

POLIMI

Department of Architecture and Urban Studies

Ph.D. Programme in Urban Planning, Design and Policy

LECTURE SERIES ON OPEN SPACE DESIGN

Greening strategies in compact cities

Cynthia Echave

Urban Ecology Agency of Barcelona

Milan, 6th February 2017

Green & blue infrastructure

CESTRIA (VVLGO) CHESTER, ANGLIÆ CIVITAS.



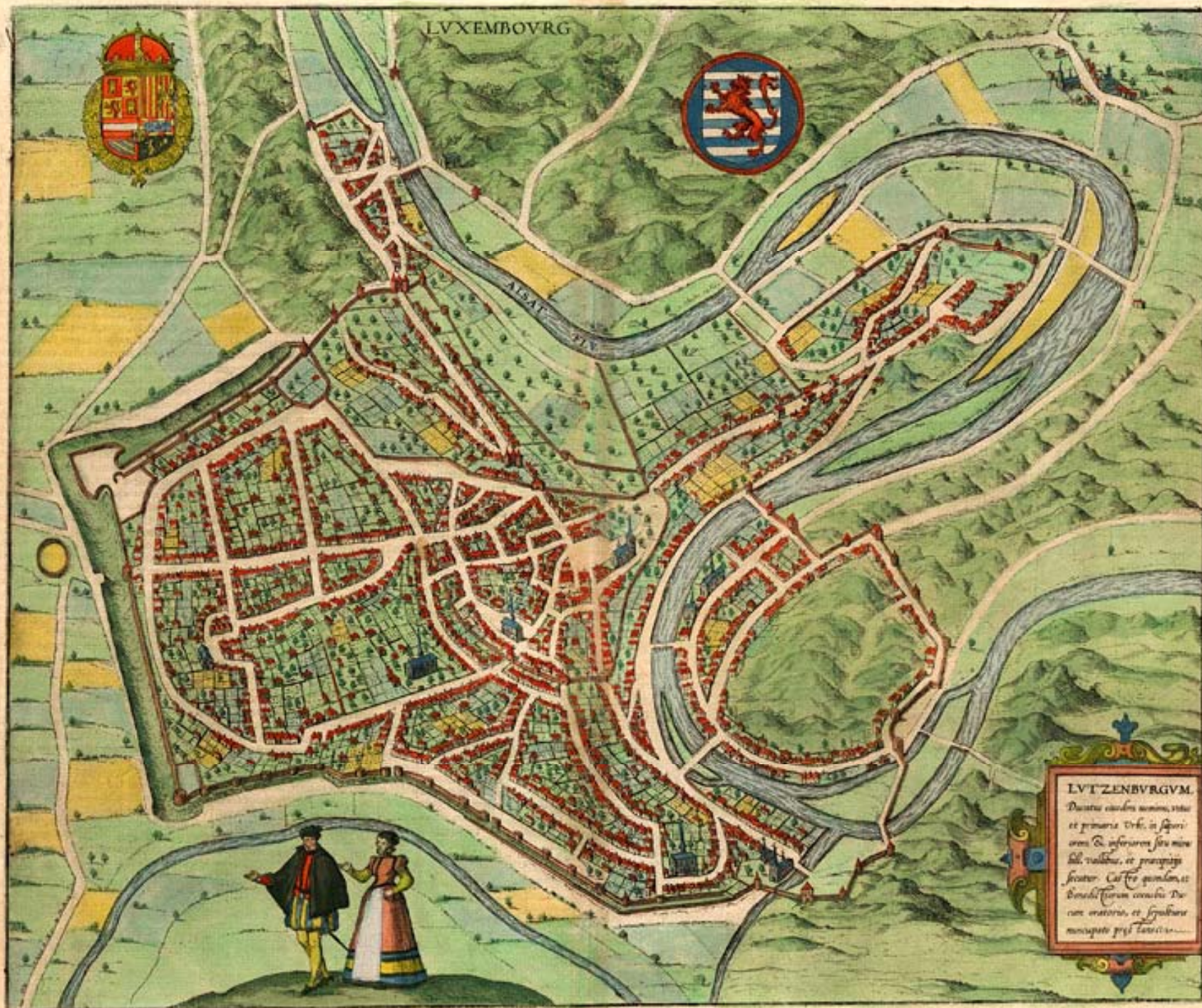
- Index*
1. S. Werbor ecclesia
 2. Aula Cnactis
 3. Domus Episcopi
 4. Domus Ducum
 5. Turris frumentaria
 6. Turris septentrionalis
 7. S. Petrus
 8. S. Petrus ad cruce alt.
 9. S. Trinitas
 10. Porta ad Orientem
 11. S. Iohanna
 12. Porta ad aquam
 13. Domus fratrum milite
 14. S. Martini
 15. S. Brigida
 16. S. Michael
 17. S. Maria super millia
 18. S. Olava
 19. Porta ad portum
 20. Castellum Episcopi
 21. Suburbia vetera
 22. Porta nova
 23. Pons
 24. Turris nova

Luffus Comes
 1199 anno 1199
 Hugo Comes
 1199 anno 1199
 Richardus Comes
 1199 anno 1199
 Hugo Comes
 1199 anno 1199
 Ramphus comes
 1232 anno 1232
 Lobartus comes
 1232 anno 1232
 Sotus Cestrie Comes
 1232 anno 1232

Hoc flumen Dea dicitur Angliam et Walliam
 oritur in Wallia septentrionali & cursu suo
 tendit in lacu Tequam proprie vocatum
 Quo in lacu quidam piscis est genus quod haud
 unquam flumen enarat neq. Salmones quibus
 flumen abundat, veniat in Lacum praedictum.



Baetus
 1575

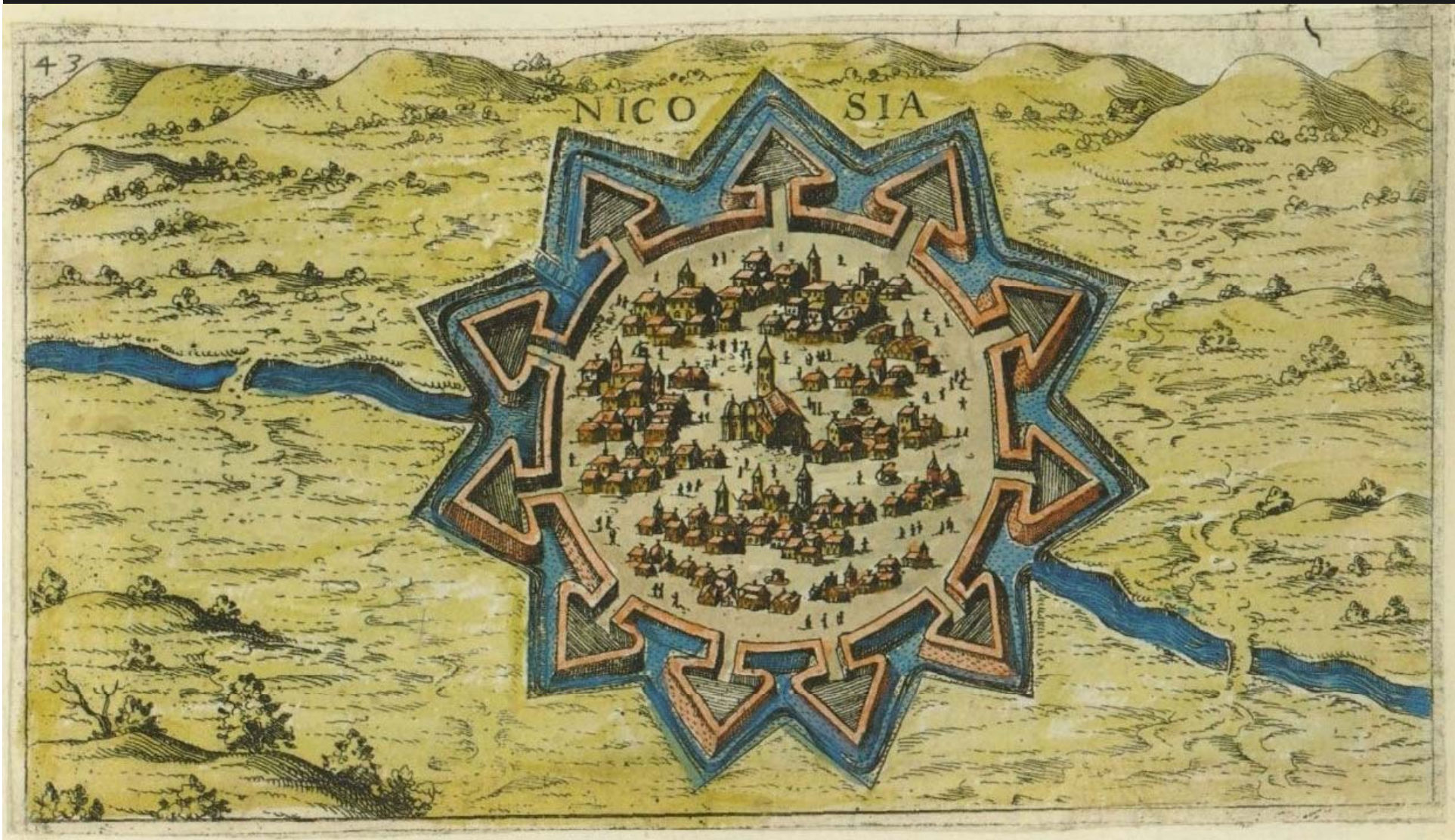


LUXEMBOVRG

ALSAT

LVTZENBURGVM.

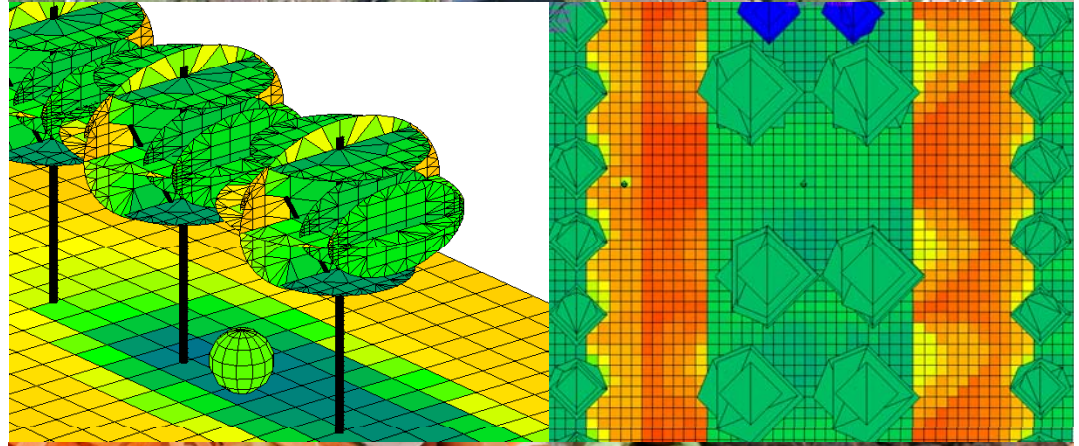
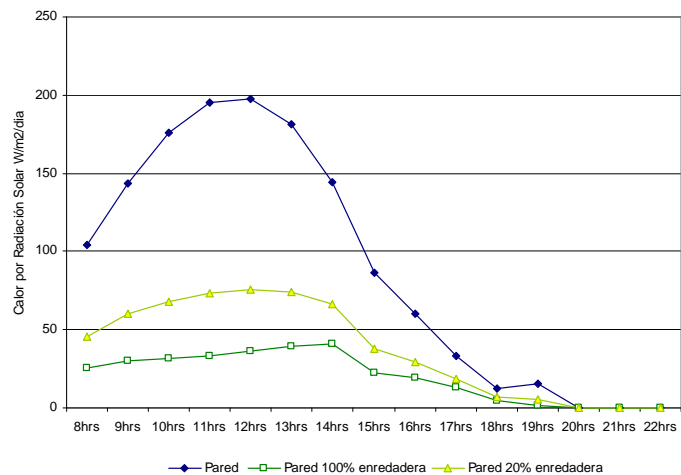
Ducatus casalis nominis, vnde
et prima Urbs, in fiqui
omni de inferiori seu mra
hll. vallibus, et principijs
hinc. Cuius quibus, et
bonis hinc cancha De
con oratoris, et fratribus
nuncupato pps latetis.



Green & blue

Sustainable urban metabolism

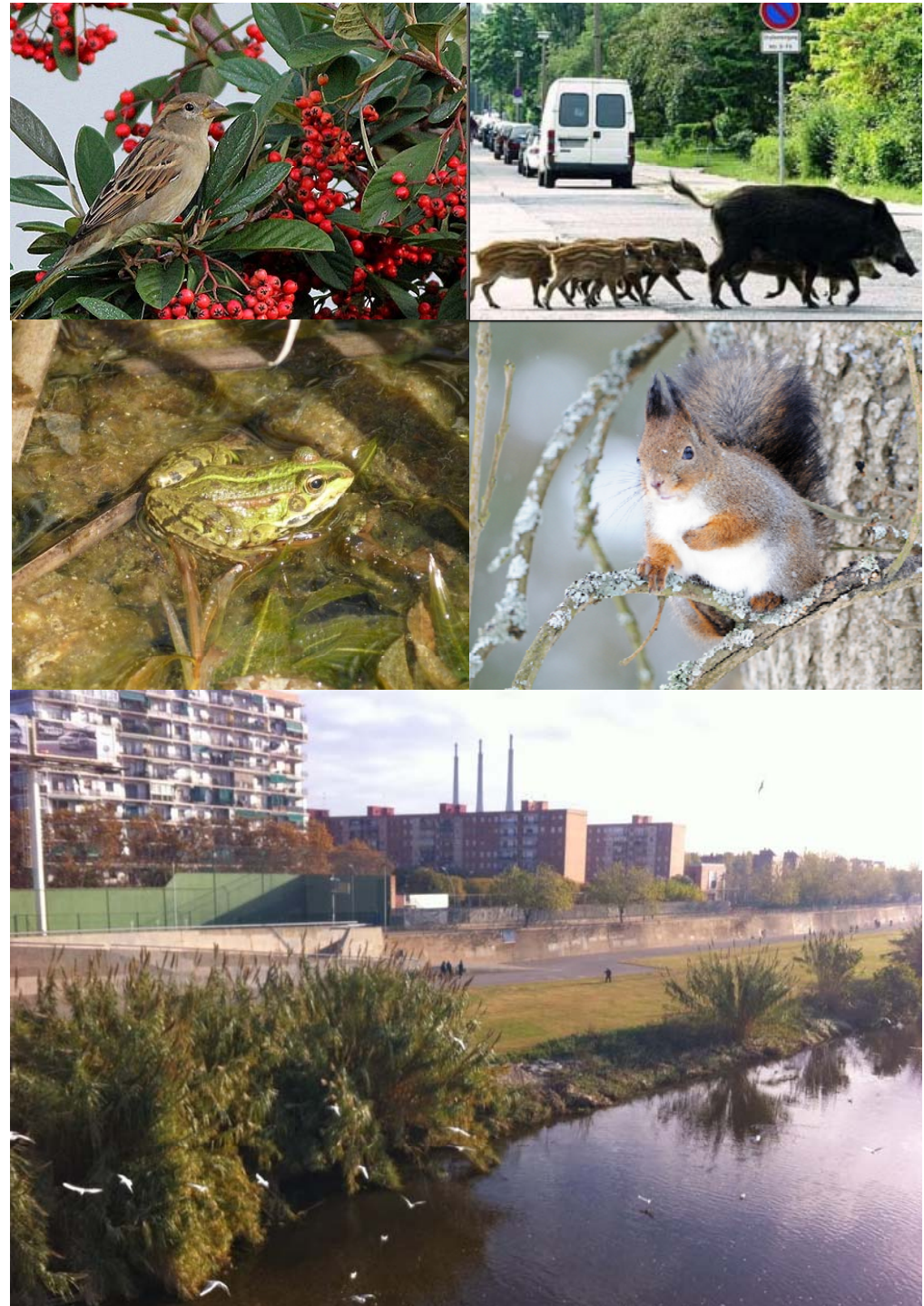
- Run-off control - water cycle
- Energy savings - UHI mitigation
- Carbon sequestration
- Local productive areas (gardening)
- Circular economy - organic cycle



Green & blue

Sustainable urban biodiversity

- Connected urban biotopes network
- Protection of vulnerable species
- Control of exotic species
- Protection of pollinating species



Green & blue

urban health and social cohesion

- Comfortable public spaces
(mitigation of noise, pollution & heat)
- Encourage relational spaces
- Community empowering



Green and blue means

Life

Biotope

Habitat

Biocenosis

Community



Area of uniform environmental conditions providing a living place (**habitat**) for a specific assemblage of plants and animals .

Biotope

Habitat

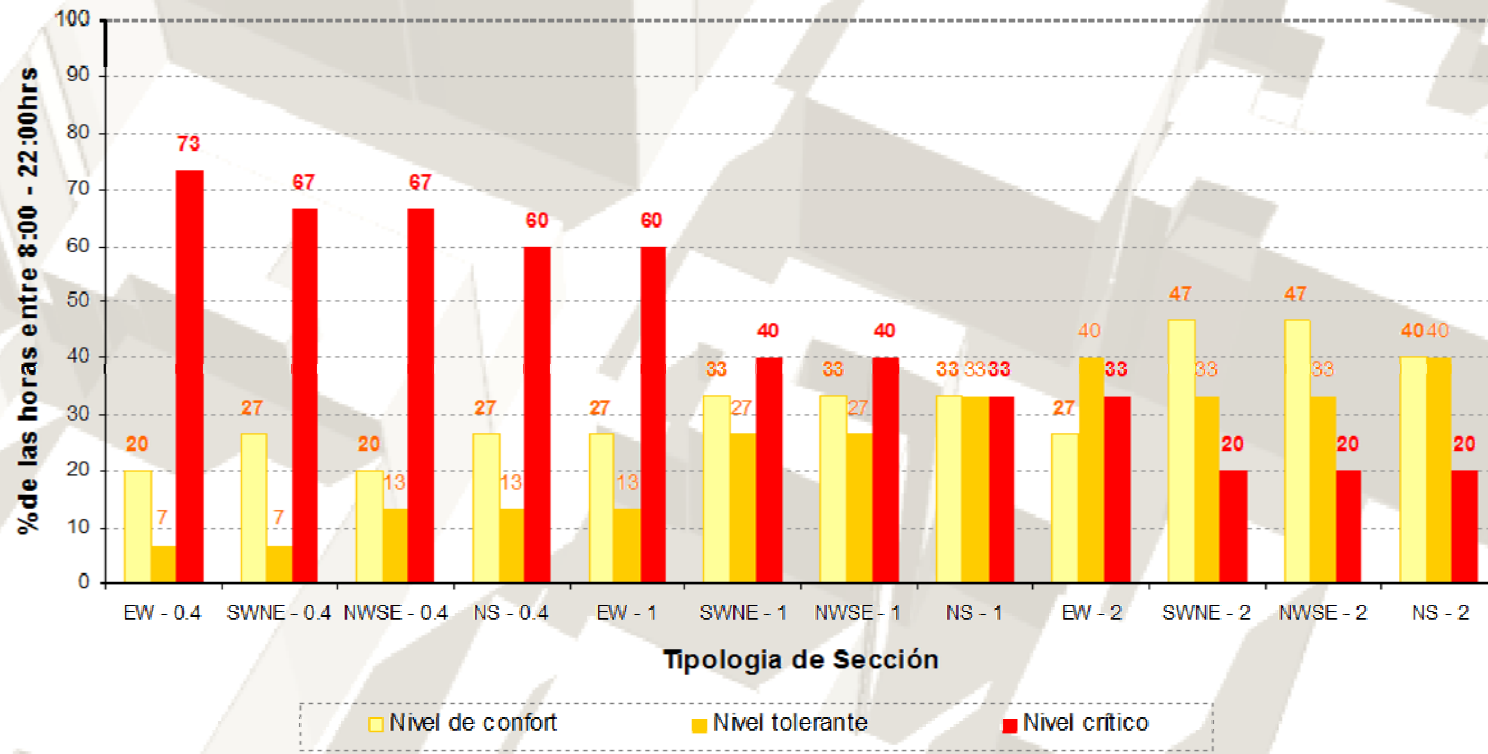
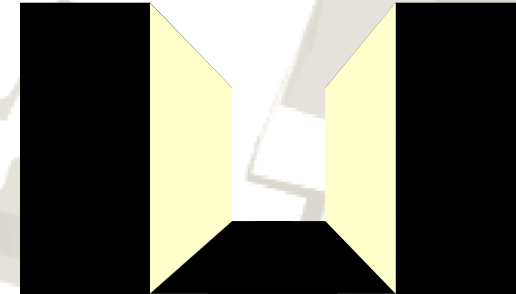
Biocenosis

Community



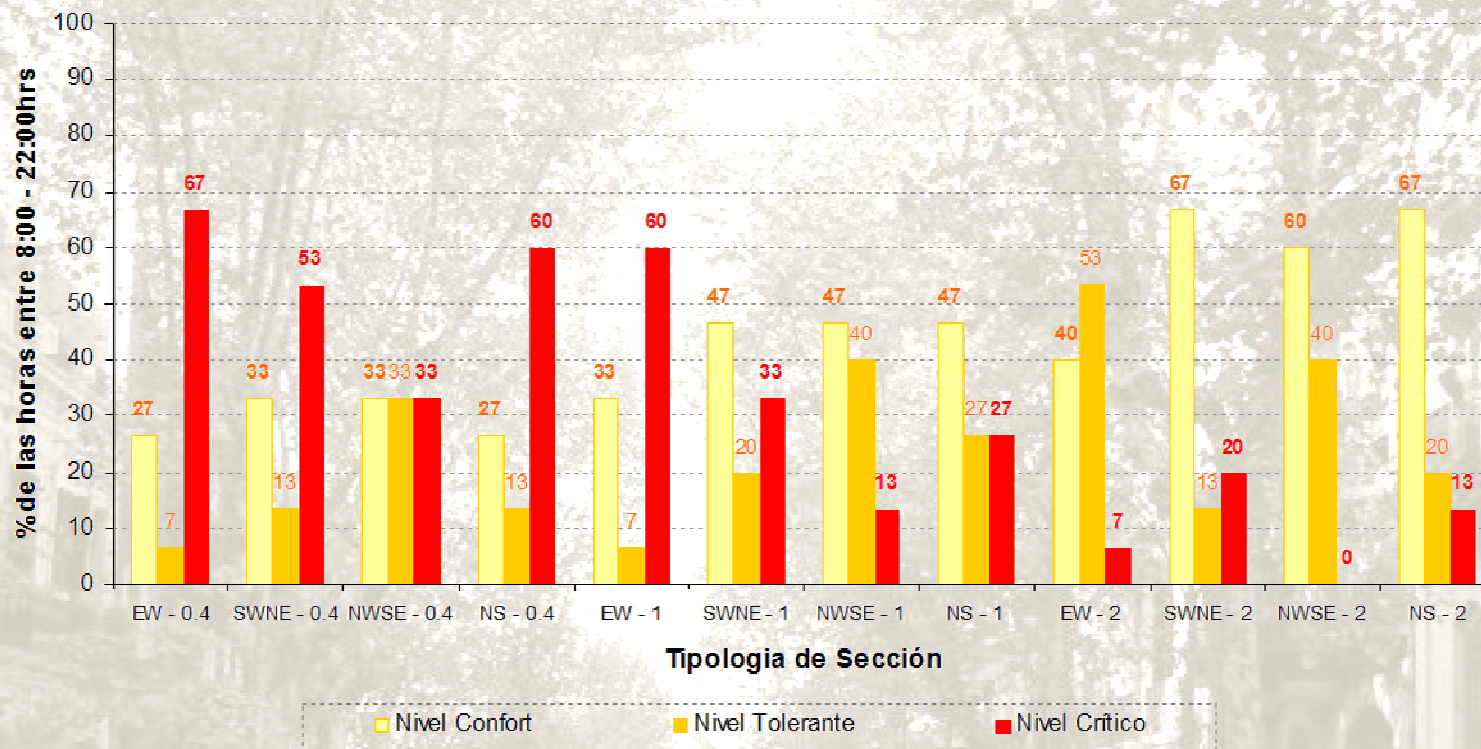
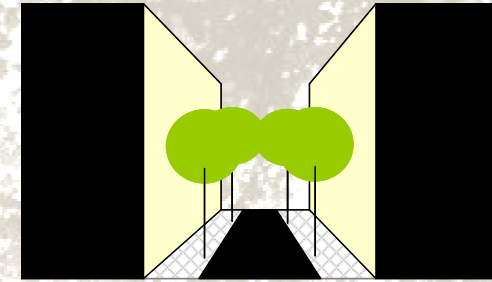
Area of uniform environmental conditions providing a living place (**habitat**) for a specific assemblage of plants and animals .

Urban canyon effect



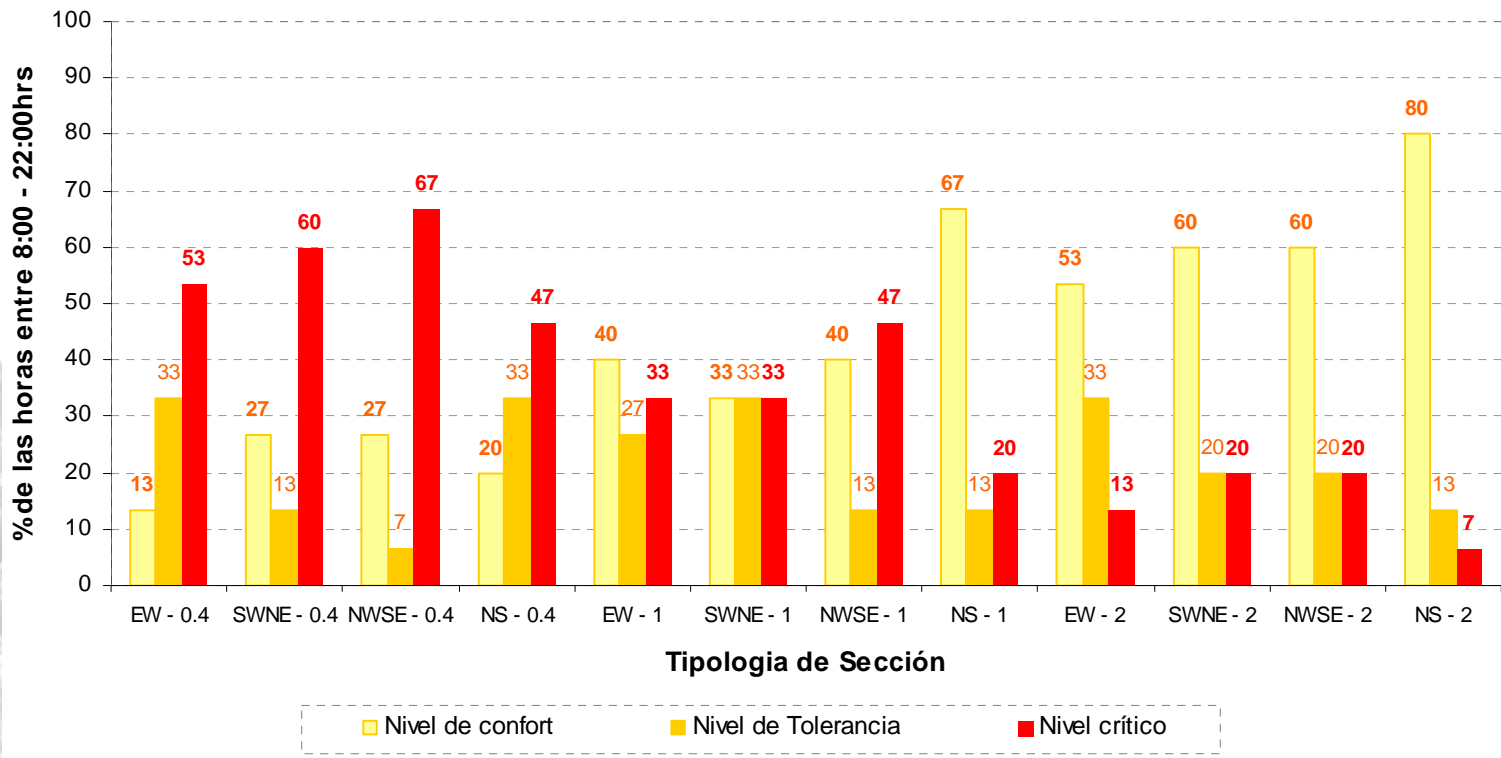
**% Thermal comfort potential hours per day
June (8h – 22h)
C. Echave 2007**

Trees effect



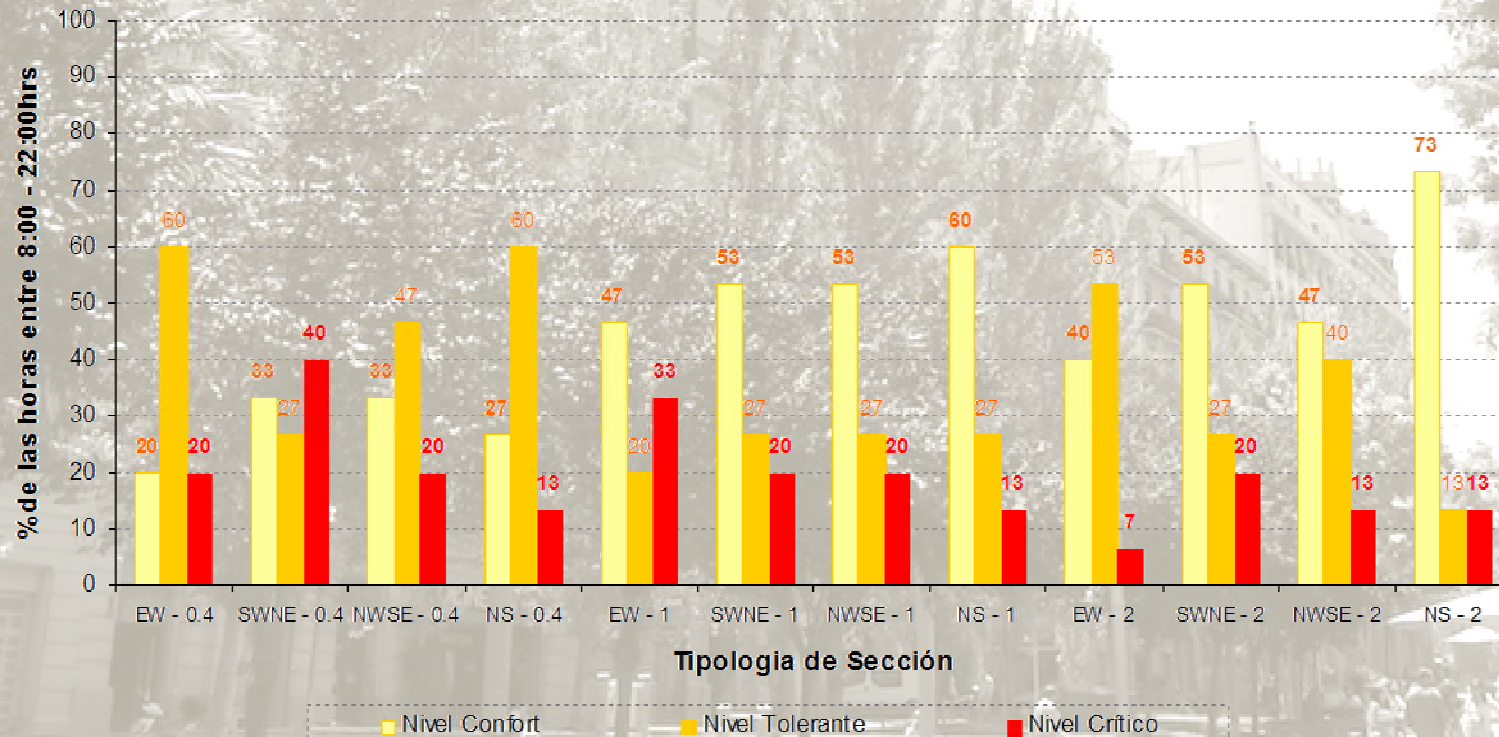
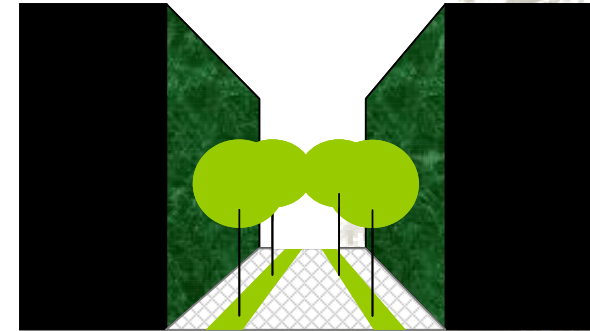
% Thermal comfort potential hours per day
 June (8h - 22h)
 C. Echave 2007

Green walls effect



% Thermal comfort potential hours per day
 June (8h – 22h)
 C. Echave 2007

Green corridors effect



% Thermal comfort potential hours per day
June (8h - 22h)
C. Echave 2007

Constraints of urban model

Sprawl city

- Monofunctional areas
- Extensive land use occupation
- Longer distances / car dependence
- Null public space
- Impacts on urban health and livability:
pollution, noise, urban heat island



Compact city

- Mix use areas
 - Critical mass (inhabitants + activities)
 - Proximity to services
 - Less car dependence and more feasibility of public transport systems
 - Dynamic public space
-
- Impacts on urban health and livability:
pollution, noise, urban heat island
 - Lack of space for greening

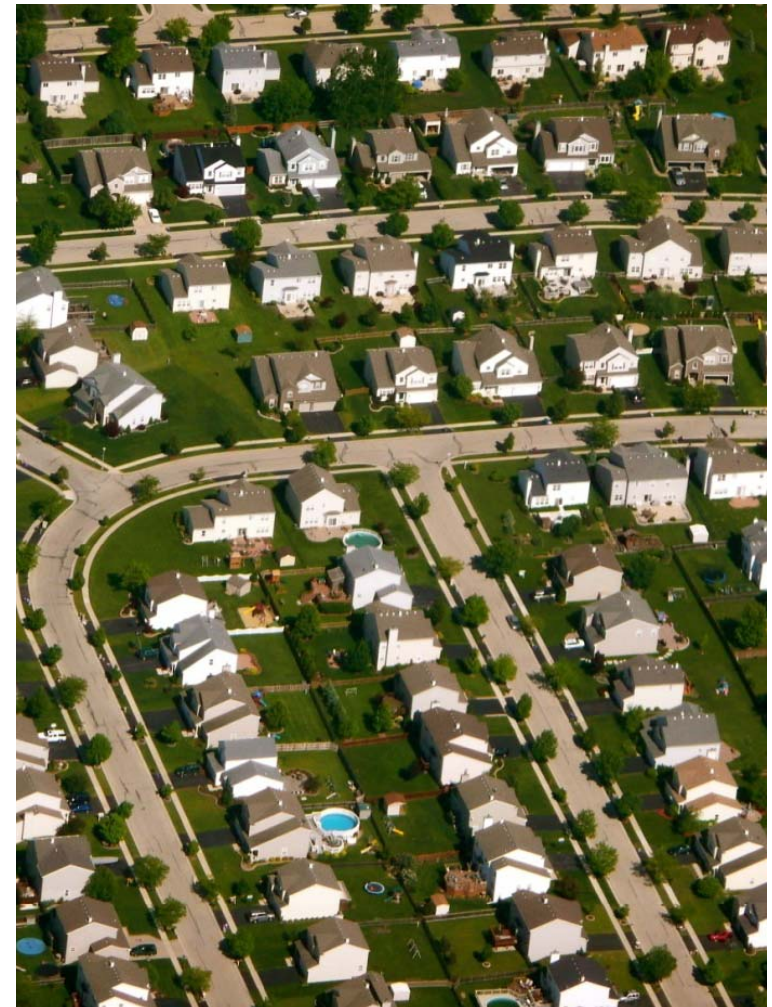
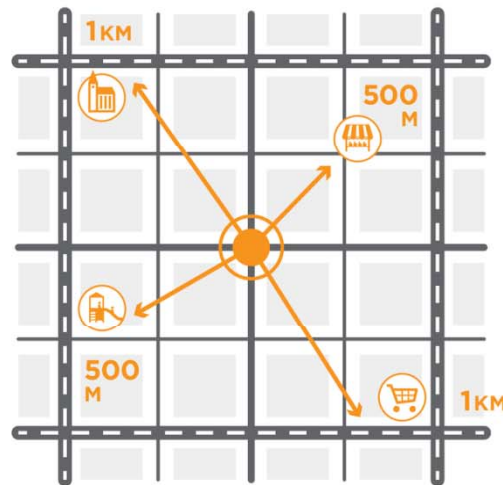
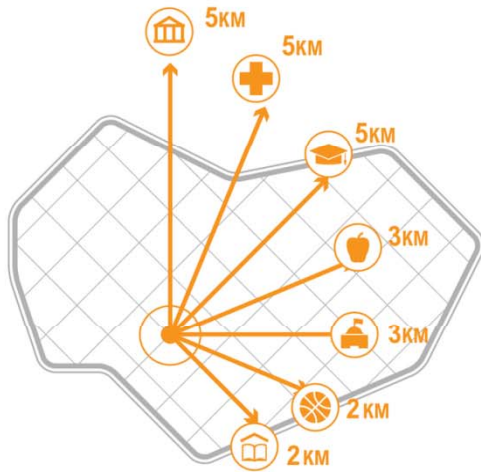


Urban lifestyle

Sprawled City

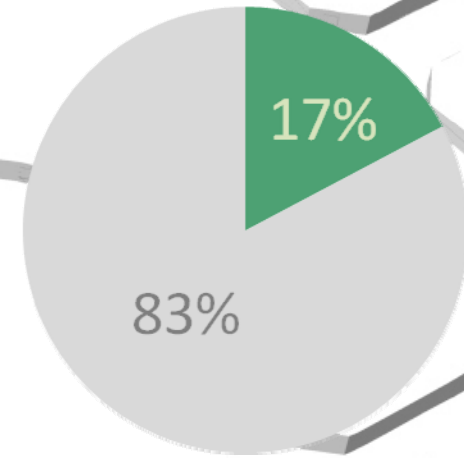
vs.

**Compact,
Connected City**



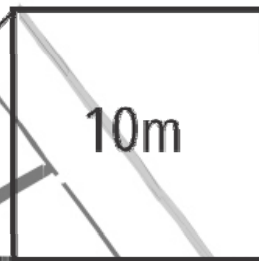
Density

Green space demands



10m²/inhab

h/d = 0,5



20 m

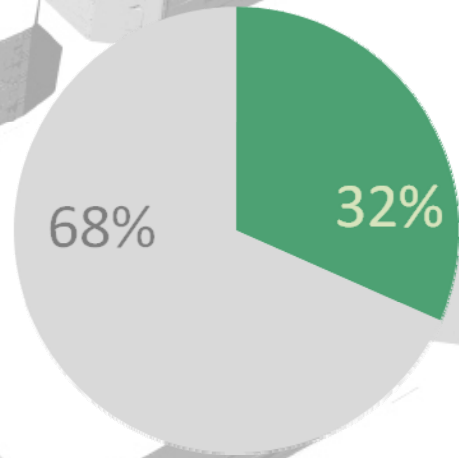


dwellings/ha
82



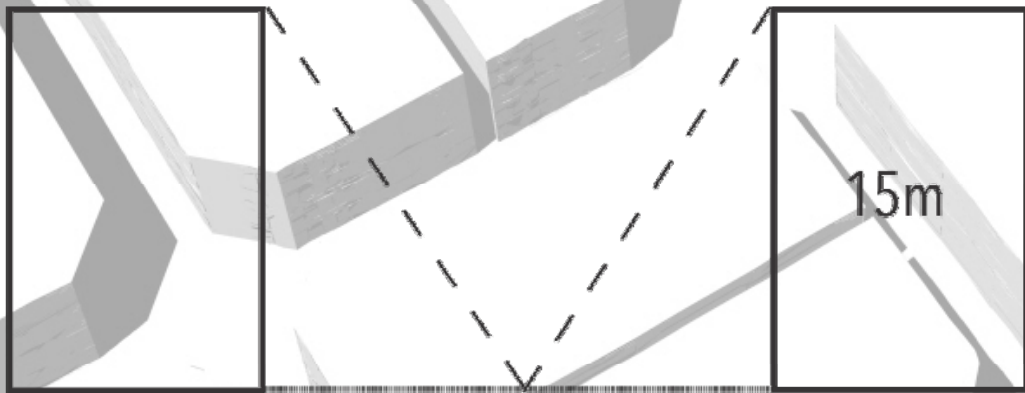
Density

Green space demands



10m²/inhab

h/d = 0,8



311,6
inhab/ha



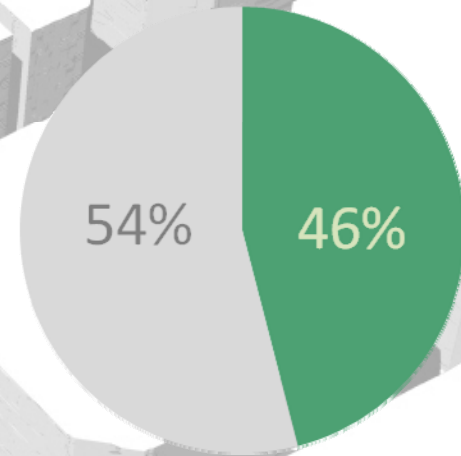
dwellings/ha

151



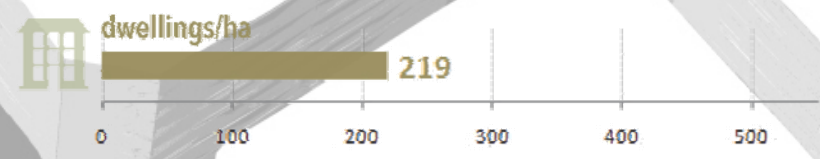
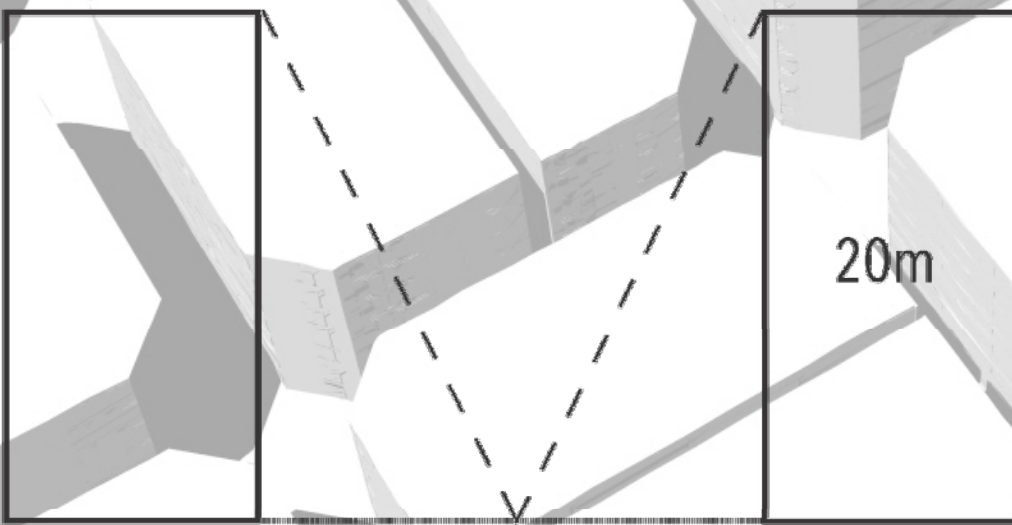
Density

Green space demands



10m²/inhab

h/d = 1,0



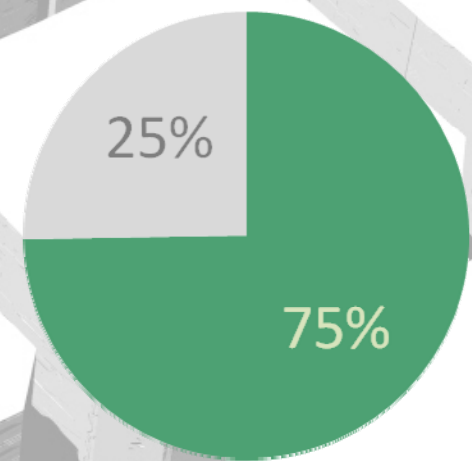
20 m

Density

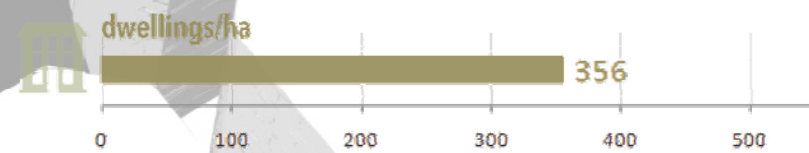
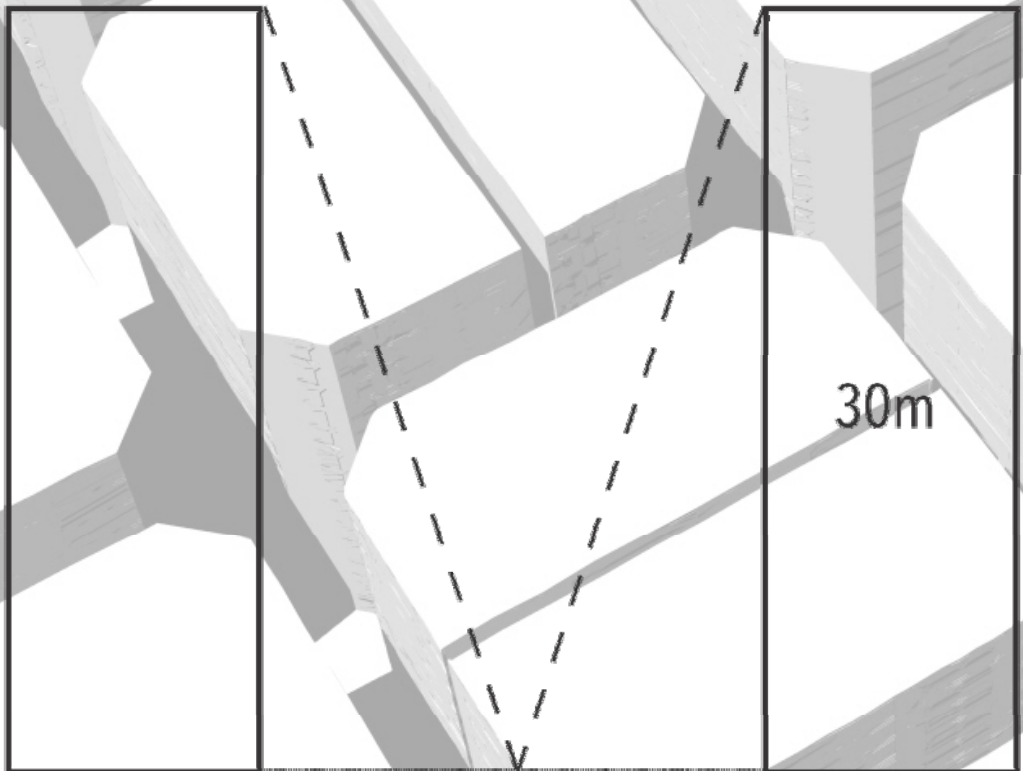
Green space demands



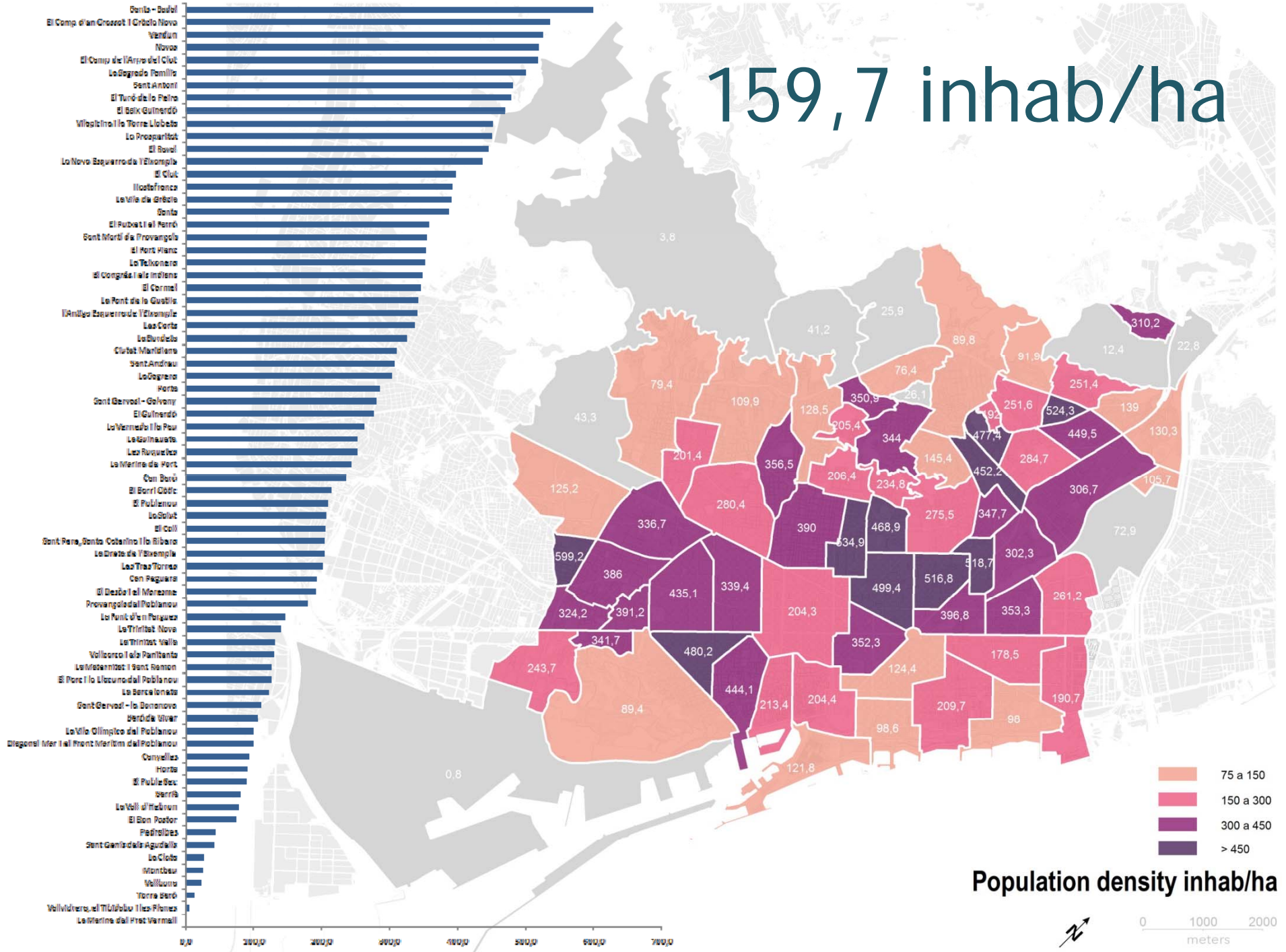
10m²/inhab



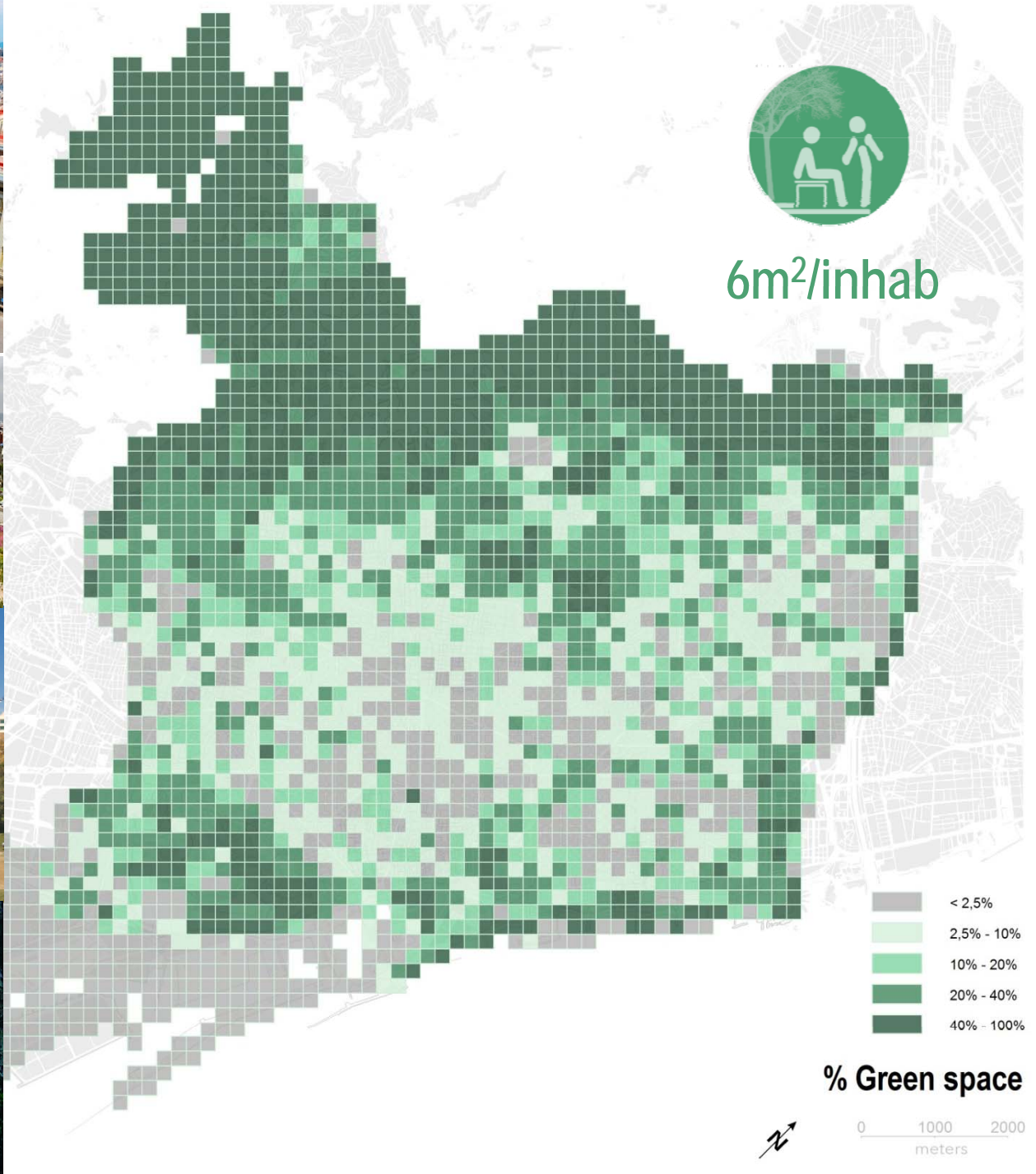
h/d = 1,5



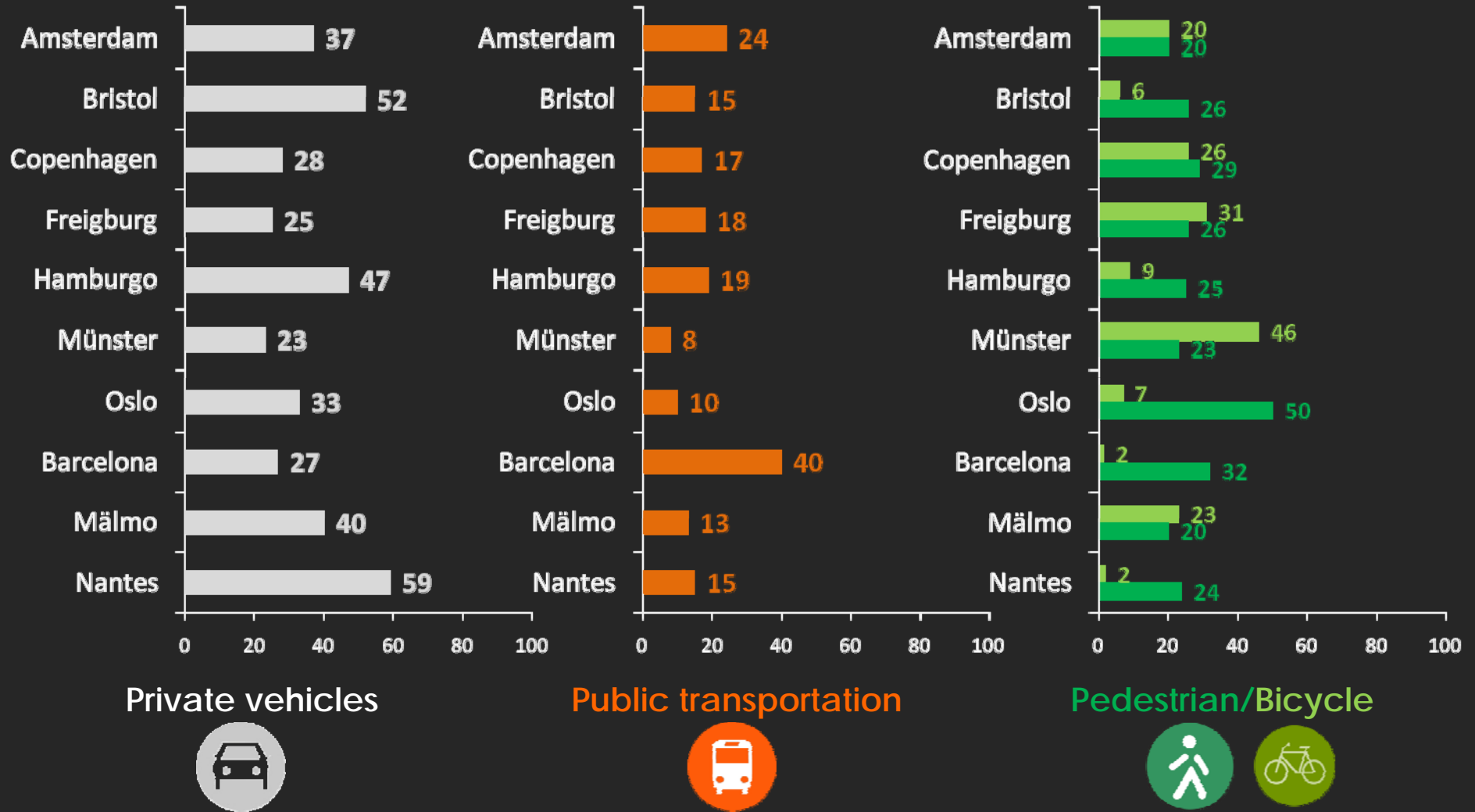
159,7 inhab/ha



Neighborhood	Population Density (inhab/ha)
Santa - Badal	600,0
El Camp d'an Crosset I Ordoño Nova	580,0
Vendun Nova	570,0
El Camp de l'Arred del Clot	560,0
La Sagrada Família	550,0
Sant Antoni	540,0
El Turó de la Peira	530,0
El Baix Guimeró	520,0
Miliciana I la Torre Llobeta	510,0
La Precipitació	500,0
El Boverí	490,0
La Nova Esquerxada I l'Exempça	480,0
El Clot	470,0
Ildefonso	460,0
La Vila de Grècia	450,0
Santa	440,0
El Pubell I el Ferró	430,0
Sant Martí de Provençals	420,0
El Fort Pienc	410,0
La Teixonera	400,0
El Congrés I els Indians	390,0
El Carmel	380,0
La Font de la Guàrdia	370,0
l'Antiga Esquerxada I l'Exempça	360,0
Las Cortes	350,0
La Dividida	340,0
Clutat Maresme	330,0
Sant Andreu	320,0
La Sagrada Família	310,0
Força	300,0
Sant Gervasi - Galvany	290,0
El Guimeró	280,0
La Vermeja I la Pau	270,0
Les Guineuades	260,0
Les Roquetes	250,0
La Marina de Port	240,0
Can Baró	230,0
El Borni Clot	220,0
El Poblenou	210,0
La Clota	200,0
El Coll	190,0
Sant Pere, Santa Caterina I la Ribera	180,0
La Creueta del Viver	170,0
Les Tres Torres	160,0
Can Peguera	150,0
El Desballe I el Monestir	140,0
Provençales del Poblenou	130,0
La Font d'en Fargues	120,0
La Trinitat Nova	110,0
La Trinitat Vella	100,0
Vallcarlos I els Penitents	90,0
La Mercaderia I Sant Ramon	80,0
El Parc I la Llacuna del Poblenou	70,0
La Barceloneta	60,0
Sant Gervasi - la Bonanova	50,0
Beridà Nova	40,0
La Vila Olímpica del Poblenou	30,0
Diagonal Mar I el Front Marítim del Poblenou	20,0
Conxelles	10,0
Força	5,0
El Poble Sec	2,0
Serra	1,0
La Vall d'Hebron	0,8
El Bon Pastor	0,5
Pedrols	0,2
Sant Gaudadi Agudall	0,1
La Clota	0,1
Montbau	0,1
Vallcarlos	0,1
Torre Baró	0,1
Vallvidrera, el Tibidabo I les Planes	0,1
La Marina del Prat Vermell	0,1



Mobility model



Pollution vs urban health



Air pollution (exterior) causes
premature deaths per year

27.000 – Spain

3.700.000 - World

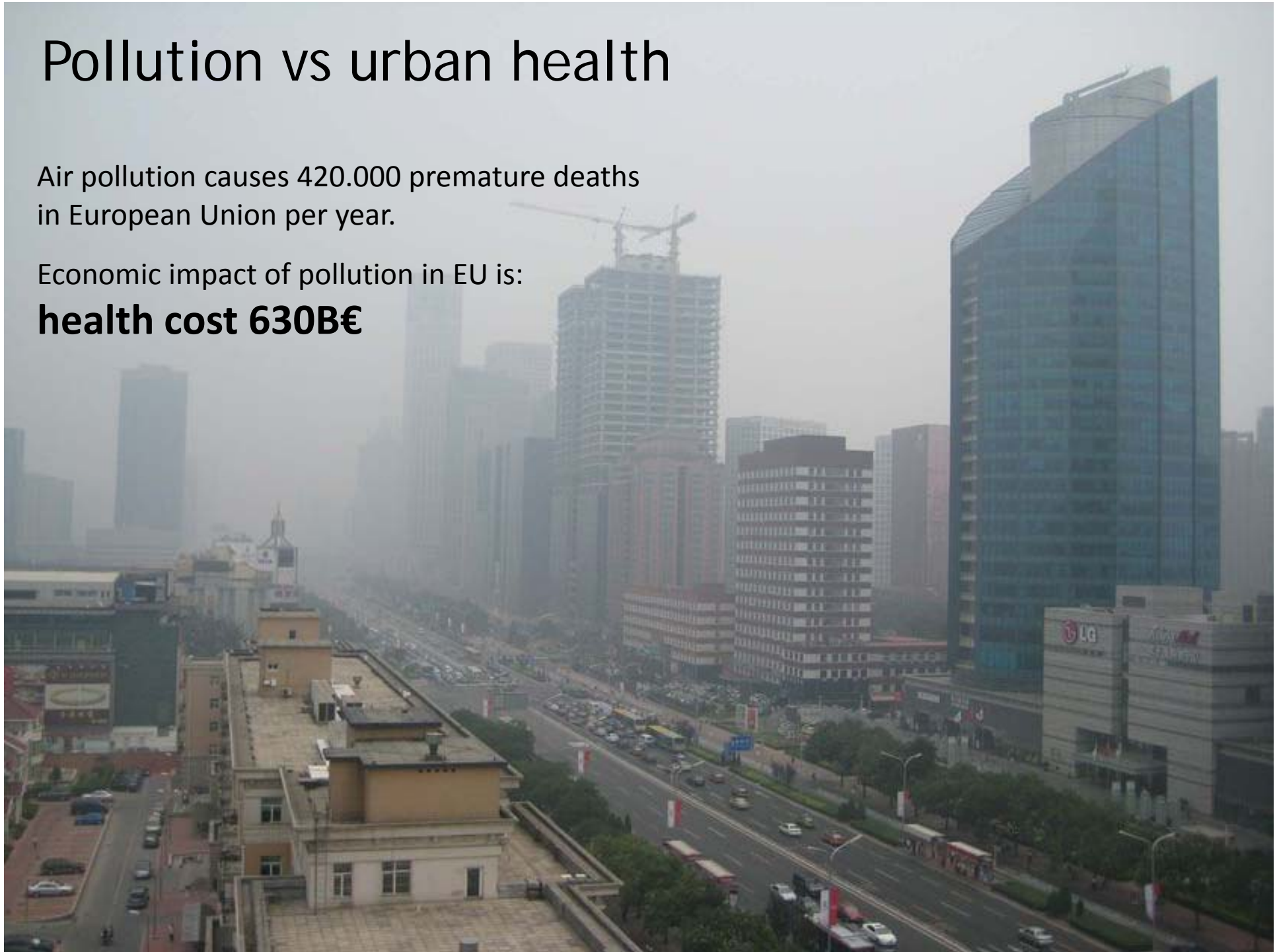
(2015)

Pollution vs urban health

Air pollution causes 420.000 premature deaths in European Union per year.

Economic impact of pollution in EU is:

health cost 630B€

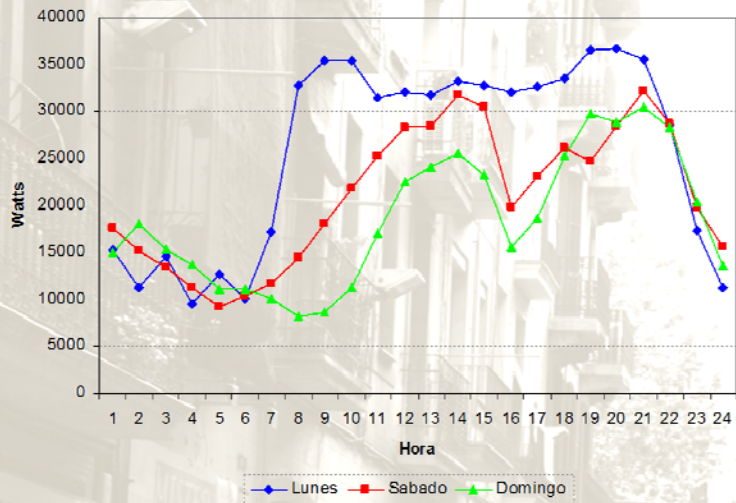


Urban heat island impacts

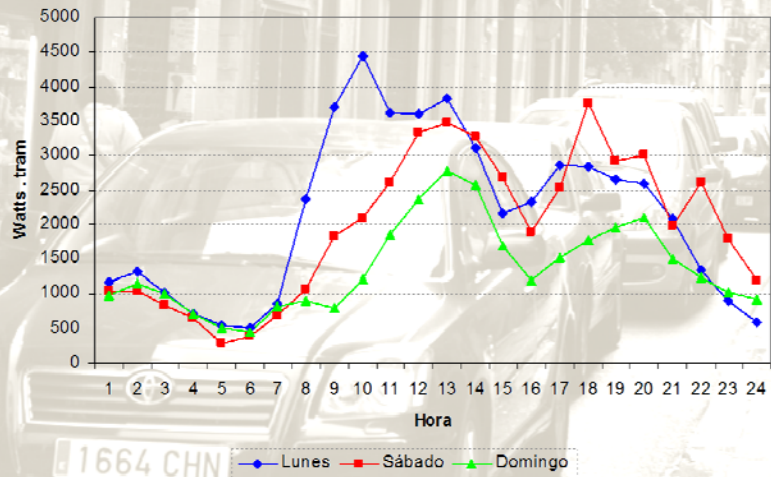
- 01 Increased energy consumption
- 02 Human health (thermal & ozone)
- 03 Biodiversity affections



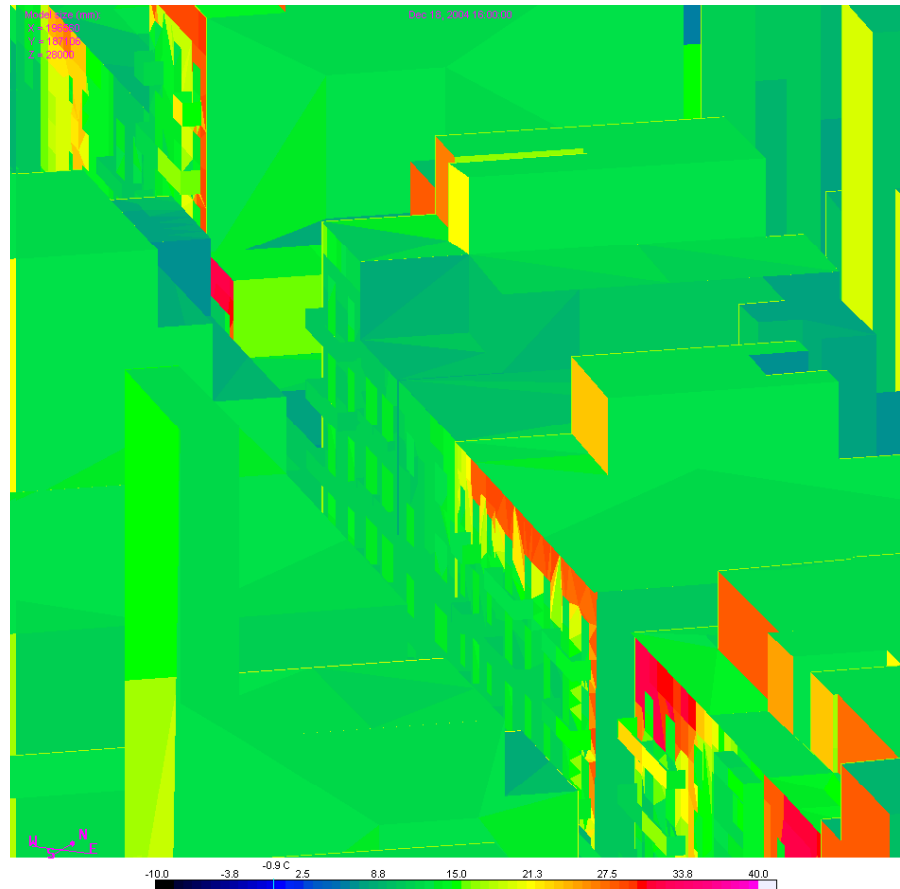
Traffic street -(C/Aragó)

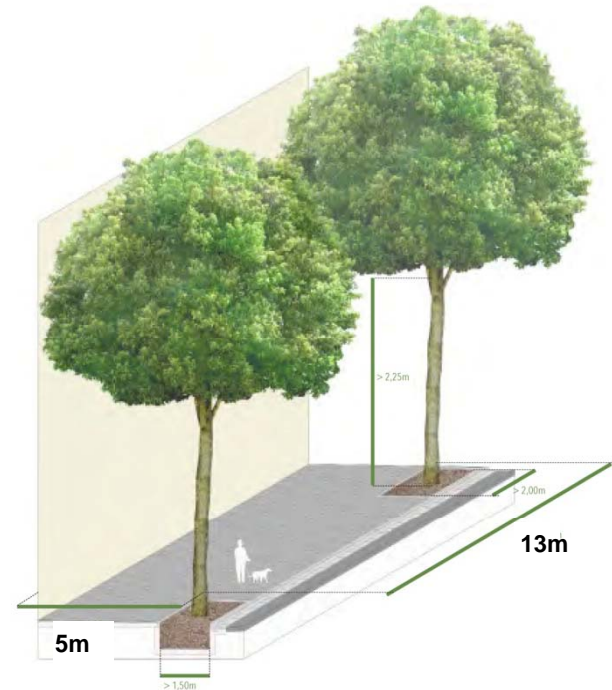
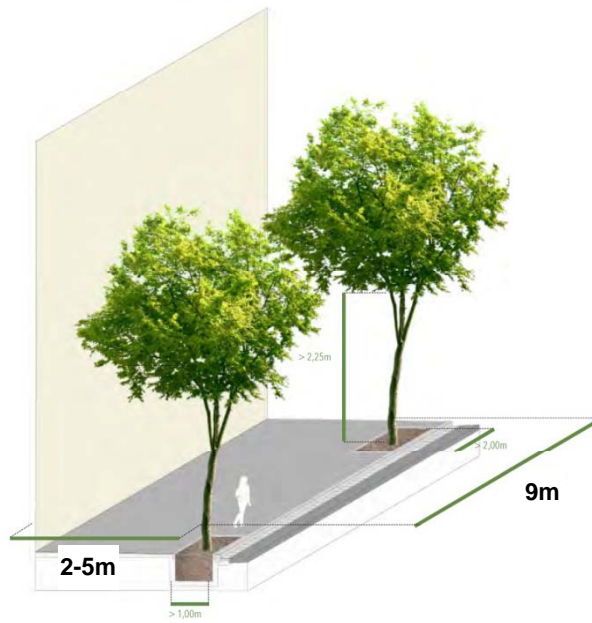
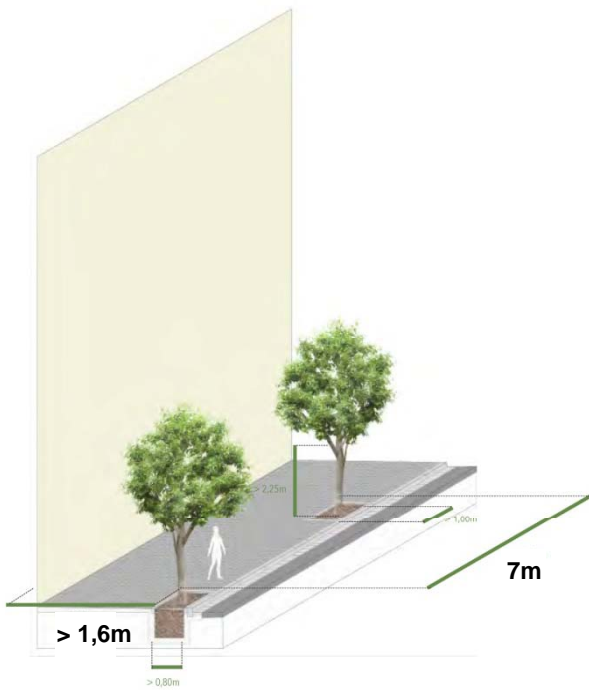


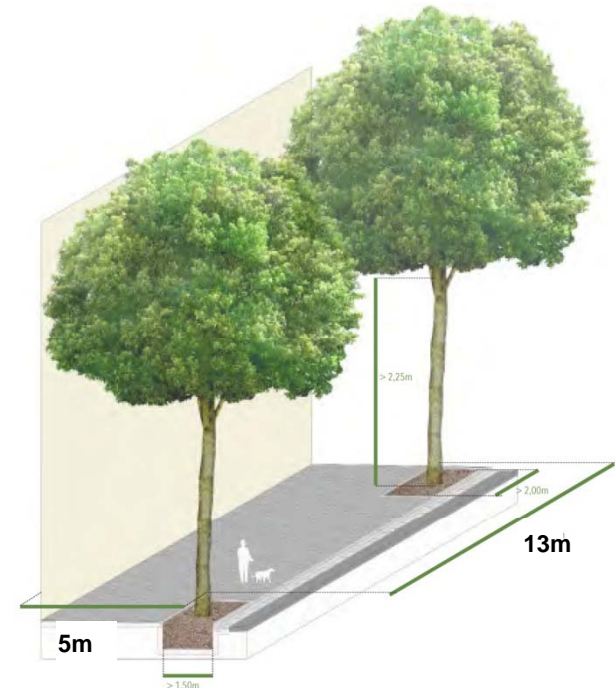
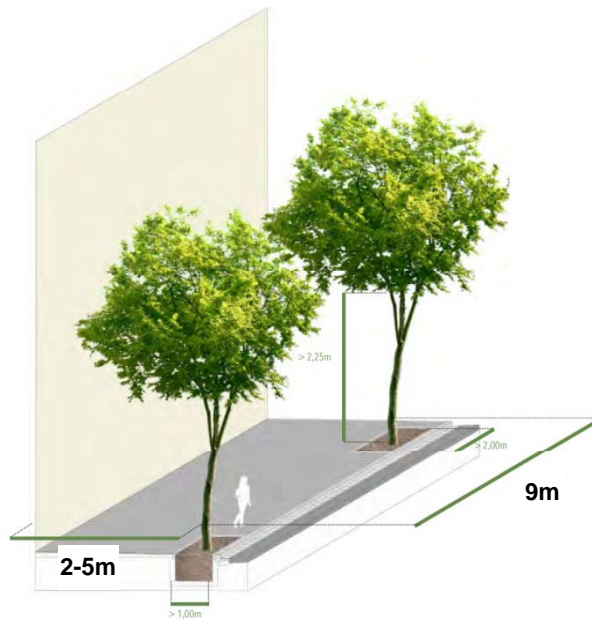
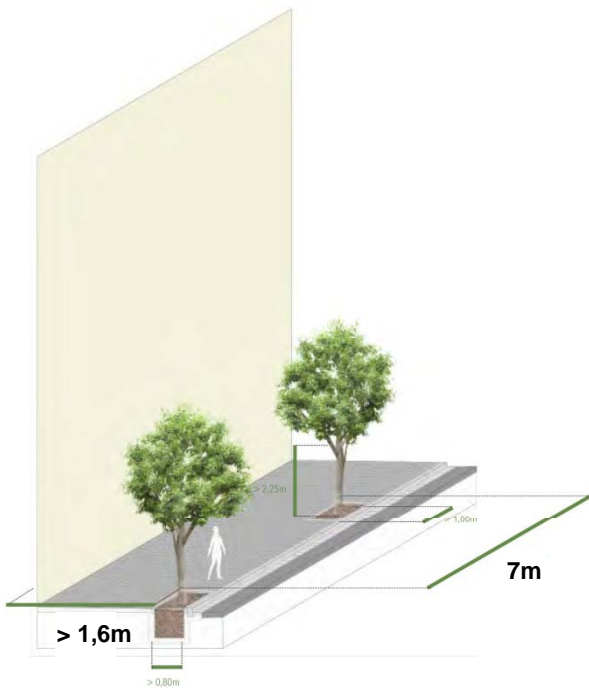
Urban Green Corridor - (Passeig de St. Joan)



Source: Agencia de Ecología Urbana de Barcelona

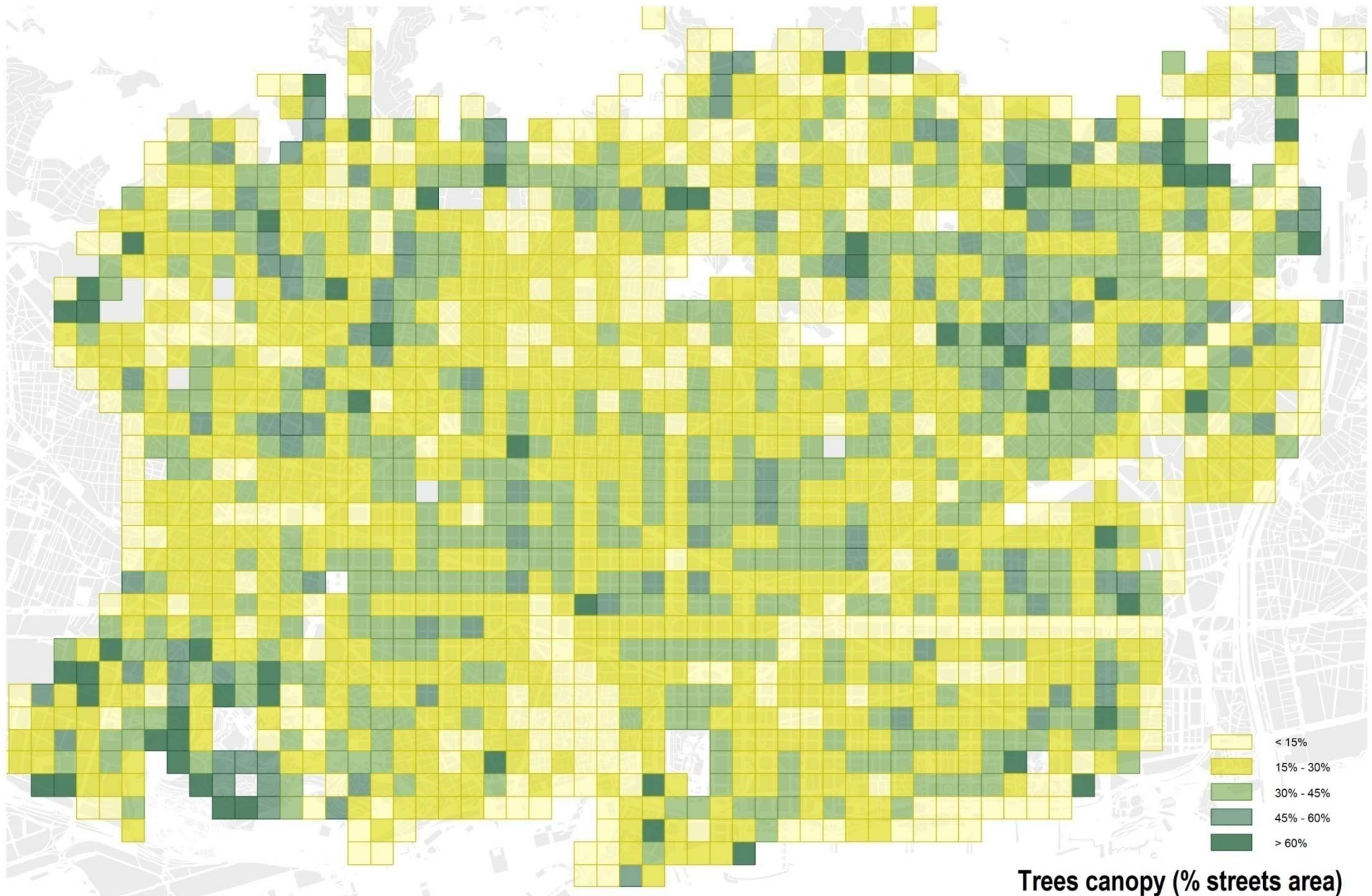






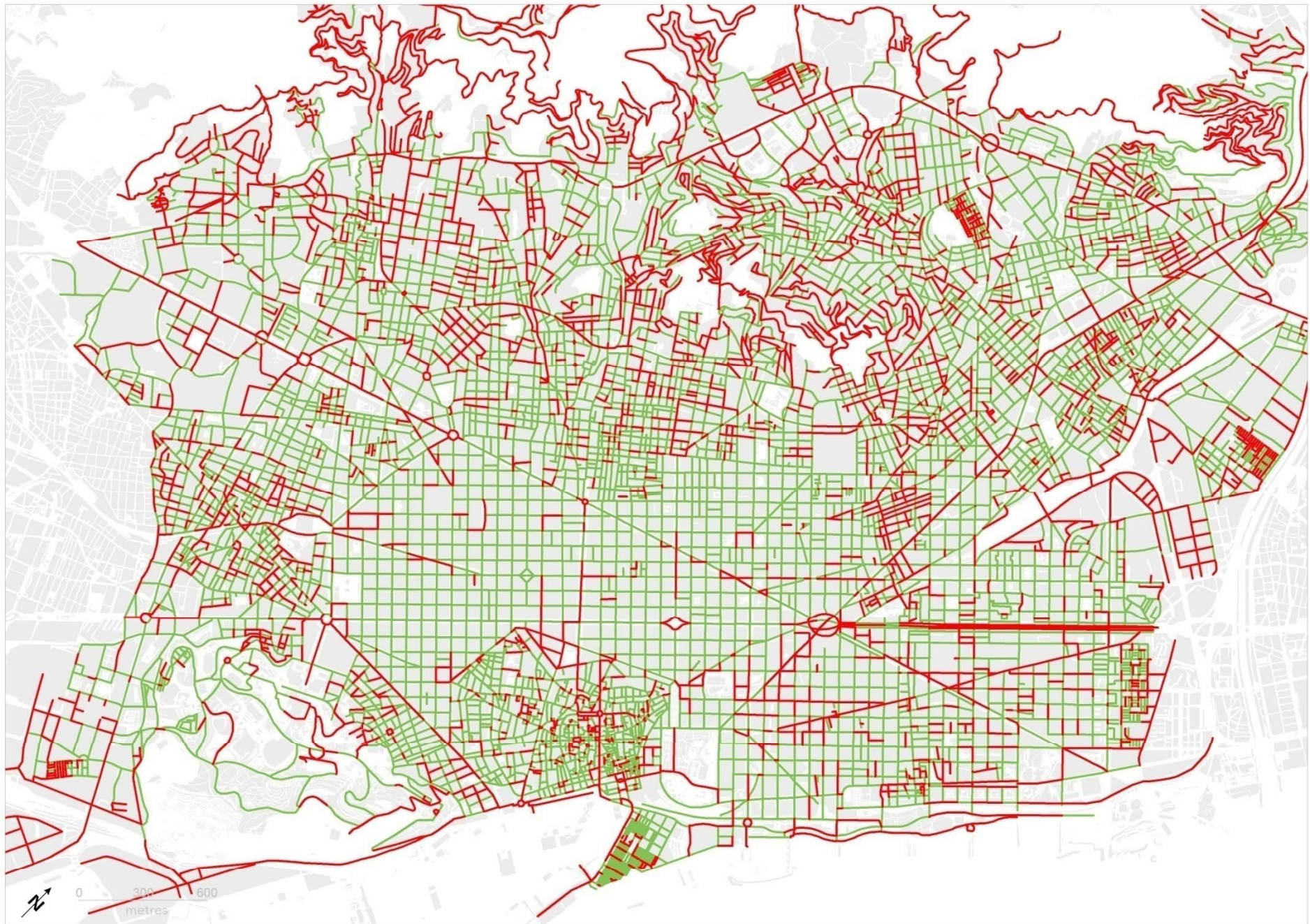


<http://climate-adapt.eea.europa.eu/metadata/case-studies/barcelona-trees-tempering-the-mediterranean-city-climate/11302624.pdf>



Trees canopy (% streets area)

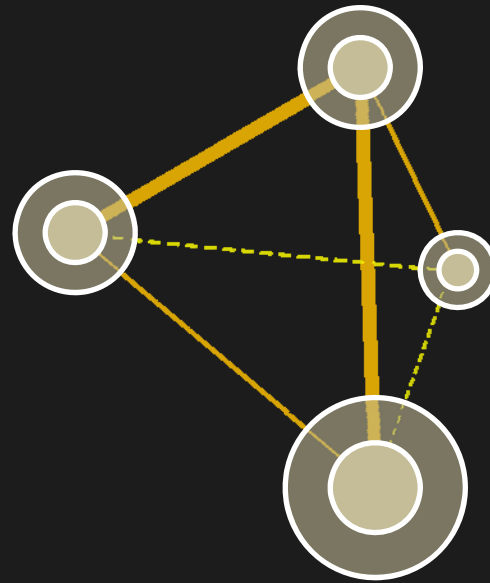




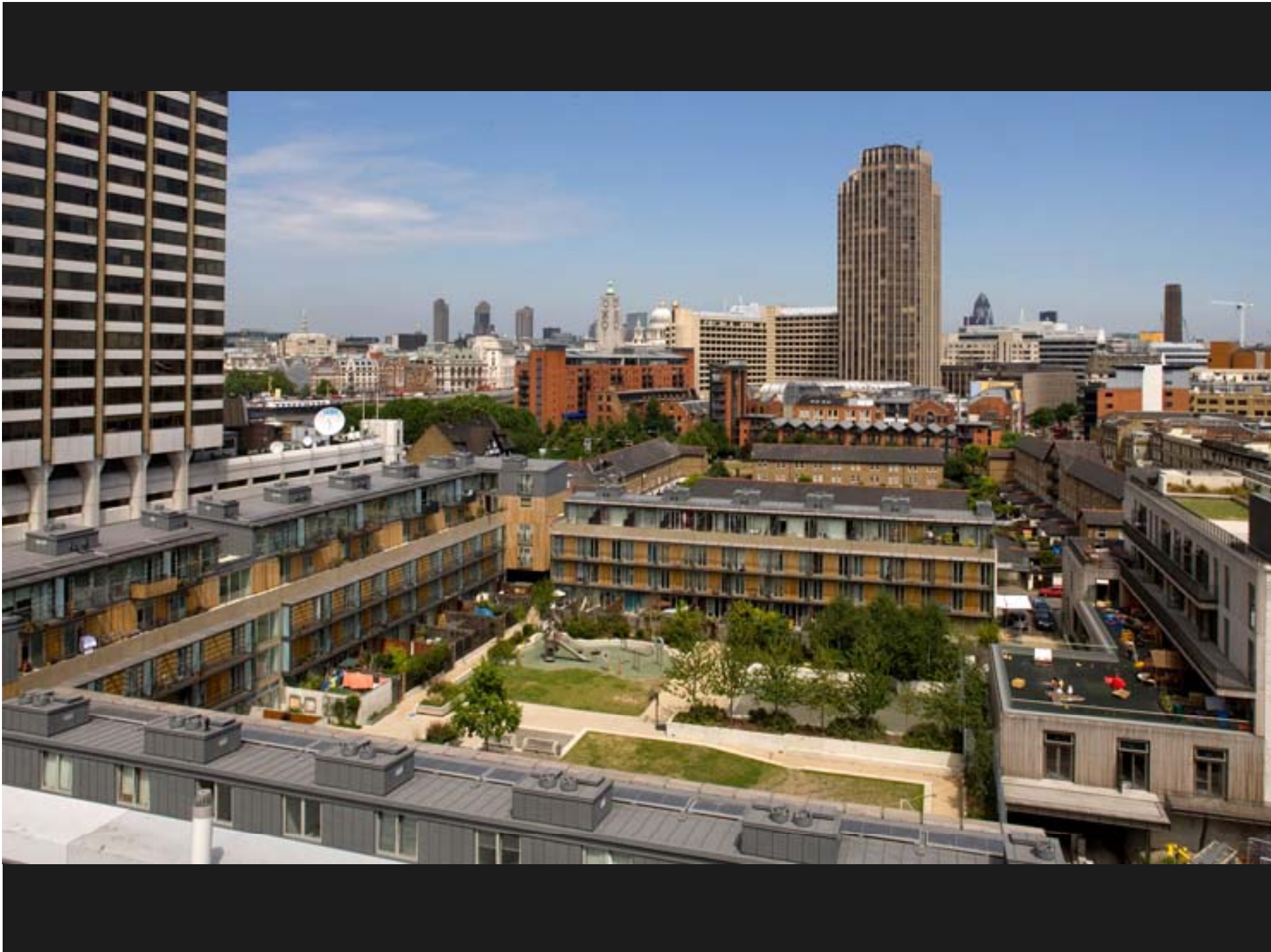
Solar radiation obstruction

— Streets with enough solar obstruction — Streets without enough solar obstruction

Biotopes network

















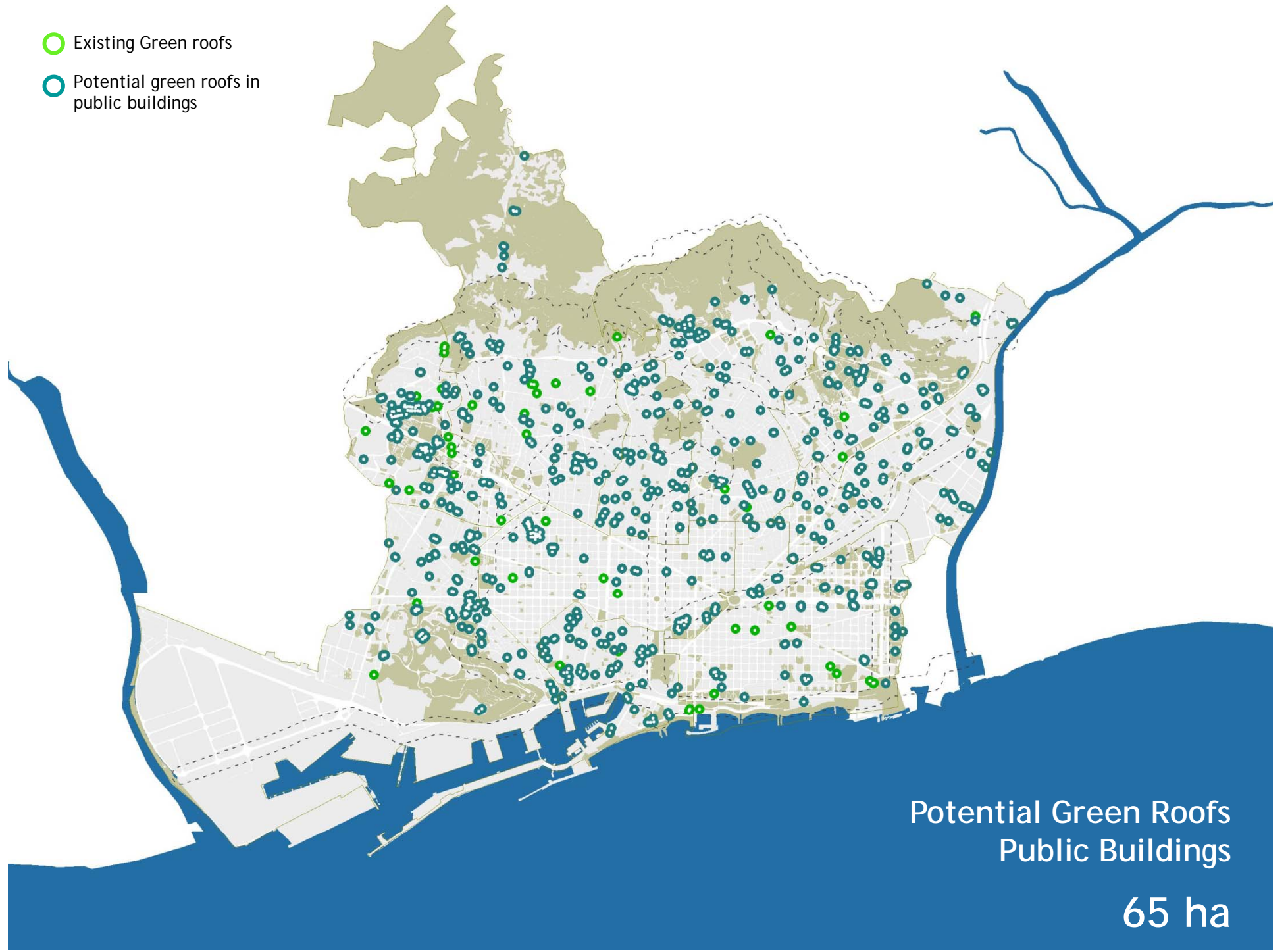




- 1 a 2 plantes d'alçada
- 3 a 5 plantes d'alçada
- 6 a 9 plantes d'alçada



- Existing Green roofs
- Potential green roofs in public buildings









Livability Index *(ecosystemic assessment)*

Ergonomical

DISPLACEMENT & MOVEMENT



Space distribution respect cars



Accessibility



Street proportion

Psychological

ATTRACTION PERCEPTION



Urban diversity



Attractive activities



Vegetation presence

Physiological

HEALTH & COMFORT



Acoustic comfort (dB)



Air quality (NOx)



Thermal comfort (W/m²)

Proximity

WALKING DAILY ACTIVITIES



Access to sustainable mobility networks



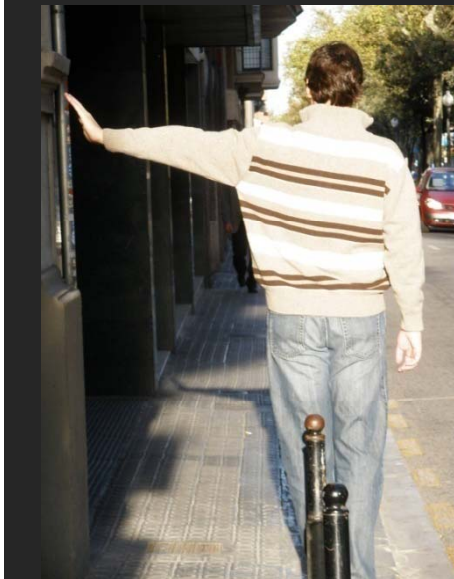
Daily supply



Public services

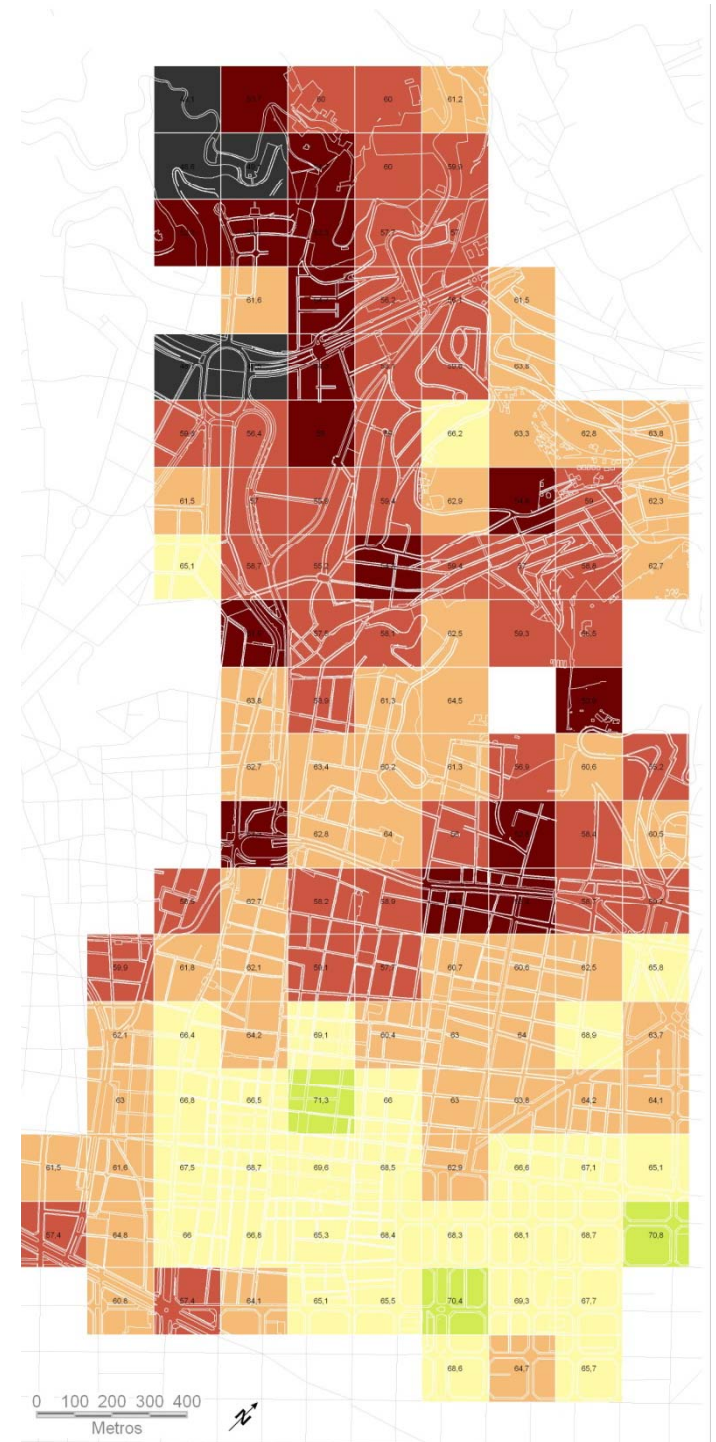
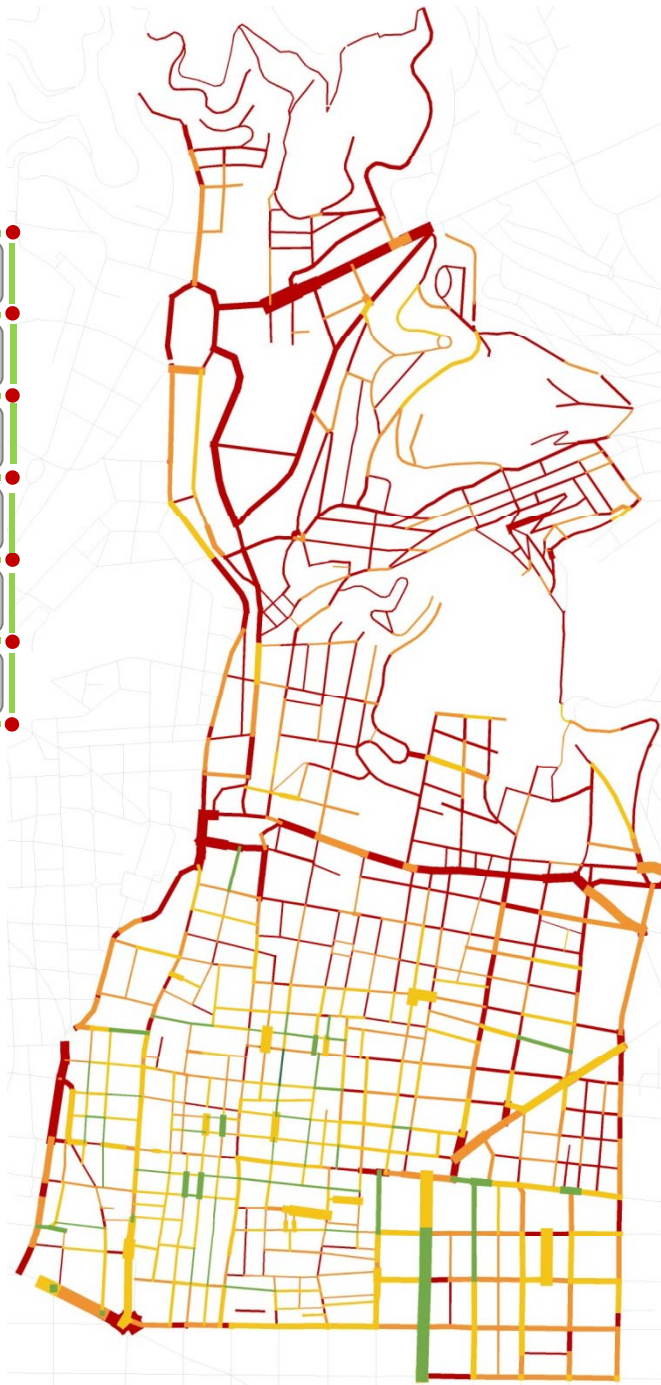
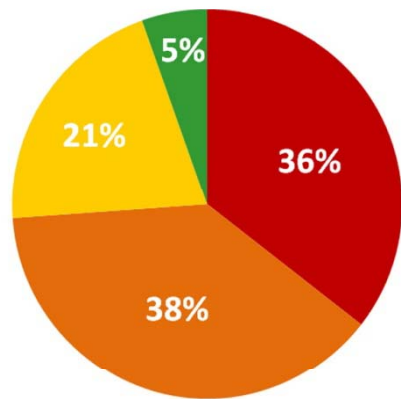
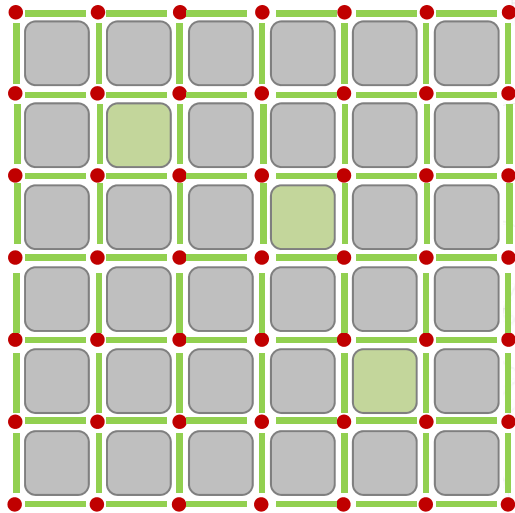


Public parks



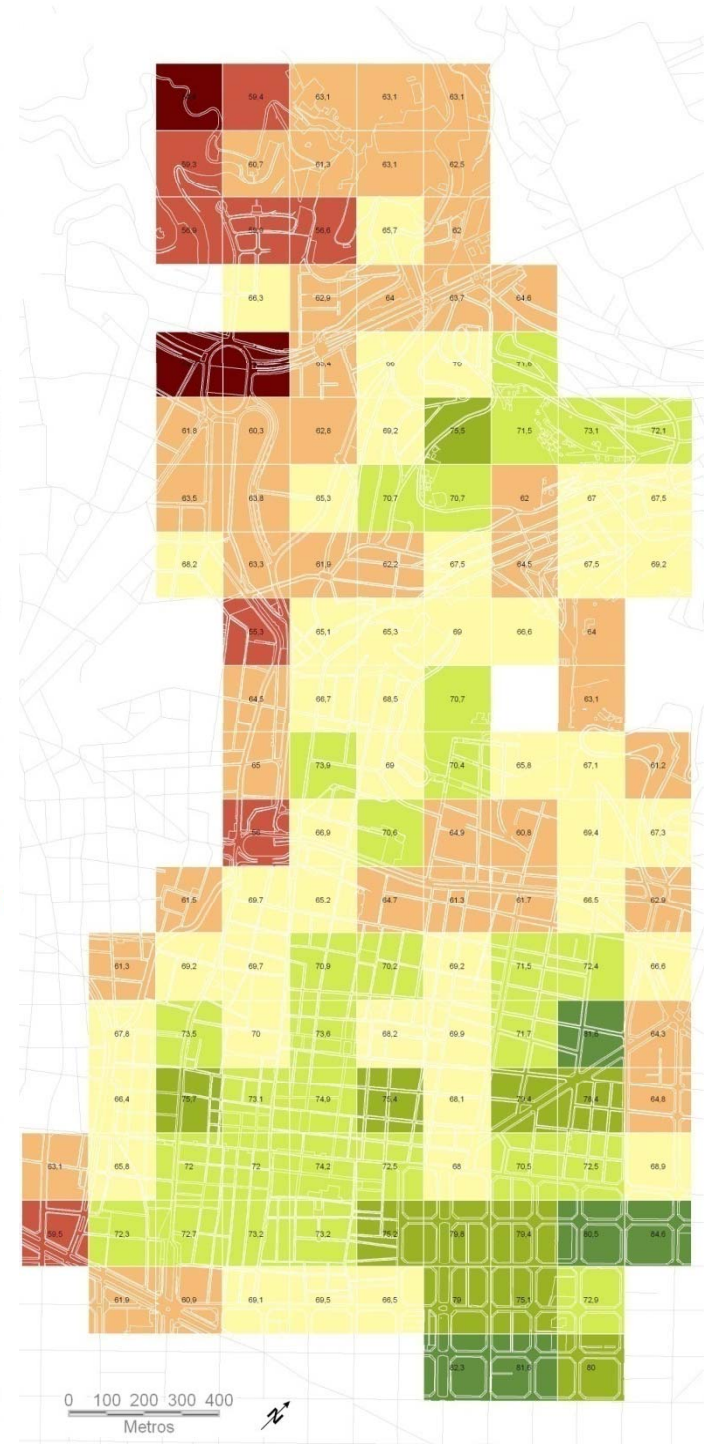
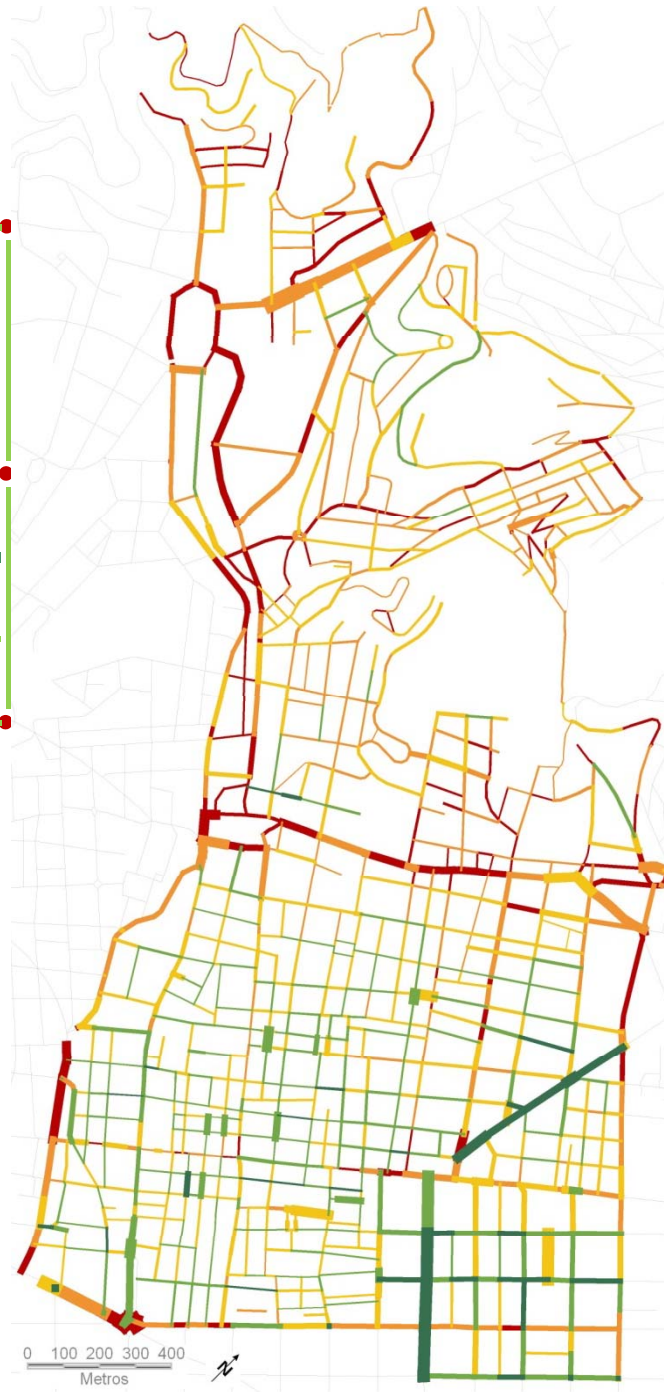
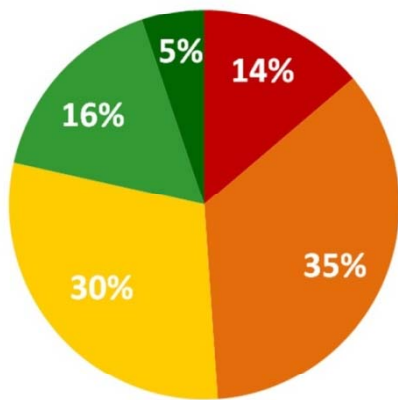
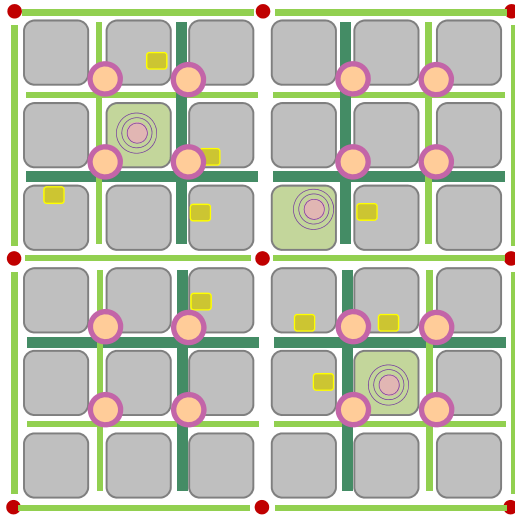
Gracia

Current



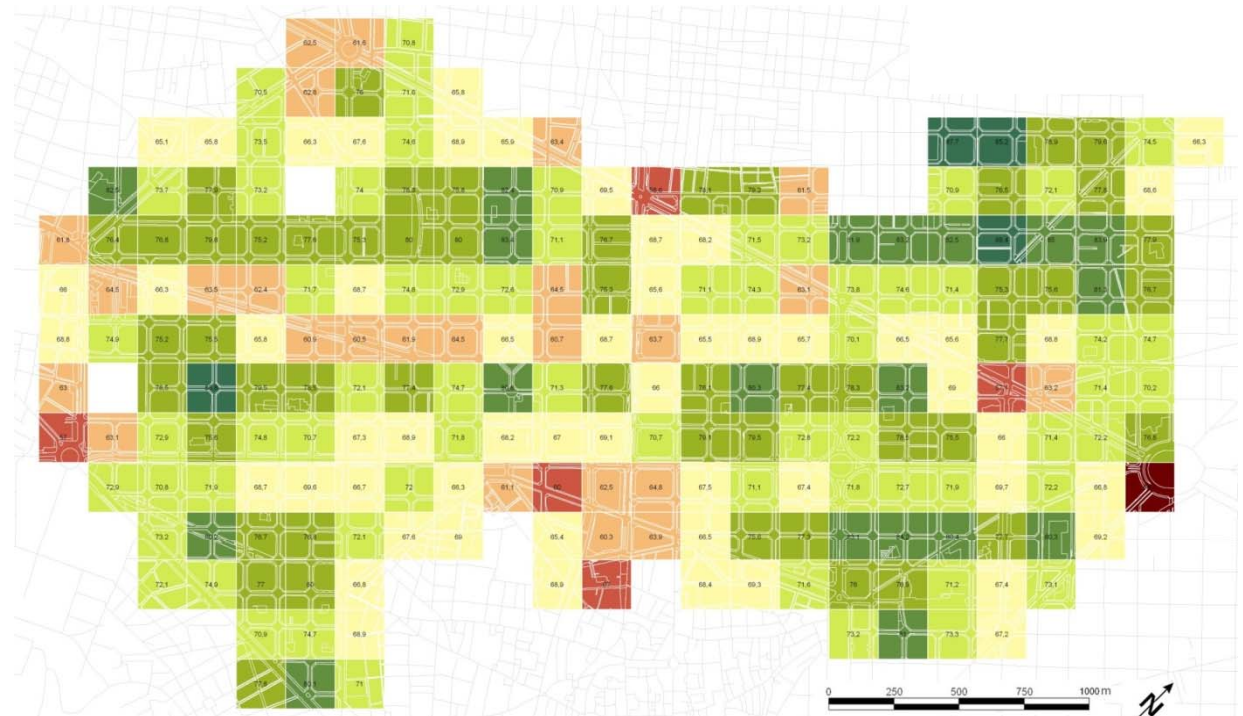
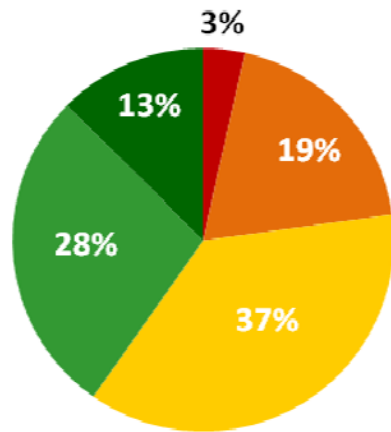
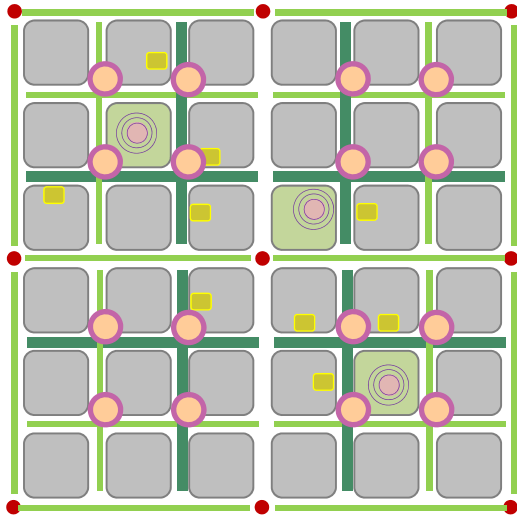
Gracia

Superblocks

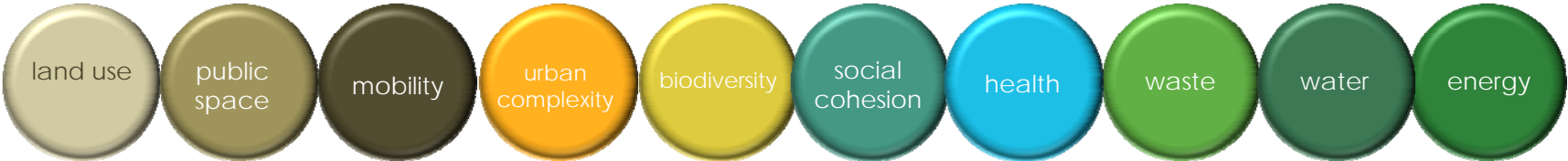
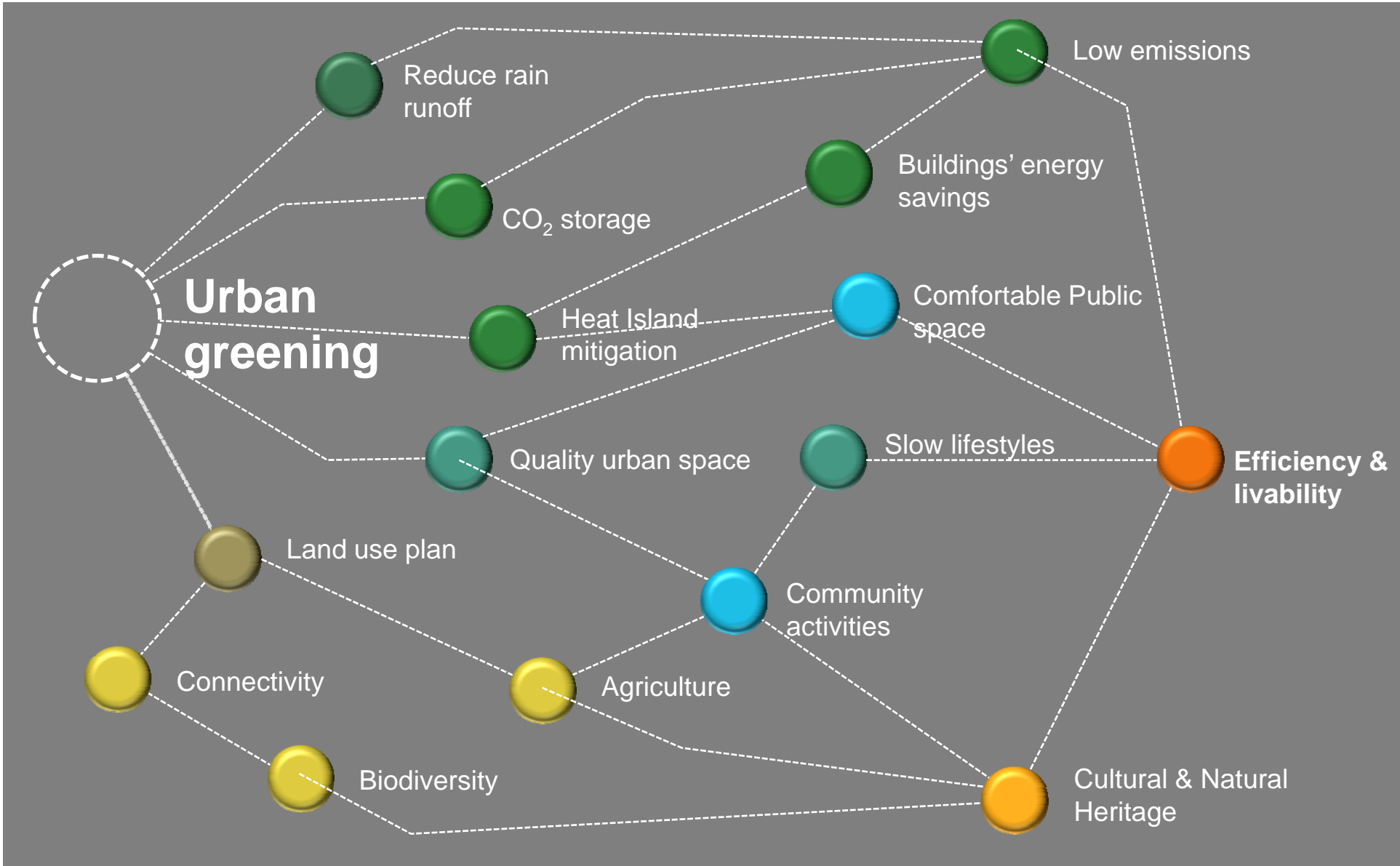


Eixample

Superblocks



Why should cities invest in eco-efficiency and sustainable infrastructures and incorporate it on planning strategies?





Thank you