Data integration for resilient urban-regions

7 Oct 2019
Dagstuhl

Andrew Simmons, Director of Research, Resilience Brokers

resilience brokers

ecological sequestration trust

Introduction to Resilience Brokers and the Trust

- UK group to speed up and scale up transformative urban/rural development;
- Operates in space between private, public, knowledge and civil society sectors;
- Leading experts foster **integrated-systems thinking** and **collaborative approaches**;
- Develop tools and demonstrators to support implementation of 2030 agenda in city regions;
- Open source, free-to-use tools - "**resilience.io**" integrated-systems modelling platform
- Data-driven, social and natural science based.

resilience brokers

ecological sequestration trust

Systems solutions to systemic problems

A new way of looking at development, human wellbeing and risk management with more possibilities in data science and technological capability than ever before.

Our approach

1. Systems thinking that embraces open data and the open source movement, powered by pioneering systems modelling technology and advanced data science.

2. Networked organisation. Drawing strength from our open and collaborative approach and the far-reaching networks of our delivery and knowledge partners.

3. Unlocking value from insights derived through systems thinking. Unique infusion of systems thinking, resource efficiency with knowledge support of relevant best practices through research network partners.

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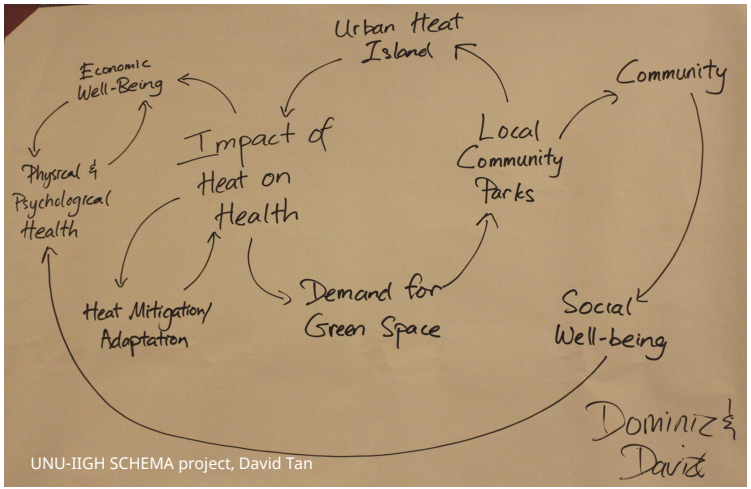
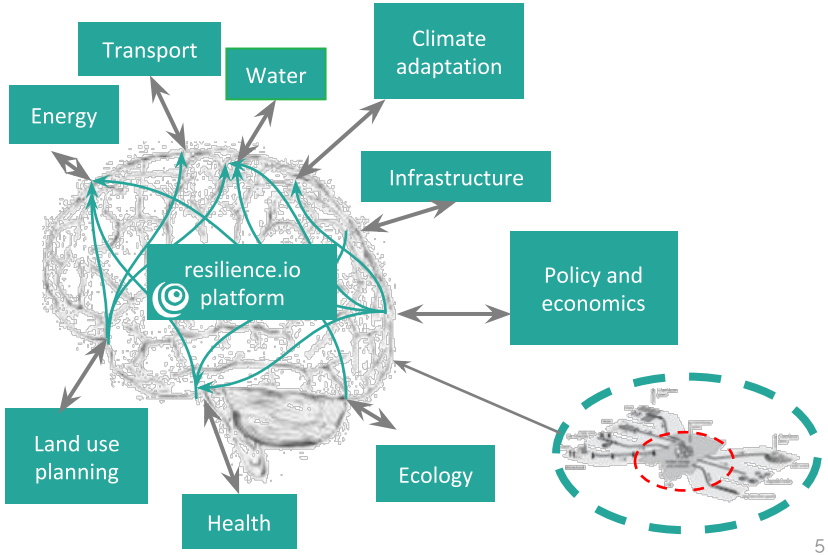
resilience.io

Systems thinking and collaborative intelligence

*By using **systems thinking** and **collaborative intelligence** together with integrated planning, **transformational change** is within reach of communities and governments.*

Example: human health and wellbeing, urban heat island effect:





resilience brokers | ecological sequestration trust | resilience.io

Data brokering approach - a change in paradigm

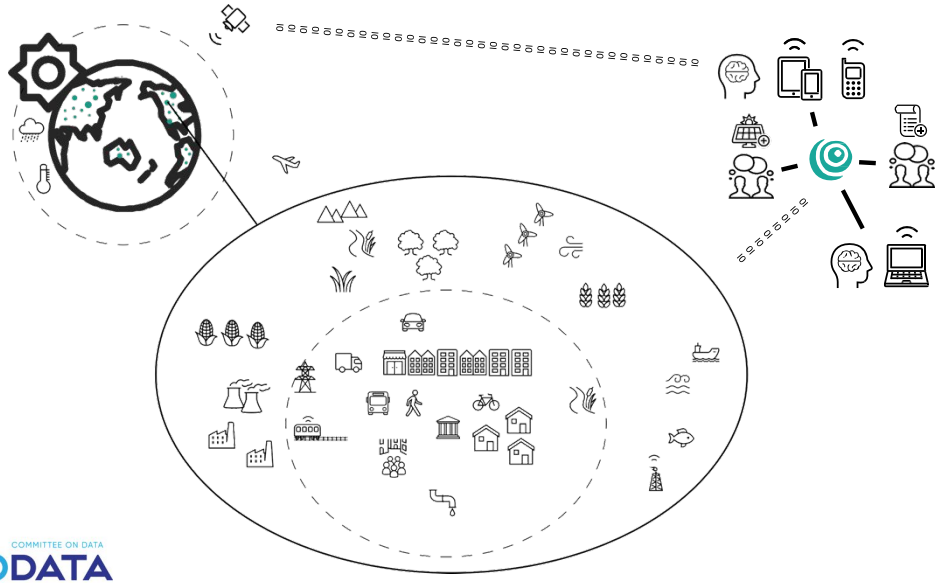
Interoperability through mediation -

System of systems integration, linking complex and heterogeneous systems by building bridges between existing network platforms and systems infrastructures.

Geo-locate flows, infrastructure - ML

Data-brokering infrastructure enables access to and interoperability with a wide variety of data sources:

- geo-locational data and from Earth observations;
- open datasets across scales (e.g., local, regional);
- proprietary data sets;
- ground-based sensors;
- crowdsourced data.



Imperial College London | IIER | GEO GROUP ON EARTH OBSERVATIONS | COMMITTEE ON DATA CODATA INTERNATIONAL SCIENCE COUNCIL

resilience.io platform use cases

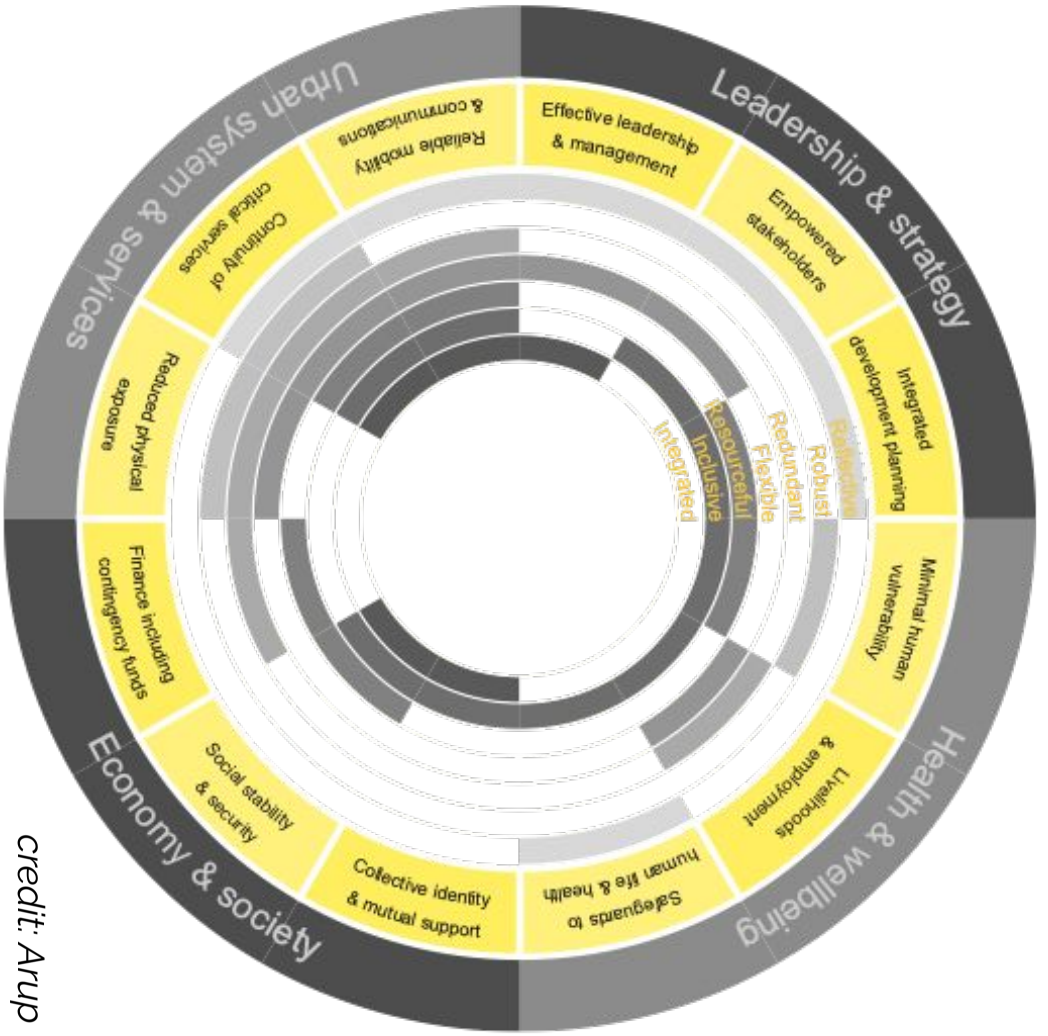
Greater Accra, Ghana	*Water supply, sanitation and accessibility*
Hunter Valley, Australia	*Water infrastructure, energy transition, institutional resilience*
Union Canal, Scotland, UK	*Water supply, sanitation and accessibility*
Anninghe, Sichuan, China	*Integrated multi-hazard modelling*
Queen Elizabeth Olympic Park, London, UK	*Digital and social inclusion, green space accessibility*

Additional Resilience Brokers Projects

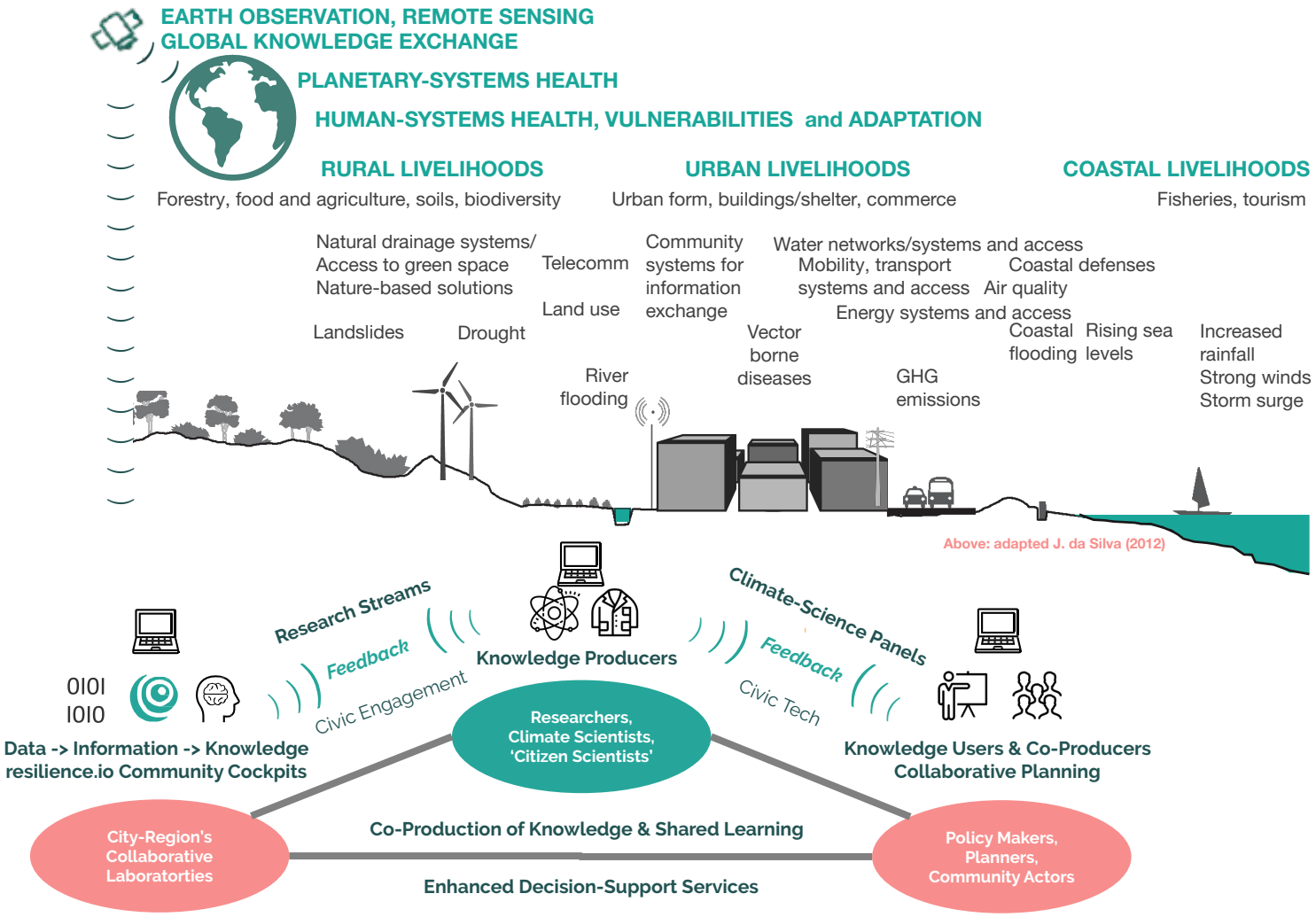
Medellín, Colombia	*Air quality, public health, transport, green space*
Beirut, Lebanon	*Green space, urban health, pedestrian and cycling routes*
Western Cape, South Africa	*Water supply, energy transition*
Meridian Water, London, UK	*Data integration, urban mobility, integrated flood modelling and 'nature-based solutions' (NBS)*

Urban Resilience Framework

Developed by Arup for Rockefeller Foundation 100 Resilient Cities



credit: Arup


EARTH OBSERVATION, REMOTE SENSING
GLOBAL KNOWLEDGE EXCHANGE
PLANETARY-SYSTEMS HEALTH
HUMAN-SYSTEMS HEALTH, VULNERABILITIES and ADAPTATION
RURAL LIVELIHOODS
Forestry, food and agriculture, soils, biodiversity
URBAN LIVELIHOODS
Urban form, buildings/shelter, commerce
COASTAL LIVELIHOODS
Fisheries, tourism
Natural drainage systems/
Access to green space
Nature-based solutions
Telecomm
Land use
Community
systems for
information
exchange
Water networks/systems and access
Mobility, transport
systems and access
Coastal defenses
Air quality
Energy systems and access
Landslides
Drought
River
flooding
Vector
borne
diseases
GHG
emissions
Coastal
flooding
Rising sea
levels
Increased
rainfall
Strong winds
Storm surge
Above: adapted J. da Silva (2012)
Research Streams
Feedback
Civic Engagement
Knowledge Producers
Climate-Science Panels
Feedback
Civic Tech
0101
1010
Data -> Information -> Knowledge
resilience.io Community Cockpits
Researchers,
Climate Scientists,
'Citizen Scientists'
Knowledge Users & Co-Producers
Collaborative Planning
City-Region's
Collaborative
Laboratorties
Co-Production of Knowledge & Shared Learning
Enhanced Decision-Support Services
Policy Makers,
Planners,
Community Actors

‘Smart’ cities and ‘resilient’ cities

Defining the role of open data in different city strategies

‘Is the smart city focus on efficiency at odds with the need for resilient cities to be open, democratic and inclusive, processes which are time and labor intensive?’

Pamela Robinson, Ryerson University and GeoThink Researcher

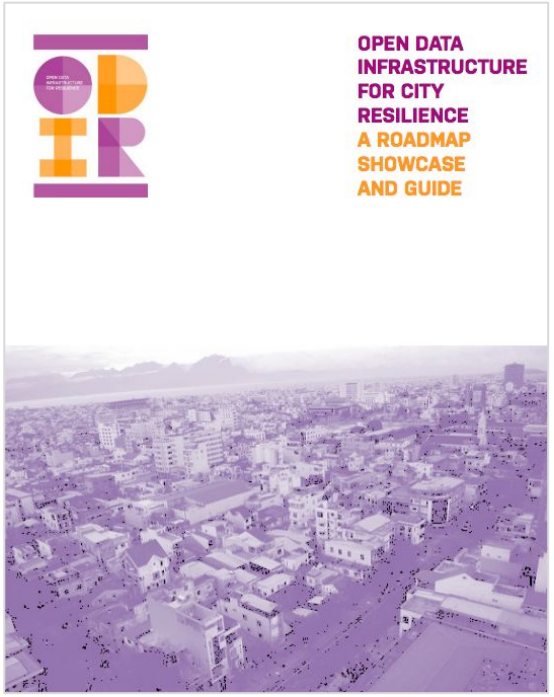
‘The ability to ingest crowd sourced data, and turn data into actionable information is a trait of engaged administrations and data programmes that leverage platforms to harness new data and feedback on local issues.

This includes the ability to allow partners to stream sensor based data to a city’s open portal.’

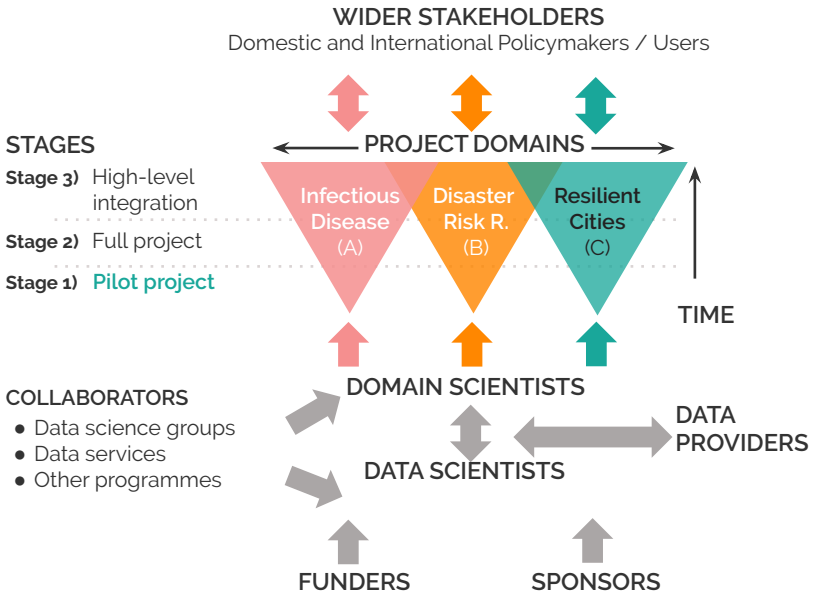
Sifa Mawiyoo, Open Data Geospatial Technologist, ICT Authority, Kenya

‘OPEN DATA INFRASTRUCTURE FOR CITY RESILIENCE:
A roadmap showcase and guide’

May 2018, available through UNDRR [UNISDR]
www.unisdr.org/campaign/resilientcities/toolkit/article/open-data-infrastructure-for-city-resilience



Pilot projects for three global challenges: *stages*



ISC-CODATA pilot project for resilient cities

Wider project objectives *(selected)*

- To demonstrate the power of data integration to provide practical benefit to the resilient cities domain.
- To develop and demonstrate mechanisms to support SDG/Paris agreement reporting.
- To identify the need for further data that will enhance the potential of data integration to achieve major new insights in the resilient cities domain.
- To enhance standards and definitions for metadata, research approaches and methodologies > measurement of indicators (city-region level).
- To develop tools that enable data infrastructure/ecosystem assessment and enhancement.
- To demonstrate how research approaches, data collection, processing and dissemination used for municipal decision-making = “enhanced urban resilience”.
- To identify interdependence in data analysis frameworks used for monitoring and evaluation of urban services.
- To build capacity and assist city regions in utilising integrated data and interdisciplinary research to underpin ‘bankable’ project development > attracts investment > helps build business case for data infrastructure.

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ISC-CODATA pilot project for resilient cities

Objectives for domain pilot on urban resilience

- To demonstrate the power of data integration to provide practical benefit to the resilient cities domain as well as to demonstrate mechanisms to support reporting of the SDGs and Sendai Framework;
- To demonstrate effective research approaches that are participatory and practice-driven, data collection, processing and dissemination used for municipal decision-making;
- To identify interdependence in data analysis frameworks used for the monitoring and evaluation of urban services;
- To provide knowledge of accessible resources and relevant actors to build capacity and assist city regions in utilising integrated data and interdisciplinary research to underpin integrated approaches to project delivery and administration to maximize societal benefit;
- To encourage appreciation and adoption of the importance of 'FAIR' data principles (findable, accessible, interoperable, reusable) and open-data approaches and infrastructures as key enablers of collaborative problem definition, risk analysis and societal response that resilience action planning requires.
- To identify together the need for further data and practical approaches that can enhance the potential of data integration to achieve major new insights in the resilient cities domain.

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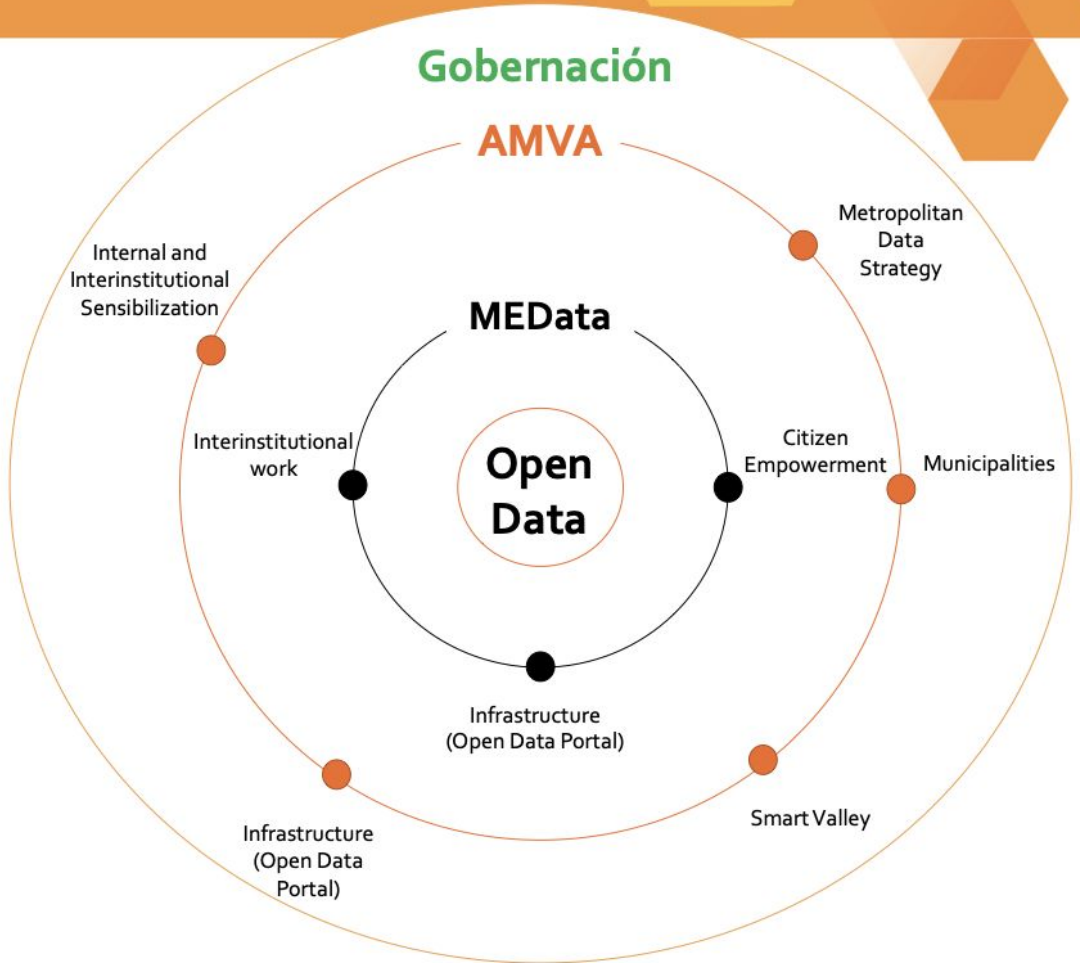
MEDELLÍN


Gobernación
AMVA
Internal and Interinstitutional Sensibilization
Metropolitan Data Strategy
MEData
Interinstitutional work
Open Data
Citizen Empowerment
Municipalities
Infrastructure (Open Data Portal)
Infrastructure (Open Data Portal)
Smart Valley

CODATA pilot project for resilient cities

Medellin case study

Action plan

1. **Define topic.** - a systems approach to **air quality** (and **public health** and **economic outcomes**) was agreed, advancing existing initiatives in Medellin.
2. **Define scope.** *(what questions are asked of the data and who needs to access the data, for what purpose)*
3. **Identify what data sets are required,** and **what datasets are available** (pm2.5).
4. **Identify key areas of interoperability of data between disciplines** *(air quality, demographics, economics, land use, health, green space, GHG emitters/traffic and transport).*
5. **What are the data functions required.** *(e.g., machine learning, extraction of data from pdf documents)*
6. **Collect data and build integrated data tools & analyses.**
7. **Conduct intensive data lab at Dagstuhl workshops - metadata workshop.**
8. **Present initial results to Medellin and ISC CODATA groups.**

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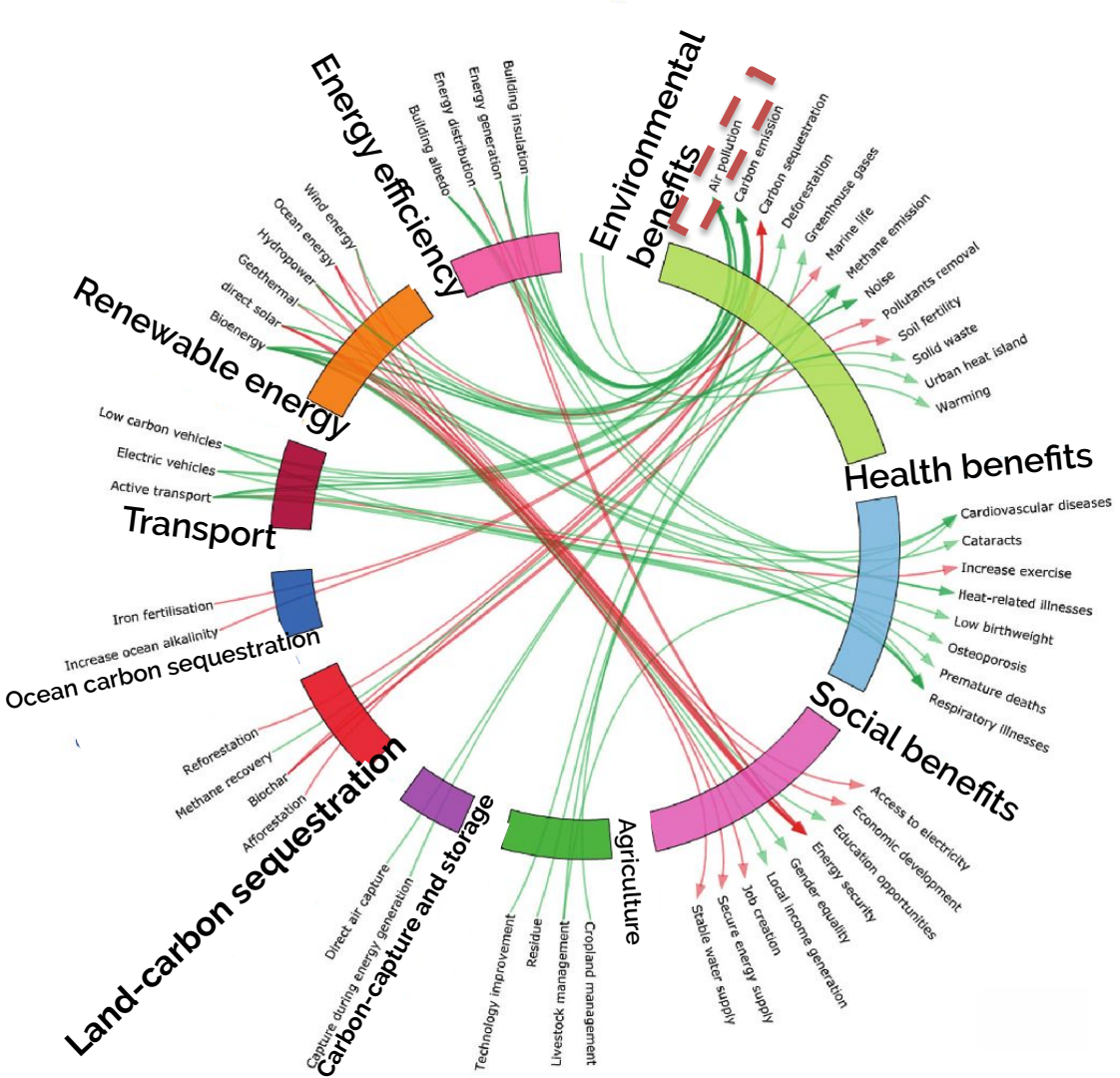
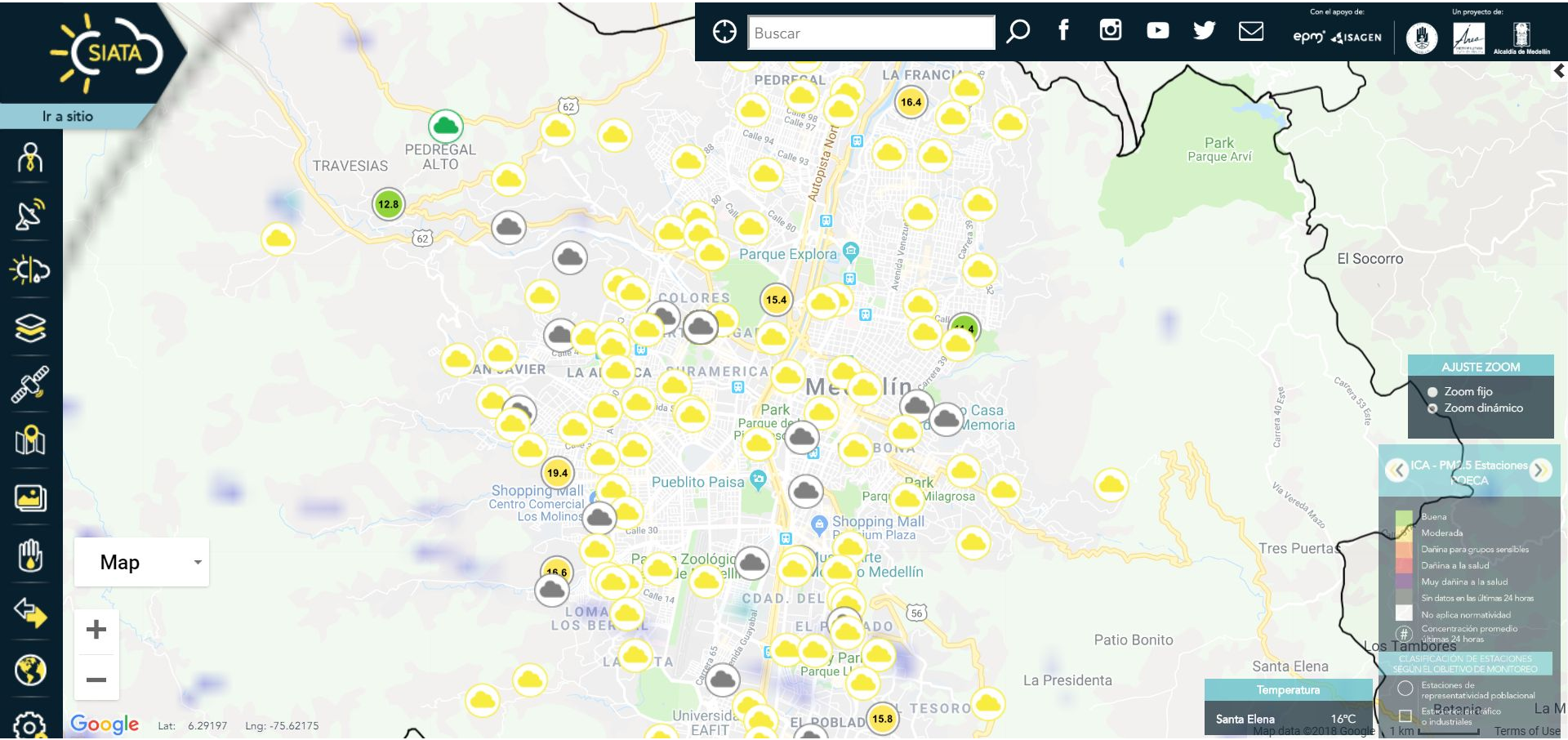


adapted from The Lancet –
for illustrative purposes only

SIATA air quality (citizen scientists through Ruta-N initiative)

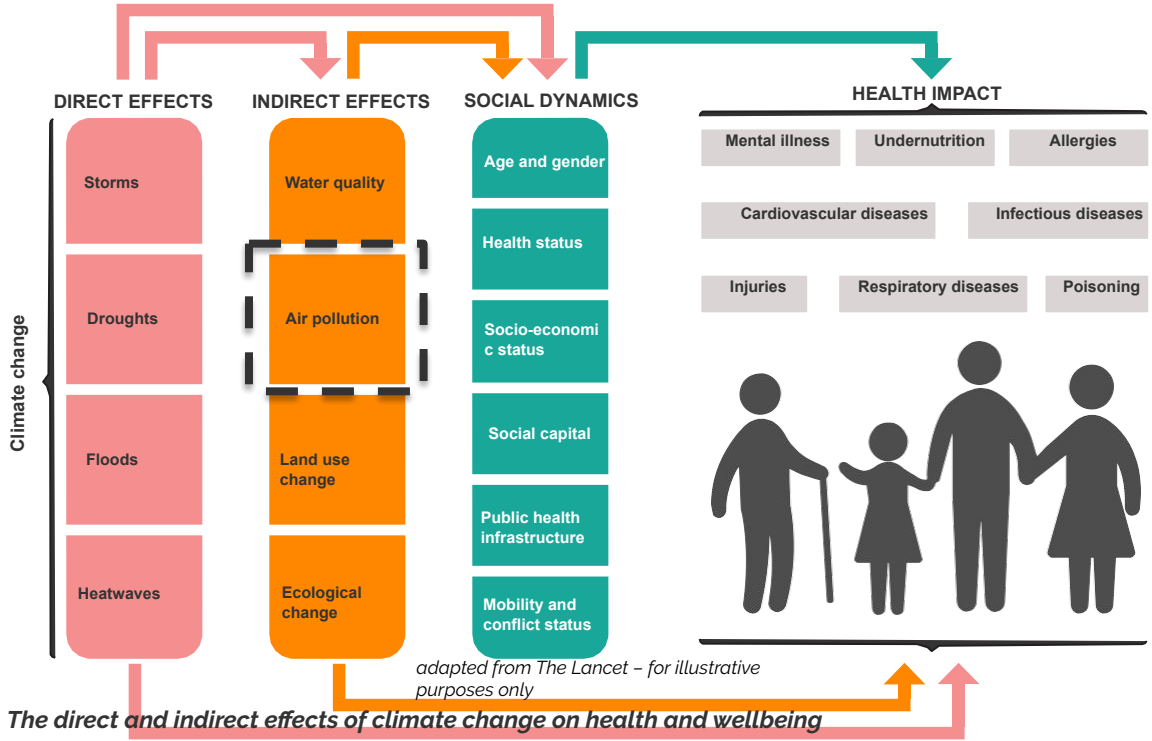


credit: SIATA *used for illustrative purposes only*

CODATA DATA INTEGRATION INITIATIVE | Advancing Interdisciplinary Research on Global Challenges through Data Integration

International Science Council

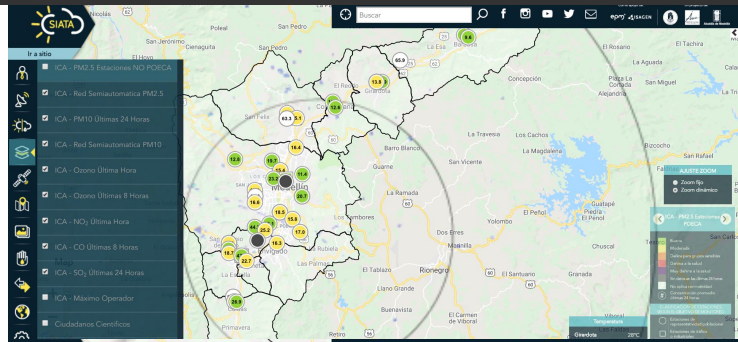
CODATA ICSU

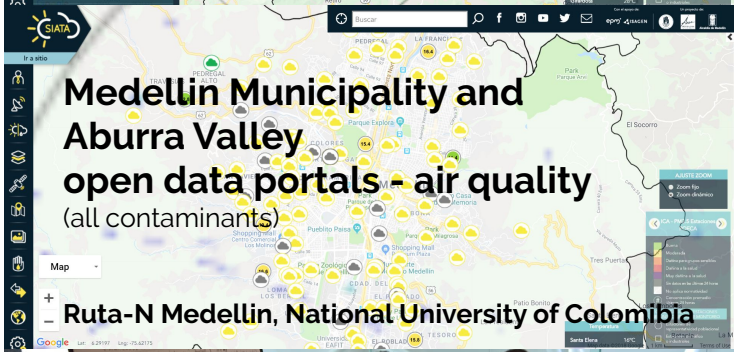


adapted from The Lancet – for illustrative purposes only

The direct and indirect effects of climate change on health and wellbeing

There are complex interactions between both causes and effects. Ecological processes, such as impacts on biodiversity and changes in disease vectors, and social dynamics, can amplify these risks. Social responses also ameliorate some risks through adaptive actions.





CODATA pilot project for resilient cities

Medellin case study

Integrated data approach on a topic in Medellin

- a systems approach to **air quality** (and **public health** and **economic outcomes**) was agreed, advancing existing initiatives in Medellin.

Medellin project working group:

- Ruta N - Business & Innovation Center for Medellin Municipality - *Jaime Rugeles* *(Medellin lead)*
- Universidad Nacional de Colombia - Sede Medellín (UNALMED) - *Santiago Medina Hurtad*
- Medellin Municipality - Planning Office and Chief Resilience Officer *(CRO)*
- Foundation Makaia
- Instituto Tecnológico Metropolitano de Medellín (ITM)
- Departamento Administrativo Nacional de Estadística (DANE) - *Carlos Felipe Lombo, Angelica Robayo*
- Medellin Data Council members - Paola Pollmeier
- Medellín Lab (ACI Medellin)

CODATA pilot project for resilient cities

Medellin case study

Action plan

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5. What are the data functions required. *(e.g., machine learning, extraction of data from pdf documents)*
6. Collect data and build integrated data tools & analyses.
7. Conduct intensive data lab at Dagstuhl workshops (1-5 October) – metadata workshop.
8. Present initial results to Medellin and ISC CODATA groups.

Data integration workshops in Medellin for CODATA

credit: Ruta N

ISC-CODATA Documentation/Findings Taller 1 (English) from Medellin workshop 2018-08-15

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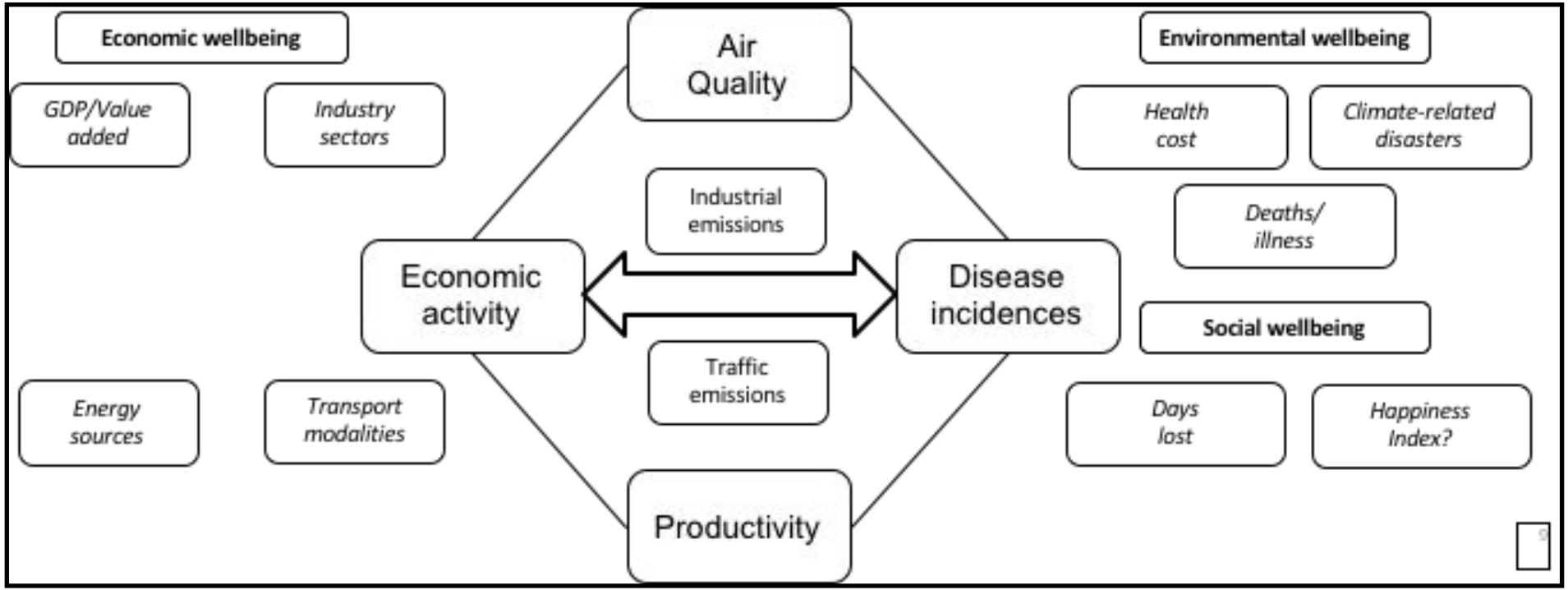
Rate of absorption of pollutants from urban trees?

	A	B	C	D	E	F
1	**Rate of absorption of pollutants from urban trees?**	**What datasets are available?**	**Who generates the data?**	**Who needs access to the data? For what purpose?**	**What datasets are necessary?**	**Who needs access to the data? For what purpose?**
2	Rate of absorption of pollutants from urban trees?	* Urban Trees * Contaminants	AMVA			
3	Projection of pollutants from the city?	Contaminants monoxide and nitrogen dioxide, ozone (O3), PM 1, PM 2.5, PM10, sulfur dioxide (SO2)	AMVA	Transport, construction, health and education companies	Health	
4	**Correlation between respiratory diseases (according to time of exposure to contaminants, location, travel...)**	* Contaminants monoxide and nitrogen dioxide, ozone (O3), PM 1, PM 2.5, PM10, sulfur dioxide (SO2) * Destination origin survey * Travel information of waze (Medellín, Bello and Envigado) * Duration of waze trips * Zones with a higher concentration of pollutants	AMVA Medellin's town hall Municipalities Valle de Aburrá	Health service companies	Respiratory diseases (Registry of Ministry)	Sura (Insurance Company) EPS
5	What is the generation rate of pollutants due to congestion?	Mobile Senores in Garbage Collection Vehicles (Gas)	AMVA SIATA Pilot Renting Colombia	Transport companies, vehicle rental and fuel		
6	**How does the quality of the air impact the economic development of the City?**	* No Jobs, Economic Development - GDP, taxes, budget execution * Data of cloudiness, air quality, temperature, winds, noise, river levels	Multiple public and private sources	RutaN, Sec de Desarrollo Economica	Impact Sale of Private Vehicles how motorcycles No of Disabilities, Tourist Data, Cancellation of events, Sales of Motorcycles	
7	**How do mobility measures influence commerce or business activity in**	Effects of mobility measures (such as peak and plate) on air	AMVA Mobility secretary Waze	Chambers of Commerce	Microdata Mobility in real	


Economic wellbeing
GDP/Value added
Industry sectors
Air Quality
Industrial emissions
Economic activity
Disease incidences
Traffic emissions
Productivity
Energy sources
Transport modalities
Environmental wellbeing
Health cost
Climate-related disasters
Deaths/ illness
Social wellbeing
Days lost
Happiness Index?