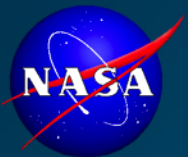


Integrating Diverse Data on Hazards, Exposure, Vulnerability and Impacts

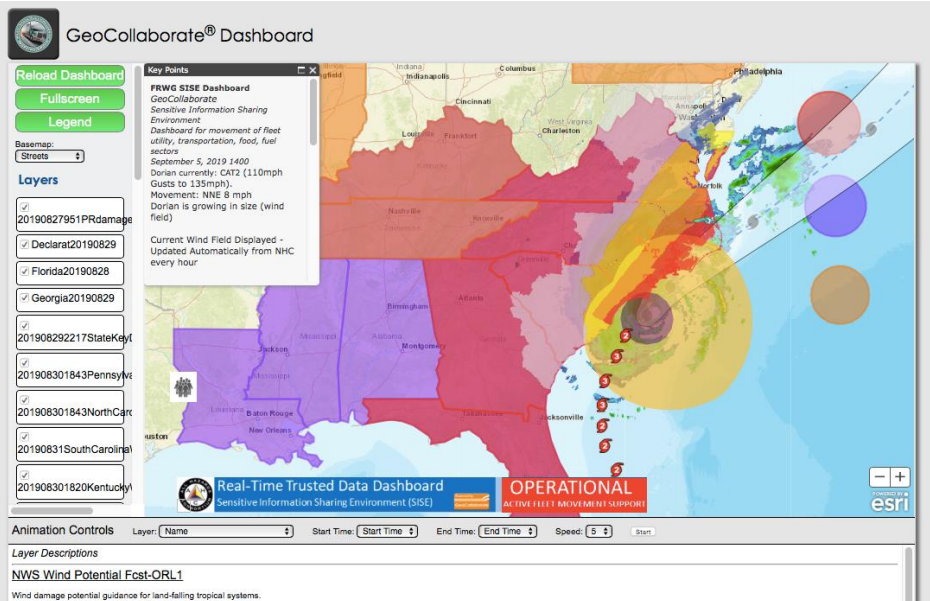
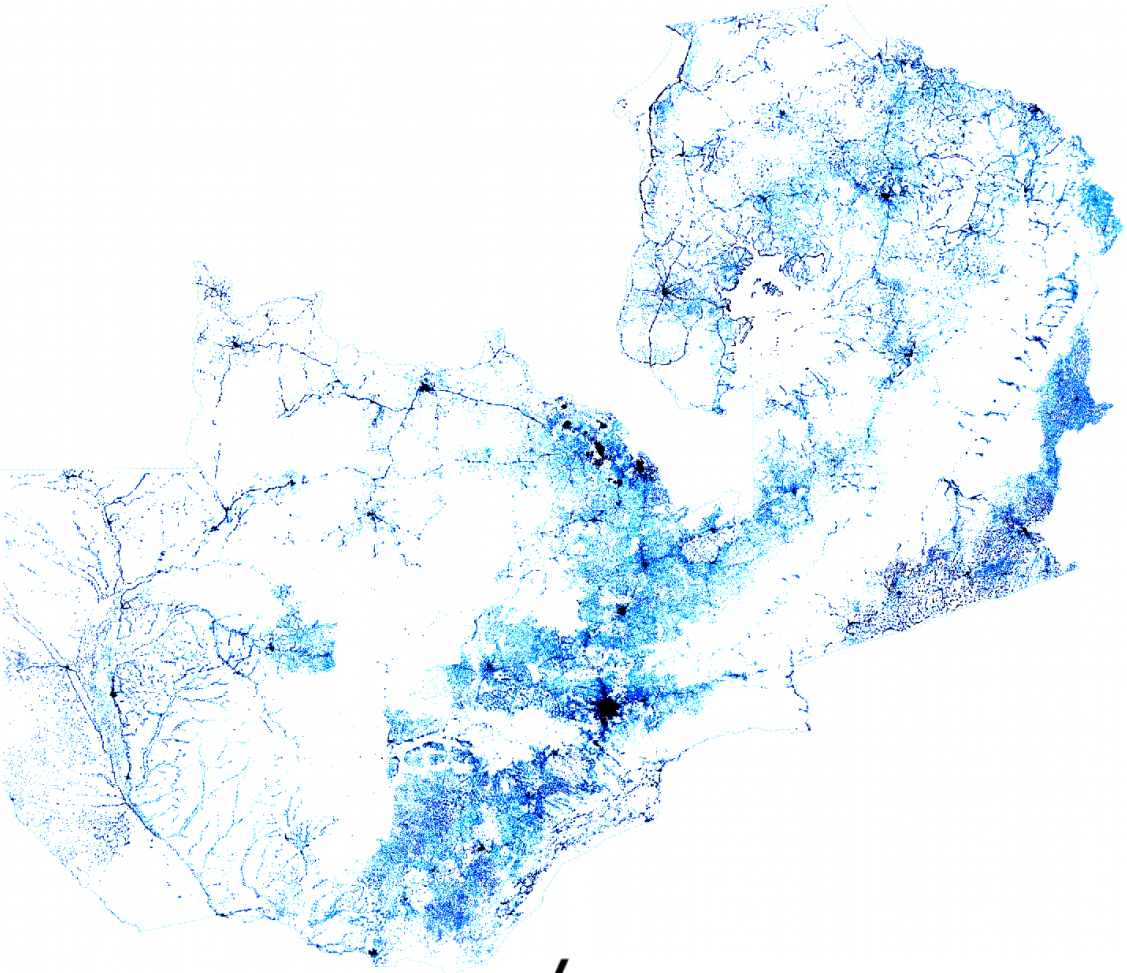
Robert S. Chen

Director, CIESIN, The Earth Institute, Columbia University
Manager, NASA Socioeconomic Data and Applications Center (SEDAC)
Co-chair, UN SDSN Thematic Research Network on Data and Statistics

TRENDS

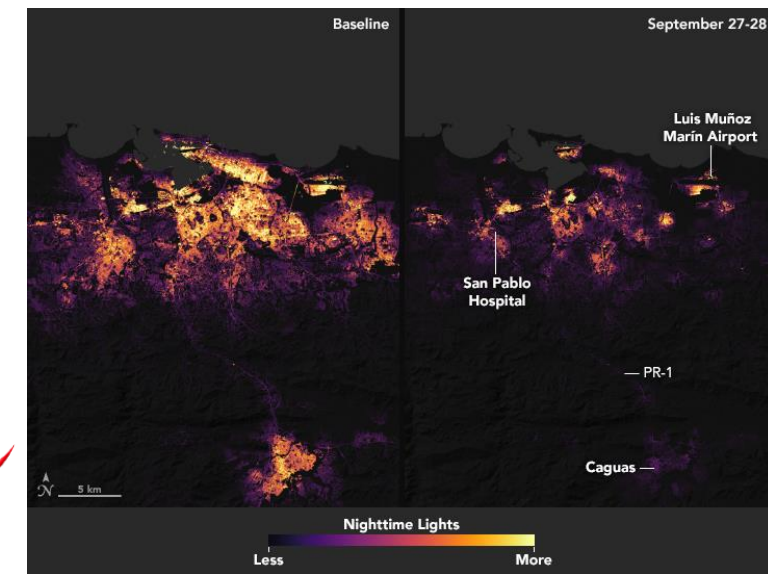
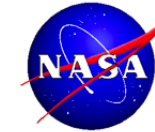
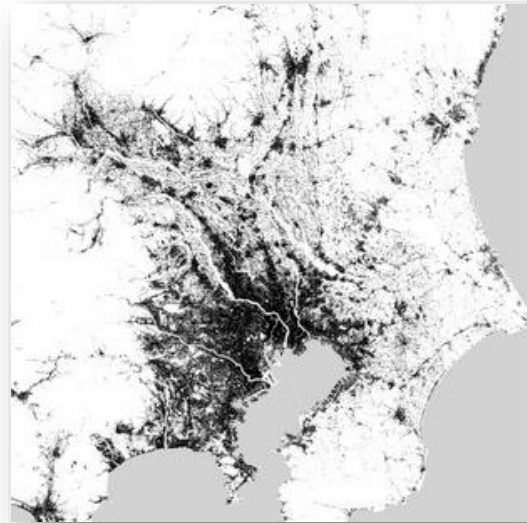


Georeferenced Population Data Are Critical to Understanding Exposure and Vulnerability to Hazards



Improve mapping of population, settlements, infrastructure, movement, etc.

- Night-time lights (DMSP > 1 km → VIIRS ~750m)
- Landsat (~30 m)
- Radar (~12 m)
- High resolution imagery (< ~3m resolution)



<https://earthobservatory.nasa.gov/images/91044/pinpointing-where-the-lights-went-out-in-puerto-rico>



<https://urban-tep.eo.esa.int/#!pages/dataservices>



<http://ghslsys.jrc.ec.europa.eu/index.php>

internet.org by facebook

<https://data.humdata.org/organization/facebook>



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POPGRID: A “Data Collaborative” for Settlement, Infrastructure, and Population Data

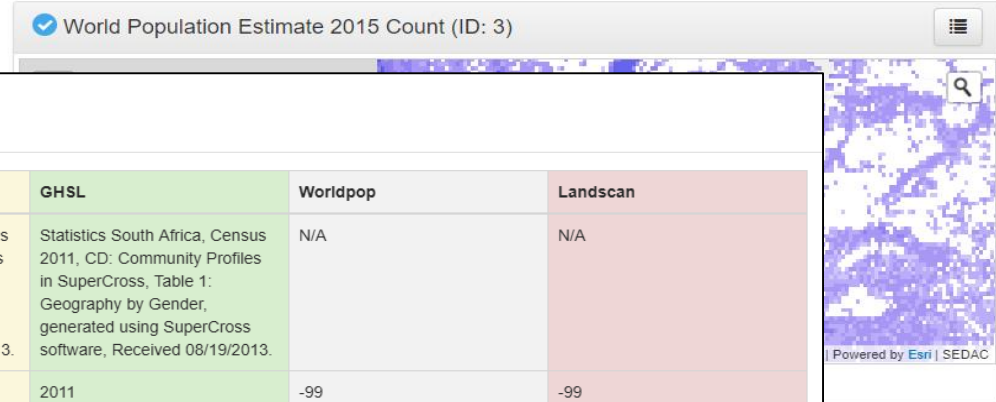
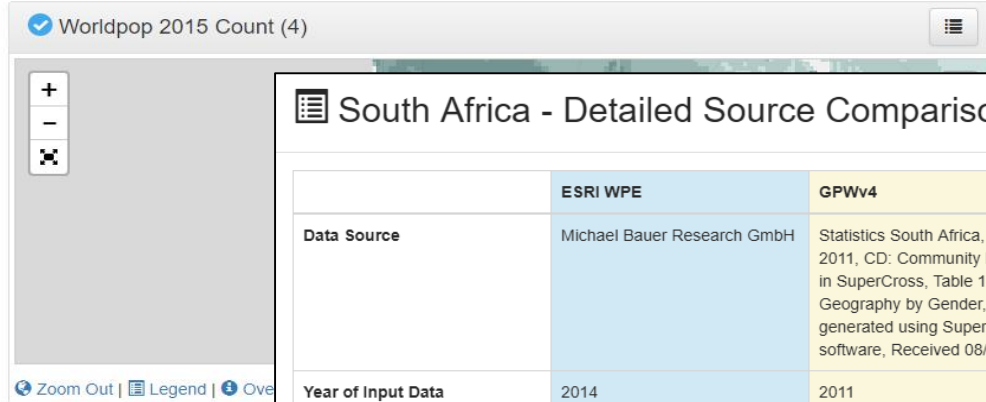
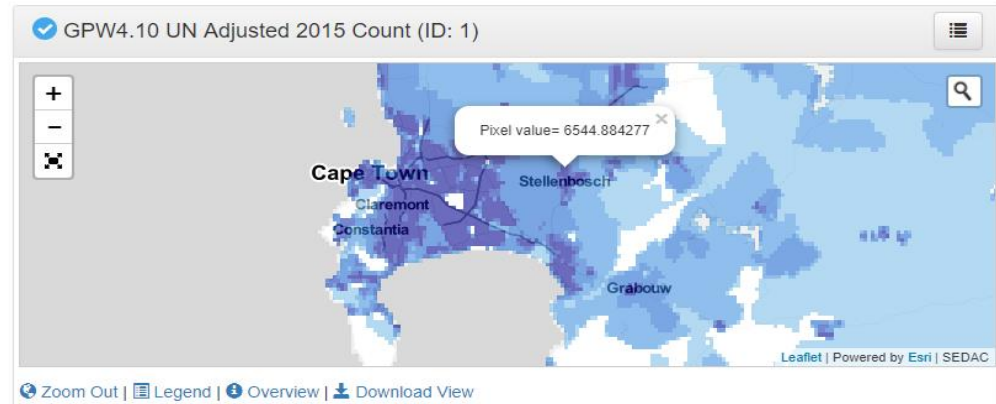
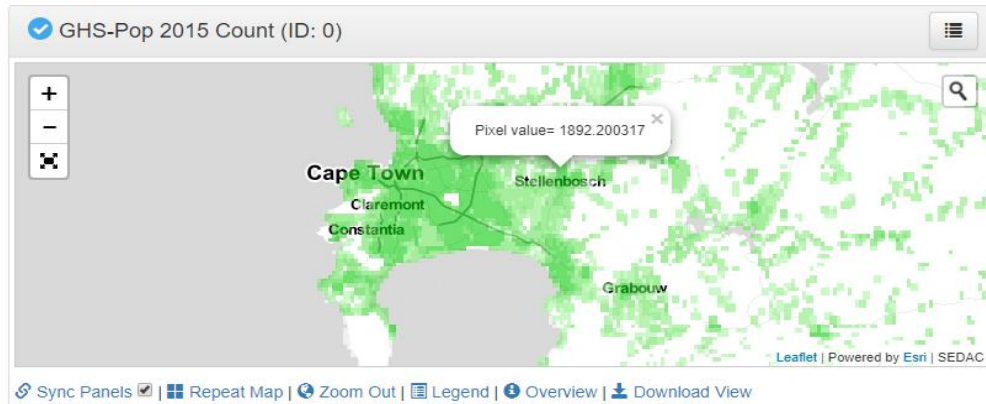
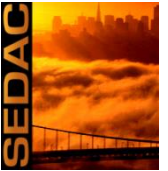
- ▶ *Public–private data partnership involving intergovernmental organizations, national & academic research institutions, large and small companies, NGOs, foundations, universities, data stewards, etc.*

- ▶ [HTTPS://POPGRID.ORG](https://popgrid.org)





POPGRID Viewer



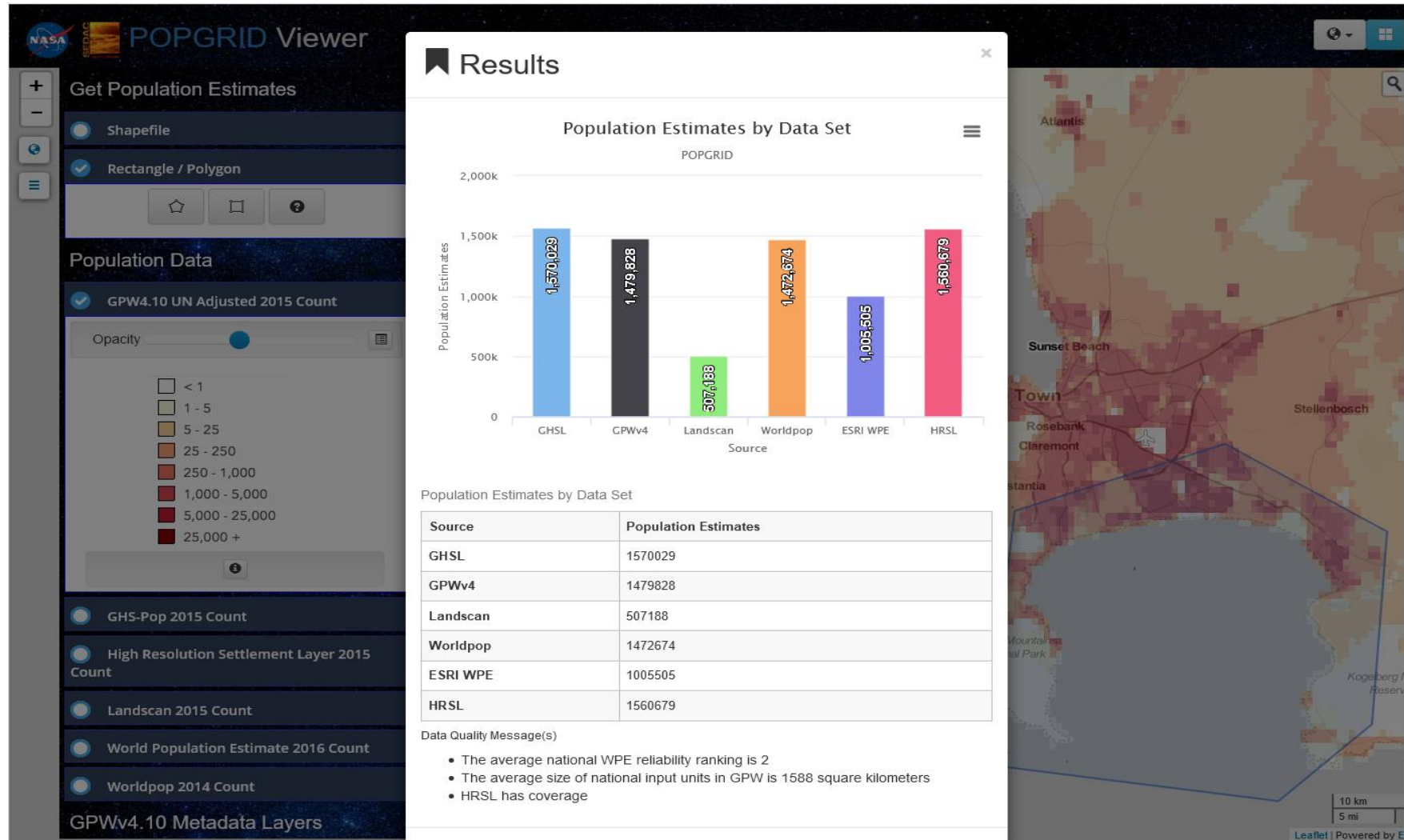
South Africa - Detailed Source Comparison

	ESRI WPE	GPWv4	GHS-L	Worldpop	Landscan
Data Source	Michael Bauer Research GmbH	Statistics South Africa, Census 2011, CD: Community Profiles in SuperCross, Table 1: Geography by Gender, generated using SuperCross software, Received 08/19/2013.	Statistics South Africa, Census 2011, CD: Community Profiles in SuperCross, Table 1: Geography by Gender, generated using SuperCross software, Received 08/19/2013.	N/A	N/A
Year of Input Data	2014	2011	2011	-99	-99
Input Feature Count	234	86983		-99	-99
Year of Last Census	2014-MBR-est	2011	2011	-99	-99

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



POPGRID Viewer



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

Review Article Just Published

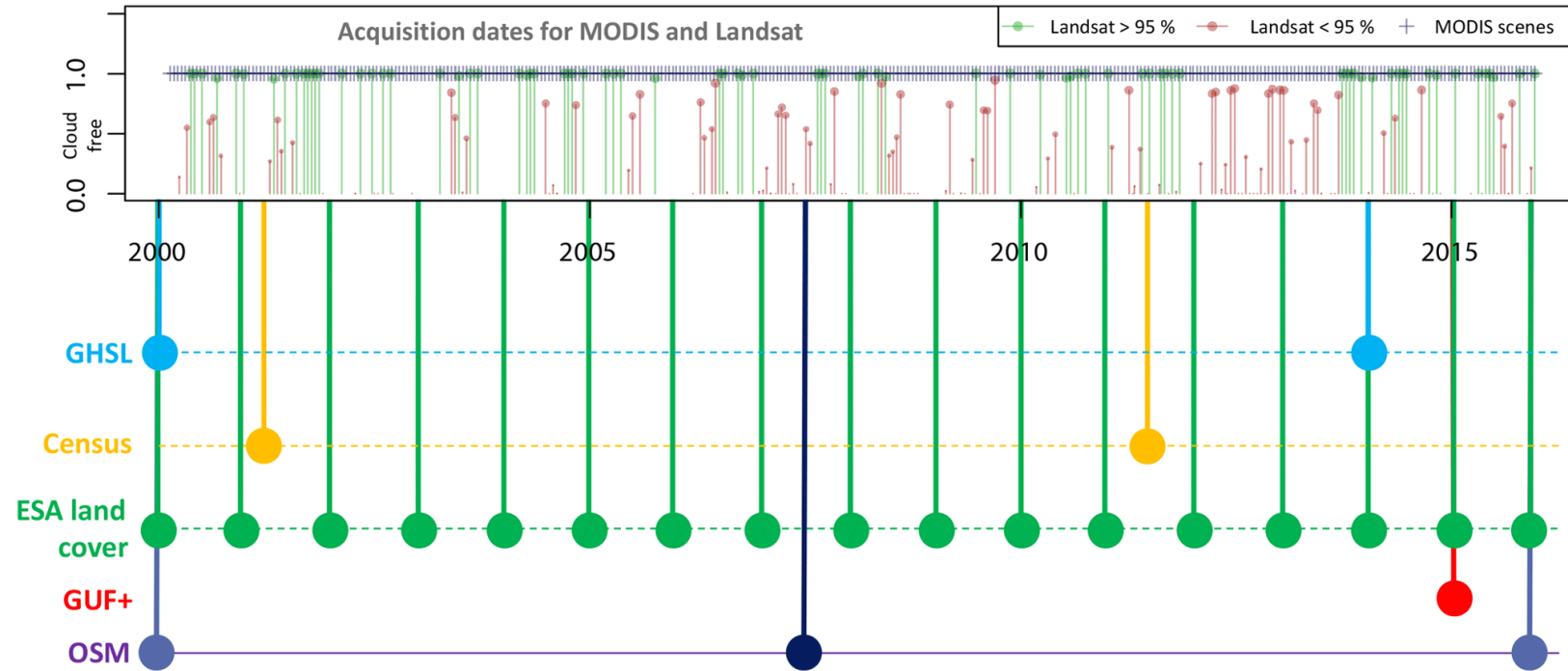


Figure 2. Identification of different ancillary data that inform spatial and temporal interpolation approaches to create gridded population data across scales of interest.



Review article

The spatial allocation of population: a review of large-scale gridded population data products and their fitness for use. S. Leyk *et al.* *Earth Syst. Sci. Data*, 11, 1385–1409, 2019

<https://doi.org/10.5194/esd-11-1385-2019>

PERN Cyberseminar on Application of Gridded Population and Settlement Products in Geospatial Population–Environment Research

14-18 October 2019

Moderator

- ▶ Andrea Gaughan, University of Louisville

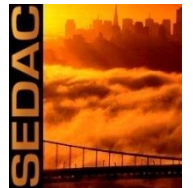
Invited Experts

- ▶ Maria Jose Andrade-Nuñez, University of Puerto Rico-Rio Piedras
- ▶ Brian Blankespoor, World Bank
- ▶ Sergio Freire, European Commission's Joint Research Centre (JRC)
- ▶ Stefan Leyk, University of Colorado Boulder
- ▶ Catherine Linard, University of Namur
- ▶ Alessandro Sorichetta, University of Southampton
- ▶ Cascade Tulholske, University of California Santa Barbara

<https://www.populationenvironmentresearch.org/cyberseminars>



futurearth



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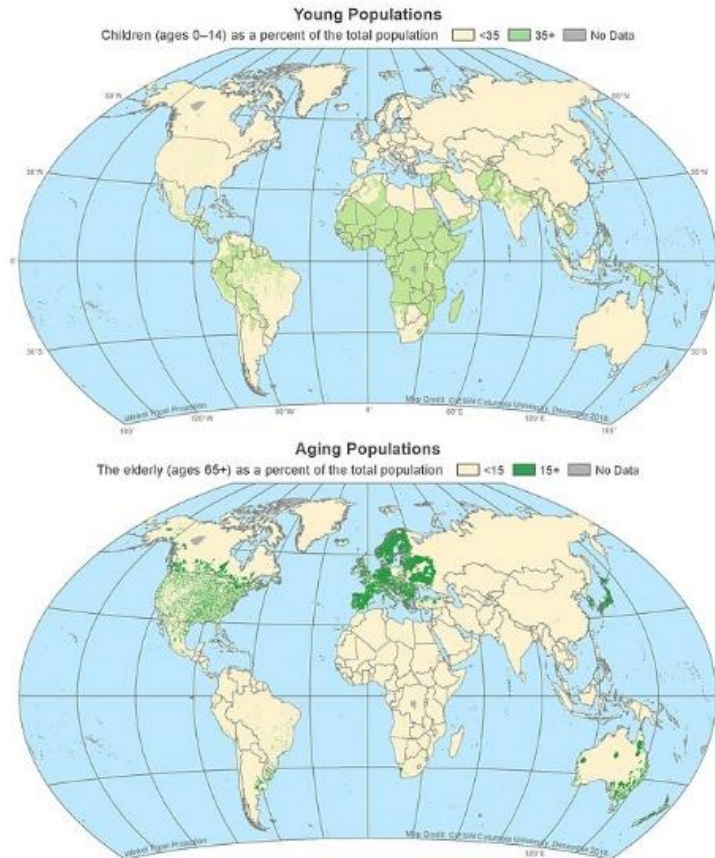


GPW version 4.11 Demographic Estimates Available through Population Estimation Service version 3



Basic Demographic Characteristics, v4.11, 2010: Young and Aging Populations

Gridded Population of the World, Version 4 (GPWv4)

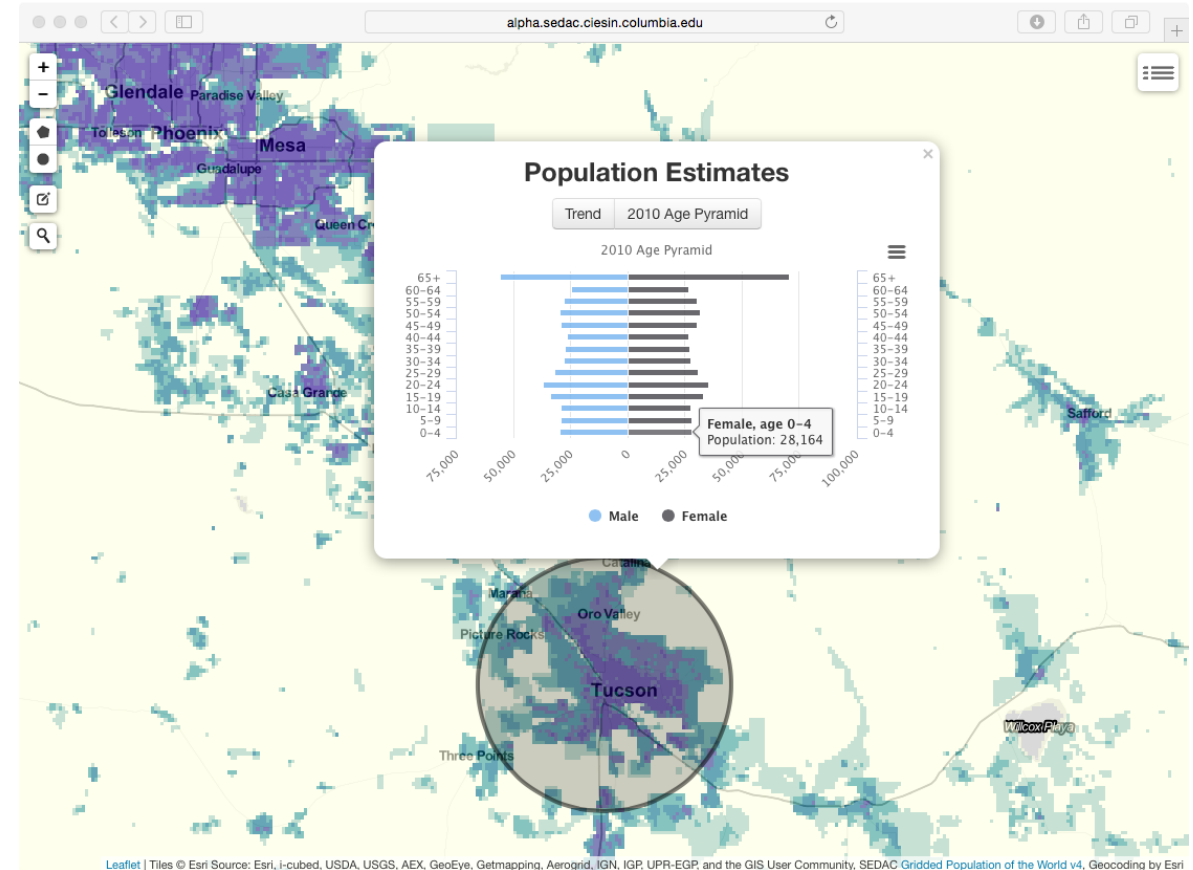


Gridded Population of the World, Version 4 (GPWv4) Basic Demographic Characteristics, Revision 11 consists of estimates of human population by age and sex consistent with national censuses and population registers for the year 2010. Young and aging populations refer to populations which have a greater proportion of young or old individuals, respectively. A young population has 30-35% or more of its population under age 15, while an aging population has 10-15% or more of its population over age 65 (parp.iussp.org, 101-S03).

Data Source: Center for International Earth Science Information Network - CIESIN - Columbia University, 2018.
Gridded Population of the World, Version 4 (GPWv4) Basic Demographic Characteristics, Revision 11, Palisades, NY:
NASA Socioeconomic Data and Applications Center (SEDAC), <https://info.org/10.7927/H46M34XX>,
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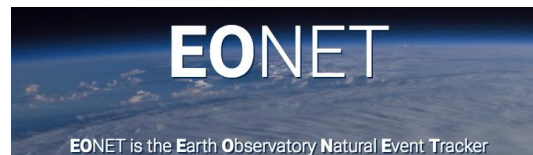
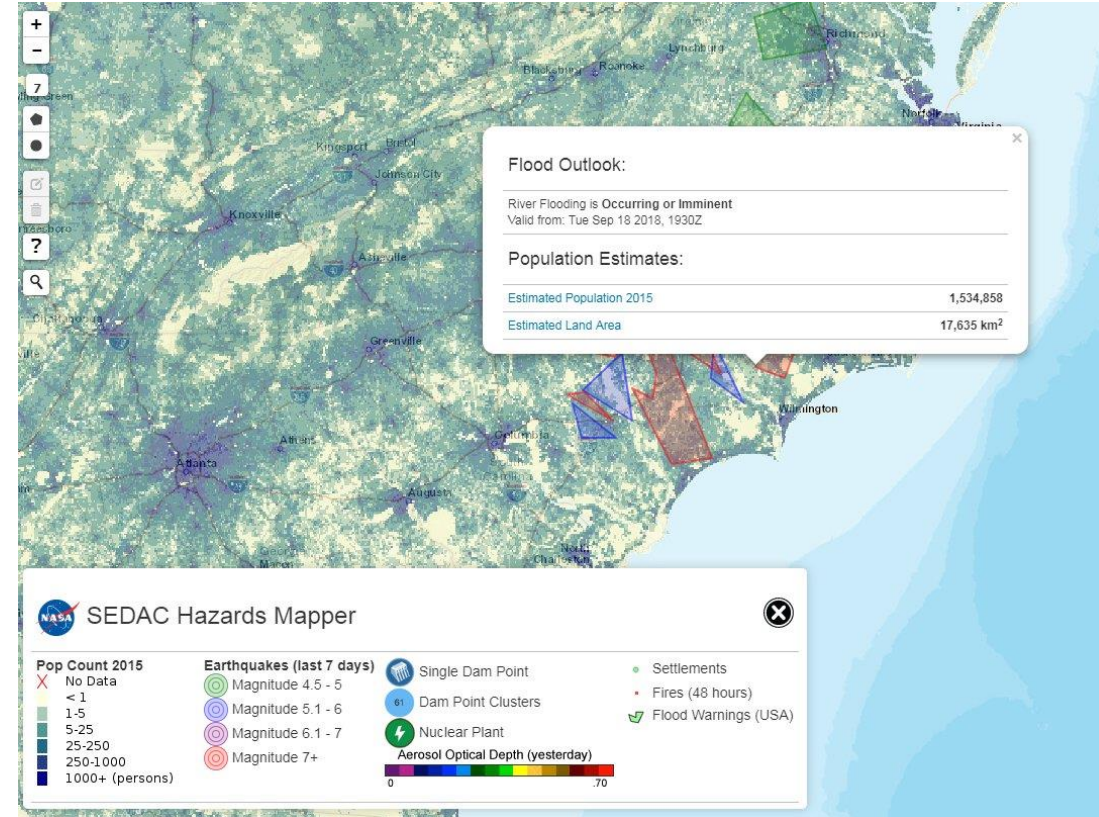
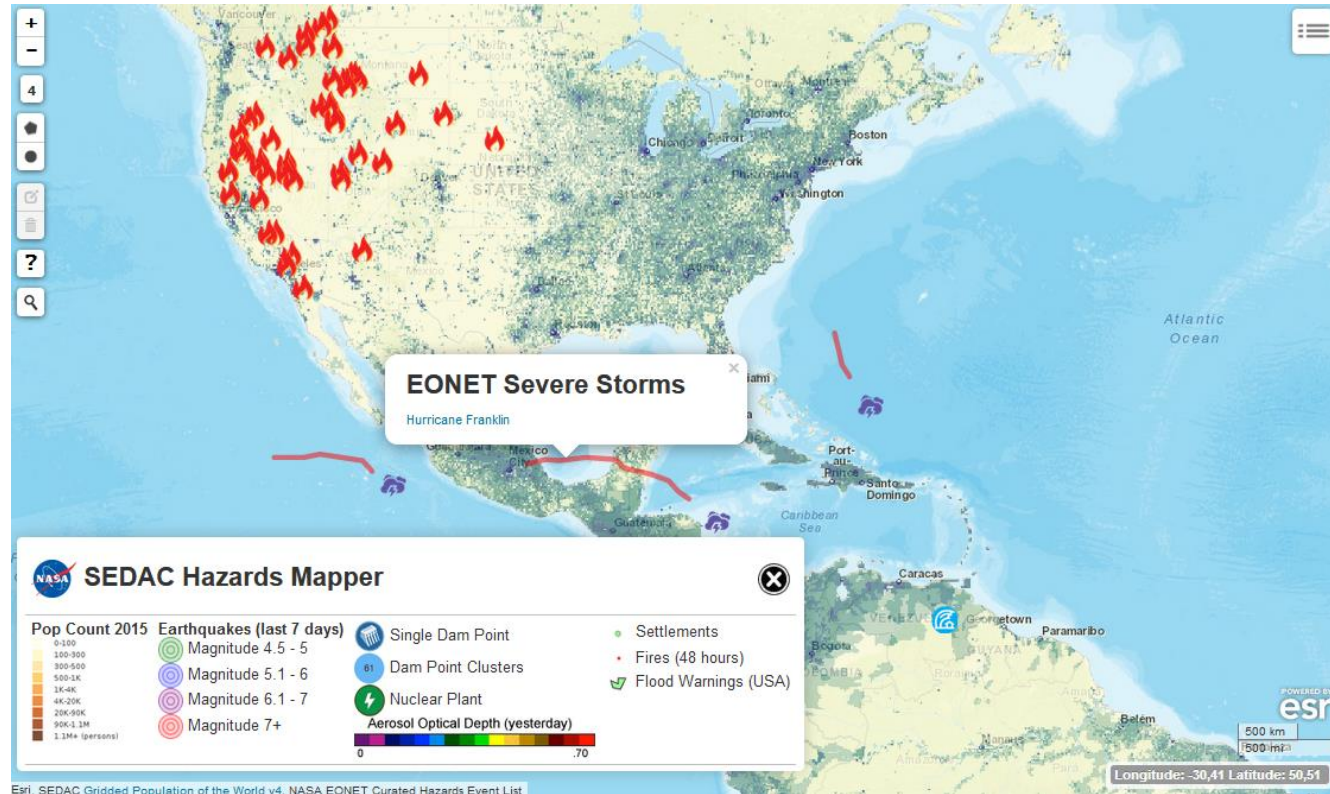
Population Estimation Service version 3

<http://sedac.ciesin.columbia.edu/mapping/poest/pes-v3/>

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SEDAC Hazards Mapper: Past and Projected Events

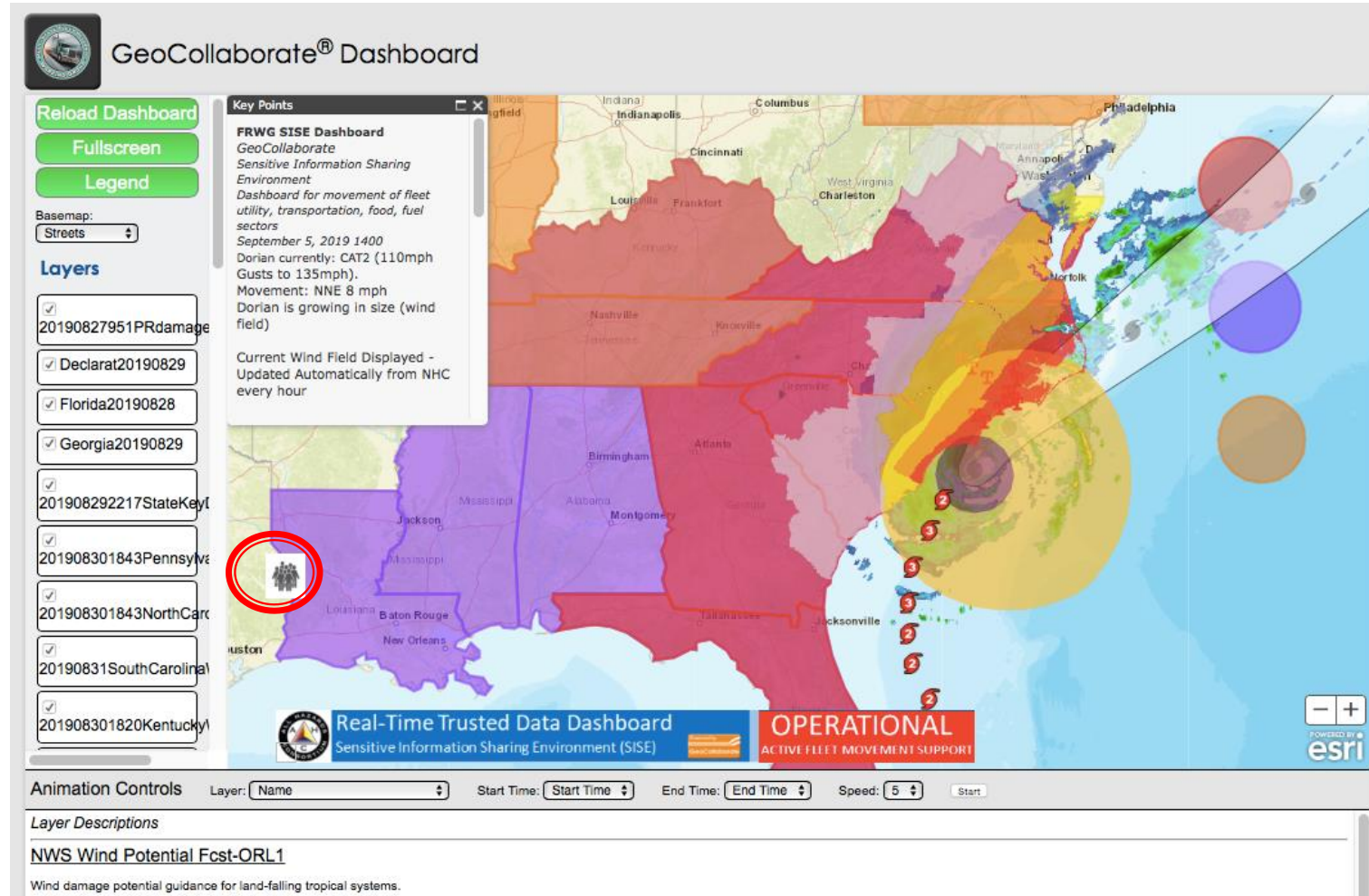


SEDAC Hazards Mapper
<http://sedac.ciesin.columbia.edu/mapping/hazards>

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GeoCollaborate Daily Dashboard

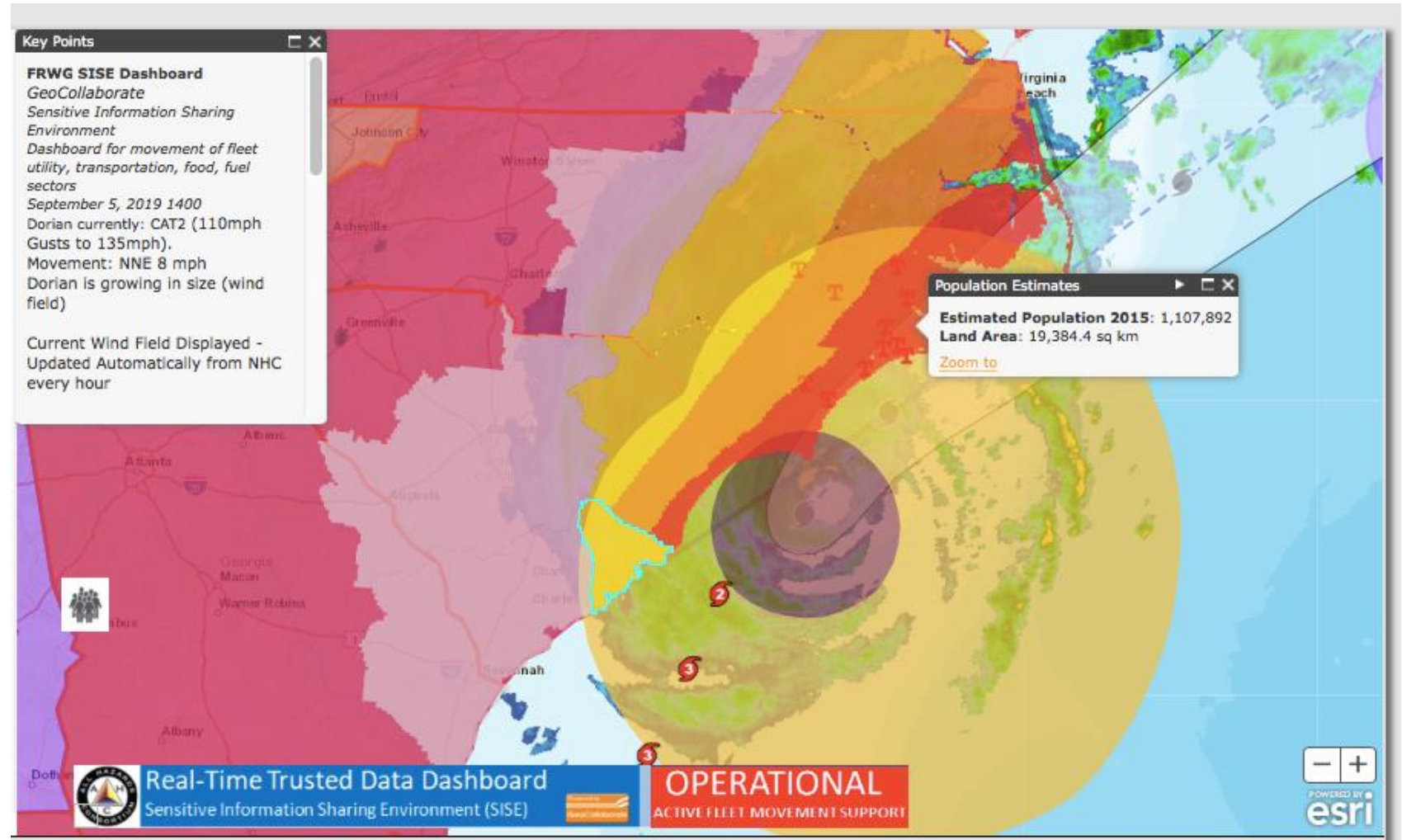
- ▶ Online situational awareness/data sharing environment developed by StormCenter Communications, Inc.
- ▶ Adopted by Fleet Response Working Group of the All Hazards Consortium beginning in 2016
- ▶ Provides RT/NRT data feeds from variety of sources
- ▶ Has Leader/follower capability to facilitate coordination sessions
- ▶ Accesses SEDAC Population Estimation Service to provide custom population estimates



<https://frwg.geocollaborate.com/dashboard/>

GeoCollaborate Population Estimates

- ▶ User draws polygon or circle to identify area of interest
- ▶ Query is submitted to SEDAC Population Estimation Service (PES)
- ▶ Population estimates for 2010-2020 returned

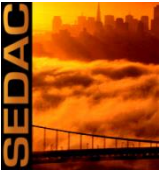


<https://frwg.geocollaborate.com/dashboard/>

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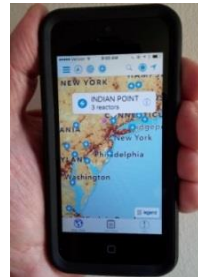


HazPop Mobile App for iOS and Android



- ▶ **Android version of HazPop mobile app** released in July via Google Play Store
 - Runs on Android tablets and phones
 - Offers most of the functions of the iOS version
- ▶ **Version 2.0 of the iOS version of HazPop mobile app** released in August. Updates in the new version include:
 - Population estimation now based on version 3.0 of the SEDAC Population Estimation Service (PES v3), which uses the latest Population Count data set from SEDAC's Gridded Population of the World (GPW) data collection, version 4.11.
 - Users may display a chart showing estimated population trends in 5-year intervals from 2000 to 2020.

<https://apps.apple.com/us/app/hazards-population-mapper/id1092168898>



Hazards and Population Mapper

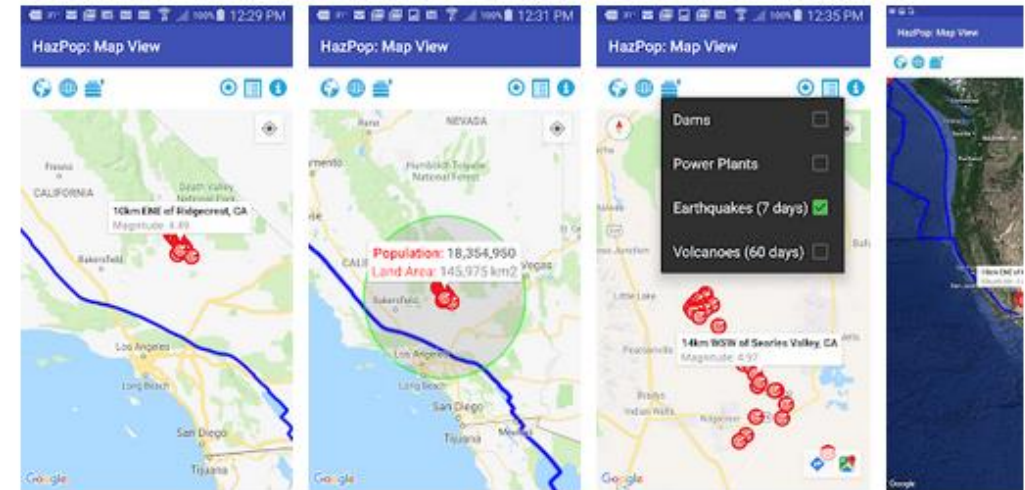
NASA Books & Reference

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Spatial Economic and Infant Mortality Data



Global Gridded Geographically Based Economic Data (G-Econ), Version 4, GDP in PPP (2005)

Spatial Economic Data



The Global Gridded Geographically Based Economic Data (G-Econ), Version 4 is part of the Spatial Economic Data Collection. The data derived from the Yale G-Econ project provides gridded economic data of Gross Domestic Product (GDP) in Purchasing Power Parity (PPP) at a spatial resolution of one degree for the years 1990, 1995, 2000, and 2005. The PPP is the exchange rate between a country's currency and U.S. dollars adjusted to reflect the actual cost in U.S. dollars of purchasing a standardized market basket of goods in that country using the country's currency. This map displays GDP in PPP where each grid cell represents billions of U.S. dollars for the year 2005.

U.S. Dollars (Billions)

No Data	0.156–0.469	4.693–9.387
< 0.016	0.469–0.939	9.387–15.644
0.016–0.023	0.939–1.564	15.644–1,564.419
0.023–0.156	1.564–4.693	

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Data Source: Nordhaus, W.D. and X. Chen: 2016, Global Gridded Geographically Based Economic Data (G-Econ), Version 4, Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). <http://dx.doi.org/10.7927/H42V2D1C>.

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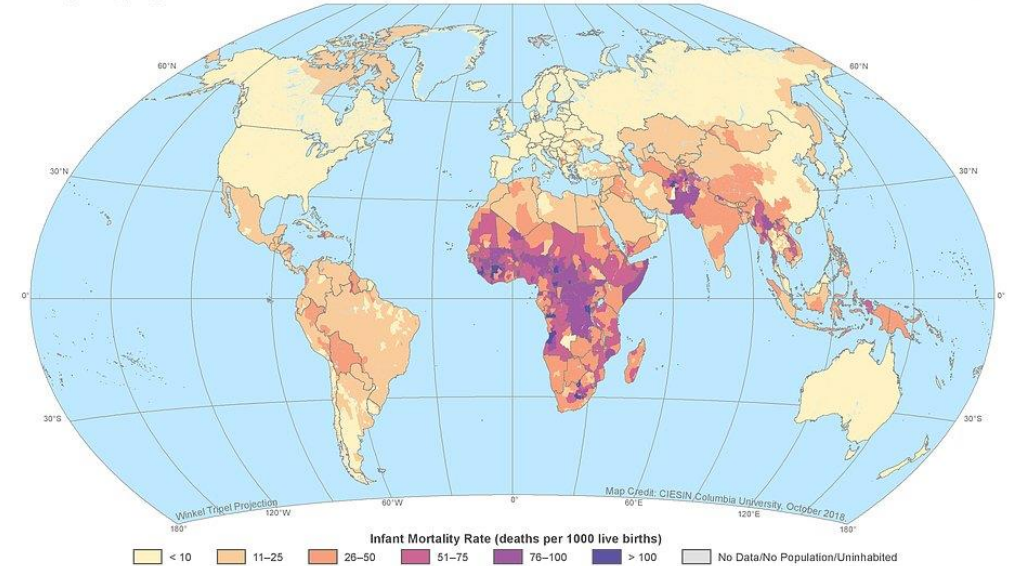


<https://sedac.ciesin.columbia.edu/data/set/spatialecon-gecon-v4>

Global Subnational Infant Mortality Rates, Version 2

Poverty Mapping

2015



Global Subnational Infant Mortality Rates, Version 2 is part of the Poverty Mapping collection. This map displays infant mortality rate (IMR) estimates for 234 countries and territories, 143 of which include subnational units, at a spatial resolution of 30 arc-seconds (~1 km) for the year 2015.

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Data Source: Center for International Earth Science Information Network - CIESIN - Columbia University, 2018, Global Subnational Infant Mortality Rates, Version 2, Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). <https://doi.org/10.7927/H4PN93JJ>.

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<https://sedac.ciesin.columbia.edu/data/set/povmap-global-subnational-infant-mortality-rates-v2>

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Future Population: Global Population Projection Grids Based on SSPs, v1 (2010–2100)



- ▶ Need to understand where people live today *and* in the future
- ▶ Future estimates developed by Bryan Jones, a joint product of CUNY Institute for Demographic Research and National Center for Atmospheric Research (NCAR)

Global Population Projection Grids Based on SSPs, 2100: Total Population - SSP4
Population Dynamics

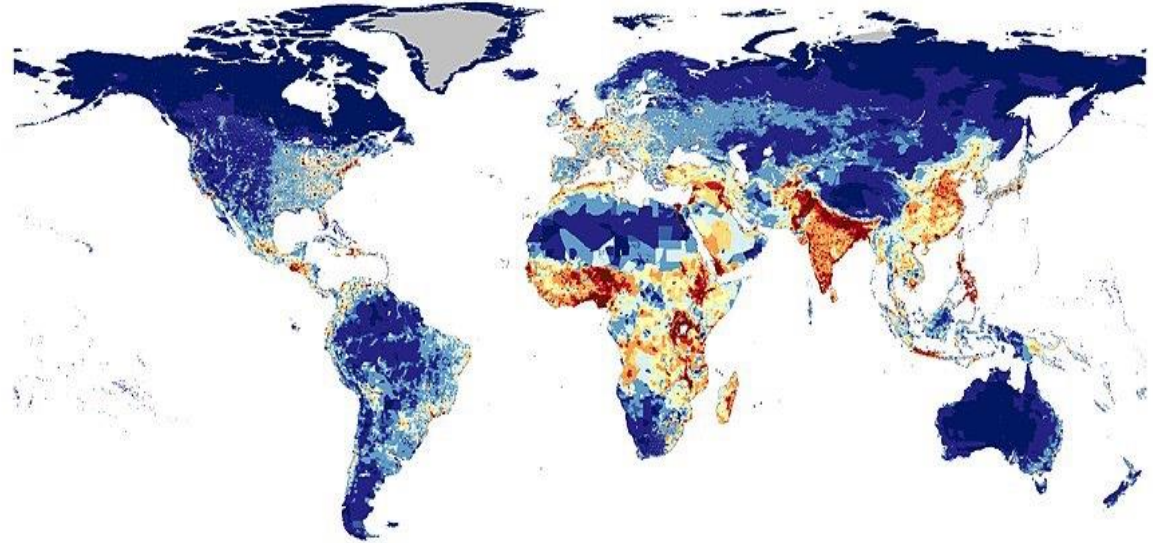
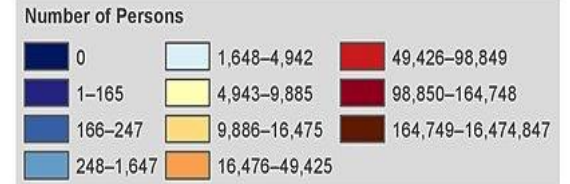


Plate Carree Projection
Map Credit: CIESIN Columbia University, May 2017.

The Global Population Projection Grids Based on Shared Socioeconomic Pathways (SSPs) are part of the Population Dynamics collection. The data consists of urban, rural, and total population at a resolution of one-eighth degree (7.5 arc minutes), consistent qualitatively and quantitatively with the SSPs at ten-year intervals for 2010–2100. The SSPs are developed to support future climate and global change research and the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6). This map represents total population based on SSP4 for 2100.

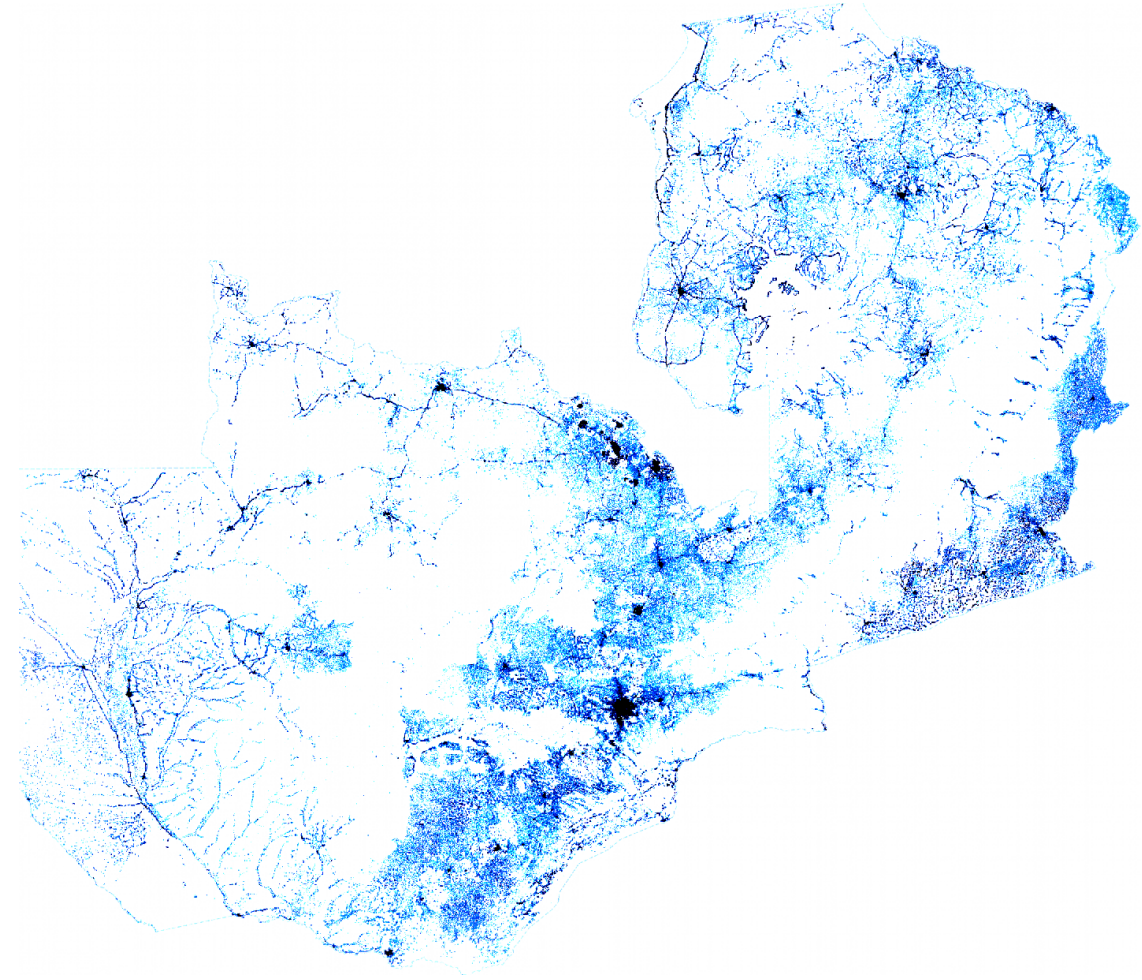


<http://sedac.ciesin.columbia.edu/data/set/popdynamics-pop-projection-ssp-2010-2100>

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High Resolution Settlement Maps

- ▶ Collaboration with **Internet.org/Facebook** to produce open access 30-m resolution population density estimates: based on 50-cm remote sensing imagery (IKONOS)
- ▶ Data for about 140 countries released on Humanitarian Data Exchange



<https://dataforgood.fb.com/population-density-maps-documentation/>

<https://data.humdata.org/organization/facebook>

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Last updated on September 6, 2019

Facebook's Data for Good program includes tools built from de-identified data on our platform, as well as tools that we develop using satellite imagery and other publicly available sources. When data is shared responsibly with the communities that need it, it can improve wellbeing and save lives.

facebook

Twitter Facebook Messenger

Datasets Activity Stream Stats

Data [144] Search all datasets ... Show filter: Show 25 | 50 | 100 ORDER BY Last Modified ▼

Refine your search: Clear all

FEATURED: -

- ☐ CODs [0]
- ☒ Sub-national [144]
- ☐ Geodata [61]
- ☐ Datasets on request(HDX)

SouthAsia_AS47: High Resolution Population Density Maps

Facebook

100+ Downloads

Updated July 20, 2019 | Dataset date: Jul 19, 2019

This dataset updates: Every six months

The territories of Pakistan and India are mostly covered by the non-political blocks AS42 through AS50, going roughly from West to East. Please see the attached map of these non-political boundary blocks.

ZIP 5 633

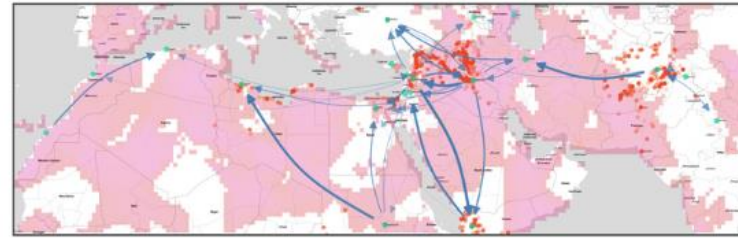
Data Analytics and Tools for Ecoscurity (DANTE)

Objectives

- ▶ Provide ready access to relevant **literature** documenting analytic methods, datasets, and toolkits.
- ▶ Acquire and maintain regularly updated **datasets**.
- ▶ **Harmonize** datasets by performing country/administrative code matching, translation between incompatible units of analysis, and resolving differences in temporal and spatial resolution.
- ▶ Perform **integrated analysis** of tabular, geospatial feature, and geospatial raster data.
- ▶ Provide well documented vignettes and end-to-end **analytic use cases**.
- ▶ Distribute a pre-configured and **extensible** virtual machine image to simplify installation and use of a complete software stack.

Welcome to the DANTE project!

The DANTE project (Data Analytics and Tools for Ecoscurity) will provide **open source software** tools that will accelerate interdisciplinary analysis of environmental stresses, demographics, economics, health, conflict areas, disaster response, and national boundaries enabling analysts to better understand and anticipate conditions that may require humanitarian relief, disaster recovery investments, and conflict management responses.



DANTE: Visualizing linkages between refugee outflows, climatic stress, and conflict in Northern Africa and Western Asia between 2013-2017.

The DANTE software toolkit

The DANTE software toolkit will address a range of technical issues that pose common barriers to data analysts addressing environment-security issues. The DANTE toolkit will provide a suite of tools that integrate with the **R** statistical computing environment, designed to:

► **SUBSCRIBE**

Subscribe to DANTE announcements

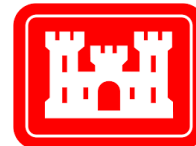
SUBSCRIBE

► **CONTACT**

Email the DANTE team

info@dante-project.org

<https://www.dante-project.org>

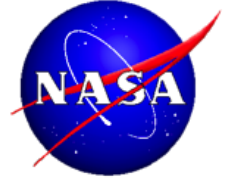


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Key Challenges

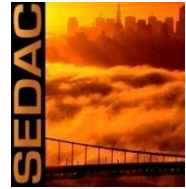
▶ Accessing and sharing **georeferenced infrastructure data**

- Building characteristics and occupancy
- Critical infrastructure



▶ Integration and harmonization of **impact and exposure data**

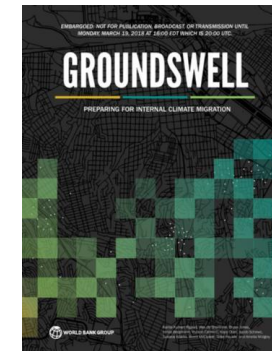
- Spatial and temporal harmonization
- Subnational administrative units and boundaries
- Economic exposure vs. loss, by sector
- Vulnerable population exposure vs. loss, by category



▶ Linking spatial and **household survey data**

▶ Improved understanding of risk dynamics

- Displaced populations
- Multiple hazards and climate change
- Infrastructure vulnerability ↔ economic/social conditions



Opportunities to Collaborate?

- 1) Improve mapping of population, settlements, infrastructure, movement, etc.: current and historical
- 2) Develop tools to automate harmonization and quality control of exposure and impact data
 - Utilize Population Estimation Service to provide estimates of exposed population by category for defined boundaries of past events at specific times?
 - Develop map interface or app to support delineation of affected areas at different levels of exposure/risk, e.g., taking into account infrastructure, land use/cover, terrain, road networks, environmental factors, vulnerable groups?
- 3) Collaborate on developing multi-hazard risk data and assessments
 - Coordinate with WMO on new data schema?
 - New North American Alliance on Hazards and Disasters Research Institutes (NAAHDRI)

2nd Human Planet Forum

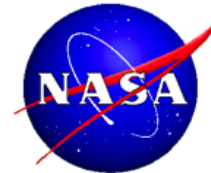
Columbia University, Lamont Campus

September 30–October 2, 2019



Primary Forum Themes

1. Advances in slum mapping
2. Development of the Human Planet Atlases, 2020-22
3. Global definition of cities and rural areas
4. Downscaled future scenarios of population & economic activity
5. Mapping internal administrative boundaries
6. Validation and intercomparison strategies for human settlement and population data
7. Applications, decision support, and stakeholder engagement





HUMAN PLANET SESSIONS

Who's at Risk? Assessing Population and Infrastructure Exposure and Vulnerability for Hazard, Climate, Coastal, and Health Applications I

Chairs: Robert S Chen, Charles K Huyck

IN43B, Thursday, 12 December 2019, 13:40 - 15:40

Moscone West - 2020, L2

Who's at Risk? Assessing Population and Infrastructure Exposure and Vulnerability for Hazard, Climate, Coastal, and Health Applications II

Chairs: Andrea E Gaughan, William Duncan Solecki

IN44B, Thursday, 12 December 2019, 16:00 - 18:00

Moscone West - 2020, L2

Who's at Risk? Assessing Population and Infrastructure Exposure and Vulnerability for Hazard, Climate, Coastal, and Health Applications III Posters

Chairs: Alexander M de Sherbinin, Nancy D Searby

IN51G, Friday, 13 December 2019, 08:00 - 12:20

Moscone South - Poster Hall

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Kytt MacManus, Deborah Balk, Gordon McGranahan, Hasim Engin

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Open Critical Infrastructure Exposure for Disaster Forecasting, Mitigation and Response

Charles K Huyck, Shubharoop Ghosh, Ronald T Eguchi, Gregory Yetman and Mhairi Elizabeth O'Hara
IN51C-10, eLightning, Friday, 13 December 2019, 08:00 - 10:00
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Annie Winson, Colm Jordan, Kay B Smith, John Rees, Vitor Silva, Paul Henshaw, Christopher Sampson, Mhairi Elizabeth O'Hara, Charles K Huyck, Shubharoop Ghosh, Luca Petrarulo, Aileen Lyon, Charles Msangi, Ganesh Jimée, Suman Pradhan, Sharad Wagle, Bimal Regmi, Shamim Zakaria and John Kiriwai
IN51C-01, eLightning, Friday, 13 December 2019, 08:00 - 10:00
Moscone South - eLightning Theater III