Human Planet updates and new data and services for GEO's engagement priorities

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16 June 2023, Geneva, Switzerland
GEO Open Data Knowledge Workshop

HPI updates and new data and services

1. Global Human Settlement Layer (GHSL) 2.0 Release (March 2023)

2. Copernicus EMS –Exposure Component

3. Use Cases

4. Selected SDG Indicators and Associated Services

5. Other New HPI-Related Data and Scenarios

GHSL 2.0 Main Features

Data and tools to monitor planet Earth through **time series** of **global information** on **built-up areas**, **population**, and **settlements**

- **Improved spatial resolution**

  - Built-up surface fraction at 10 m spatial resolution

  - Population density at 100 m

- **Built-up classification**: residential and non-residential uses

- Building height and Volume information at 100 m spatial resolution

- **Extended time series**: 1975-2030 in 5 year intervals at 100 m

Open and Free Geospatial Data for Download
GHSL 2.0

https://ghsl.jrc.ec.europa.eu/download.php

GHSL 2.0 knowledge package available soon

GHSL R2023

Input Sentinel 2 Imagery
Built-up Surface 10 m

Building footprints on a
10m spatial grid → Surface
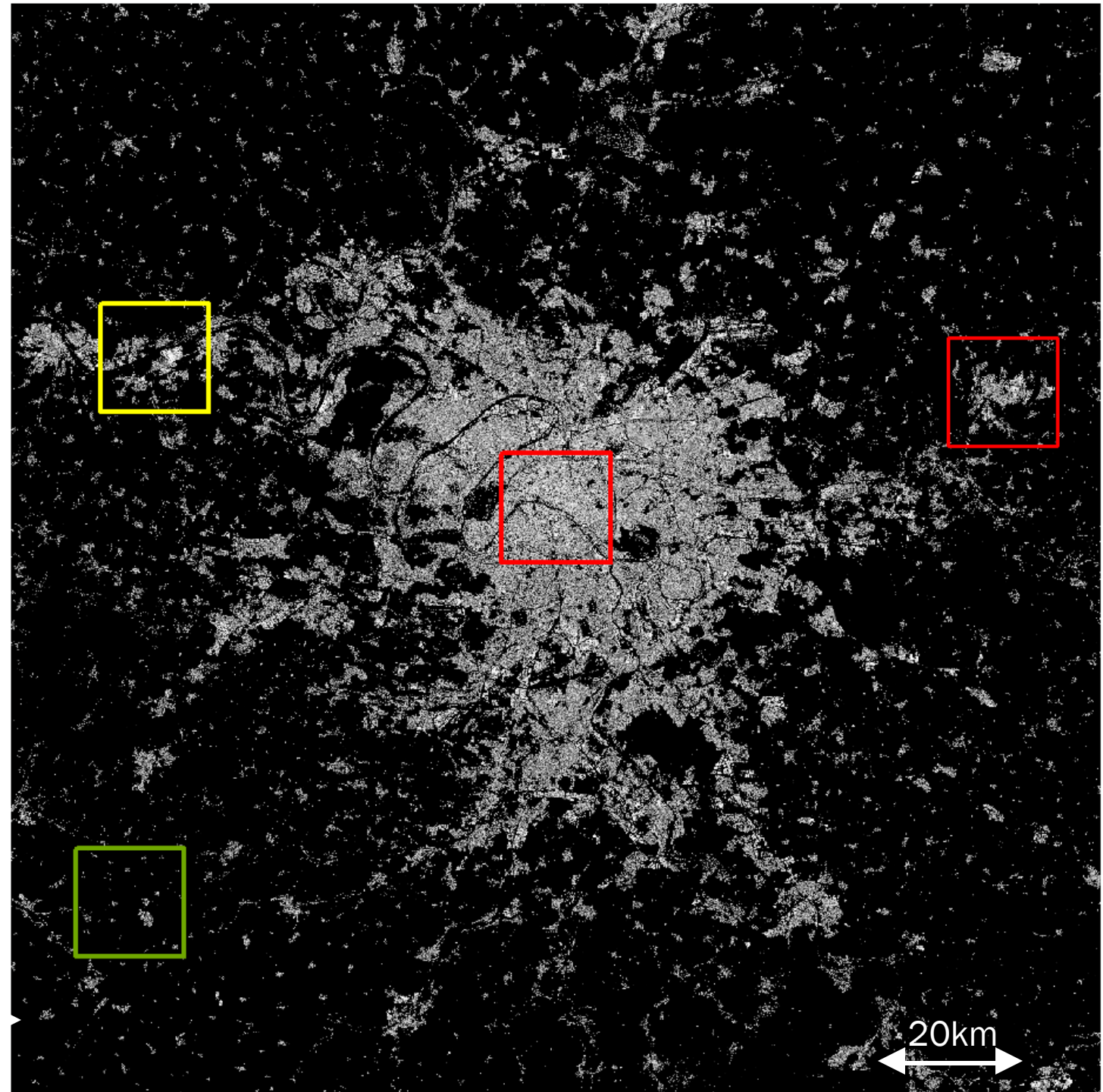
GHSL R2023

Input Sentinel 2 Imagery
Built-up Surface 10 m
Built-NR 10 m

Building footprints on a
10m spatial grid → Surface

04/07/2023
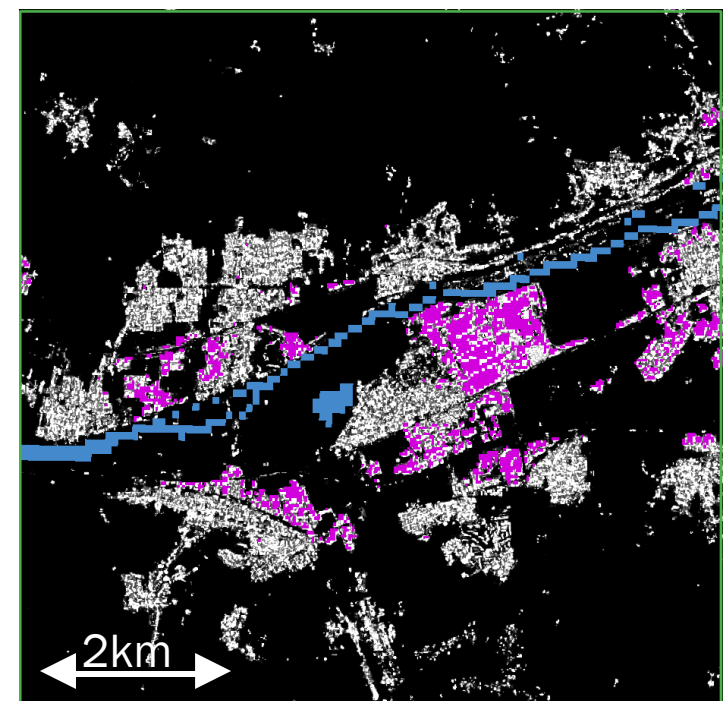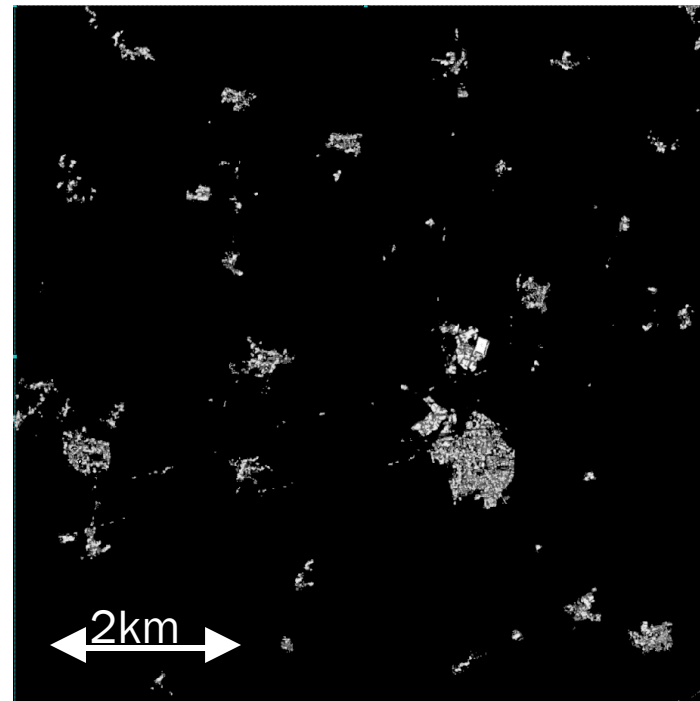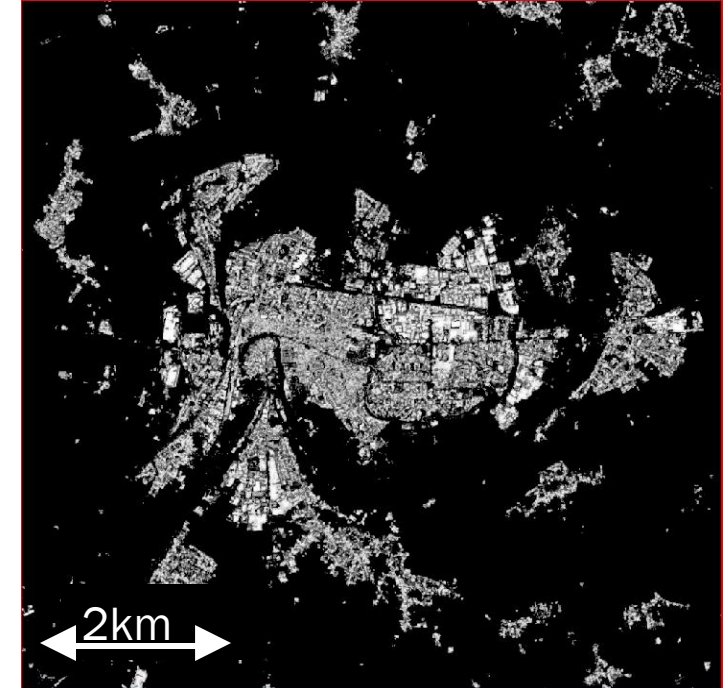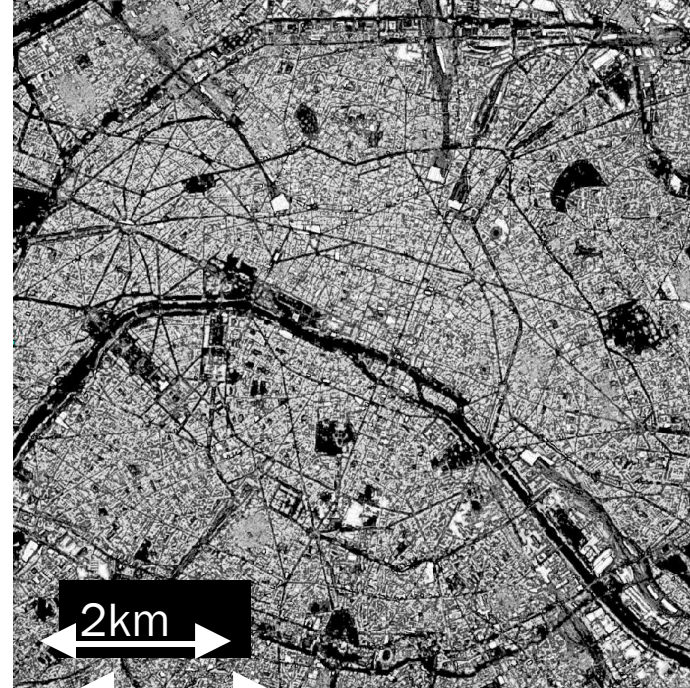
GHSL R2023

Built-up over time 100 m

Legend
- ⬜ Built-up in 1975
- 🟧 Built-up in 2000
- 🟥 Built-up in 2020

World Population: 1950-2050
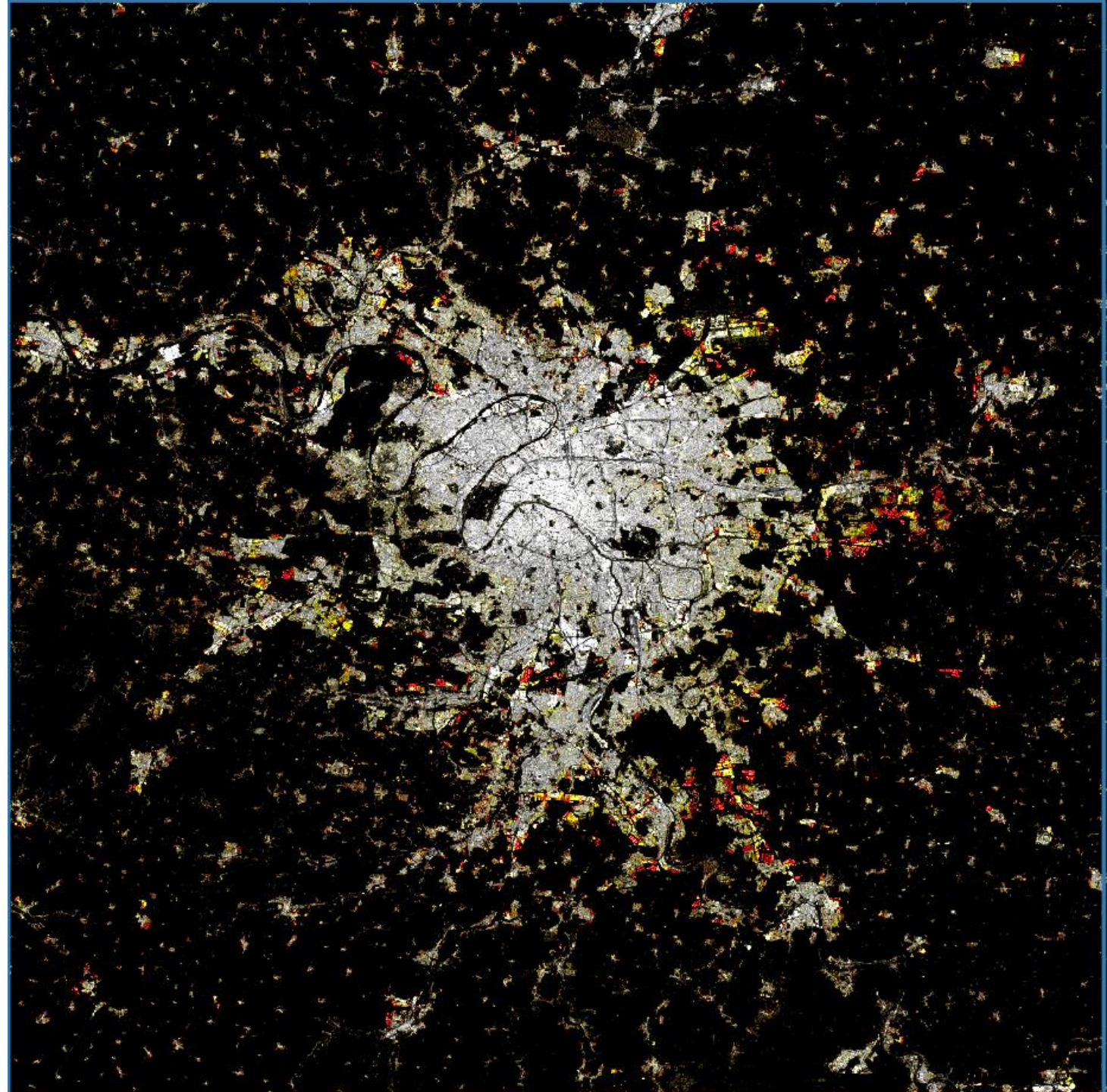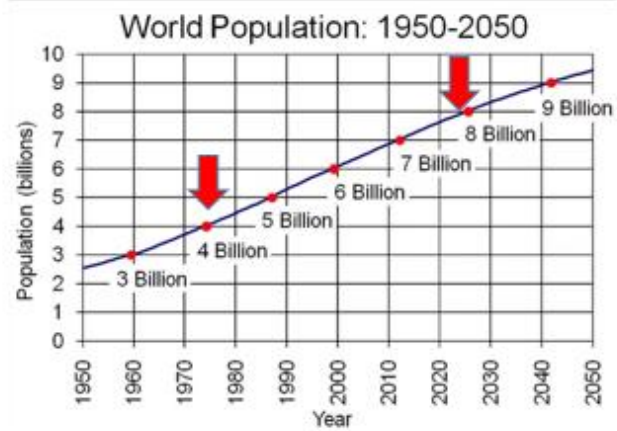
GHSL R2023

Input: Built-up, Census

Multi-temporal Population 100 m

Population
- □ no data (transparent)
- □ 0 - 5
- □ 6 - 20
- □ 21 - 100
- □ 101 - 300
- □ 301 - 500
- ■ 501 - 1,000
- ■ 1,000 - Max

World Population: 1950-2050

04/07/2023
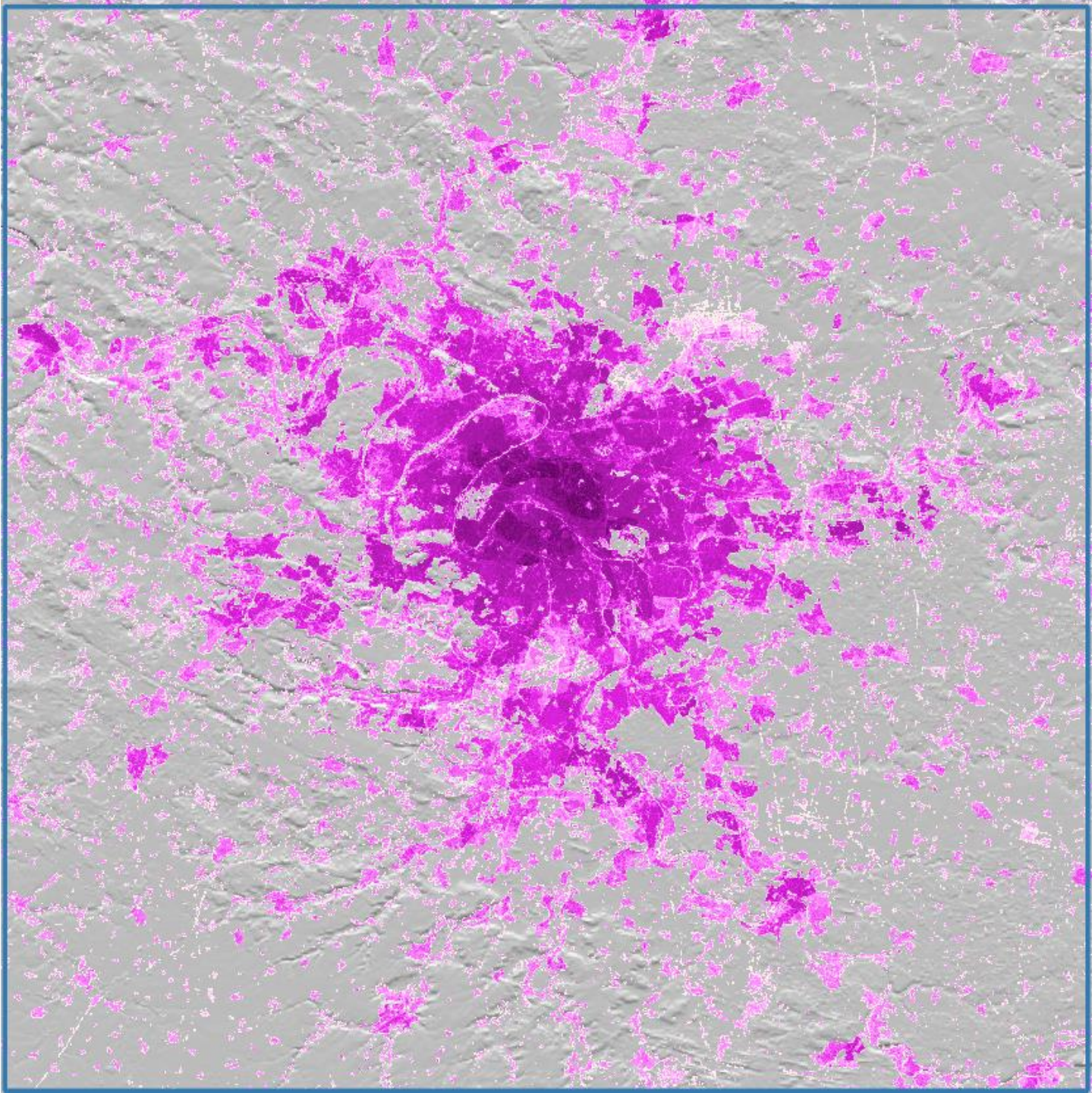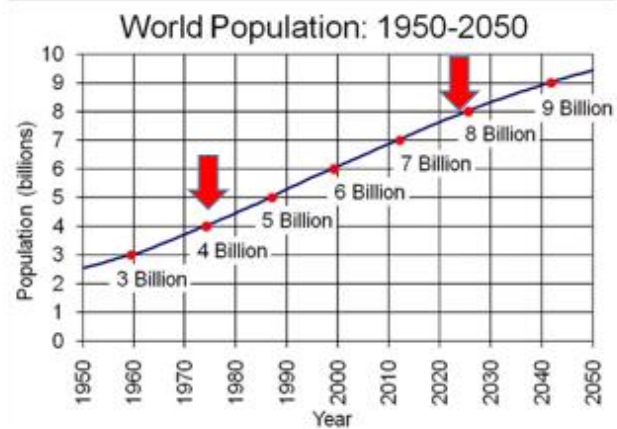
GHSL R2023

Input: Built-up, Population

Settlement Model (SMOD)

Legend

Degree of Urbanisation

Urban centre (City):
- 🟥 Urban centre (City)

Urban cluster (Town & suburb):
- 🟧 Dense and semi-dense urban cluster (Town)
- 🟨 Suburban or peri-urban cells (Suburb)

Rural grid cells (Rural area):
- 🟩 Rural cluster (Village)
- ⬜ Low density rural grid cells (Dispersed rural area) - transparent
- ⬜ Very low density rural grid cells (Mostly uninhabited area) - transparent

Degree of urbanization
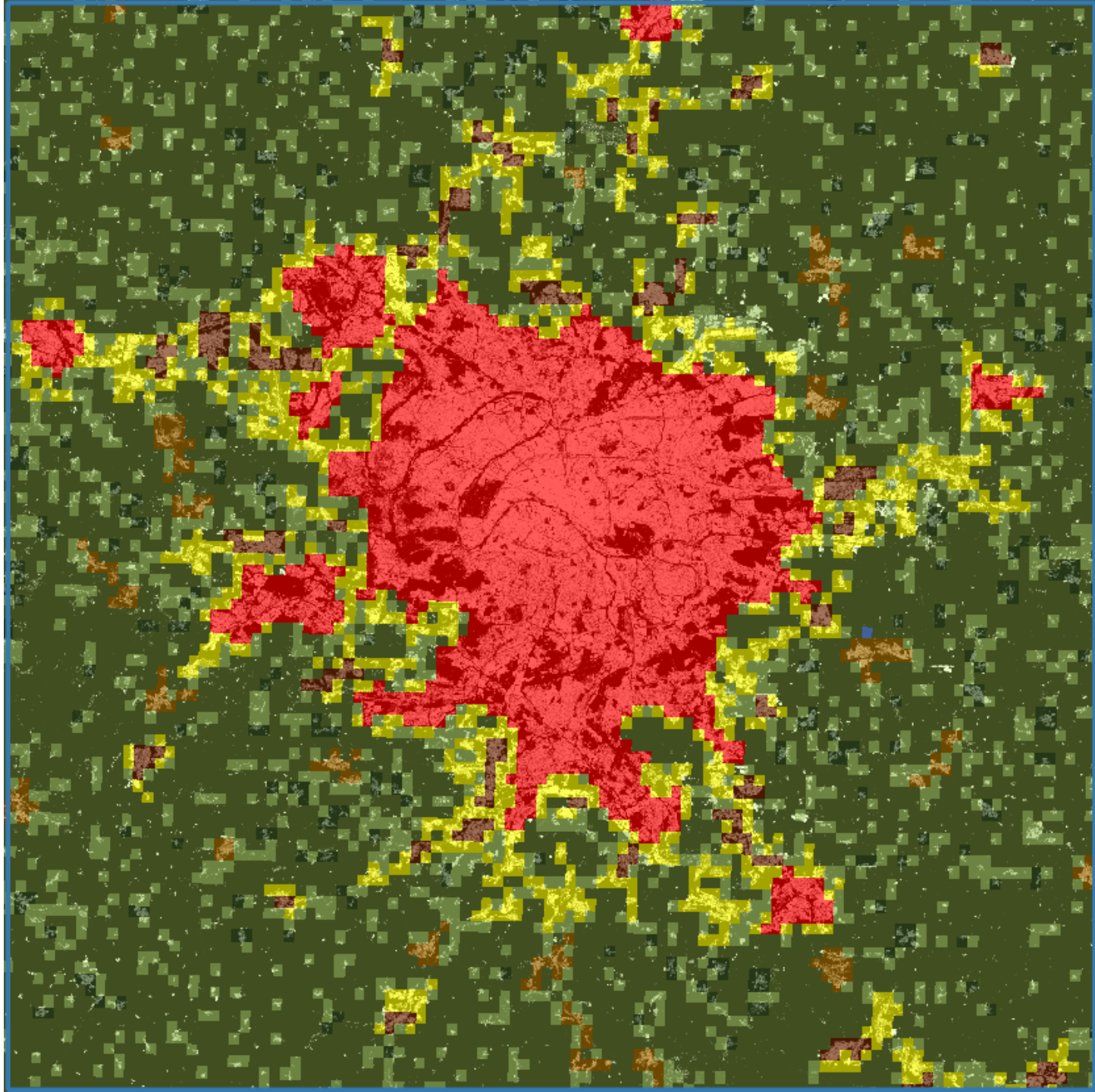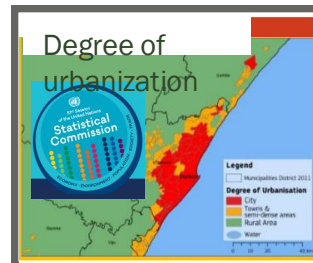
GHSL R2023

Built-up Height 100m

[NEW feature](#)
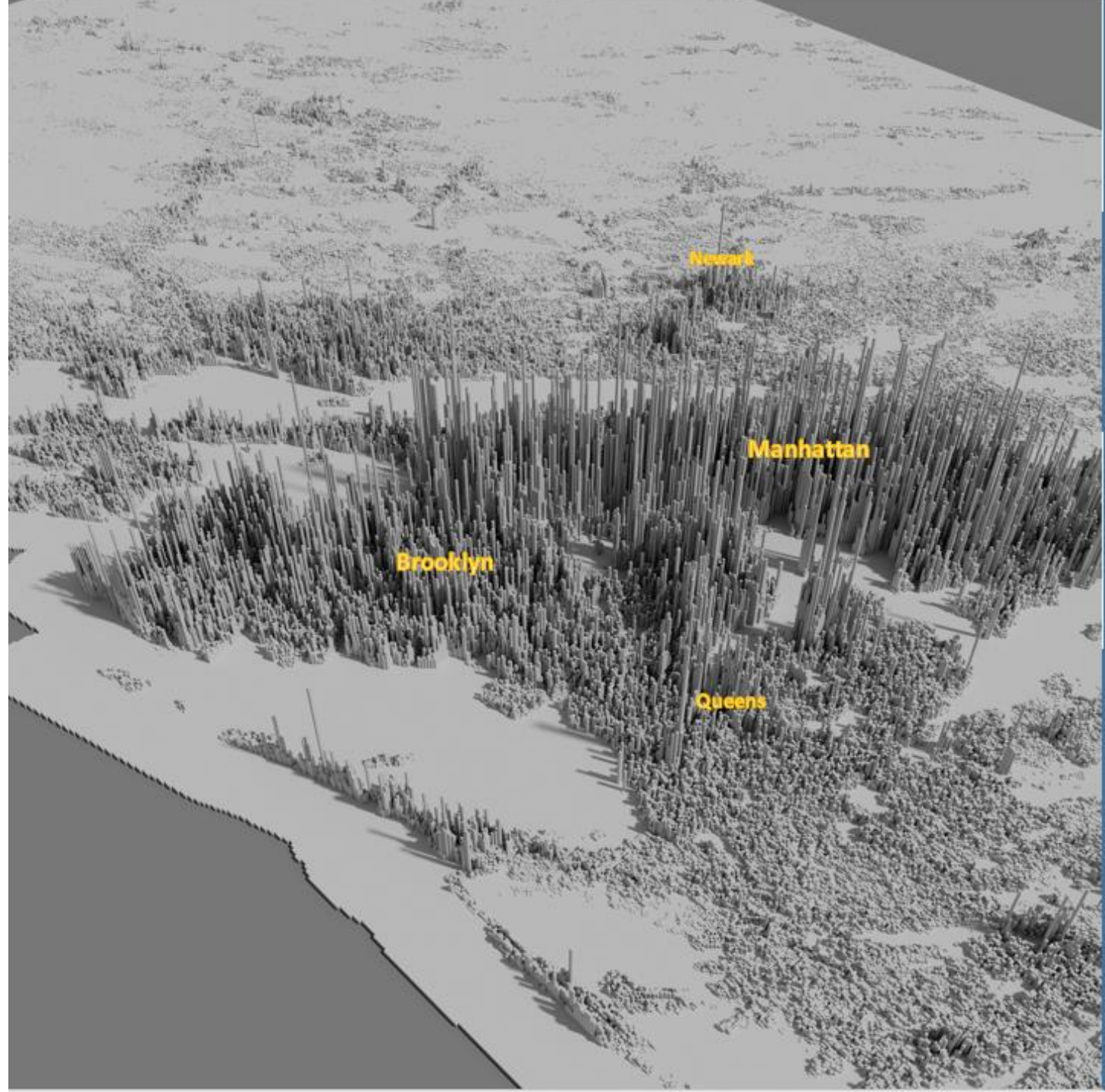
Essential societal variables

...to address GEO's societal challenges
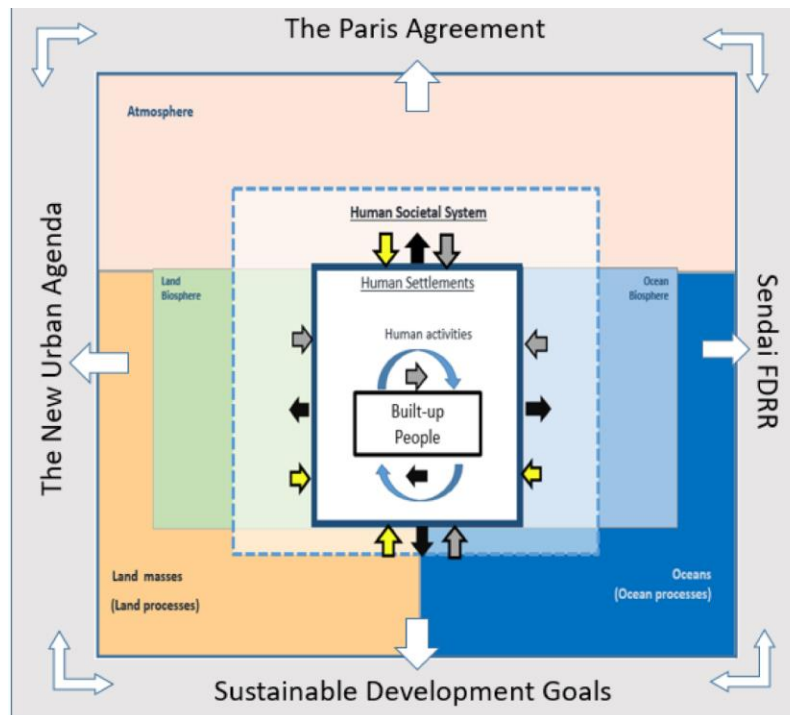
… to Analyze Human Presence, Societal Impact and Sustainability <doi.org/10.3390/su13147851>

https://www.gdacs.org/

Degree of urbanization

https://eotoolkit.unhabitat.org/

http://emergency.copernicus.eu/
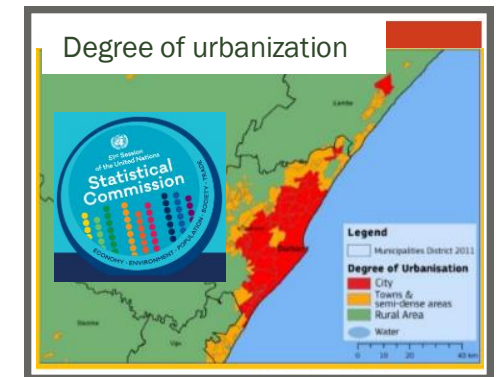
Use cases of GHSL in international policy frameworks

GEO 6 & GEO 6 Cities by UNEP urbanization statistics from GHSL Data
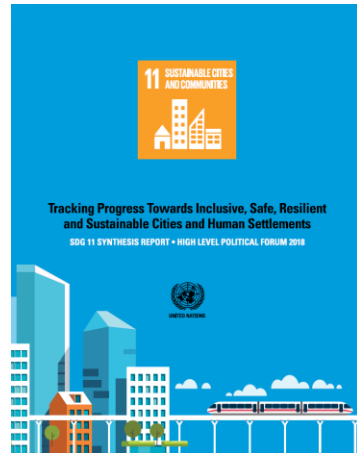
UN-Habitat SDG 11 synthesis report
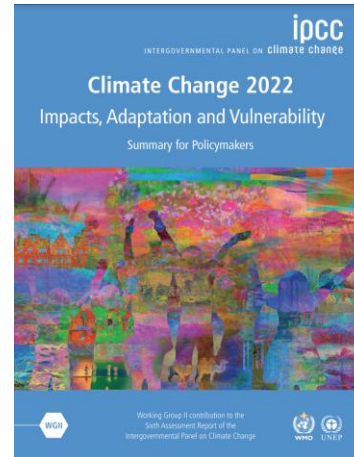
UNEP WMO IPCC 6th Assessment Report
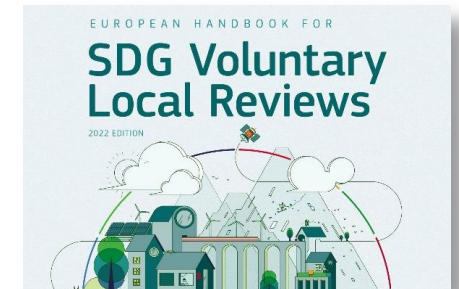
And many more …

EARTH OBSERVATIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS

Earth Observations Toolkit for SUSTAINABLE CITIES AND HUMAN SETTLEMENTS

Use Case: Pediatric Exposure to Pollution

A Population aged 1–18 years

Population size (thousands)
- 0–10
- 11–100
- 101–1000
- 1001–2500
- 2501–5000
- 5001–7000
- 7001–10000
- 10001–25000
- 25001–50000
- 50001–100000
- 100001–300000
- 300 001–500 000

- Achakulwisut, P., Brauer, M., Hystad, P., & Anenberg, S. C. 2019. Global, national, and urban burdens of paediatric asthma incidence attributable to ambient NO2 pollution: estimates from global datasets. *The Lancet Planetary Health*. doi: 10.1016/S2542-5196(19)30046-4.
  - Used 2015 GHS-POP from JRC & SEDAC
  - Estimated pediatric populations by applying GPWv4.10 Demographic Characteristics for ages 1-4, 5-9, 10-14, and 15-18
  - Compared with surface & satellite-based NO2 estimates

B Population-weighted asthma incidence rates

Incidence rates (per 100 000)
- 500–750
- 751–1,000
- 1001–1250
- 1251–1500
- 1501–1750
- 1751–2000
- 2001–2250
- 2251–2500
- 2501–2750
- 2751–3000
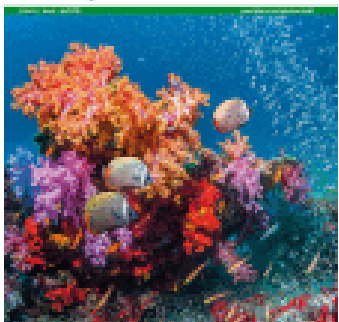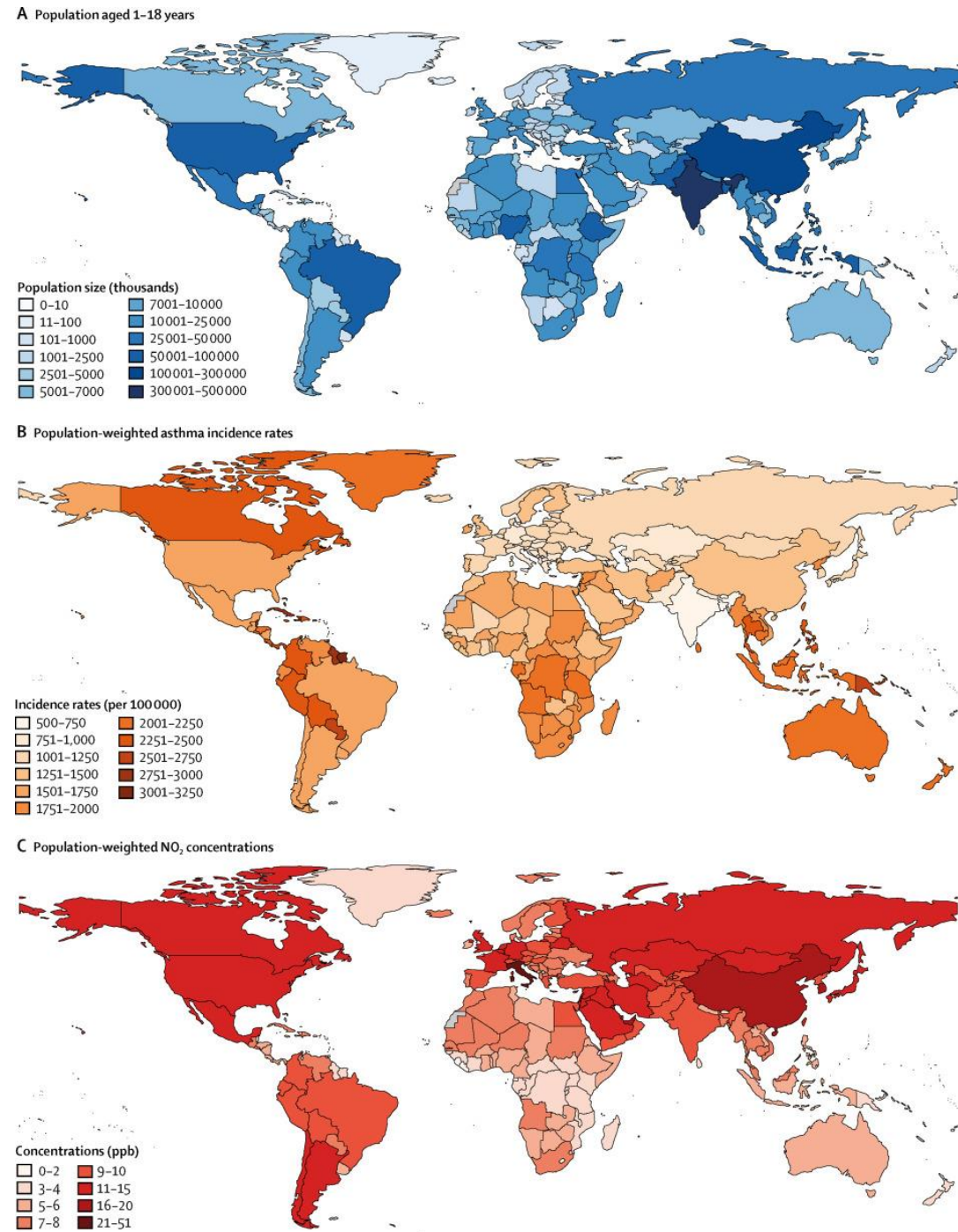- 3001–3250

THE LANCET
Planetary Health

Figure 1 National estimates of population aged 1–18 years (A), population-weighted annual asthma incidence rates (B), and population-weighted annual average nitrogen dioxide (NO2) concentrations (C)

C Population-weighted NO₂ concentrations

Concentrations (ppb)
- 0–2
- 3–4
- 5–6
- 7–8
- 9–10
- 11–15
- 16–20
- 21–51

Use Case: Exposure to Multiple Hazards

- OECD, 2022. *Monitoring Exposure to Climate-Related Hazards: Indicator Methodology and Key Results*. https://doi.org/10.1787/19970900.
  - Uses GHSL-POP as common population exposure layer for assessing different hazards
  - Assesses extreme temperature, extreme precipitation, drought, wildfire, wind threats, river flooding, coastal flooding
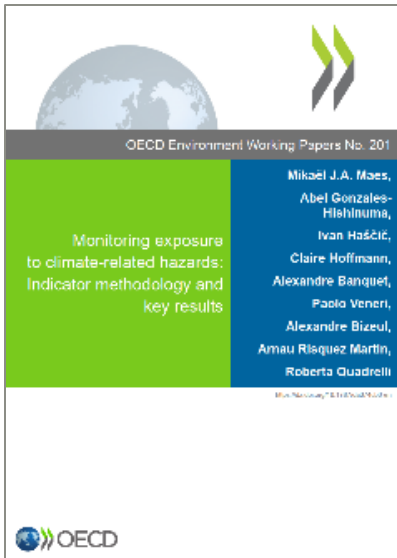

Figure 27. Most countries experience at least one climate-related natural hazard

	Extreme temperature			Extreme precipitation	Drought	Wildfire		Wind threats		River flooding	Coastal flooding
	Hot days	Tropical nights	Heat stress	Cropland exposure	Cropland exposure	Population exposure	Forest exposure	Population exposure	Built-up area exposure	Built-up area exposure	Built-up area exposure
Argentina	3	11	11		5	11	11	34	32	8	30
Australia	6	13	18		3	2	5	26	26	37	30
Austria	28	37	32		24	25	35	19	20	7	NA
Belgium	20	15	38		4	39		6	7	20	2
Brazil	8	6	4	5	9	7	12	44	44	32	30
Bulgaria	18	30	24		15	10	15	42	43	33	
Canada	36	28	34			34	32	21	18	16	24
Chile	35	47	27	13	35	9	20	27	28	27	35
China	4	5	9	13	18	6	18	31	31	1	3
Colombia	27	38	7	3	13	20	21	47	46	22	
Costa Rica	40	8	5	4	36	12	14			50	
Croatia	21	18	21		26	33	23	24	25	5	17
Czech Republic	33	35	36		17	36	31	22	22	15	NA
Denmark		45	46	11	37	29		12	13	49	5
Estonia		43	43		31	40	27	41	41	30	
EU27	23	25	26	13	22	19	22	17	17	18	7
Finland		44	47	13		42		40	40	9	11
France	14	22	29		10	17	19	15	15	14	15
Germany	24	27	35		7	22	29	8	9	19	9
Greece	7	16	14		40	15	10	33	34	42	23
Hungary	13	4	22		30	26	36			6	NA
Iceland					41			1	1	48	10
India	1	1	2			5	8	36	37	13	20
Indonesia	30	10	1	1	33	24	25	45	45	26	12
Ireland			50	7	39			2	2	36	25
Israel	5	19	6			8	2			43	
Italy	16	12	15			21	17	23	23	29	14
Japan	17	14	19	11		44	39	3	3	17	6
Korea	12	7	20		23	27	33	9	10	21	21
Latvia		40	42		21	37		37	35	2	13
Lithuania		42	41		14	41	24	28	30	35	22
Luxembourg	31	41	39		2			10	11	40	NA
Malta		2	25			28	16	13	12		
Mexico	22	33	8	8	19	3	3	35	36	24	29
Netherlands	29	29	40		6	23		4	4	3	1
New Zealand		31	45			35	38	16	14	46	30
Norway		48	49	6				11	5	41	4
Peru	37	32	13	2	32	43	28			25	
Poland	34	36	37	9	16	31	26	38	39	23	19
Portugal	26	24	28		11	4	6	14	16	44	27
Romania	19	26	23		8	13	30	43	42	11	
Saudi Arabia	2	3	3		12	45	1	46		45	16
Slovakia	25	39	31		29	30	34	39	38	4	NA
Slovenia	32	21	30		38	46		30	29	10	
South Africa	11	23	12		1	1	4	29	27	47	
Spain	9	17	17	13	28	18	9	18	19	38	34
Sweden		46	48		27	32	37	25	24	28	18
Switzerland	38	34	33		25			7	8	12	NA
Turkey	15	20	16		20	14	7	32	33	31	28
United Kingdom	39	49	44	9	34	38		5	6	39	8
United States	10	9	10			16	13	20	21	34	26

OECD Environment Working Papers No. 201

Mikaël J.A. Maes,
Abel Gonzales-Hishinuma,
Ivan Haščič,
Claire Hoffmann,
Alexandre Banquet,
Paolo Veneri,
Alexandre Bizeul,
Arnau Risquez Martin,
Roberta Quadrelli

Monitoring exposure to climate-related hazards: Indicator methodology and key results
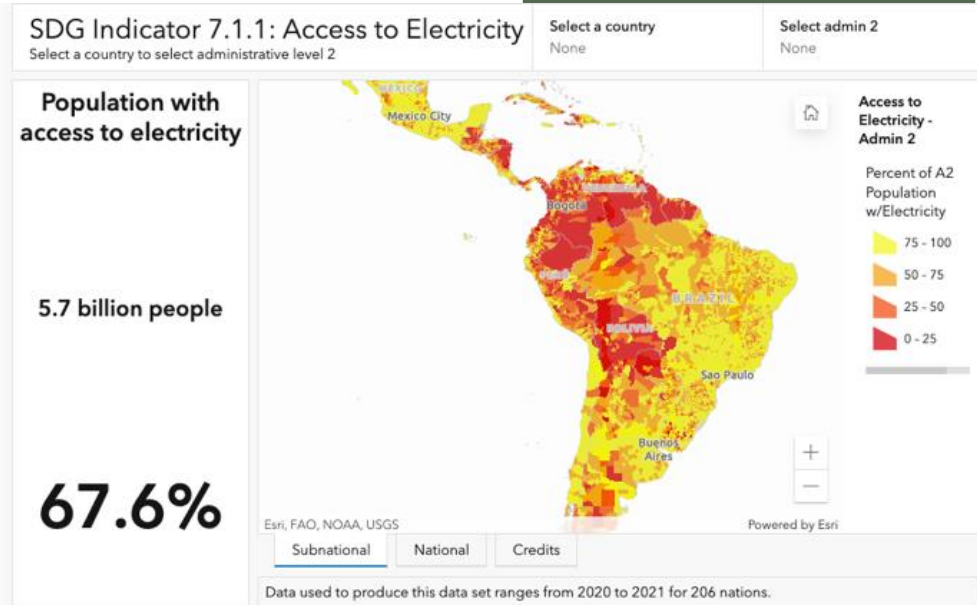
OECD

GEO GROUP ON EARTH OBSERVATIONS

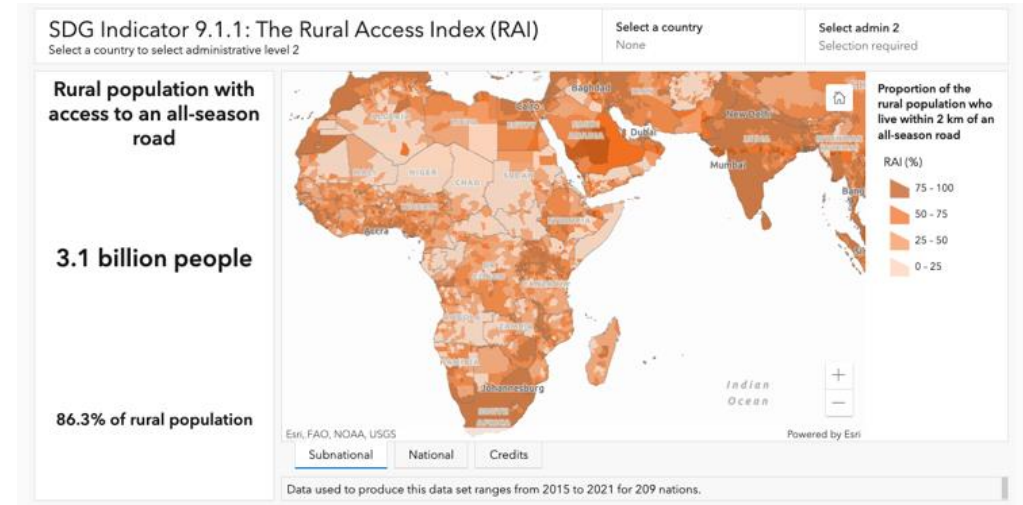Four SDG indicator datasets and associated StoryMaps now available via **SDGs Today** and **GEO Knowledge Hub**:

- 7.1.1 Access to Electricity
- 9.1.1 Rural Access Index
- 11.2.1 Urban Access to Public Transport
- 11.7.1 Urban Public Space

https://sdgstoday.org/

https://gkhub.earthobservations.org/

SDGs TODAY

GROUP ON EARTH OBSERVATIONS

https://sdgstoday.org/

https://gkhub.earthobservations.org/

Gridded Relative Deprivation Index (GRDI), Version 1
Poverty Mapping

Global Gridded Relative Deprivation Index (GRDI), v1

https://doi.org/10.7927/3xxe-ap97

Relative deprivation on a 1-km grid-cell basis, incorporating the following layers:

1. Subnational human development index (from Smits & Permanyer 2019)

2. Child dependency ratios (from SEDAC's GPW v4 Basic Demographic Characteristics)

3. Infant mortality rates (from SEDAC's Global Subnational Infant Mortality Rates, Version 2.01)

4. Building footprints as a proportion of each grid cell (from HRSL, Microsoft, and Geofabrik/OSM)

5. Current nighttime lights (from VIIRS DNB)

6. Change in nighttime lights (from VIIRS DNB)

North Africa

Algiers   Tunis
Rabat   Tripoli
                          Cairo

In-Migration
■ High certainty in high levels of climate in-migration
■ Low certainty in high levels of climate in-migration

Out-Migration
■ High certainty in high levels of climate out-migration
■ Low certainty in high levels of climate out-migration

★ National capital

Groundswell Spatial Population and Migration Projections at One-Eighth Degree According to SSPs and RCPs, 2010-2050

https://doi.org/10.7927/c5kq-fb78

Projections of the effect of slow-onset climate change impacts on water availability and crop productivity, coupled with sea-level rise and storm surge, on future population distribution and climate-related internal migration in low to middle income countries.

Rigaud, K.K., A. de Sherbinin, B. Jones, J. Bergmann, V. Clement, K. Ober, J. Schewe, S. Adamo, B. McCusker, S. Heuser, and A. Midgley. 2018. *Groundswell: Preparing for Internal Climate Migration*. Washington DC: World Bank.
https://openknowledge.worldbank.org/handle/10986/29461

Clement, V., K.K. Rigaud, A. de Sherbinin, B. Jones, S. Adamo, et al. 2021. *Groundswell Part 2 : Acting on Internal Climate Migration*. Washington, DC: The World Bank.
https://openknowledge.worldbank.org/handle/10986/36248

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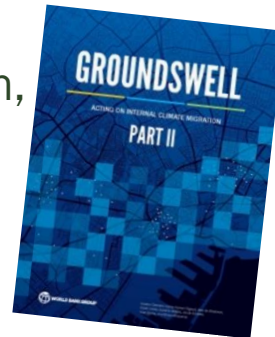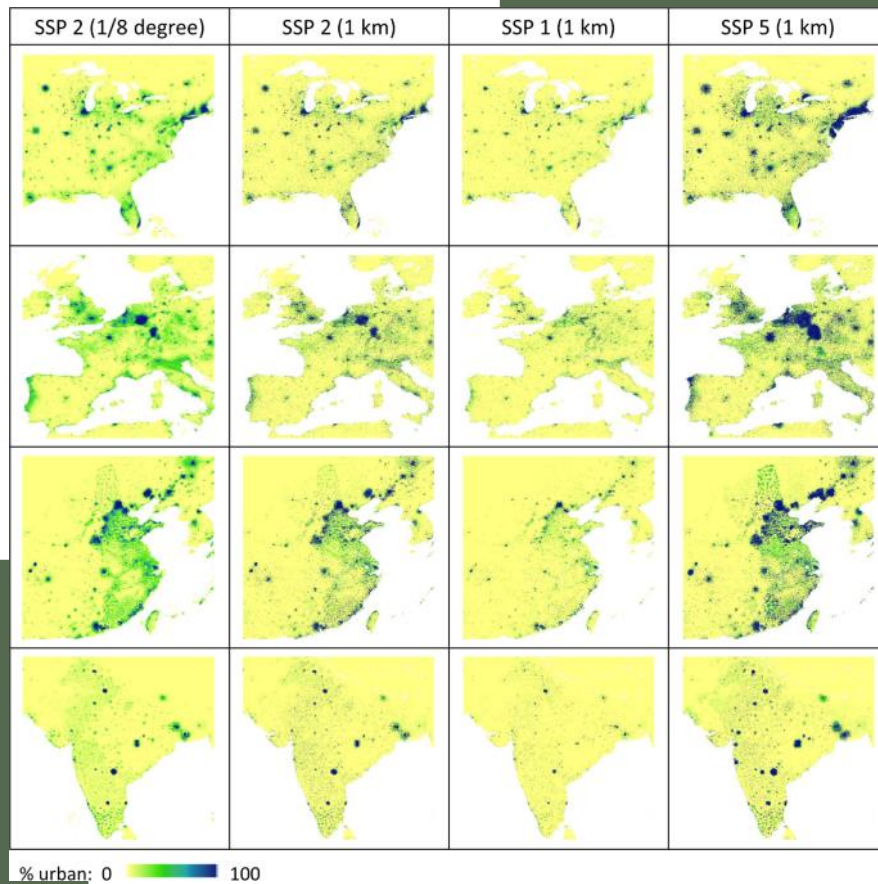
Global 1-km Downscaled Urban Land Extent Projection and Base Year Grids by SSP Scenarios, v1 (2000 – 2100)
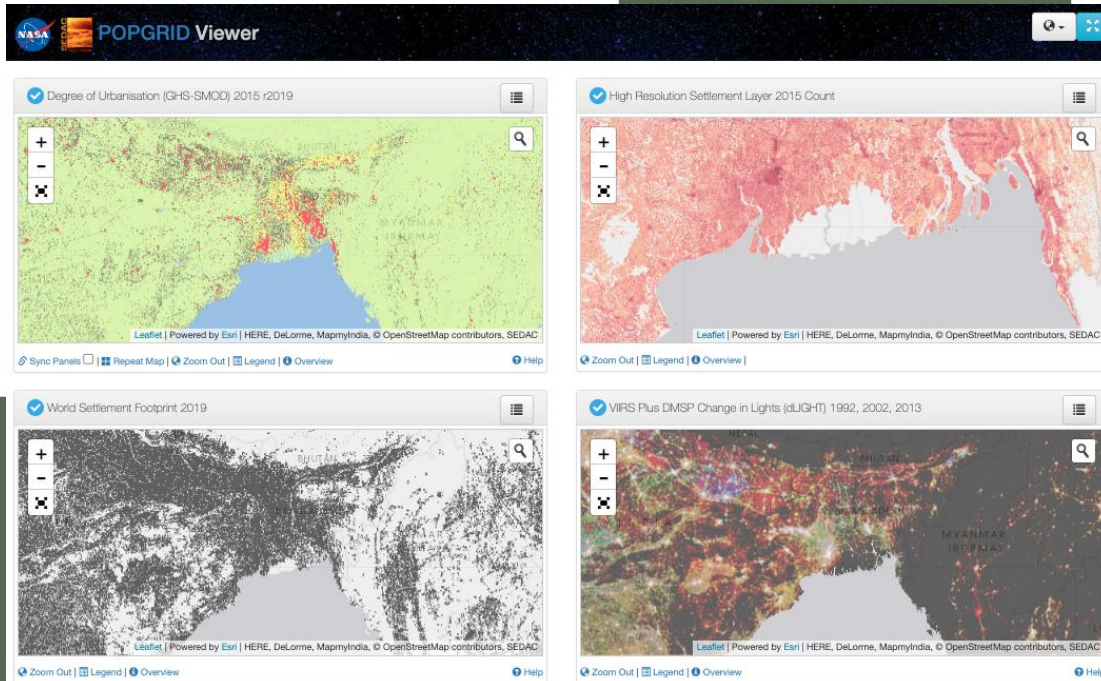
Global SSP-consistent spatial urban land fraction data for the base year 2000 and projections at ten-year intervals for 2010-2100 at a resolution of 1-km

- Inputs from Global Human Settlement Layer (GHSL) developed by JRC

Gao, J. and M. Pesaresi. 2021. Downscaling SSP-consistent Global Spatial Urban Land Projections from 1/8-degree to 1-km Resolution 2000-2100. *Scientific Data* 8(1): 281. https://doi.org/10.1038/s41597-021-01052-0.

Fig. 2. 2100 urban land projections for various parts of the world (North America, Europe, East Asia, South Asia) under urban land expansion scenarios consistent with SSP 2 (middle of the road), SSP 1 (sustainability), and SSP 5 (fossil-fuelled development).

scientific **data**

- **POPGRID Data Collaborative** facilitates access to multiple global gridded population and settlement data sets
- **SEDAC POPGRID Viewer** facilitates visualization and intercomparison
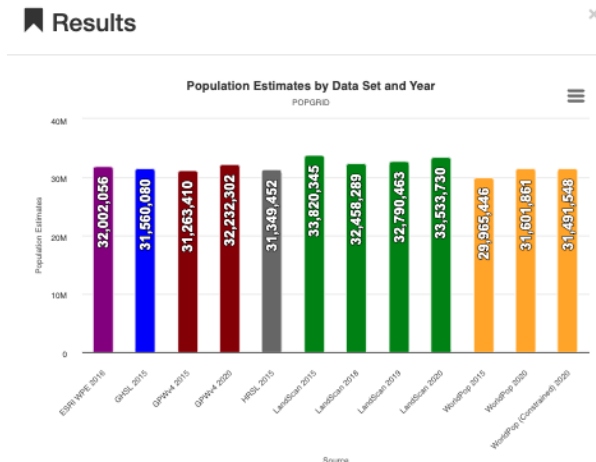
SEDAC POPGRID Viewer with Settlement Layers

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04/07/2023

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