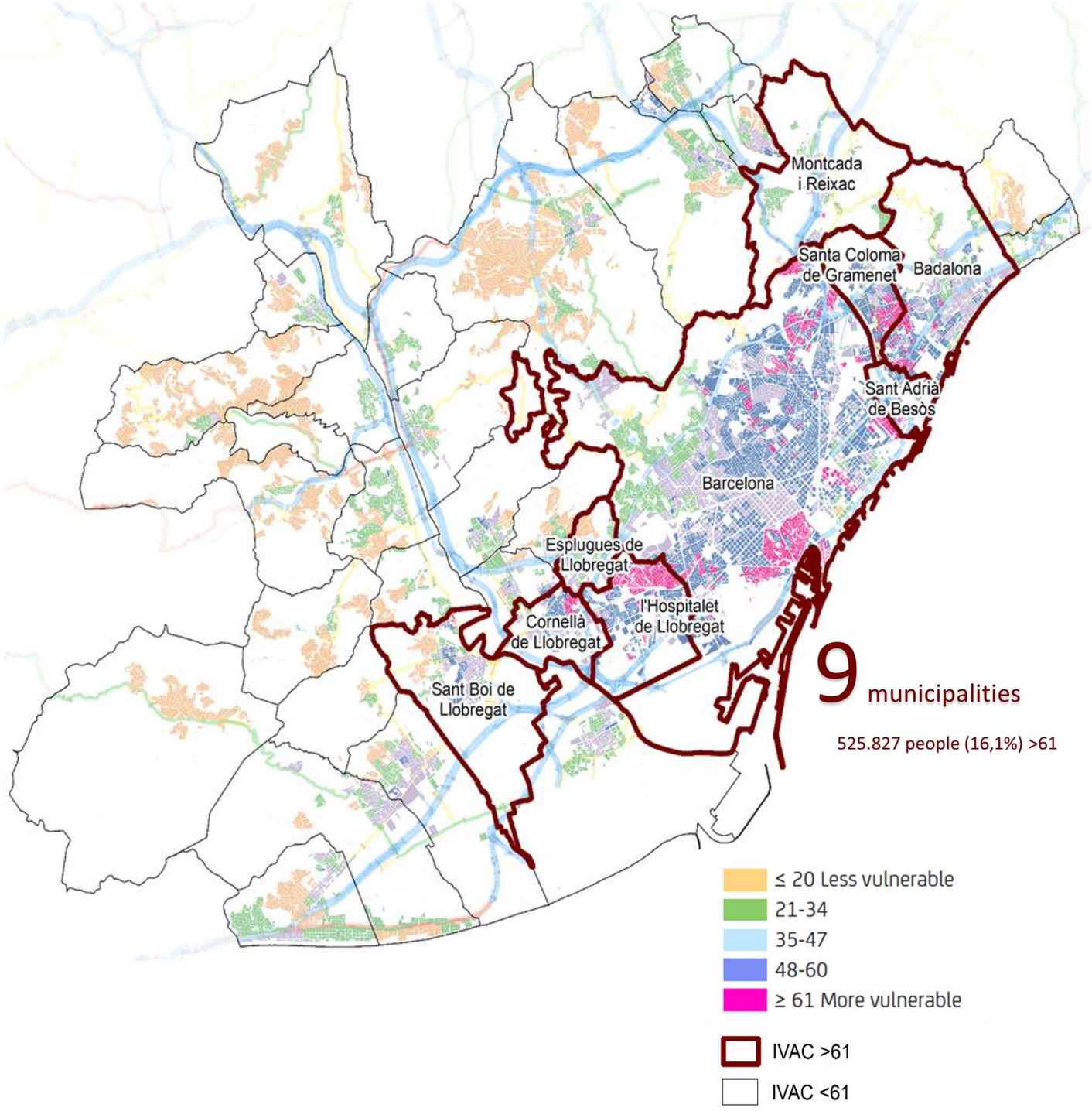
AMB Àrea Metropolitana de Barcelona

Xarxa metropolitana de **refugis climàtics**

Metropolitan Climate Shelter Network

Climate Change Vulnerability Index (CCVI)



COMPONENT 1. Densely populated areas with a lack of green spaces.

COMPONENT 2. Low income population, lower proportion of population with higher education, foreign.

COMPONENT 3. Elderly women in relatively older housing (1951 to 1980).

COMPONENT 4. Elderly people living alone in older homes (≤ 1950).

Study of the potentiality of the territory

PHASE 1

Benchmarking climate shelters in other cities and regions of the world

PHASE 2

Define criteria for facilities

Telephone contact

PHASE 3

GIS Analysis

Select parks:

Extensive surface area (> 0.5 ha) and vegetation (NDVI > 0.4)

Schools:

NDVI > 0.2

PHASE 4

Distribution maps

Integration of travel time (10’ and 15’)

Vulnerable population
> 65 years old
0-5 years old

PHASE 5

Conclusions

(330 public facilities + 80 parks)

CRITERIA

- → Spaces that provide **thermal comfort** during extreme temperatures
- → Apart from these events, they have **other uses**
- → They can be **indoor or outdoor spaces**.
- → Easy **access**, rest areas, **water** and security
- → They are NOT **sensitive facilities**

TYPE

- → **Public facilities**
- → **Private** facilities
- → **Schools** (open spaces and playground area)
- → **Urban parks** with leafy vegetation

‘Indoor or outdoor accessible space that during extreme weather episodes provides the population (especially vulnerable people) with thermal comfort, rest and safety’.

Creation of the Climate Shelter Network

2019

- Study of potentiality
- *Bioclimatic criteria guide to improve the quality of parks*

2020

- Webinar to present the study (19/35 city councils)
- Voluntary call to create the metropolitan climate shelter network

2021

- 7 municipalities (**20 climate shelters**)
- Graphic image design
- Alliances/ collaboration with other public institutions
- Creation of financial aids (to create new CS)

Diputació Barcelona

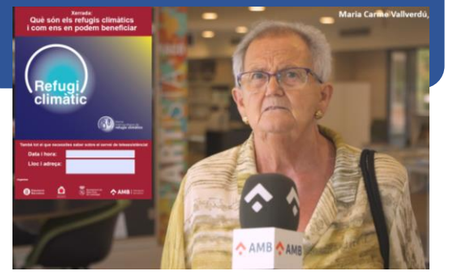
Ajuntament de Barcelona

AMB Parcs

ISGlobal Instituto de Salud Global Barcelona

2022

- 9 municipalities **(55 Climate shelters)**
- Communication campaign
- Talks to vulnerable people
- CCVI
- Monitoring thermal comfort in small parks



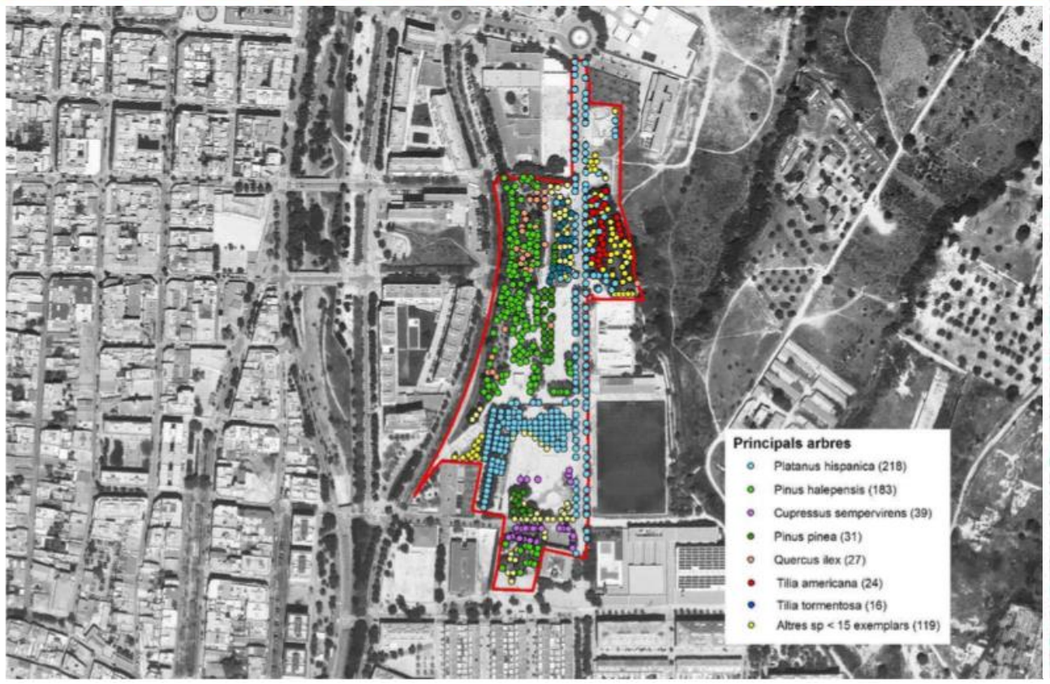
2023

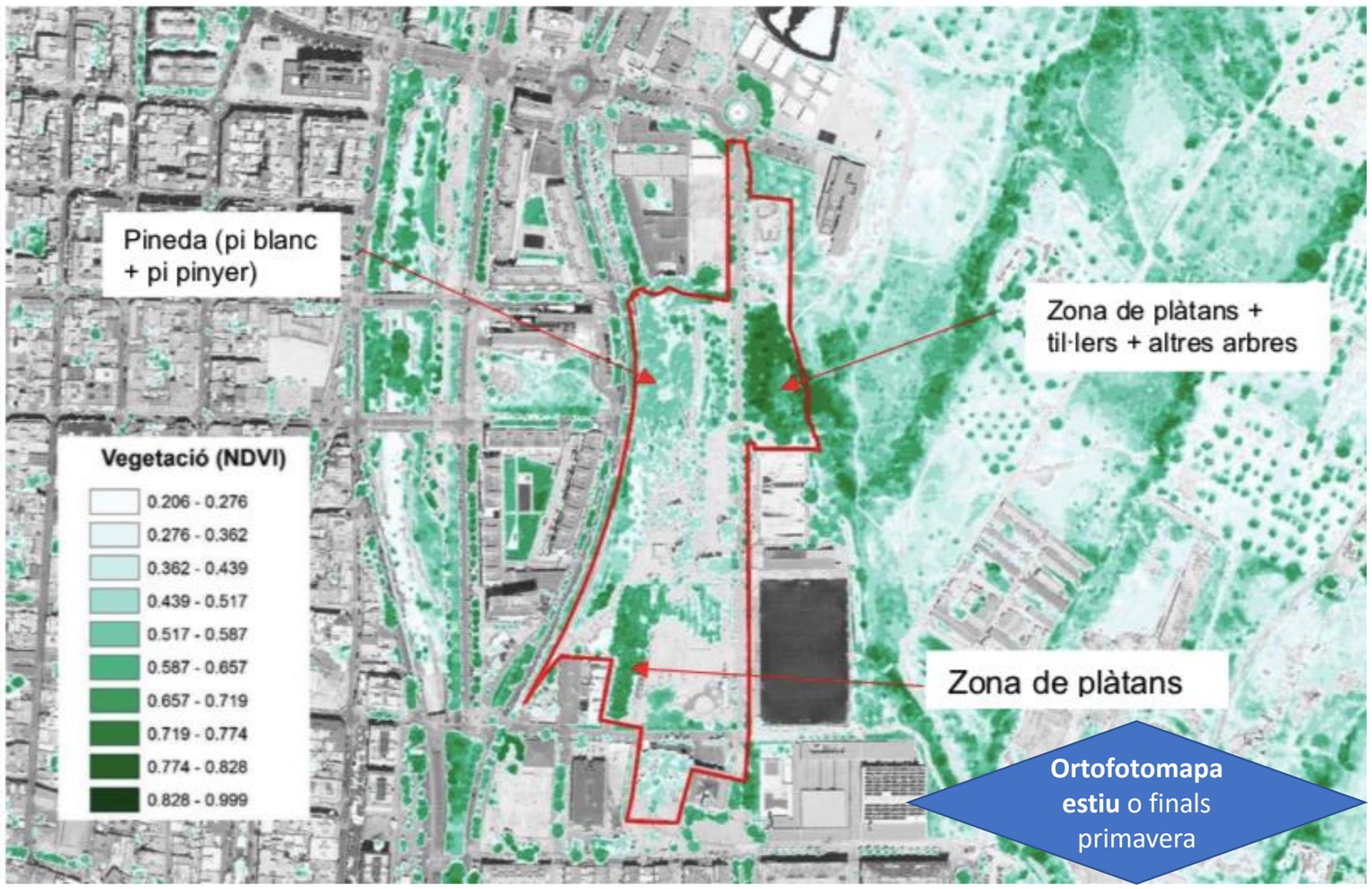
- 11 municipalities **(74 Climate shelters)**
- Climate shelter network adhesion protocol
- Training to facilities support staff
- Production of merchandising articles
- Communication campaign
- Monitoring thermal comfort in small parks

Detailed analysis of parks

Imatge 10: Ortofotomapa del Parc Torre Roja i els seus voltants

- Presence of **outstanding vegetation** (NDVI> 0,4) (and surroundings)
- Tree cover with **deciduous species**
- **Permeable soil**
- Presence of **water**
- **Accessible and safe** (orography)
- **Climate shelter areas** nearby the entrance
- **Banks under shade** (ergonomic +65 years)
- **Fountains** (drinking water)
- **Quiet area** (air quality and noise)





Monitoring thermal comfort

Small parks ≤ 0,5 h

Parc	Hectarees
Can Buxeres	6.8
Infantil	0.78
Europa	0.11
zona adjacent de la marina	0.32
Parc de la marina	0.45
Parc Ossó	0.06
Parc de la biblioteca	0.06

Climate shelters ≥ 0,5 h

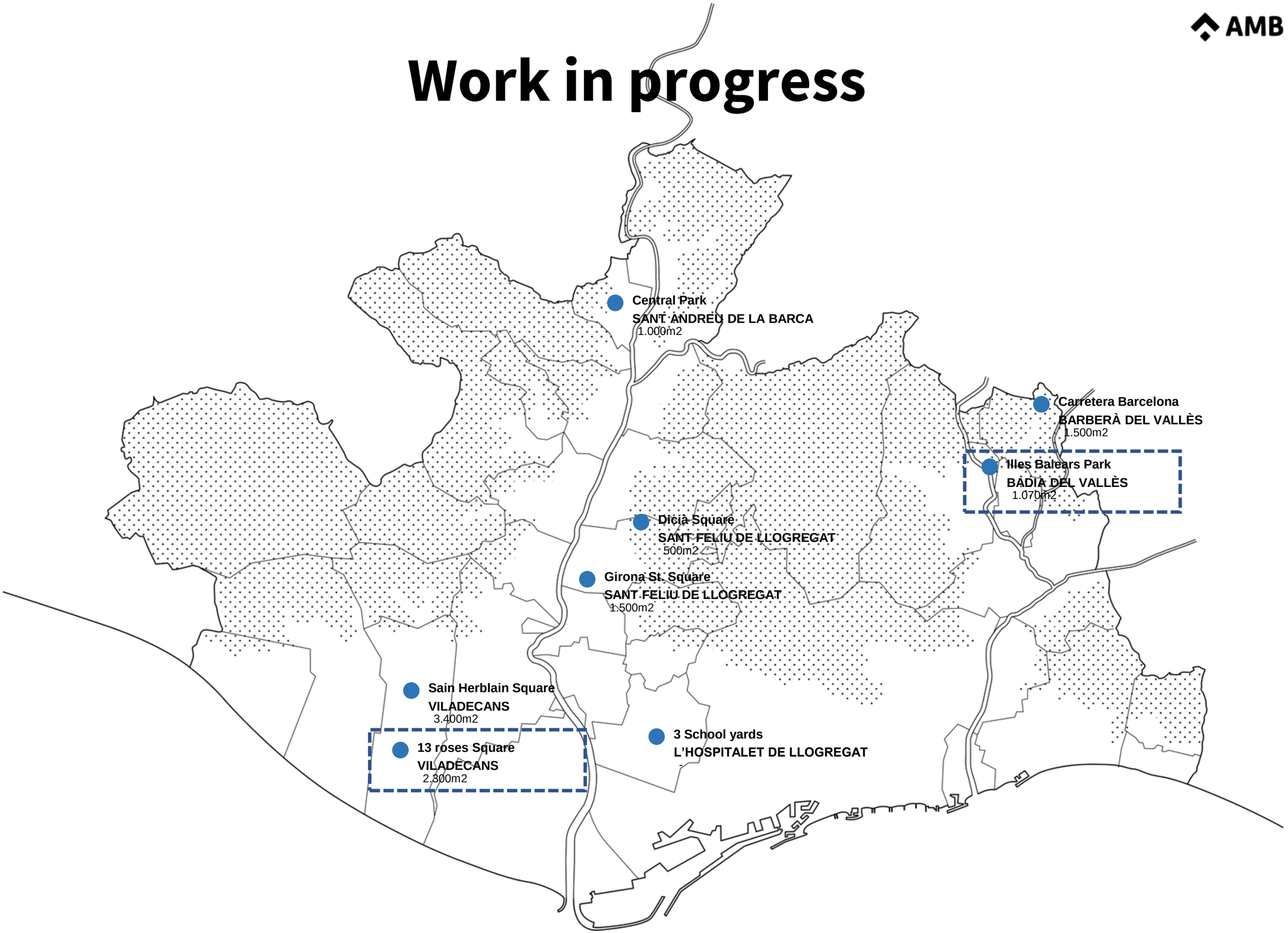
Small parks can provide thermal comfort with a similar capacity than bigger parks classified as climate shelters. The measured difference between the UTCI inside and outside parks ranges between 0.1 and 4.4 °C.

From networking with municipalities to integration in investment programes

Municipi	Actuació	Import (IVA inclós)
Sant Feliu de Llobregat	Creació de refugi climàtic a Plaça Dicià	153.873,70 €
Sant Feliu de Llobregat	Urbanització plaça carrer Girona	295.000,00 €
Santa Coloma de Gramanet	Patis 6 Escoles	152.000,00 €
Viladecans	Plaça Saint Herblain	259.328,81 €
Badia del Vallès	Refugi climàtic al parc de les Illes Balears	213.291,04 €
L'Hospitalet de Llobregat	Naturalització de (5+1) patis i implantació de refugis climàtics	1.850.660,95 €
Molins de Rei	Plaça del Pont de la Cadena	2.063.555,00 €
Viladecans	13 Roses	898.448,88 €
Barbera del Vallès	carrer Nàpols i via de Sant Oleguer	373.750,00 €
		6.259.908,38 €

Small scale climate shelters in the metropolitan area of Barcelona

Work in progress



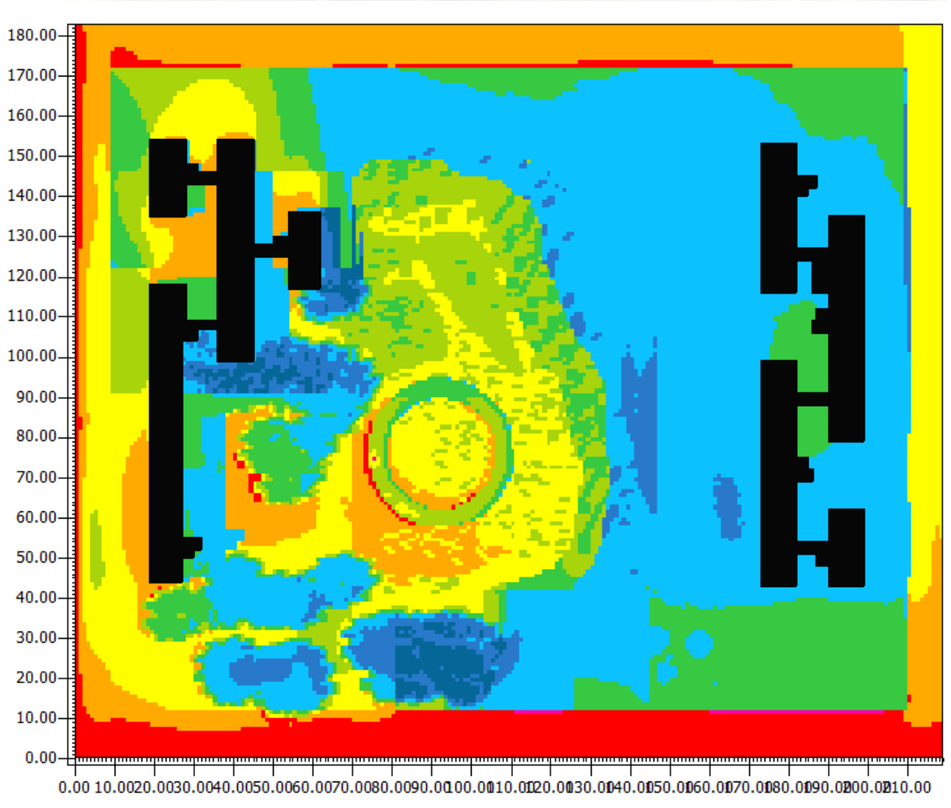
Work flow

1. Selection of **multidisciplinary teams** through design competition
- urban/landscape designers
- bioengineers
- simulation experts

2. Development of **preliminary design** with bioclimatic strategies

3. **Ambiental simulation**

- Software: ENVI-met, urban climate modeling tool



4. **Project development**

Bioclimatic criteria

AMB Bioclimatic criteria to improve quality of green urban spaces

- **Location:**

multi shadowed sites, wind conditions, air flow

- **Vegetation:**

concentration of dense vegetation capable of evotranspiration

- **Water:**

water next to usable spaces, naturalized water ponds, water playgrounds

- **Materials:**

low albedo materials, drainage paviment

HISTORICAL REFERENCES

Alhambra Gardens. Granada

Pedralbes Gardens. Gaudí pergola. BCN

Santa Clotilde Gardens. Blanes

Illes Balears Park, Badia

Intervention area

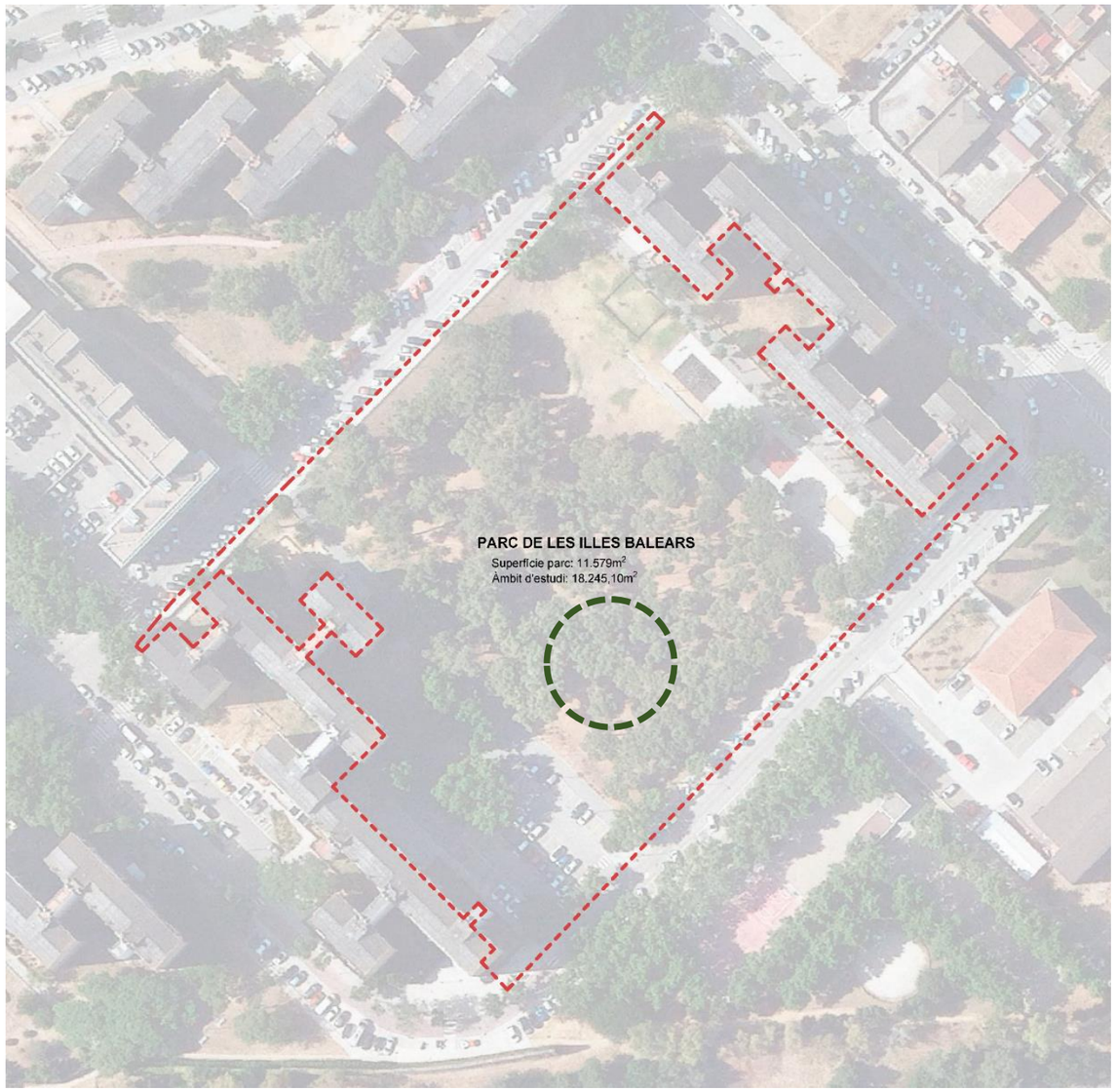
Park:
18.245m²

Climate Shelter:
1.070m²

214.000 €

Project:

Carles Enrich Studio



strategies

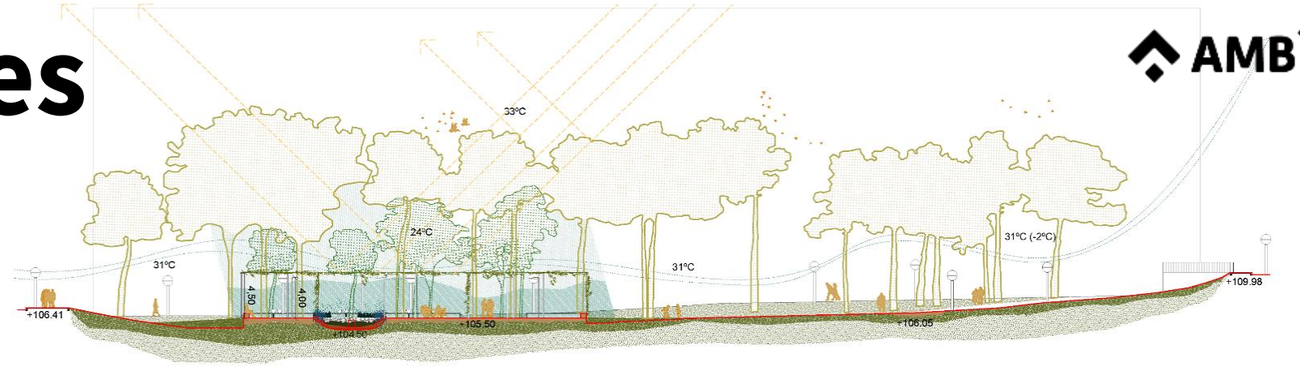
1. Focus action at the lowest point → Maximize the collection of rainwater

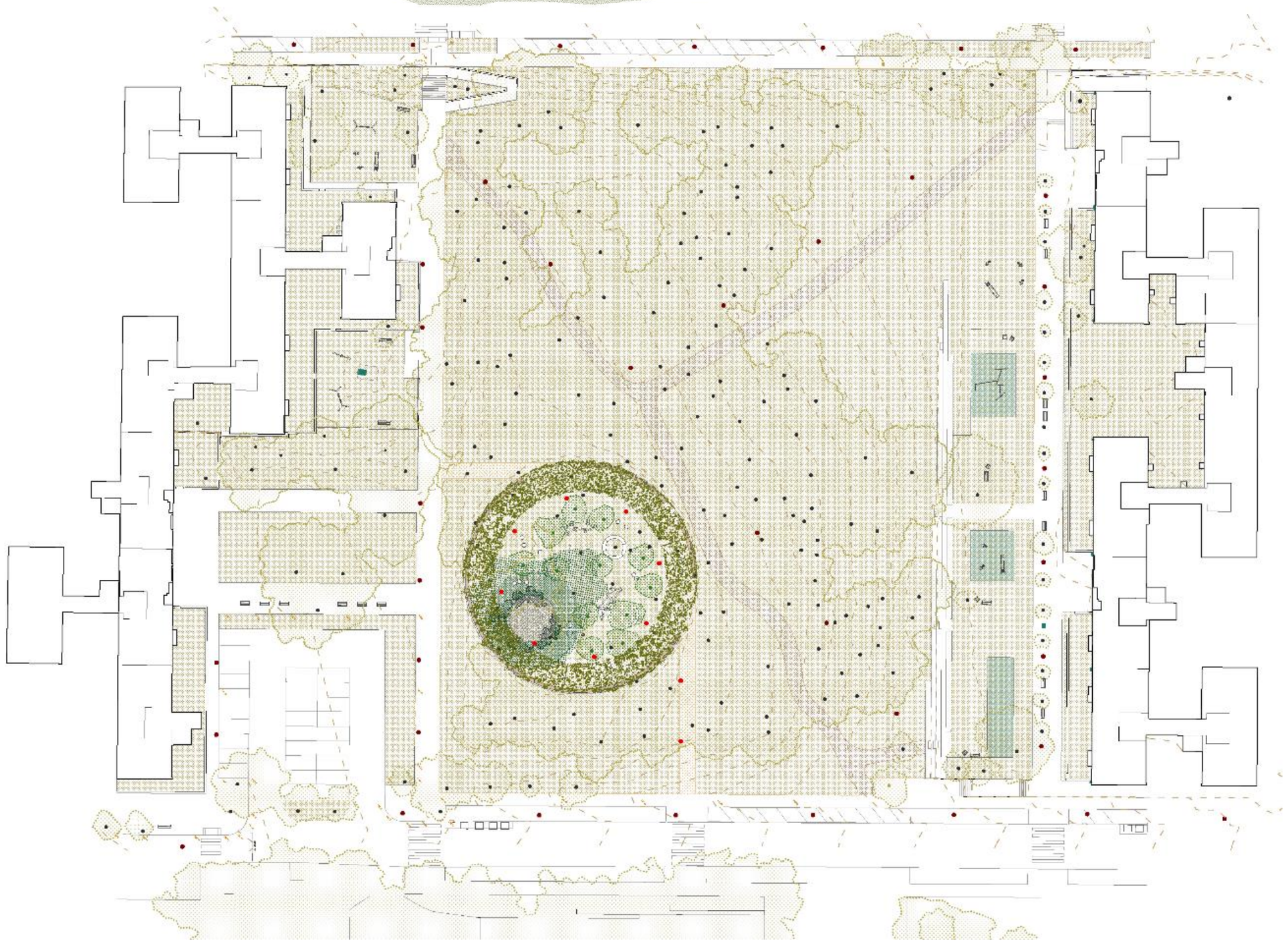
2. Generating central living space under the shade → Improve accessibility, incorporate furniture, play grounds...

3. Generating a double shade with a vegetated pergola → Allows temperature and humidity to be stratified

4. Establish drainage area → Allows to incorporate wet vegetation

5. Consider the **vegetation evolution process** → A **growth scenario 10-30 years ahead**





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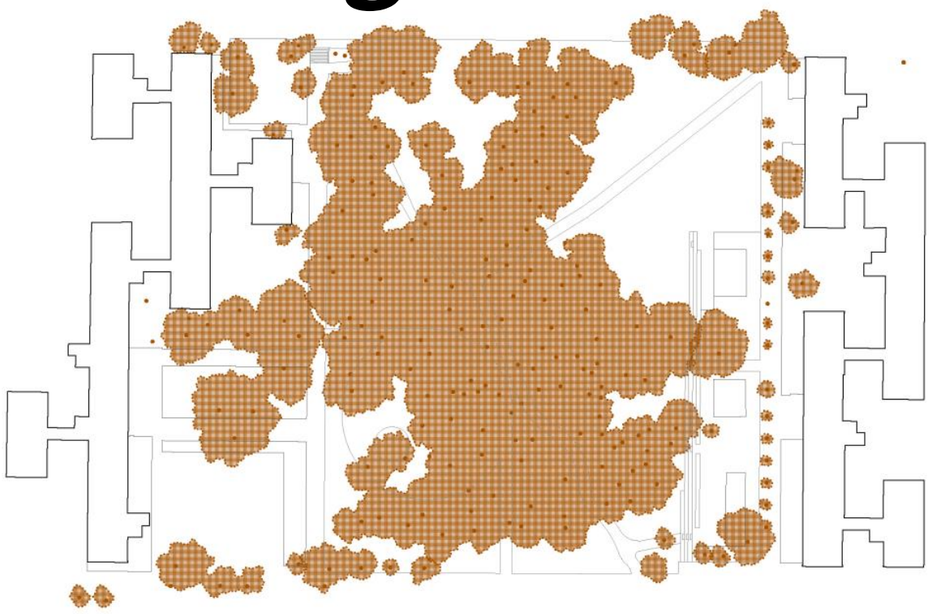
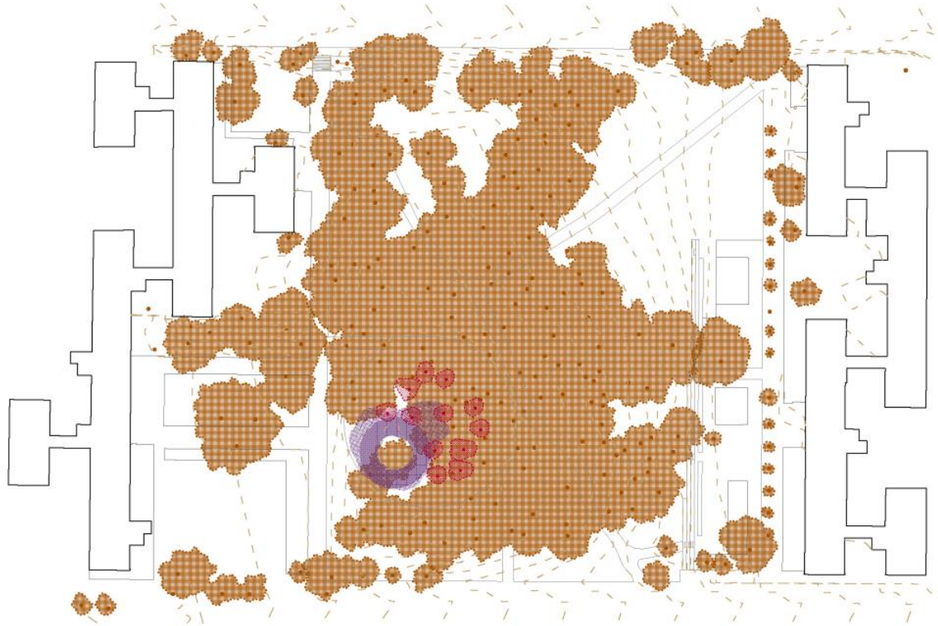
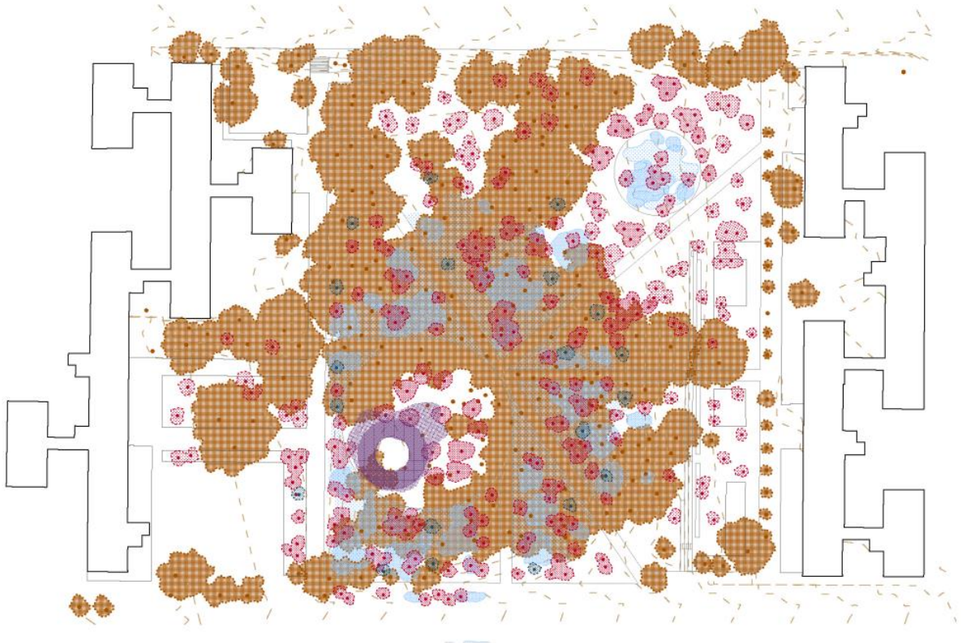


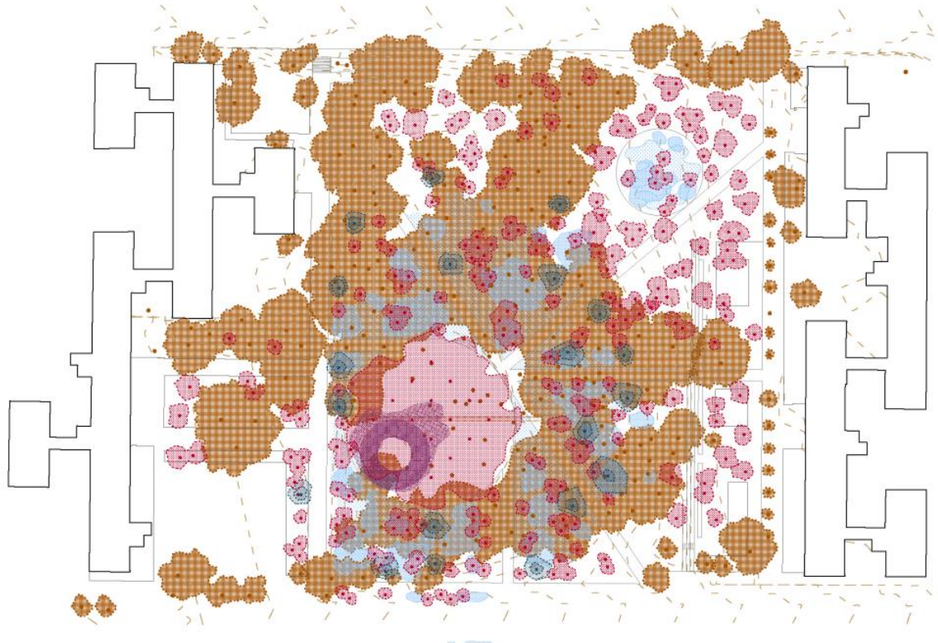
Refugi 2023 - Estat actual



Refugi 2024 - Fase I



Refugi 2030 - Fase II



Refugi 2050 - Fase III

Arbrat existent
Pineda existent

Nou arbrat
Arbrat de ribera
Arbrat bosc humit perenne
Vegetació halòfita
Arbrat bosc sec
Bosc humit caducifoli
Arbustiva sotabosc

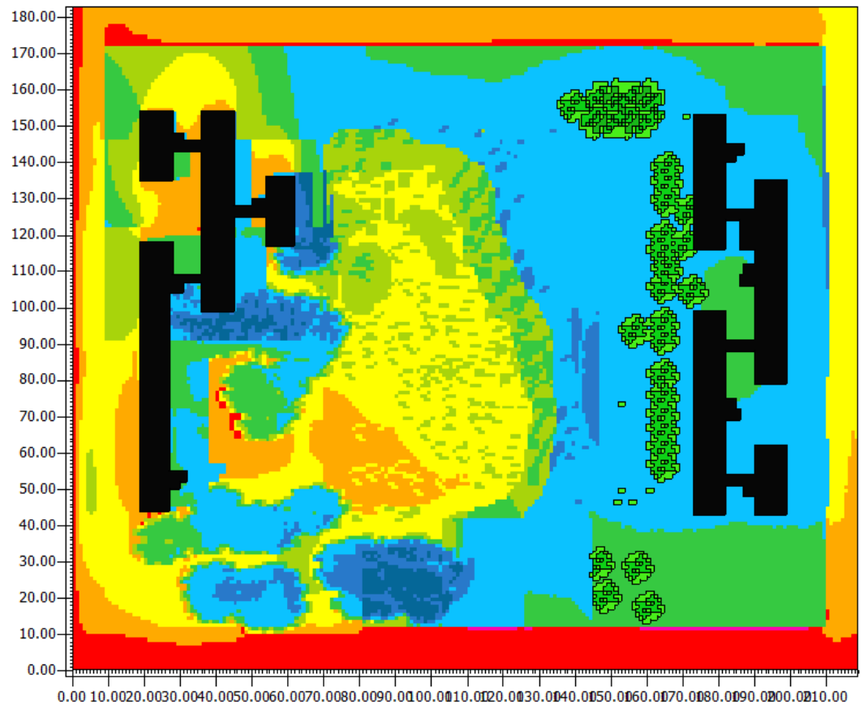
simulation

EnvyMED Simulation urban climate modeling tool

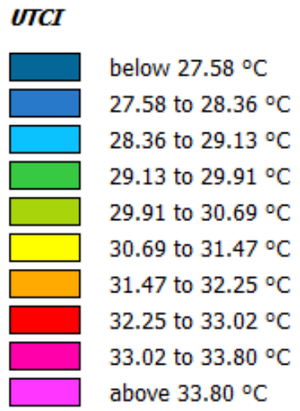
Analysis of the effect of small-scale changes in urban design (buildings, vegetation, materials,…

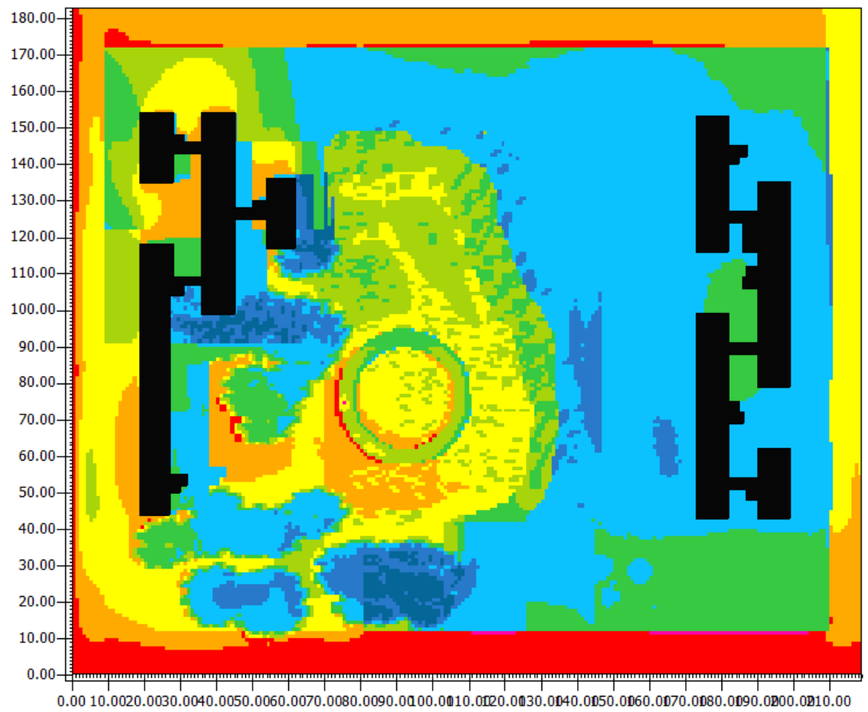
Universal Thermal Climate Index (UTCI)

Physiological Equivalent Temperature (PET)



Without vegetated pergola:





With vegetated pergola:

PET[°C]	UTCI[°C]	Physiological Stress
≥ 41	> 46	Extreme heat stress
	38 to 46	Very strong heat stress
35 to 41	32 to 38	Strong heat stress
29 to 35	26 to 32	Moderate heat stress
23 to 29		Slight heat stress
18 to 23	9 to 26	No thermal stress
13 to 18	0 to 9	Slight cold stress
8 to 13	− 13 to 0	Moderate cold stress
4 to 8	− 27 to − 13	Strong cold stress
≤ 4	− 40 to − 27	Very strong cold stress
	<− 40	Extreme cold stress

13 Roses square, Viladecans

AMB PSA

Intervention area

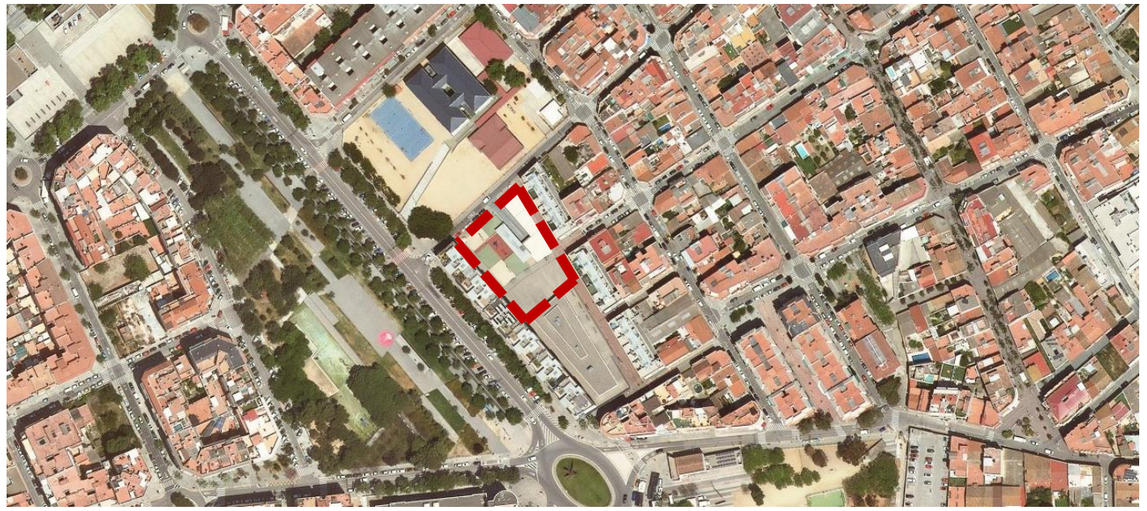
Square:
3.567m²

Climate Shelter:
2.327m²

1.067.224,44 €

Project:

MATAALTA studio



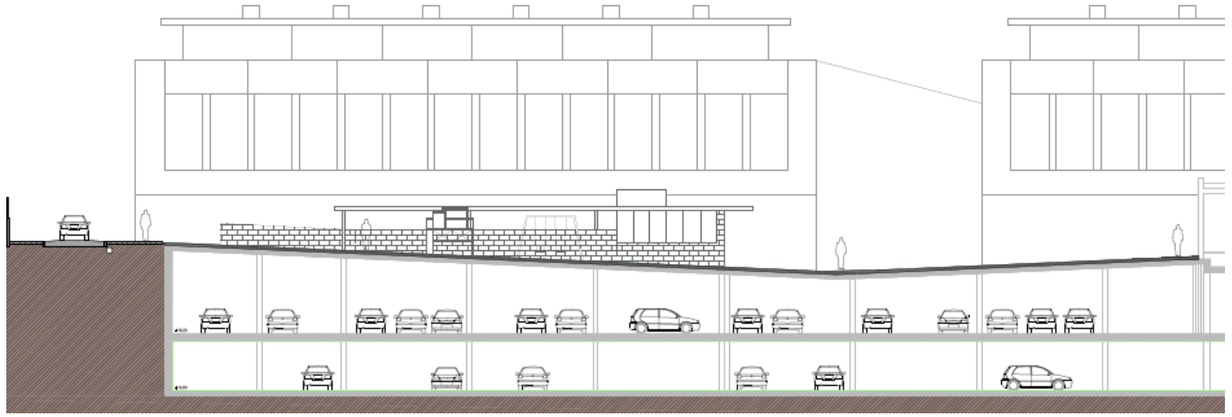
strategies

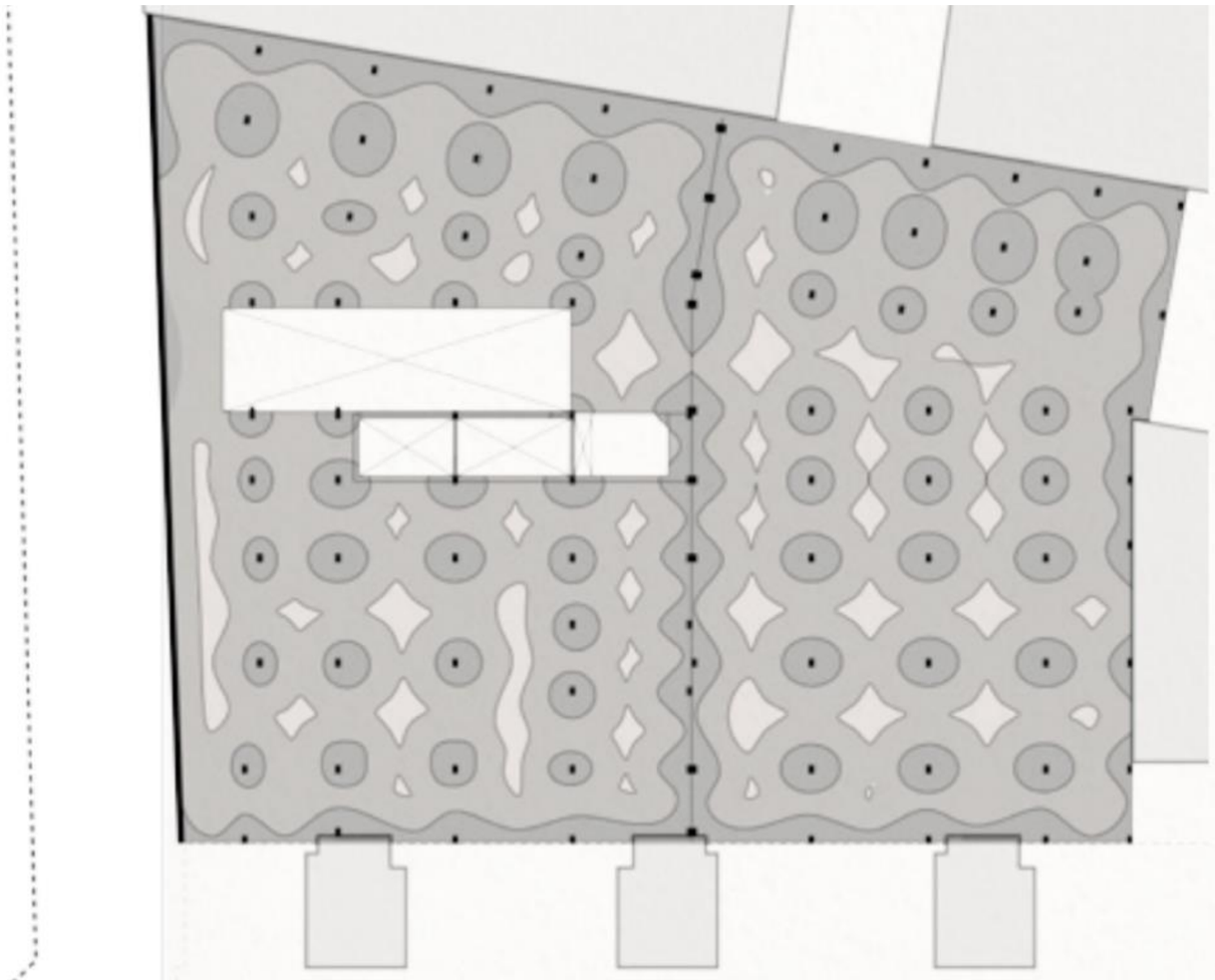
1. Evaluate the structural capacity → Optimize the layout of land for the growth of vegetation

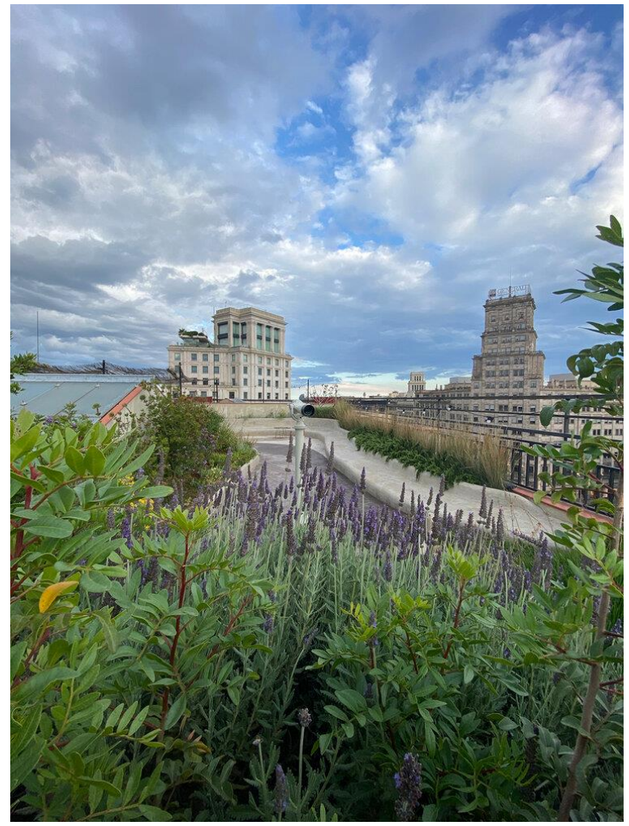
2. Design the urban landscape → Depending on the arrangement of flower beds, circulatory flows and uses

3. Incorporate water → an element of playful play and thermal regulation strategy

3. Integrating a light vegetated structure → A semi-closed space with vegetation, concentration of shade and humidity







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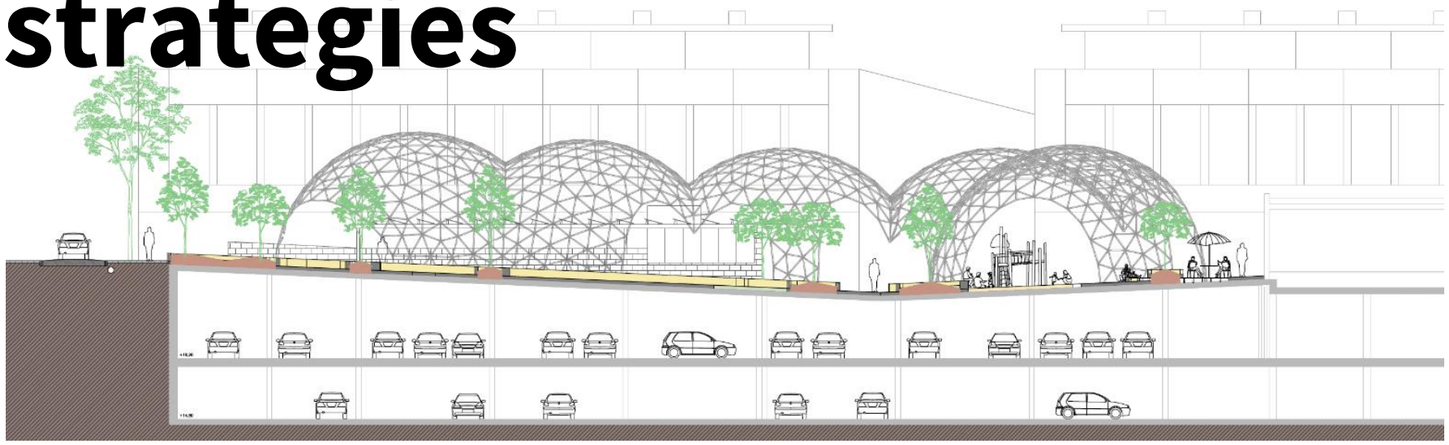

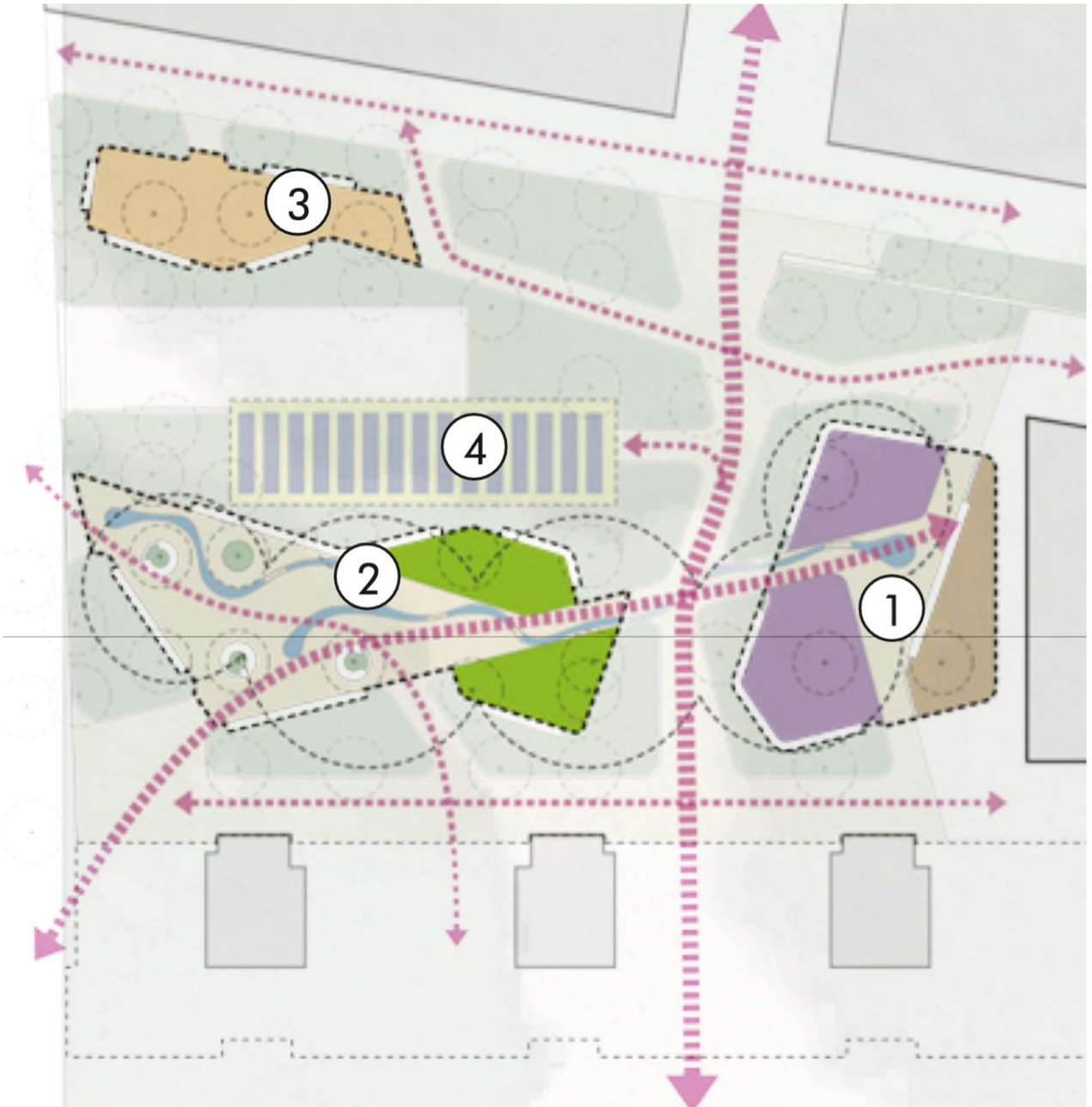

- ARTIFICIAL LANDSCAPE
- SOCIAL COMFORT SPACE
- BIOCLIMATIC CANOPY
- BIOSOLAR ROOF
- WATER PLAYGROUND

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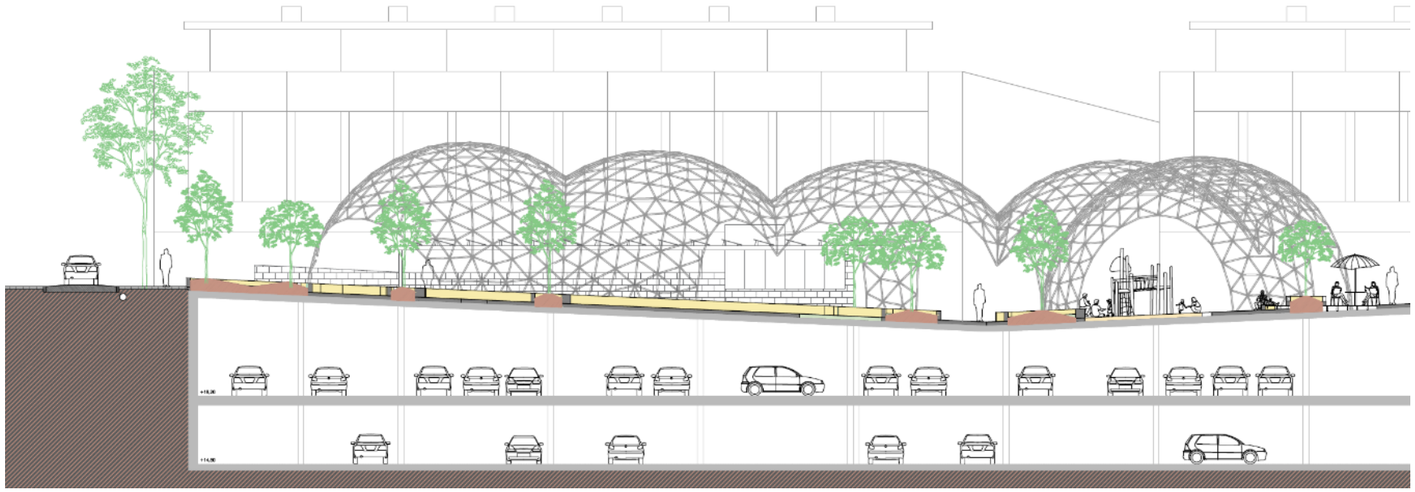
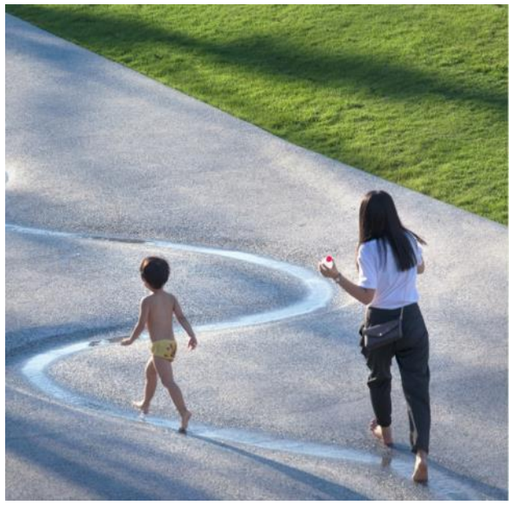




Sustainability protocol Quick guide

Environmental criteria

for AMB and IMPSOL

projects and works

Sustainability protocol

v. 1.2 / 2021

AMB

AMB

6 groups

19 criteria

- Transversal analysis and follow-up
- Water
- Energy
- Comfort and health
- Materials
- Site sustainability

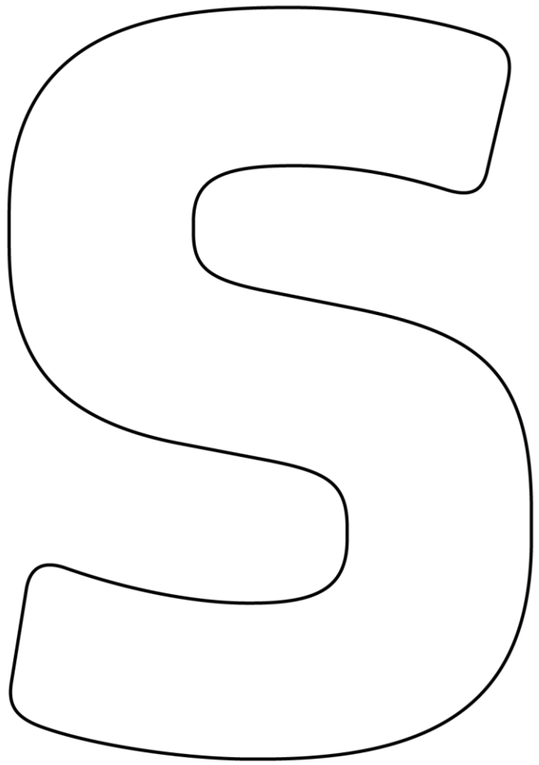
Sustainability protocol

Quick guide

Environmental criteria

for AMB and IMPSOL

projects and works



v. 1.2 / 2021

AMB

AMB

6

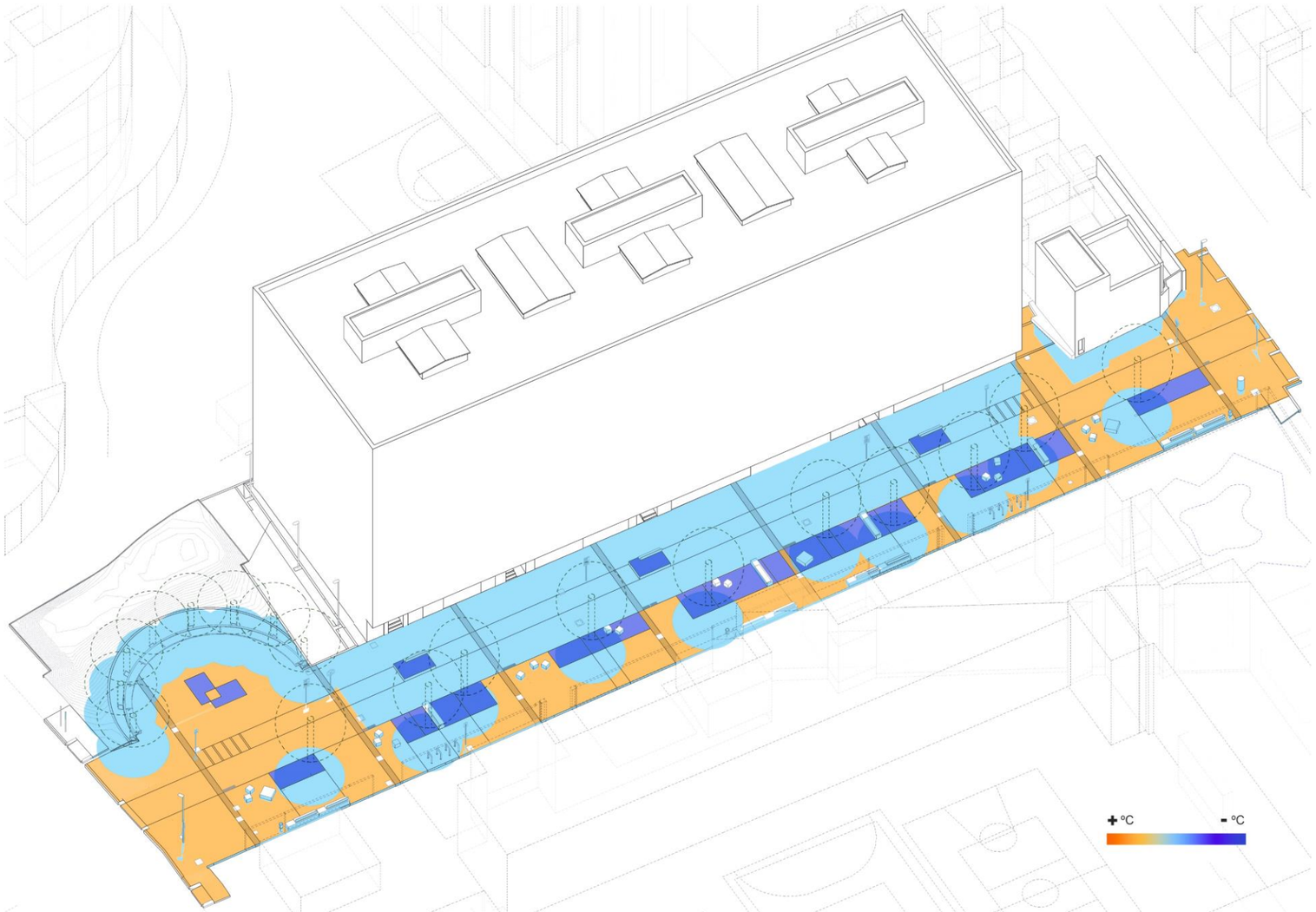
areas

19

criteria

- **Transversal analysis and follow-up**
- **Water**
- **Energy**
- **Comfort and health**
- **Materials**
- **Site sustainability**

Heat island effect reduction



Impermeable surface exposed to the sun 46%

(requirement for streets: maximum 70%)

Measured on june 21st, 13h

Strategies to reduce heat retention in projects:

— Shadow
— Permeable pavements
— Green

Other strategies that could be included:
— Water surfaces
— Light coloured materials (according to SRI)

Project: Joan de Batlle street in Sant Feliu de Llobregat (2021)

Surface avoiding heat retention

Reference data

16.1 Table of values for the 2020 horizon.

Project type	Impermeable pavement surface exposed to sun
Streets	70%
Squares	45%
Parks	25%

Reference data

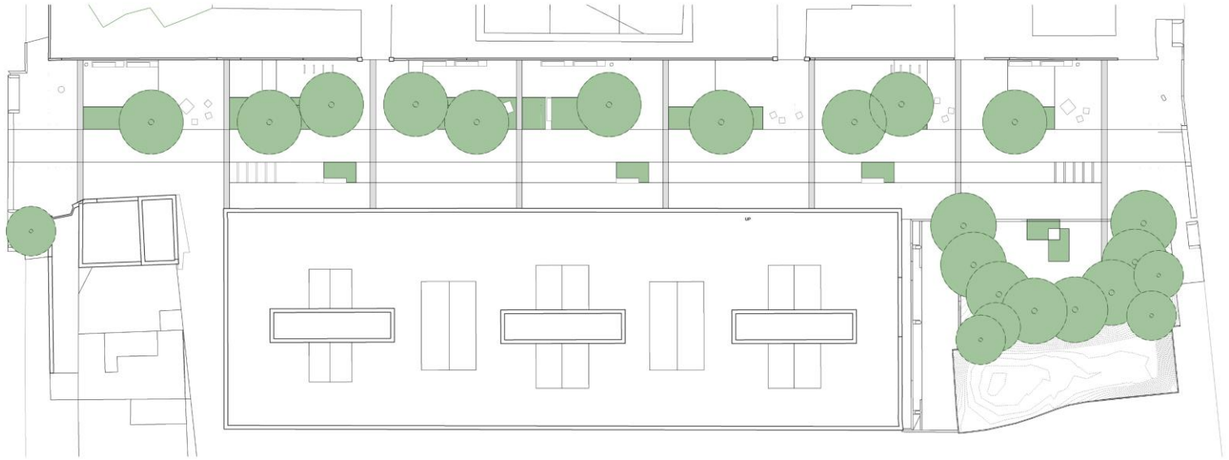
17.1 Table of values for the 2020 horizon.

Roof surface	Surface of façades with greatest sun exposure
40%	40%

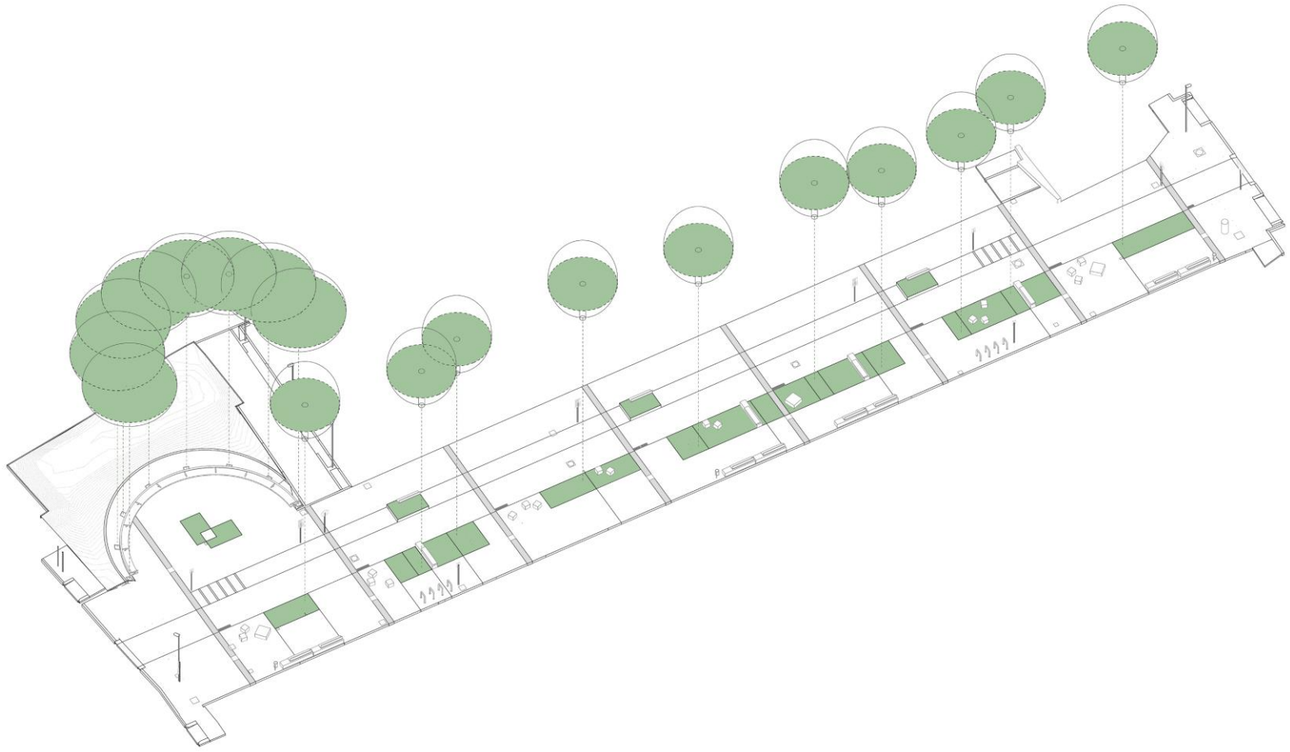
Source: AMB sustainability protocol

Minimum green surface

Green coverage
25%
(requirement for streets: minimum 25%)



Sum of vegetation layers
29%
(requirement for streets: minimum 25%)



Project: Joan de Batlle street in Sant Feliu de Llobregat (2021)

Minimum green surface

Reference data

13.1 Table of values for the 2020 horizon.

Project type	Total sum of vegetation layers	Green coverage
Buildings	20%	-
Streets	25%	25%
Squares	65%	50%
Parks	100%	70%

Source: AMB sustainability protocol

Thank you!

Download the protocol

More information
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