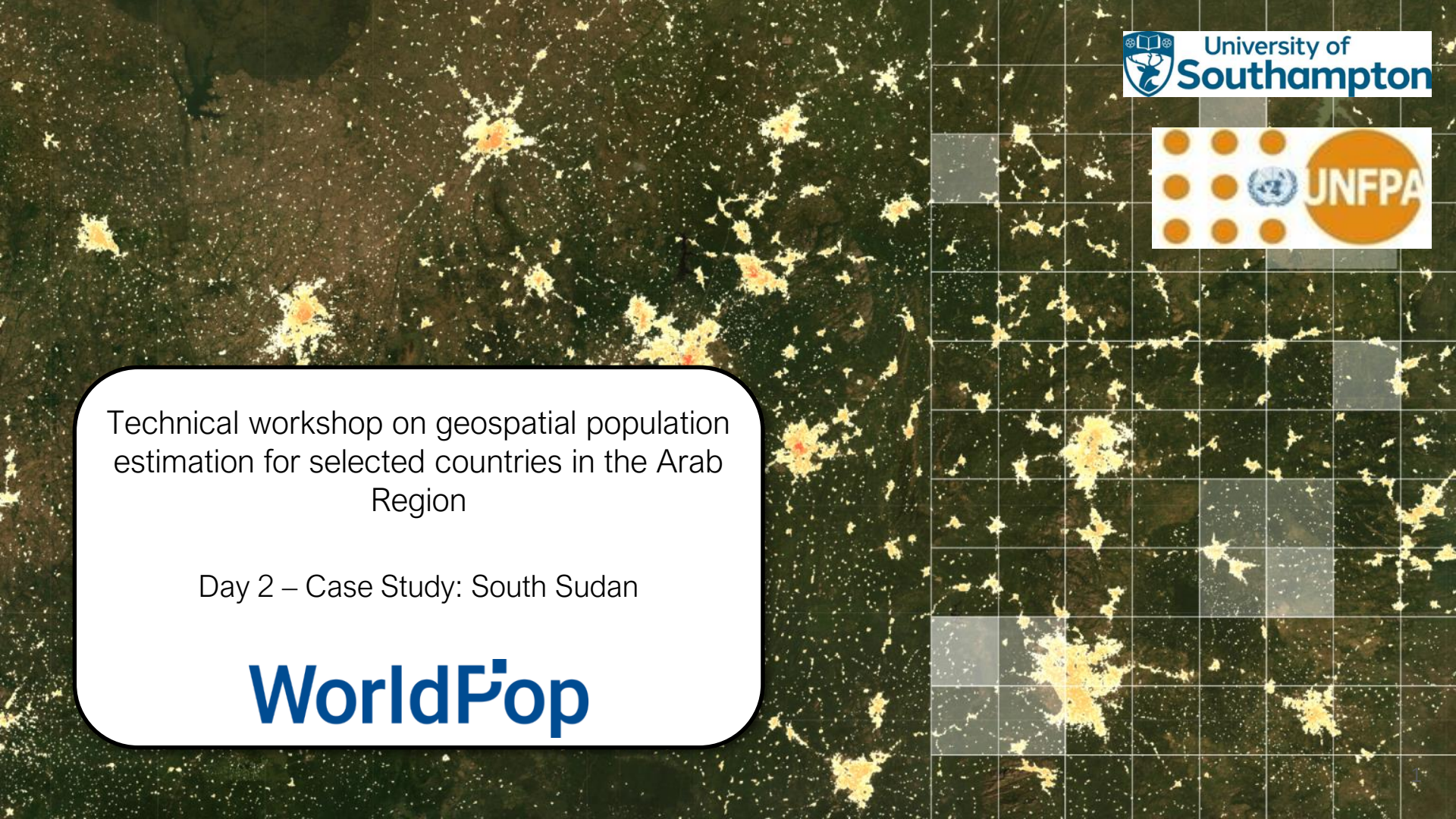

University of Southampton

UNFPA

Technical workshop on geospatial population estimation for selected countries in the Arab Region

Day 2 – Case Study: South Sudan

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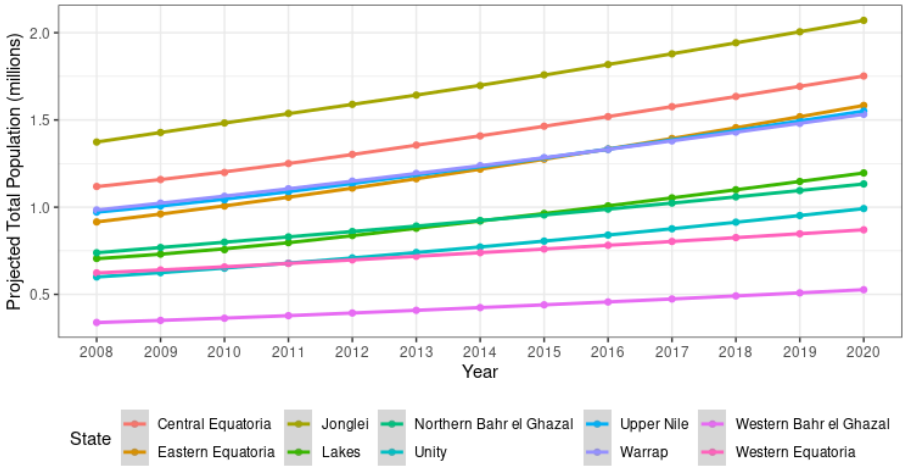
South Sudan – background

- South Sudan context:
  - Last census in 2008
  - Independence in 2011
  - Conflicts, civil war 2013 – 2020
  - Famine in 2017
  - Floods (2020-2021)
  - Return migration
  - > 2 million IDPs
  - > 2 million refugees

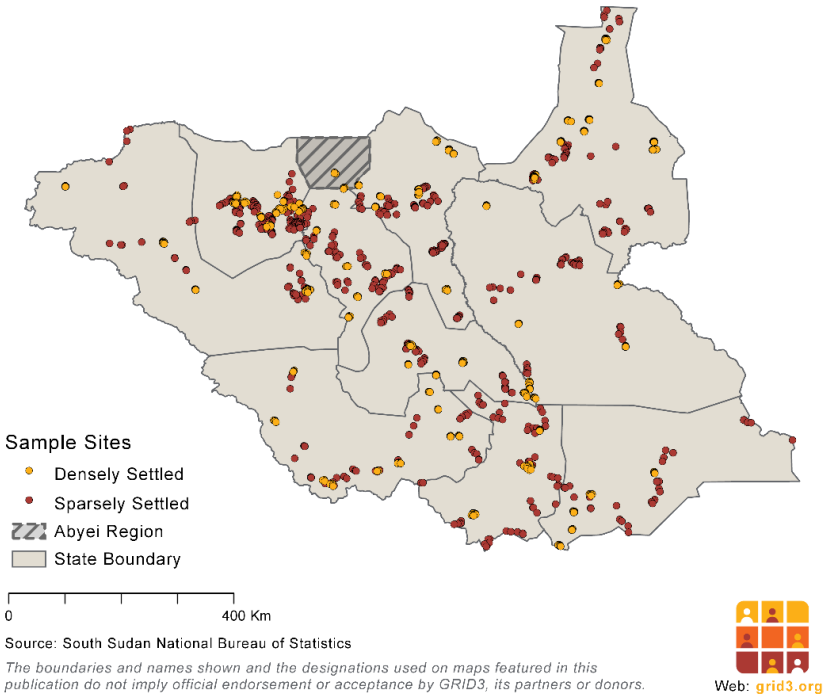
- Population Estimation Survey (PES)
  - Started in 2019
  - New population estimate
  - Led by the National Bureau of Statistics (NBS). Engagement led by UNFPA with support of GRID3
  - WorldPop responsible for assisting with sample design and analysis



Despite the challenging context of the country, the official population projections still make the strong assumption of smooth, uninterrupted growth.

Sample design

- Population Estimation Survey provided enumerated population counts
- Estimate local variation in population density and demographic characteristics
  - Stratified random sample
  - Dense/sparse settled + 10 state areas
  - Randomly selected *payams*
  - Randomly sampled “seed” points
  - Sample not based on past enumeration areas or frames



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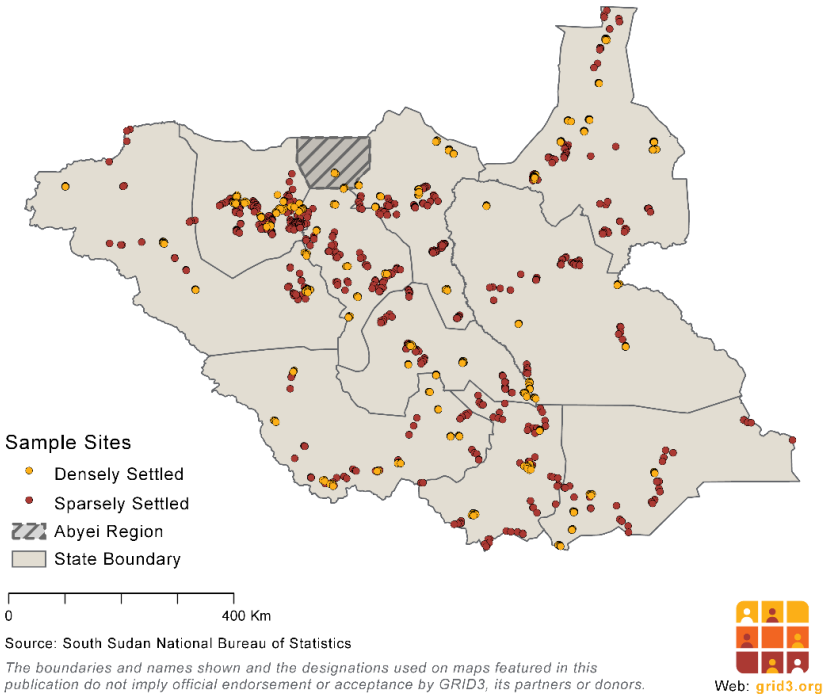
Sample design

- Constraints:
  - Limited number of teams
  - Minimise travel
  - Include all states
- Simulation study for size:
  - Using top-down estimate of the population (SSD v.1.0)
  - Implement different designs and sample sizes
  - Compare ability to recover true population



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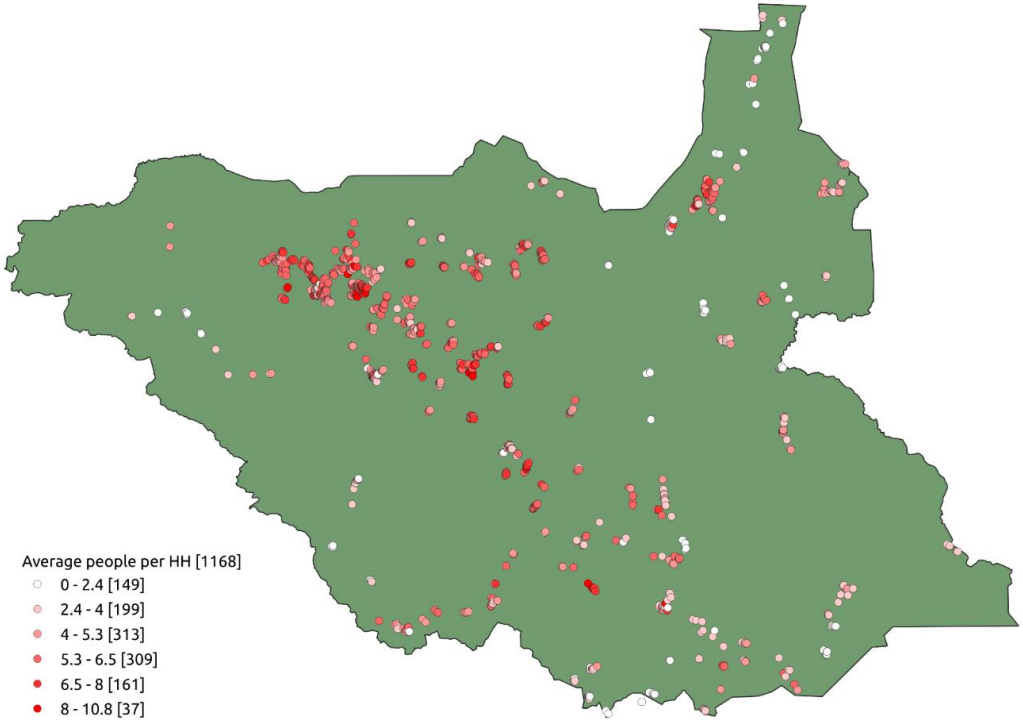
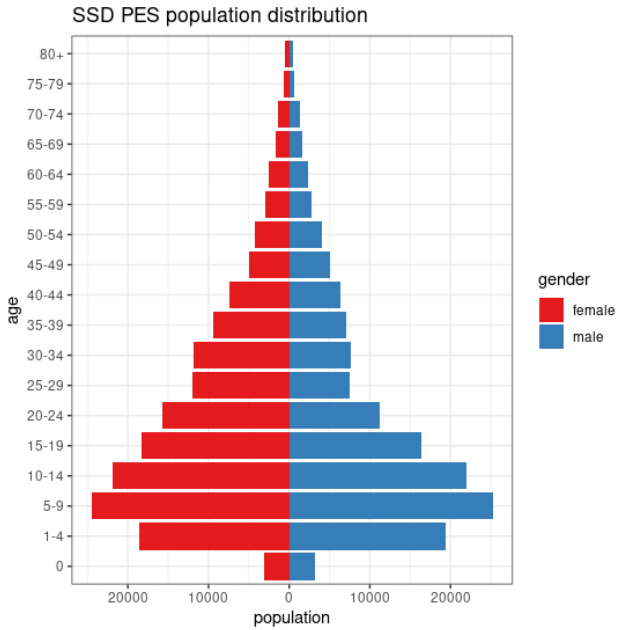
Data collection

- Questionnaire expanded to include HH survey
  - Input from all government and UN
- Conducted April/May – July 2021
- Fieldwork carried out by NBS staff
  - Supported by other government offices / UN
- Tablet data collection using ESRI Survey123

- Challenges:
  - Rain / flooding – impassable roads
  - Inaccessible areas due to conflict
  - Lack of electricity / internet
  - Few landmarks or identifiers to locate sites

Data collection - Results





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Modelling approach

- Two stage method for total population:

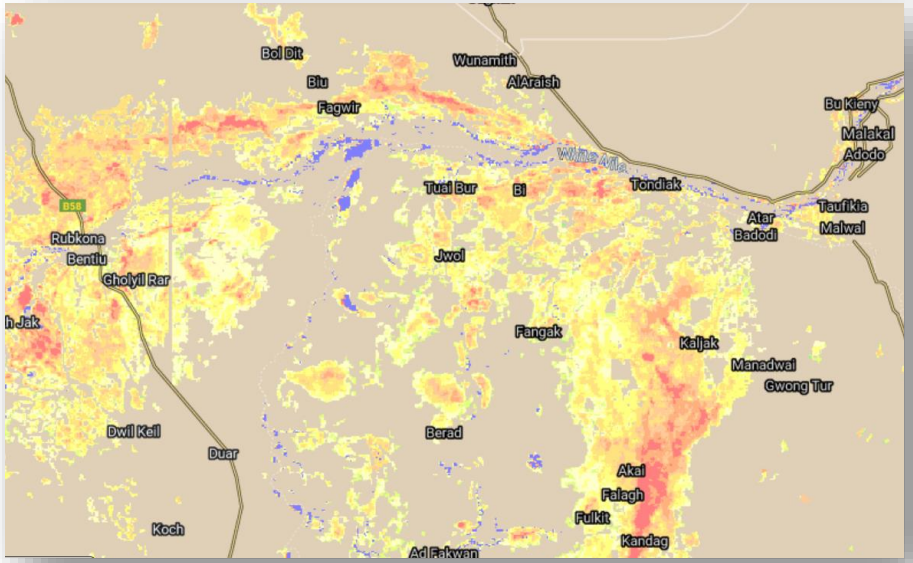
1. **Bottom-up model**
    - Using PES data at cluster level (including vacant locations)
    - Predict “baseline” population
    - Excludes IDPs and IDP camp locations

2. **Assign IDPs** to camps and community sites
    - Digitise the boundary of known camps
    - Point locations of community sites
    - Assign IOM Displacement Tracking Matrix population to camps
    - Randomly sample settled pixels in a buffer and assign HH to community

Modelling approach

- Covariates:
  - Flood maps
  - Conflict locations
  - Distance to main roads
  - Vegetation index

- Age-sex modelled separately
  - Dirichlet-Multinomial model at state x settlement type
  - Posterior mean proportion in each group applied to population estimates



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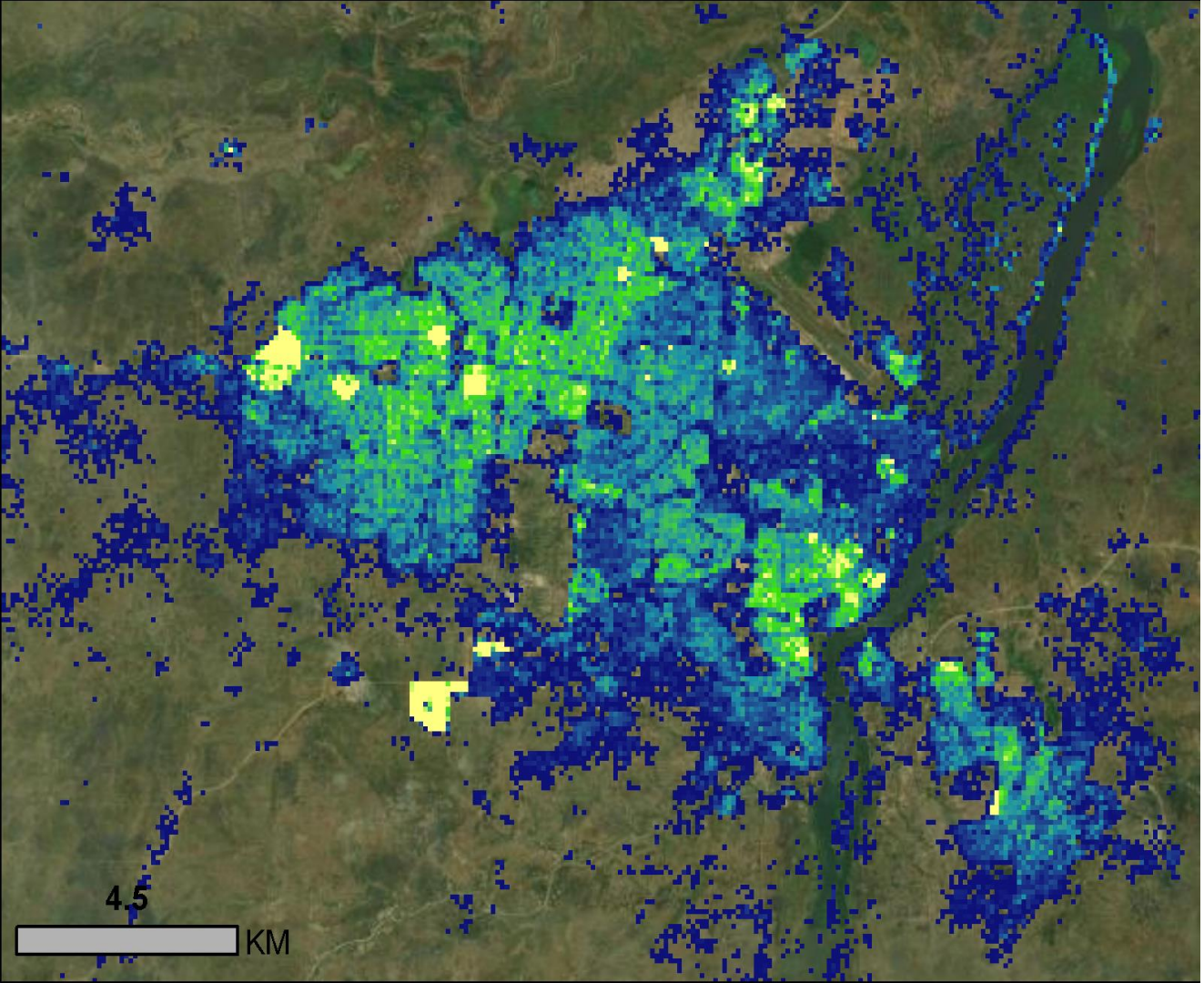

Example of Juba

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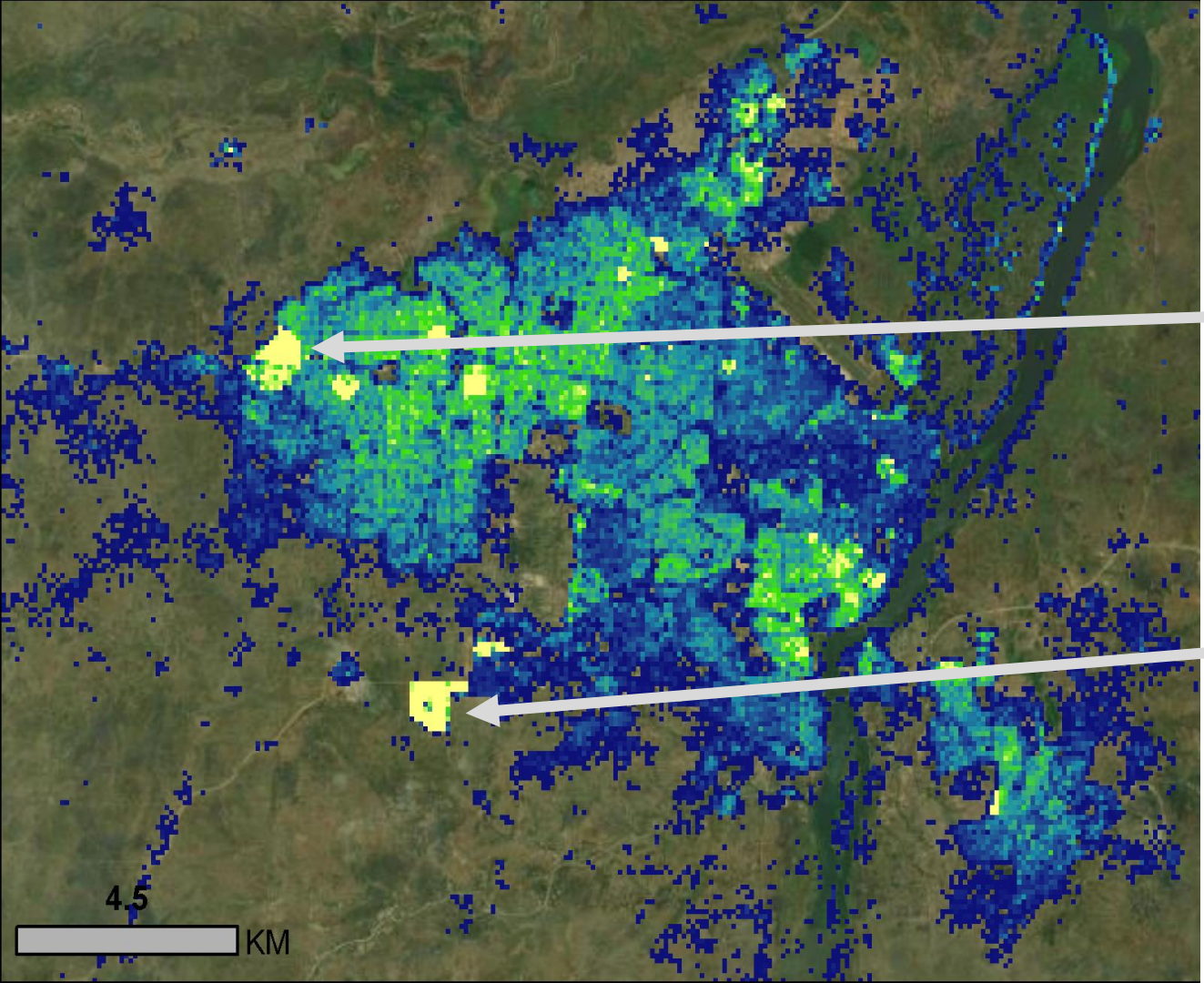
Example of Juba



IDP locations reported in the community. Added to the baseline population

IDP/PoC camp near UN compound. Un-modelled population assigned to settled pixels in boundary

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Results and Reflections

- Government involvement and endorsement of the project was key
  - Engagement and buy-in of many stakeholders
  - But it affected timelines
  - And must be comfortable releasing control

- Many technical, logistical, political, economic challenges
  - Lack of electricity, internet, computers and software
  - Limited transportation and communication for fieldwork
  - Capacity strengthening processes

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Results and Reflections

- Data and analysis
  - Required knowledge of surveys, questionnaire design, fieldwork and population modelling
  - Messy data forced compromises (e.g. cluster definitions)

- Results
  - Overall the model seems accurate
  - But large uncertainty in some predictions
  - Lots of local-scale variation that isn't well explained

- Opportunities for improvements
  - Modelling population components
    - people per household, HH per building, buildings
  - Updated settlement information on IDP camps and locations
  - Probabilistic model of displaced populations
  - Better accounting for nomads and seasonal migrants

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Additional examples....

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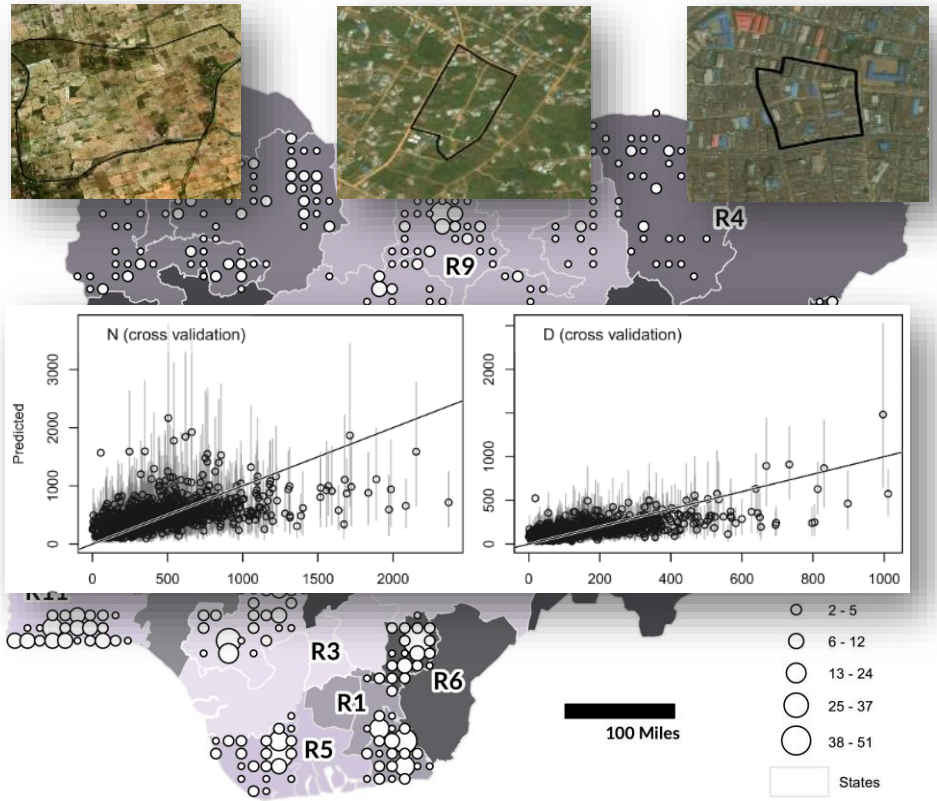
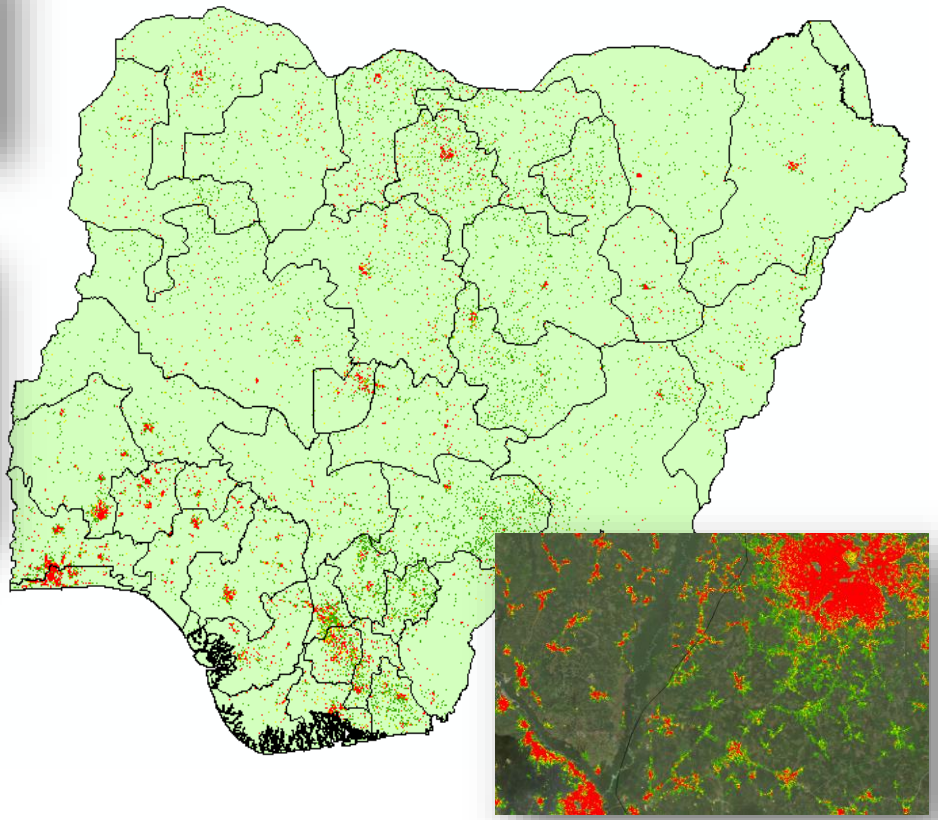
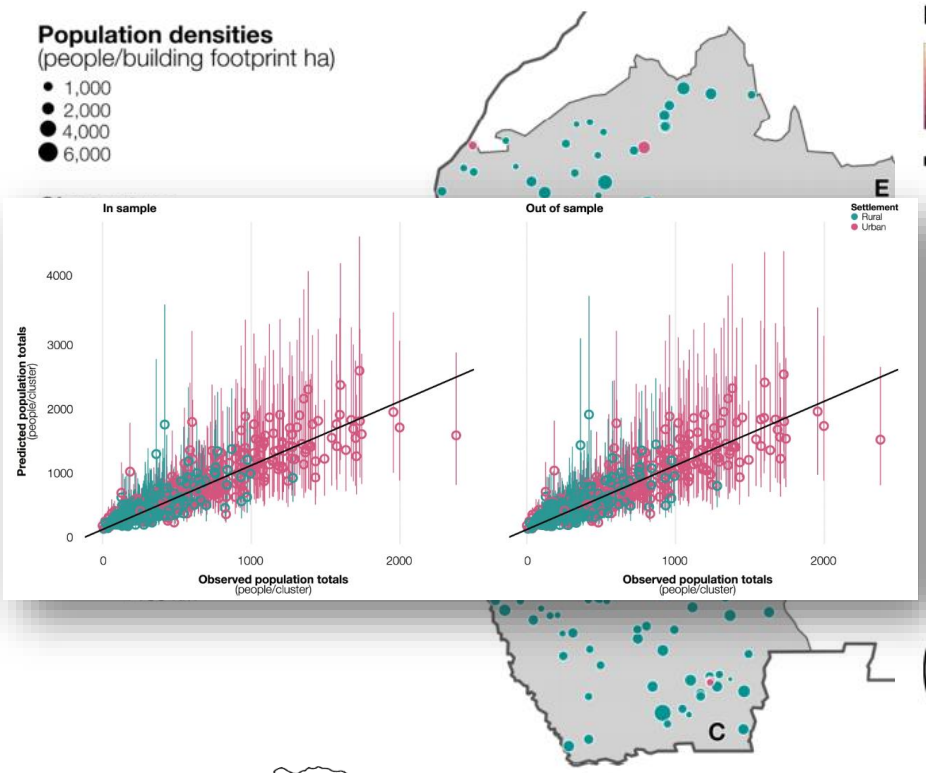
Nigeria: Bespoke enumeration surveys

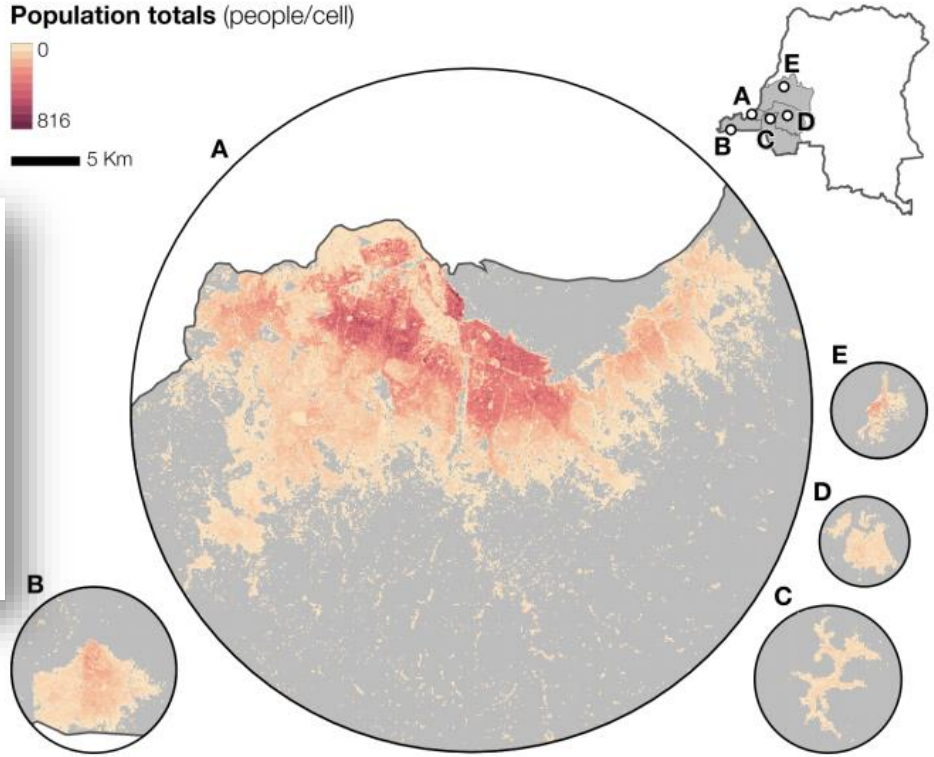




Leasure et al. (2020) PNAS
https://wopr.worldpop.org/?NGA/Population/v2.0

DR Congo: Bespoke enumeration surveys





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