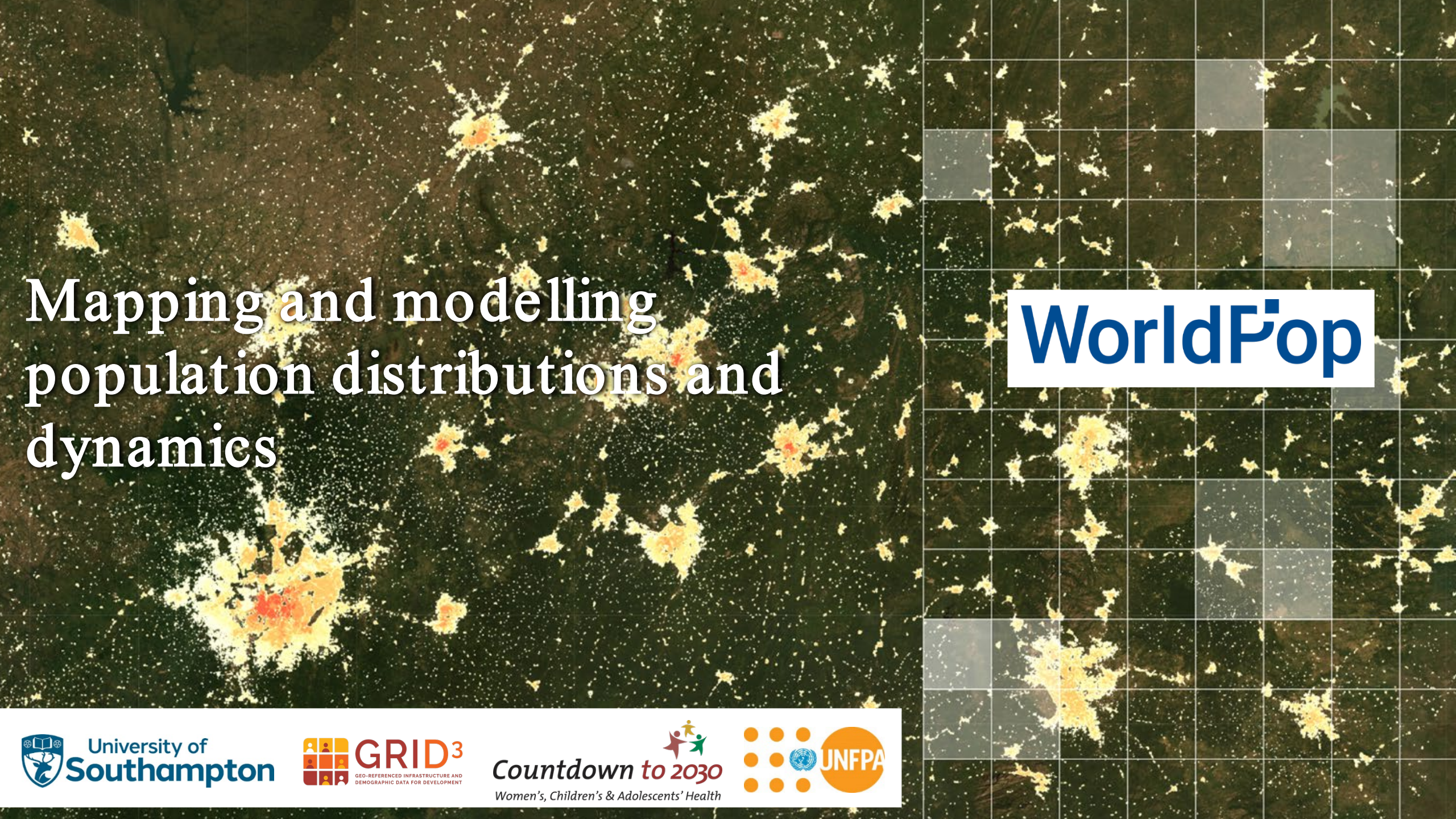
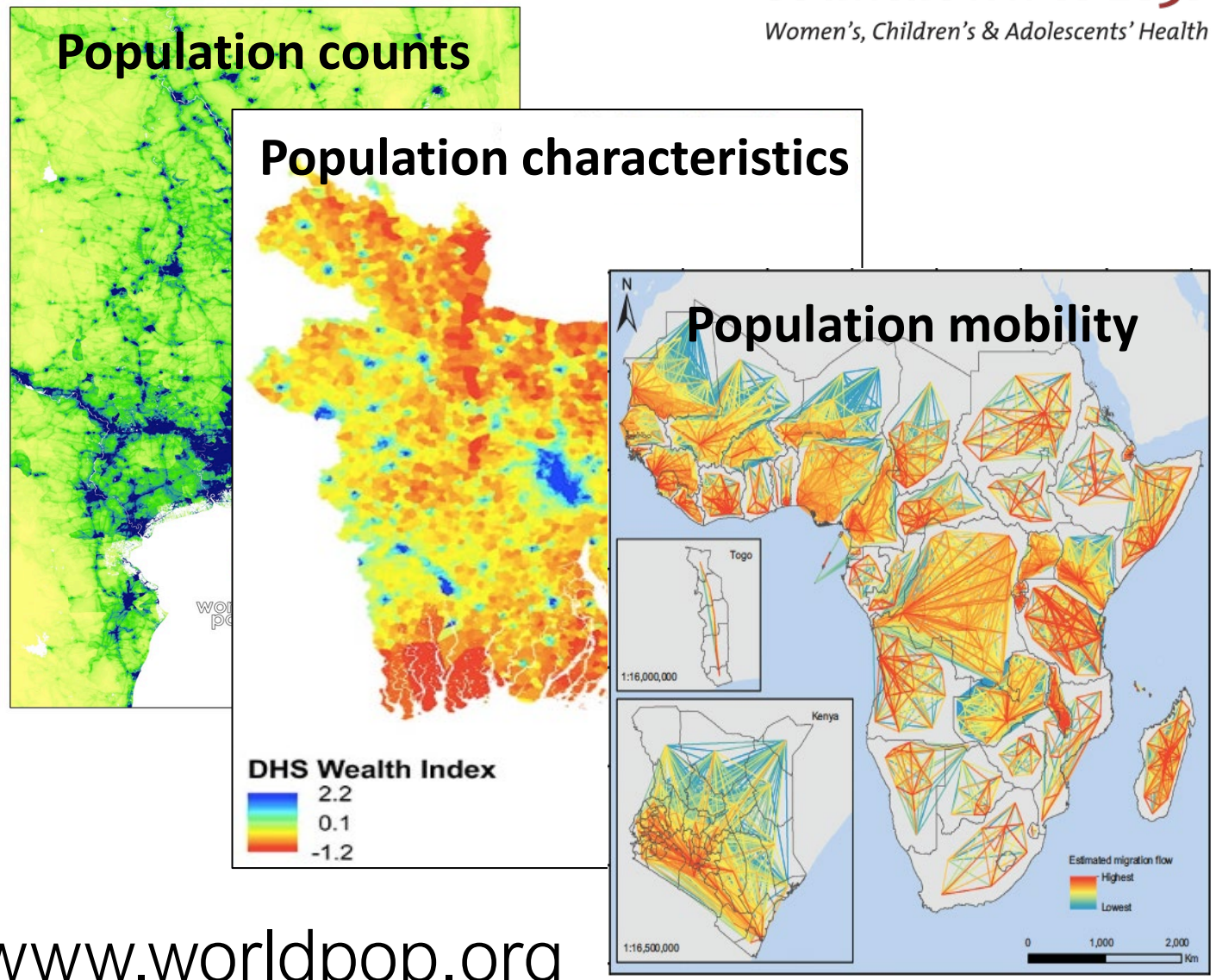

Mapping and modelling
population distributions and
dynamics
WorldPop
University of
Southampton
GRID3
GEO-REFERENCED INFRASTRUCTURE AND
DEMOGRAPHIC DATA FOR DEVELOPMENT
Countdown to 2030
Women's, Children's & Adolescents' Health
UNFPA

WorldPop

GRID3
GEO-REFERENCED INFRASTRUCTURE AND DEMOGRAPHIC DATA FOR DEVELOPMENT

Countdown to 2030
Women's, Children's & Adolescents' Health

University of Southampton



www.worldpop.org

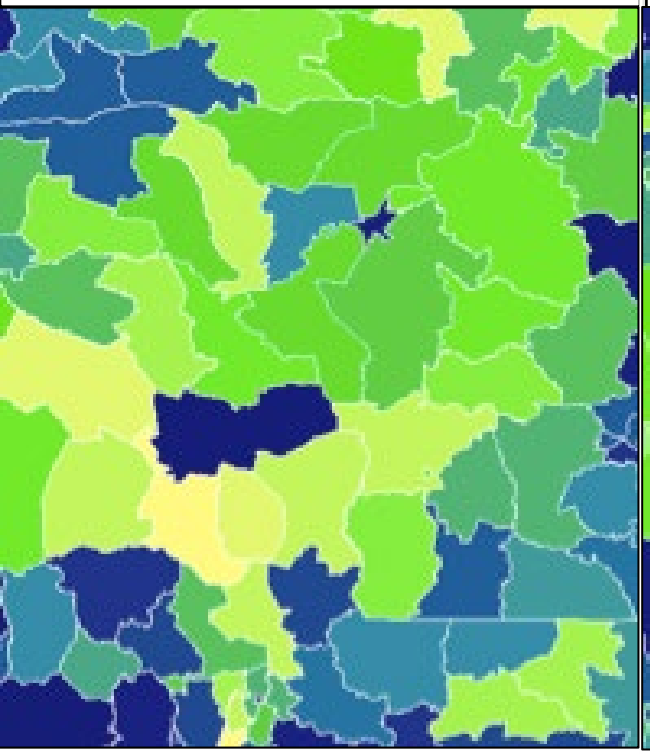
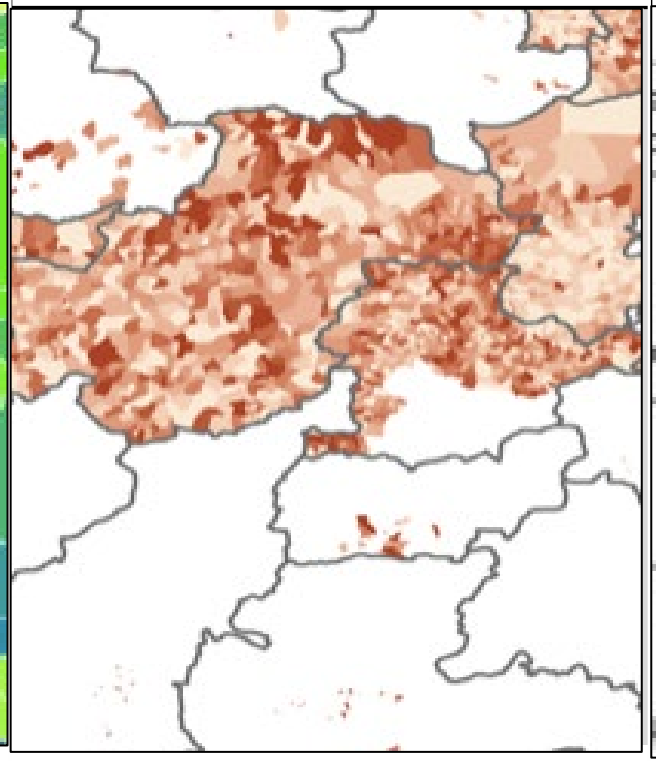
Applied research and implementation group

Open data, open peer-reviewed methods, co-development, capacity strengthening

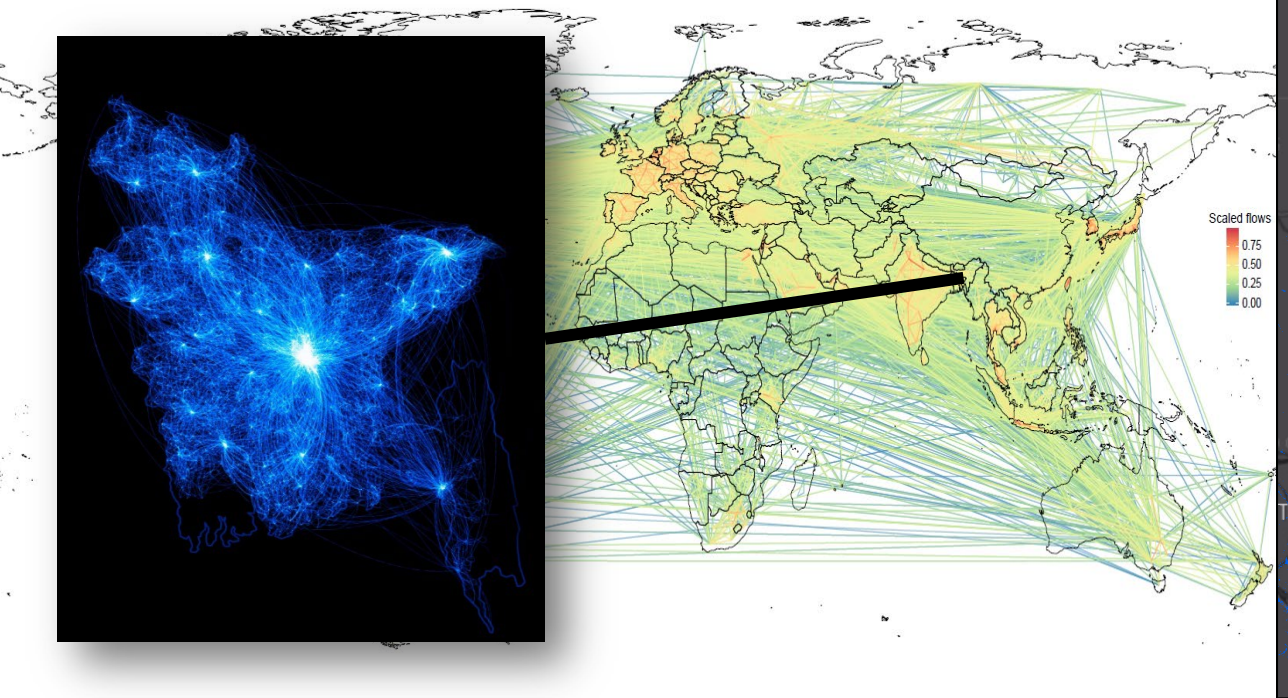
Mapping small area demographics and dynamics for low and middle income countries

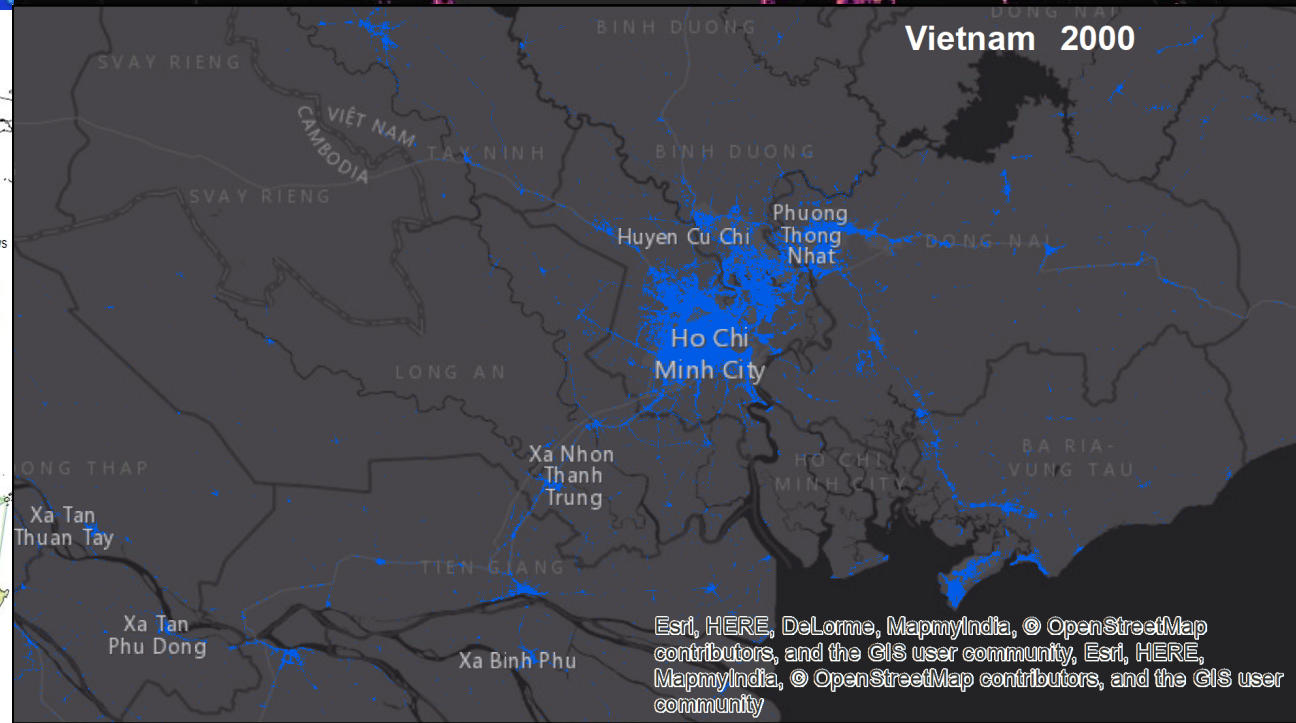
Gridded population datasets used by many UN agencies, Governments

Major application areas in census support, RMNCAH, childhood vaccination, epidemiology

Coarse resolution	Outdated	Incomplete	Inaccuracies, missing populations
			

Demographic data challenges


Scaled flows
0.75
0.50
0.25
0.00


Vietnam 2000
BINH DUONG
SVAY RIENG
VIỆT NAM
CAMBODIA
TAY NINH
BINH DUONG
SVAY RIENG
DONG NAI
Huyen Cu Chi
Phuong Thong Nhat
Ho Chi Minh City
LONG AN
Xa Nhon Thanh Trung
HO CHI MINH CITY
BA RIA-VUNG TAU
LONG THAP
Xa Tan Thuan Tay
TIEN GIANG
Xa Tan Phu Dong
Xa Binh Phu
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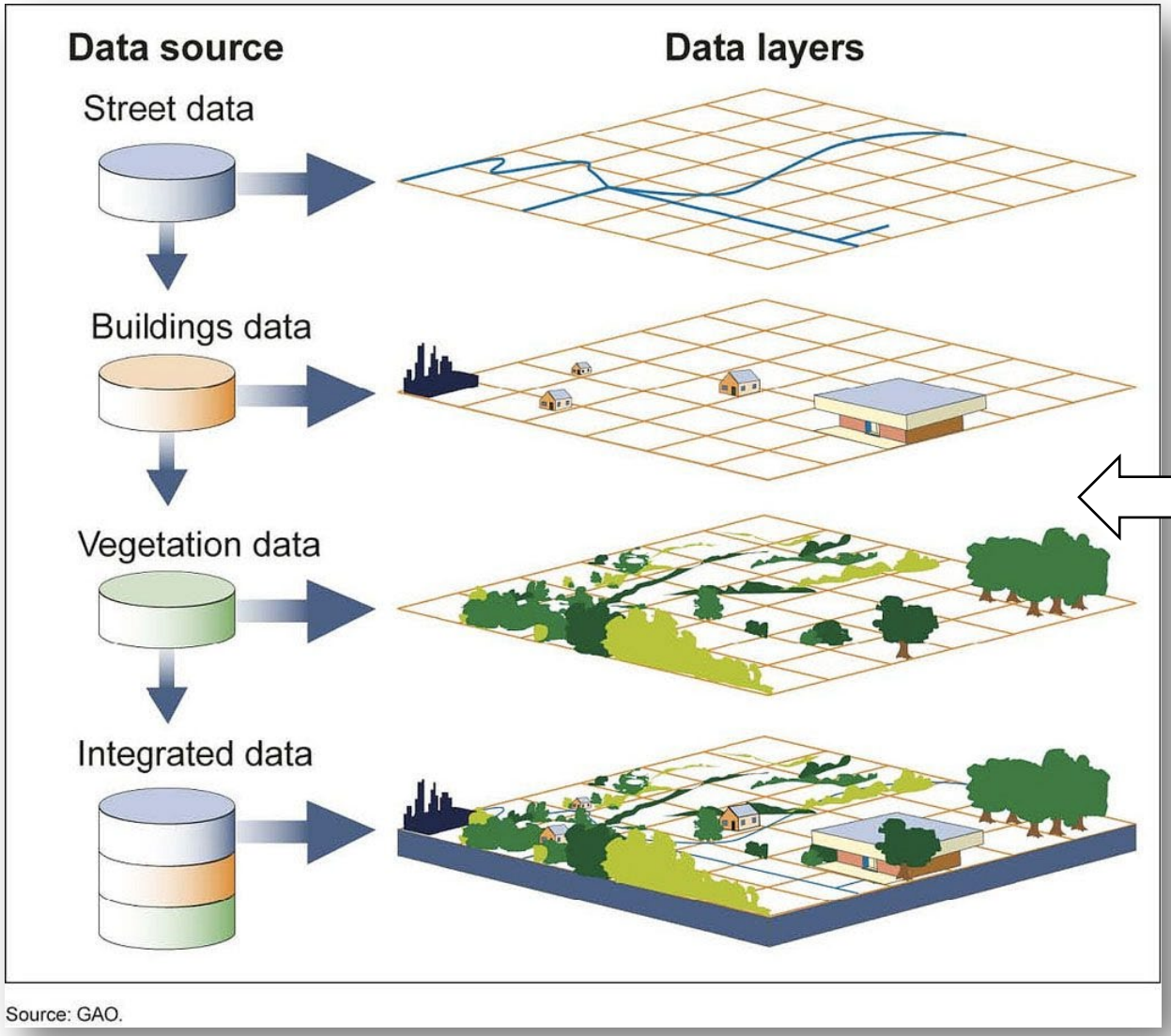
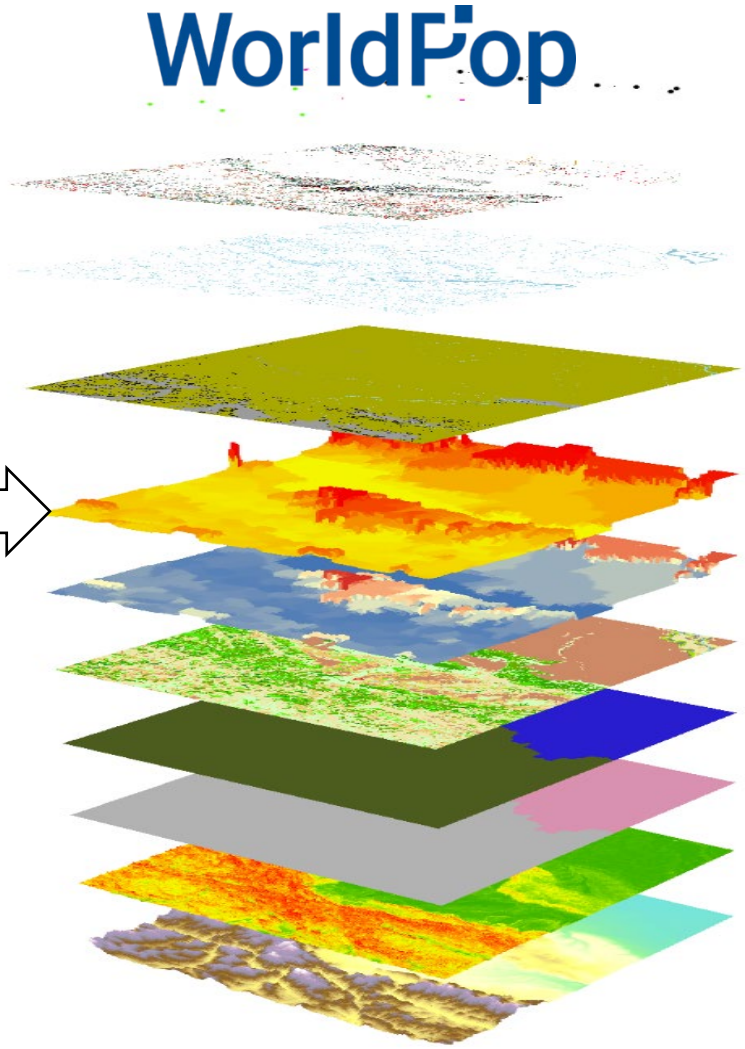
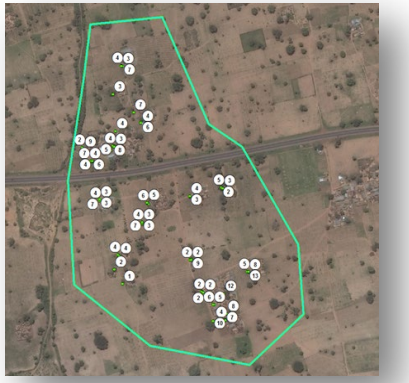
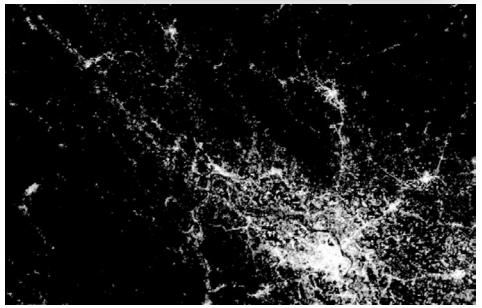
Mapping correlates of demographic variations

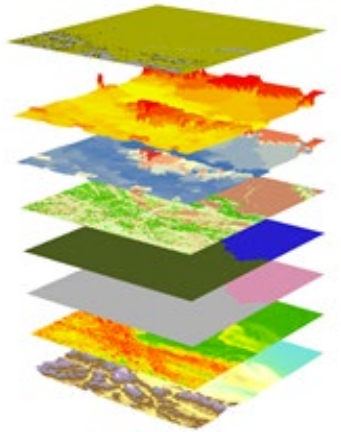




Spatial demographic modelling







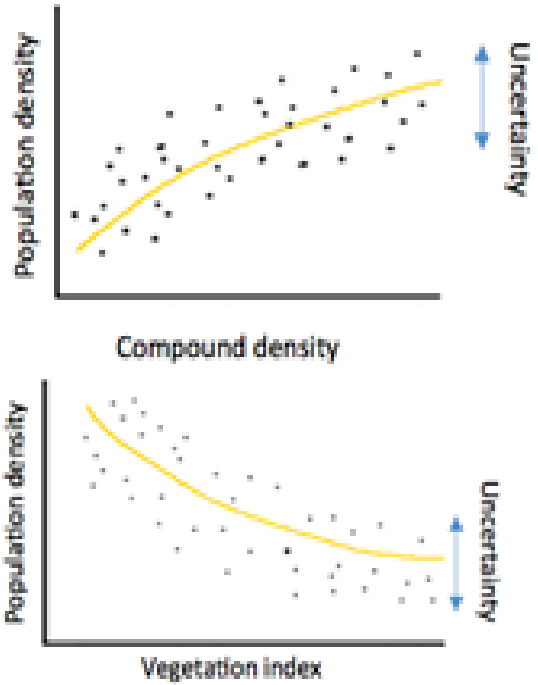
Population Data

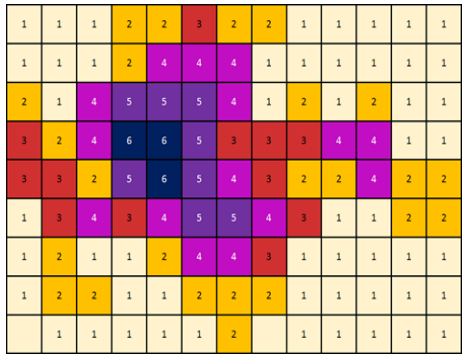
Settlement

Geospatial covariates

Spatial statistical model

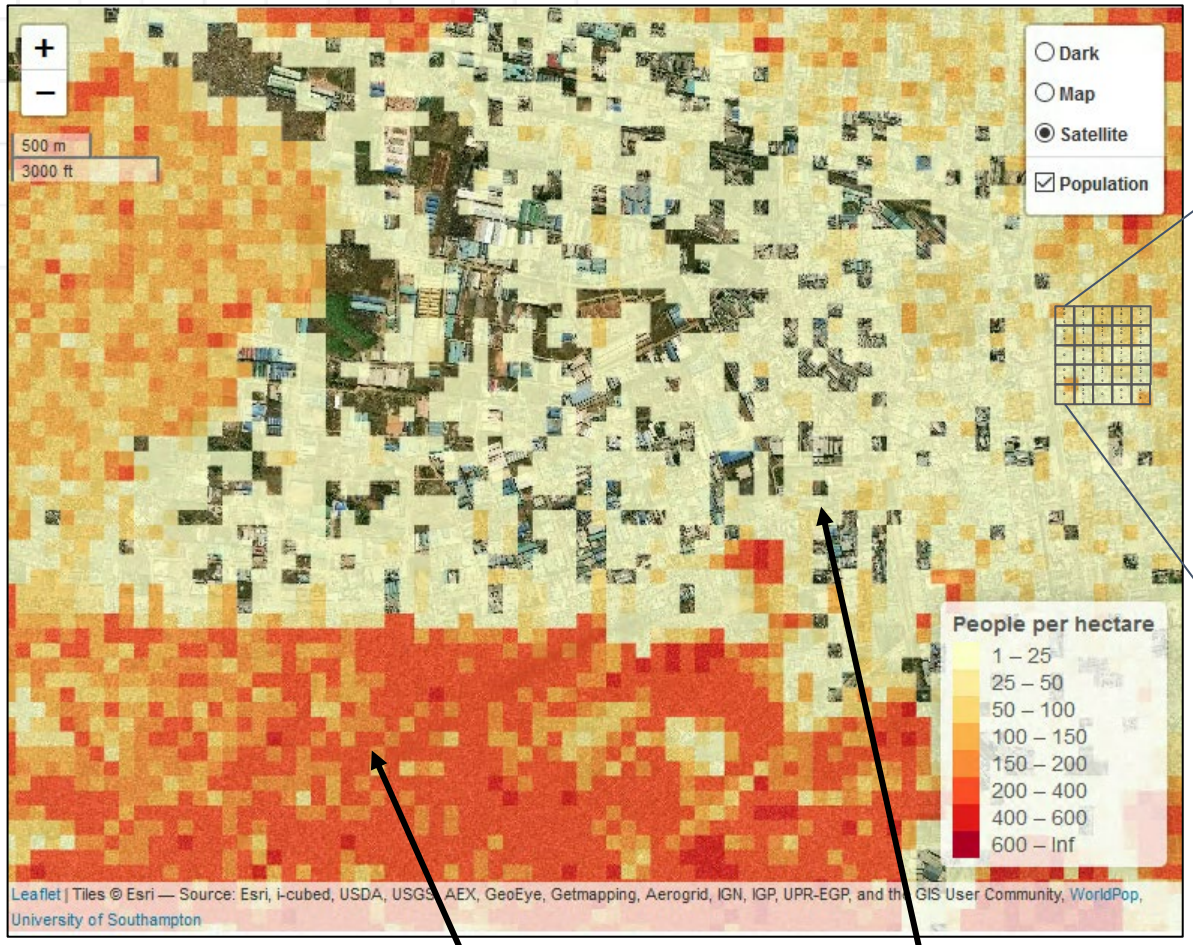
Population estimates (ideally with uncertainty)





Wardrop et al (2018) PNAS

Gridded population estimates



Approx. 100m

60.6	121.2	60.6	18.0	12.0
0.9	43.1	121.2	60.6	60.6
0	8.6	60.6	12.0	12.0
0.9	8.6	12.9	0.9	12.9
0	129.4	0	0.9	0.9

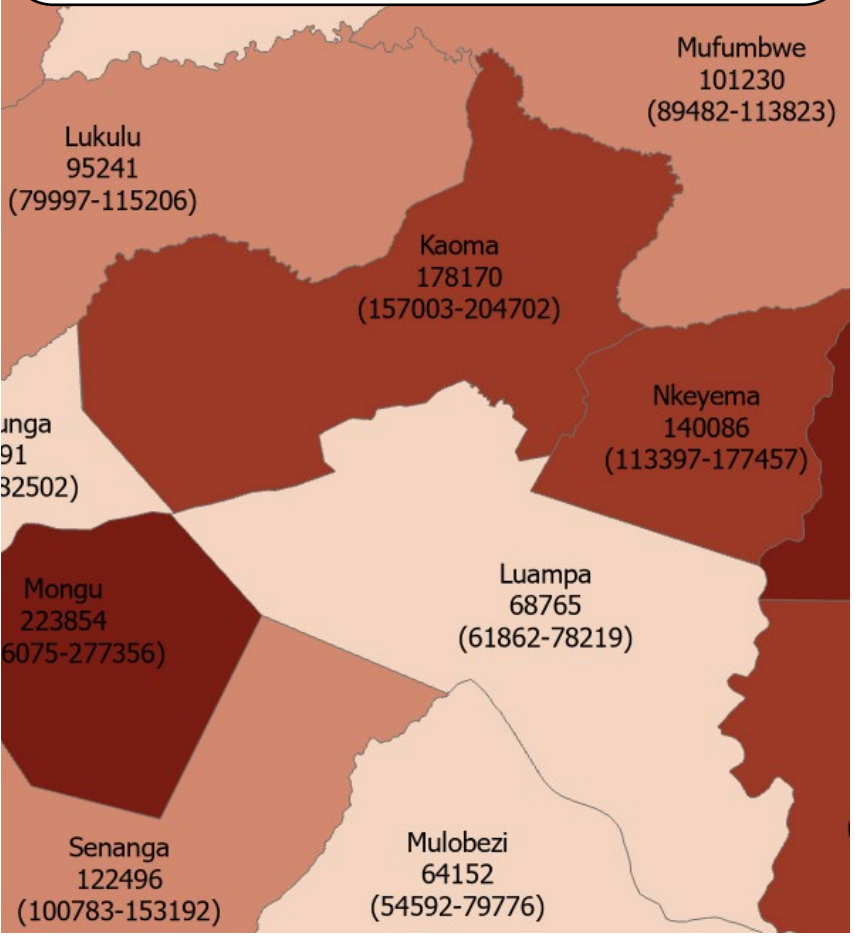
High pop. count

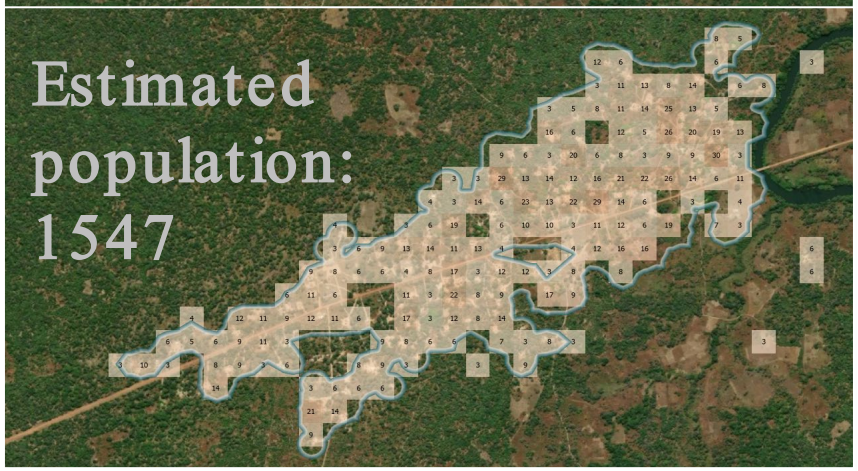
Low pop. count

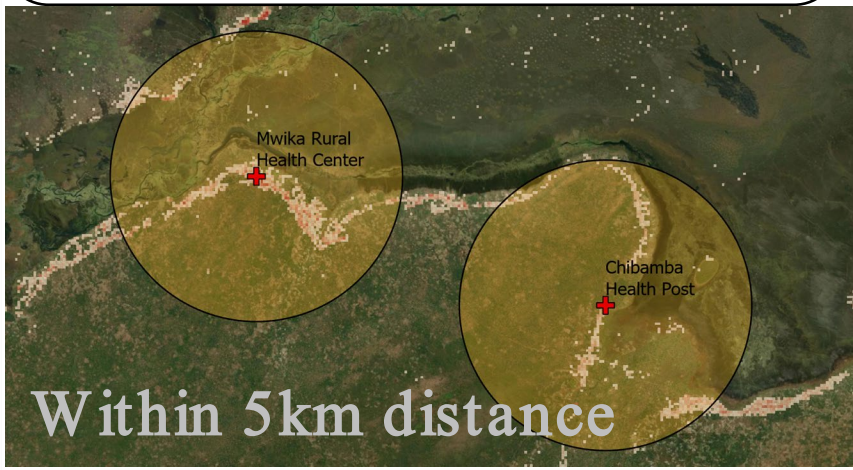
Administrative units / Health units / Enumeration areas

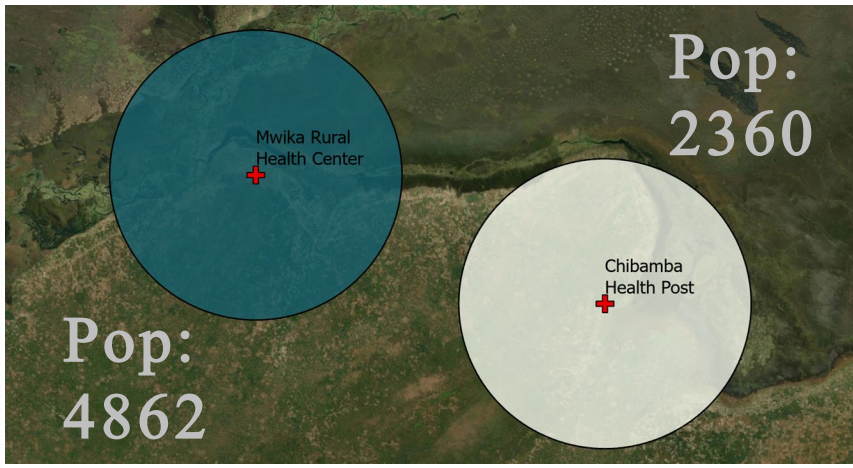
Settlement extents

Custom e.g. specified proximity/distance





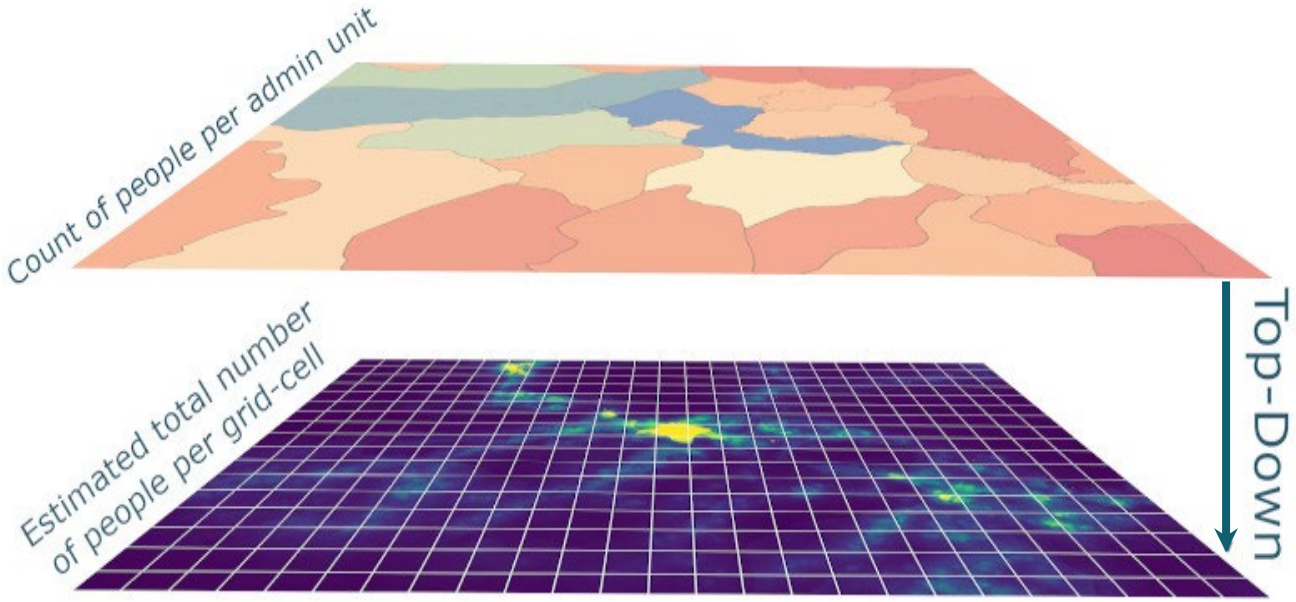




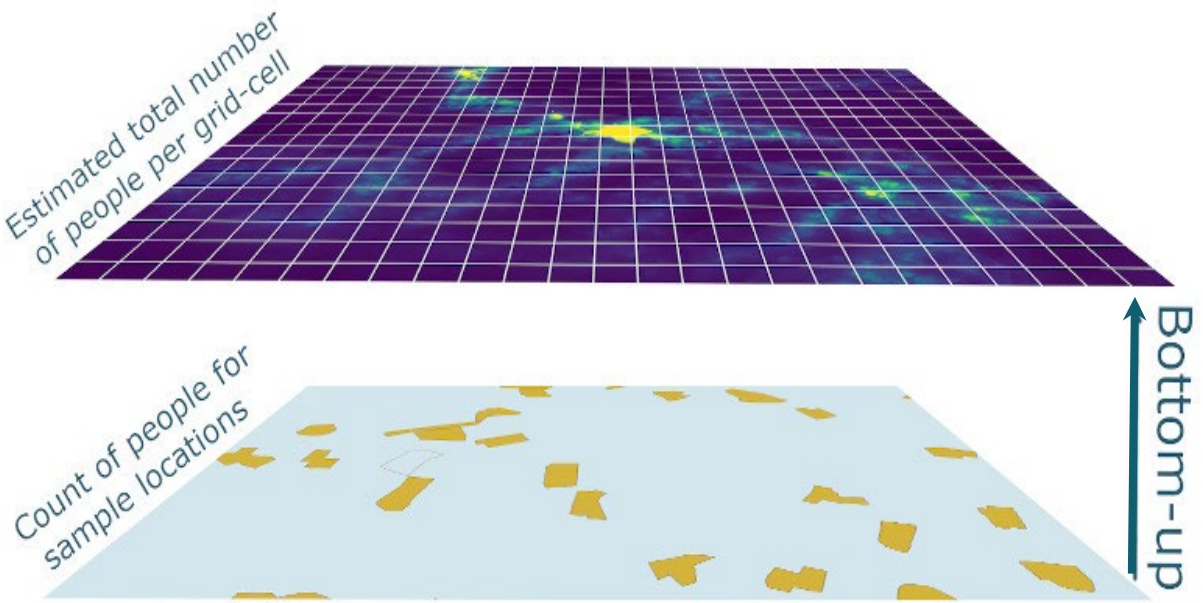
Gridded population data: Flexibility in aggregation of population estimates

Overview of approaches for creating gridded population datasets

“Top down” modelling approach

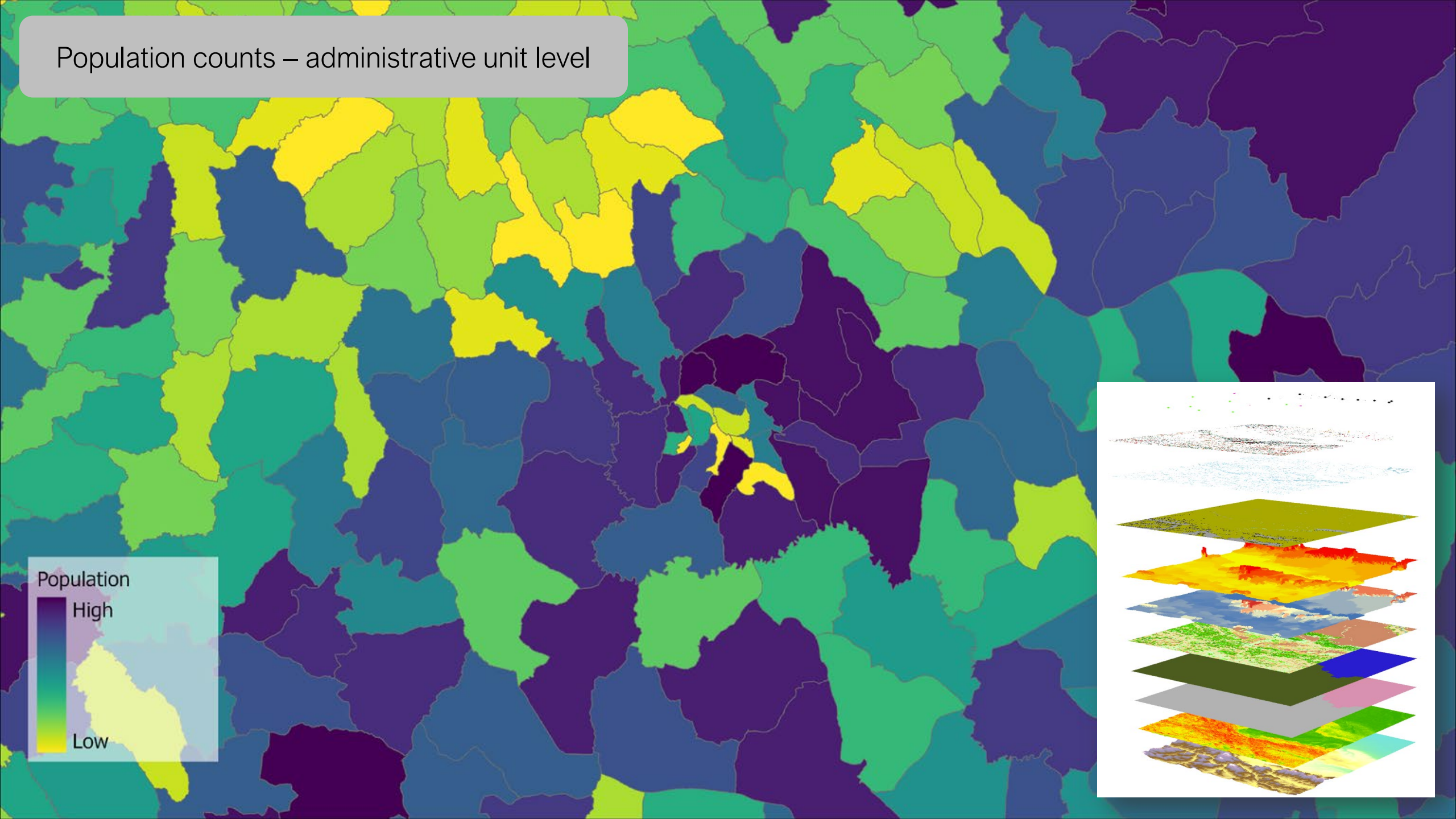


“Bottom-up” modelling approach

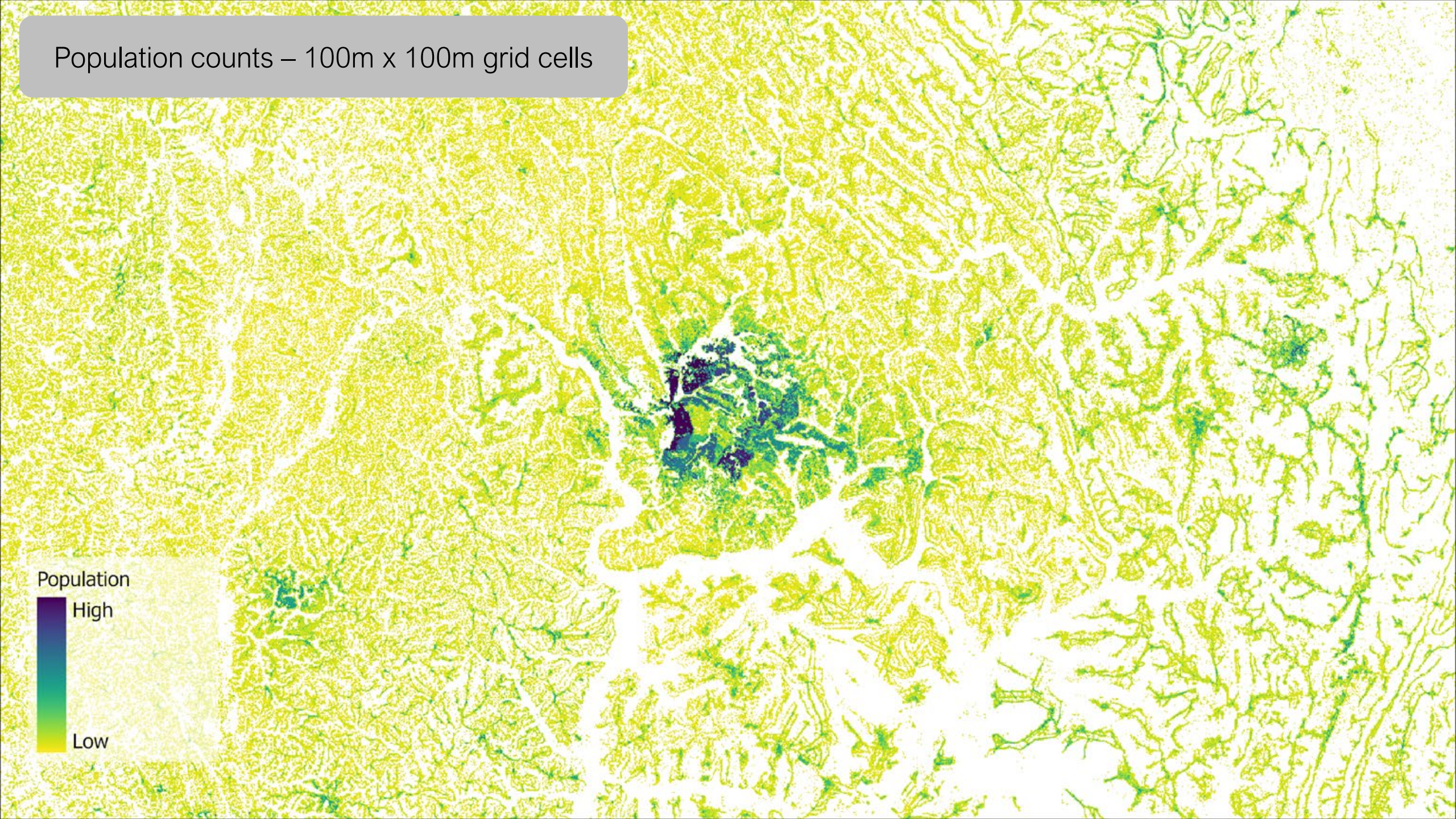


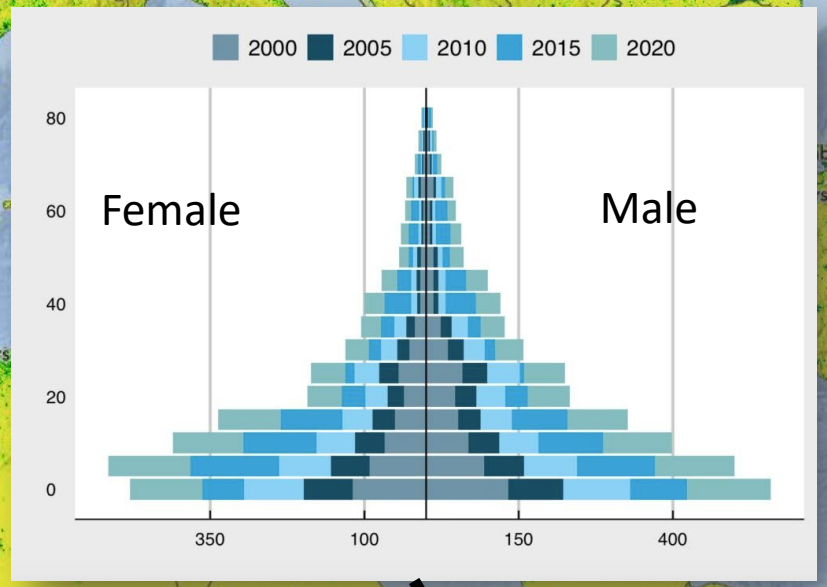
www.worldpop.org/methods/populations

Population counts – administrative unit level



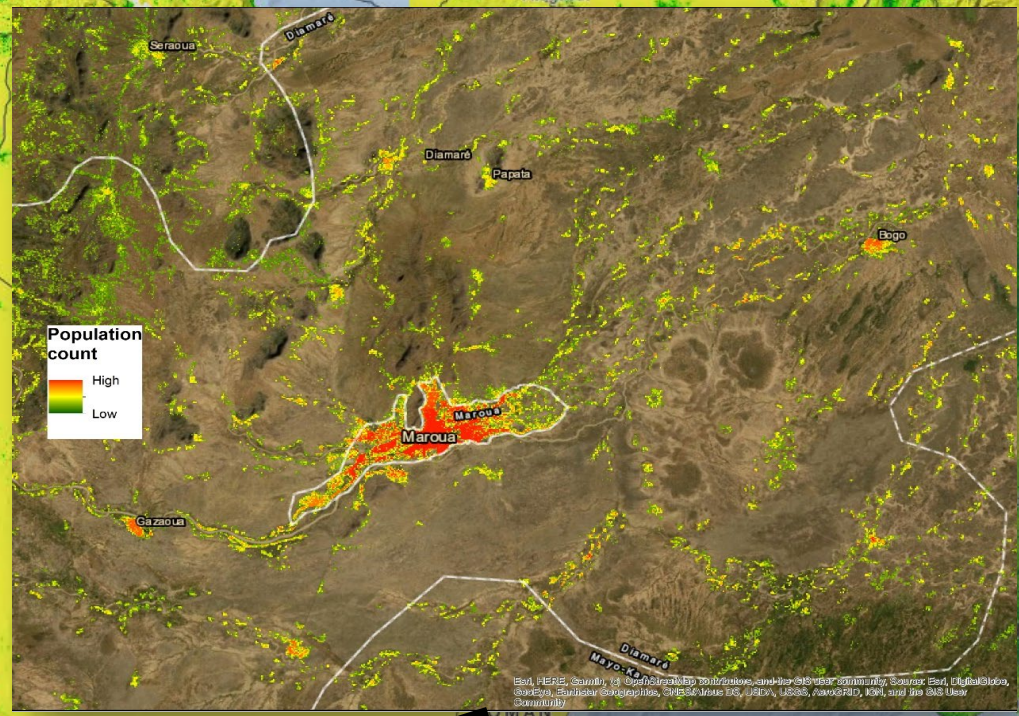
Population counts – 100m x 100m grid cells





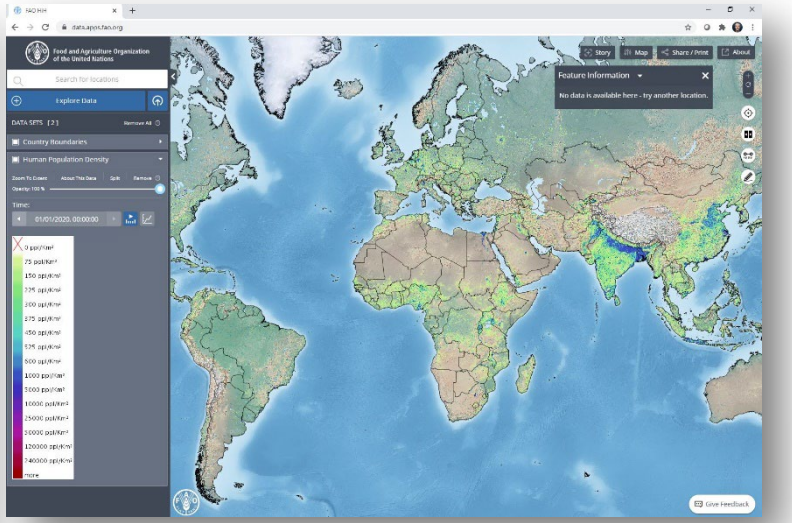
ArcGIS Living Atlas of the World

UNFPA Population Data Portal



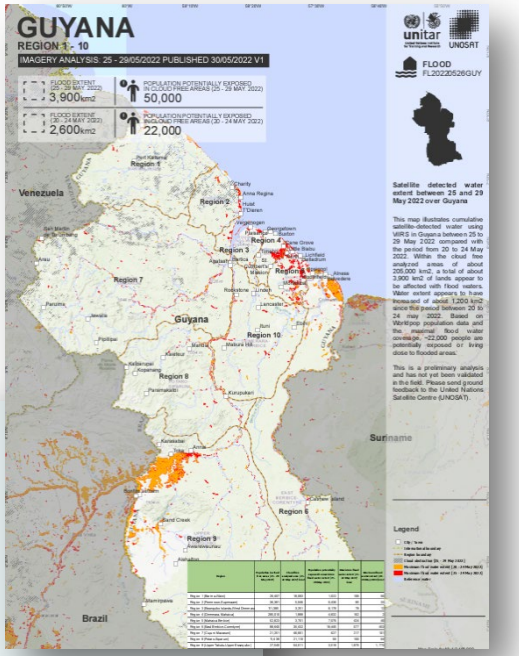
www.portal.worldpop.org

www.portal.worldpop.org/demographics



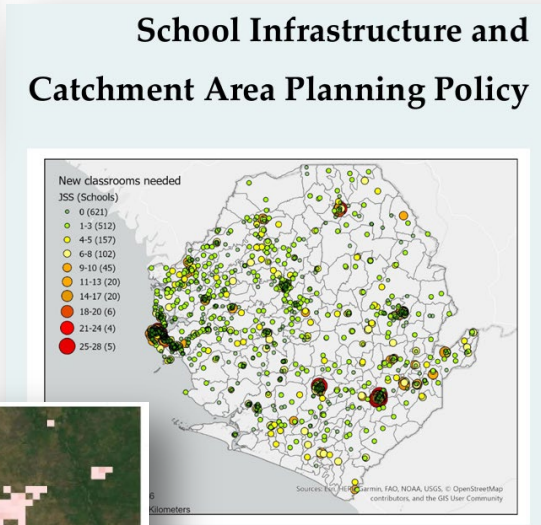
unitar United Nations Institute for Training and Research 1963-2023

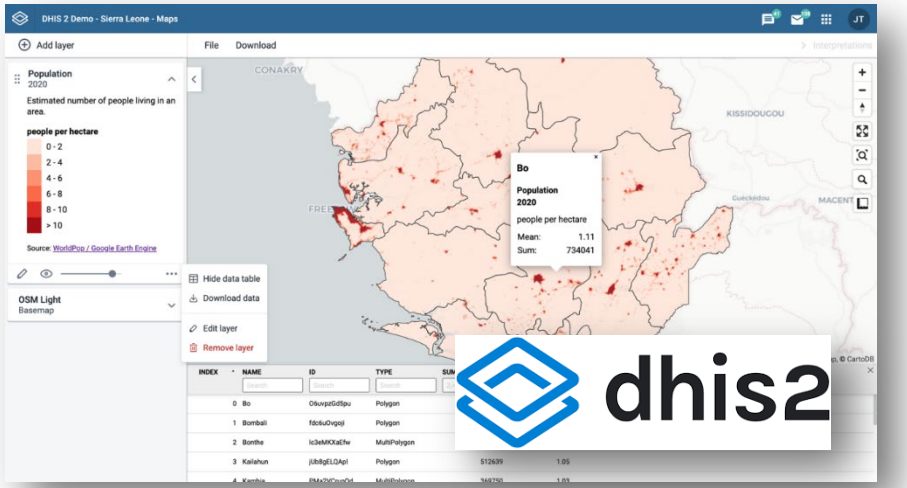
UNOSAT



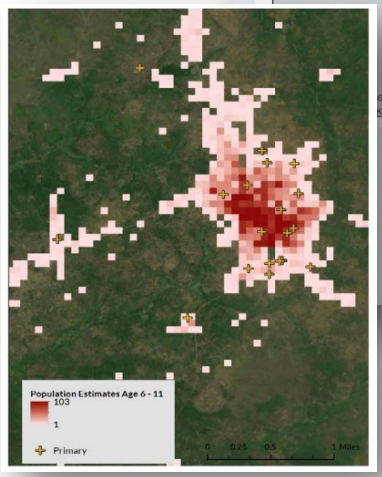
Food and Agriculture Organization of the United Nations

World Health Organization





dhis2



Statistics Sierra Leone
Stats SL

UNFPA

GRID3
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https://grid3.org/news/sierraleone-grid3insights-newpolicy

https://docs.dhis2.org/en/use/user-guides/dhis-core-version-236/analysing-data/maps.html

Co-development and training

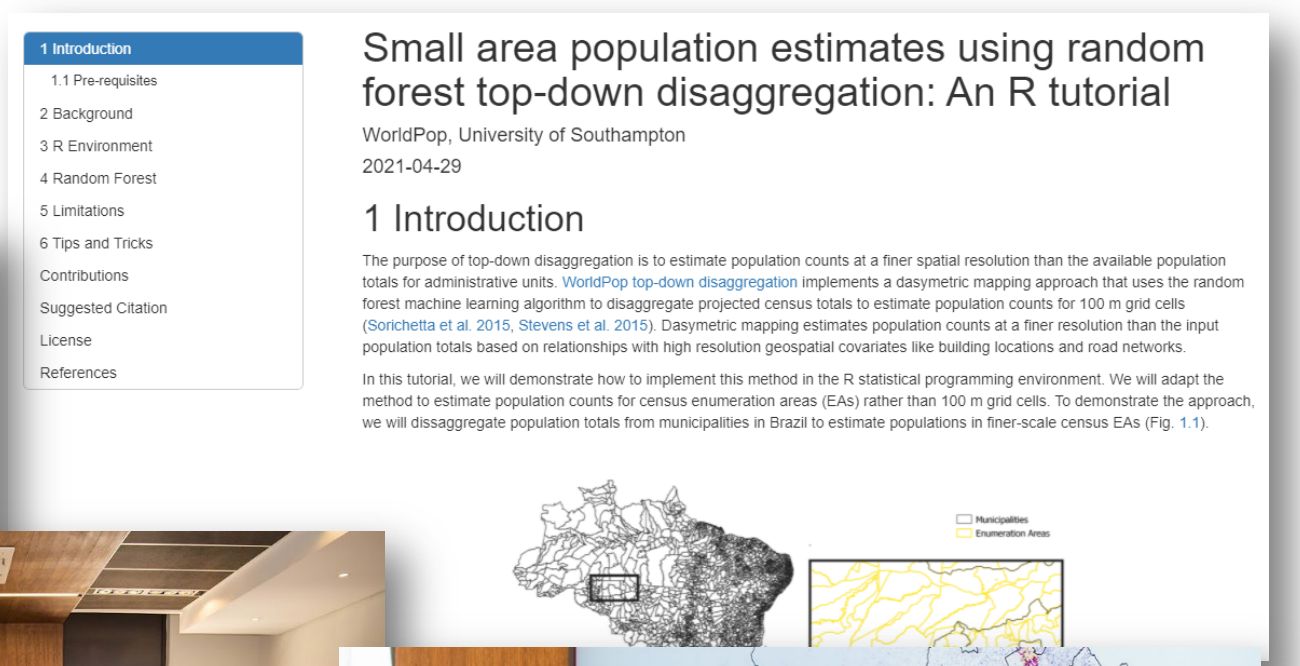
Small area population estimates using random forest top-down disaggregation (Part 2): the **popRF** 'R' package

WorldPop, University of Southampton

2021-11-17

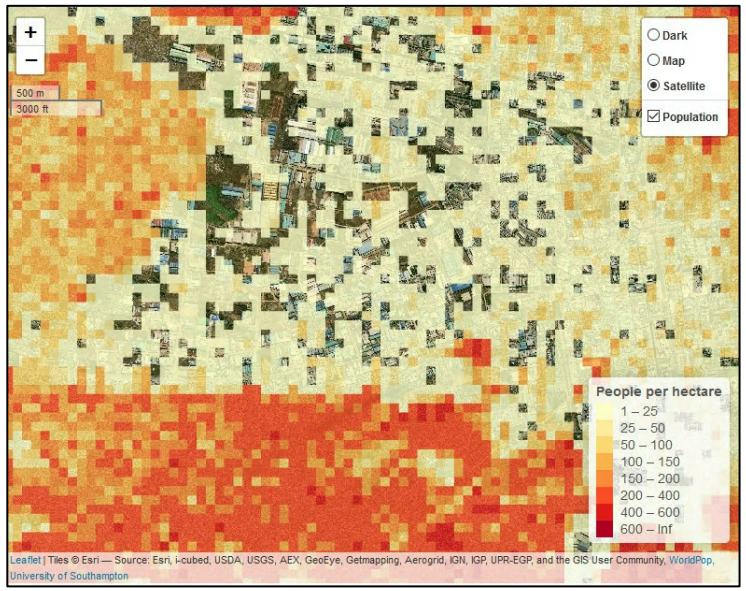
1 Introduction

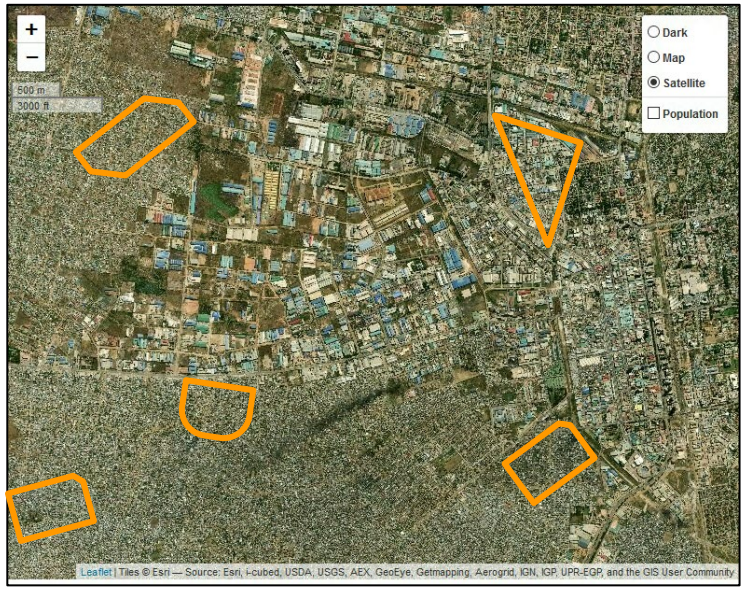
The purpose of top-down disaggregation is to estimate

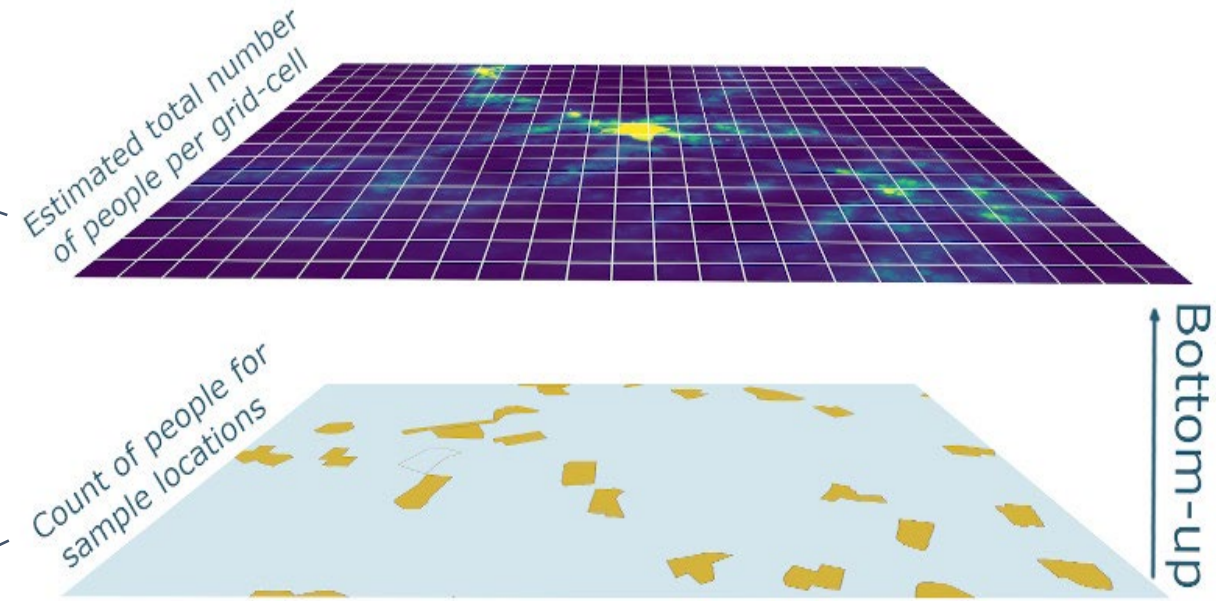


https://data.worldpop.org/repo/docs/leasure2021small/
https://data.worldpop.org/repo/docs/lazar2021poprf

“Bottom-up” modelling approach



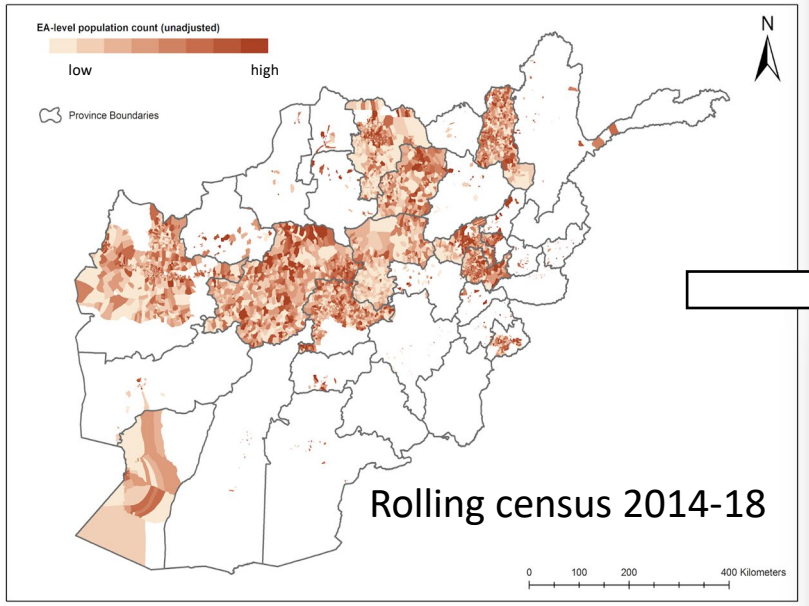


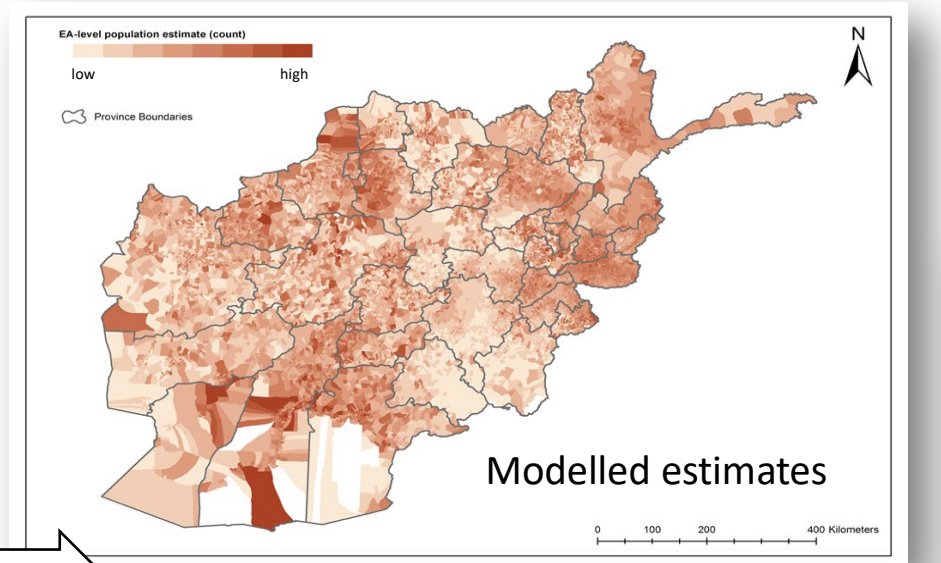


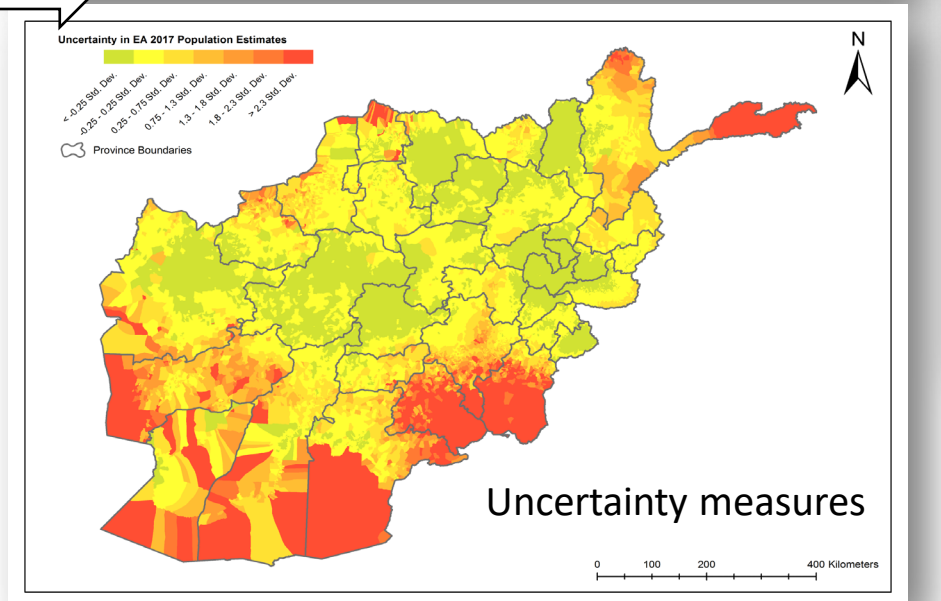
WorldPop

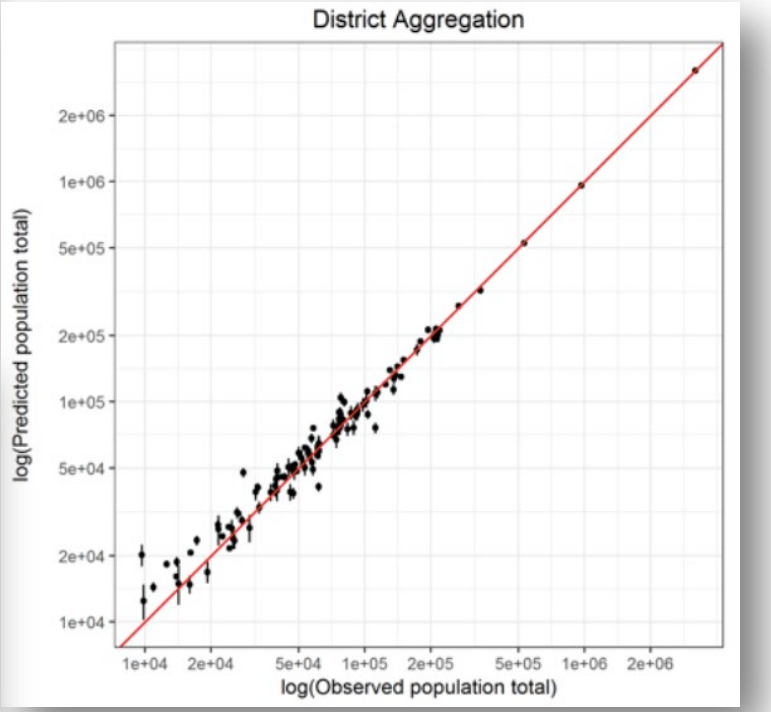
www.worldpop.org/methods/populations

Afghanistan: Moving beyond 1979









UNFPA

NSIA

https://www.worldpop.org/case_studies/mapping_afg_pop; *Chamberlain et al (2023)*

Afghanistan: Moving beyond 1979

"Analyses resulted in an additional $15 million in financing for GAVI vaccines in Afghanistan based on the population data – there are over a million kids who are vaccinated now because of this."

Walker Kosmidou-Bradley, the World Bank

UNFPA

د احصايي او معلوماتو ملي اداره
ادارهٔ ملی احصائیه و معلومات
NSIA

https://www.worldpop.org/case_studies/mapping_afg_pop; *Chamberlain et al (2021)*

Burkina Faso and Mali: Filling census gaps

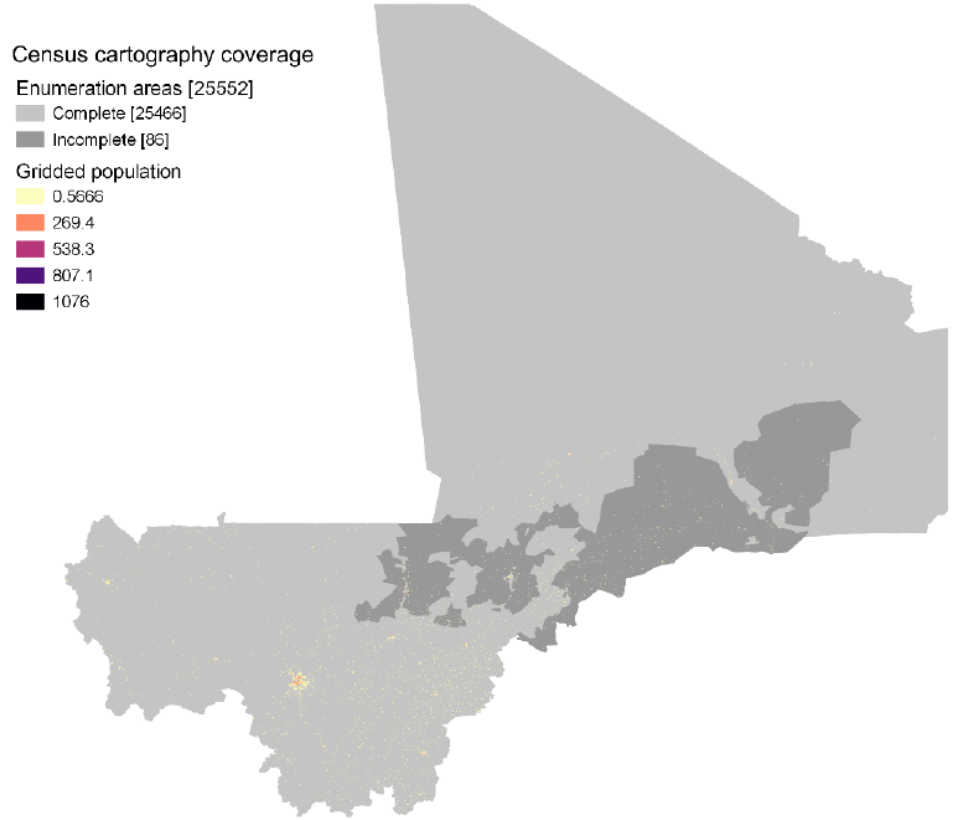
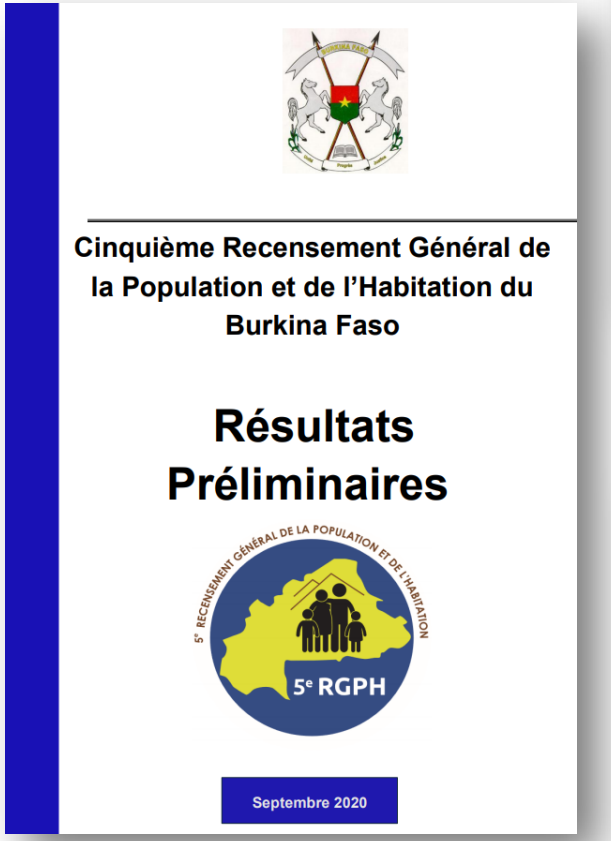
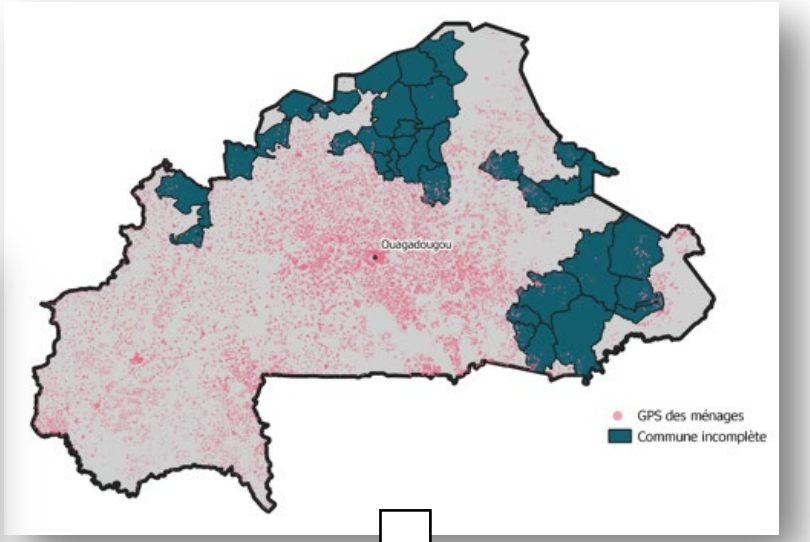
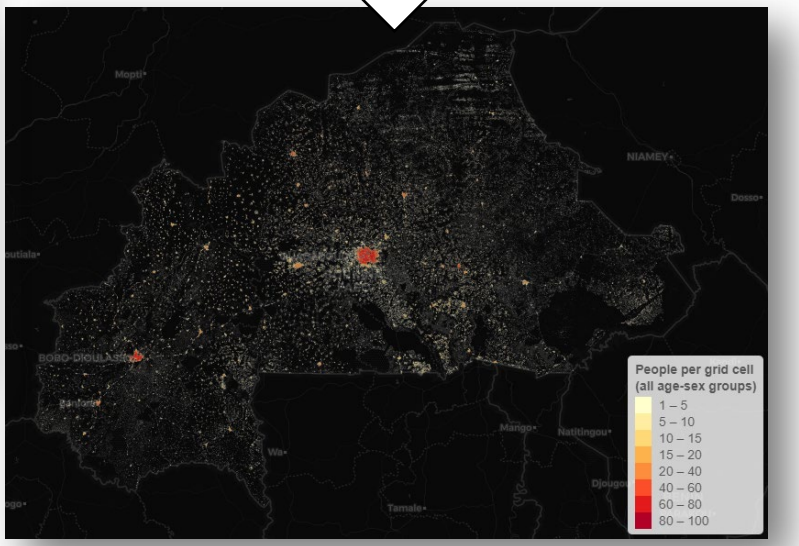


Figure 1 Census cartography coverage

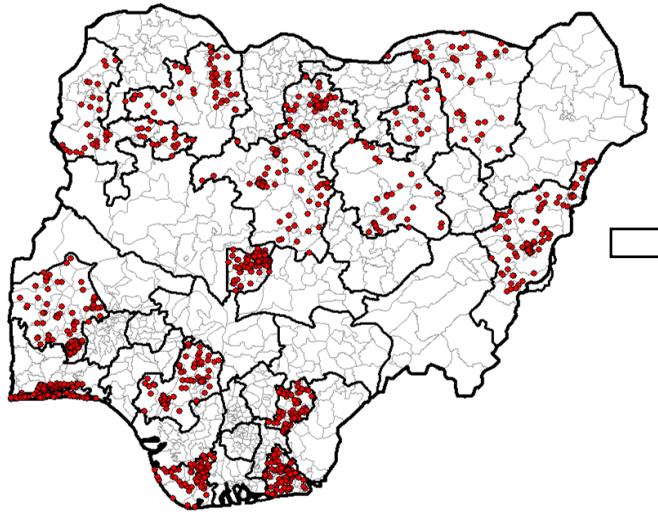


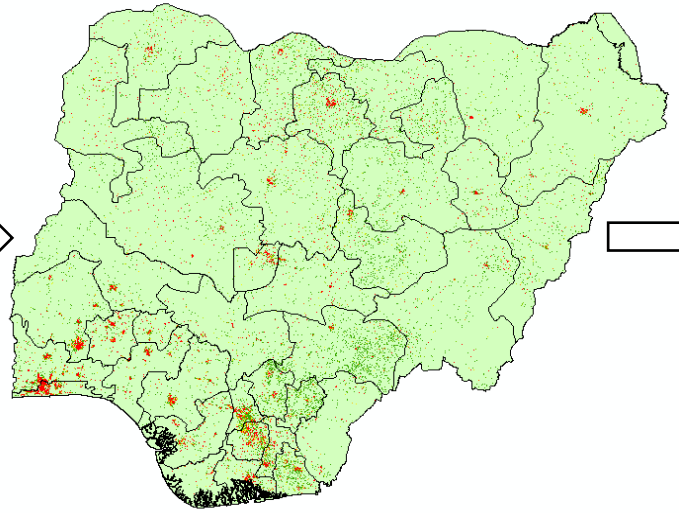


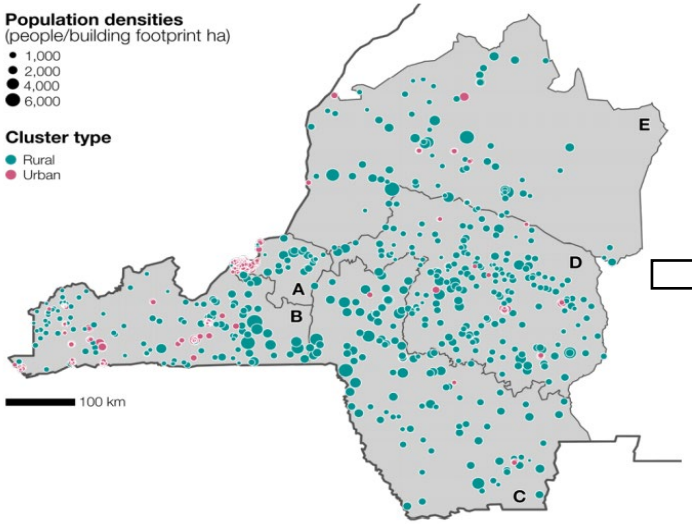


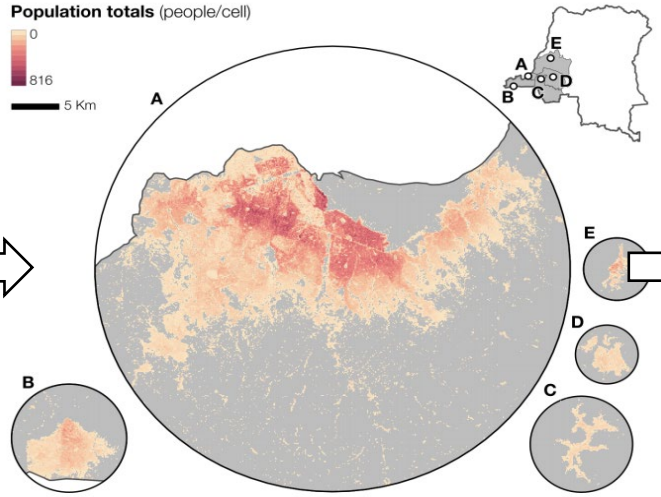
WorldPop and INSTAT (2022) 10.5258/SOTON/WP00745 Darin et al (2022) Population

Nigeria and DR Congo: Supporting vaccination campaigns



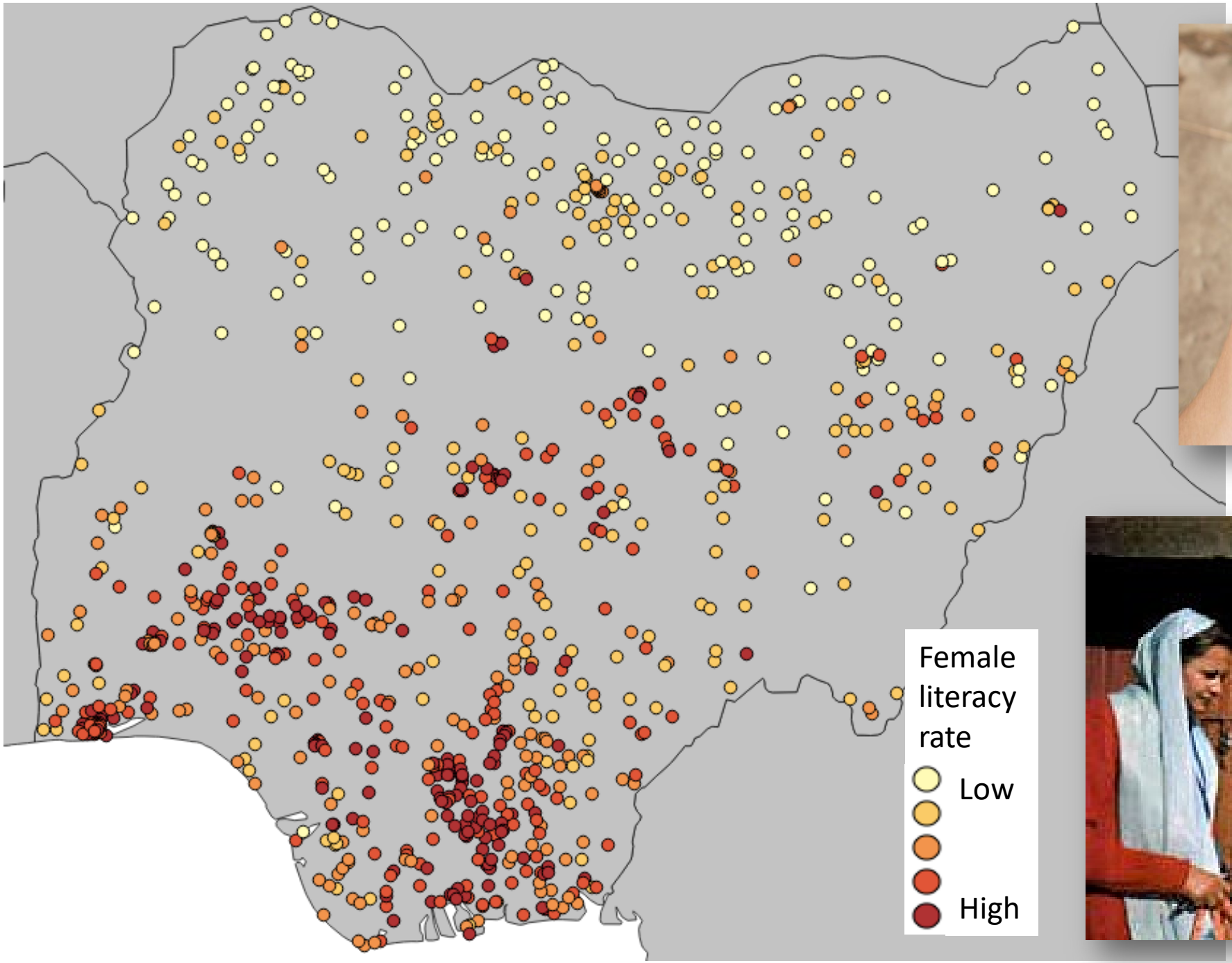




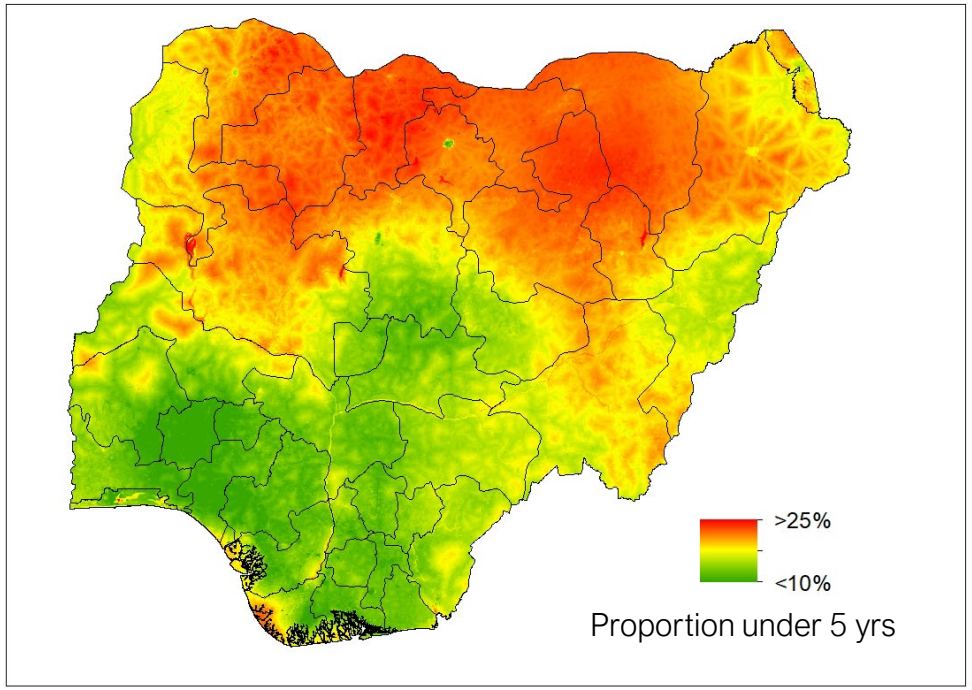


Leasure et al. (2020) PNAS https://wopr.worldpop.org/?NGA/Population/v2.0

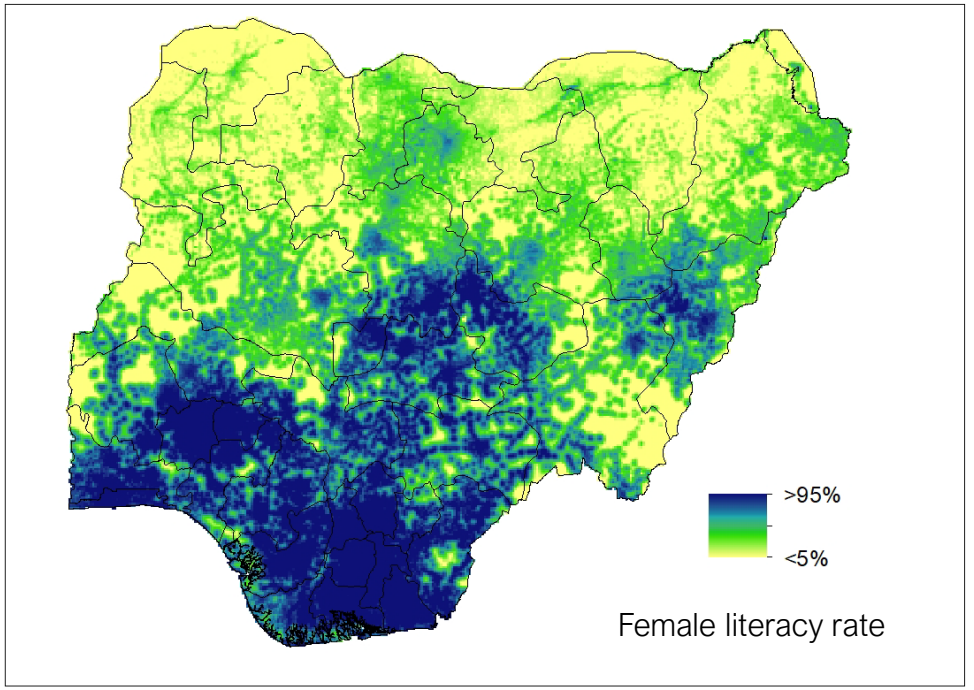
Boo et al. (2022) Nature Comms; https://wopr.worldpop.org/?COD/Population/v3.0


Female literacy rate
Low
High

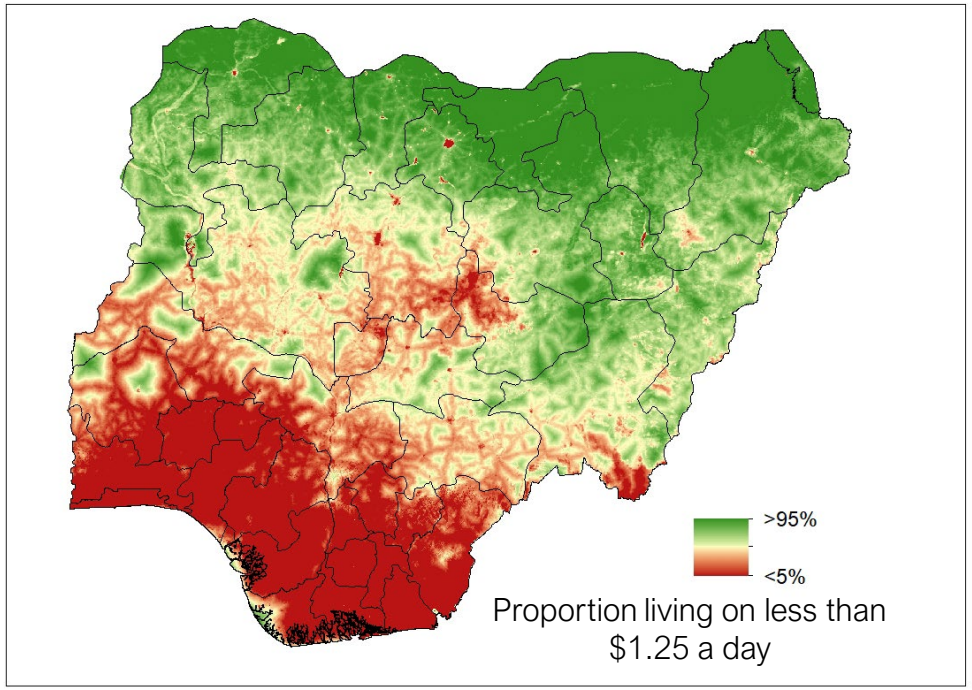

Avg Descnt
12
Elevation
90
GARMIN



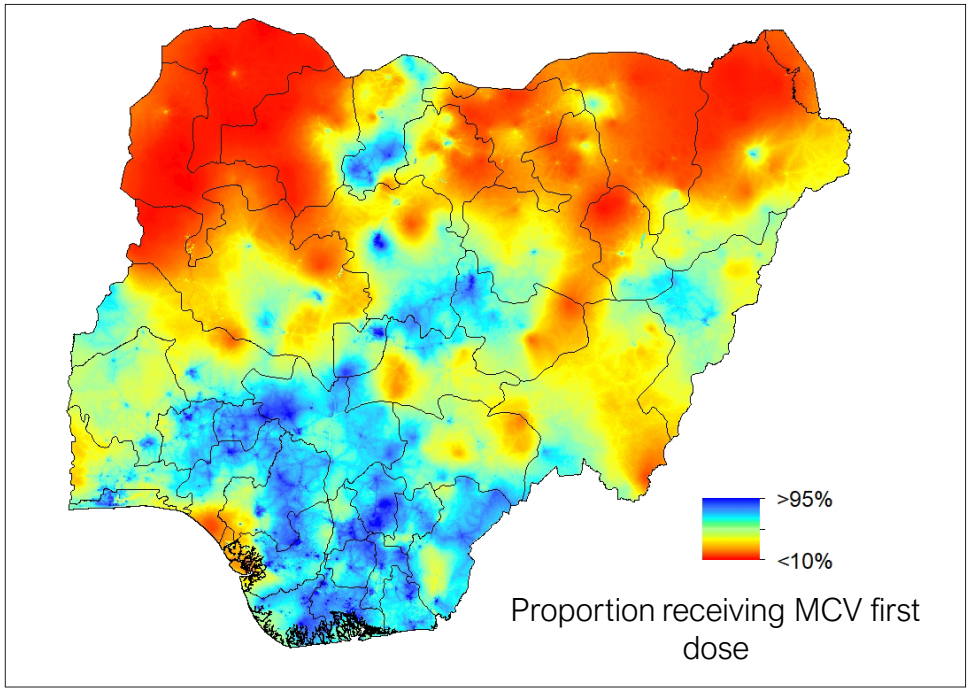
Proportion under 5 yrs



Female literacy rate

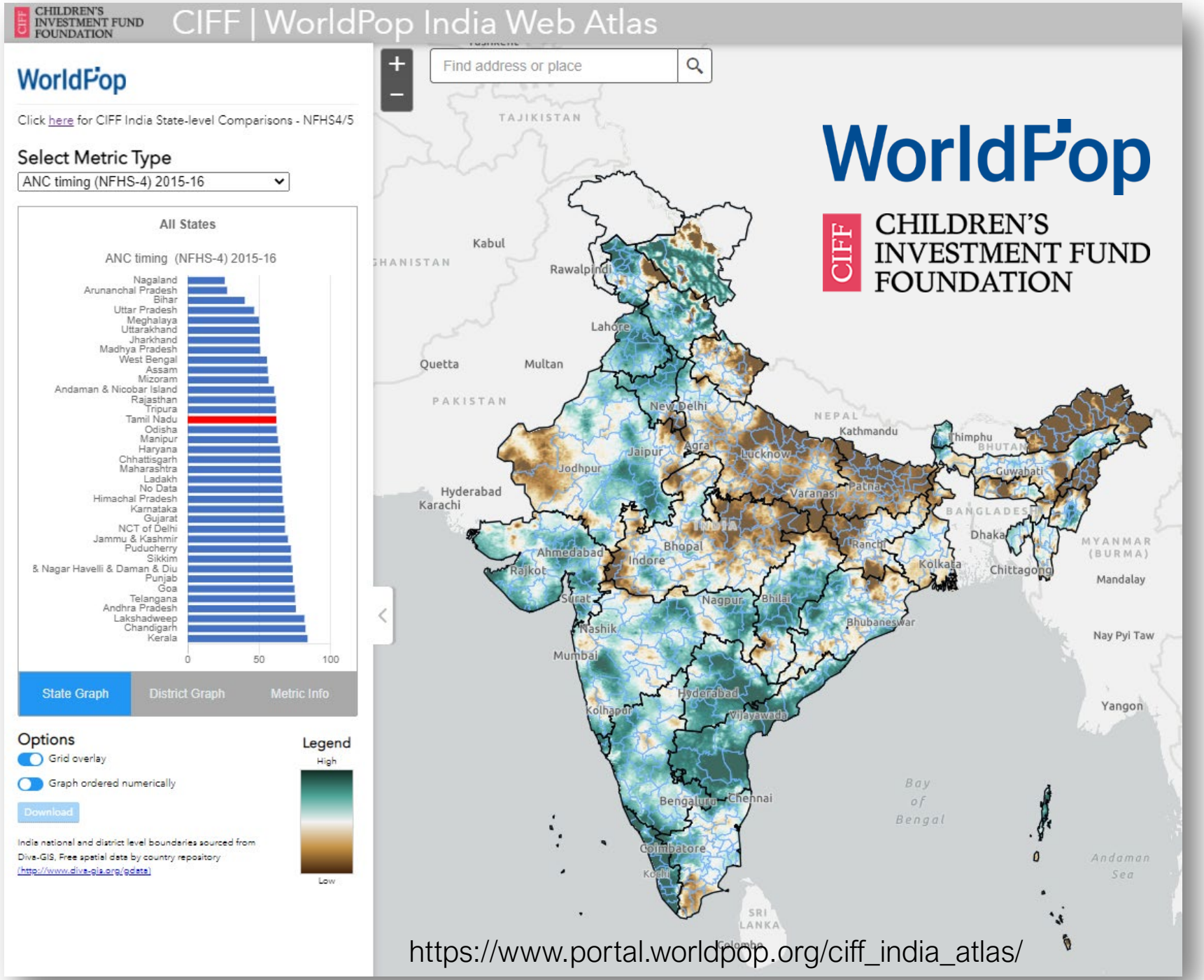


Proportion living on less than $1.25 a day



Proportion receiving MCV first dose

- **Girl Capital**
  - Contraceptive prevalence (NFHS-4) 2015-16
  - NAR secondary - girls (%) (NFHS-4) 2015-16
  - NAR secondary - boys (%) (NFHS-4) 2015-16
  - Completed secondary education (women) (IHME) 2010
  - Completed secondary education (women) (IHME) 2015
  - **Completed secondary education (women) (IHME) 2017**
  - Child marriage- girls (below 15) (NFHS-4) 2015-16
  - Child marriage- girls (below 18) (NFHS-4) 2015-16
  - Child marriage (below 18) (AHS) 2012-13
  - Teenage pregnancies (NFHS-4) 2015-16
  - Teenage pregnancies (AHS) 2012-13
  - Female labour force participation (NFHS-4) 2015-16
  - Female labour force participation (AHS) 2012-13
  - Women decision-making on health (NFHS-4) 2015-16
  - Total Fertility Rate (NFHS-4) 2015-16
  - ASFR 15-19 (NFHS-4) 2015-16
  - ASFR 20-24 (NFHS-4) 2015-16
  - Maternal mortality (NFHS-4) 2015-16
  - Experience of Physical Violence (NFHS-4) 2015-16
  - Comprehensive knowledge of HIV (NFHS-4) 2015-16
- **Climate Change**
  - Satellite-derived nightlights (VIIRS)
  - Air Quality (SEDAC)
- **Child Health and Development**
  - Low Birth Weight (NFHS-4) 2015-16
  - Low Birth Weight (AHS) 2012-13
  - ANC 4+ (NFHS-4) 2015-16
  - ANC timing (NFHS-4) 2015-16
  - ANC screening for infections - urine sample (NFHS-4) 2015-16
  - ANC screening infections - blood sample (NFHS-4) 2015-16
  - Iron+folic acid (IFA) during pregnancy (%) (NFHS-4) 2015-16
  - Child mortality rate (Geographic Insights Lab)
  - **Neonatal mortality rate (Geographic Insights Lab)**
  - Still birth rate (NFHS-4) 2015-16
  - Stunting prevalence (NFHS-4) 2015-16
  - Wasting prevalence (IHME) 2010
  - Wasting prevalence (IHME) 2015
  - Wasting prevalence (IHME) 2017
  - Vitamin A supplements (children 6-59 months) (%) (NFHS-4) 2015-16
- **Child Health and Development - CIFF Evaluations**
  - Low Birth Weight (CIFF Dakshata PHFI RJ) 2017
  - Low Birth Weight (CIFF Dakshata PHFI RJ) 2018
  - Low Birth Weight (CIFF Dakshata PHFI RJ) 2019
  - Low Birth Weight (CIFF Dakshata PHFI RJ) Mean
  - Low Birth Weight (CIFF Dakshata PHFI AP) 2017-18
  - Low Birth Weight (CIFF Dakshata PHFI AP) 2018-19



https://www.portal.worldpop.org/ciff_india_atlas/

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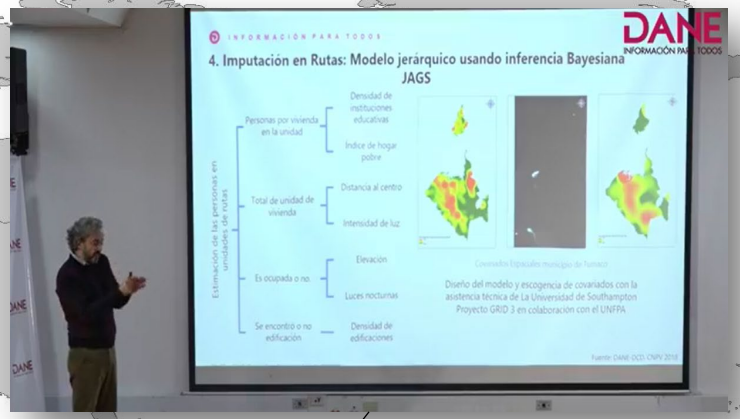
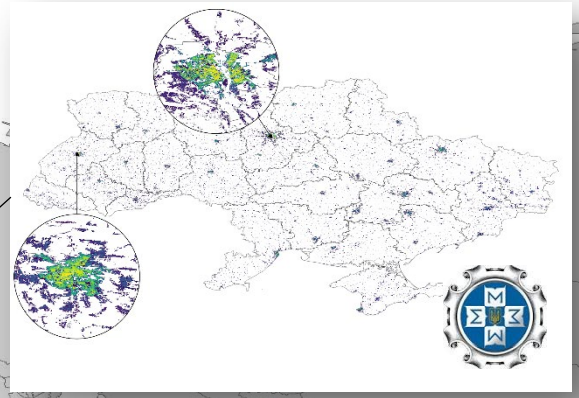
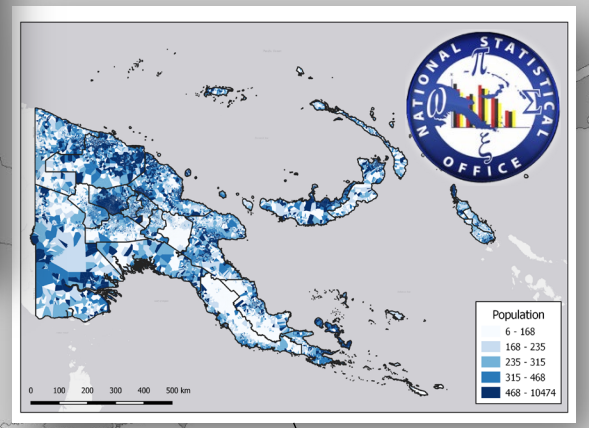
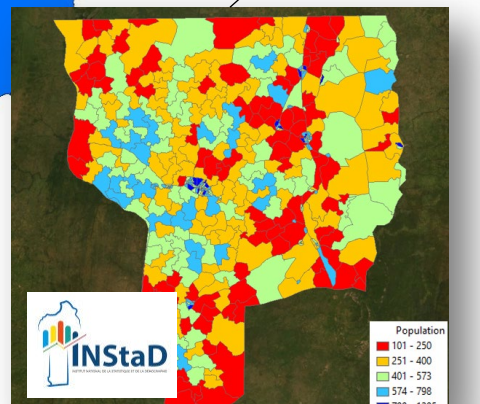
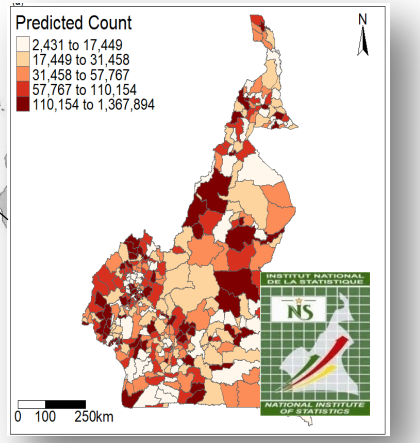
Government co-development, support











Countdown to 2030

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Co-development and training

Statistical population modelling for census support

Statistical population modelling for census support

Last compiled on 2021-09-24

WorldPop

This website contains the teaching materials for the **Statistical Population Modelling for Census Support workshop**, funded by the United Nations Population Fund. It has been developed at the WorldPop Research Group, University of Southampton.

It has been first taught to the Brazilian Stats Office, Instituto Brasileiro de Geografia e Estatística (IBGE), in October 2021.

Material

- Introduction
- Tutorial 1: How to think about population as a Bayesian?
- Tutorial 2: How to model large-scale spatial variations?
- Tutorial 3: How to model small-scale spatial variations?
- Tutorial 4: Advanced model diagnostics and prediction

Raw code

The raw code of the website and tutorials, including the R code can be found here.

Acknowledgements

This tutorial was written by Edith Darin from WorldPop, University of Southampton and Douglas Leasure from Leverhulme Centre for Demographic Science, University of Oxford, with supervision from Andrew Tatem, WorldPop, University of Southampton. Funding for the work was provided by the United Nations Population Fund (UNFPA).

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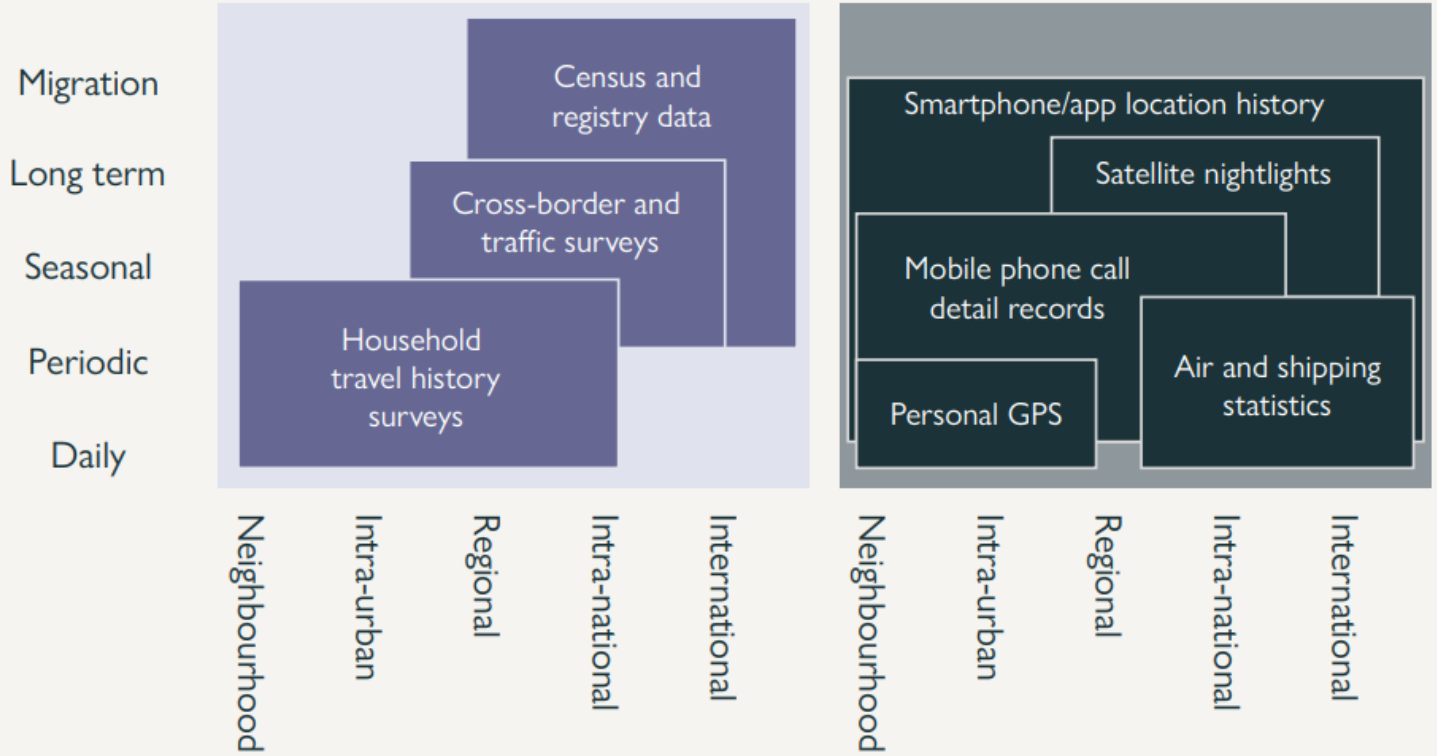
https://wpgp.github.io/bottom-up-tutorial/

Figure 1. Sources of data for measuring population mobility

TRADITIONAL DATA SOURCES

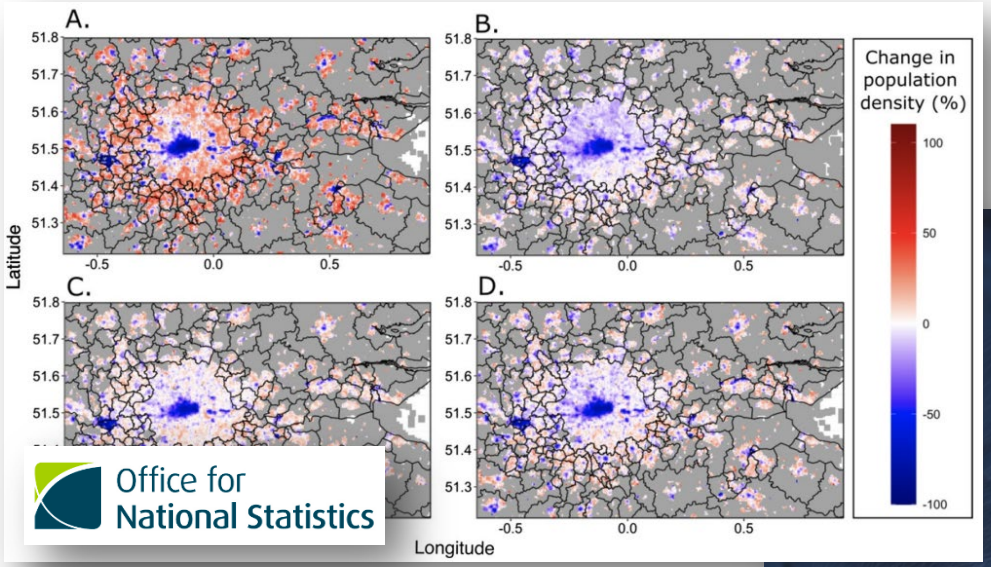
NEW DATA SOURCES

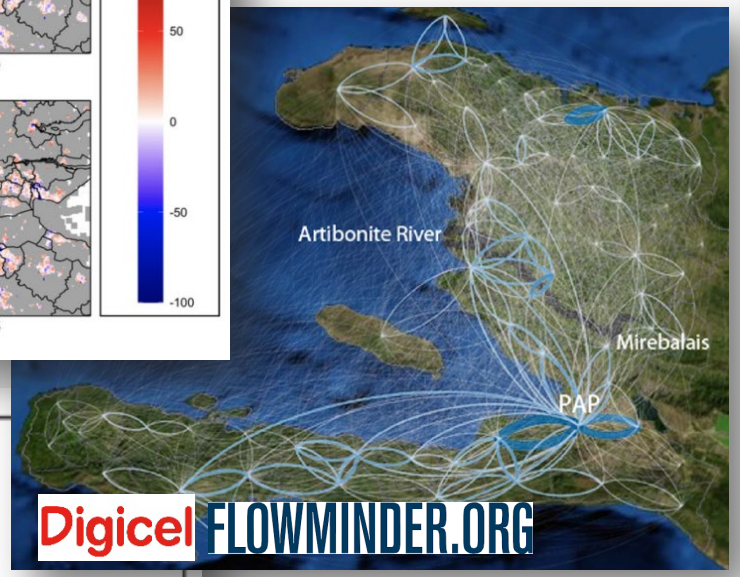


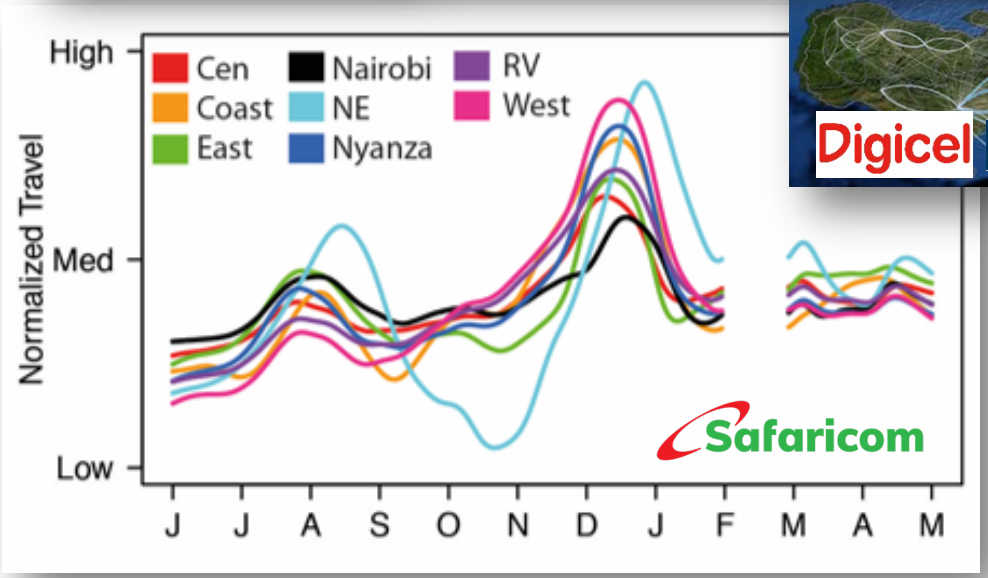
IOM UN MIGRATION

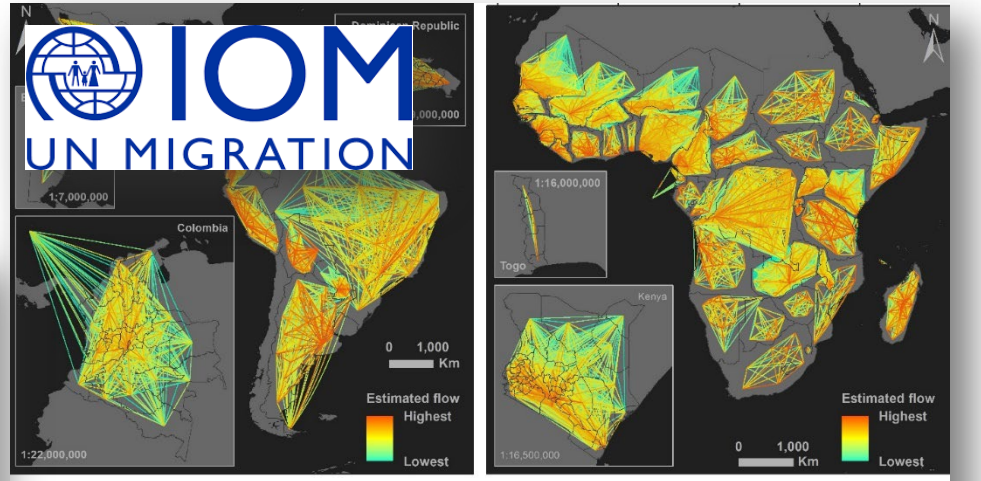
Tatem et al (2023) IOM Practitioners Handbook

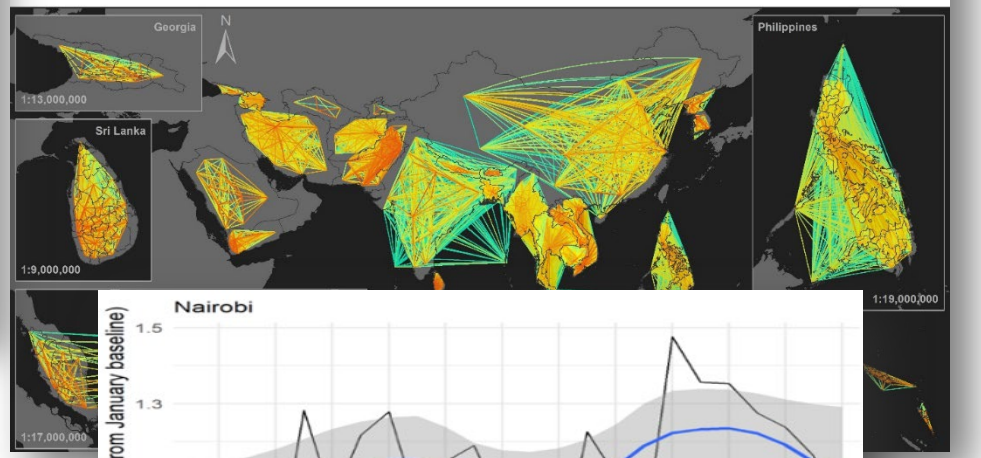
Mapping population movements across scales

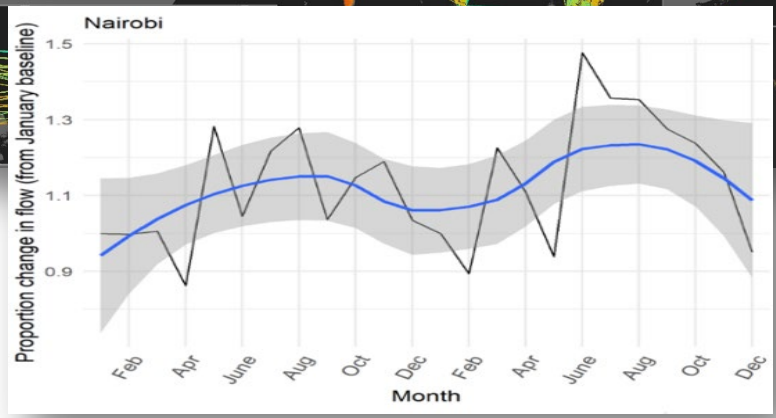






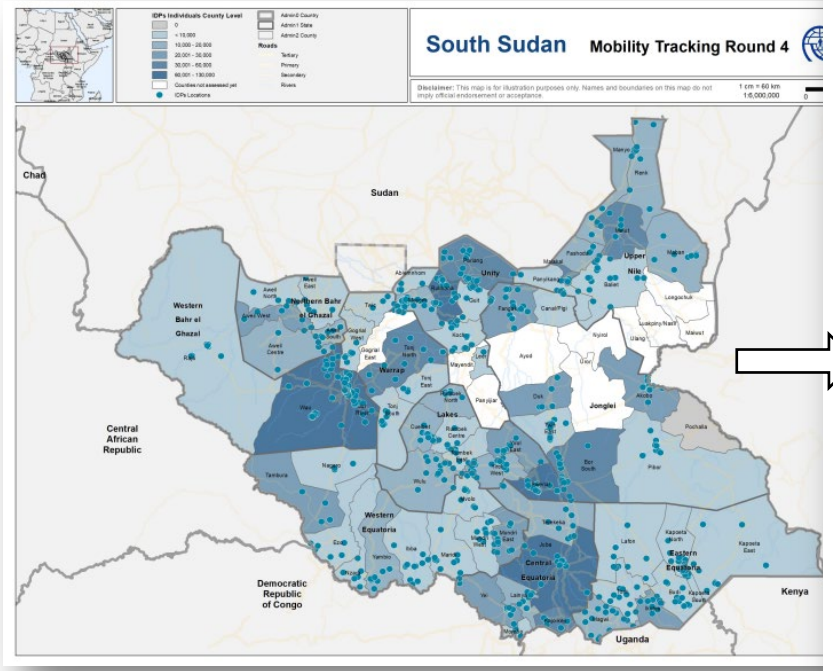


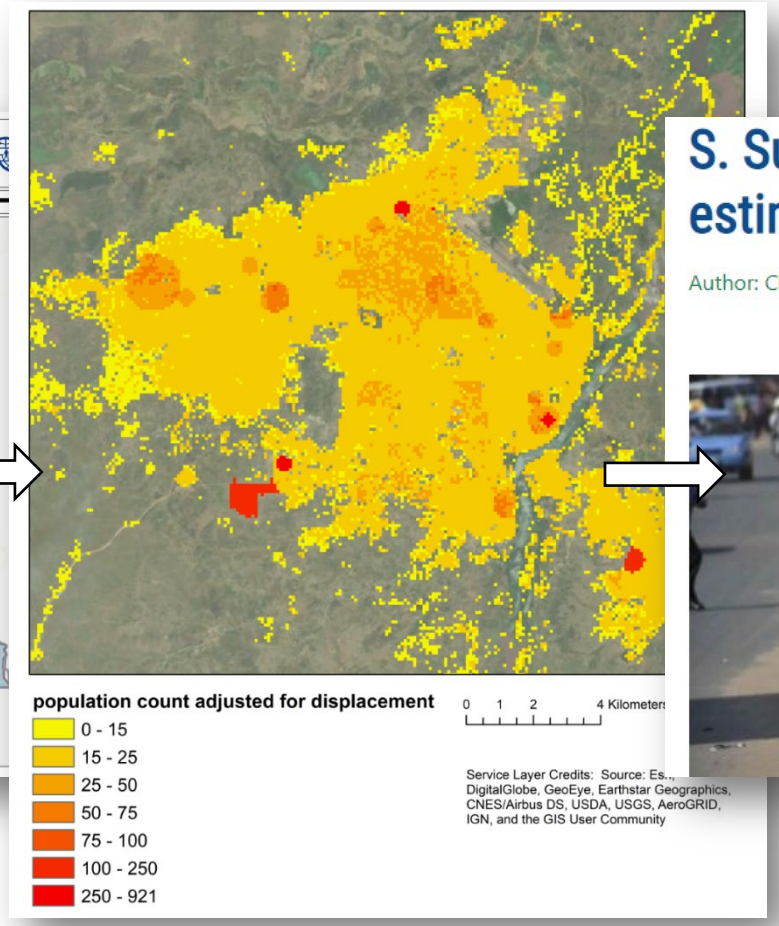




Ruktanonchai et al (2021) Nature Sci Reports; Shepherd et al (2022) IJHG; Wesolowski et al (2017) Nature Comms; Sorichetta et al (2020)

Integrating mobility data into population estimates





UNHCR The UN Refugee Agency

International Organization for Migration (IOM) The UN Migration Agency
DTM

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GRID3 GEO-REFERENCED INFRASTRUCTURE AND DEMOGRAPHIC DATA FOR DEVELOPMENT

UNFPA

Dooley et al (2021) https://wopr.worldpop.org/?SSD/Population/v2.0

Key messages

- The wide variety of needs, data and changing situations mean that one-size-fits-all population mapping and modelling approaches are often not the most appropriate

- Small area population estimates are never perfect – important to validate outputs, and understand, measure and communicate uncertainties

- Population numbers can be highly sensitive and political - local ownership, co-development with governments, open methods and data, are vital for developing trust and seeing outputs used

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