

Thailand

Cambodia

Vietnam

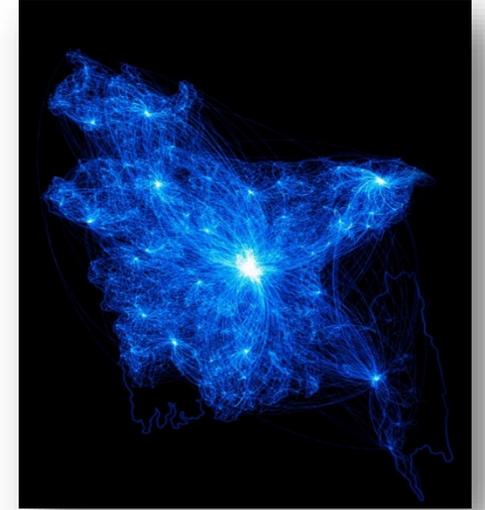
**Global High-Resolution Population
Denominators (WorldPop Global)**



FLOWMINDER.ORG

Alessandro Sorichetta

- **WorldPop: Research Program** in Dept Geography & Environment focused on methods for **improving the demographic evidence base** in low/middle income countries
- **Flowminder:** Non-profit foundation working with data providers and international/government agencies to **operationalize and scale research** in **support of vulnerable populations** and **sustainable development** in low/middle income countries
- 50+ staff; focus on data science and integration in fields of spatial demography and mobility to support disease, disaster and development applications



Partners and donors



Asian Development Bank



WorldPop Global Project



University of Southampton



Tatem A., A. Sorichetta, S. Saxton, M. Bondarenko, C. Lloyd, D. Kerr, H. Chamberlain, S. Dutka, J. Nieves, C. Pezzulo, A. Carioli, and S. Hanspal

Gaughan A. , F. Stevens, P. Sinha, and P. Reed

Linard C.

Sadler J. , I. Wadlock, J. Austin, and G. Hornby

Yetman G., L. Pistolesi, J. Mills, O. Borkovska, K. MacManus, and S. Adamo



SUSTAINABLE DEVELOPMENT GOALS



Leave no-one behind: no goal should be met unless it is met for *everyone*



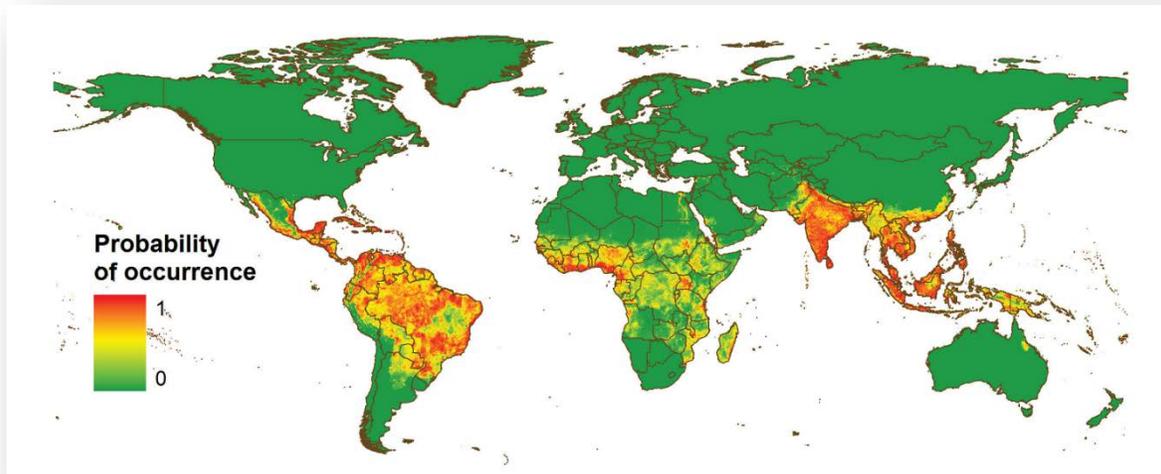
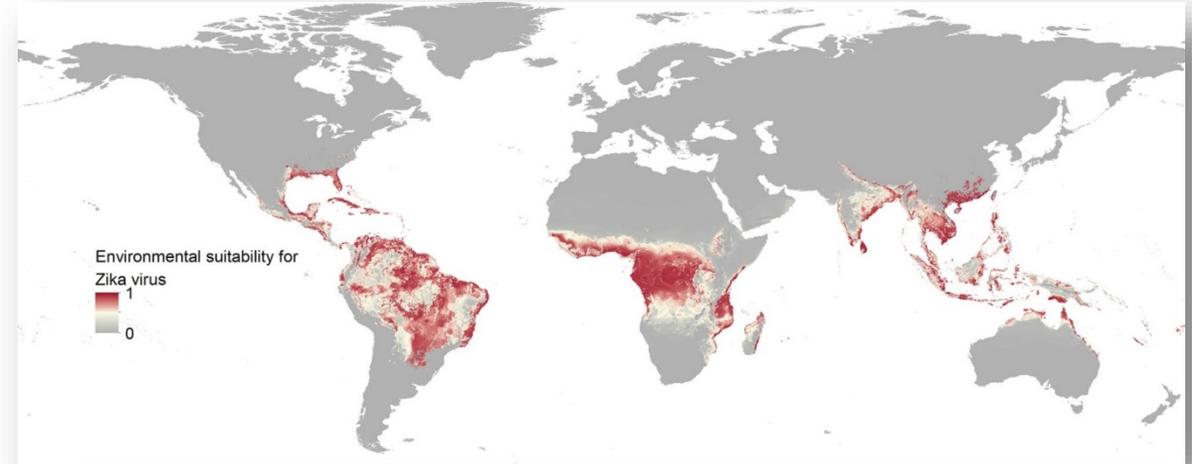
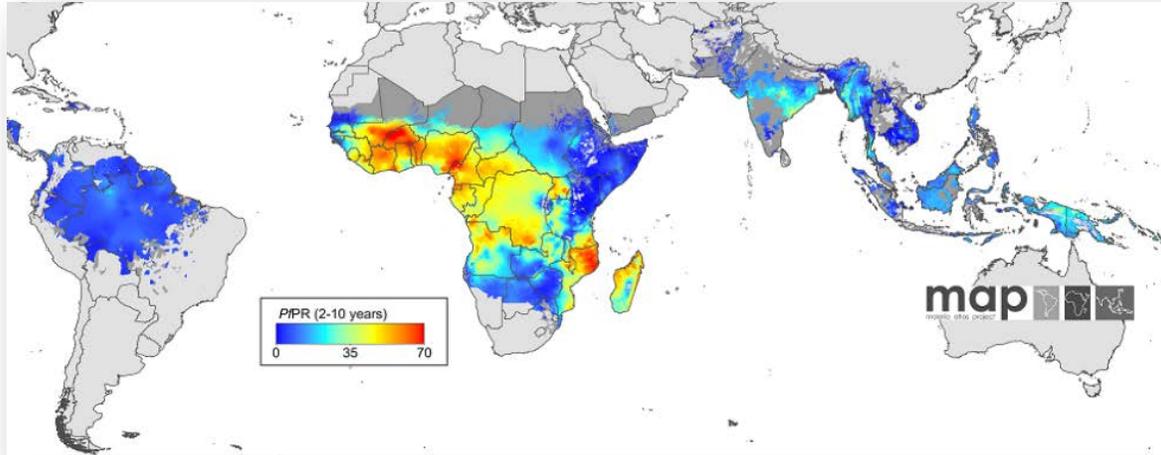
'Endeavour to reach the furthest behind first'



A focus on achieving x,y,z *everywhere* = geography is important



Health Metrics Being Gridded Globally...



Gates Foundation Awards \$279 Million for Health Metrics, Evaluation

JANUARY 26, 2017

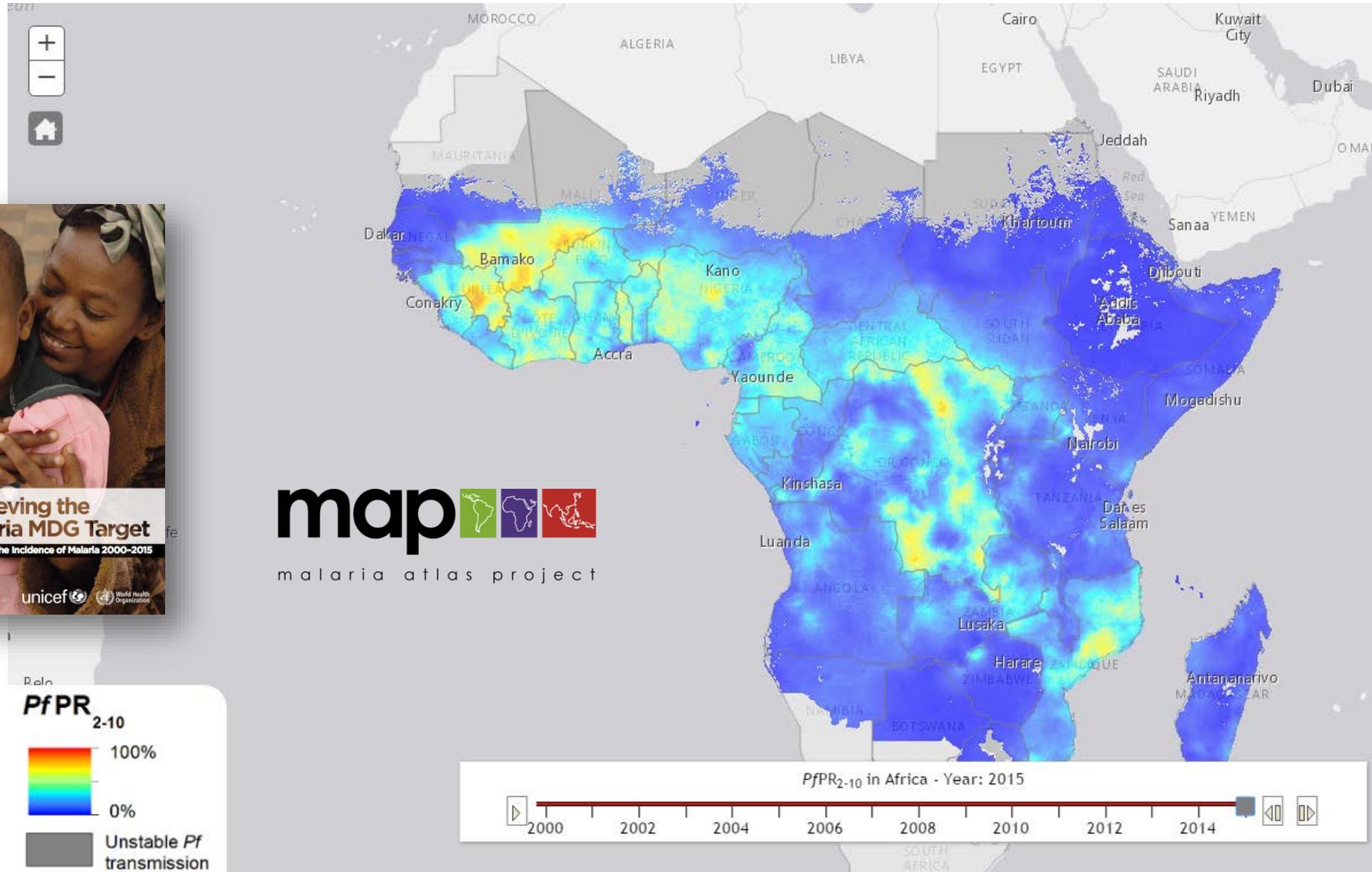
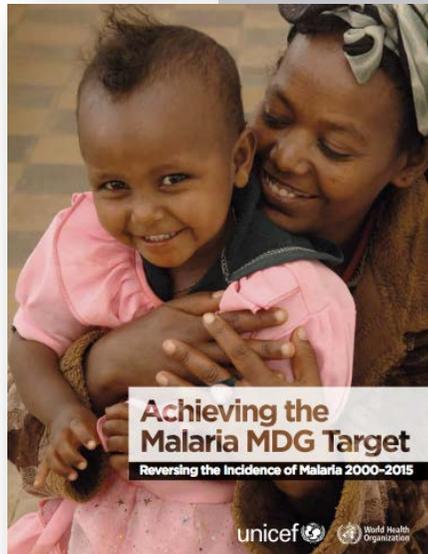
[Facebook](#) 3 [Twitter](#) [LinkedIn](#) 18 [Google](#) [Email](#) [Share](#) 21 [Print](#)



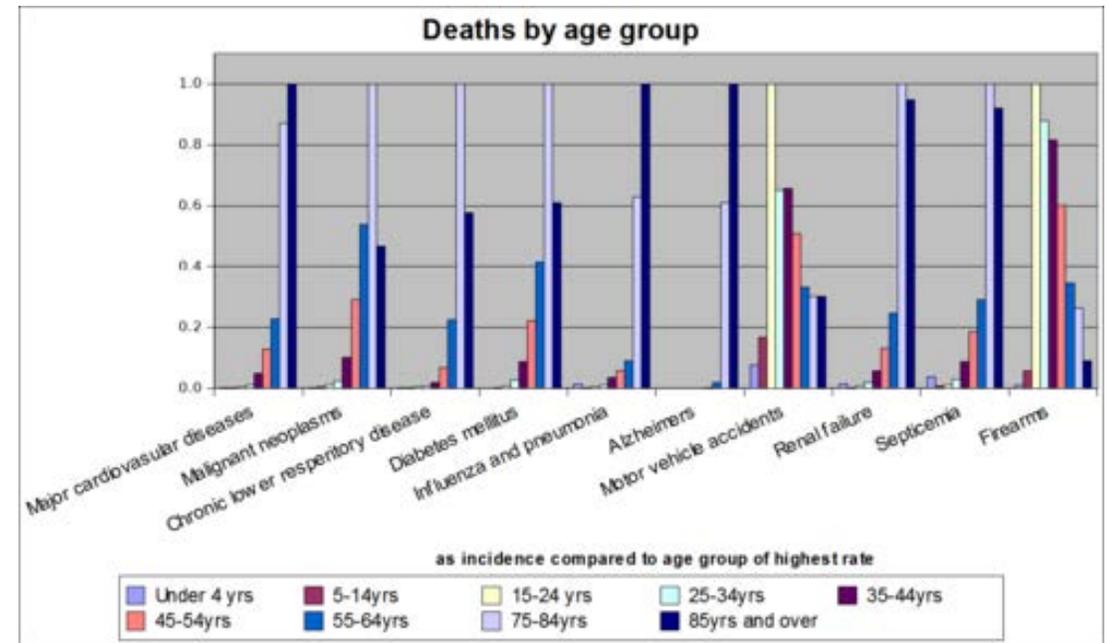
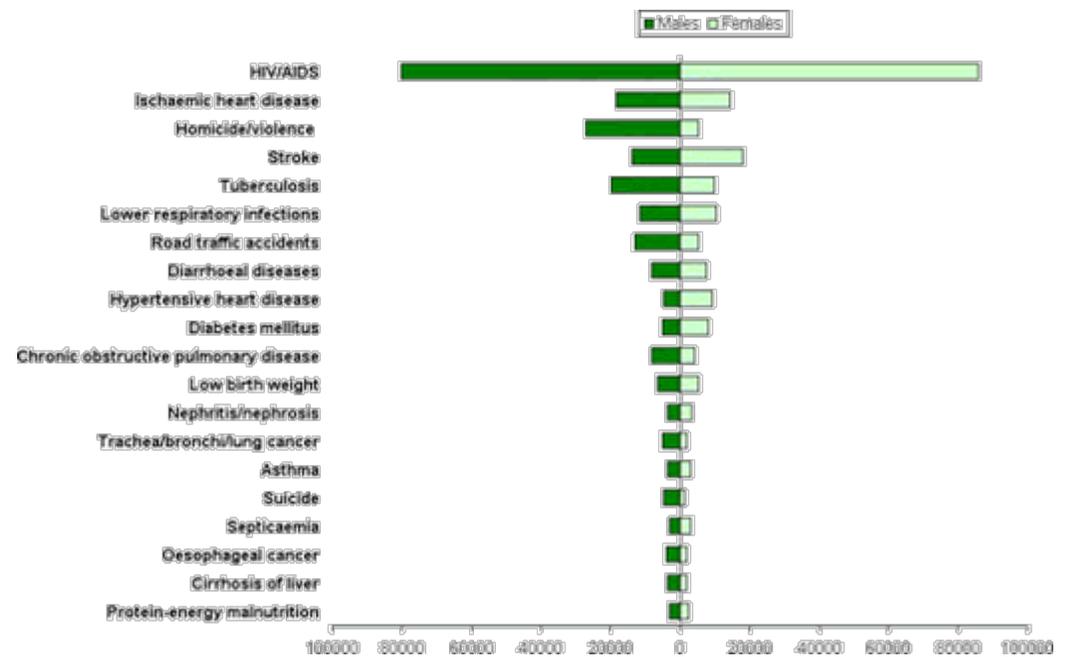
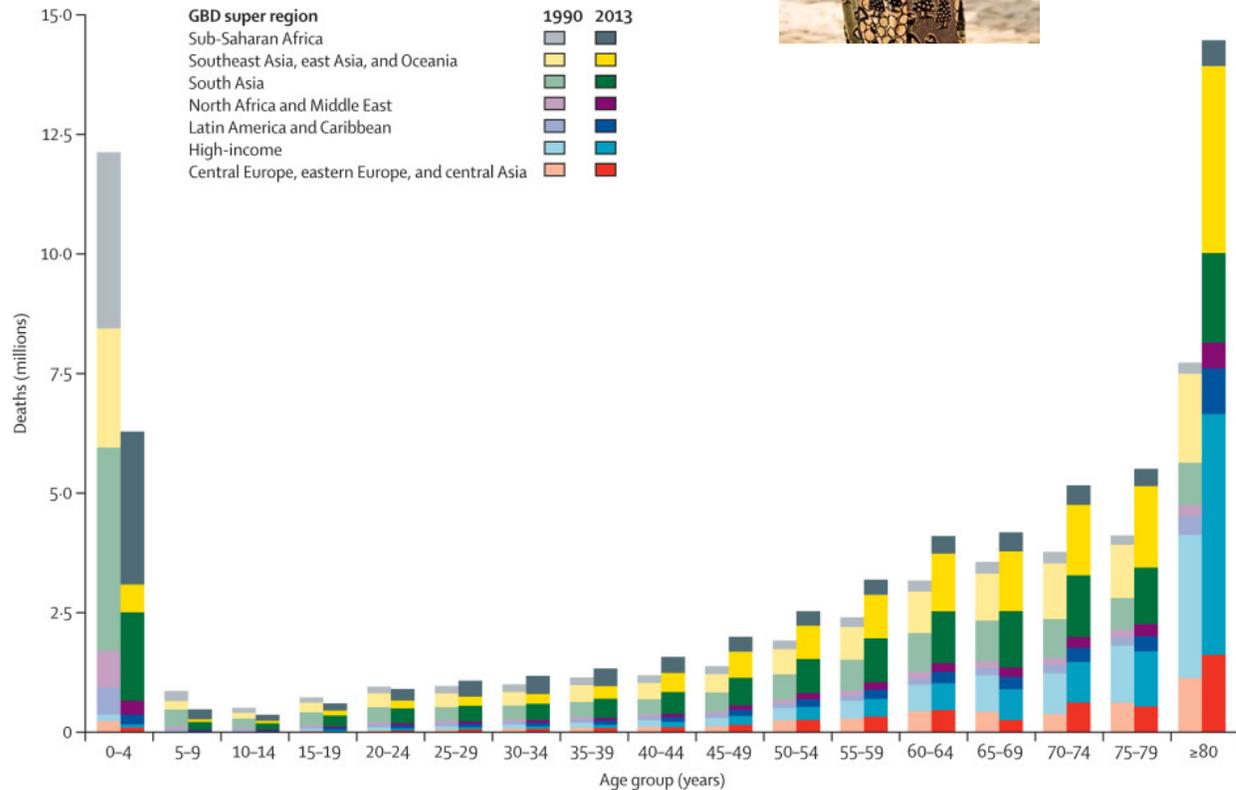
The [Bill & Melinda Gates Foundation](#) has announced a ten-year, \$279 million commitment in support of the [University of Washington's Institute for Health Metrics and Evaluation](#).

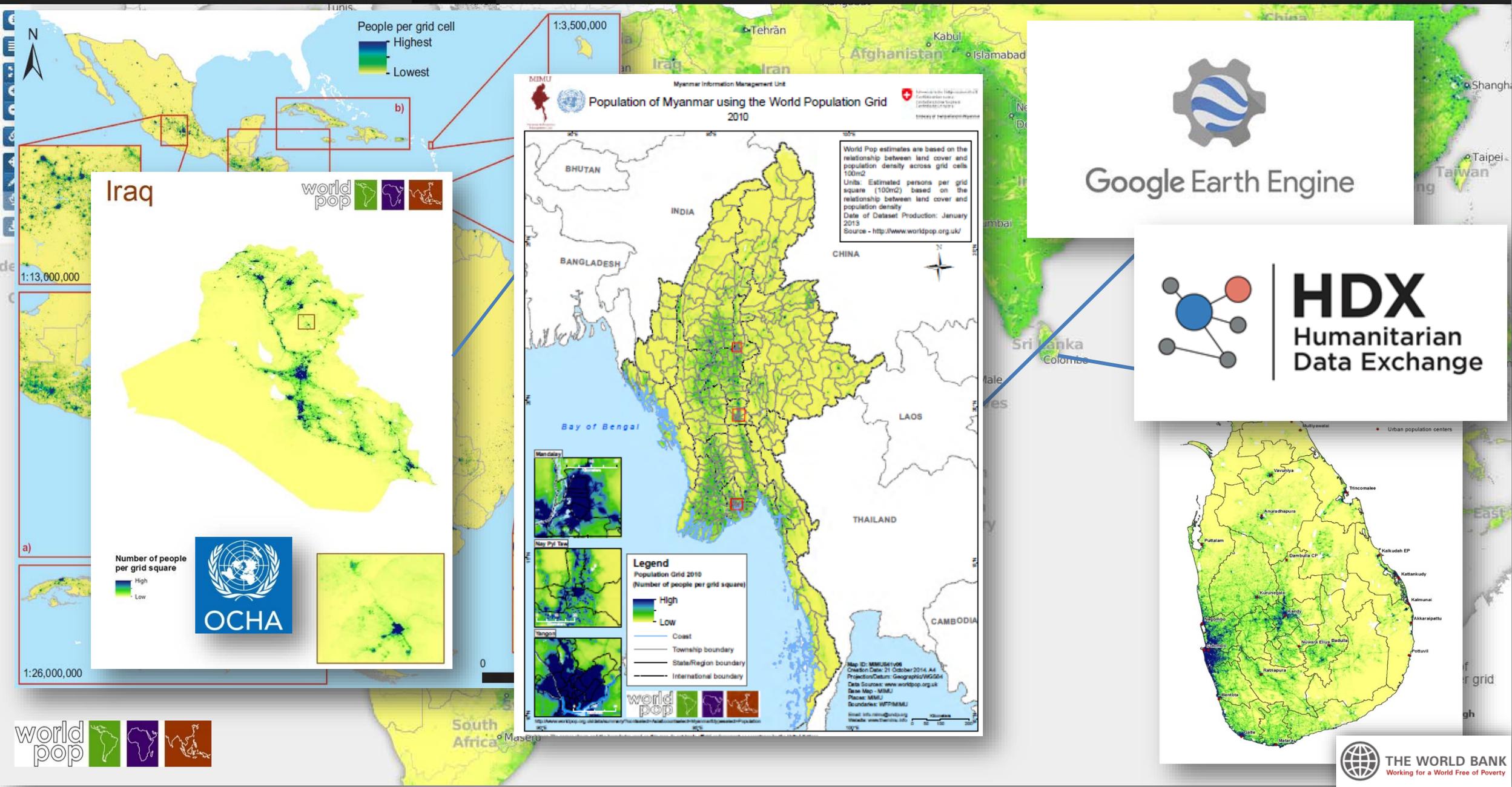
The largest private donation in the university's history will enable IHME to build on its efforts to improve population health by providing independent and rigorous analysis of global health issues and evaluating strategies to address them. Among other things, the grant will fund the institute's efforts to track how health resources

For Multiple Points in Time

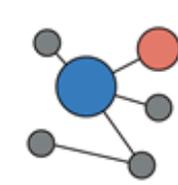


Age and Sex Components





Google Earth Engine



HDX
Humanitarian
Data Exchange



Population of Myanmar using the World Population Grid 2010

World Pop estimates are based on the relationship between land cover and population density across grid cells 100m²
 Units: Estimated persons per grid square (100m²) based on the relationship between land cover and population density
 Date of Dataset Production: January 2013
 Source - <http://www.worldpop.org.uk/>

Legend
 Population Grid 2010
 (Number of people per grid square)

- High
- Low

Coast
 Township boundary
 State/region boundary
 International boundary

Map ID: MMU04106
 Creation Date: 21 October 2014, 4:4
 Projection/Crs: Geographic/WSG84
 Data Source: www.worldpop.org.uk
 Base Map - MIMU
 Tiles: MIMU
 Boundaries: WFP/MIMU
 Contact: info.mim@undp.org
 Website: www.themaps.info

Iraq

Number of people per grid square

- High
- Low

OCHA

Myanmar Information Management Unit

Population of Myanmar using the World Population Grid 2010

World Pop estimates are based on the relationship between land cover and population density across grid cells 100m²
 Units: Estimated persons per grid square (100m²) based on the relationship between land cover and population density
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Coast
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Iraq

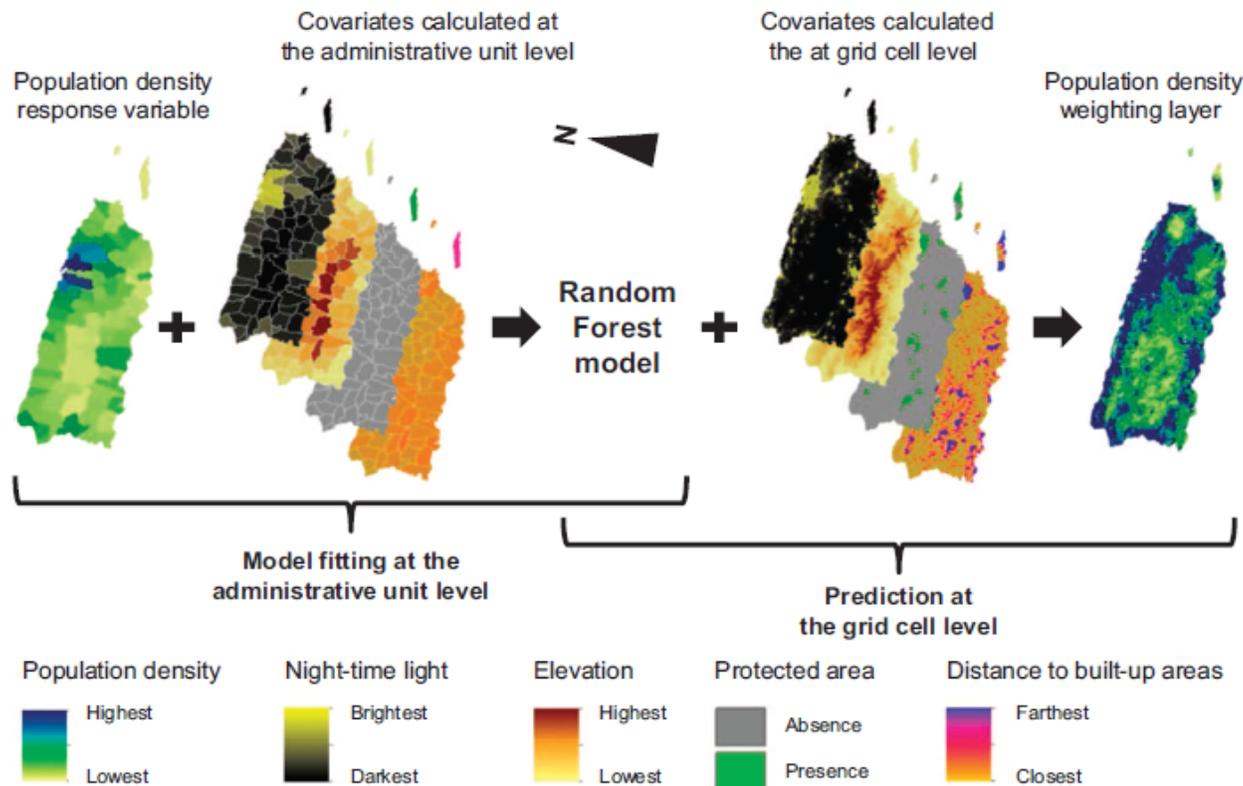
Number of people per grid square

- High
- Low

OCHA

Modeling Population Distribution

- Using a RF-based dasymetrically approach to disaggregate subnational census-based figures[^], #



RESEARCH ARTICLE

Disaggregating Census Data for Population Mapping Using Random Forests with Remotely-Sensed and Ancillary Data

Forrest R. Stevens^{1*}, Andrea E. Gaughan¹, Catherine Linard^{2,3}, Andrew J. Tatem^{4,5}

1 Department of Geography and Geosciences, University of Louisville, Louisville, Kentucky, United States of America, **2** Fonds National de la Recherche Scientifique (F.R.S.-FNRS), Rue d'Egmont 5, B-1000 Brussels, Belgium, **3** Biological Control and Spatial Ecology, Université Libre de Bruxelles, CP 160/12, Avenue FD Roosevelt 50, B-1050 Brussels, Belgium, **4** Department of Geography and Environment, University of Southampton, Highfield, Southampton SO17 1BJ, United Kingdom, **5** Fogarty International Center, National Institutes of Health, Bethesda, MD 20892, United States of America

* forrest.stevens@louisville.edu



SCIENTIFIC DATA 

OPEN

SUBJECT CATEGORIES

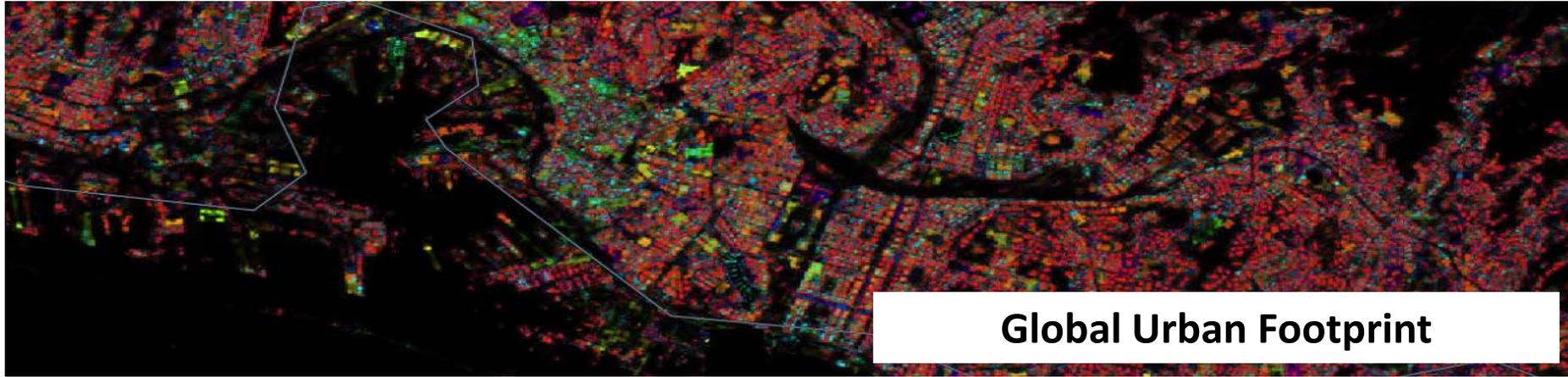
- » Geography
- » Malaria
- » Sustainability
- » Environmental sciences

High-resolution gridded population datasets for Latin America and the Caribbean in 2010, 2015, and 2020

Alessandro Sorichetta^{1,2}, Graeme M. Hornby³, Forrest R. Stevens⁴, Andrea E. Gaughan⁴, Catherine Linard^{5,6} & Andrew J. Tatem^{1,7,8}

[^]Stevens et al, 2015; #Sorichetta et al., 2015

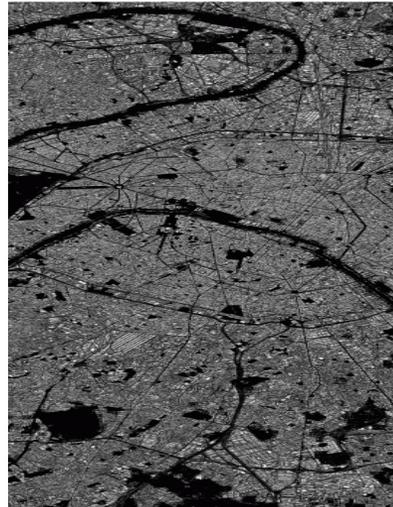
High Resolution Settlement Datasets



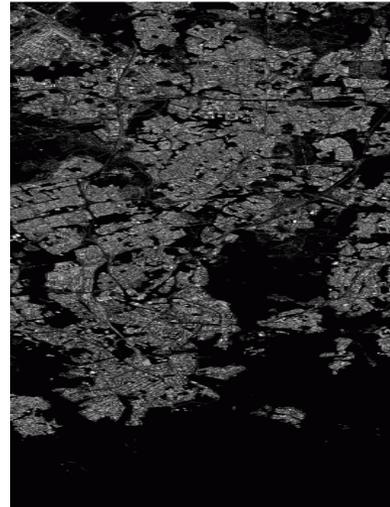
Global Urban Footprint



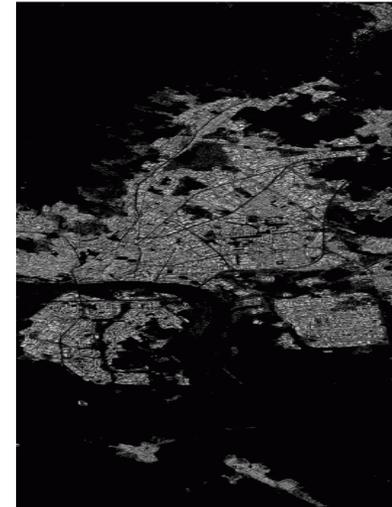
EU capitals from space
Paris



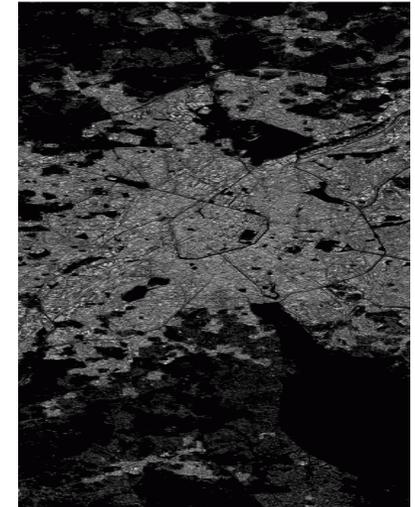
EU capitals from space
Helsinki



EU capitals from space
Bratislava



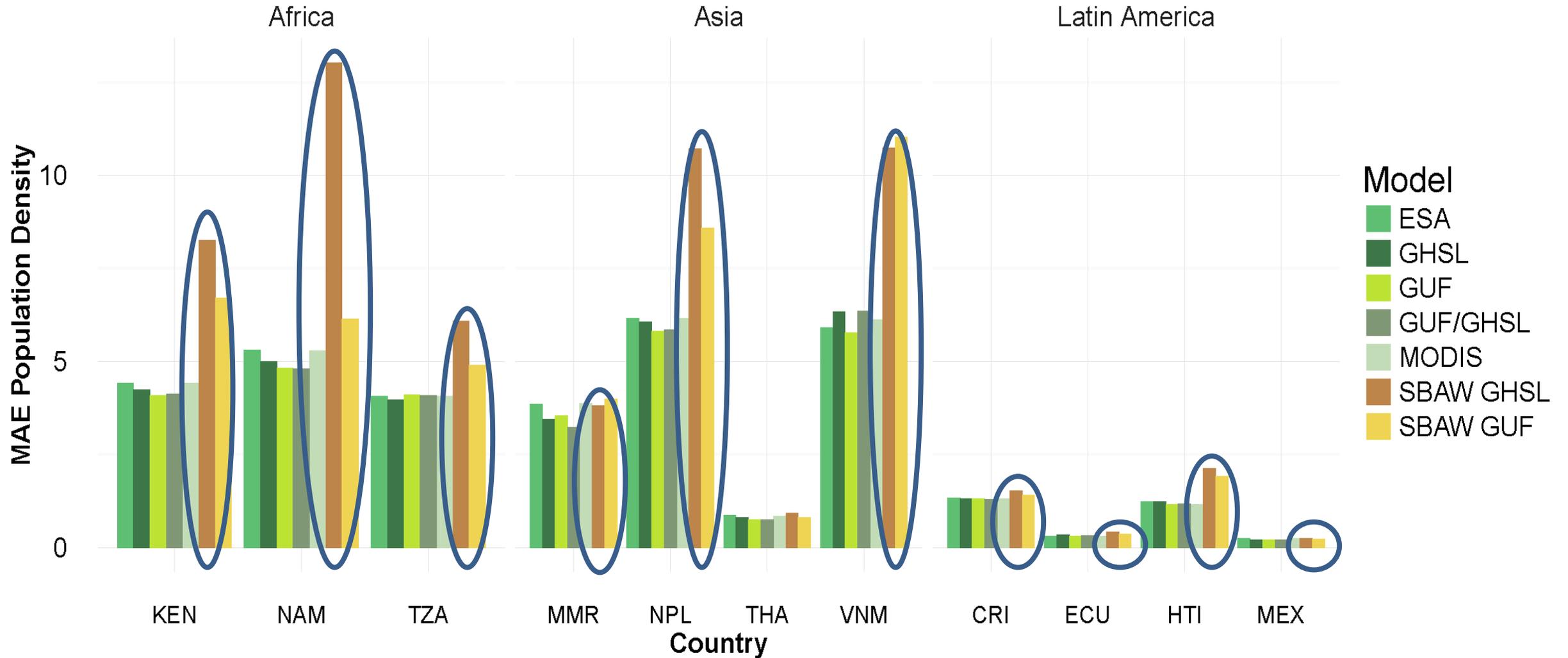
EU capitals from space
Brussels



Global Human Settlement Layer

Quantitative Model Comparison

MAE of Population Density by Model Fit and Country



Buildings Vs People

Mapping buildings/settlements is a valuable initial step

But, buildings do not directly translate to people

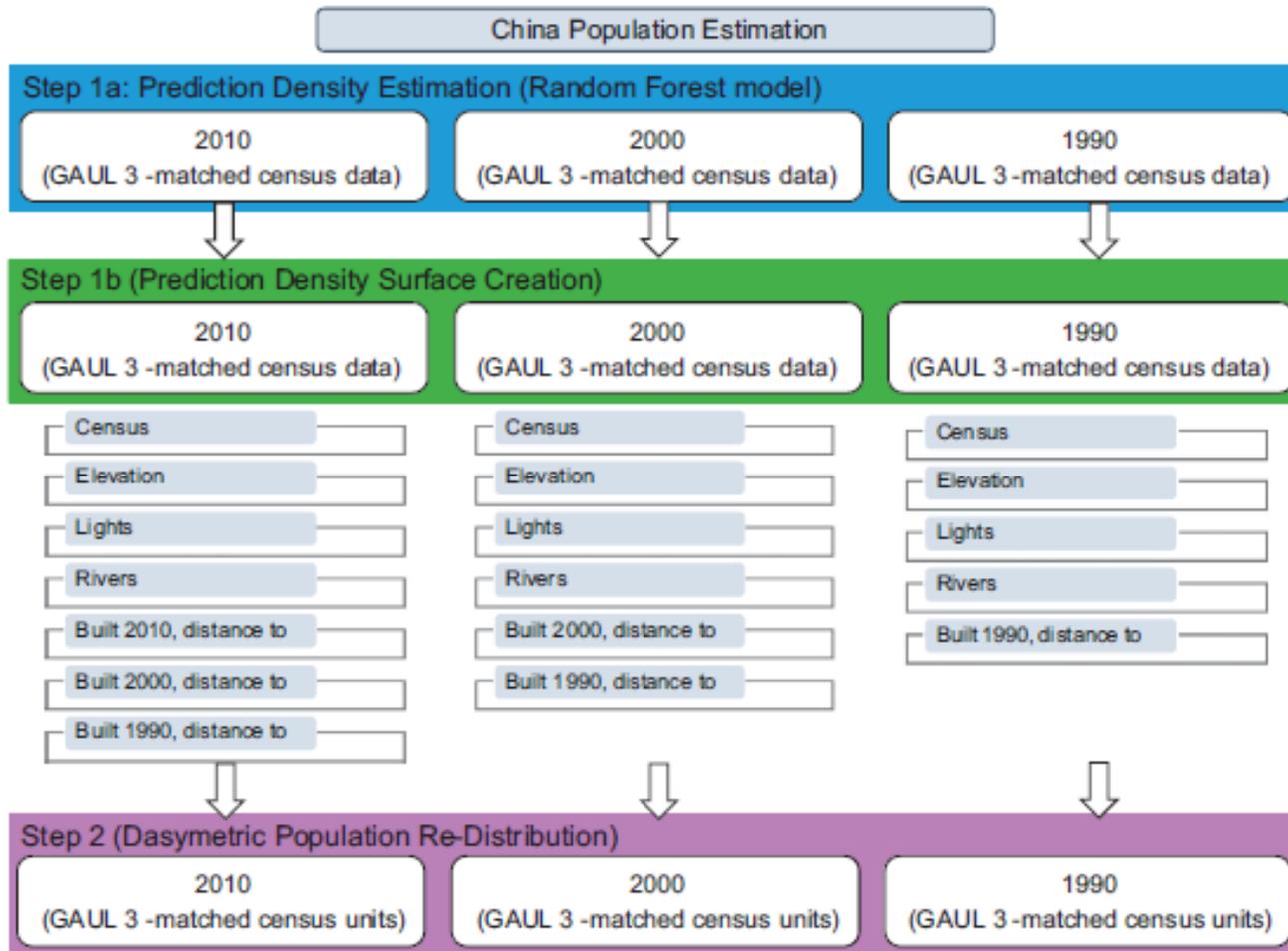
Multiple factors drive differences in distributions and demographics

Importance of integrating multiple data sources



Multitemporal

- Using a temporally-explicit modeling framework[#]



SCIENTIFIC DATA

OPEN

SUBJECT CATEGORIES
» Sustainability
» Geography
» Databases

Spatiotemporal patterns of population in mainland China, 1990 to 2010

Andrea E. Gaughan¹, Forrest R. Stevens¹, Zhuojie Huang², Jeremiah J. Nieves¹, Alessandro Sorichetta^{3,4}, Shengjie Lai^{2,3,5}, Xinyue Ye⁶, Catherine Linard^{7,8}, Graeme M. Hornby³, Simon I. Hay^{9,10,11}, Hongjie Yu² & Andrew J. Tatem^{3,5,10}



International Journal of Digital Earth

ISSN: 1753-8947 (Print) 1753-8955 (Online) Journal homepage: <http://www.tandfonline.com/loi/tjde20>

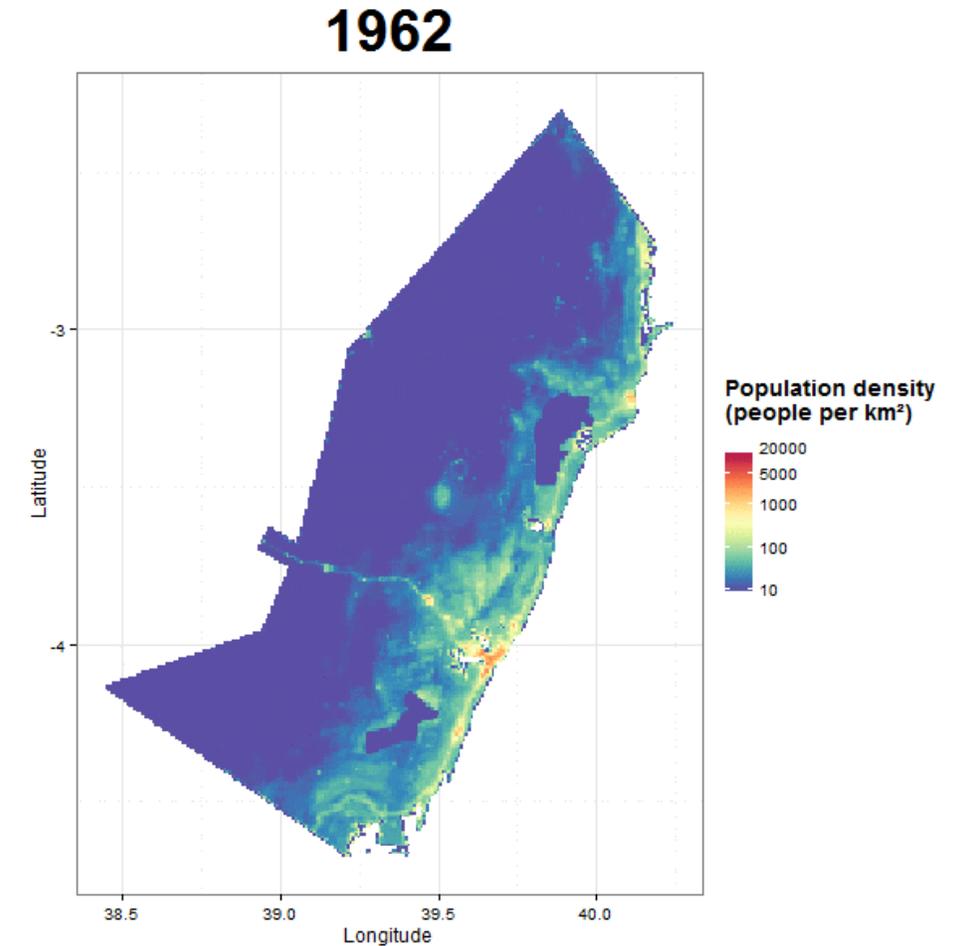
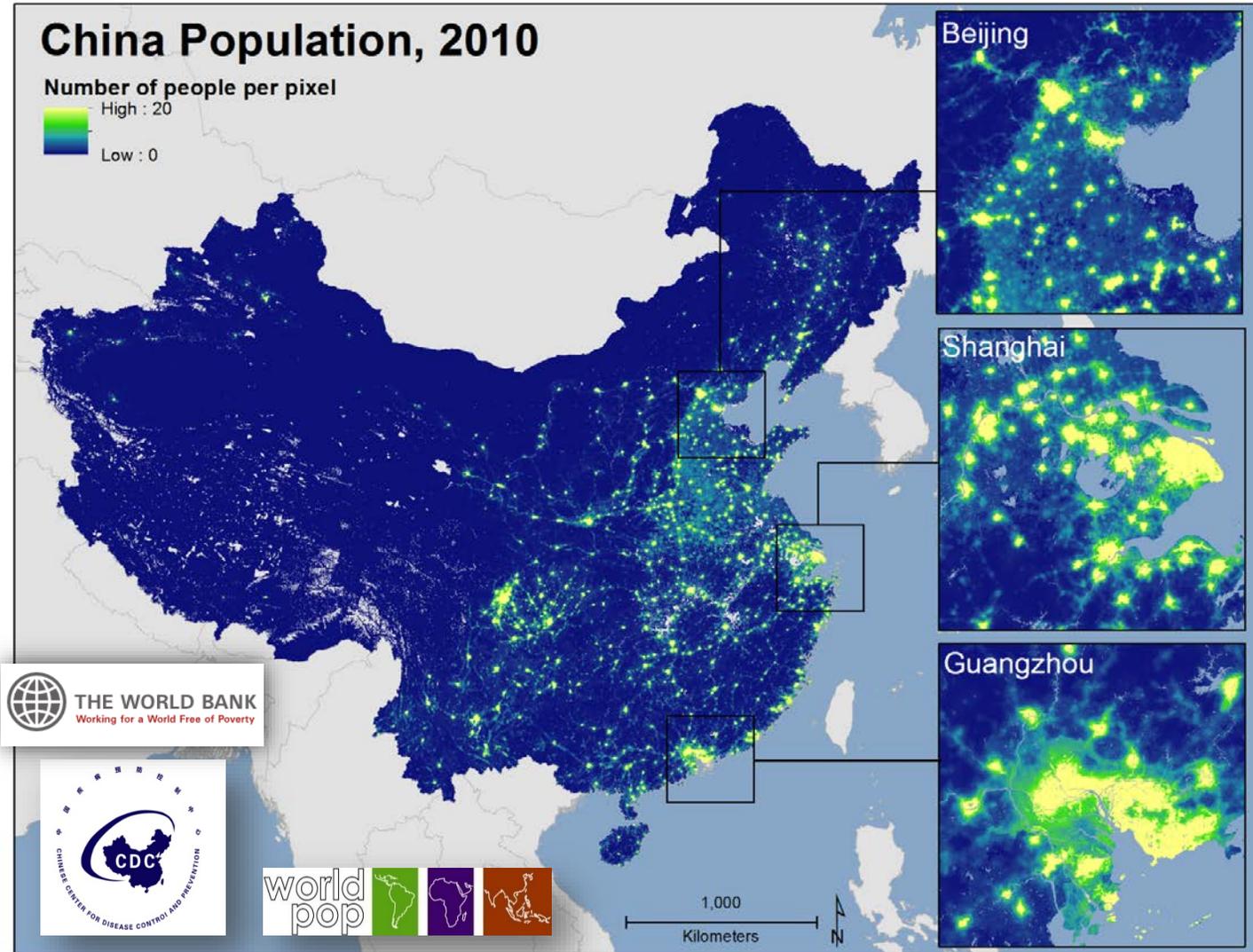


Modelling changing population distributions: an example of the Kenyan Coast, 1979–2009

Catherine Linard, Caroline W. Kabaria, Marius Gilbert, Andrew J. Tatem, Andrea E. Gaughan, Forrest R. Stevens, Alessandro Sorichetta, Abdisalan M. Noor & Robert W. Snow

[#]Gaughan et al., 2016; Linard et al., 2017

Mapping Population Change



Age/Sex Structure Mapping

- Combining population count datasets with the subnational age/sex proportion datasets

OPEN

Data Descriptor: Sub-national mapping of population pyramids and dependency ratios in Africa and Asia

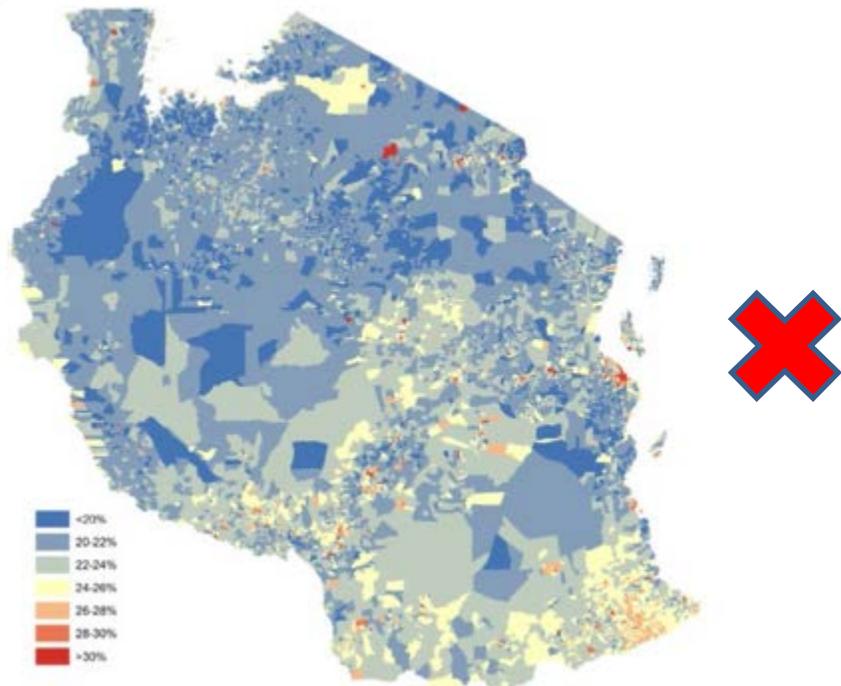
Received: 9 March 2017

Accepted: 2 June 2017

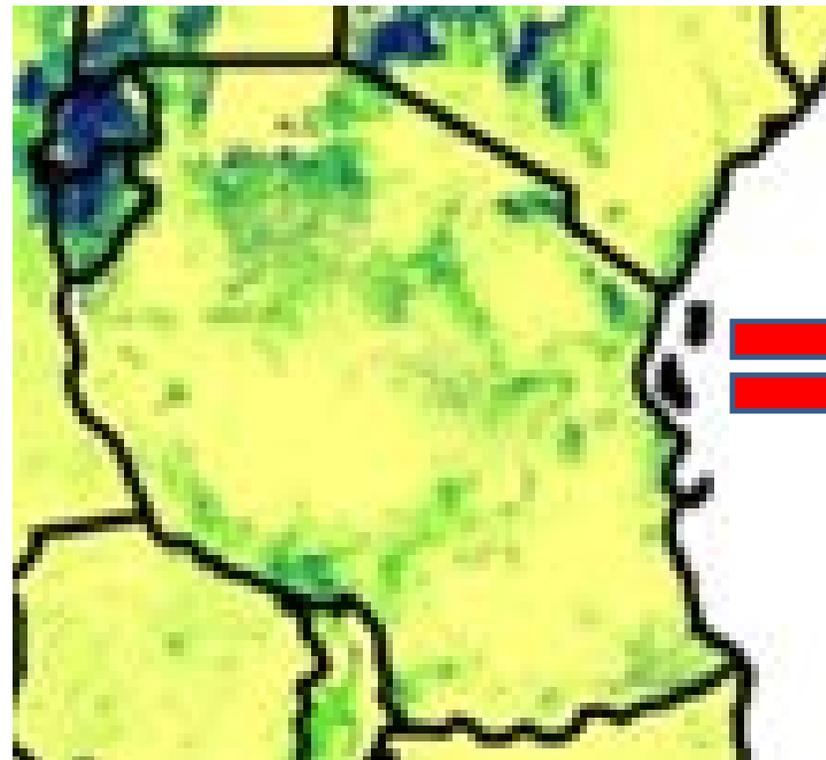
Published: 19 July 2017

Carla Pezzulo^{1,2}, Graeme M. Hornby^{1,3}, Alessandro Sorichetta^{1,2}, Andrea E. Gaughan⁴, Catherine Linard^{5,6}, Tomas J. Bird^{1,2}, David Kerr², Christopher T. Lloyd¹ & Andrew J. Tatem^{1,2}

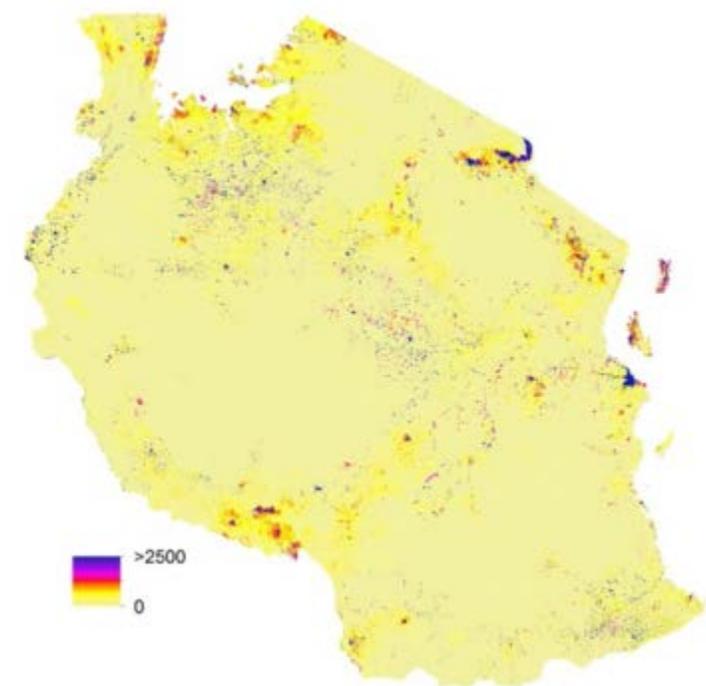
Age/sex proportions



Population counts



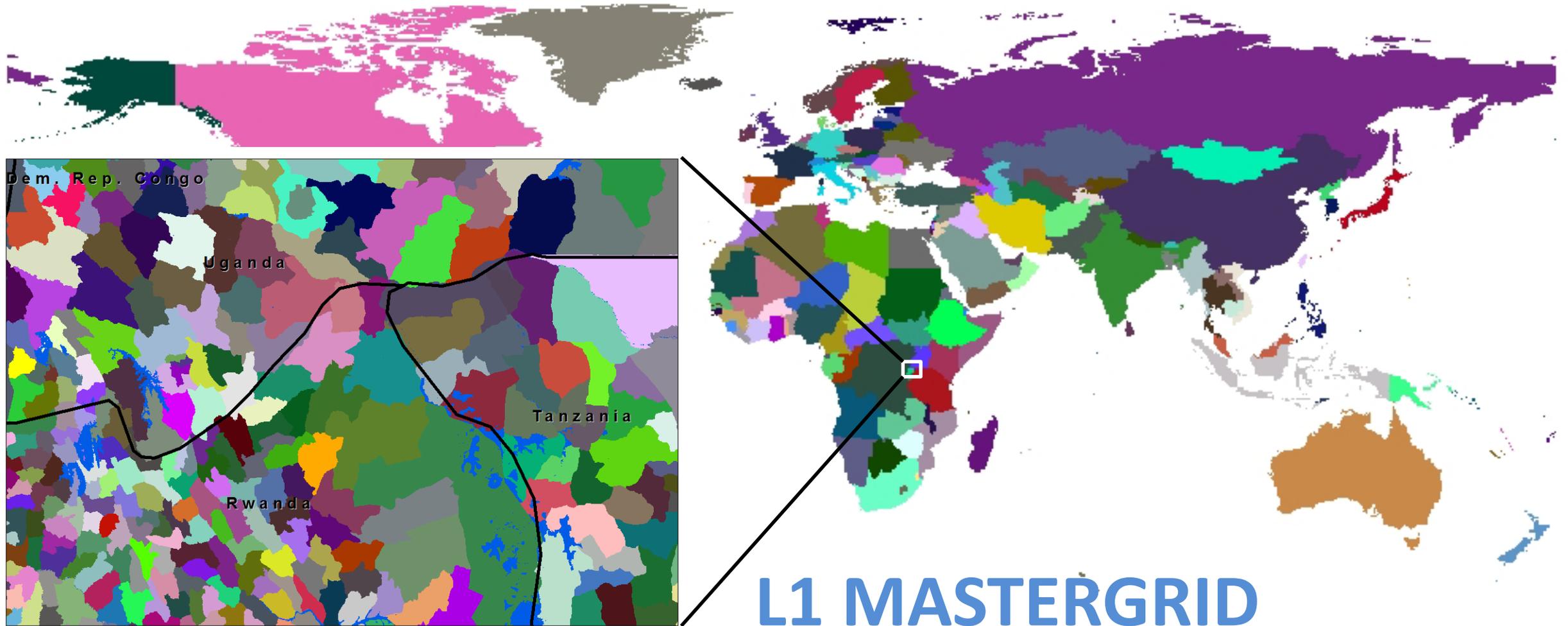
Age/sex counts



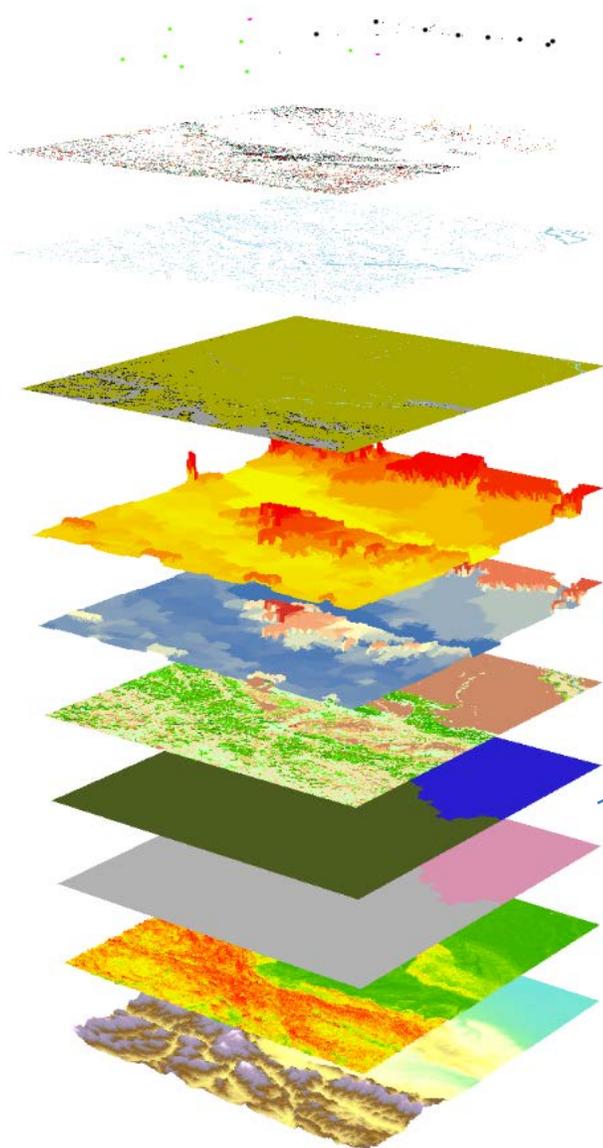
Global Project Objectives

- Annual high-resolution gridded global population distribution datasets from 2000 to 2020
- Disaggregated by 5-year age groups (from 0-12months, 1-4, to 80+) split by gender
- High-resolution co-registered gridded global covariate datasets for use in population studies (both temporally-explicit and time-invariant)
- Annual high-resolution gridded global settlement datasets (2000-2020)

L0 Mastergrid (Template)



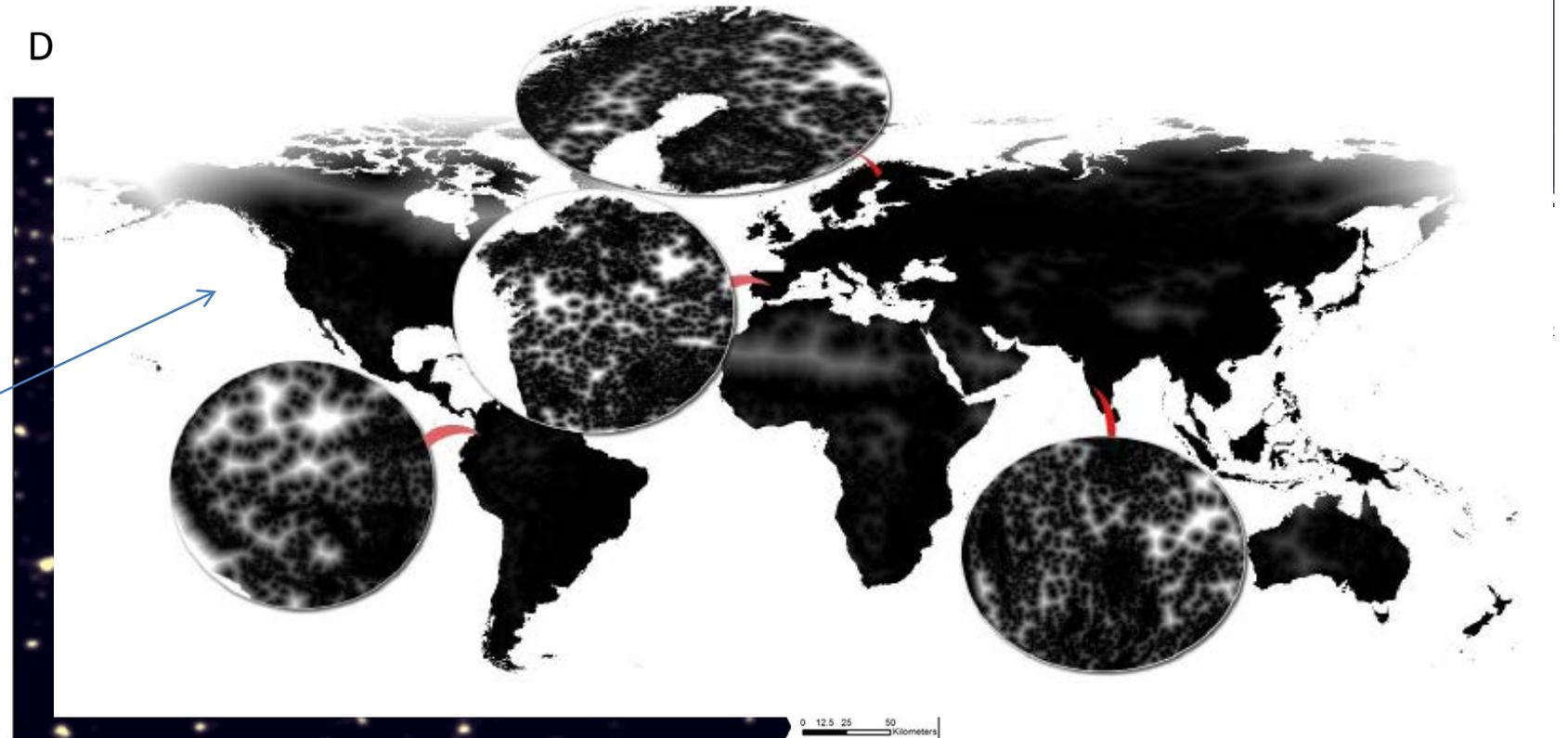
Continuous and Categorical Covariates



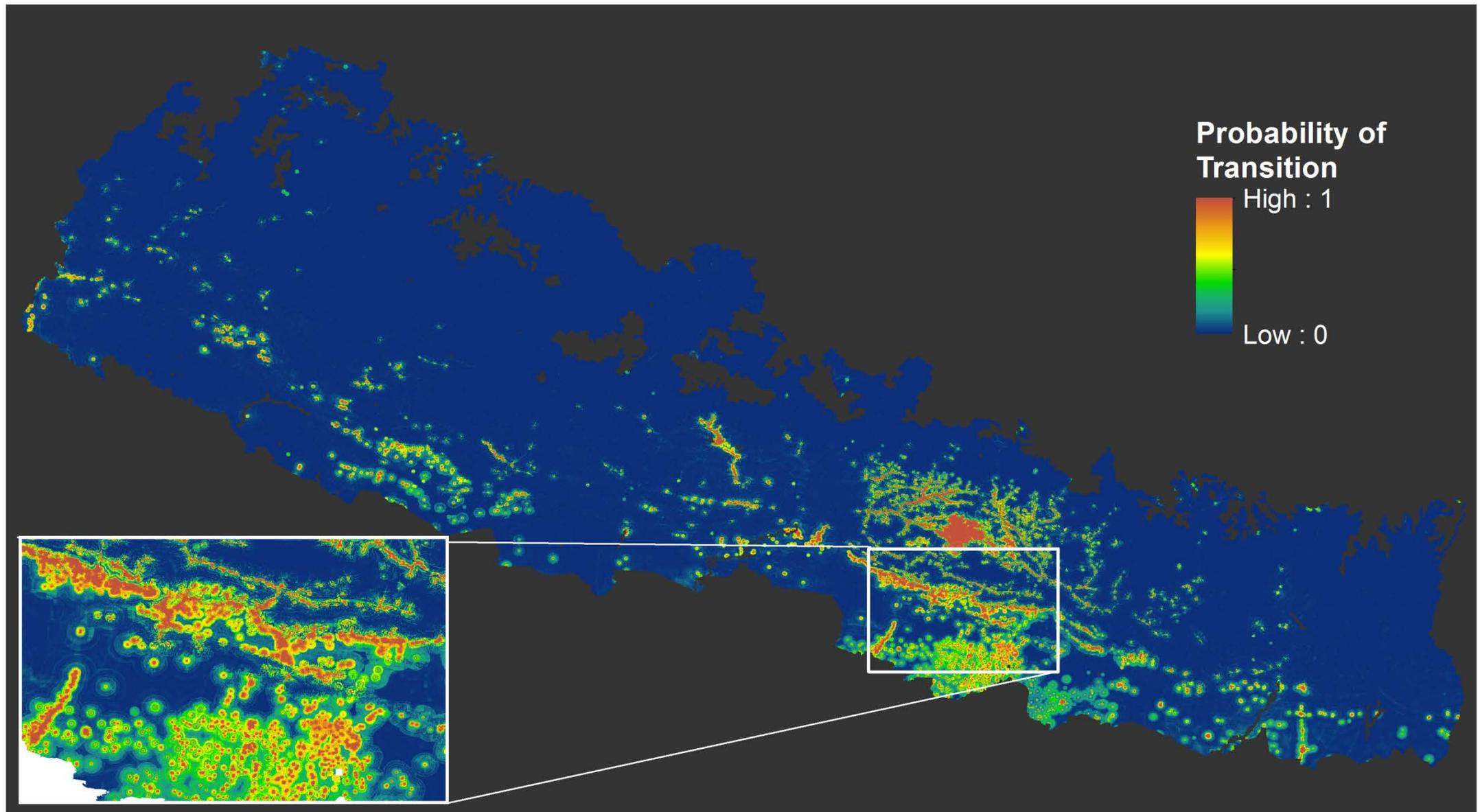
VIIRS



D



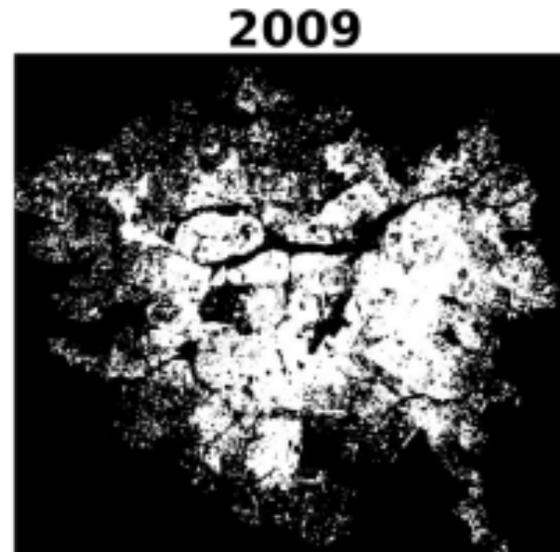
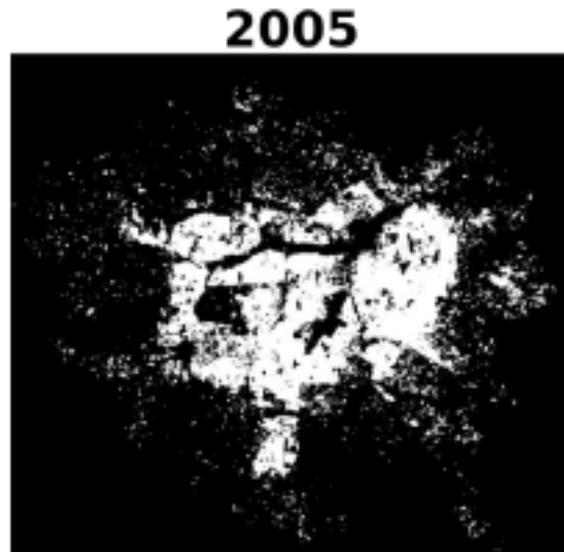
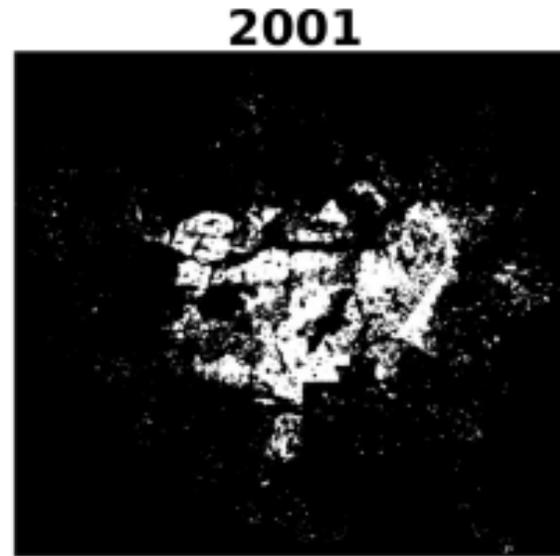
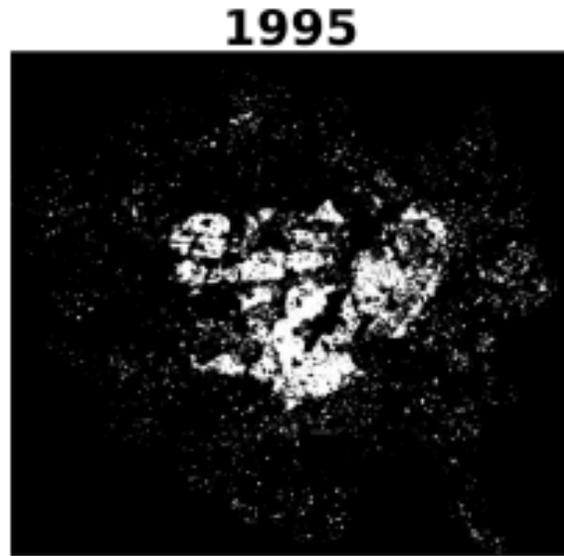
Global Built-Settlement Growth Model



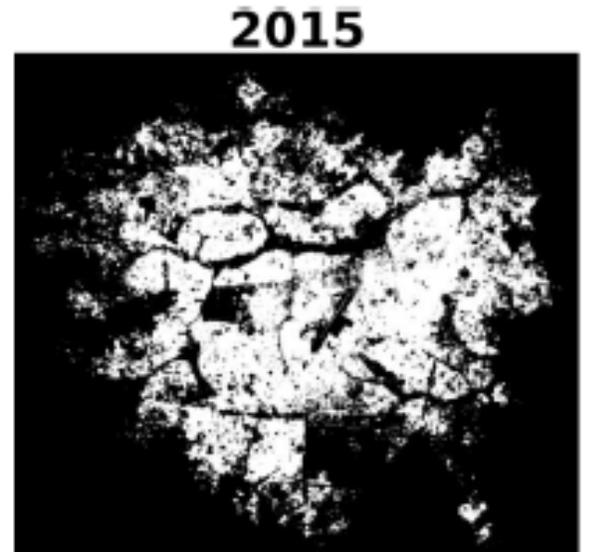
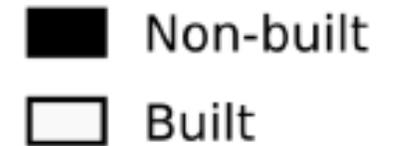
Global Built-Settlement Growth Model Validation



Delineating urban extent for multiple points in time using temporal HRRS archived data (both optical and SAR) of 48 African cities



Ouagadougou

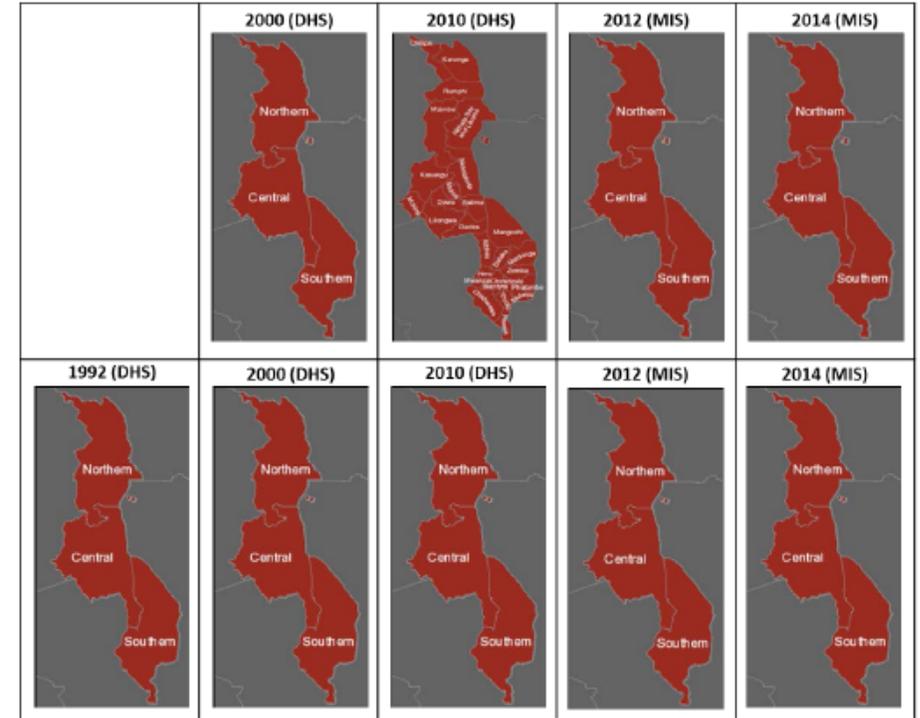


Age/Sex Proportion Data

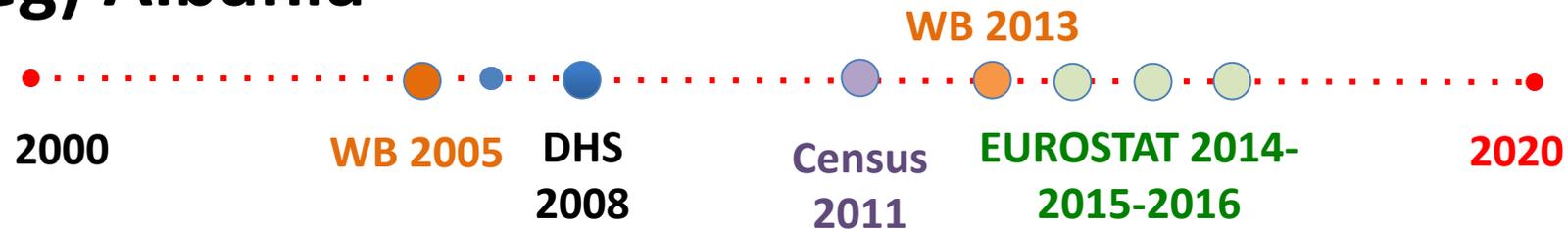
Collecting data from multiple sources:

- Census data
- EUROSTAT
- U.S. Census Bureau
- IPUMSI (census microdata)
- Household Surveys (eg, DHS)
- UNPD (National)

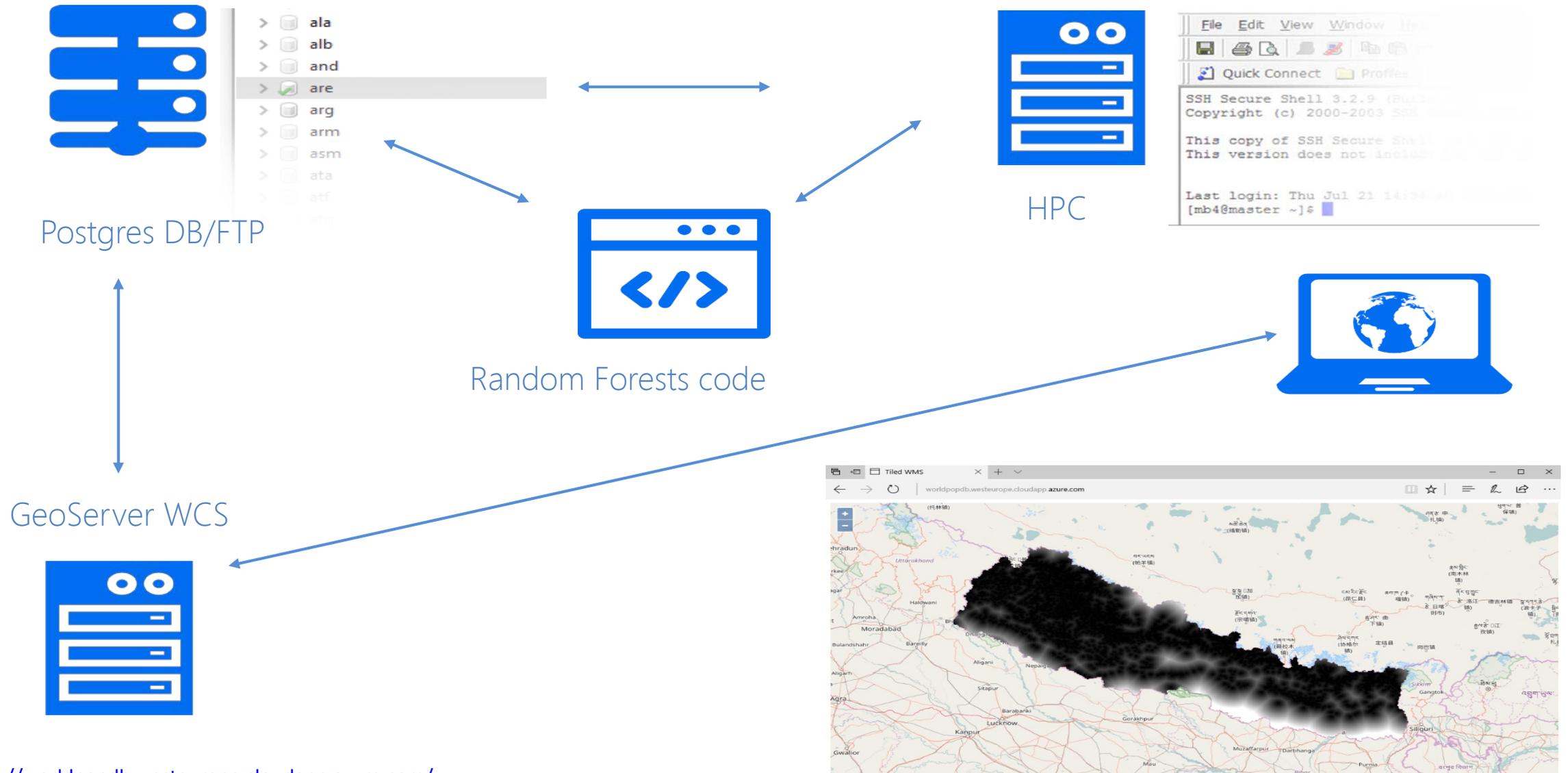
Malawi



eg) Albania



Pipeline/Workflow : HPC+Postgres DB/FTP+RF



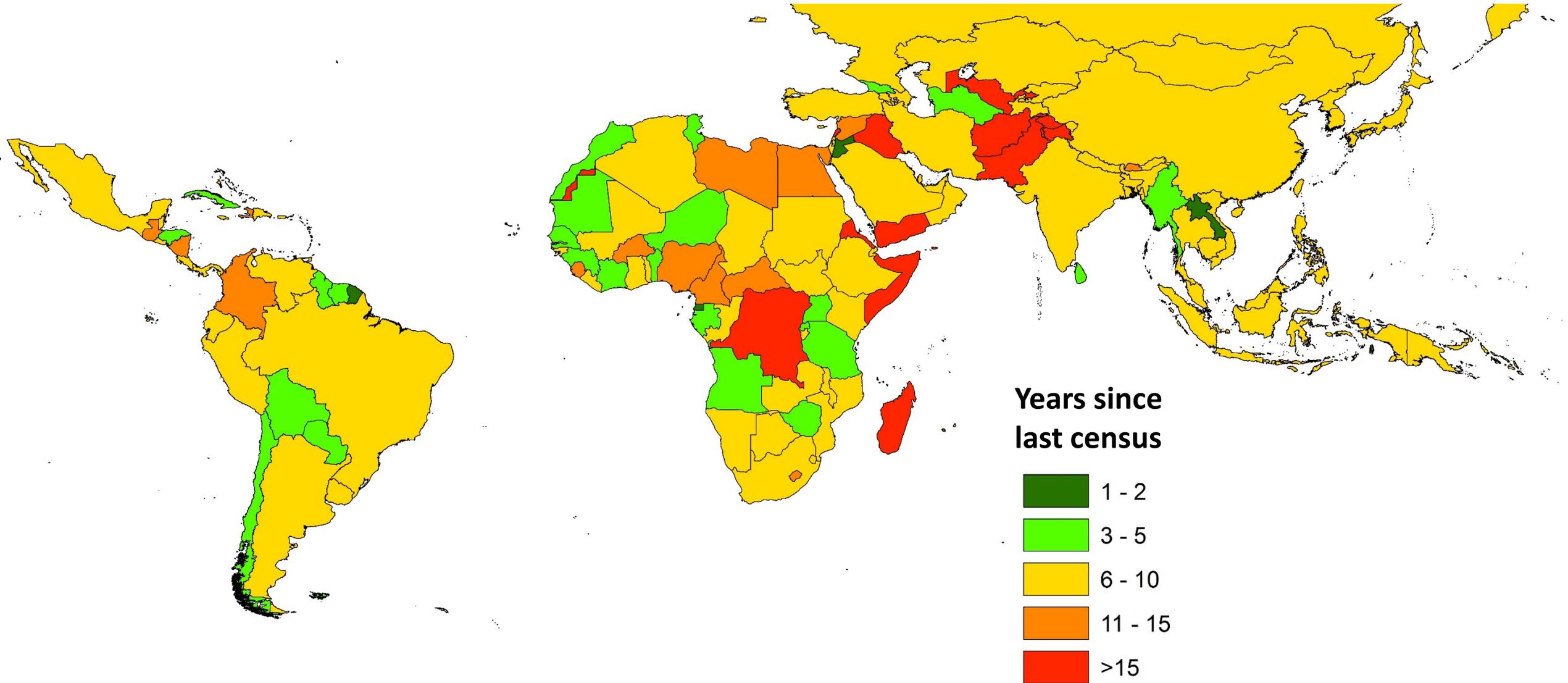
<http://worldpopdb.westeurope.cloudapp.azure.com/>

<http://worldpopdb.westeurope.cloudapp.azure.com/geoserver/ows?service=WCS&version=2.0.1&request=GetCapabilities>

Major Project Timeline

- **Testing multiple sampling approach for the RF parametrization (Nov 2017)**
- **Global population distribution dataset for 2000 (Jan 2018)**
- **Built-Settlement Growth Model datasets (Feb 2018)**
- **Age/sex subnational structure for all countries and years (Sep 2018)**
- **Functional web portal providing free and open access to all demographic datasets and accompanying metadata (Dec 2018)**

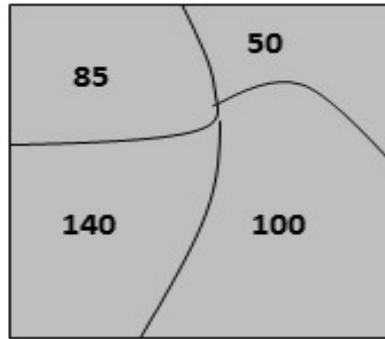
But... (Census Data Limitations)



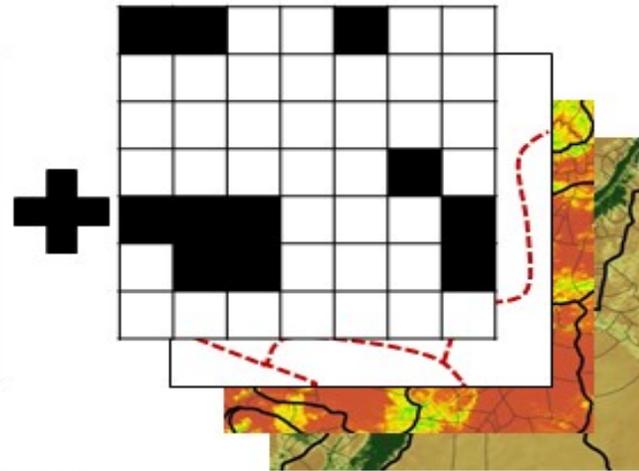
Top-Down Vs Bottom-Up Approach

a) Top down approach

Census population counts



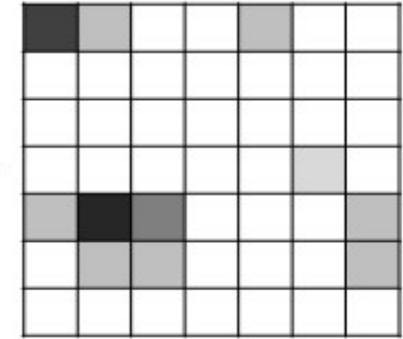
Geospatial covariates



Population disaggregation

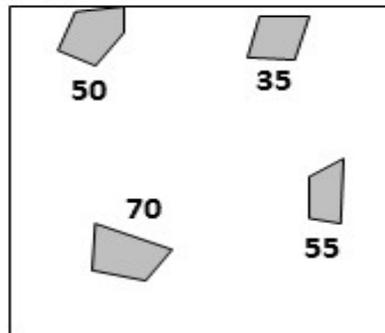
Spatial weighting layer created based on covariates, using dasymetric mapping

Gridded population

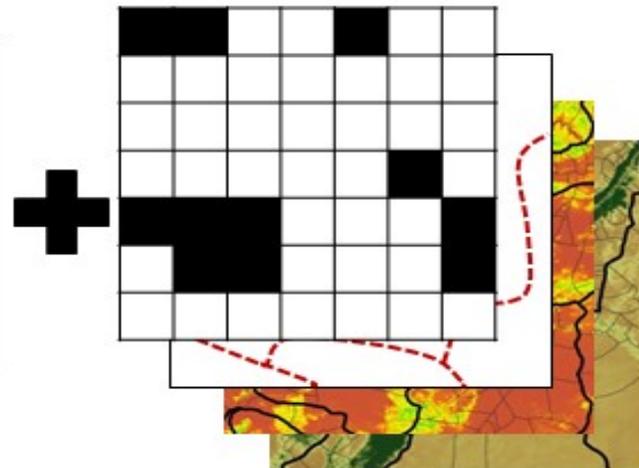


b) Bottom-up approach

Microcensus population counts



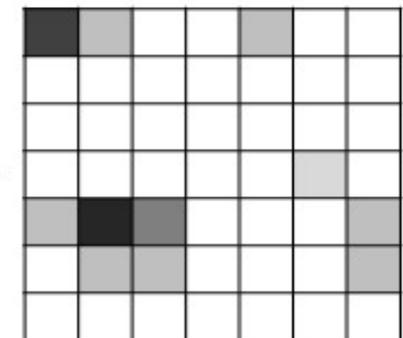
Geospatial covariates



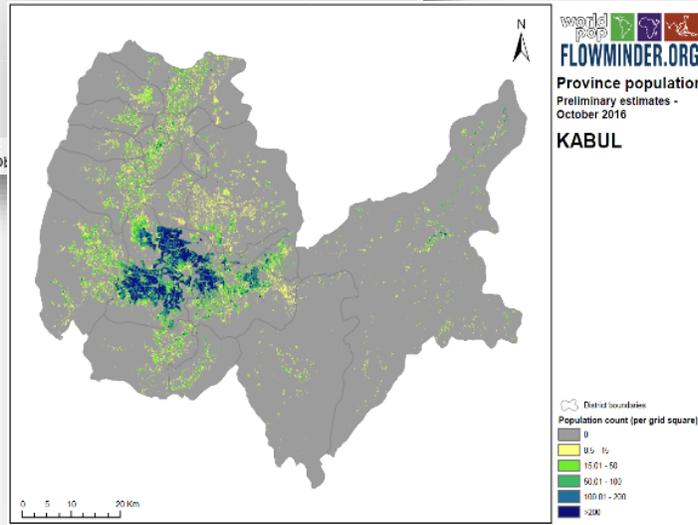
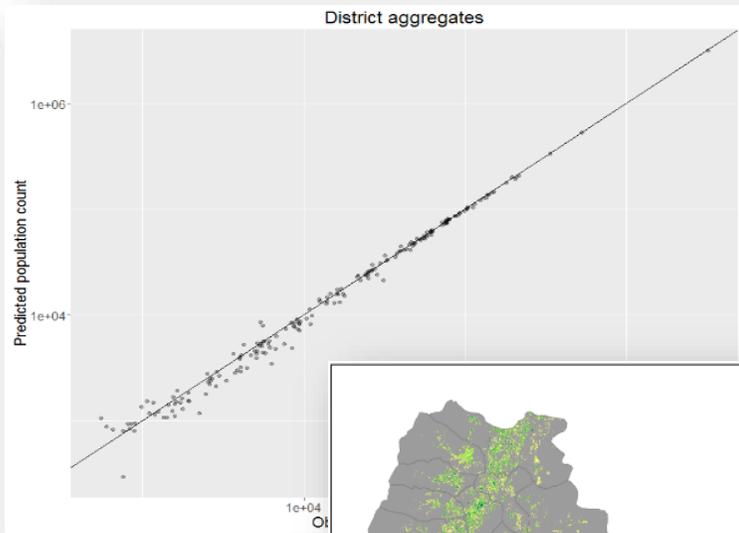
Population estimation

Prediction of population in unsurveyed areas based on covariates, using statistical modelling

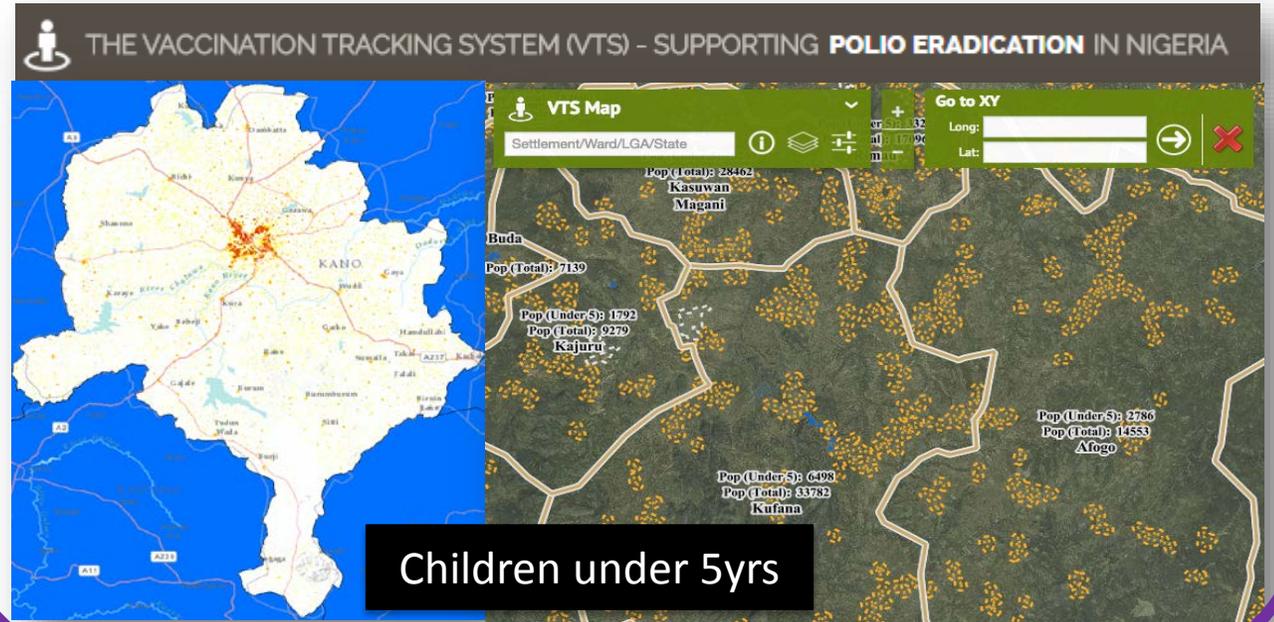
Gridded population



Afghanistan

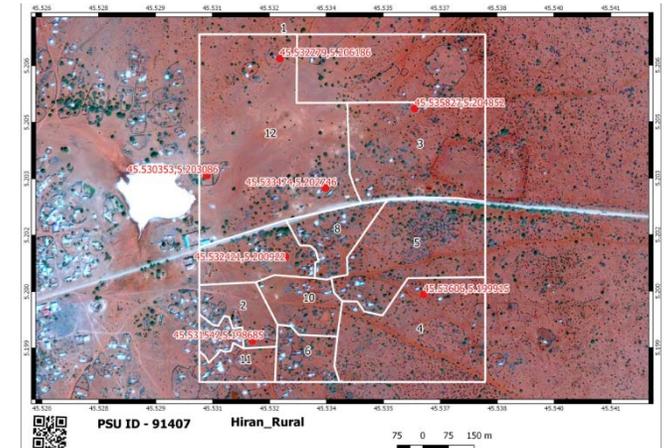


Nigeria



Somalia

Design sample frame



A user-friendly tool to generate household survey sampling units in complex settings

Get started



www.gridsample.org



Thank You!



**Hope to chat with
you tomorrow at
the World Cafe'!**

www.worldpop.org

 [@WorldPopProject](https://twitter.com/WorldPopProject)

www.flowminder.org

 [@Flowminder](https://twitter.com/Flowminder)