

living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE
OF OUR PLANET FROM SPACE



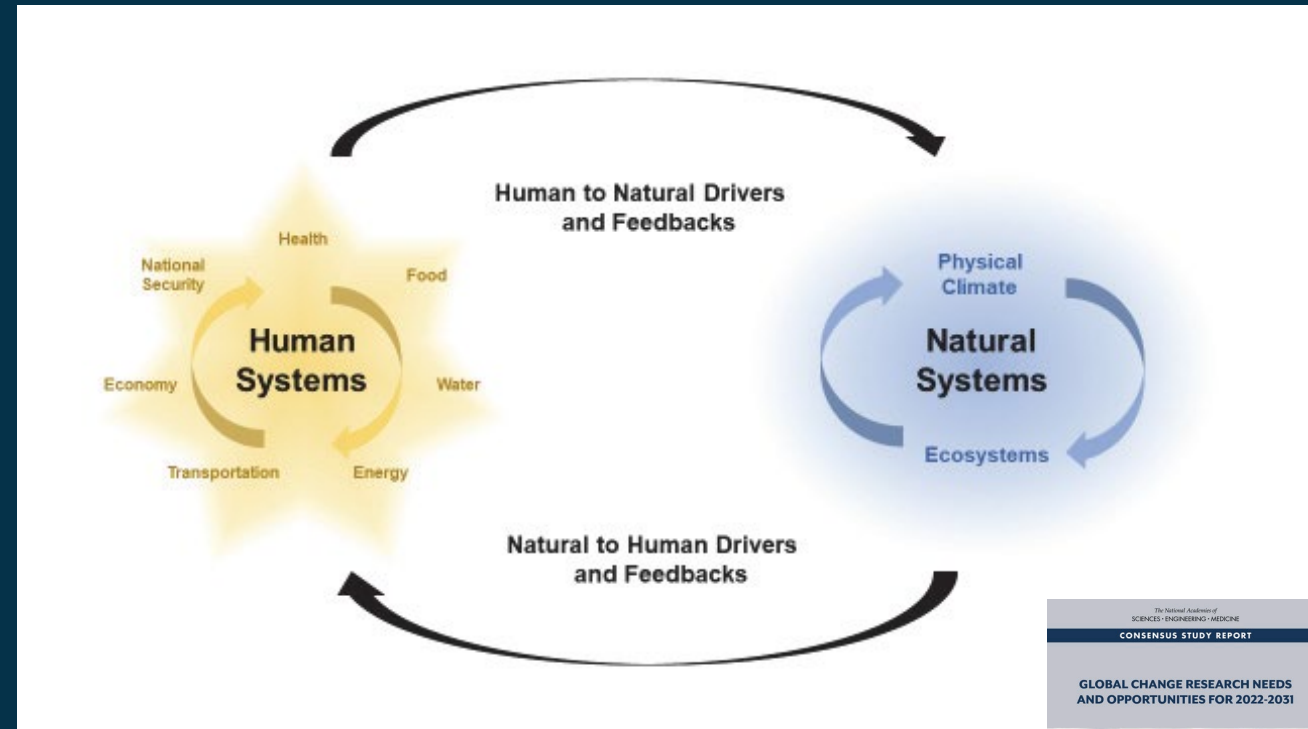
Understanding Human Settlements with free and open data: the GEO Human Planet Initiative

Dr. Thomas Kemper, European Commission, Joint Research Centre

24 May 2022

The GEO Human Planet Initiative (HPI)

- Human and natural systems are closely coupled
- Dynamic integration of human and environmental data is essential
- HPI has focused on using EO to improve mapping and modeling of human settlements, infrastructure, and population – now and in the future – in support of diverse applications



<https://www.nap.edu/catalog/26055/global-change-research-needs-and-opportunities-for-2022-2031>



From HPI Data to Open Knowledge

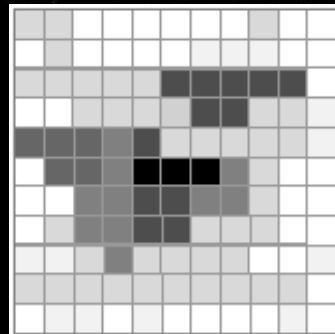
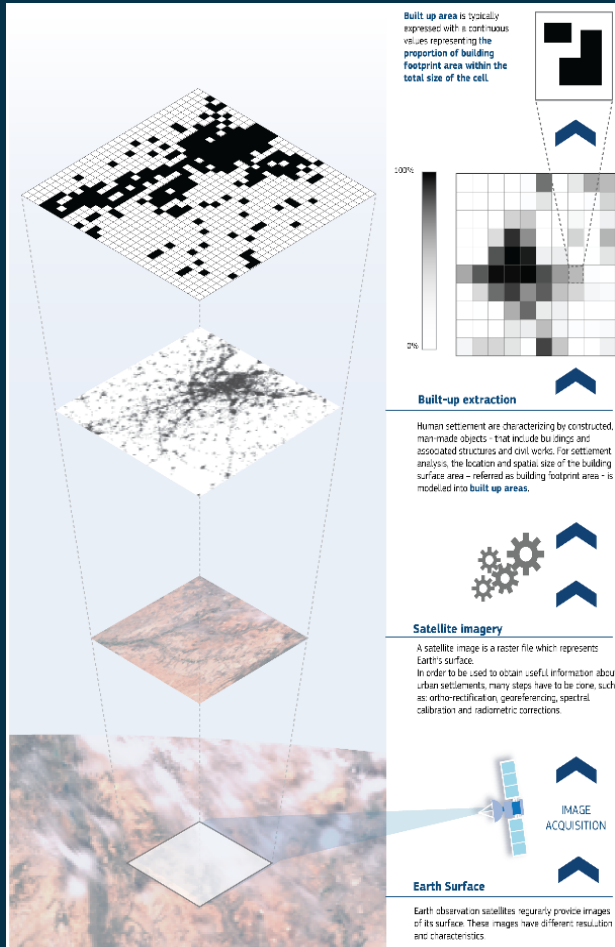
To make decisions, people need specific **data** about who is affected and who can take action.

They need detailed **information** about available data, models, and predictions and their associated uncertainties and limitations.

They need trustworthy **open knowledge** about how both human and environmental systems will evolve and respond over time and across space to complex stresses.

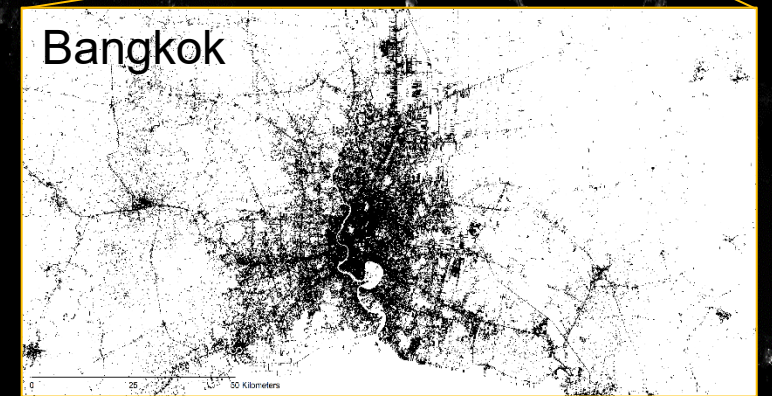
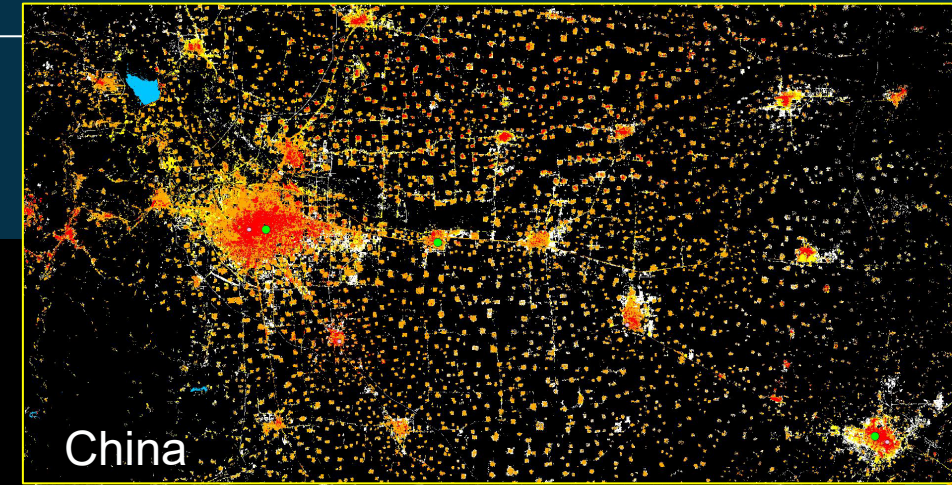


HPI Data: Built Up Areas



Available for period
1975-2030

<https://ghsl.jrc.ec.europa.eu>



HPI Data: Settlement Classification

Satellite imagery

2015
2000
1990
1975

Legend

- Administrative boundaries (Gadm level 3)

The image on the left is a satellite image of the city of Madrid, Spain in 2015. The overlapped administrative boundaries (in blue) show their differences in size and unevenness of borders.

GHS BUILT-UP

Built-up area (resolution 38m)

Built up area is typically expressed with a continuous values representing the proportion of building footprint area within the total size of the cell.

The value of the cells in this area are significantly different, from 0 to 98.

100%
0%

GHS POP

Population grids (resolution 250m)

In the population grid, grid cell value represents the number of inhabitants.

In this specific area, the number of inhabitants varies from 3 to about 12,000 per sqKm.

max
min

GHS S-MOD

Settlement Model (resolution 1Km)

The GHS S-MOD aims at classifying human settlements according to certain rules of population and built-up density and contiguity of grid cells.

In the example on the left, the urban centre of Madrid, with relative urban clusters and rural settlements.

Settlement classification

- No data
- Rural
- Urban Cluster
- Urban Centre

Pop. % change 1975-2015

- < -5
- 4.9 - 5
- 5.1 - 50
- 50.1 - 100
- > 100

Degree of urbanisation (3%) and national defined urban areas, 2015

Country	Share of population, in %
Sri Lanka	~35
Nepal	~25
Afghanistan	~45
Tajikistan	~80
India	~55
Bangladesh	~55
Kyrgyzstan	~35
Pakistan	~45
Maldives	~55
Bhutan	~20
Uzbekistan	~75
Azerbaijan	~70
Kazakhstan	~75
Armenia	~75
Iran	~85

Degree of Urbanisation – a harmonised definition of cities, urban & rural areas

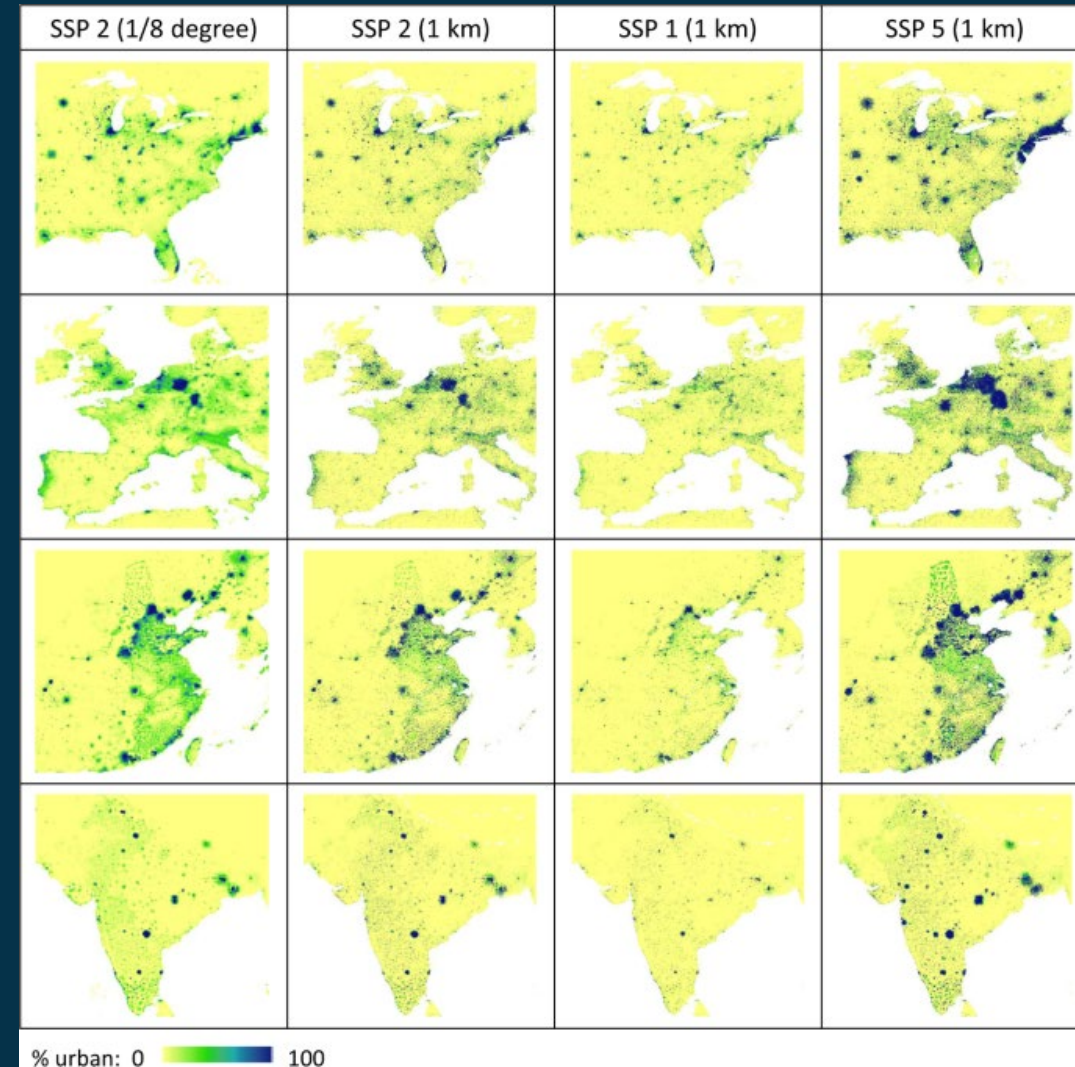
HPI Information: Future Urban Land Scenarios

Global 1-km Downscaled Urban Land Extent Projection and Base Year Grids by SSP Scenarios, v1 (2000–2100)

Global spatial urban land fraction data consistent with the Shared Socioeconomic Pathways (SSPs) 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. *Scientific Data* 8(1): 281. <https://doi.org/10.1038/s41597-021-01052-0>.



HPI Information: Comparing Population Data

There are now a variety of sources of gridded population data, based on different data sources and models of population distribution

Users often don't know which data products are appropriate for their application, and what uncertainties exist in available estimates

SEDAC's POPGRID Viewer facilitates intercomparison of data for user-defined areas of interest

The screenshot displays the POPGRID Viewer interface. On the left, there are controls for 'Get Population Estimates' (Shapefile, Rectangle / Polygon), 'Population Data' (GPWv4.11 UN Adjusted 2020 Count), and a legend for population density. The main area shows a 'Results' window with a bar chart titled 'Population Estimates by Data Set and Year' and a table below it. The bar chart compares population estimates for various sources in 2015 and 2020. The table provides the exact values for each source.

Source	Population Estimates
GHSL 2015	1,168,070
GPWv4 2015	1,167,638
LandScan 2015	543,416
WorldPop 2015	1,175,809
HRSL 2015	1,165,745
ESRI WPE 2016	854,999
LandScan 2018	586,270
GPWv4 2020	1,270,014
WorldPop 2020	1,336,866

Data Quality Message(s):

- The average national WPE reliability ranking is 2
- HRSL has coverage
- The average size of national input units in GPW is 1588 square kilometers

<https://sedac.ciesin.columbia.edu/mapping/popgrid/>

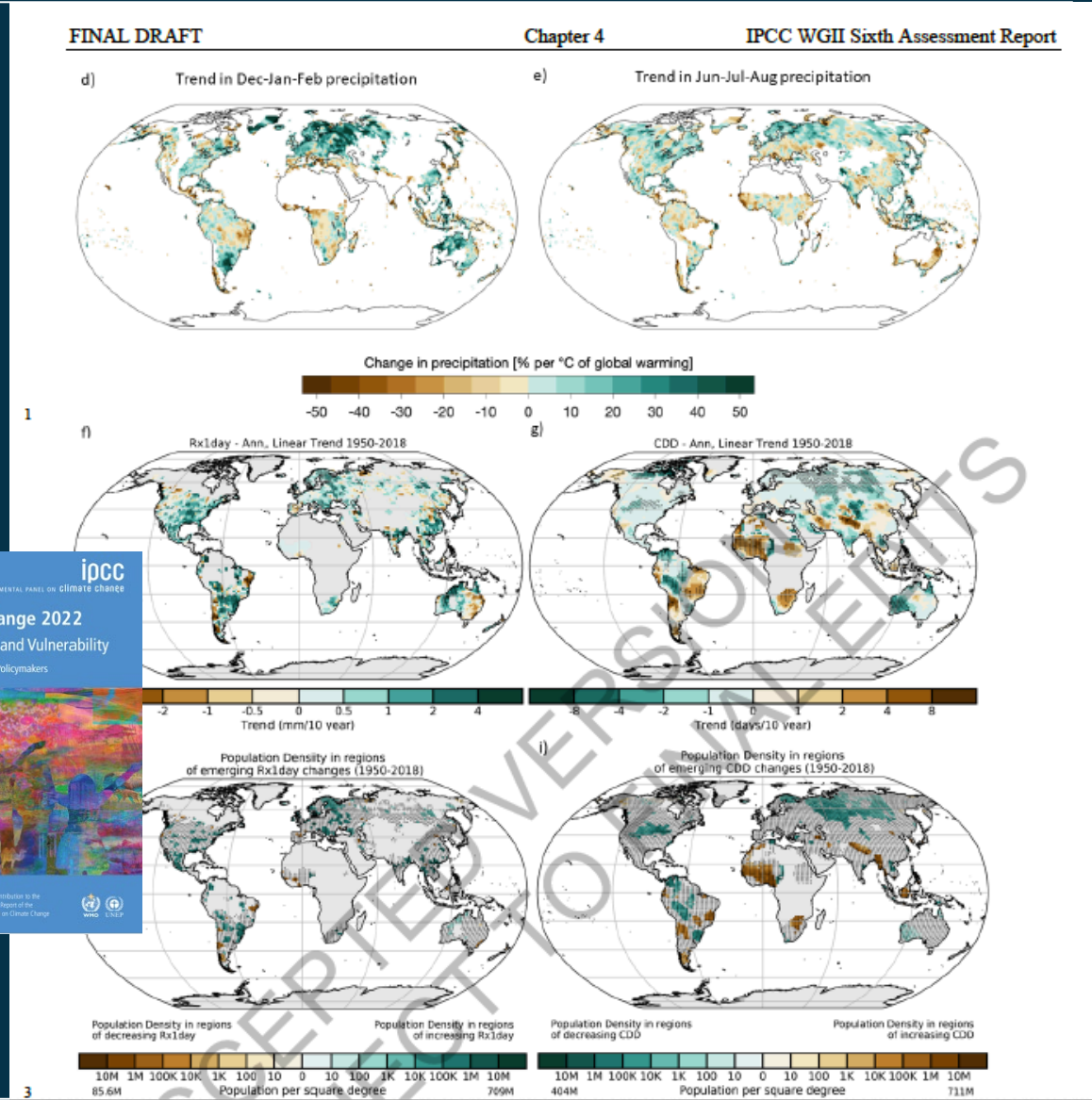
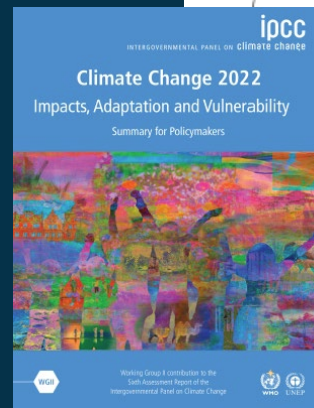
HPI Open Knowledge Examples

*IPCC 6th Assessment Report, WG II
Climate Change 2022: Impacts,
Adaptation and Vulnerability*

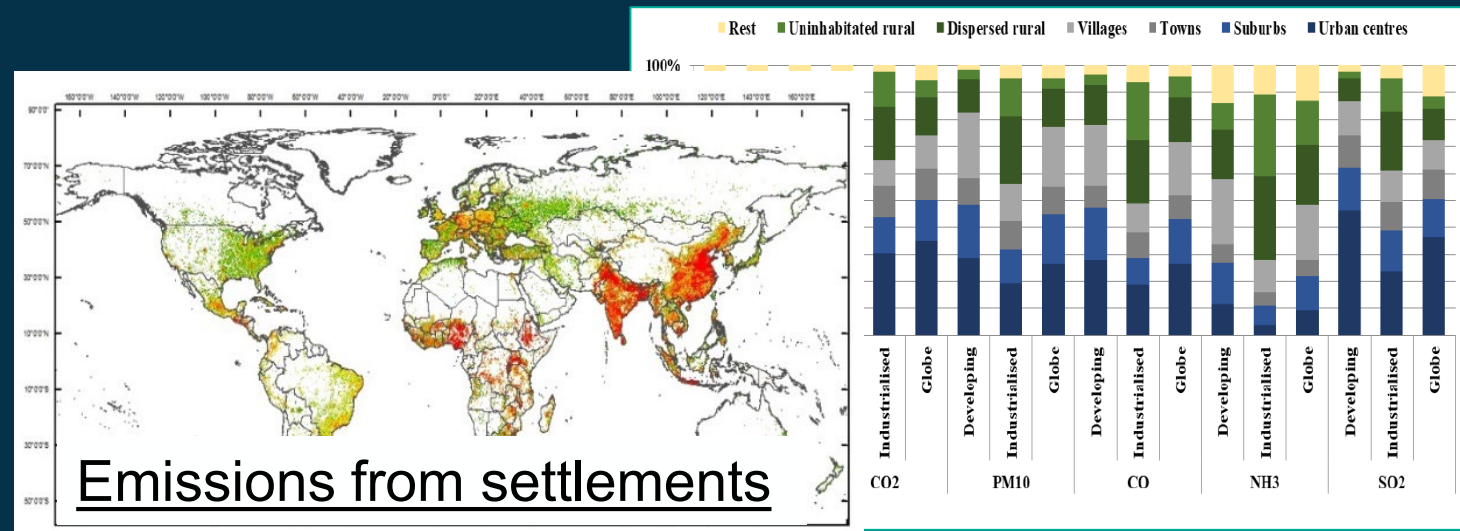
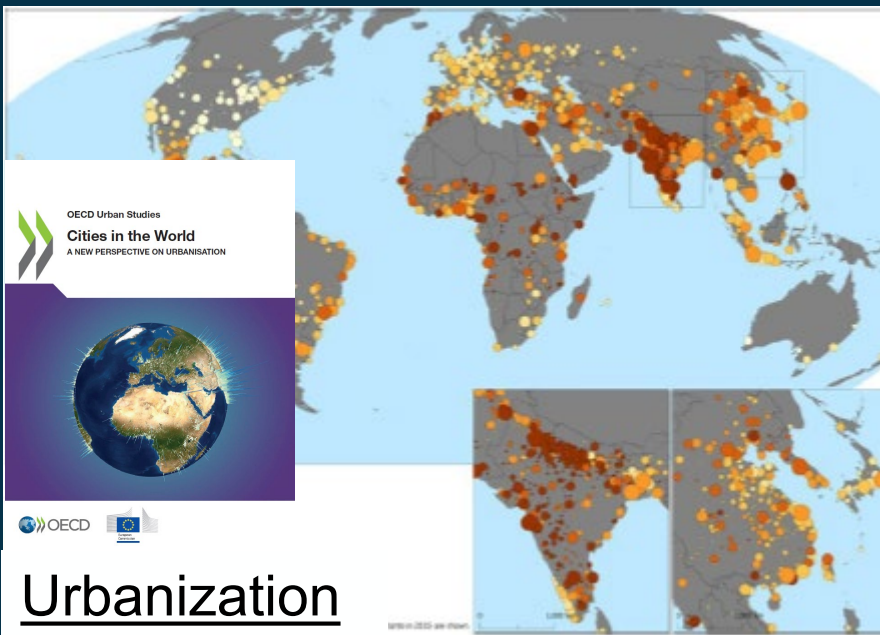
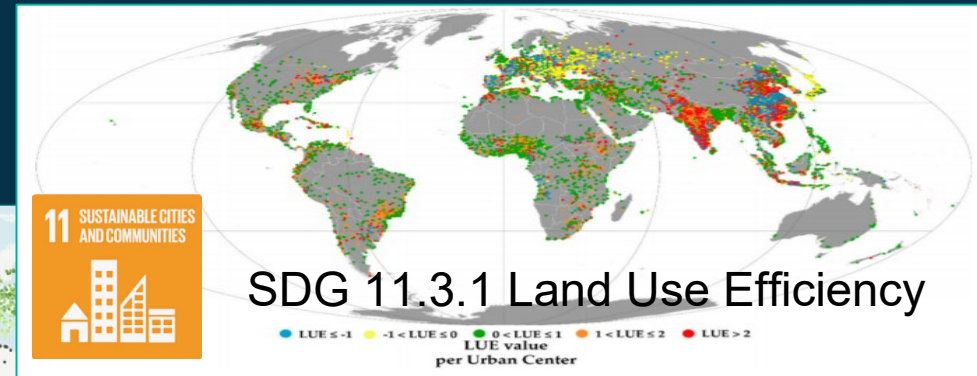
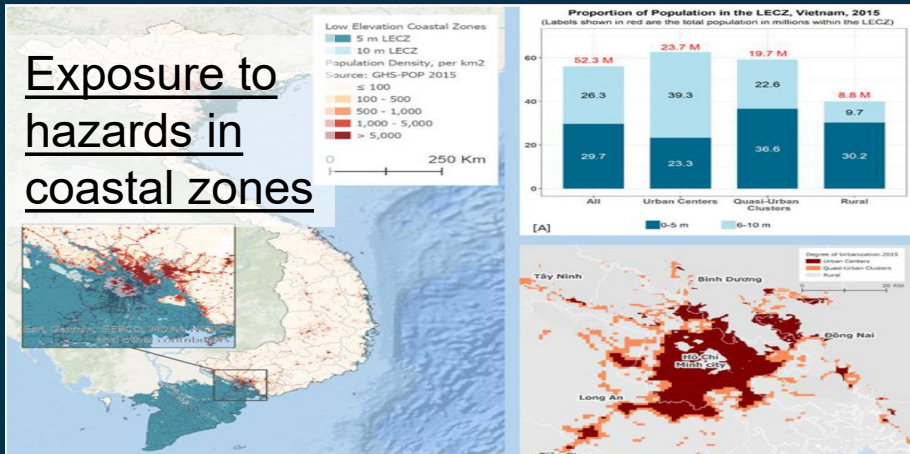
Figure 4.3, “Observed mean and extreme precipitation, and people experiencing the emergence of historically unfamiliar precipitation and changes in extreme precipitation”

- Based in part on SEDAC’s Gridded Population of the World (GPW) data

https://ipcc-data.org/data_catalogue.html



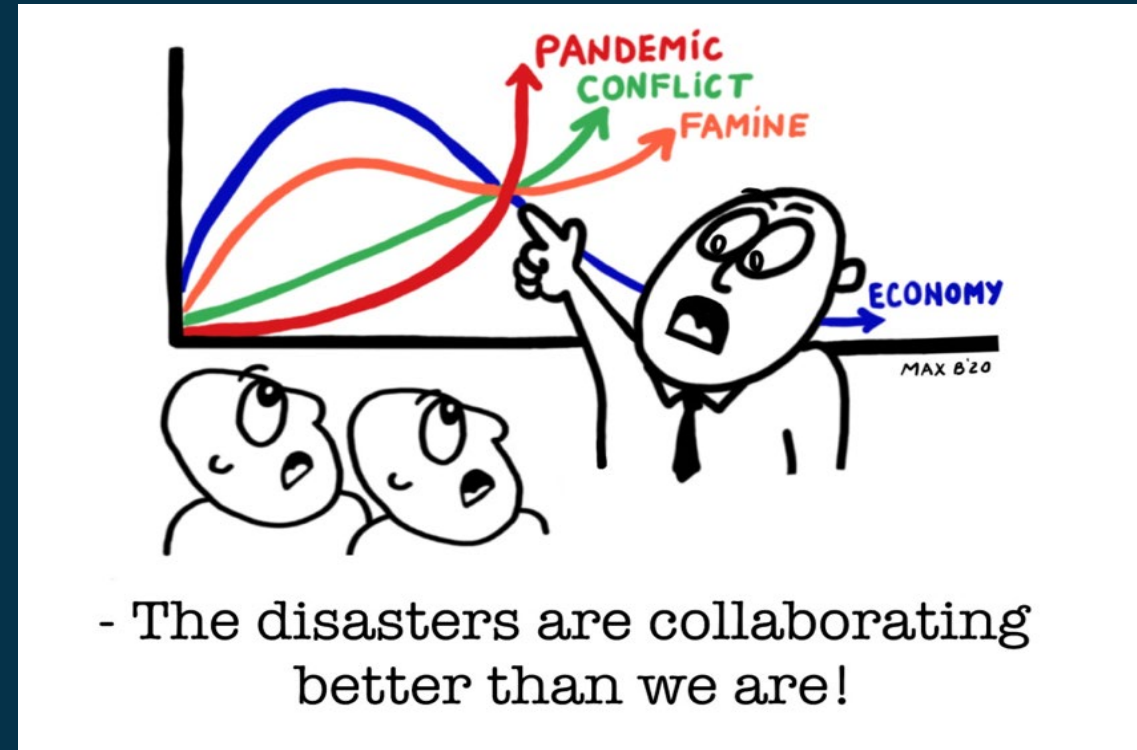
HPI Open Knowledge Examples



- Open knowledge → HPI data are open and reproducible, HPI provides both the products and the tools to re-create those products (whenever possible).
- Challenges → Societal challenges focus on understanding human processes and the interplay with natural processes. Socio and demographic variables are difficult to get and HPI contributes to fill data gaps.
- Benefits → HPI products focus on socio and demographic variables that are “essential” to address current local and global challenges. Variables can be used by other GEO projects to address GEO engagement priorities.
- Engagement → HPI needs to obtain feedback and use cases from practitioners and policy makers on how to make HPI data, information, and knowledge more useful, usable, and timely.

HPI Plans: Building on the GKH

- Expand the range of HPI Knowledge packages to encompass more diverse topics and application areas
- Engage the HPI community more directly in using the GKH as an open knowledge resource for building visibility and interlinkages
- Facilitate integration of HPI data, tools, and services with those of other GEO initiatives, flagships, and regional initiatives via the GKH and other interfaces such as the EO4SDGs Urban Toolkit and the DRR WG risk portal



Paul Bisca: <https://twitter.com/pmbisca?lang=en>