



Dataset Deep Dive Webinar Series

WorldPop Gridded Population Datasets



Wednesday 9 December 2020

9 am New York | 3 pm Geneva | 5 pm Nairobi



The mission of the Centre is
to increase the **use** and **impact** of
data in humanitarian response.

Our focus areas



Data
Services



Data
Responsibility



Data
Literacy



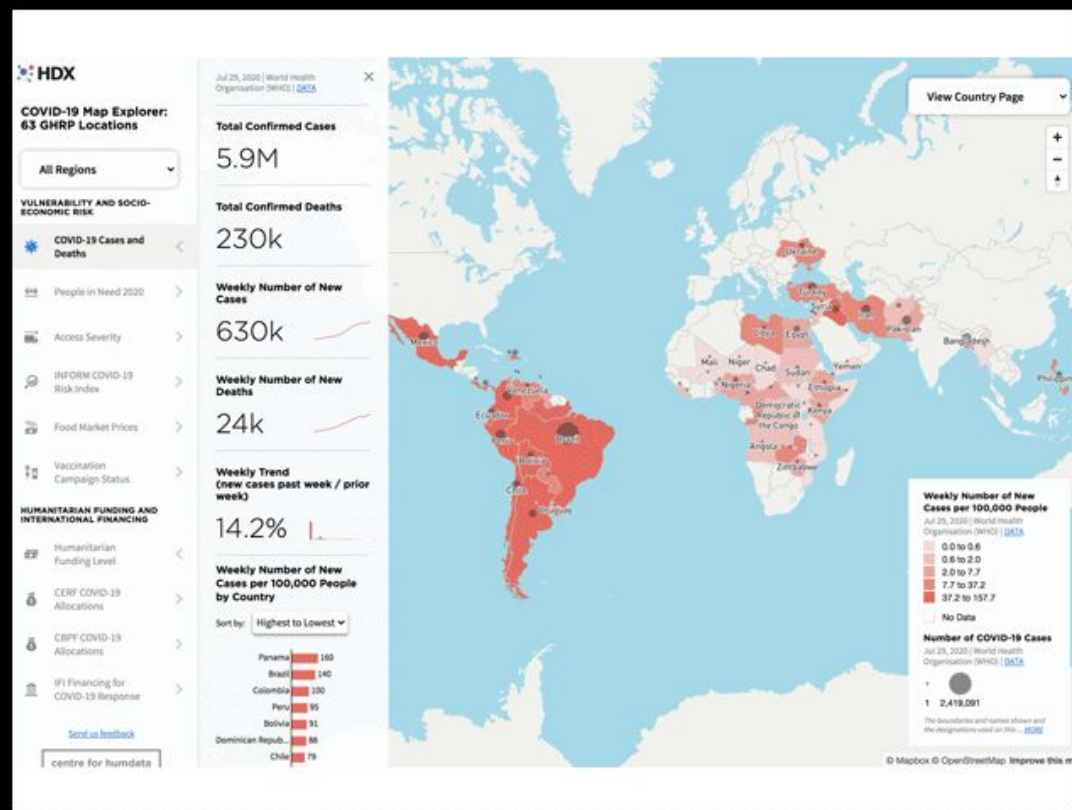
Predictive
Analytics

COVID-19 Data Explorer

63 countries are considered most vulnerable to COVID-19, often because of ongoing humanitarian emergencies.

Our visualization brings together dozens of datasets from over 20 sources, supporting better decisions about aid allocation and distribution.

<https://data.humdata.org/visualization/covid19-humanitarian-operations/>



Today's agenda

15:05 – 15:15: **Introduction to WorldPop**

Andrew Tatem

15:15 – 15:20: **How to Find and Use WorldPop Datasets on HDX**

Godfrey Takavarasha

15:20 – 15:40: **Overview of the WorldPop Gridded Population Datasets**

Andrew Tatem, Alessandro Sorichetta, Maksym Bondarenko

15:40 – 16:00: **Questions and Answers**

Introduction to WorldPop

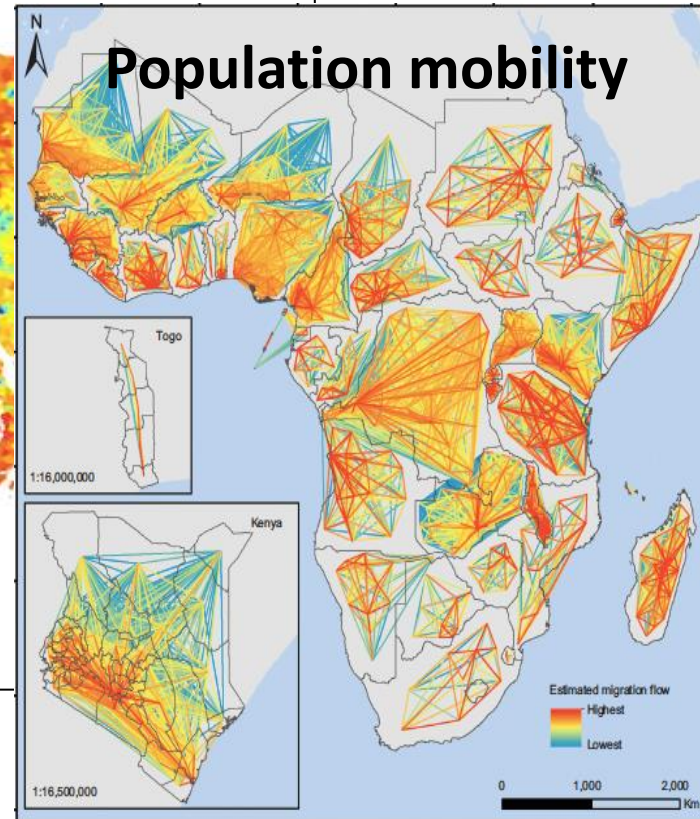
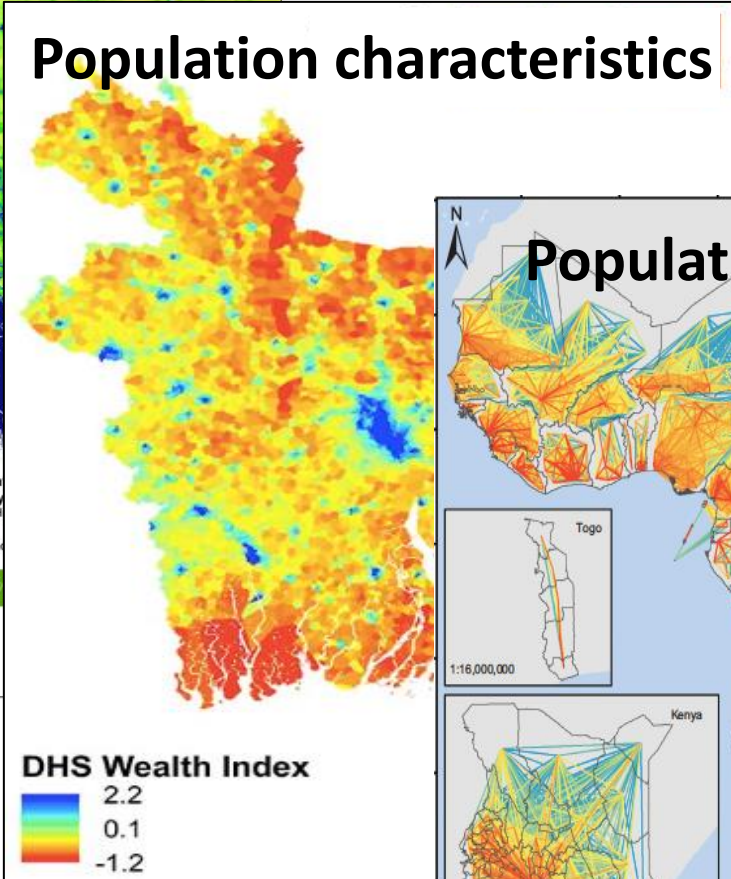
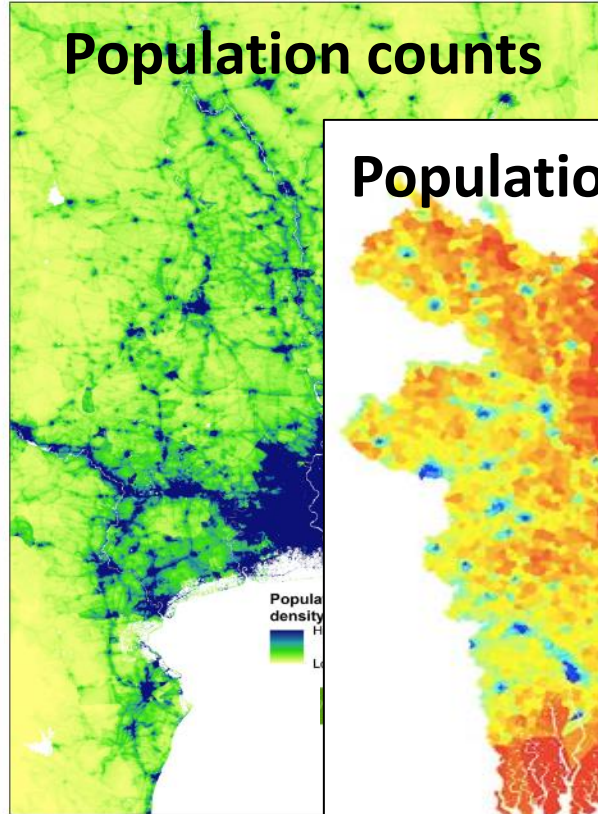
Thailand

Cambodia

Vietnam

**world
pop**





Applied research and
implementation group

Mapping small area population
distributions, demographics and
dynamics

Open data, open peer-reviewed
statistical methods, user
engagement

Application in epidemiology,
maternal/newborn health,
childhood vaccination

Dynamic population mapping using mobile phone data

Pierre Deville^{a,b,c,1}, Catherine Linard^{c,d,1,2}, Samuel Martin^e, Marius Gilbert^{c,d}, Forrest R. Stevens^f, Andrea E. Gaughan^f, Vincent D. Blondel^g, and Andrew J. Tatem^{g,h,i}

^aDepartment of Applied Mathematics, Université catholique de Louvain, 1348 Louvain-la-Neuve, Belgium; ^bCenter for Complex Network Research and Physics Department, Northeastern University, Boston, MA 02115; ^cFonds National de la Recherche Scientifique, B-1000 Brussels, Belgium; ^dBiological Control and Spatial Ecology, Université Libre de Bruxelles, B-1050 Brussels, Belgium; ^eUniversité de Lorraine CNRS, Centre de Recherche en Automatique de Nancy, UMR 7039, 54518 Vandoeuvre-lès-Nancy, France ^fDepartment of Geography and Geosciences, University of Louisville, Louisville, KY 40292; ^gDepartment of Geography and Environment, University of Southampton, Southampton SO17 1BJ, United Kingdom; ^hFogarty International Center, National Institutes of Health, Bethesda, MD 20892; and ⁱFlowminder Foundation, 17177 Stockholm, Sweden

Edited by Michael F. Goodchild, University of California, Santa Barbara, CA, and approved September 15, 2014 (received for review May 8, 2014)

During the past few decades, technologies such as remote sensing... derive health and development indicators (3, 5, 26, 27). However,

ARTICLE

<https://doi.org/10.1057/s41599-019-0242-9> OPEN

Exploring the use of mobile phone data for national migration statistics

Shengjie Lai^{1,2,3}, Elisabeth zu Erbach-Schoenberg^{1,2}, Carla Pezzulo¹, Nick W. Ruktanonchai^{1,2}, Alessandro Soricchetta^{1,2}, Jessica Steele¹, Tracey Li², Claire A. Dooley^{1,2} & Andrew J. Tatem^{1,2}

National population mapping from sparse survey data: A hierarchical Bayesian modeling framework to account for uncertainty

Douglas R. Leasure^{a,1}, Warren C. Jochem^a, Eric M. Weber^b, Vincent Seaman^c, and Andrew J. Tatem^a

^aWorldPop, Geography and Environmental Science, University of Southampton, Southampton SO17 1BJ, United Kingdom; ^bNational Security Emerging Technologies Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830; and ^cGlobal Development Division, The Bill and Melinda Gates Foundation, Seattle, WA 98109

INTERFACE

rsif.royalsocietypublishing.org

Research



Fine resolution mapping of population age-structures for health and development applications

V. A. Alegana¹, P. M. Atkinson¹, C. Pezzulo¹, A. Soricchetta¹, D. Weiss², T. Bird¹, E. Erbach-Schoenberg¹ and A. J. Tatem^{1,3,4}

Open, peer-reviewed methods and datasets

Spatially disaggregated population estimates in the absence of national population and housing census data

N. A. Wardrop^{a,b,1}, W. C. Jochem^{a,b,1}, T. J. Bird^{a,b}, H. R. Chamberlain^{a,b}, D. Clarke^{a,b}, D. Kerr^{a,b}, L. Bengtsson^{a,b}, S. Juran^c, V. Seaman^d, and A. J. Tatem^{a,b,2}

Computers, Environment and Urban Systems

ELSEVIER

journal homepage: www.elsevier.com/locate/ceus

Annually modelling built-settlements between remotely-sensed observations using relative changes in subnational populations and lights at night

Jeremiah J. Nieves^{a,b,*}, Alessandro Soricchetta^{a,b}, Catherine Linard^{b,c}, Maksym Bondarenko^{a,b}, Jessica E. Steele^{a,b}, Forrest R. Stevens^{a,d}, Andrea E. Gaughan^{a,d}, Alessandra Carioli^{a,b}, Donna J. Clarke^{a,b}, Thomas Esch^e, Andrew J. Tatem^{a,b}

Article

Classifying settlement types from multi-scale spatial patterns of building footprints

Warren C Jochem, Douglas R Leasure, Oliver Pannell, Heather R Chamberlain, Patricia Jones and Andrew J Tatem

WorldPop, School of Geography and Environmental Science, University of Southampton, UK

EPB: Urban Analytics and City Science

0(0) 1–19

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DOI: 10.1177/2399808320921208

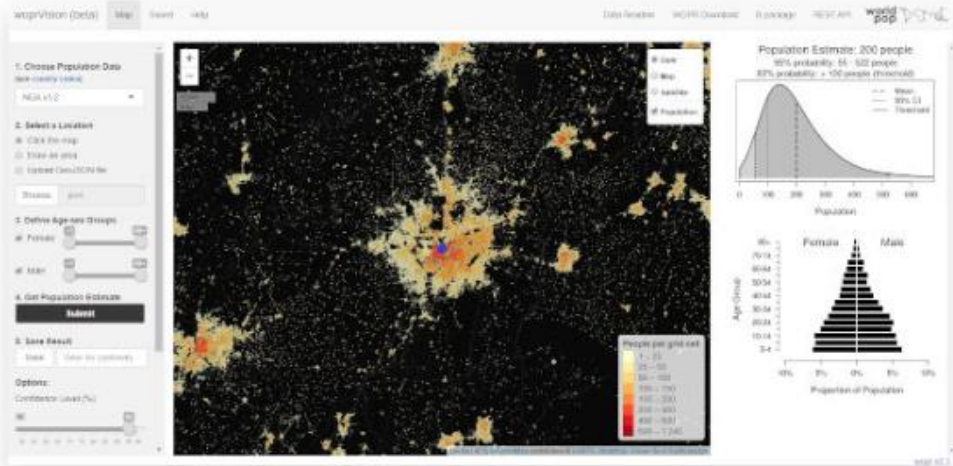
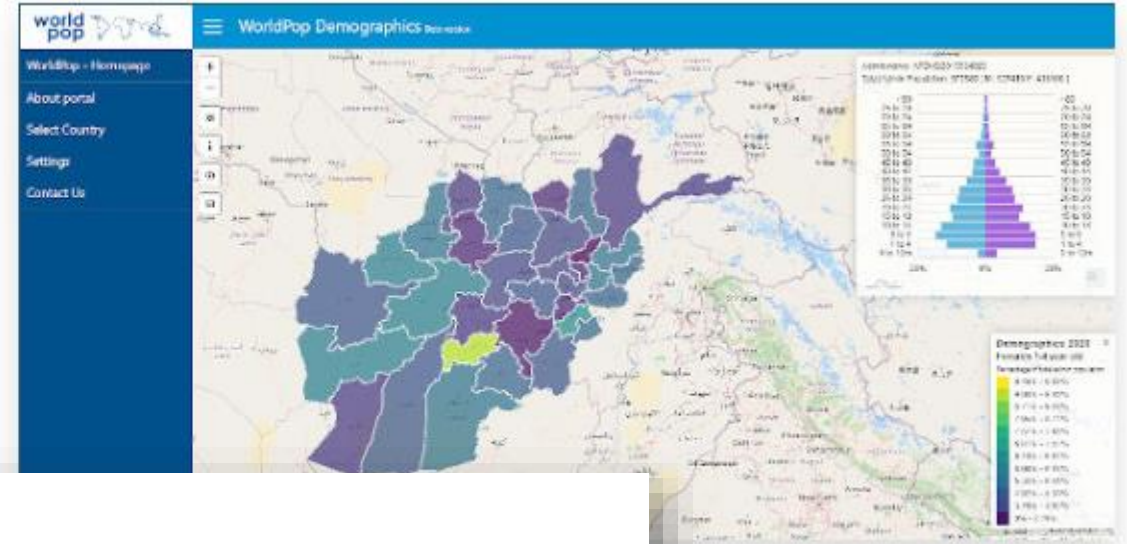
journals.sagepub.com/home/epb



WorldPop Demographics Portal

Global subnational age and sex structured estimates for 2020 obtained through integrating census, microdata and survey datasets in a spatiotemporal modelling framework.

[DETAILS](#)



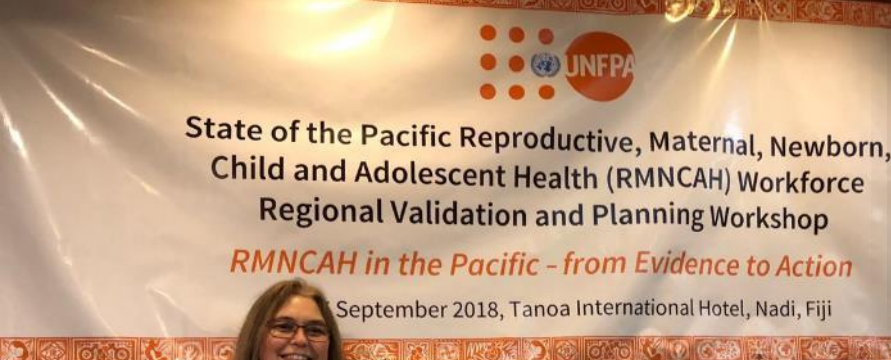
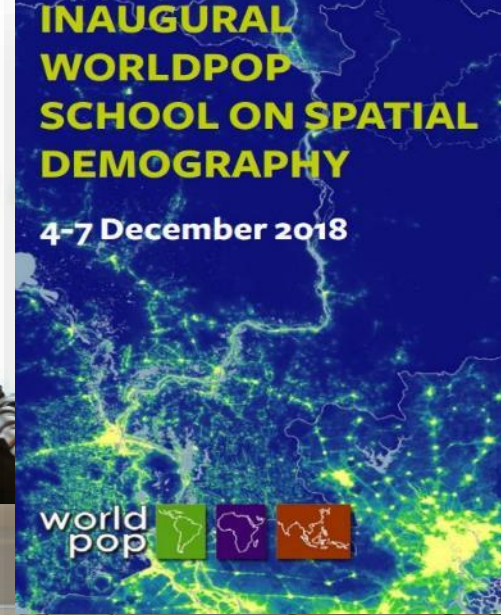
WorldPop Applications

Putting the power of population data into your hands.

[DETAILS](#)

Open datasets,
code,
applications

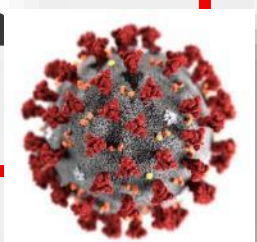
User engagement and capacity strengthening



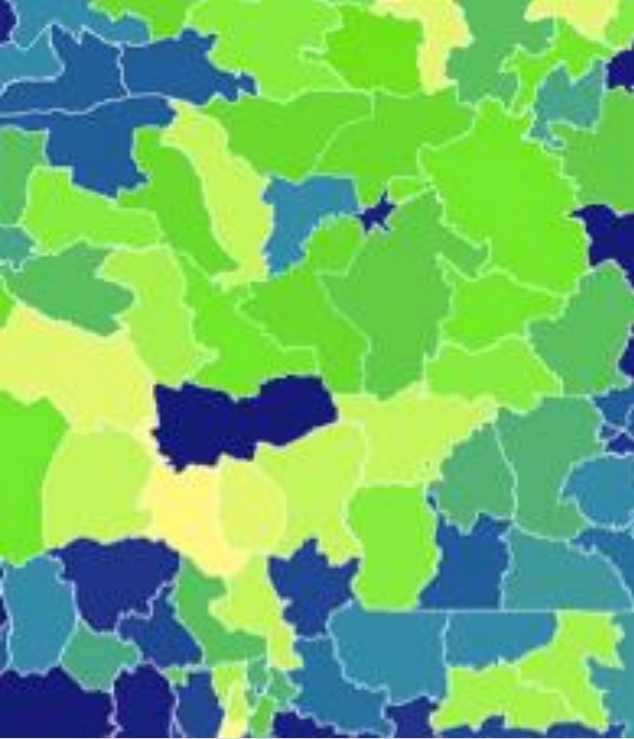


Uses of small area demographic data

- Planning elections
- Calculating GDP
- Local governance
- Traffic planning
- Financial services
- Delivering utilities
- Agricultural subsidies
- Taxation
- Land use management
- Energy strategies
- Disaster response
- Humanitarian needs
- Health system planning
- Supply chain management
- Health metrics
- Meeting SDGs
- Controlling infectious diseases
- Modelling disease spread and intervention effects



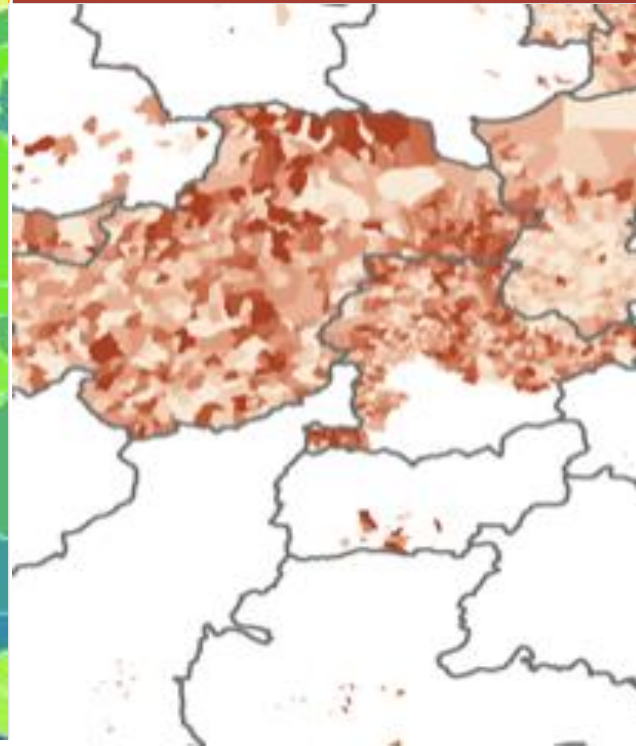
Coarse resolution



Outdated



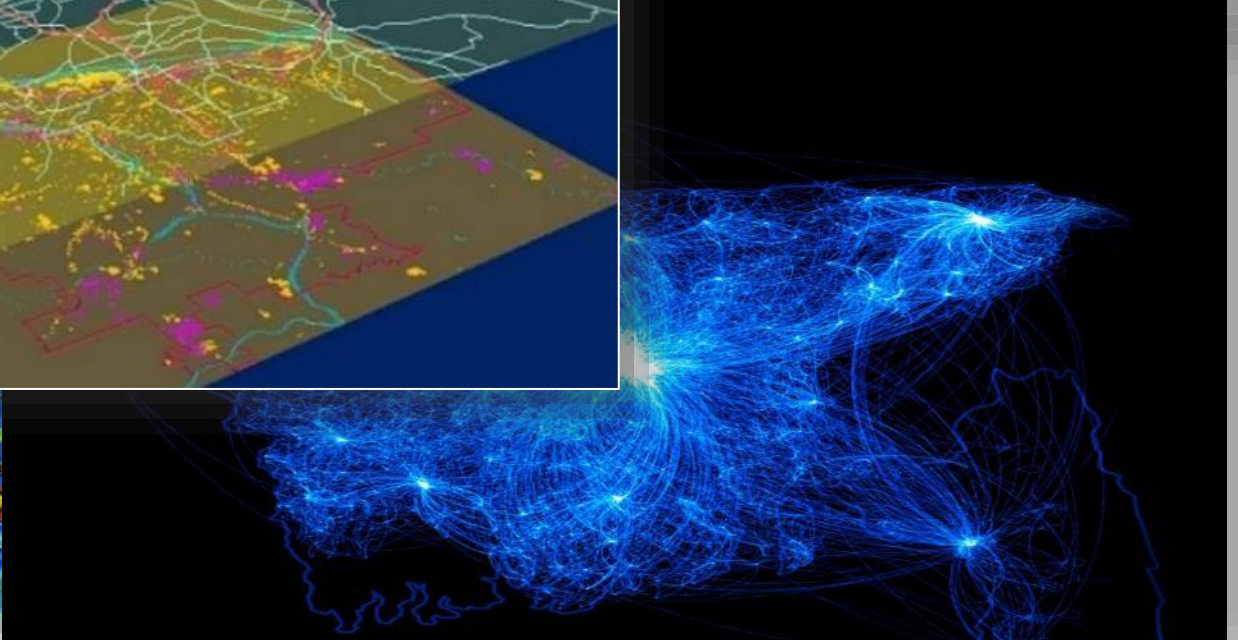
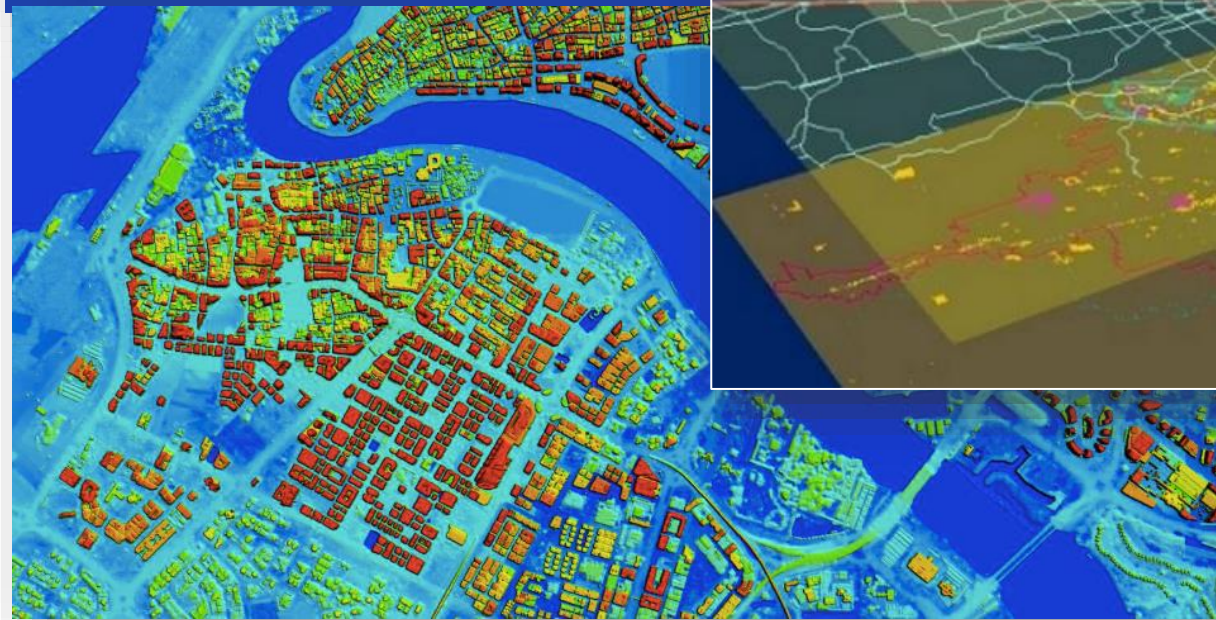
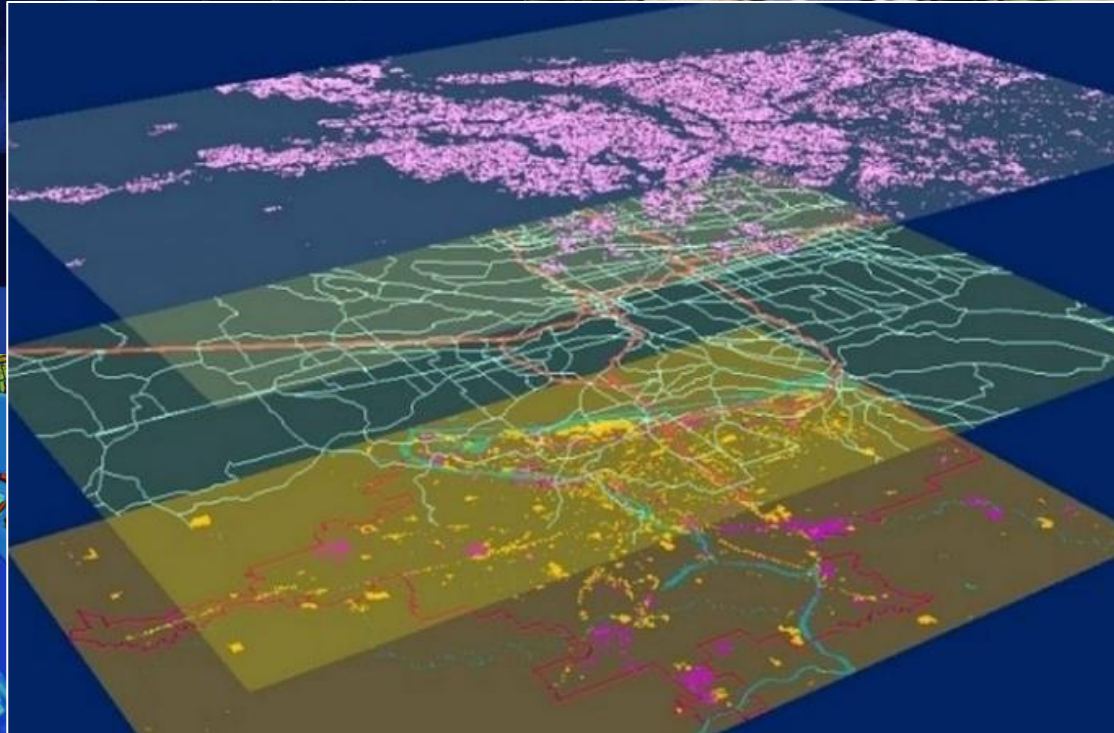
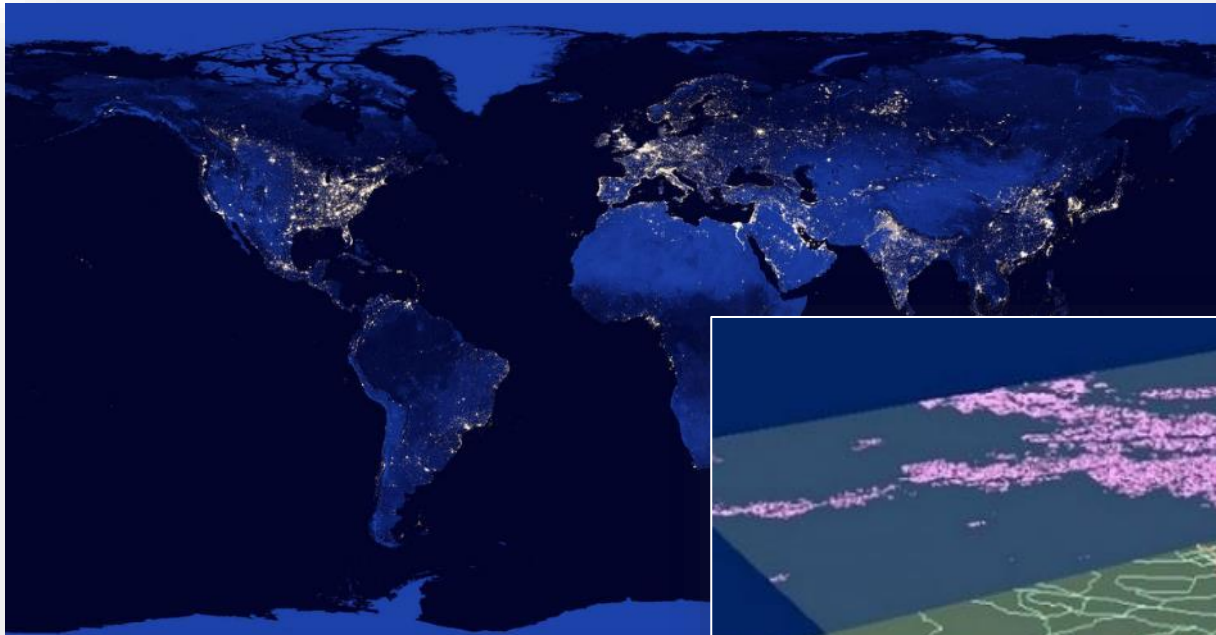
Incomplete



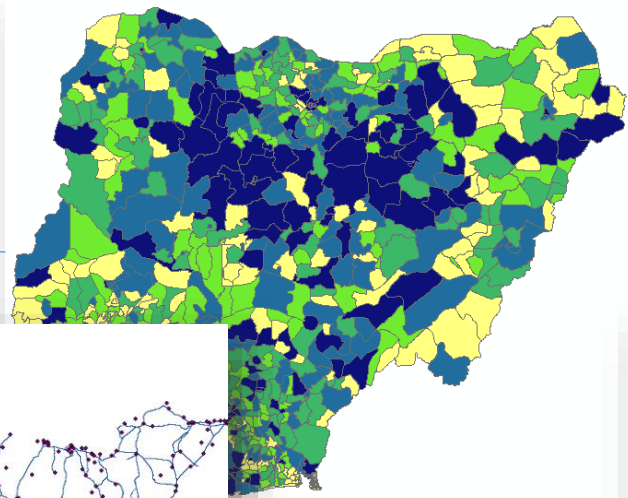
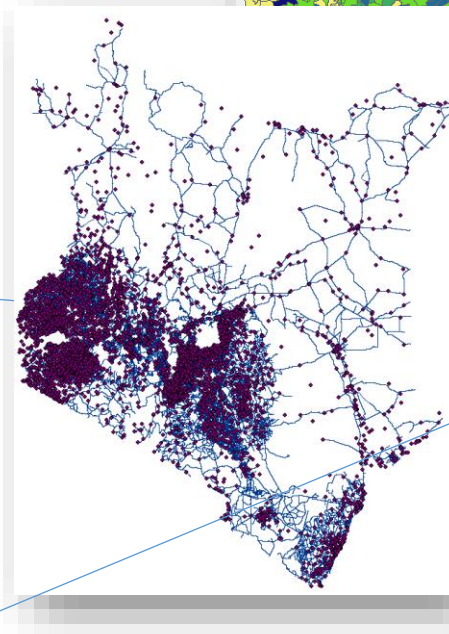
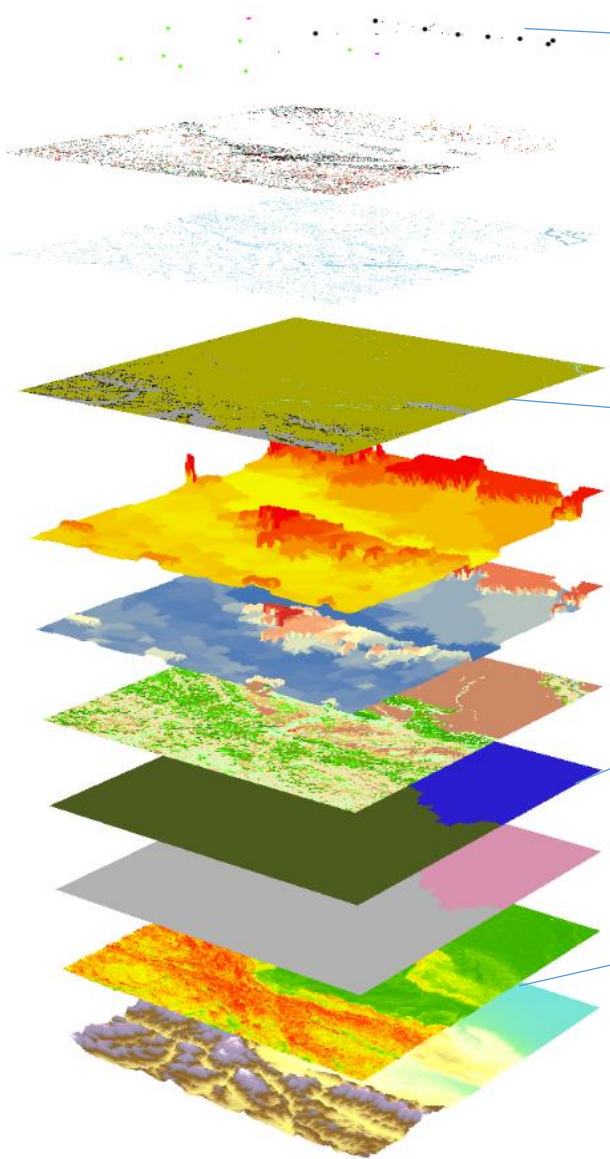
**Inaccuracies,
missing populations**



Demographic data challenges



Data integration

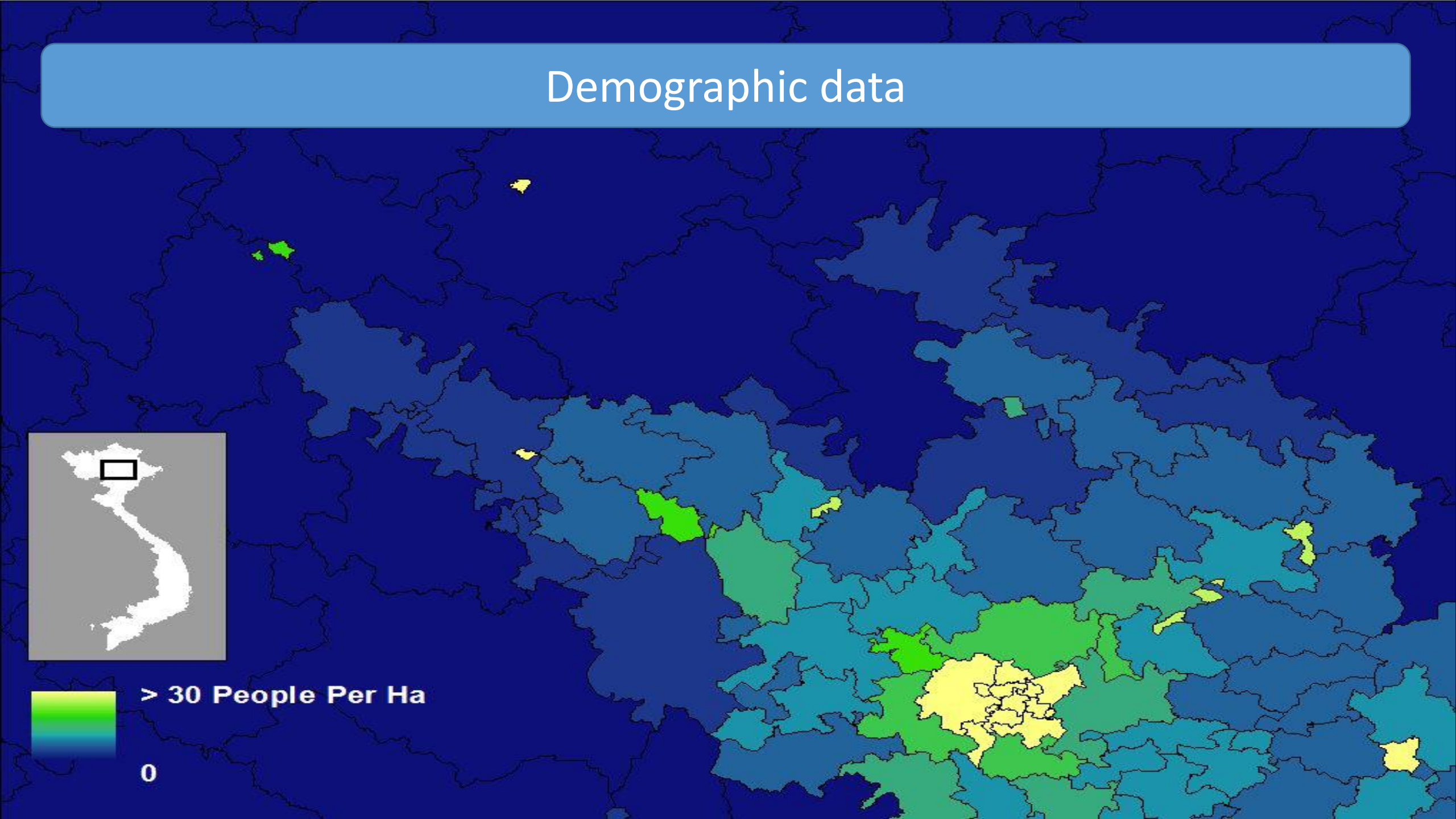


Demographic data



> 30 People Per Ha

0

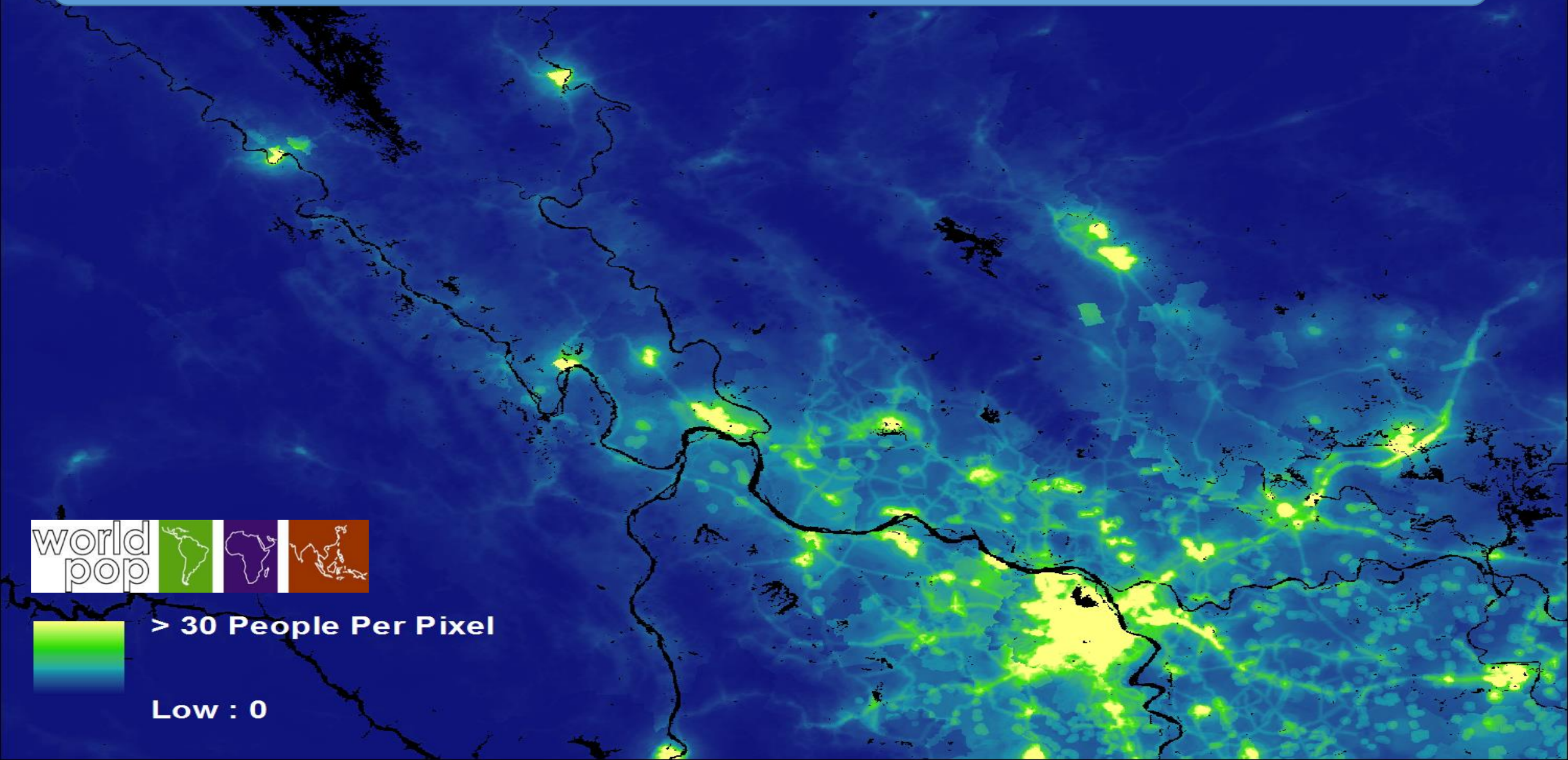


Population counts per 100 x 100m grid square

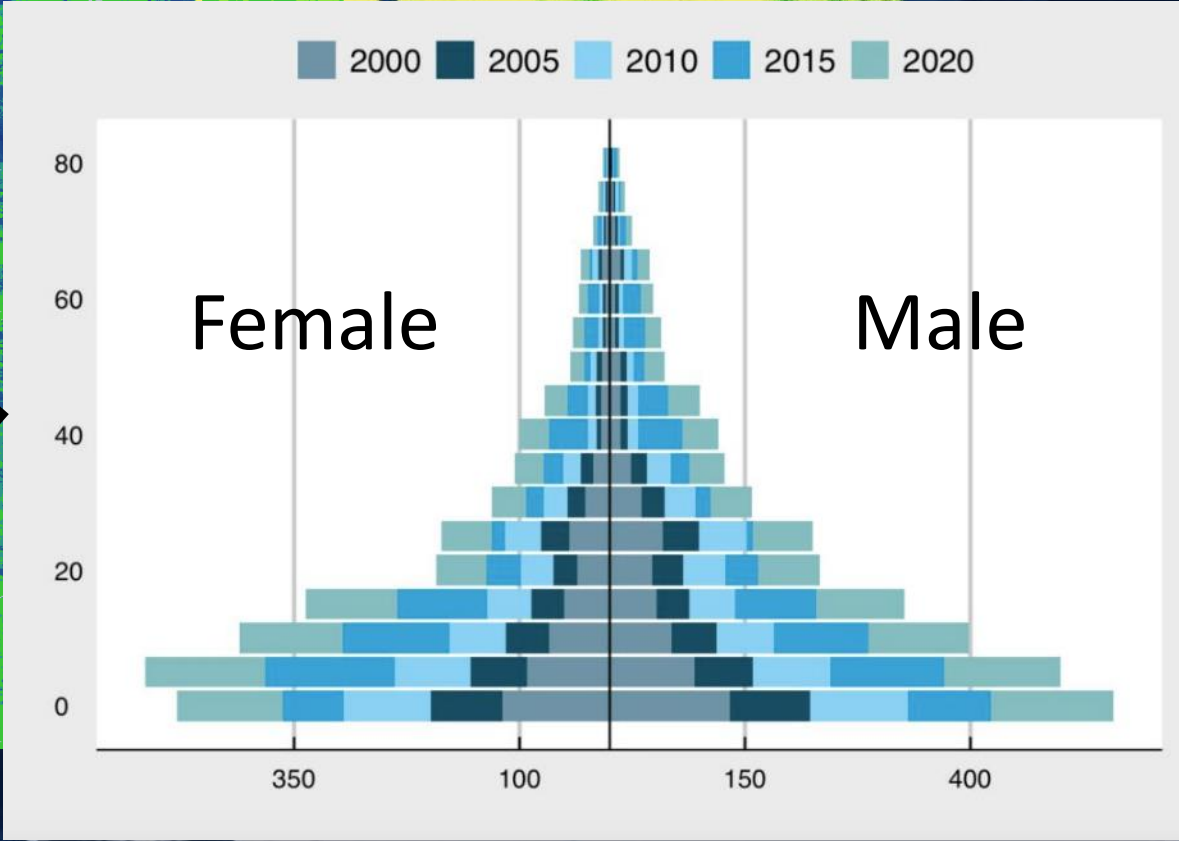
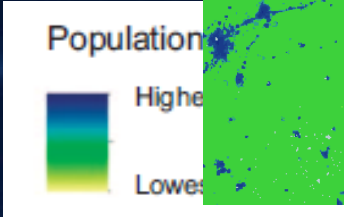
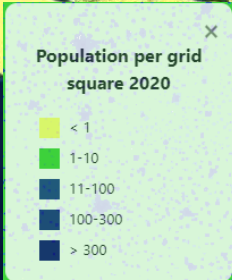


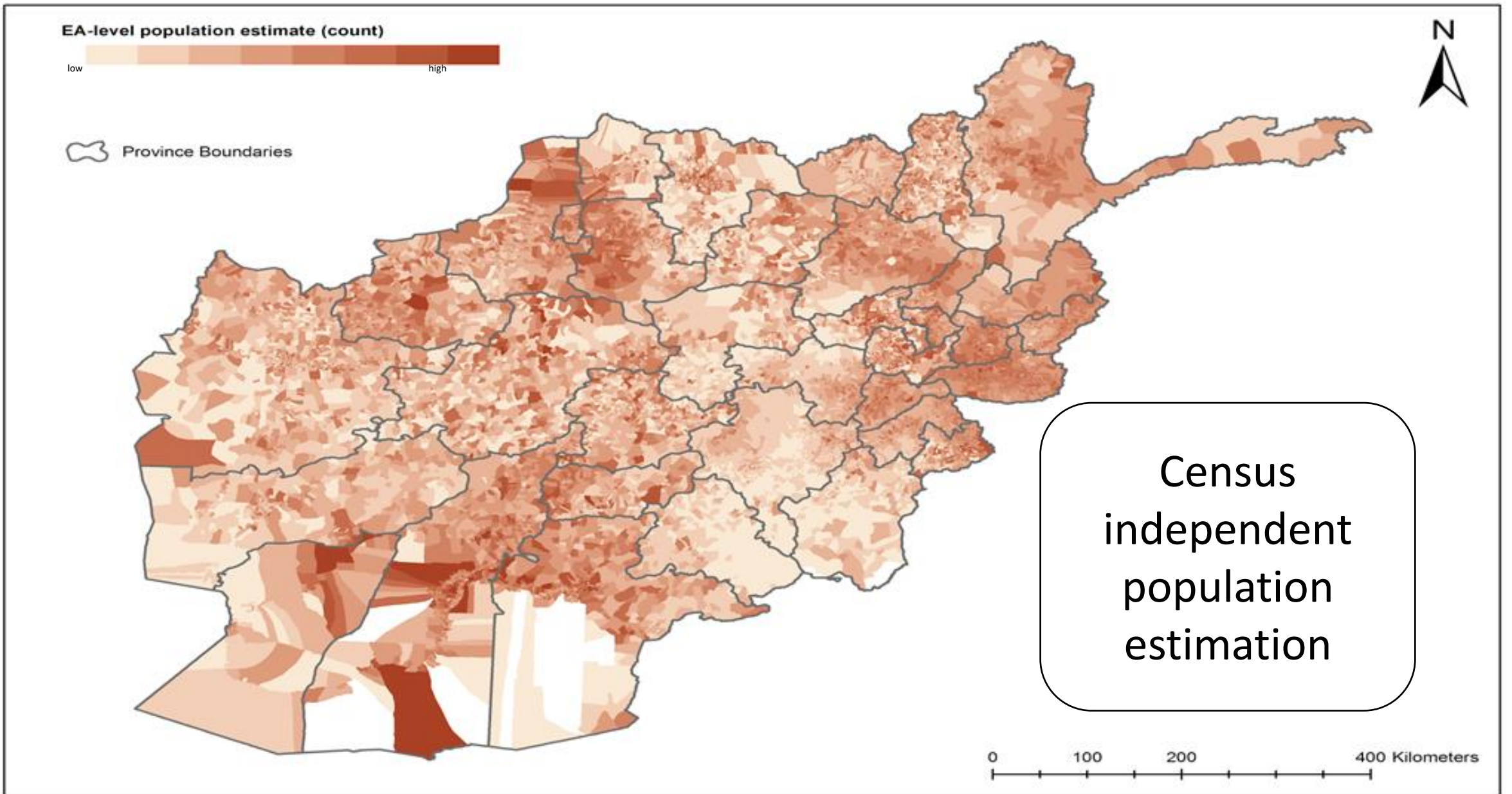
> 30 People Per Pixel

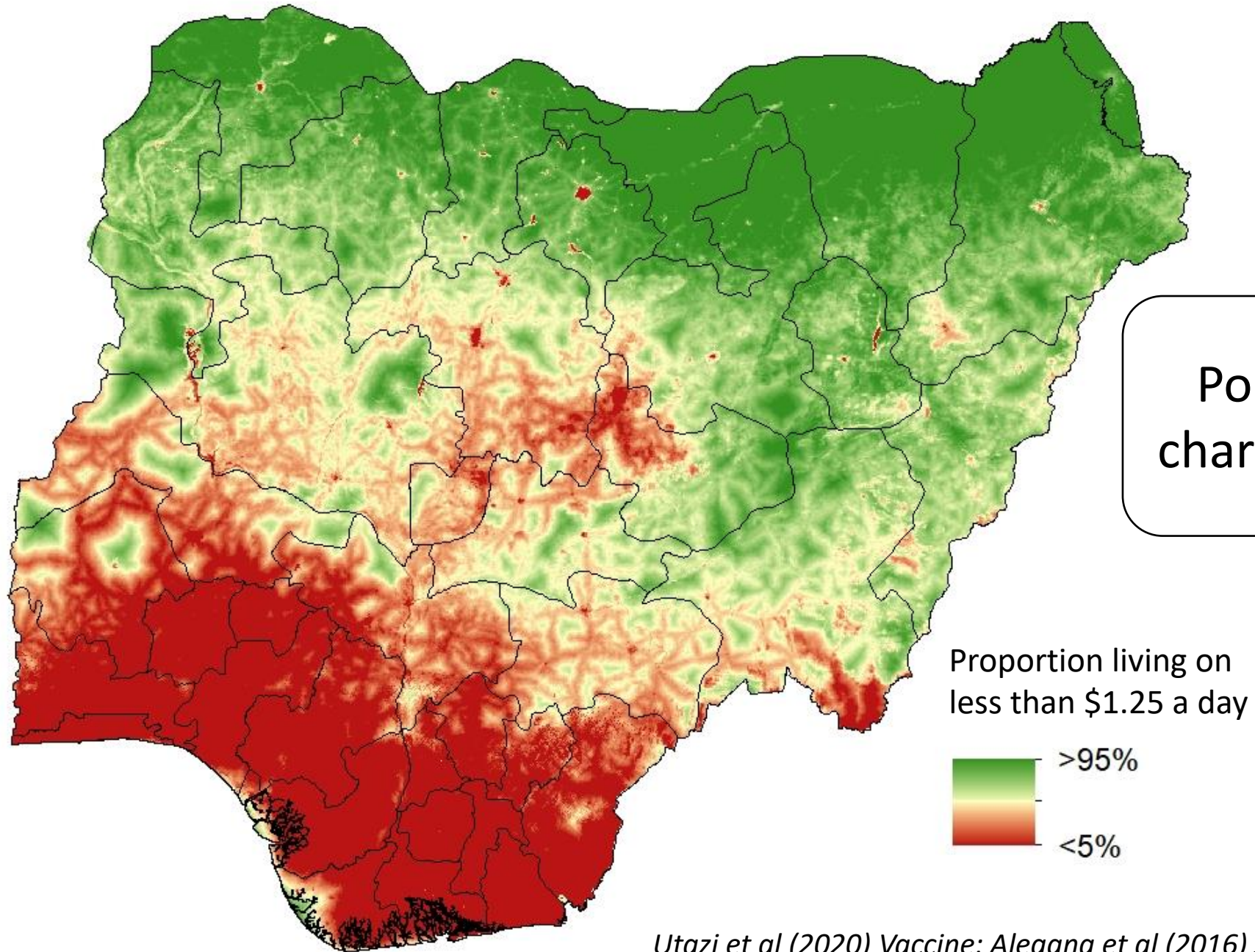
Low : 0



Age/sex structured global population mapping 2000-2020



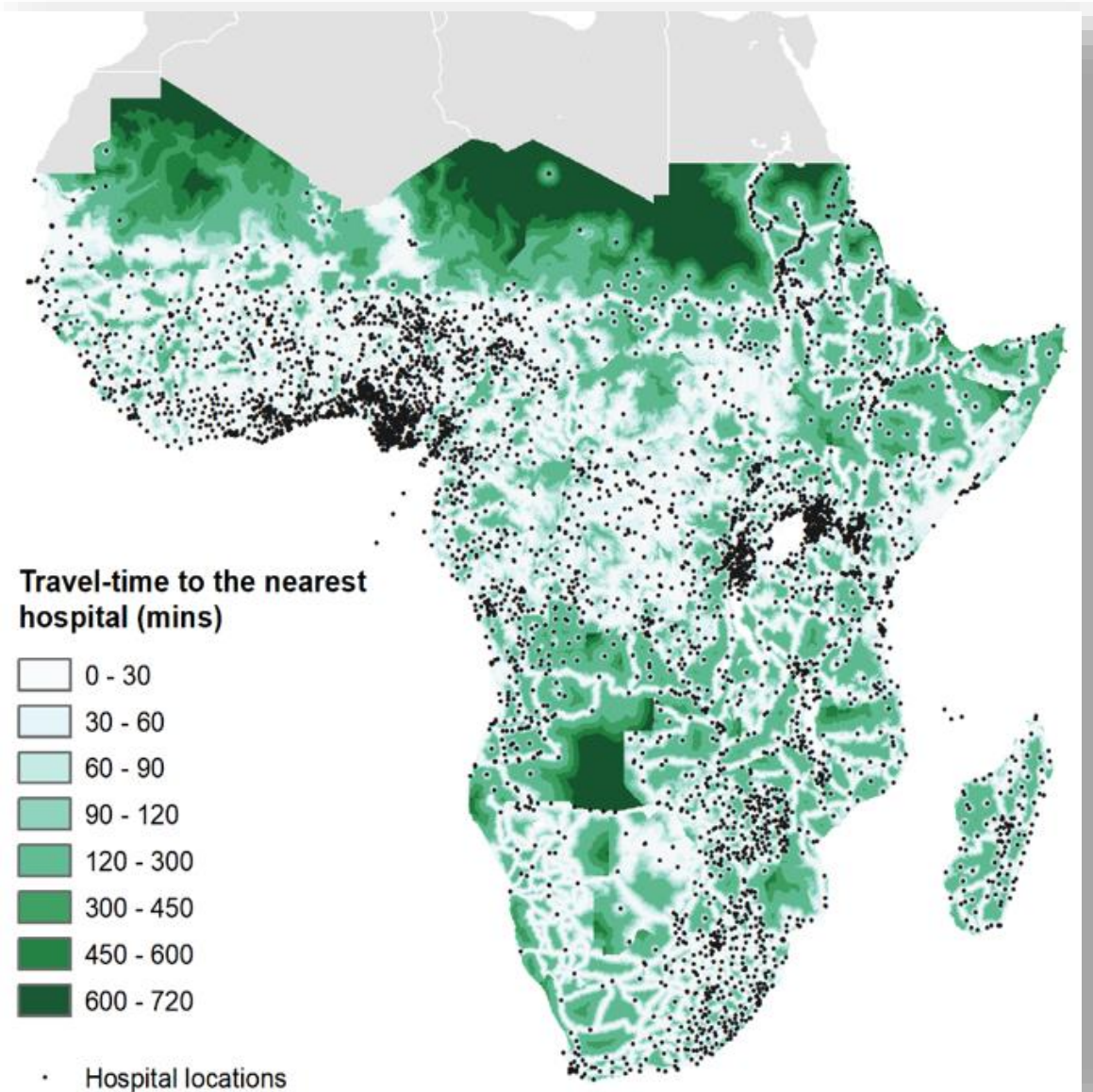
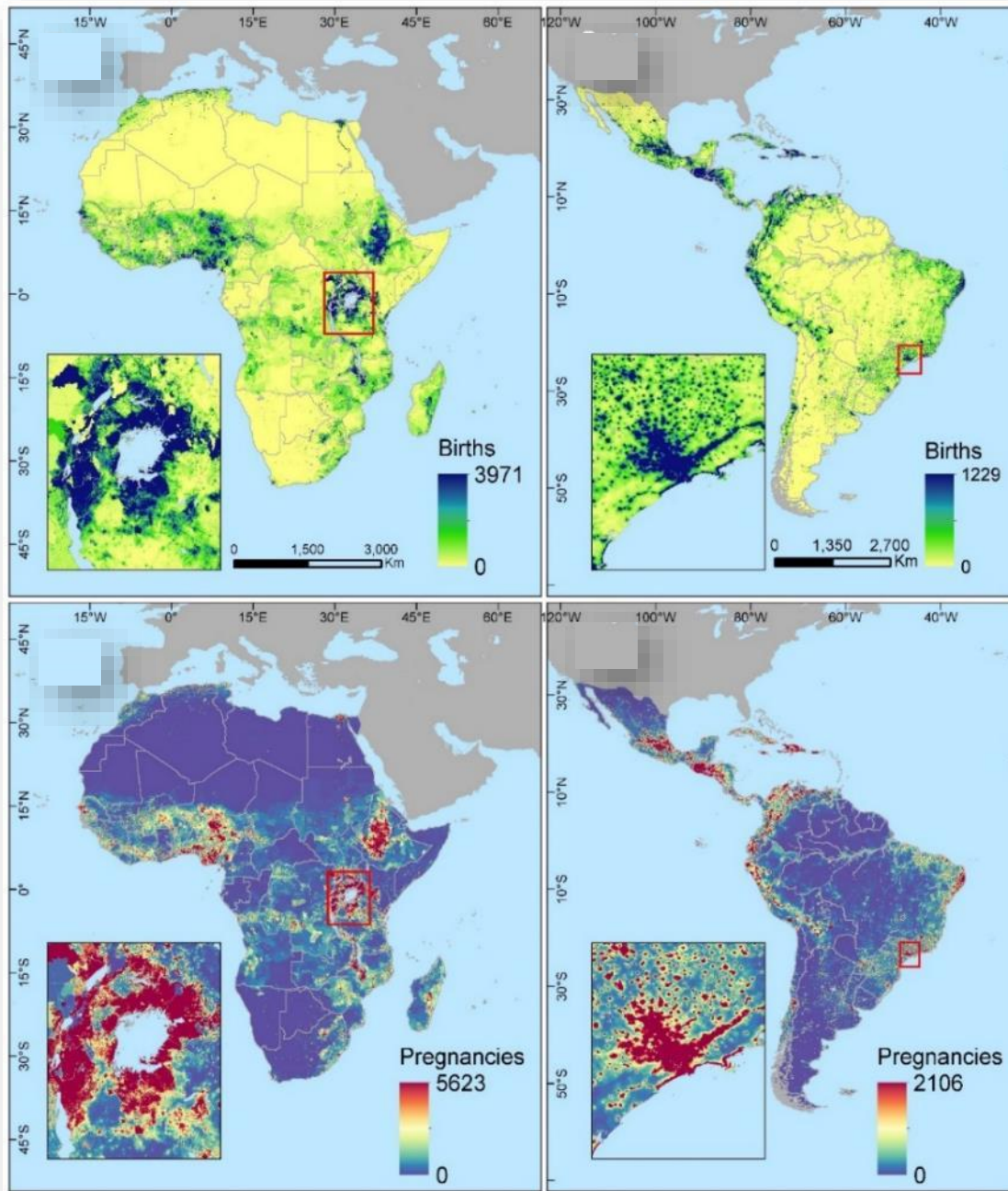


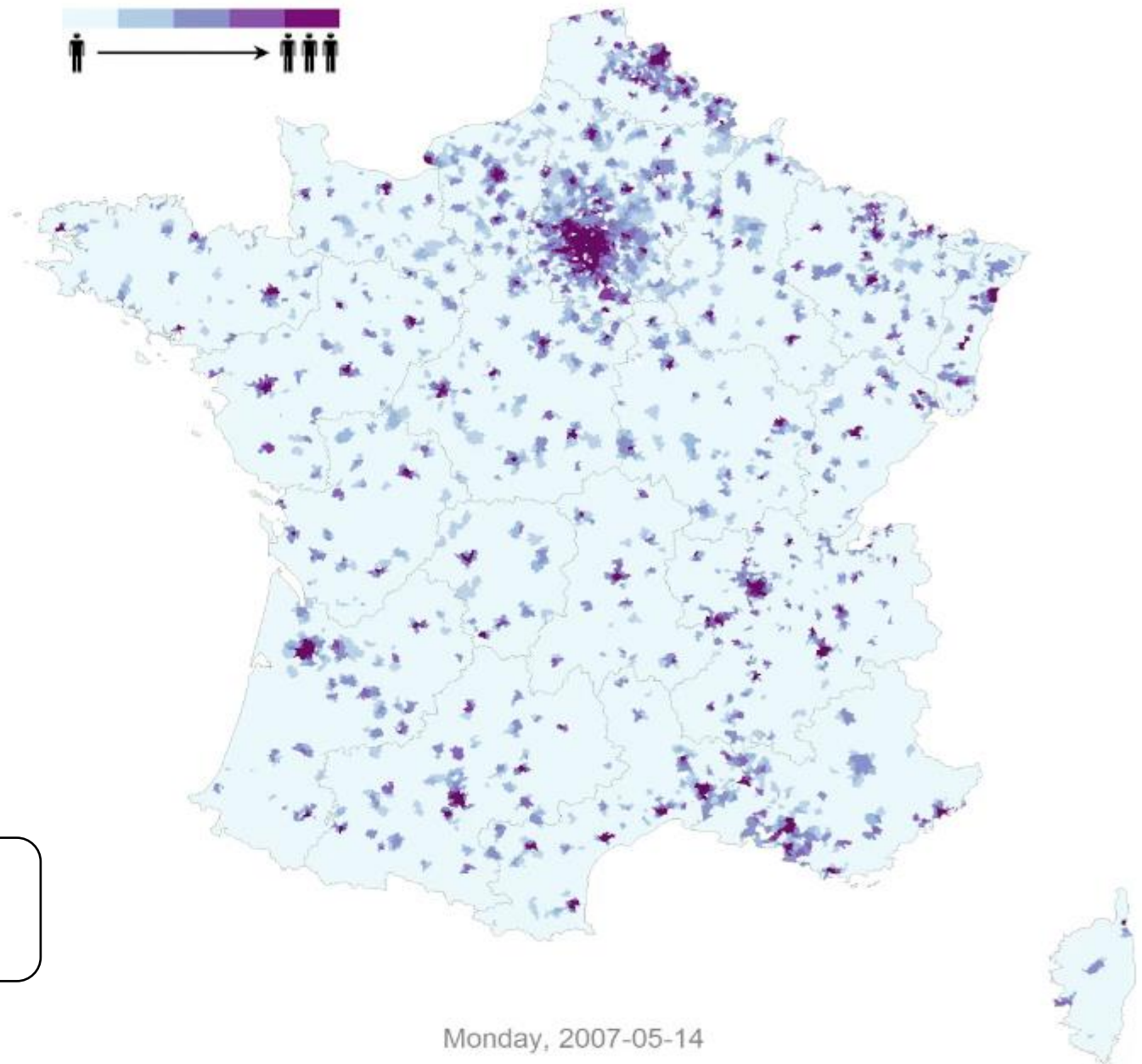


Population characteristics

Utazi et al (2020) Vaccine; Alegana et al (2016) J Royal Society Int; Bosco et al (2017) J Royal Society Int

Scaling up data and insights

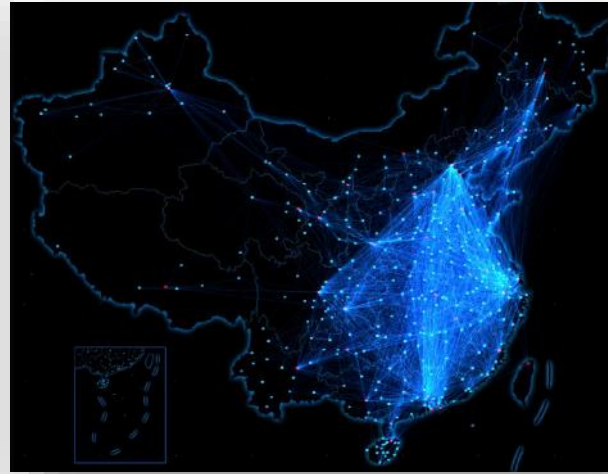
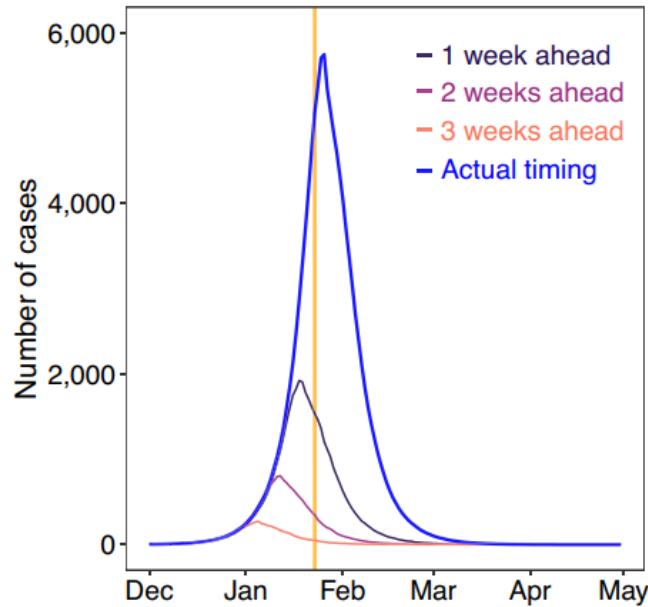




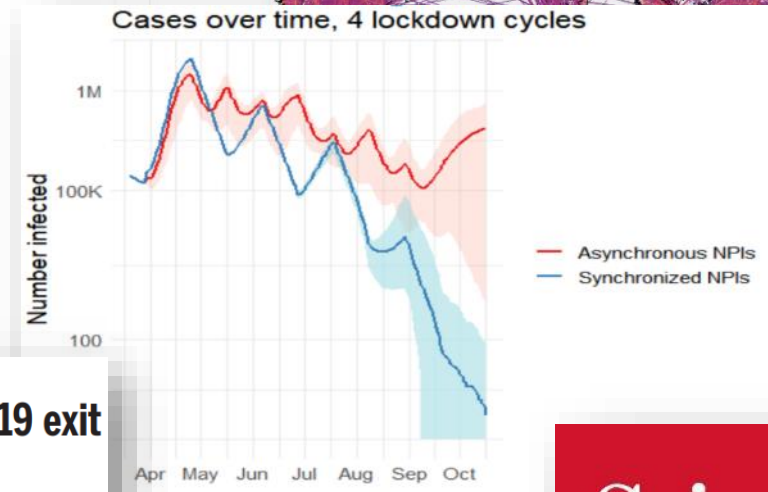
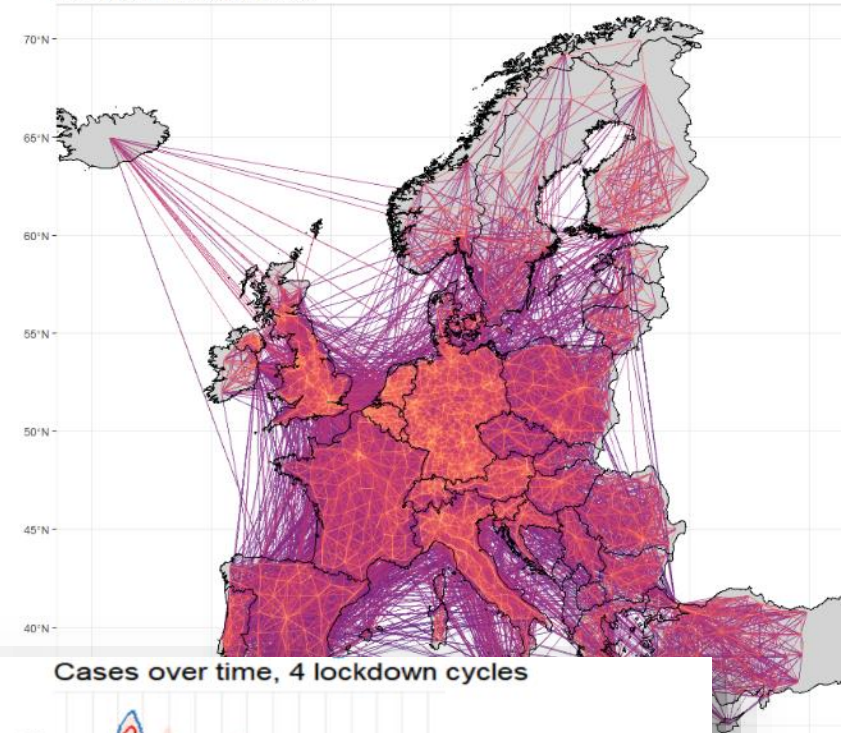
Mapping population dynamics

Accelerated Article Preview

Effect of non-pharmaceutical interventions to contain COVID-19 in China



Probability of moving per 8 hours



CORONAVIRUS

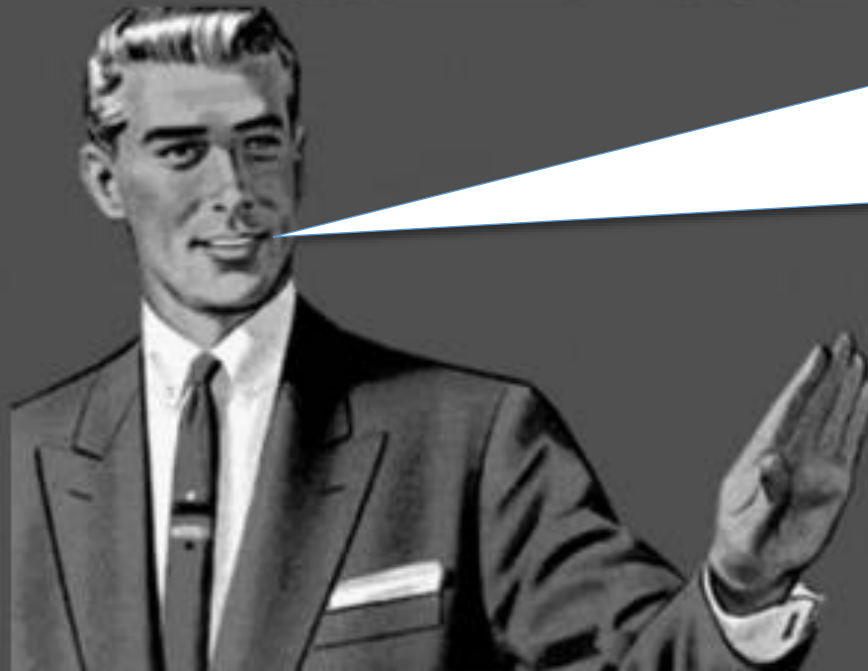
Assessing the impact of coordinated COVID-19 exit strategies across Europe

N. W. Ruktanonchai^{1,2*}†, J. R. Floyd^{1*}†, S. Lai^{1*}†, C. W. Ruktanonchai^{1†}, A. Sadilek³, P. Rente-Lourenco⁴, X. Ben³, A. Carioli¹, J. Gwinn⁵, J. E. Steele¹, O. Prosper⁶, A. Schneider³, A. Oplinger³, P. Eastham³, A. J. Tatem¹

Spatial modelling of infectious diseases



HOLD UP



WAIT A MINUTE

Is any of this finding its way outside of academia?

1. Choose Population Data (see country codes)

NGA v1.2

2. Select a Location

- Click the map
- Draw an area
- Upload GeoJSON file

Browse No file selected

3. Define Age-sex Groups

Female

Male

4. Get Population Estimate

Submit

5. Save Result

Save Result Name (option)

Options:

Confidence Level (%):

50 95

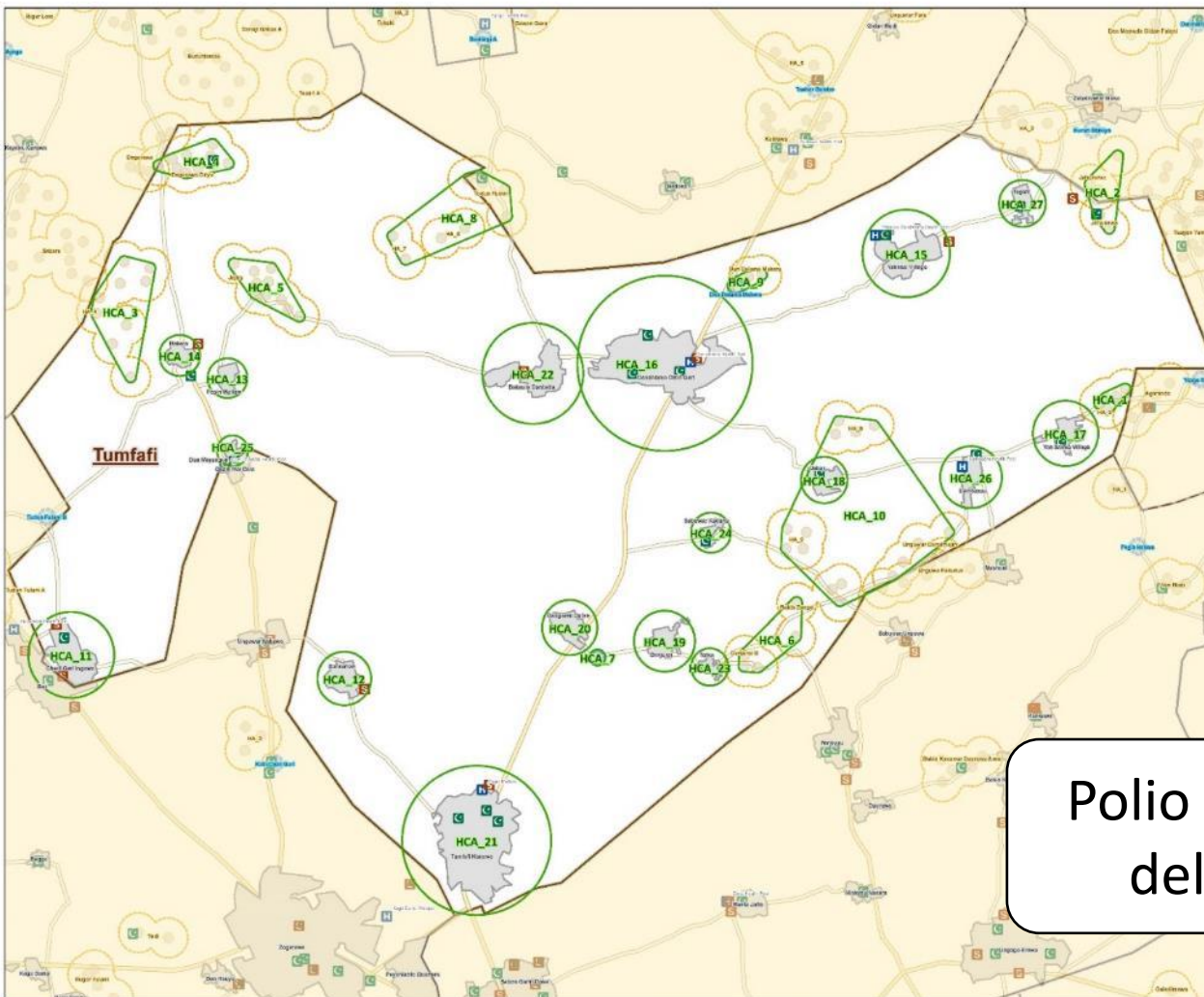
50 55 60 65 70 75 80 85 90 95 99

Confidence Type

Interval

Population Threshold

100

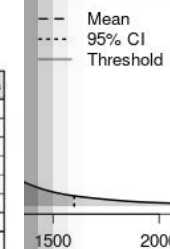


Ward: Tumfafi
 LGA: Dawakin Tofa
 State: Kano

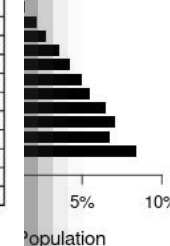
Total targeted population: 56334
 Total # of HCAs: 26

Area Name	Rural Target Pop	Urban Target Pop	# HC Days
HCA_1	126	0	2
HCA_2	128	0	2
HCA_3	231	0	4
HCA_4	257	0	4.5
HCA_5	257	0	4.5
HCA_6	128	0	2
HCA_7	0	154	1.5
HCA_8	231	0	4
HCA_9	51	154	2.5
HCA_10	385	0	6.5
HCA_11	0	3848	38.5
HCA_12	0	1744	17.5
HCA_13	0	1077	11
HCA_14	0	1077	11
HCA_15	0	4156	41.5
HCA_16	0	13339	133.5
HCA_17	0	1539	15.5
HCA_18	0	1334	13.5
HCA_19	0	1796	18
HCA_20	0	1547	15.5
HCA_21	0	14058	140.5
HCA_22	0	4002	40
HCA_23	0	667	6.5
HCA_24	0	667	6.5
HCA_25	0	482	4.5
HCA_26	0	1486	15
HCA_27	0	1129	11.5
Total	1796	54538	576.5

21 people
 00 people
 le (threshold)



Male

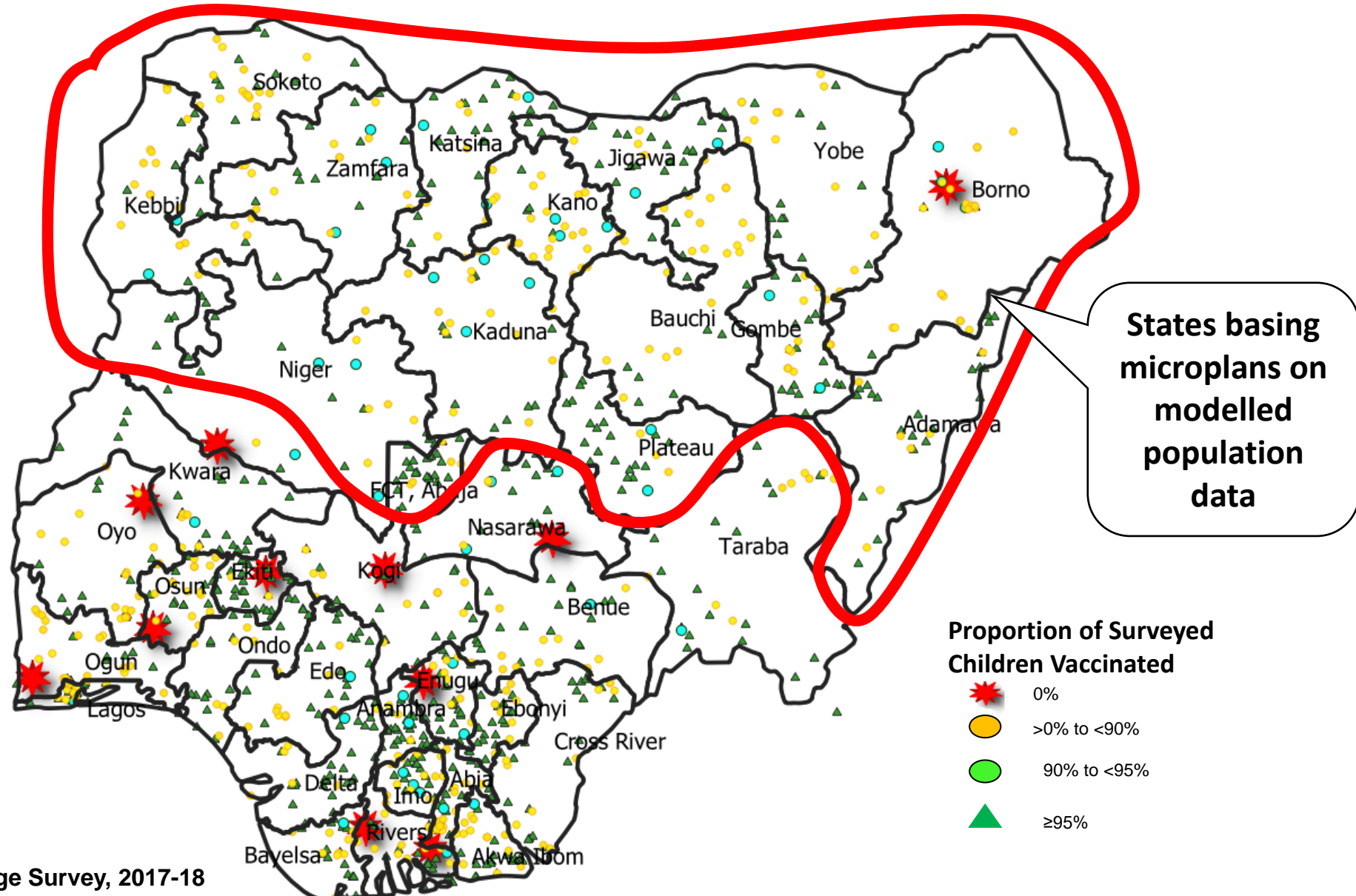


Population

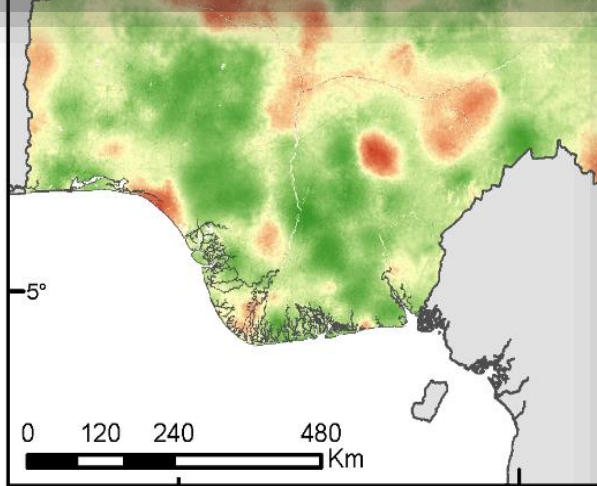
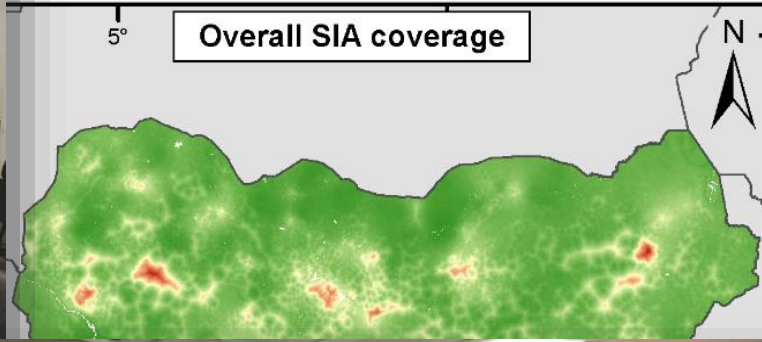
Polio vaccine delivery

0m grid cell:
tion total
nce interval
structure

Measles Vaccination Post-Campaign Coverage Survey, by EA – Nigeria, 2017-18



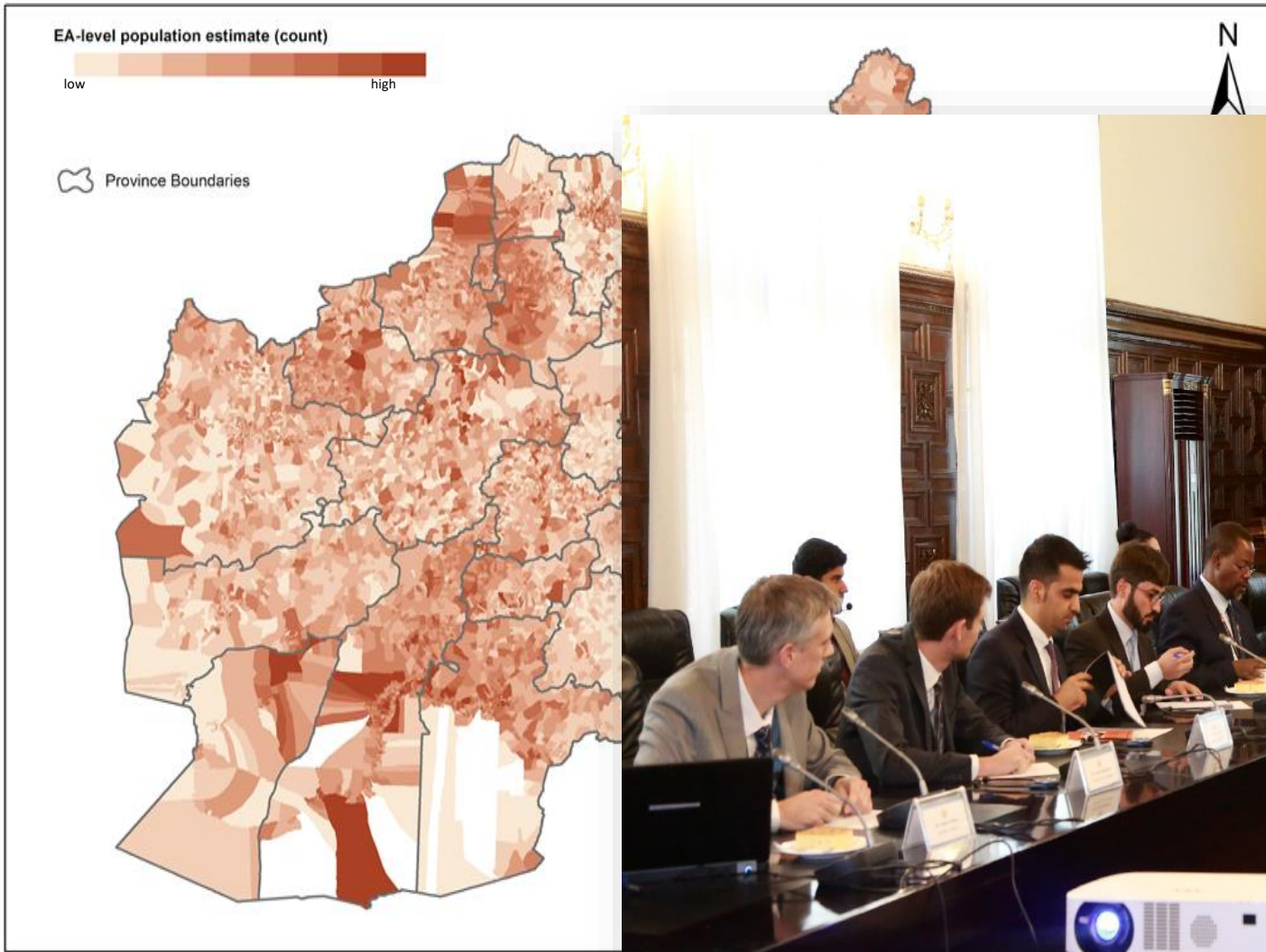
Source: Nigeria MVC Post Campaign Coverage Survey, 2017-18



Childhood vaccination coverage mapping

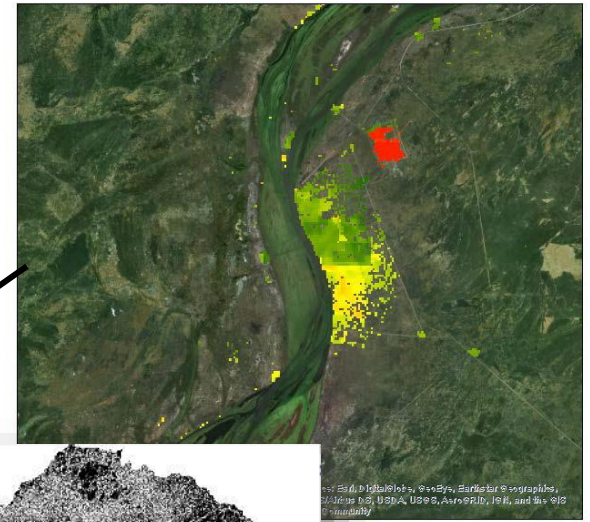
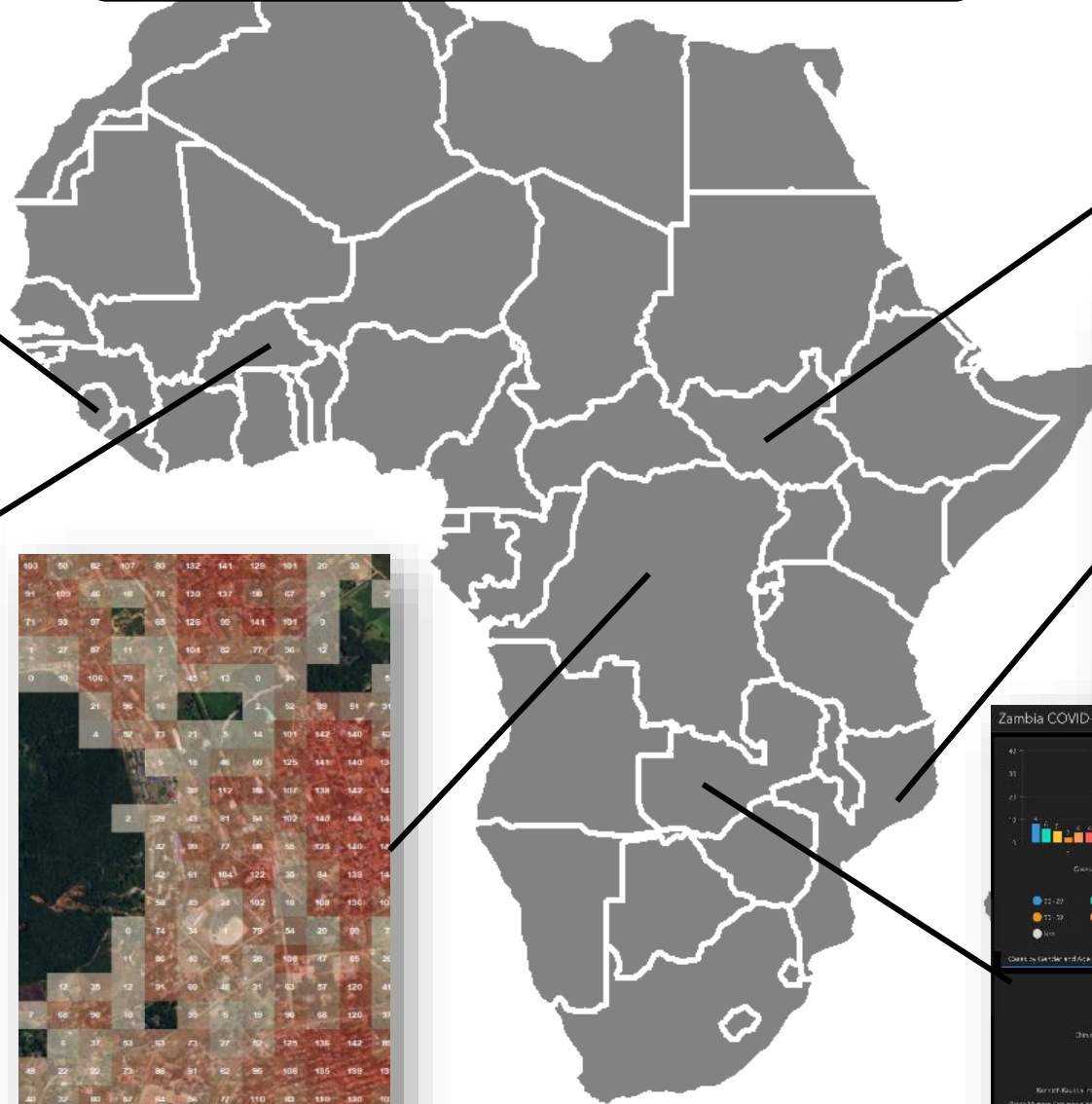
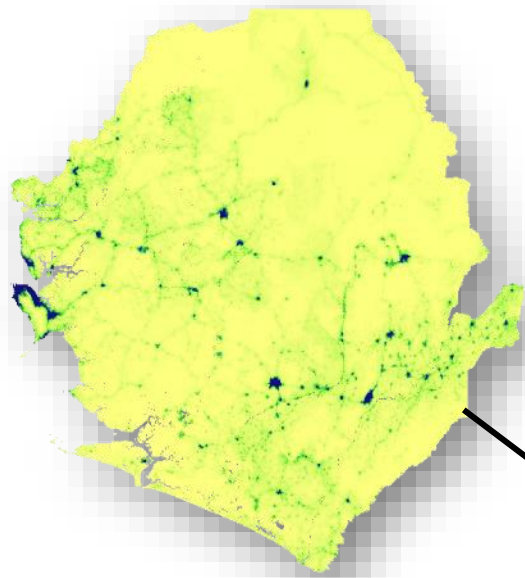
BILL & MELINDA
GATES foundation



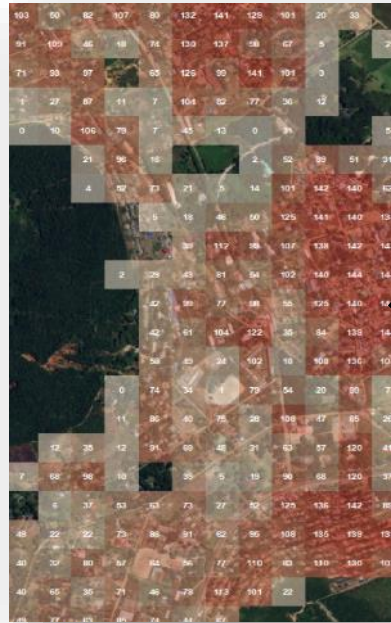
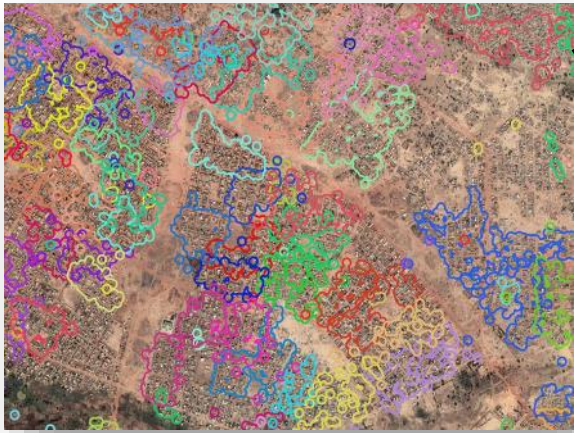
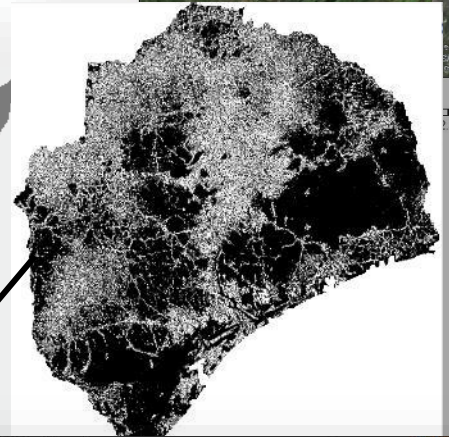


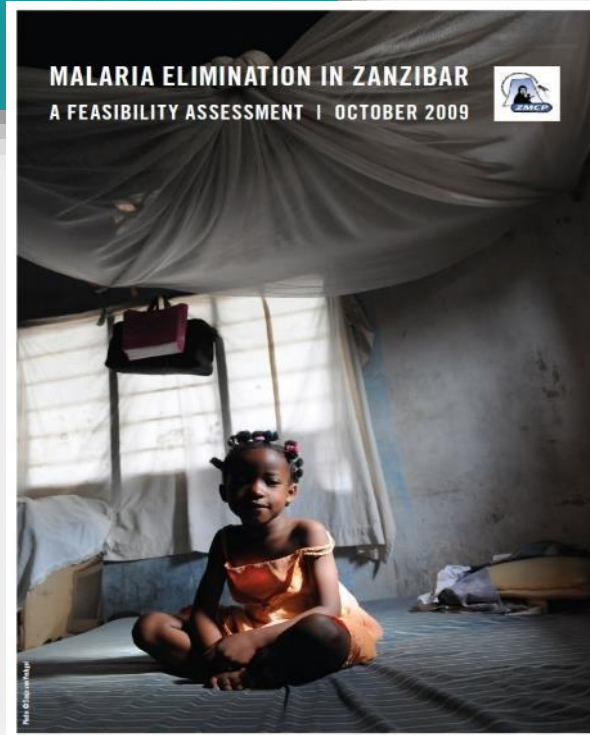
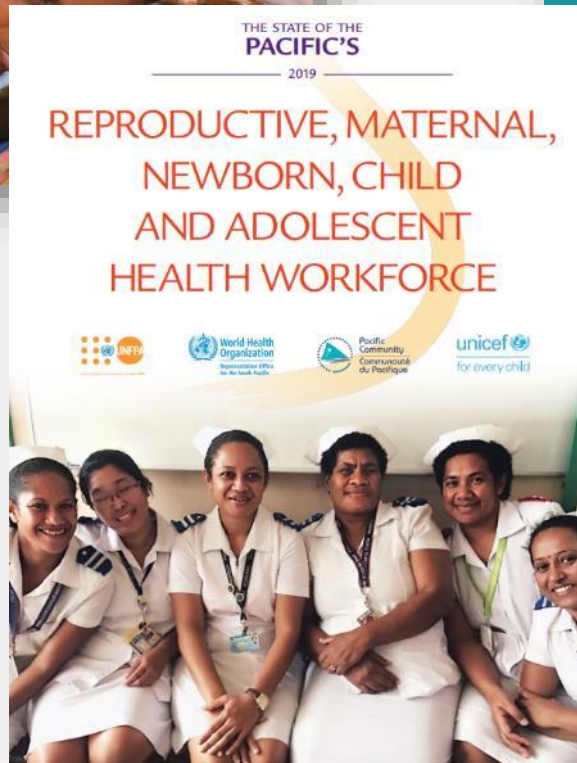
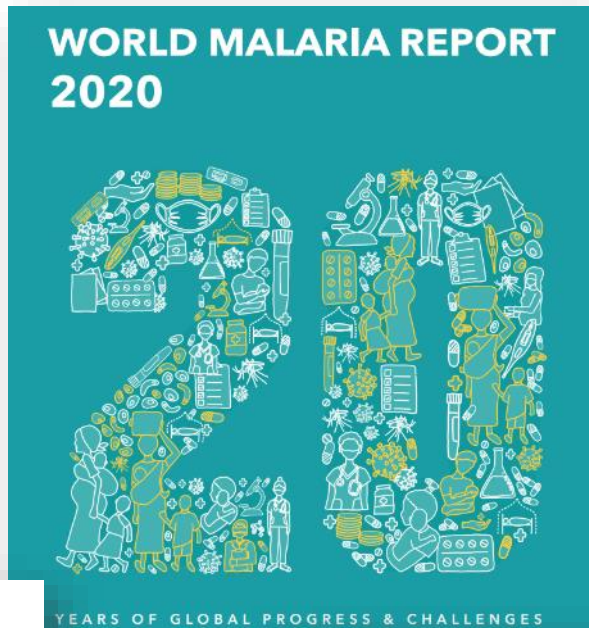
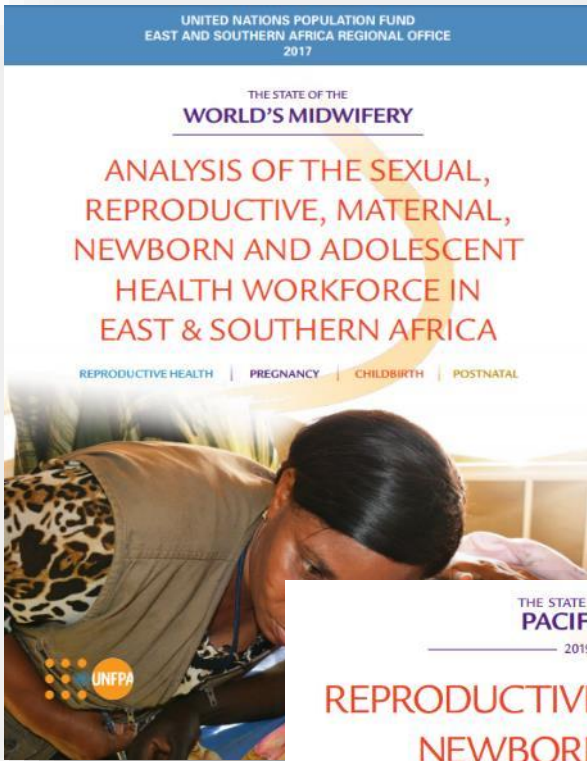
Supporting the census process

Government engagement



Kilometers
0 2.5 5 7.5 10





Health and development metrics and strategy





UNOSAT
Tropical Cyclone ETA-20
Population Exposure Analysis in Honduras
5 November 2020

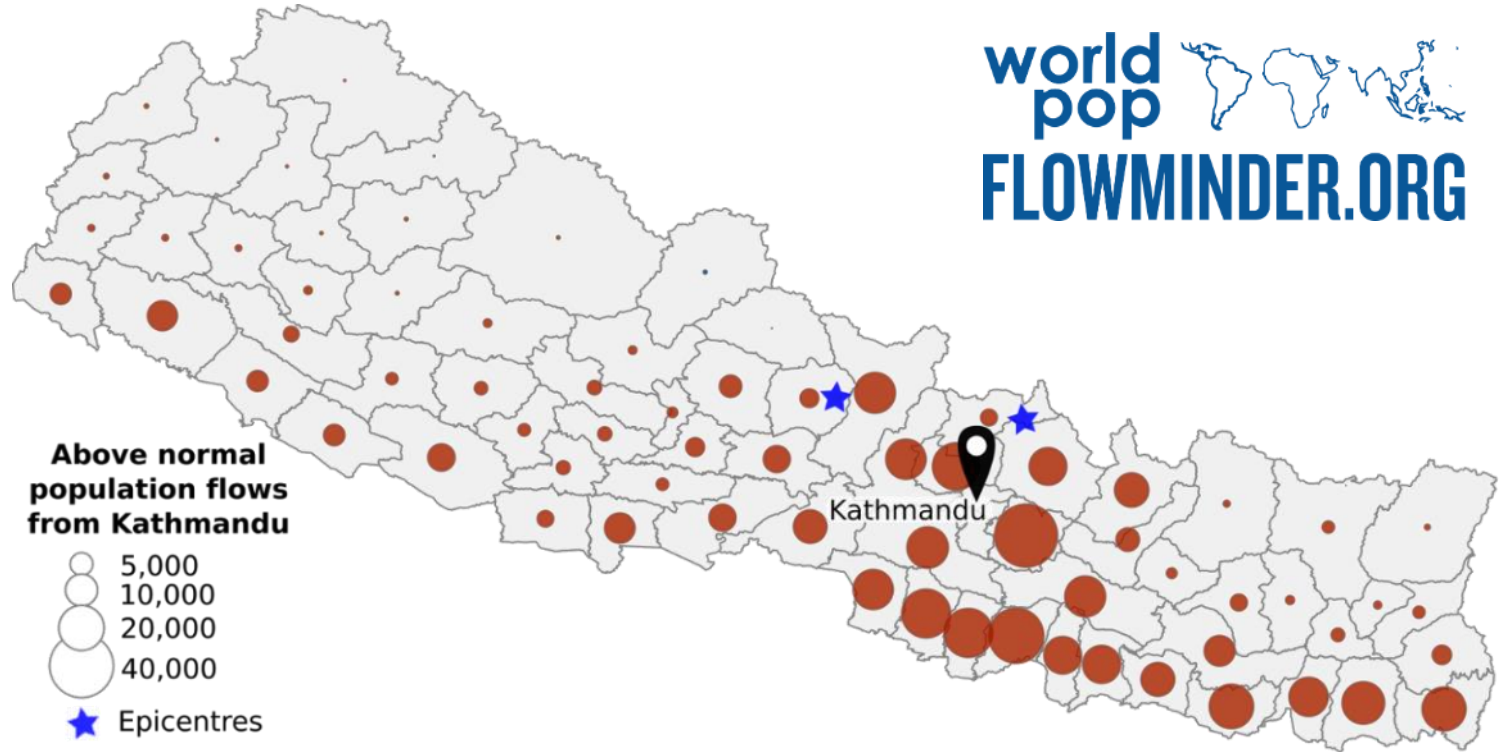


Haiti: Hurricane Matthew
Estimated Population Movements as of 22 November 2016

Flowminder Foundation - Digicel Haiti - World Food Programme

Produced on 24 November 2016

Disaster response

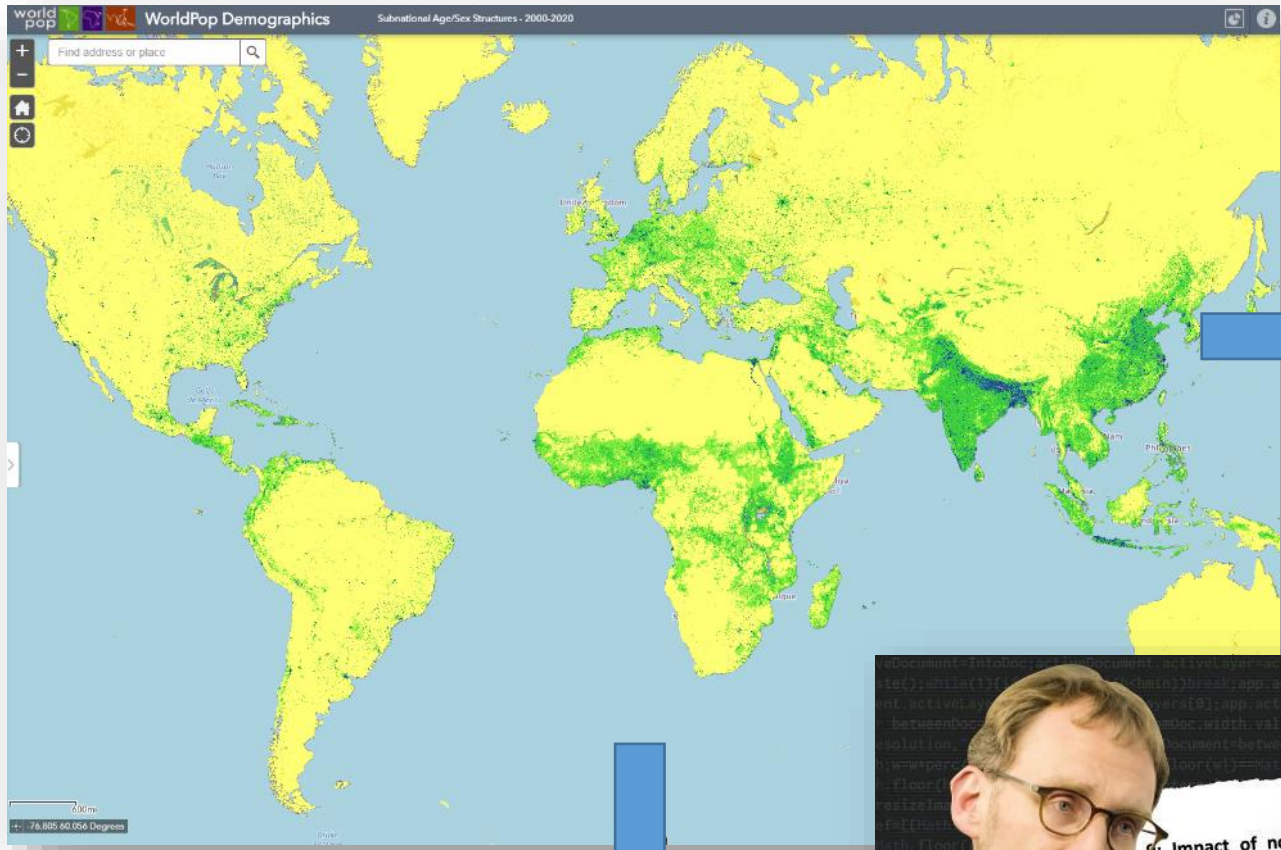


Landslides and displacement in earthquake affected areas
Bi-weekly update
27 July 2015

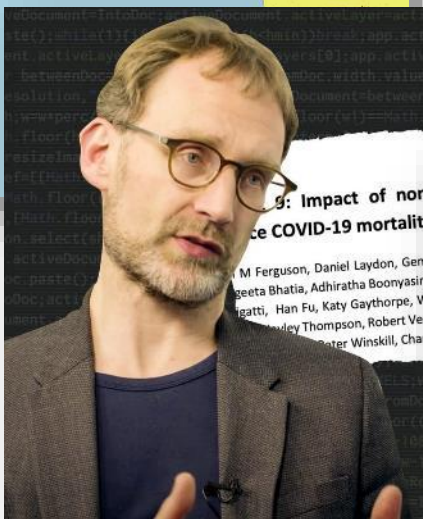
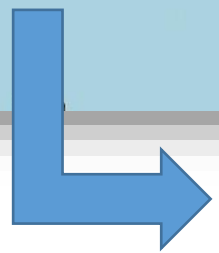


Nepal Earthquake Assessment Unit





Supporting
disease
modelling



Imperial College
London

MRC

Centre for
Global Infectious
Disease Analysis



Further information



www.worldpop.org

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



www.grid3.org

 [@GRID3Global](https://twitter.com/GRID3Global)

E-mail: A.J.Tatem@soton.ac.uk

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

How to Find and Use WorldPop Datasets on HDX

Humanitarian Data Exchange (HDX)

HDX makes data easy to find and use for analysis.

The screenshot displays the HDX website interface. At the top, there is a navigation bar with the HDX logo, a search bar, and links for DATA, LOCATIONS, ORGANISATIONS, and QUICKLINKS. A red 'ADD DATA' button is visible in the top right corner. Below the navigation bar, the main content area features a large teal background with the text 'The Humanitarian Data Exchange' and the tagline 'Find, share and use humanitarian data all in one place'. A 'LEARN MORE' button is positioned below this text. To the right, there is a 'FIND DATA' section with a search bar and statistics: 19,371 DATASETS, 253 LOCATIONS, and 1,351 SOURCES. Below this, an 'ADD DATA' section offers two options: 'UPLOAD FILE' (Make your dataset available on HDX) and 'ADD METADATA' (HDX Connect: let others request your data). The 'Highlights' section at the bottom features four preview cards: 'Centre for Humanitarian Data' (WEBSITE), 'COVID-19 Appeals and Plans' (DATAVIZ), 'West and Central Africa Coronavirus COVID19 Situation' (DATAVIZ), and 'Partnership With The Rockefeller Foundation To Create Early Insight Into Crises' (BLOG). A red banner at the bottom of the page reads 'Coronavirus COVID-19 Pandemic data »'.

<https://data.humdata.org>

HDX at a Glance

100,000+
USERS
PER MONTH

17,800+
DATASETS
SHARED

1,300+
DATA
SOURCES

275+
ACTIVE
ORGANISATIONS

25,000
UNIQUE
DOWNLOADS PER
MONTH

Why join HDX?

- Find and Share Data **Fast**
Be data-ready for the next crisis.
- Get **Insight** into Crises around the World
Explore and understand data through interactive visualisations.
- Join a Global **Community**
Be part of the mission to connect data from organisations around the world.

WorldPop on HDX

Access by searching for 'WorldPop'

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

The screenshot shows the HDX website interface. At the top, there is a navigation bar with links for 'OCHA Services', 'Complete setting up your account', 'Data Responsibility for COVID-19', 'FAQ', 'Kareem Elbayer', 'Log out', and 'Switch to HDX Lite'. Below this is the HDX logo and a search bar. The main content area displays the 'WorldPop' organization page, which includes a header with '4 MEMBERS | 527 FOLLOWERS | VISIT WEBSITE' and a description of the project. A sidebar on the right contains social media icons and a 'FOLLOW' button. The main content area is divided into tabs for 'Datasets', 'Activity Stream', 'Members', and 'Stats'. Under the 'Datasets' tab, there is a search bar, a filter toggle, and a list of datasets. The first dataset listed is 'Zimbabwe - Population Density' by WorldPop, with 10+ downloads and a dataset date of Jan 1, 2000-Dec 31, 2020. A sidebar on the left under 'Refine your search:' shows filters for 'FEATURED:', 'CODs [0]', 'Sub-national [1068]', and 'Geodata [1]'. A right sidebar contains a paragraph of text about the organization's data types and download options, along with 'More' and 'GEOTIFF' buttons.

OCHA Services » Complete setting up your account Data Responsibility for COVID-19 ? FAQ Kareem Elbayer Log out Switch to HDX Lite

HDX Search Datasets DATA | LOCATIONS | ORGANISATIONS | QUICKLINKS ADD DATA

HOME / ORGANISATIONS / WORLDPOP

WorldPop

4 MEMBERS | 527 FOLLOWERS | VISIT WEBSITE

Last updated on November 24, 2020

The WorldPop project was initiated in October 2013 to combine the AfriPop, AsiaPop and AmeriPop population mapping projects. It aims to provide an open access archive of spatial demographic datasets for Central and South America, Africa and Asia to support development, disaster response and health applications. The ... [More](#)

FOLLOW | Request Membership |

Datasets Activity Stream Members Stats

Data [1068] Search all datasets ... Show filter: Show 25 | 50 | 100 ORDER BY Last Modified

Refine your search: Clear all

FEATURED:

- CODs [0]
- Sub-national [1068]
- Geodata [1]

Zimbabwe - Population Density

WorldPop

10+ Downloads

Updated November 24, 2020 | Dataset date: Jan 1, 2000-Dec 31, 2020

This dataset updates: Every year

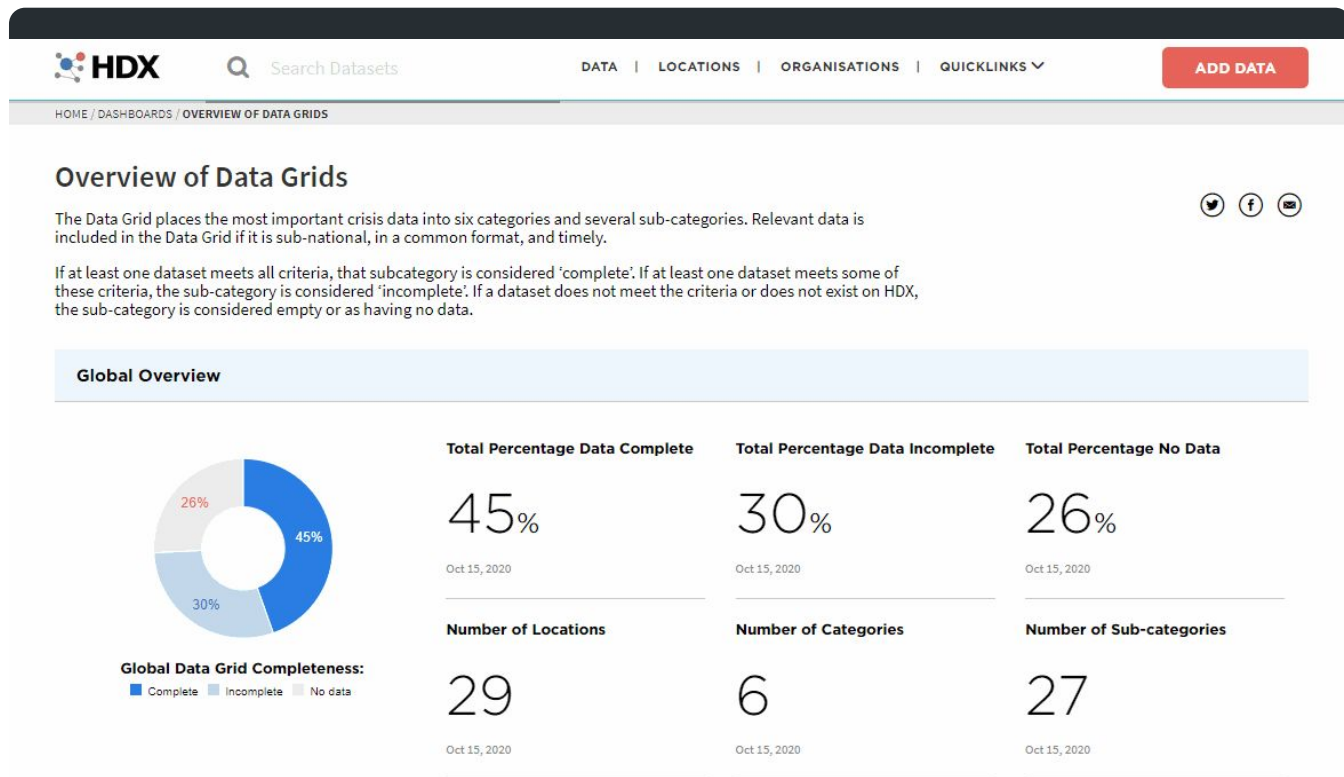
WorldPop produces different types of gridded population count datasets, depending on the methods used and end application. Please make sure you have read our Mapping Populations overview page before choosing and downloading a dataset. Datasets are available to download in Geotiff and ASCII XYZ format at a resolution of 3 and 30 arc-seconds (approximately 1km at the ...

[More](#)

GEOTIFF

Data Grids

Our Crisis Data Grids examine availability and freshness of key datasets across six categories and 27 indicators.



<https://data.humdata.org/dashboards/overview-of-data-grids>

Overview of the WorldPop Gridded Population Datasets

Gridded population datasets

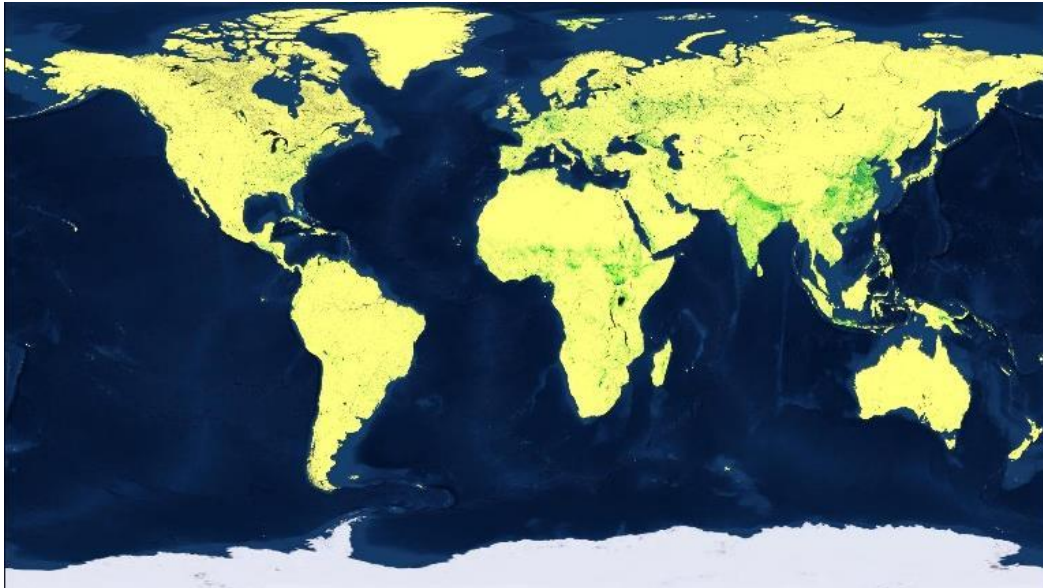
Andy Tatem



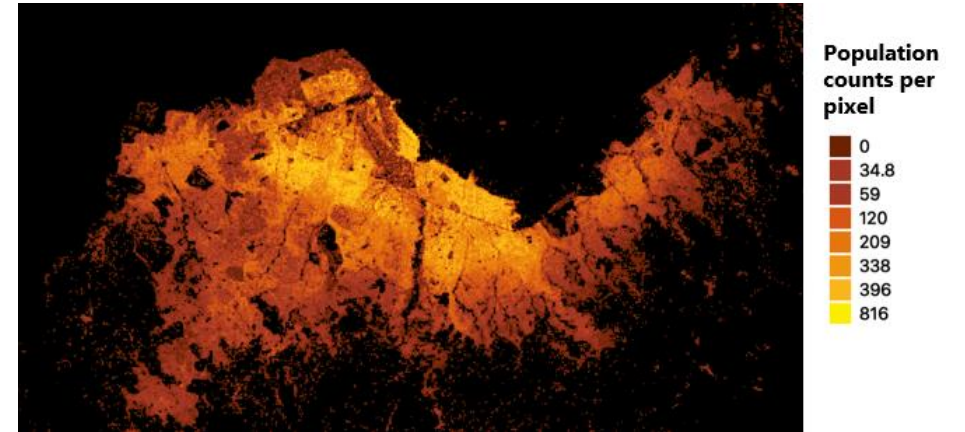
Gridded population datasets/methods

'Top down' global estimates

- 'Unconstrained' 2000-2020
- 'Constrained' 2020



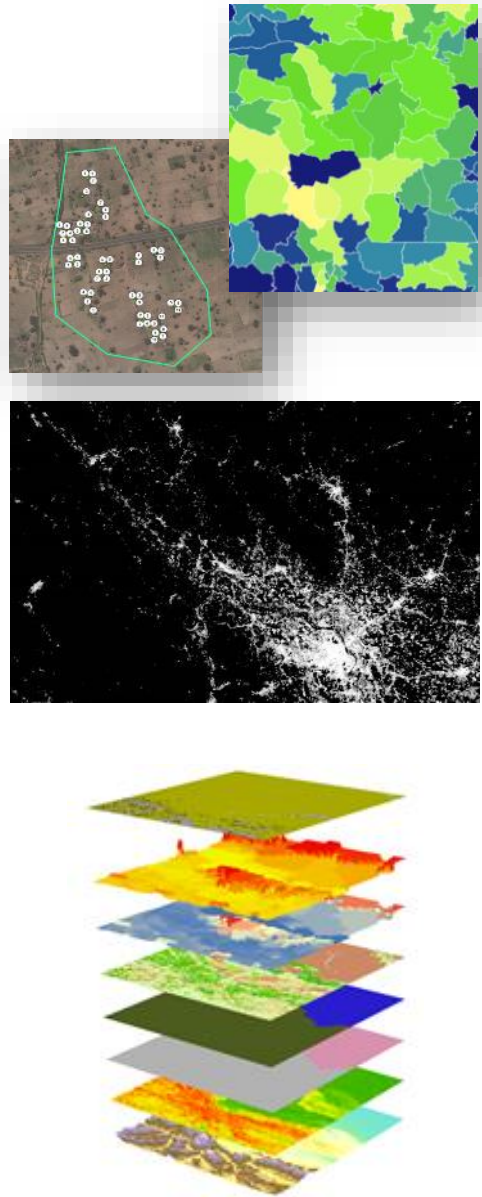
'Bottom up' bespoke country estimates



'Peanut butter' web application



Population distribution modelling



Population Data

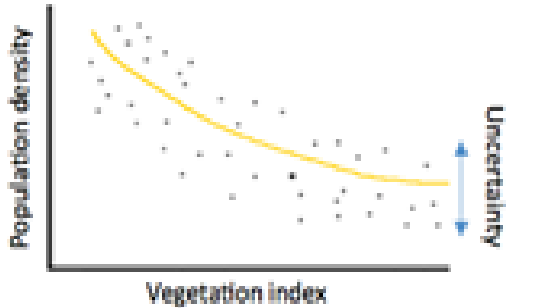
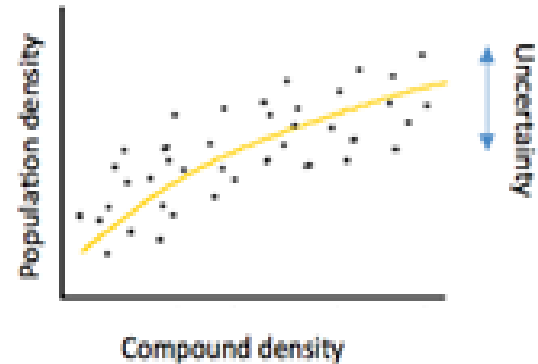
Settlement

Geospatial covariates

Spatial statistical model

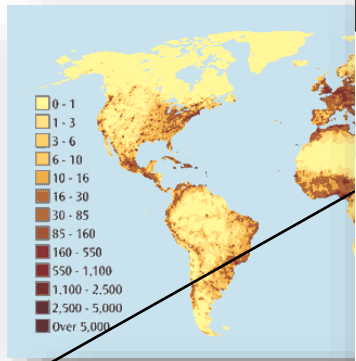
Population estimates

1	1	1	2	2	3	2	2	1	1	1	1	1	1
1	1	1	2	4	4	4	1	1	1	1	1	1	1
2	1	4	5	5	5	4	1	2	1	2	1	1	1
3	2	4	6	6	5	3	3	3	4	4	1	1	1
3	3	2	5	6	5	4	3	2	2	4	2	2	2
1	3	4	3	4	5	5	4	3	1	1	1	2	2
1	2	1	1	2	4	4	3	1	1	1	1	1	1
1	2	2	1	1	2	2	2	1	1	1	1	1	1
1	1	1	1	1	1	2	1	1	1	1	1	1	1



**Adjustments:
National totals,
age/sex**

Benefits of 'gridded' demographic data



OCHA Services | Data Responsibility for COVID-19 | ? FAQ | Log in | Sign up | Switch to HDX Lite

HDX Search Datasets DATA | LOCATIONS | ORGANISATIONS | QUICKLINKS | ADD DATA

HOME / DATASETS / CHAD - WORLDPOP POPULATION ESTIMATES BY COD ADMINISTRATIVE UNIT

Chad - WorldPop Population Estimates by COD Administrative Unit

world pop

These data summarize the latest available [WorldPop gridded population datasets](#) into the administrative units of the [common operational dataset](#) (COD). Note that these data should not be considered the COD datasets for population unless endorsed by the humanitarian community in country, but rather as a starting point if no COD dataset is available, or as a point of [... More](#)

100+ Downloads | This dataset updates: As needed | Contact the contributor

DOWNLOADS

Month	Downloads
Jul	6
Aug	4
Sep	2
Oct	3
Nov	2
Dec	2

RELATED SHOWCASES

There are no showcases for this dataset.

ACTIVITY

HDX - Tag Bot updated the dataset **Chad - WorldPop Population**

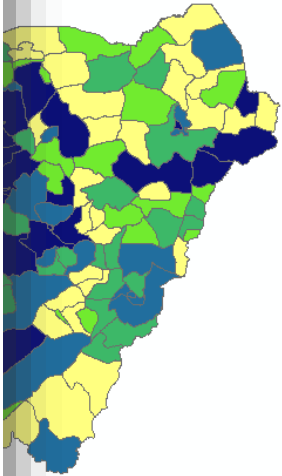
Data and Resources Metadata

TCD.zip Updated: August 10, 2018
Zipfile containing one CSV per administrative unit level with population estimates for each
[... More](#) [DOWNLOAD](#) [MORE](#)

Data Dictionary (2.0K) Updated: August 10, 2018
A text file containing defintions for the fields in the associated CSV files
[DOWNLOAD](#) [MORE](#)

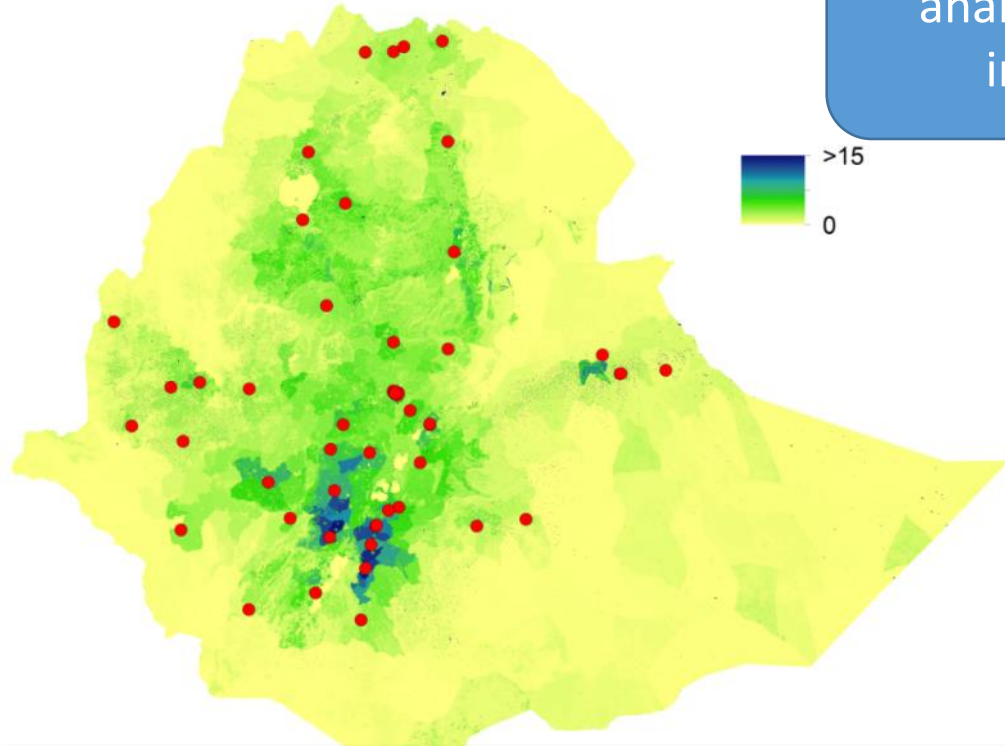
Ability in
on to any
ative unit
el

Grids: con
format
integrati

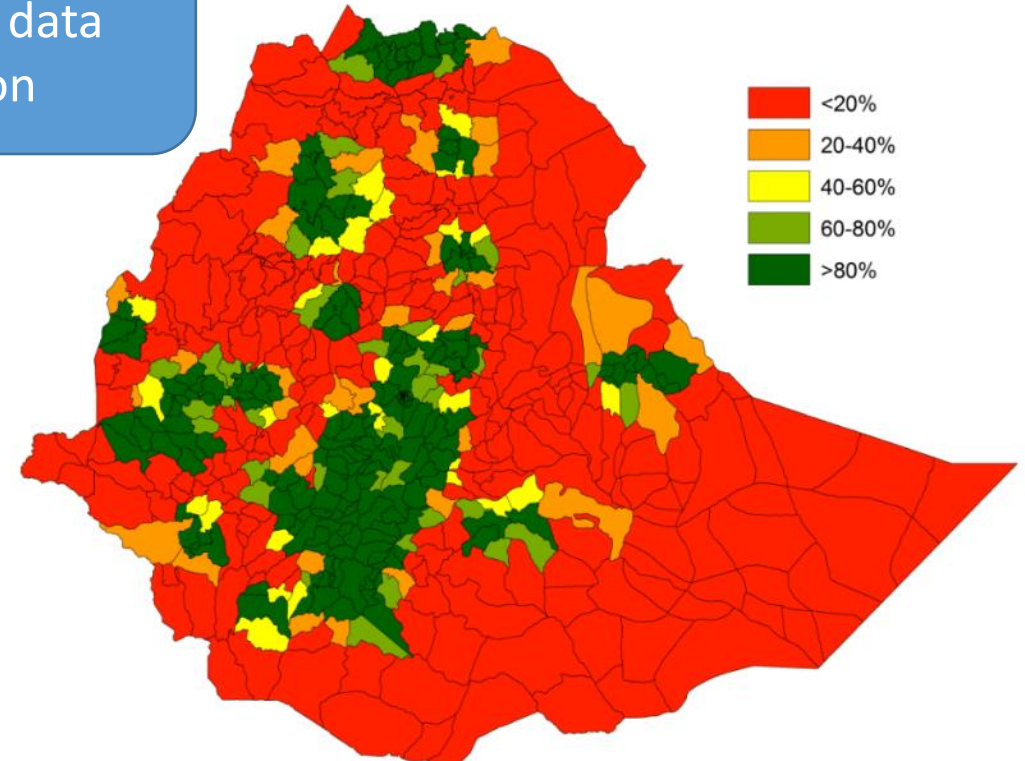


Benefits of 'gridded' demographic data

Grids: flexibility in analysis and data integration

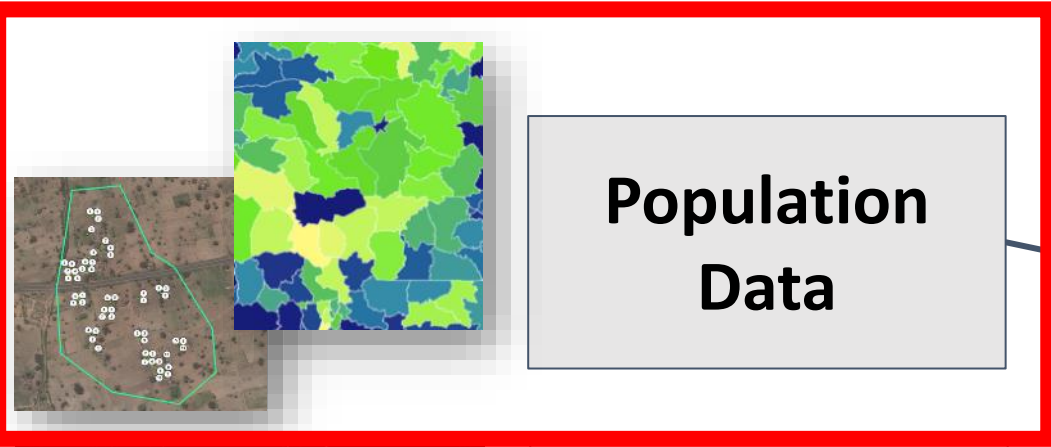


Comprehensive Emergency Obstetric and Neonatal Care (CEmONC) Facilities overlaid on grid of women of childbearing age

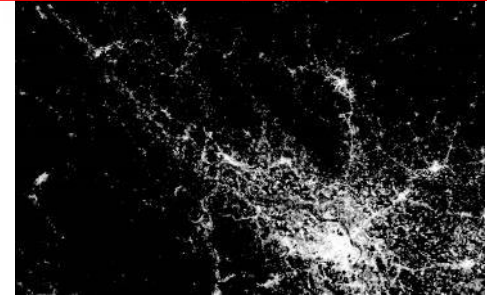


Percentage of women of childbearing age per woreda within 50km of a CEmONC

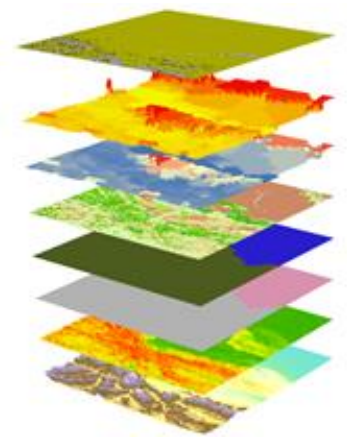
Population distribution modelling



Population Data



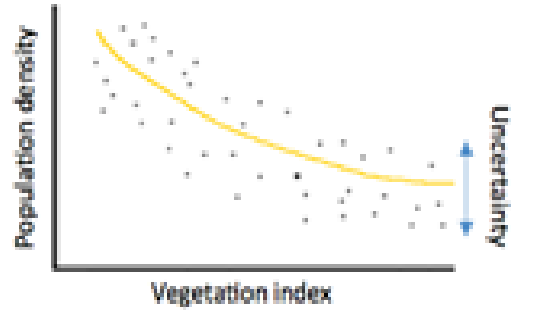
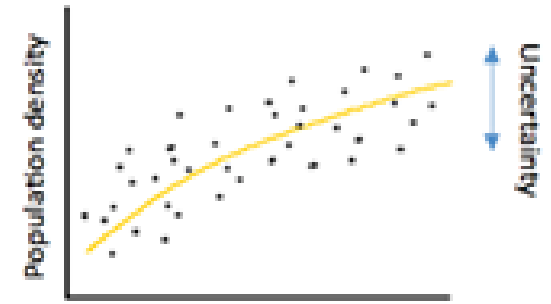
Settlement



Geospatial covariates

Spatial statistical model

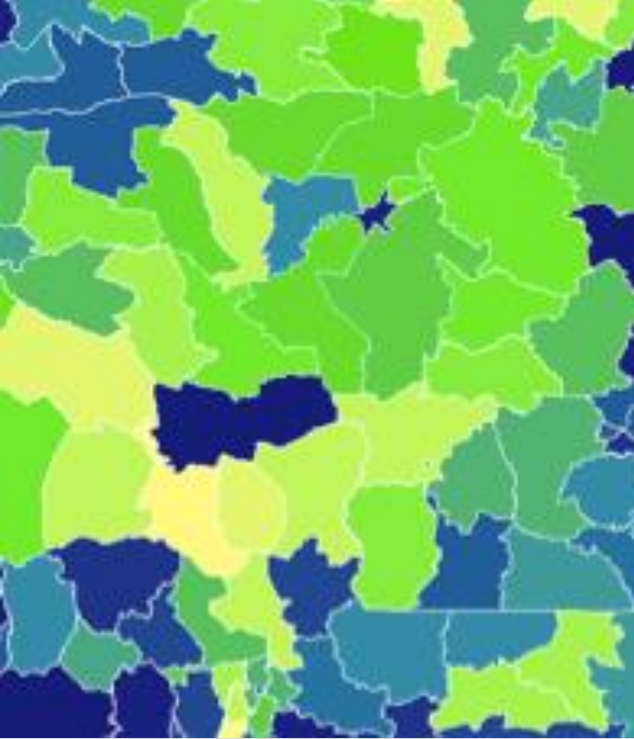
Population estimates



1	1	1	2	2	3	2	2	1	1	1	1	1	1
1	1	1	2	4	4	4	1	1	1	1	1	1	1
2	1	4	5	5	5	4	1	2	1	2	1	1	1
3	2	4	6	6	5	3	3	3	4	4	1	1	1
3	3	2	5	6	5	4	3	2	2	4	2	2	2
1	3	4	3	4	5	5	4	3	1	1	1	2	2
1	2	1	1	2	4	4	3	1	1	1	1	1	1
1	2	2	1	1	2	2	2	1	1	1	1	1	1
1	1	1	1	1	1	2	1	1	1	1	1	1	1

**Adjustments:
National totals,
age/sex**

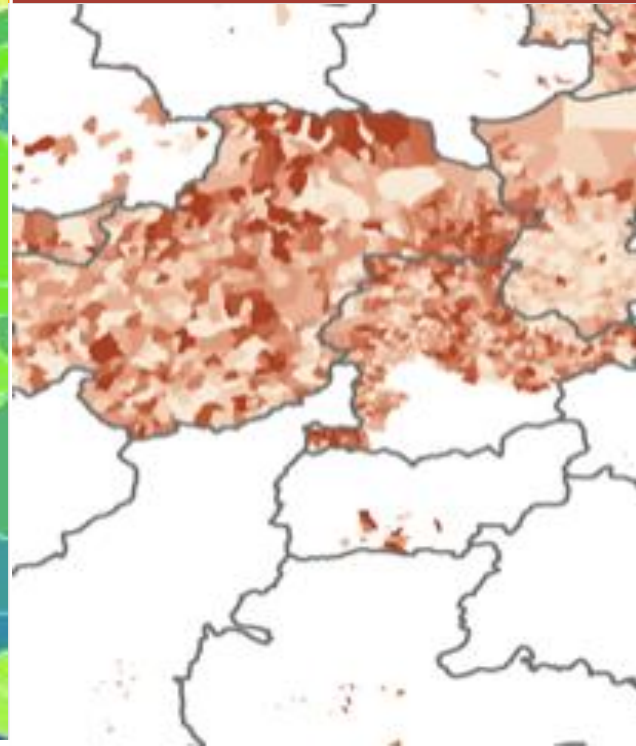
Coarse resolution



Outdated



Incomplete



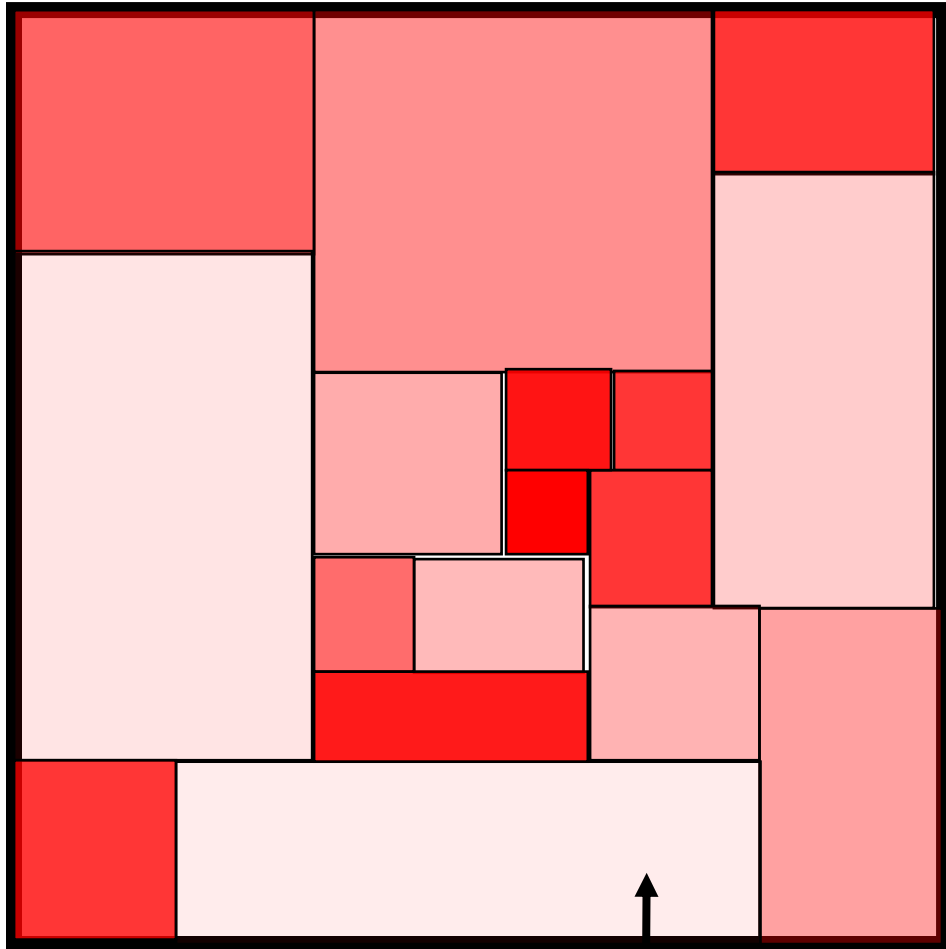
**Inaccuracies,
missing populations**



Demographic data challenges

Complete: census or projections

Population totals for enumeration zones with full national coverage.

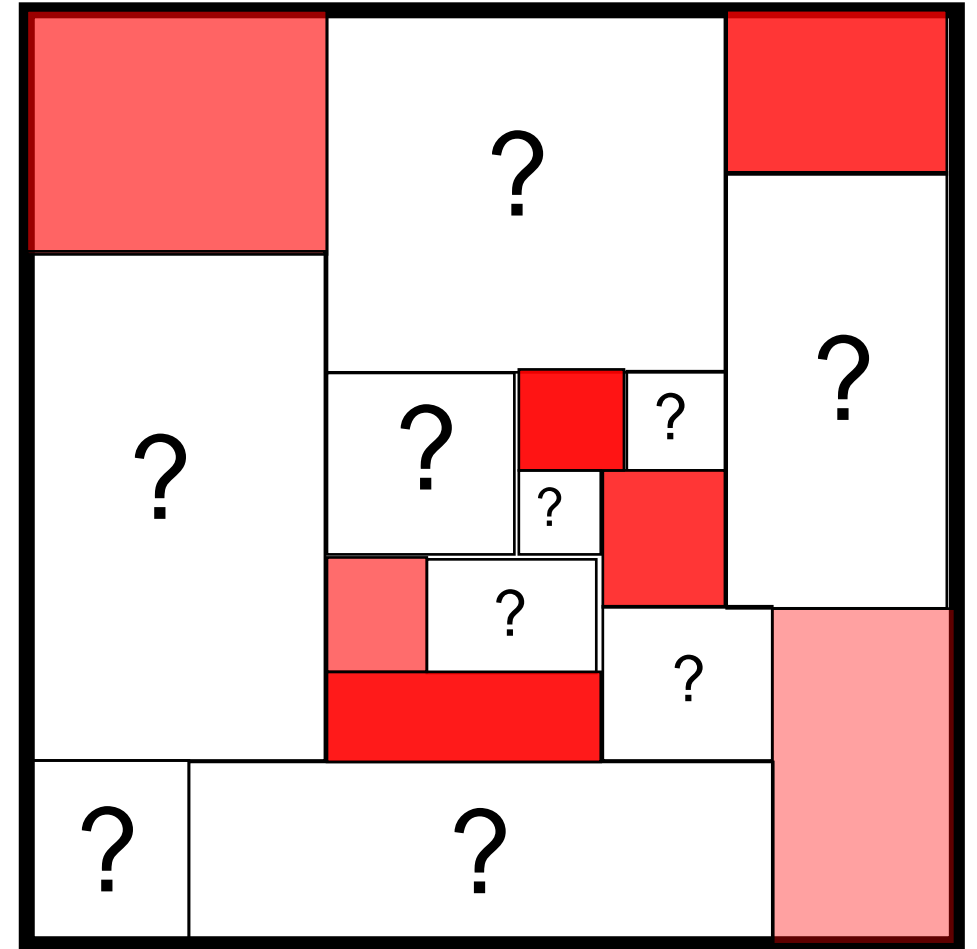


National Boundary

Enumeration Zone

Incomplete: partial census or enumeration surveys

Population totals for a sample of enumeration zones.



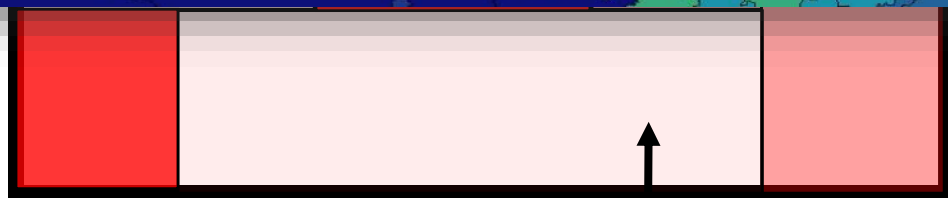
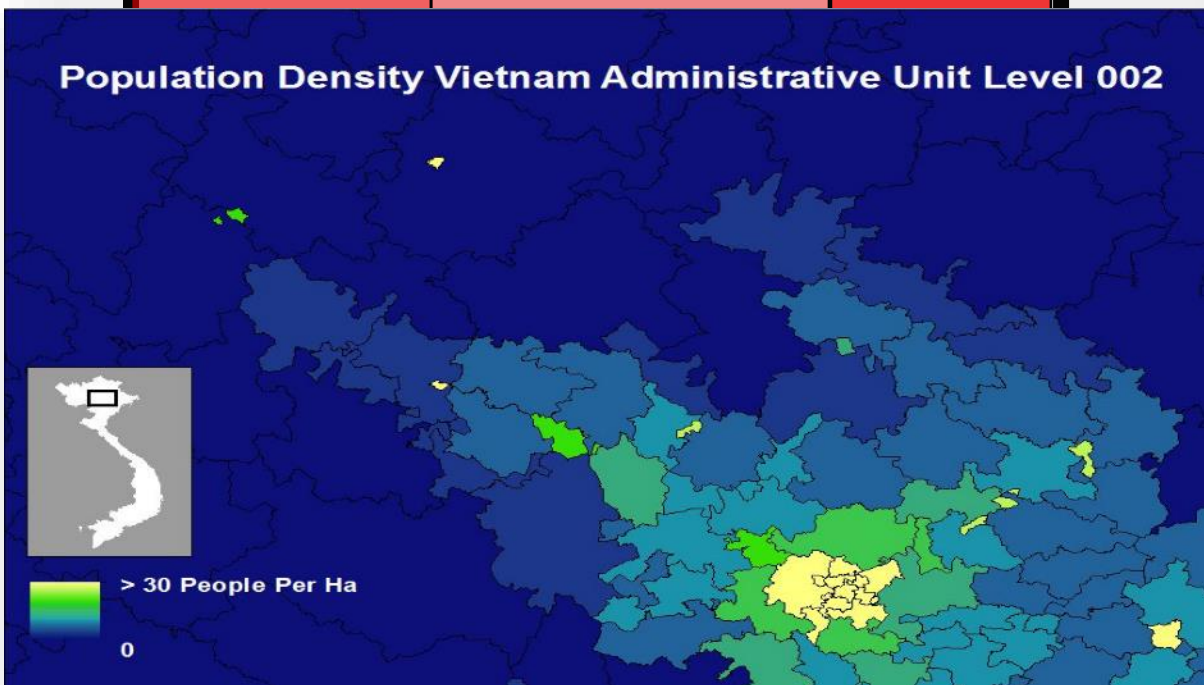
More red = more people

Complete: census or projections

Population totals for enumeration zones with full national coverage.



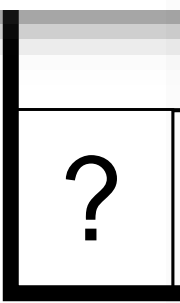
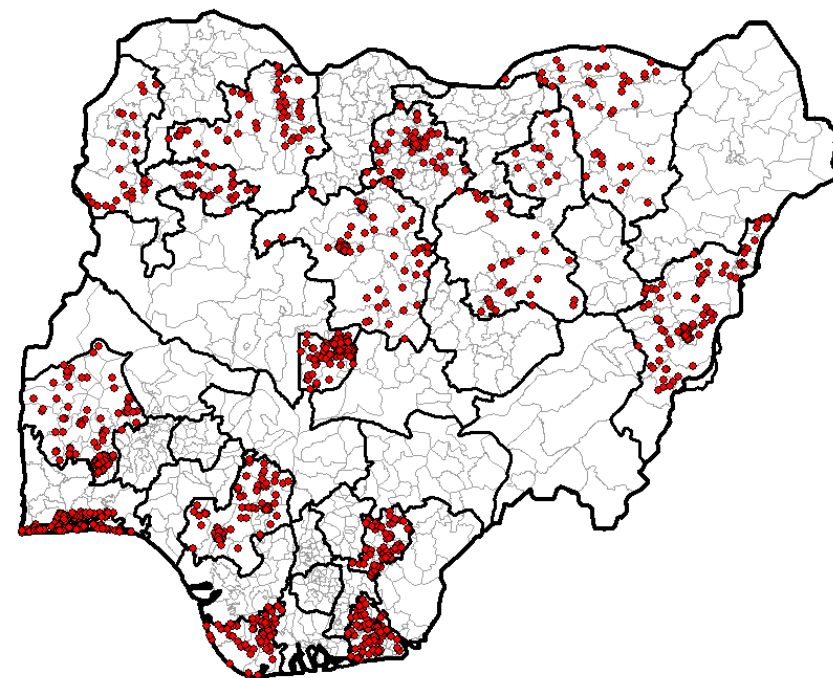
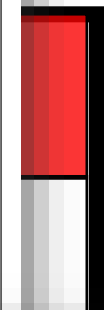
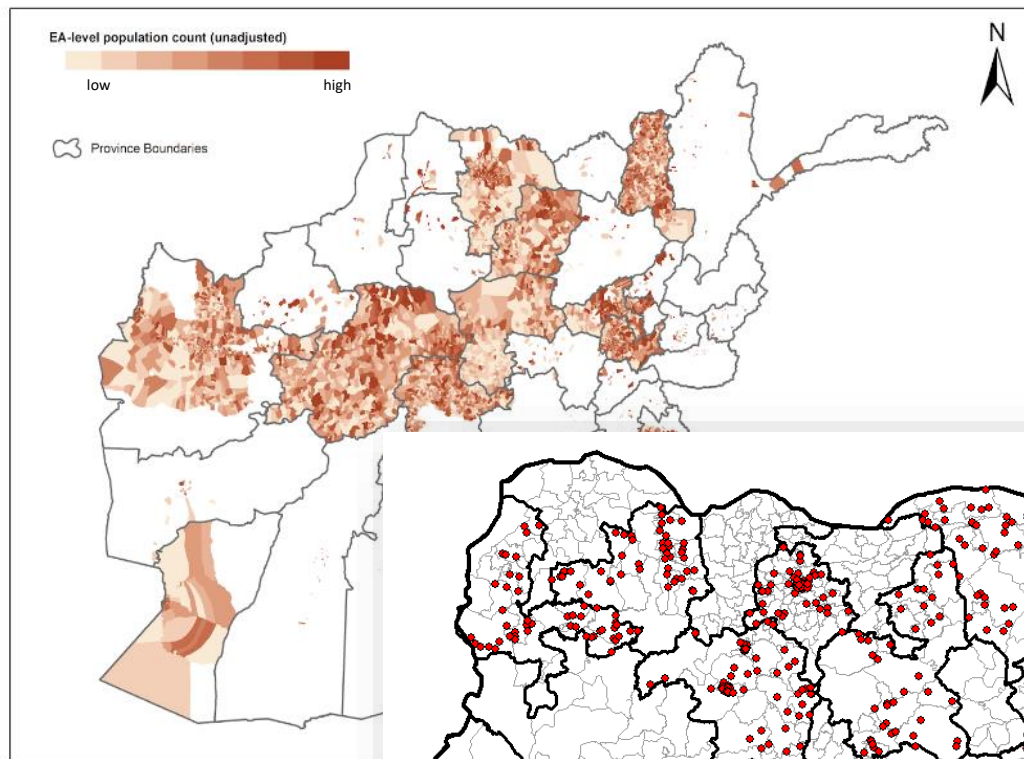
Population Density Vietnam Administrative Unit Level 002



National Boundary

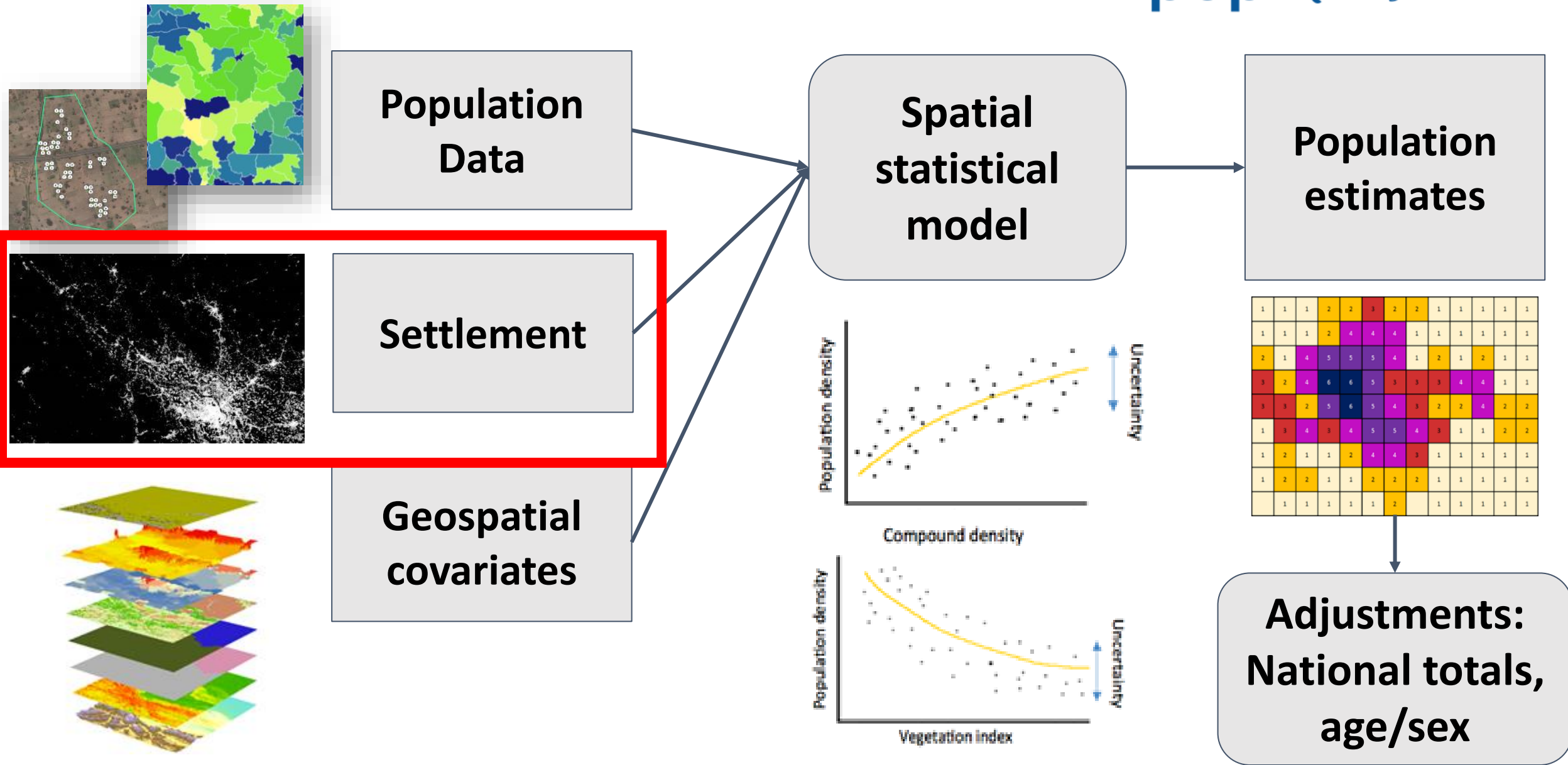
Enumeration Zone

Incomplete: partial census or enumeration surveys



More red = more people

Population distribution modelling

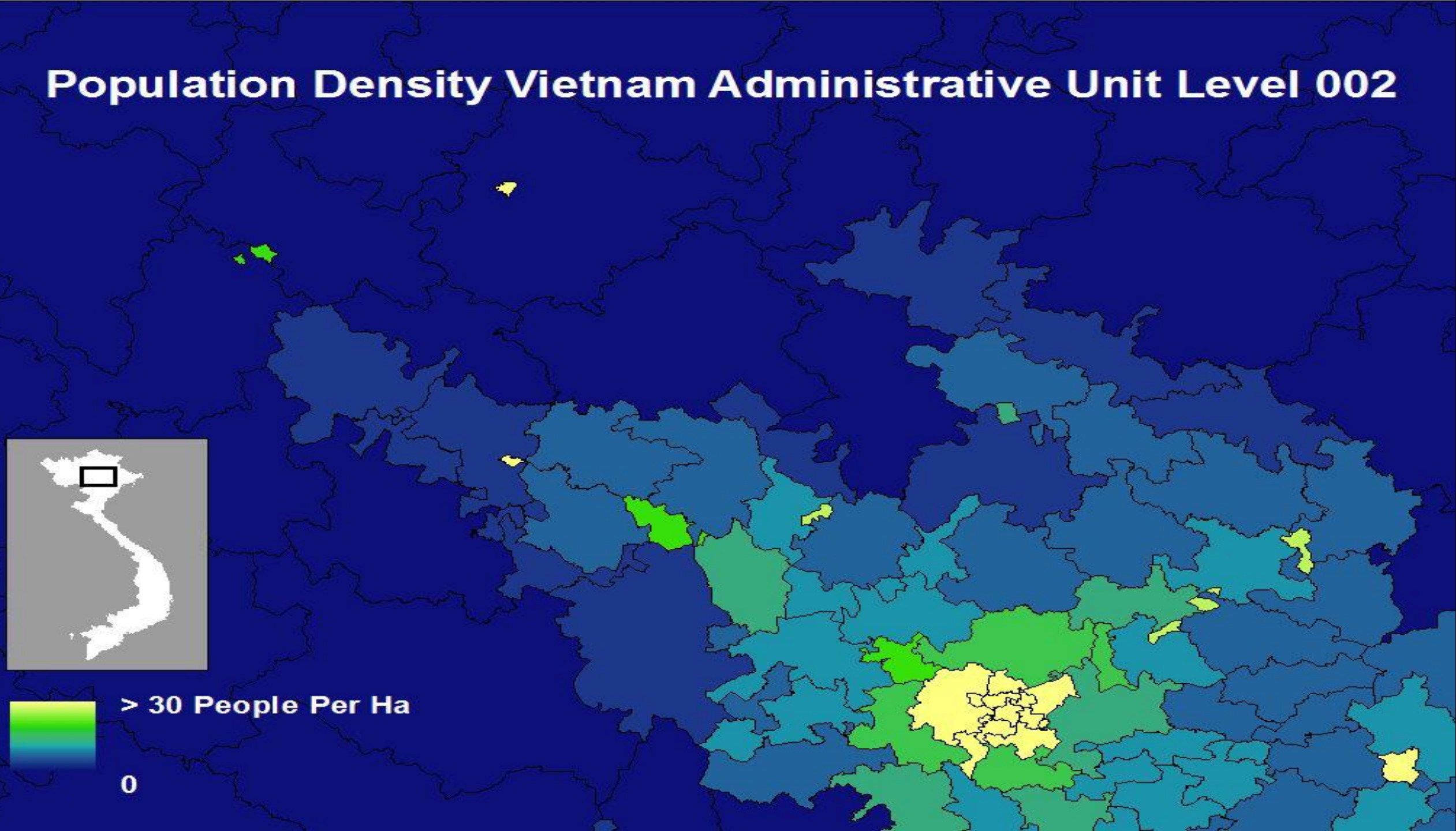


Population Density Vietnam Administrative Unit Level 002

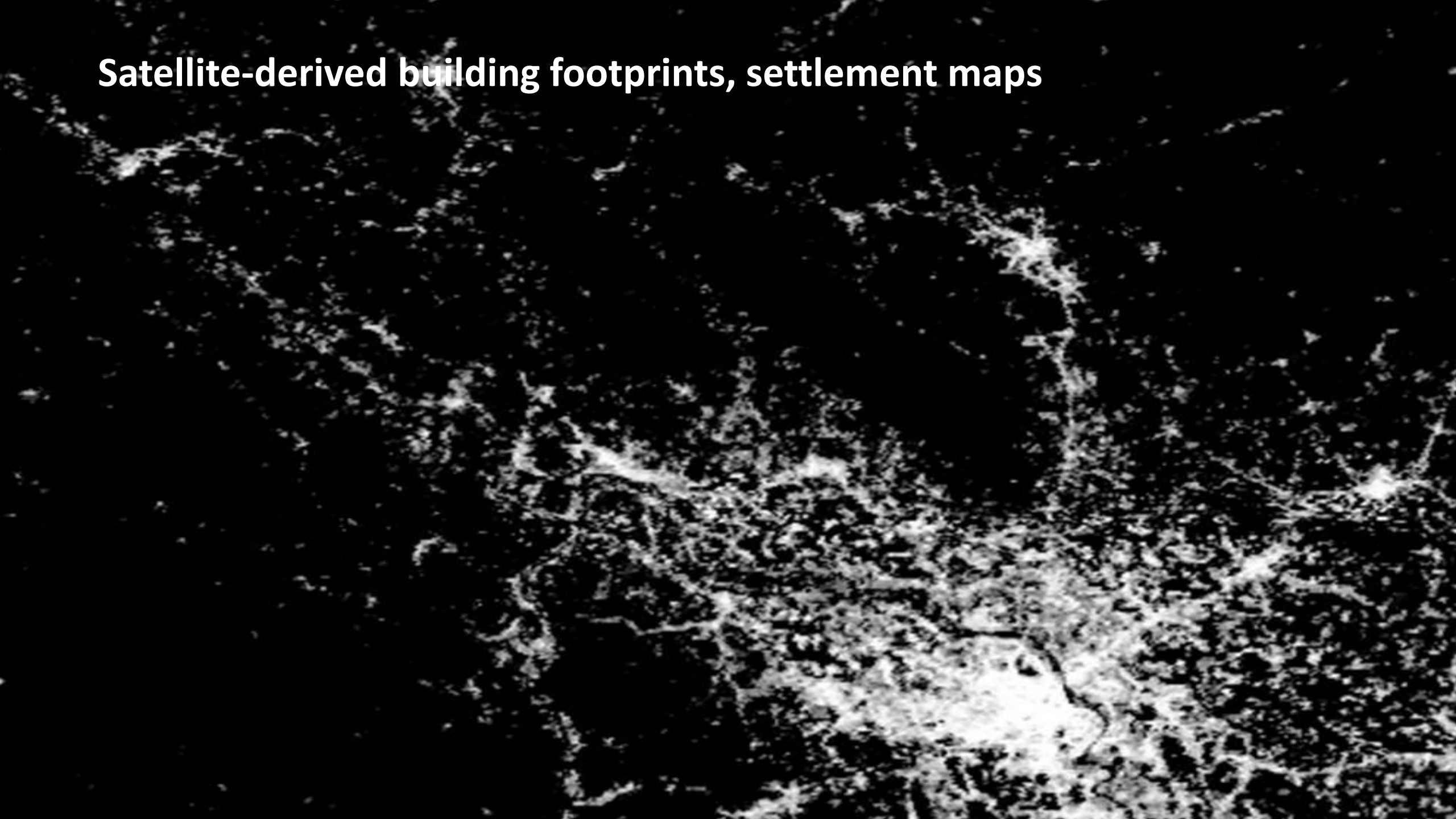


> 30 People Per Ha

0



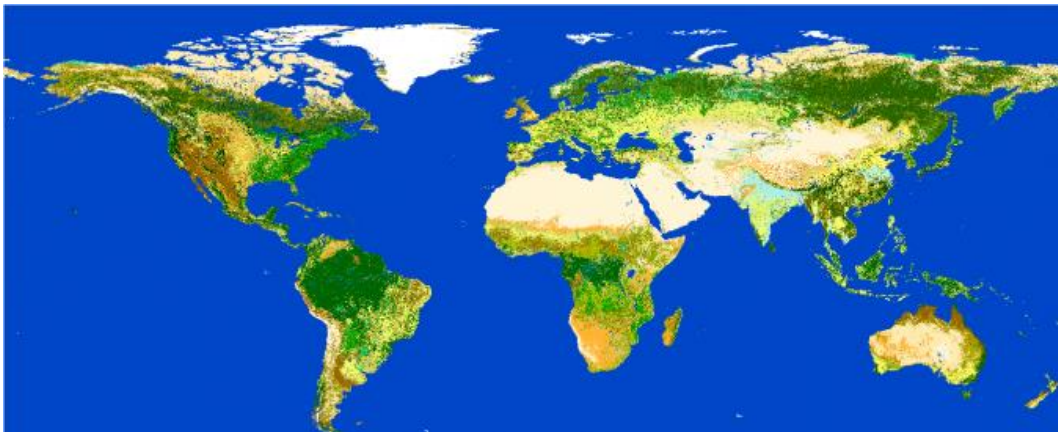
Satellite-derived building footprints, settlement maps



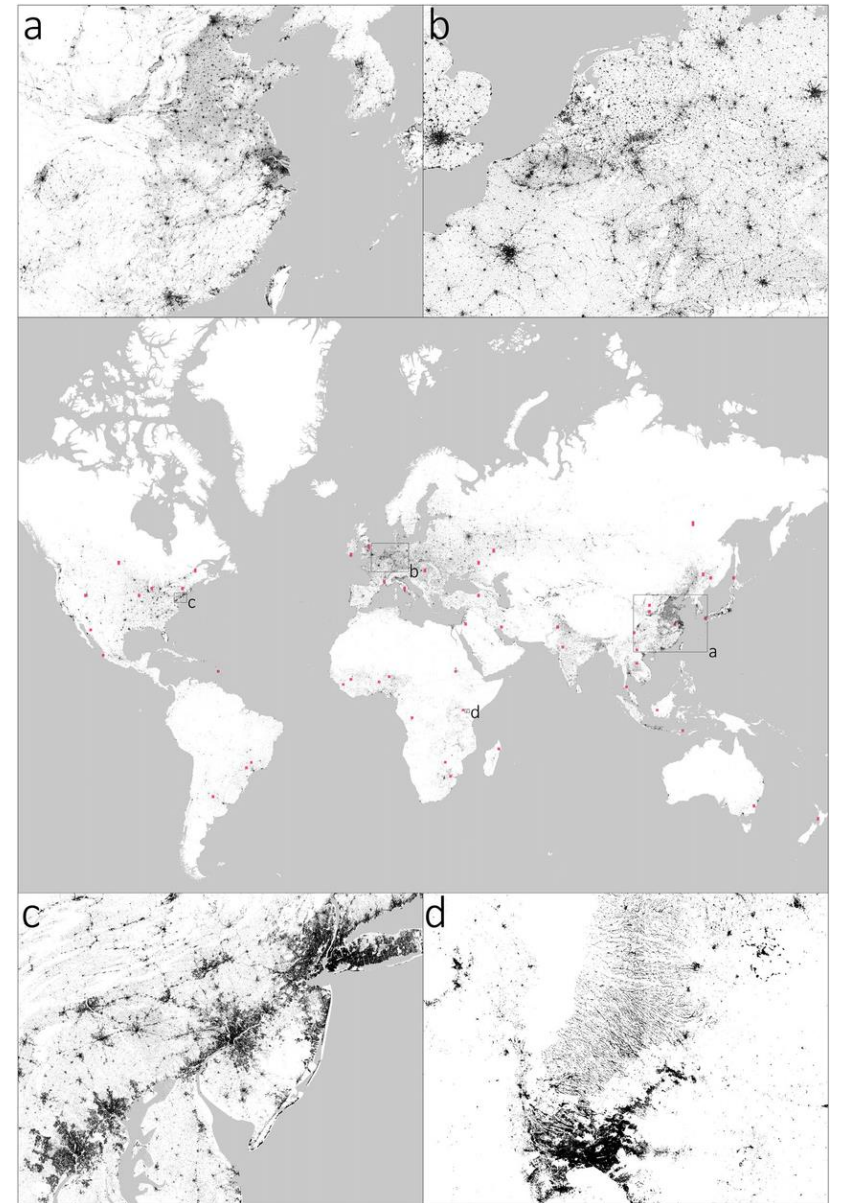
Global settlement datasets



Global Human Settlement Layer (GHSL) 1975, 1990, 2000, 2014

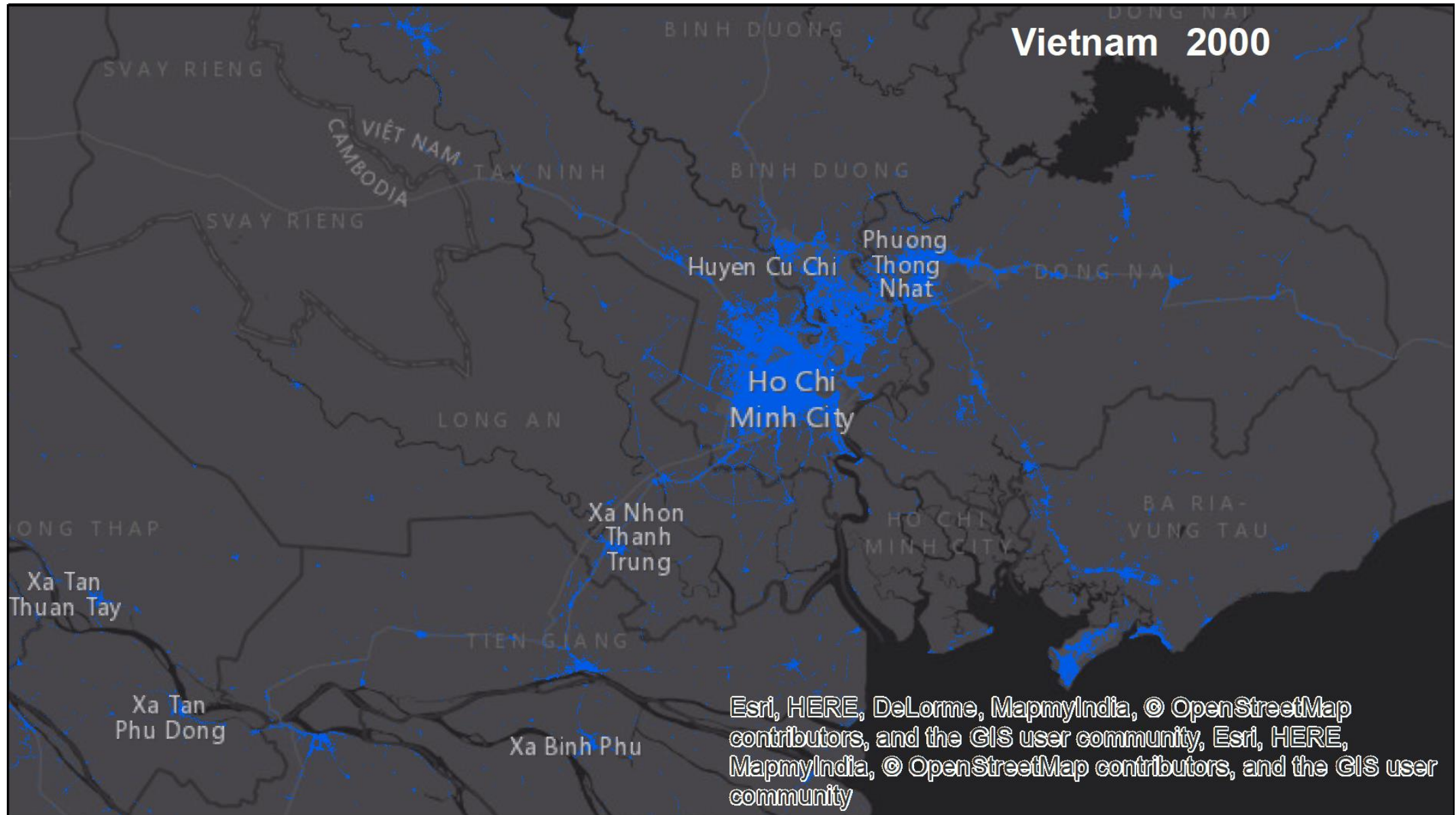


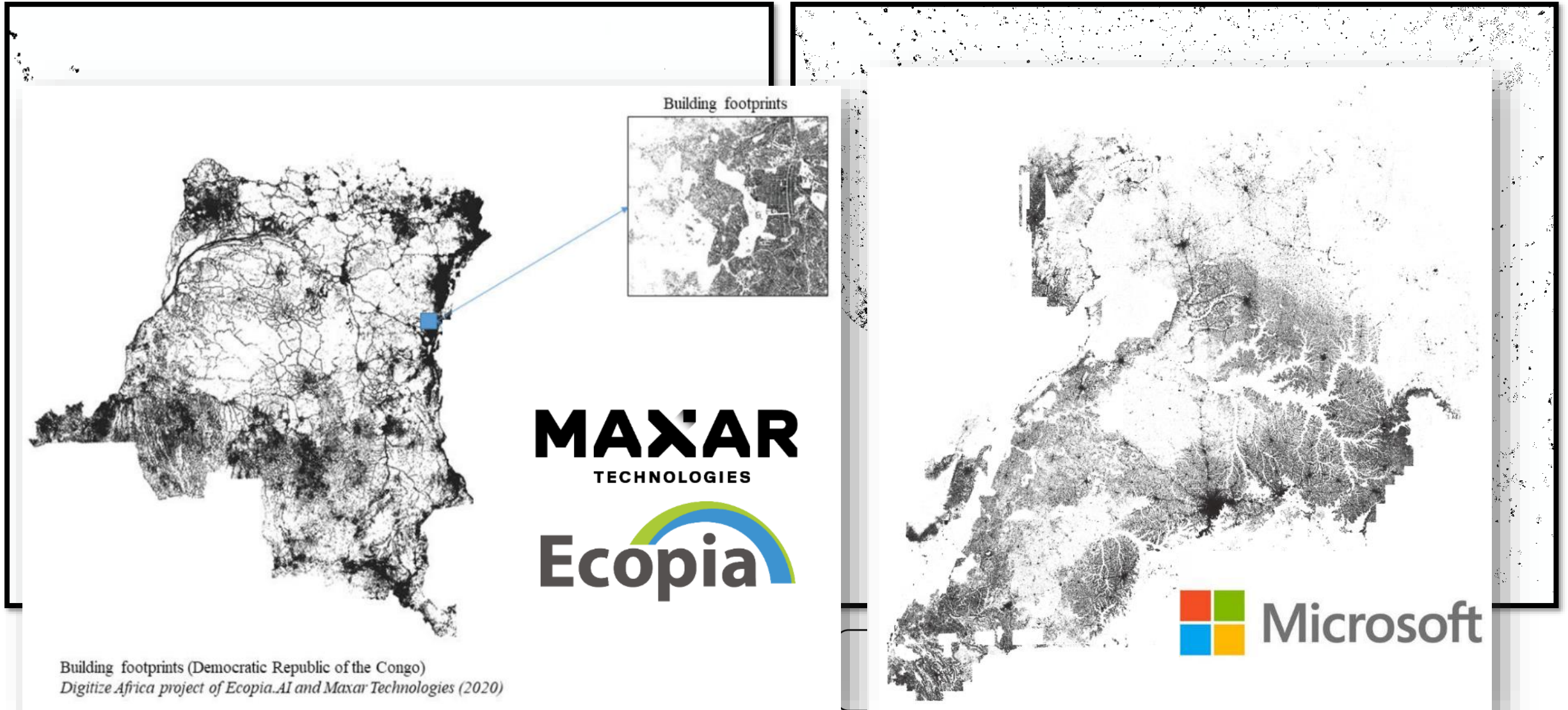
ESA CCI Land cover: 1992-2015



World Settlement Footprint (WSF): 2015

Built settlement growth model: 2000-2020





Building footprints

MAXAR
TECHNOLOGIES

Ecopia

 **Microsoft**

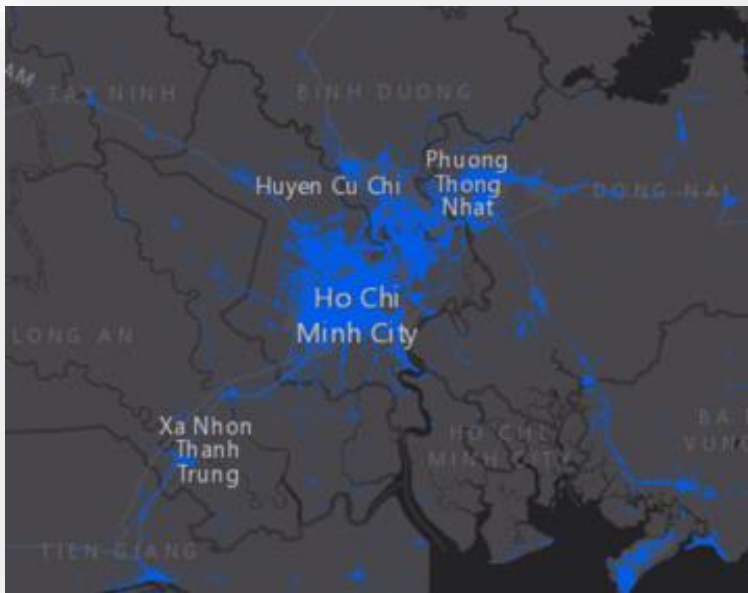
Building footprints (Democratic Republic of the Congo)
Digitize Africa project of Ecopia.AI and Maxar Technologies (2020)

Detail within urban areas

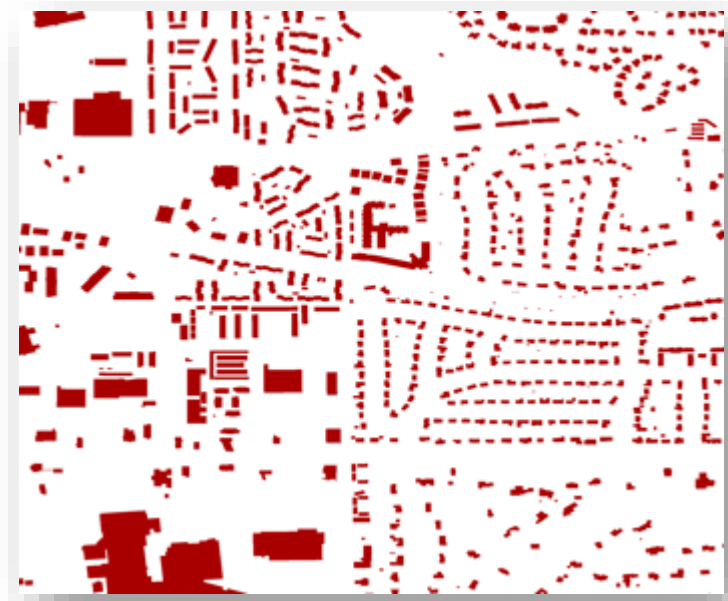


Global + multitemporal vs Regional + recent

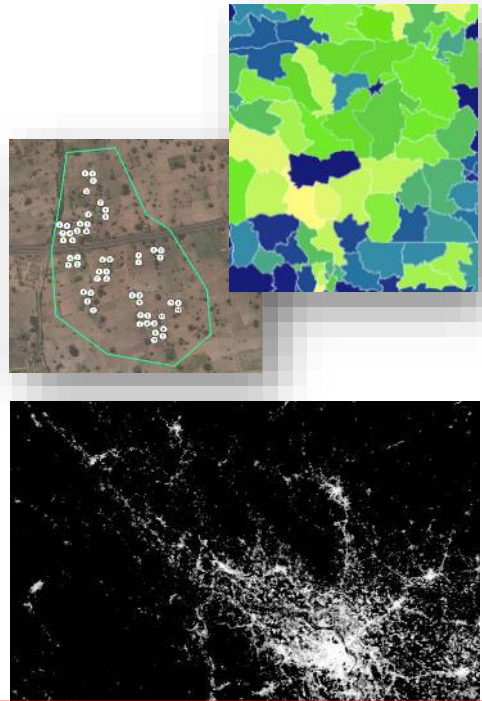
Built settlement growth model
annual estimates
2000-2020



Building footprints
circa 2018-20



Population distribution modelling



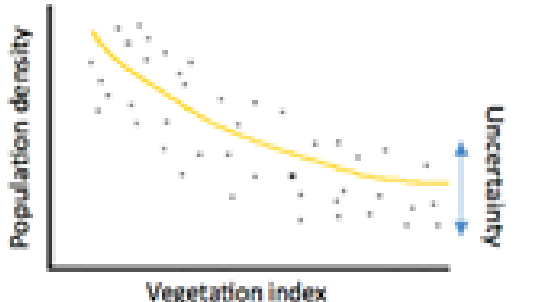
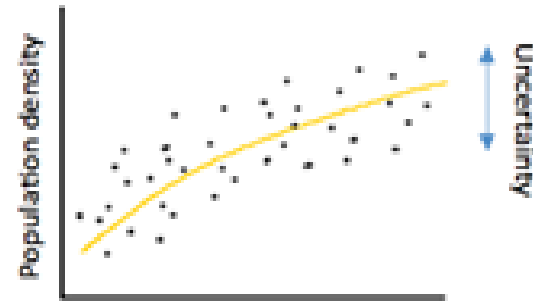
Population Data

Settlement

Geospatial covariates

Spatial statistical model

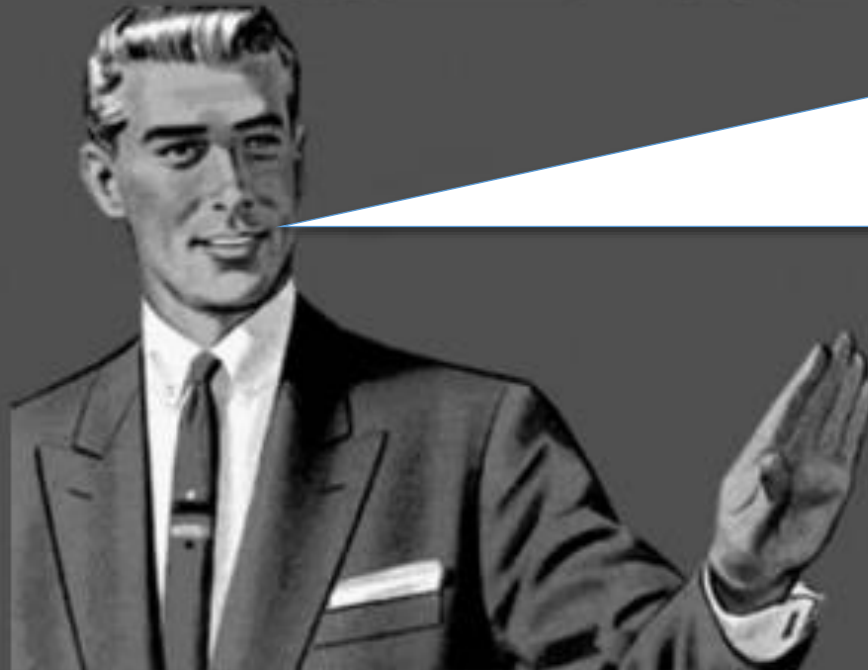
Population estimates



1	1	1	2	2	3	2	2	1	1	1	1	1	1
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2	1	4	5	5	5	4	1	2	1	2	1	1	1
3	2	4	6	6	5	3	3	3	4	4	1	1	1
3	3	2	5	6	5	4	3	2	2	4	2	2	2
1	3	4	3	4	5	5	4	3	1	1	1	2	2
1	2	1	1	2	4	4	3	1	1	1	1	1	1
1	2	2	1	1	2	2	2	1	1	1	1	1	1
1	1	1	1	1	1	2	1	1	1	1	1	1	1

**Adjustments:
National totals,
age/sex**

HOLD UP



WAIT A MINUTE

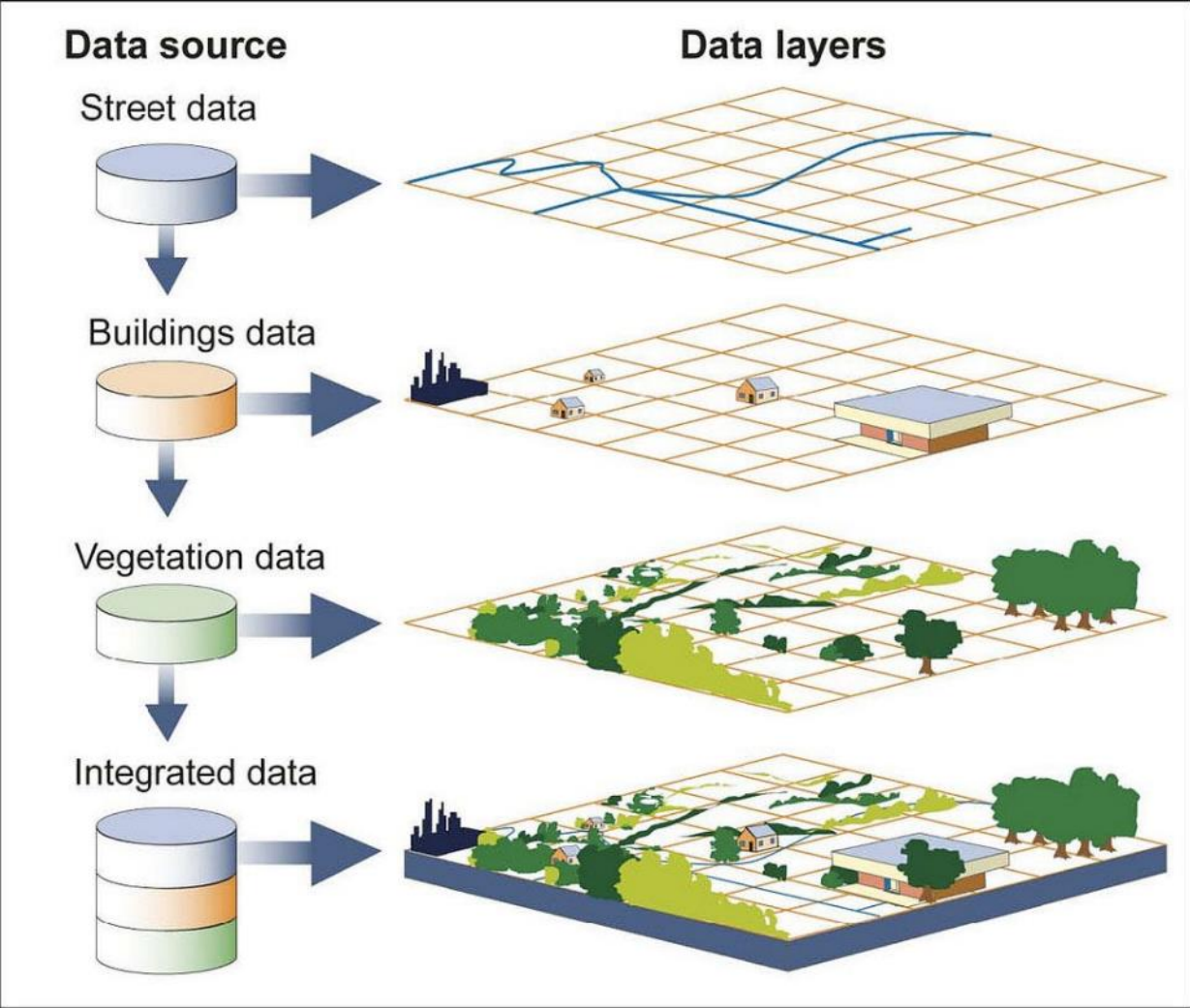
Why do we need these extra layers if we have buildings and people?

Pakistan: Mean household



Buildings + population data?

Capturing characteristics that determine variations in population density



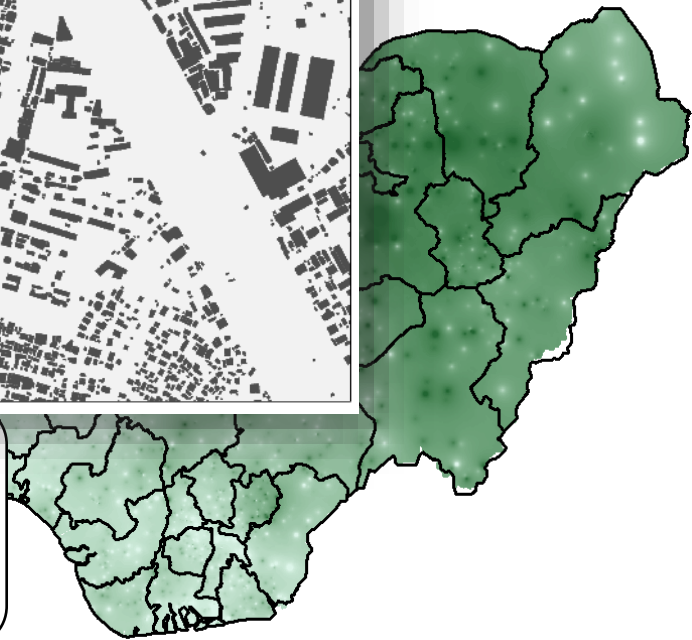
Source: GAO.

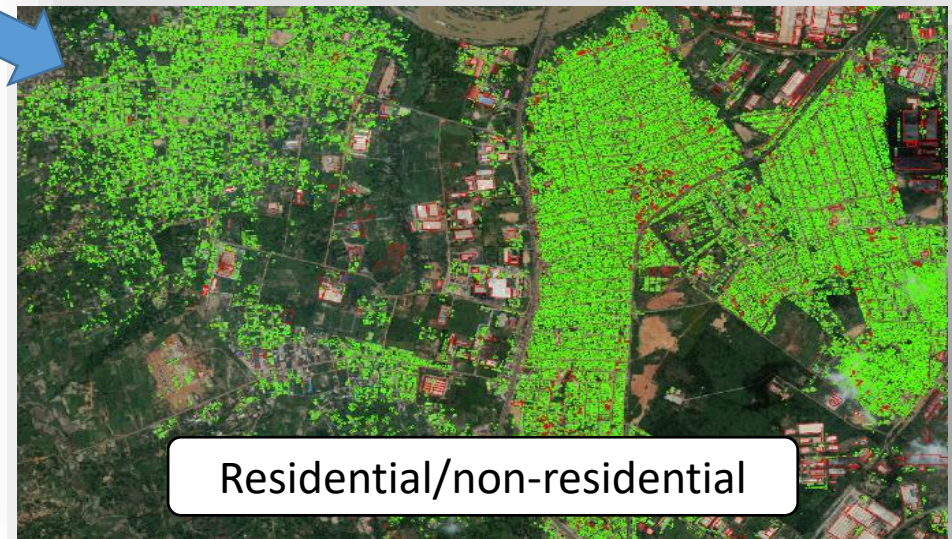
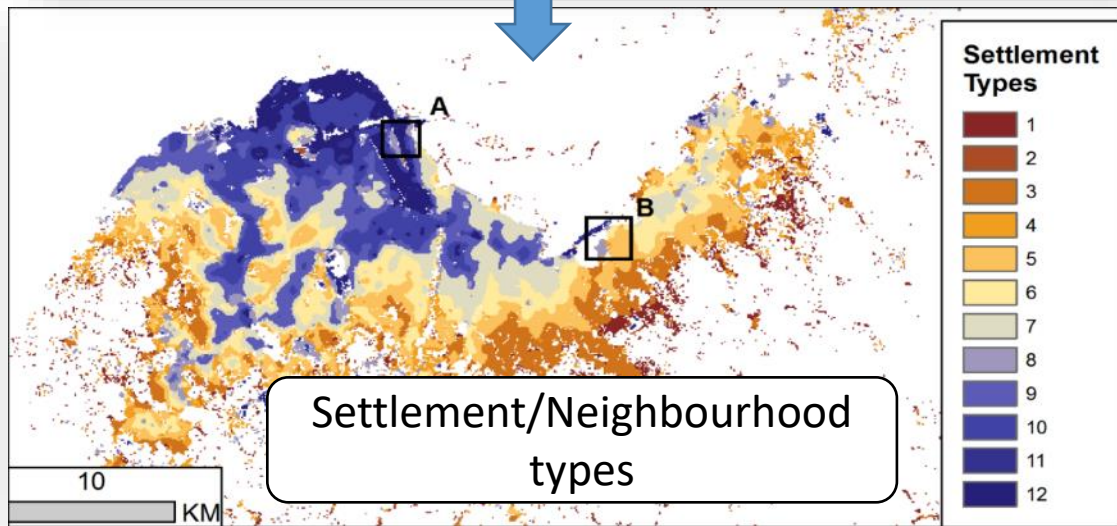
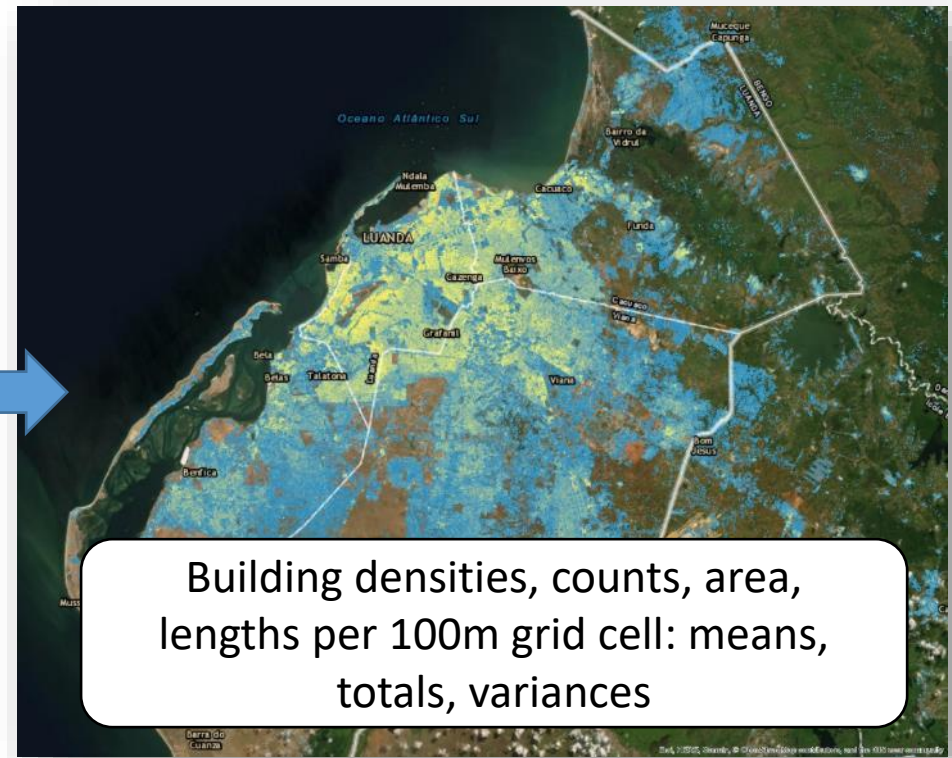
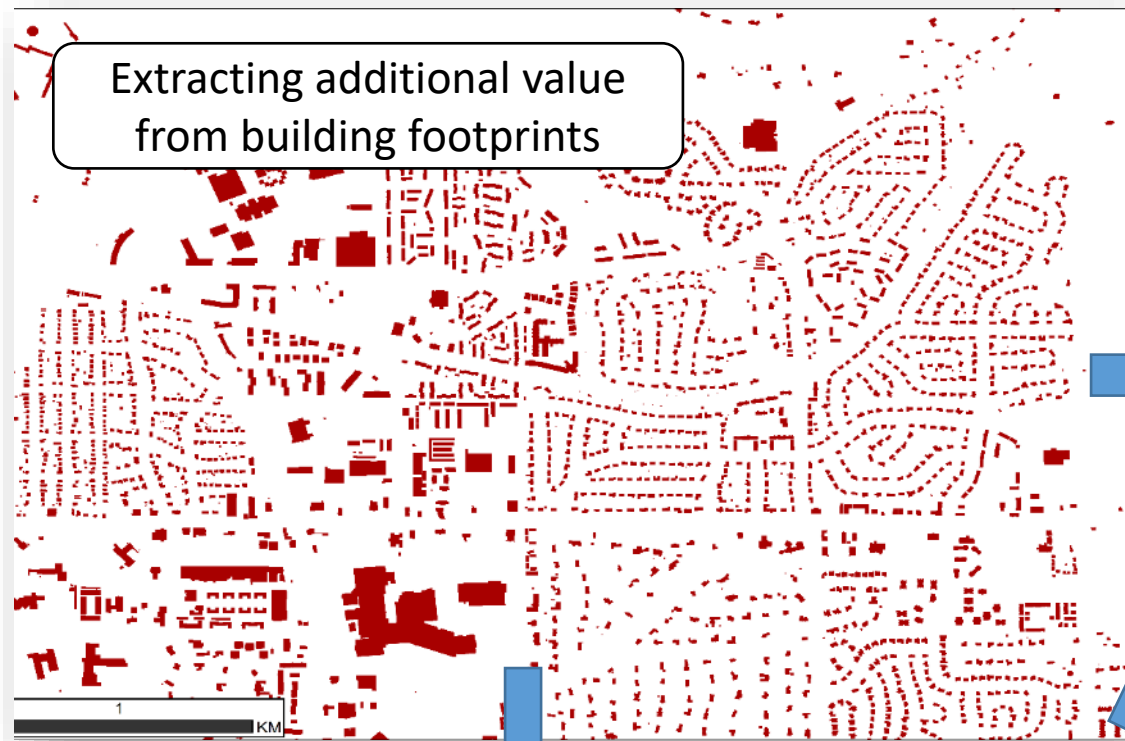


Densities of schools, roads, market places, conflicts etc



Household sizes, regional groupings, poverty rates

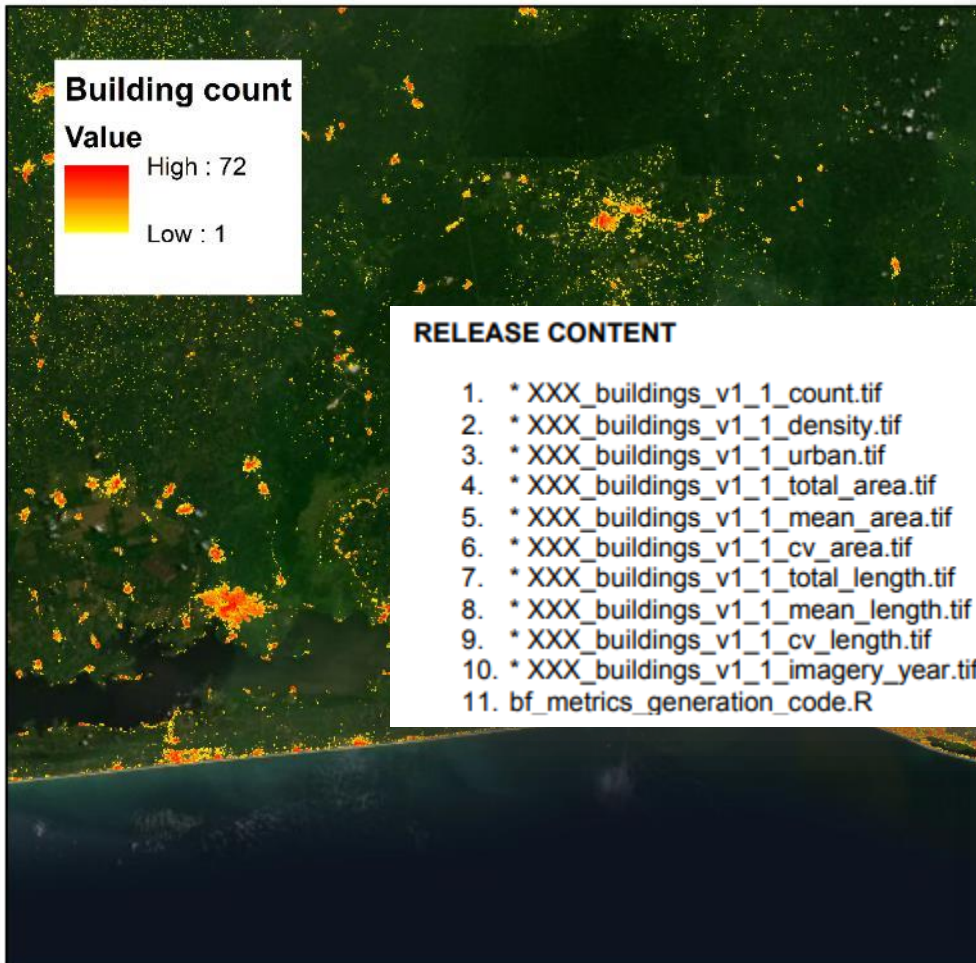




Gridded maps of building patterns throughout sub-Saharan Africa

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Example: Abidjan, Côte d'Ivoire



world pop WorldPop Open Population Repository

The WorldPop Open Population Repository (WOPR) provides access to gridded population estimates and related data created using bespoke methods for individual countries, including final products as well as early experimental results. Refer to data README for more information. Some of these data sets can be explored using [WorldPop web applications](#). Global population data sets that are consistent across countries and years are available from the [WorldPop website](#).

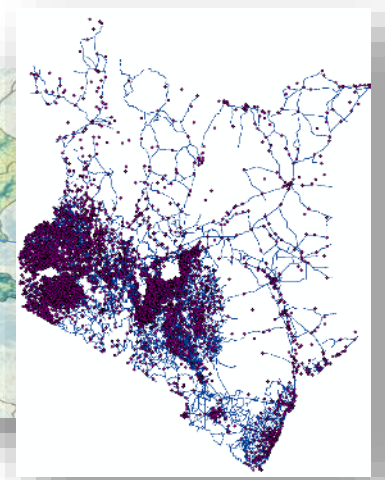
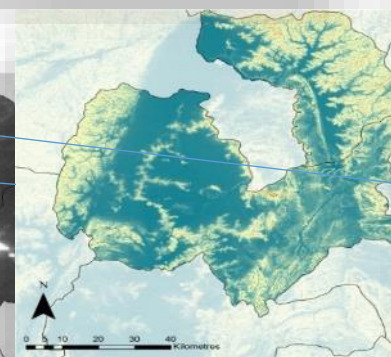
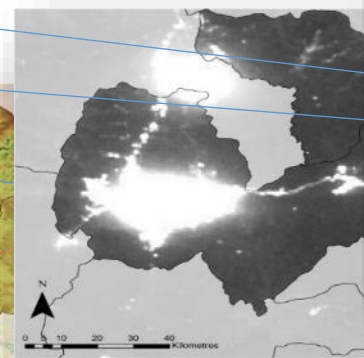
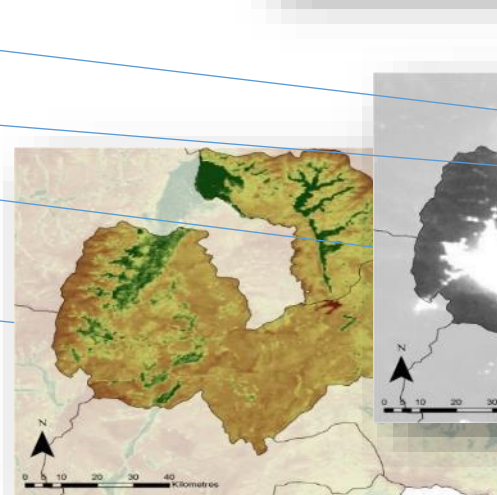
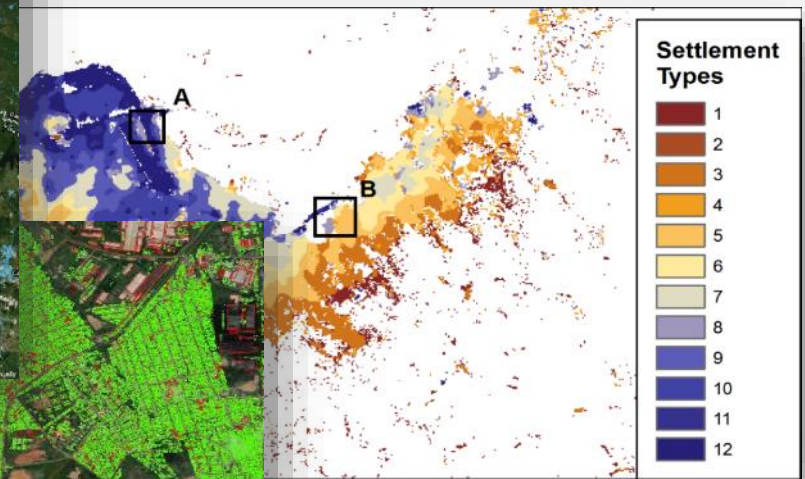
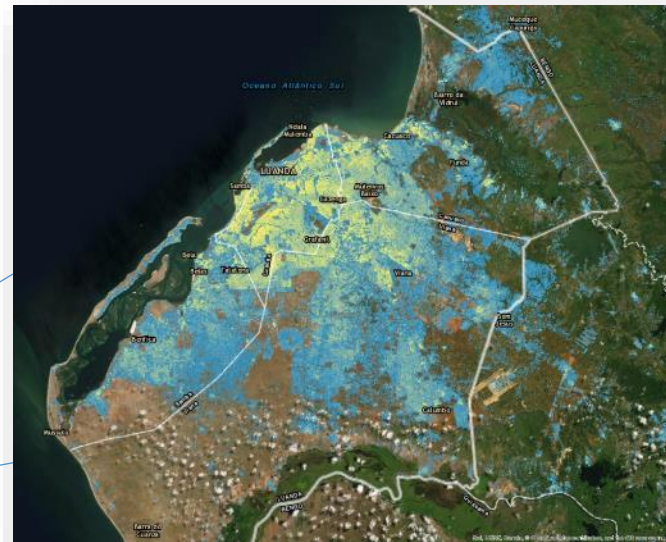
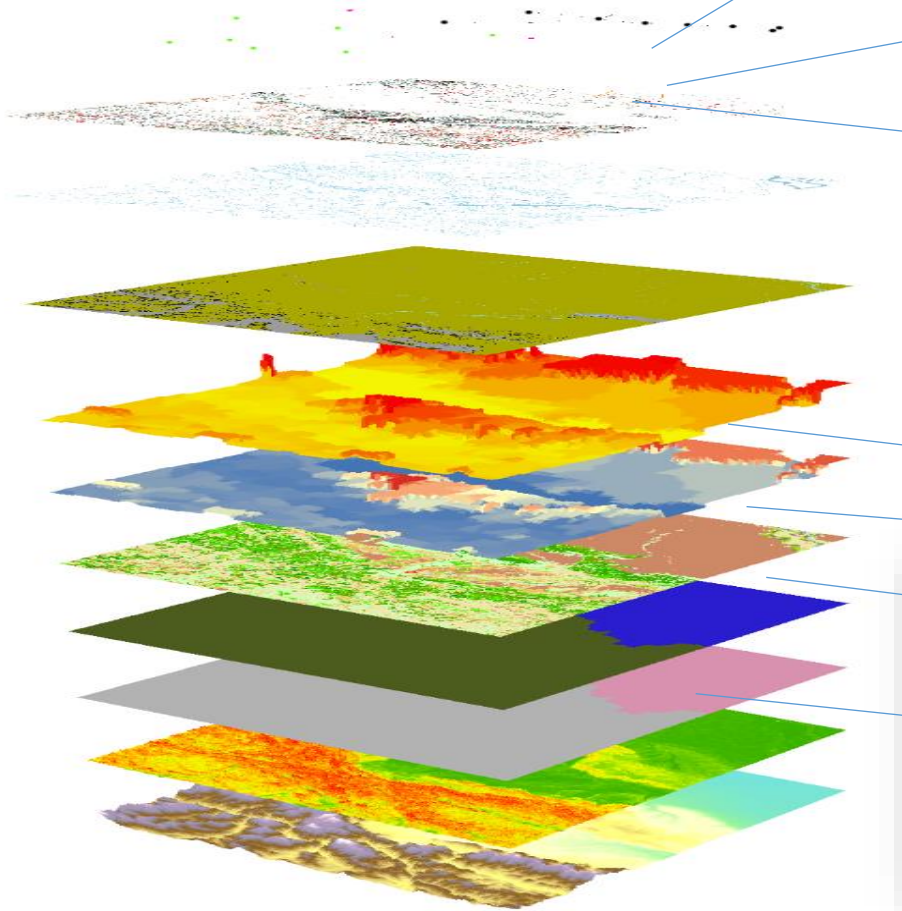
Buildings Select country ... Version ... Reset

Show 25 entries

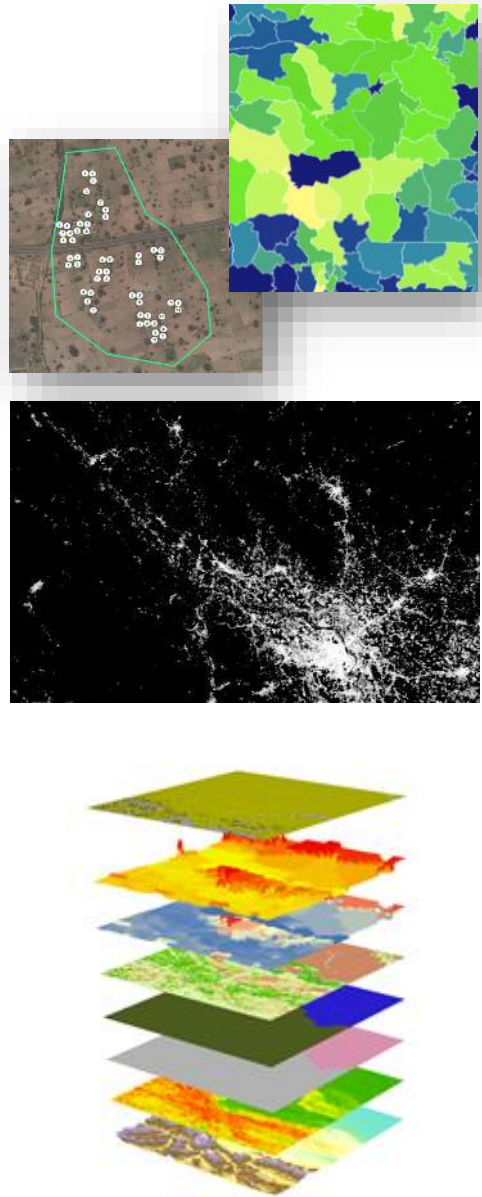
ISO3	Category	File	Date	Version		
AGO	Buildings	Gridded maps of building patterns	2020-07-08	v1.1	Details	Download
AGO	Buildings	README: AGO Buildings v1.1	2020-07-08	v1.1	Details	Download
BDI	Buildings	Gridded maps of building patterns	2020-07-08	v1.1	Details	Download
BDI	Buildings	README: BDI Buildings v1.1	2020-07-08	v1.1	Details	Download
BEN	Buildings	Gridded maps of building patterns	2020-07-08	v1.1	Details	Download
BEN	Buildings	README: BEN Buildings v1.1	2020-07-08	v1.1	Details	Download
BFA	Buildings	Gridded maps of building patterns	2020-07-08	v1.1	Details	Download
BFA	Buildings	README: BFA Buildings v1.1	2020-07-08	v1.1	Details	Download
BWA	Buildings	Gridded maps of building patterns	2020-07-08	v1.1	Details	Download
BWA	Buildings	README: BWA Buildings v1.1	2020-07-08	v1.1	Details	Download
CAF	Buildings	Gridded maps of building patterns	2020-07-08	v1.1	Details	Download
CAF	Buildings	README: CAF Buildings v1.1	2020-07-08	v1.1	Details	Download

Dooley et al (2020): <https://wopr.worldpop.org/?/Buildings>

Adding building footprint-based covariates to the WorldPop stack



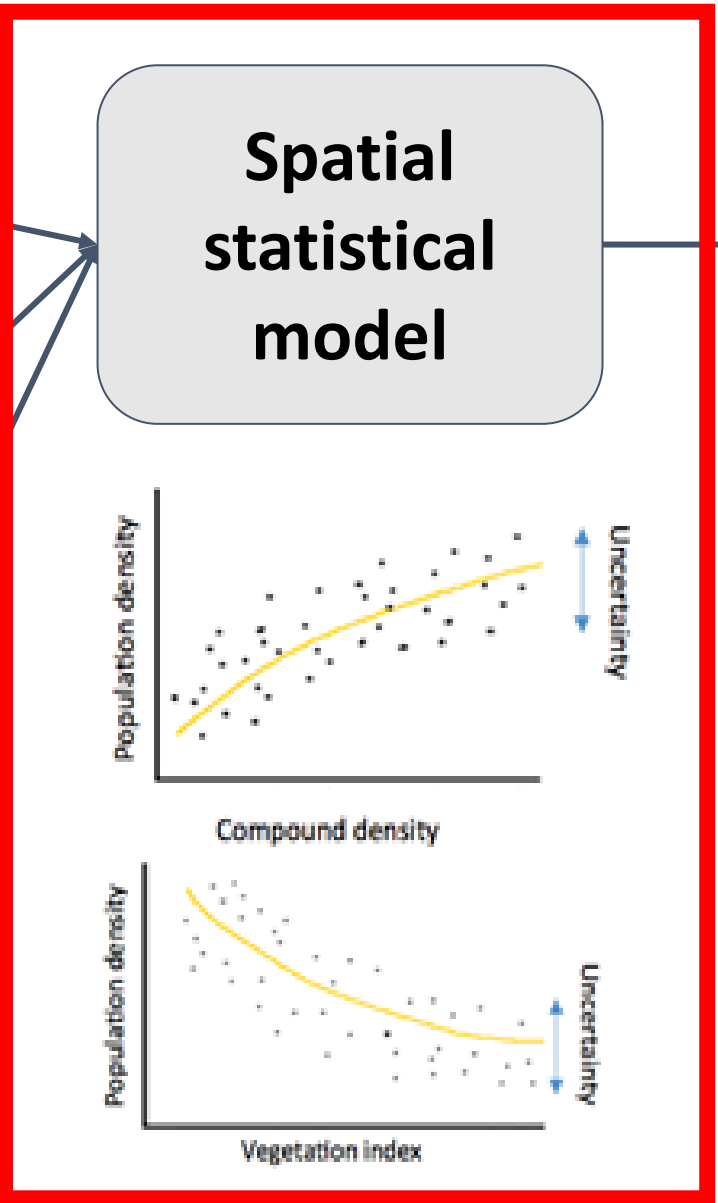
Population distribution modelling



Population Data

Settlement

Geospatial covariates



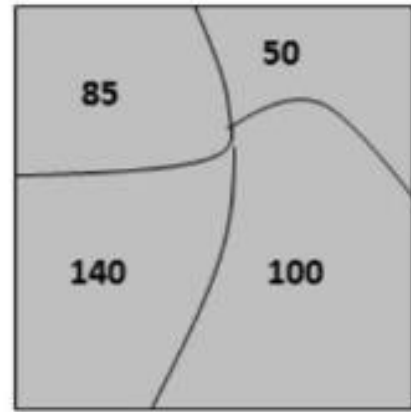
Population estimates

1	1	1	2	2	3	2	2	1	1	1	1	1	1
1	1	1	2	4	4	4	1	1	1	1	1	1	1
2	1	4	5	5	5	4	1	2	1	2	1	1	1
3	2	4	6	6	5	3	3	3	4	4	1	1	1
3	3	2	5	6	5	4	3	2	2	4	2	2	2
1	3	4	3	4	5	5	4	3	1	1	1	2	2
1	2	1	1	2	4	4	3	1	1	1	1	1	1
1	2	2	1	1	2	2	2	1	1	1	1	1	1
1	1	1	1	1	1	2	1	1	1	1	1	1	1

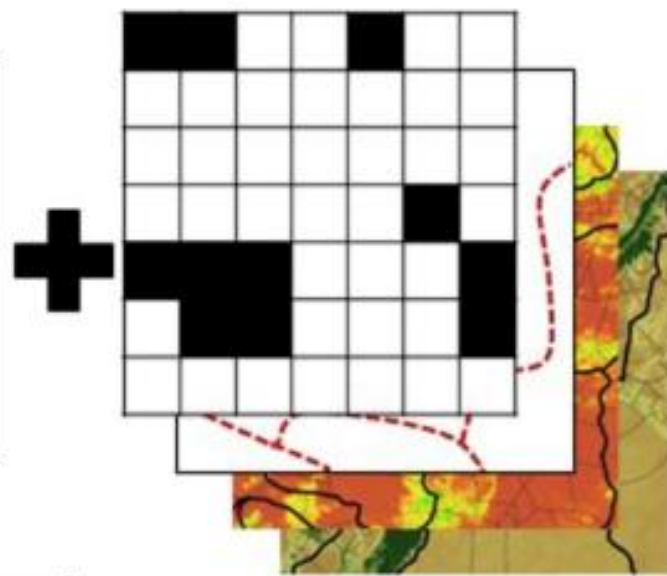
**Adjustments:
National totals,
age/sex**

A Top down approach

Census population counts



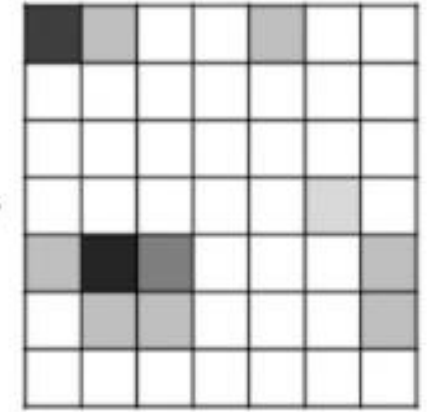
Geospatial covariates



Population disaggregation

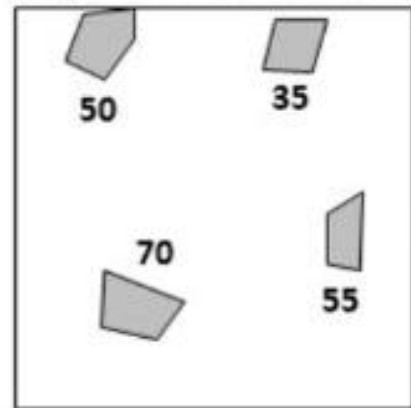
Spatial weighting layer created based on covariates, using dasymetric mapping

Gridded population

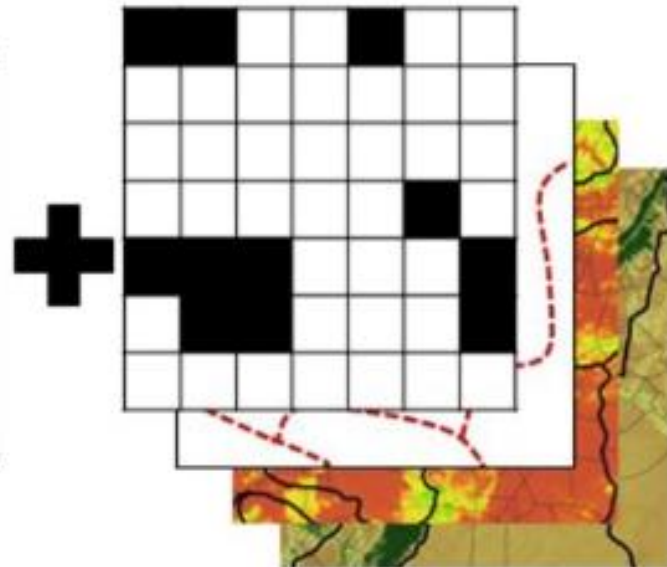


B Bottom-up approach

Microcensus population counts



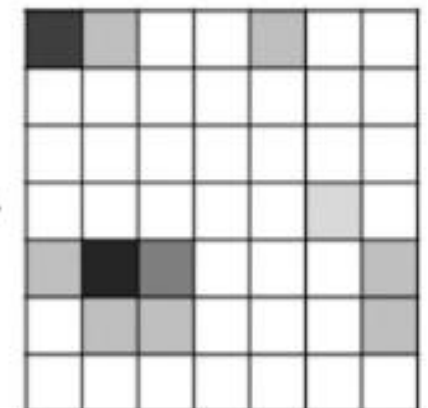
Geospatial covariates



Population estimation

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

Gridded population





ABOUT | METHODS & TOOLS | NEWS | DATA | CONTACT

Mapping Populations

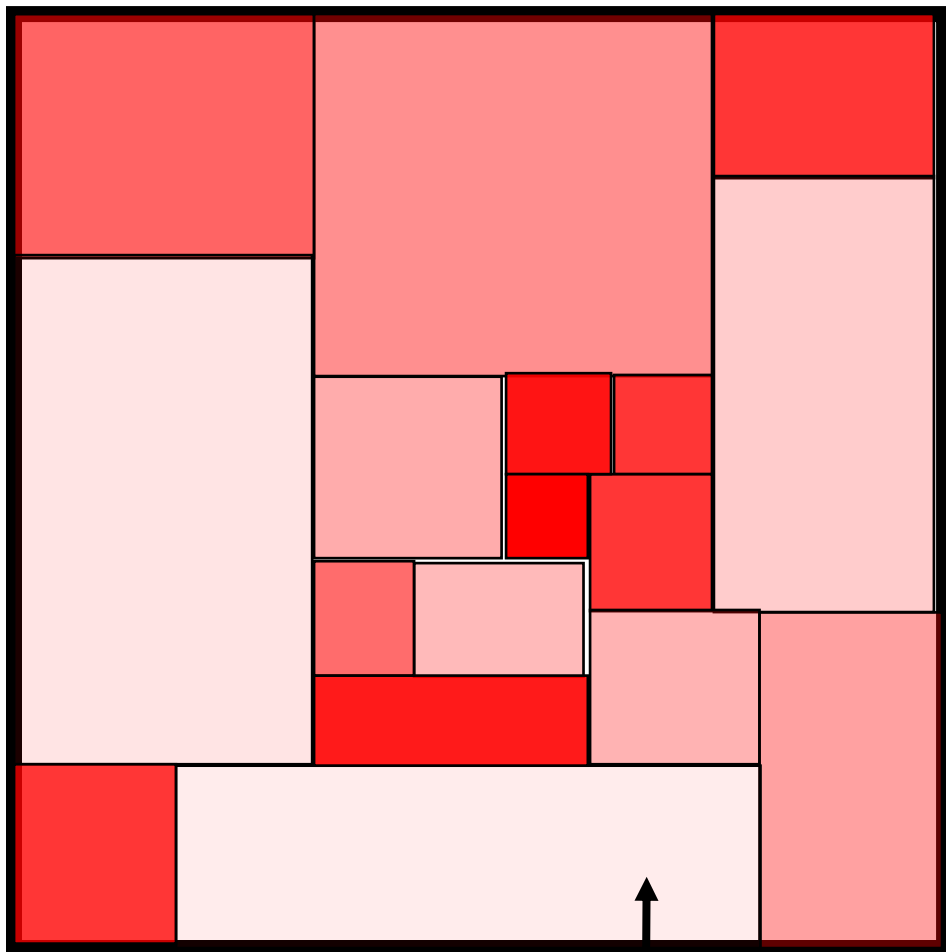
WorldPop gridded population estimate datasets and tools

How are they different and which should I use?

www.worldpop.org/methods/populations

Complete: census or projections

Population totals for enumeration zones with full national coverage.

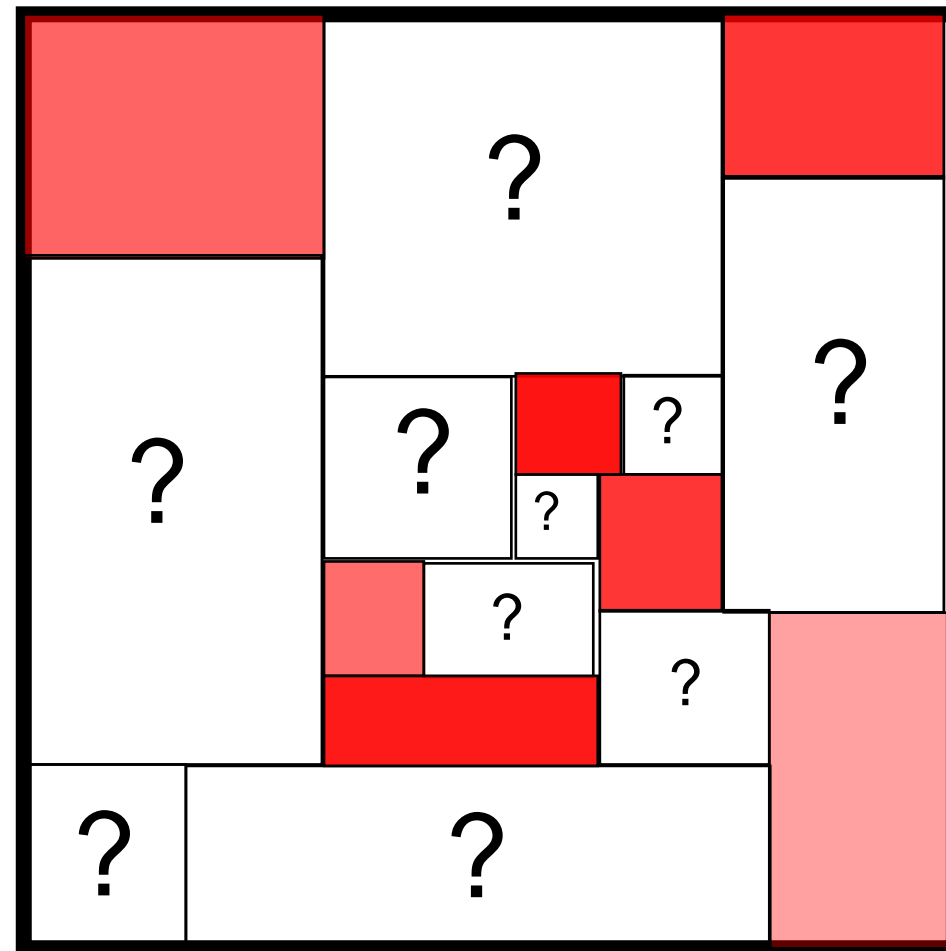


National Boundary

Enumeration Zone

Incomplete: partial census or enumeration surveys

Population totals for a sample of enumeration zones.



More red = more people

Inputs

Top-down

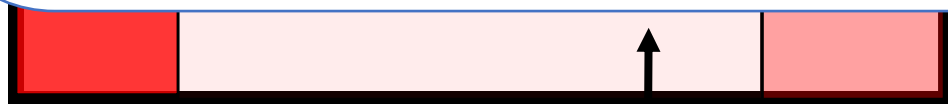
Population totals for enumeration zones with full national coverage.



“I have recent and reliable census counts matched to boundaries and want gridded estimates”

“I trust these subnational province-level projections, but need finer scale estimates”

“I need gridded outputs that match my district unit totals”



National Boundary

Enumeration Zone

More red = more people

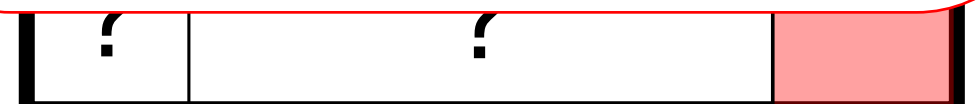
Bottom-up

Population totals for a sample of enumeration zones.



“The last national census was 1984 so don't trust that data, but I need small area population data and do have some recent sample enumeration data”

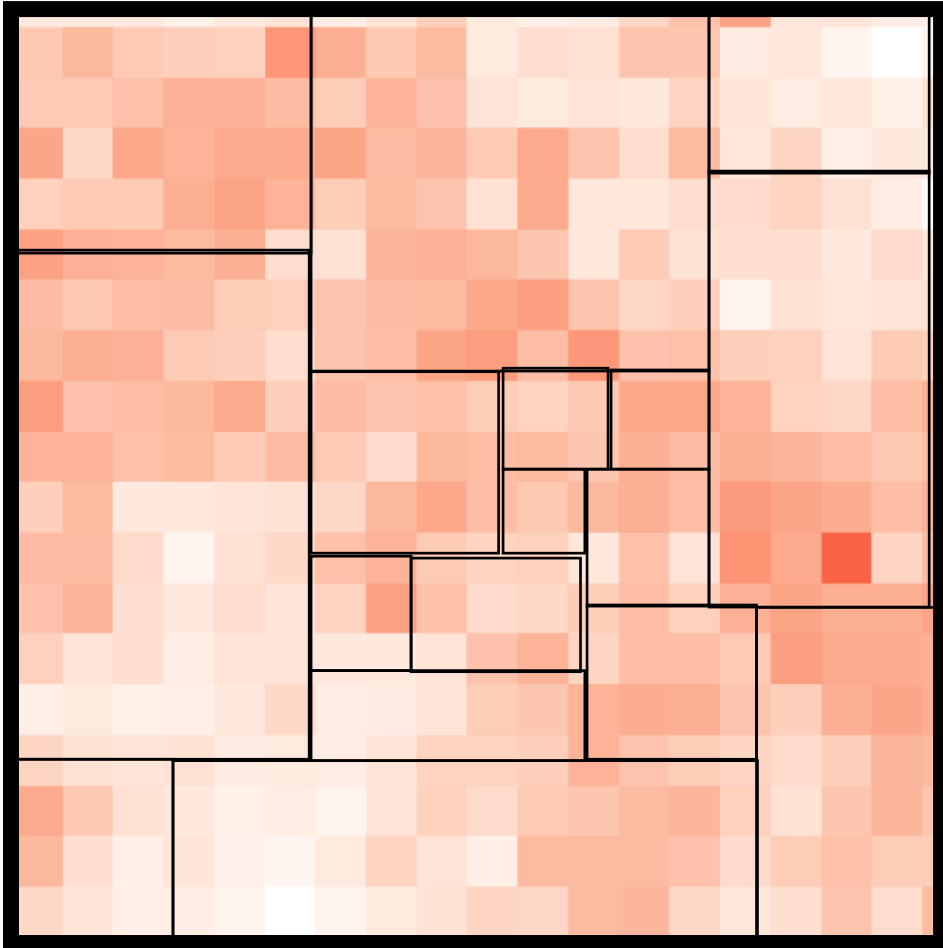
“I have geolocated listings from a recent household survey and want to use these to build population estimates”



Inputs

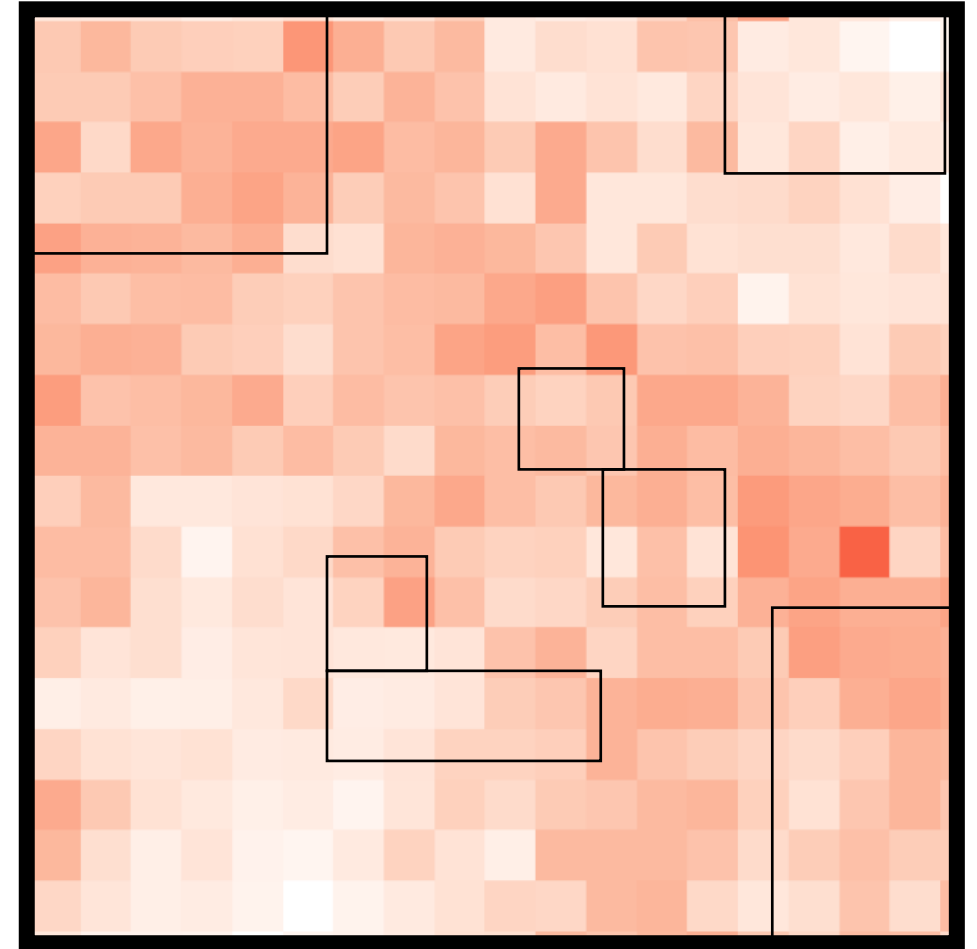
Top-down

**Geospatial covariates and
settlement data (e.g. building footprints)**



Bottom-up

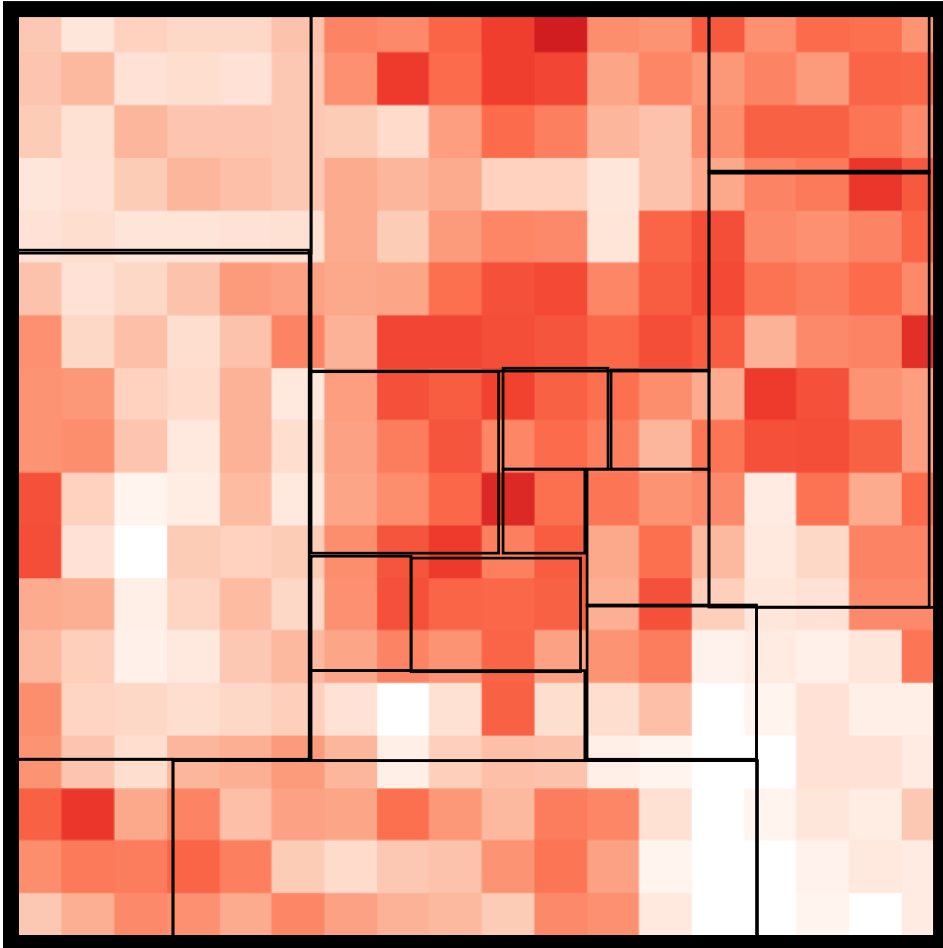
**Geospatial covariates and
settlement data (e.g. building footprints)**



Outputs

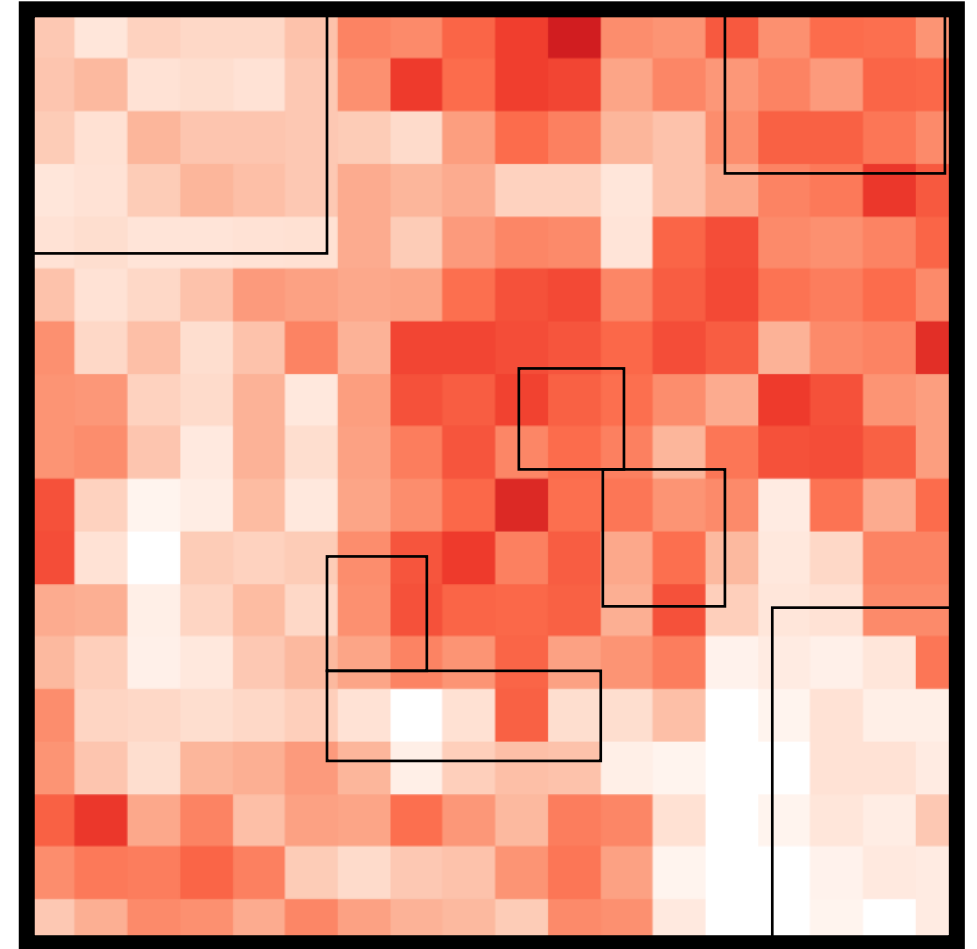
Top-down

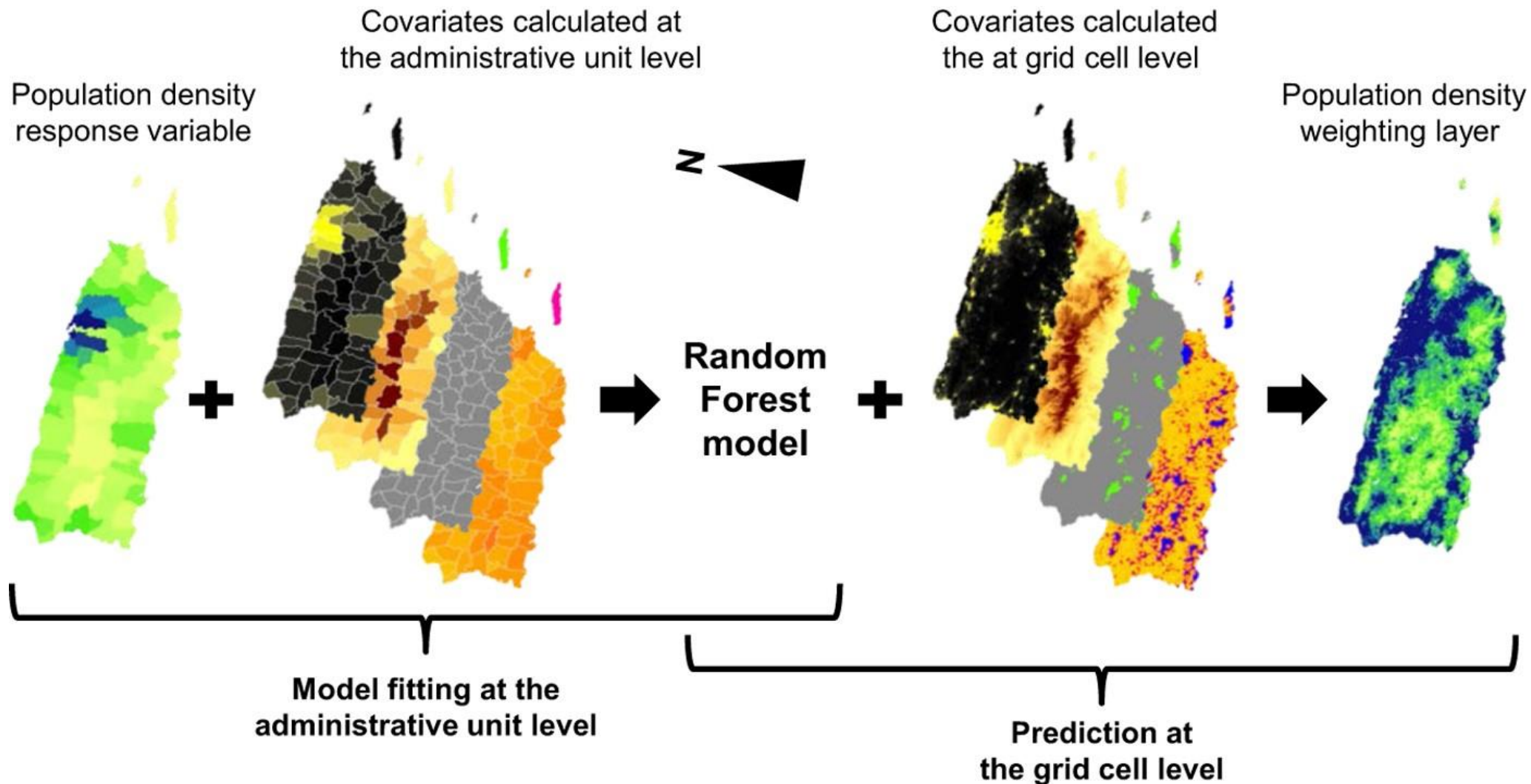
Gridded population estimates (100 m) that **sum to pre-defined population totals.**



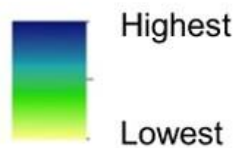
Bottom-up

Gridded population estimates (100 m) that **fill gaps between surveyed areas.**





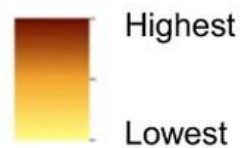
Population density



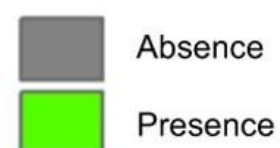
Night-time light



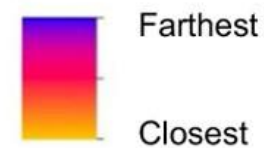
Elevation



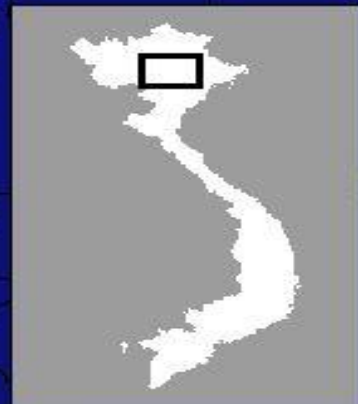
Protected area



Distance to built-up areas

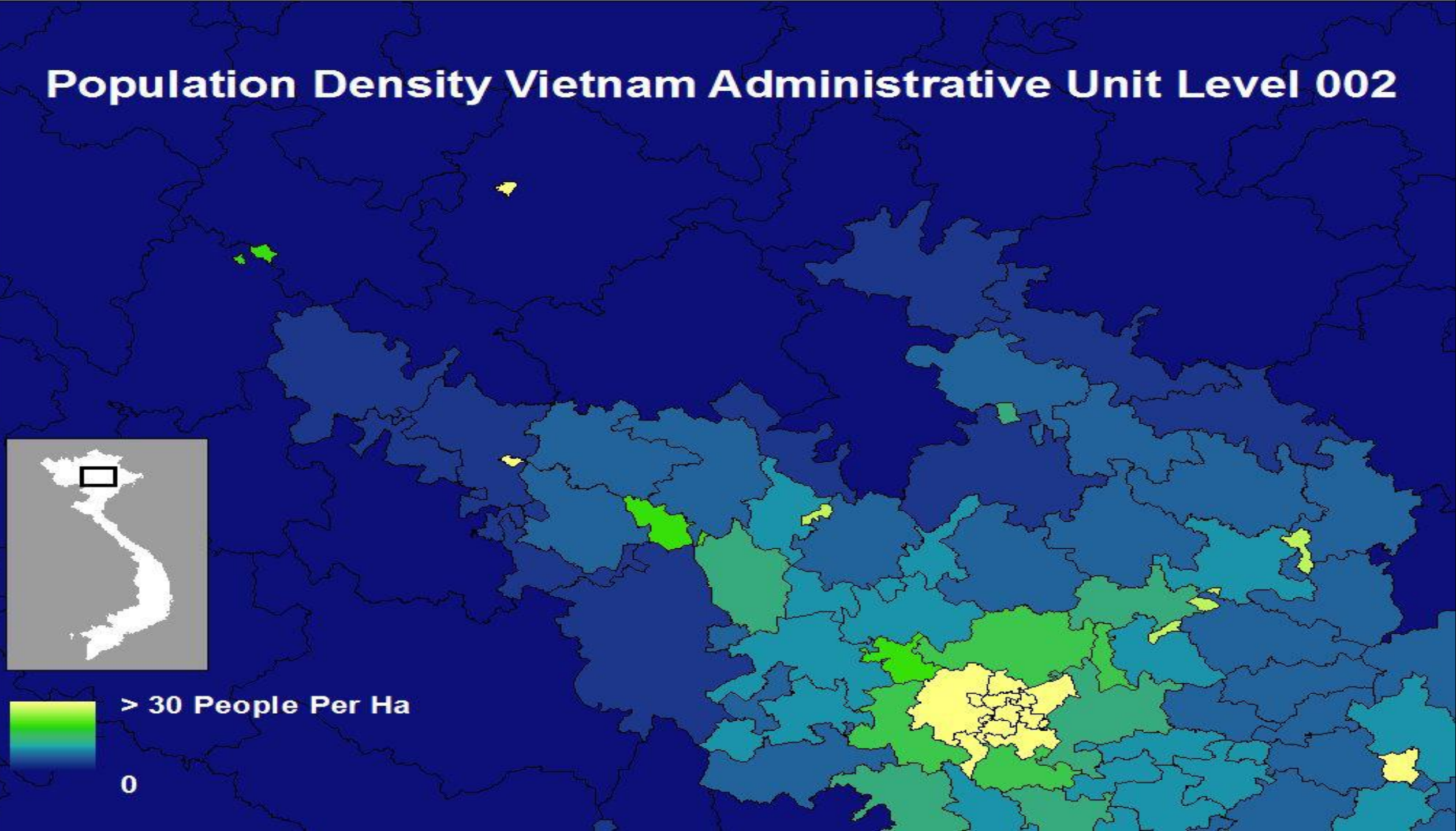


Population Density Vietnam Administrative Unit Level 002

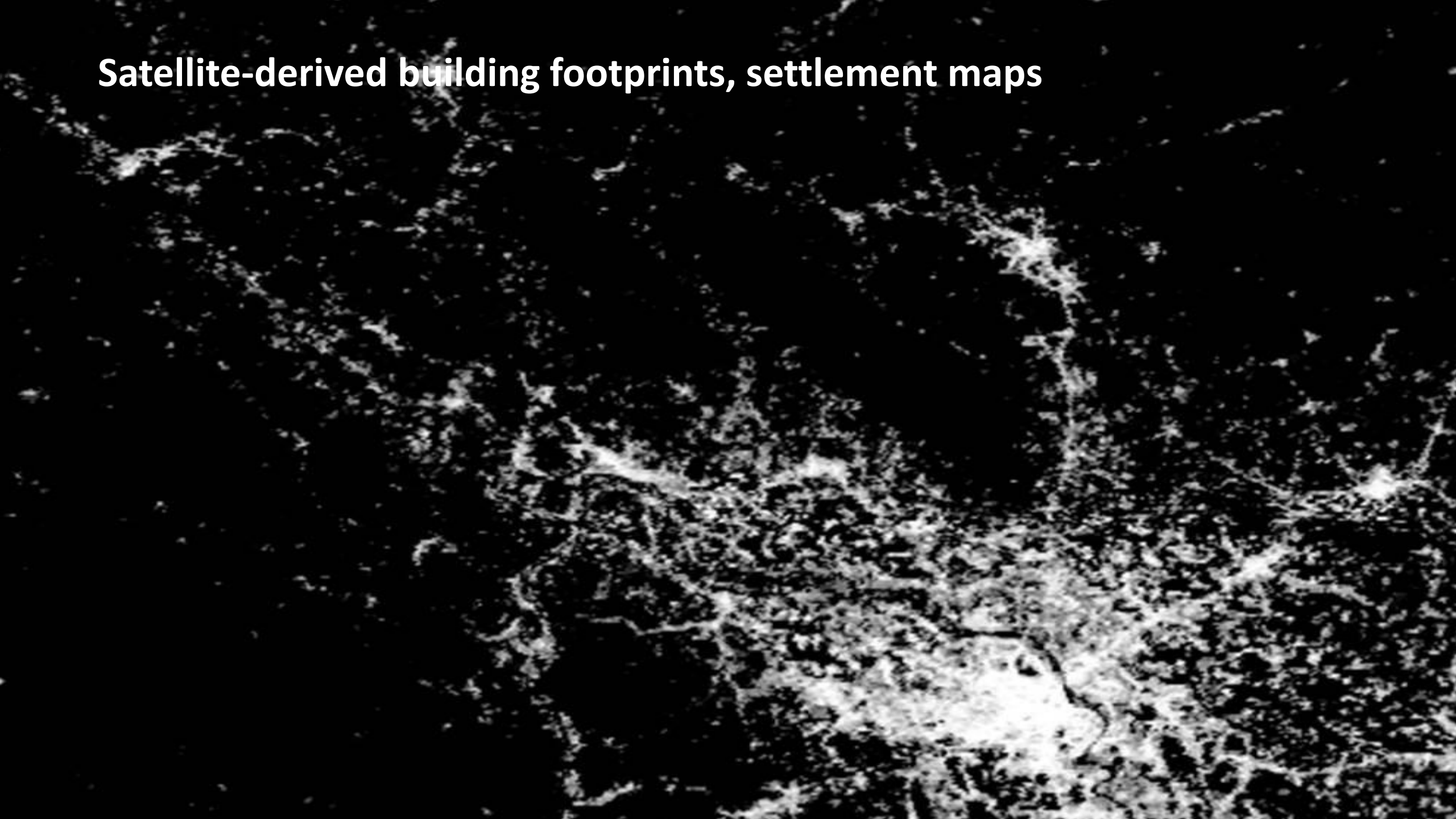


> 30 People Per Ha

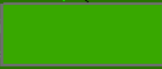
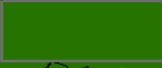

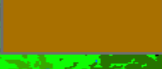
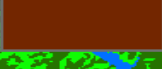




0



Satellite-derived building footprints, settlement maps



Vietnam MDA GeoCover Land Cover (30 m Pixels)

-
-  Cultivated
 -  Woody
 -  Shrubby
 -  Herbaceous
 -  Aquatic
 -  Urban Built
 -  Bare
 -  Water
 -  Rural Built

NOAA Suomi VIIRS-derived Lights at Night 2012 for Vietnam

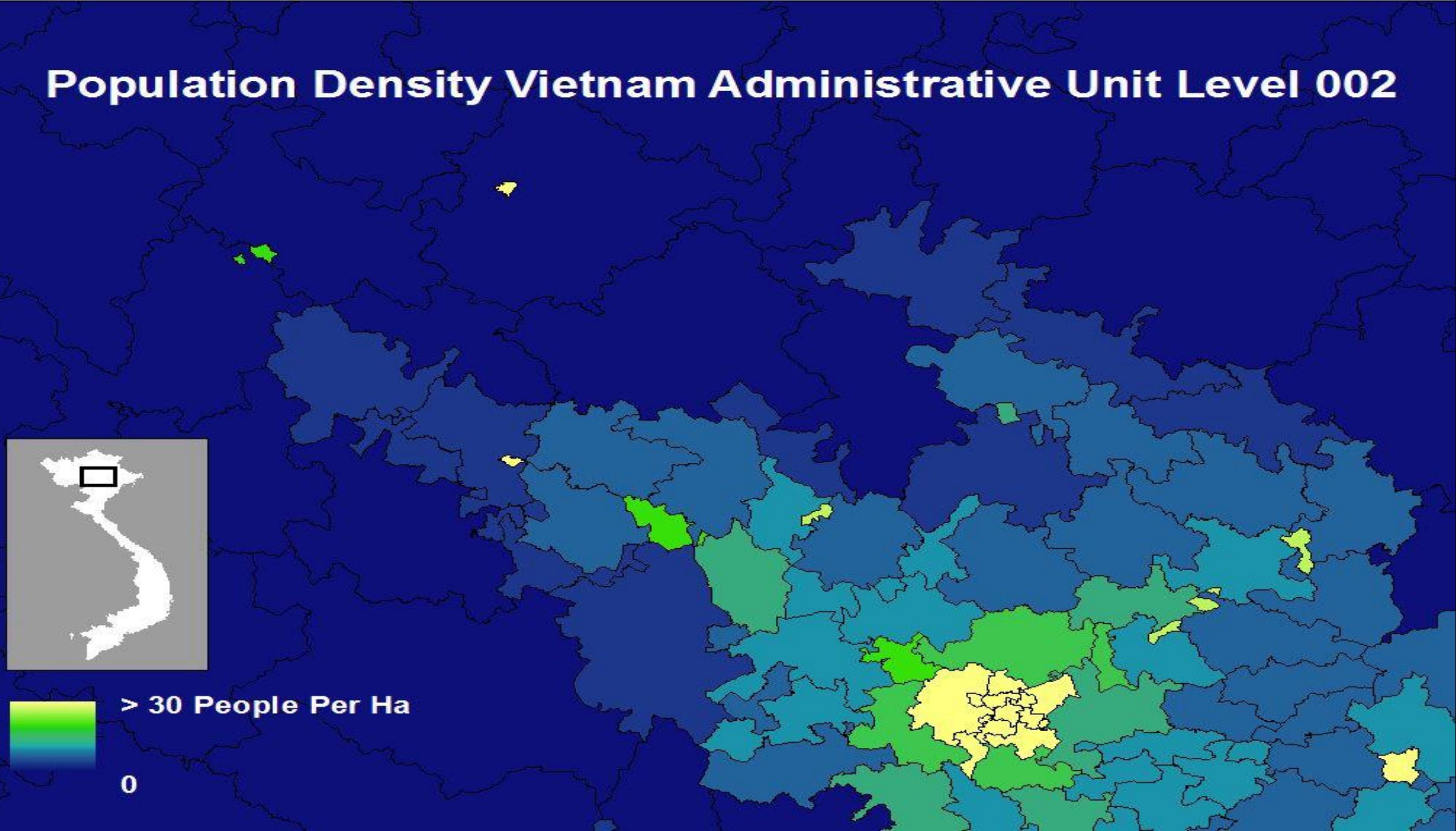


Population Density Vietnam Administrative Unit Level 002



> 30 People Per Ha

0

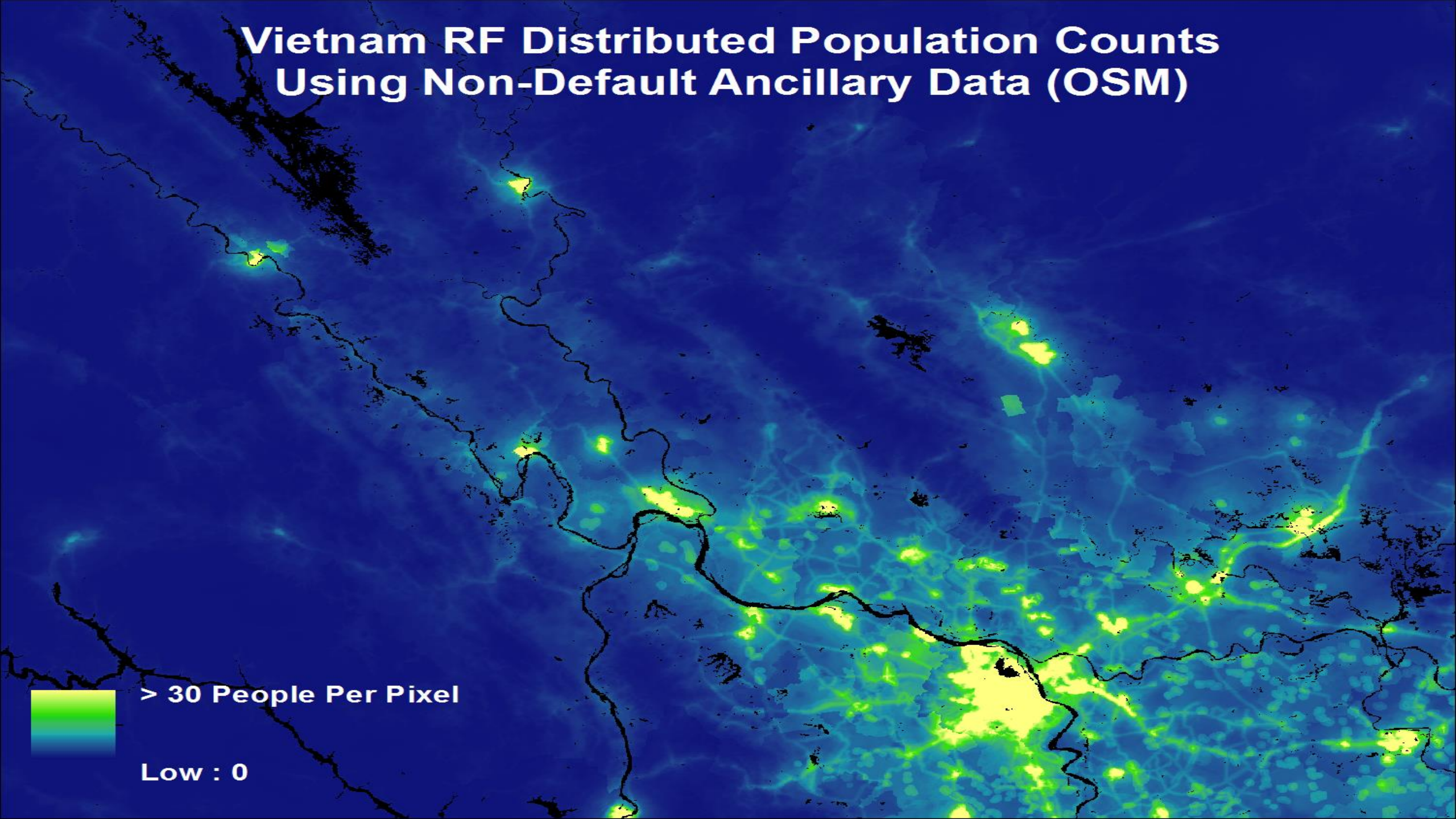


Vietnam RF Distributed Population Counts Using Non-Default Ancillary Data (OSM)




> 30 People Per Pixel


Low : 0



2000-2020 subnational census/projections

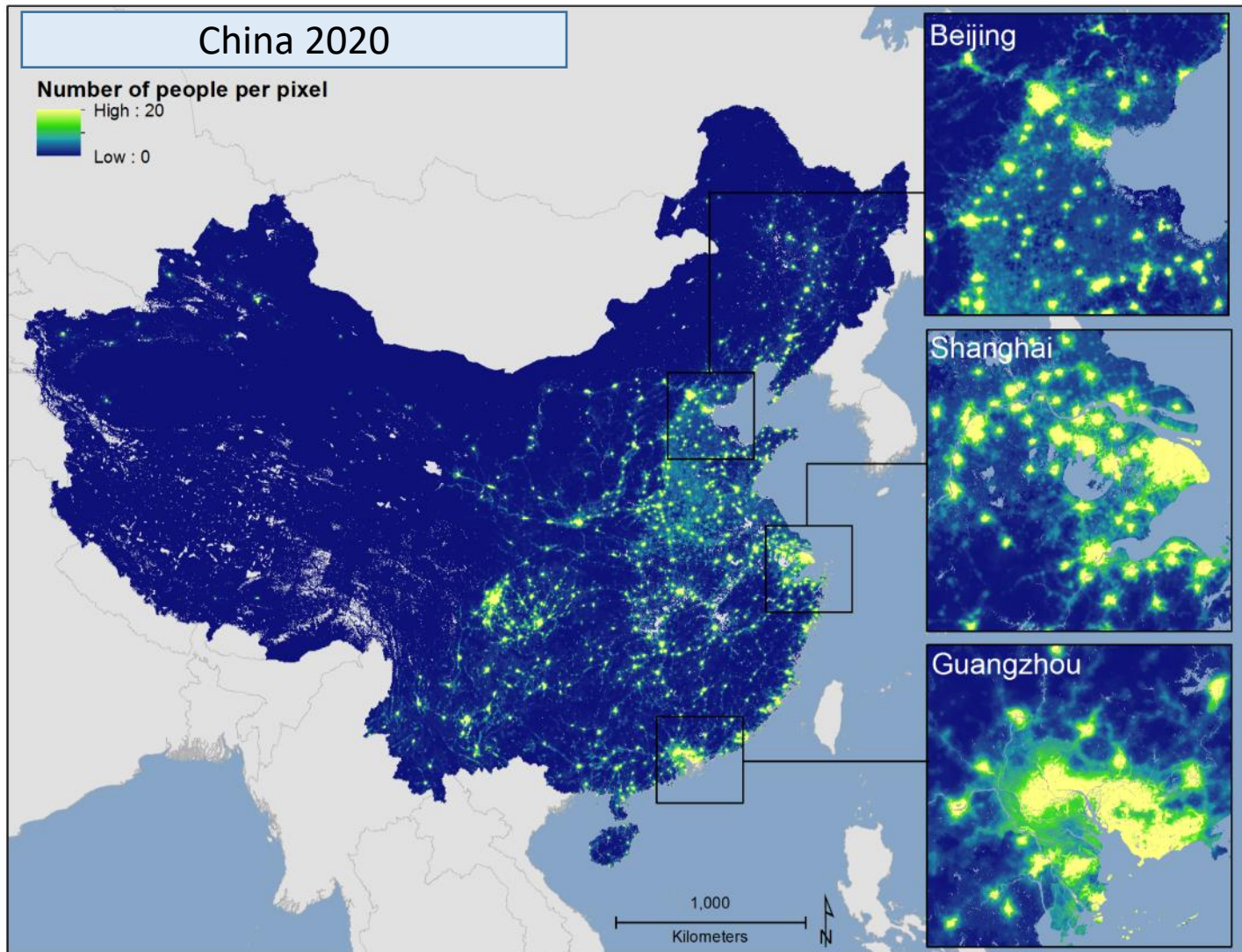


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Country/Territory/Dependency				Administrative Levels								Total Population				
2	Country or Territory Name	Continent	ISOAlpha	ISO Numeric	Admin Level 1 Name	Admin Level 2 Name	Admin Level 3 Name	Admin Level 4 Name	Admin Level 5 Name	Admin Level 6 Name	Highest Admin Level Used	Number of Units	Population Year	Population Source Type	Population Estimate/Projection Type	Population Admin Level Used	Population Source Citation
3	Aruba	Americas-North America	ABW	533	Region	Zone					2	55	2010	Final Census	not applicable		Central Bureau of Statistics of Aruba, Fifth Population Census 2010 Aruba, Table P-A.3.a: Population by province and sex, Received 09/26/2012.
4	Afghanistan	Asia	AFG		Province	District					2	401	2011	Population Estimate/Projection	UN Urban and Rural Population by Age and Sex (URPAS) 2010 estimates		Central Statistics Organization Afghanistan, Population 2011-2012, Published 10/16/2011, http://cso.gov.af/files/2107/2012
5	Angola	Africa	AGO	24	Província	Município					2	161	2014	Preliminary/Provisional Census	not applicable		Instituto Nacional de Estatística, Recenseamento Habitacional 2014, Tables 1.1 to 18.1 - População residente por área de residência, segundo o sexo e índice de mortalidade, Received 11/06/2014.
6	Anguilla	Americas-North America	AIA	660							0	1	2011	Preliminary/Provisional Census	not applicable		Anguilla Statistics Department, Published 12/5/2011, Preliminary Census Findings #6B, Table 2 - Population 2011, (5yr age groups), Published 12/5/2014, http://www.gov.ai/department.php?id=1&dept=4 , Accessed 12/5/2014.
7	Åland Islands	Europe	ALA	248	Municipality						1	16	2010	Population Register	not applicable		Statistics Åland, 2010 Population Register, Tabell 1: 2011 efter år, ålder, kommun och kön, http://www.aland.ax/en/fakta/statistik/ , Accessed 12/5/2014.
8	Albania	Europe	ALB	8	County	District	Municipality				3	373	2011	Final Census	not applicable		Thomas Brinkhoff: City Population, http://www.citypopulation.de/php/albania-admin.php , Housing Census 2011 from Instituti i Statistikës, Tirana, 12/23/2013.
	Andorra	Europe	AND	20	Parish						1	7	2010	Population Register	not applicable		Statistics of Andorra, 2010 Population Register, http://www.estadistica.ad/serveiestadiv/web/index

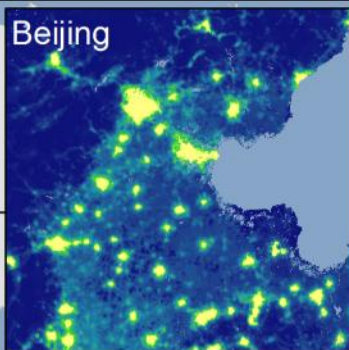


China 2020

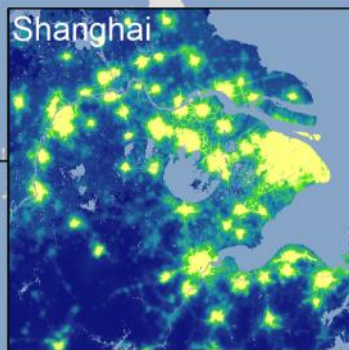
Number of people per pixel



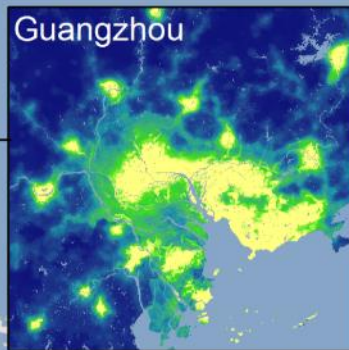
Beijing



Shanghai



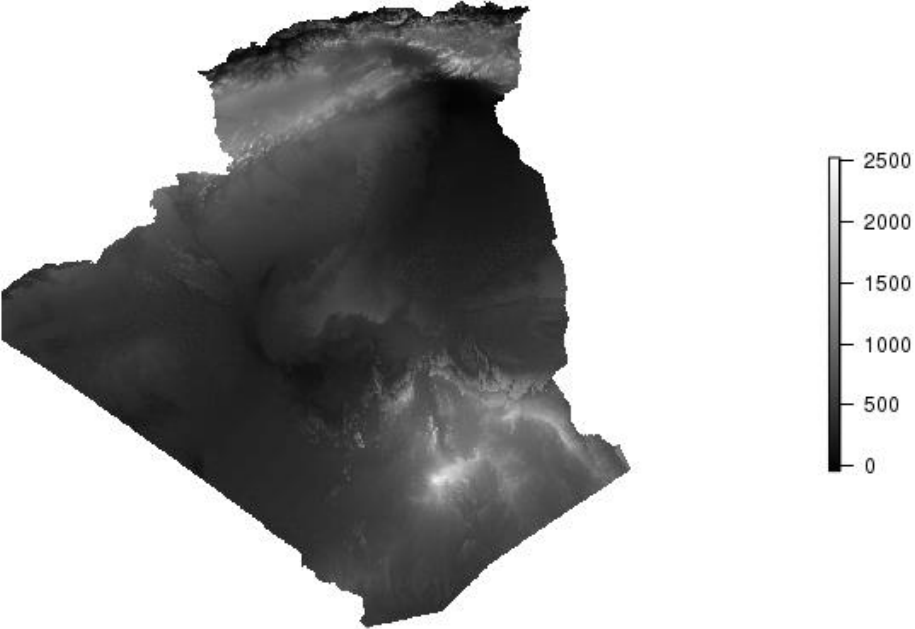
Guangzhou



Algeria Population Map Metadata Report

Covariate importance for DZA RF Model

Elevation



Topo

Data Source: Viewfinder Panoramas (<http://viewfinderpanoramas.org/>), Digital Elevation Data (<http://viewfinderpanoramas.org/dem3.html>)

Download: ftp://ftp.worldpop.org.uk/WP515640_Global/time_invariant

approximately 100 m at the equator) obtained using the Random Forest (RF) used to dasymmetrically disaggregate population counts from administrative being adjusted to match the most recent UNPD estimates# available at the al distribution of each covariate, is also provided in this metadata report.

Mapping Using Random Forests with Remotely-Sensed and Ancillary Data.

Random Forest Diagnostics

Covariate importance for DZA RF Model

Prediction Error (MSE) Stability for DZA RF Model

Covariate Metadata

Distance to cultivated areas 2006

Distance to woody areas 2006

Distance to cultivated areas 2006

Distance to herbaceous areas 2006

Distance to sparse vegetation areas 2006

Introduction

Dependencies and installation

Getting started

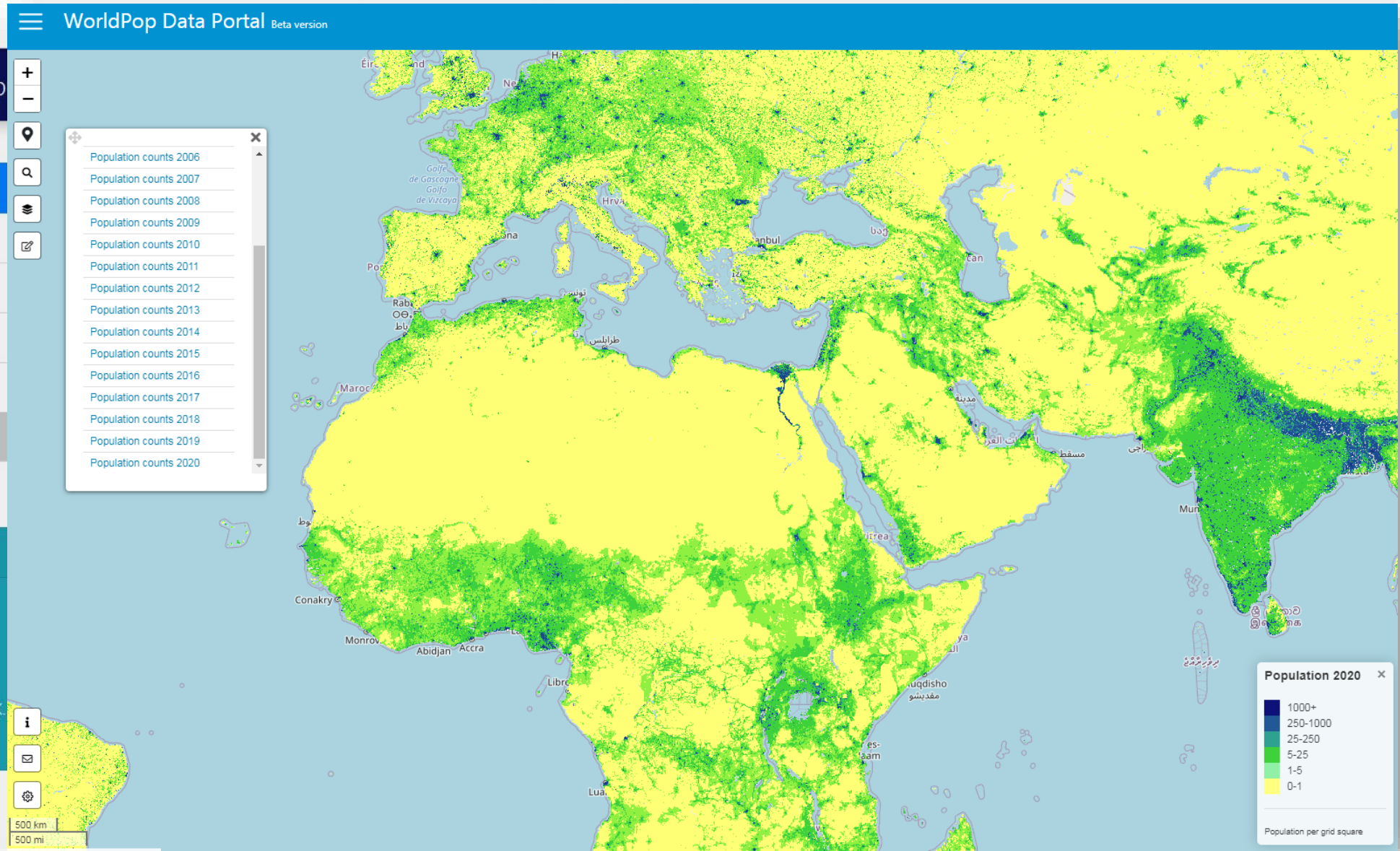
Outputs

Download

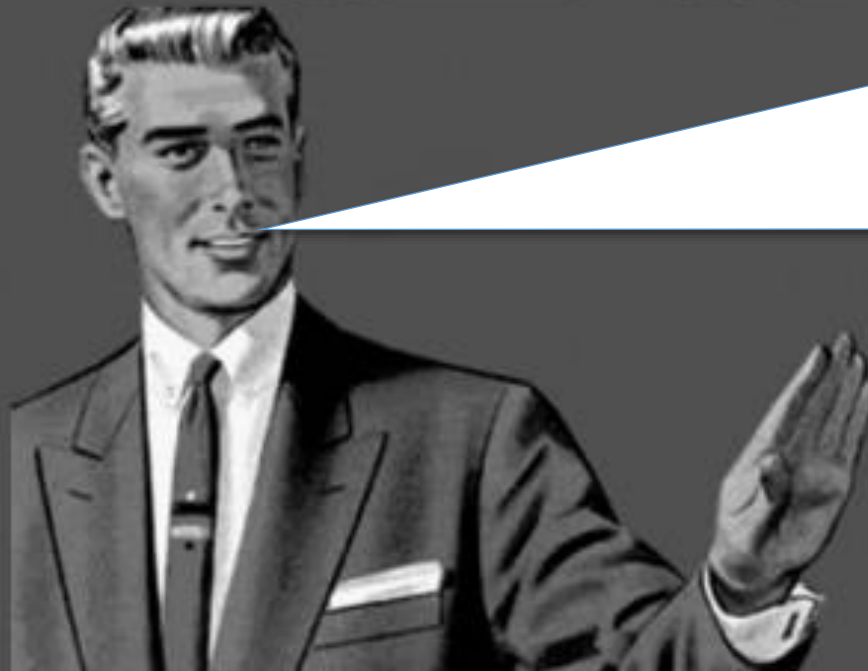
Latest release from Github

Suggested citation

Bondarenko M. , Nieves J. J., Stevens F. R., Gaughan A. E., Tatem A. and Sorichetta A. 2020. wpgpRFPMS: Random Forests population modelling R scripts, version 0.1.0. University of Southampton: Southampton, UK. 10.5258/SOTON/WP00665



HOLD UP

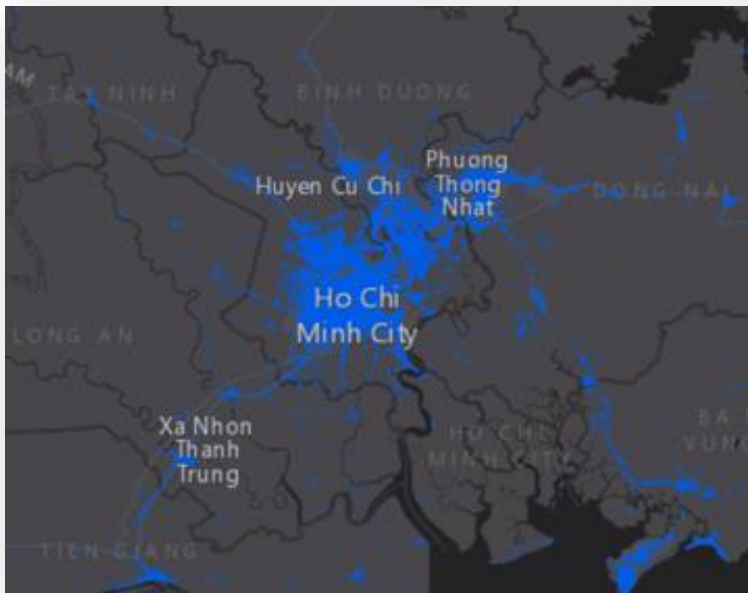


WAIT A MINUTE

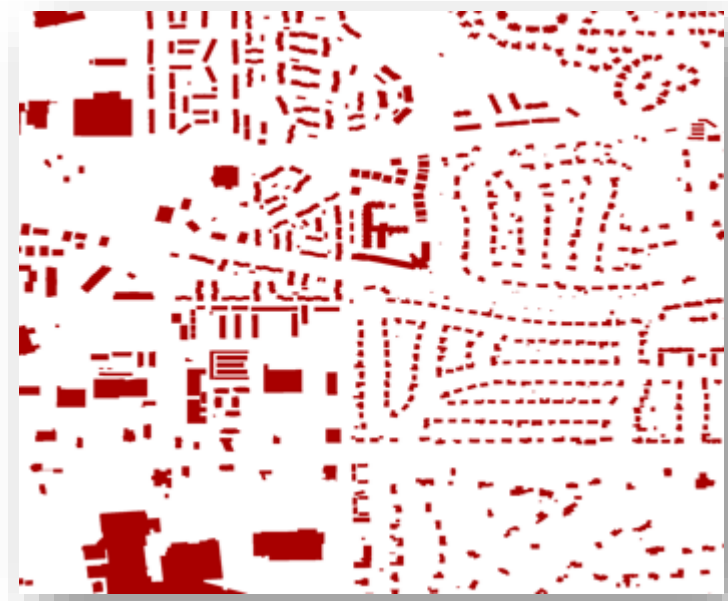
Didn't you
mention
'unconstrained'
and
'constrained'
estimates?

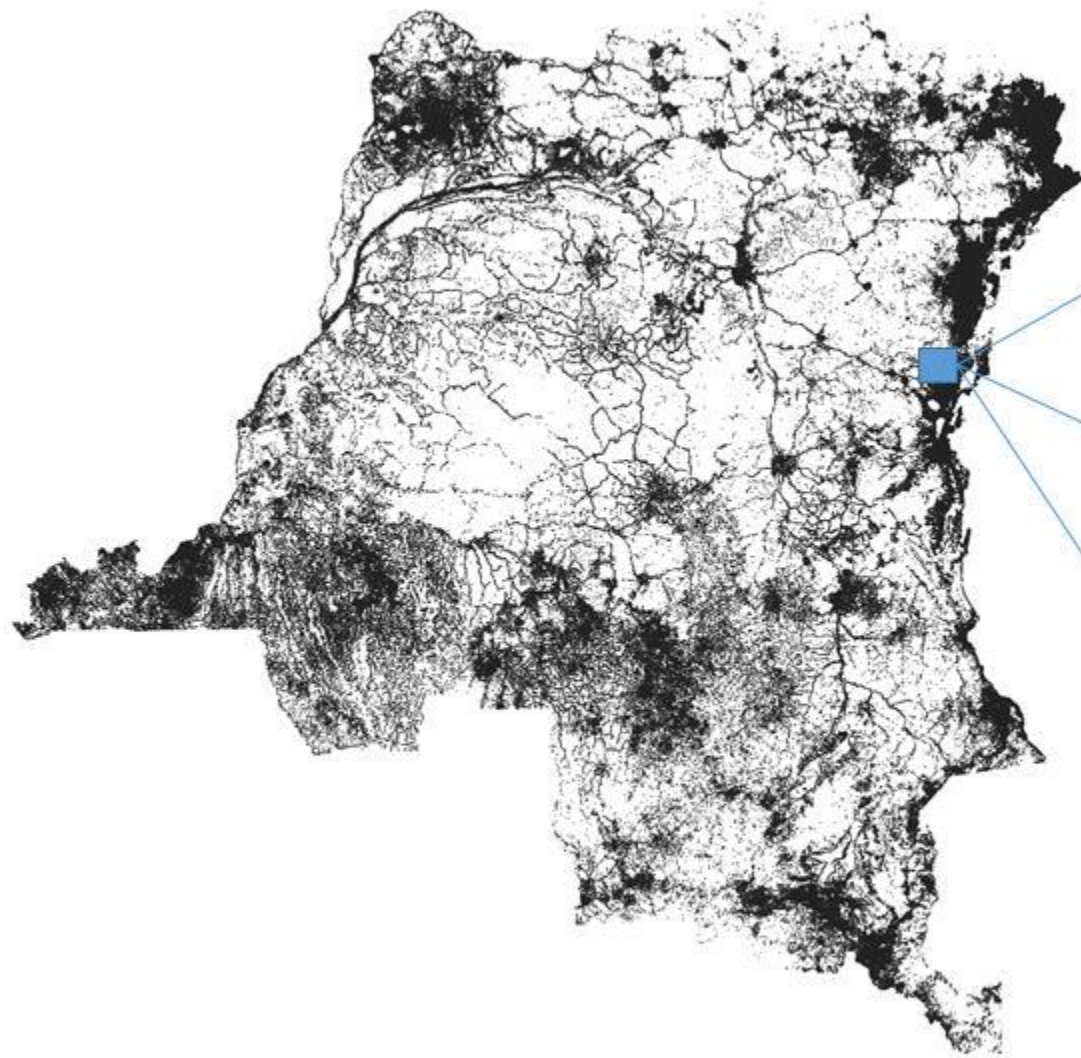
Global + multitemporal vs Regional + recent

Built settlement growth model
annual estimates
2000-2020



Building footprints
circa 2018-20

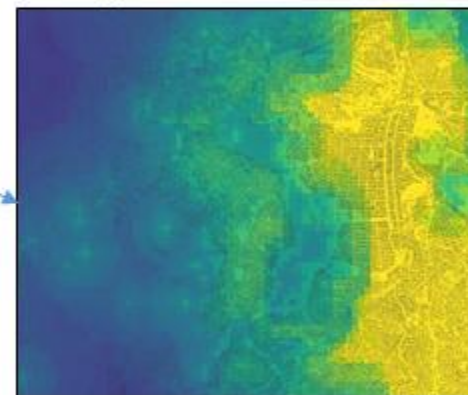




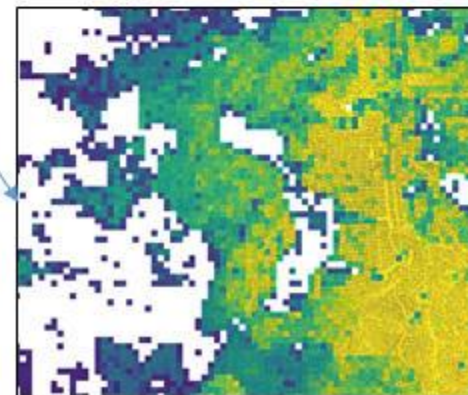
Building footprints



Top-down unconstrained



Top-down constrained



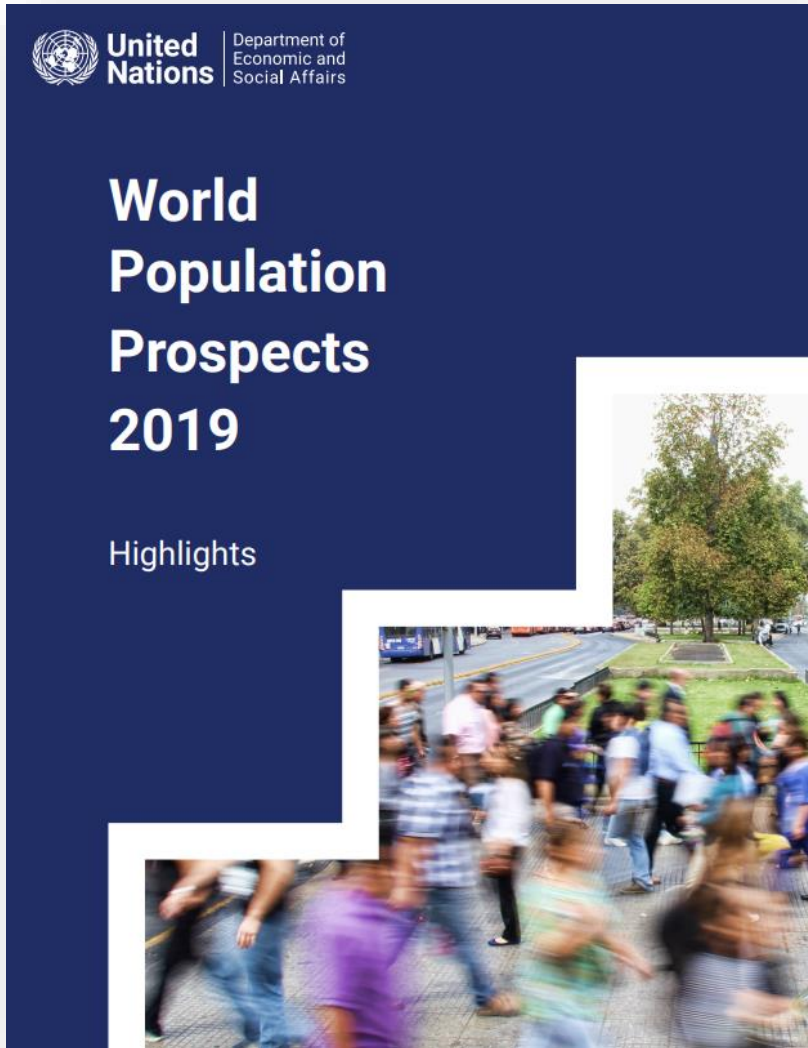
Building footprints (Democratic Republic of the Congo)
Digitize Africa project of Ecopia.AI and Maxar Technologies (2020)

Top-down estimation modelling

Top-down estimation modelling: Constrained vs Unconstrained

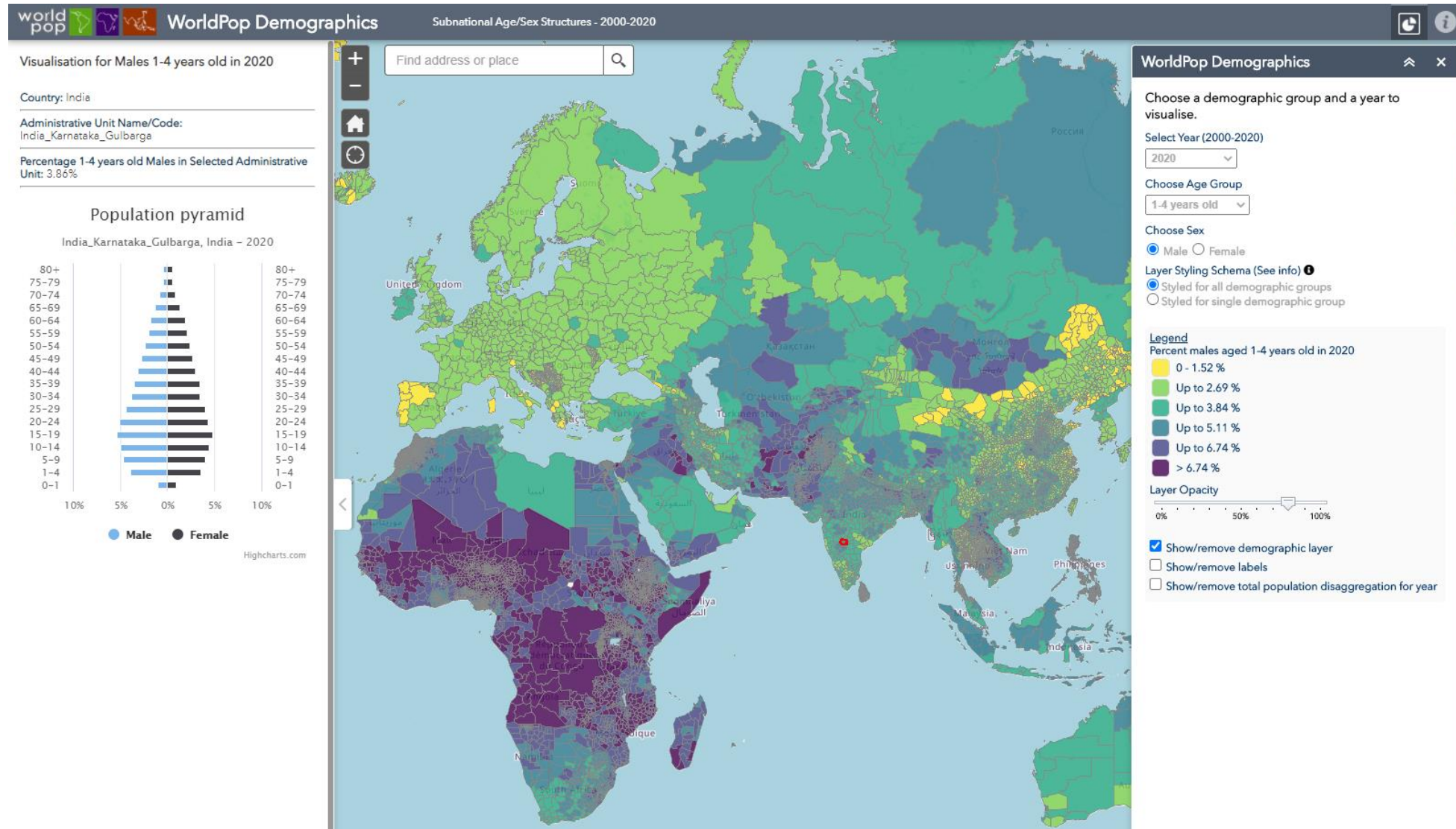
www.worldpop.org/methods/top_down_constrained_vs_unconstrained

Adjustments: National population totals



- non-adjusted = maintaining GPWv4 census database estimates
- UN-adjusted = national population total adjusted to match World Population Prospects 2019 estimates

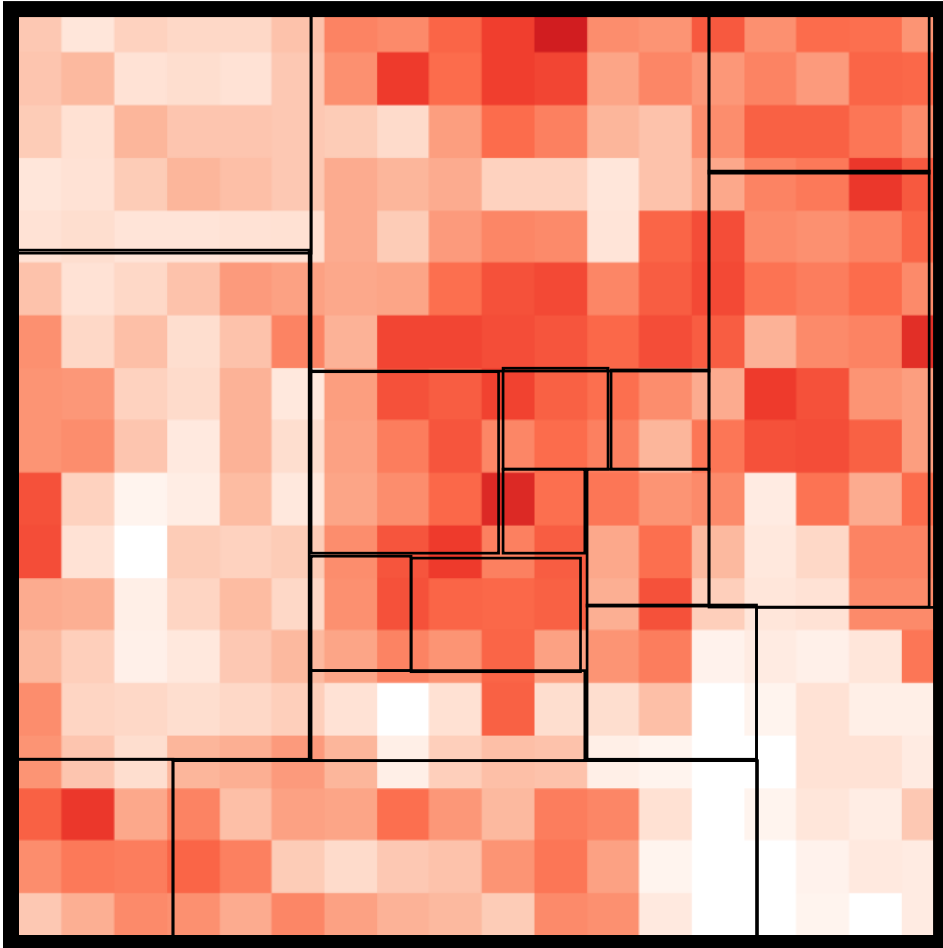
Adjustments: Age/sex structures



Outputs

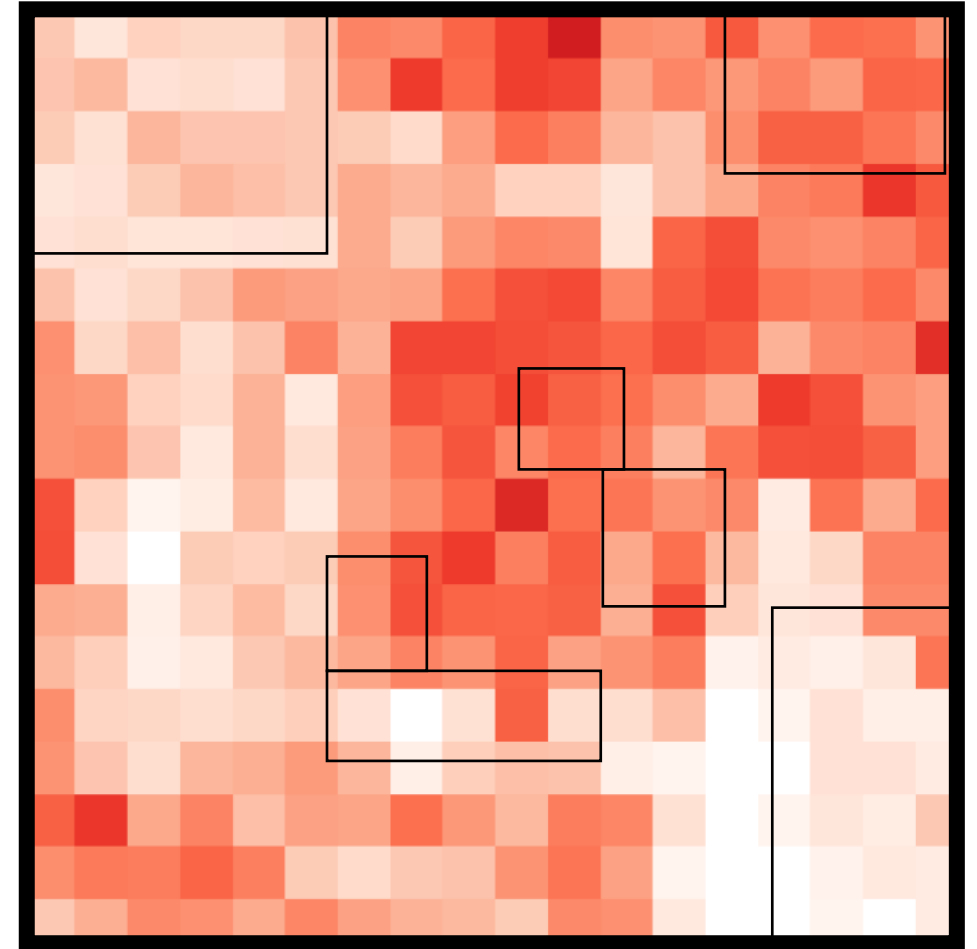
Top-down

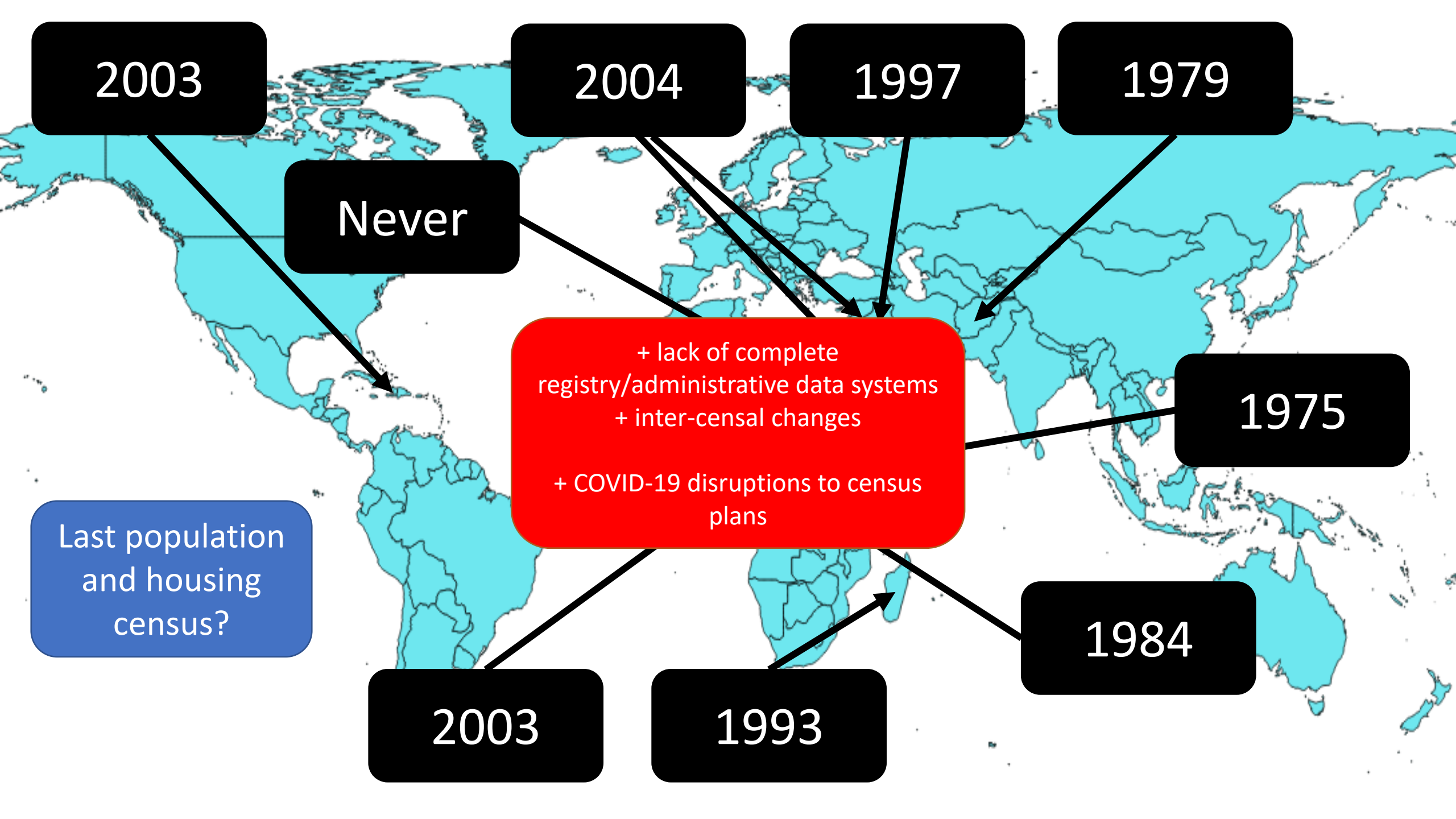
Gridded population estimates (100 m) that **sum to pre-defined population totals.**



Bottom-up

Gridded population estimates (100 m) that **fill gaps between surveyed areas.**





2003

2004

1997

1979

Never

+ lack of complete
registry/administrative data systems
+ inter-censal changes

+ COVID-19 disruptions to census
plans

1975

Last population
and housing
census?

1984

2003

1993

Afghanistan

- Last national population census in 1979
- Current estimates largely based on projections
- Significant uncertainties in national and subnational estimates
- One-third of country covered by a rolling census, but insecurity preventing additional data collection

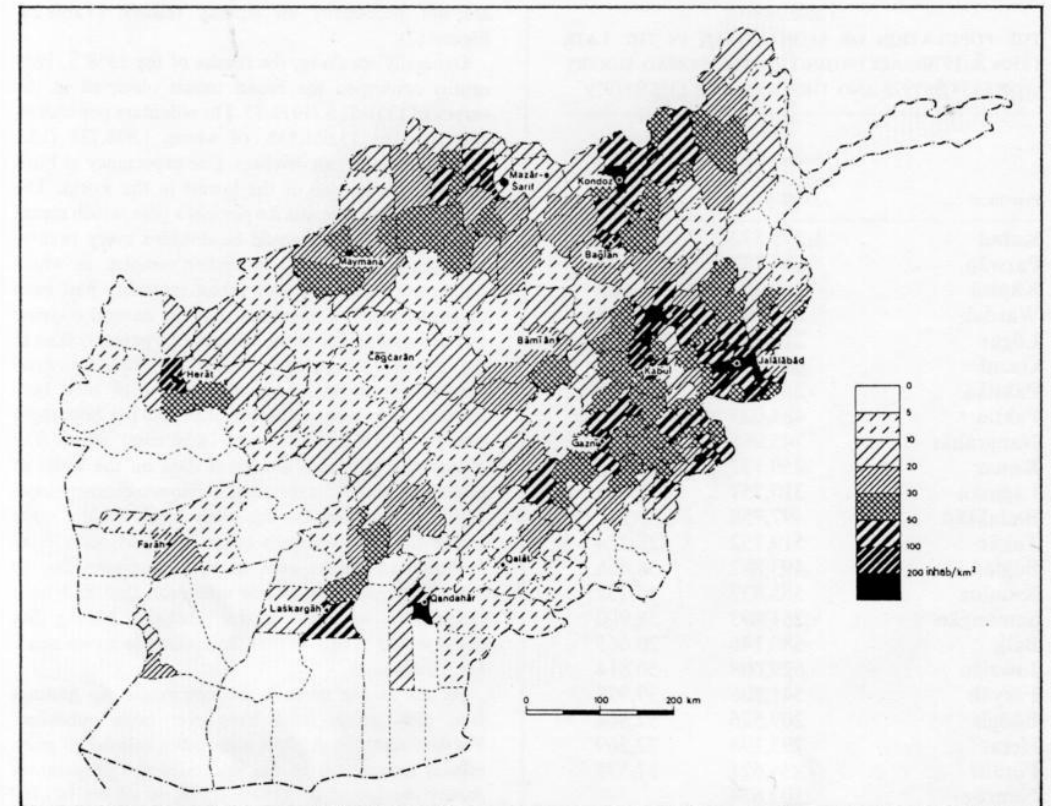
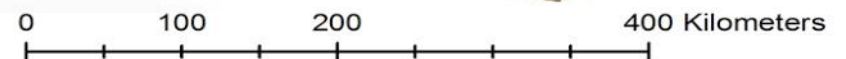
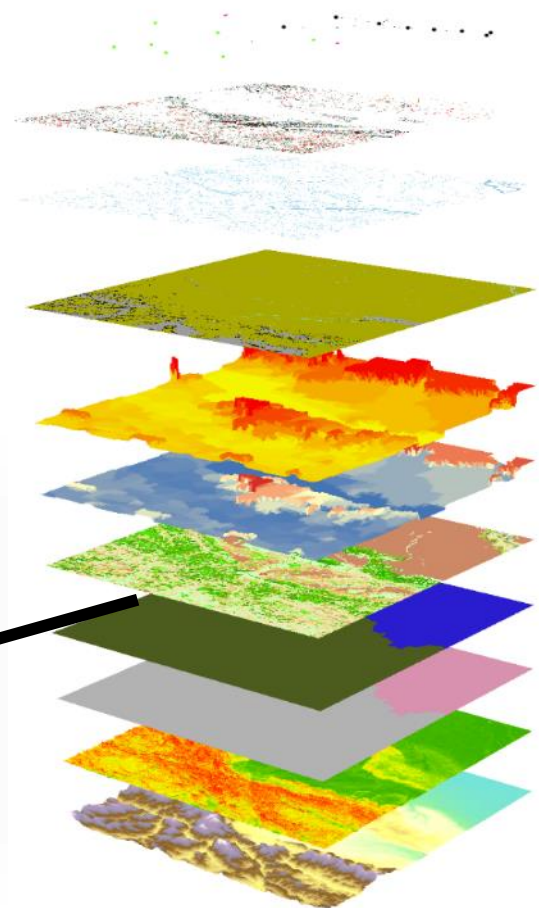
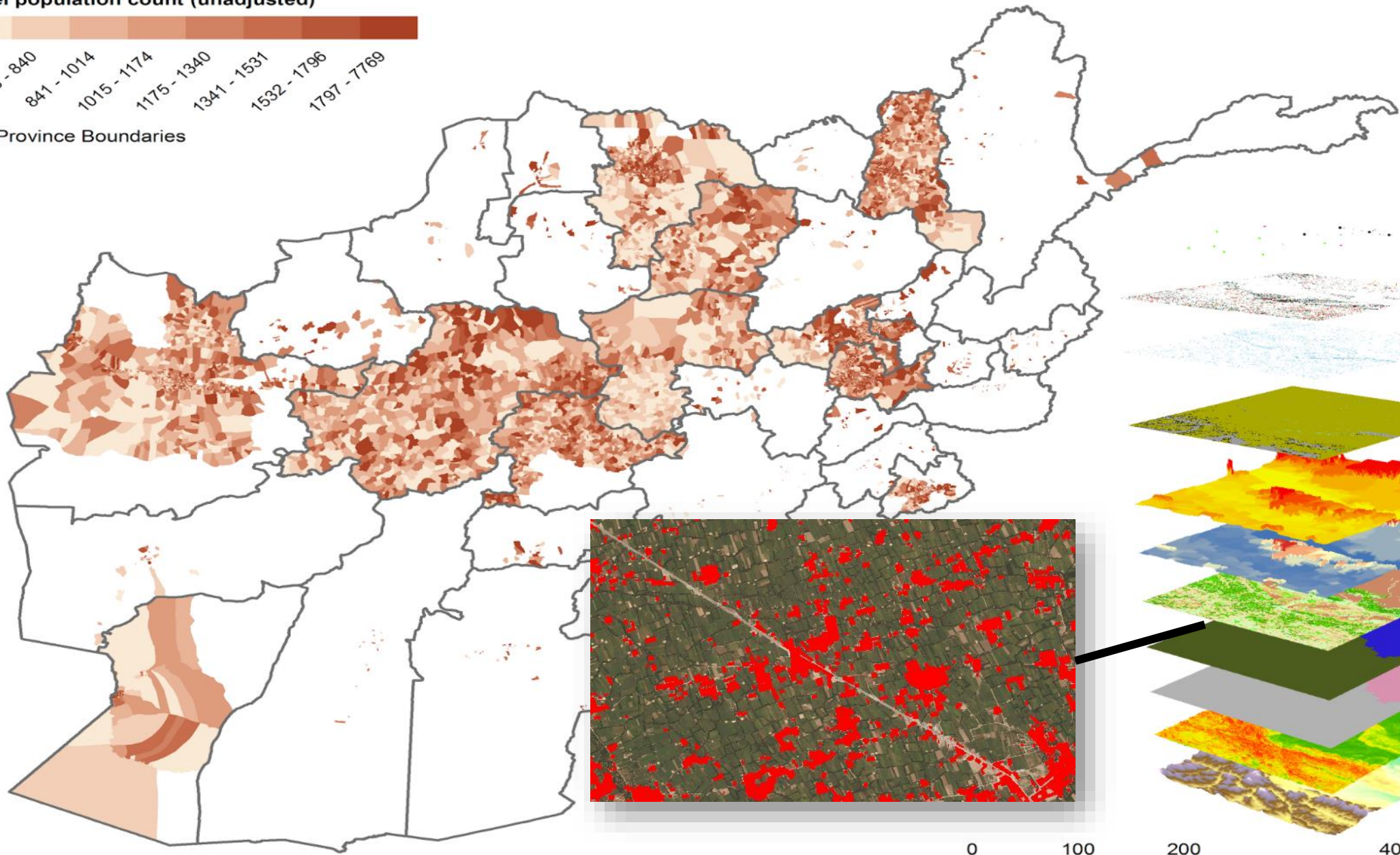


Figure 12. Geographical distribution of the settled population in Afghanistan, according to the 1358 Š./1979 census. Source: CSO, *Natāyej*, pp. 148ff.

EA-level population count (unadjusted)



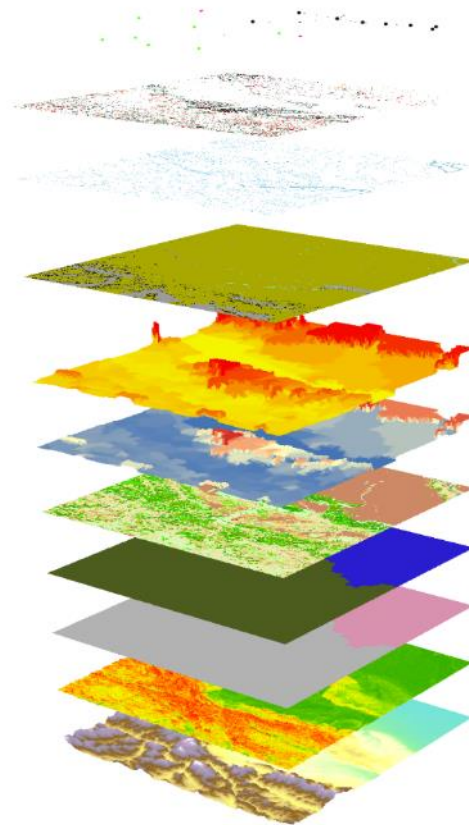
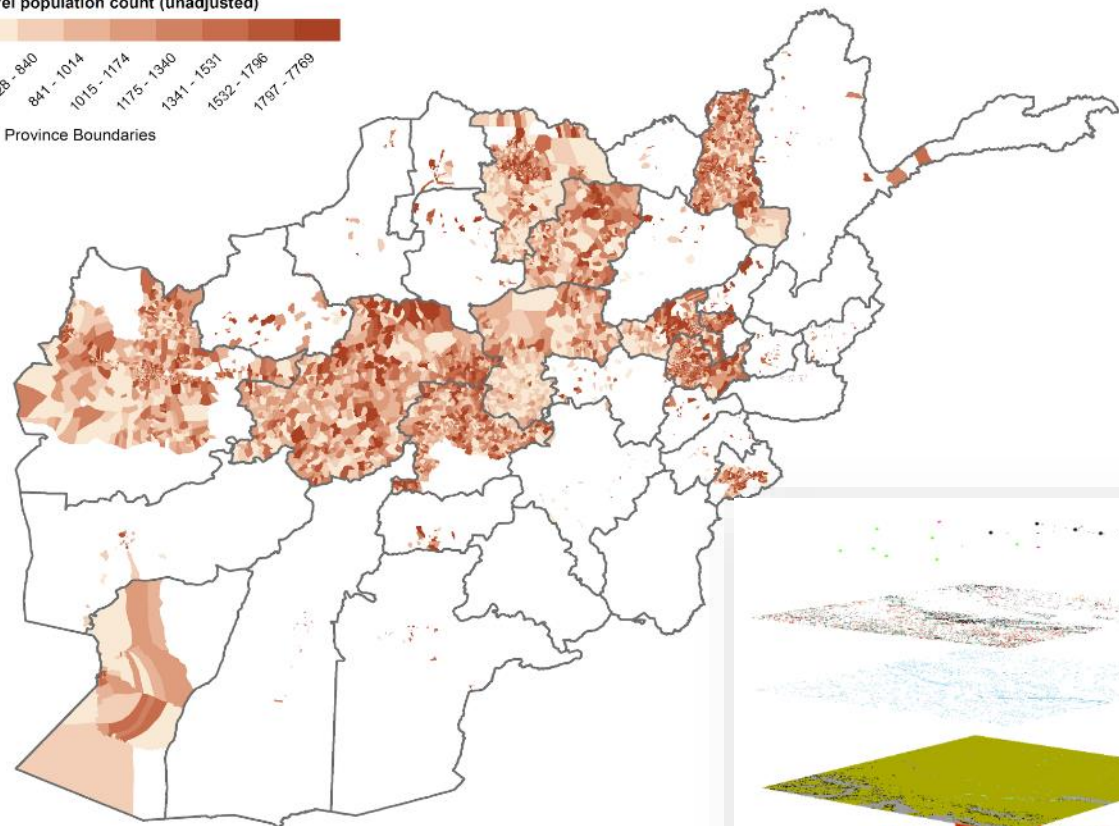
Province Boundaries



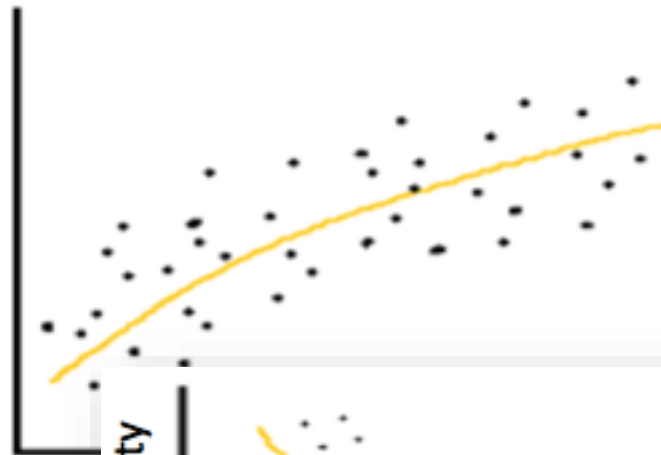
EA-level population count (unadjusted)



Province Boundaries

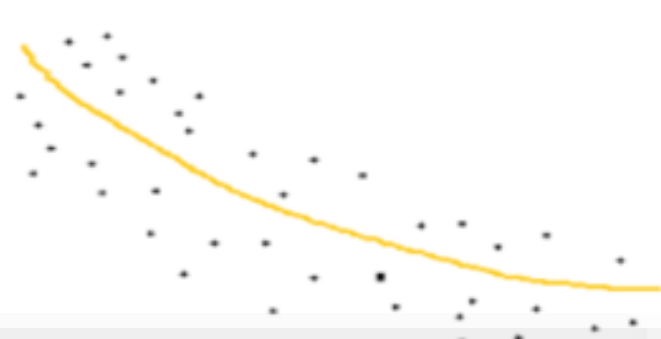


Population density



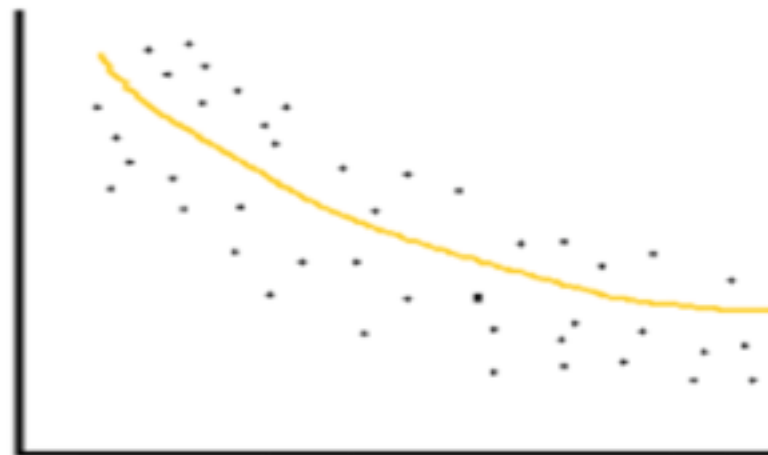
Uncertainty

Population density



Uncertainty

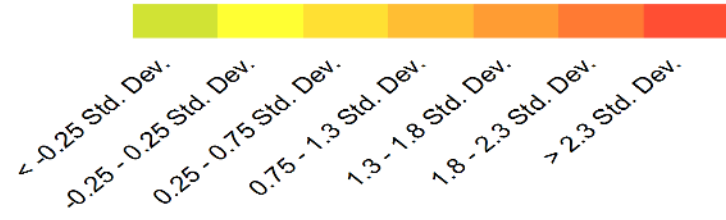
Population density




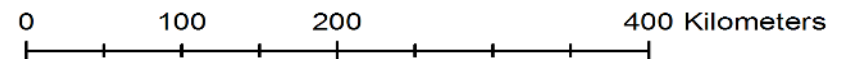
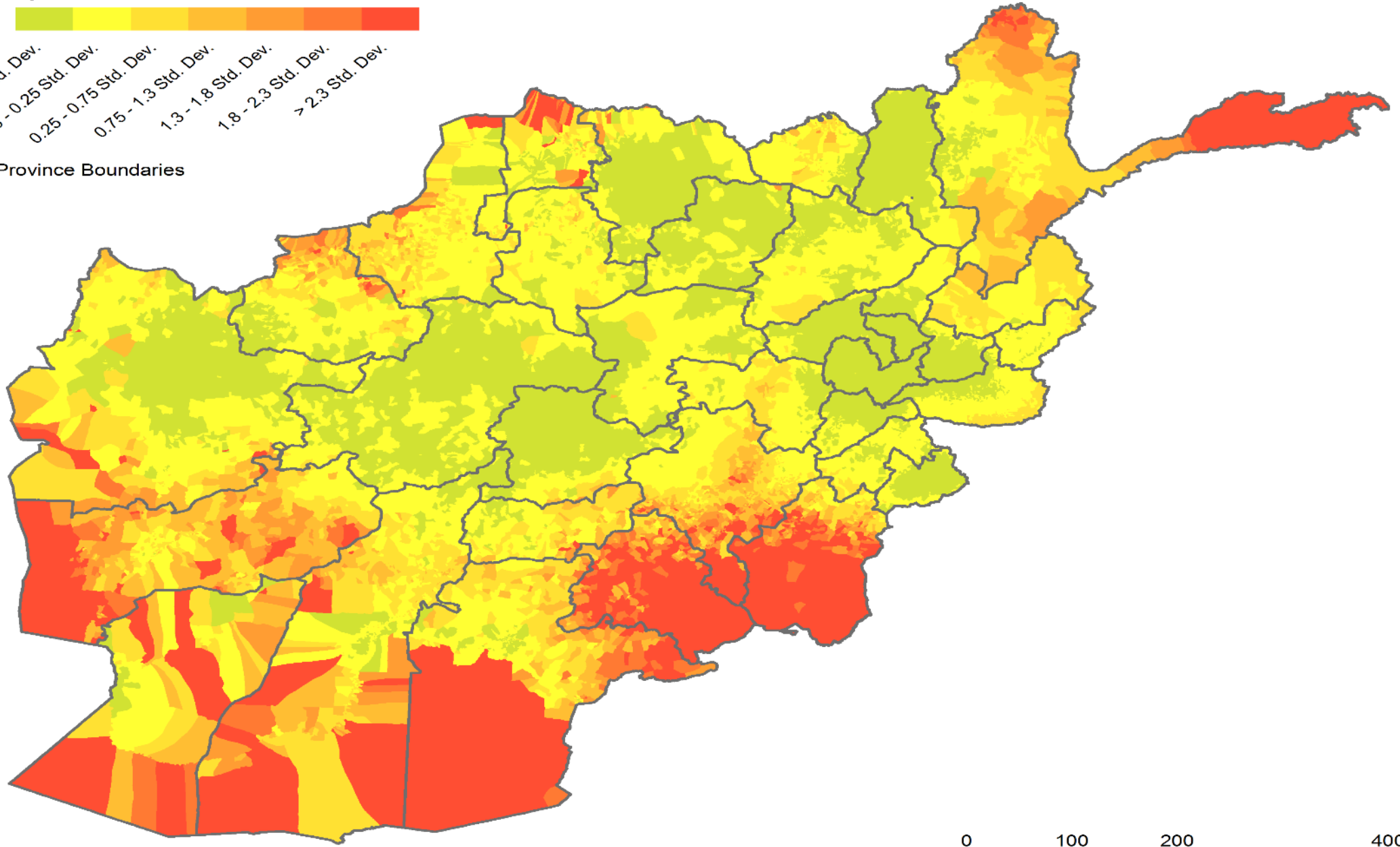
Uncertainty

Settlement fragmentation

Uncertainty in EA 2017 Population Estimates



 Province Boundaries

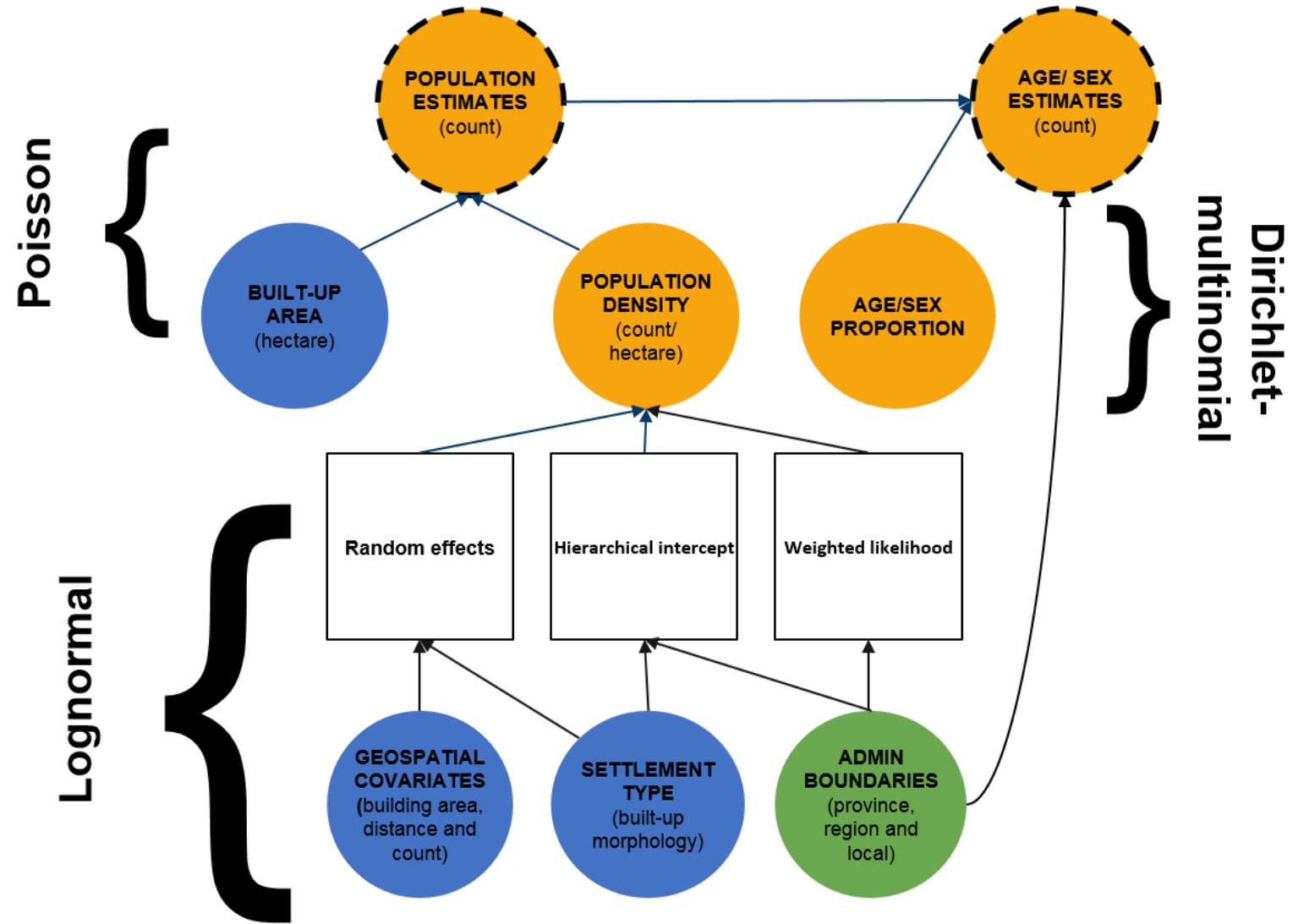


Bespoke models

Bayesian hierarchical model

Production of population estimates with uncertainty metrics broken down by age/sex

Variants developed and implemented for Zambia, Nigeria, DRC, Burkina Faso



Schematic representation of the DRC v2.0 model

The WorldPop Open Population Repository (WOPR) provides access to gridded population estimates and related data created using bespoke methods for individual countries, including final products as well as early experimental results. Refer to data README for more information. Some of these data sets can be explored using [WorldPop web applications](#). Global population data sets that are consistent across countries and years are available from the [WorldPop website](#).

Population ▾
Select country ... ▾
Version ... ▾
Reset

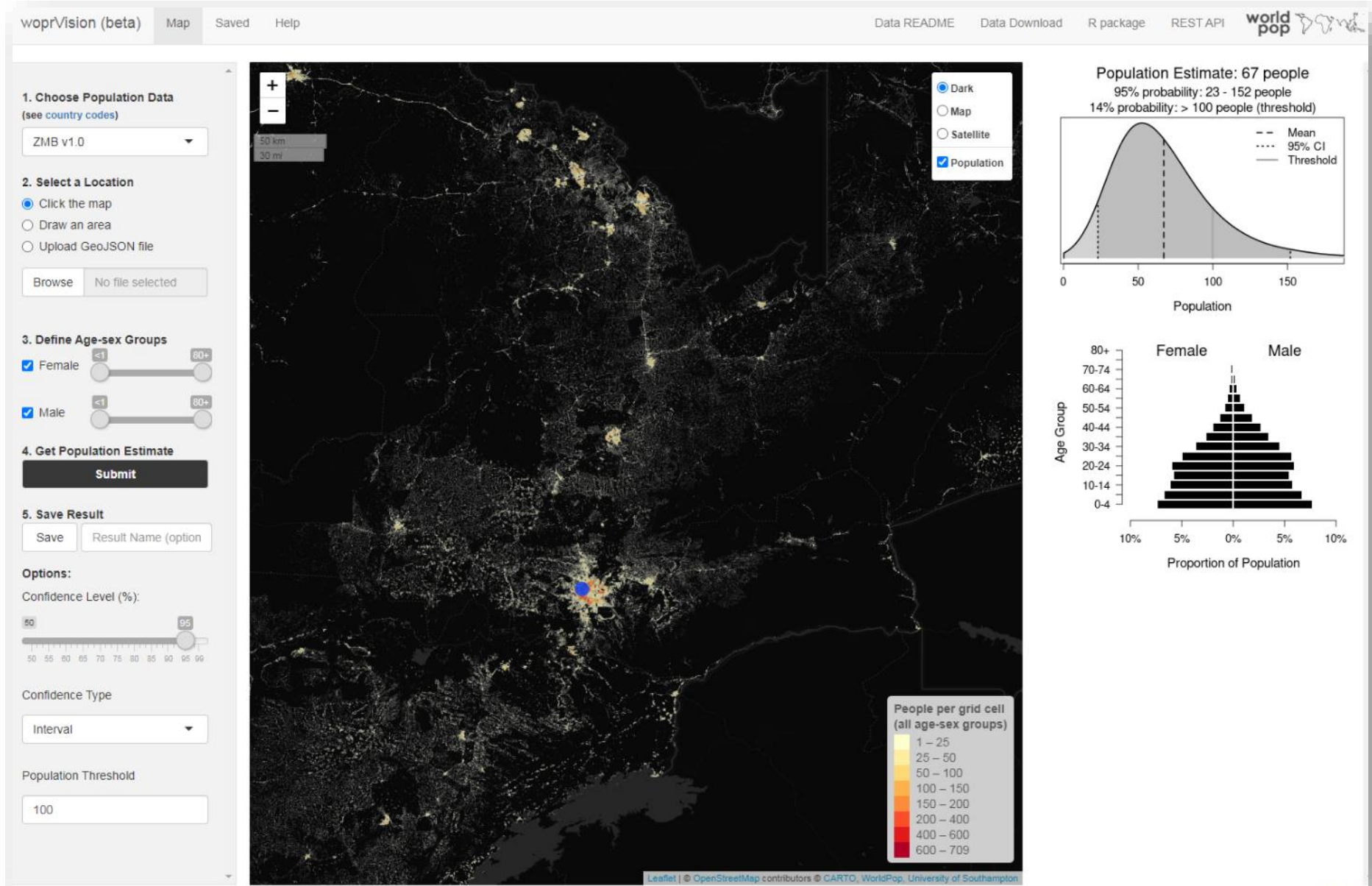


<https://wopr.worldpop.org/>

ZMB	Population	Bottom-up gridded population estimates (~100m) for specific age-sex groups	2020-04-07	v1.0	Details	Download
ZMB	Population	Bottom-up gridded population estimates (~100m) for Zambia	2020-04-07	v1.0	Details	Download
ZMB	Population	Mastergrid for gridded population estimates	2020-04-07	v1.0	Details	Download
ZMB	Population	README: ZMB Population v1.0	2020-04-07	v1.0	Details	Download
ZMB	Population	SQL database with Bayesian posterior population predictions	2020-04-07	v1.0	Details	Download
ZMB	Population	Image tiles for gridded population estimates	2020-04-07	v1.0	Details	Download
NGA	Population	Bottom-up gridded population estimates (~100m) for specific age-sex groups	2020-03-16	v1.2	Details	Download
SSD	Population	Top-down gridded population estimates (~100m) for South Sudan	2019-12-06	v1.0	Details	Download
SSD	Population	README: SSD Population v1.0	2019-12-06	v1.0	Details	Download
NGA	Population	Bottom-up population totals for administrative units in Nigeria	2019-07-10	v1.2	Details	Download
NGA	Population	Bottom-up gridded population estimates (~100m) for Nigeria	2019-07-10	v1.2	Details	Download
NGA	Population	Mastergrid for gridded population estimates	2019-07-10	v1.2	Details	Download
NGA	Population	README: NGA Population v1.2	2019-07-10	v1.2	Details	Download
NGA	Population	SQL database with Bayesian posterior population predictions	2019-07-10	v1.2	Details	Download
NGA	Population	Image tiles for gridded population estimates	2019-07-10	v1.2	Details	Download
COD	Population	Bottom-up gridded population estimates (100m) for Democratic Republic of the Congo	2019-05-20	v1.0	Details	Download
COD	Population	Mastergrid for gridded population estimates	2019-05-20	v1.0	Details	Download
COD	Population	README: COD Population v1.0	2019-05-20	v1.0	Details	Download
COD	Population	SQL database with Bayesian posterior population predictions	2019-05-20	v1.0	Details	Download
COD	Population	Image tiles for gridded population estimates	2019-05-20	v1.0	Details	Download

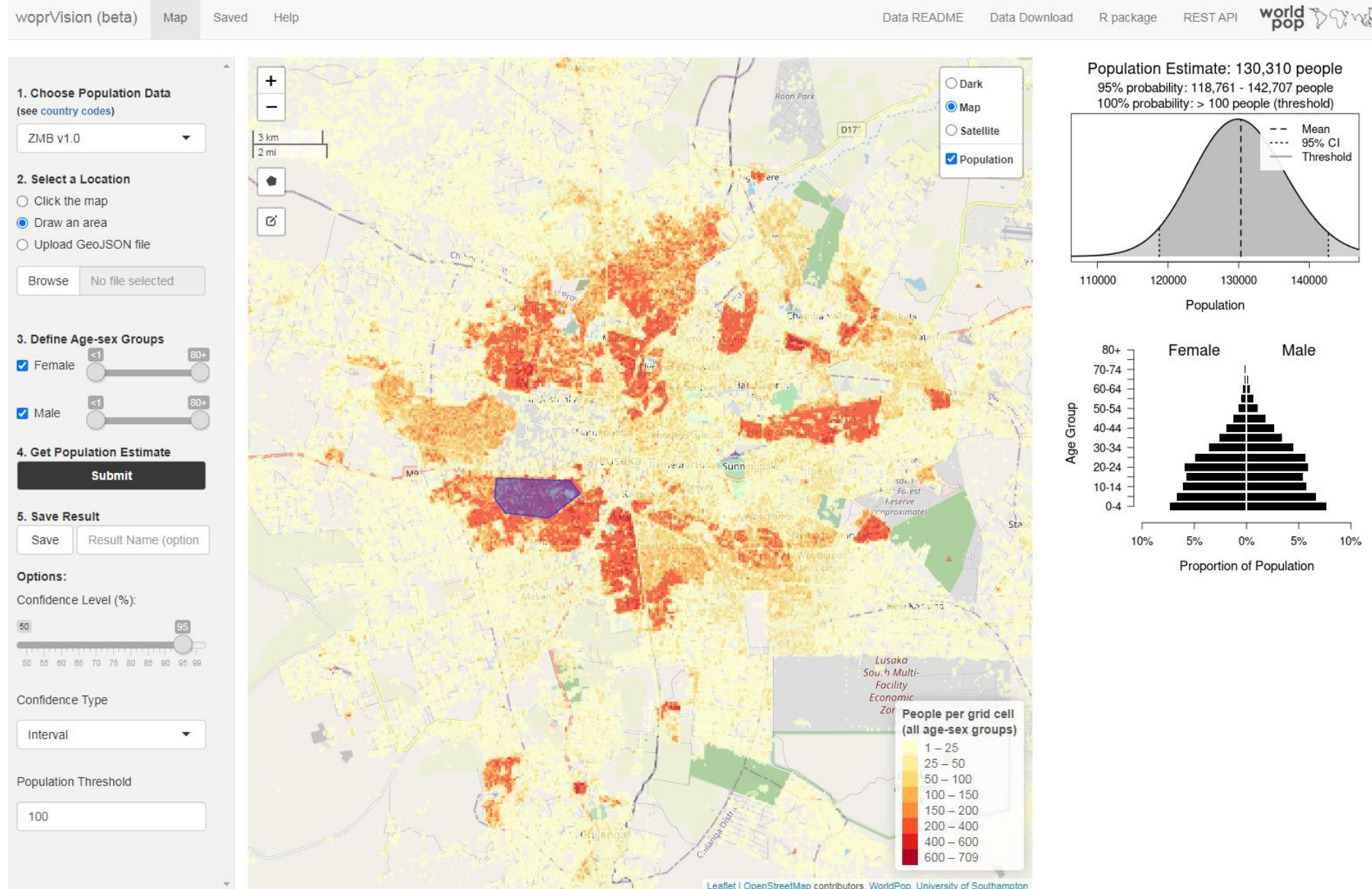
Interacting with modelled estimates: WoprVision

<https://apps.worldpop.org/woprVision/>



Interacting with modelled estimates: WoprVision

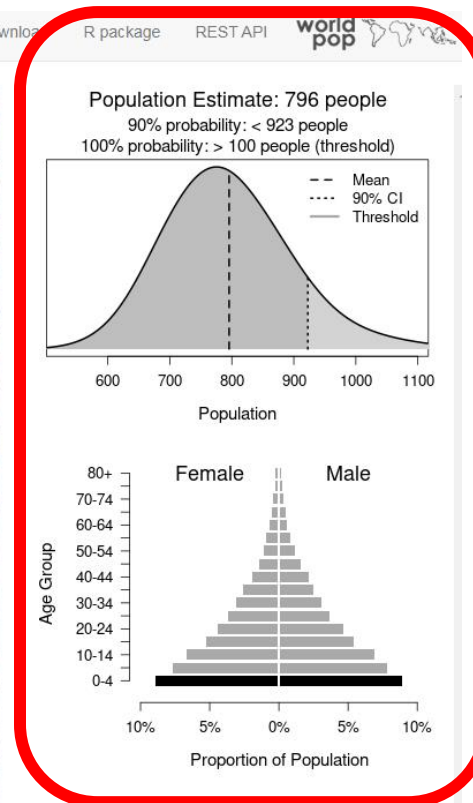
<https://apps.worldpop.org/woprVision/>



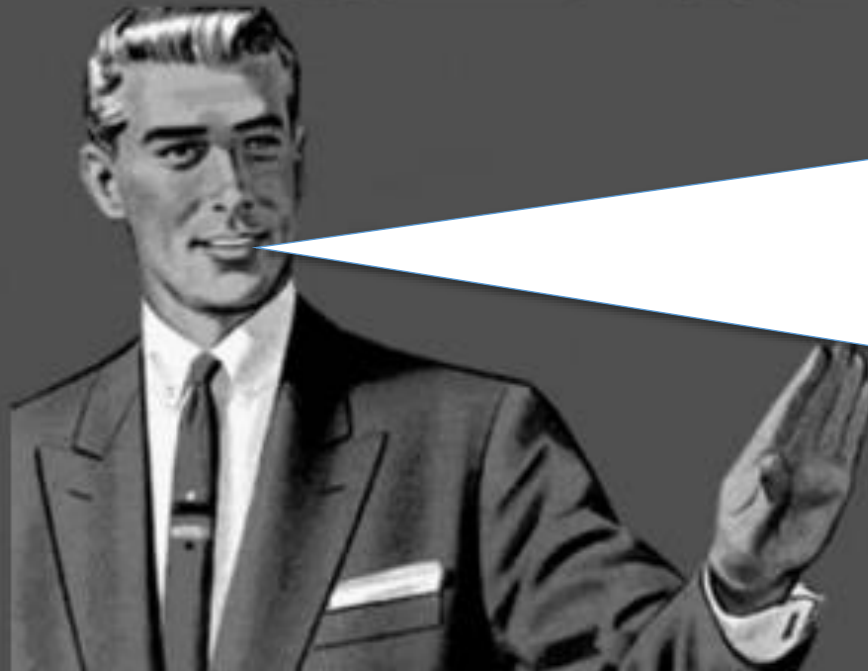
Using uncertainty – *how much vaccine do we need?*

There is a 90% probability that no more than 923 children under 5 live here

<https://apps.worldpop.org/woprVision/>



HOLD UP



WAIT A MINUTE

What if I have my own sample enumeration data or projections and want to produce a rapid gridded population map using building footprints?

Select Country

Madagascar

Upload Polygons (GeoJson)

Browse No file selected

Column name with population totals

(no polygons uploaded)

 Show Advanced Controls >>

Age-sex Selection

The gridded population estimates that you download will represent the population within the selected age-sex groups.

 Female Male

⚠ The population totals that you provide (above) must represent total population rather than a specific age-sex group.

Aggregate

Disaggregate

About

<https://apps.worldpop.org/peanutButter/>

Do-It-Yourself Gridded Population Estimates

The "disaggregate" tool allows you to disaggregate your own population totals from administrative units (or other polygons) into gridded population estimates based on a high resolution map of building footprints¹. See the "About" tab for details.

- i** Provide a polygon shapefile (GeoJson format) that contains the total population for each polygon. Adjust other settings as needed using the control panel to the left.
- i** Click the "Gridded Population Estimates" button and the peanutButter application will use a high resolution map of building footprints to disaggregate your population totals into a 100 m grid.

[↓ Gridded Population Estimates](#)[↓ Source Files](#)

¹ Building footprints for Madagascar were based on satellite imagery from 2019 (64%), 2018 (25%), 2017 (7%), 2016 (2%), 2015 or earlier (1%) (Ecopia.AI, Maxar 2020; Dooley et al. 2020).

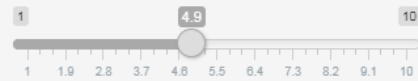
The "disaggregate" tool allows you to disaggregate your own population totals from administrative units (or other polygons) into gridded population estimates based on a high resolution map of building footprints

Select Country

Madagascar

Urban Settlements

Mean people per housing unit



Mean housing units per residential building

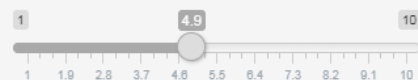


Proportion building footprints that are residential



Rural Settlements

Mean people per housing unit



Mean housing units per residential building



Proportion building footprints that are residential



Do-It-Yourself Gridded Population Estimates

The "aggregate" tool will apply your estimates of people per building to every building and then aggregate buildings to estimate population size for each ~100 m grid cell using a high resolution map of building footprints¹. See the "About" tab for details.

- 1 Move the sliders on the left panel to adjust settings² and then click "Refresh Results" to calculate a summary of the population estimates that will appear in the table below.
- 2 When you are satisfied that the settings and the results are reasonable, click the "Gridded Population Estimates" button to download a 100 meter population grid (geotiff raster, WGS84) created using your settings.

Refresh Results

Population Total	27,568,189
% Urban Population	10%
Urban: Population	2,855,393
Rural: Population	24,712,796
Urban: People per building footprint	3.1
Rural: People per building footprint	2.8
Urban: Building footprints	913,375
Rural: Building footprints	8,695,565

Gridded Population Estimates

Settings

Source Files

The "aggregate" tool will apply your estimates of people per building to every building and then aggregate buildings to estimate population size for each ~100 m grid cell using a high resolution map of building footprints

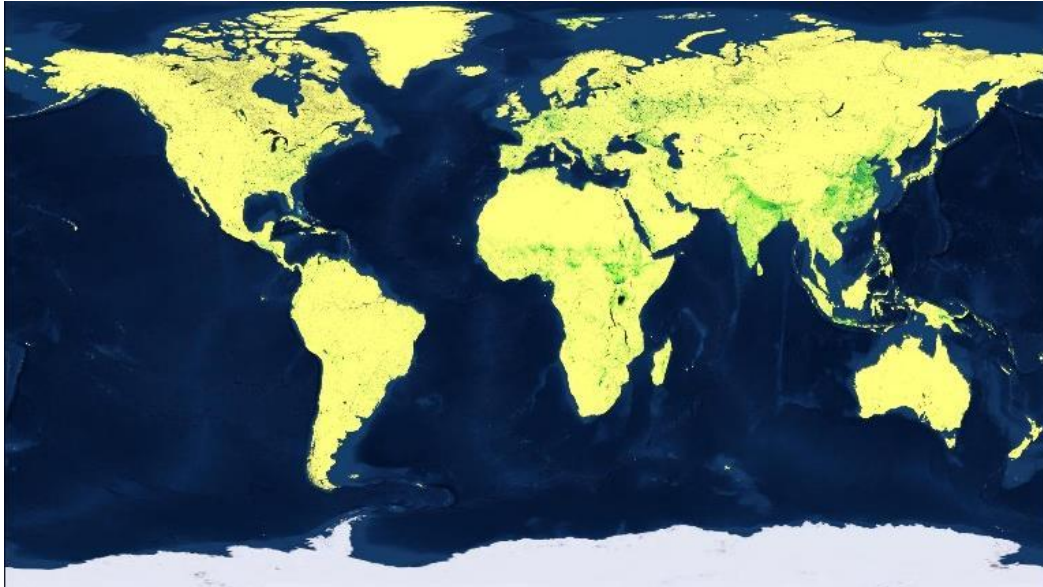
¹ Building footprints for Madagascar were based on satellite imagery from 2019 (64%), 2018 (25%), 2017 (7%), 2016 (2%), 2015 or earlier (1%) (Ecopia.AI, Maxar 2020; Dooley et al. 2020).

² Default values: "Population Total" represents the year 2020 from UN World Population Prospects (2019); "Mean people per housing unit" is from United Nations (2019) or United Nations (2017).

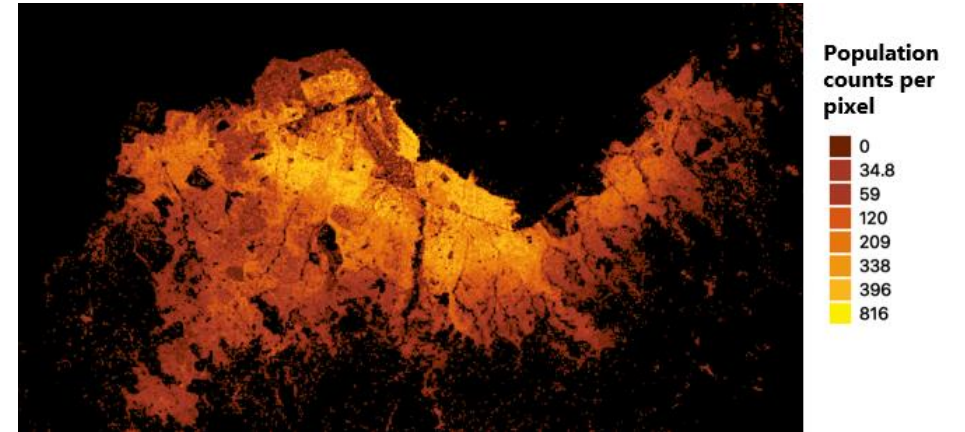
Gridded population datasets/methods

'Top down' global estimates

- 'Unconstrained' 2000-2020
- 'Constrained' 2020



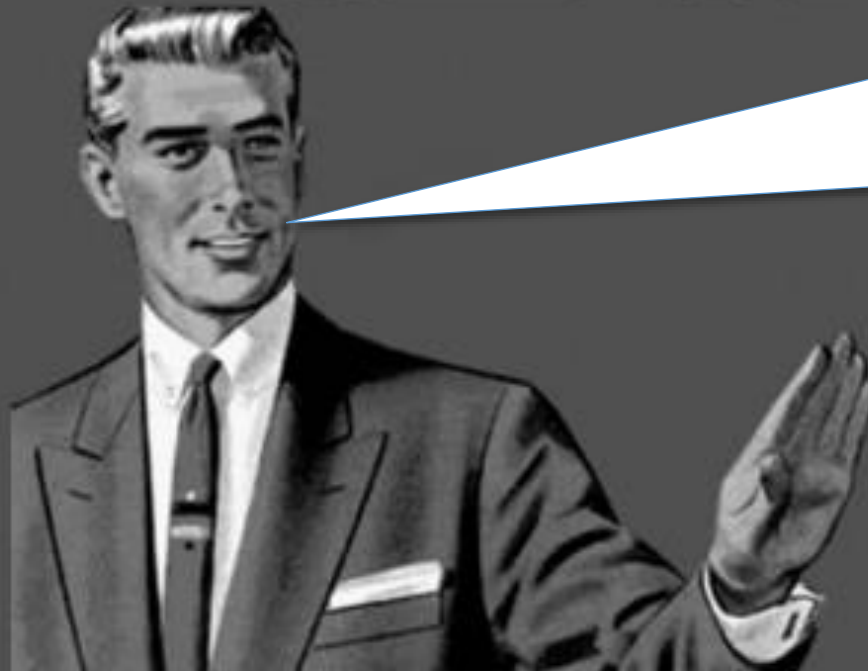
'Bottom up' bespoke country estimates



'Peanut butter' web application



HOLD UP



WAIT A MINUTE

How are these estimates used?

The Value of Modelled Population Estimates for Census Planning and Preparation



Publication Date: May 2020

Author: UNFPA

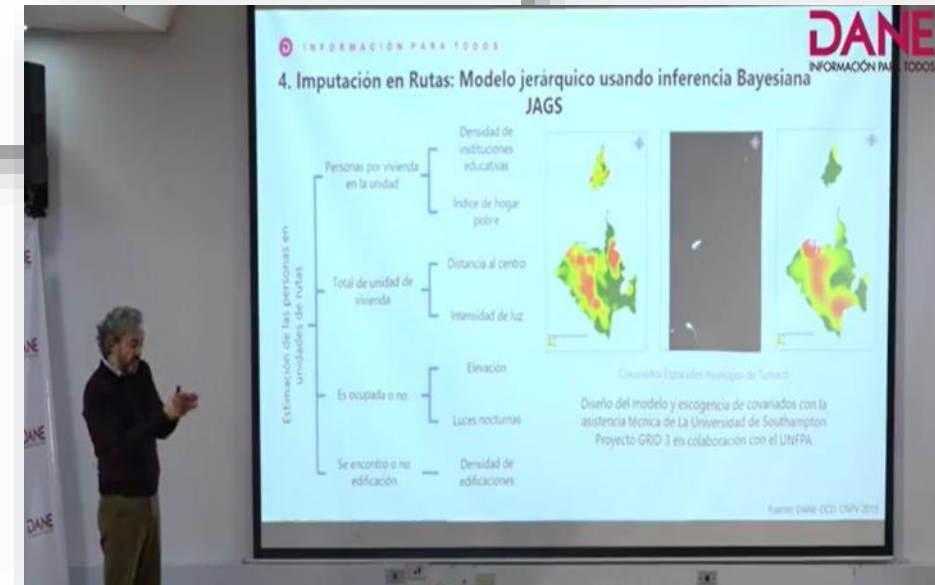
Download
 English
 Spanish
 French
 Arabic
 Russian

This guidance note details how modelled population estimates can support national statistics offices in planning, conducting and performing quality assurance checks during the census exercise.



New EA boundaries

Old EA boundary





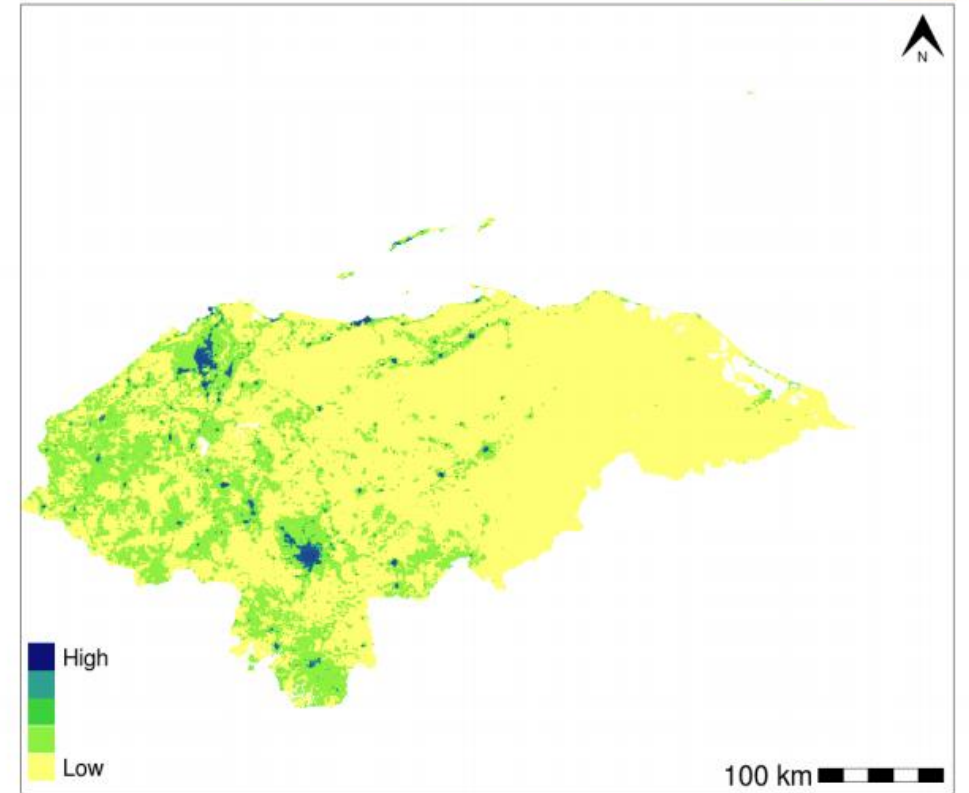
UNOSAT Tropical Cyclone ETA-20 Population Exposure Analysis in Honduras 5 November 2020



Map1: Tropical cyclone ETA-20 track with wind speed zones. Download PDF map [here](#).

Honduras population 2020

Estimated total number of people per grid-cell at a resolution of (3 arc seconds approximately 100m at the equator)



WorldPop (www.worldpop.org – School of Geography and Environmental Science, University of Southampton; Department of Geography and Geosciences, University of Louisville; Département de Géographie, Université de Namur) and Center for International Earth Science Information Network (CIESIN), Columbia University (2018). Global High Resolution Population Denominators Project – Funded by the Bill and Melinda Gates Foundation (OPP1134076). <https://dx.doi.org/10.5258/SOTON/WP00645>

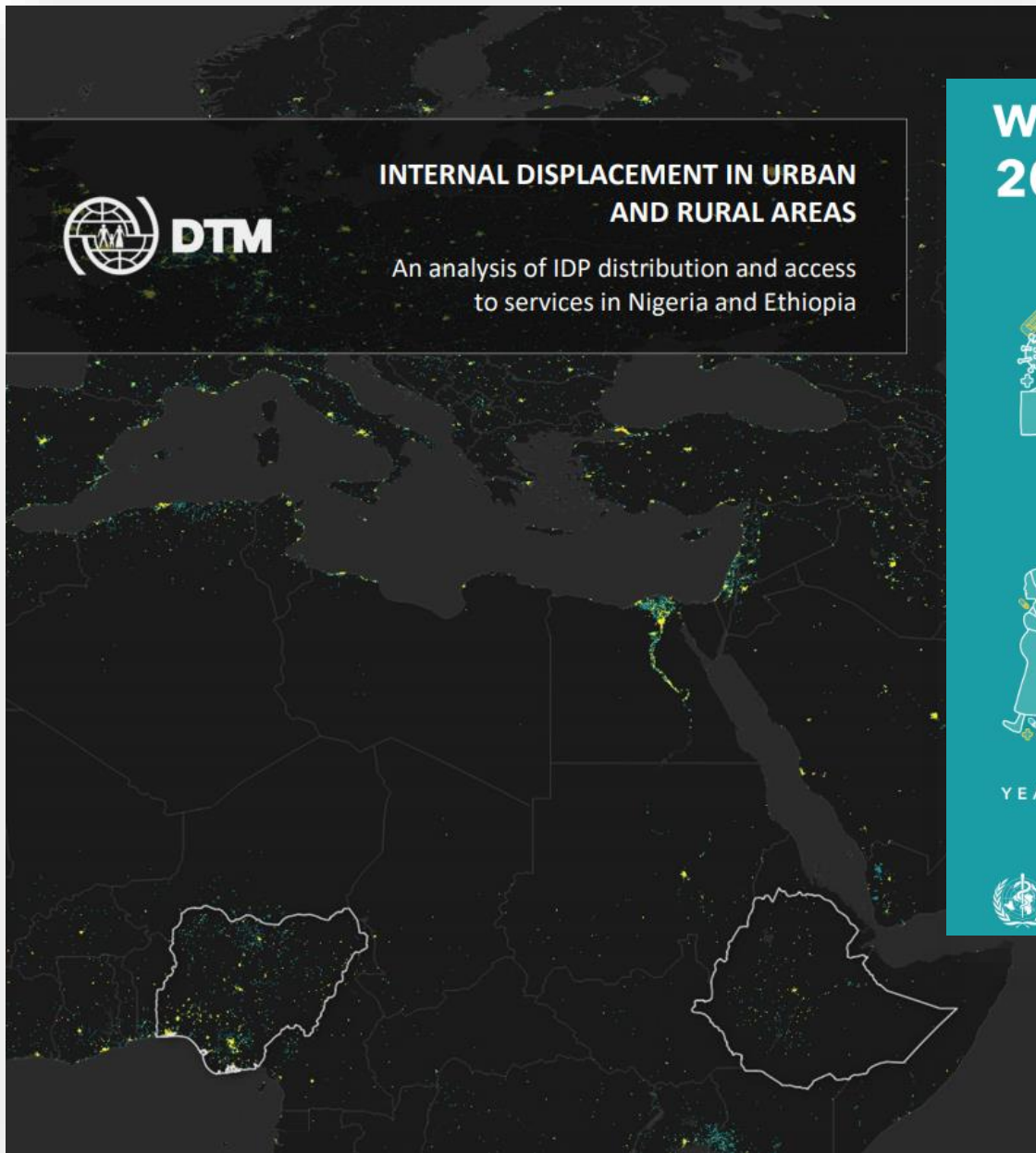
©2018 This work is licensed under a Creative Commons Attribution 4.0 International License

<https://unitar.org/maps/countries>



INTERNAL DISPLACEMENT IN URBAN AND RURAL AREAS

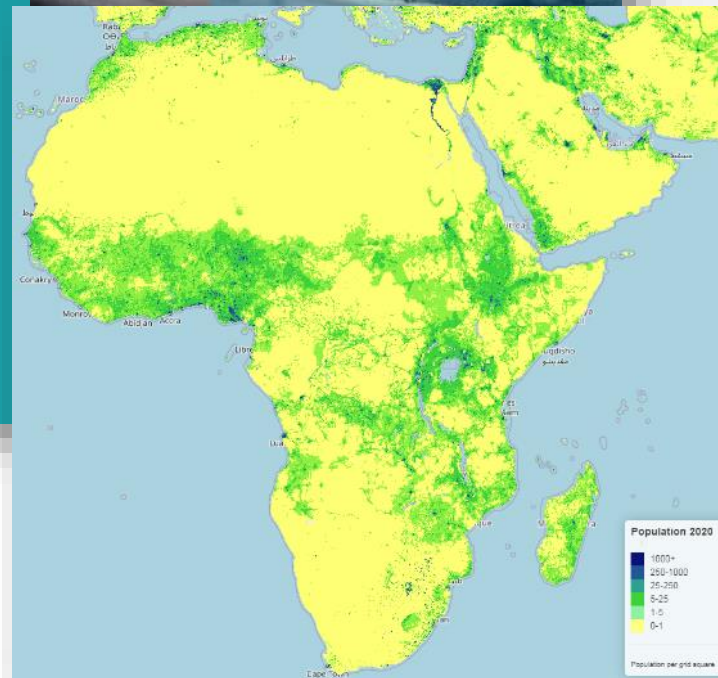
An analysis of IDP distribution and access to services in Nigeria and Ethiopia

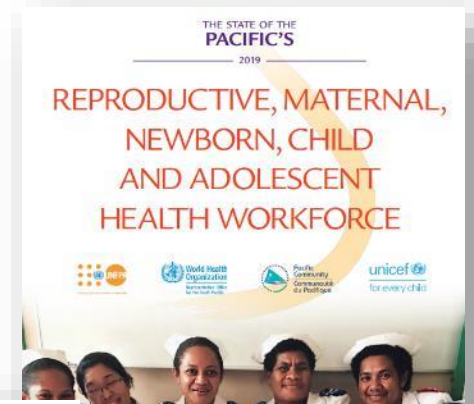
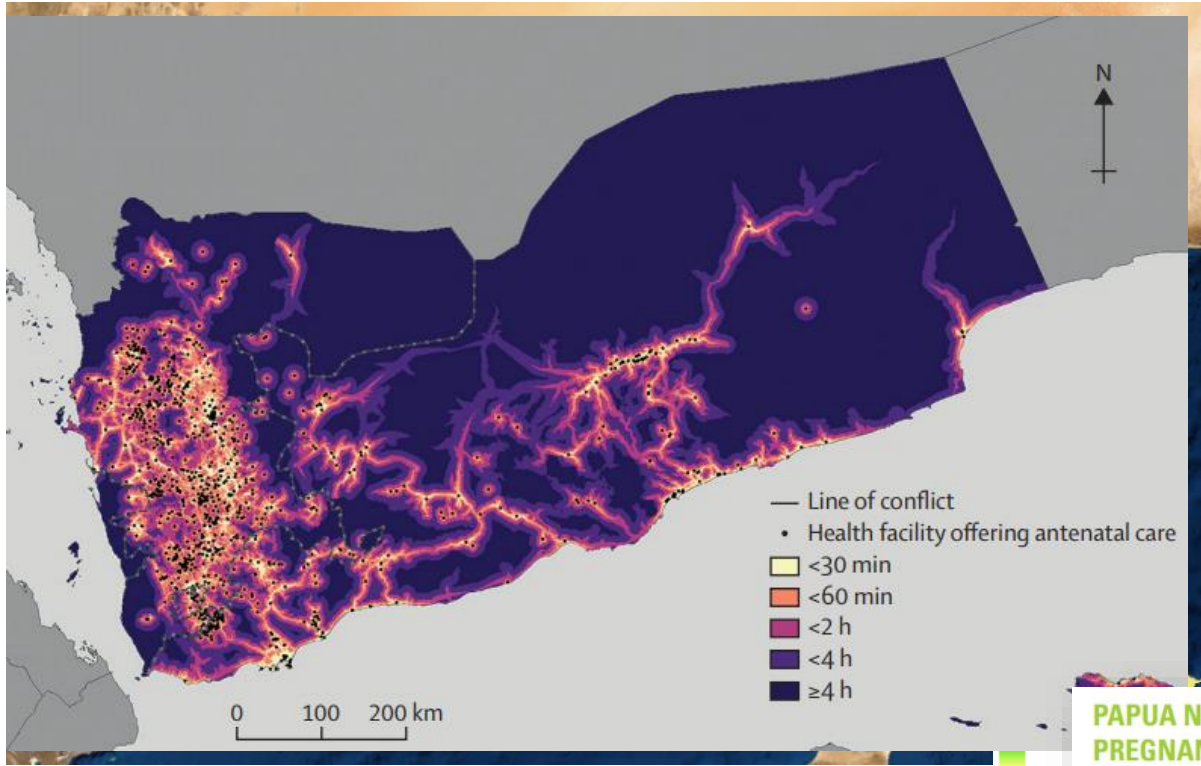


WORLD MALARIA REPORT 2020



YEARS OF GLOBAL PROGRESS & CHALLENGES

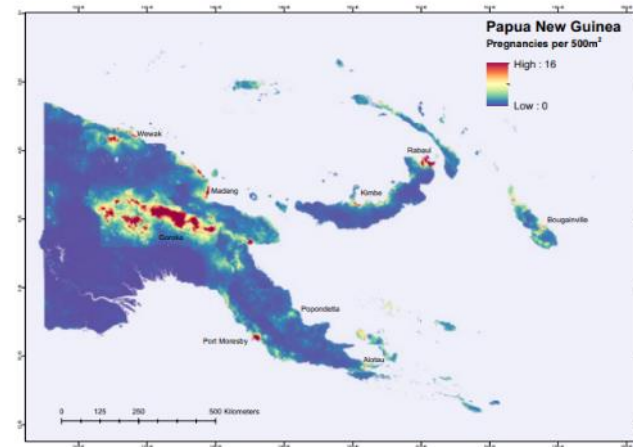




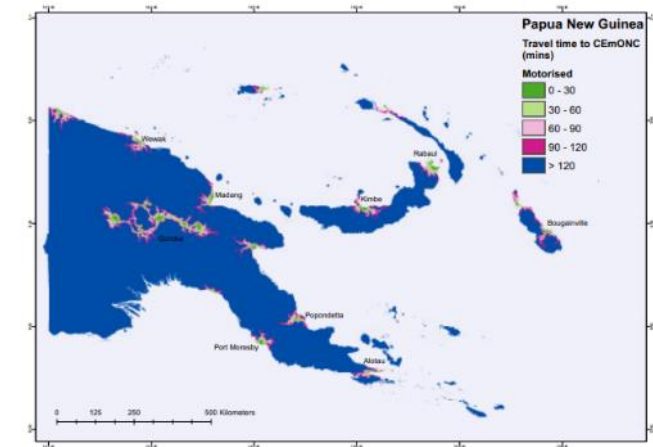
Pregnancies total	Accessible within 2 hours by motorised transport		Accessible within 2 hours on foot	
	total	%	total	%
367,528	142,944	39	46,907	13

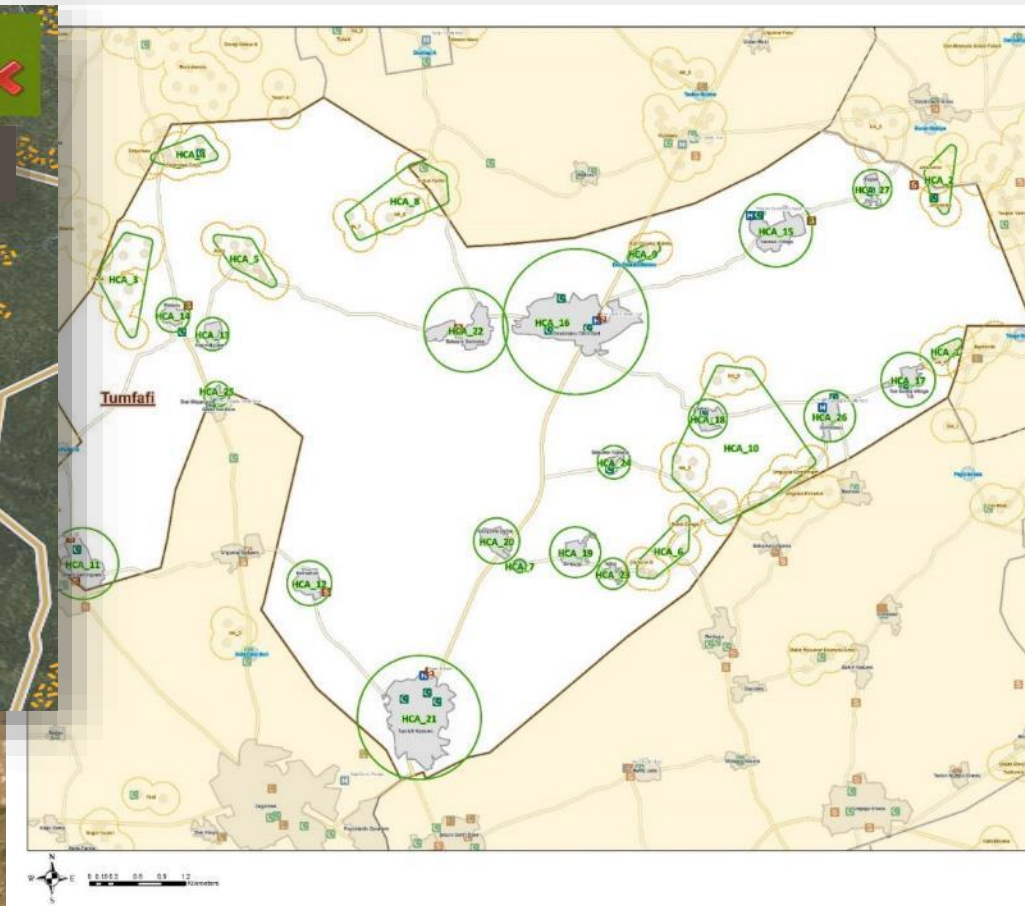
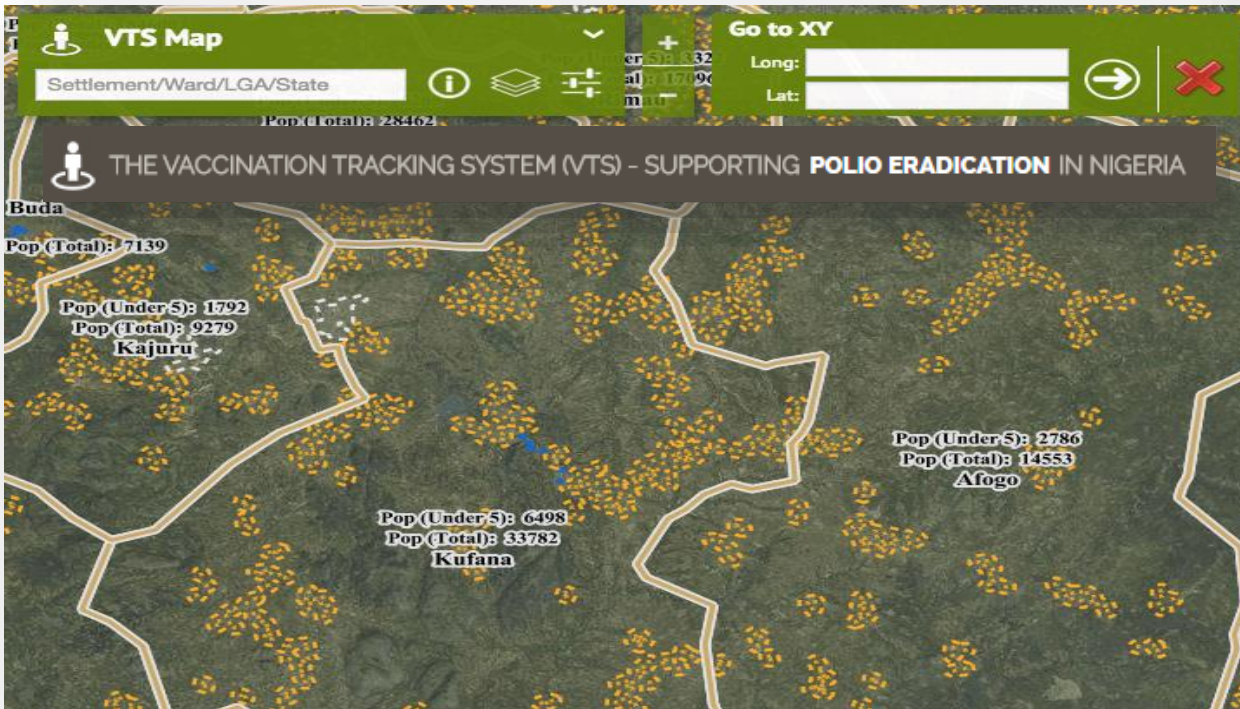


PAPUA NEW GUINEA: PREGNANCY HEAT MAP



PAPUA NEW GUINEA: TRAVEL TIME MAPS



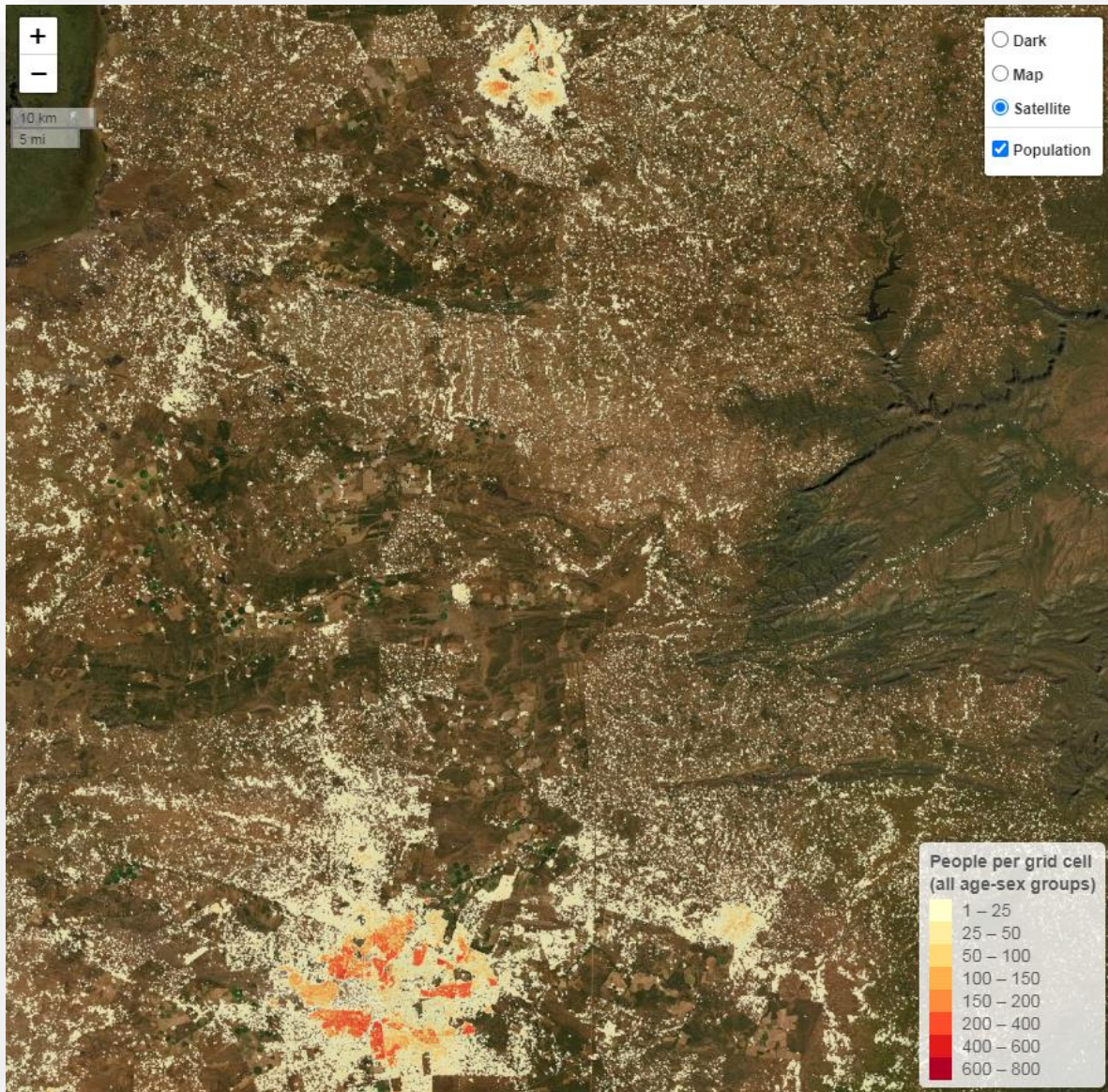


Ward: Tumbafi
LGA: Dawkan Tofa
State: Kano

Total targeted population: 56334
 Total # of HCAs : 95

Area Name	Rural Target Pop	Urban Target Pop	# HC Days
HCA_1	128	0	2
HCA_2	128	0	2
HCA_3	231	0	4
HCA_4	297	0	4.5
HCA_5	297	0	4.5
HCA_6	128	0	2
HCA_7	0	154	1.6
HCA_8	231	0	4
HCA_9	91	154	2.5
HCA_10	285	0	6.6
HCA_11	0	2848	38.5
HCA_12	0	1744	17.5
HCA_13	0	1077	11
HCA_14	0	1077	11
HCA_15	0	4186	41.6
HCA_16	0	13339	131.5
HCA_17	0	1559	15.5
HCA_18	0	1534	15.5
HCA_19	0	1796	18
HCA_20	0	1867	18.5
HCA_21	0	14099	140.5
HCA_22	0	4092	40
HCA_23	0	897	9.5
HCA_24	0	897	9.5
HCA_25	0	452	4.5
HCA_26	0	1489	14
HCA_27	0	1129	11.6
Total	1798	54535	576.6





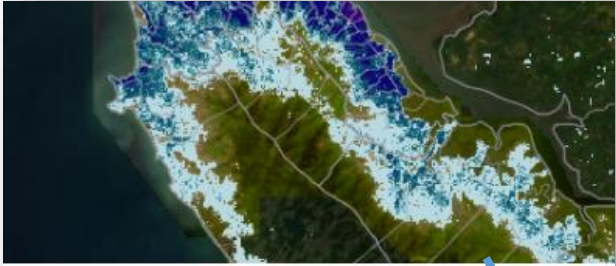
Akros @akros_global · Nov 26

Last month, Akros joined Zambia's NMEP to assist w/ IRS & #ITN resource microplanning for vector control—together making ~120 district maps using enumeration & @grid3global data. We know these maps will prove invaluable to get ahead on vector control before the annual rains come!

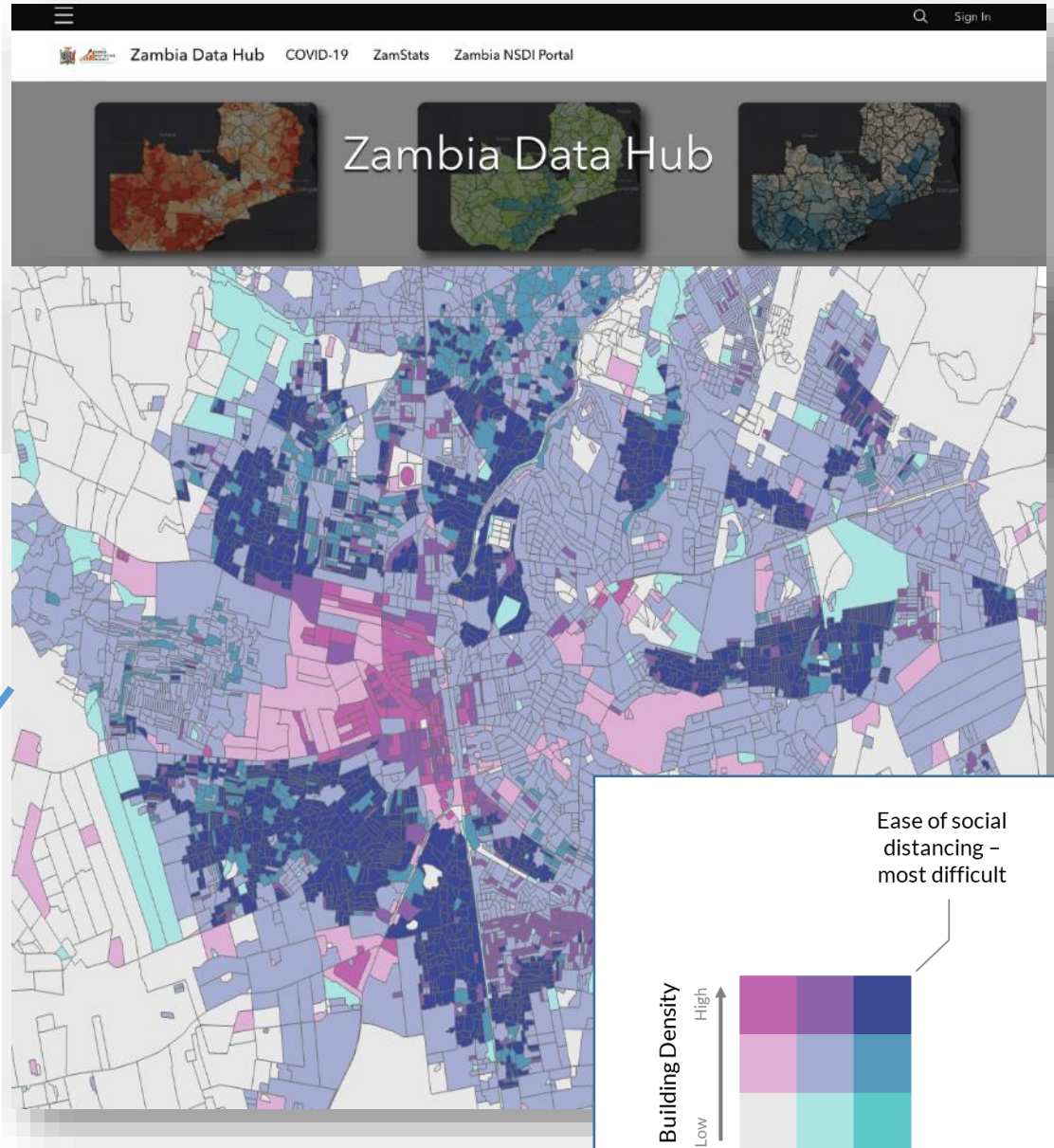


<https://wopr.worldpop.org/?ZMB/Population>

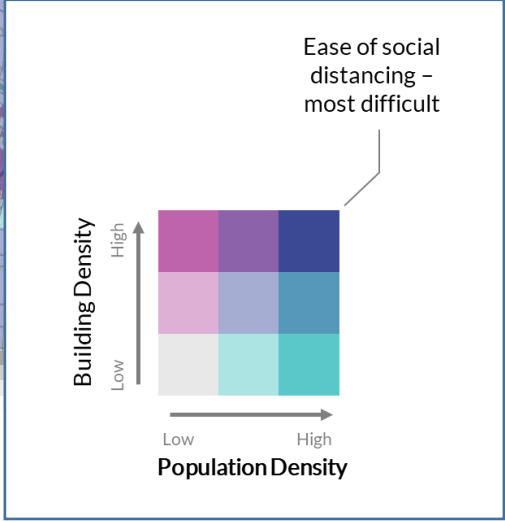
Sierra Leone COVID-19 Response Hub



Sierra Leone Population



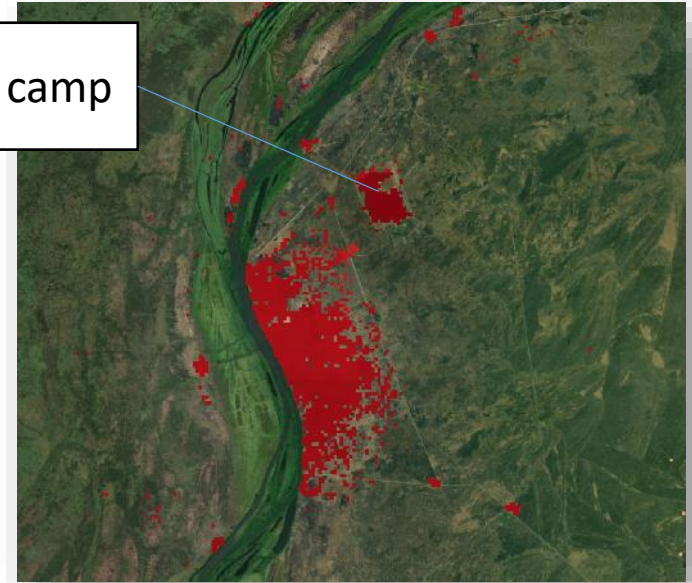
Zambia Data Hub



Some next steps

- *Small area projections*: integrating displacement data
- *Seasonal population mapping*: geospatial data integration
- *New covariates*: neighbourhood mapping, residential/non-residential, building heights
- *Methods development*: developing and validating rapid and bespoke models
- *Methods documentation and webinar development*
- *GRID3*: supporting new countries

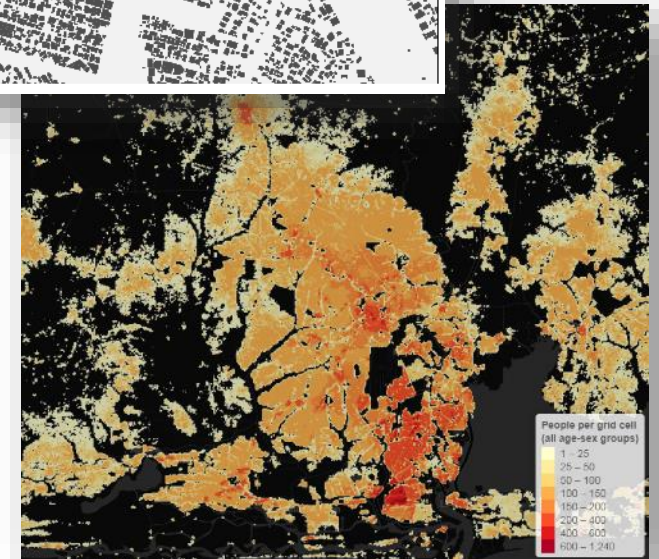
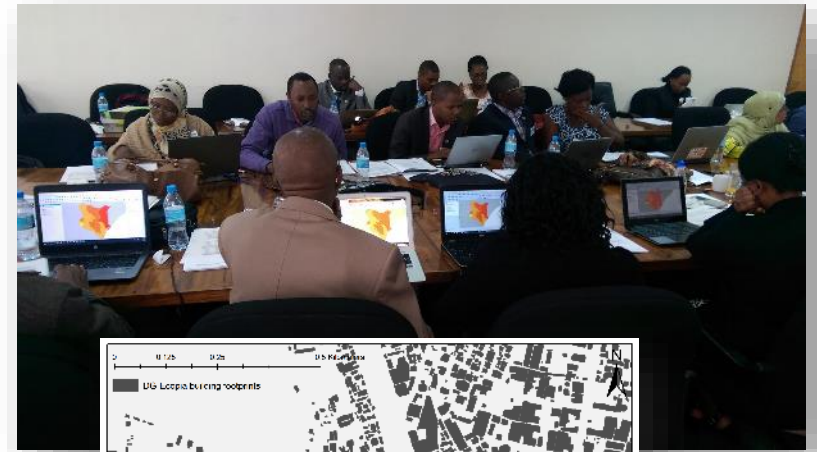
Refugee camp



South Sudan: Dooley et al (2020)
<https://wopr.worldpop.org/>

Key messages

- Small area population estimates form the basis of decision making across multiple fields
- In resource poor settings, population data can often be coarse, outdated and/or unreliable
- A range of geospatial modelling methods exist to complement traditional data collection methods to produce timely small area estimates
- Models are never perfect = importance of validation, and of measuring, communicating and using uncertainty
- End-user engagement and capacity strengthening vital to adoption and sustained use



Acknowledgements

These slides contain input from members of the WorldPop group: Maksym Bondarenko, Gianluca Boo, Heather Chamberlain, Donna Clarke, Claire Dooley, Chris Jochem, Doug Leasure, Chris Lloyd, Jeremiah Nieves, Sarchil Qader, Alessandro Sorichetta

Thanks to them and both the whole WorldPop group and GRID3 team for wider input and support



Further information



www.worldpop.org

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



www.grid3.org

 [@GRID3Global](https://twitter.com/GRID3Global)

E-mail: A.J.Tatem@soton.ac.uk

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

Questions & Answers

Thank you!

centre.humdata.org

 [humdata](https://twitter.com/humdata) | centrehumdata@un.org

