twinning towards
research excellence
in evidence-based planning
and urban design

Il Ruolo della Natura Terapeutica per Promuovere la Salute Mentale Attraverso i Co-Benefici del Verde Urbano.

Ilaria Geddes

Society and Urban Form (SURF) Research Lab,
Department of Architecture, University of Cyprus, Cyprus

4° Convegno Nazionale sul Verde Terapeutico
28th Novembre 2025

This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101078890

UK Research and Innovation

This project has received funding from the UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee under grant numbers 10052856 and 10050784.

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TWIN2EXPAND

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University of Cyprus

Densità urbana

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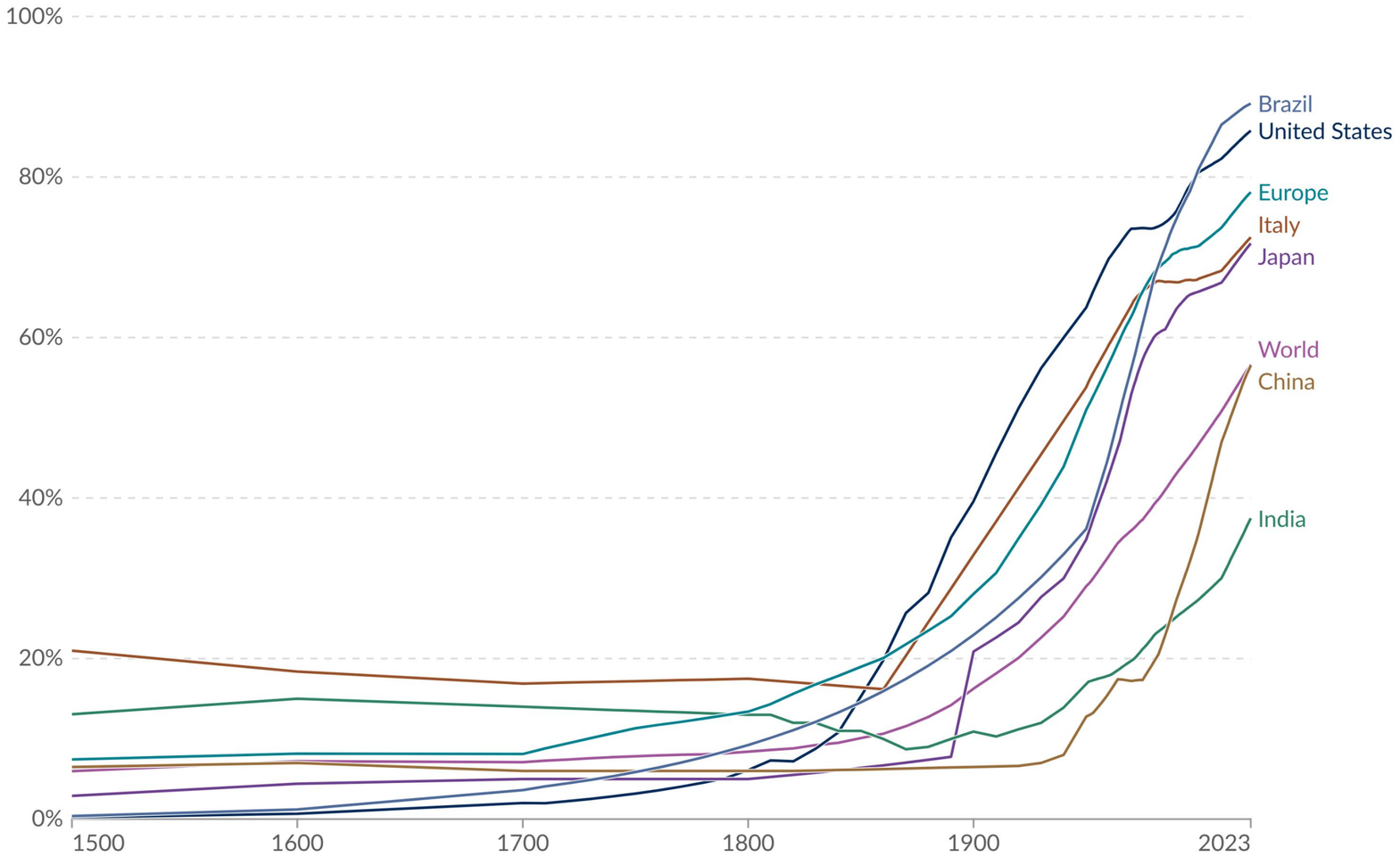
Percentuale della popolazione che vive in zone urbane, 1500–2023



Data source: HYDE (2023)

OurWorldinData.org/urbanization | CC BY

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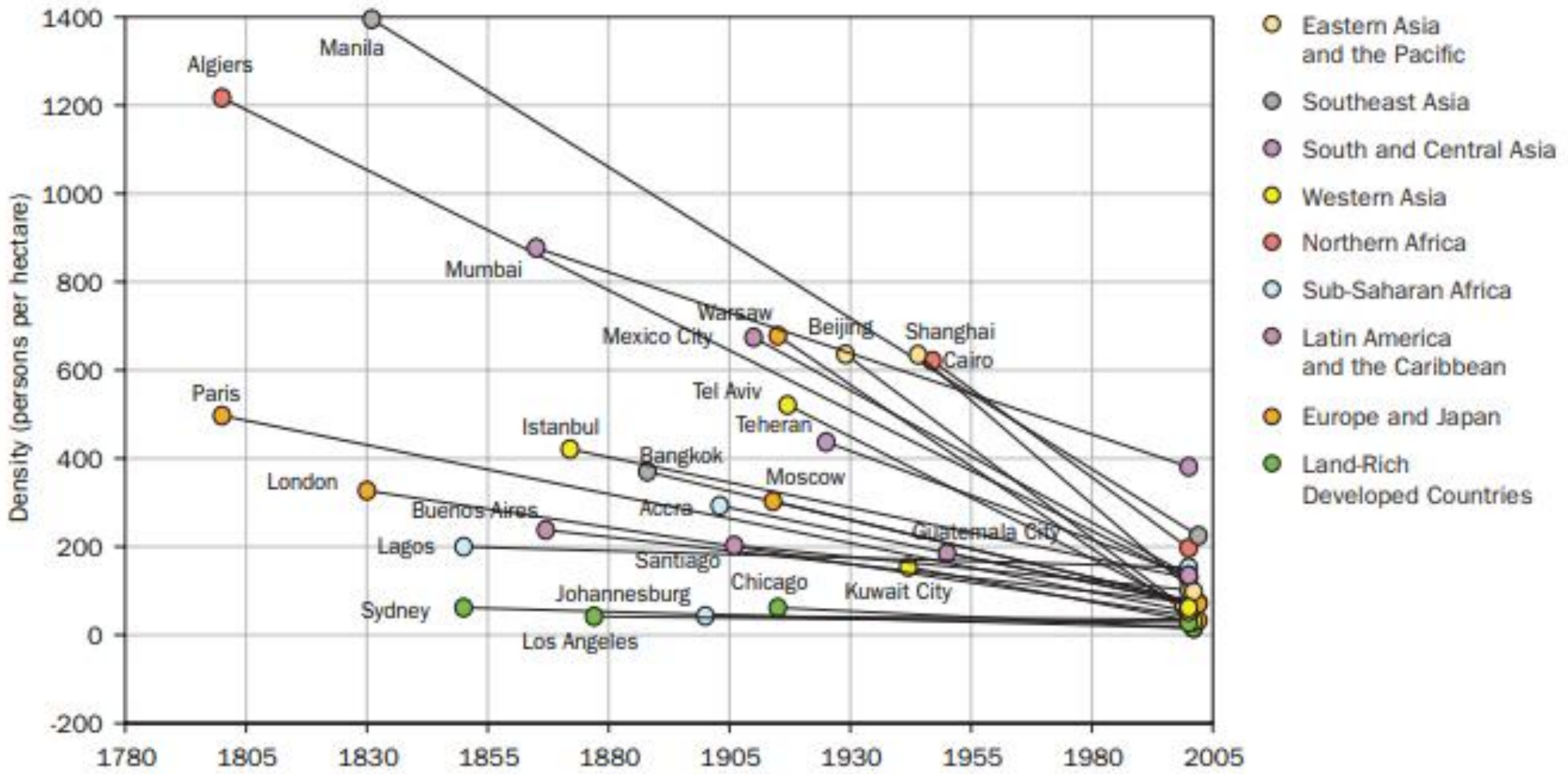
Declino delle aree edificate in 25 città, 1800–2000



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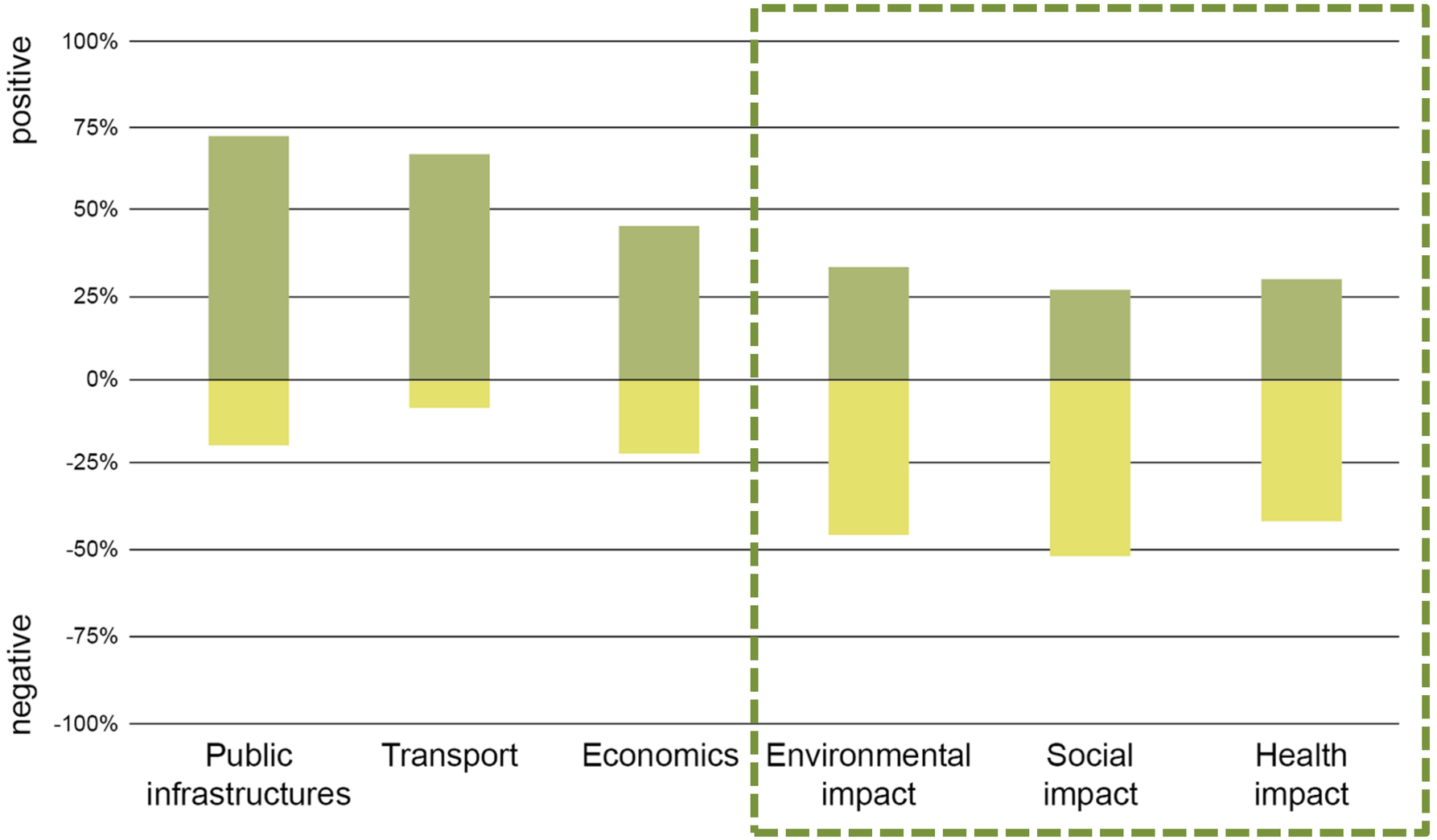
Angel, S. (2011). Making room for a planet of cities. Lincoln Institute of Land Policy.

Reported relationship between density and sustainable urban development



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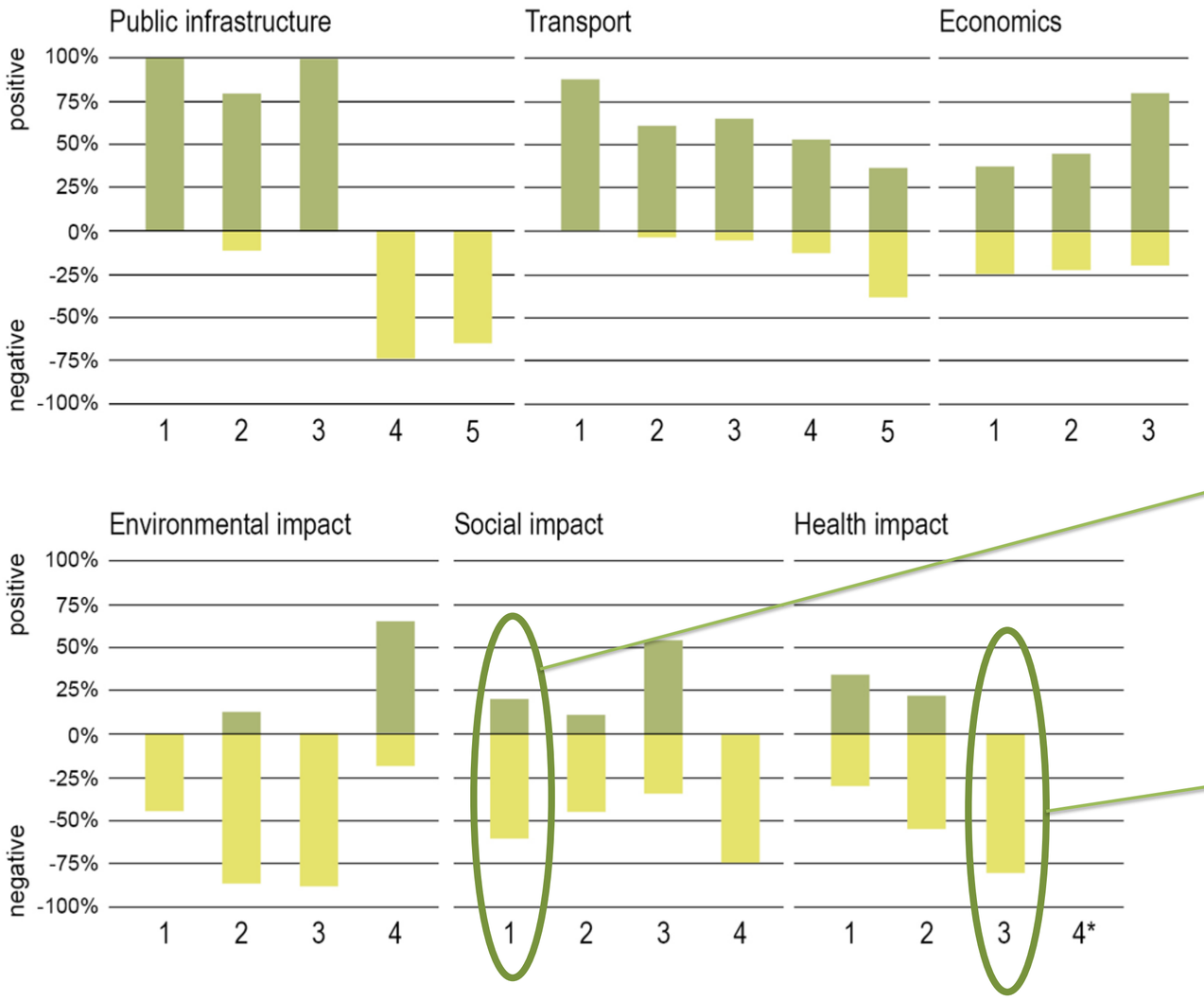
Berghauser Pont et al. (2021). Systematic review and comparison of densification effect and planning motivations..

Reported relationship between density and sustainable urban development



Public infrastructure
1 Technical infrastructure
2 Resource efficiency
3 Service infrastructure
4 Water management
5 Recreational infrastructure

Transport
1 Public transport
2 Pedestrian & bicycle
3 Private motorised
4 Travel behaviour
5 Traffic safety

Economics
1 Productivity
2 Property value
3 Public finances

* *less than 3 studies*

Environmental impact
1 Biodiversity
2 Ecological condition
3 Micro-climate
4 Macro-climate

Social impact
1 Well-being
2 Social interaction
3 Social equity
4 Crime

Health impact
1Physical health
2 Air and noise pollution
3 Psychological health
4 Other health risks

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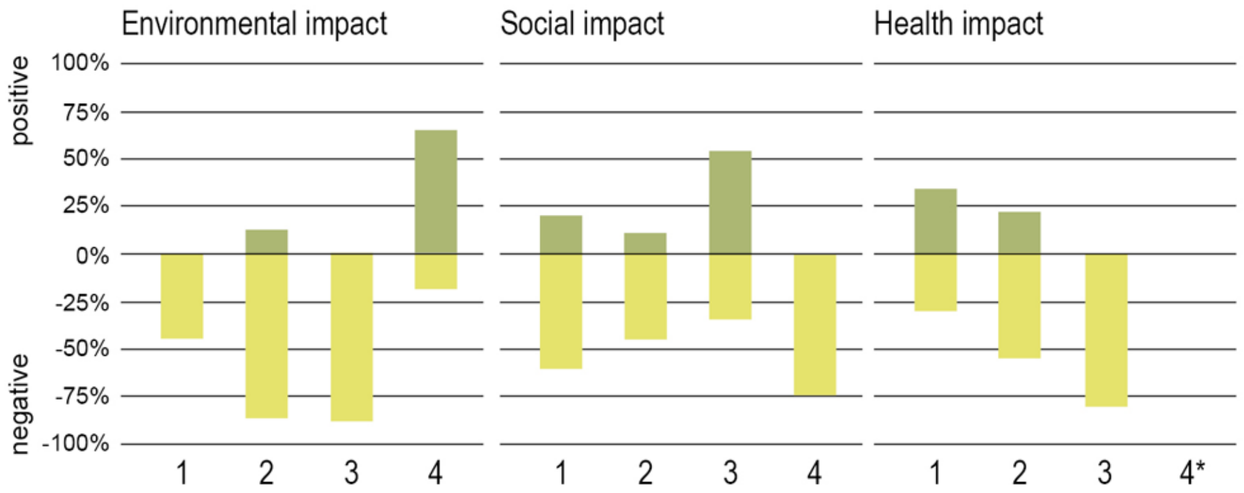
Berghauser Pont et al. (2021). Systematic review and comparison of densification effect and planning motivations..

Awareness of impacts in motivations for densification

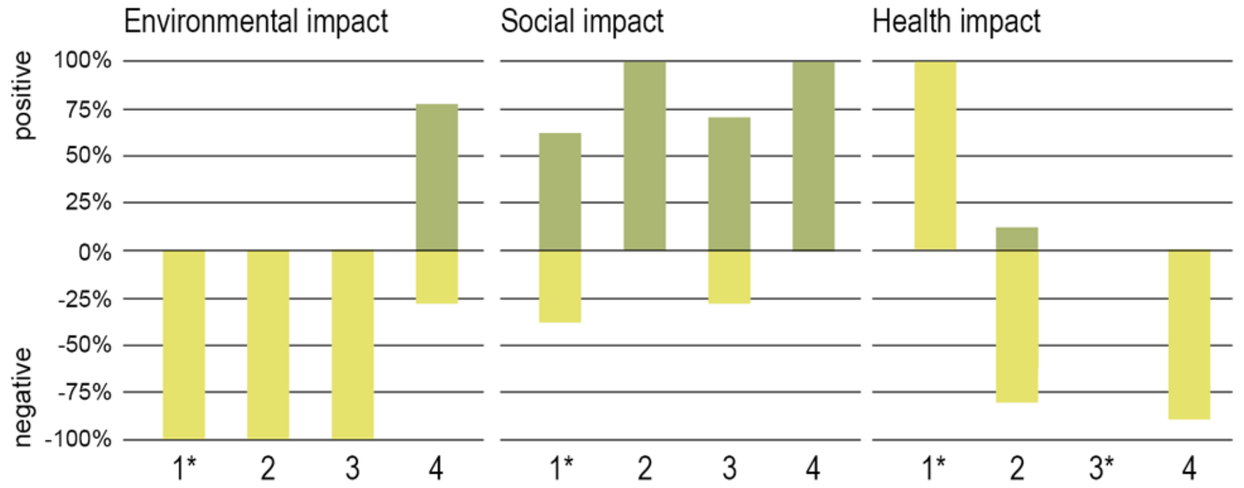
impacts



Environmental impact
1 Biodiversity
2 Ecological condition
3 Micro-climate
4 Macro-climate

Social impact
1 Well-being
2 Social interaction
3 Social equity
4 Crime

motivations



Health impact
1Physical health
2 Air and noise pollution
3 Psychological health
4 Other health risks

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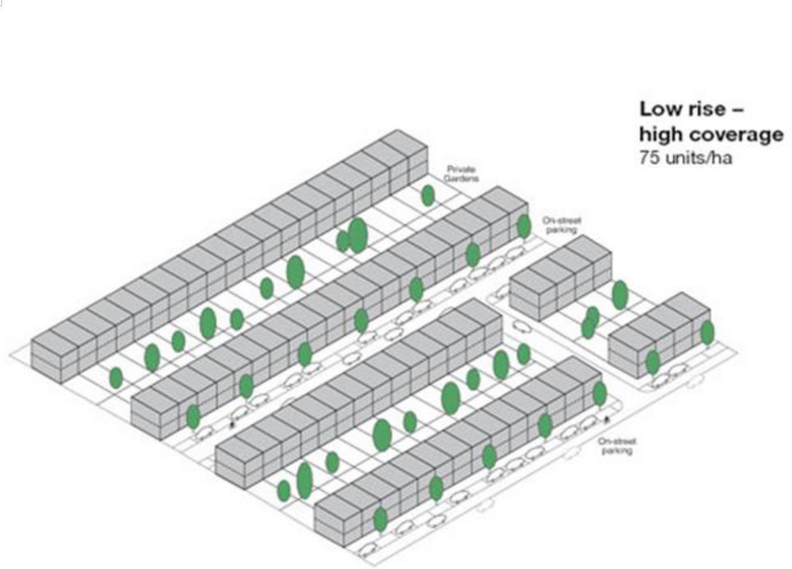
Berghauser Pont et al. (2021). Systematic review and comparison of densification effect and planning motivations..

Stessa densità, diversi i risultati della progettazione



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Government of South Australia (2017). The 30-year Plan for Greater Adelaide

La natura terapeutica?

L’urbanizzazione continua...

...é possibile densificare senza impatti negativi?

L’approccio urbanistico socio-ecologico

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urban form
research
lab

Spazi verdi e salute mentale

Uno studio condotto da ISGlobal ha stimato che l'implementazione di Corridoi Verdi nella città di Barcellona potrebbe ridurre:

14% di casi di salute mentale (auto percepiti)

13% di visite a professionisti di salute mentale

13% di uso di antidpressivi

8% di uso di tranquillanti e ansiolitici

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Vidal Yañez et al. (2023). An urban green space intervention with benefits for mental health: A health impact assessment of the Barcelona "Eixos Verds" Plan. *Environment International* 174.

L’effetto del verde sulla salute mentale

Table 3. **Summary of mental health outcomes per green space category – experimental studies**

	Short-term health																					Long-term health																	
	Affect			Vitality			Restorative outcomes			Perceived stress			Physiological stress			Problem behaviour			Brain activity			Mental health			Severity of a mental disorder			Prevalence of a mental disorder			Satisfaction with life			Quality of life			Subjective well-being		
	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–
Urban GS	4	2	1				1	1		2																													
Park	13	2		2			4			3	2		8	11									1		4						1					1	1	
Garden	2	2								1			3	3		3	1	1		1					4	2	1							1					
Forest	18	8	3	4			4			2	1		12	12	1										1														
Grassland	2		1							1	1			2																							1		
Trees & plants	3	1		1			2						1		1										1									1					
Biodiversity		1					1	1					1	1																									

GS = green space
Note: numbers in cells reflect numbers of studies.

Table 4. **Summary of mental health outcomes per green space category – cross-sectional and longitudinal studies**

	Short-term health																					Long-term health																	
	Affect			Vitality			Restorative outcomes			Perceived stress			Physiological stress			Problem behaviour			Brain activity			Mental health			Severity of a mental disorder			Prevalence of a mental disorder			Satisfaction with life			Quality of life			Subjective well-being		
	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–	+	□	–
Urban GS	1	1					1				1											1	1			1					1			1			3	1	
Park	1	1								2	1					2	2					3	2	2								1		1	1		5	1	1
Garden										1													1															2	
Forest	2									1				1			1					3	2		1			1	1			1		1			2	1	
Grassland	1																					1		2				1	1							1	1	
Trees & plants								1	1							1	1					2	2		1	1	1	3								1		
Biodiversity	1						1	1																		1					1					1	1	

GS = green space
Note: numbers in cells reflect numbers of studies.

+ Positive outcomes □ Neutral outcomes – Negative outcomes 1–5 studies 6–10 studies 11–15 studies >15 studies 1–5 studies 6–10 studies 1–5 studies

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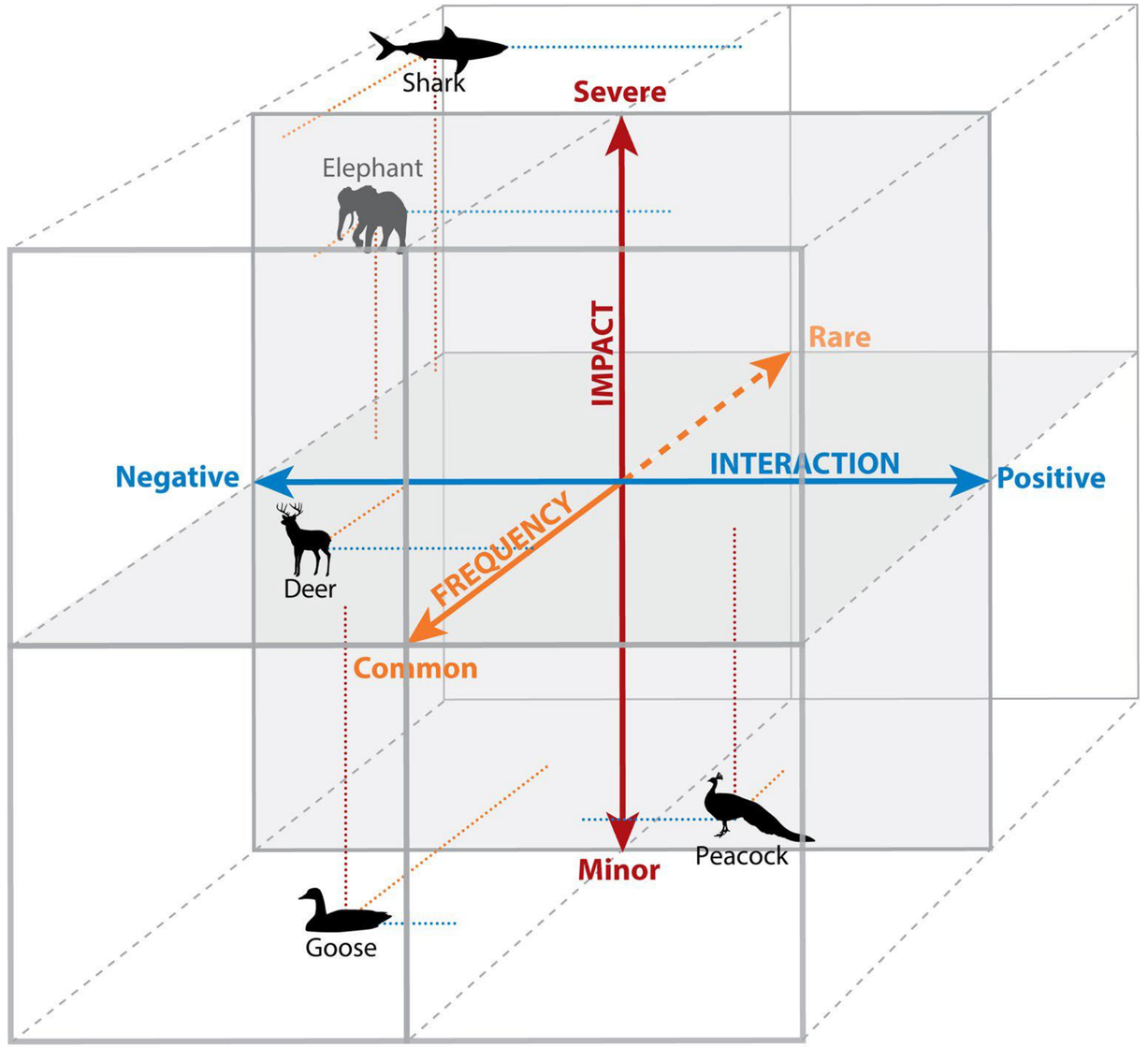
Interazione tra persone a fauna

The **interaction between people** and **fauna** is an important **social-ecological phenomenon** in cities.
It provides **benefits** for **people** (e.g. health and wellbeing) but also **disbenefits**(e.g. injuries, diseases).
Also, **humans** can be a **threat** to other **species** and **biodiversity**.



Nyhus, P. J. (2016). Human-Wildlife Conflict and Coexistence..

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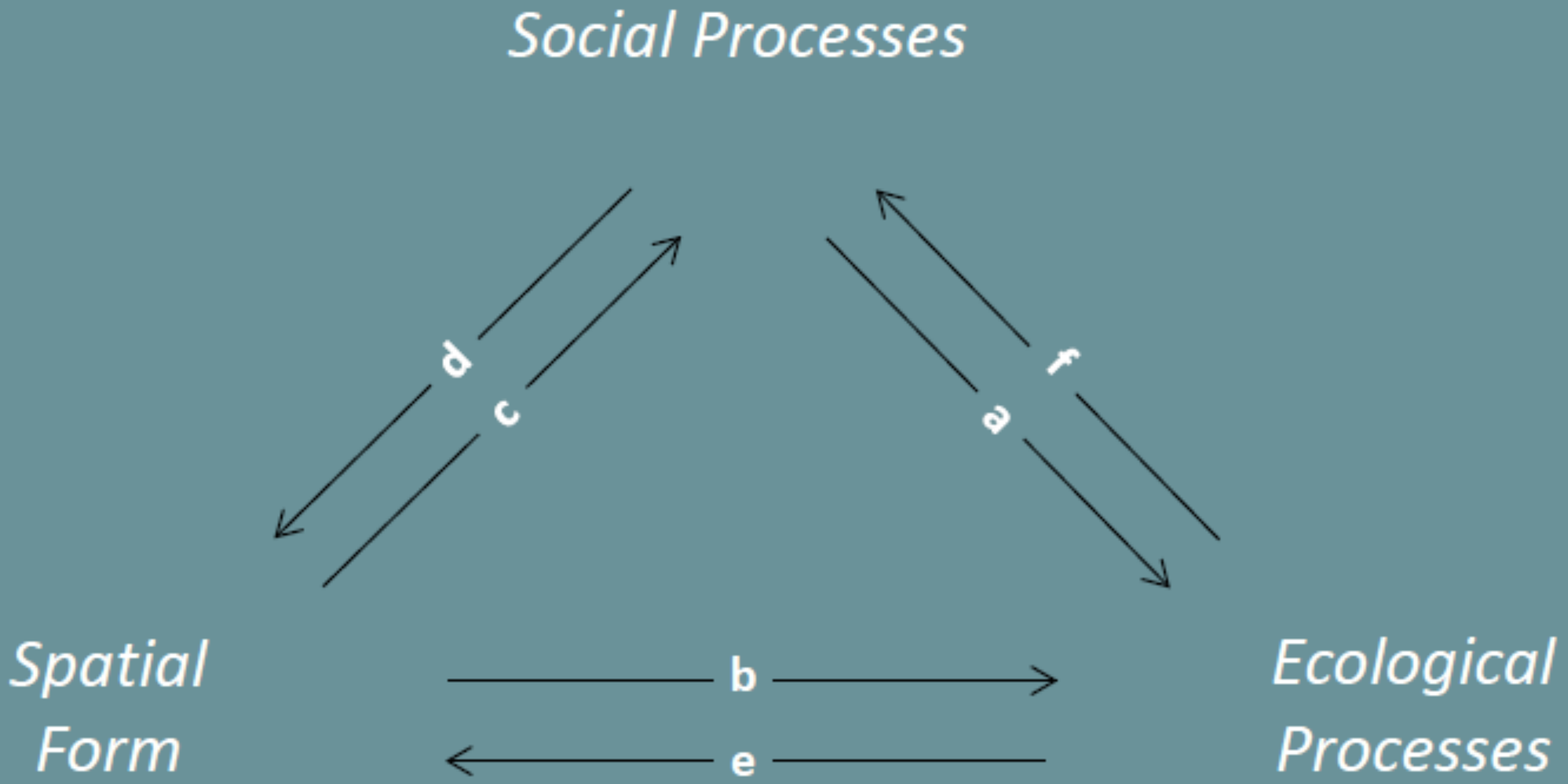
Urbanismo socio-ecologico



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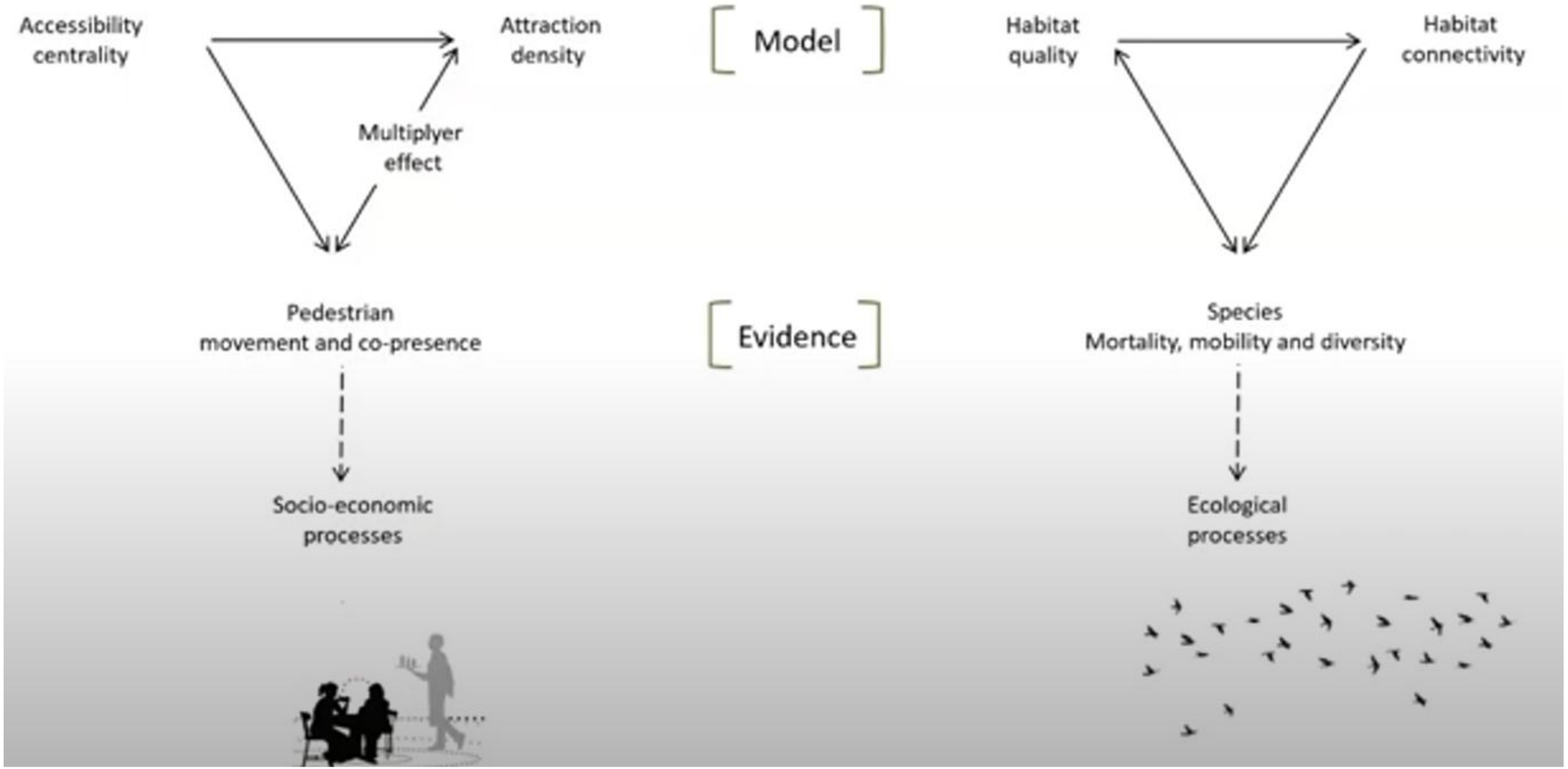
Processi socio-economici ed ecologici nelle città



Integrare la pianificazione urbana con l'ecologia urbana

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Zofie Cimburova, PhD thesis 2022 (Trondheim University, Norway), *Capturing the context: Developing GIS methods for modelling the ecosystem services of urban trees* :

Evidence-based design: metodi analitici

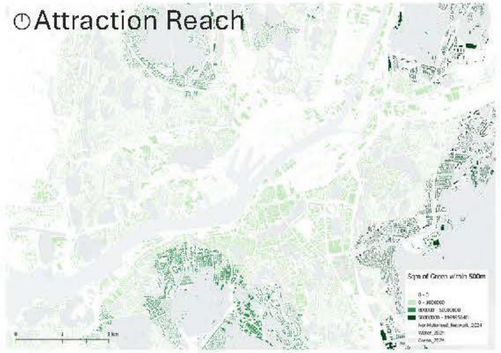
PST (Place Syntax Tool) [1]

- QGIS plugin
- PST is a tool for performing space syntax and regular accessibility analyses

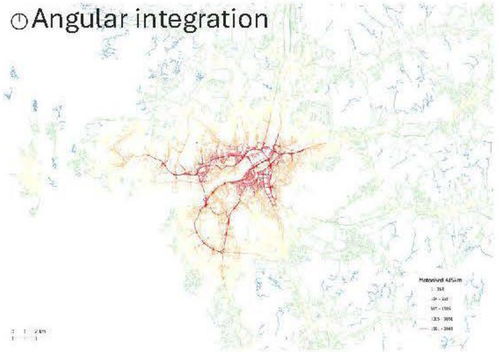
HNAT (habitat network analysis tool) [2]

- QGIS Plugin
- The tool supports analyses of species habitat networks with the capacity of supporting a multi-species approach.

Attraction Reach



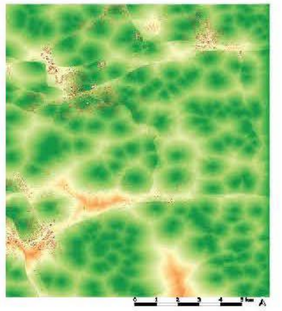
Angular integration



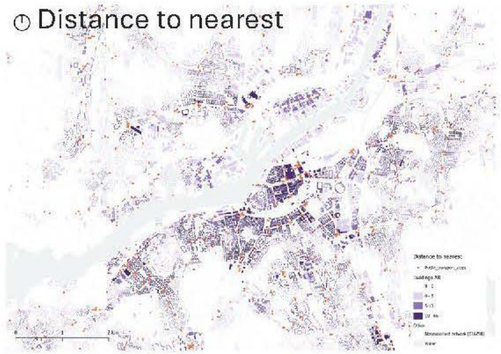
Sources map

Friction map

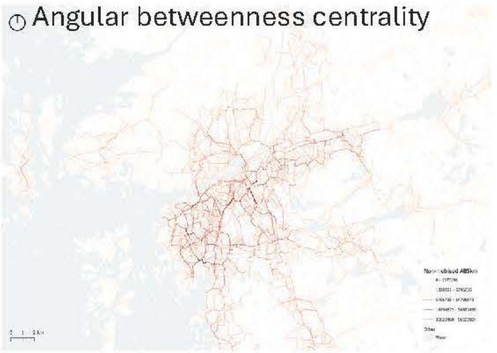
Cost-Distance map



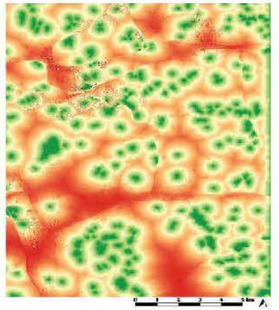
Distance to nearest



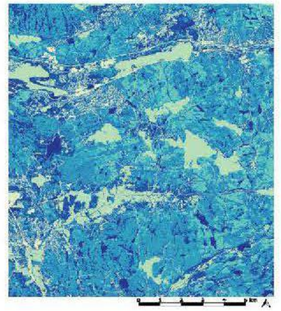
Angular betweenness centrality



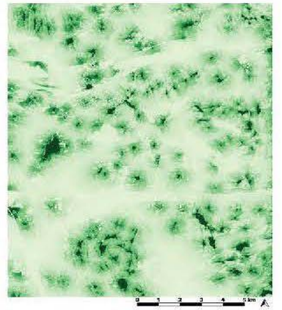
Dispersal map



Habitat Quality map



Functionality map

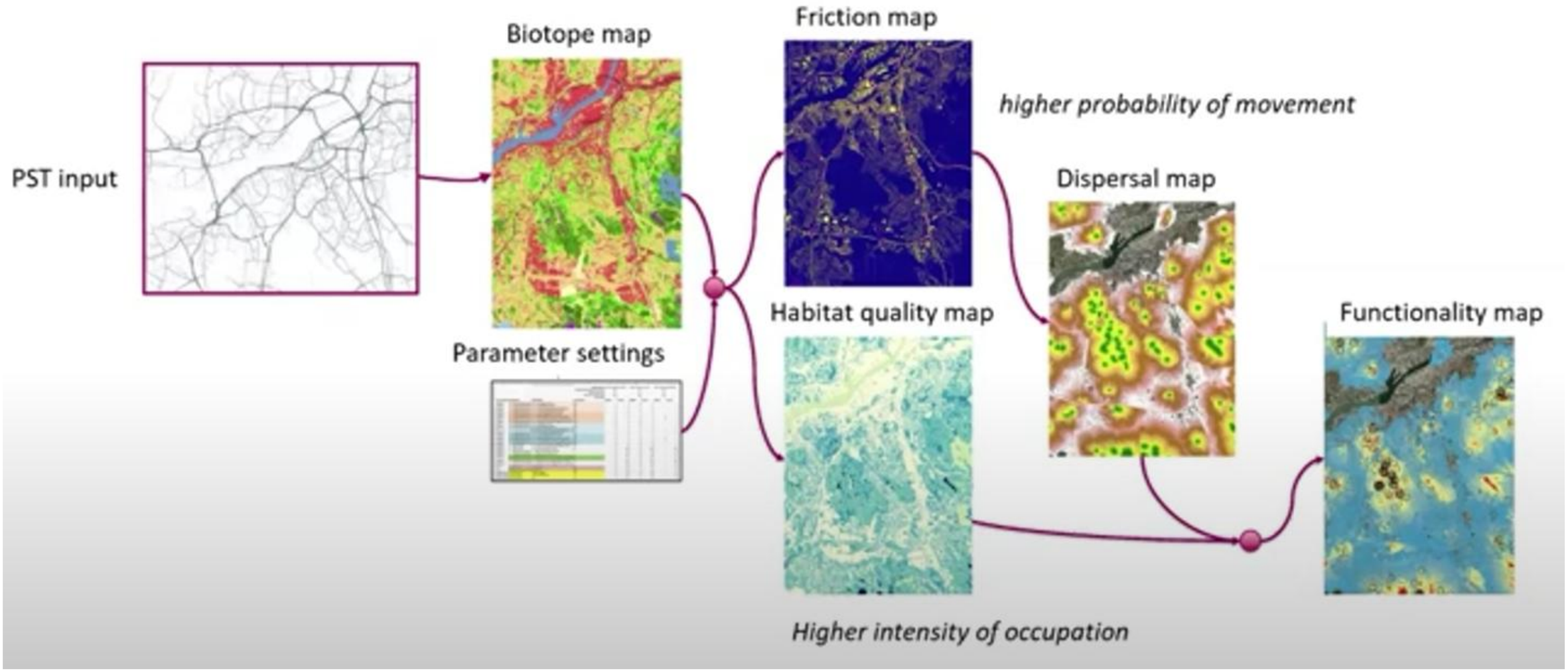


[1] Gianna Stavroulaki, Meta Berghauser Pont, and Martin Fitger, *PST Documentation v3.3.1 241101*, 2024, https://doi.org/10.13140/RG.2.2.18816.03847/1.

[2] Oskar Kindvall et al., *DOCUMENTATION HNAT Habitat Network Analysis Tool v0.1.3*, 2025, https://doi.org/10.13140/RG.2.2.28653.70889.

2025-04

Integrazione della forma urbana nell'analisi ecologica



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SPECIE IN CONSIDERAZIONE

TWIN2EXPAND

HOOPOE

Reproduces: Woody broadleaved dedicious trees
Biotope: *Permanent herbaceous; Non and sparsely vegetated; Low-growing woody; Woody needle leaved trees; Woody Broadleaved deciduous trees; Water.*
Friction: medium
Travel Range: 500m
Importance: ***contribute to ecosystem health by acting as seed dispersers and insect control agents; symbolic and religious importance.***

CYPRUS WARBLER

Reproduces: Low-growing woody
Biotope: Low-growing woody; Woody Broadleaved deciduous trees; Woody needle leaved trees; Permanent herbaceous; Water; Non and sparsely vegetated.
Friction: medium
Travel Range: 500m
Importance: ***insect control agents.; national symbol of Cyprus; global biodiversity (only breeds in Cyprus).***

HUMAN

Reproduces: Buildings (mostly)
Biotope: wide range; thrive in temperate dedicious forests; C climates (warm summers and cool winters)
Friction: high
Travel Range (walking): 1200m
Importance: ***super-generalists predators; they can stabilize ecosystems.***

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Research by Ilaria Geddes, Regas Georgiou, Gehad Mohammed, Iason Giraud, Yannis Parakevopoulos.

TWIN2EXPAND

DOMANDE DI RICERCA:

BIODIVERSITA

1. Quale è la funzionalità (disponibilità di nidificazione + cibo) del biotopo nella zona di Strovolos?

ESSERI UMANI

2. Quale è la distanza percorribile a piedi dagli edifici alle aree ad alta funzionalità?

3. Quale è la probabilità di imbattersi in un'elevata biodiversità durante un qualsiasi tipo di viaggio?

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FUNZIONANALITÀ [Warbler]

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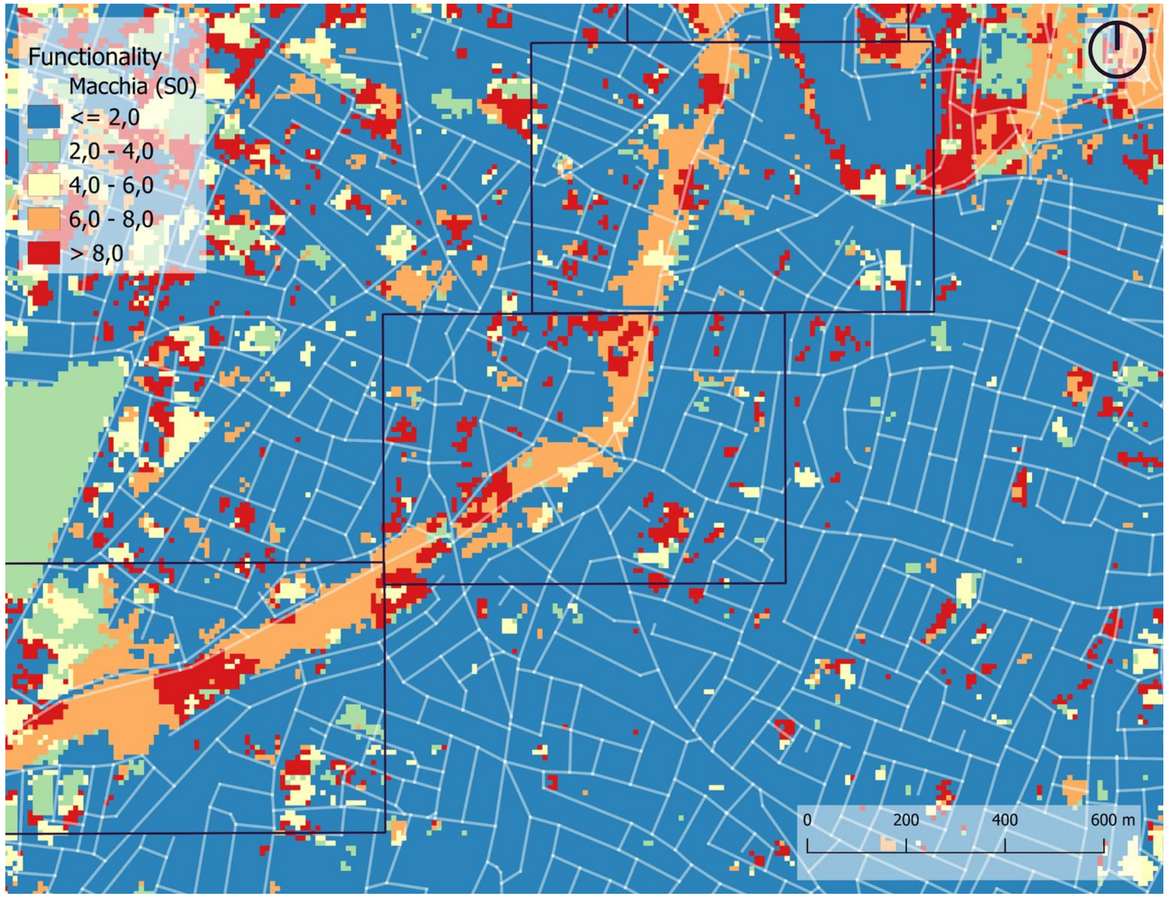

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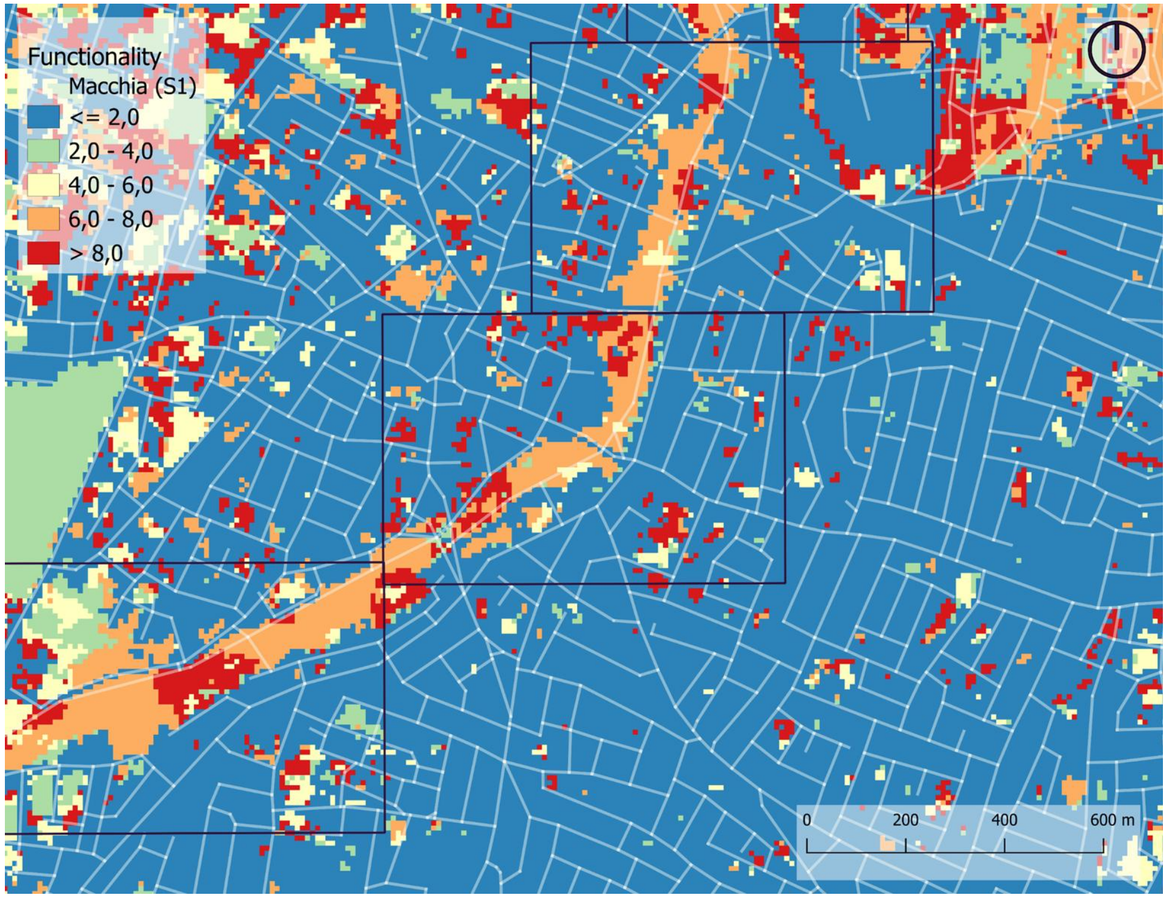

MASTERPLAN

High values (Red) have high quality and high dispersal > places where you expect to find this specie

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HOW WE ARE GOING TO ACHIEVE THE VISION

TWIN2EXPAND

CYPRUS WARBLER

Increase sources along the linear park and surrounding urban areas

HOOPOE

Increase quality of biotope by adding low-growing woody plants in the linear park and surrounding urban areas

HUMAN

Retaining old bridge for pedestrians only as it provides a more direct and shorter connection between old and new cores

More connection through the linear park to increase access to high quality biotope

Increase biotope quality in high density urban areas with high potential for connectivity

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DESIGN PROPOSAL

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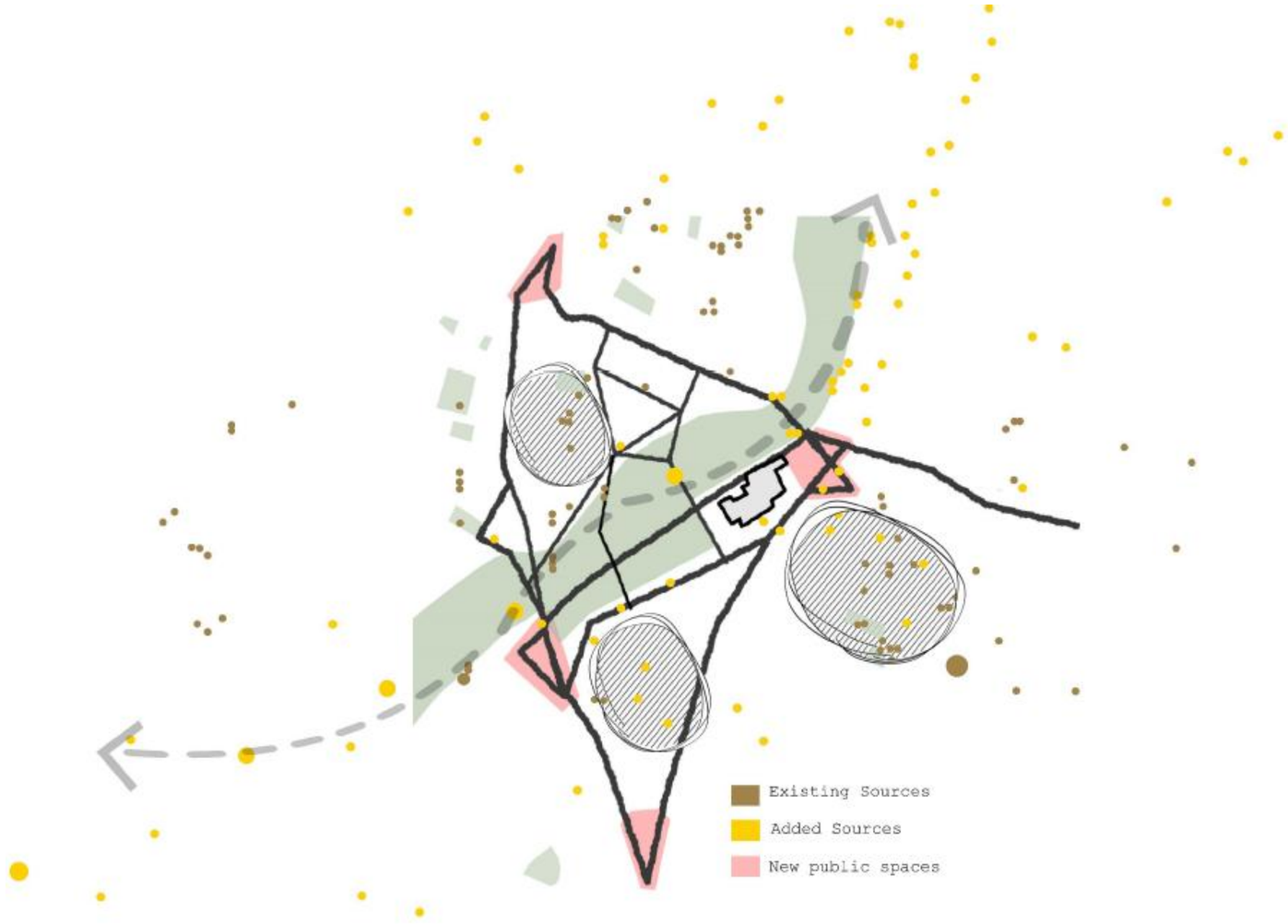

NEW ECO-URBAN CENTRE

more connections: ENABLING PEOPLE TO WALK ALONG AND THROUGH HIGH QUALITY BIOTOPE

more sources for warblers: INCREASING AND SPREADING OUT SOURCES ALONG PARK AND IN URBAN AREA

public spaces in the nodes: INCREASE BIOTOPE QUALITY BETWEEN THE NODES

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FUNZIONANALITÀ [Warbler]

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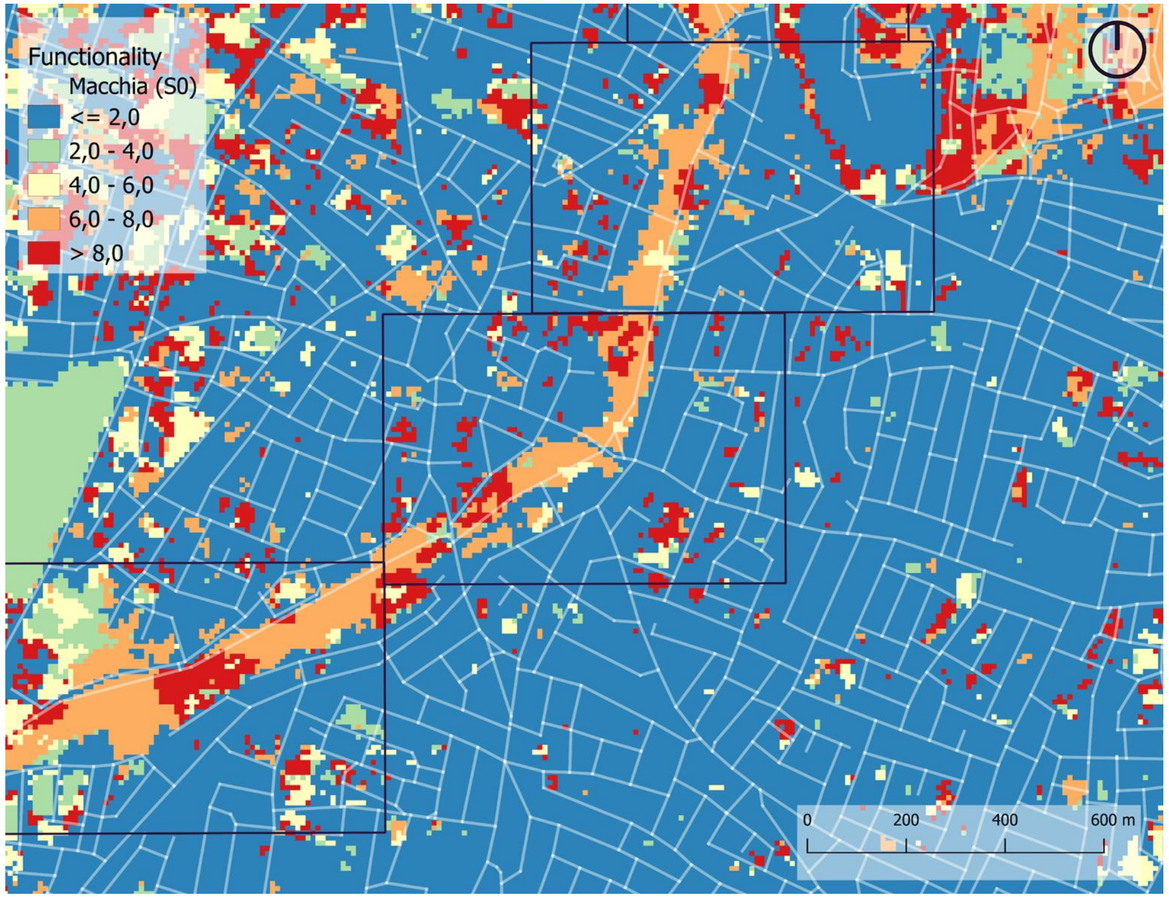
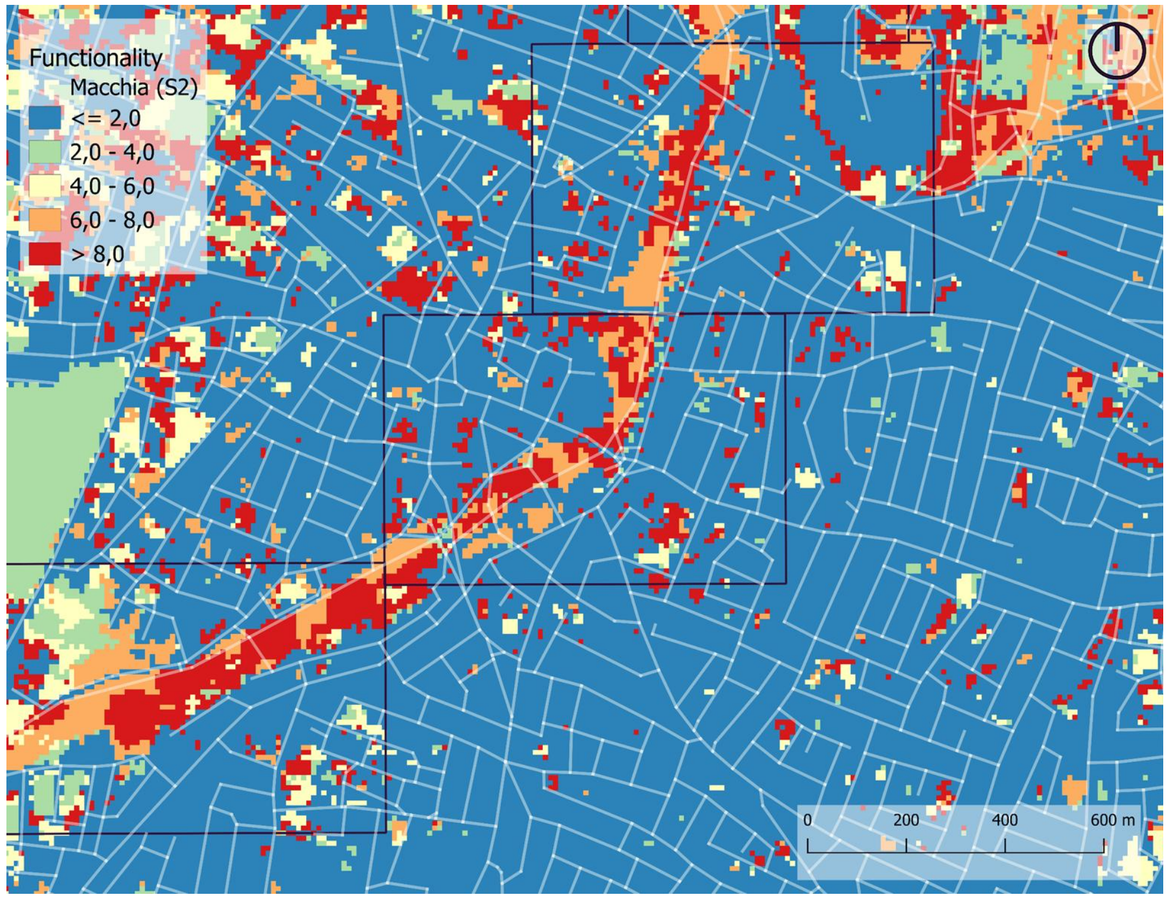


EXISTING
Avg. 1.63



NEW ECO-URBAN CENTRE
Avg. 1.81 (+11%)

High values (Red) have high quality and high dispersal > places where you expect to find this specie

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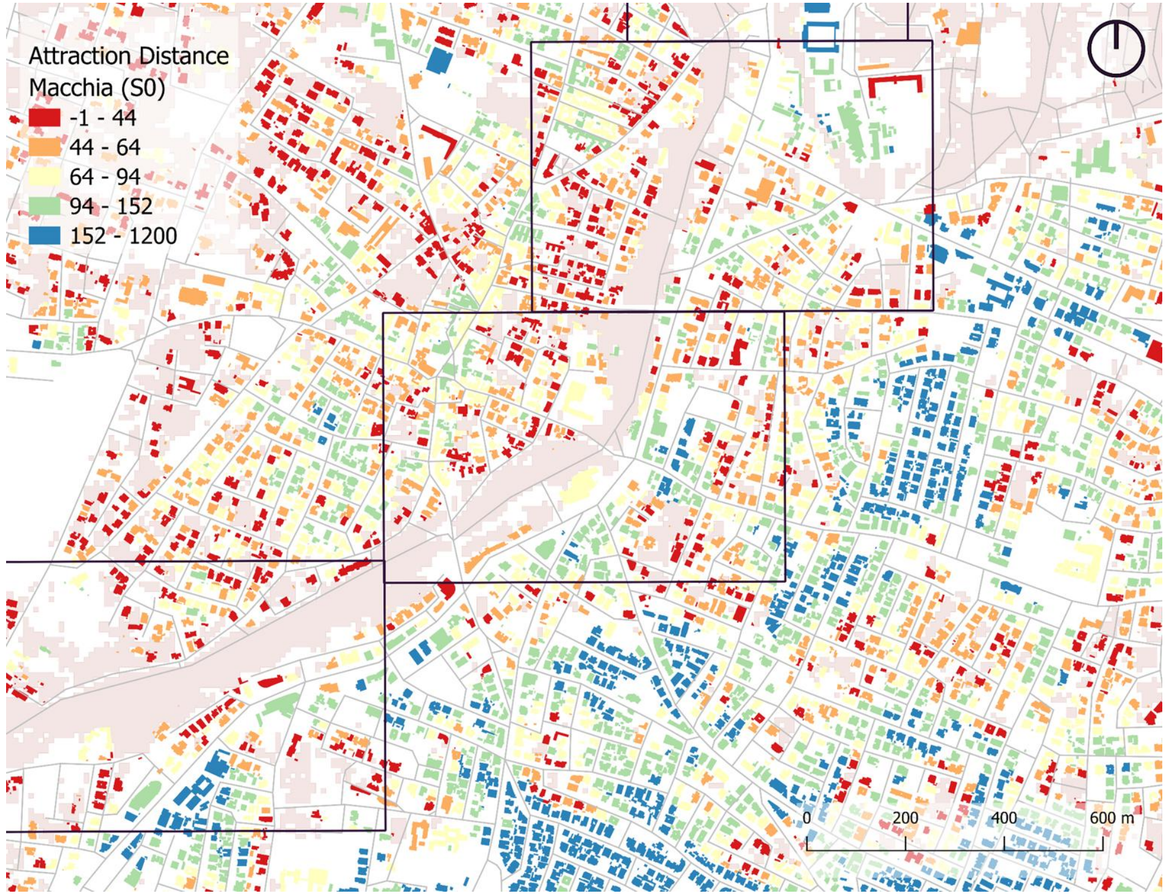
Quale è la distanza percorribile a piedi dagli edifici alle aree ad alta funzionalità? **[Esseri Umani - Warbler]**

TWIN2EXPAND



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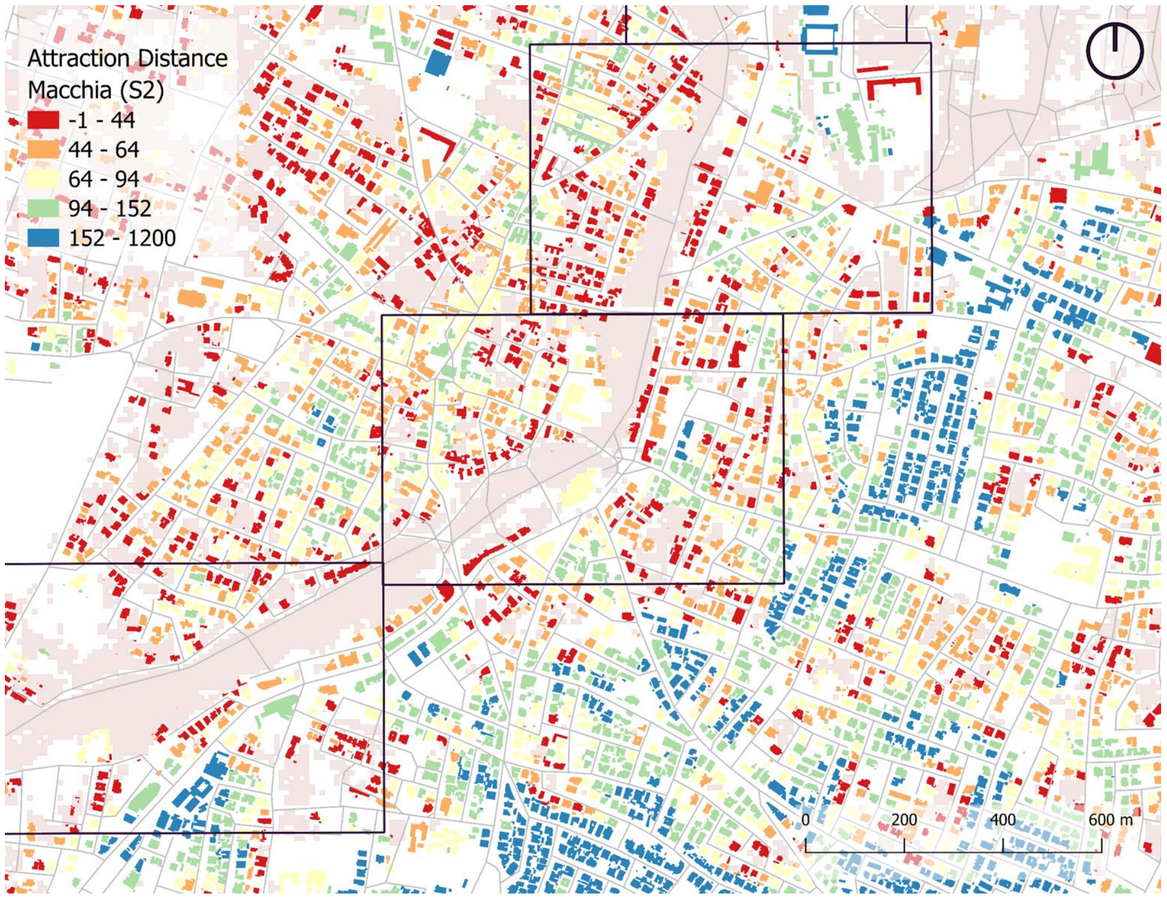

NEW ECO-URBAN CENTRE

Attraction Distance: How distant buildings are from a high functional area.

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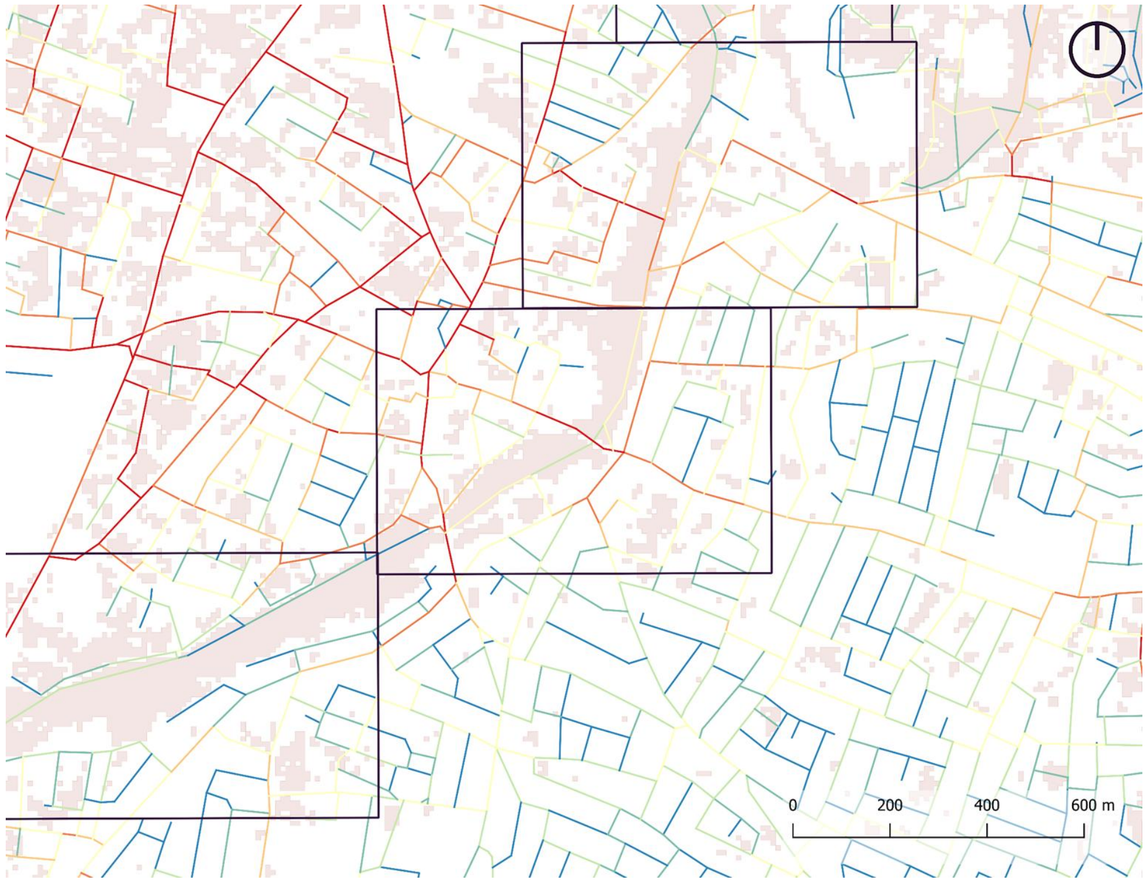
Quale è la probabilità di imbattersi in un'elevata biodiversità durante un qualsiasi tipo di viaggio? **[Esseri Umani - Warbler]**

TWIN2EXPAND

low betweenness — high betweenness



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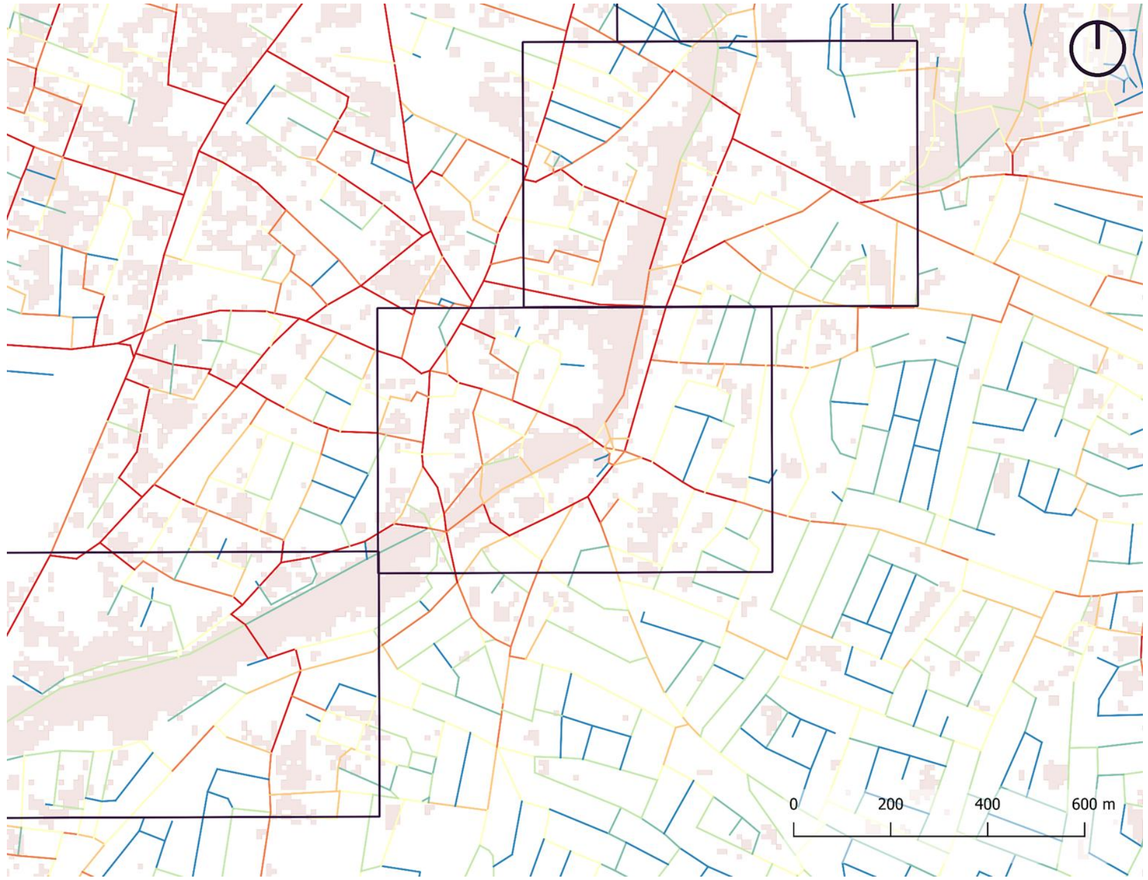

NEW ECO-URBAN CENTRE

Attraction Betweenness: How often a network segment is part of the shortest route from any place to any other place going though high functional areas

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Opportunità

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society and
urban form
research
lab

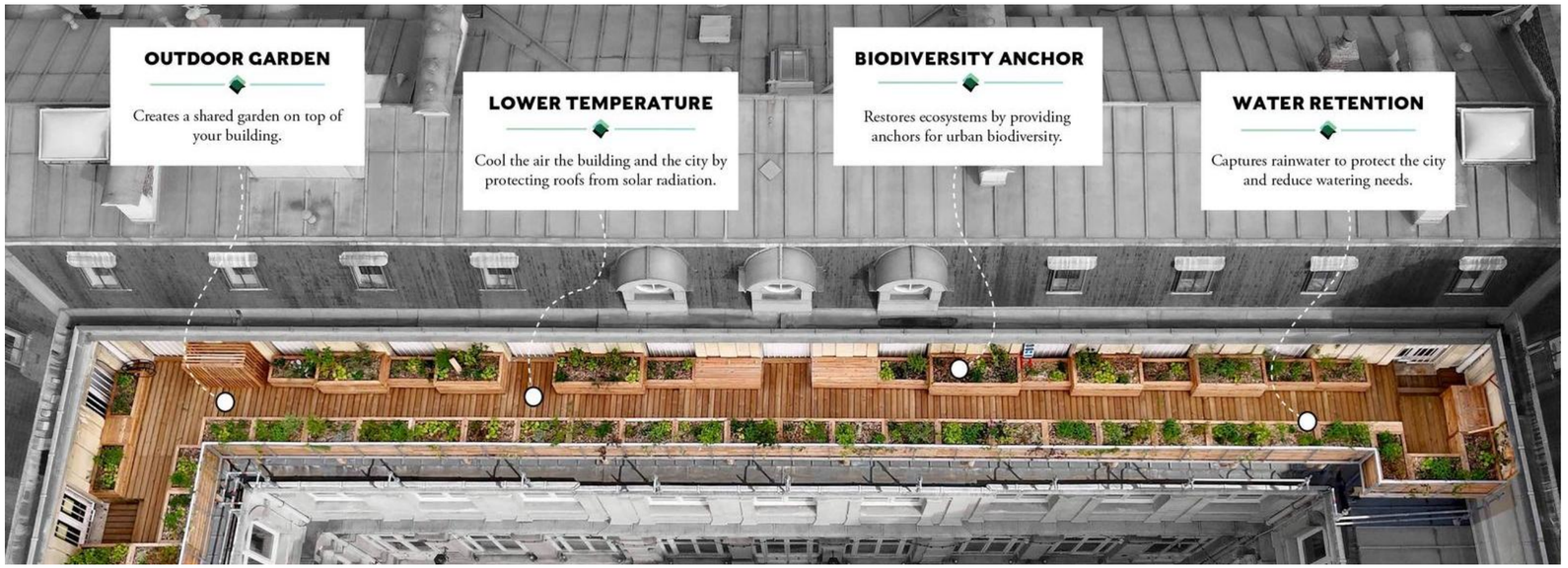
L'OPPORTUNITÀ

I tetti delle città dell'Europa meridionale sono ampiamente sottoutilizzati.

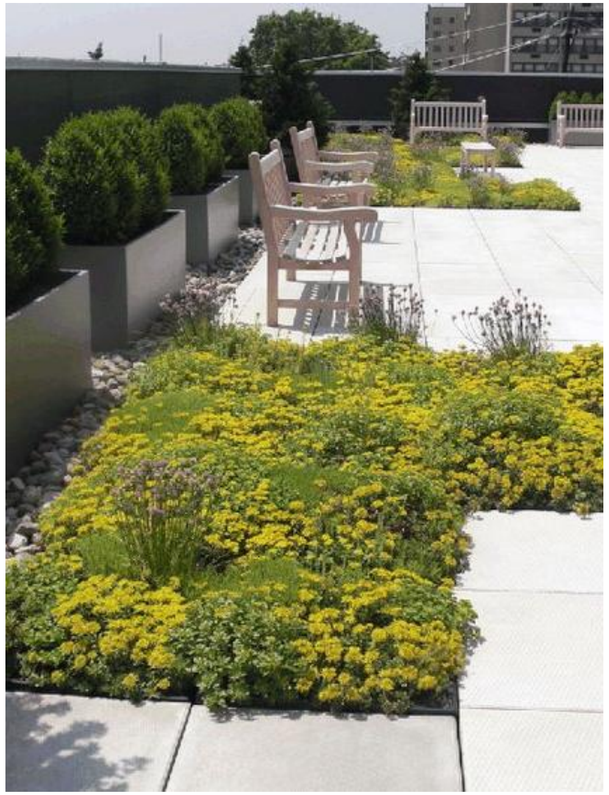
Eppure hanno il potenziale per:

- Ridurre le emissioni di carbonio e le isole di calore urbane.
- Creare spazi verdi, sociali e ricreativi.
- Supportare la logistica con droni e l'agricoltura urbana..


55°
1m
70°
Solar radiations
Mineral surface overheated
45°
1m
45°
Shade
Mineral surface shaded
40°
1m
35°
Shade +
Évapotranspiration
Vegetalized surface


OUTDOOR GARDEN
Creates a shared garden on top of your building.
LOWER TEMPERATURE
Cool the air the building and the city by protecting roofs from solar radiation.
BIODIVERSITY ANCHOR
Restores ecosystems by providing anchors for urban biodiversity.
WATER RETENTION
Captures rainwater to protect the city and reduce watering needs.

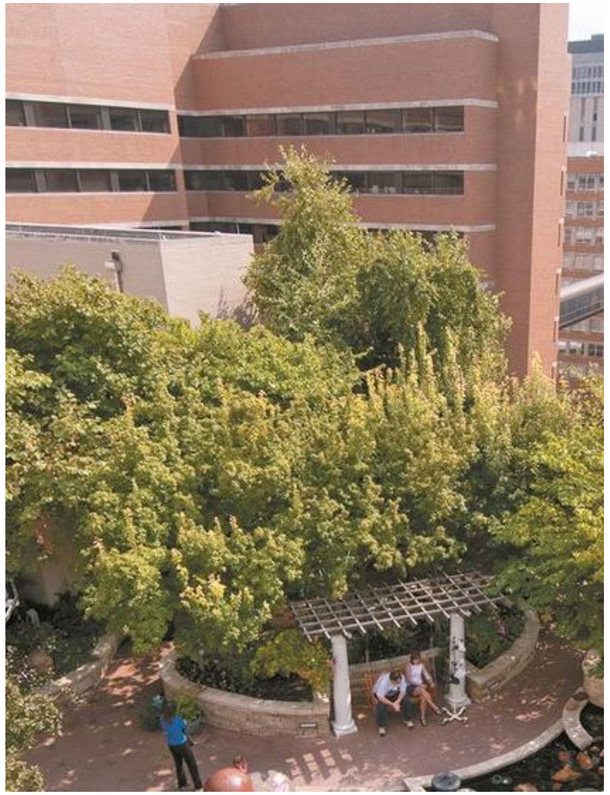
I tetti terapeutici



John Theurer Cancer Center

Bristol Precinct Urban Gardens – Bristol Haematology and Oncology Centre roof garden. © NHS Forest

Southmead Hospital's rooftop herb garden, leading off the Vu Restaurant for staff. Photo: Vicki Brown / Centre for Sustainable Healthcare 2021. Attribution 4.0 International (CC BY 4.0).



St. Louis Children's Hospital

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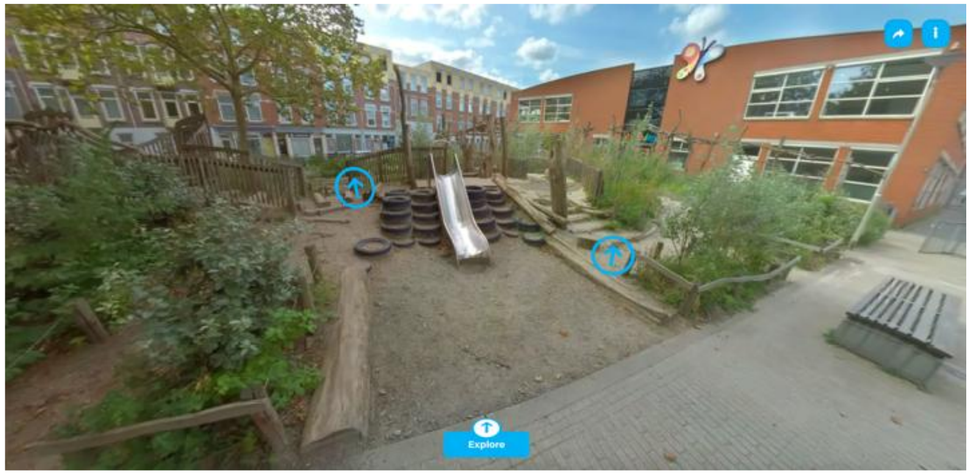
After renovation. Markham Elementary School, Oakland, CA. Source: https://www.greenschoolyards.org/living-school-grounds



Immersive view and tour of transformed schoolyard. Source: https://www.greenblueschoolyardtour.org/

Irma Coulson Public School in Milton, Ontario, Canada 2023. Source: https://www.evergreen.ca/impacts/climate-ready-schools/[a]

Example interventions from secondary schoolyard transformation, Ecoscholen,, Antwerp

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Solution Type	Evergreen	Boston	Antwerp	Refugis	OASIS	Green-Blue NL	CRS London	Ré-création
Green NbS								
Tree planting / shade canopy	x	x	x	x	x	x	x	x
Native & pollinator gardens	x	x	x	x	x	x		x
Green facades or walls				x				
Green roofs / living roofs	x						x	
Natural windbreaks / hedges			x				x	x
Blue NbS								
Rain gardens / bioswales	x	x	x		x	x	x	
Playful water management / infiltration				x		x		
Ponds or wetlands			x			x		
Water play / fountains / misters				x				

Solution Type	Evergreen	Boston	Antwerp	Refugis	OASIS	Green-Blue NL	CRS London	Ré-création
Grey Infrastructure								
De-paving / permeable paving	x	x	x	x	x	x	x	x
Reflective or light-colored paving				x	x		x	
Shade structures (pergolas, etc.)	x	x		x	x		x	x
Rainwater harvesting / cisterns	x	x	x	x		x	x	
Tactical paving / surface painting		x			x	x		x
Hybrid Solutions								
Sponge schoolyard / integrated systems	x					x	x	
Outdoor classrooms + ecological features	x	x	x		x	x	x	x
Solar panels (on shade structures)				x				

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Project	Focus on Child Health/Development	Approach Depth	Methods or Features Used
Community Schoolyards™ (USA)	Physical activity, nature access, equity	High – long-term studies	User behavior monitoring, gender equity analysis
Evergreen Climate Ready (Canada)	Play, cognition, emotional well-being	High – integrated design logic	Sponge design, sensory play, learning zones
Refugis Climàtics (Barcelona)	Heat stress, mental well-being	High – monitored impacts	Climate and air quality sensors, educational integration
OASIS (Paris)	Physical and mental health	Medium – linked to resilience	Outdoor learning, biodiversity, inclusive design
Opération Ré-Création (Brussels)	Movement, mixed play, emotional health	Medium – design-oriented	Mounds, tunnels, quiet zones, sensory variety
Green Schoolyards America (USA)	Sensory and developmental diversity	High – research-supported	Tree canopy equity, outdoor classrooms
Cool Schools (EU-wide)	Well-being, co-benefits focus	High – research still in progress	NbS impact studies on learning and health
Blauw Groen Vlaanderen (Belgium)	General well-being and physical activity	Light – embedded in goals	Biodiverse zones, natural materials
AIS Amsterdam	Play and cognitive development	Medium	Multifunctional zoning.

- De-paving and tree planting are nearly universal features, appearing in almost all analysed best practices. These interventions are key strategies for increasing surface permeability, improving stormwater management, and providing shade and thermal comfort. Their simplicity, affordability, and high multifunctionality make them starting points in adaptation design.

- Rain gardens, bioswales, and other stormwater management solutions are particularly prioritized in areas facing high flood risk or urban water runoff challenges in the North-West Europe.

- Hybrid educational–infrastructure models, such as sponge yards, multifunctional gardens, and outdoor classrooms are increasingly recognized as high-impact approaches. These interventions have a dual role: they mitigate environmental risks while simultaneously enhancing learning experiences.

- Grey solutions such as engineered shading structures, reflective paving, and surface treatments are also gaining attention as critical complements to nature-based strategies. These interventions offer rapid and targeted benefits, particularly in addressing heat stress in high-exposure areas, and are often more feasible in densely built environments where tree planting or large-scale depaving may not be possible.

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