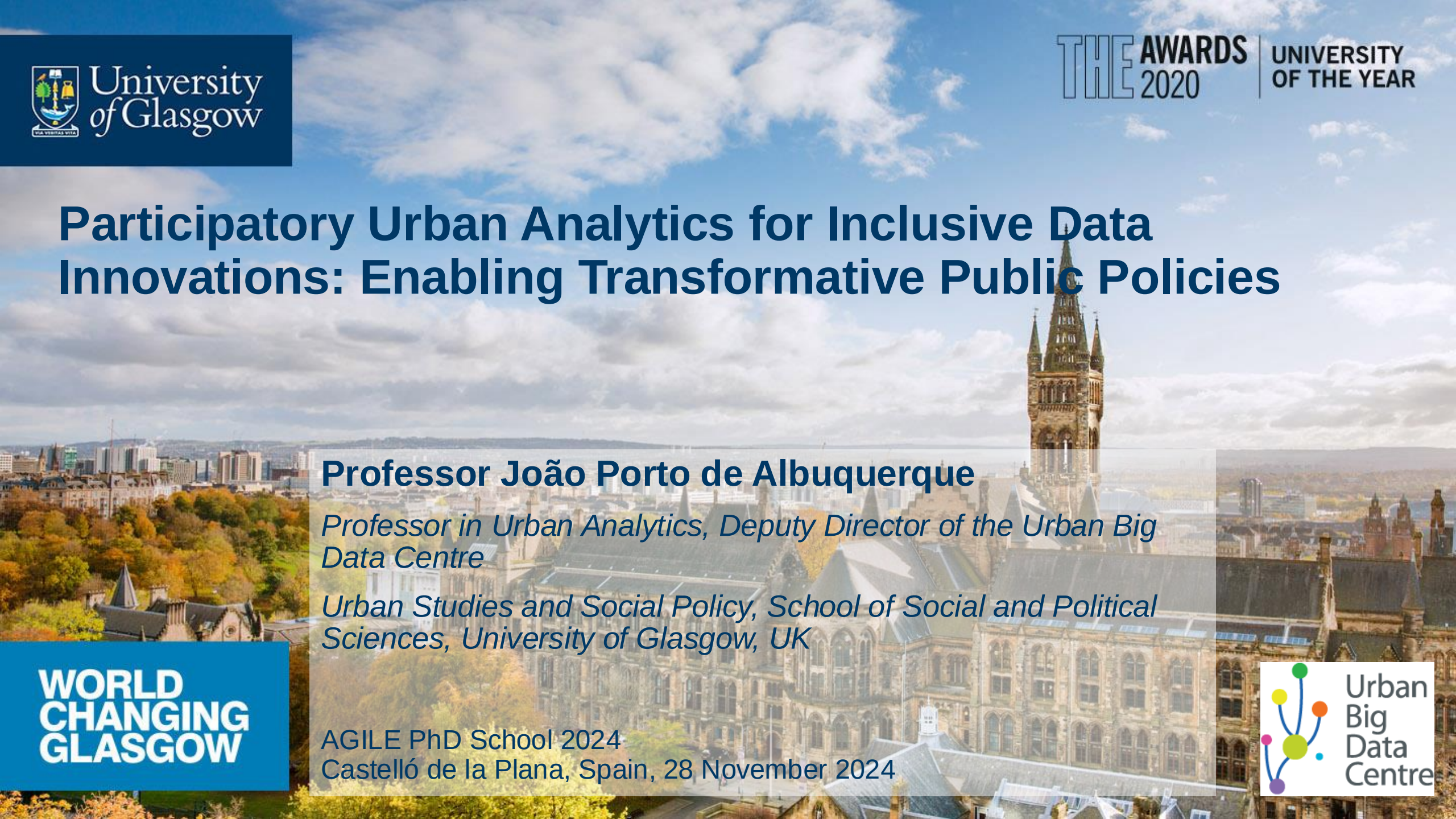


# Participatory Urban Analytics for Inclusive Data Innovations: Enabling Transformative Public Policies


**Professor João Porto de Albuquerque**

*Professor in Urban Analytics, Deputy Director of the Urban Big Data Centre*

*Urban Studies and Social Policy, School of Social and Political Sciences, University of Glasgow, UK*


AGILE PhD School 2024
Castelló de la Plana, Spain, 28 November 2024

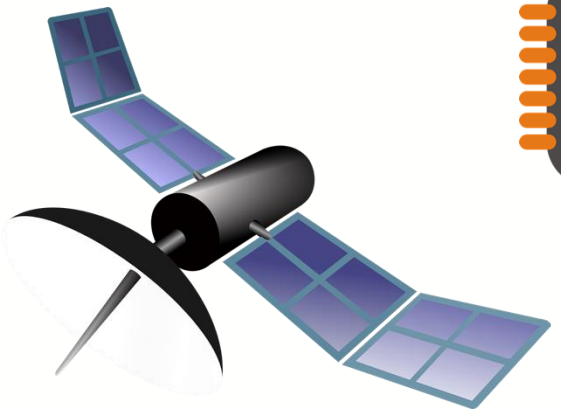
# Participatory urban analytics: resilient cities and communities with citizen science

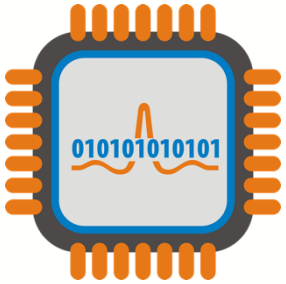
UBDC: Funded by ESRC and the University of Glasgow since 2014 (£10M+): Research Centre and UK Data Service. Themes: Housing, Transport, Labour Market/Education, Governance, **Urban Sustainability and Participation**

- **Flood** resilience in Brazil: "Waterproofing Data": (PI: €1m ESRC/GCRF/Belmont Forum/Norface grant) with FGV and Cemaden (National Centre for Disaster Monitoring and Early-Warning). Resilience and education: GRTA Waterproofing Data++ (PI: £370K UKRI GCRF): collaboration with FGV and Cemaden/Brazil
- Landslides and **community resilience** in Brazil and Colombia: "URBE Latam" (PI: £1m UKRI GCRF) : collaboration with BGS, Universidad de Antioquia, Colegio Mayor and UFRJ
- **Healthcare access** in slums in Bangladesh, Kenya, Pakistan, Nigeria: NIHR Global Health Unit on Improving Health in Slums (Co-I: £6m NIHR grant).
- Creating Interfaces: **Food-Water-Energy Nexus** in Poland, Romania and the US (Co-I, Belmont Forum/ESRC/AHRC JPI €1.35m overall budget).
- The role of Digital Footprint Data in **localisation of the Sustainable Development Goals** (Co-I: £2m UKRI ESRC - work package of the UBDC Digital Footprint Data Service): study of data innovations for SDG monitoring.
- CityCashTransfer: Evaluation of Urban Sustainability in Municipal **Cash Transfer Programs using Local Currency** (PI: £19.9K), collaboration with FGV, UFRN, e-Dinheiro, Niteroi and Maricá municipal governments.
- **IDEAMAPS: A participatory data-modelling ecosystem for deprived area map production in LMIC cities (PI: $1.6m, BMGF, Oct/2022-Sep/2025), collaboration with APHRC, Uni. of Lagos,, ITC/Uni. Twente, Uni. York, George-Washington Uni.**


# Urban analytics: What cities can we read out of data?


Sensors

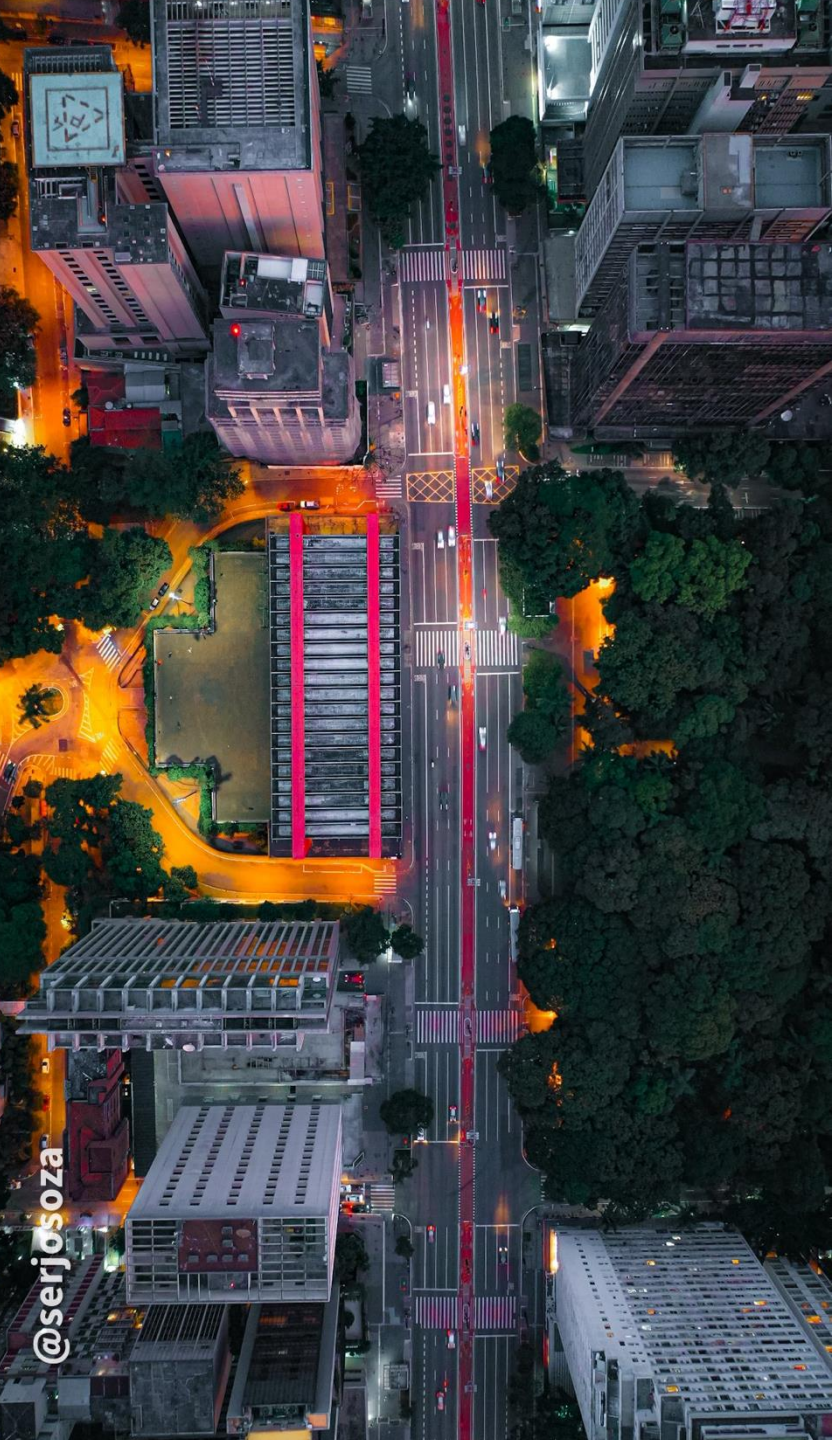





Online and administrative systems

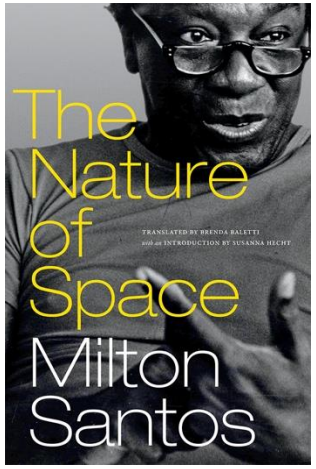

Citizen-generated data

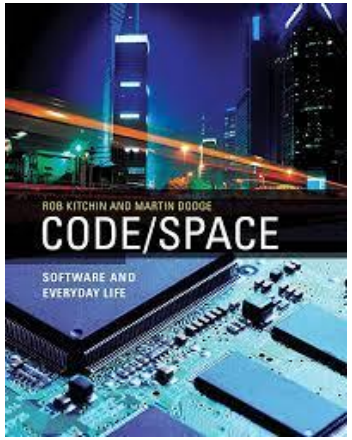
Big Data || Digital Footprints || Smart Data




# As cities make data, data makes cities

*"Science and technology, together with **information, are the very foundation for the production, use and functioning of space**"*
*(Santos, [1996] 2002, p. 238)*

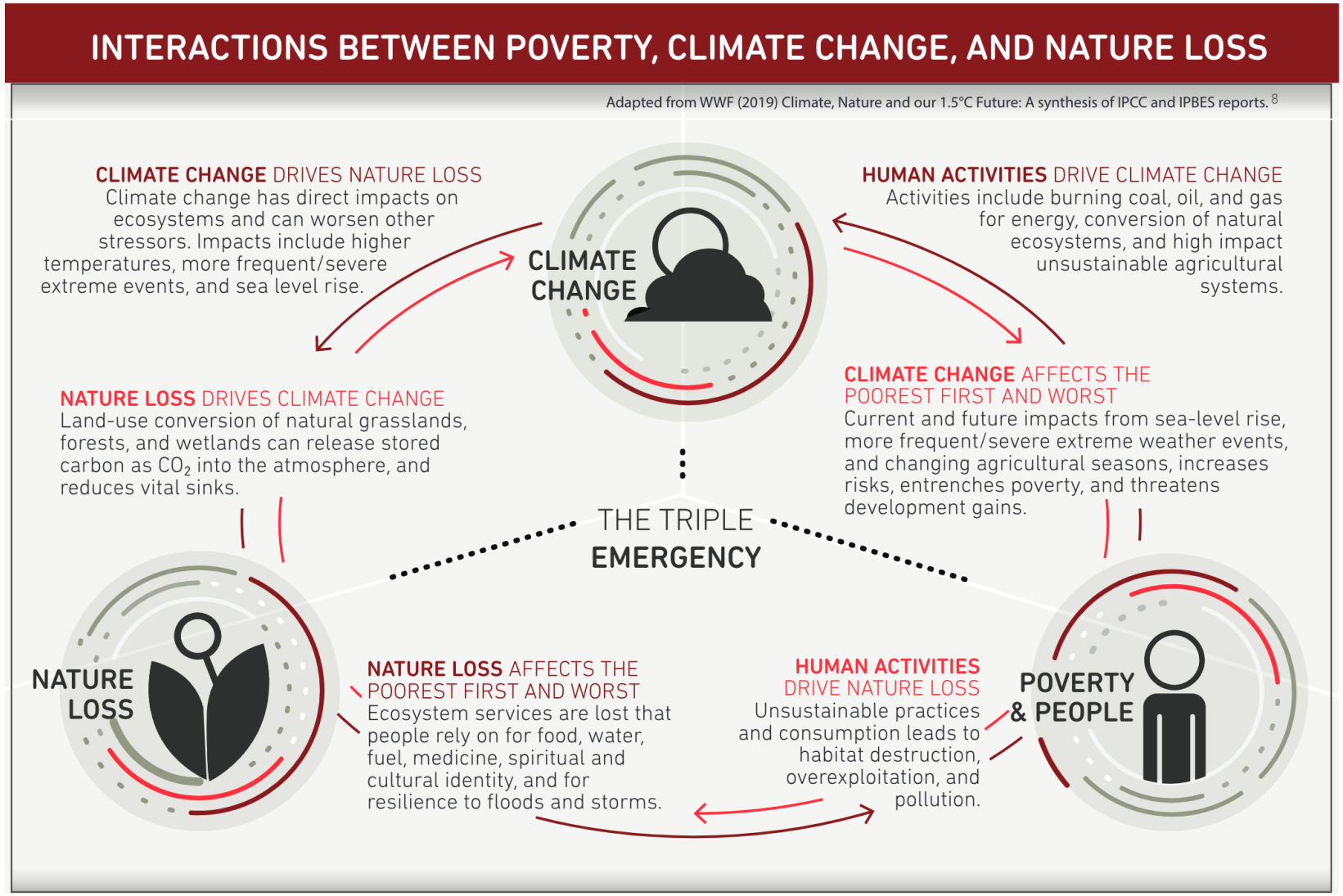



*"Code/space is quite literally constituted through software-mediated practices, wherein code is essential to the **form, function, and meaning of space**"*
*(Kitchin and Dodge, 2014)*

What cities are being **made** out of data?

# Climate justice: cities and data in the context of a triple emergency




Pettengell, C. (2020). *Addressing the Triple Emergency: Poverty, Climate Change, and Environmental Degradation* (Issue April 2020, pp. 1–37).

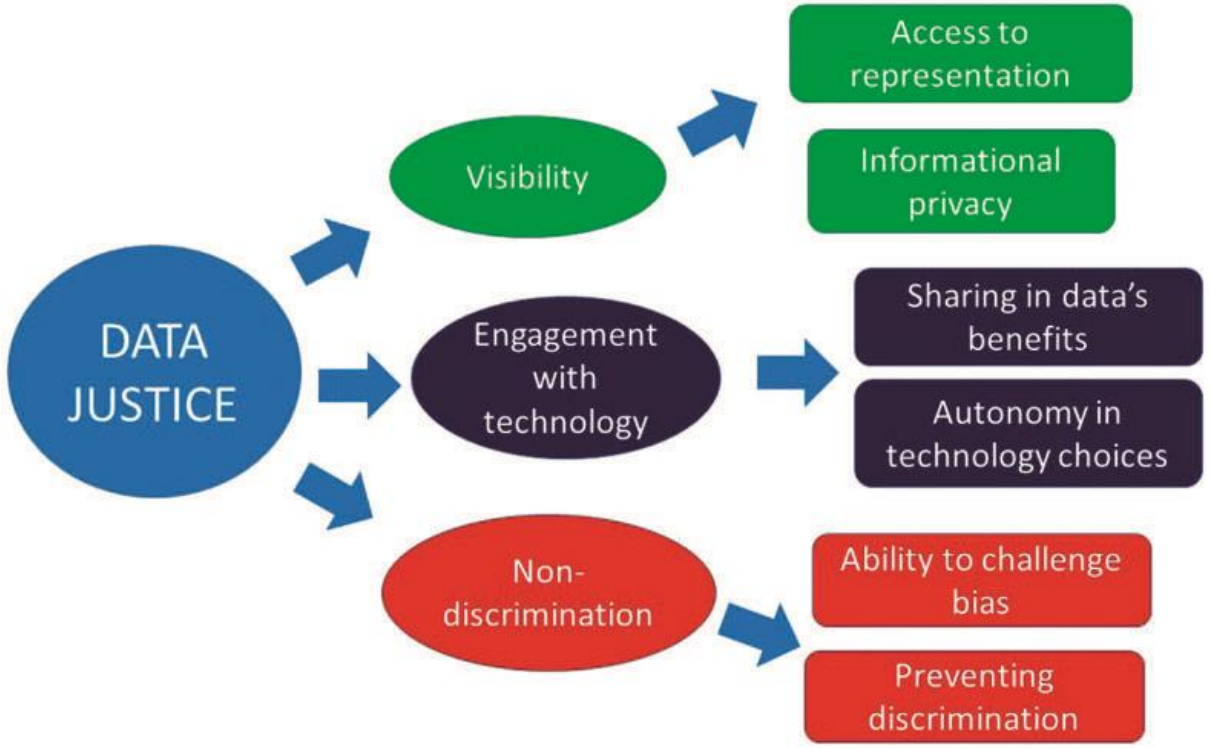

# Urban inequalities: the city multiple

*"For indeed any city, however small, is in fact divided into two,* ***one the city of the poor, the other of the rich****; these are at war with one another; and in either there are many smaller divisions, and* ***you would be altogether beside the mark if you treated them all as a single State****."*

*Plato, Republic, 234a*

# Data inequalities and data justice

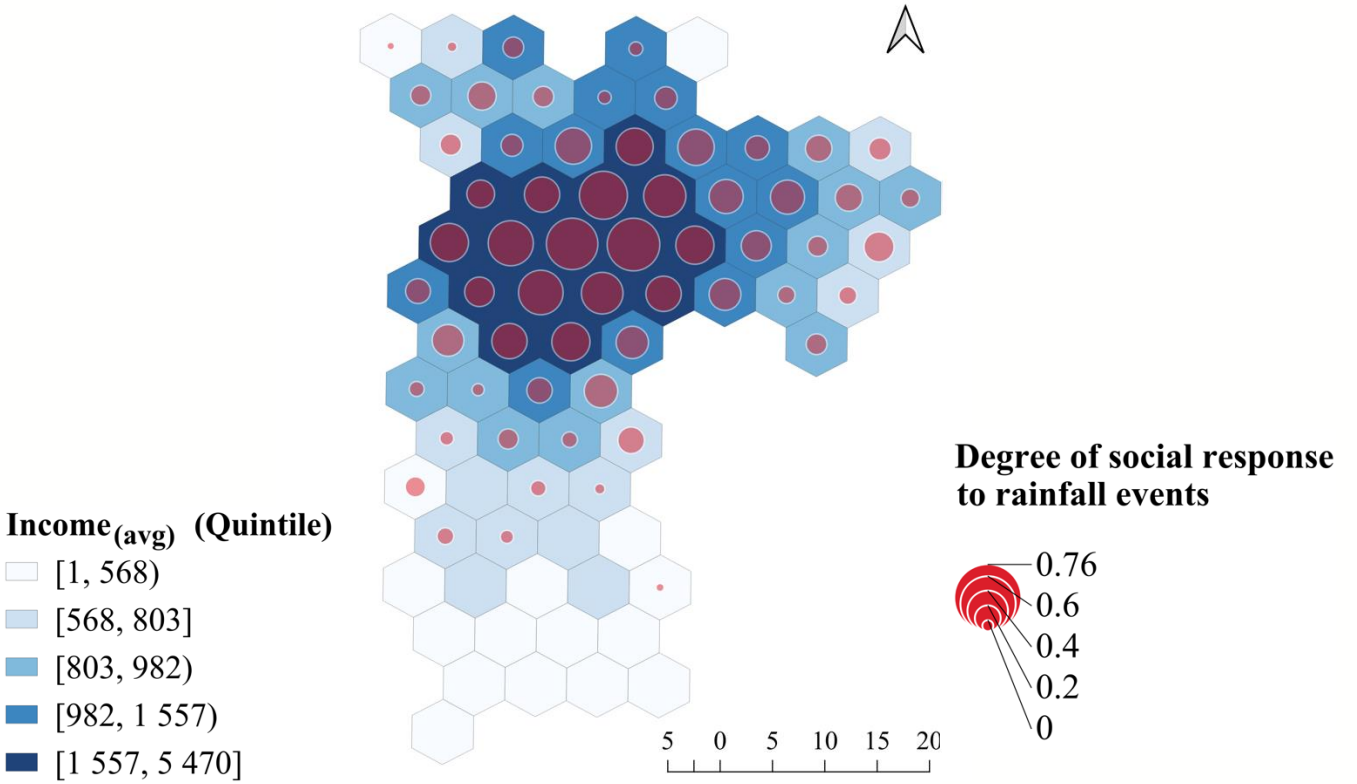
- **Data inequalities** (Cinnamon, 2000): access to data, control of data flows, representation
- **Data justice** (Taylor, 2017): visibility, engagement with technology, non-discrimination




*"An idea of justice is needed in order to establish the rule of law, an idea of data justice is necessary to determine ethical paths through a datafying world." (Taylor, 2017)*

# Urban socio-spatial inequalities are associated with data inequalities

## Social media response to rainfall




*Andrade, Albuquerque, et al. (2021): The effect of intra-urban mobility flows on the spatial heterogeneity of social media activity: investigating the response to rainfall events, International Journal of Geographical Information Science,* ***https://doi.org/10.1080/13658816.2021.1957898***

nature communications



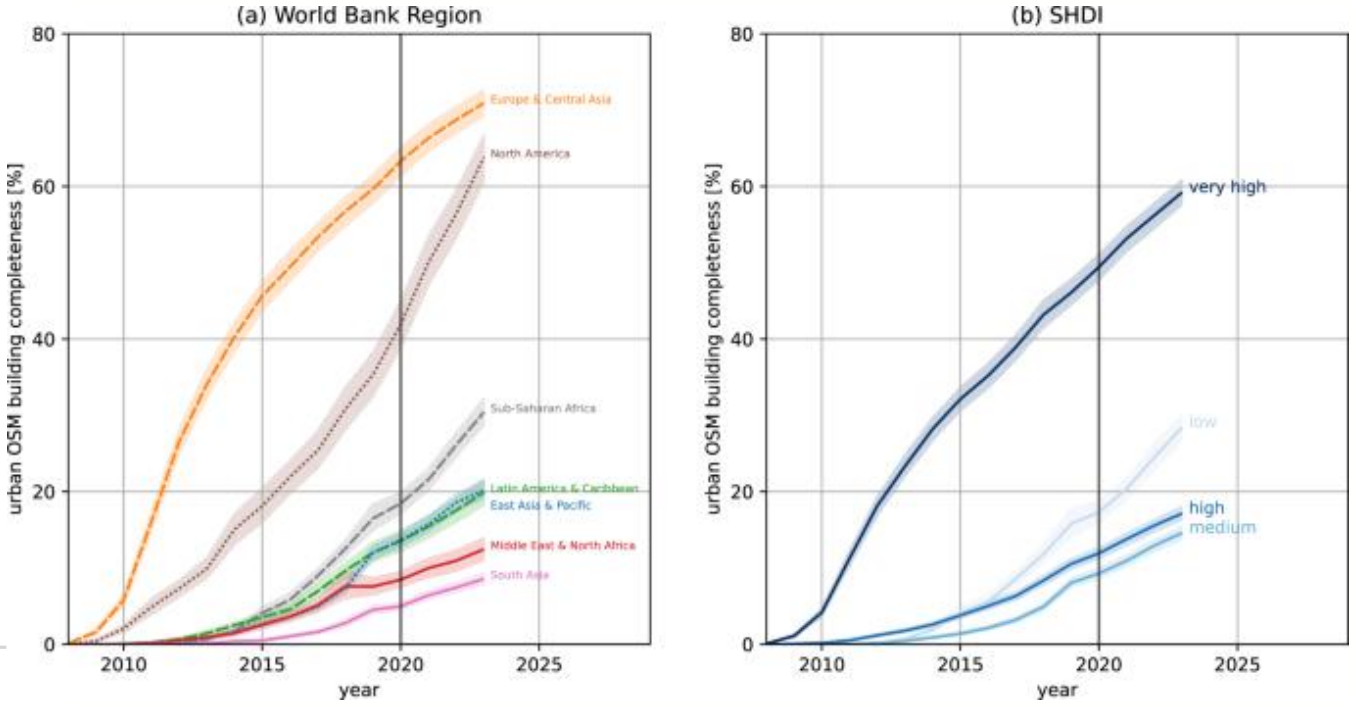
Article | Open Access | Published: 06 July 2023

# A spatio-temporal analysis investigating completeness and inequalities of global urban building data in OpenStreetMap

Benjamin Herfort ✉, Sven Lautenbach, João Porto de Albuquerque, Jennings Anderson & Alexander Zipf

*Nature Communications* **14**, Article number: 3985 (2023) | Cite this article

**4** Altmetric | Metrics

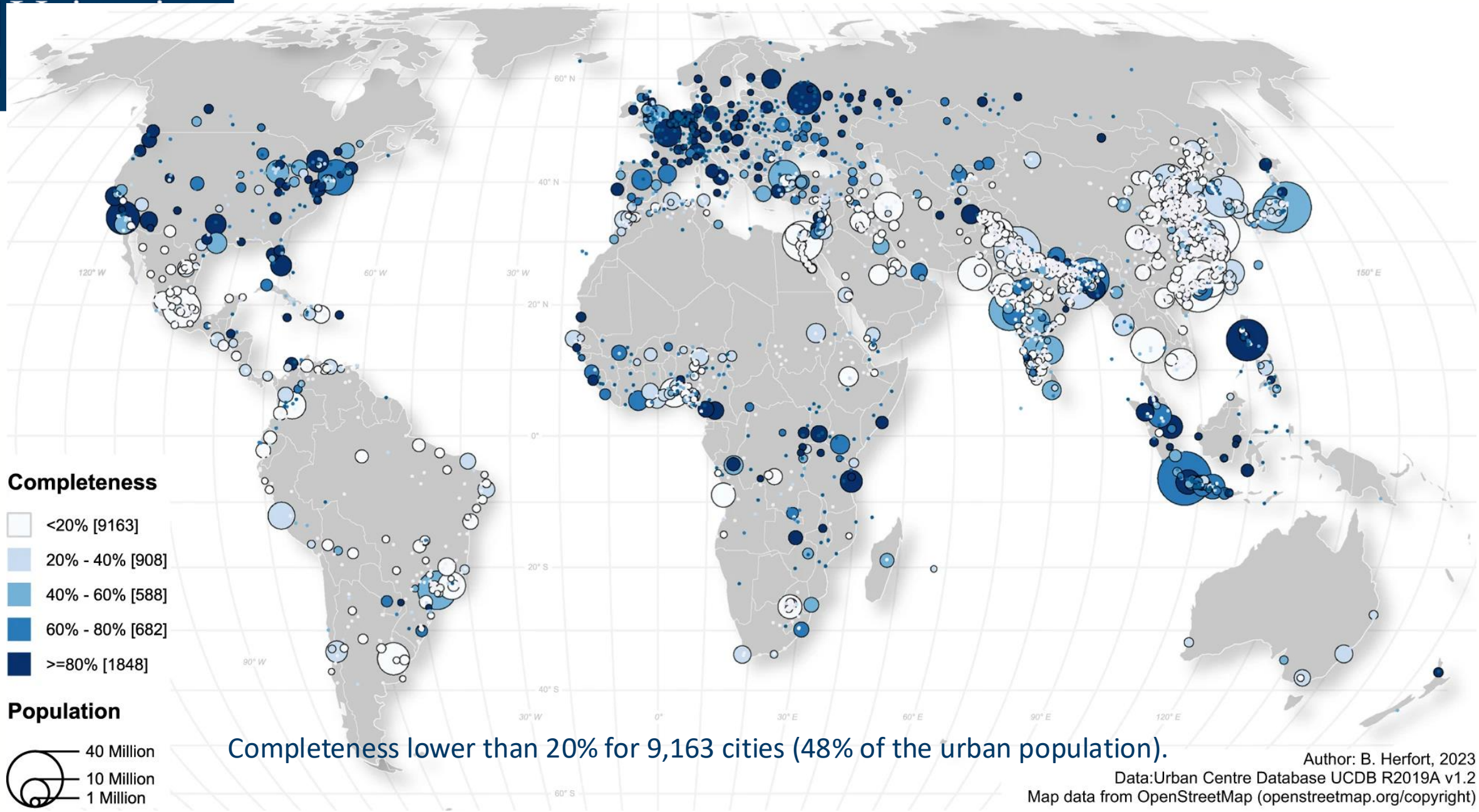



## Abstract

OpenStreetMap (OSM) has evolved as a popular dataset for global urban analyses, such as assessing progress towards the Sustainable Development Goals. However, many analyses do not account for the uneven spatial coverage of existing data. We employ a machine-learning model to infer the completeness of OSM building stock data for 13,189 urban agglomerations worldwide. For 1,848 urban centres (16% of the urban population),

https://www.nature.com/articles/s41467-023-39698-6

# OpenStreetMap Building Completeness in 13,189 Urban Centres

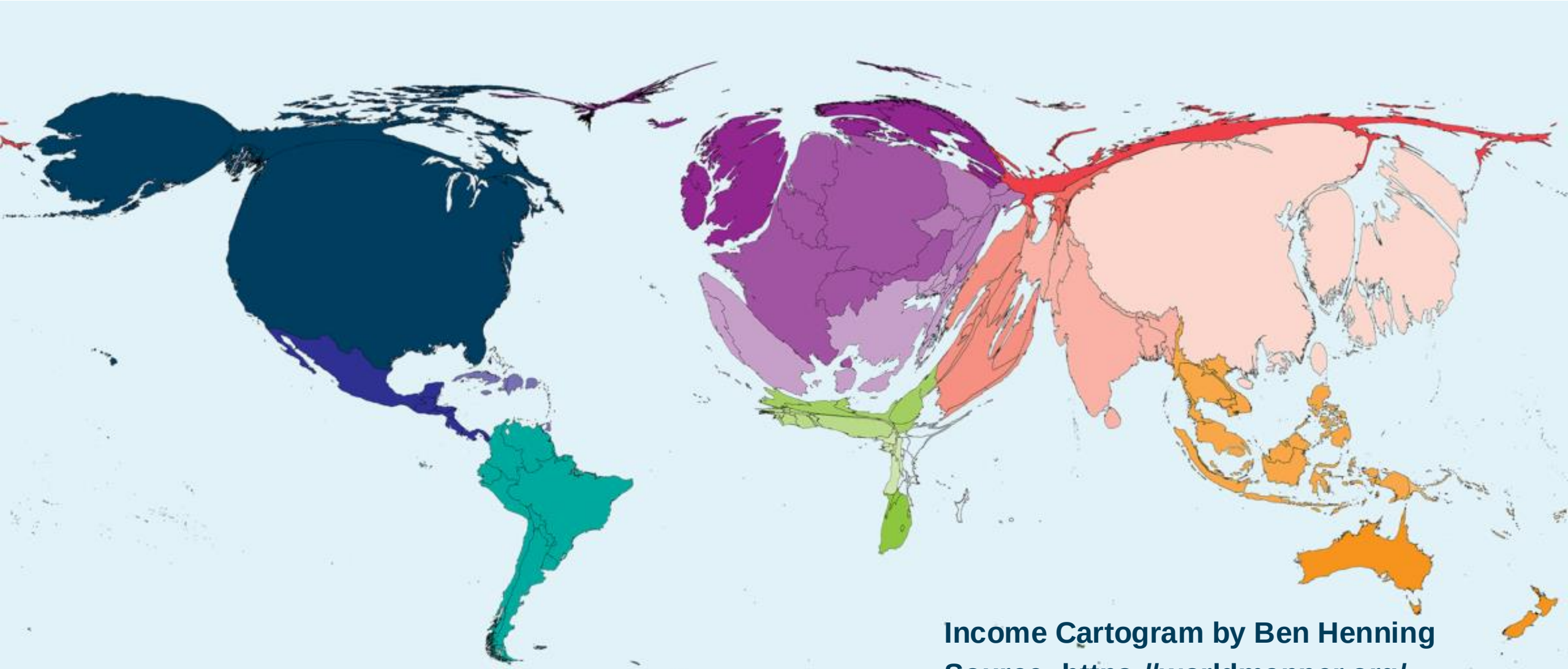



Completeness lower than 20% for 9,163 cities (48% of the urban population).

Author: B. Herfort, 2023
Data:Urban Centre Database UCDB R2019A v1.2
Map data from OpenStreetMap (openstreetmap.org/copyright)

University of Glasgow

# Does urban analytics challenge or exacerbate inequalities?



Income Cartogram by Ben Henning
Source: https://worldmapper.org/

# How can we embed climate and data justice into urban analytics?

Albuquerque, J. P. de & Almeida, A. A. de, (2020). Modes of engagement: reframing 'sensing' and data generation in citizen science for empowering relationships. In: Davies, T. and Mah, A. (2020), *Toxic Truths: Environmental Justice and Citizen Science in a Post Truth Age*. Manchester, UK: Manchester University Press.


# EXAMPLE 1: (RE)MAKING CITIES OUT OF DATA

## Waterproofing Data: How to engage citizens in data-driven disaster risk reduction

Celebrating Impact PRIZE 2023
Winner
Outstanding Societal Impact
UKRI Economic and Social Research Council

MOBILISING RESEARCH INTO ACTION
Highly commended
EMERALD AWARDS 2022/23
REAL IMPACT

THE AWARDS 2022
SHORTLISTED
RESEARCH PROJECT OF THE YEAR: ARTS, HUMANITIES & SOCIAL SCIENCES

# Waterproofing Data

## Engaging stakeholders in sustainable flood risk governance for urban resilience

(Sep/2018-Jun/2022)

***How to rethink flood data production and flow to enable transformations to build sustainable, flood resilient communities?***

Project Partners:

University of Glasgow

Cemaden
Centro Nacional de Monitoramento e Alertas de Desastres Naturais

FGV EAESP
ESCOLA DE ADMINISTRAÇÃO DE EMPRESAS DE SÃO PAULO

WARWICK
THE UNIVERSITY OF WARWICK

UNIVERSITÄT HEIDELBERG
ZUKUNFT SEIT 1386

Co-operation Partners:

PREFEITURA DE SÃO PAULO
INOVAÇÃO E TECNOLOGIA

SECRETARIA DE ESTADO DE MEIO AMBIENTE

ACRE

CPRM
Serviço Geológico do Brasil

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Funding Agencies:

UKRI Economic and Social Research Council

GCRF Global Challenges Research Fund

FAPESP
SÃO PAULO RESEARCH FOUNDATION

Federal Ministry of Education and Research

In coordination with:

Transformations to Sustainability

BELMONT FORUM

NORFACE ERA-NET

# Waterproofing Data

## *Engaging stakeholders in sustainable flood risk governance for urban resilience*

# Objectives

**Develop three innovative interdisciplinary methods:**

1. **Make visible how stakeholders engage with data**
   *Data diaries, spatial data analysis*
2. **Engage citizens to produce, circulate and embed data**
   *Data gardening*
3. **Integrate citizen-generated data with other sources to support decision and policy making**
   *Participatory mapping, participatory software design*

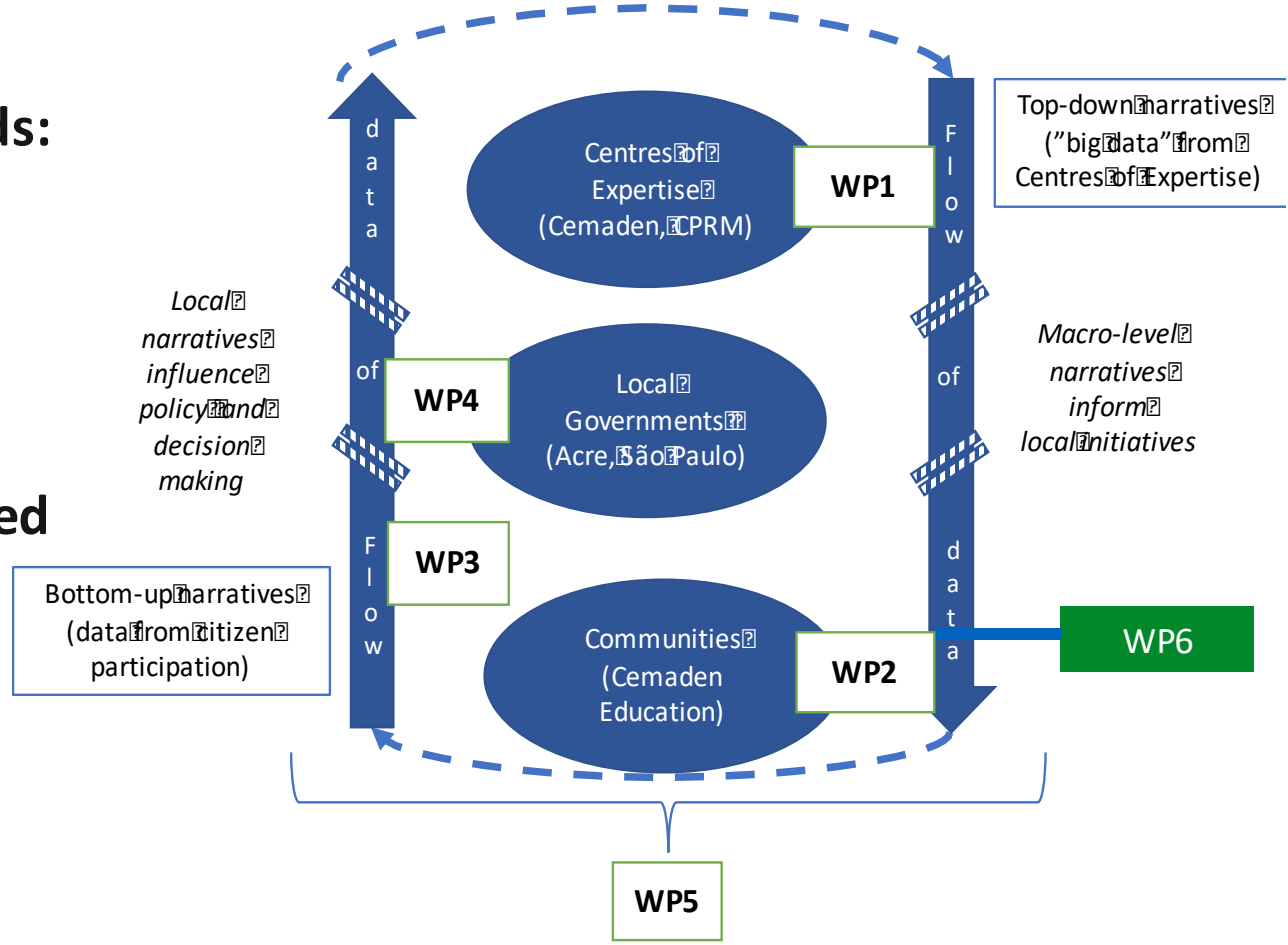


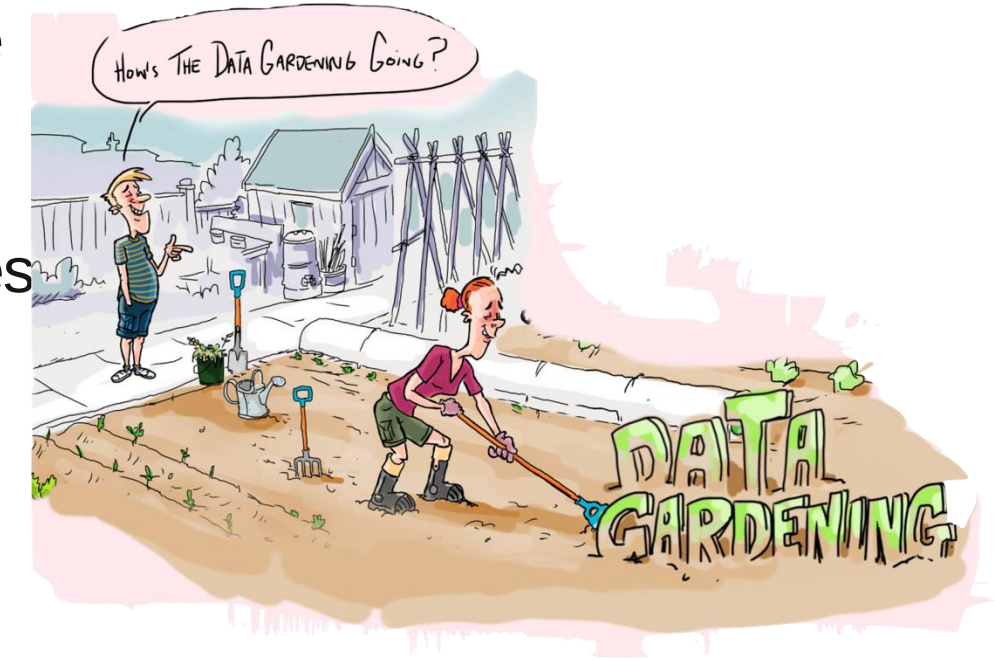

Figure 1. Scales and work packages of the project

*Coaffee, J., de Albuquerque, J. P., & Pitidis, V. (2021). Risk and Resilience Management in Co-production. In The Palgrave Handbook of Co-Production of Public Services and Outcomes (pp. 541–558). Springer International Publishing. https://doi.org/10.1007/978-3-030-53705-0_28*

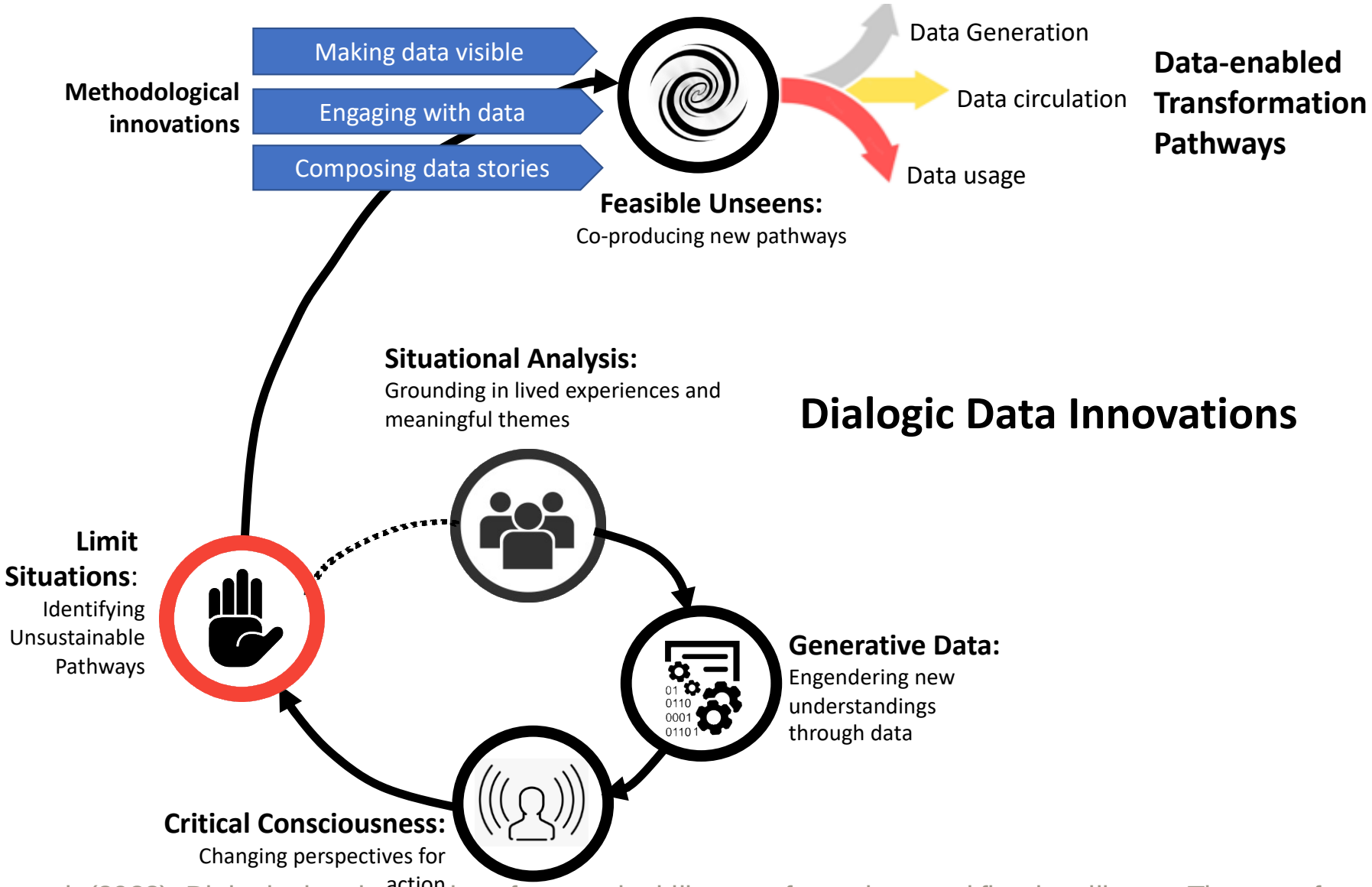
# Outputs:: Waterproofing Data

## Main results: methodological innovations

1. **Data diaries and "conversaction" roundtables**: from data practices to data praxis
2. **Data gardening and pollination**: engaging communities, schools, civil protection to cultivate multiple forms of citizen-generated data
3. **Dialogic data stories:** mobile app, data pipelines and dashboard
4. **Dialogical-participatory mapping**: towards a transformative mapping praxis

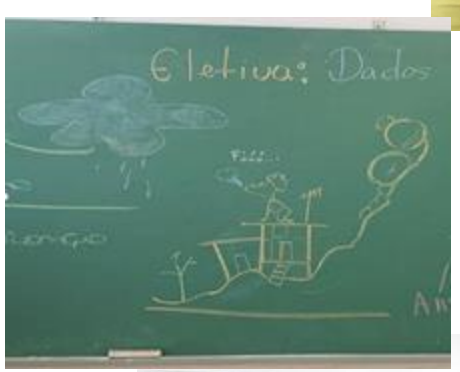


# Results:: A framework for data-enabled pathways to urban sustainable transformations




Porto de Albuquerque, J., et al. (2023). Dialogic data innovations for sustainability transformations and flood resilience: The case for waterproofing data. *Global Environmental Change*, *82*(October 2022), 102730. https://doi.org/10.1016/j.gloenvcha.2023.102730

# Dialogic data generation: from data gathering to ‘data gardening’

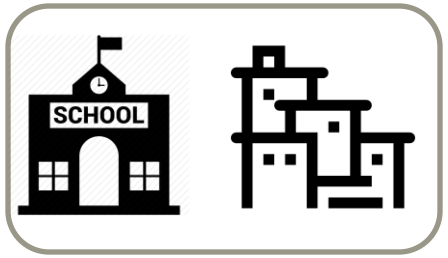




Digital Flood Memories

**Data Gardening**

Citizen Science

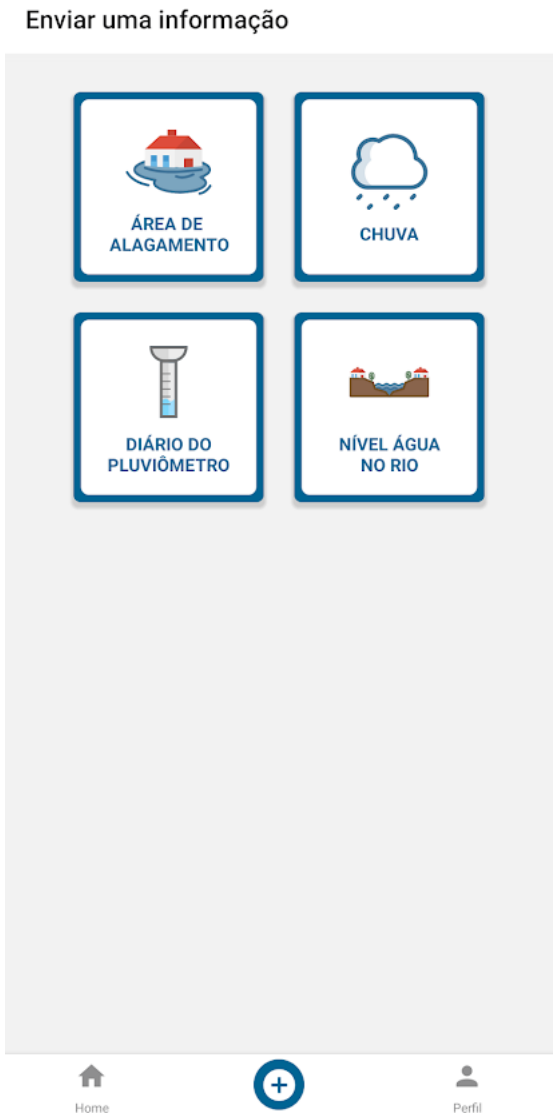
Participatory Mapping in OpenStreetMap



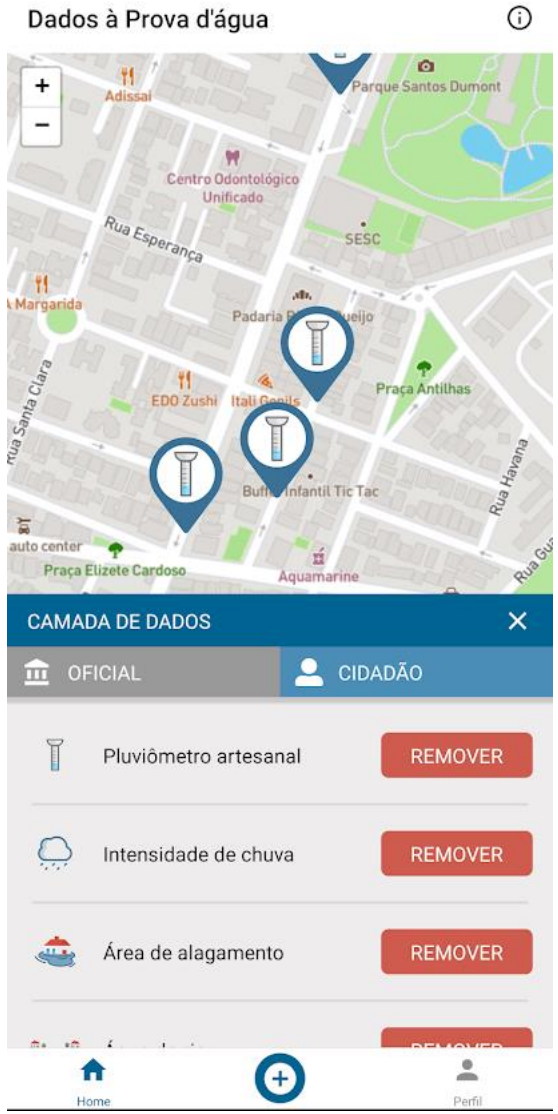

Artistic Installations

Collaborative Risk Perception Mapping

# Co-creation of pedagogical resources: the Waterproofing Data mobile app and Teacher's guide

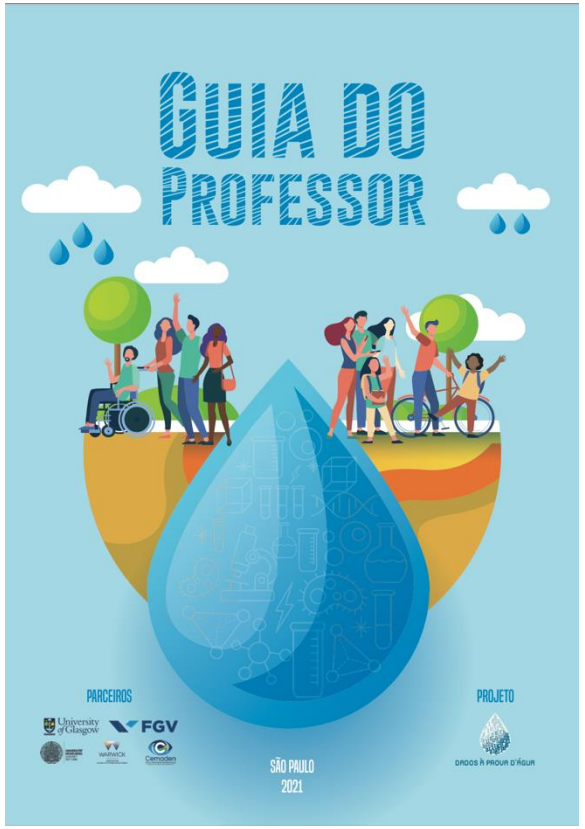







# “Pollination”: spreading the seeds

**Teacher’s guide for a template course with activities/teaching plans on citizen science, disaster risk, floods, digital mapping**




Unidade II | Capítulo VII
Medindo a chuva e gerando dados com pluviômetros artesanais

armazena a água da chuva. A diferença entre eles é que o pluviômetro artesanal é feito com garrafas PET, permitindo o monitoramento diário da chuva de forma mais simples e barata. Ele pode ser usado em atividades escolares e contribui para fortalecer a experiência de pesquisa no processo de ensino-aprendizagem (Figura 42).

**Figura 42** - Pluviômetro artesanal.

**Fonte:** acervo do Projeto Dados à Prova D'Água, E. E. Vicente Leporace, São Paulo, SP (2019).

SAIBA MAIS

O vídeo "Como funciona um pluviômetro?" apresenta o que são esses equipamentos e seus diferentes tipos, podendo ser interessante para uso na sala de aula: https://www.youtube.com/watch?v=ZolSxYsIJKs (acesso em 5 de dezembro de 2021).

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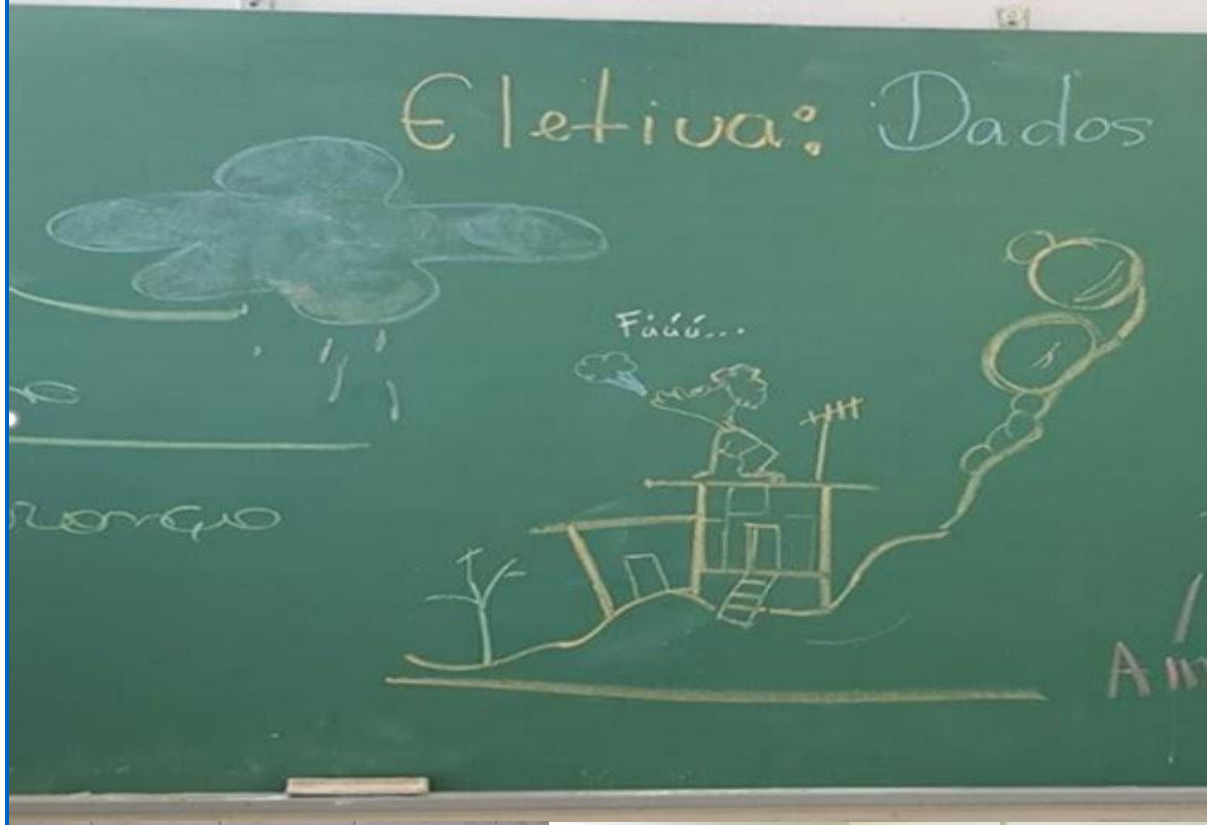
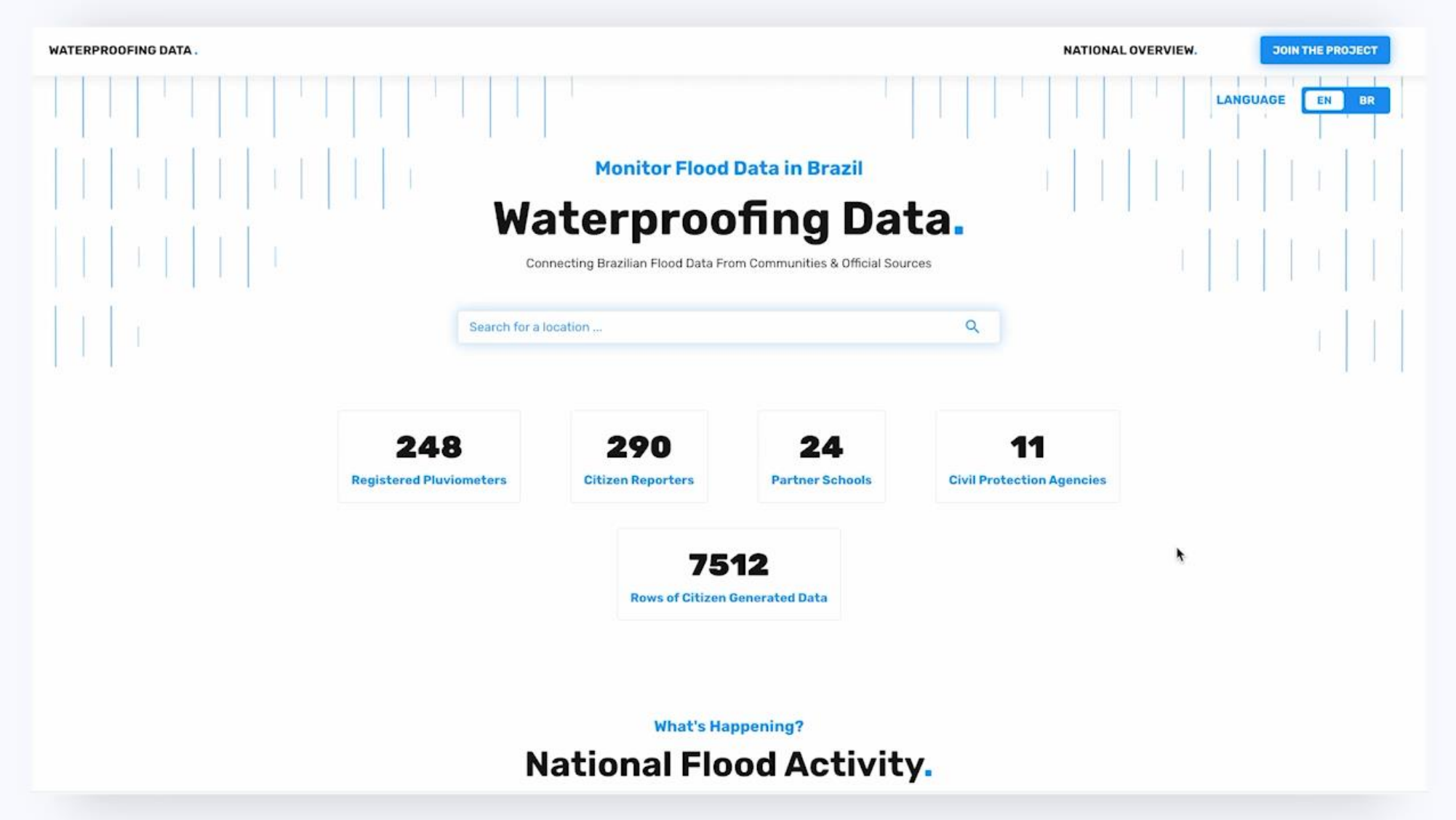



# Data integration:  Waterproofing Data Dashboard



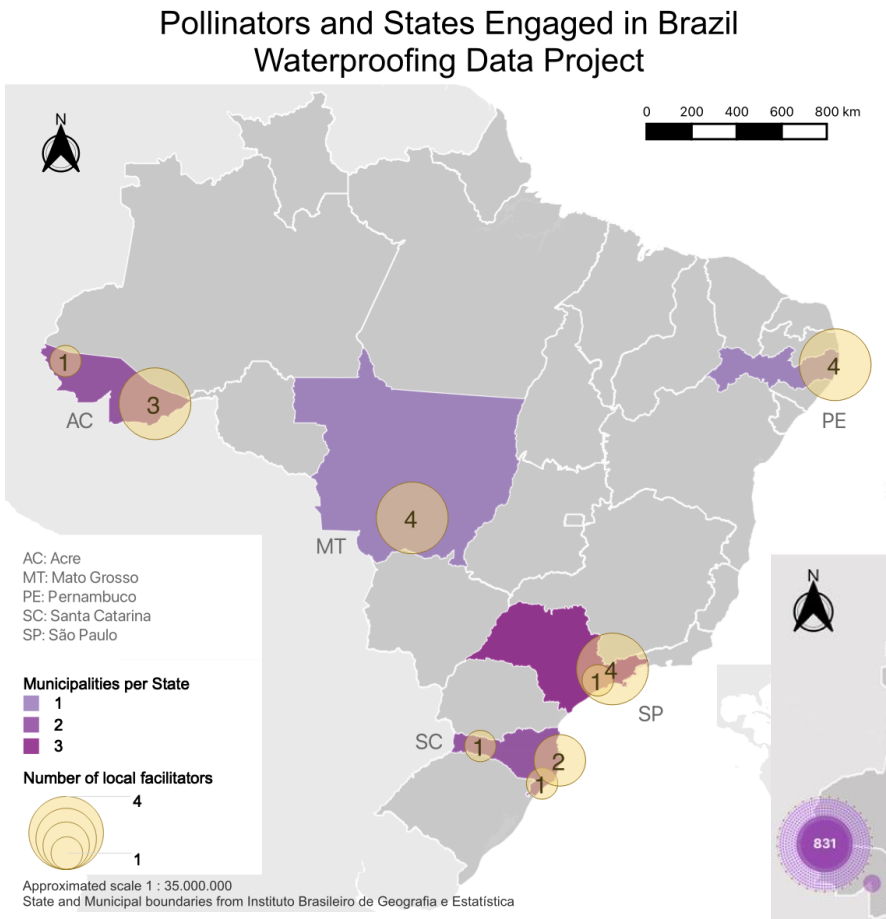

https://waterproofing-data.ubdc.ac.uk/

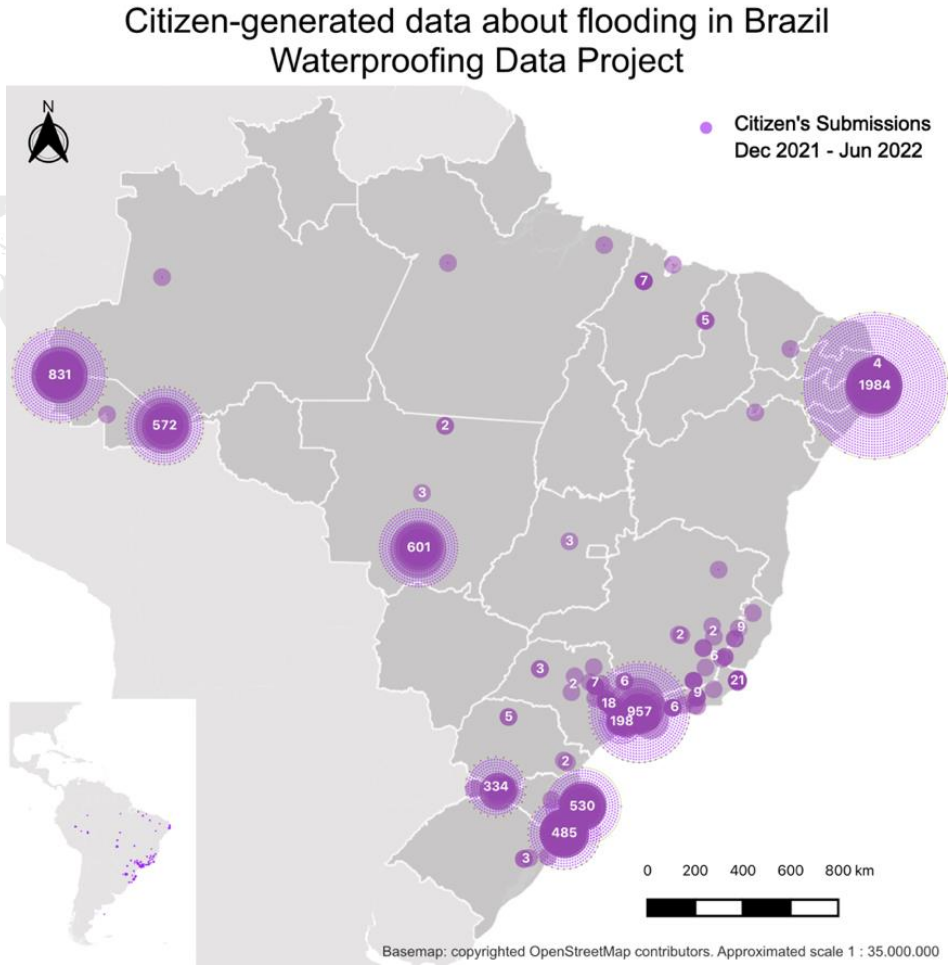
# Outcomes

**21 “Pollinators”**
**5 Brazilian states**
**9 cities**

AC: Rio Branco/ Cruzeiro do Sul
PE: Jaboatão dos Guararapes
MT: Cuiabá
SP: São José dos Campos/ São Paulo
SC: Florianópolis/ Criciúma/ Xanxerê

**In 2022:**
**+400 citizen scientists**
**+7500 reported records**
**+43 partner schools and civil protection agencies**



# Impacts: media coverage


- Waterproofing Data project has been featured in more than 180 media outlets, which emphasised that results can “change the way we deal with floods”.
- This media coverage include interviews and in-depth features of our approach and the results achieved by 5 national broadcast TV channels in Brazil (including a 5-minute feature in “O Globo Jornal Nacional”, the most widely watched TV news programme in Brazil), articles in 5 major Brazilian newspapers (including a whole-page article in “Folha de São Paulo”), an article in international specialised media (“Smart Cities World”), and many local TVs, radios and newspaper reports in all over Brazil (see a complete list in this link).

# Case Study: Northeast Brazil Floods, May 2022



## At least 91 dead in Brazil floods and landslides with many more missing

**Favelas in north-eastern cities of Recife and Jaboatao dos Guararapes have been worst hit by disasters many blame on climate change**

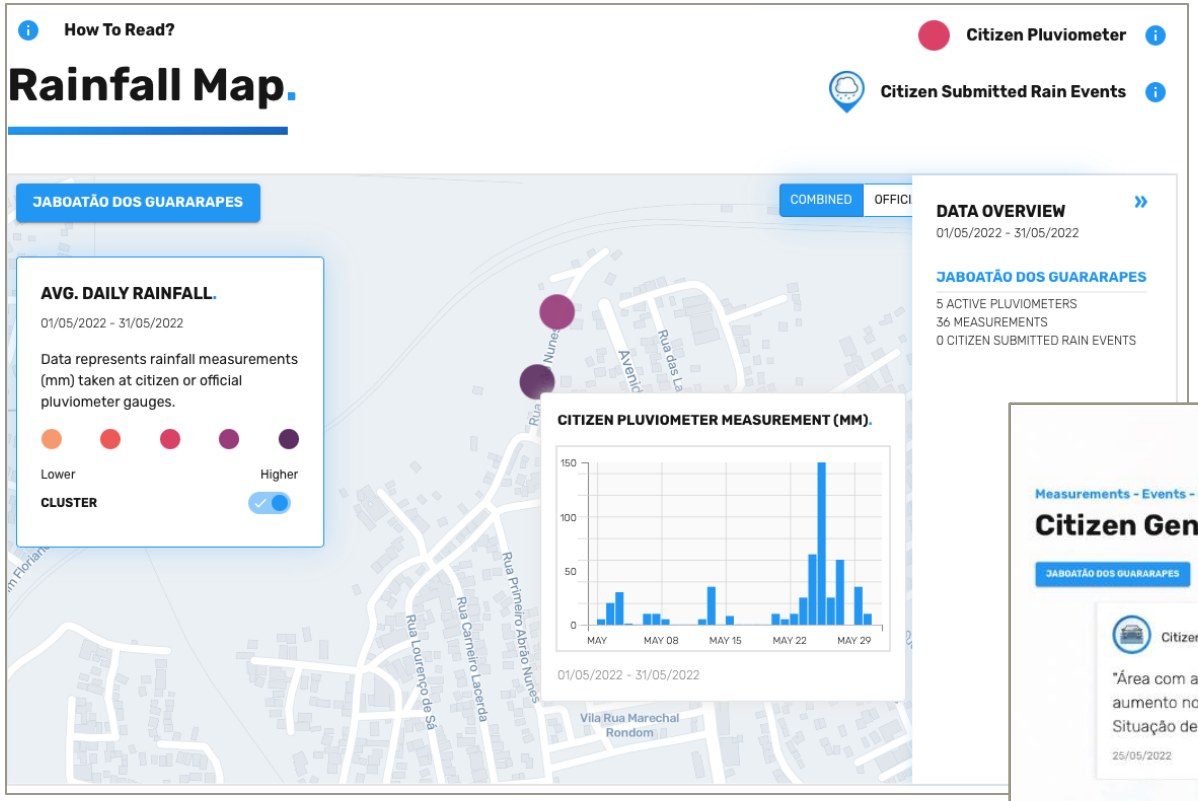
A landslide caused by heavy rains in Recife where at least 91 people have died in the city and surrounding area. Photograph: Reuters

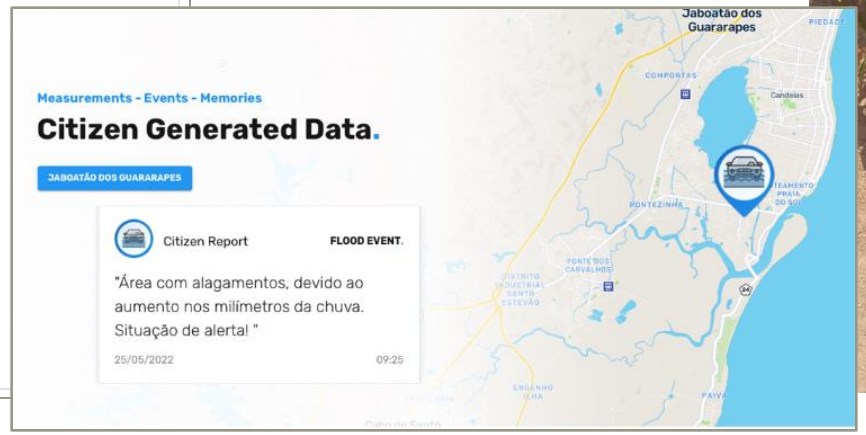
*Associated Press*

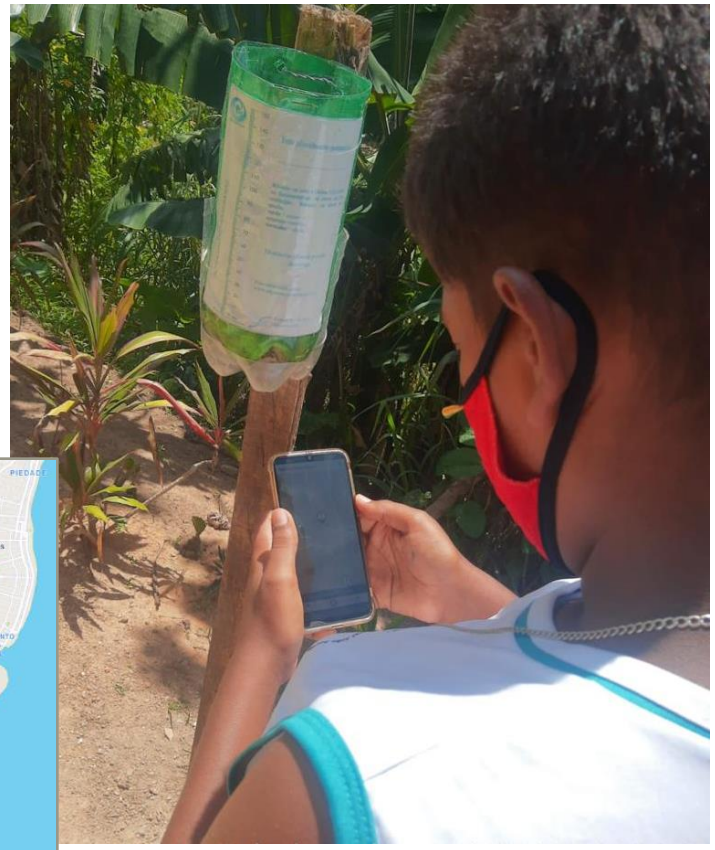
Tue 31 May 2022 01.41 BST

# Impacts: critical data literacy in practice

## Our mobile app has been used to record daily rainfall before intense rains in the Recife Metropolitan area (Pernambuco) in May 2022

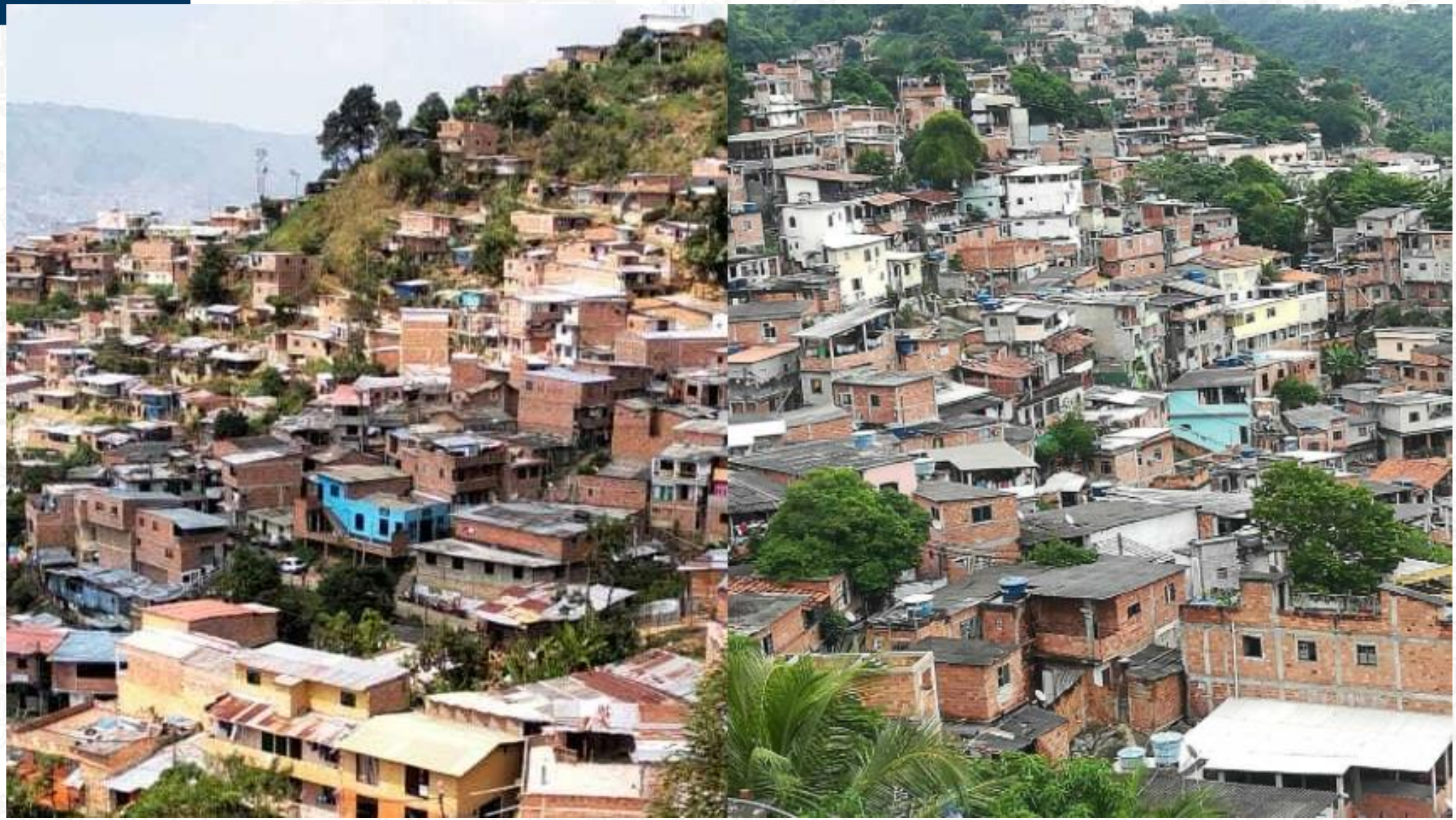


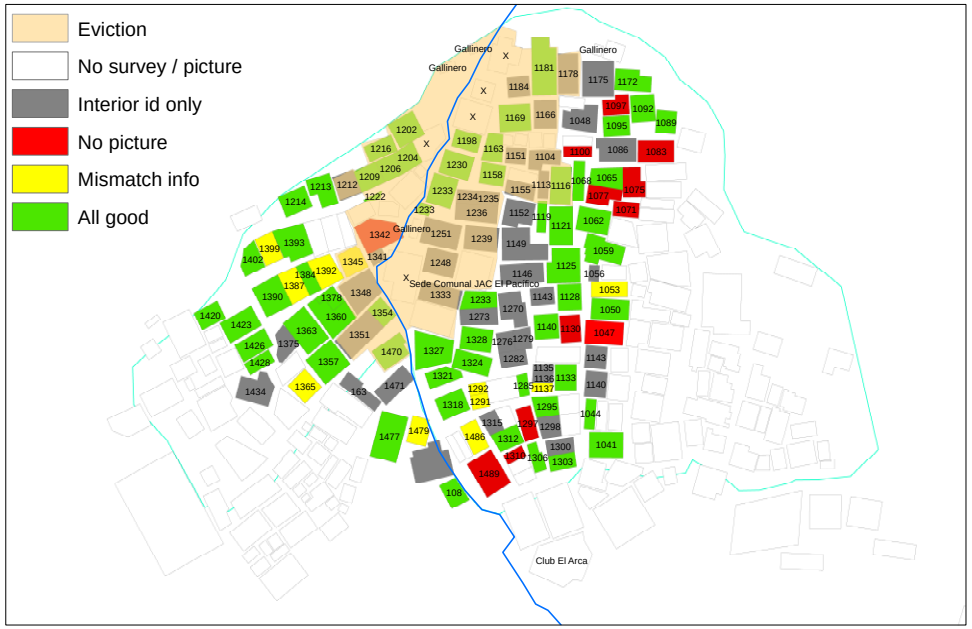
*We had damages and houses affected in the areas of the project, but we had no victims because people left their homes at the early warnings. But in other areas of the district, where we did not have our community work, people resisted leaving their homes early and were severely affected, including human losses. (Civil Defence Agent, June 2022)*

# Example 2: URBE Latam – data justice to advance climate justice



# Participatory Mapping

- **Colombia**: detailed maps of El Pacífico, community engagement for gathering data about population and physical vulnerability, paper about data governance, documentary
- **Brazil**: detailed maps of Morro do Preventório, development of mobile app, community mapping methodology and training for other favelas, microcredit methodology

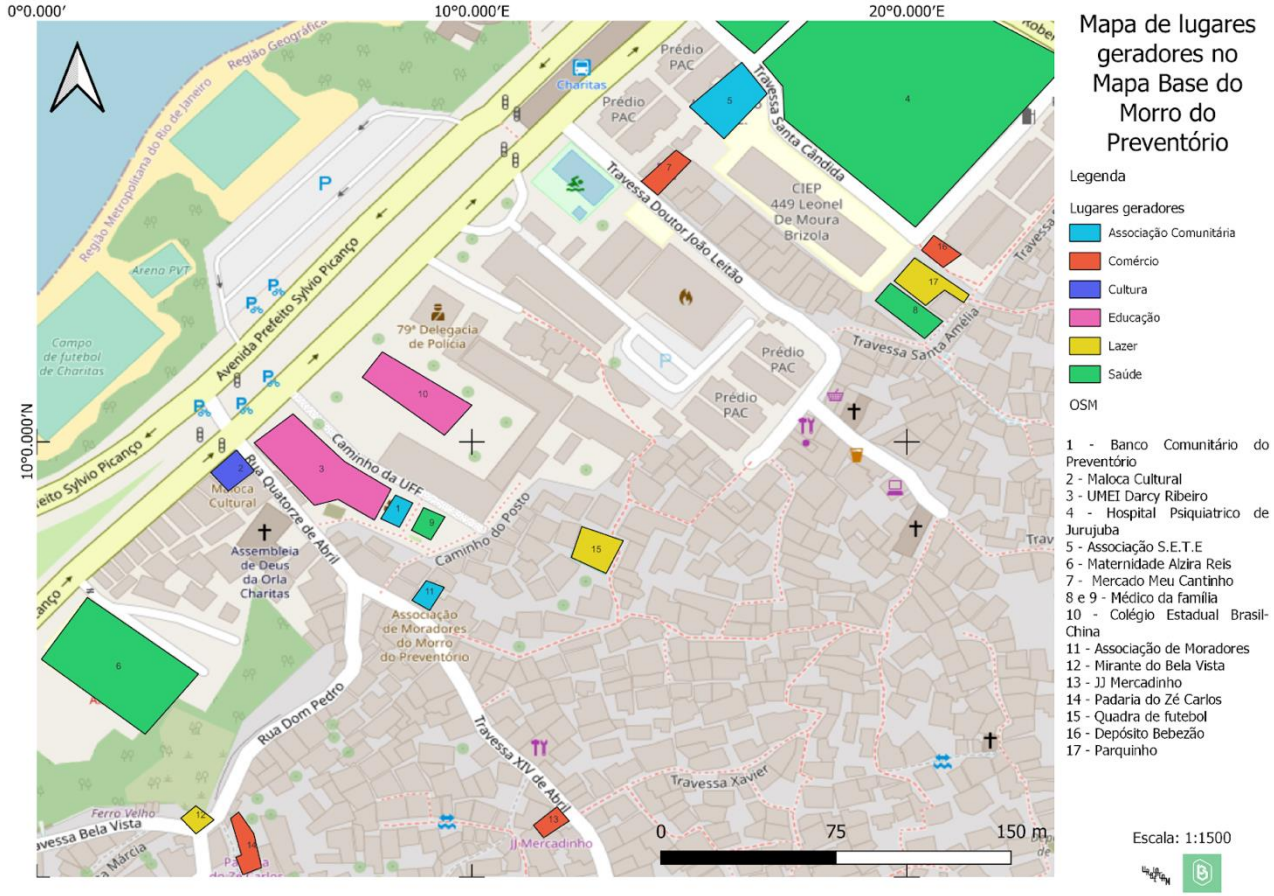


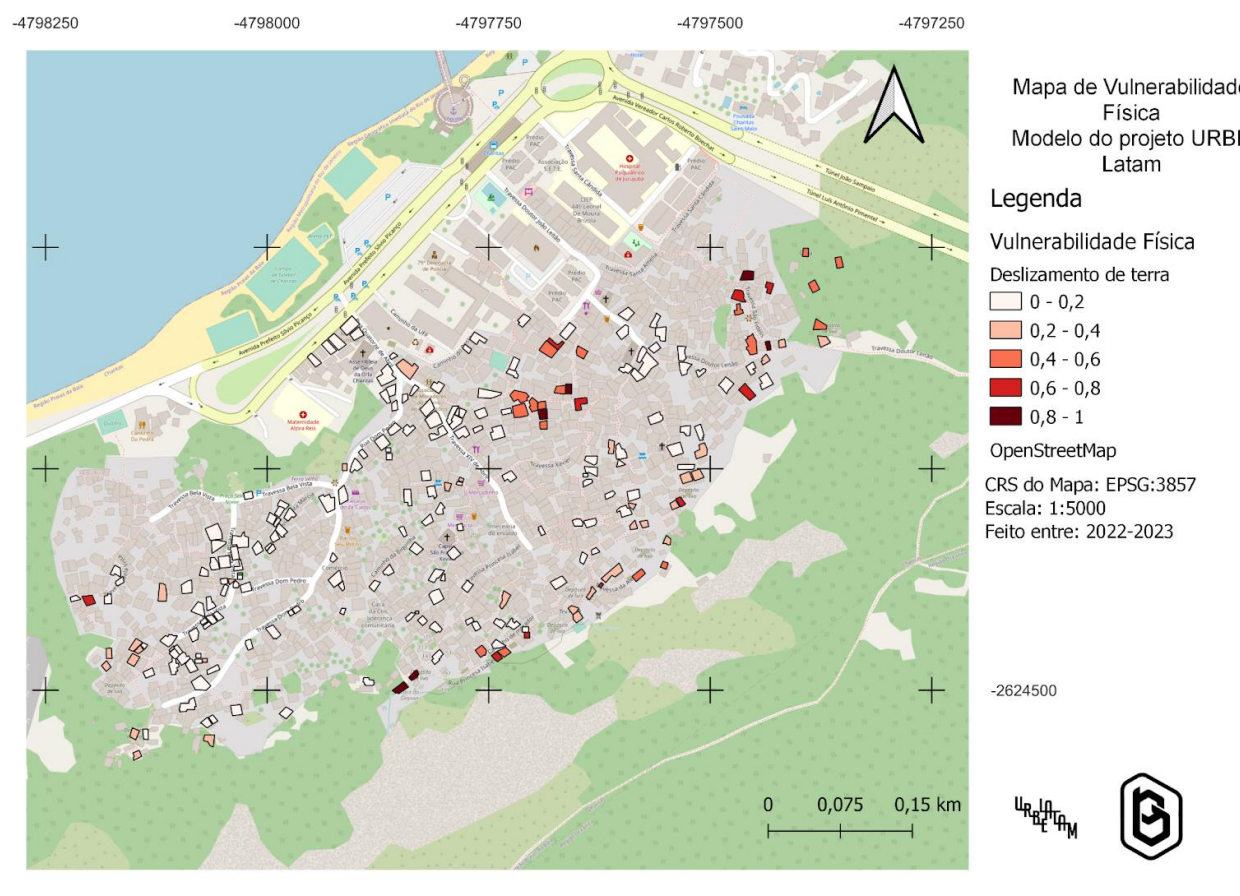



Rivera Flórez, L. A., Builes-Jaramillo, A., Gómez Miranda, I. N., Restrepo Estrada, C. E., Rodríguez Gaviria, E. M., & Porto de Albuquerque, J. (2024). Community mapping based on Milton Santos as a tool for disaster response and risk management in self-built communities: Case study of El Pacífico, Medellín, Colombia. *Cogent Social Sciences*, *10*(1), 2307181. https://doi.org/10.1080/23311886.2024.2307181

Rodríguez-Gaviria, E. M., Rivera-Flórez, L. A., & Albuquerque, J. P. de. (2024). Enhancing equity of the post-disaster recovery governance through community data generation. *International Journal of Disaster Risk Reduction*, *111*, 104700. https://doi.org/10.1016/j.ijdrr.2024.104700

# Potentialities and Vulnerabilities



University of Glasgow

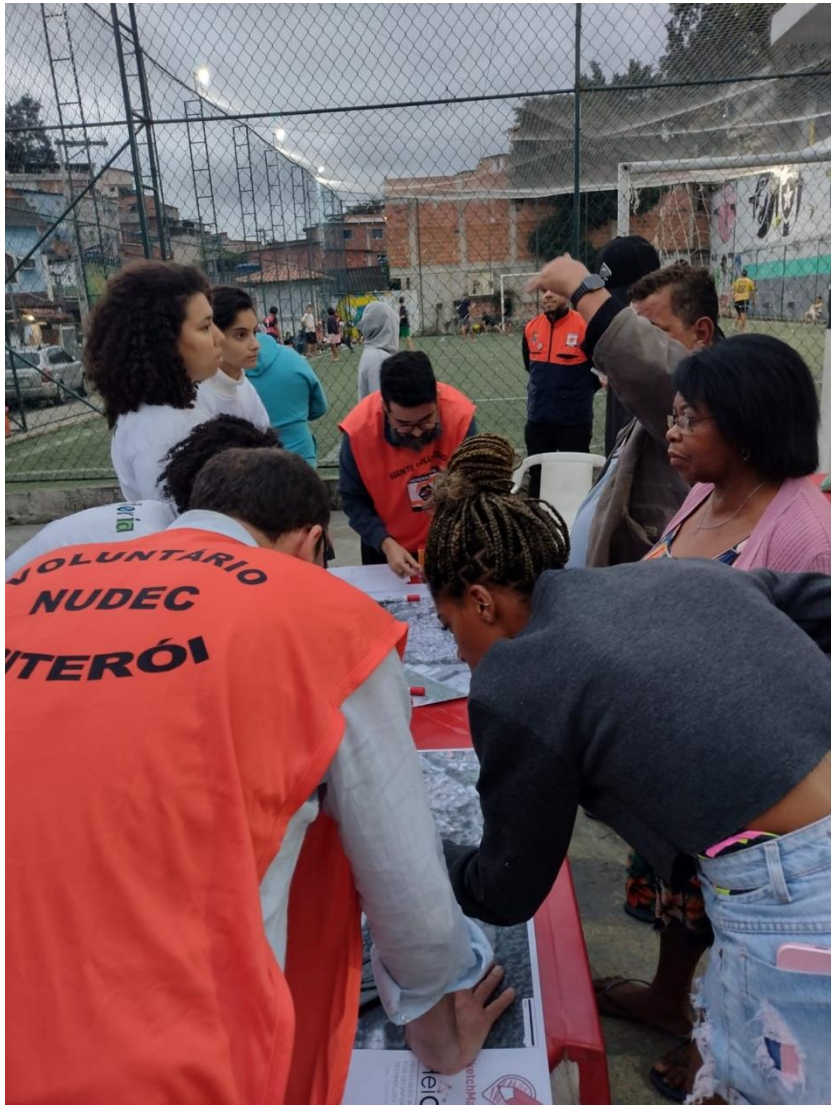
# Results of participatory mapping and data-driven citizen science


# Outreach: participatory mapping as public policy in Brazil

## Federal Ministry for Cities

https://mapadasperiferias.cidades.gov.br/





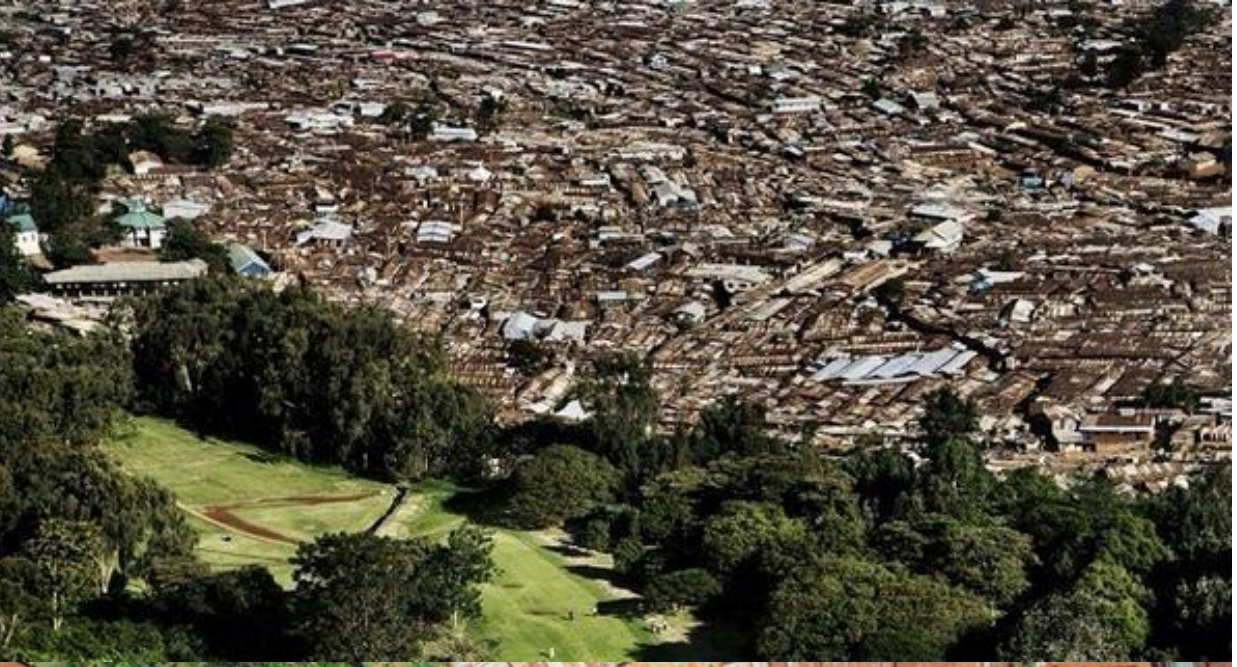
# Example 3: IDEAMAPS Data Ecosystem

To co-create an integrated data ecosystem that enables **routine**, **accurate** mapping of slums, informal settlements, and other deprived areas across LMIC cities

**Pilot cities:** Lagos, Kano (Nigeria) and Nairobi (Kenya)

**www.ideamapsnetwork.org**

IDEAMAPS concept paper: https://doi.org/10.3390/socsci9050080



https://unequalscenes.com/nairobi

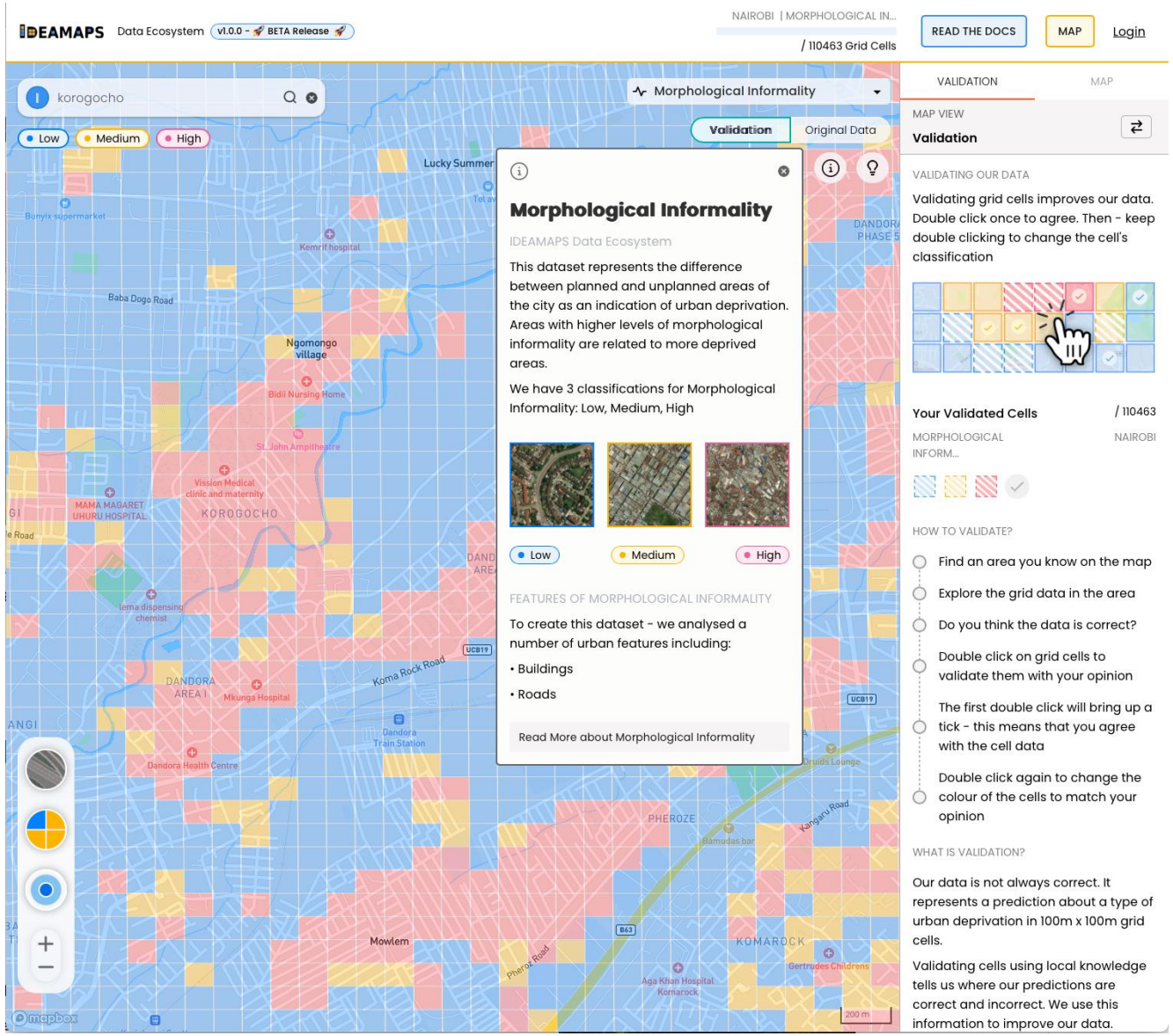
IDEAMAPS Network

**1 in 4**
**African will live in slums by 2030**

**Currently, 1 billion people are estimated to live in slums and informal settlements worldwide**

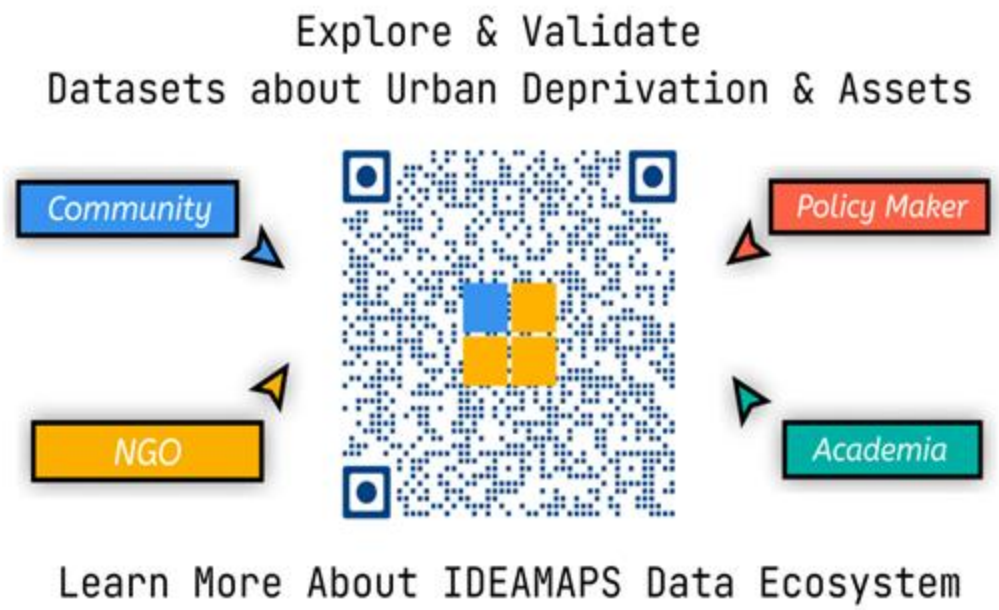
**Many of them are not visible in the data used for policy and decision making**

# IDEAMAPS Data Ecosystem: A digital platform and process for validating urban data

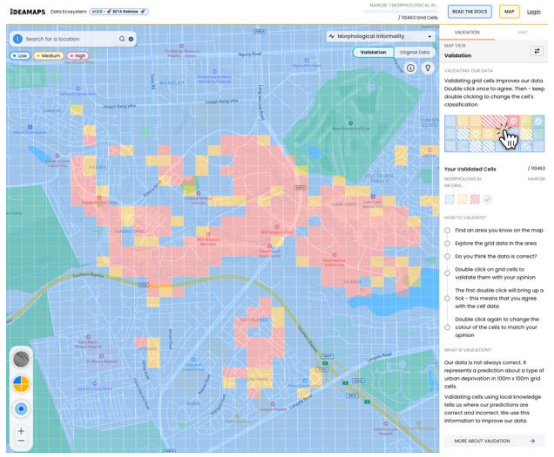



https://ideamapsdataecosystem.org

V.1.0.0 - Prototype Release



# Our evolutionary participatory process



Urban model is co-designed with domain experts, local researchers and stakeholders. Model outputs are ingested into the IDEAMAPS Data Ecosystem platform

**1. Codesign and Implementation**

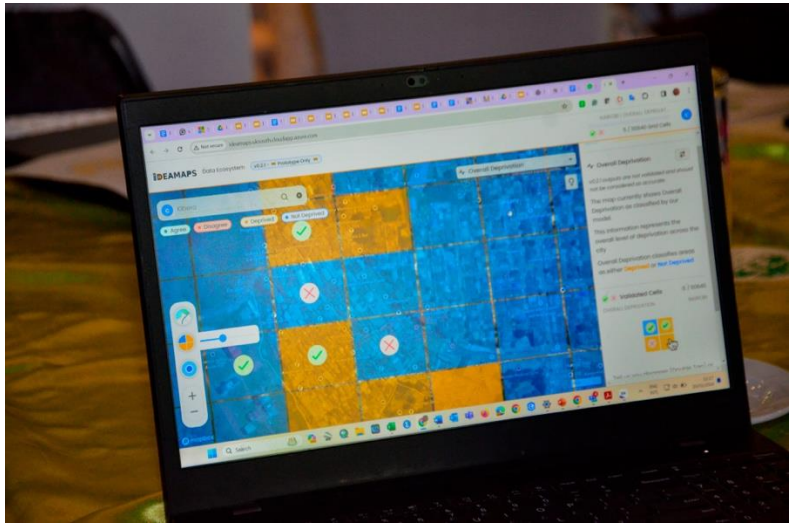
**2. Validation**

Model outputs and model specifications are discussed and validated with community members, local government and international stakeholders


**3. Improvement**

Quantitative data from user interactions in the platform are analysed together with qualitative feedback to determine improvements

# IDEAMAPS: urban analytics is only impactful within an ecosystem



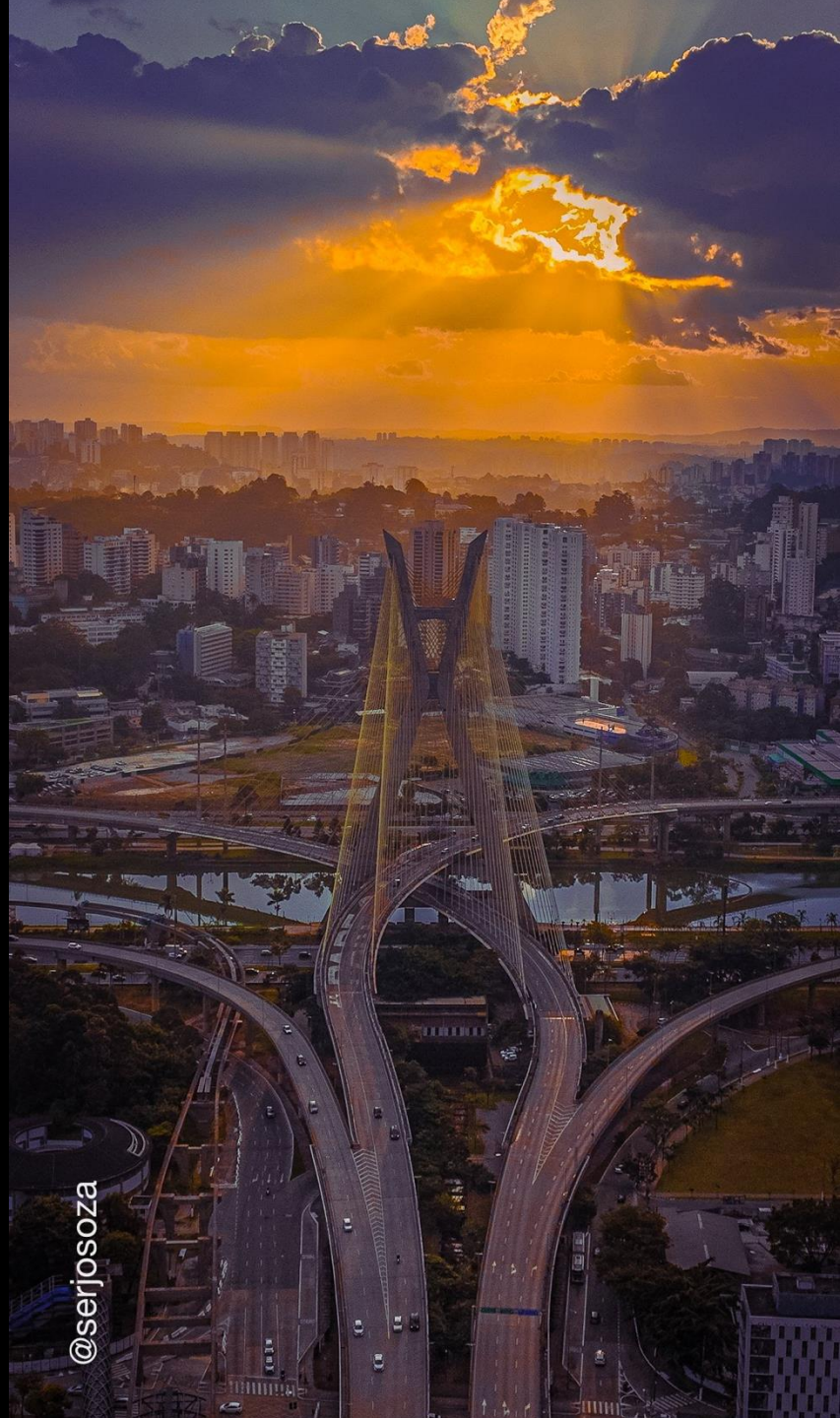


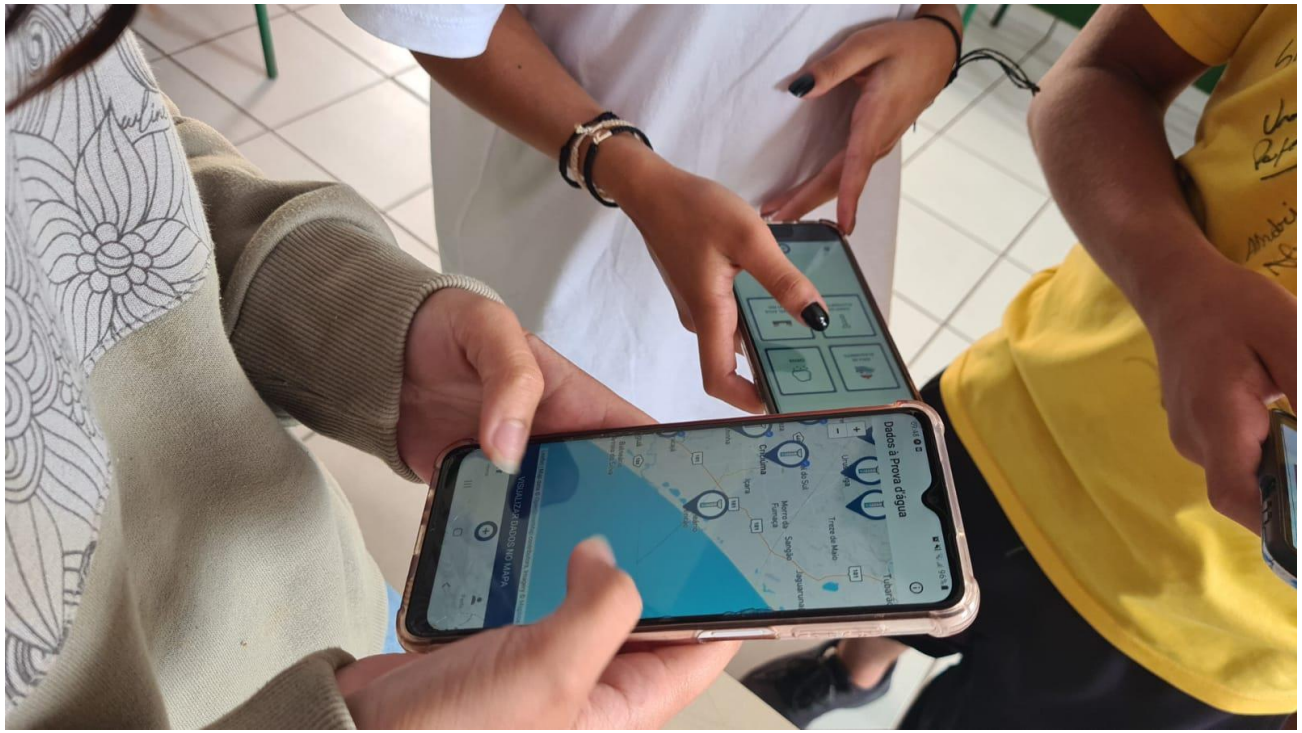
# Towards participatory urban analytics :: key messages

1. Addressing urban inequalities needs to be at the core of urban analytics methods and concerns

2. A transformative approach to participatory urban analytics needs to dialogue with structurally marginalised groups in the construction of knowledge and data

3. Embedding data and climate justice will enable us to unlock pathways to more equitable, just and sustainable cities






IDEAMAPS Network

# Thank you

Visit the IDEAMAPS website and sign up for our newsletter.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