

The future of urban agriculture from a social and metabolic perspective

The second Edible City Network Conference
17/03/2023

<https://urbag.eu/>



Integrated System
Analysis of
Urban Vegetation
and Agriculture



Objectives of the workshop



To present a comprehensive vision of the current urban agriculture challenges and opportunities, by considering both social and environmental perspectives, while employing the Metropolitan Area of Barcelona as case study



To discuss and weight how relevant are the urban agriculture impacts observed in the Metropolitan Area of Barcelona.

Agenda

- 
- 11:40 Start-up business for the implementation of urban agriculture
(Verónica Arcas/Tectum Garden & ICTA-UAB)
- 11:48 Social perspective of urban agriculture: drivers and obstacles
(Johannes Langemeyer/ICTA-UAB)
- 11:54 Metabolic perspective of urban agriculture
(Gara Villalba/ICTA-UAB)
- 12:01 Potential of nutrient recovery from the organic municipal solid waste
(Juan Arosemena/ICTA-UAB)
- 12:10 Q&A
- 12:20 Urban agriculture in the AMB: potential changes in vulnerabilities
(David A. Camacho/ICTA-UAB)
- 12:30 Participatory exercise

Tectum Garden:

the development of a start up business for the implementation of urban agriculture



A black and white photograph of a modern building with a glass facade, partially obscured by trees and a large circular graphic. The building is on the right side of the image, and the trees are on the left. A large, semi-transparent circular graphic is overlaid on the left side of the image, containing the word "Team".

Team

spin-off UAB

Tectum garden



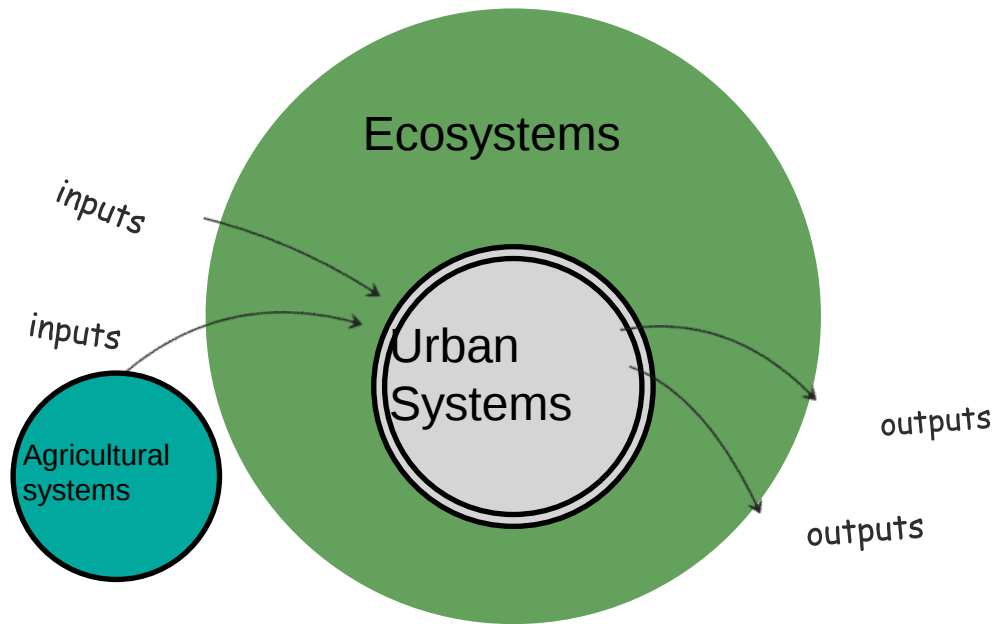


Mission



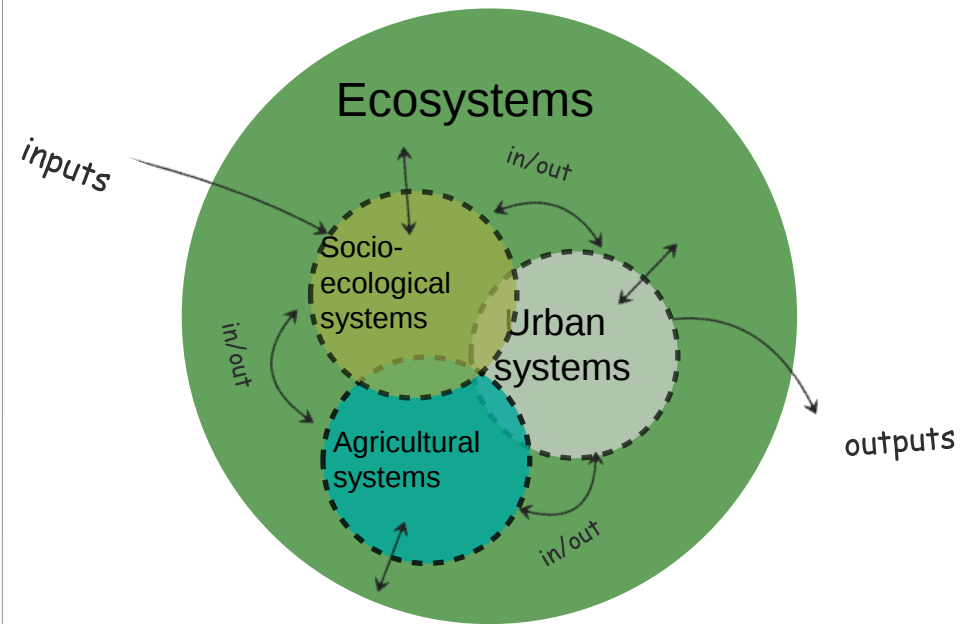
**Tool to improve the circularity of
resources and sustainability in cities.**

Agriculture and technology meet society.



Convencional systems

ISOLATED



Integrated systems

PHYSIC AND DINAMIC
CONNECTIVITY

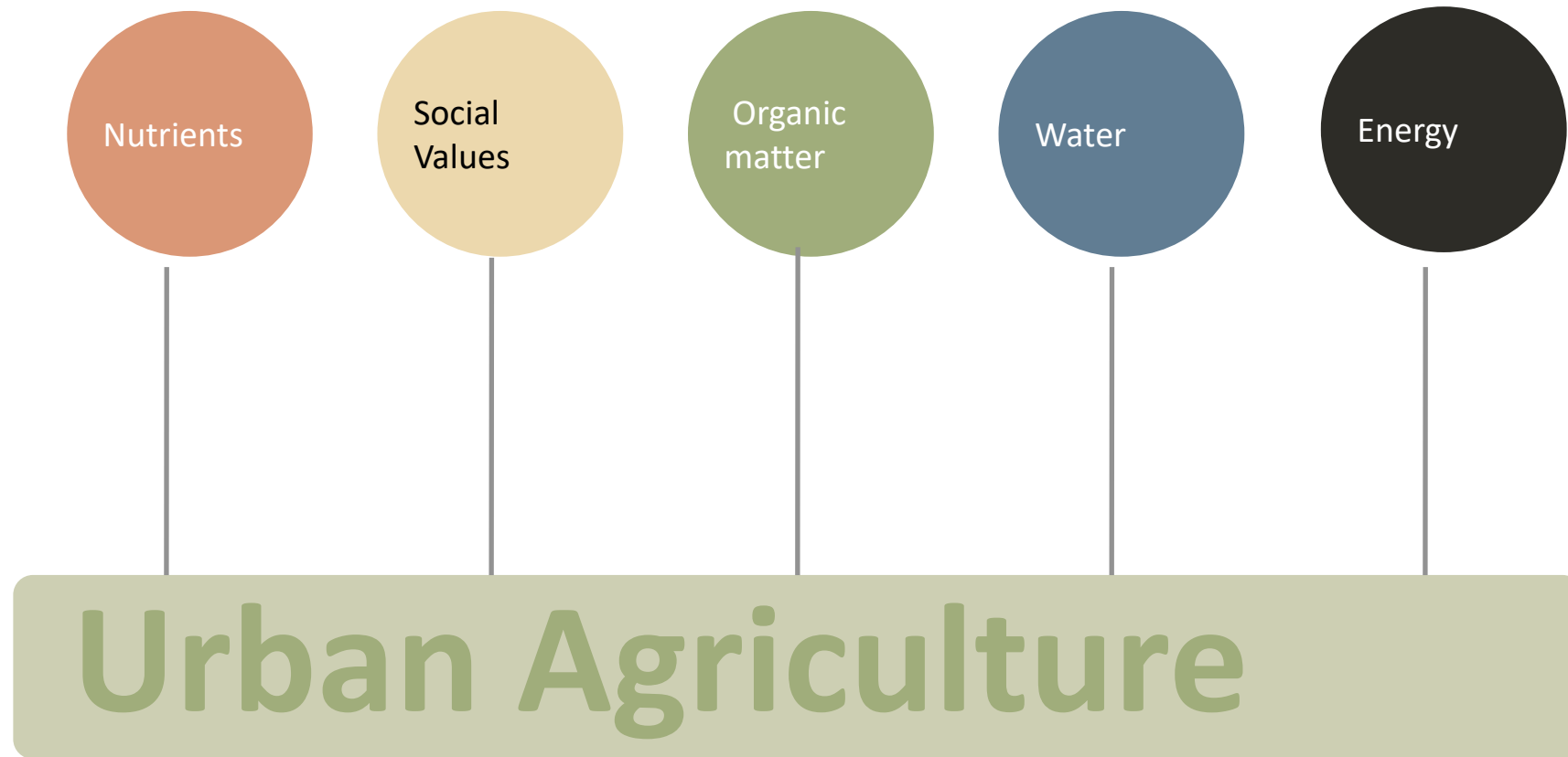


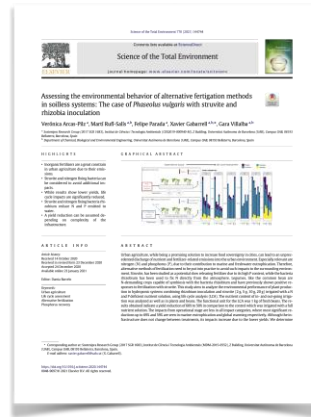
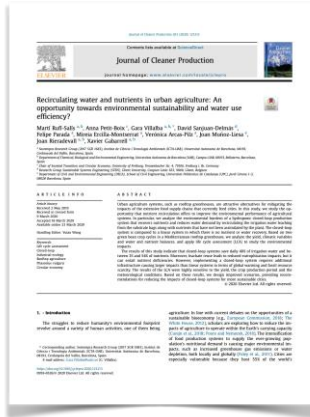
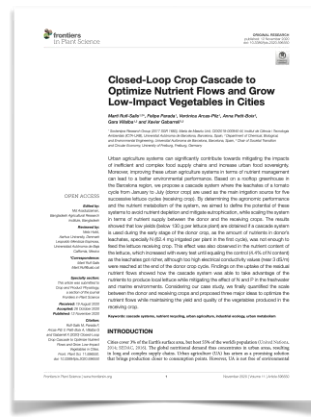
- Not only production oriented benefits
- Tools to transform dense cities
- Gives urban landscapes a wide range of functions

Multiple social and ecological benefits



Agriculture for people

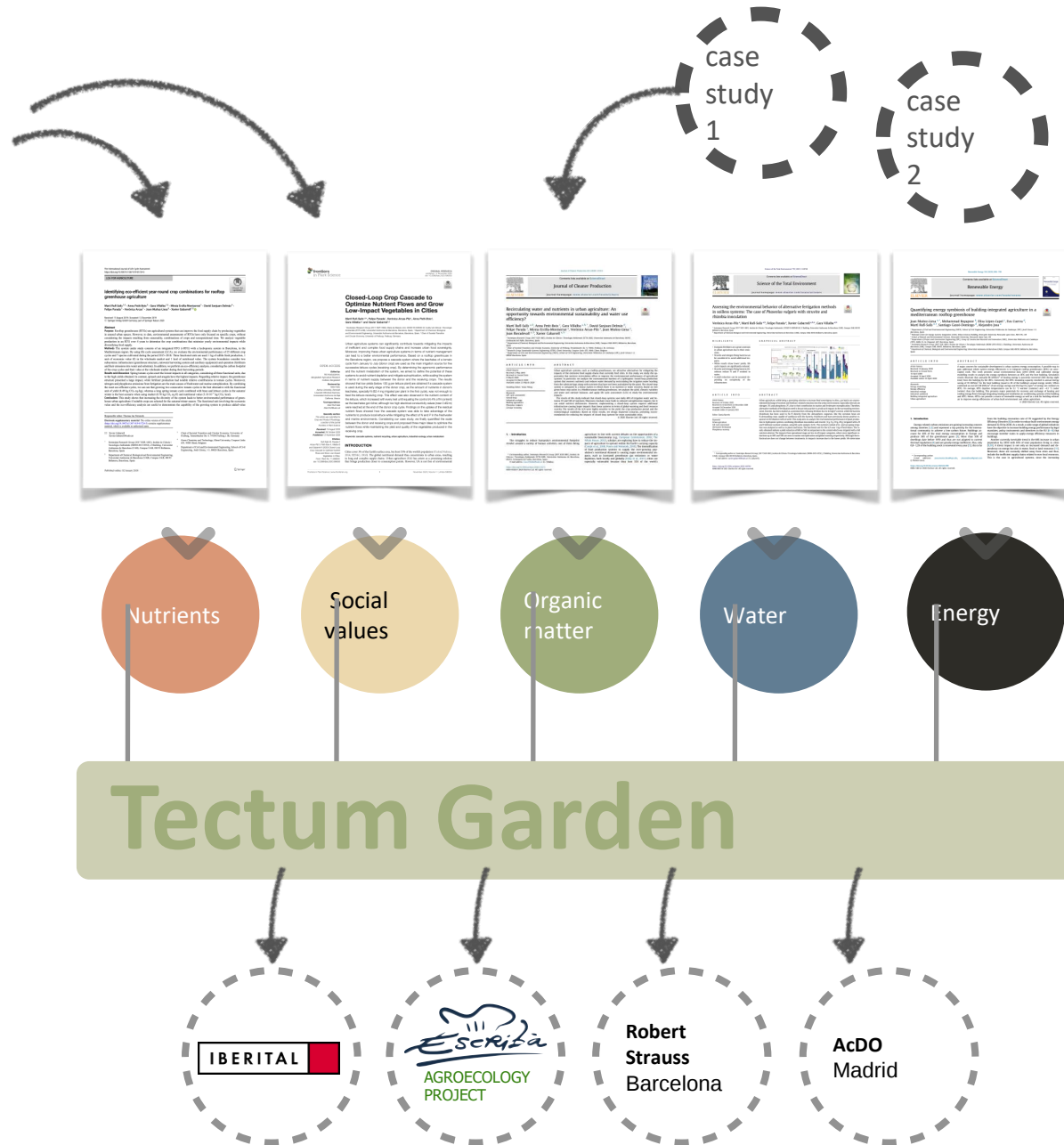




Urban Agriculture



Case study:
Rooftop
greenhouse
ICTA-UAB
Building



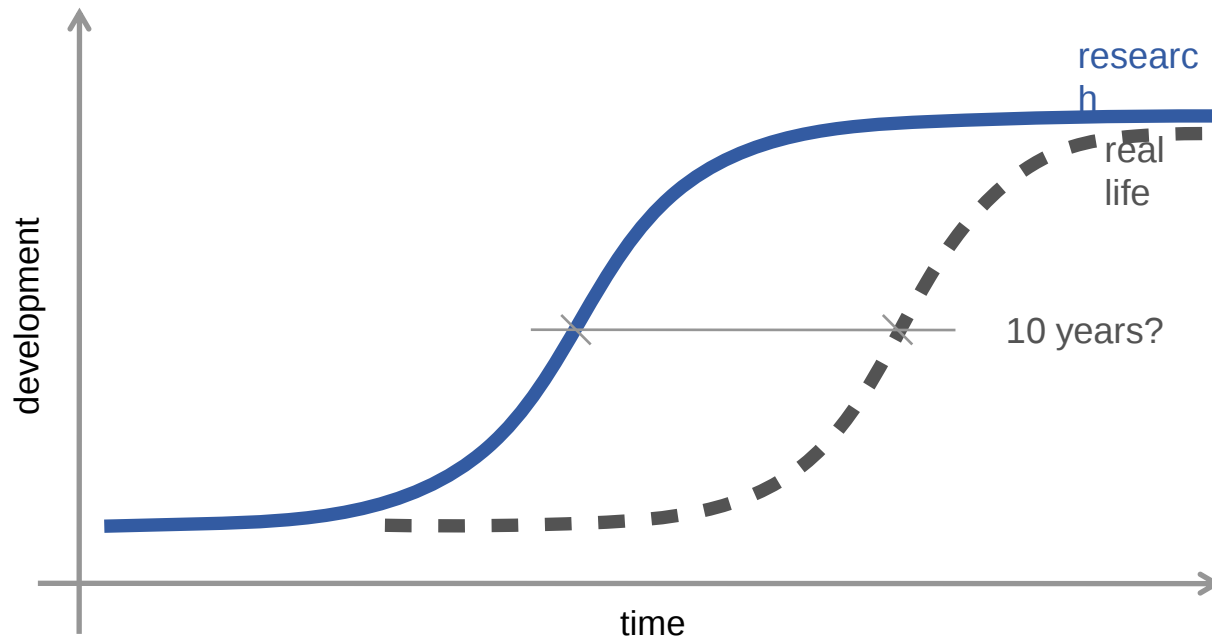
Knowledge
transfer







A timescale problem



- Research is prospective = important to continue feeding it
- Time gap = transition towards sustainable urban models
- Contradictions with global changes



Projects



Ongoing and finished projects

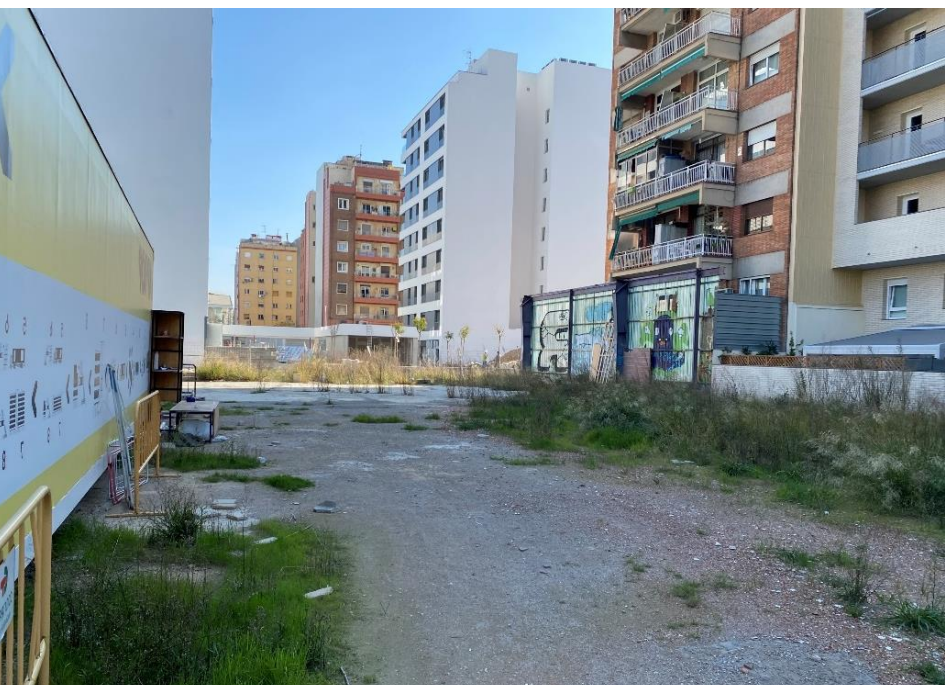
IMPD, Barcelona
Urban Agriculture maintenance project,
with the Institute of Disabled People of the
Barcelona City Council

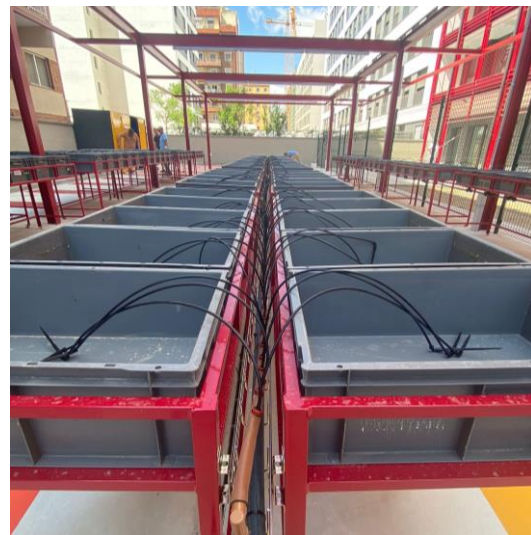
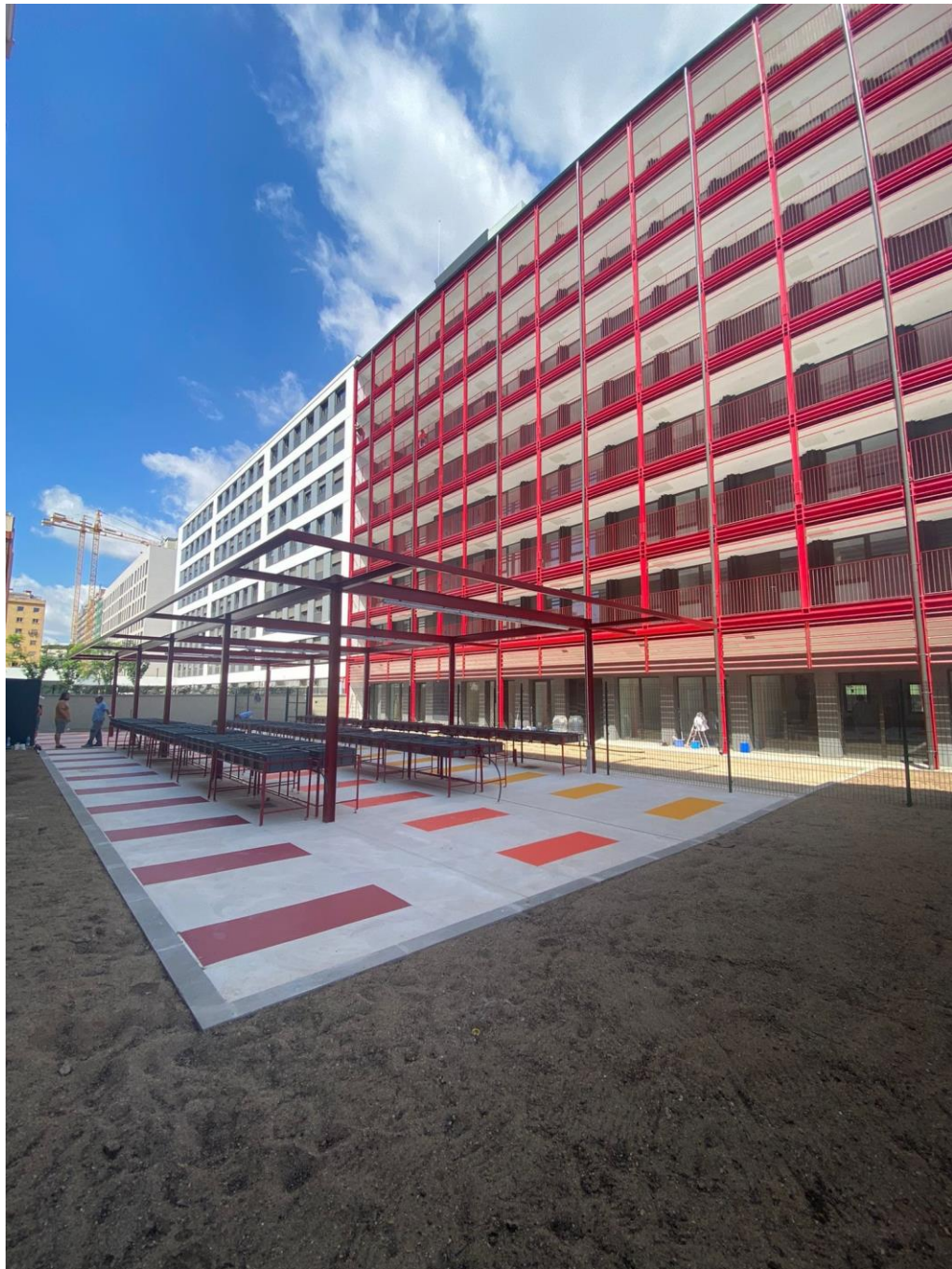




IMPD-Glòries, Barcelona
IMPD and BARCELONA COUNCIL
ARCHITECTURE,
social Urban Agriculture project for the use
of rainwater and food production
with studio9am





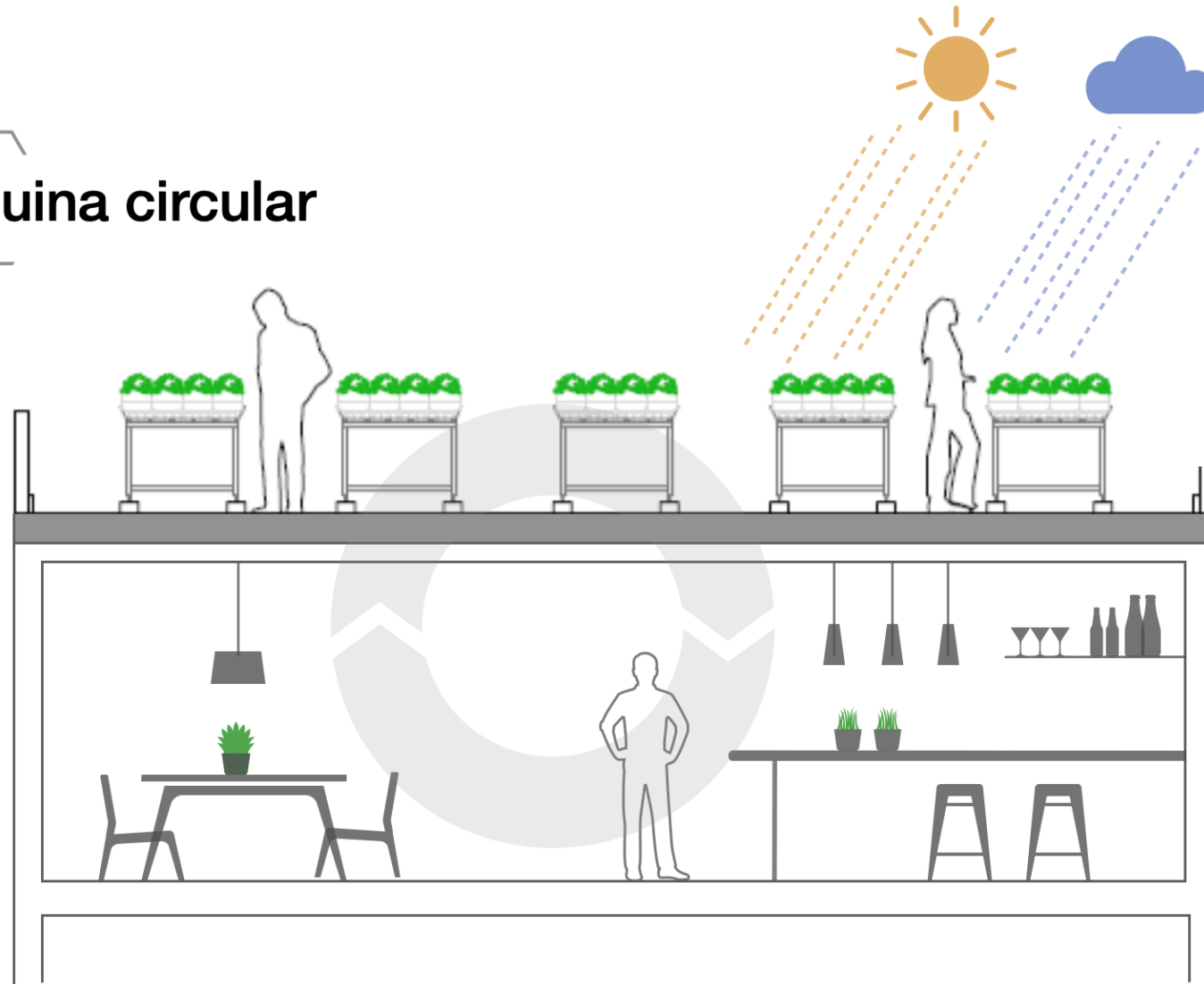




Escribà Restaurante, Girona
Restoration Project



Cuina circular



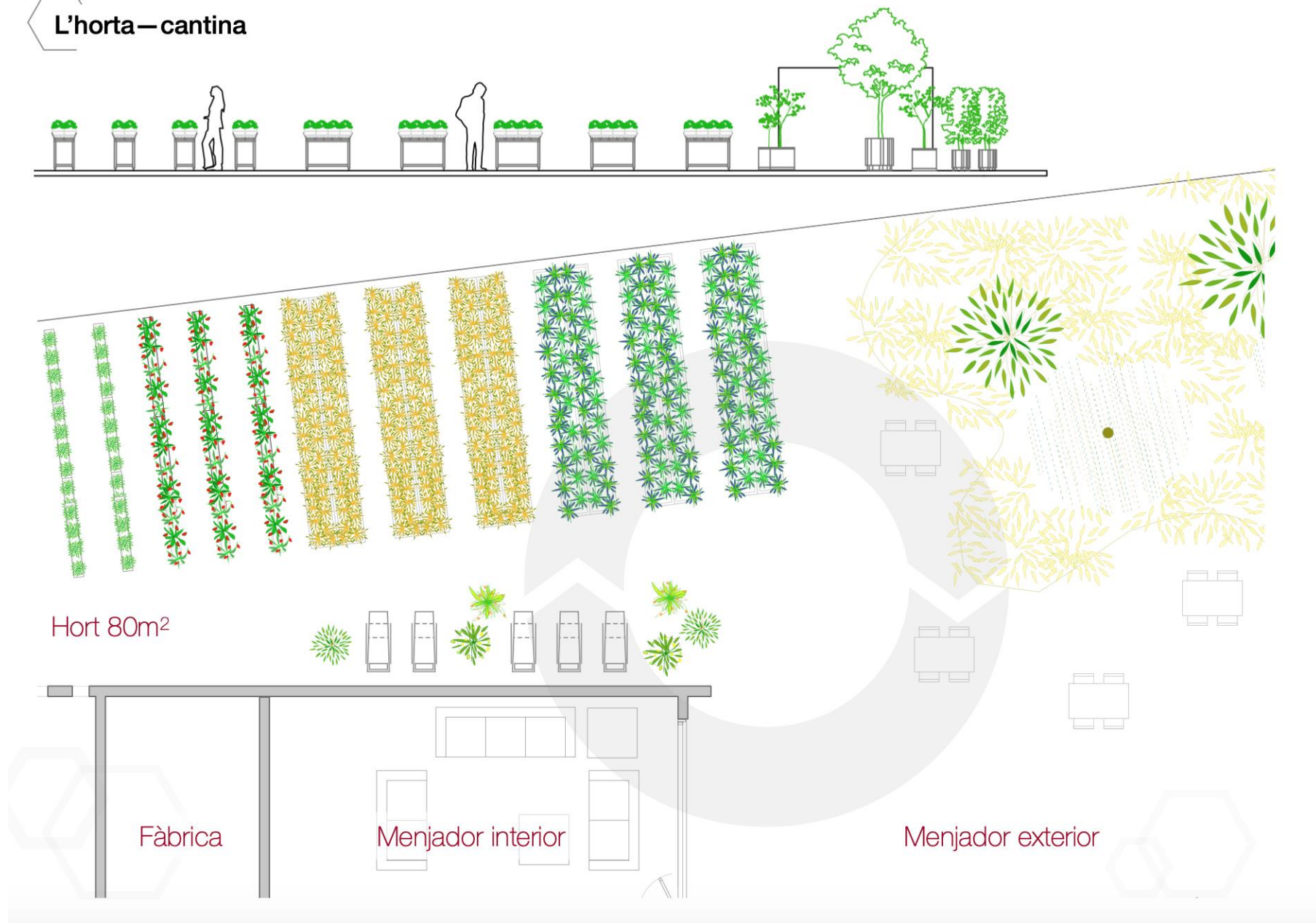




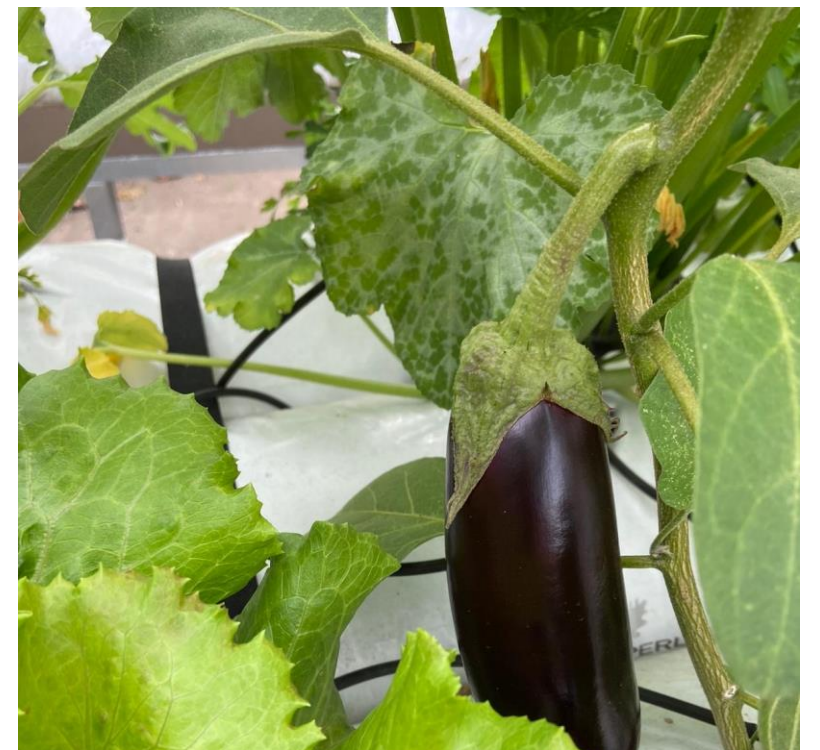
IBERITAL, Barcelona
ELECTRICAL SECTOR COMPANY, AU
canteen project for workers



L'hort—cantina







Módulo REGREEN, CETAQUA VEOLIA
Urban Agriculture demonstration
greenhouse project using regenerated
wastewater





Proyecto Mueble kettal,
Urban Agriculture indoor furniture project.
with Kettal and Studio9am

The logo for Kettal is a solid light beige square. Inside the square, the word "kettal" is written in a lowercase, black, sans-serif font.

kettal



kettal

Proyecto SIRAH
Smart irrigation Project with the research
group Sostenipra





Smart irrigation prototypes





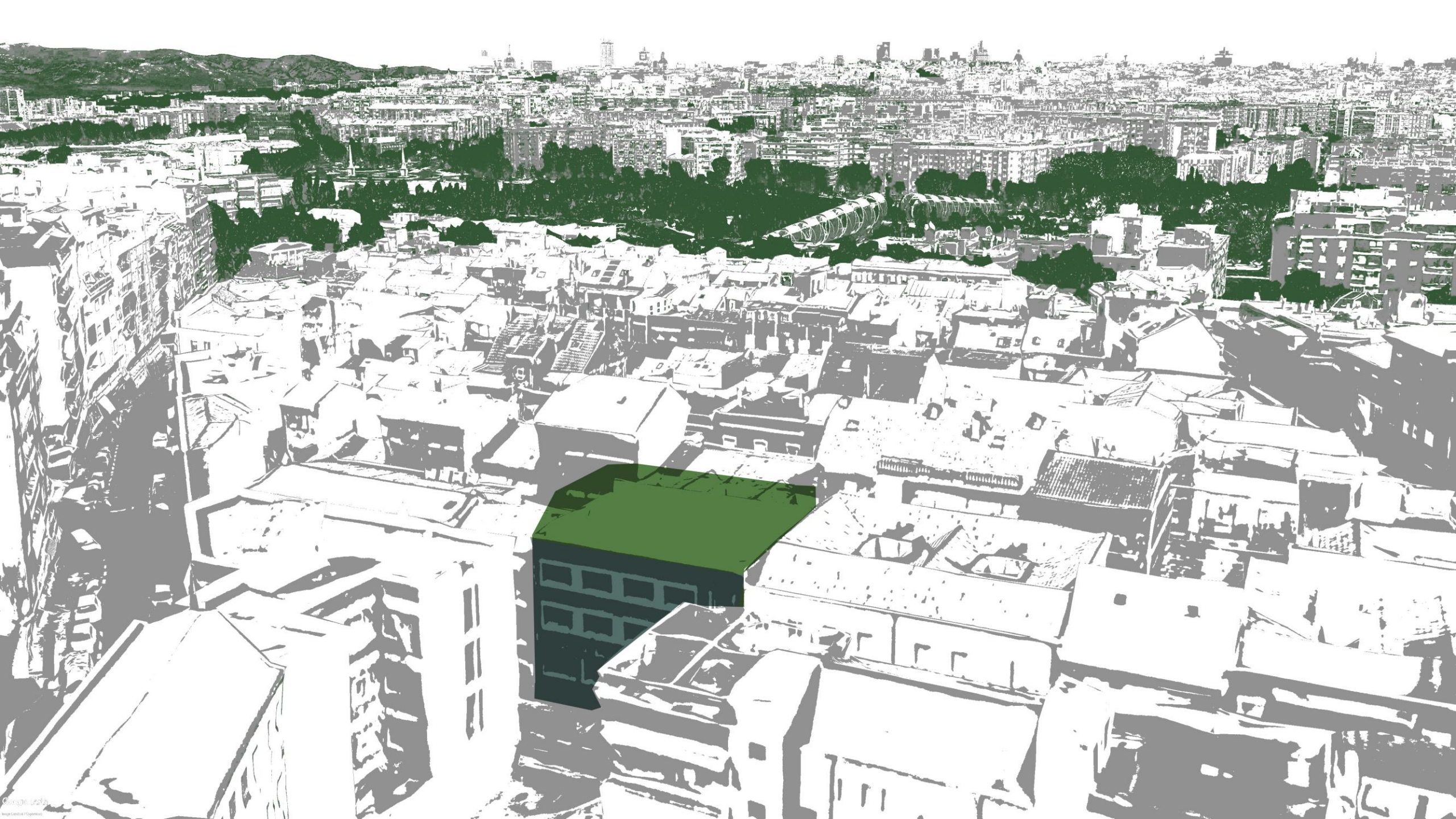
Projects

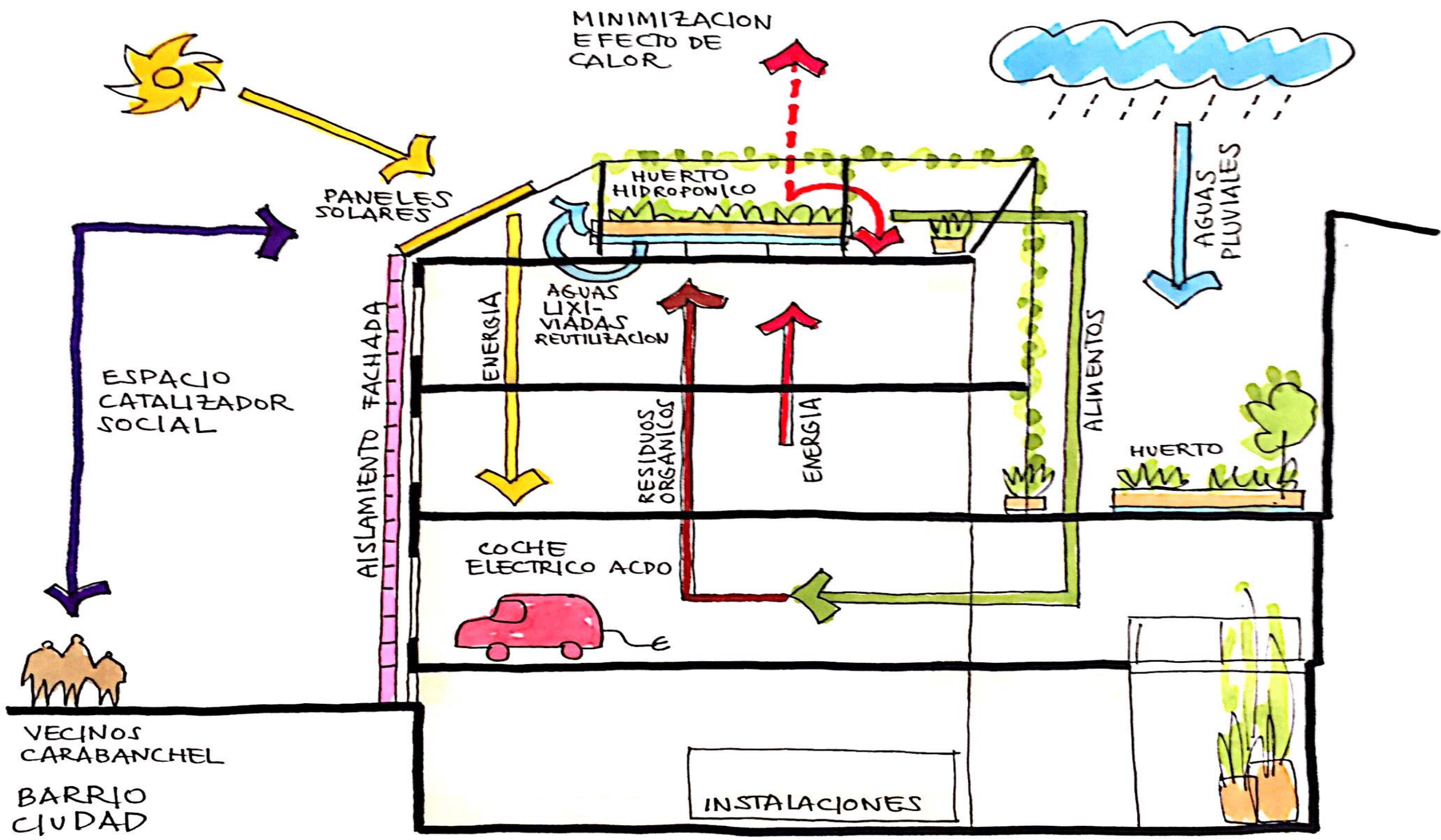


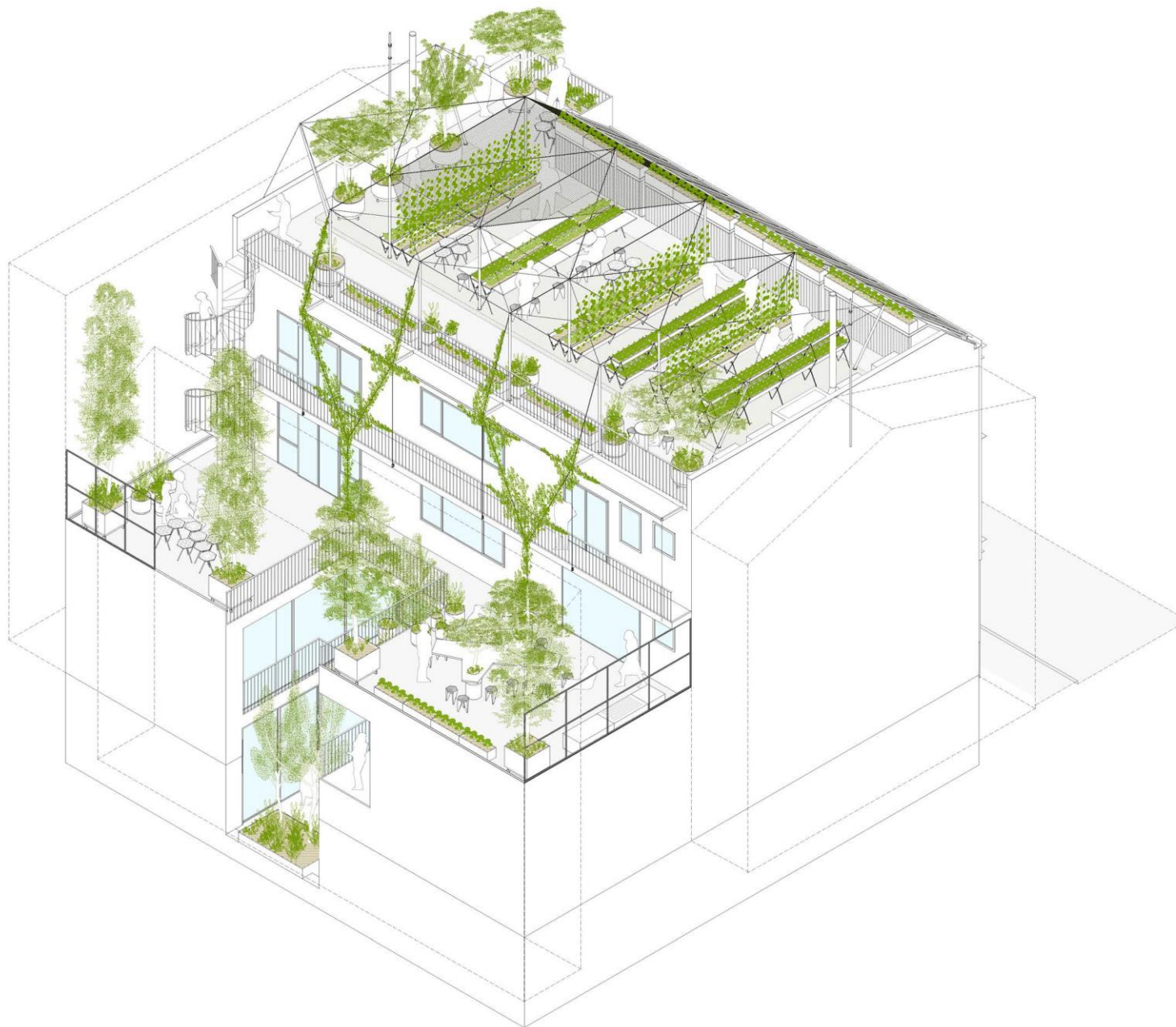
Future projects

Proyecto ACdO
ACDO DESIGN COMPANY
Mosaic roof project using water, energy
and food
with Studio9am, ACdO







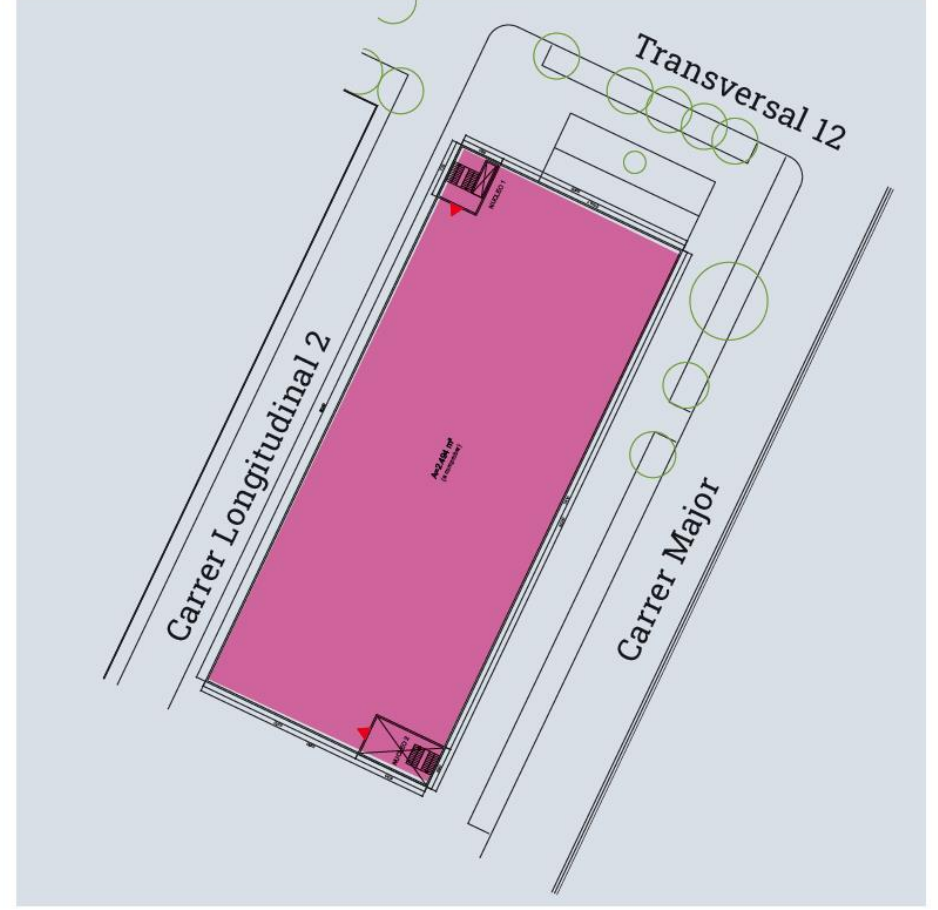






Proyecto Mercabarna,
MERCABARNA FOOD LOGISTICS COMPANY.
Energy mosaic roof project, intensive food
production in open air and greenhouse
with Studio9am



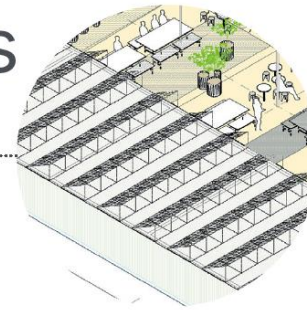
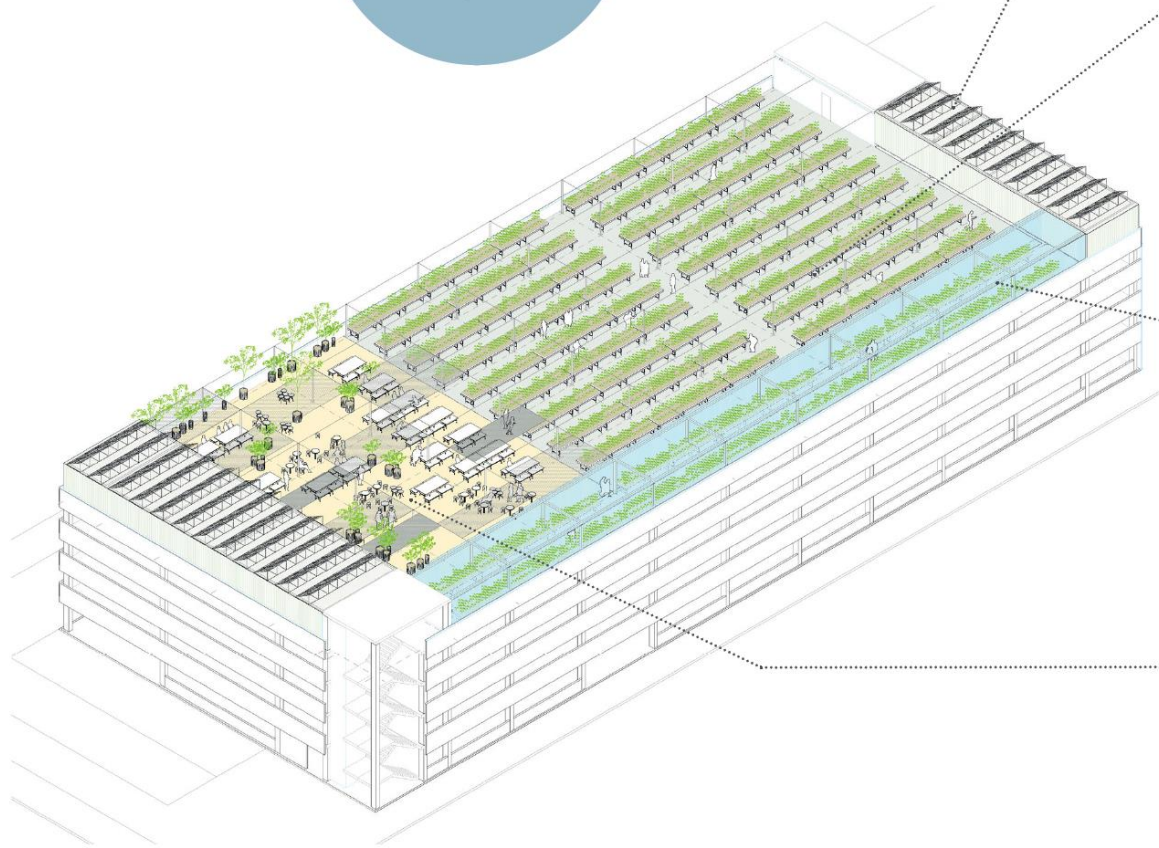


Propuesta de sistema y subsistemas

En estos gráficos se muestra un esquema básico de disposición para la cubierta de Mercabarna identificando los elementos potenciales con los que llevar a cabo su transformación.

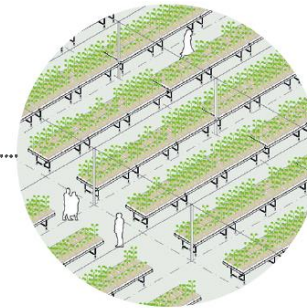
Agua

Recolección de agua de lluvia y atenuación de caudales de tormentas



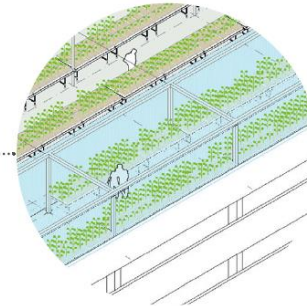
Energía

Paneles fotovoltaicos y espacios auxiliares



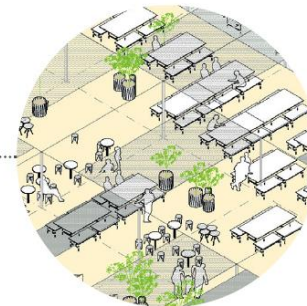
Alimentos

Producción agrícola al aire libre utilizando principalmente sistemas hidróponicos



Invernaderos

Producción intensiva de cultivos específicos



Áreas de trabajo

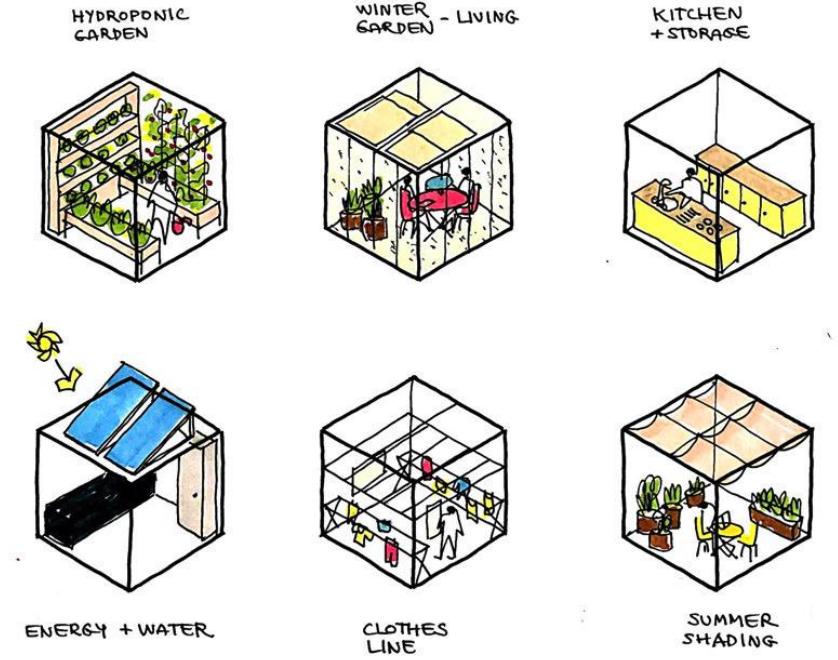
usos asociados:
sociales, divulgativos,
escolares, formación,
etc.

Proyecto Bithabitat,
BARCELONA CITY COUNCIL
COMPETITION

Multifunctional greenhouse module Project
with Studio9am, Serenovables and kettal.

The logo for kettal features the word "kettal" in a black, lowercase sans-serif font, centered within a light beige rectangular background.

kettal





Gràcies
info@tectumgarden.cat





EXCELENCIA
MARÍA
DE MAEZTU

ICTA



Institut de Ciència
i Tecnologia Ambientals - UAB

Spatial-temporal Dynamics and Leverage Points of Agricultural Transitions

The case of the Metropolitan Area of Barcelona

The Edible Cities Network Conference 2023

Johannes Langemeyer

17 March 2023

Johannes.Langemeyer@uab.cat
<https://urbag.eu/>

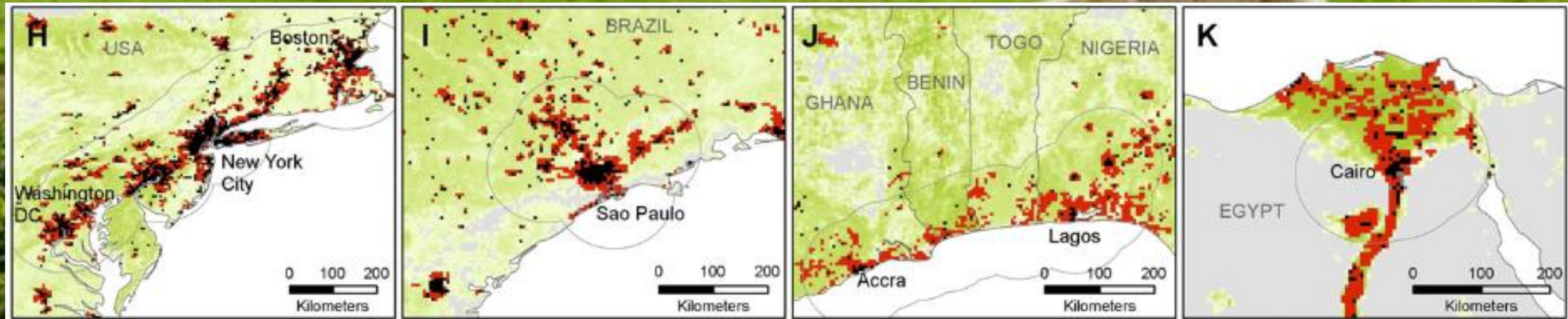


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Future urban expansion will take place in areas currently under cultivation.

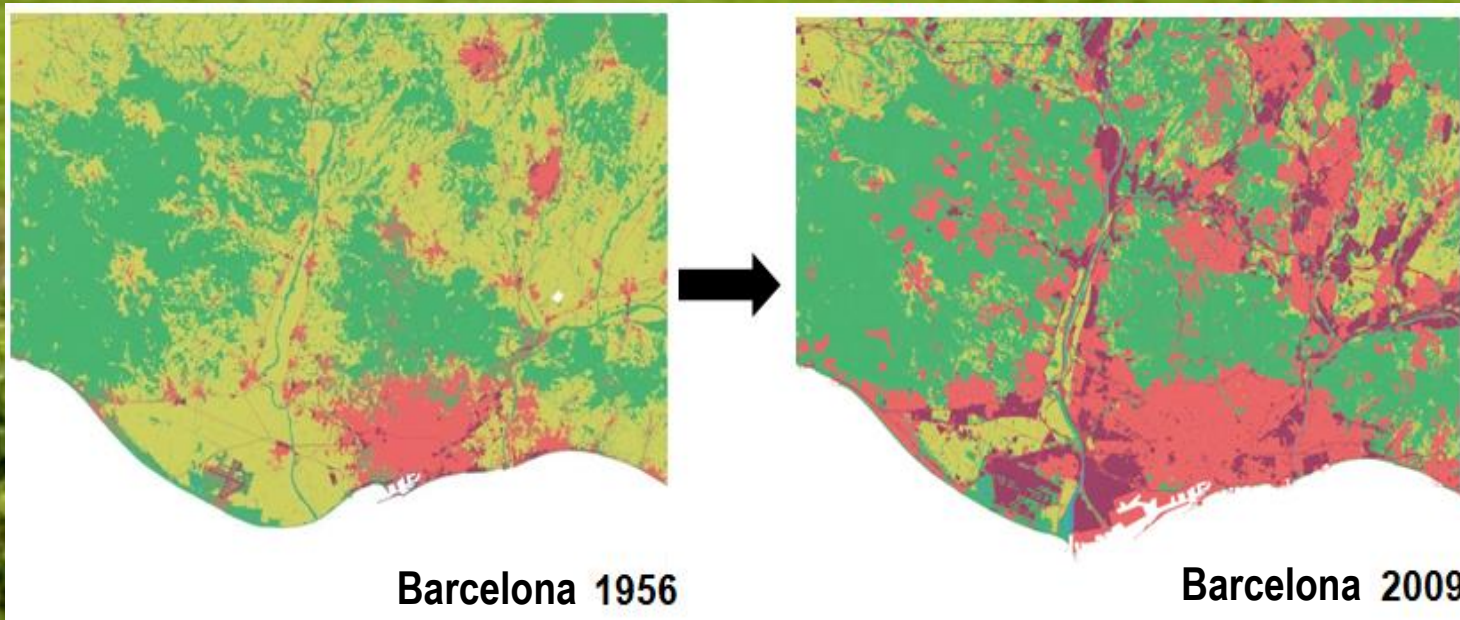
Bren d'Amour et al., 2017



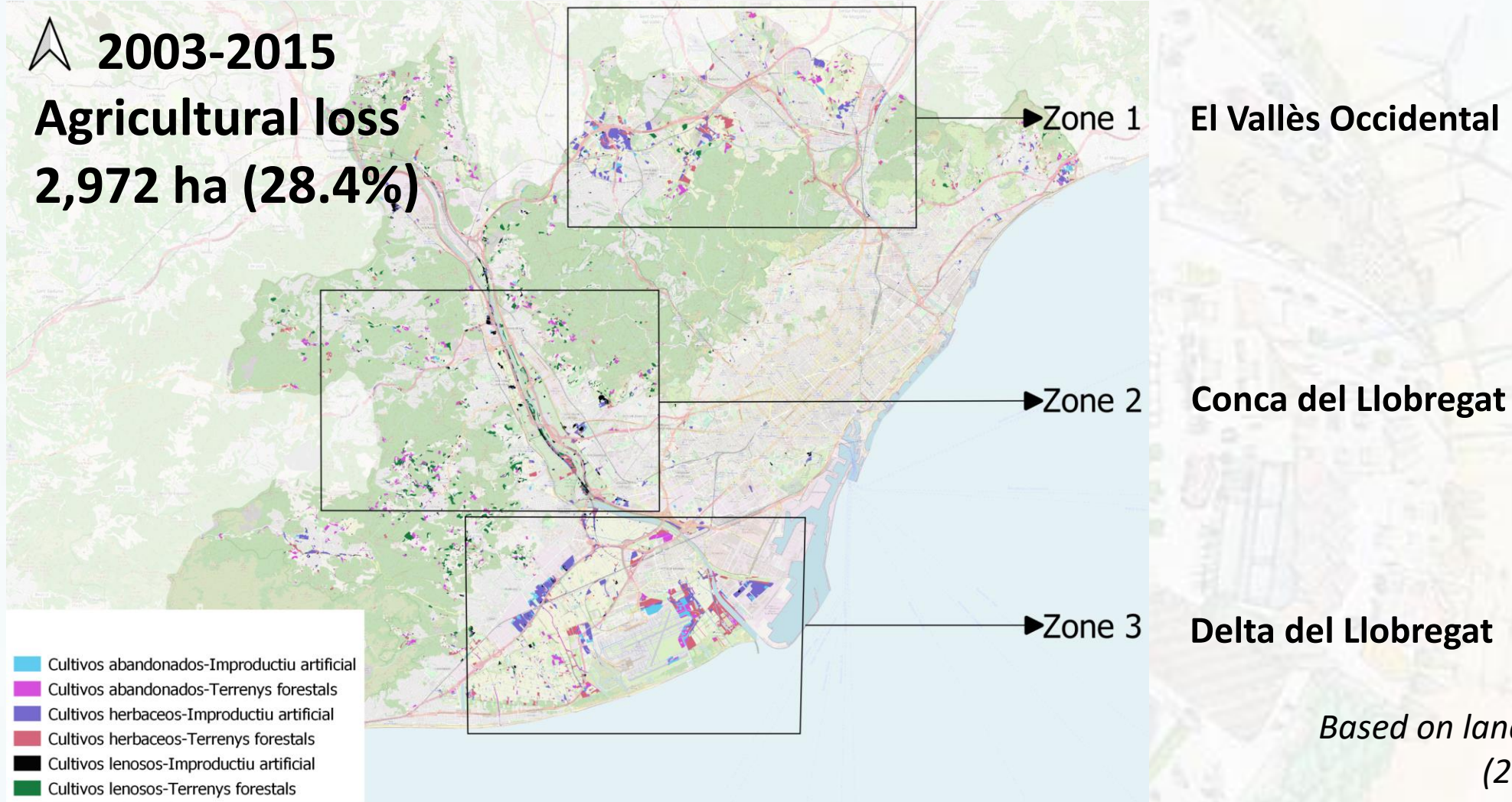


Future urban expansion will take place in areas currently under cultivation.

Bren d'Amour et al., 2017

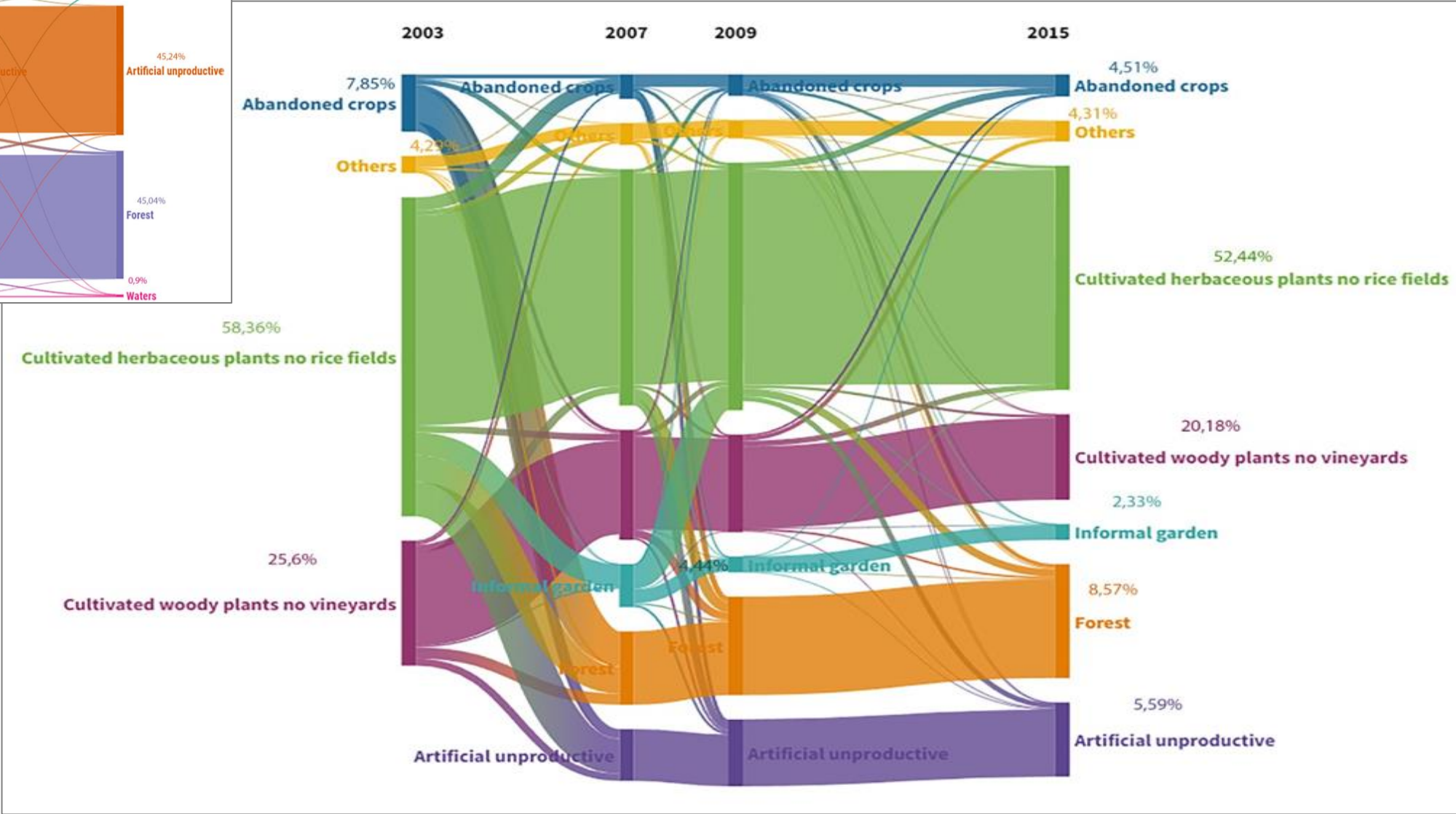
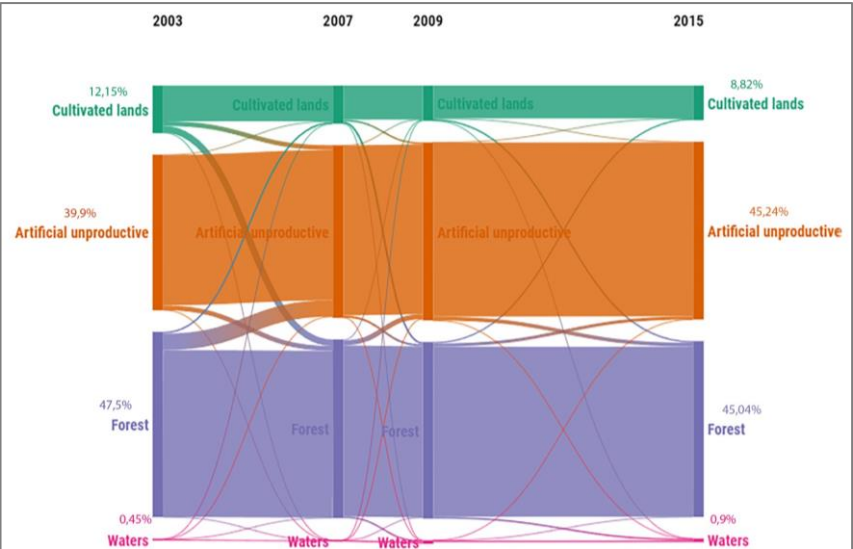


Metropolitan Area of Barcelona



*Based on land-cover maps by CREAM
(2003, 2007, 2009, 2015)*

Superficie agrícola en el Area Metropolitana de Barcelona

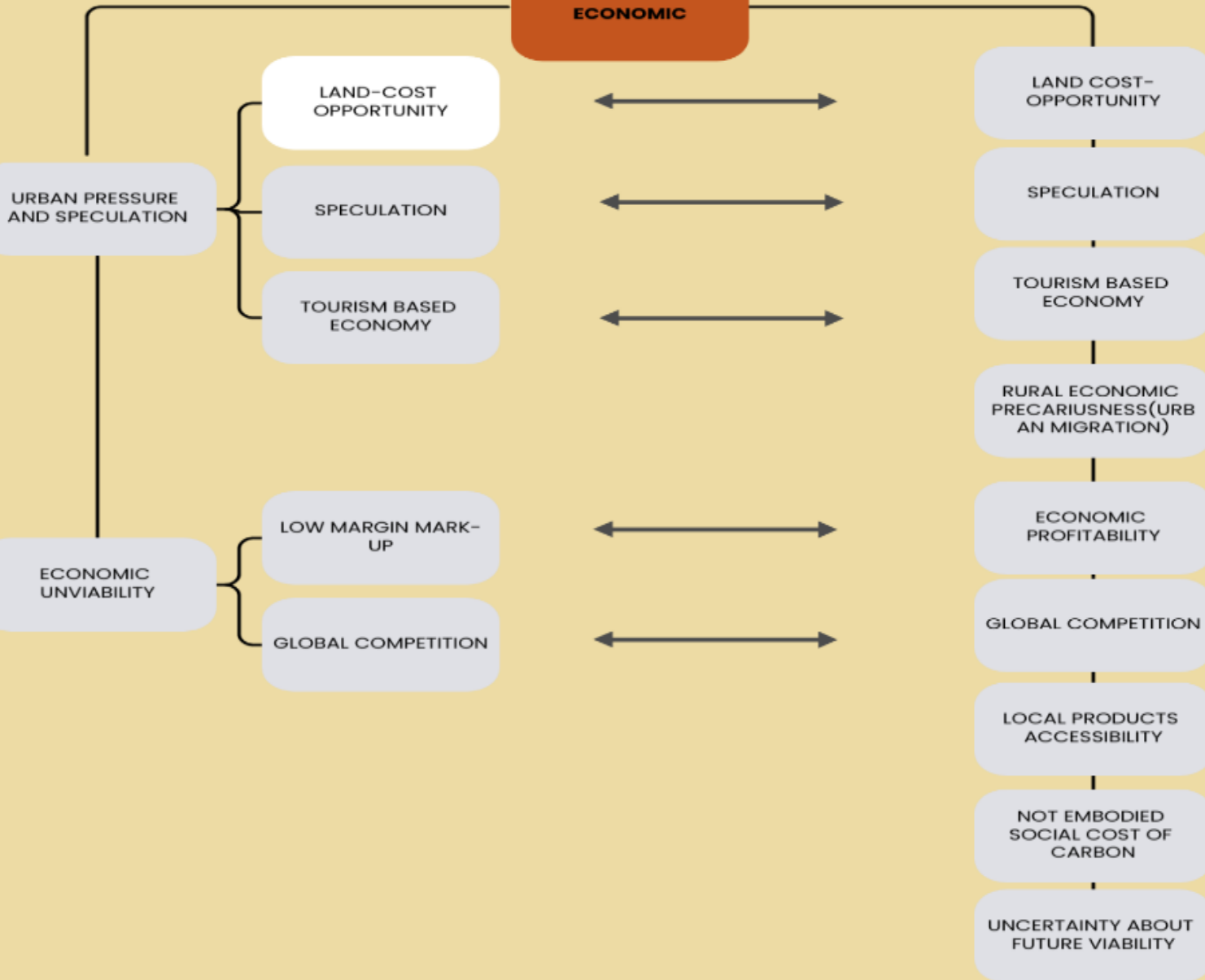


Individual interviews

Drivers/Obstacles

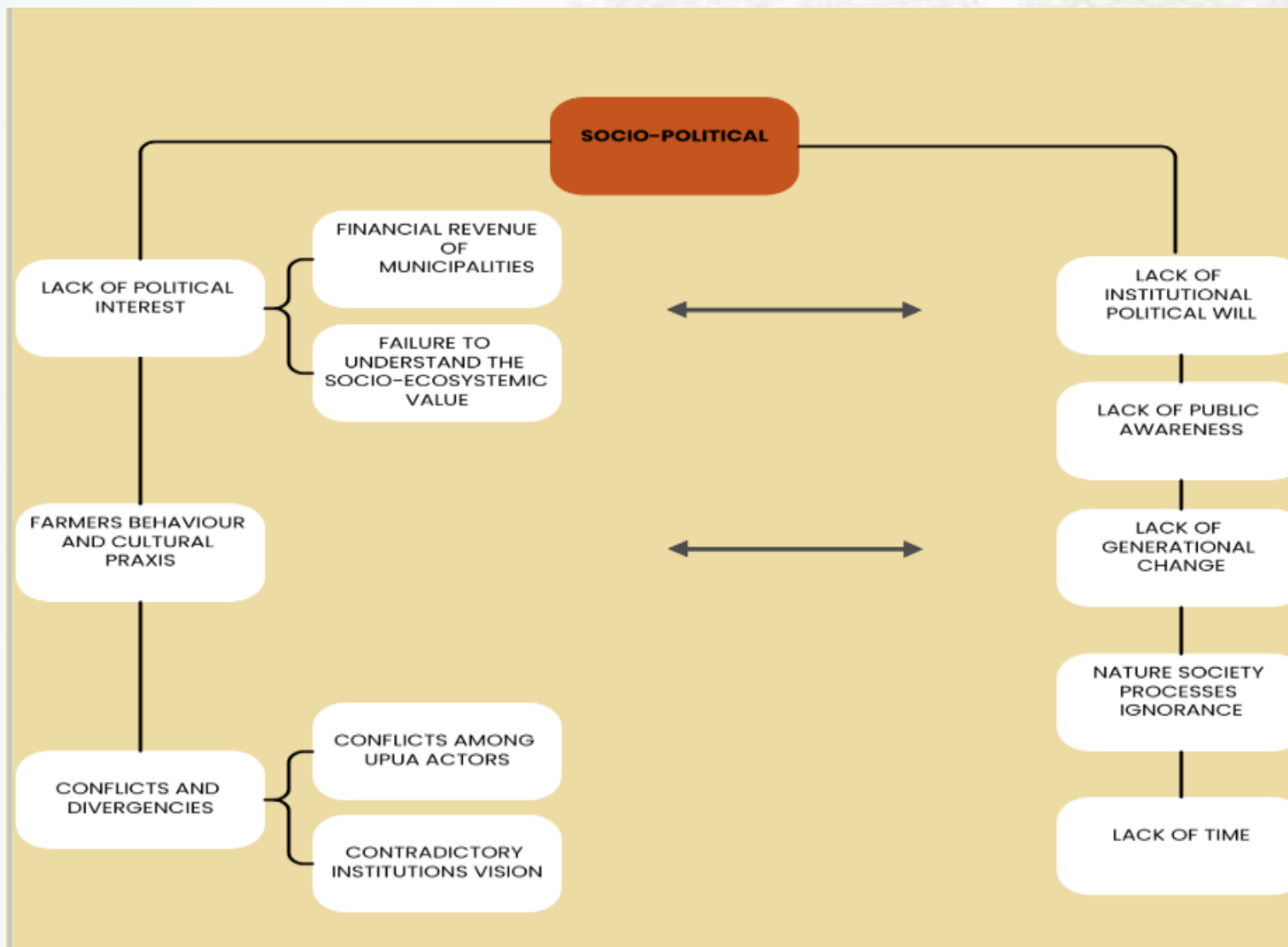
Focus groups

ECONOMIC



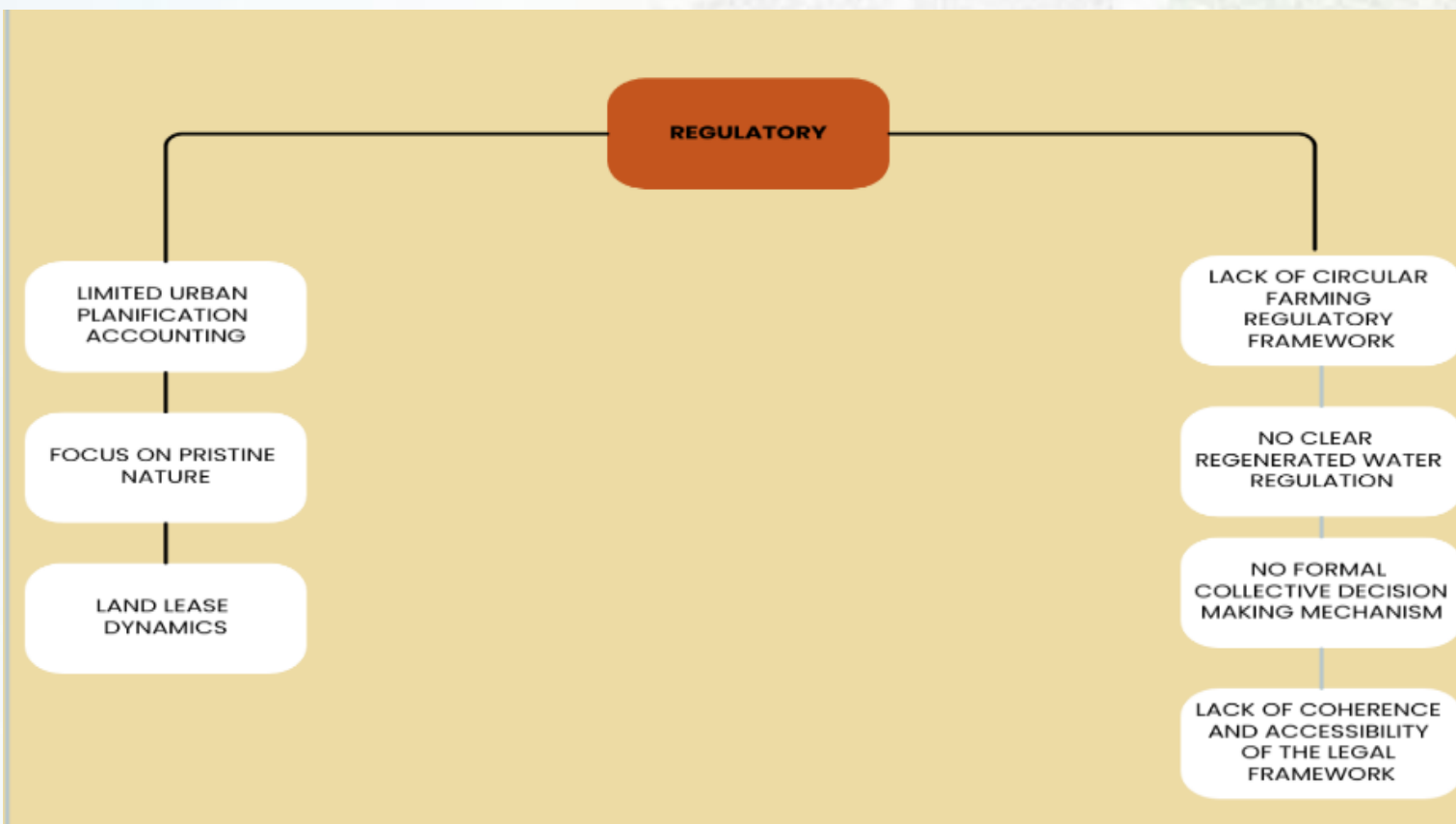
Economic drivers and obstacles

- Low economic profitability (esp. fruit trees)
- Urban pressure and speculation
- Economic uncertainties hinder investments



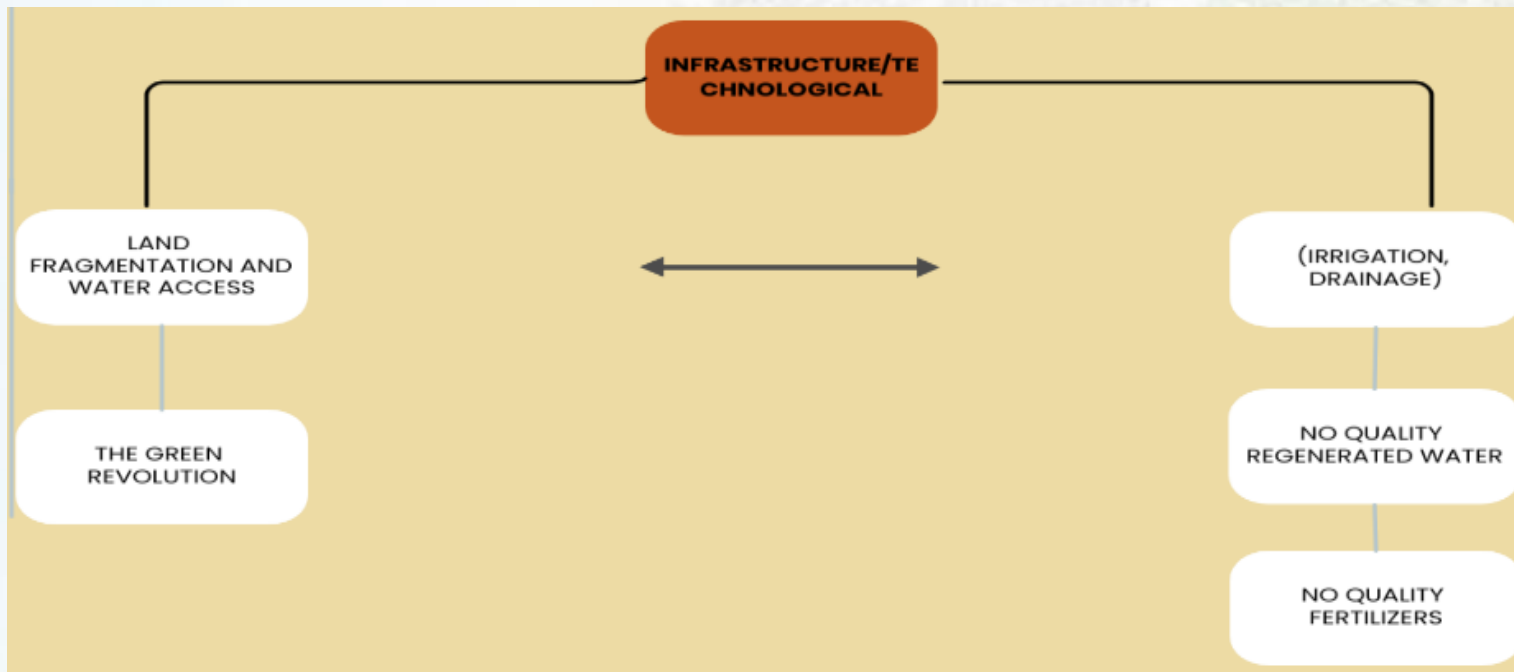
Socio-political drivers and obstacles

- Lack of political interest / awareness
- Loss of feeling / linkage (intergenerational change)
- Conflict between actors in urban agriculture



Regulatory drivers and obstacles

- Focus on the protection of pristine nature (forestry law vs. agricultural framework)
- Limited accounting of urban agriculture by urban planning (circular farming, regenerated water)



Infrastructure/technological drivers and obstacles

- Continuous technification ("Green Revolution")
- Fragmentation of agricultural land
- Lack of access to water (in upland areas)

Concluding remark:

The principal drivers of decline and obstacles to urban agriculture are still in place. Without tackling these, new initiatives will unlikely to unfold their potential.



Thank you for your attention!

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**The future of urban agriculture from a
social and metabolic perspective**

**The Edible Cities Network Conference
2023**

Gara Villalba
17 de març de 2023



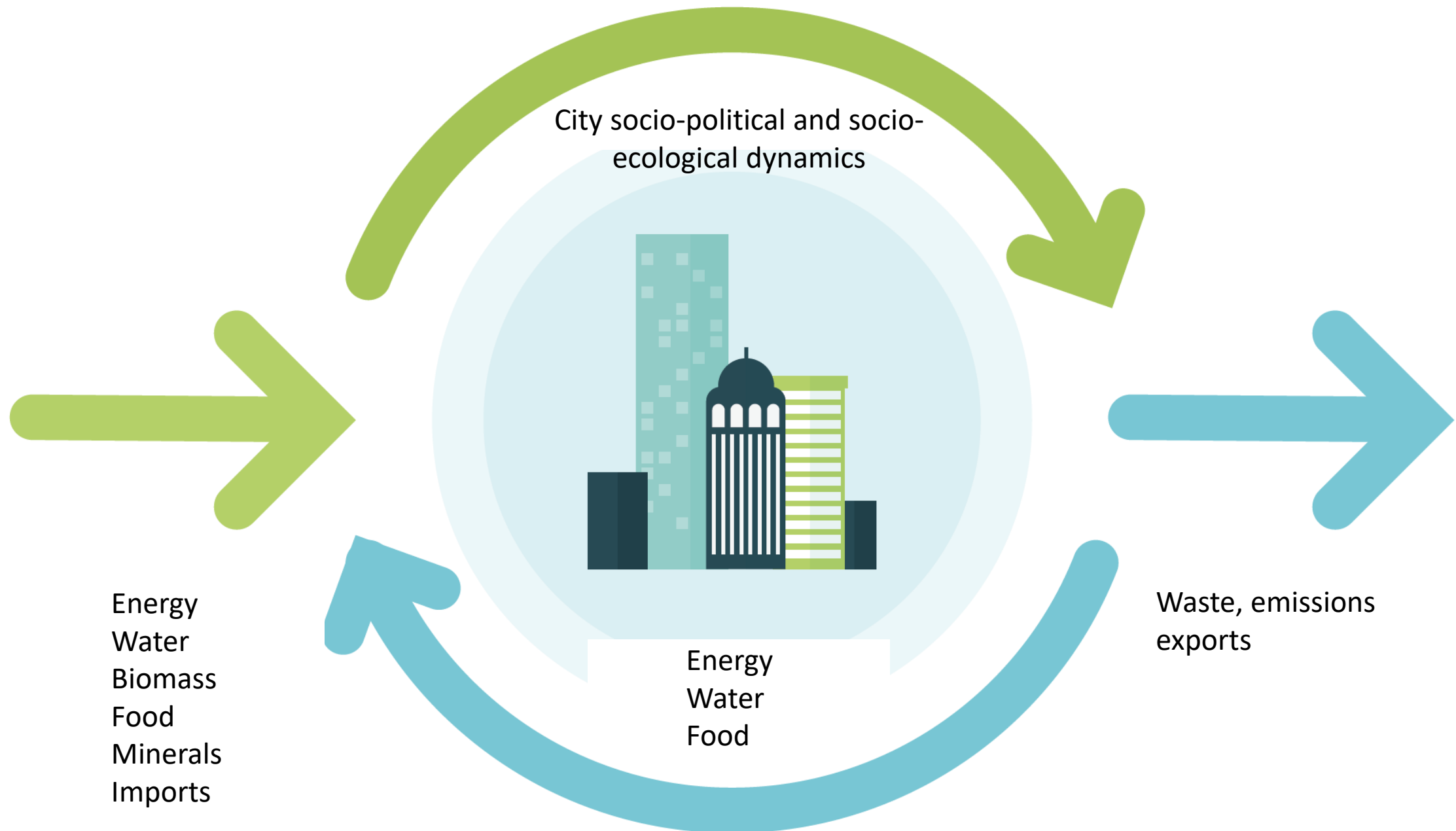
Integrated System
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Gara.Villalba@uab.cat
<https://urbag.eu/>

Urban Metabolism:

sum of the technical and socio-economic processes that occur within the cities, resulting in growth, production of energy, and elimination of waste





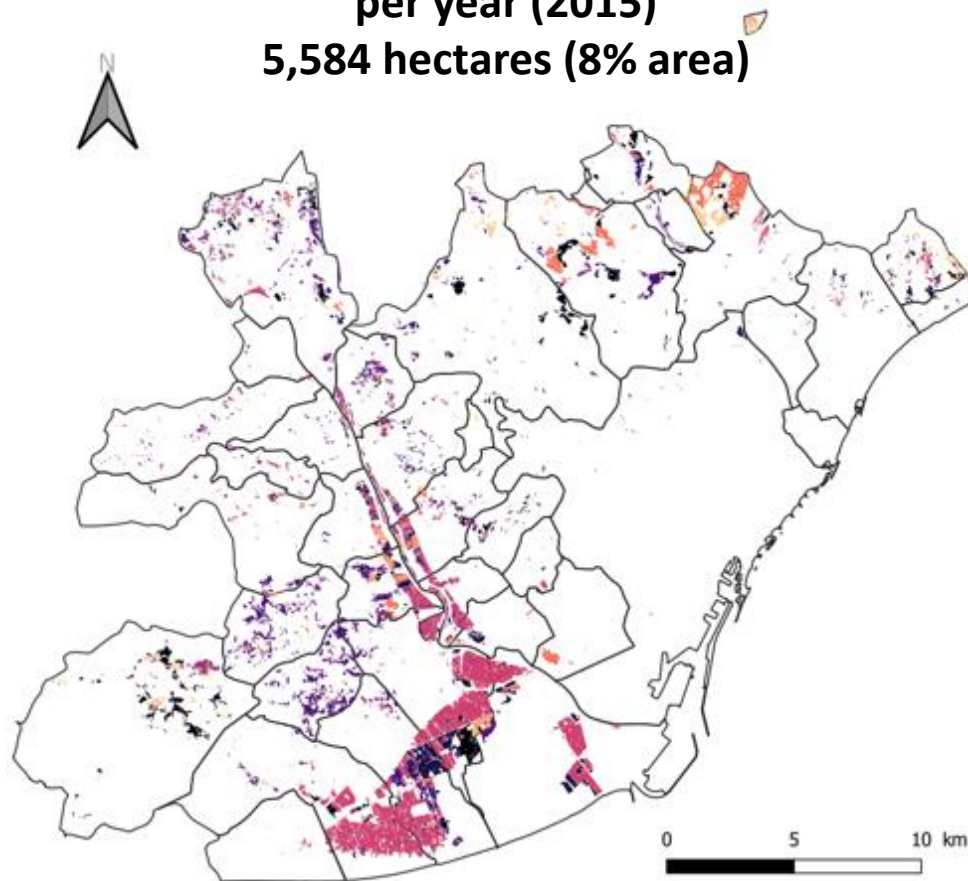
Nutrients:

What are the impacts associated to urban agriculture in terms of fertilizer use? How can circularity of nutrients in urban areas reduce impacts, both direct and indirect?



Peri-urban agriculture in the AMB

**68,716 tonnes of fruit and vegetables
per year (2015)**
5,584 hectares (8% area)



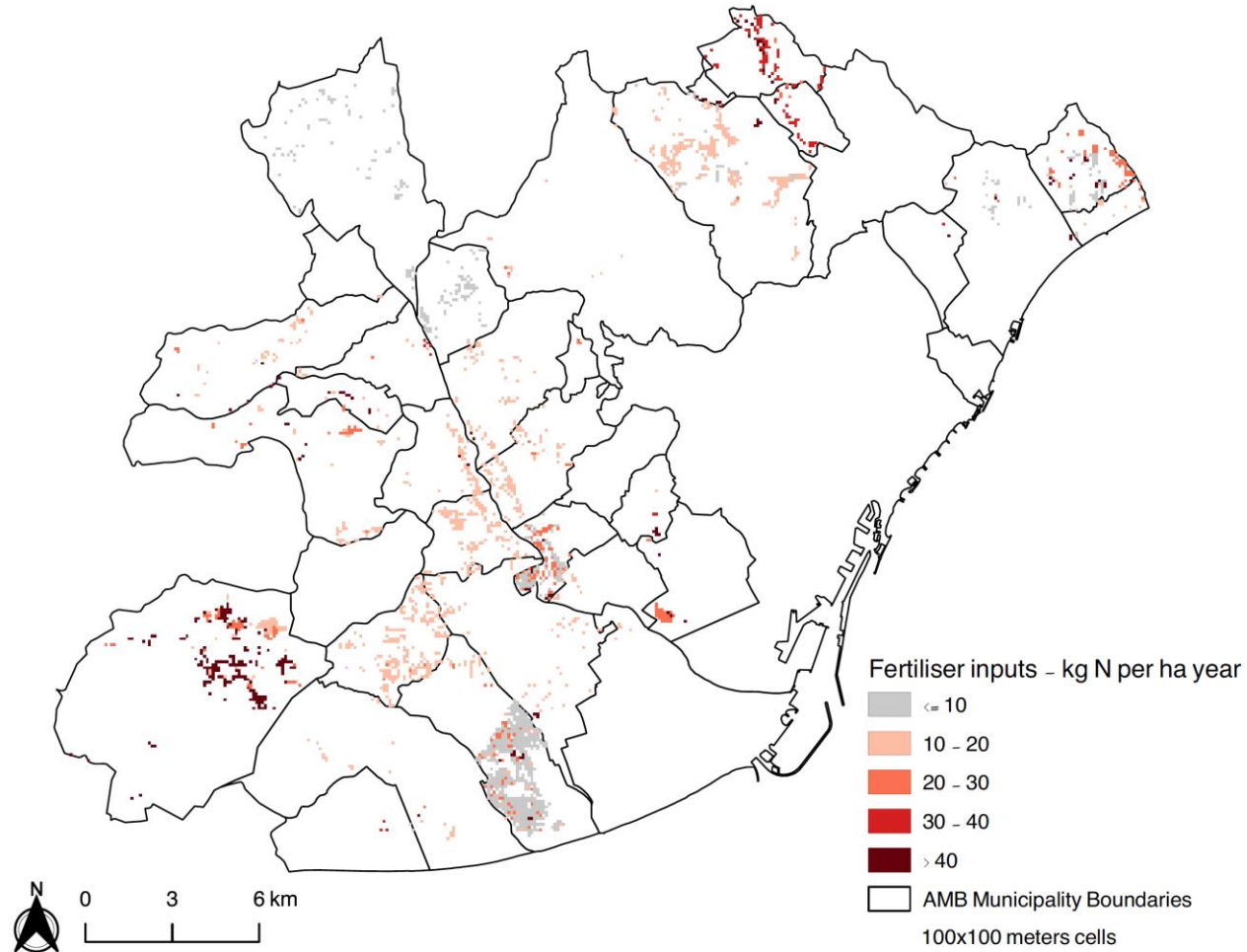
Categories mapa URBAG

Albercoquers	Garroferers abandonats - prats en zones agrícoles
Alfals	Garroferers en bancals
Altres conreus herbacis	Guaret no sie/sup. lliure sembra
Altres conreus herbacis abandonats - prats en zones agrícoles	Guaret sie/sup. lliure sembra
Altres conreus herbacis abandonats regadiu no regat - prats en zones agrícoles	Hivernades
Altres conreus herbacis abandonats regadiu no regat - prats en zones agrícoles en bancals	Horta
Altres conreus herbacis en bancals	Horta familiar
Altres conreus herbacis en bancals en regadiu	Mandariner
Altres conreus herbacis en regadiu	Nectarins
Altres fruiters	Nesprers
Ametllers	Oliverars
Blat dur	Oliverars abandonats - prats en zones agrícoles
Blat tou	Oliverars en bancals
Caqui	Oliverars en regadiu
Carabassa	Oliveres
Carxofa	Ordi
Cireres	Pereres
Civada	Pesols
Codony	Pomeres
Cogombre	Presseguers
Colza	Presseguers/Nectarins
Conreus d'horta sota plàstic	Pruneres
Conreus en transformació	Ray-grass
Faves i favons	Rompudes agrícoles
Figuera	Sorgo
Fruiters no cítrics	Taronger
Fruiters no cítrics abandonats - prats en zones agrícoles	Tomaquet
Fruiters no cítrics abandonats - prats en zones agrícoles en bancals	Trepadella
Fruiters no cítrics abandonats regadiu no regat - prats en zones agrícoles	Triticale
Fruiters no cítrics en bancals	Veca i civada
Fruiters no cítrics en bancals en regadiu	Vinyes
Fruiters no cítrics en regadiu	Vinyes
Fruiters varis	Vinyes abandonades - prats en zones agrícoles
Garroferers	Vinyes en bancals
	Vivers agrícoles
	Municipis AMB

Location of peri-urban agriculture in the Metropolitan Area of Barcelona (AMB) and different land uses according to the URBAG map. Taken from: Mendoza Beltran et al., (2022)

Nutrients: peri-urban agriculture

**Use of fertilizers 963 tonnes of N and
152 tonnes of P per year (2015)**



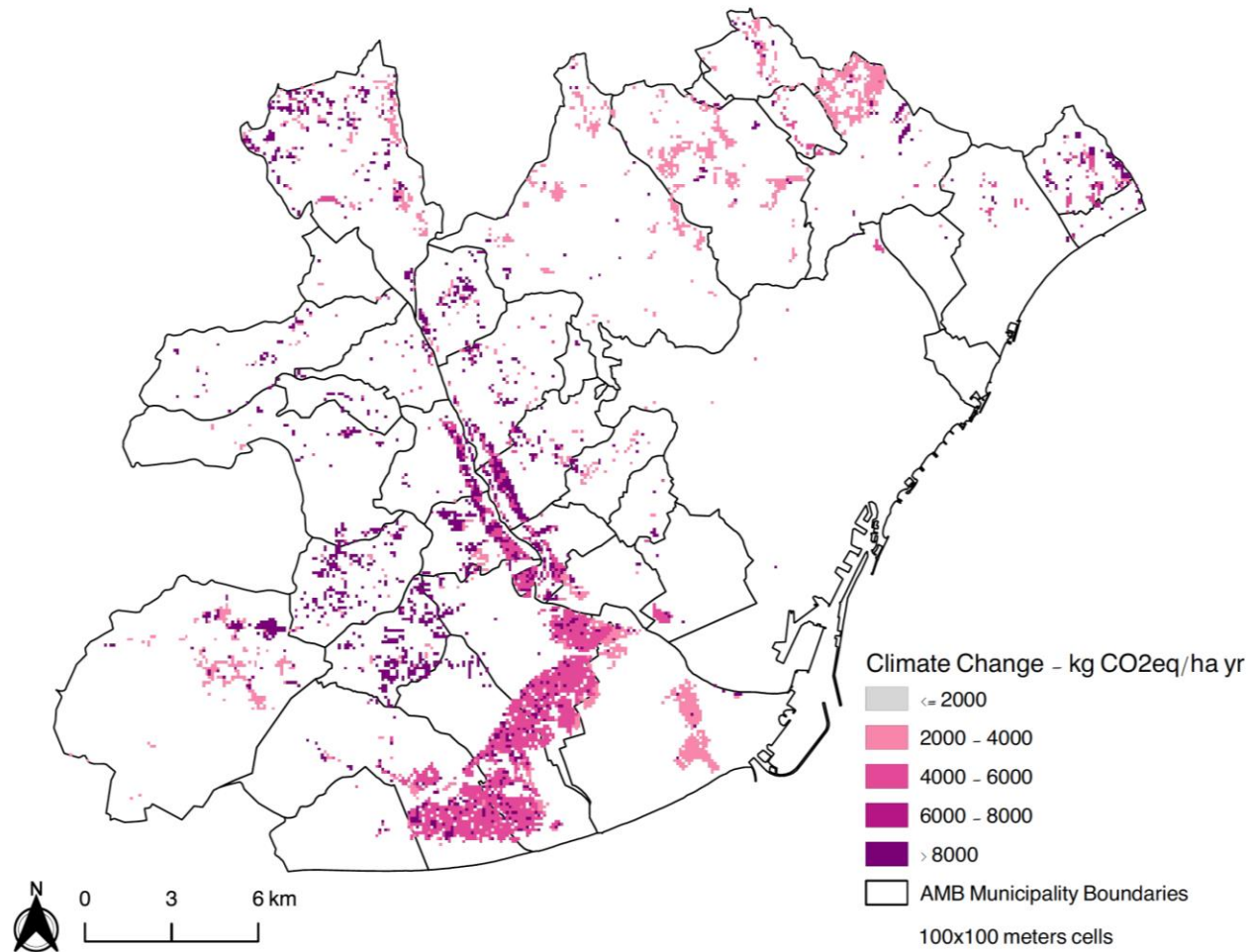
-mostly from mineral fertilizer

-less than 7% of fertilizer supply
comes from compost

-there is no recovery of nutrients
from other sources

Nutrients: peri-urban agriculture

Climate change impact: 12,120 tonnes of CO₂e per year (2015)



-65% from production of mineral fertilizer

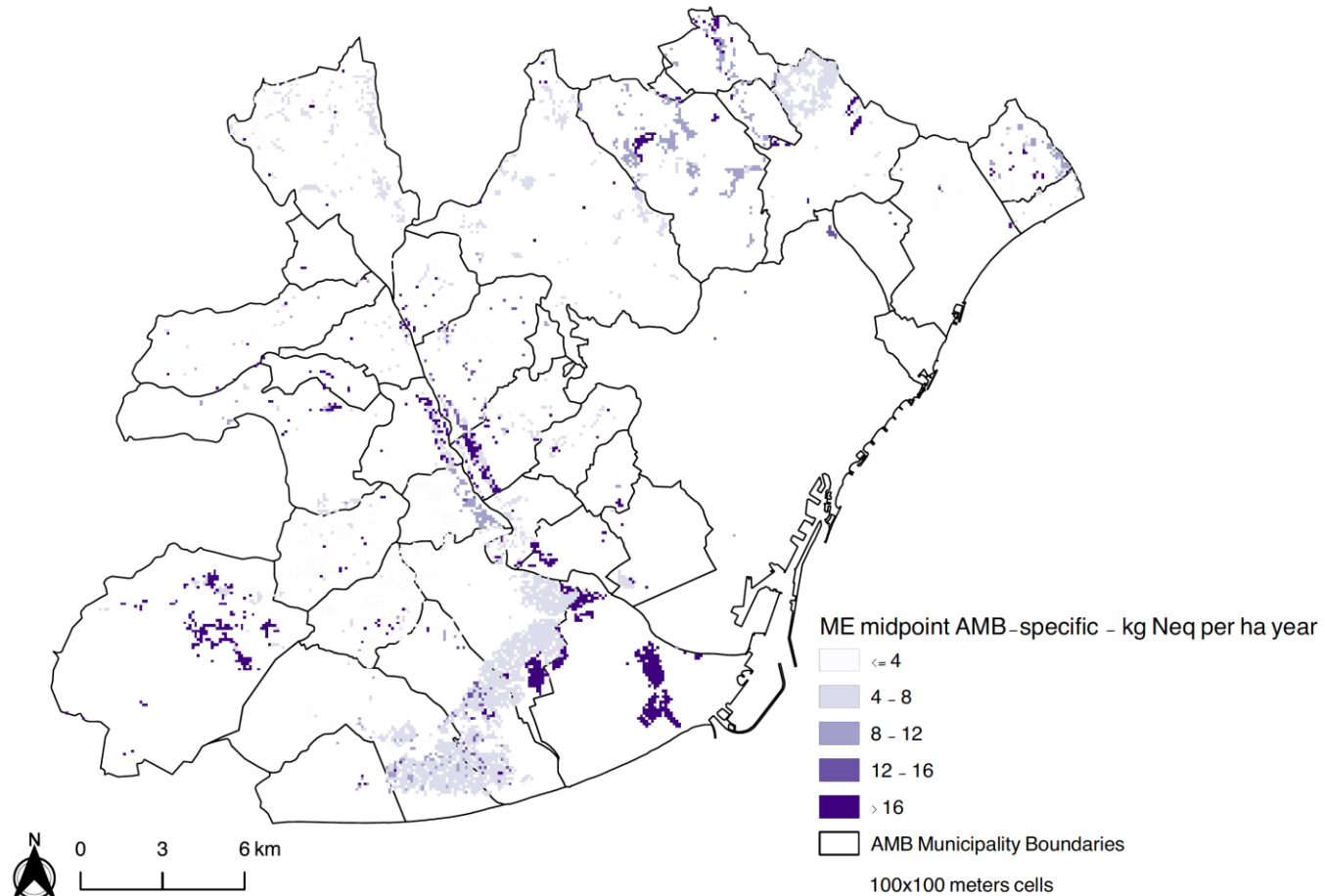
-35% direct emissions due to fertilizer application on the soil

-compost could reduce agriculture carbon footprint by 65% if all organic waste is composted (substituting mineral fertilizer)

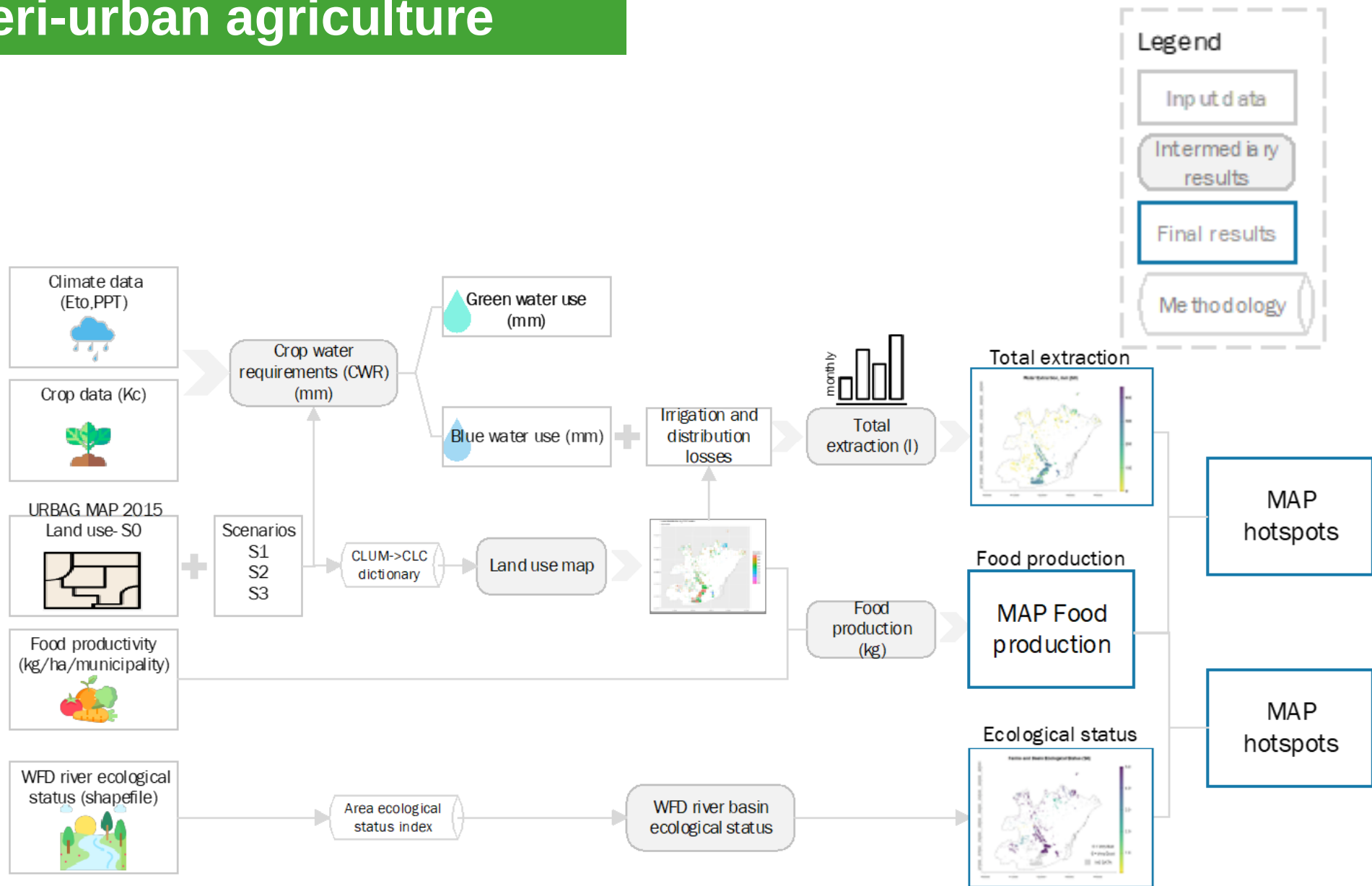
-Estruvite from WWTPs: we have 5 times the P necessary for the agriculture of the AMB. Could reduce by half the CO₂e/kg P attributed to production of P.

Nutrients: peri-urban agriculture

Eutrophication
Agriculture emits 48.9 tonnes of N equivalents
to the sea yearly (2015)



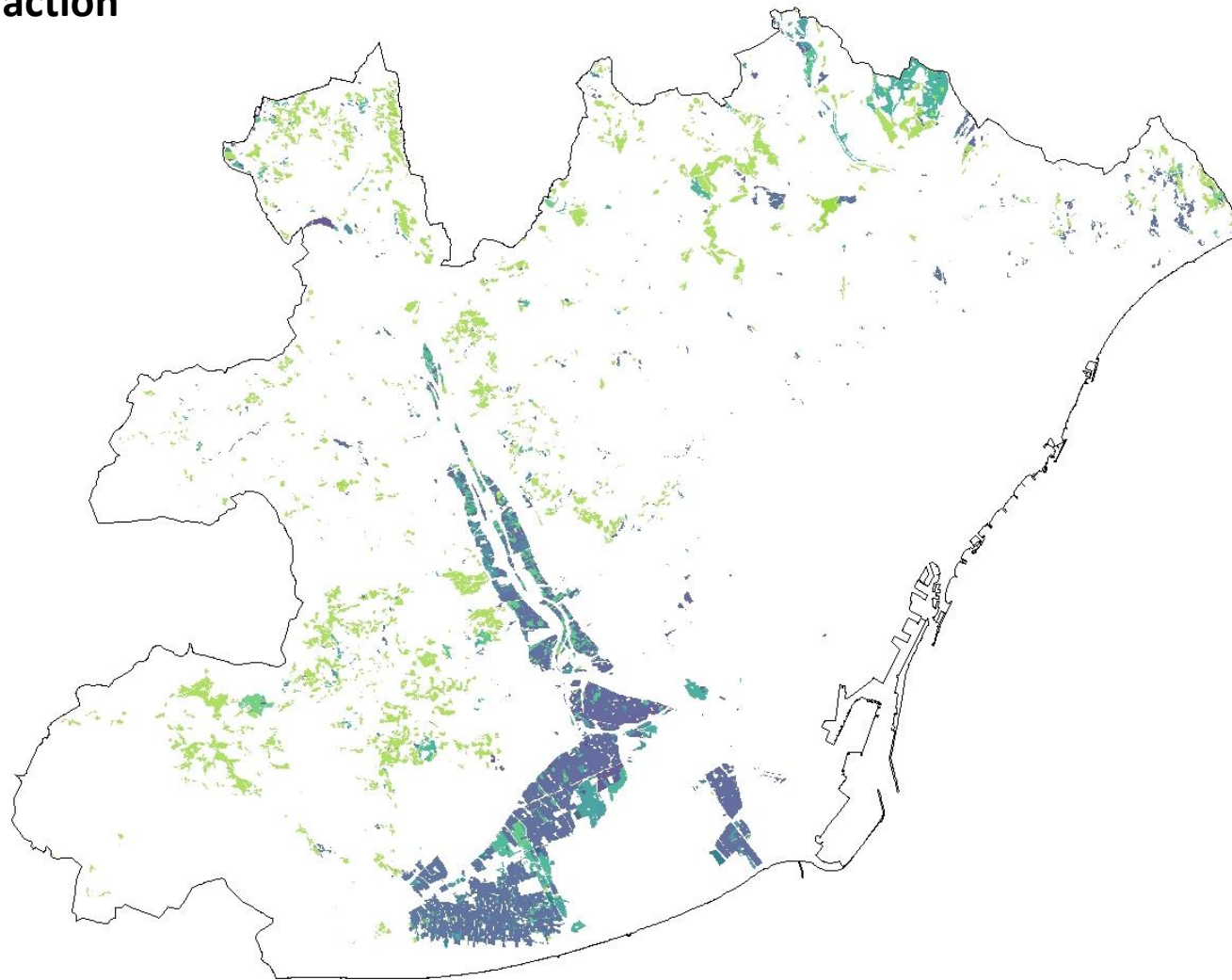
Water: peri-urban agriculture



Water: peri-urban agriculture

15 hm³ irrigation

25.7 hm³ extraction



mm

700

600

500

400

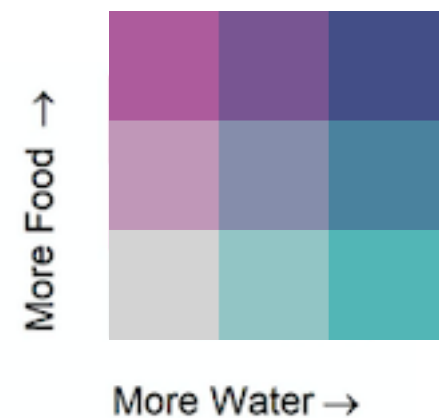
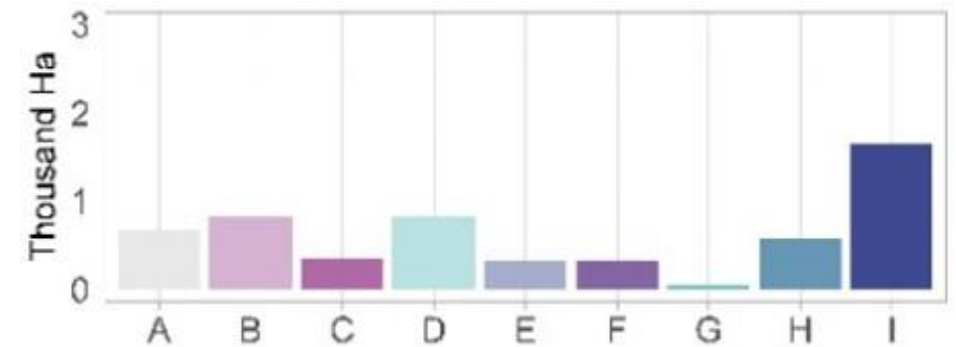
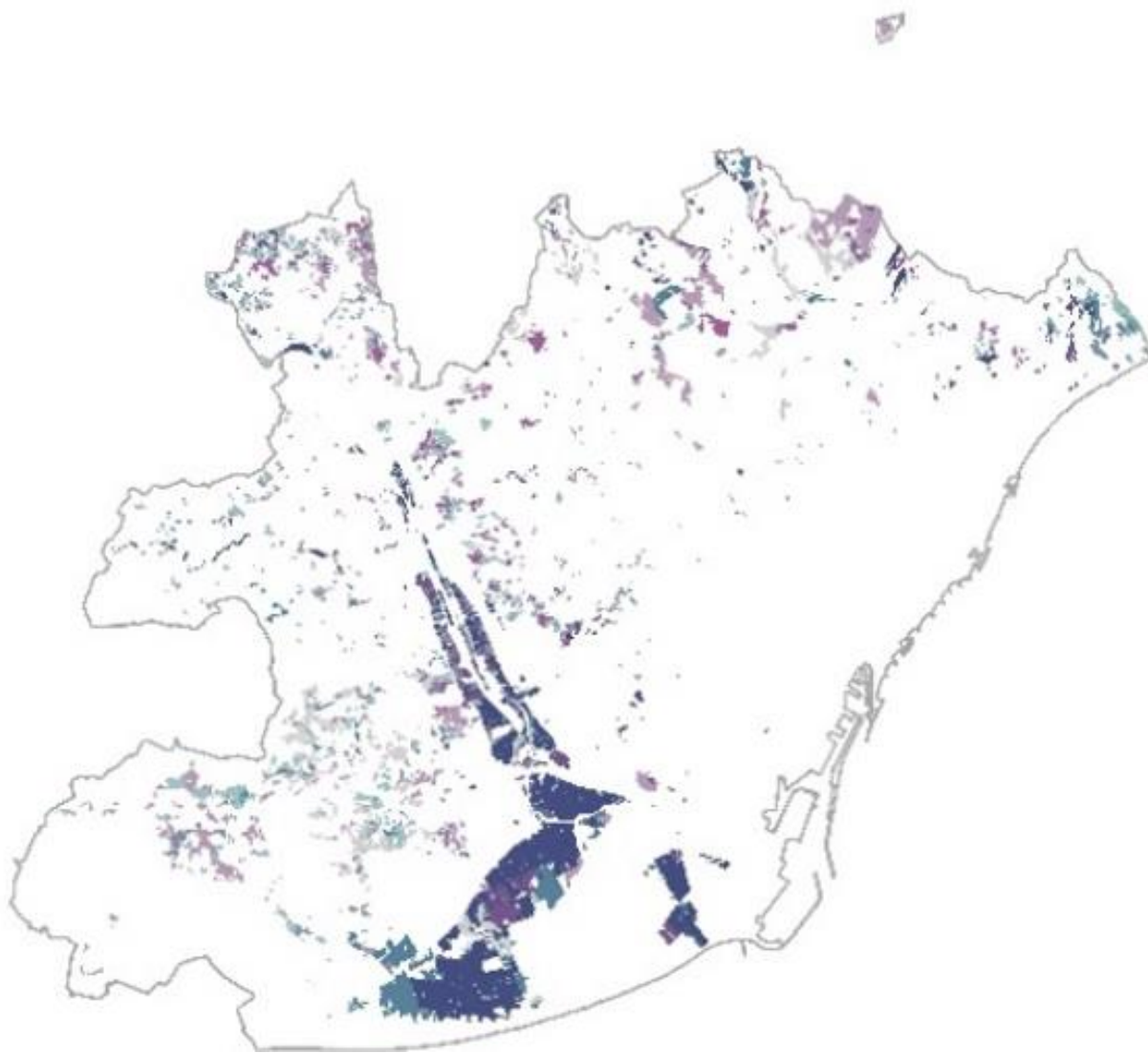
300

200

100

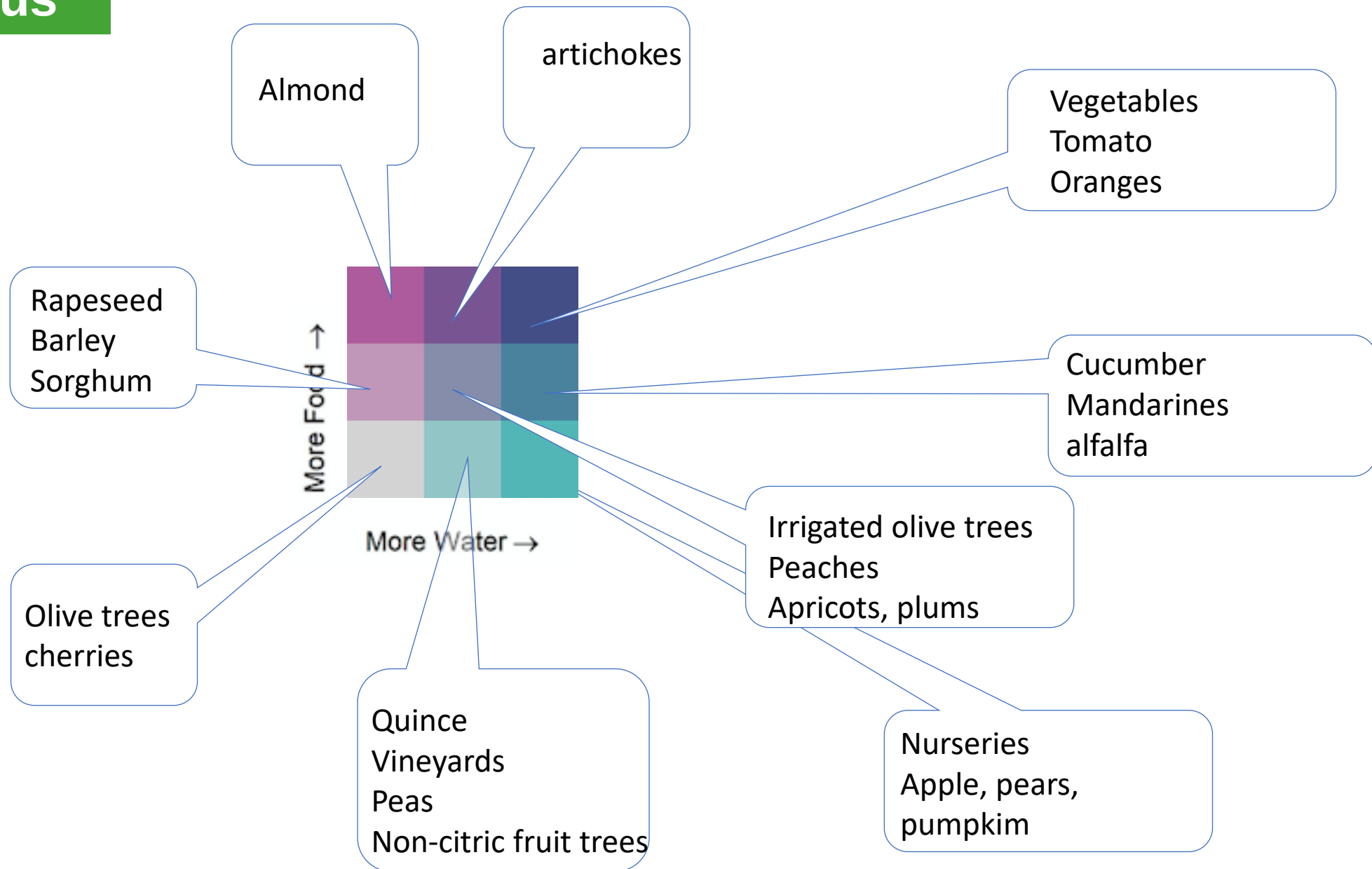
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Water-Food nexus



Manuscript: “A georeferenced sustainability water metabolism assessment for managing trade-offs at the nexus between water, peri-urban agriculture, and the environment ” in progress.

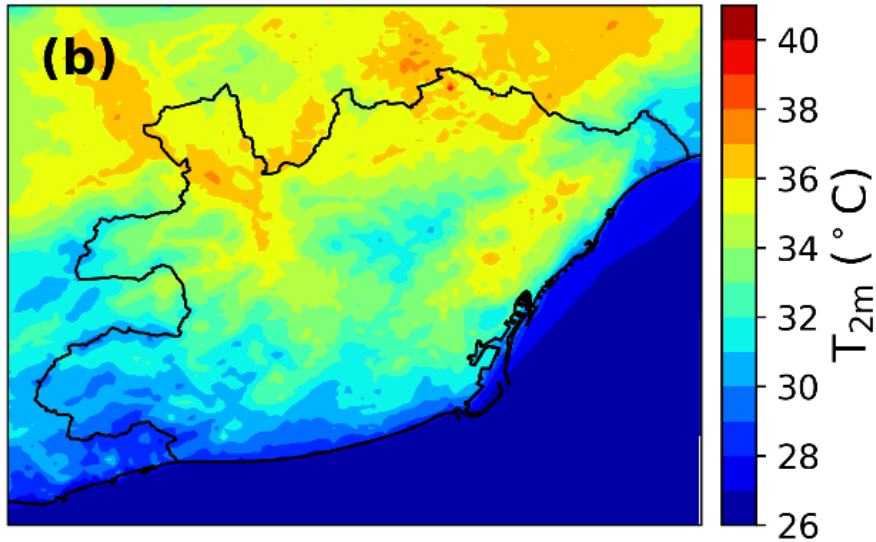
Water-Food nexus



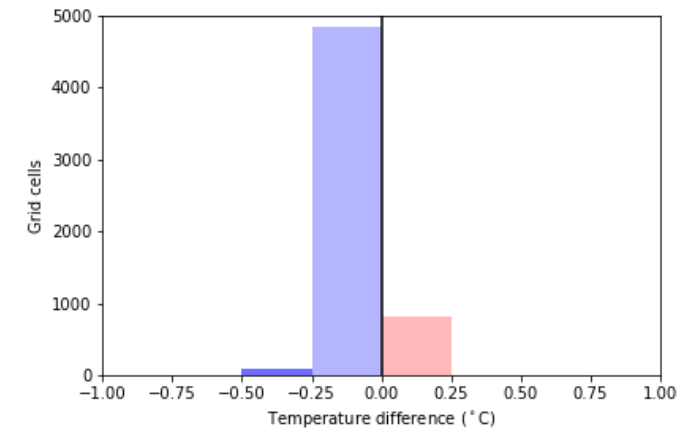
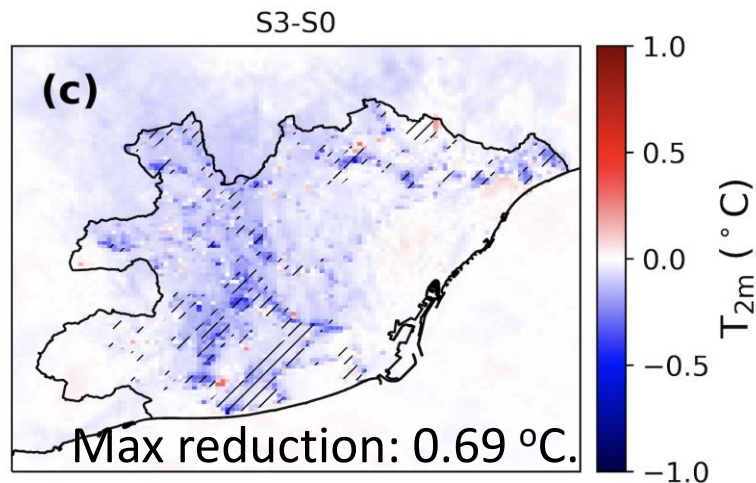
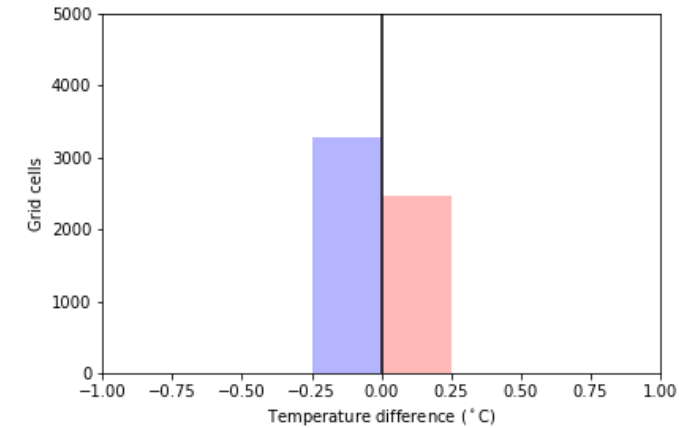
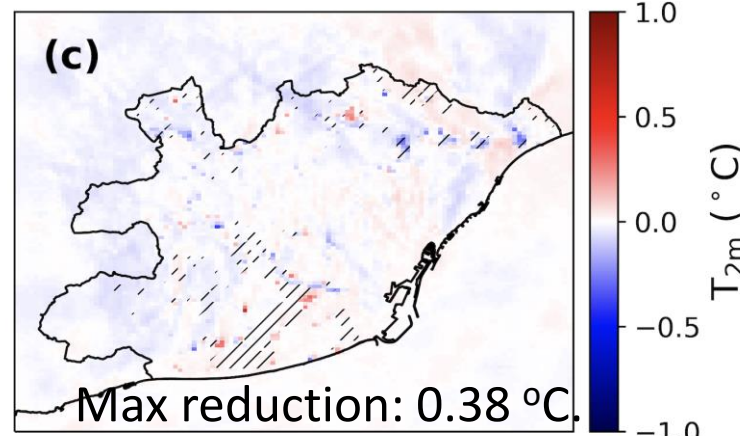
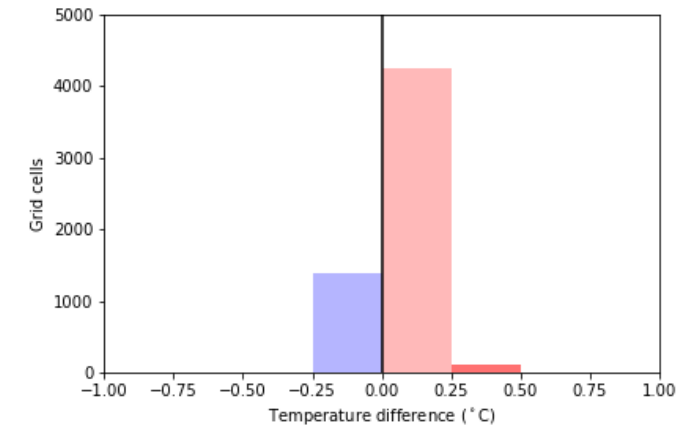
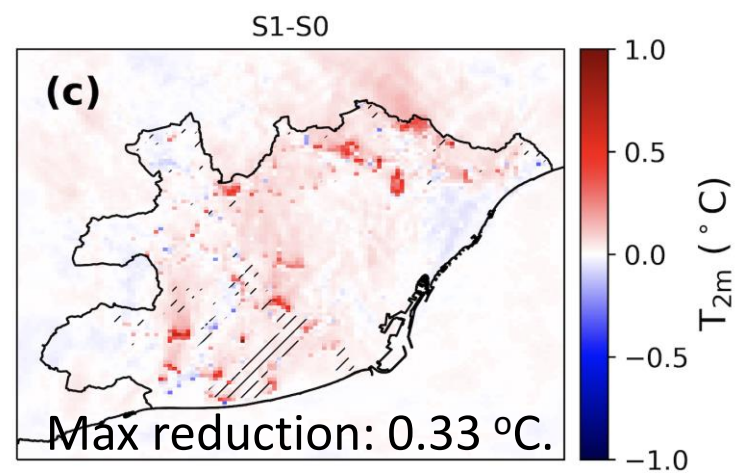
Manuscript: “A georeferenced sustainability water metabolism assessment for managing trade-offs at the nexus between water, peri-urban agriculture, and the environment ” in progress.

Energy-water-agriculture

25 juny - 25 july 2015
Mitjana horària
entre 13 - 16h



	Land-cover				
	Urban*	Forest**	Agriculture	Pastures	Other***
S0.	45%	42%	8%	3%	2%
S1.	52%	38%	6%	2%	2%
S2.	46%	38%	12%	2%	2%
S3.	45%	32%	20%	2%	2%





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Thank you for your attention!



Gara.Villalba@uab.cat
<https://urbag.eu/>



Potential of nutrient recovery from
organic municipal solid waste:
Application to peri-urban agriculture
of the AMB

The Edible Cities Network Conference
2023

Juan Arosemena
March 17th, 2023



Integrated System
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Juandavid.Arosemena@uab.cat
<https://urbag.eu/>

Context

Urban growth = Cities need to tackle:
Food demand & municipal solid waste
generation

Urban agriculture

Local resources → Urban crop production

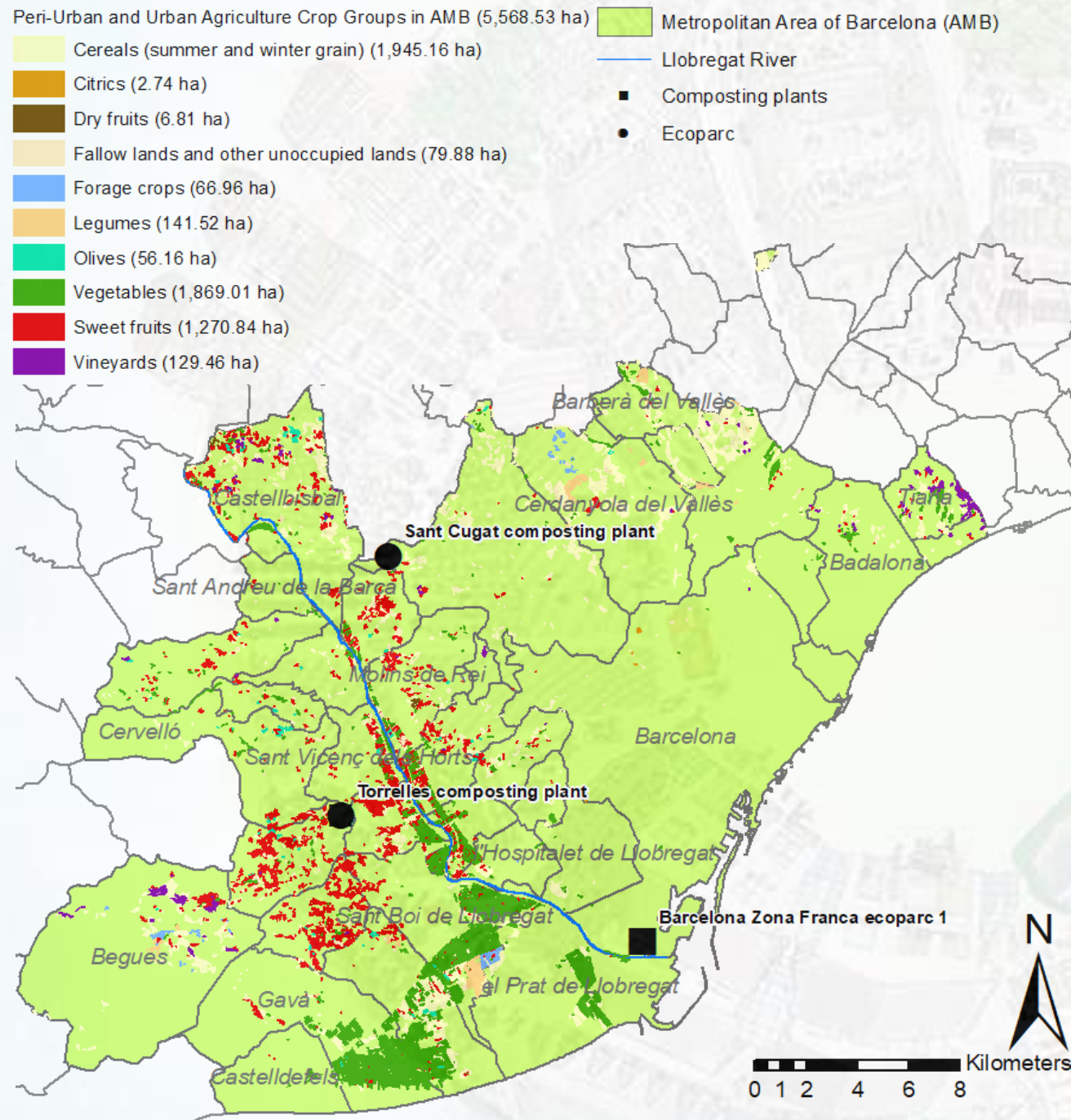
Organic solid waste → Compost fertilizer

Circular strategies → Nutrient recovery



Research aim

- **Potential of OMSW compost to supply nutrients (N, P and K) demanded by UA in AMB?**
- **Environmental benefits of replacing mineral fertilizer while minimizing OMSW in AMB?**



Materials & methods

NPK demand?

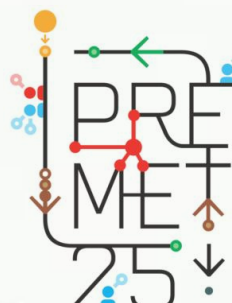
✓ Agricultural spatial data

Compost NPK supply?

✓ Centralized compost production reports

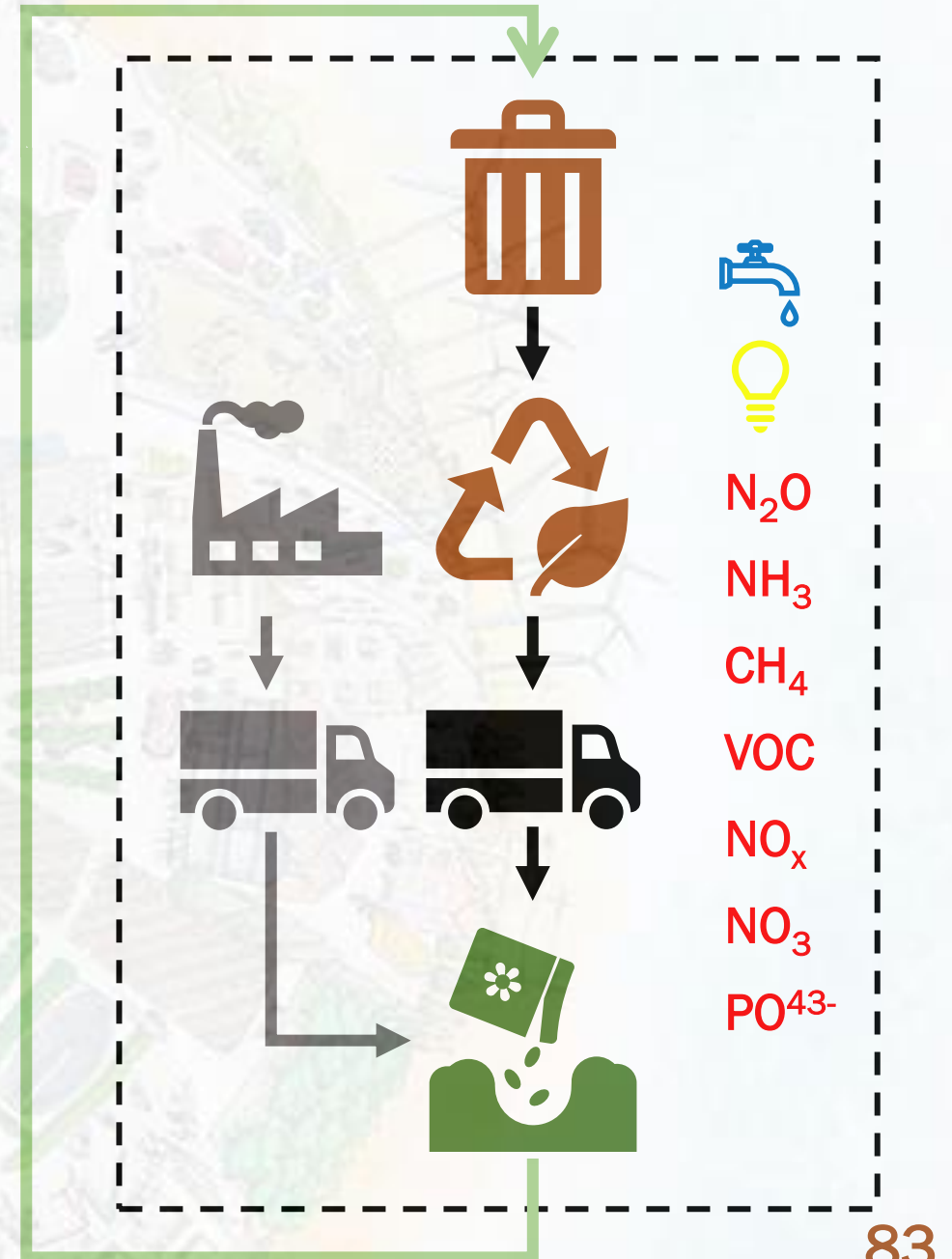
Materials & methods

Scenarios?

1. Mineral fertilizer only
2. + Compost supply (current)
3. + Compost supply ()

Impacts/benefits?

- ✓ Life Cycle Assessment (LCA)



Results – Compost NPK supply potential

The AMB needs a yearly total of **1,519 tonnes** of NPK for 68,800 tonnes of fresh produce . . .

N - 769 t
P - 158 t
K - 592 t



can potentially supply

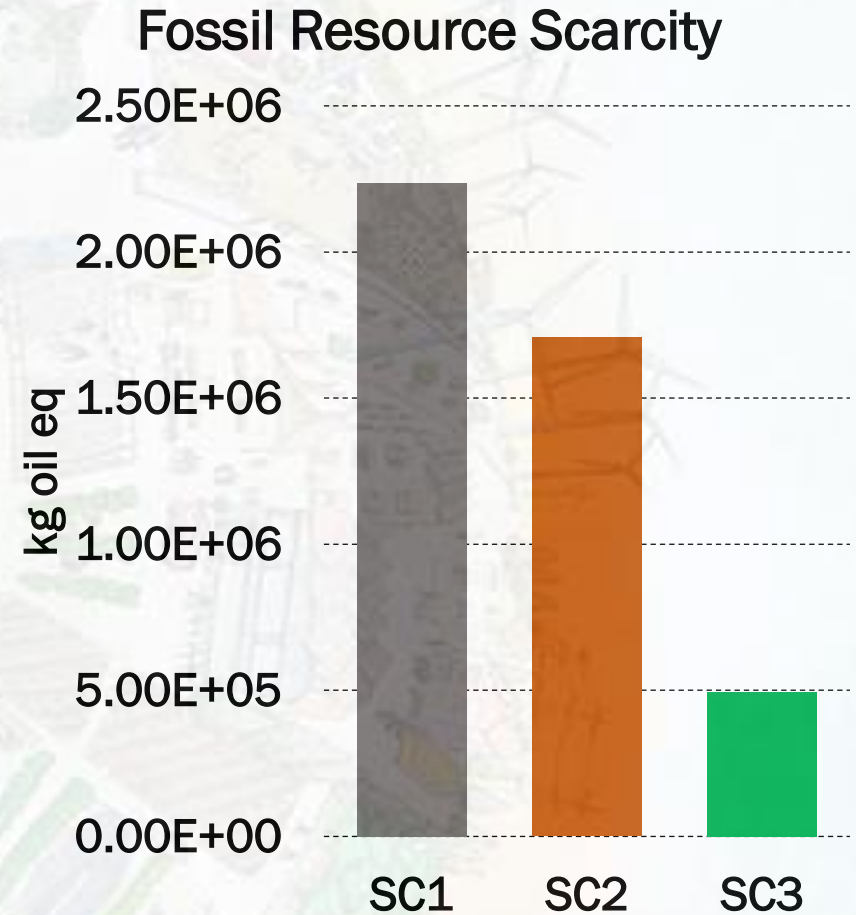
7% of the total NPK demand with current compost system

and **21%** if compost production is increased



Results – Environmental assessment of scenarios

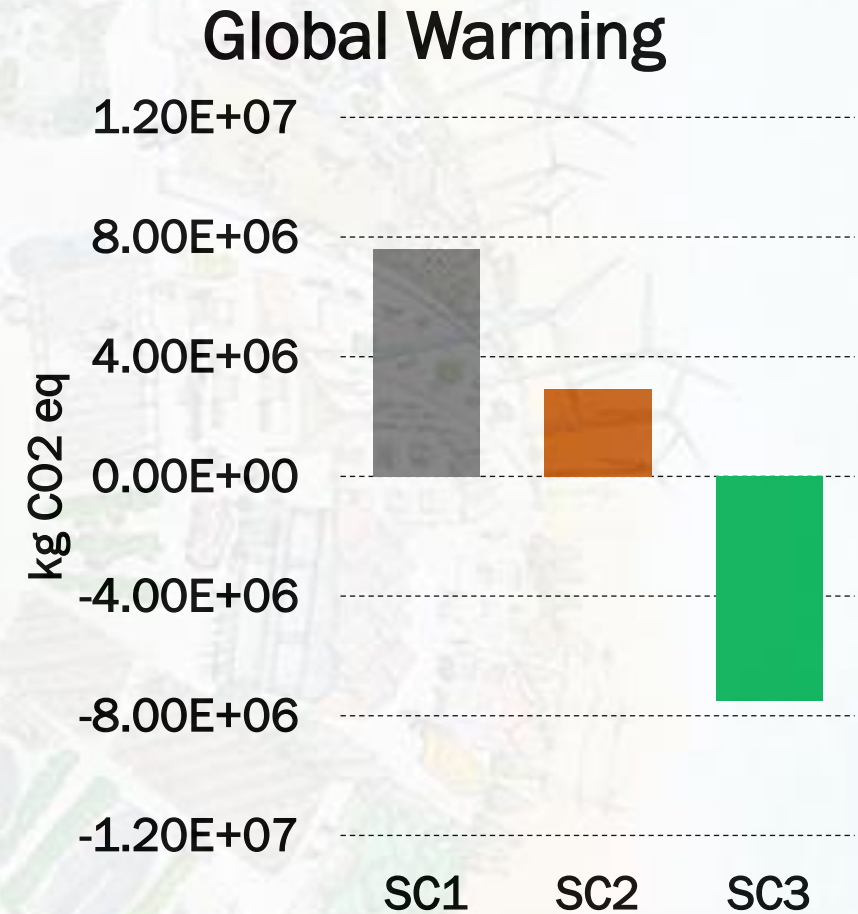
Compost scenarios
outperformed the mineral
fertilizer only scenario with
impact decreases of up to 78%
(Fossil Resource Scarcity) . . .



SC1 = Mineral fertilizer
SC2 = + Compost supply (current)
SC3 = + Compost supply (PREMET25)

Results – Environmental assessment of scenarios

... and **environmental savings**
equal to 9% of the total net
carbon footprint of the MSW
system in the AMB



SC1 = Mineral fertilizer

SC2 = + Compost supply (current)

SC3 = + Compost supply (PREMET25)

What's next?

- ✓ Policy making based on a **life cycle perspective**
- ✓ Exploit city's benefits as **nutrients circularity** and synergies between UA and OMSW

Limitations or opportunities?

- Compost end-use, regulations (use of organic fertilizers), **soil regeneration**



Integrated System
Analysis of
Urban Vegetation
and Agriculture

Thank you for your attention!



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<https://urbag.eu/>



Q&A



Peri-urban agriculture in the Metropolitan Area of Barcelona

*Understanding its impacts through a through a
vulnerability lens*

The Edible Cities Network Conference 2023

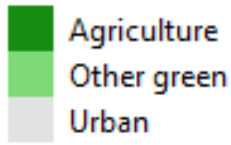
March 17th, 2023

David A. Camacho

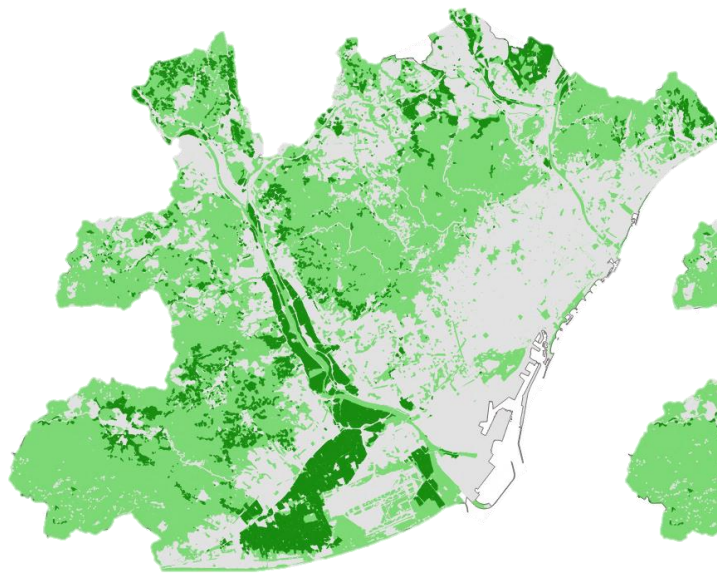
davidalejandro.camacho@uab.cat

davidalejandrocc@gmail.com

AMB scenario description

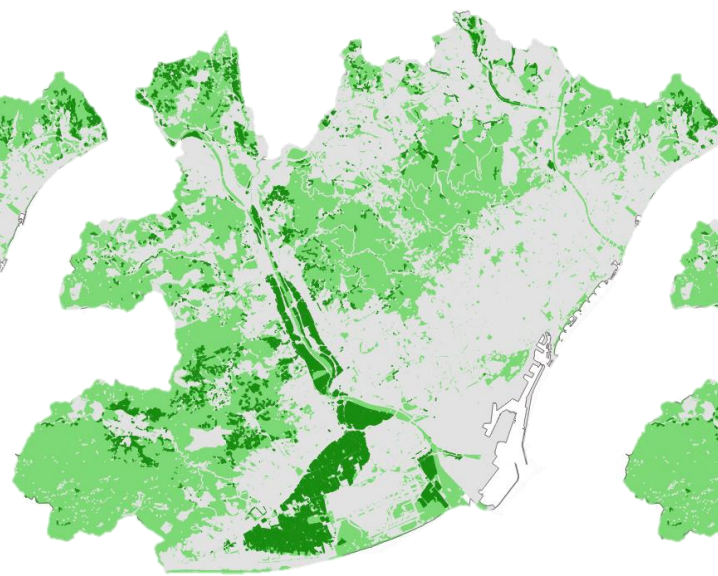


S0. Current



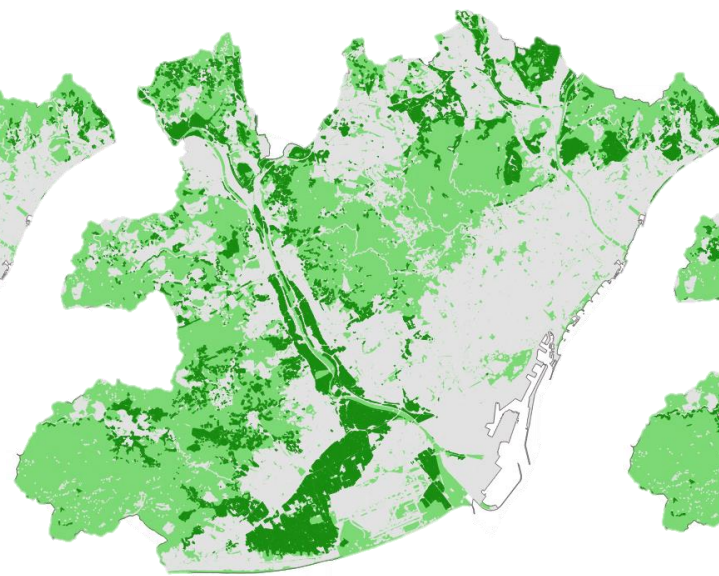
Agriculture	8%
Other green	45%
Urban	47%

S1. Trending



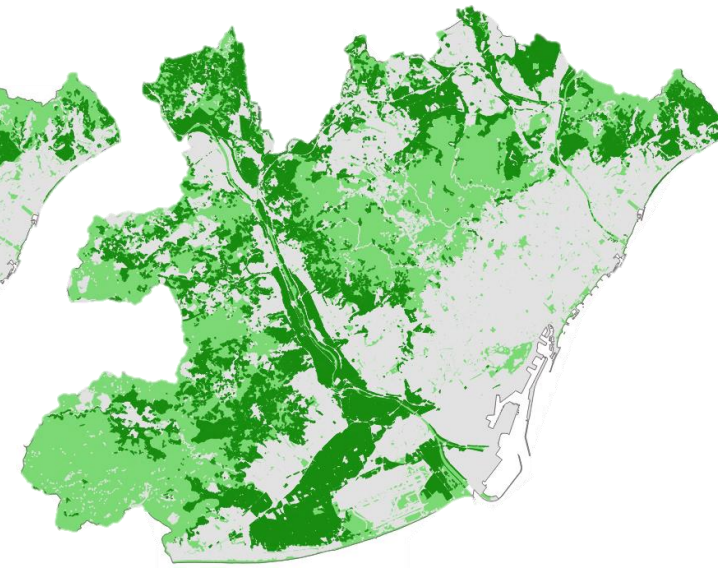
Agriculture	6%
Other green	40%
Urban	54%

S2. Alternative



Agriculture	12%
Other green	40%
Urban	48%

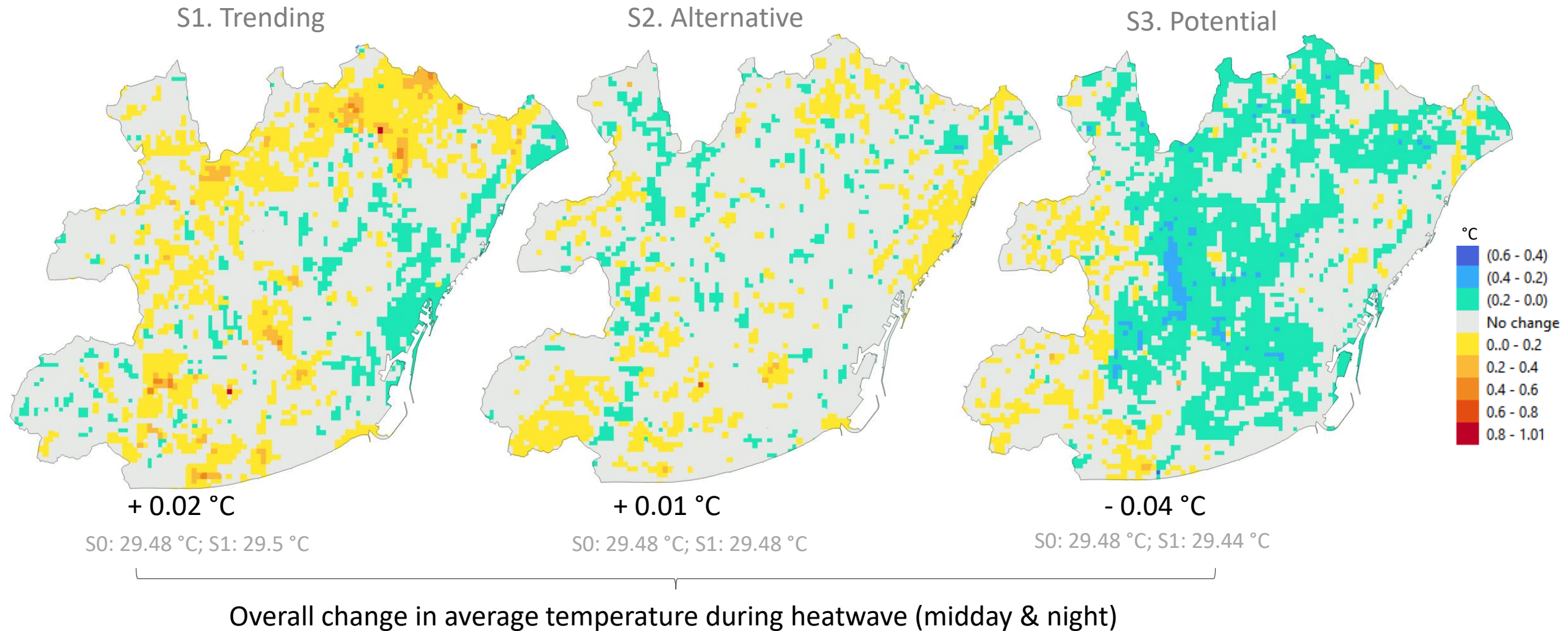
S3. Potential



Agriculture	20%
Other green	34%
Urban	46%

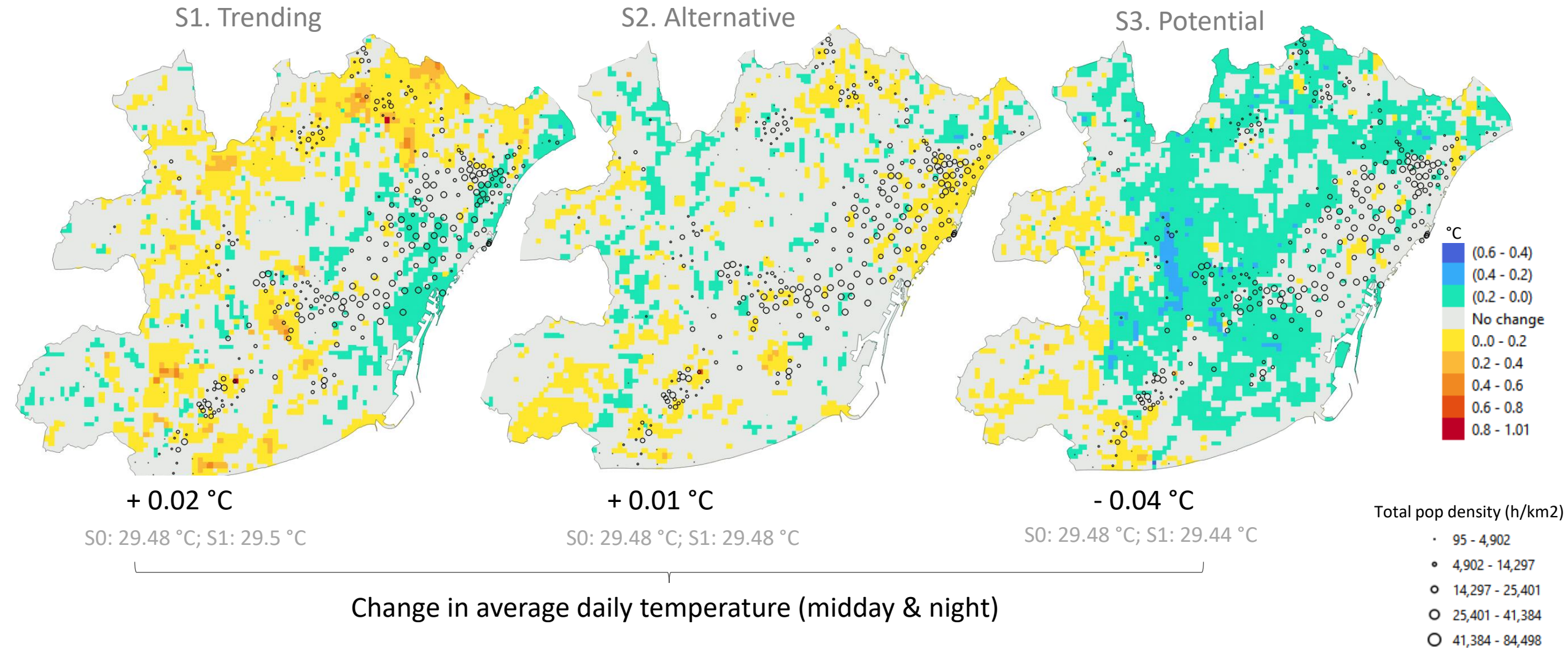
Heat conditions and exposure

Current state VS possible future scenarios



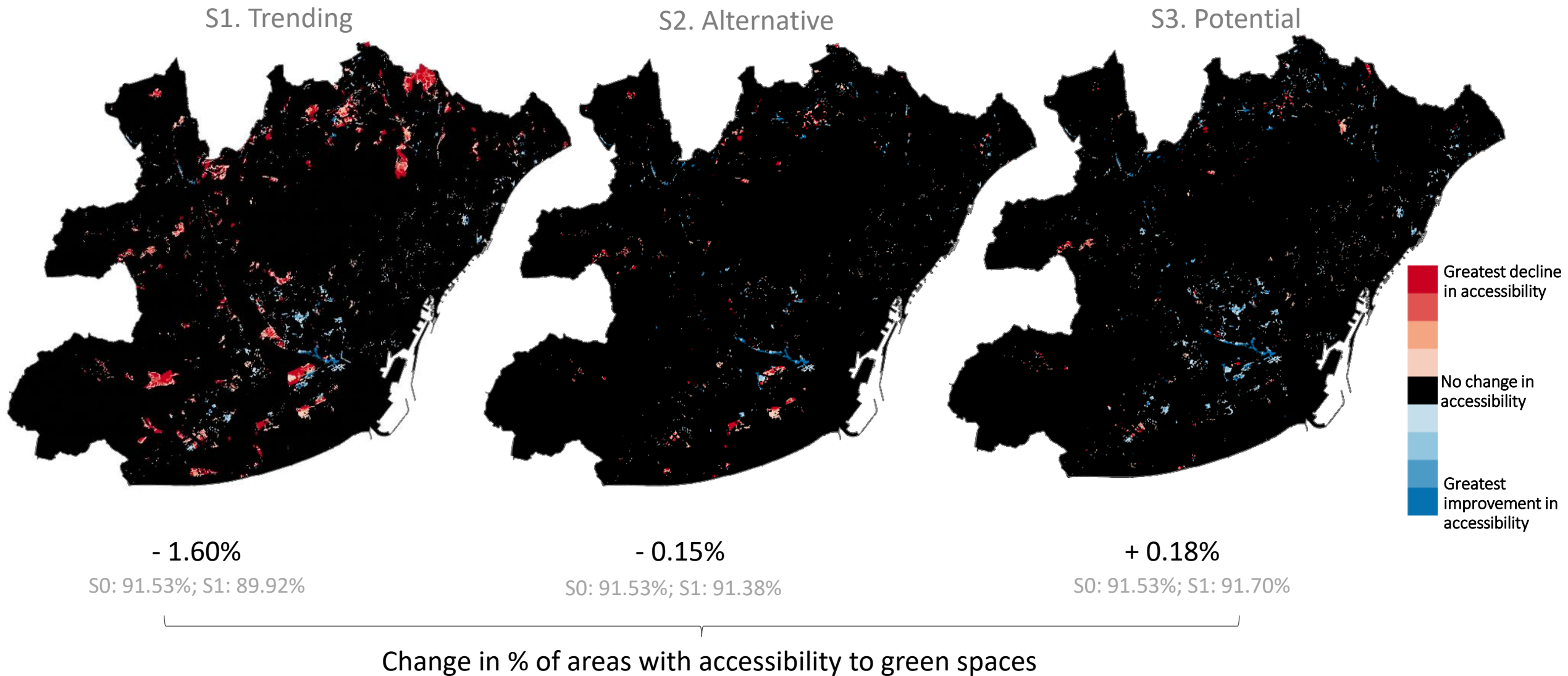
Heat conditions and exposure

Current state VS possible future scenarios



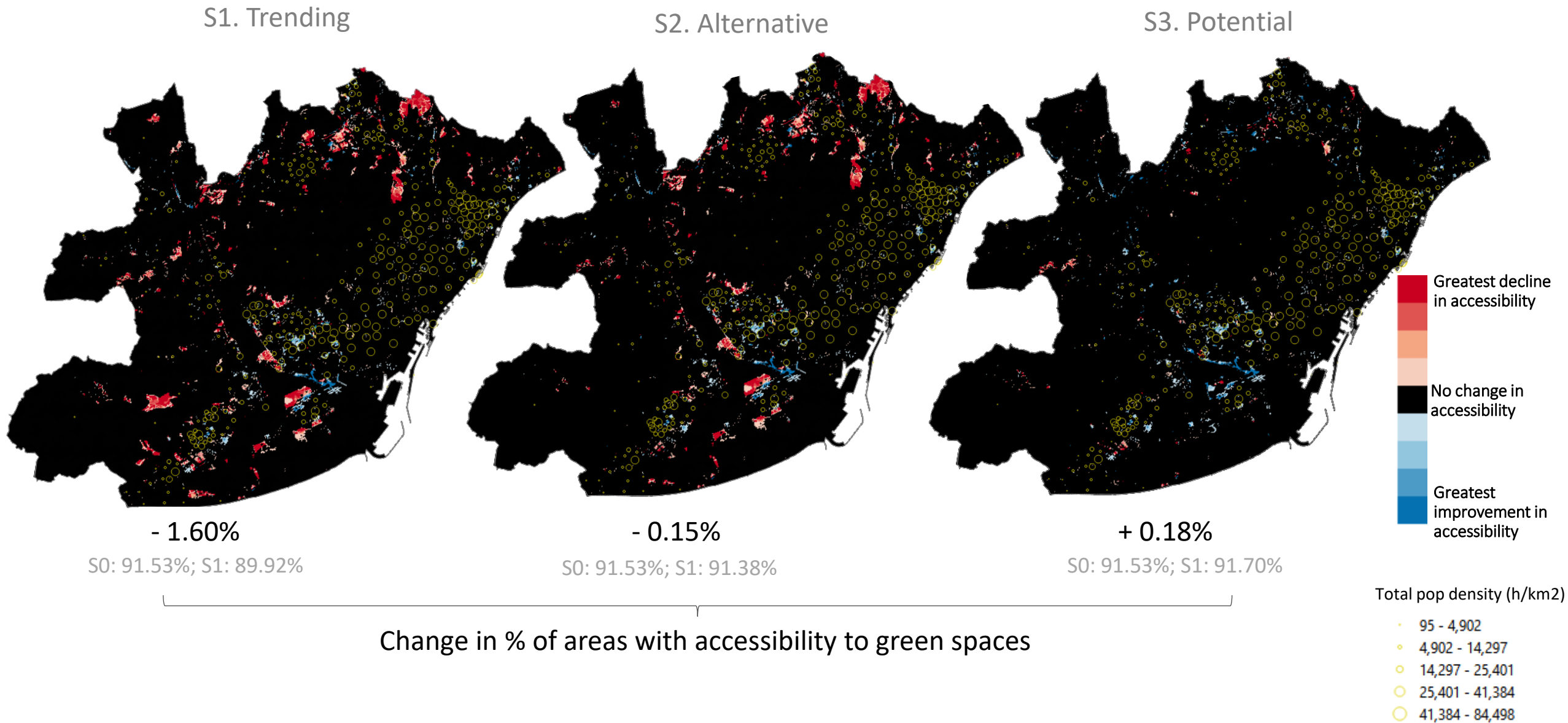
Spaces for cultural and recreational experiences

Current state VS possible future scenarios



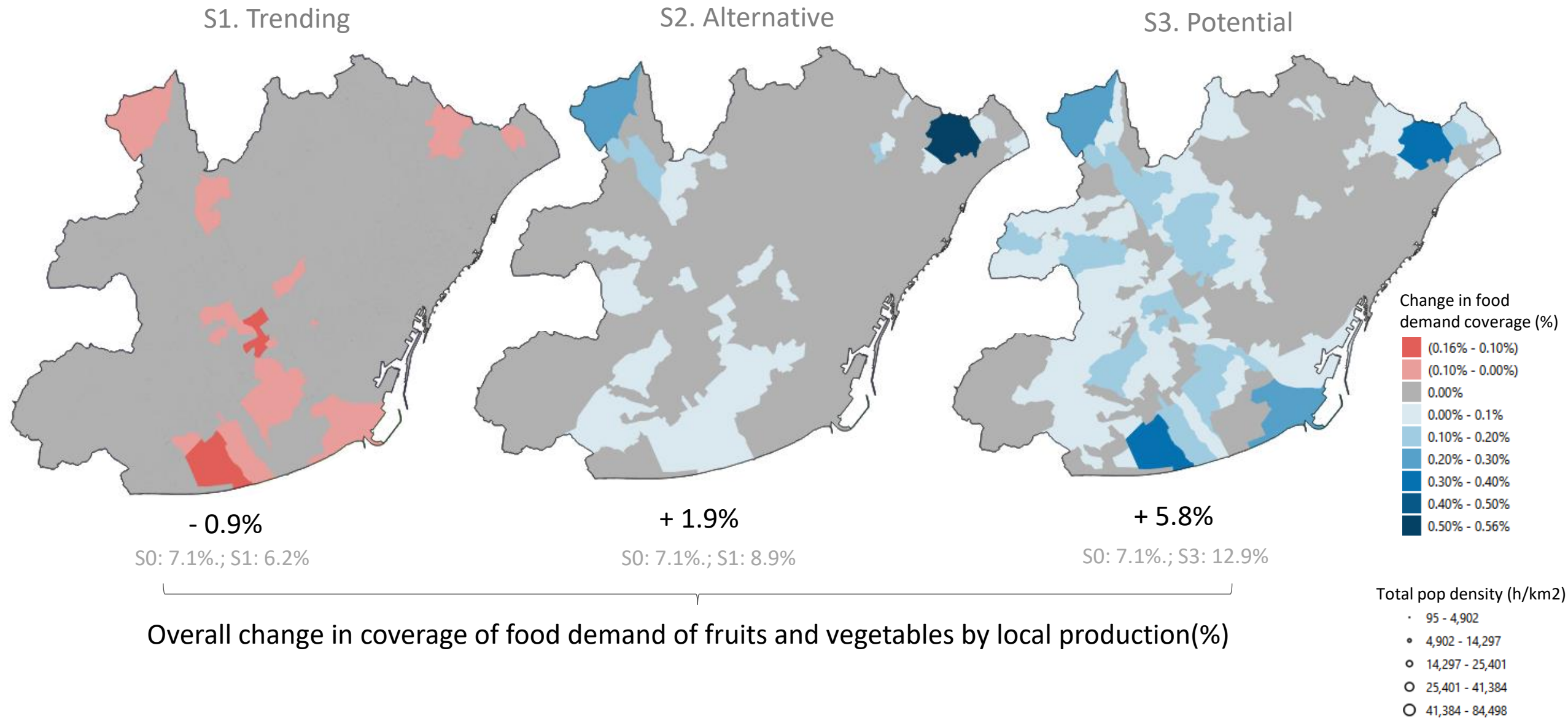
Spaces for cultural and recreational experiences

Current state VS possible future scenarios



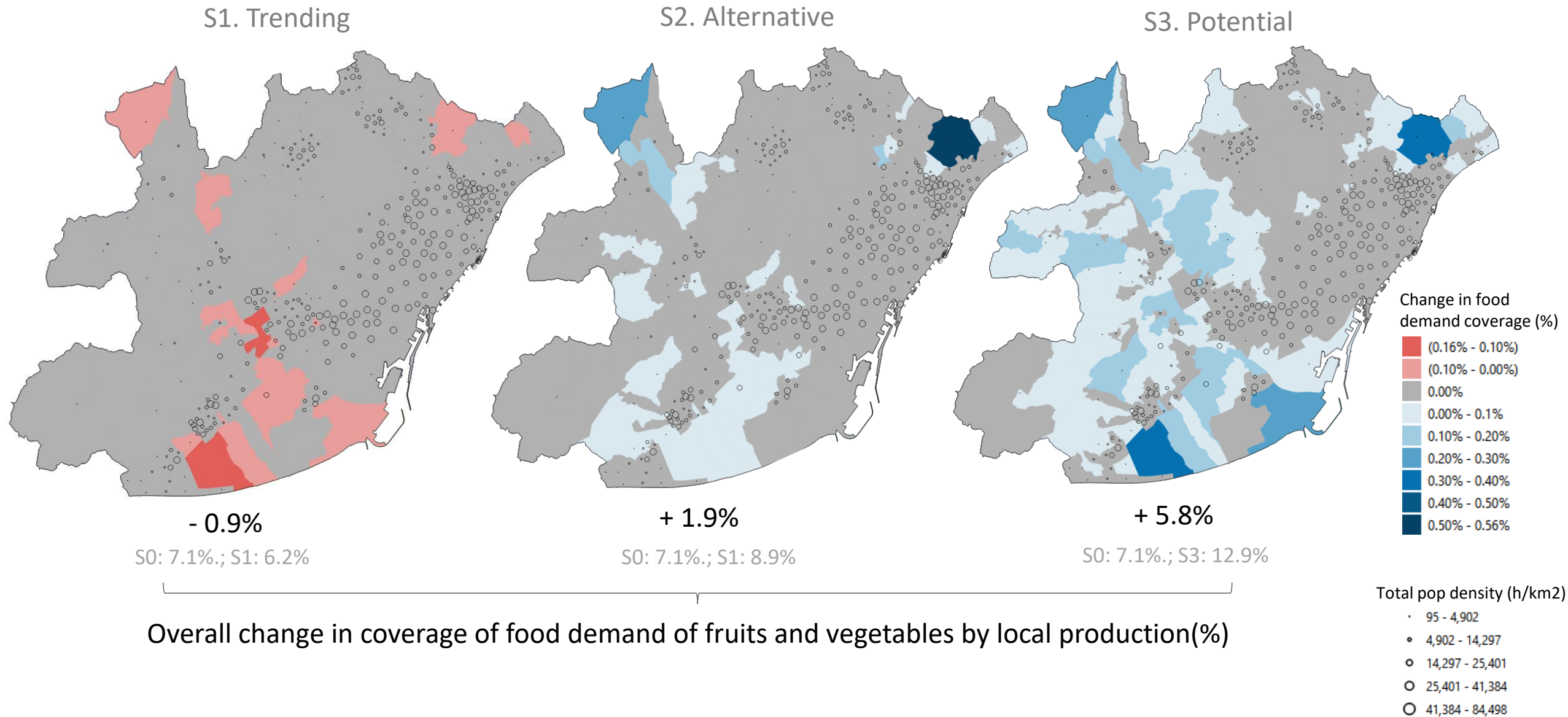
Food self-sufficiency (FOOD)

Current state VS possible future scenarios



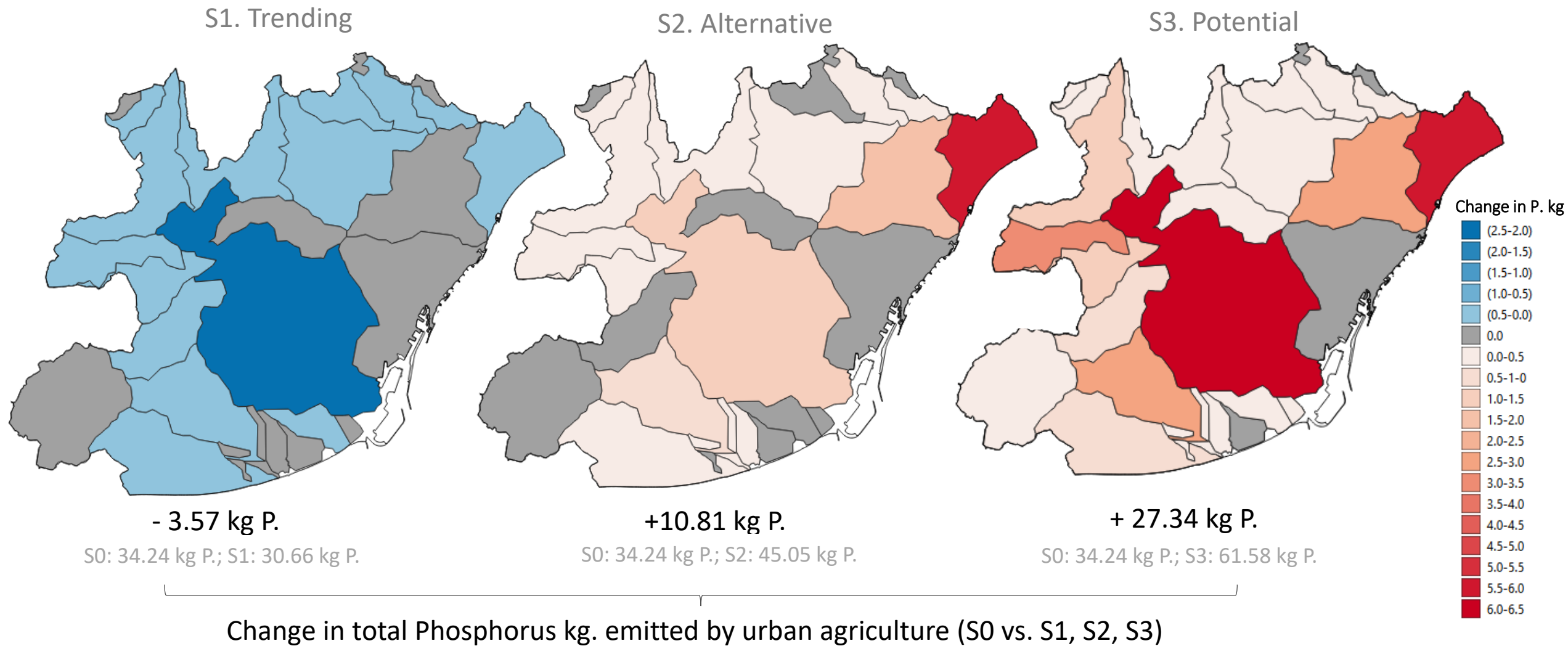
Food self-sufficiency (FOOD)

Current state VS possible future scenarios



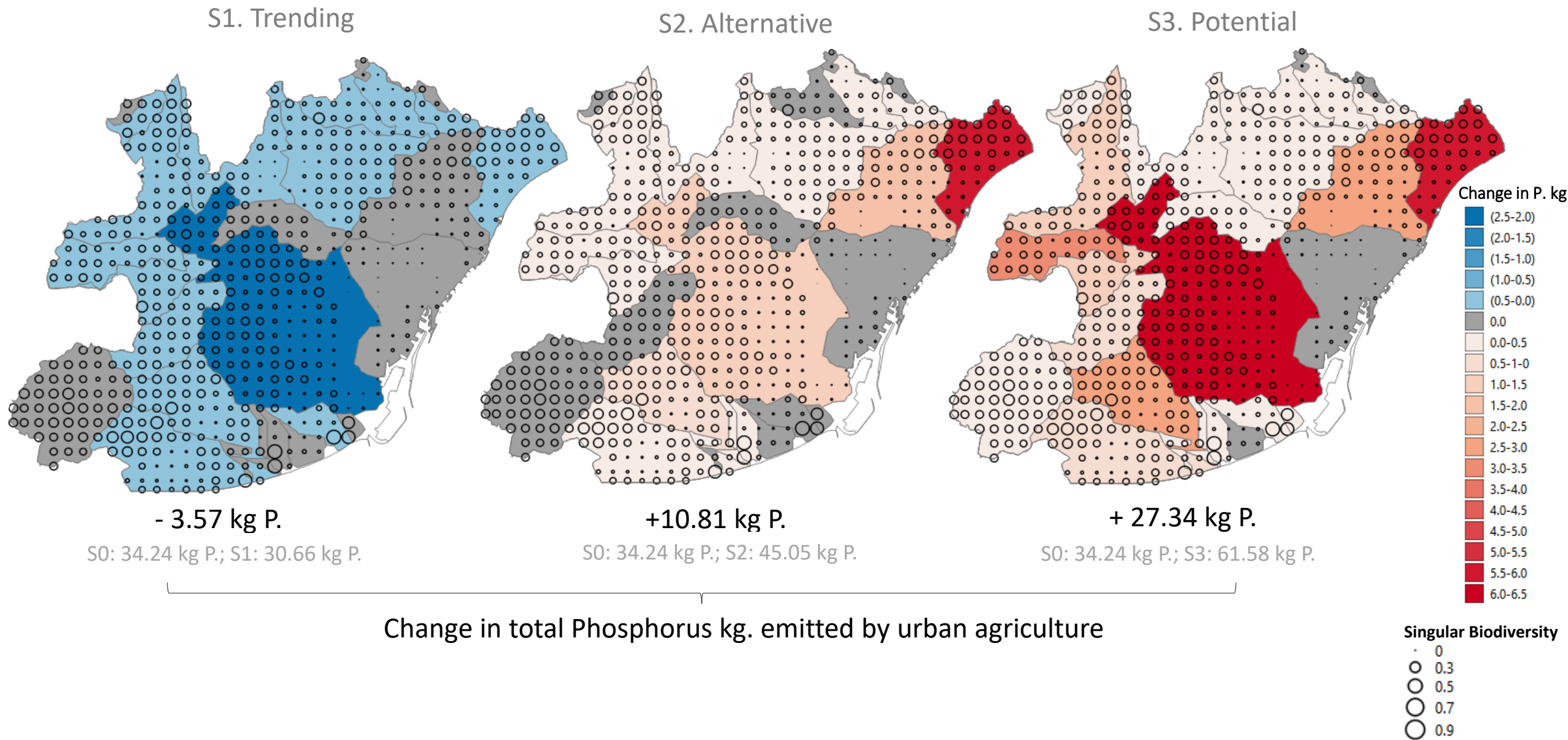
Environmental impacts of fertilizer use

Current state VS possible future scenarios



Environmental impacts of fertilizer use

Current state VS possible future scenarios



Overall vulnerabilities

Heat conditions and
exposure



Spaces for cultural
and recreational
experiences



Food self-sufficiency



Environmental
impacts of fertilizer
use



Overall vulnerabilities

Heat conditions and
exposure



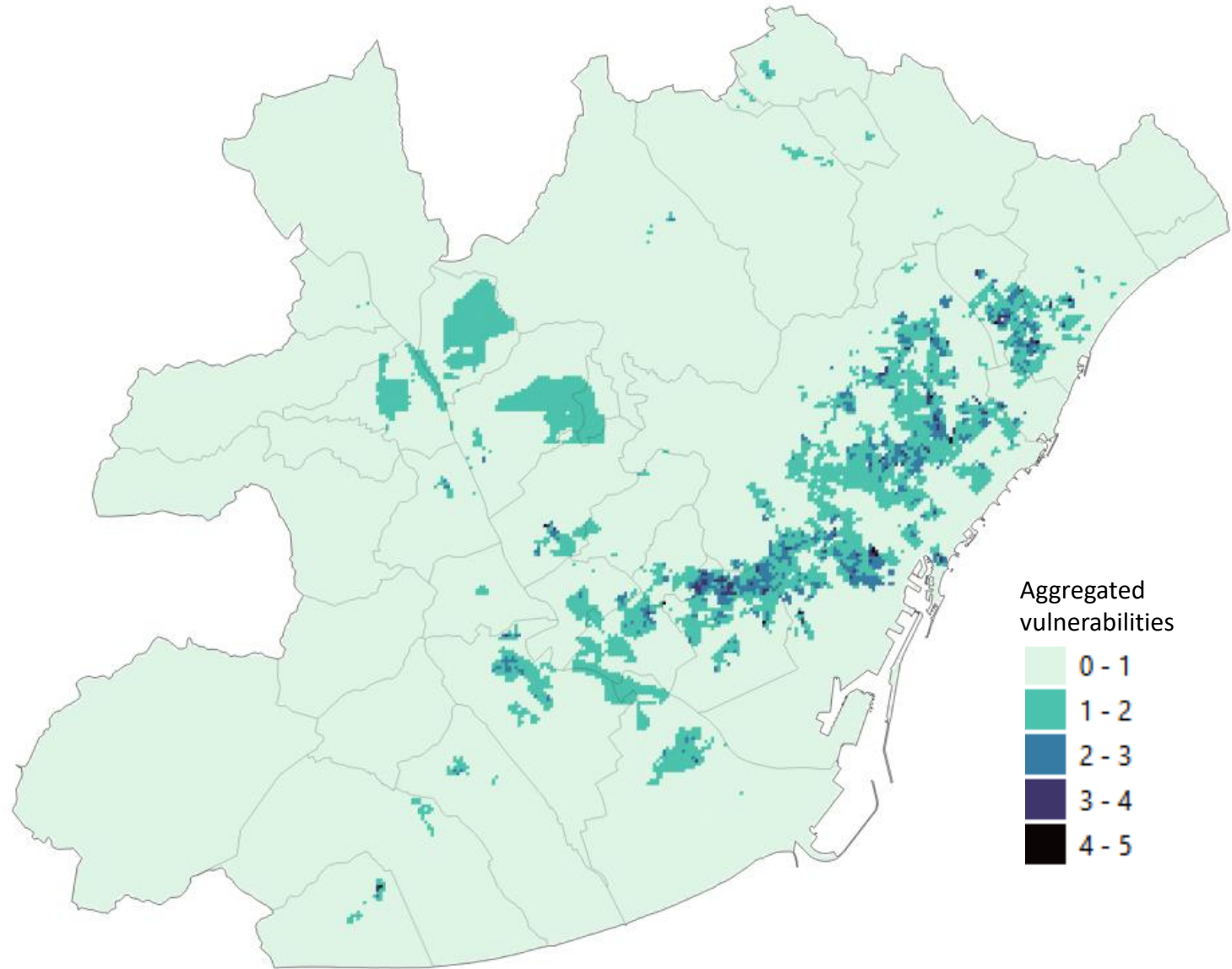
Spaces for cultural
and recreational
experiences

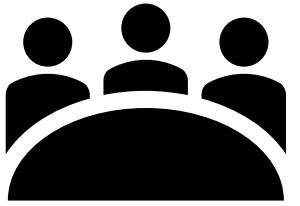


Food self-sufficiency



Environmental
impacts of fertilizer
use





Objective: discuss and weight the relevance of each criterion when assessing the impacts of peri urban agriculture areas in the Metropolitan Area of Barcelona

How?

- 1) Split in groups of 5 people
- 2) Individually, assign pebbles among criteria (more pebbles -> more relevant the criterion)
- 3) As a group, discuss the results
- 4) Redistribute pebbles if necessary

Heat conditions and exposure

Presence of heat waves in urban areas and population affected by their effects

Spaces for cultural and recreational experiences

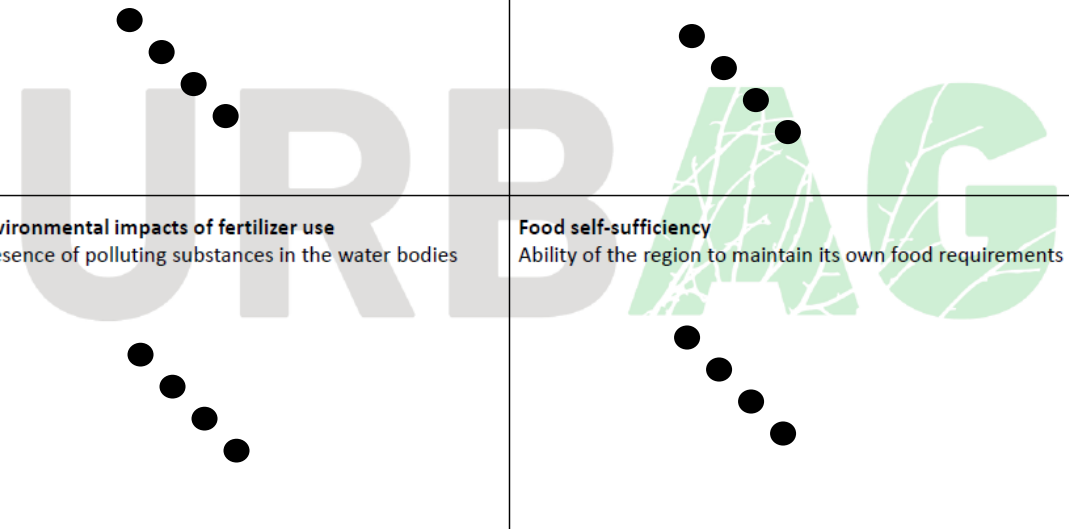
Spaces for activities related to leisure, recreation and maintenance of cultural heritage

Environmental impacts of fertilizer use

Presence of polluting substances in the water bodies

Food self-sufficiency

Ability of the region to maintain its own food requirements



EU Horizon2020 ERC consolidator grant (818002-URBAG):
Integrated System Analysis of Urban Vegetation and Agriculture
(www.urbag.eu)

Institute of Environmental Science and Technology (ICTA)
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