

# EARTH OBSERVATIONS FOR CLIMATE-RESILIENT CITIES



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| vi. Olanda Bata (USAID CCAP)                       | 131 |

## Session description:

[https://resilientcities2018.iclei.org/wp-content/uploads/RC2018\\_Session\\_Description\\_B5\\_Earth\\_Observations.pdf](https://resilientcities2018.iclei.org/wp-content/uploads/RC2018_Session_Description_B5_Earth_Observations.pdf)



ICLEI 9<sup>th</sup> Global Forum on  
Urban Resilience and Adaptation

## Earth observations for climate-resilient cities

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@eo4sdg



# Session agenda

ICLEI Resilient Cities, April 2018



## Speakers

- **Thomas Kemper**, Joint Research Center (JRC), European Commission
- **Marc Paganini**, European Space Agency
- **David Stevens**, United Nations Office for Disaster Risk Reduction (UNISDR)
- **Philip Briscoe**, Rezatec
- **Stephen Passmore**, Resilience Brokers
- **Olanda Bata**, Mozambique Coastal Cities Adaptation Project (USAID)



## Desired outcomes

- Knowledge of case studies, available resources and value of Earth observations



# Group on Earth Observations

An overview

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## What is GEO?

GEO is an intergovernmental organization working to improve the availability, access and use of Earth observations for the benefit of society.





# Investing in GEO

Global Earth information for local solutions

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## GEO & THE ECONOMY

The systems and policies championed by GEO contribute to broad economic benefits and growth for all.





# Investing in GEO

Global Earth information for local solutions

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## GEO & SECURITY

GEO is contributing to efforts to combat food insecurity, water insecurity, and the economic, social, and environmental costs of disasters.





# GEO IN NUMBERS

**7** continents



**8** benefit areas



**12** years



**73** work programme activities

**105** members



**115** participating organizations



**5,000** data providers



**400,000,000**

Earth observations







SPACE-BASED  
OBSERVATIONS

IN SITU  
OBSERVATIONS



An aerial photograph showing a dense forest with green and yellow trees on the left, and a body of water on the right. The text is overlaid on a black background in the center.

COORDINATED GLOBALLY,  
REGIONALLY, **NATIONALLY** & **LOCALLY**  
COMPREHENSIVE ACROSS  
DOMAINS,  
NETWORKS & PLATFORMS  
SUSTAINED OVER TIME



# Data Sharing

## Open Data for the Benefit of Humankind

### How do countries benefit from open data?

There are many diverse benefits and opportunities from providing open data for unrestricted use worldwide.

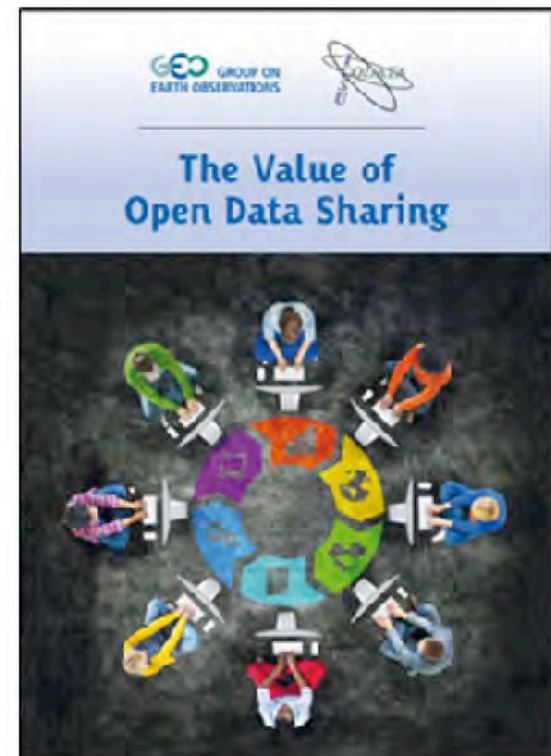
ECONOMY

EDUCATION

GOVERNANCE

RESEARCH & INNOVATION

SOCIETY





# GEOSS

The GEOSS Common Infrastructure (GCI) presently brokers more than 165 open data catalogs and information systems, comprising over 400 million data and information resources .

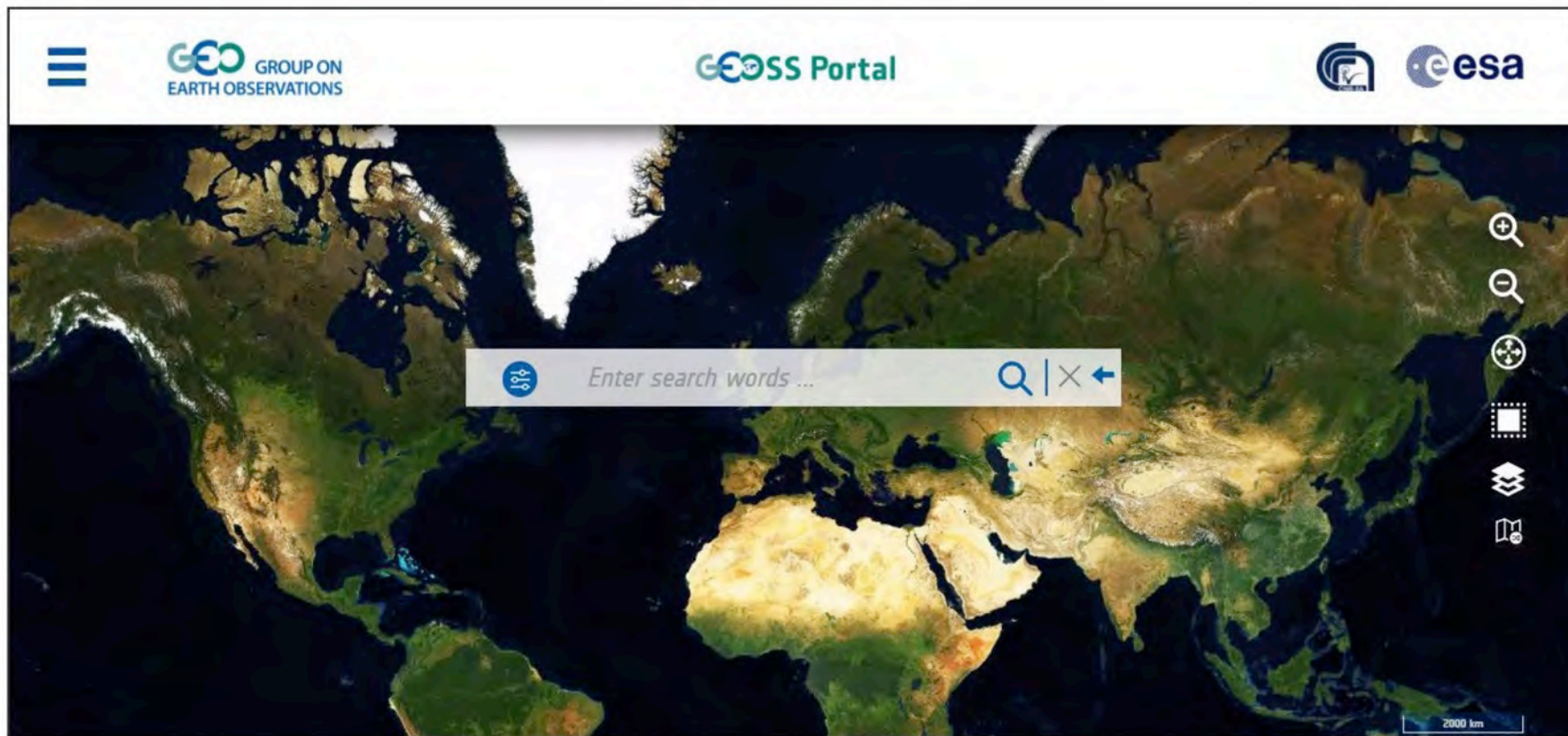
**35** languages  
**5000** contributing organizations  
**200,000** keywords  
**400,000,000**  
 open EO data resources





# GEOSS

## Global Earth Observation System of Systems



[www.geoportal.org](http://www.geoportal.org)



# Societal Benefit Areas

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**GEO works across 8 Societal Benefit Areas (SBAs) to find solutions for global challenges.**

Climate change and associated impacts cut across all SBAs.



Biodiversity and Ecosystem Sustainability



Disaster Resilience



Energy and Mineral Resource Management



Food Security and Sustainable Agriculture



Public Health Surveillance



Transport



Sustainable Urban Development



Water Resources Management





# GEO WORK PROGRAMME

2017-2019

**70+**: FLAGSHIPS, INITIATIVES &  
COMMUNITY ACTIVITIES

**SCORES** OF COUNTRIES

**THOUSANDS** OF COLLABORATORS

**HUNDREDS OF MILLIONS** INVESTED

IMPACT ON **BILLIONS** OF LIVES



# GEO WORK PROGRAMME FLAGSHIPS





# GEO Flagships

Geo Biodiversity Observation Network (GEO BON)

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**GEO BON contributes to effective management of the world's biodiversity and ecosystem services.**

Over 100 governments and organizations are collaborating through GEO BON to organize and improve terrestrial, freshwater and marine biodiversity observations globally.





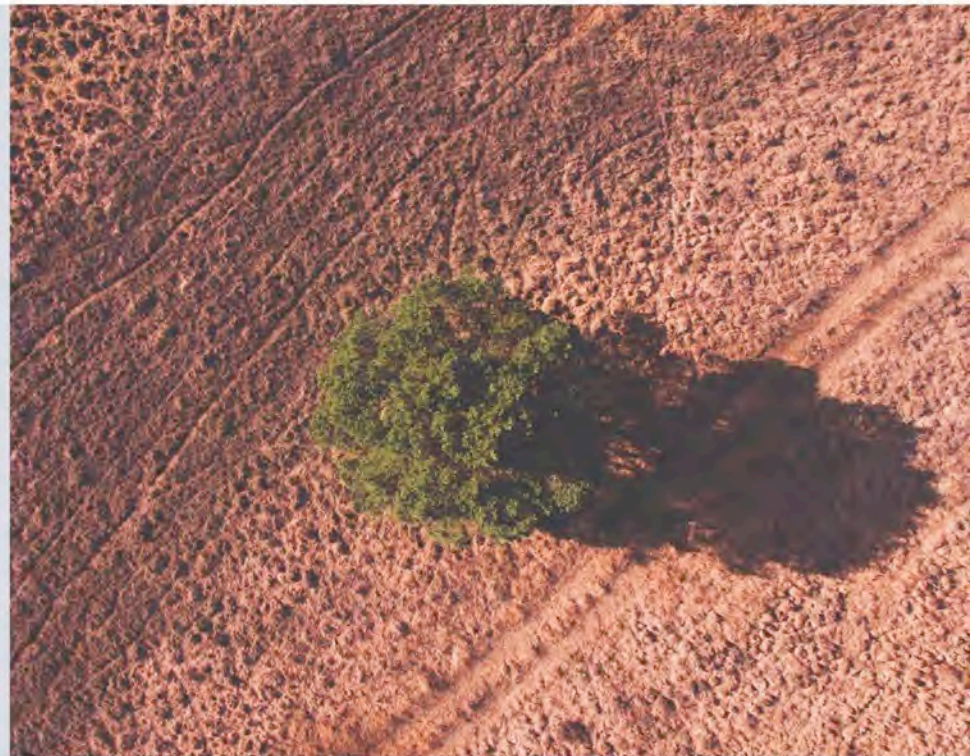
# GEO Flagships

Global Agricultural Monitoring Initiative (GEOGLAM)

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## GEOGLAM is working to fight food insecurity.

By using Earth observations, GEOGLAM reinforces the international community's capacity to produce and disseminate relevant, timely and accurate projections of agricultural production at national, regional and global scales.





# GEO Flagships

Global Forest Observation Initiative (GFOI)

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## GFOI helps countries measure and monitor forests for REDD+.

GFOI supports REDD+ countries to develop their national forest monitoring systems and associated emissions measurement, reporting and verification procedures.





# GEO Flagships

## Global Observation System for Mercury (GOS4M)

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### **GOS4M contributes to the tracking of mercury released in the environment.**

GOS4M facilitates cooperation of governments and institutions tracking chemical pollutants and fosters the adoption of advanced sensors in monitoring mercury and its compounds.





Urban areas face specific challenges in dealing with their water resources.

**GEOGLOWS facilitates the use of Earth observation assets to contribute to mitigating water shortages, excesses and degraded quality arising from population growth,**







**Cities around the world are growing rapidly, putting their wetland ecosystems at risk.**

Healthy urban wetlands are vital for urban environments. They help reduce flooding, improve water supply and quality, filter waste, improve air quality, promote well-being, provide economic opportunities for many, and more.







**VENER**  
VISION FOR ENERGY

GEO-VENER contributes to the availability of Earth observation data for the effective development and operation of renewable energy systems.





# GEO ENGAGEMENT PRIORITIES



PARIS2015  
UN CLIMATE CHANGE CONFERENCE  
COP21•CMP11





# GEO & Climate Change

Priority Engagement Area

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## Climate change and its impacts cut across all areas of GEO's work.

GEO makes available Earth observations in support of effective policy making for climate change adaptation and mitigation, working with partners to enhance global observation systems in order to strengthen resilience and adaptive capacity to climate-related hazards.



PARIS2015  
UN CLIMATE CHANGE CONFERENCE  
COP21•CMP11





# GEO & Climate Change

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## Responding to the Paris Agreement

### Articles 4 & 13: National Reporting

- Reported five-yearly by parties, successive reductions in emissions
- Using existing methods and guidance; not validation

### Article 5: Mitigation

- Knowledge of evolution of sinks and sources

### Article 7: Adaptation

- (7.6) Strengthening cooperation,
- (7.7c) Research, systematic observation

### Article 10: Technology Transfer

### Article 11: Capacity Development

### Article 14: Global stocktaking

- in the light of equity and the best available science: 2023, 2028...

### Article 15 Compliance

### GEO PB Action (August 2017):

Organize a workshop on the EO response to climate change.



**PARIS2015**  
UN CLIMATE CHANGE CONFERENCE  
COP21·CMP11



# GEO & Disaster Risk Reduction

Priority Engagement Area

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**GEO supports disaster resilience by increasing coordination of Earth observations to forecast and prepare for disasters, to reduce damage and to better manage and recover from disasters.**

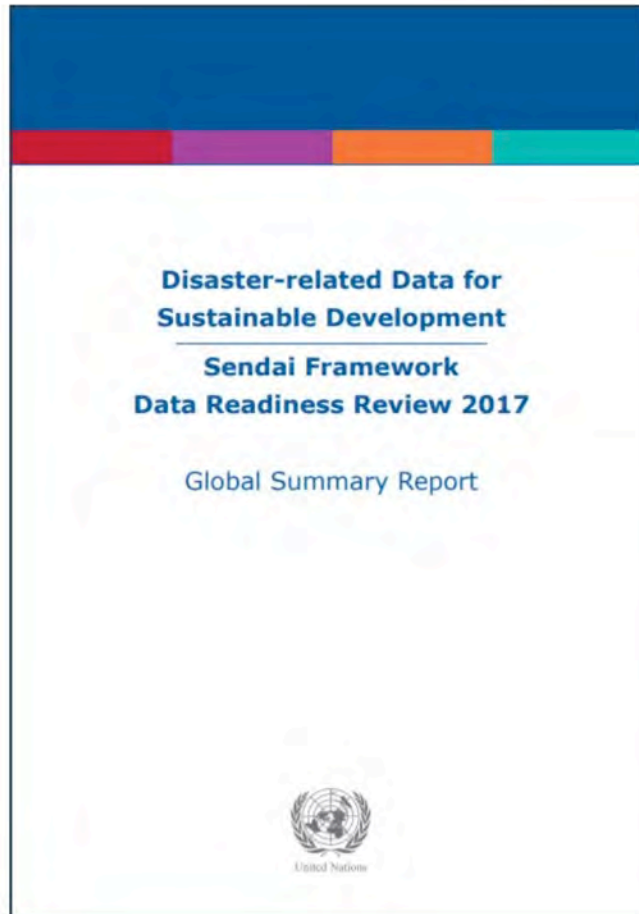


UN World Conference on  
Disaster Risk Reduction  
2015 Sendai Japan





# Disaster Resilience



## Disaster-related Data for Sustainable Development: Sendai Framework Data Readiness Review 2017 Section 2.2

<http://bit.ly/drrreport>



22-26 MAY, 2017 | CANCUN, MEXICO  
**2017 GLOBAL PLATFORM**  
FOR DISASTER RISK REDUCTION



# GEO & the SDGs

## Priority Engagement Area

**Earth observations play a major role in achieving the SDGs.**



Earth observations are used for monitoring goals, targets, and indicators, tracking progress and helping Member States and custodial agencies make decisions and ongoing adjustments.

GEO is instrumental in integrating Earth observation data into the methodology of measuring and achieving the SDGs.



# EO4SDG



EARTH OBSERVATIONS FOR THE  
SUSTAINABLE DEVELOPMENT GOALS

## INITIATIVE CO-CHAIRS

Eduardo De La Torre  
Mexico/INEGI



Chu Ishida  
Japan/JAXA



Lawrence Friedl  
USA/NASA



## EXECUTIVE SECRETARY

Argyro Kavvada  
USA/NASA-BAH



UN-GGIM

United Nations Secretariat  
Global Geospatial Information Management

*Positioning geospatial information to address gl*  
[ggim.un.org](http://ggim.un.org)



A satellite view of Earth from space, showing the curvature of the planet and the blue oceans. A black rectangular box is centered on the image, containing white text.

# Indicators

6.6.1

11.3.1

15.3.1

<http://eo4sdg.org>  
Twitter: @EO4SDG



# DANE Pilot Project (I)

National Administrative Department of Statistics in Colombia

Pilot project using EO to examine  
SDG11, Indicator **11.3.1**

*Ratio of land consumption to  
population growth*

DANE developed a method that  
incorporates freely available  
Landsat images with population  
data to investigate the relationship  
between land consumption and  
population growth in the  
Barranquilla Metropolitan Area  
(MA) in northern Colombia.



[http://eo4sdg.org/wp-content/uploads/2017/08/4.-  
Report\\_Pilot\\_Project\\_Colombia\\_v3-1.pdf](http://eo4sdg.org/wp-content/uploads/2017/08/4.-Report_Pilot_Project_Colombia_v3-1.pdf)



# DANE Pilot Project (III)

National Administrative Department of Statistics in Colombia

## Next steps

EO and statistical data to address other aspects of SDG 11 Indicator 11.7.1 - Average share of the built-up area of cities that is open space for public use for all. Also use Earth observations for informing the next census.

Continue to work with EO4SDG and GPSDD: Global Partnership for Sustainable Development Data



[http://eo4sdg.org/wp-content/uploads/2017/08/4.-Report\\_Pilot\\_Project\\_Colombia\\_v3-1.pdf](http://eo4sdg.org/wp-content/uploads/2017/08/4.-Report_Pilot_Project_Colombia_v3-1.pdf)



# GEO Land Degradation Neutrality

## Proposed GEO Work Programme Initiative

This proposed GEO initiative will work to improve the availability and use of Earth observations to monitor land use change in support of sustainable land management practices, for the benefit of all.





# GEO Land Degradation Neutrality

## Proposed GEO Work Programme Initiative

### Earth Observations for Land Degradation

GEO is partnering with UNCCD to help countries develop the capacity to monitor and report on SDG 15.3.1: *“proportion of land that is degraded over total land area”*





# Agenda 2030

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## EO case studies

GEO is instrumental in integrating Earth observation data into the methodology of measuring, monitoring and achieving the SDG Indicators.

This brochure gives graphic illustrations of EO data allowing decision-makers to help identify the status of conditions they need to report, as well as visualize solutions.

[https://www.earthobservations.org/documents/publications/201703\\_geo\\_eo\\_for\\_2030\\_agenda.pdf](https://www.earthobservations.org/documents/publications/201703_geo_eo_for_2030_agenda.pdf)





# GEO REGIONAL INITIATIVES





# PRIVATE SECTOR ESSENTIAL

## Data providers



## Value added providers



## Downstream users







Earth Observations for Impact

# GEO SYMPOSIUM 2018

#EO4IMPACT18

11-12 June 2018 / Geneva, Switzerland



# Thank You

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Communicate and Collaborate with GEO:





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# Opportunities for Sustainable Urban Development exploiting Big Data from Space

**Thomas Kemper**, European Commission, Joint Research Center  
**Marc Paganini**, European Space Agency

The 9<sup>th</sup> Global Forum on Urban Resilience and Adaptation, Resilient Cities 2018 | 26-28 April 2018  
B5 Panel: Earth Observations for climate-resilient cities



# EO supporting Global Development Policies

## Climate Action

Paris Agreement



**Monitoring Climate  
Change &  
Understanding**

## Sustainable Development

UN SDGs



**Measuring  
Development Status  
& Progress**

## Disaster Risk Reduction

Sendai Framework



**Supporting  
Disaster Resilient  
Societies**





Mahmoud Mohieldin, SVP, World Bank





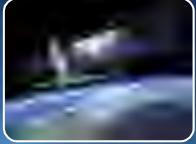
# **Advent of steady satellite data streams for urban sustainable development**



# The European Copernicus program, *Securing free access to satellite data on the long term*



**S-1**



Radar

**A**



3 Apr. 2014

**B**



25 Apr. 2016

**C**

2022/23

**D**

> 2022/23

**S-2**



High  
Resolution  
Optical

**A**



23 Jun. 2015

**B**



6 Mar. 2017

**C**

2022/23

**D**

> 2022/23

**S-3**



Medium  
Resolution  
Optical &  
Altimetry

**A**



16 Feb. 2016

**B**

2018

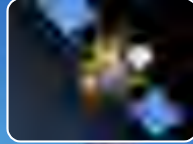
**C**

2023

**D**

> 2023

**S-4**



Atmospheric  
Chemistry  
(SEO)

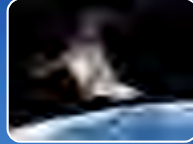
**A**

2021

**B**

2027

**S-5P**



Atmospheric  
Chemistry  
(LEO)

**A**



13 Oct. 2017

**S-5**



Atmospheric  
Chemistry  
(LEO)

**A**

2021

**B**

2027

**C**

> 2027

**S-6**



Altimetry

**A**

2020

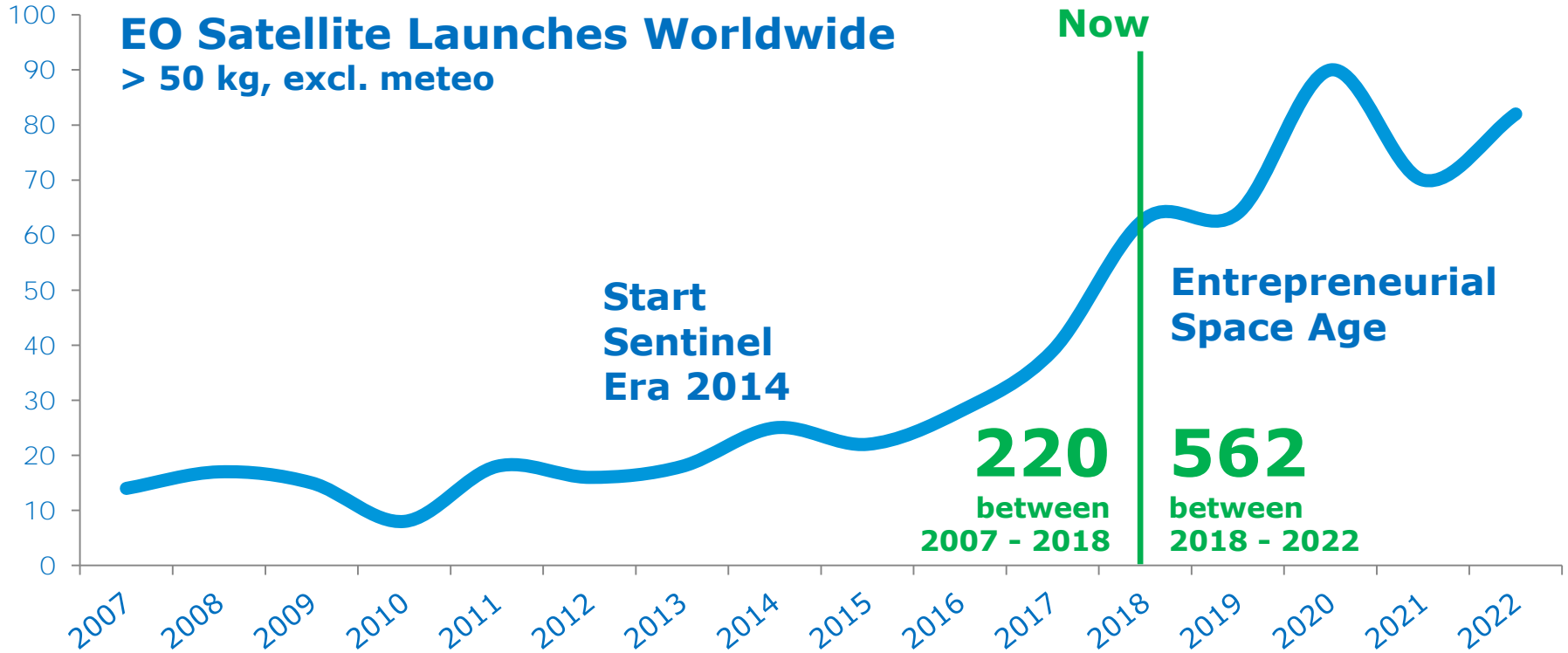
**B**

2025

Free and  
open data  
policy



# More Eyes in the Sky



Source: Euroconsult Database, 2017



# Big Data Revolution

ESA EO Data Archive  
Petabyte





# Towards efficient “big data” exploitation platforms

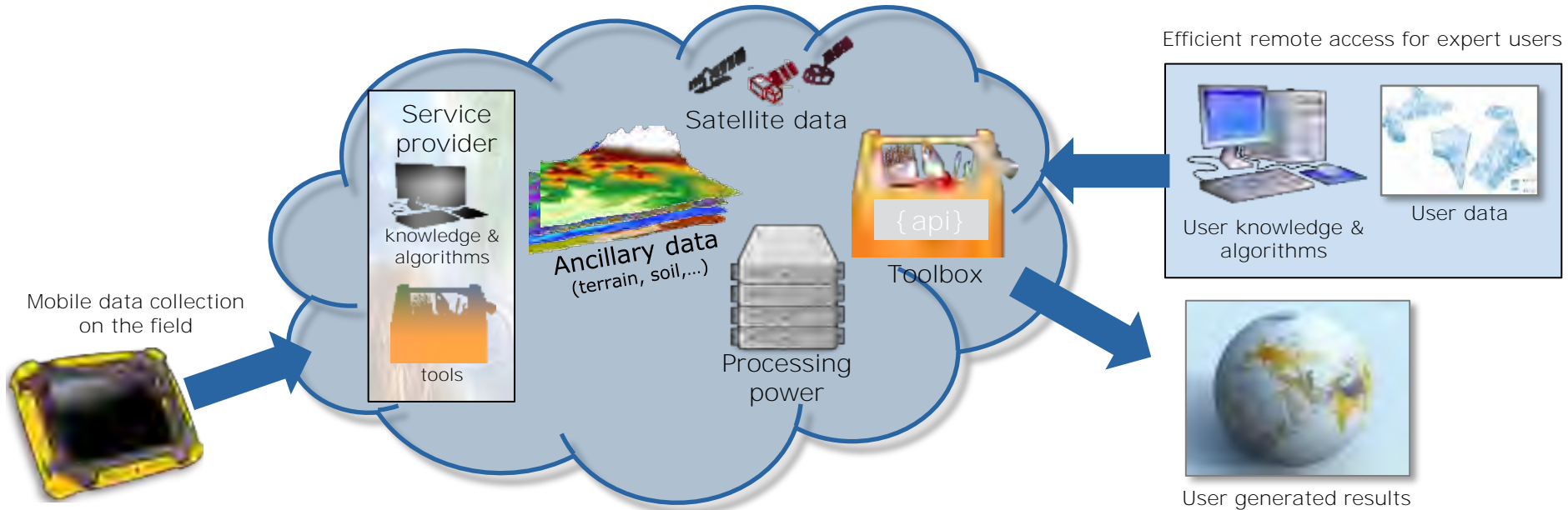
The power of the  
Cloud  
The power of  
Partnerships

***“Bringing the users to the data”***

**Simplify the extraction of information** from EO data

**Enable large scale exploitation** of EO data

**Stimulate innovation** with EO data





# Advances in Big Data Processing

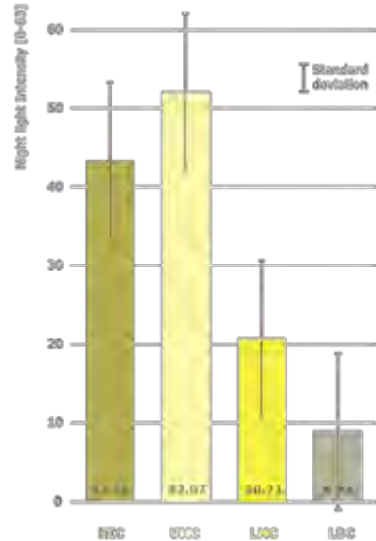
- Landsat data volume:
  - 32,808 data sets with a volume of **23 TB**
- Single computer: **210 days**
- Computer cluster: **2 weeks**
- JRC Earth Observation Data Processing Platform (JEODPP): **1 day**



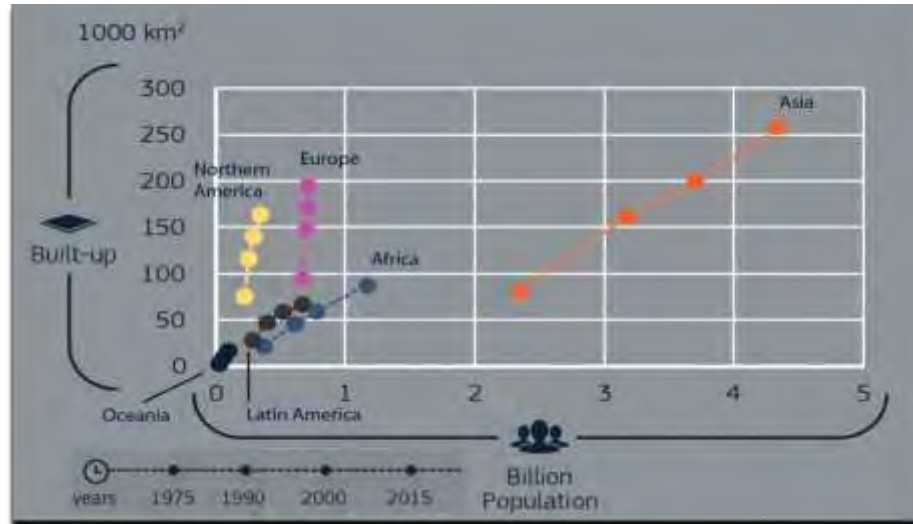


# Combining EO and socio-economic information

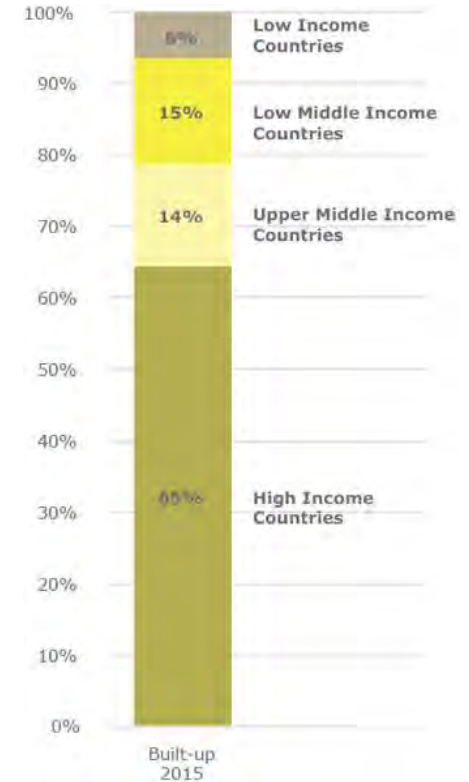
The availability of global EO data sets opens new pathways for spatializing socio-economic and other data and for creating new knowledge



Nightlight in settlements



Nightlight in settlements



Built-up area by income class



# Emergence of urban global data sets with local details





## Monitoring urban development

Shanghai  
**1985-2015**







## Monitoring urban development

Shanghai  
**1985**







## Monitoring urban development

Shanghai  
**1990**







## Monitoring urban development

Shanghai  
**1995**





## Monitoring urban development

Shanghai  
**2000**





## Monitoring urban development

Shanghai  
**2005**





## Monitoring urban development

Shanghai  
**2010**







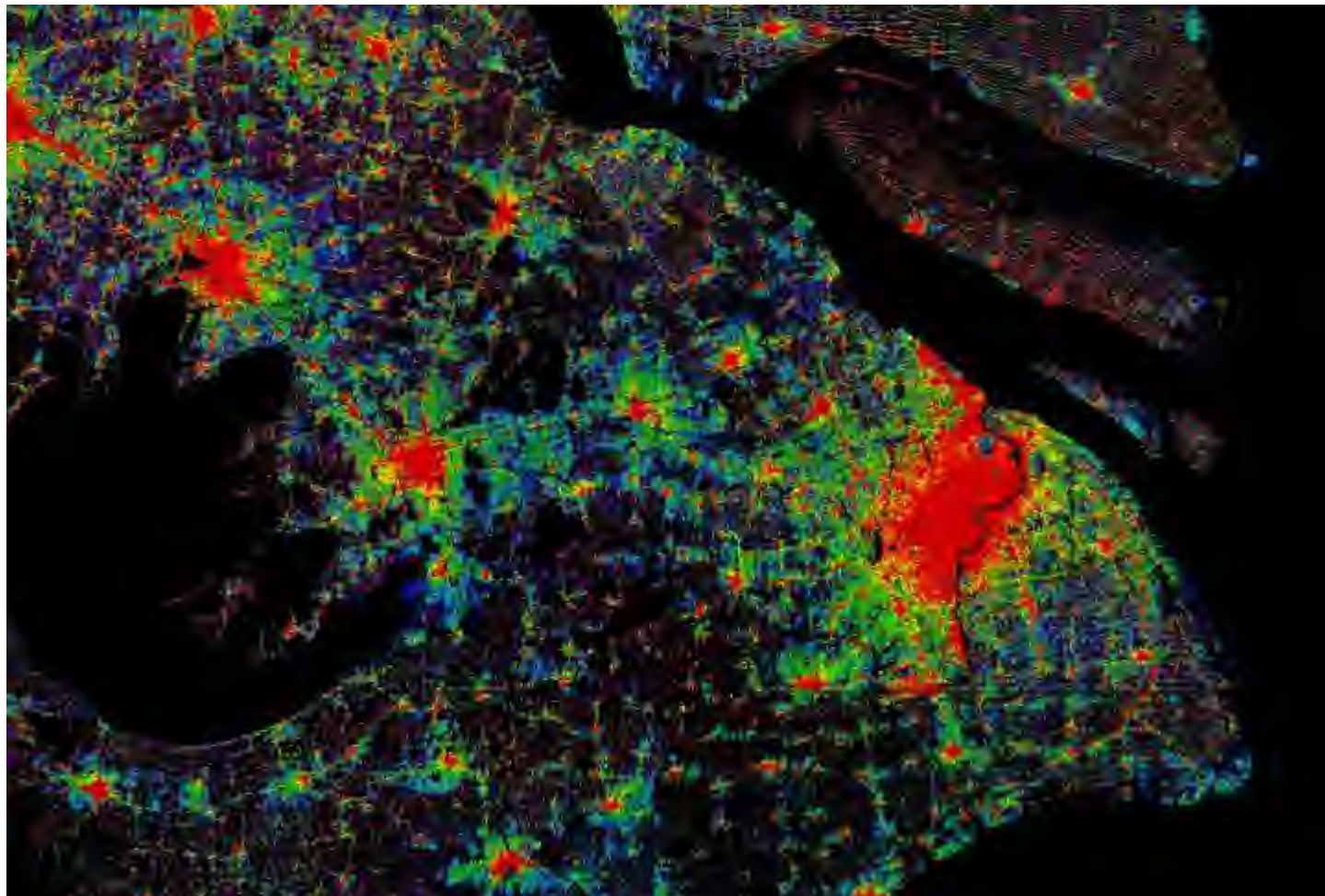
## Monitoring urban development

Shanghai  
**2015**





## Monitoring urban development





**U-TEP, a collaborative on-line infrastructure for urban applications and analytics**



# Towards efficient data exploitation

Wouldn't it be nice, if ...

... all **data** and **tools**  
needed to provide **actionable**  
**information** ...

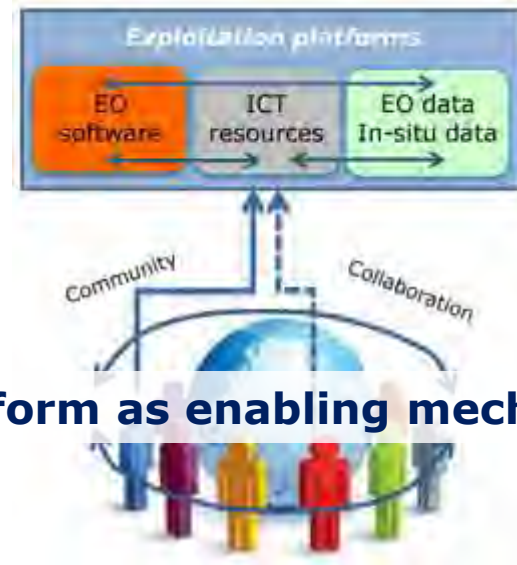
... were available in **one place**?

→ TEP URBAN

Urban TEP represents a web-based platform that allows users to effectively utilize EO imagery.  
[Read more]

## ***"Bringing the people to the data"***

- Simplify the extraction of information from EO data
  - Enable large scale exploitation of EO data
  - Stimulate innovation with EO data
  - Foster collaborative action



**Platform as enabling mechanism**

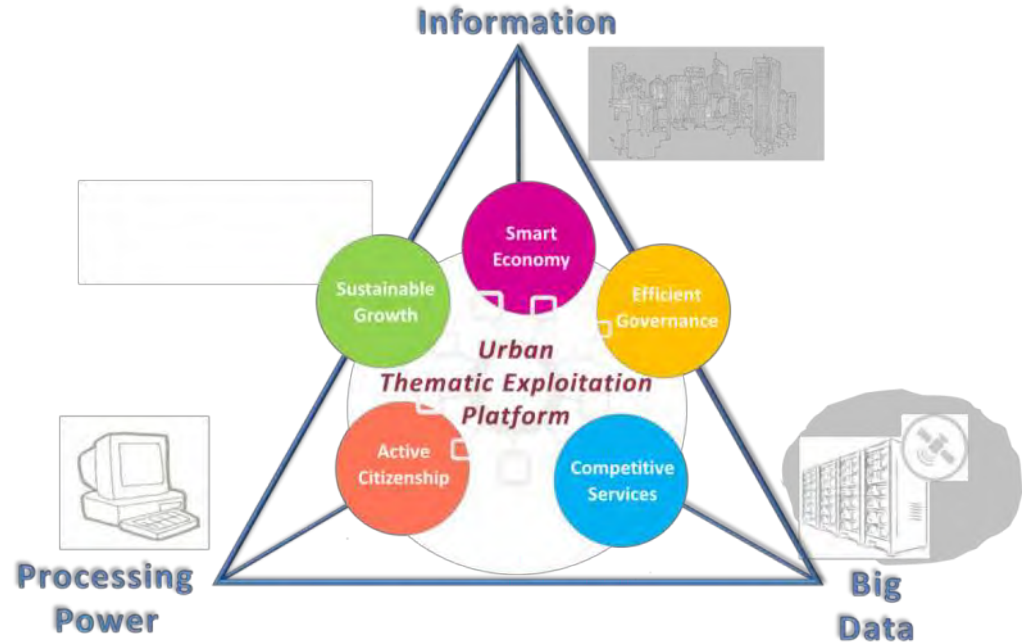


# Towards efficient data exploitation

A platform providing **end-to-end solutions** for a **broad spectrum of users** to extract information & indicators for urban management and sustainability.

→ TEP URBAN

Urban TEP represents a web-based platform that allows users to effectively utilize EO imagery.  
[Read more]





# Towards efficient data exploitation



## *Early Adopters*



WORLD BANK GROUP



OECD



BILL & MELINDA GATES foundation



unicef





# Towards efficient data exploitation

WEBBROWSER



The screenshot shows the Urban TEP website interface. At the top, there is a navigation bar with the 'urban tep' logo on the left and seven menu items with icons: 'Background' (lightbulb), 'Use Scenarios' (bar chart), 'Data & Services' (target), 'Quick Start' (hand pointing to a document), 'Activities' (notepad and pencil), and 'Partners' (three people). Below the navigation bar is a large banner featuring a grayscale map of Europe. Overlaid on the map is the text 'Global Urban Footprint (GUF) layer now available' in bold, followed by a subtitle: 'Discover DLR's new Global Urban Footprint (GUF) data at the Urban TEP platform and inspect the urban and rural human settlements pattern in a so far unique precision and consistency'. A button labeled 'Browse GUF' is positioned at the bottom left of the banner. To the right of the map, a gray box contains the URL 'urban-tep.eo.esa.int'. Below the banner, there are three large icons with corresponding text: a magnifying glass over a globe icon for 'Explore or task thematic applications', a group of three people icon for 'Connect with users and communities', and three interlocking gears icon for 'Develop and offer content'.

urban  
tep

Background Use Scenarios Data & Services Quick Start Activities Partners

[urban-tep.eo.esa.int](http://urban-tep.eo.esa.int)

**Global Urban Footprint (GUF) layer now available**  
Discover DLR's new Global Urban Footprint (GUF) data at the Urban TEP platform and inspect the urban and rural human settlements pattern in a so far unique precision and consistency

Browse GUF

Explore or task thematic applications

Connect with users and communities

Develop and offer content



# Towards efficient data exploitation



urban  
tep

Resilient  
Cities 2018

WEBBROWSER

The screenshot shows the Urban TEP web browser interface. At the top, there is a navigation bar with the Urban TEP logo and several menu items: Background, Use Scenarios, Data & Services, Quick Start, Activities, and Partners. Below the navigation bar is a large banner area. On the right side of the banner, the URL [urban-tep.eo.esa.int](http://urban-tep.eo.esa.int) is displayed. The main text of the banner reads: "Global Urban Footprint (GUF) layer now available". Below this text, it says: "Discover DLR's new Global Urban Footprint (GUF) data at the Urban TEP platform and inspect the urban and rural human settlements pattern in a so far unique precision and consistency". At the bottom of the banner, there is a "Browse GUF" button. Below the banner, there are four icons representing different features: Geobrowser, Analytics, Developer environment, and User Community forum.

urban  
tep

Background Use Scenarios Data & Services Quick Start Activities Partners

[urban-tep.eo.esa.int](http://urban-tep.eo.esa.int)

**Global Urban Footprint (GUF) layer now available**  
Discover DLR's new Global Urban Footprint (GUF) data at the Urban TEP platform and inspect the urban and rural human settlements pattern in a so far unique precision and consistency

Browse GUF

Geobrowser Analytics Developer environment User Community forum

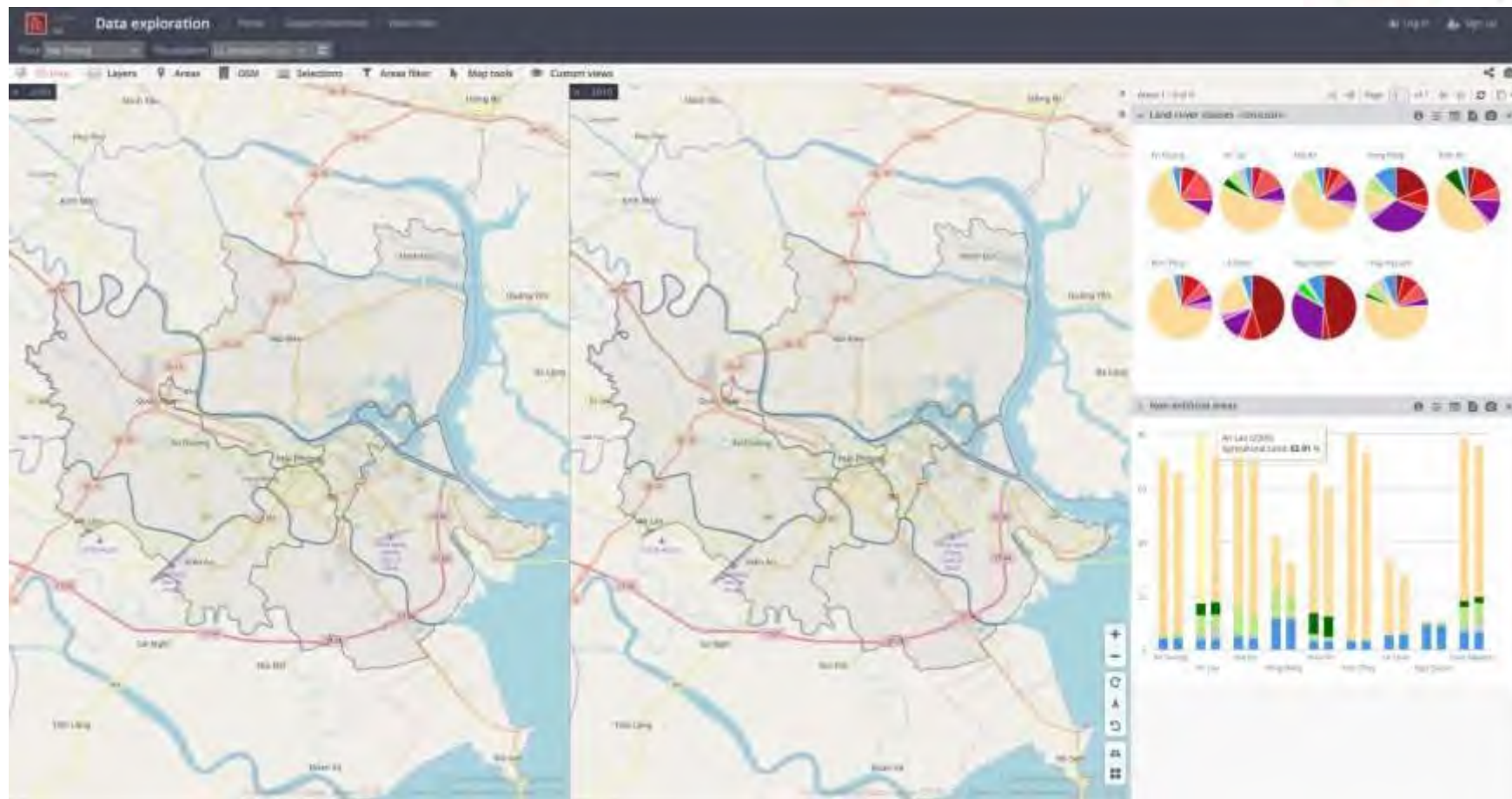


## Urban TEP: Innovative Studies



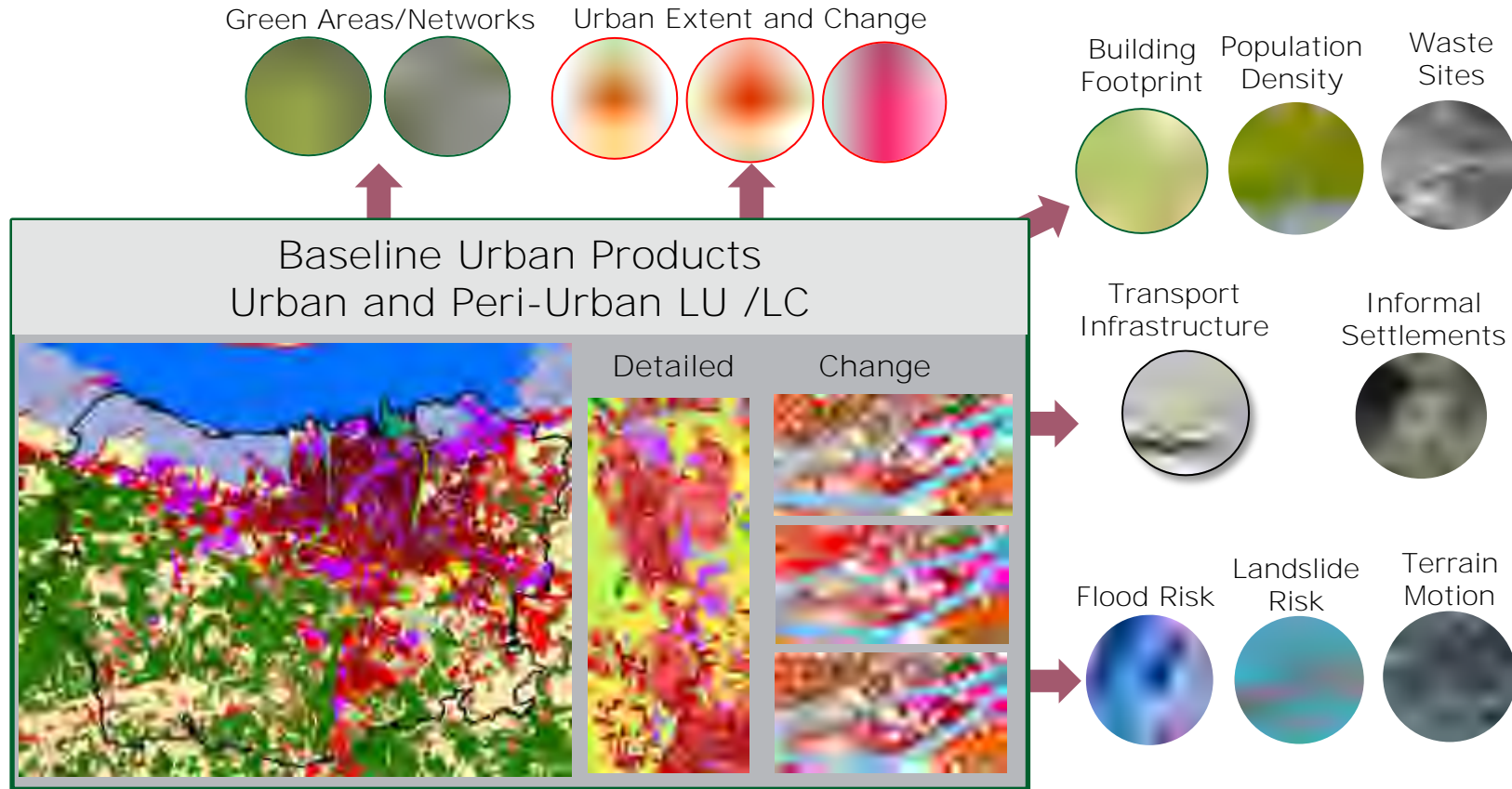


# Urban TEP – Analytics & statistics





# EO Products for Urban Development





# **Global city-scale information with the Global Human Settlement Layer**



# The Global Human Settlement Layer

## SATELLITE IMAGERY

**GHSL Global: any open and free  
decametric-scale or better platform/data**

Landsat MSS TM ETM - 15, 30, 80 m  
Sentinel 1 2 - 10, 20 m

**GHSL Regional/national: depending on  
bilateral data agreements**

Europe, South Africa, Syria –Spot 2.5, 1.5 m  
Brazil: CBERS 2.5, RapidEye 4m  
China: DBAR tbd



## Symbolic Machine Learning

New approach inspired to DNA sequencing and characterization



## Spatial Data Modelling

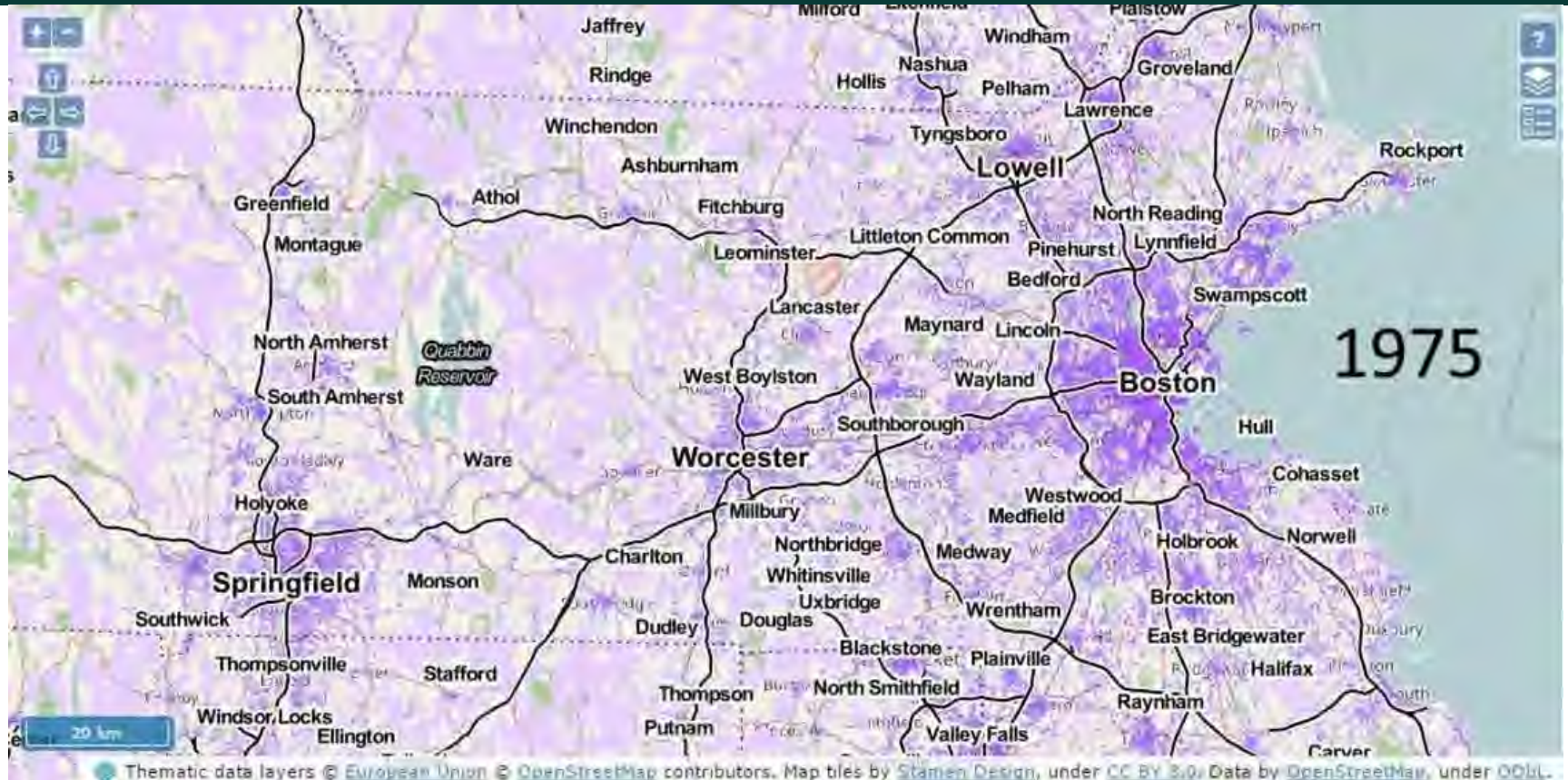
New models facilitating the science2policy



1975



# Mapping of population (1975-2015)





# Objective city-level comparison

Lagos, Nigeria: ~ 5 million inhabitants



Minneapolis, US: ~ 0.5 million inhabitants

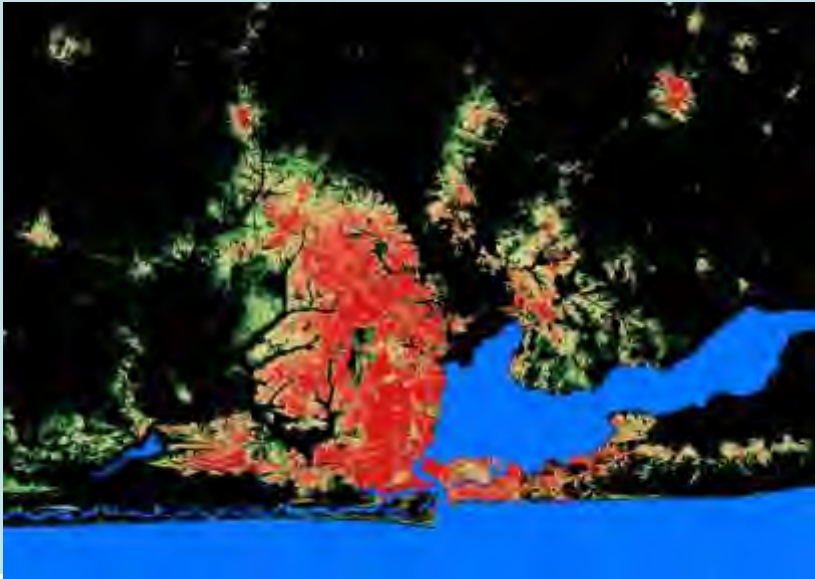


Built-Up Area 2015

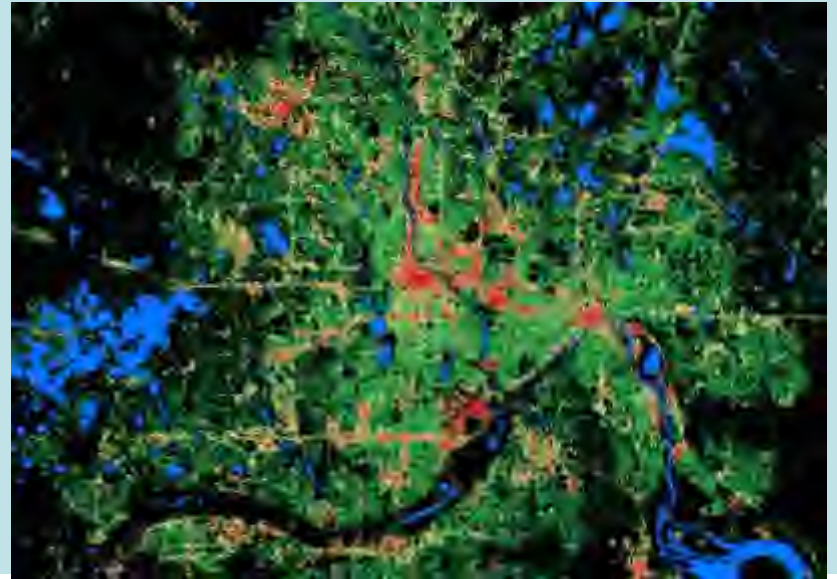


# Objective city-level comparison

Lagos, Nigeria: ~ 5 million inhabitants



Minneapolis, US: ~ 0.5 million inhabitants



Green Areas 2015



# GHSL – City Centre Database

The City Centres Database describes more the 10.000 urban centres identified by the application of the "Degree of Urbanization" model to the GHSL baseline data.



<http://ghsl.jrc.ec.europa.eu/ccdb2016Overview.php>



# Growing cities





# Shrinking cities





# Quality of life – air quality (PM<sub>2.5</sub>)





- **EO can deliver key environmental information** that supports the definition, planning, implementation, monitoring and assessment of **urban development projects** in particular in developing countries (**data poor countries**).
- **Free and open data policies** of governmental-funded satellite missions with **long term continuity** and **frequent revisiting** (like the European Copernicus program) bring **unprecedented observations for urban monitoring**.
- **Advances in Information and Computer Technology** (e.g. cloud computing, Machine Learning) allows the generation of **global urban Data sets** at affordable prices.
- **Human settlement data** combined with **socio-economic information** allows to improve global awareness on the spatial patterns and processes of today's urbanizing world.
- Availability of **on-line platforms** (such as the U-TEP) with **"all-in-one"** (data, tools & computing resources) and **"end-to-end" solutions** (transfer of raw data into ready-to-use information) facilitates the adoption of and access to EO solutions.





<b>GEO</b>	<a href="http://earthobservations.org">earthobservations.org</a>
<b>EC JRC</b>	<a href="http://ec.europa.eu/jrc/">ec.europa.eu/jrc/</a>
<b>ESA</b>	<a href="http://www.esa.int">www.esa.int</a>
<b>Copernicus</b>	<a href="http://copernicus.eu">copernicus.eu</a>
<b>Sentinels</b>	<a href="http://sentinels.copernicus.eu">sentinels.copernicus.eu</a>
<b>Urban TEP</b>	<a href="http://urban-tep.eo.esa.int">urban-tep.eo.esa.int</a>
<b>EO4SD Urban</b>	<a href="http://www.eo4sd-urban.info">www.eo4sd-urban.info</a>
<b>GHSL</b>	<a href="http://ghsl.jrc.ec.europa.eu">ghsl.jrc.ec.europa.eu</a>

**Earth Observations, a necessity for achieving sustainable development**

Marc Paganini | [marc.paganini@esa.int](mailto:marc.paganini@esa.int) | Thomas Kemper | [thomas.kemper@ec.europa.eu](mailto:thomas.kemper@ec.europa.eu)



# Backup slides





*“The integration of statistics, geospatial information, Earth observations, and other sources of Big Data, combined with new emerging technologies, analytics and processes, are becoming a fundamental requirement for countries to measure and monitor local to global sustainable development policies and programs”*

UN-GGIM co-chairs

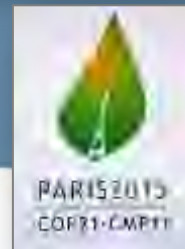
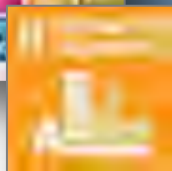




“The science and policy communities increasingly recognize that **cities** [...] and the underlying **urbanization** processes are at the center of global **climate change** and **sustainability challenges**.

Policymakers need **facts**, empirical **evidence**, and scientifically sound **theories** on how to **plan** and **manage** cities and urbanization...”

Solecki et al. (2013): It's time for an urbanization science. *Environment* 55(1), pp. 12-16





# The European Copernicus initiative

*Securing satellite data access in the long term*

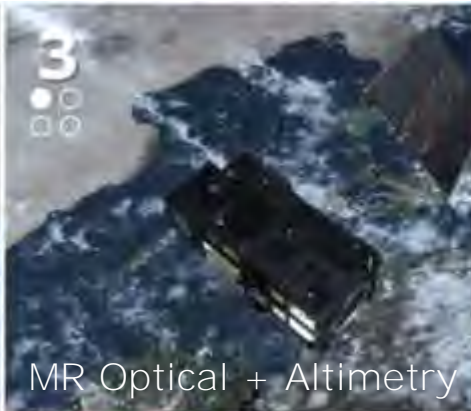


1  
●●  
○○



Radar

3  
●●  
○○



MR Optical + Altimetry

5P  
●



5  
○○  
○○



Atmos. Chemistry LEO

2  
●●  
○○



HR Optical

4  
○○



Atmos. Chemistry GEO

6  
○○



Altimetry



# GEO Human Planet Initiative

- New initiative in the **GEO 2017-2019 work programme** supporting the GEO Strategic Plan 2016-2025.
- Aims to support novel evidence-based assessment of the **human presence on the planet Earth**.
- Leverages on **advances of Earth Observation technologies** and geo-spatial data analytics for improving the global awareness on the **spatial patterns** and **processes** of the today's urbanizing world.



# Human Planet Initiative Core Group





# Human Planet Working Groups

Human Planet Expert Group	Institution	Contact person
Global harmonized definition of cities and settlements	European Commission, DG for Regional and Urban Policy	L. Dijkstra
Global Settlements in Disaster Risk Reduction	UNOOSA, UN-SPIDER Program	J. Post
Global Urban Climate and Mitigation Planning	University of Dublin, World Urban Database and Access Portal Tool (WUDAPT)	G. Mills
Global updated and historical baseline data on built-up areas	European Commission, Joint Research Centre	T. Kemper
Global high resolution age-structured population maps 2000 - 2020	Univ. of Southampton, WorldPop Project, Flowminder Foundation	A.J. Tatem
Global Settlements, Infrastructure, and Population Data Intercomparison	Columbia University, Center for International Earth Science Information Network (CIESIN)	R. Chen
Global future population grids including demography and migration	City University New York, Demographic Research	D. Balk
Global urban metabolism	University of Denver, Geography & Environment	P. Sutton
Urbanization dynamics in China and the "one belt one road" region	Chinese Academy of Sciences, Institute of Remote Sensing and Digital Earth	L.L. LU
Capacity building and trainee-ships	University of Twente, Faculty of Geo-Information Science and Earth Observation	R. Sliuzas
Poverty Mapping	George Washington University, Center for Urban and Environmental Research	R. Engstrom



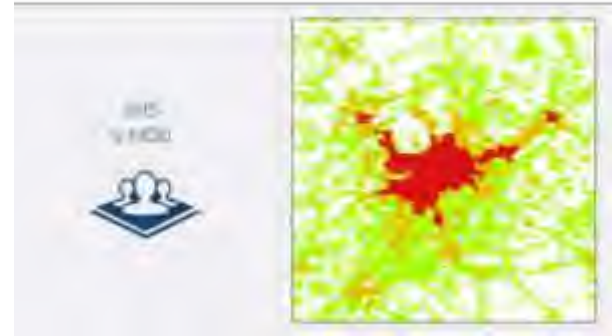
# Human Planet Working Steering Committee

Contact person	Institution
ALAN BELWARD	European Commission, JRC
ANDREW J TATEM	University of Southampton
ANGEL SHLOMO	New York University
ARBAB KHAN	UN Food and Agriculture Organization
BENJAMIN BECHTEL	University of Hamburg
ROBERT CHEN	Columbia University
CHAO REN	Chinese University of Hong Kong
DAVINA JACKSON	Goldsmiths University of London
DEBORAH BALK	City University of New York, Institute for Demographic Research
ELEN HAMILTON	The World Bank (WB)
EUGENIE L. BIRCH	University of Pennsylvania
GERALD MILLS	University College Dublin
GORA MBOUR	Global Observatory Linking Research to Action (GORA)
JOACHIM POST	UN Office for Outer Space Affairs
LEWIS DIJKSTRA	European Commission, DG REGIO
LINLIN LU	Chinese Academy of Sciences
MARK R. MONTGOMERY	Population Council
PAUL C. SUTTON	University of Denver
RICHARD SLIUZAS	University of Twente
SARA HERTOIG	UN Population Division, Department of Economic and Social Affairs
SHAROLYN ANDERSON	University of South Australia
STEFAN LEYK	Colorado University
STEFFEN FRITZ	International Institute for Applied System Analysis (IIASA)
THOMAS KEMPER	European Commission, JRC
TIMOTHY F TRAINOR	US Census Bureau, UN GGIM
VINCENT SEAMAN	Bill & Melinda Gates Foundation
MARC LEVY	Columbia University, Center for International Earth Science Information Network (CIESIN)
THOMAS ESCH	German Aerospace Center (DLR)
ROBERT MDUGWA	United Nations Human Settlements Programme (UN-Habitat)



# Global Definition of Cities and Settlements

- Voluntary Commitment of the European Union, OECD, World Bank and FAO
- Evidence based policy support





# Geospatial Data for SDG 11 – Indicator 11.2.1

## Target 11.2: Transport

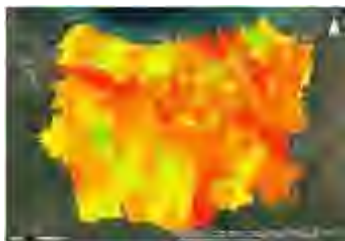
**11.2.1:** Proportion of the population that has convenient access to public transport by sex, age and persons with disabilities

% with access to Public transport  
$$= 100 \times \frac{\text{population with convenient access to Public transport}}{\text{City Population}}$$

*Semarang, Indonesia*

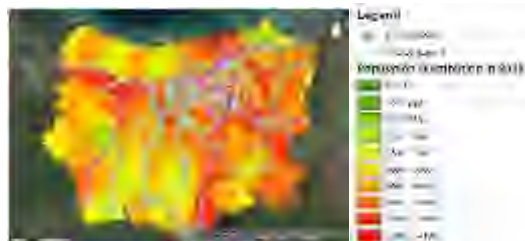
### Input Data:

EO4SD-Urban Population Product  
Census Data per Ward Level for 2013

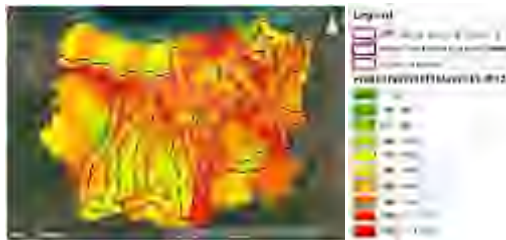


### Other Spatial Data:

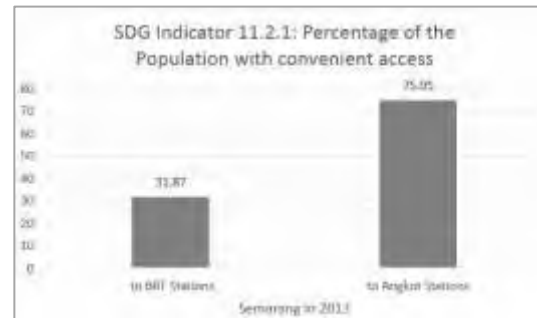
Public Transport Stations (BRT, Angkot)



### Buffer Analysis:



### Results:



Population Distribution Mapping based on controlled disaggregation of national census data



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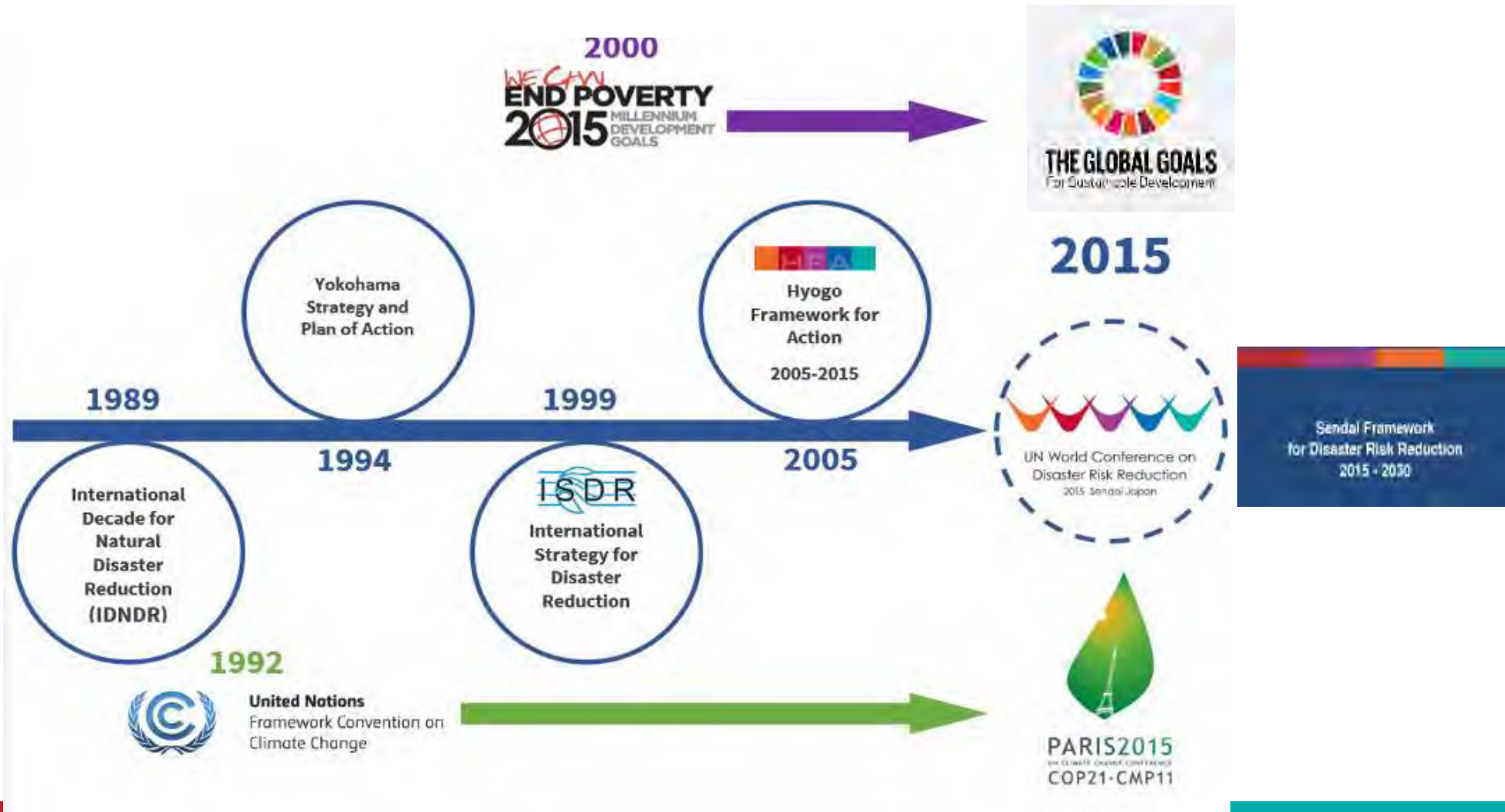
# The Sendai Framework for Disaster Risk Reduction 2015-2030



David Stevens  
Head of Bonn Office  
United Nations Office for Disaster Risk Reduction



# The Long and Winding Road to DRR





## 7 GLOBAL TARGETS

# Reduce

**Mortality/  
global population**

2020-2030 Average << 2005-2015 Average

**Affected people/  
global population**

2020-2030 Average << 2005-2015 Average

**Economic loss/  
global GDP**

2030 Ratio << 2015 Ratio

**Damage to critical infrastructure  
& disruption of basic services**

2030 Values << 2015 Values

# Increase

**Countries with national  
& local DRR strategies**

**2020** Value >> 2015 Value

**International  
cooperation**

**to developing countries**

2030 Value >> 2015 Value

**Availability and access  
to multi-hazard early warning  
systems & disaster risk  
information and assessments**

2030 Values >> 2015 Values



# Target C

**Global target C: Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.**

C-1 (compound)	<u>Direct</u> economic loss attributed to disasters in relation to global gross domestic product.
C-2	<p>Direct agricultural loss attributed to disasters.</p> <p><i>Agriculture is understood to include the crops, livestock, fisheries, apiculture, aquaculture and forest sectors as well as associated facilities and infrastructure.</i></p>
C-3	<p>Direct economic loss to all other damaged or destroyed productive assets attributed to disasters.</p> <p><i>Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those <u>economic</u> sectors relevant to their economies. This would be described in the associated metadata.</i></p>
C-4	<p>Direct economic loss in the housing sector attributed to disasters.</p> <p><i>Data would be disaggregated according to damaged and destroyed dwellings.</i></p>
C-5	<p>Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters.</p> <p><i>The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant.</i></p>
C-6	Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.



UNISDR

PreventionWeb

English



**SENDAI FRAMEWORK**  
FOR DISASTER RISK REDUCTION

LOGIN

## MEASURING IMPLEMENTATION OF THE SENDAI FRAMEWORK

ANNOUNCEMENT

### The Sendai Framework Monitor system is now live!

After the adoption of Sendai Framework in 2015, 38 indicators were defined to measure progress in achieving its 7 Global targets. This system is the official tool to report these indicators to both the Sendai Framework and SDG's reporting processes.




United Nations DesInventar | X

Secure | https://www.desinventar.net

Apps M UNISDRWEBMAIL M Entrada - dstevens@ M Inbox - tazarkount@ M Entrada - contato@ EIRD.ORG - Agenda Facebook 19 Google Calendar

**UNISDR** DesInventar Sendai


 **SENDAI FRAMEWORK**  
FOR DISASTER RISK REDUCTION

HOME ABOUT ANALYSIS ADMINISTRATION DOWNLOAD CONTACT


[What is DesInventar?](#)  
[What is DesInventar Sendai?](#)  
[Basic methodology](#)  
[Disaster Hazards classification](#)  
[Definition of effects](#)  
[About loss data sources](#)  
[How to migrate to Sendai mode](#)  
[Recent publications](#)

**Welcome to DesInventar Sendai !!!**

Disaster loss data for Sustainable Development Goals and Sendai Framework Monitoring System



**Download DesInventar Sendai software**




The DesInventar Sendai server software is open-source and is free of charge for commercial and non-commercial use. It is distributed under an "Apache-2" license, which is even less restrictive than GNU and FreeBSD licenses.

Please use it well, this software has been built and is distributed this way thinking that it can help a bit making this planet a better place.

**Available datasets worldwide**

**Detailed disaster loss data for more than 89**



Explore Sendai Framework main documents

**Download DesInventar Sendai and other materials**



Target

A

Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population

B

Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)

C

Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions of basic services, attributed to disasters

D

E

Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030

F

Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.

G

Goal 1.  
Target 1.5



Goal 11.  
Target 11.5



Goal 11.  
Target 11.b



Goal 13.  
Target 13.1





# Reporting Submitted for 2017 Data

31 MAR 2018 - SDG Monitoring Unit, UNDESA

Region	No. of countries	Percentage
Africa	13	24%
Arab States	4	7%
Asia-Pacific	9	17%
Americas	8	15%
Europe and Central Asia	20	37%
Total	54	100%

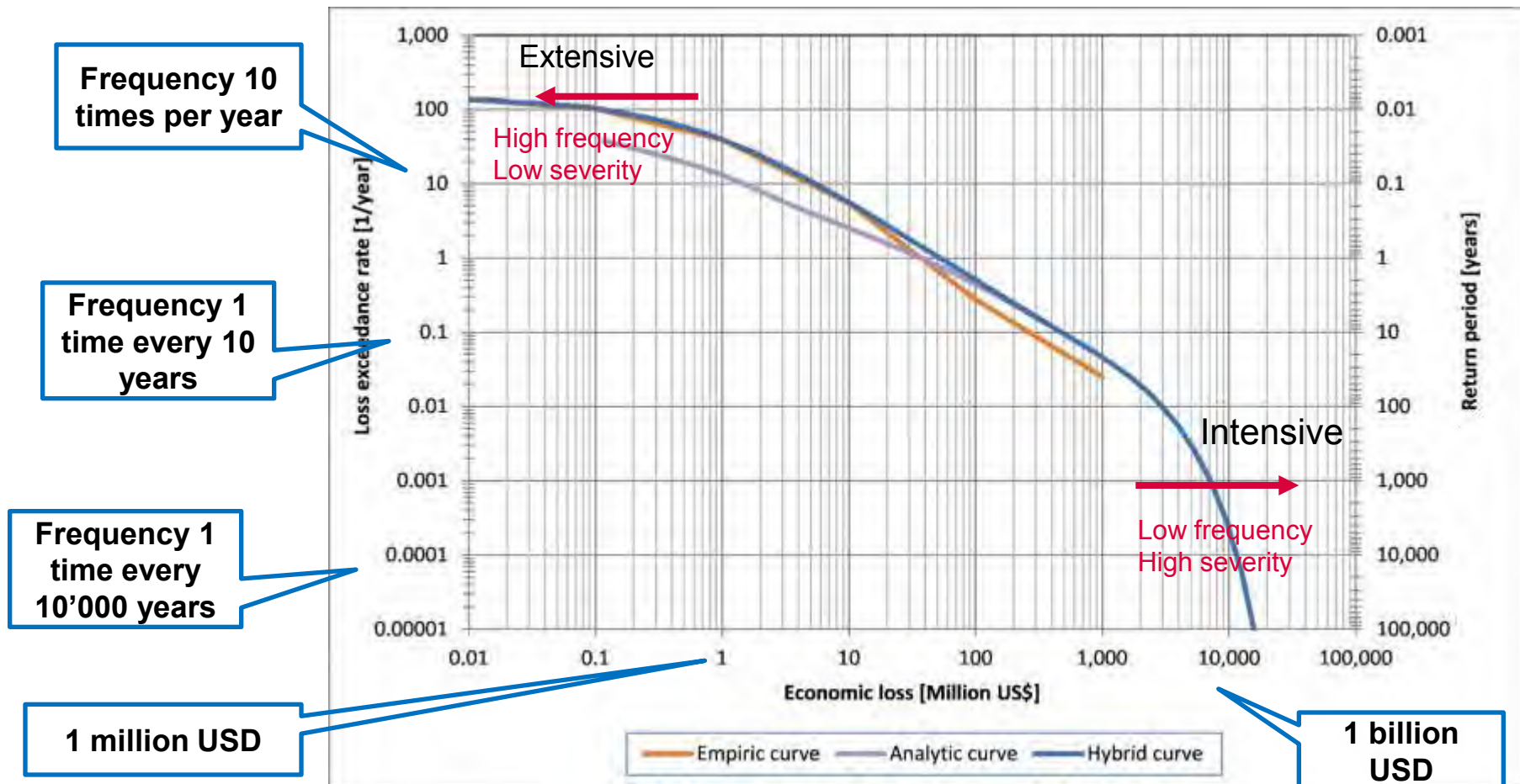


# Using data to define policy, inform investments and make decisions





# Revealing risk: integrating analytical and historical views





# Risk Strategies

## 1 Risk reduction

Corrective: Building retrofitting, mitigation strategies.

## 2 Risk retention

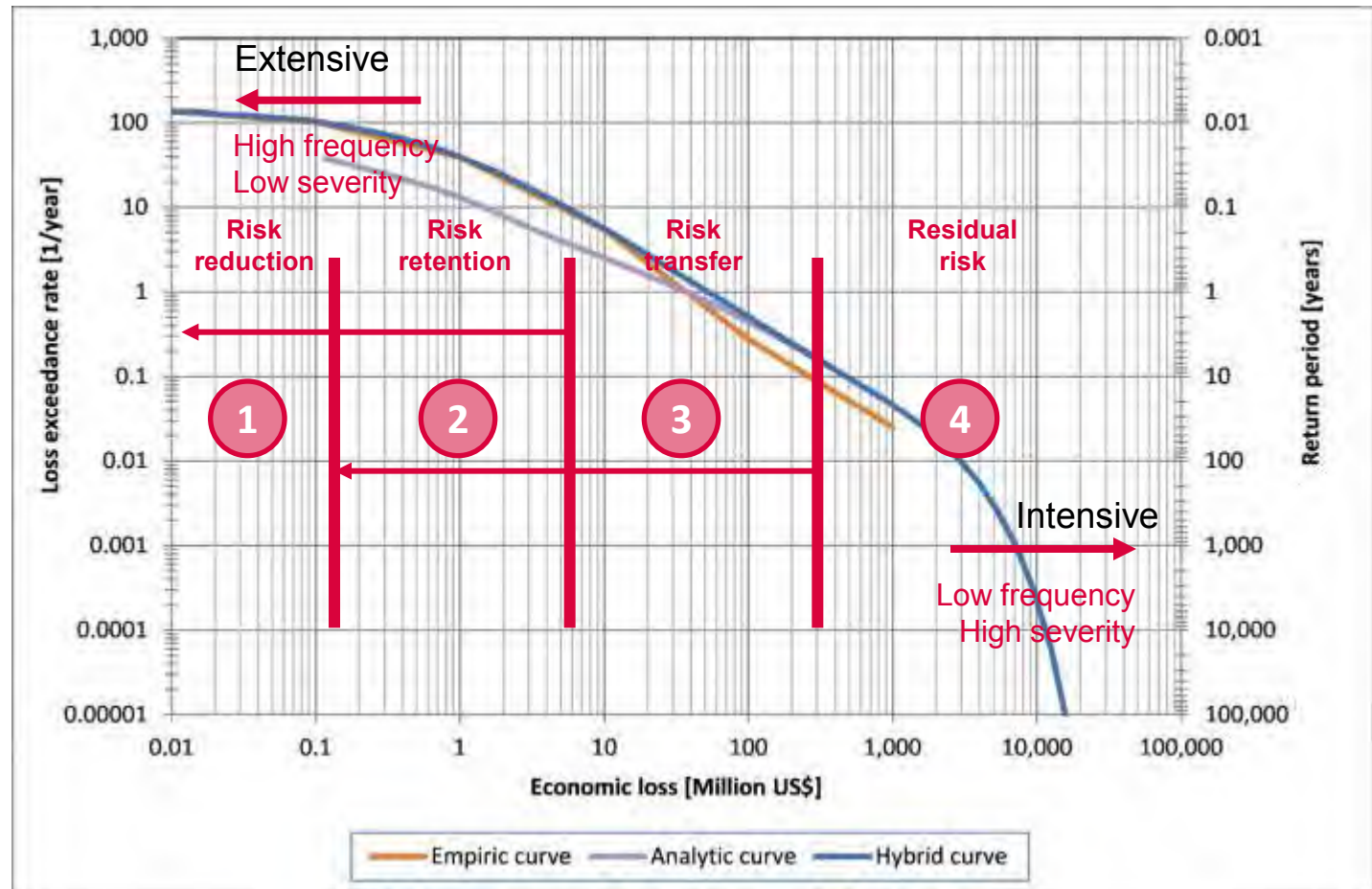
Prospective: Financial reserves, public investment, laws and regulations.

## 3 Risk transfer

Compensatory: Insurance, contingency funds.

## 4 Residual risk

The risk we will have “to live with...”





# THANK YOU

In support of the Sendai Framework  
for Disaster Risk Reduction 2015 – 2030



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# Earth observations (EO) for climate-resilient cities: Case Studies



**Philip Briscoe**, Chief Operating Officer, Rezatec  
26<sup>th</sup> April 2018



# Sustainable Development Goals

Resilient  
Cities 2018



TRANSFORMING OUR  
WORLD:  
THE 2030 AGENDA FOR  
SUSTAINABLE  
DEVELOPMENT

**1** NO  
POVERTY



**2** ZERO  
HUNGER



**3** GOOD HEALTH  
AND WELL-BEING



**4** QUALITY  
EDUCATION



**5** GENDER  
EQUALITY



**6** CLEAN WATER  
AND SANITATION



**7** AFFORDABLE AND  
CLEAN ENERGY



**8** DECENT WORK AND  
ECONOMIC GROWTH



**9** INDUSTRY, INNOVATION  
AND INFRASTRUCTURE



**10** REDUCED  
INEQUALITIES



**11** SUSTAINABLE CITIES  
AND COMMUNITIES



**12** RESPONSIBLE  
CONSUMPTION  
AND PRODUCTION



**13** CLIMATE  
ACTION



**14** LIFE  
BELOW WATER



**15** LIFE  
ON LAND



**16** PEACE, JUSTICE  
AND STRONG  
INSTITUTIONS



**17** PARTNERSHIPS  
FOR THE GOALS





# City Resilience: EO in practice



SDG 6: Water Quality  
Risk Monitoring

SDG 9: Infrastructure Risk  
Monitoring

SDG 7: Green Energy  
Site Identification

SDG 3: Green Space  
Monitoring



# City Resilience: EO in practice



Re-naturalisation Index  
*Flood mitigation decision  
support tool*

wood.



# Flood mitigation decision support tool

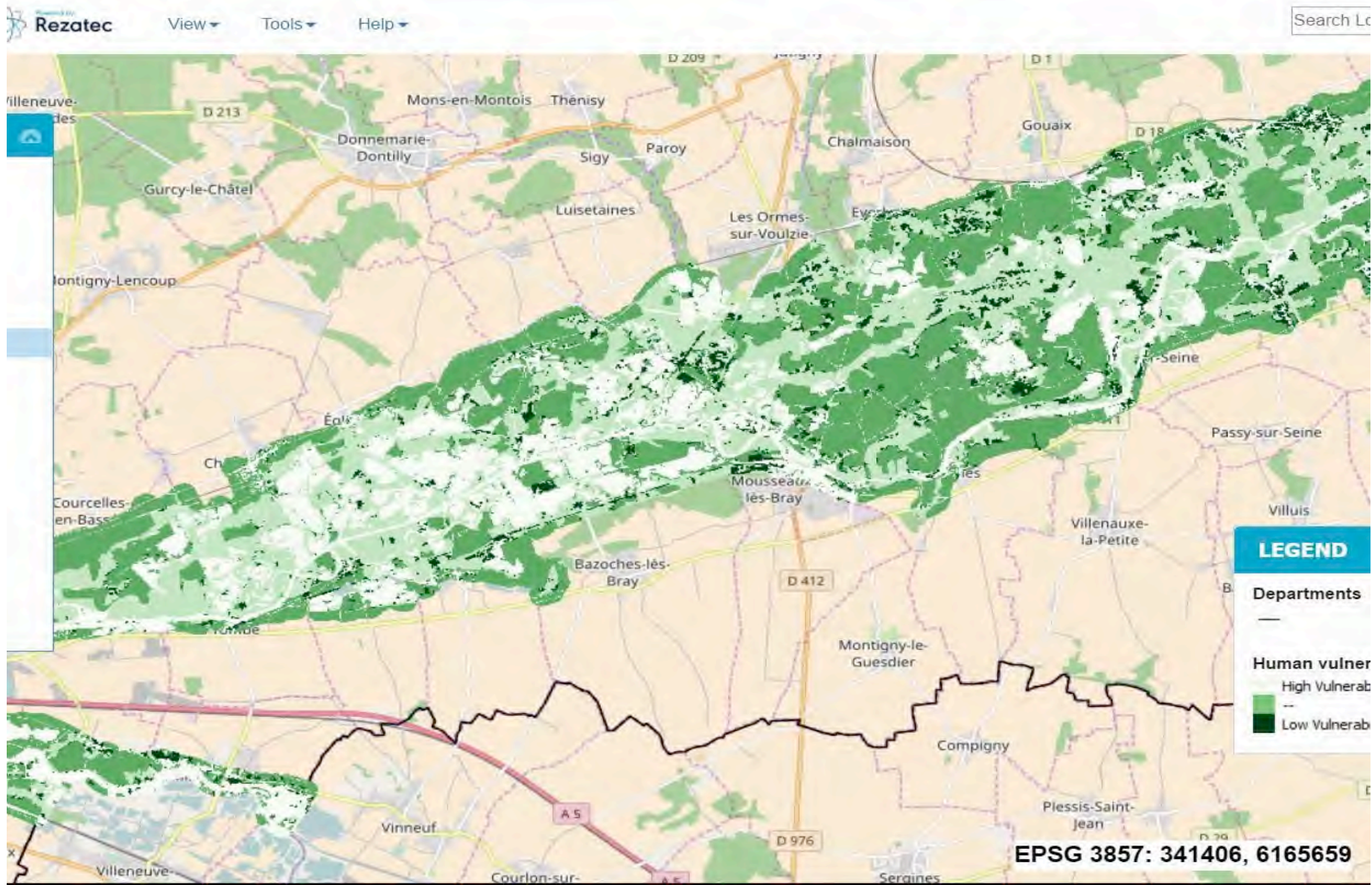
Primary Objective: to establish a method allowing first to identify green spaces with the capacity to mitigate flood events and then prioritise them according to their potential to receive and curb floods.

The index is composed of the following criteria:

1. Human Vulnerability
2. Soil Permeability
3. Slope
4. Flood Storage Potential



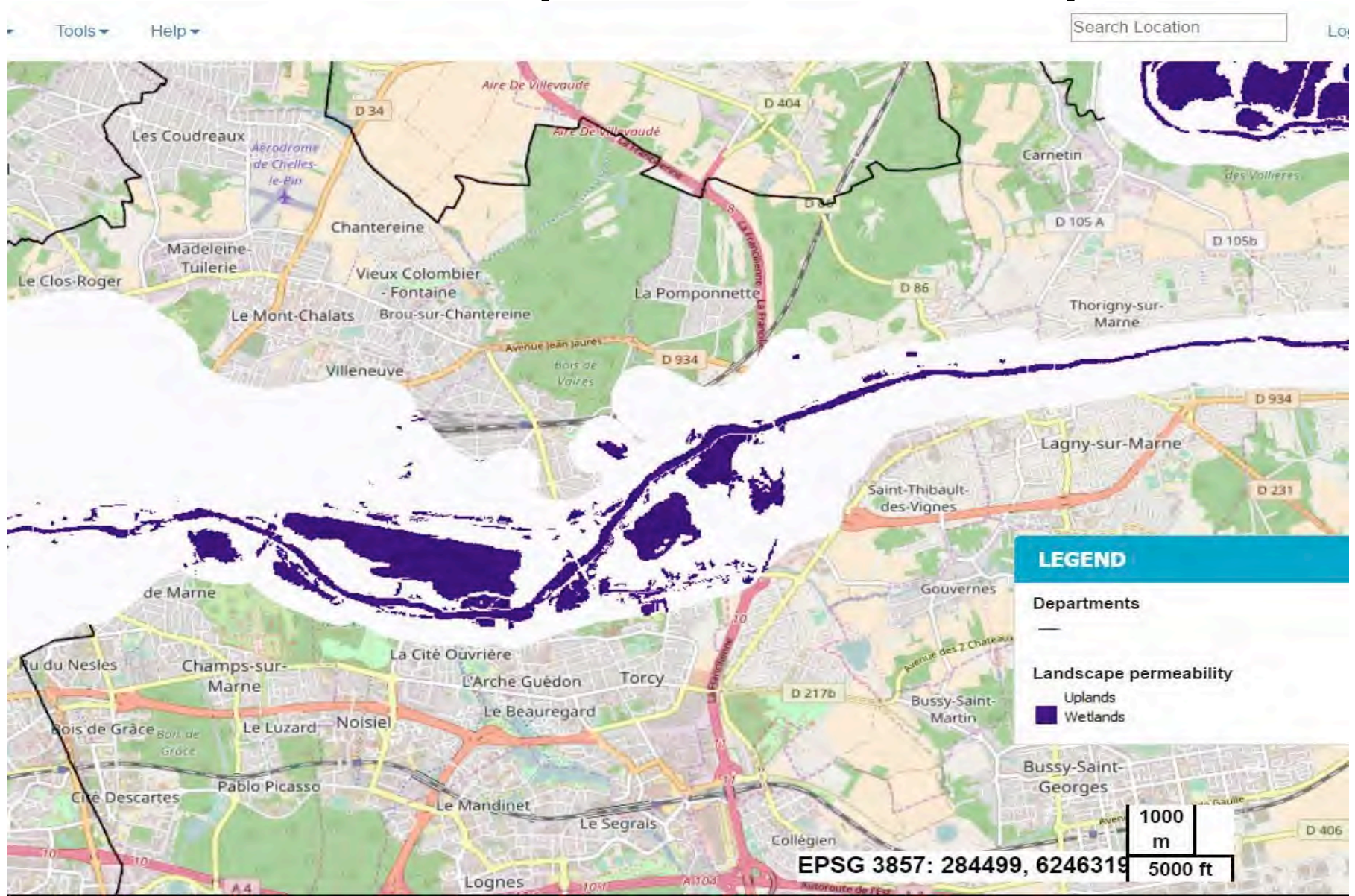
# Human vulnerability





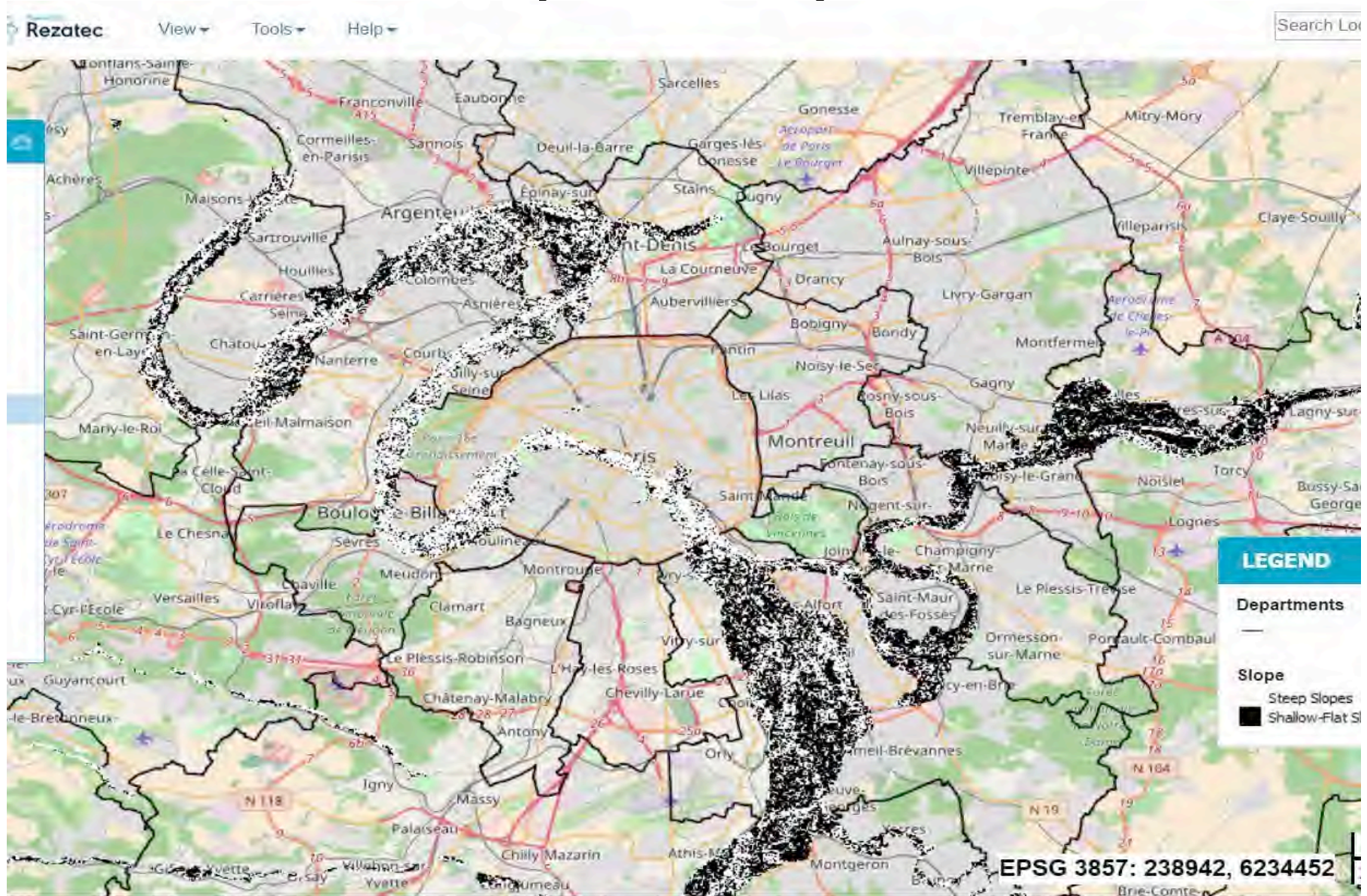
# Landscape Permeability

Resilient  
Cities 2018



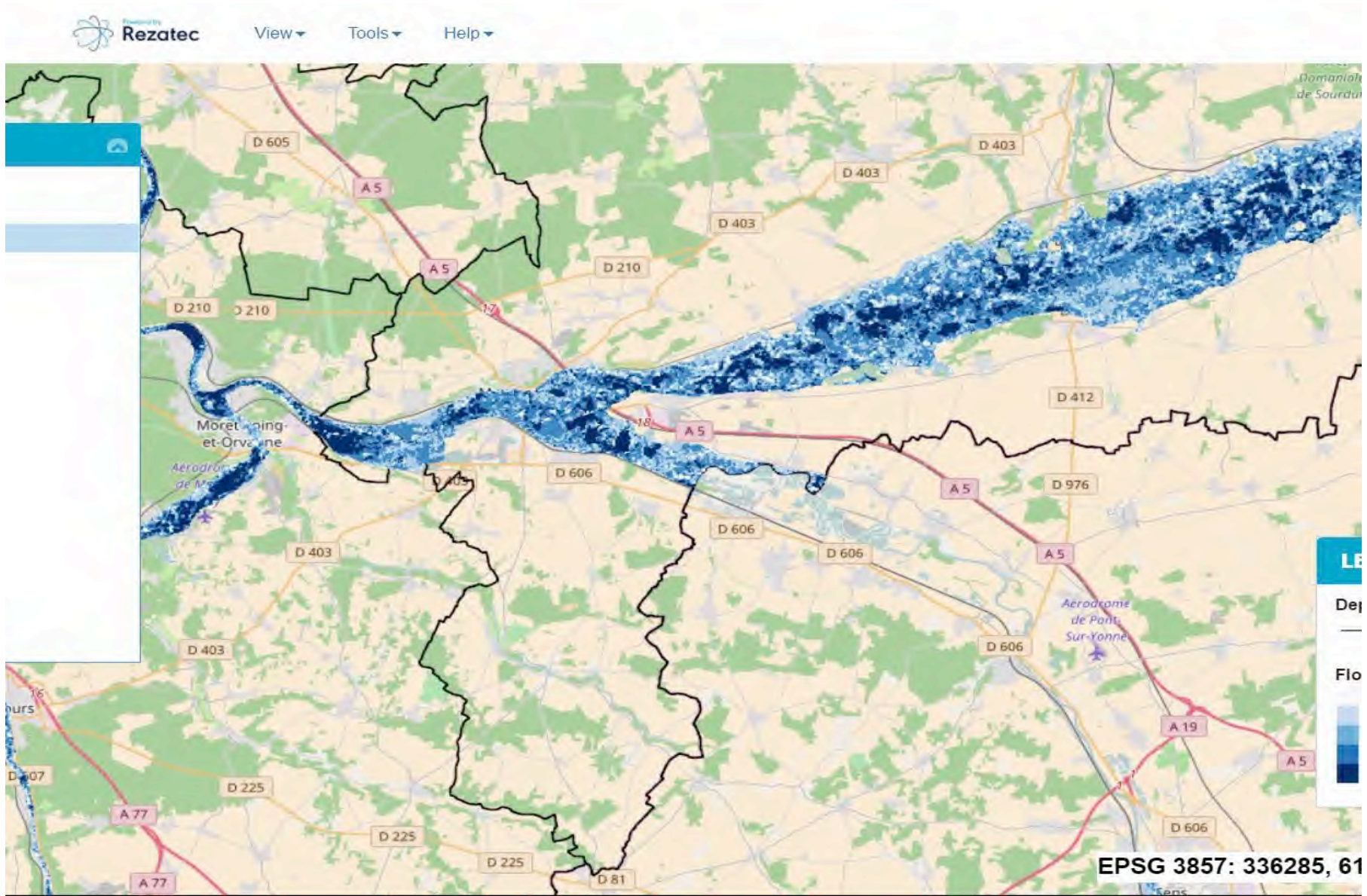


# Slope Analysis



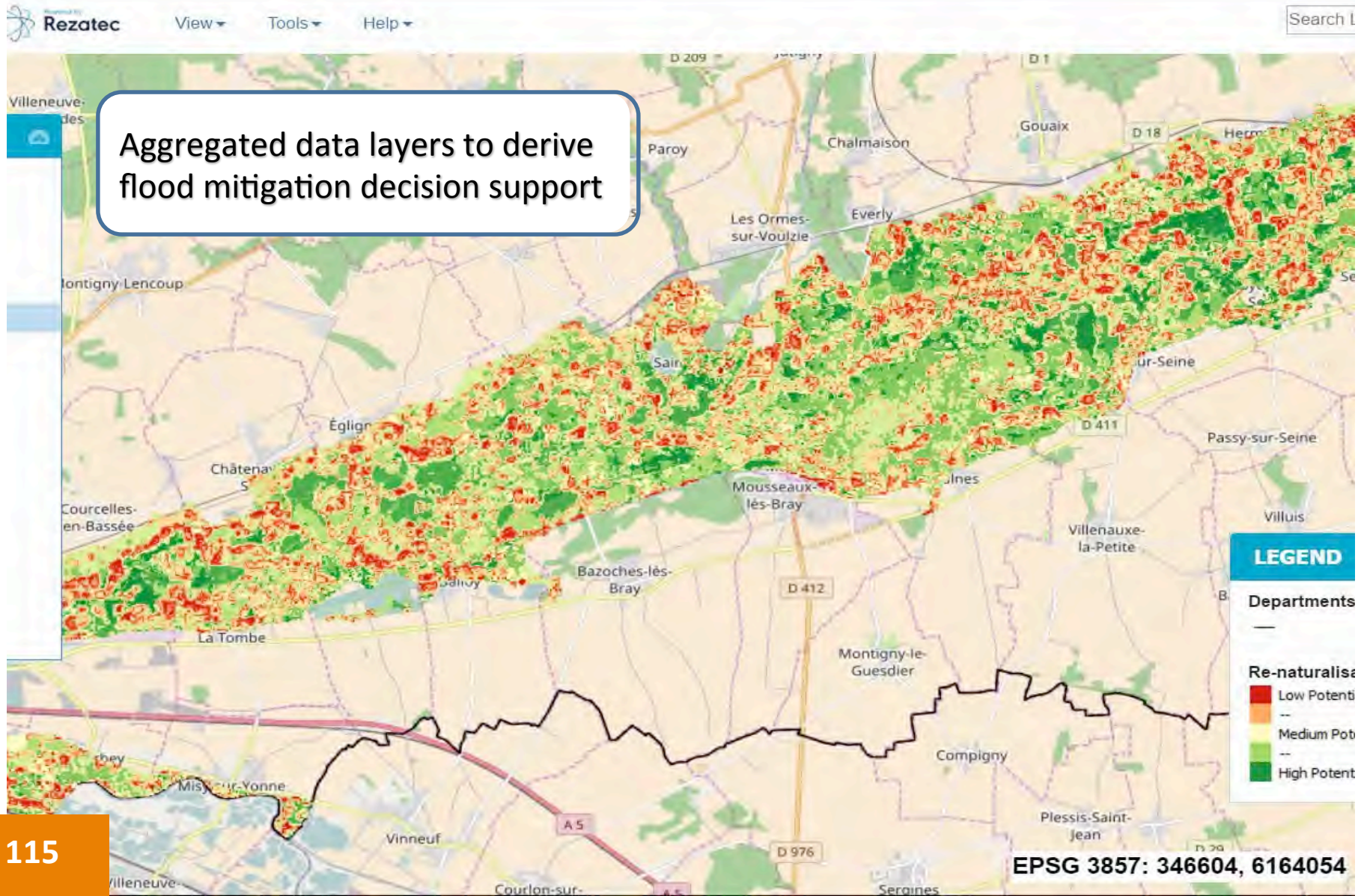


# Flood Storage Potential





# Re-Naturalization Index





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# resilience.io and 'URGED'

## project

URGED - Urban Resilience GEO Dataportal

*Stephen Passmore* FRSA  
*EO for climate-resilient cities*  
*ICLEI Resilient Cities - Bonn*  
*April 26<sup>th</sup> 2018*

Working to enable 5 billion  
people to live safe, healthy  
and fulfilling lives by 2030

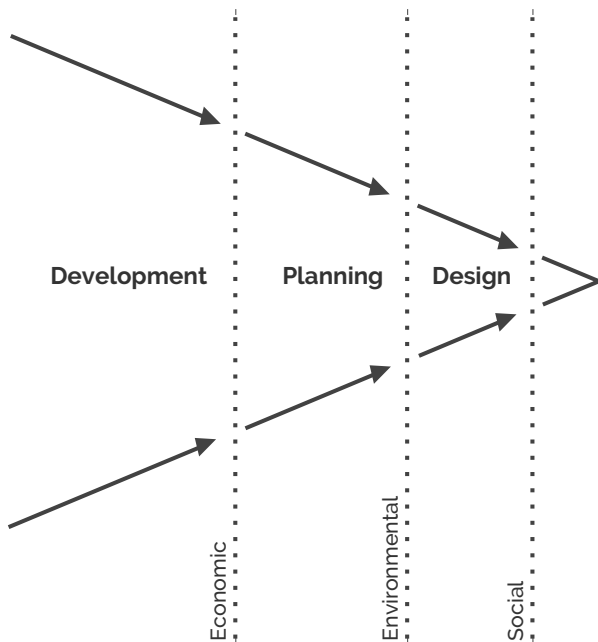


- UK charity 2011 to speed up and scale up transformative urban/rural development;
- Operate in space between private, public, knowledge and civil society sectors;
- Leading experts foster integrated **systems thinking, collaborative** approaches, open source tools;
- Develop tools and demonstrators to support implementation of 2030 agenda in 200 city regions in 5 years;
- Resilience Brokers Programme



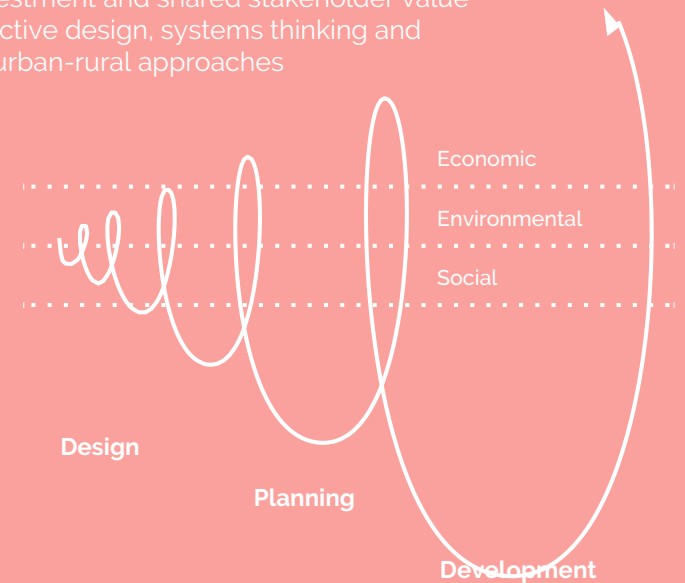


# Current approach



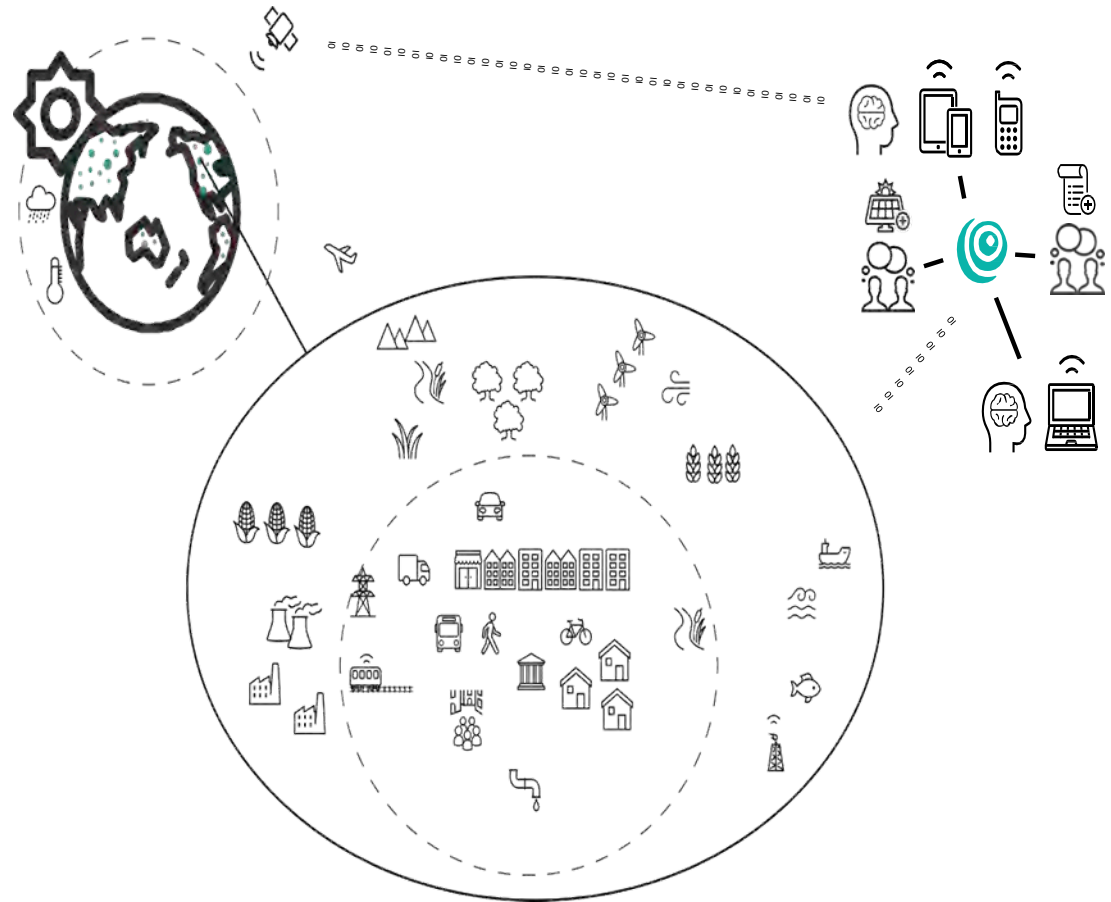
# *Shared data, integrated*

Increasing investment and shared stakeholder value through interactive design, systems thinking and collaborative urban-rural approaches





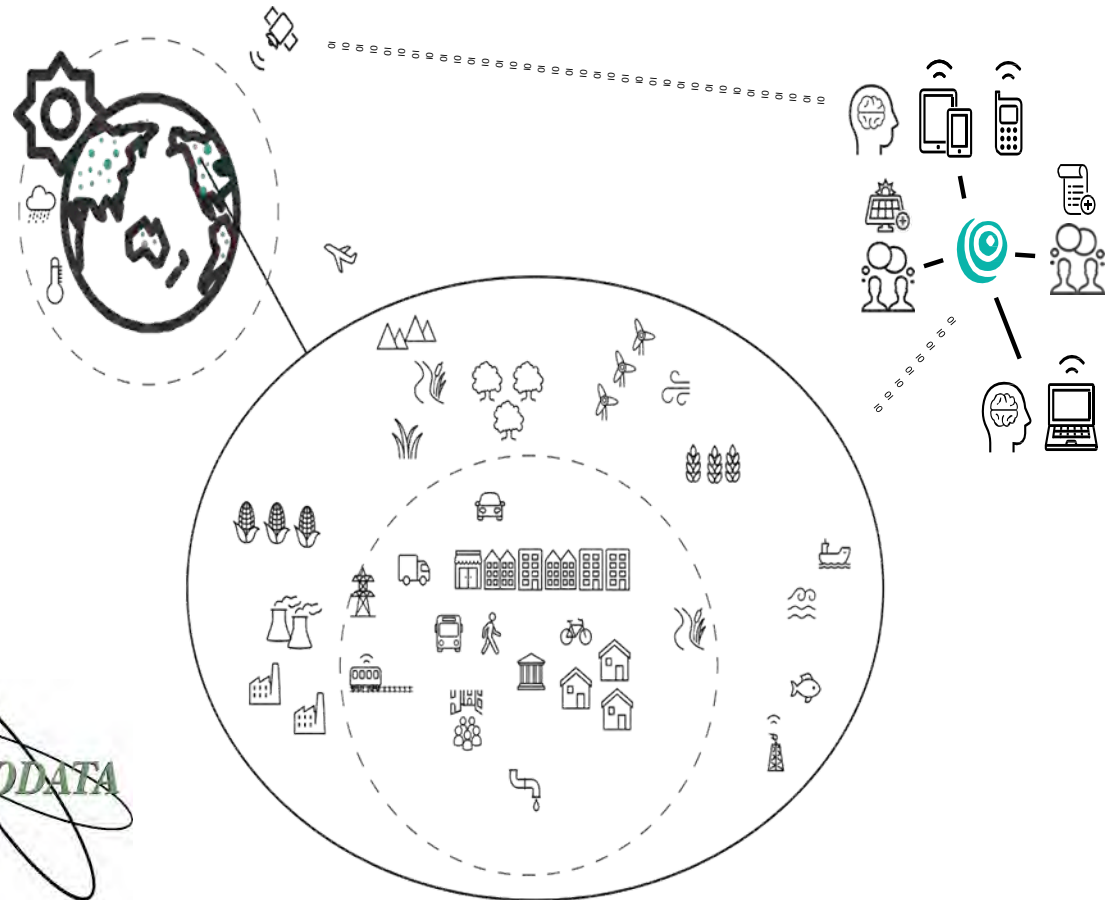
*An integrated Earth-human  
systems modelling  
platform for city-regions  
City + Planet + People*





*Visualisation, User Interface*

- Data Brokerage
- Geo-locate flows, infrastructure - MI
- ICSU CODATA





## Decisions - Investment in infrastructure

- Energy, Water, Transport, Housing, ...
- Local, foreign, government, private, ...

## Decisions - Market Policies and planning

- Taxation, tariffs, quota, subsidies, ...
- Land use plans, regulations, ...

## Indicator outcome range (5-20 years)

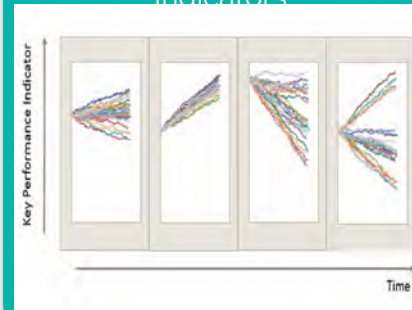
- Sector resource and energy flows
- Effects on imports & exports
- Wastes & Emissions (CO<sub>2</sub>, CH<sub>4</sub>,...)
- Employment, income, in(equality)
- Human well-being indicators
- Sector economic activity / GDP
- Access to service / %



- Technology options
- Proposed locations
- Market rules and regulation



### Key performance Indicators

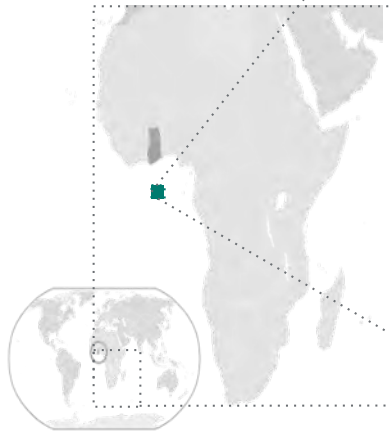


Policy & Investment Decisions



## Use Case: Greater Accra, Ghana

- Meeting Accra Global Goal 6 targets.
- Integrated-systems modelling allowing smart collaborative decision making for investment.





## 'URGED' - Urban Resilience GEO Dataportal

supported by ESA's Artes 20 IAP programme (Integrated Applications Promotion)

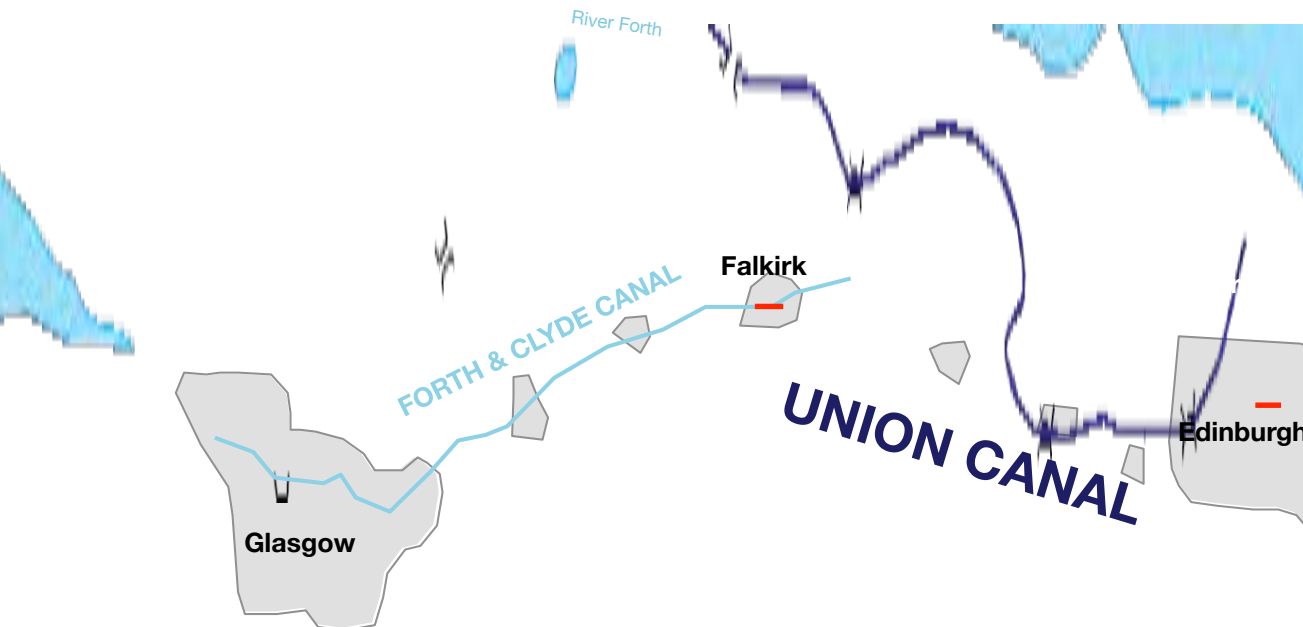
**demo project: Union Canal, Scotland** (34 mile / 55 km span)

### Primary purposes:

- Identification of flood hazard;
- Assessment of exposure to flood hazard;
- Relative estimation of urban flood vulnerability;
- Updated flood risk associated with urban, rural land cover scenarios

### Tools and techniques:

- **EO, raster analyses:** ERDAS Imagine, Harris ENVI and SARscape and SNAP;
- **Vector data mgt:** FME, QGIS, GDAL and PostGIS;
- **Hydrological analyses:** MIKE FLOOD, WhiteBox;
- **Time series and forecasting:** R-Shiny / R-Studio.





# *Terrain Motion Methods*



SAR image (Before deployment)



SAR image (After deployment)



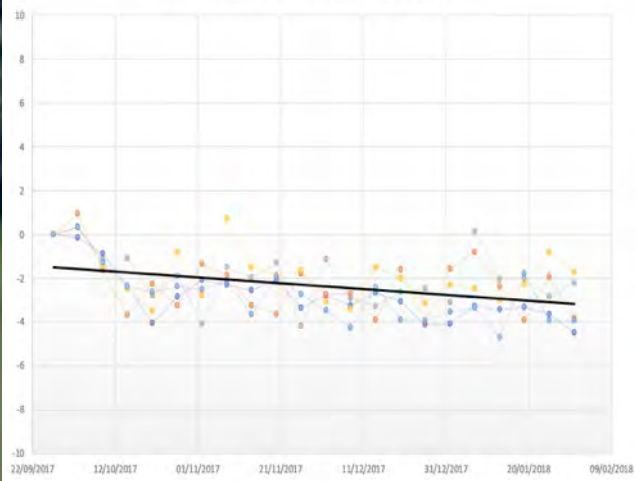
Overlay (After deployment)



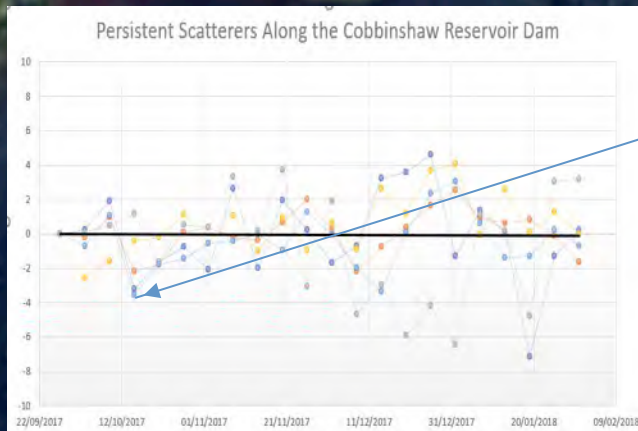




Selected Persistent Scatterers Along the Avon Aqueduct









- > View Select
- ▼ Locations
- Search map
- ▼ Base Layers
- ▼ Data Layers
- ▼ Downslope Risk
- Union Canal

● Downslope Area Risk

● Hillshade

Legend

Legend

Downslope Area Risk

0

25

50

75

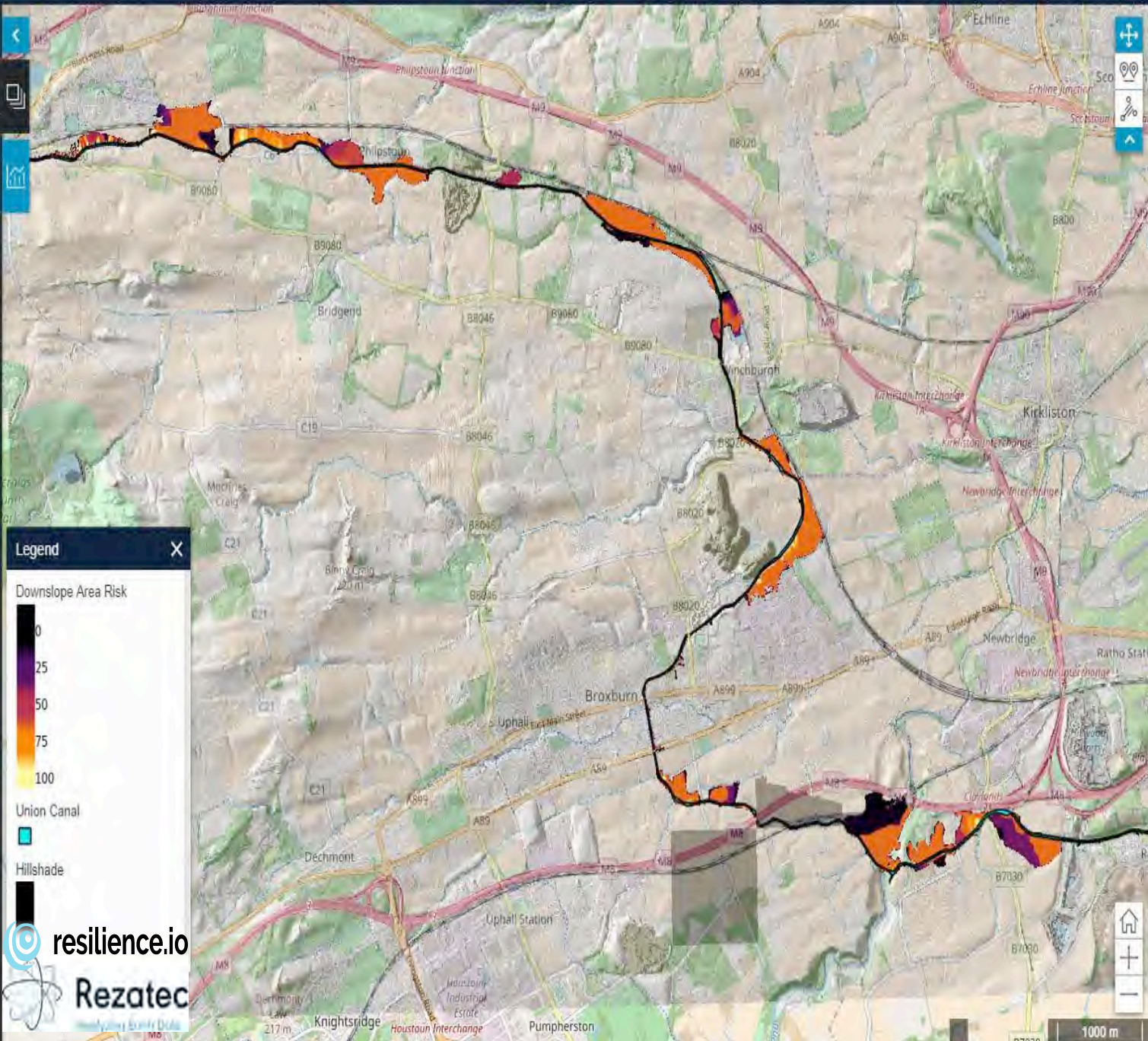
100

Union Canal

Hillshade

resilience.io

Rezatec





# Programme *Delivery Model*

Programme activity is channeled through four interlocking workstreams and supporting activities:

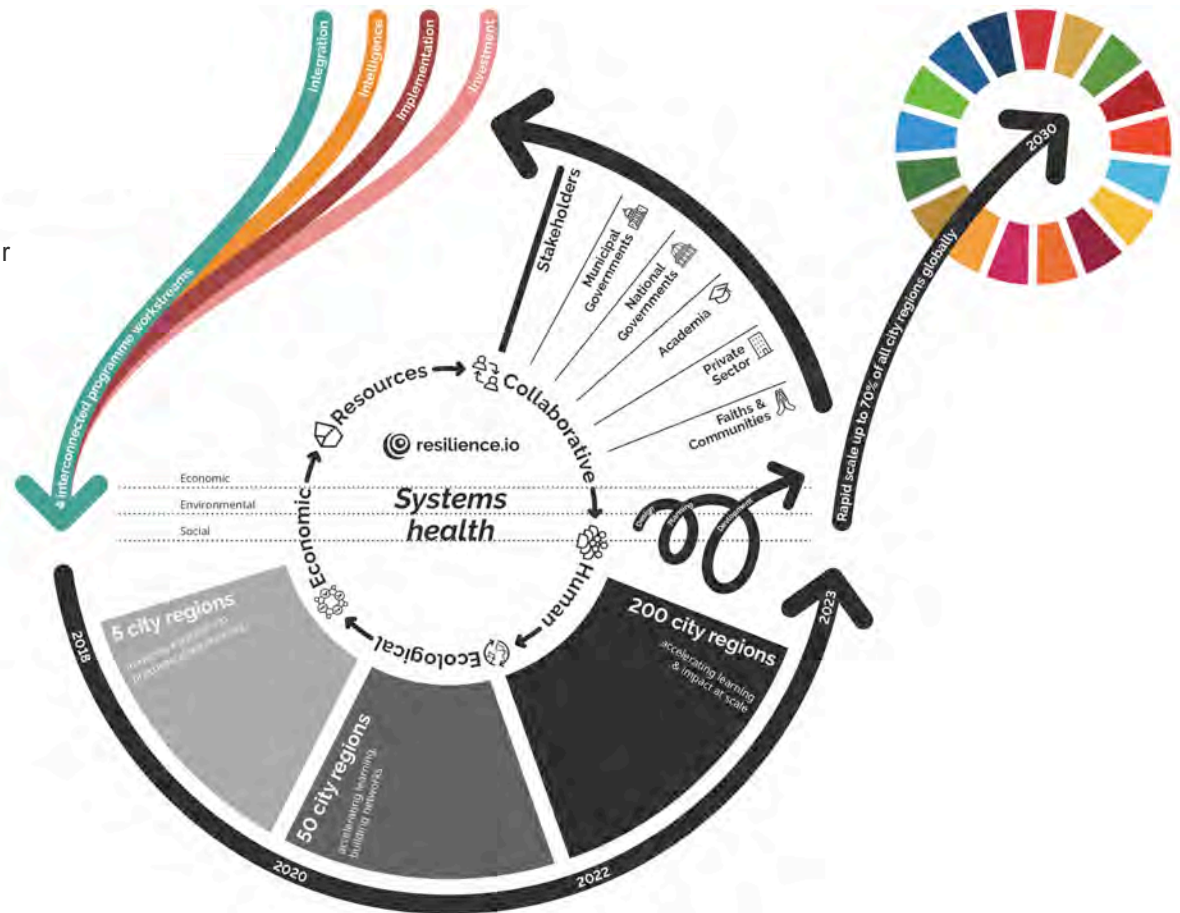
**Integration:** City region, earth systems and technology

**Intelligence:** Knowledge and interdisciplinary research

**Implementation:** Collaboration, capacity and scaling

**Investment:** Project aggregation, capital mobilisation and insurance

**Supporting activities:** Innovation Business; Youth and Leadership







# Stephen Passmore

*Technology Director*

stephen.passmore@resiliencebrokers.org  
@StephenPassmore

resiliencebrokers.org

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# STRENGTHENING ADAPTATION PLANNING IN MOZAMBICAN COASTAL CITIES



## **Olanda Bata**

Chief of Party, Coastal Cities Adaptation Project (CCAP)  
Bonn, April 26<sup>th</sup>, 2018



# COASTAL CITIES ADAPTATION PROJECT OBJECTIVES

Improve the  
provision of  
climate resilient  
urban services  
by  
**municipalities**



Increase the  
adoption of  
climate resilient  
measures by  
**communities**



Promote de  
adoption of **risk  
management  
tools**

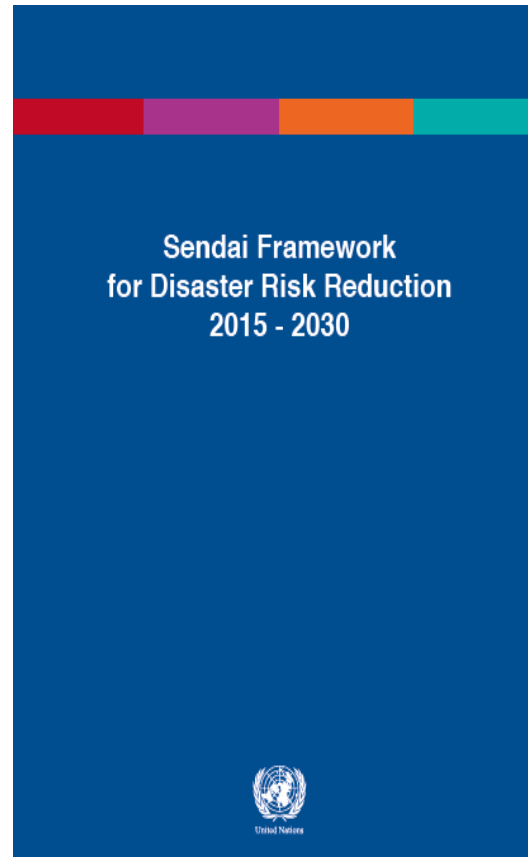




# **VULNERABILITY MAPPING & INVESTMENT IN LAND IMPROVEMENT**



# USAID-CCAP INITIATIVES INFORM GLOBAL AND NATIONAL PRIORITIES





# CCAP PRODUCTS AND TOOLS & ADAPTATION AND DRR

## 1. Climate smart decision making

**SIGIU** - Municipal information management & monitoring

Local Household infrastructure survey

**SIGIC - Integrated System for Disaster Information Management**

**CRVA** - Comprehensive risk and vulnerability assessment

## 2. Climate smart land use planning

Risk and vulnerability mapping

Integration with digital cadaster

## 3. Local resilient development plans

**LGSAT** – Local government self-assessment tool

**PLA**- Local Adaptation Plan

**ESOP** - Emergency standard Operating procedures

## 4. Climate resilience construction

Resilient housing construction techniques and procedures

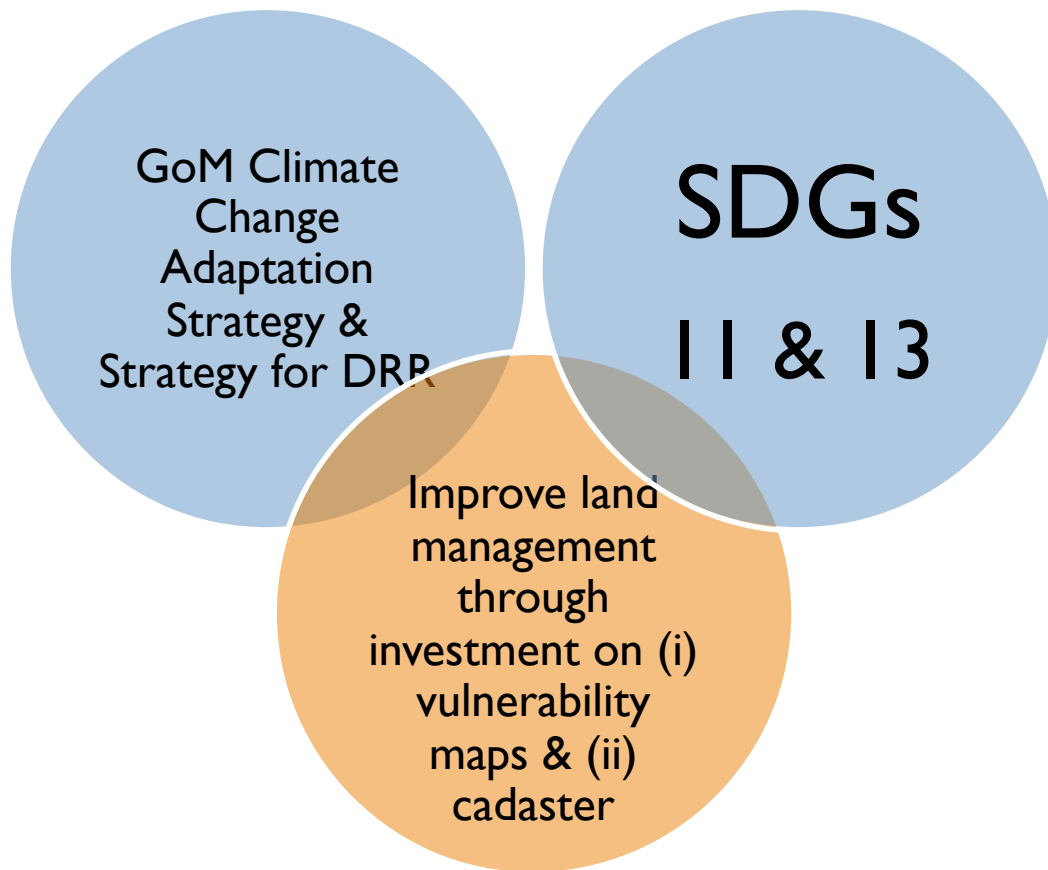
## 5. Social behavior change communication

**SBCC** strategy and actions plans

**CCA & DRR** e-course and Manual



# USAID-CCAP INITIATIVES INFORM GLOBAL & NATIONAL PRIORITIES





# VULNERABILITY MAPPING

## Process

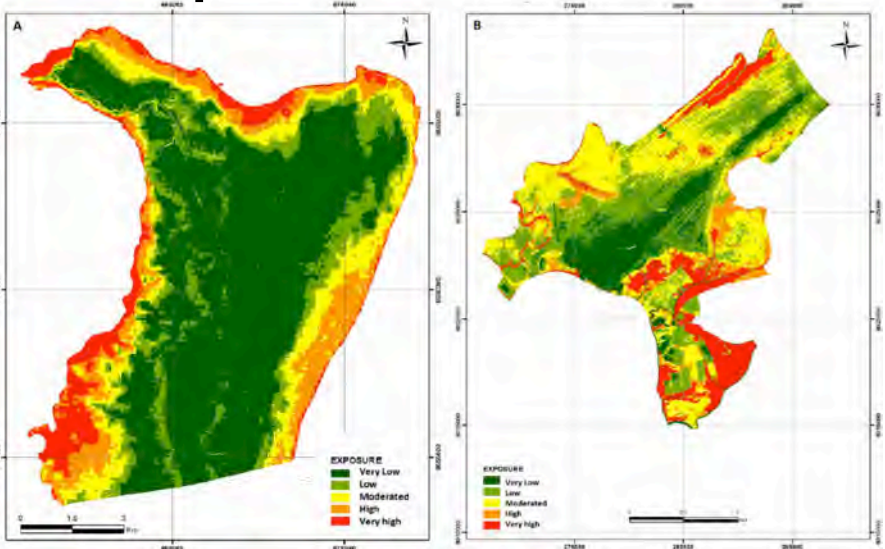
1. Conceptualization
2. Community Participation
3. Data Collection
4. Data Processing



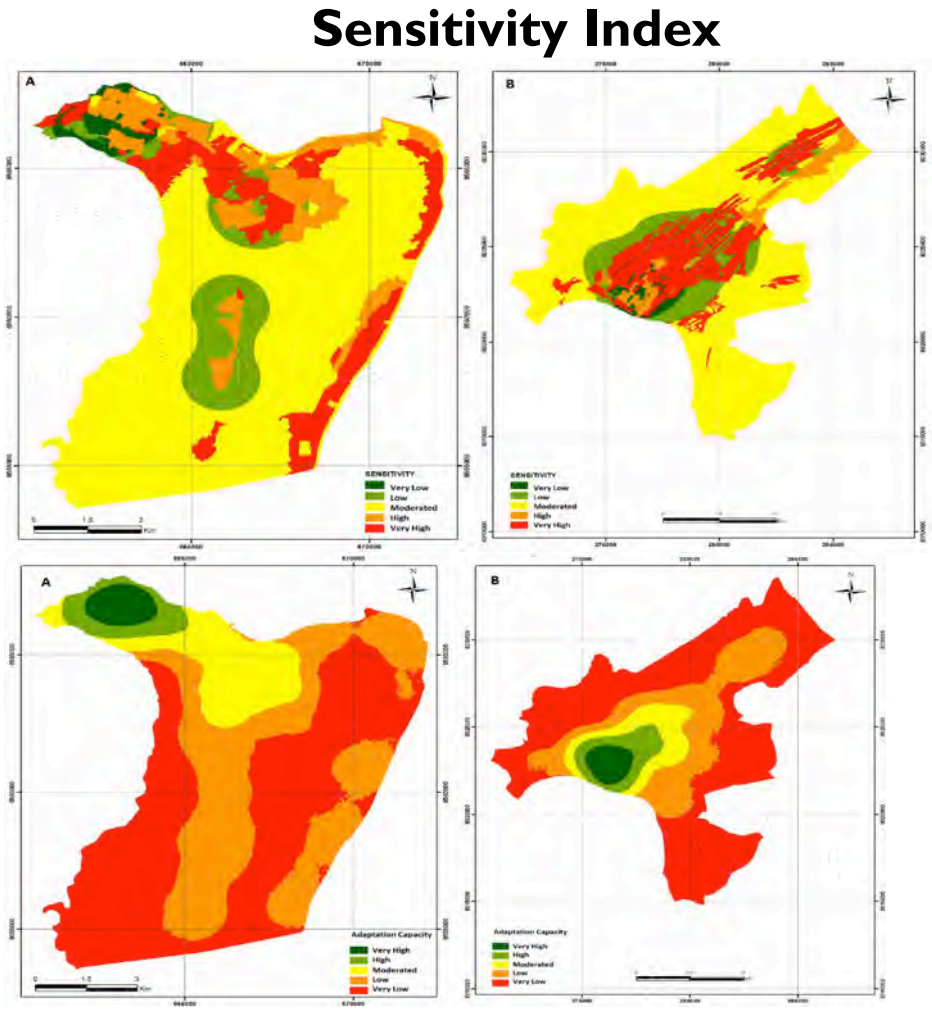


# RESULTS

## Exposure Index



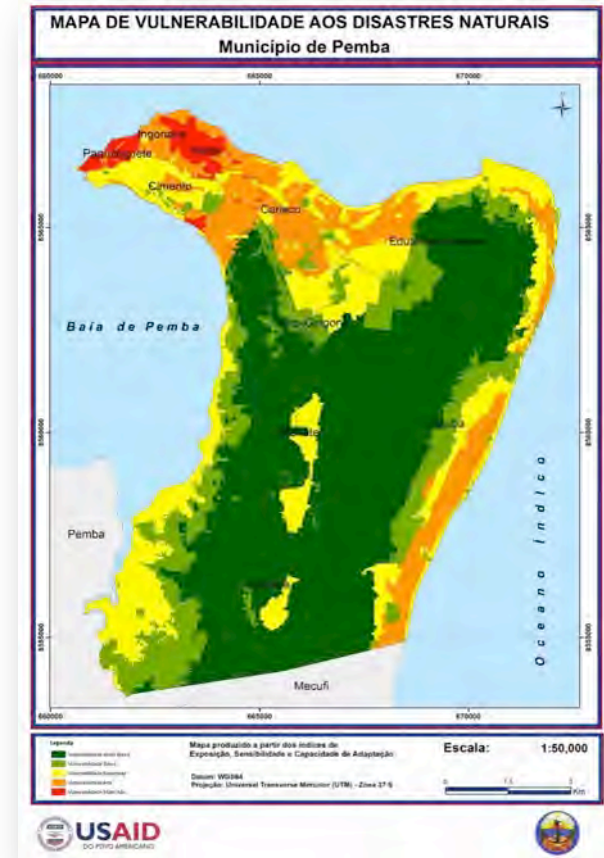
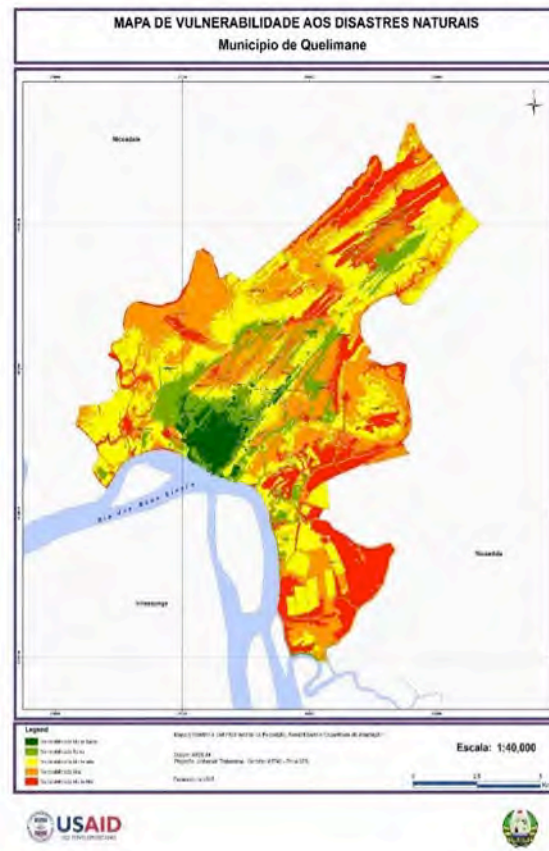
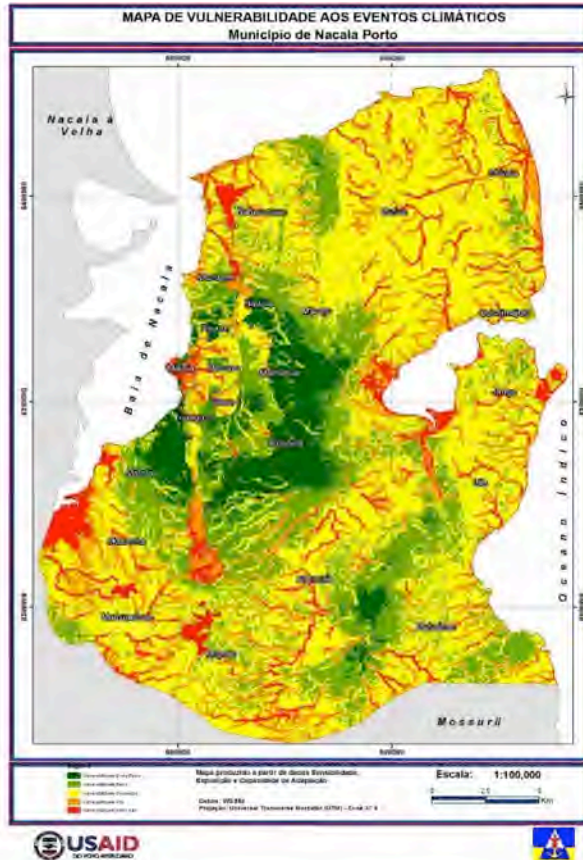
## Adaptation Capacity Index





# VULNERABILITY MAPS

$$\text{Vulnerability} = ([\text{SENSITIVITY}] + [\text{ADAPT CAPACITY}] + [\text{EXPOSURE}]) / 3$$

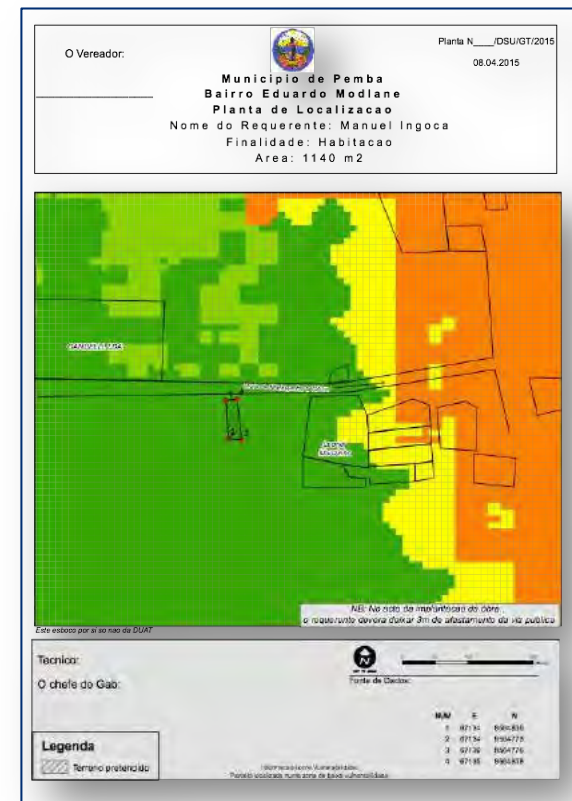




# USE OF VULNERABILITY MAPS

Inform and advise on:

- *urban land use and management;*
- *control of risk and vulnerabilities;*
- *city development.*





## **USE OF VULNERABILITY MAPS**

- Notify the landowners and inform them about the risks and vulnerability of the areas they are requesting
- Data to support the development of Local Adaptation Plans, Municipality structure plans
- Define scenarios of different extreme weather events



# LIMITATIONS

- Lack of municipality data for exposure map such as:
  - local sea level rise
  - temperature
  - storms
  - thunderstorms
- Lack of social geo-referenced data in the municipalities;



An aerial photograph showing a vast, densely packed informal settlement or slum. The settlement is built on a steep, arid hillside with sparse vegetation. The houses are small, closely packed, and have flat roofs, many of which appear to be made of corrugated metal. The terrain is dry and brown, with some green trees and shrubs scattered throughout. The sky is overcast and grey. The text "THANK YOU" is overlaid in the center of the image.

**THANK YOU**



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Session description:

[https://resilientcities2018.iclei.org/wp-content/uploads/RC2018\\_Session\\_Description\\_B5\\_Earth\\_Observations.pdf](https://resilientcities2018.iclei.org/wp-content/uploads/RC2018_Session_Description_B5_Earth_Observations.pdf)