu

Citizens

Architects



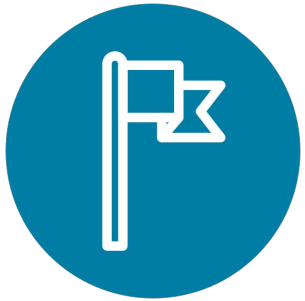
Super BARRIO

Municipalities

Neighborhood Associations

Urbinat - urbinat.eu

Technological Solutions



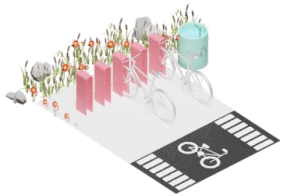
Territorial Solutions

Participatory Solutions

Social Economy

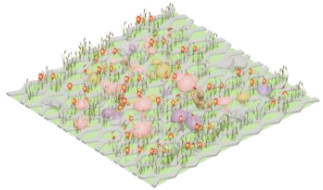
Urbinat|Green Corridors - urbinat.eu

Technological Solutions



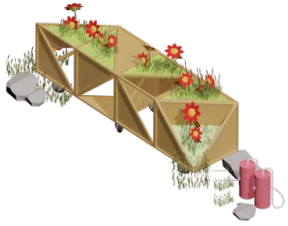
Cycle & footpath

Food production and recreational pavilion



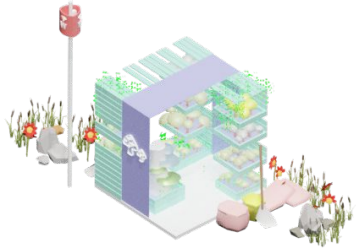
Grow Tile

Lighting

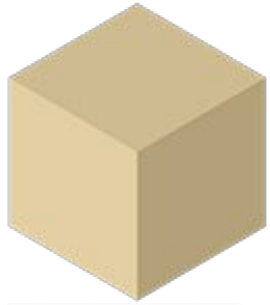


Mobile vegetable garden

Multi-function wooden structure



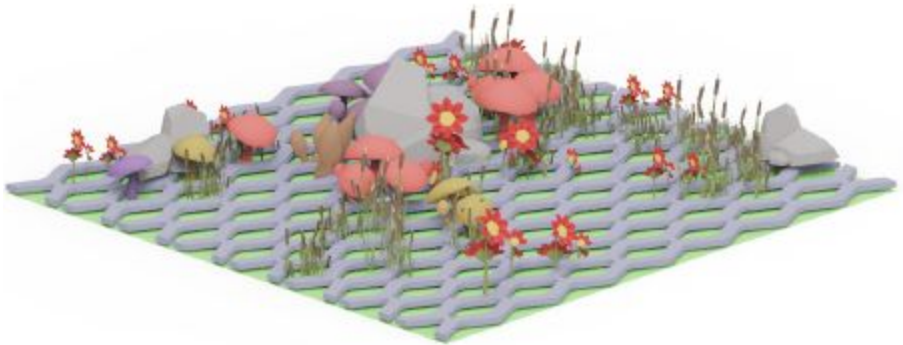
Urban Mushroom farm



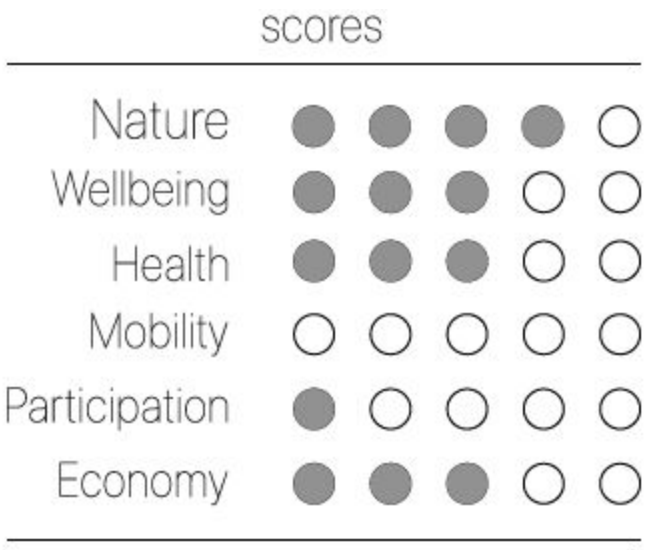
My own Nature Based Solution

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat|Green Corridors - urbinat.eu



Grow Tile



Source: Urbinat, SuperBARRIO Nantes, France

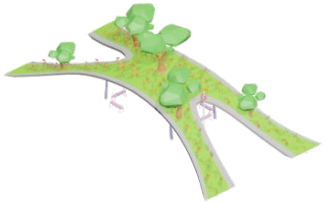
Urbinat|Green Corridors - urbinat.eu

Territorial Solutions

Autochthonous Urban Forest

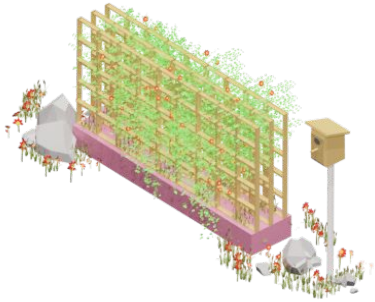
Wildlife Park

Urban Vegetable Garden



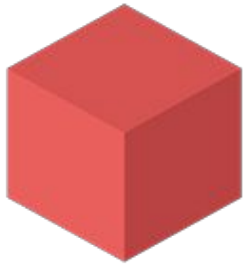
Green Roof

Beehive



Green Living Wall

Groasis



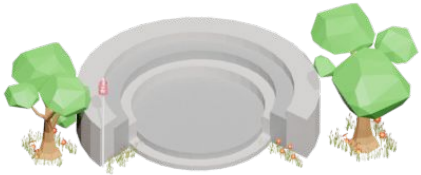
My NBS 1

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat|Green Corridors - urbinat.eu

Participatory Solutions

Community Based Arts Project



Forum Theater

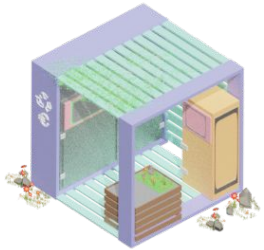
Cultural Mapping

My NBS 2

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat|Green Corridors - urbinat.eu

Social Economy

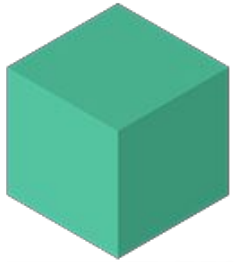


Community Composting and Social Currencies

Exchange Circuit Solidarity Fair Market

Exchange Circuit Solidarity Fair Market For Children

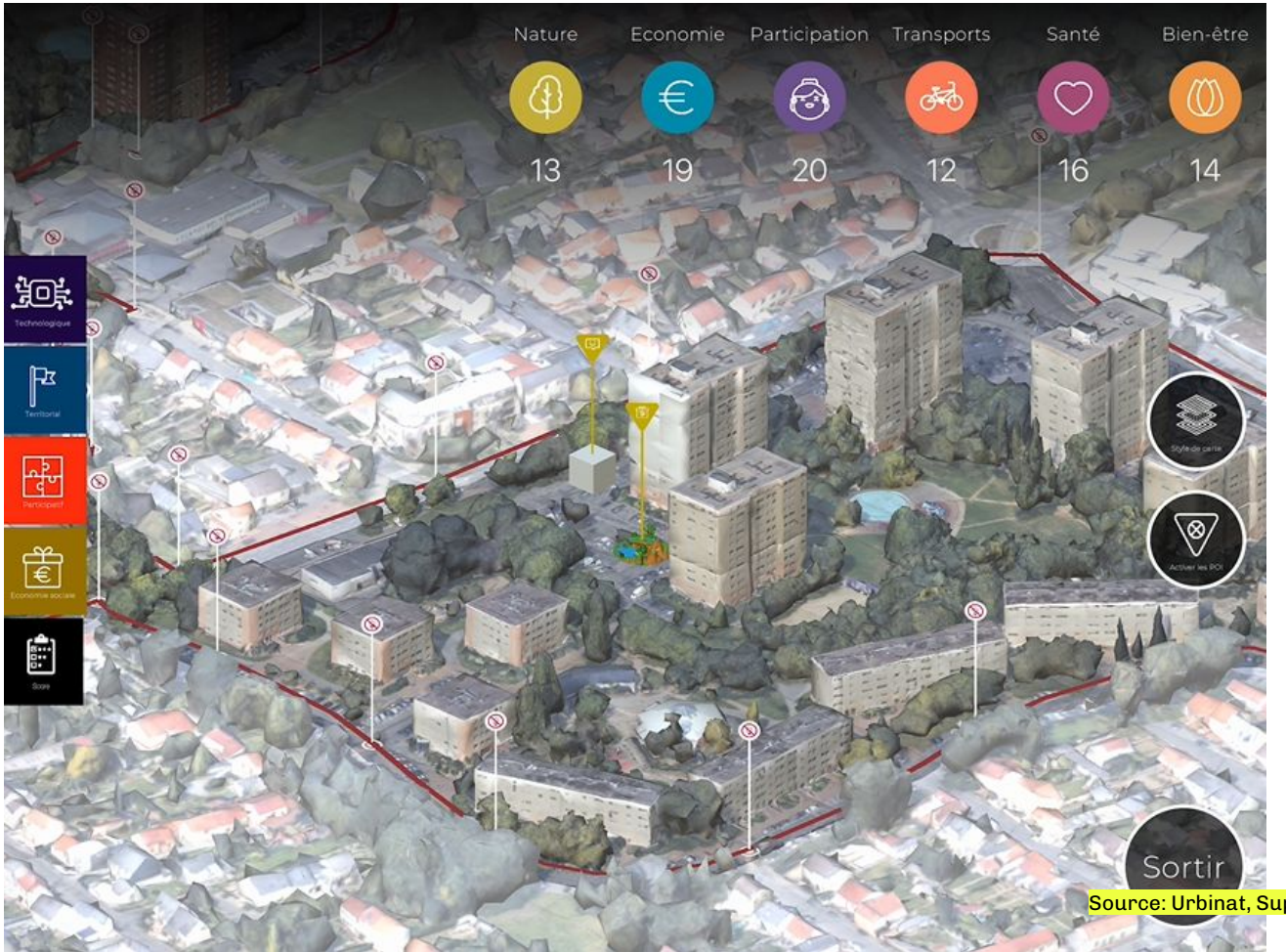
Farmer Market Network



My NBS 3

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat|Green Corridors - urbinat.eu



Source: Urbinat, SuperBARRIO Nantes, France

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat|Green Corridors - urbinat.eu

Compostage communautaire
et monnaies sociales

	5
€	4
	4
	0
	2
€	3

Échange de solidarité
et circuit de marché équitable

	2
€	5
	5
	1
	3
€	4

Circuit d'échange Solidarité
Marché équitable pour les
enfants

	2
€	5
	5
	1
	3
€	4

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat|Green Corridors - urbinat.eu

Technological Solutions

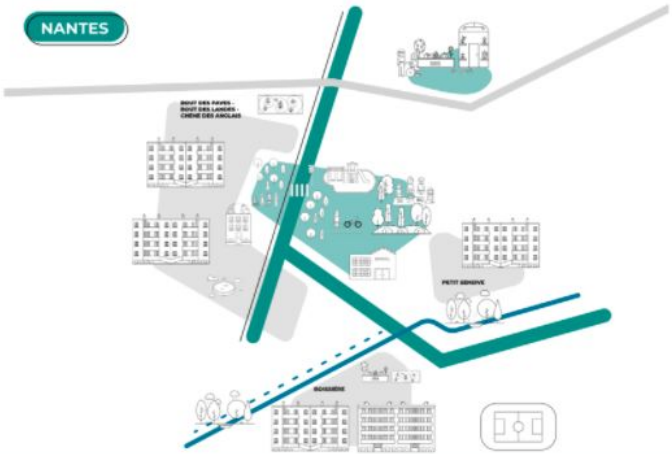
Territorial Solutions

Participatory Solutions

Social Economy

Source: Urbinat, SuperBARRIO Nantes, France

Urbinat - urbinat.eu



Super BARRIO

Digital technologies can enable people to collectively design landscape and public spaces.

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Digital technologies can enable people to collectively design landscape and public spaces.

Can **digital technologies enable designers** to approach **landscape** under a **dynamic, collective, multidisciplinary and multiscalar** perspective?

Digital technologies can enable people to collectively design landscape and public spaces.

Can **digital technologies enable designers** to approach **landscape** under a **dynamic, collective, multidisciplinary and multiscalar** perspective?

Can the access to **ecological data sets**, embedded into design processes, allow **nature** to have an **active voice in design** to **empower ecological connectivity** in urbanised areas?

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Collectively Eco-intelligent Urbanism

Simulating environmental connectivity & movement towards inclusive and resilient cities

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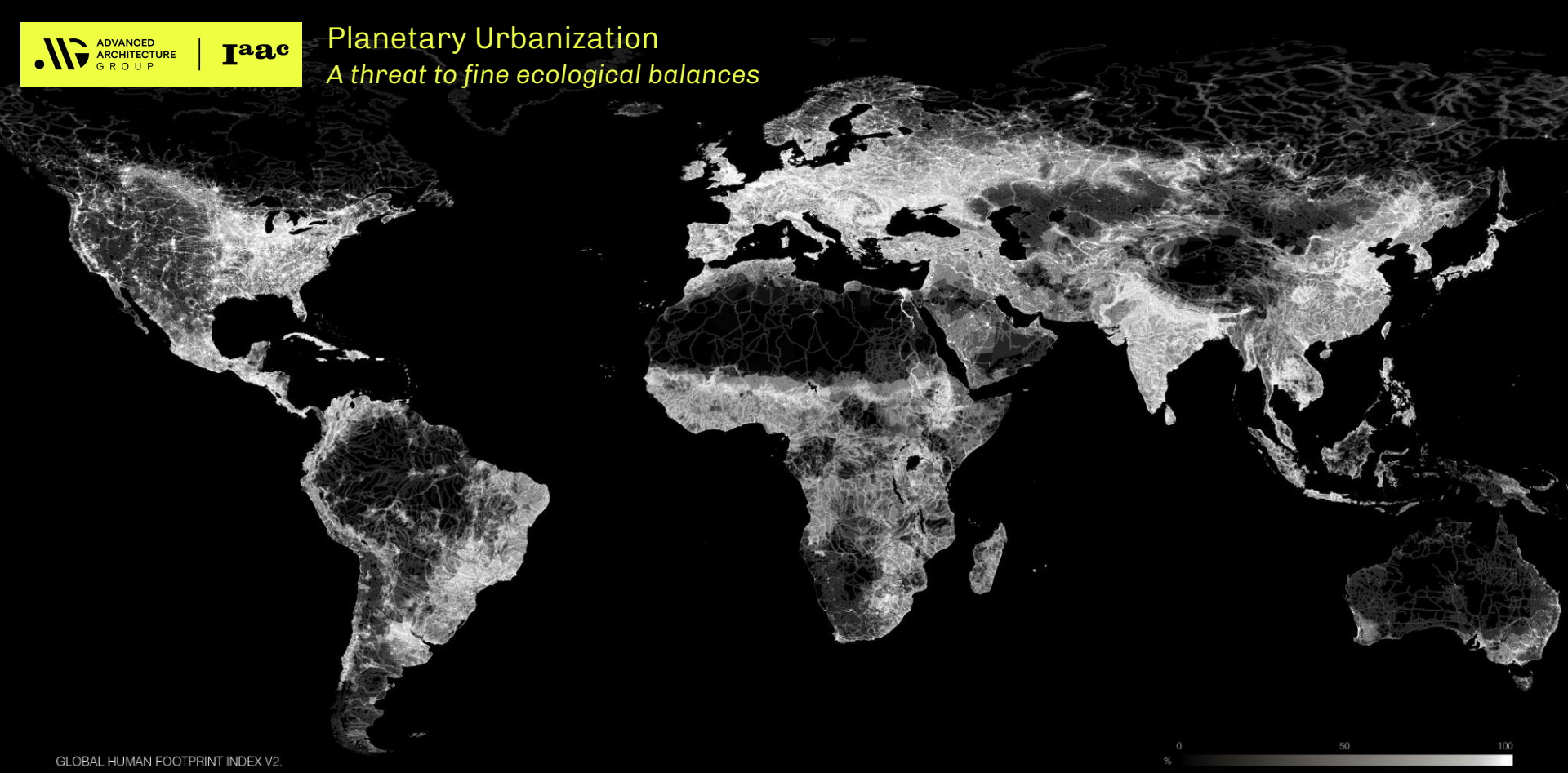
Planetary Urbanization

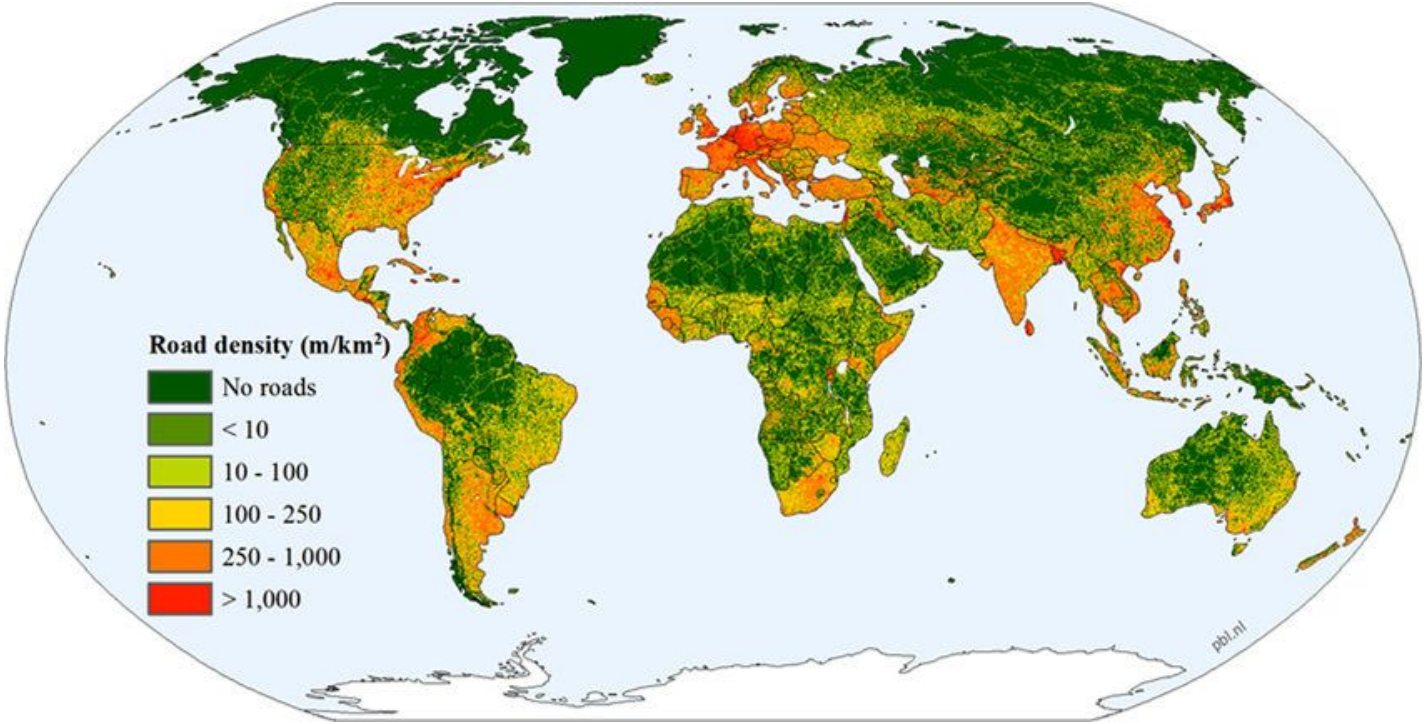
A threat to fine ecological balances



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).

Landscape Fragmentation

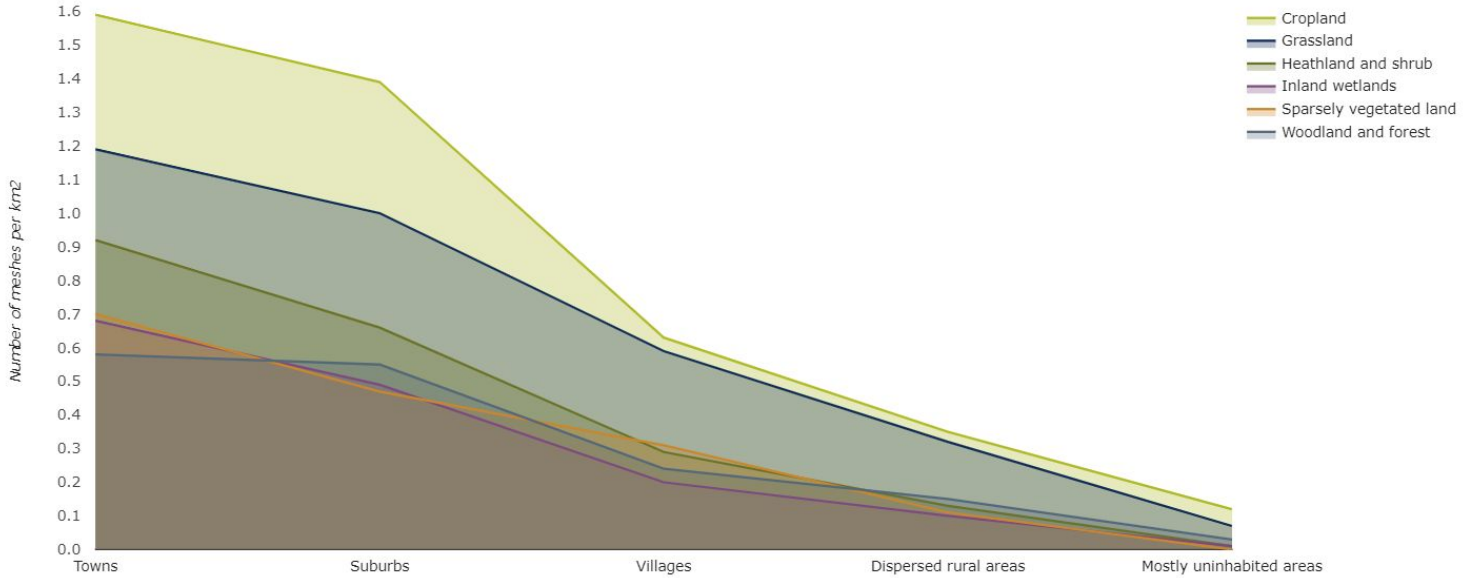
Urbanities as a drivers for Landscape Fragmentation



GRIP db

Landscape Fragmentation

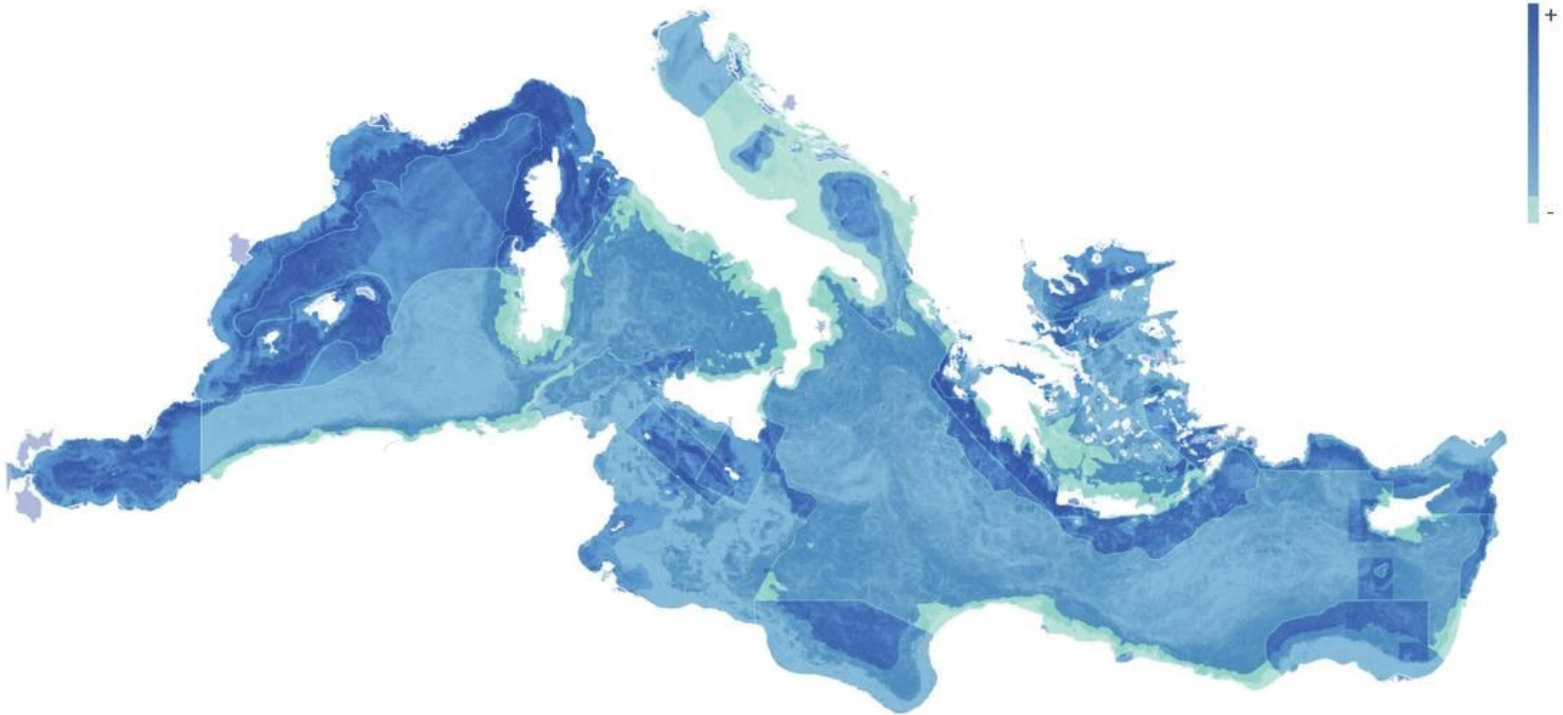
Urbanities as a drivers for Landscape Fragmentation



"Landscape Fragmentation by Degree of Urbanisation and MAES Ecosystem Type, 2018, EU-27 and the UK", European Environment Agency 2022

Habitat Resilience:

Fostering ecological connections to enhance vital ecosystem services



"Internet of Mediterranean Ecologies", Marengo M., Neri I., Farinea C. in M. Marengo, I. Neri, C. Fariena (2022), *Internet of Ecologies*, in M. Ricci, M. Pasquali, S. Mannocci (Eds.) *MedWays Open Atlas*, letteraventidue, Siracusa, ISBN 9788862427357, pp. 83-91

The methodology that follows **empowers designers** to engage with **nature as an active partner** in the process of urban design.

We therefore **reconsider the polarisation between ecological forces and anthropocentric ones**, providing an opportunity to **consciously design** for, and within, **climate change adaptation**.

The **data-driven methodology** uses **computational logics** exploited in environmental studies to **foresee ecological patterns** and include nature based solutions as **drivers to the design process**.

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Designing with Nature:

Detecting and amplifying potential and beneficial connections towards breathing cities

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Understanding potential ecological connectivity

Can we use ecological data on behaviour to simulate potential futures as a tool to design adaptive transition?

Fostering key-stone species as drivers for ecological connectivity

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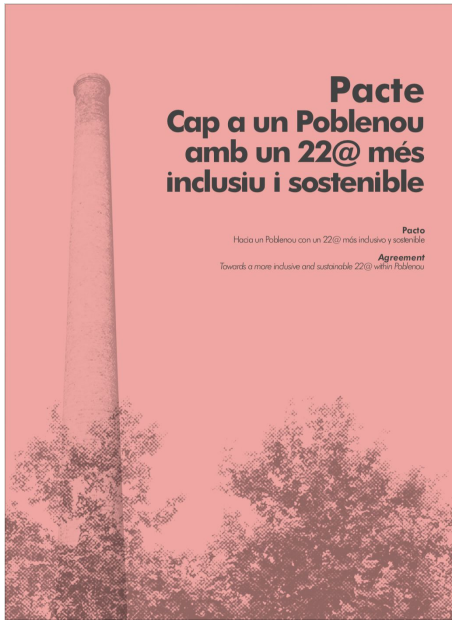
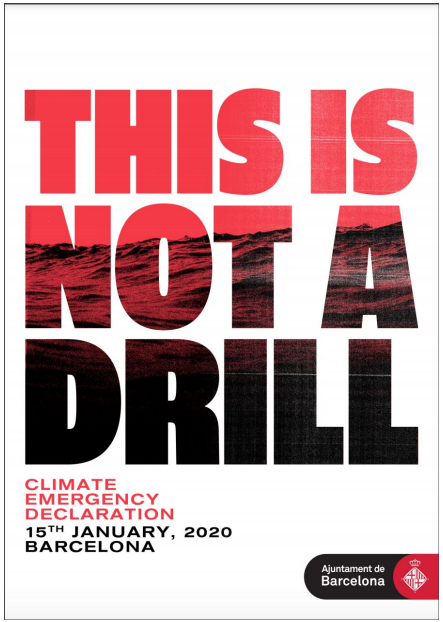
Understanding potential ecological connectivity
Barcelona: **Targets** and **Challenges** implemented through **Policy**

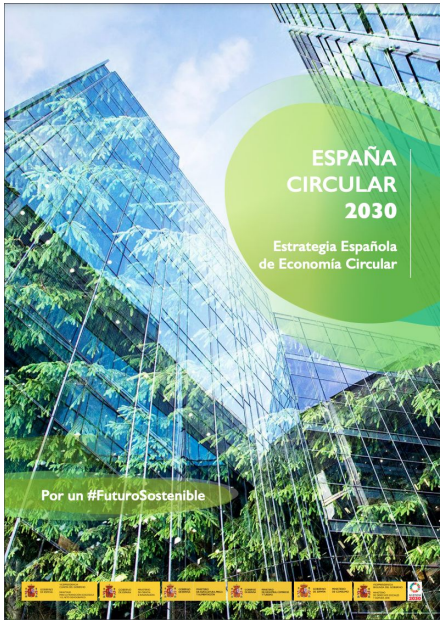


Agreement Towards a more inclusive and sustainable 22@ within Poblenou
https://ajuntament.barcelona.cat/barcelonallibres/ca/publicacions/pacte-cap-un-poblenou-amb-un-22-mes-inclusiu-i-sostenible

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

Reinforcing ecological connectivity to mitigate landscape fragmentation

1.1. Current situation

BIRD'S-EYE-VIEW OF THE CITY'S PLANT COVER

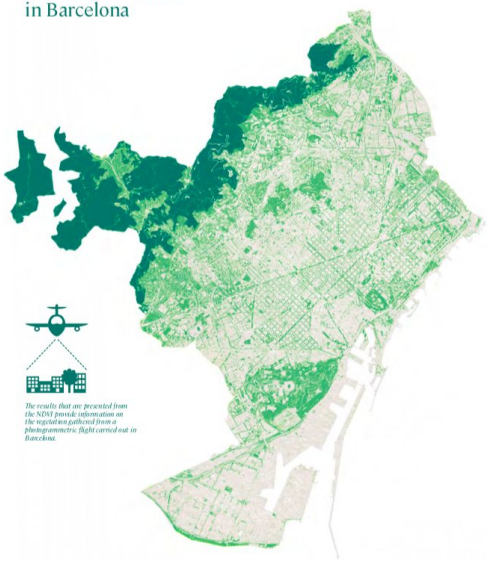
Barcelona has 3,659 hectares of plant cover identified from the sky (2019) by means of the NDVI (*Normalised Difference Vegetation Index*). This index shows the quantity, quality and development of plants through a generated image of plant cover seen from the sky. 1,582 hectares of this area correspond to the Collserola mountain range (43%).

Greenery density (7 m²/resid)

Greenery Collserola	1,582 ha	16%
Greenery rest of municipality	2,077 ha	20%
Urbanised	6,515 ha	64%

Chart 1. Distribution of plant cover compared to the rest of the city. Hectares and percentage.
Source: Barcelona Regional.

Area of plant cover in Barcelona



The results that are presented from the NDVI provide information on the vegetation gathered from a photogrammetric flight carried out in Barcelona.

Figure 1. Area of plant cover identified from the sky (NDVI).
Source: Barcelona Regional.

Greenery Model

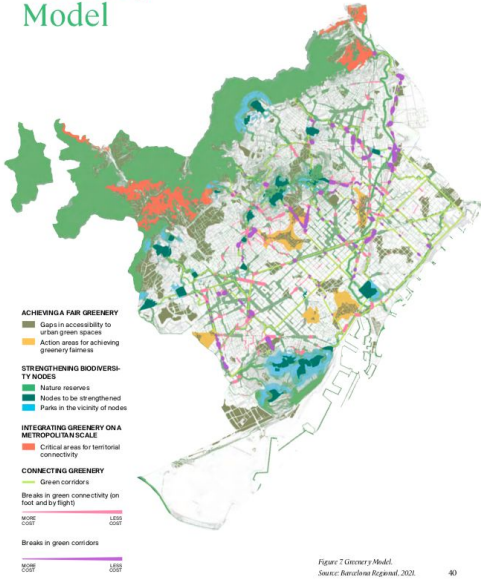


Figure 7. Greenery Model.
Source: Barcelona Regional, 2021.

- 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%202030%20WEB.pdf

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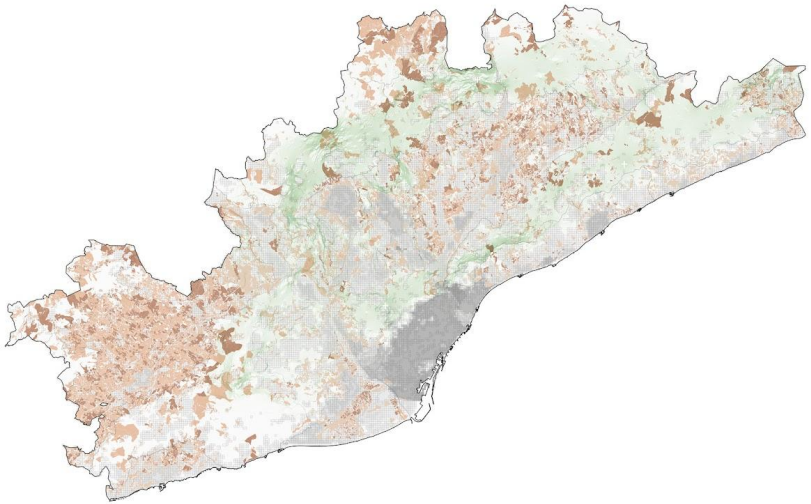
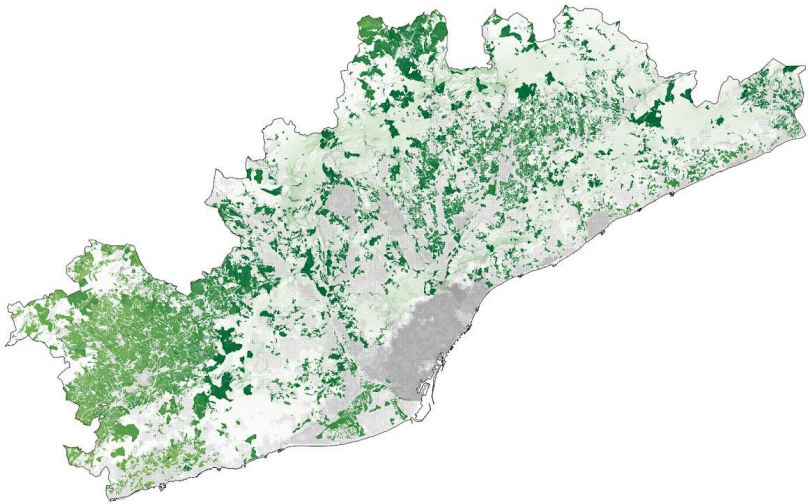
Barcelona Breath - Carbon Capture for breathing cities





Current System

Future System

Master in City & Technology 2020/21, Internet of Cities, Faculty: Mathilde Marengo, Eduardo Rico, Assistants: Iacopo Neri, Raul Bielas,
Students: Kevin Aragon, Iñigo Esteban, Diana Roussi, Tugdual Sarazin

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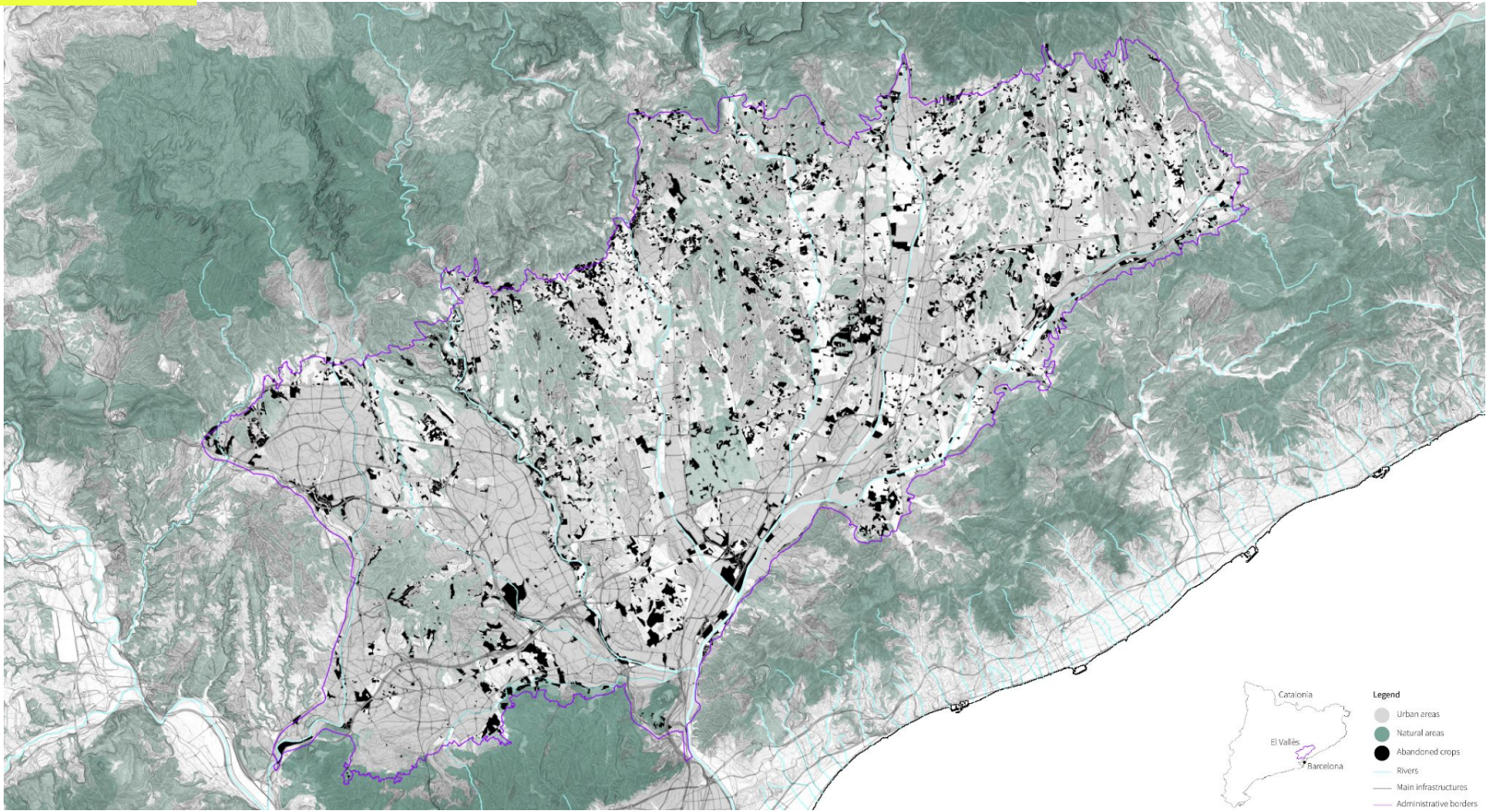
Flower Powder - Rewilding Barcelona



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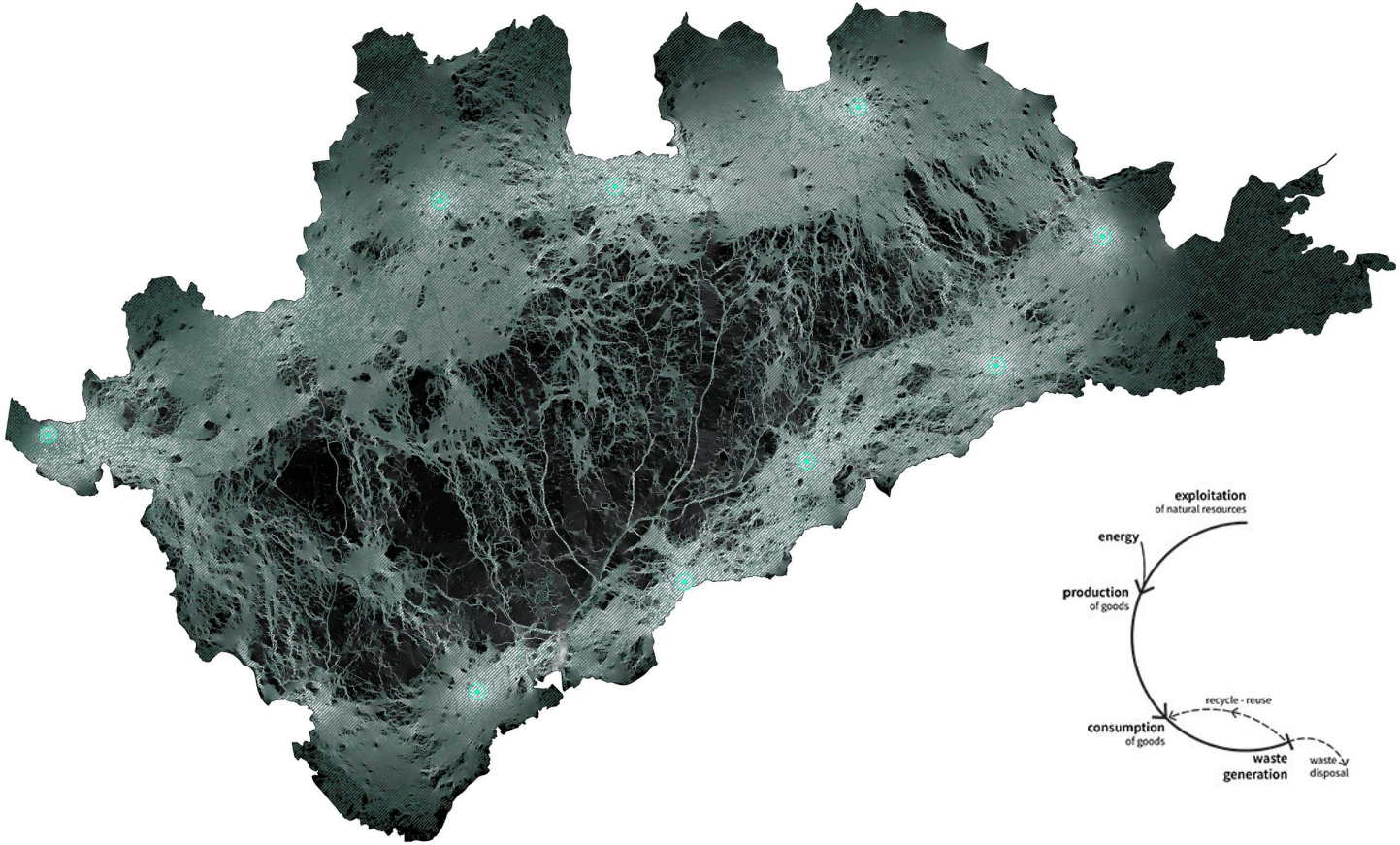

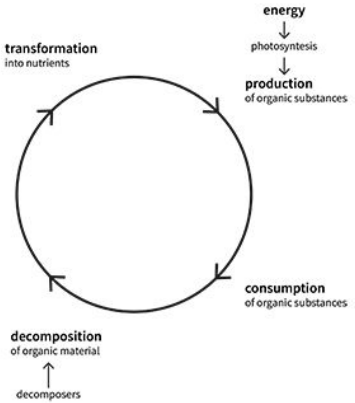

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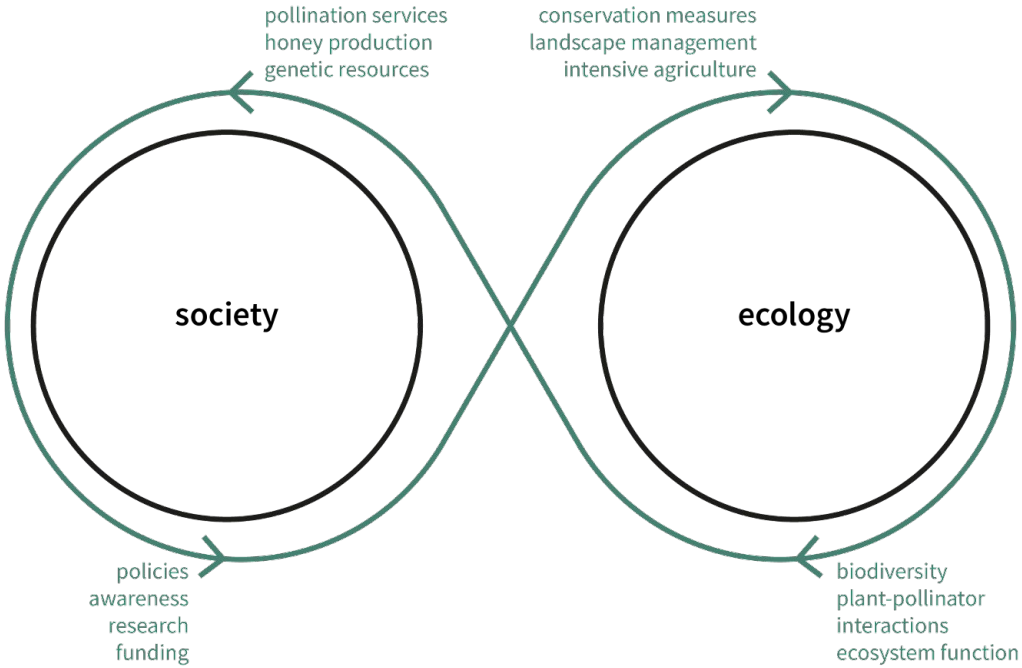

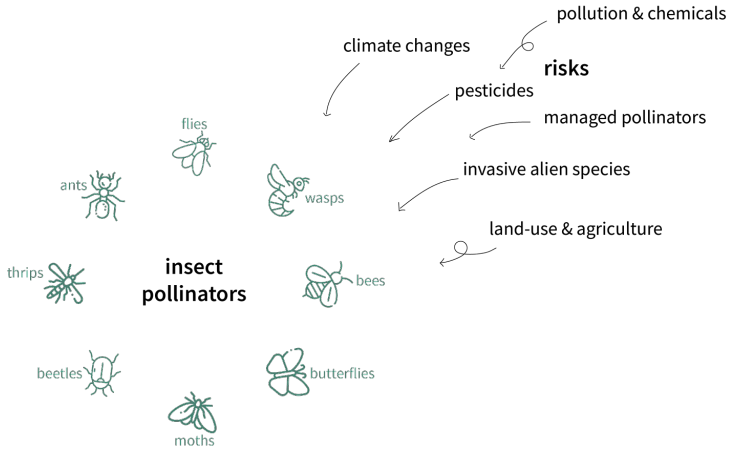

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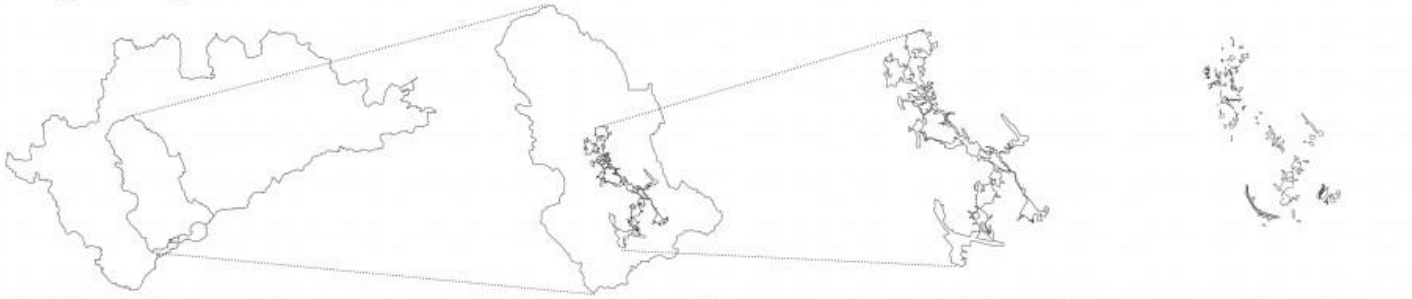
Scaling down process



el Vallès and its natural areas | Ecological corridor | Connectivity corridor | Abandoned crops

Proposal preparation

Landuse analysis | Connectivity analysis | Crops categorization | Corridor identification

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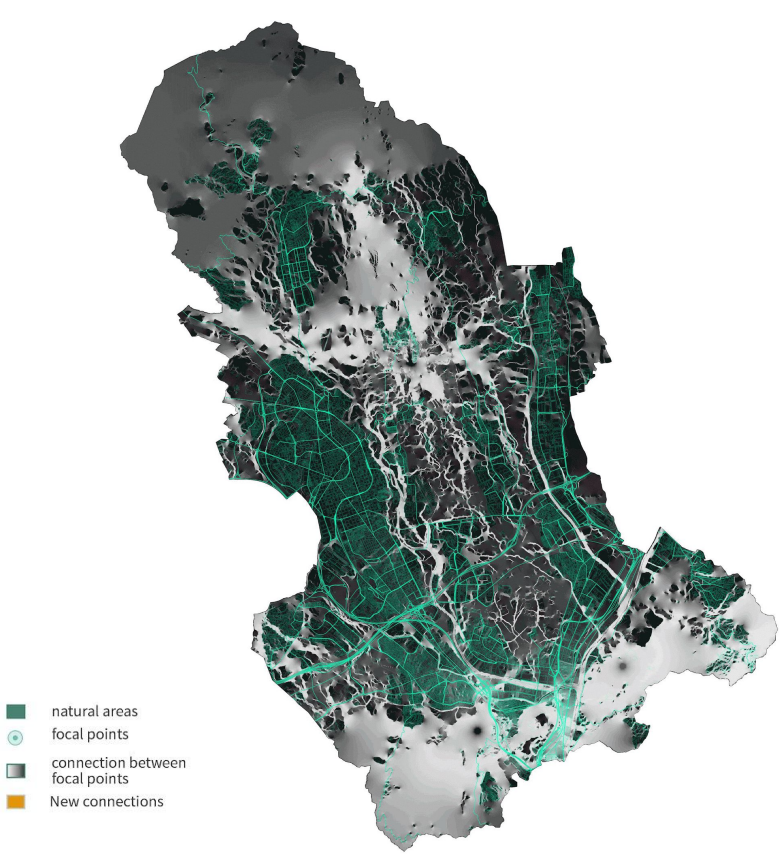

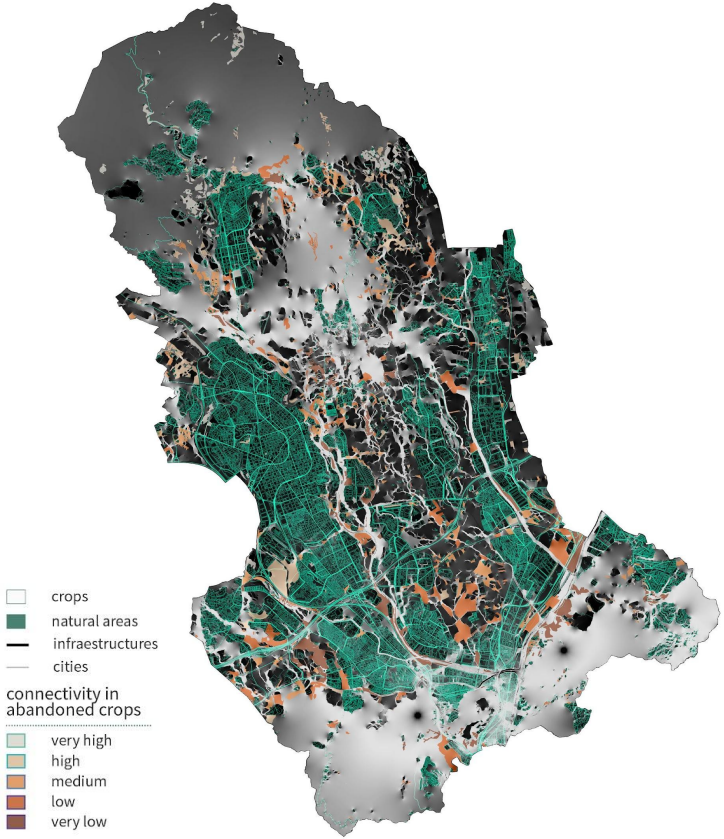

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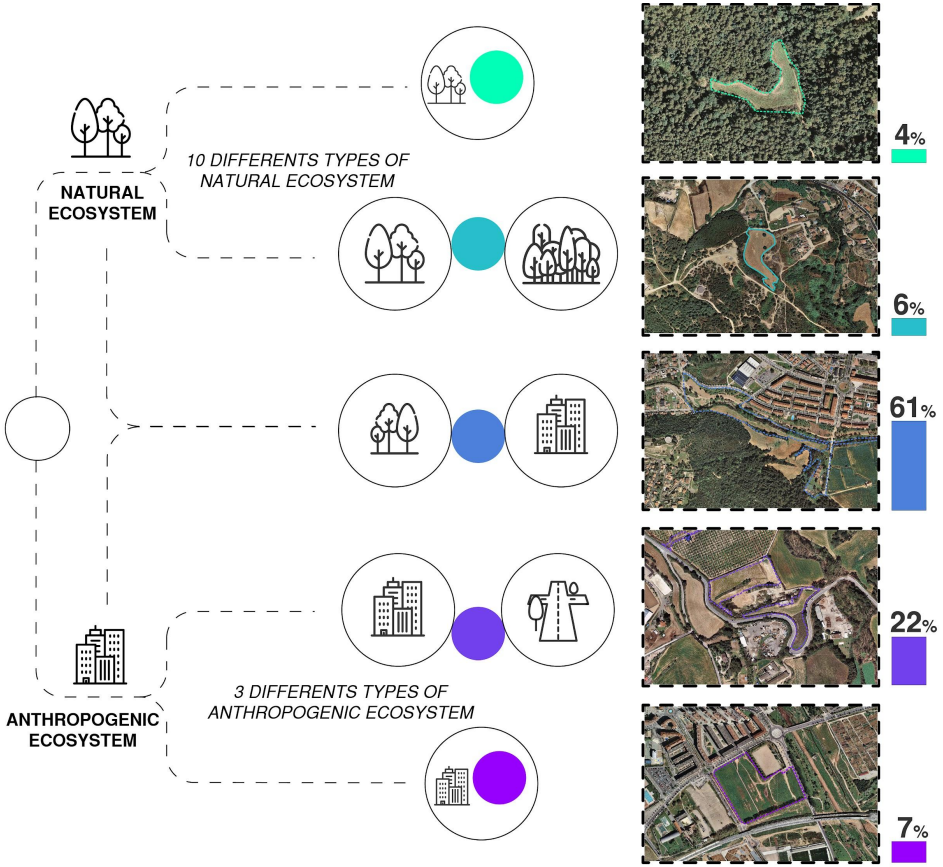

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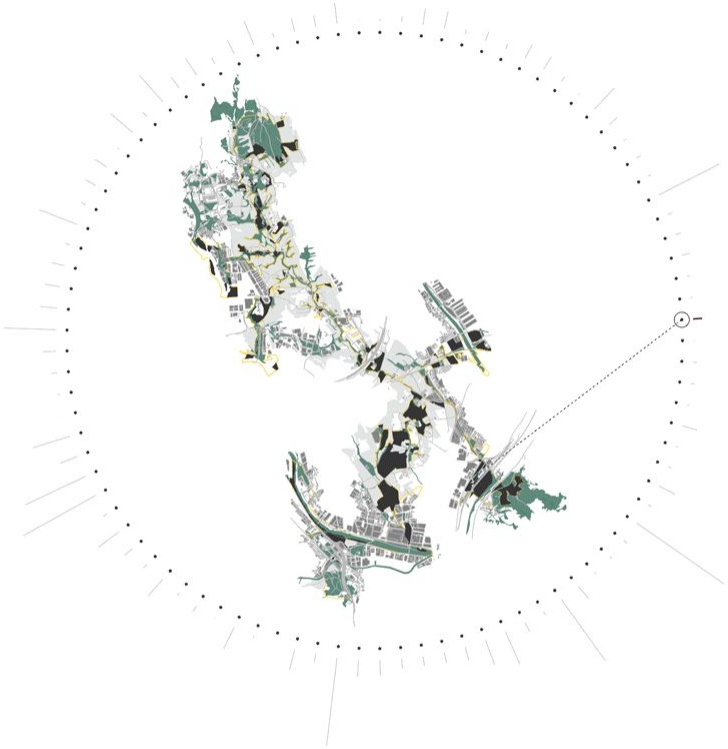

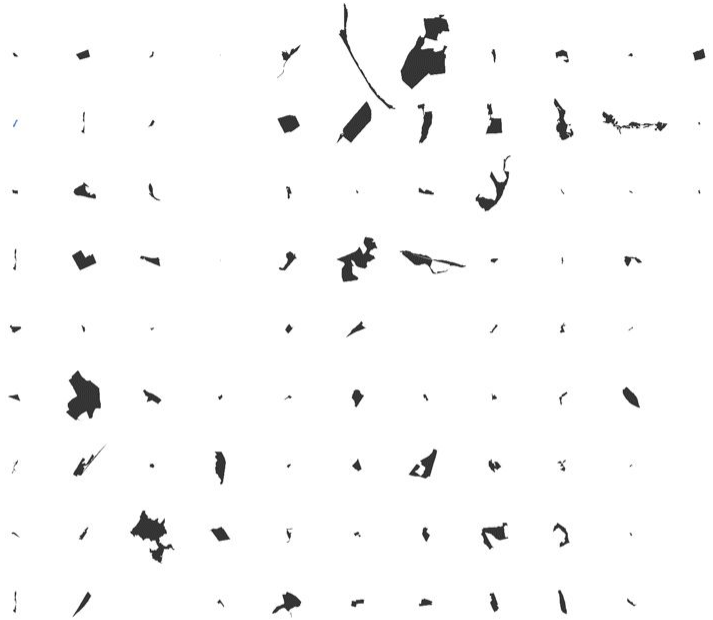

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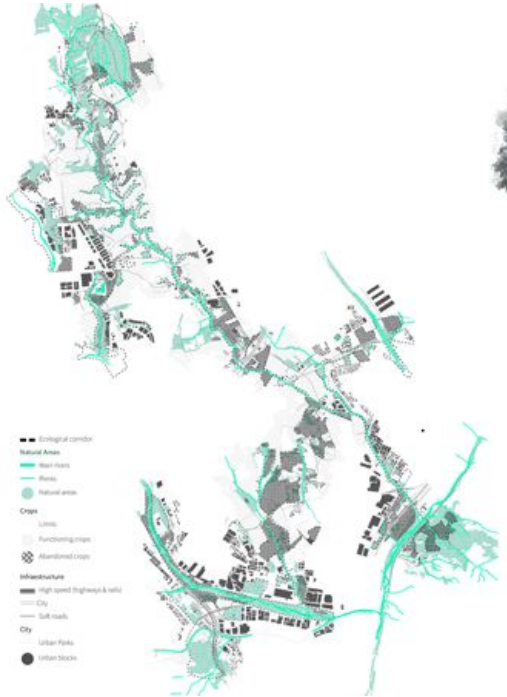

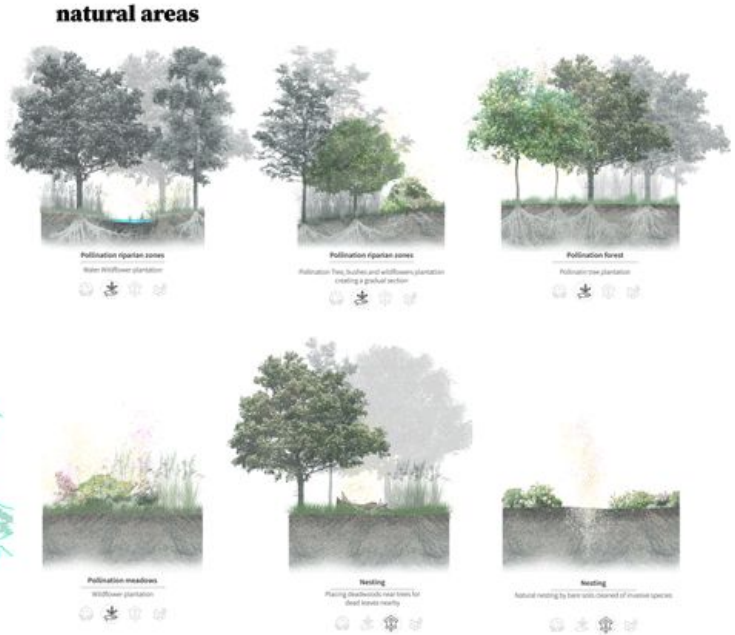

Adequation of environment

Plantation

Nesting

Beekeeping

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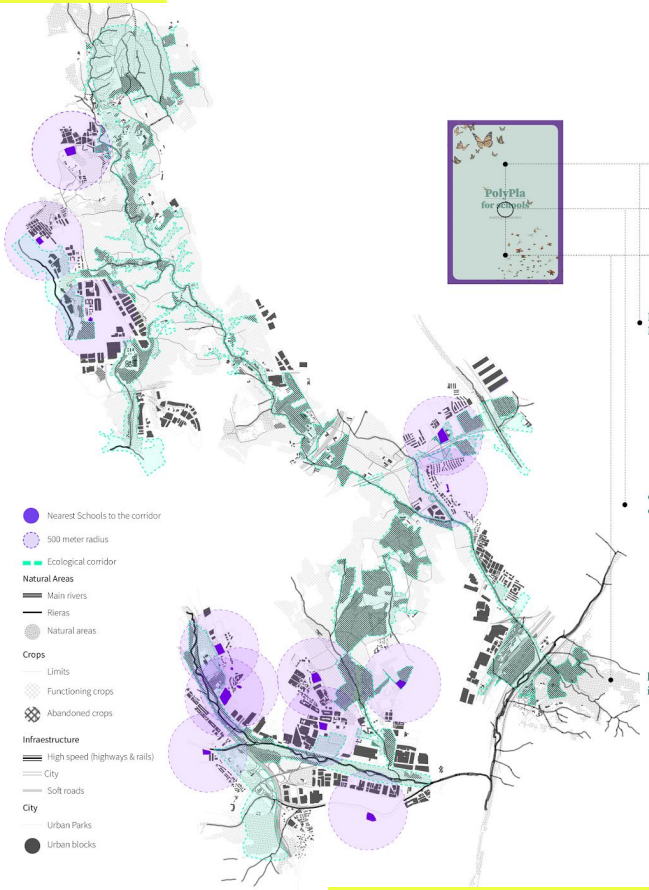
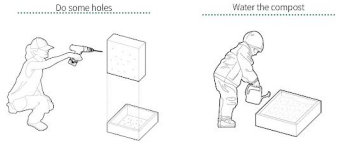
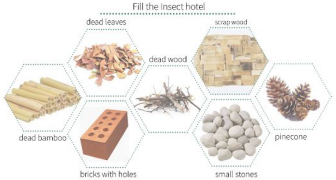


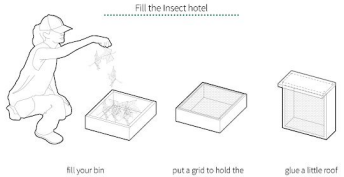
plantation of pollination wildflowers

create and distribute natural compost



build recicled insect hotels





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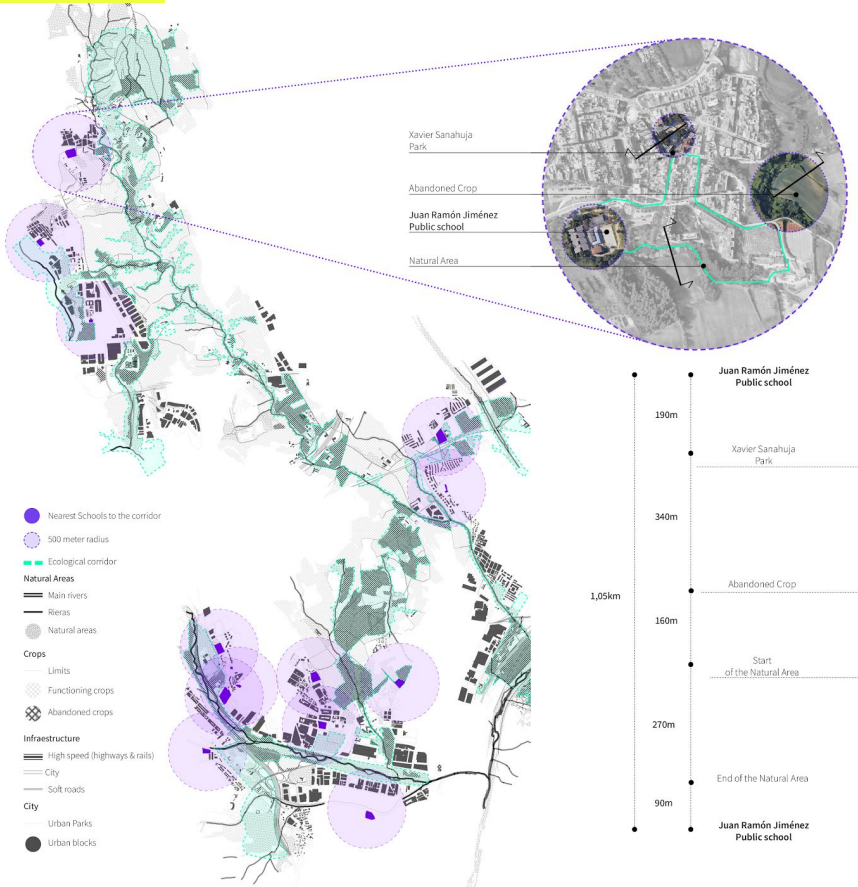

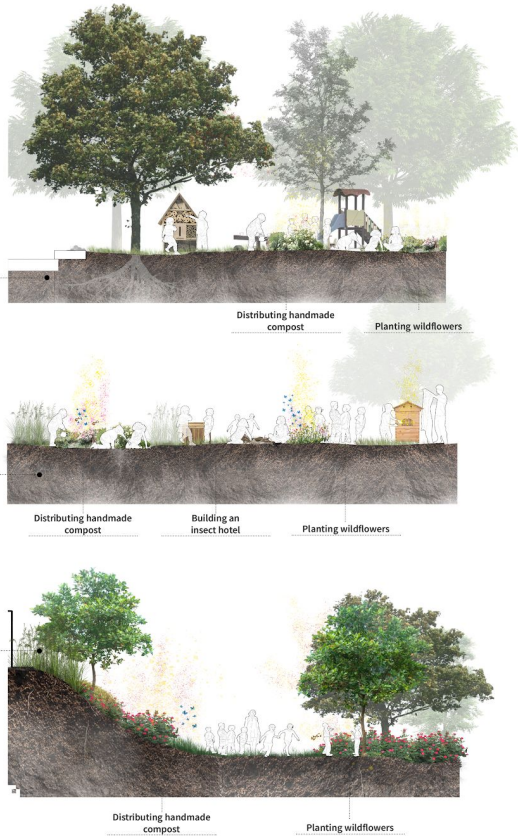

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Embedding productive ecologies

Co-designing green urban elements that produce food and energy

Fostering collective spaces as drivers for ecological connectivity

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

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

@comida.project

More info: iaac.net/project/co-mida/


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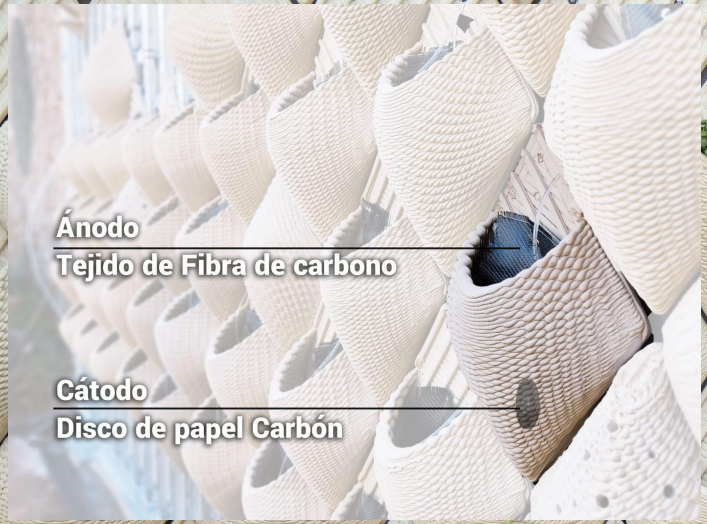

Ánodo
Tejido de Fibra de carbono

Cátodo
Disco de papel Carbón

co mida

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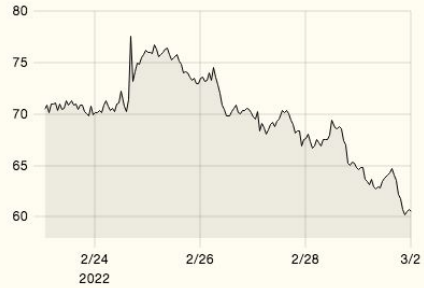
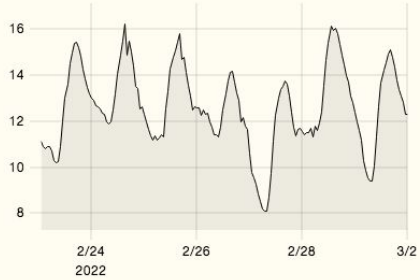
Las Amapolas

Linea 09

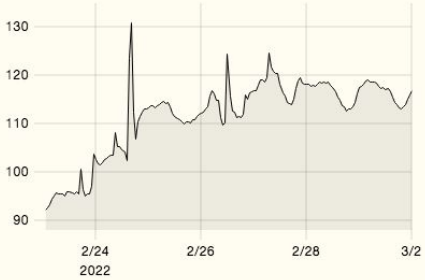
64 %
Humedad



8 °C
Temperatura



117 mV
Energia producida



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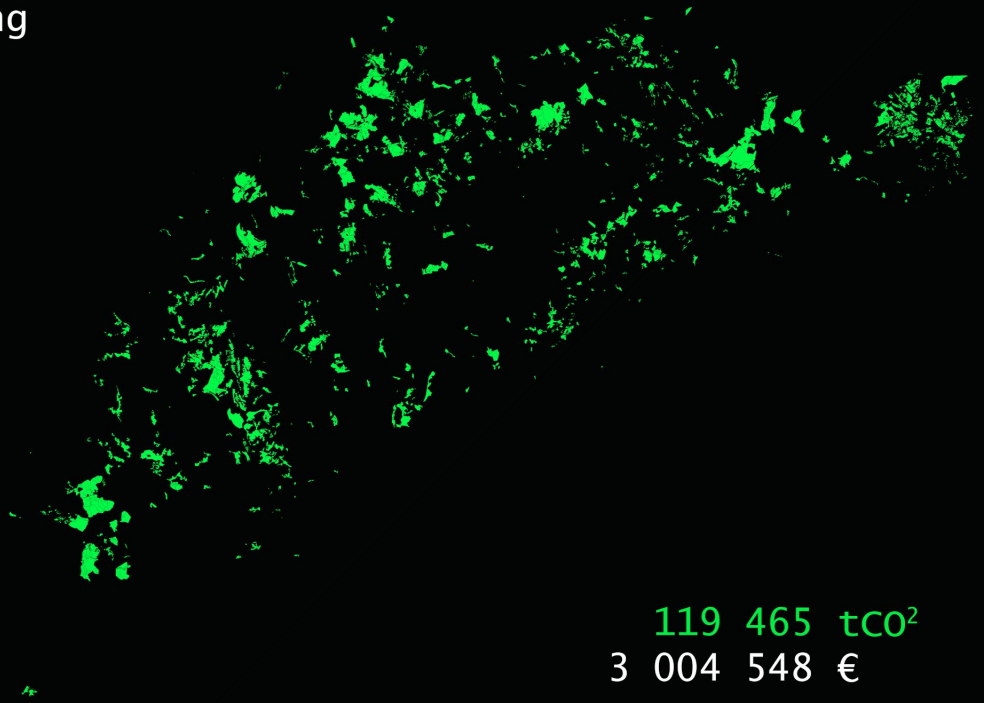
Barcelona Breath - Carbon Capture for breathing cities

Year 1 Year 2 Year 3 Year 4 Year 5 Year 6 Year 7 Year 8 Year 9 Year 10

A Breathing Organism



119 465 tCO^2

3 004 548 €

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8th International Architecture and Environment Symposium
Decision Support in Urban Social-Ecological Systems

Thank You

This presentation is a collaborative effort of many IAAC researchers, thanks to all of them too!

Contact:
mathilde.marengo@iaac.net

2nd February 2023

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