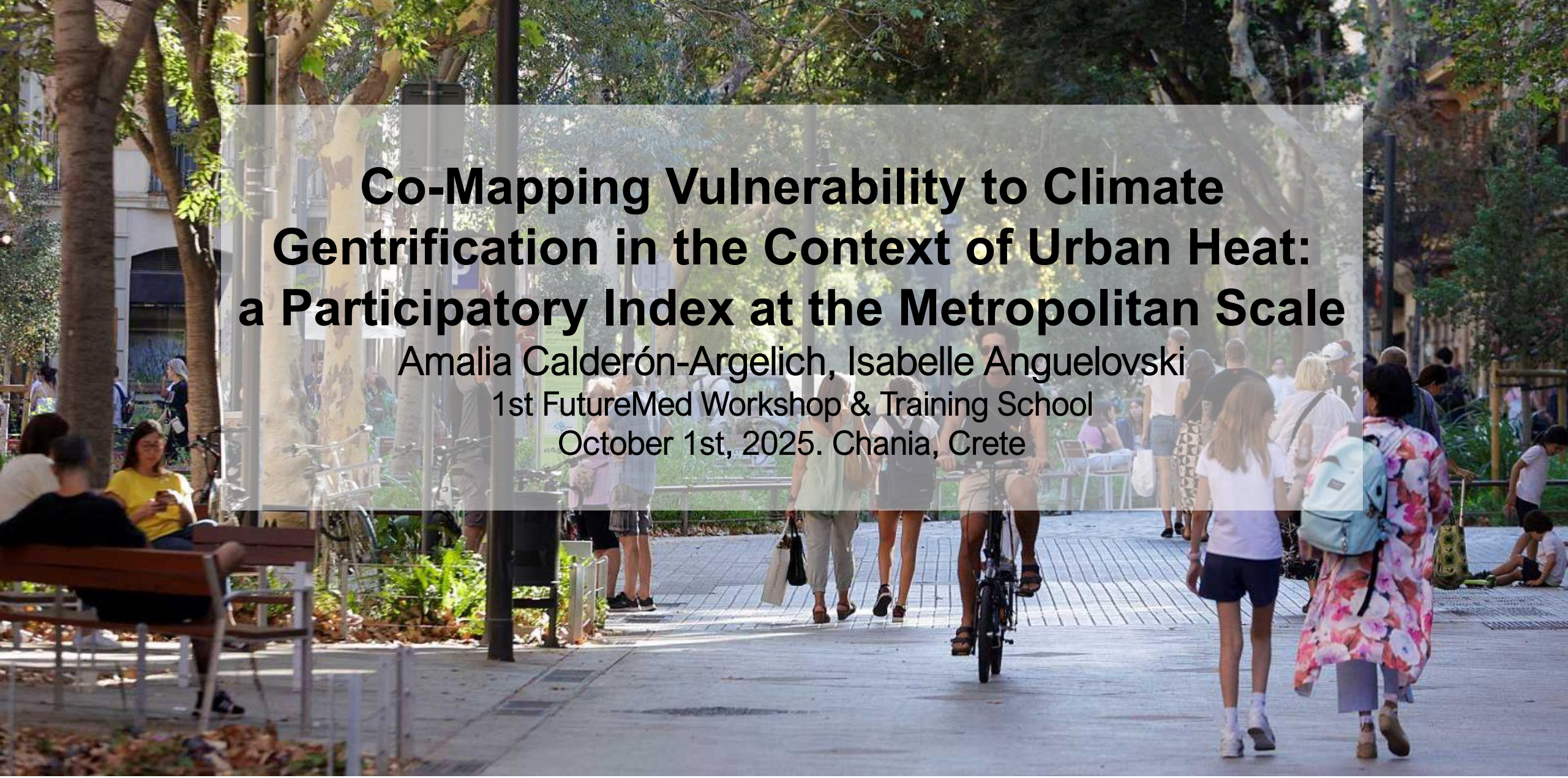


Co-Mapping Vulnerability to Climate Gentrification in the Context of Urban Heat: a Participatory Index at the Metropolitan Scale

Amalia Calderón-Argelich, Isabelle Anguelovski

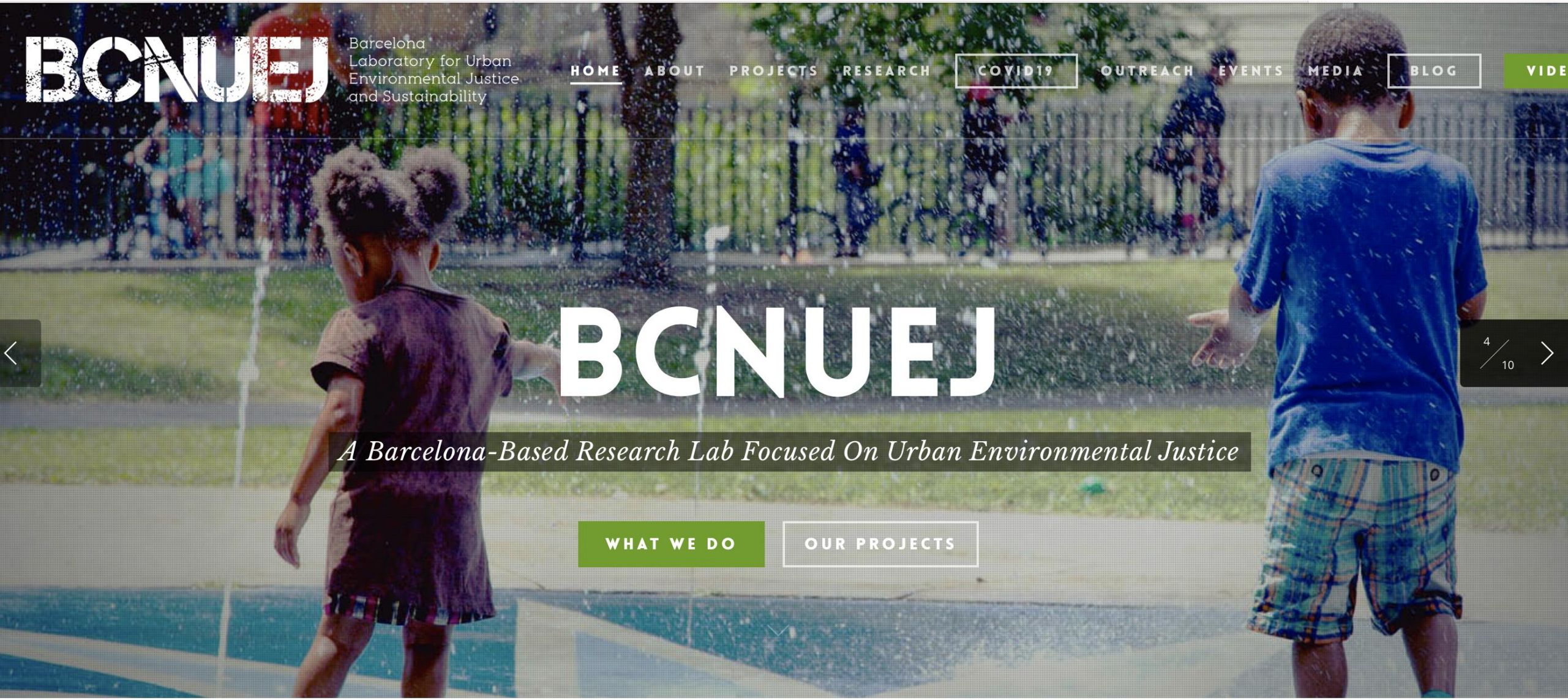
1st FutureMed Workshop & Training School

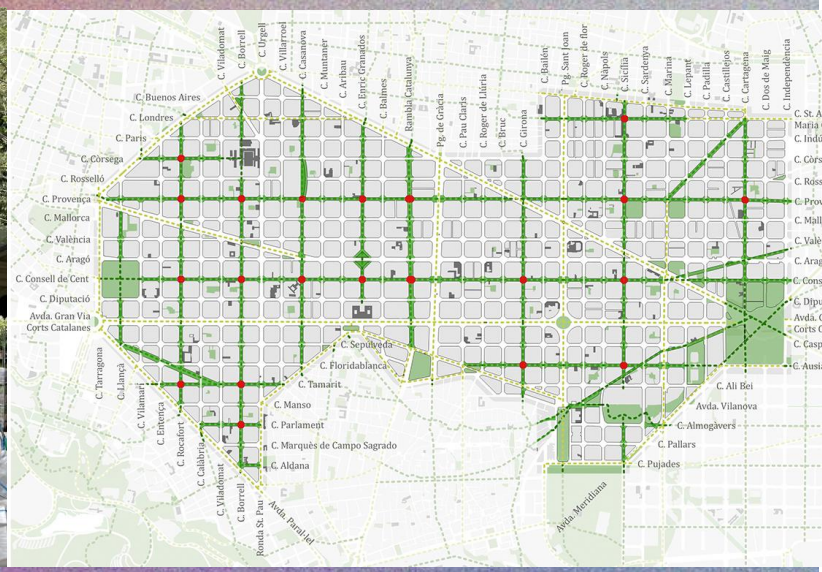
October 1st, 2025. Chania, Crete

BCNUEJ Barcelona Laboratory for Urban Environmental Justice and Sustainability

ICTA-UAB

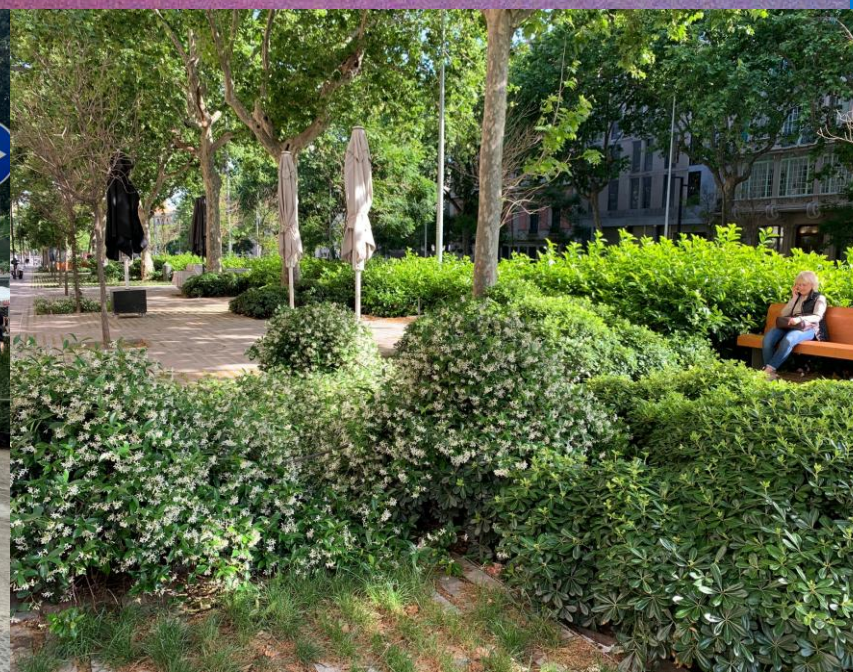
UOC Universitat Oberta de Catalunya

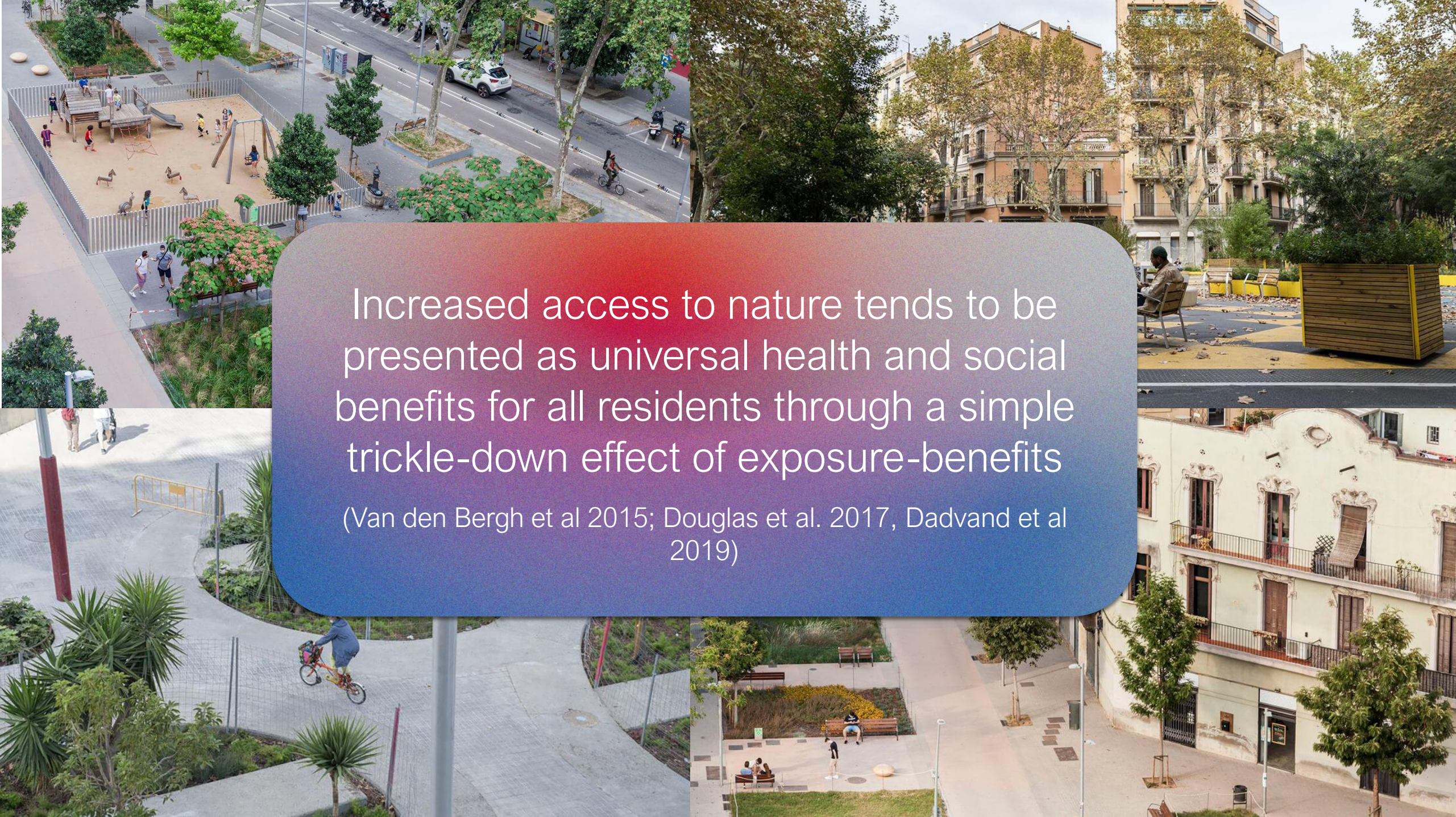

BCNUEJ
Barcelona
Laboratory for Urban
Environmental Justice
and Sustainability
HOME
ABOUT
PROJECTS
RESEARCH
COVID19
OUTREACH
EVENTS
MEDIA
BLOG
VIDE
BCNUEJ
A Barcelona-Based Research Lab Focused On Urban Environmental Justice
WHAT WE DO
OUR PROJECTS
4
10



To what extent does urban greening contribute to climate and health justice rather than reproduce existing inequalities as part of urban redevelopment?

Cities are increasingly adopted green infrastructure for their multifunctionality and their low-cost climate solutions (Meerow 2019; Shokry et al 2020)





Increased access to nature tends to be presented as universal health and social benefits for all residents through a simple trickle-down effect of exposure-benefits

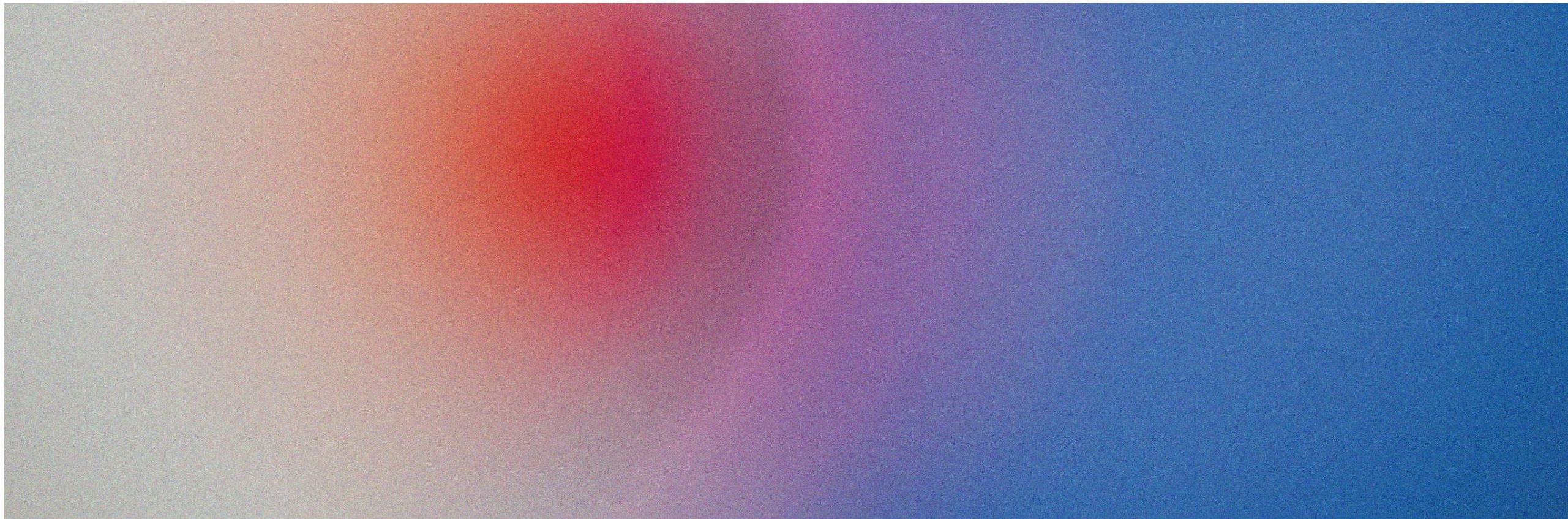
(Van den Bergh et al 2015; Douglas et al. 2017, Dadvand et al 2019)

Urban climate injustices

Socially vulnerable groups

- Have contributed least to climate change
- Are most exposed to impacts
- Have fewer means to adapt
- Are more displaced by climate resilient infrastructure

Climate gentrification: Exclusive climate protection, maladaptation, and unequal green climate security



Climate gentrification: Exclusive climate protection, maladaptation, and unequal green climate security

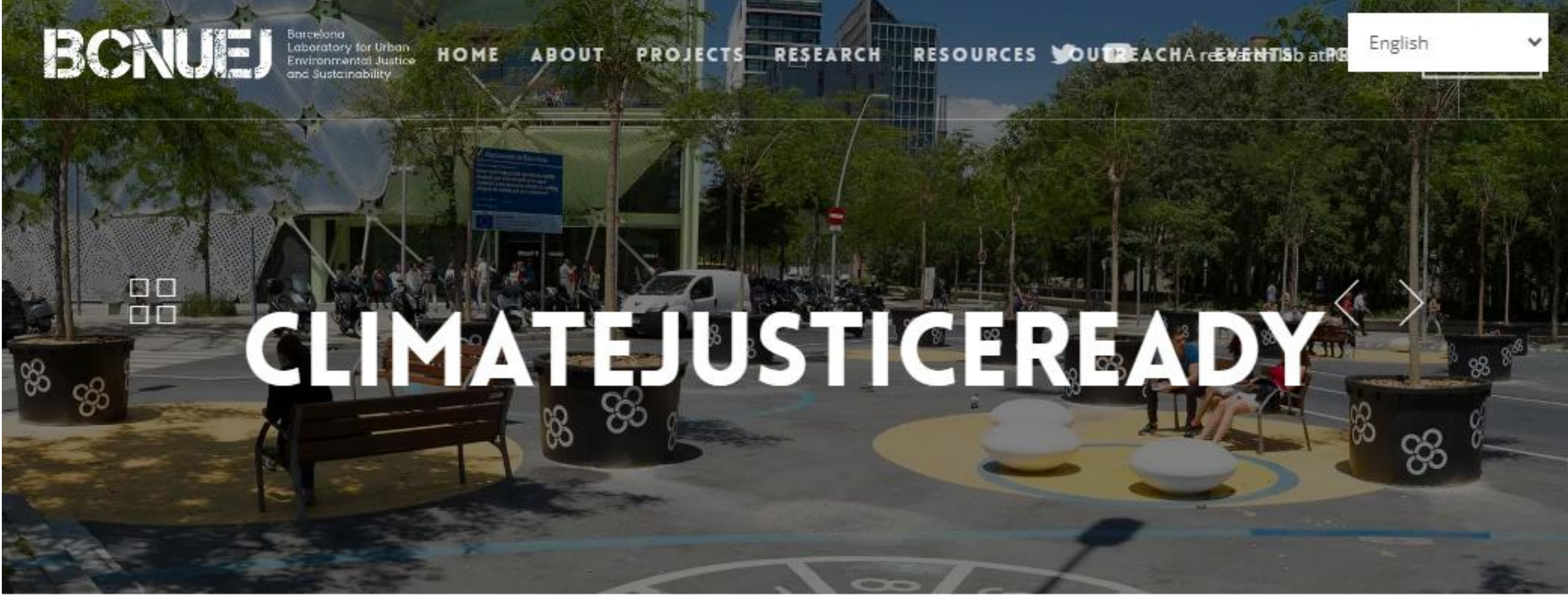
Core Hypothesis:

Working class and racialized minorities are the least able to adapt to climate change due to higher displacement vulnerability when living in gentrified areas with climate-protected/invested neighborhoods, and when having lower access to social adaptive infrastructure and secure, affordable homes

(Keenan et al. 2018; Shokry et al 2020, 2021; Best and Jouzi 2022)

Recent inquiries and questions

- How do different climate drivers and climate responses shape gentrification?
- What methods allow researchers to tease out lived experiences of (vulnerability to) climate gentrification?
- What areas in metropolitan areas are most vulnerable to climate gentrification?

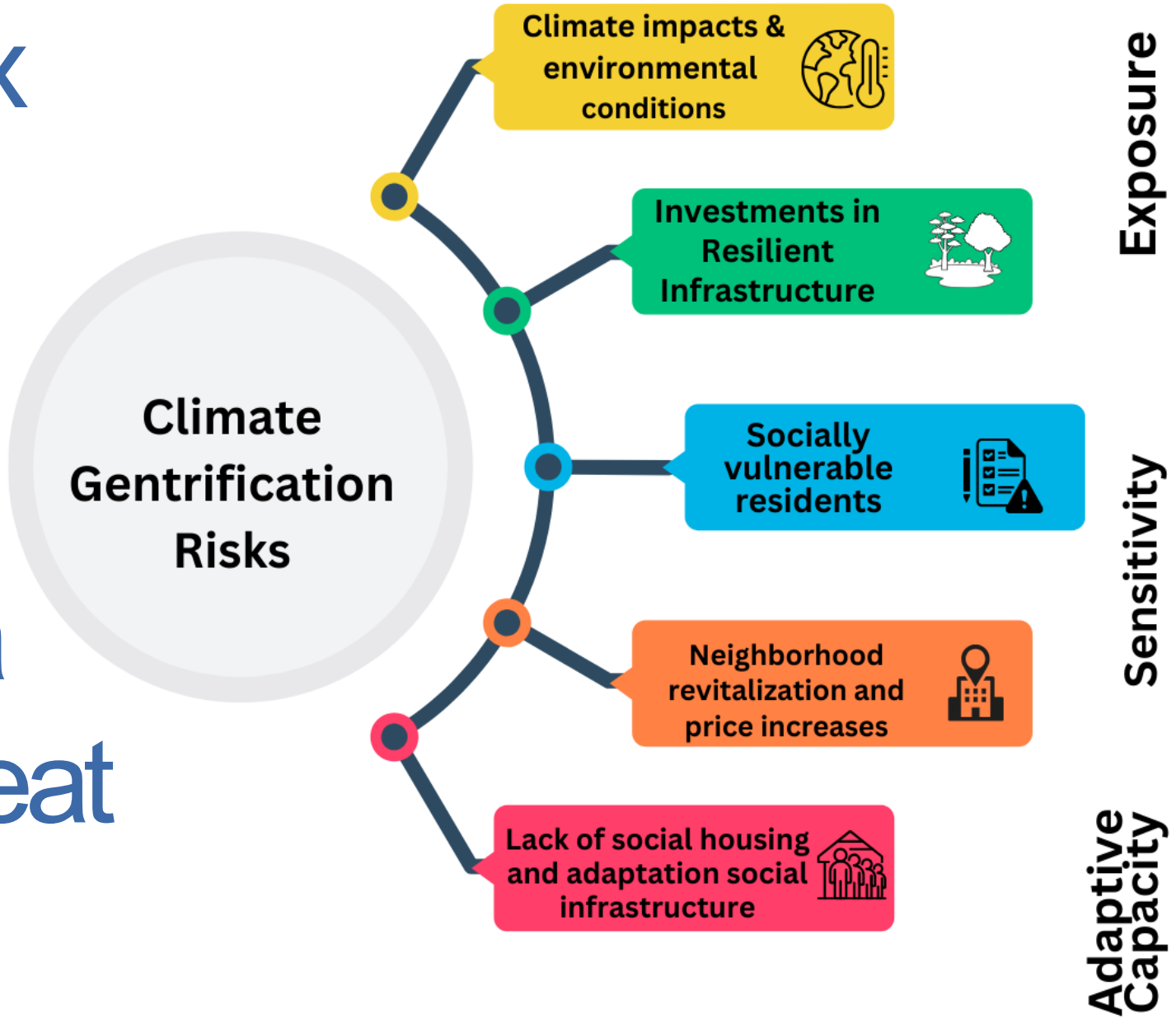


ClimateJusticeReady: Predicting and Preventing Green Gentrification in Climate-Adapting Cities

Co-mapping future climate (in)justices

- Moving beyond identifying existing patterns of gentrification: proactive approach
- Moving away from “academic” expert-driven vulnerability analysis
- Refining climate drivers of gentrification

Vulnerability index to climate gentrification for the Barcelona metropolitan area with a focus on heat



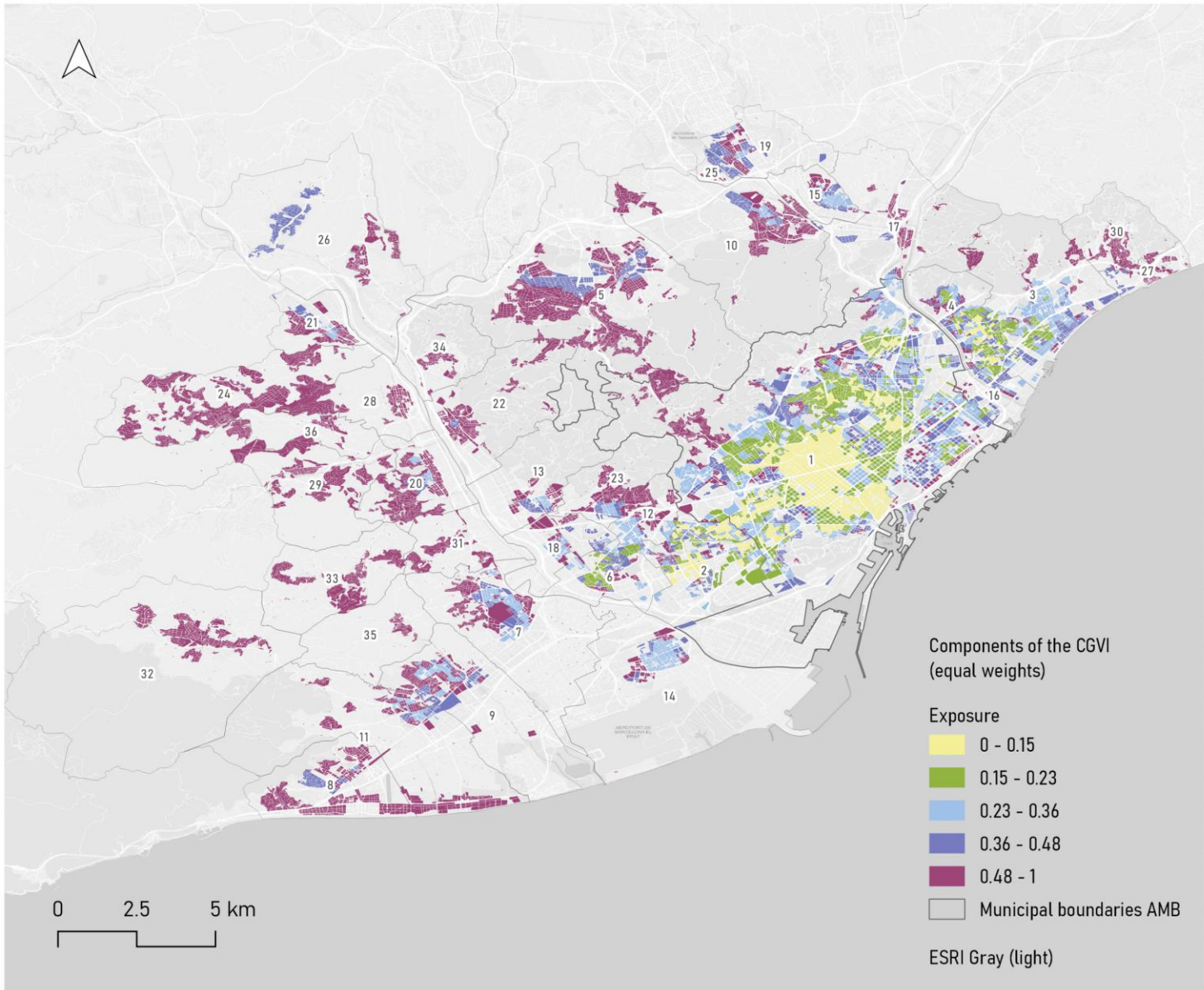
Building a vulnerability index: selection and mapping of indicators

Vulnerability to climate gentrification = Exposure to CG + Sensitivity to CG - Adaptive Capacity to CG

Exposure to Climate Gentrification - Heat

Composite sub-index including:

- Air pollution (NO2 average)
- Hours of discomfort in summer at home
- Air surface temperature
- Construction year of building
- Green and blue infrastructure
- Proximity to parks



No.	Municipality
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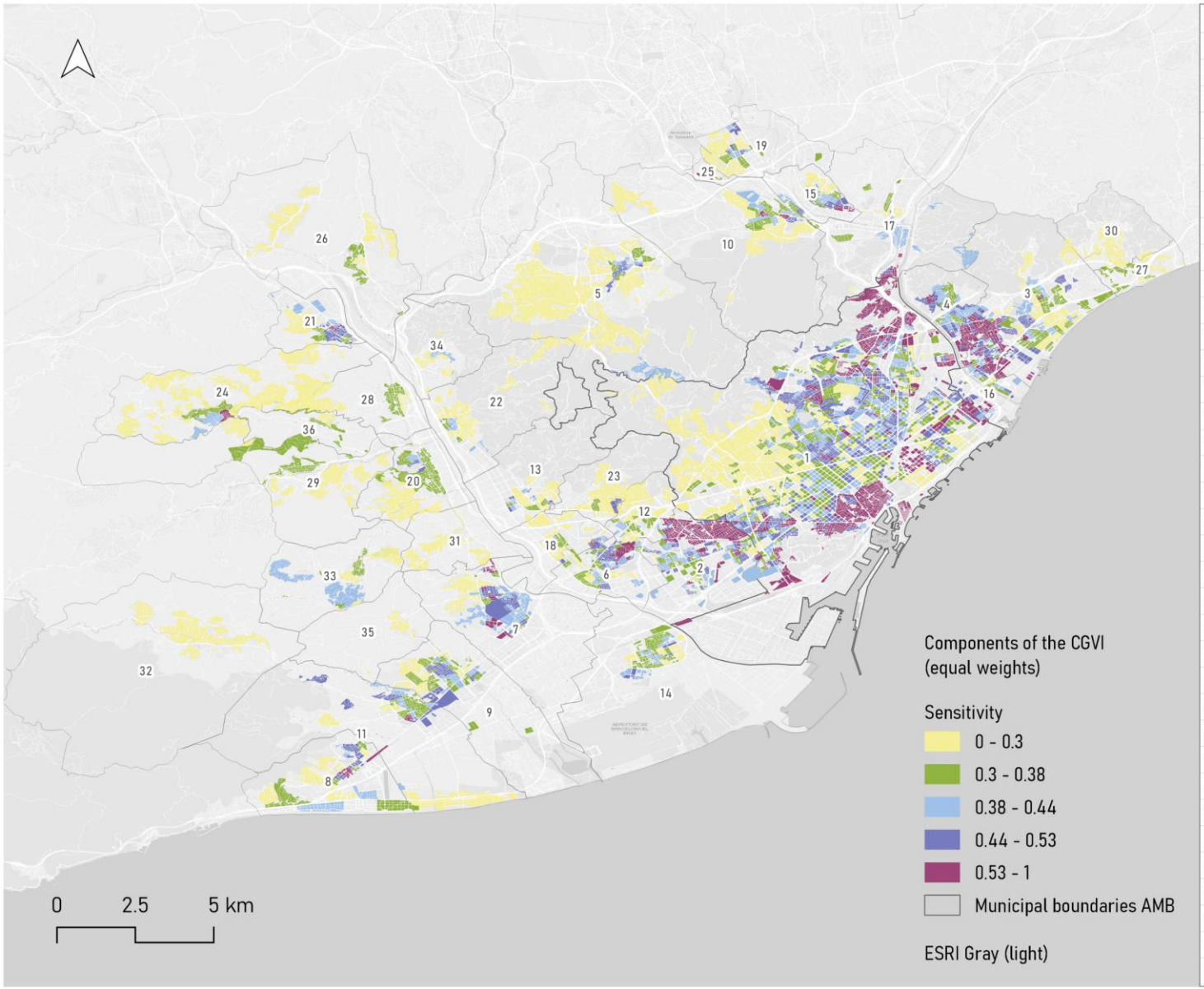
33	Torrelles de Llobregat
34	El Papiol
35	Sant Climent de Llobregat
36	La Palma de Cervelló

Category	Risk factor	Description	Unit	Year	Justification in the literature	Sign	Data source
Exposure	Climate exposure to heat and residential vulnerability	Air pollution: NO_2 annual average	NO_2 annual average (micrograms per cubic meter) at census tract	2019	Kim et al., 2023	-	ISGlobal
		Average number of hours of discomfort in summer at home	Hours/year	2017	IERMB, 2022	-	AMB (IVAC)
		Air surface temperature during the activation period of the Operational Plan to prevent the effects of heat on health in Catalonia (from June 1 to September 30).	Celsius degrees	2019		-	ISGlobal
		Percentage of homes built in or before 1950	% of homes per census tract	2021	IERMB, 2022	-	INE
		Percentage of homes built between 1951 and 1980 (both inclusive)	% of homes per census tract	2021	IERMB, 2022	-	INE
		Percentage of homes built between 1981 and 2010 (both inclusive)	% of homes per census tract	2021	IERMB, 2022	-	INE
		Percentage of homes built after 2011	% of homes per census tract	2021	IERMB, 2022	+	INE
	Green and blue infrastructure	Green infrastructure	% of cover (NDVI<0,4) per census tract	2021	Assaad and Jezzini, 2024	+	Laboratorio Metropolitano de Ecología y Territorio de Barcelona (LET)
		Blue infrastructure (land use classified as ponds, artificial canals, watercourses, reservoirs, lakes and lagoons, sea, beaches, wetlands)	% of cover (water spaces) per census tract and 300 m of buffer	2018	Shokry et al., 2022	+	Laboratorio Metropolitano de Ecología y Territorio de Barcelona (LET)
		Proximity to parks (distance from the centroid of the census tract to the nearest park)	m	2018	Assaad and Jezzini, 2024	-	AMB

Sensitivity to Climate Gentrification - Heat

Composite sub-index including:

- Recent gentrification
- People over 75 living alone
- Income
- Education level
- Population born in Global South
- Family units living on rent
- Energy poverty



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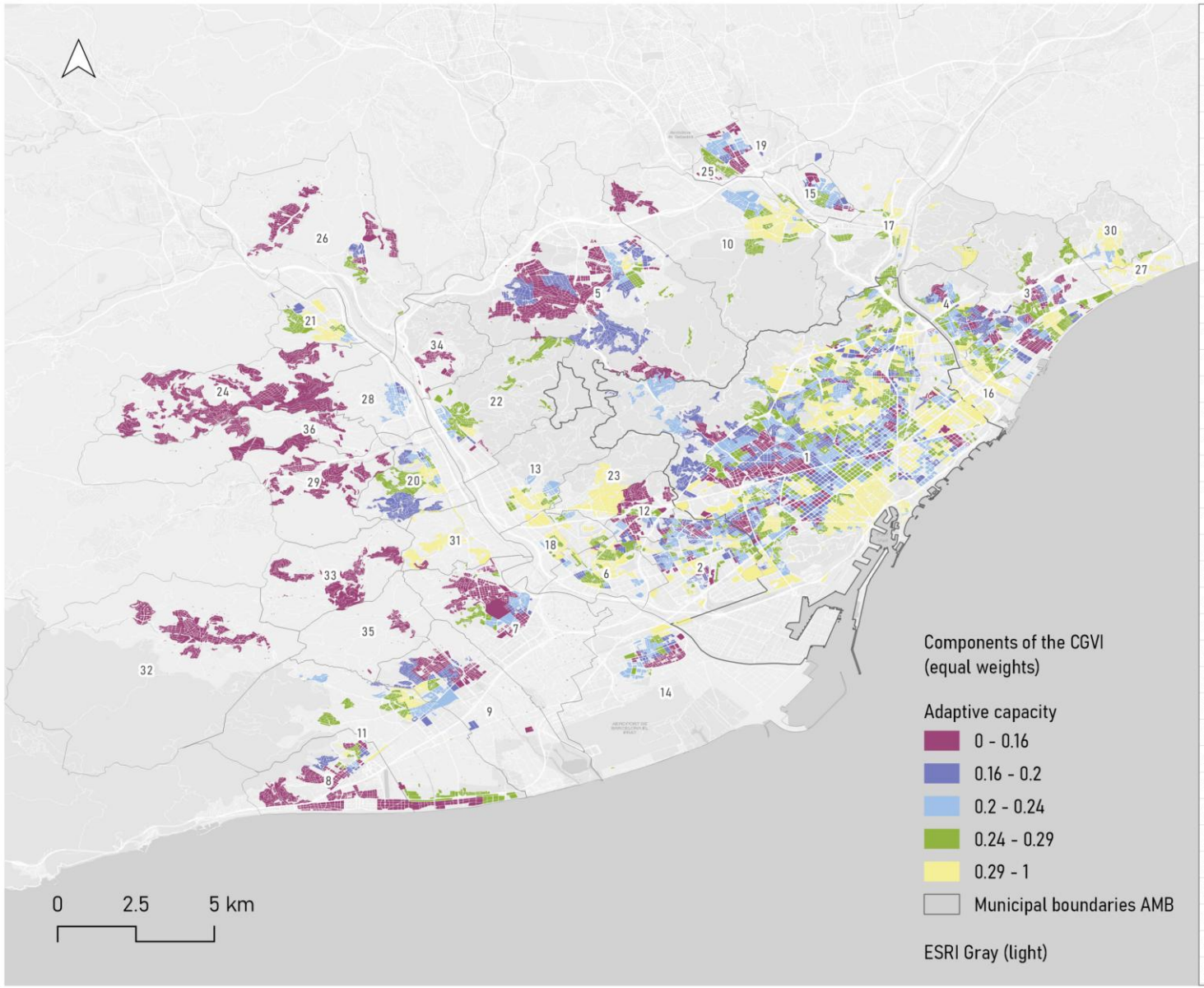
36	La Palma de Cervelló

Category	Risk factor	Description	Unit	Year	Justification in the literature	Sign	Data source
Sensitivity	Recent gentrification	Recently gentrifying tracts (2015-2021): composite index measured as rates of change in relation to the metropolitan area wide median: high income level, university education level, country of birth from Global South, rental price	Index	2015, 2021	Shokry et al., 2022	+	INE, own elaboration
	Social vulnerability	Population aged over 75 living alone	% population per census tract	2021	IERMB, 2022	+	INE
		Median income per unit of consumption	Income level (€/year)	2021	IERMB, 2022	-	INE
		Population with university education	% population per census tract	2021	IERMB, 2022	-	INE
		Population born in Global South countries	% population per census tract	2021	IERMB, 2022	+	INE
		Family units living on rent	% population per census tract	2021	IERMB, 2022	+	INE
		Energy poverty: vulnerable households with social services report (water bills)	% households per census tract	2018	IERMB, 2022	+	IVAC

Adaptive Capacity to Climate Gentrification - Heat

Composite sub-index including:

- Grey climate shelters
- Public services (social, sport and cultural facilities)
- Public housing



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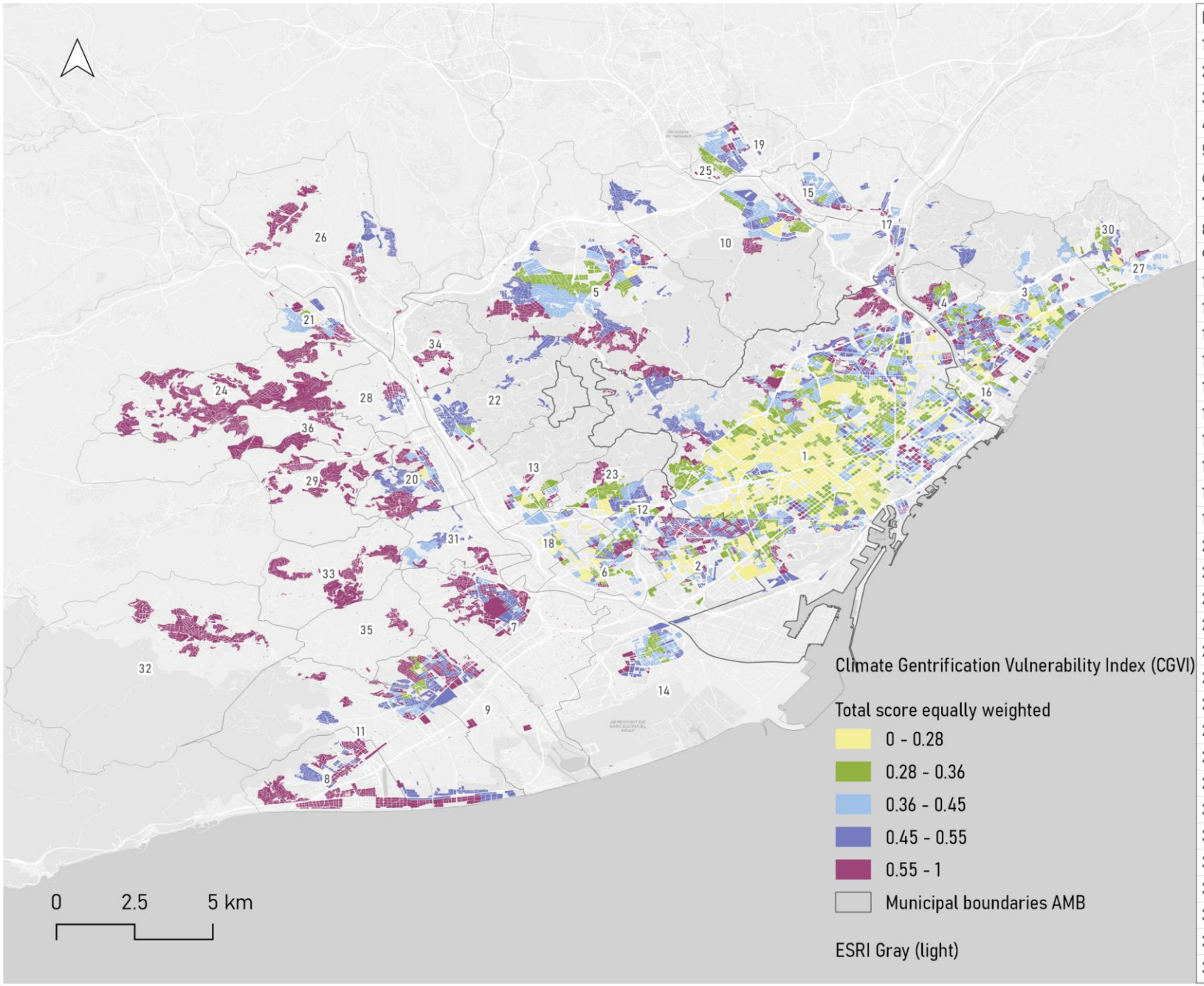
Category	Risk factor	Description	Unit	Year	Justification in the literature	Sign	Data source
Adaptive capacity	Climate adaptation	Existent grey climate shelters	no. of shelters inside census tract or within 400m	2024	IERMB, 2022	-	AMB
	Public services: social services	Public ownership centers including: health centers, social centers, retirement homes, among others.	no. of centers inside census tract or within 400m	2021	Shokry et al., 2022	-	AMB
	Public services: sport facilities	Public ownership centers including: outdoor and indoor facilities like sport centres, football fields, swimming pools, among others.	no. of centers inside census tract or within 400m	2021	Shokry et al., 2022	-	AMB
	Public services: cultural facilities	Public ownership centers including: libraries, museums, religious centers, among others.	no. of centers inside census tract or within 400m	2021	Shokry et al., 2022	-	AMB
	Public housing	Social housing every 100 inhabitants	Municipal level			-	

CGVI = Exposure + Sensitivity - Adaptive Capacity (all indicators with same ponderation)



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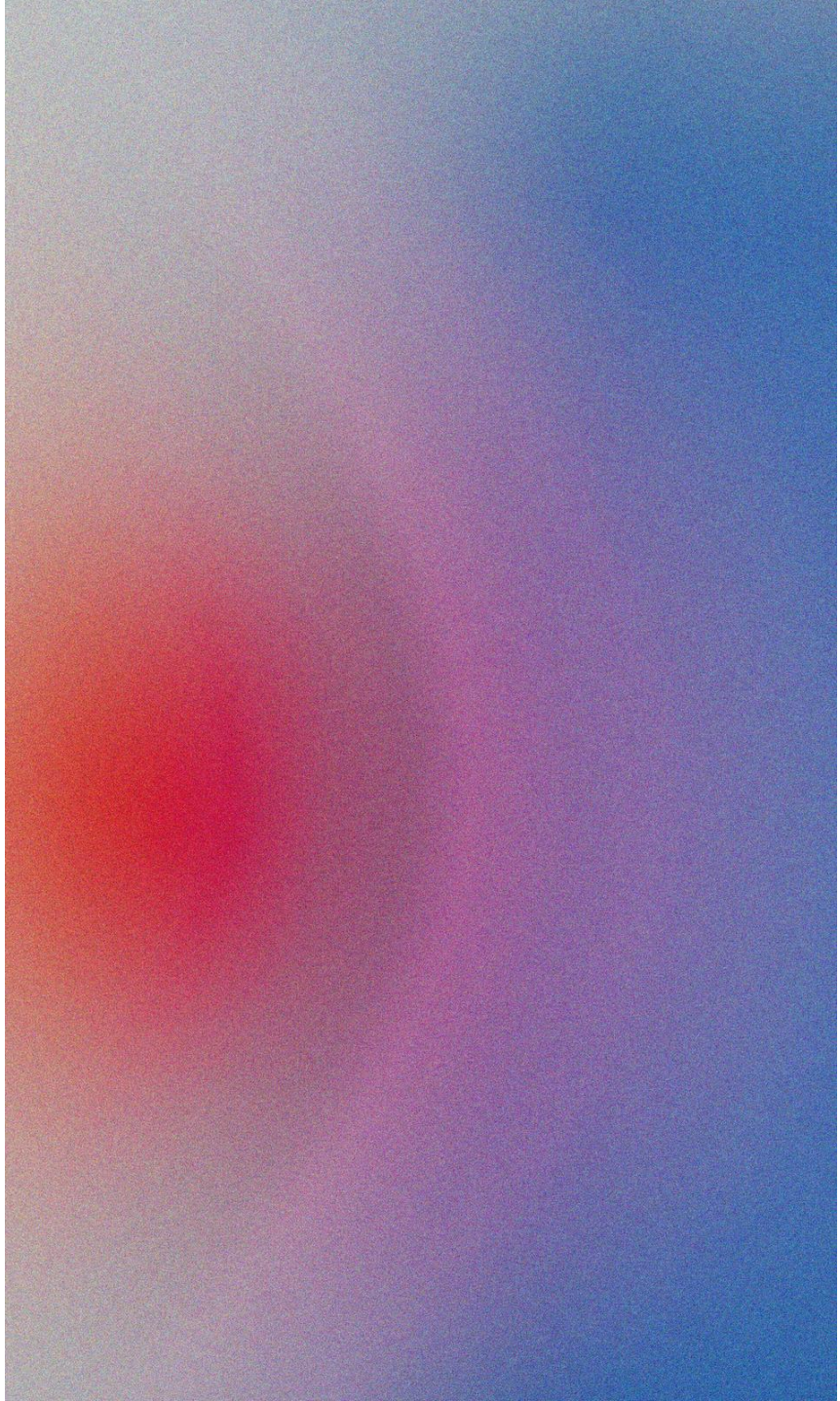
Refining a composite index

- How can participatory and collaborative mapping contribute to a more nuanced and experienced understanding of vulnerability to climate gentrification?



Participatory workshops

Expert weighting to assess the relative importance of indicators

ADMINISTRATION PRACTITIONERS

ACTIVISTS AND GRASSROOTS COMMUNITIES

INDICADORES DE EXPOSICIÓN

CONTAMINACIÓN DEL AIRE: Concentración de NO_2 en el aire (media anual)

11

AÑO DE CONSTRUCCIÓN DE LAS VIVIENDAS

23

DISCONFORT TÉRMICO EN INTERIORES EN VERANO: promedio del número de horas de al dia

28

SUPERFICIE DE INFRAESTRUCTURA VERDE: porcentaje de cobertura vegetal (NDVI)

16

SUPERFICIE DE INFRAESTRUCTURA AZUL: porcentaje de cobertura azul (ríos, playas, lagos, embalses)

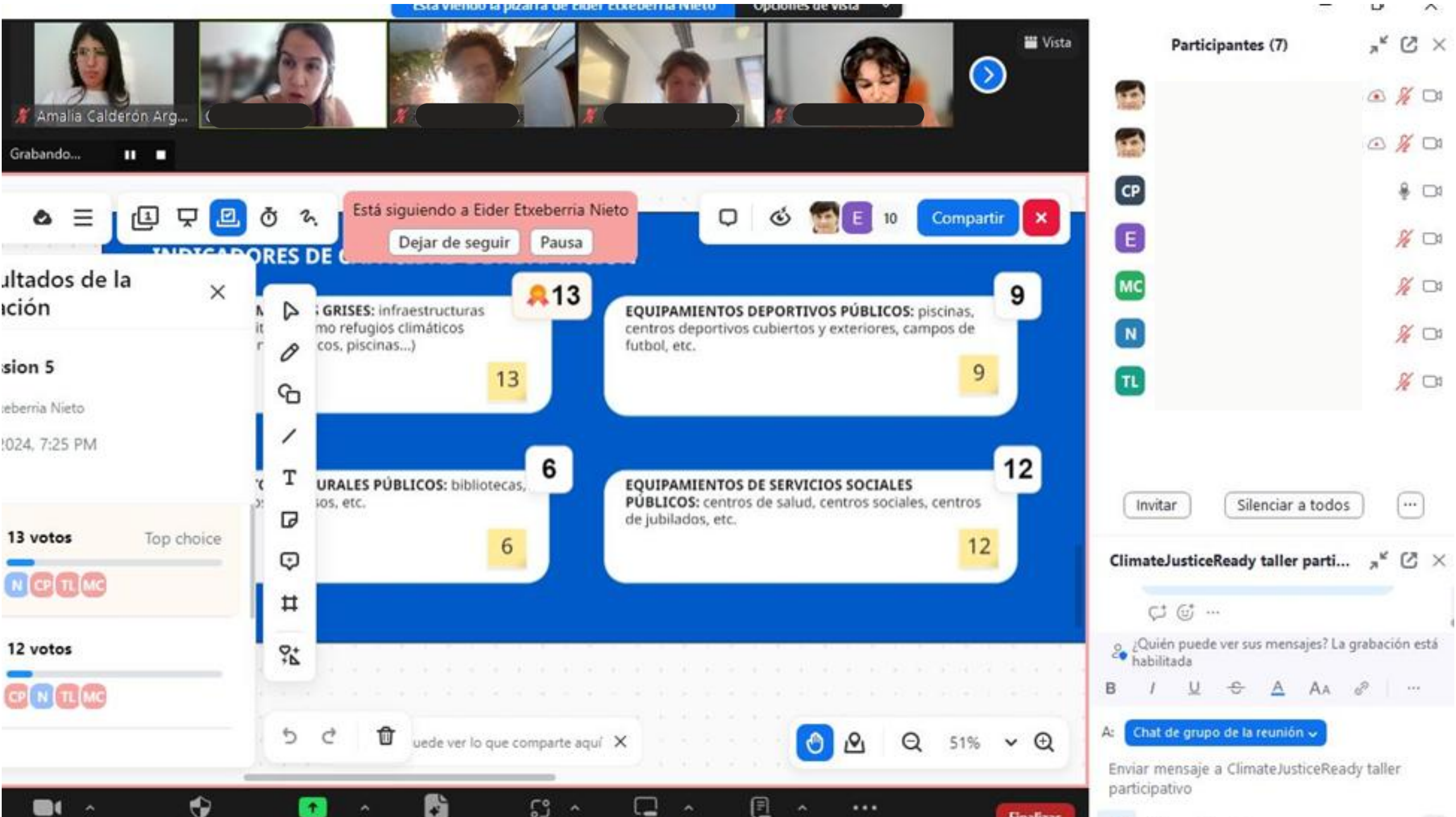
5

PROXIMIDAD A PARQUES Y JARDINES URBANOS

19

TEMPERATURA DEL AIRE EN SUPERFICIE: promedio diario para los meses de verano

12


Amalia Calderón Arg...
Vista
Grabando...
Está siguiendo a Eider Etxeberria Nieto
Dejar de seguir
Pausa
Compartir
13
GRISES: infraestructuras
mo refugios climáticos
cos, piscinas...)
13
9
EQUIPAMIENTOS DEPORTIVOS PÚBLICOS: piscinas, centros deportivos cubiertos y exteriores, campos de futbol, etc.
9
6
URALES PÚBLICOS: bibliotecas,
os, etc.
6
12
EQUIPAMIENTOS DE SERVICIOS SOCIALES PÚBLICOS: centros de salud, centros sociales, centros de jubilados, etc.
12
ultados de la
ación
sion 5
eberria Nieto
024, 7:25 PM
13 votos
Top choice
12 votos
uede ver lo que comparte aquí
51%
Participantes (7)
Invitar
Silenciar a todos
ClimateJusticeReady taller parti...
¿Quién puede ver sus mensajes? La grabación está habilitada
Chat de grupo de la reunión
Enviar mensaje a ClimateJusticeReady taller participativo

ADMINISTRATION PRACTITIONERS

ADMIN PRACTITIONERS (17.05)				GRASSROOTS COMMUNITIES (05.06)			
Indicador	**Puntos**	**%**	**%*%**	**Indicador**	**Puntos**	**%**	**%*%**
EXPOSICION				EXPOSICION			
Infrastructura verde	16,00	14,04	4,54	Infrastruc	8,00	26,67	10,00
Infrastructure azul	5,00	4,39	1,42	Infrastruc	3,00	10,00	3,75
Proximidad parques	19,00	16,67	5,39	Proximida	11,00	36,67	13,75
Año de construcción	23,00	20,18	6,53	Año de co	4,00	13,33	5,00
Contaminación del aire	11,00	9,65	3,12	Contamin	1,00	3,33	1,25
Disconfort termico	28,00	24,56	7,95	Disconfor	1,00	3,33	1,25
Temperatura de superficie del aire	12,00	10,53	3,41	Temperatu	2,00	6,67	2,50
SENSIBILIDAD				SENSIBILIDAD			
Gentrificación reciente	15,00	12,93	5,13	Gentrifica	4,00	10,00	4,00
Población mayor de 75 años	19,00	16,38	6,50	Población	4,00	10,00	4,00
Mujeres mayores de 65 años	13,00	11,21	4,45	Mujeres m	4,00	10,00	4,00
Mediana de la renta	21,00	18,10	7,19	Mediana d	4,00	10,00	4,00
Alquiler	6,00	5,17	2,05	Alquiler	7,00	17,50	7,00
Pobreza energética	30,00	25,86	10,27	Pobreza e	10,00	25,00	10,00
Nivel de educación	3,00	2,59	1,03	Nivel de e	0,00	0,00	0,00
Población nacida en el sur global	9,00	7,76	3,08	Población	7,00	17,50	7,00
CAPACIDAD DE ADAPTACIÓN				CAPACIDAD DE ADAPTACIÓN			
Refugios climaticos	33,00	26,40	7,38	Refugios c	13,00	26,00	5,85
Equipamientos deportivos publicc	25,00	20,00	5,59	Equipami	9,00	18,00	4,05
Equipamientos culturales público	15,00	12,00	3,35	Equipami	6,00	12,00	2,70
Equipamientos de servicios social	27,00	21,60	6,04	Equipami	12,00	24,00	5,40
		20,00				20,00	
IVGC				IVGC			
Exposición	22,00	32,35%		Exposició	15,00	37,50%	
Sensibilidad	27,00	39,71%		Sensibilid	16,00	40,00%	
Capacidad de adaptación	19,00	27,94%		Capacida	9,00	22,50%	

ACTIVISTS AND GRASSROOTS COMMUNITIES

ADMINISTRATION PRACTITIONERS		ACTIVISTS AND GRASSROOTS COMMUNITIES
Exposure 32%	<	**Exposure 38%**
Sensitivity 40%	=	Sensitivity 40%
Adaptive capacity 28%	>	Adaptive capacity 23%

“For me, the main cause of gentrification isn’t so much that you have improved that area and so on... It’s the fact that there are no housing policies allowing people to stay there. Not the fact that the area is better, because that is something everyone should be able to... right?” (Technician 3).

ADMINISTRATION PRACTITIONERS		ACTIVISTS AND GRASSROOTS COMMUNITIES
Exposure 32%	<	**Exposure 38%**
Sensitivity 40%	=	Sensitivity 40%
Adaptive capacity 28%	>	Adaptive capacity 23%

ADMINISTRATION PRACTITIONERS		ACTIVISTS AND GRASSROOTS COMMUNITIES
Heat discomfort at home 25%	>	Discomfort at home 3%
Year of construction 20%	>	Year of construction 13%
Median income 20%	>	Median income 11%

ADMINISTRATION PRACTITIONERS		ACTIVISTS AND GRASSROOTS COMMUNITIES
Proximity to parks 17%	<	**Proximity to parks 37%**
Average rent 6%	<	**Average rent 19%**
Born in Global South 9%	<	**Born in Global South 19%**

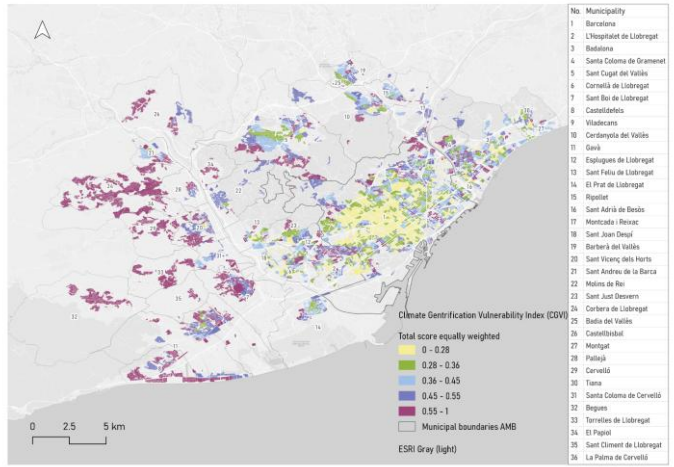
Different indexes

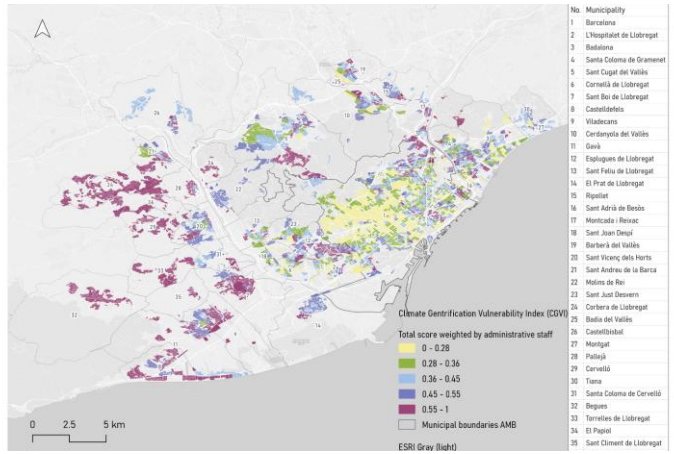
Aggregation of indicators following different weighting can lead to different quantitative representations of vulnerability

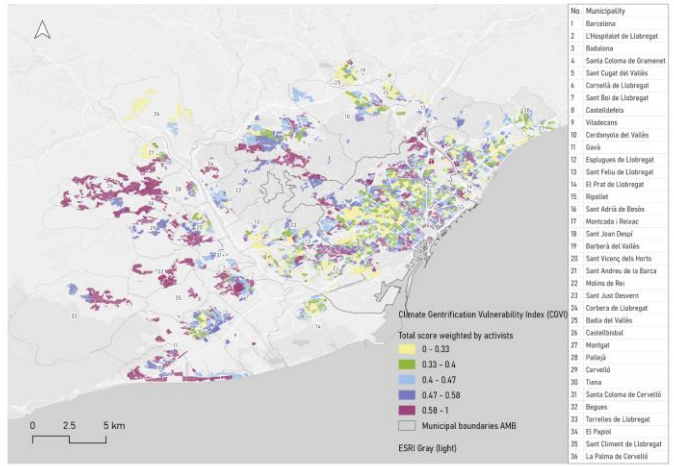
EQUAL WEIGHTS

ADMINISTRATION PRACTITIONERS

ACTIVISTS AND GRASSROOTS COMMUNITIES

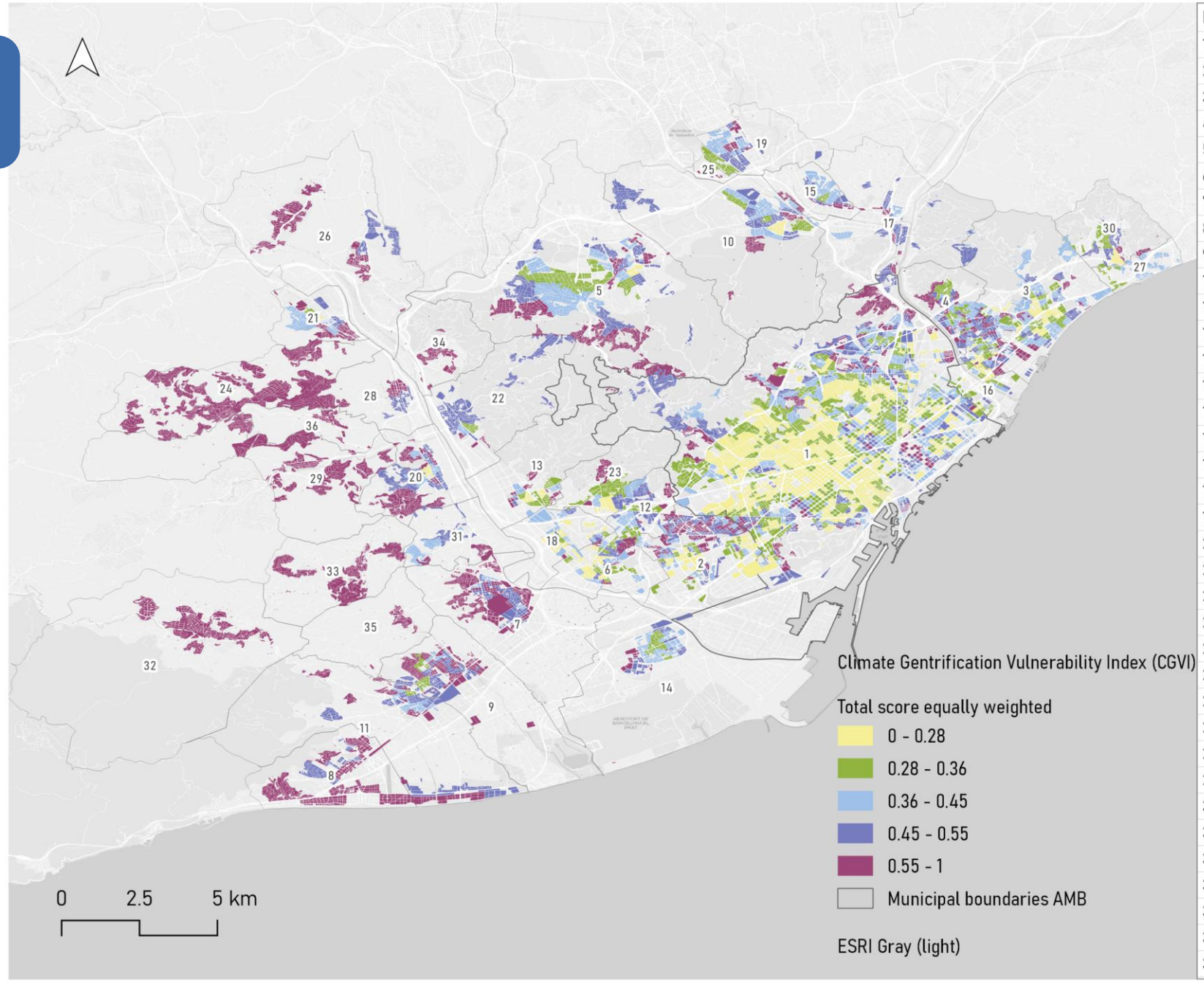






EQUAL WEIGHTS

- Areas with the highest vulnerability are located outside of Barcelona city, especially BCN's periphery and outlying areas of the AMB
- Strong impact from exposure to green spaces
- Within BCN, low to medium vulnerability except for peripherical areas with moderate social vulnerability and less adaptive capacity



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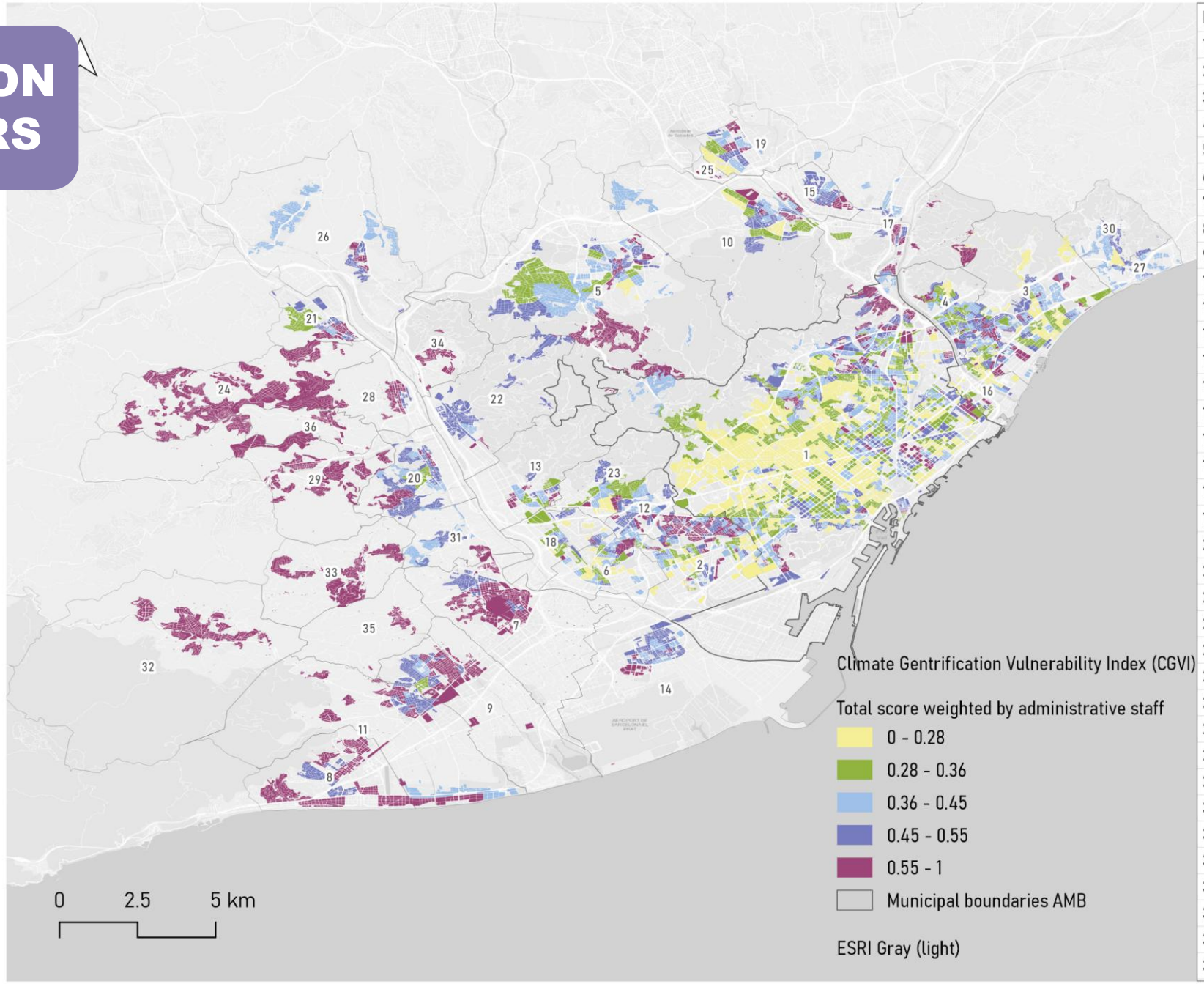
34	El Papiol
35	Sant Climent de Llobregat
36	La Palma de Cervelló

ADMINISTRATION PRACTITIONERS

- Lower vulnerability in areas with high adaptive capacity: Barcelona city
- Higher weights assigned to infrastructural and housing conditions may downplay social vulnerability factors linked to gentrification processes.



No.	Municipality
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2	L'Hospitalet de Llobregat
3	Badalona
4	Santa Coloma de Gramenet
5	Sant Cugat del Vallès
6	Cornellà de Llobregat
7	Sant Boi de Llobregat
8	Castelldefels
9	Viladecans
10	Cerdanyola del Vallès
11	Gavà
12	Esplugues de Llobregat
13	Sant Feliu de Llobregat
14	El Prat de Llobregat
15	Ripollet
16	Sant Adrià de Besòs
17	Montcada i Reixac
18	Sant Joan Despí
19	Barberà del Vallès
20	Sant Vicenç dels Horts
21	Sant Andreu de la Barca
22	Molins de Rei
23	Sant Just Desvern
24	Corbera de Llobregat
25	Badia del Vallès
26	Castellbisbal
27	Montgat
28	Pallejà
29	Cervelló
30	Tiana
31	Santa Coloma de Cervelló
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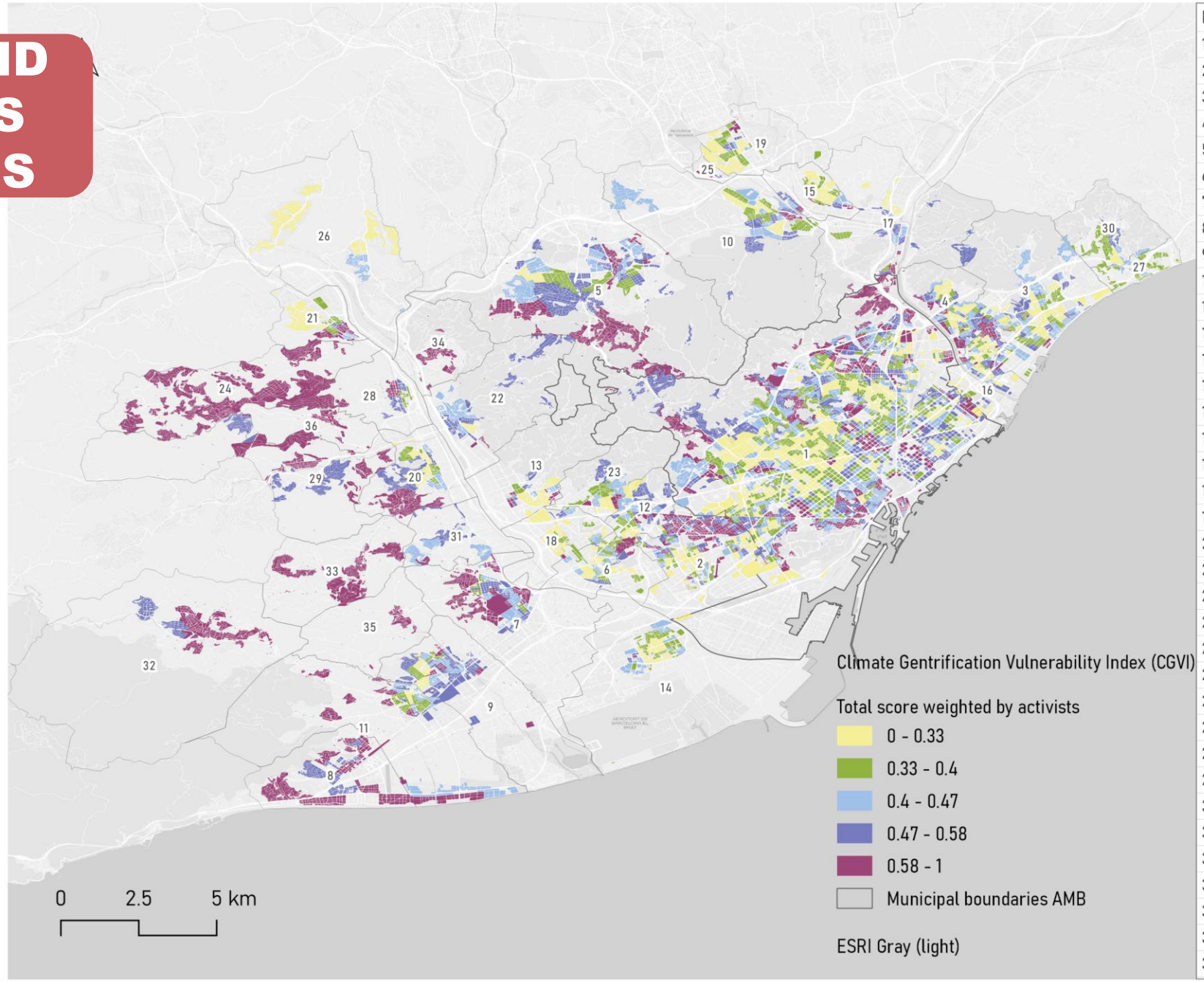
ACTIVISTS AND GRASSROOTS COMMUNITIES

- Areas with high green space combined with higher social vulnerability and gentrification have the highest vulnerability to climate gentrification



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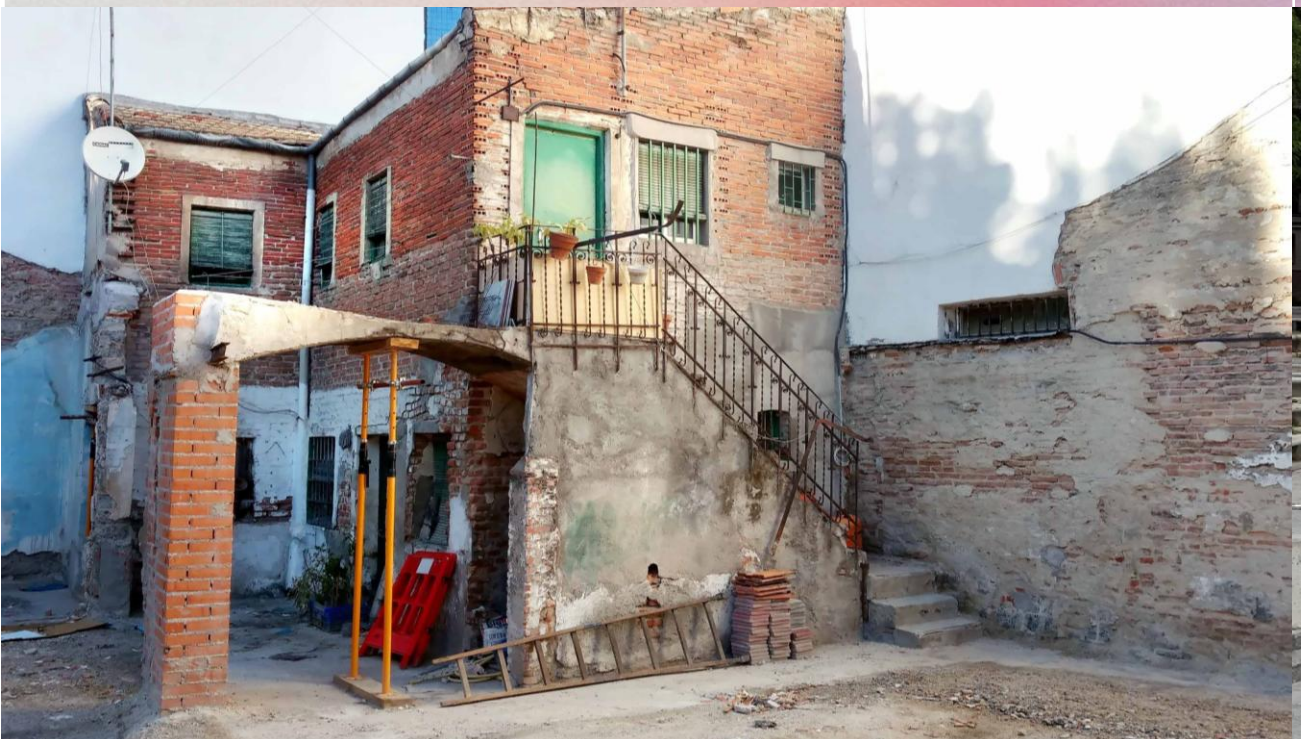
What do these differences tell us so far?

Administration practitioners prioritize **exposure indicators** (discomfort at home, year of construction) to depict climate gentrification risks, to address heat injustices in general, and put the accent on community **adaptive capacity as tool for reducing VCG**

Grassroots communities prioritize proximity to parks (**exposure**) and **sensitivity** indicators (rent and born in Global South) as main drivers of climate gentrification risks and measures that reduce heat. Social indicators are seen as key drivers to VCG



Study take aways

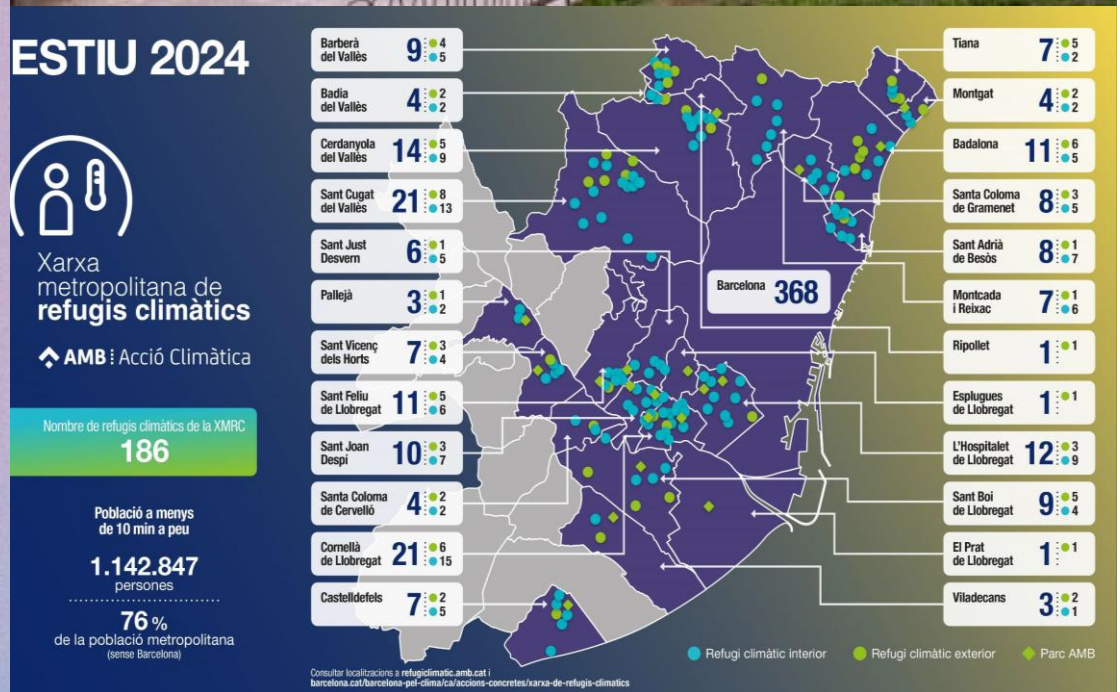
- **Institutional mandates and daily experiences** of climate vulnerability and social vulnerability shape weight assignation for VCG
- Notable concentration of high vulnerability outside Barcelona, in the western and **peripheral areas** of the AMB with lower temperature, newer buildings, and more greenery, which illustrates some heat gentrification pathways
- Importance of **metropolitan** wide dynamics of climate impacts, gentrification patterns and drivers, and overall socio-environmental adaptive capacity

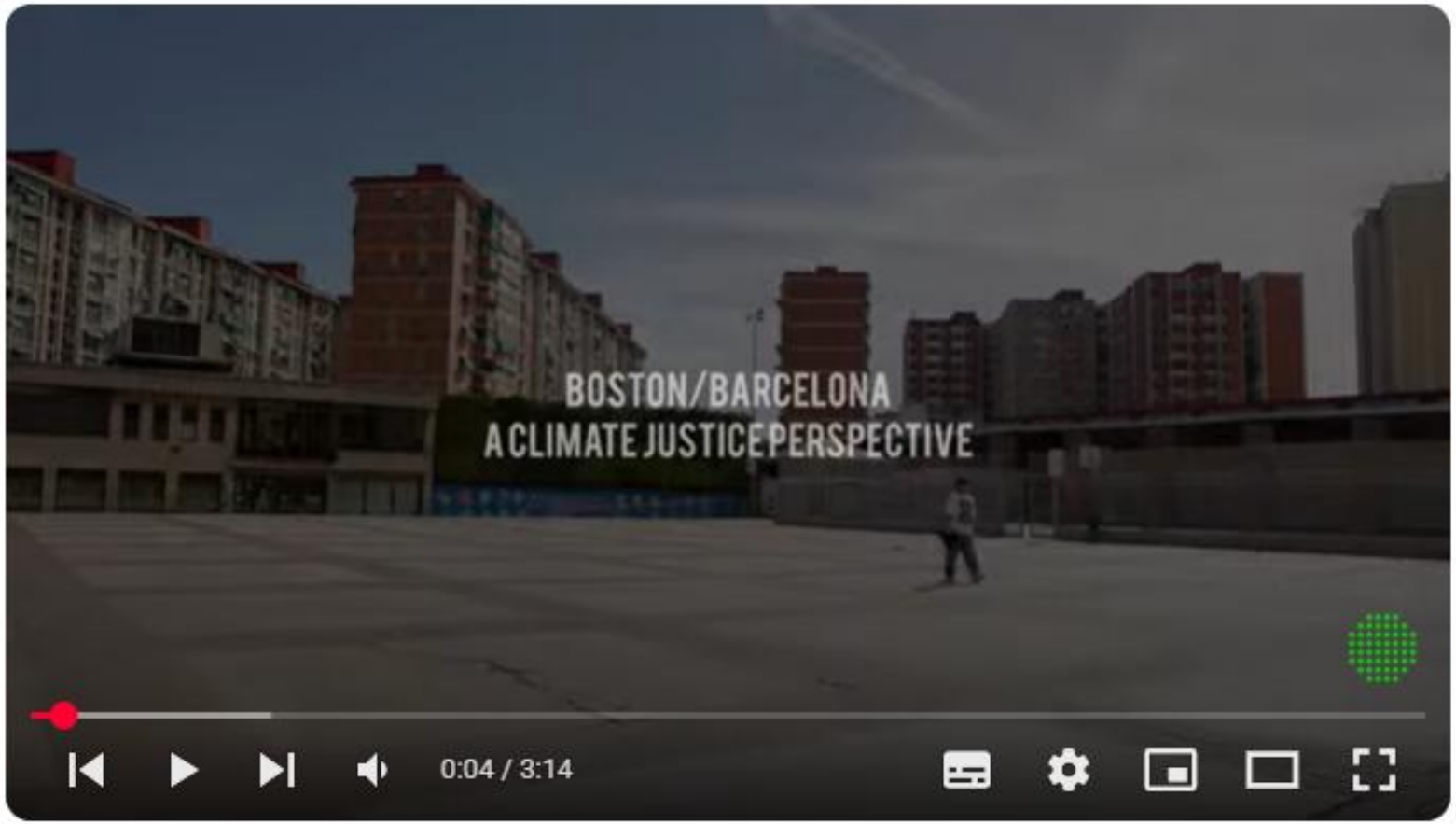
Policy take aways

- Dual pressures of increasing heat and gentrification (climate and housing)
- Opportunities for integrated strategies and policies that address both exposure to heat and sensitivity to climate (heat) gentrification for all
- Need to further explore adaptive capacity measures that resonate with communities

Best practices and challenges

- **Climate Shelters program** truly accessible
- **Housing retrofits** in socially and heat vulnerable neighborhoods but... administrative burden + potential for speculation
- **Sectoral silos** between climate action, housing, and greening
- Need for **targeted interventions in peripheral areas** with compounded effects of climate exposure and limited adaptation resources





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1 What is Heat Justice? 3:15
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2 Jaime Palomera of the Institut de Recerca Urbana de... 1:22
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3 Ana Vanegas, Program Coordinator of Comunidades... 1:09
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4 Virginia Vallvé talks about climate justice within the... 1:09
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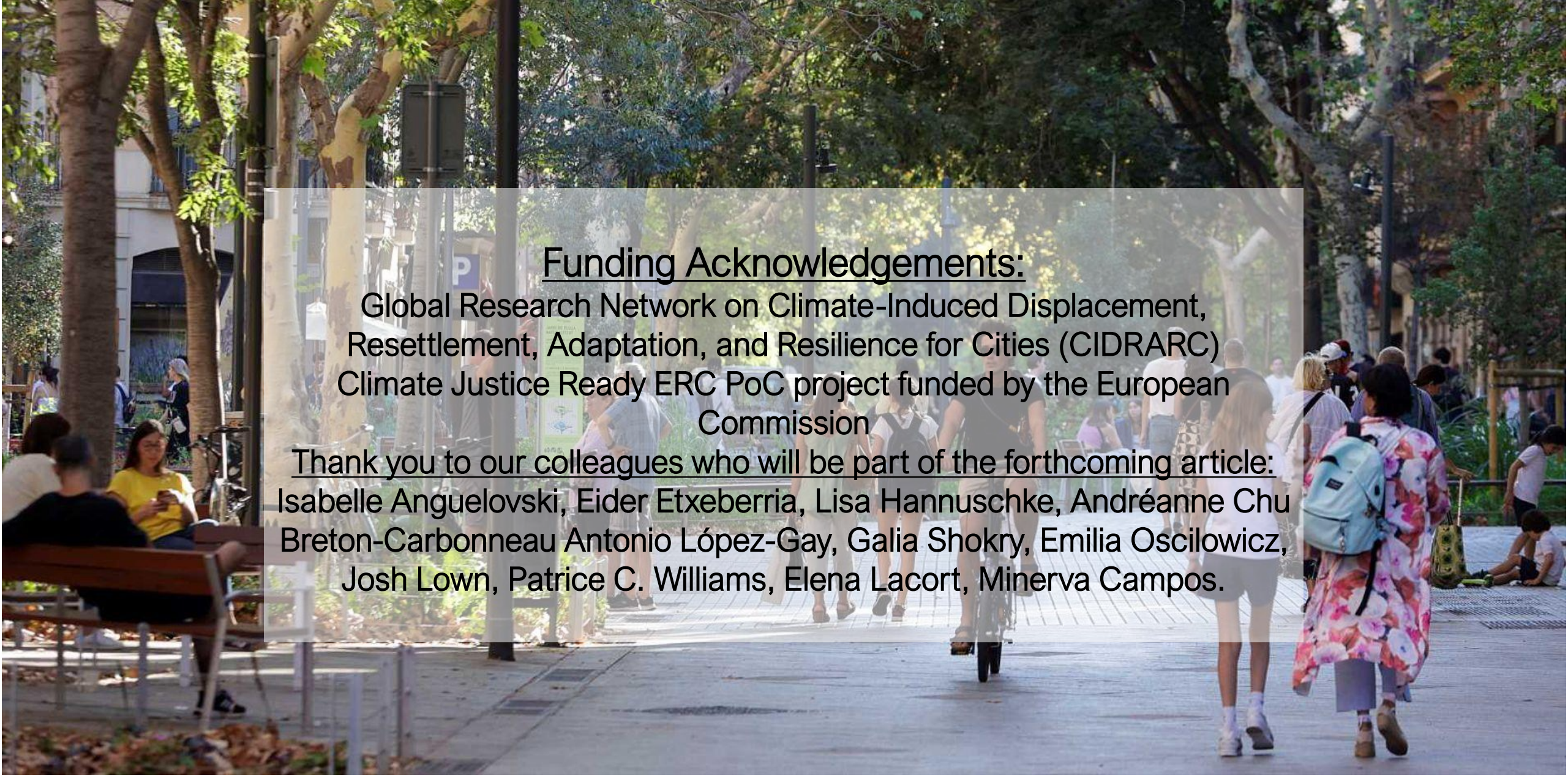

Funding Acknowledgements:

Global Research Network on Climate-Induced Displacement, Resettlement, Adaptation, and Resilience for Cities (CIDRARC)
Climate Justice Ready ERC PoC project funded by the European Commission

Thank you to our colleagues who will be part of the forthcoming article:
Isabelle Anguelovski, Eider Etxeberria, Lisa Hannuschke, Andréanne Chu Breton-Carbonneau Antonio López-Gay, Galia Shokry, Emilia Oscilowicz, Josh Lown, Patrice C. Williams, Elena Lacort, Minerva Campos.

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