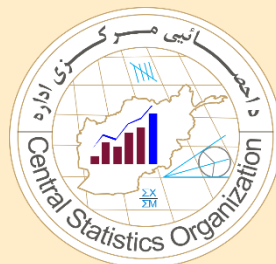


Remote Sensing Technology Complementing Official Statistics

High-resolution population mapping in Afghanistan



- ❑ Last census conducted in 1979; insecurity prevented a recent one; current estimates based on 1979 baseline population;
- ❑ Since 2011 CSO has been conducting a form of rolling census, the Socio-Demographic and Economic Survey (SDES) which includes enumeration for 50% of households (to date, the survey has covered 12 of 34 provinces);
- ❑ Challenge: Lack of reliable current disaggregated population data at provincial, district level;
- ❑ Government requested UN to assist CSO in estimating spatially disaggregated population data - Collaborative partnership of Government/UNFPA/Flowminder/WorldPop

Objective

To generate population counts disaggregated by age and sex at district level for entire country;

Data sources

Survey data (SDES and micro census), GIS data and Satellite imagery;

Population estimation

Statistical modelling was used to estimate population counts for areas with no population data - “fill in the gaps”

Phase 1: Pilot phase March 2016 - based on SDES data of 3 provinces

Phase 2: Preliminary population estimates for all 34 provinces

- Preliminary dataset delivered October 2016
- Inputs: SDES data (9 provinces), micro-census survey data (for 19 provinces)
- Statistical model developed - population estimated for all districts without data

Phase 3: Final population estimates for all provinces expected by June 2017

Population estimation and mapping process involves:

1. Enumeration of population with ground-based surveys
2. Prediction of population estimates in un-surveyed areas – modelling based on ground surveys and satellite imaging
3. Spatial disaggregation of population estimates

- Socio-Demographic and Economic Survey (SDES)
- “Microcensus” survey

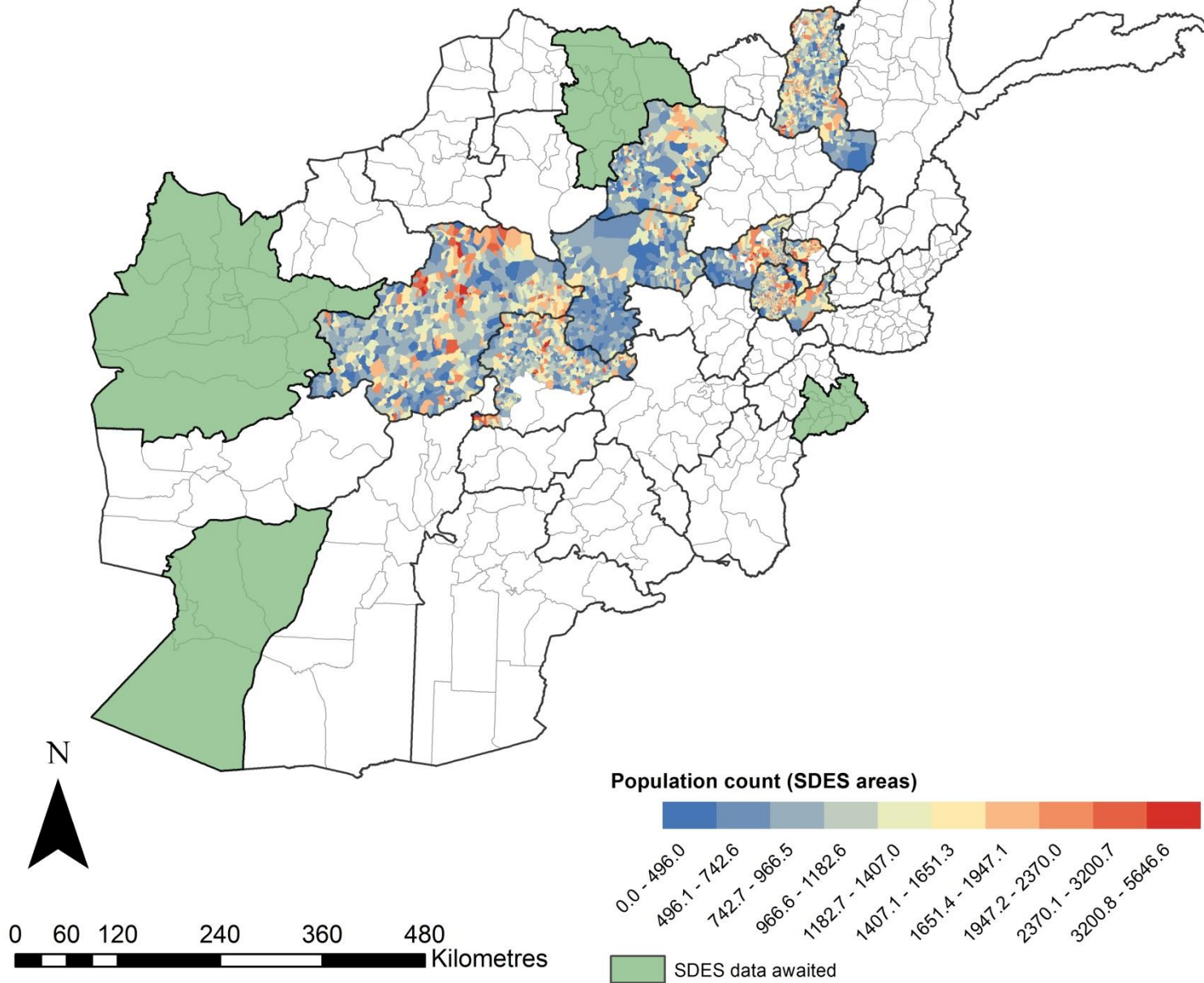


- Ancillary datasets
 - have a statistical relationship with population counts

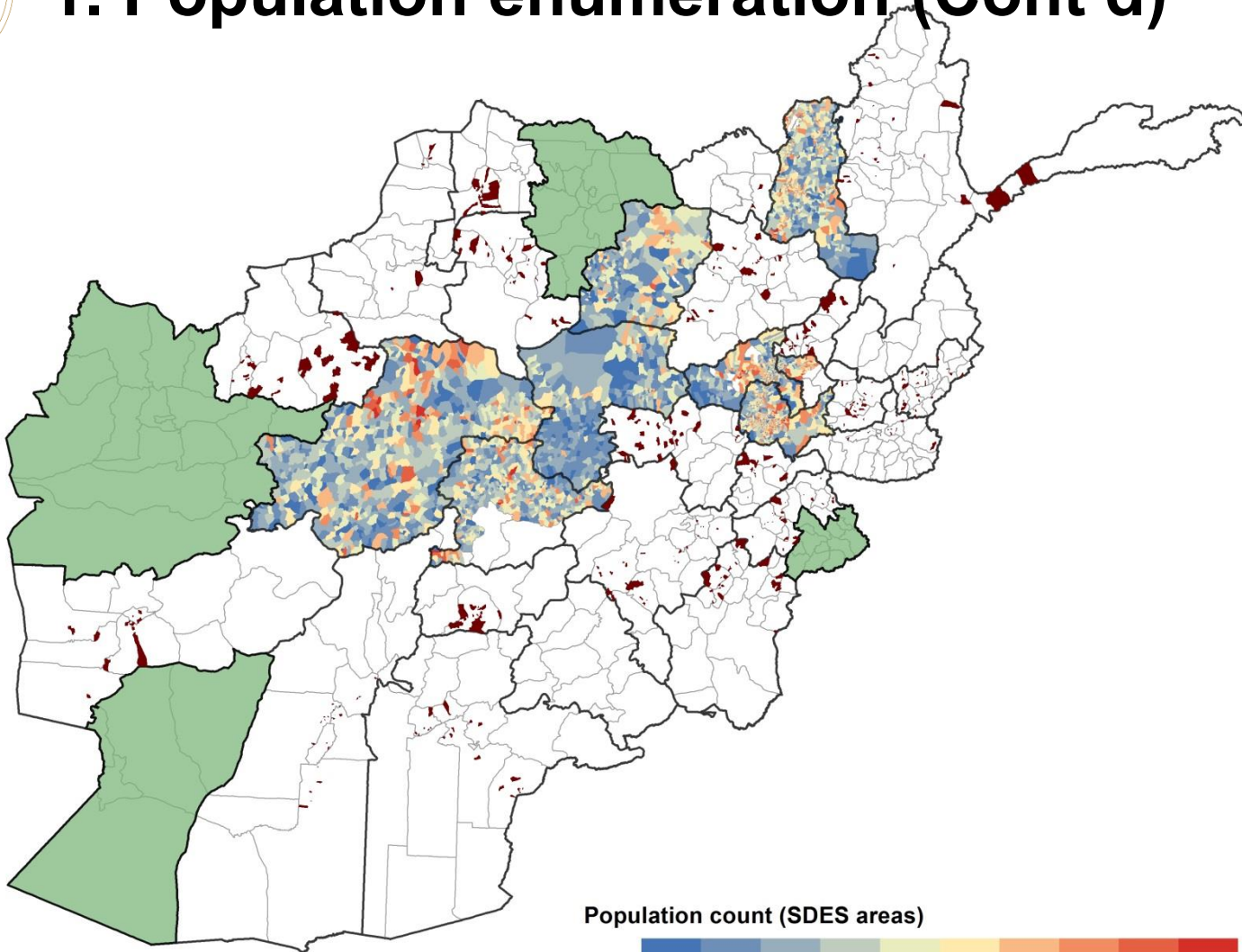


- Population estimates (broken down by age and sex)

1. Population enumeration



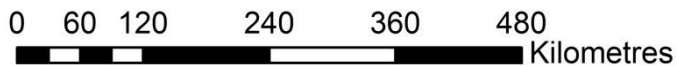
1. Population enumeration (Cont'd)



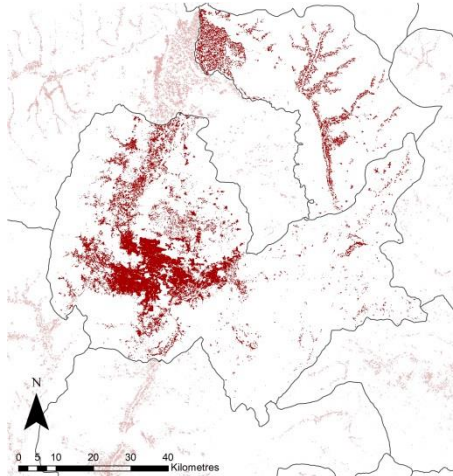
Population count (SDES areas)



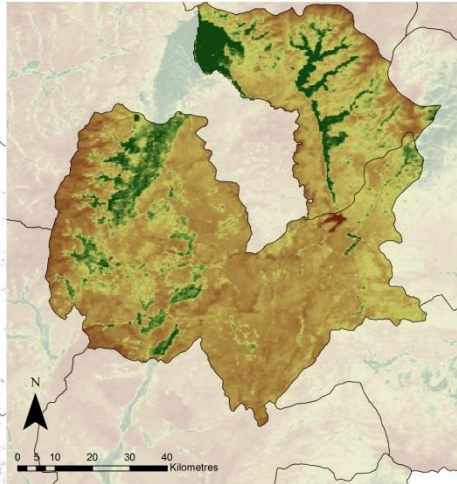
■ SDES data awaited
■ Microcensus survey data



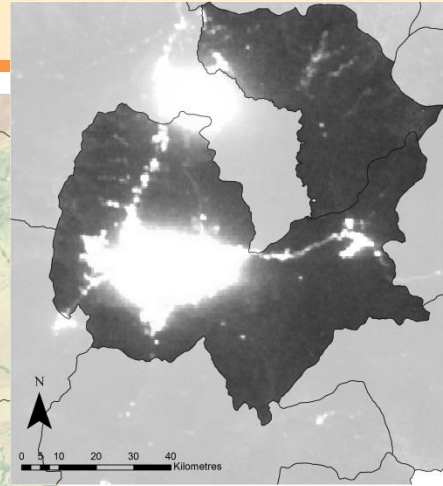
Example Ancillary datasets



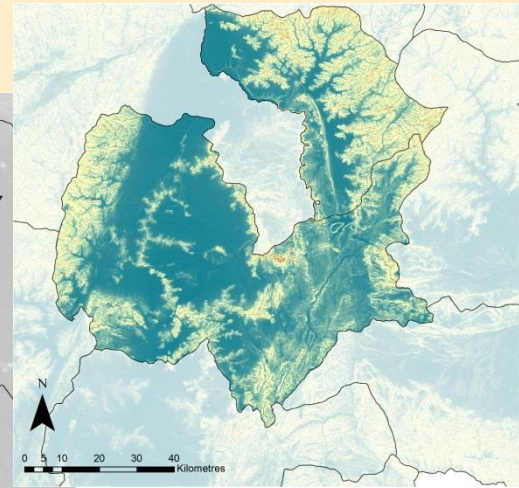
Number of compounds
& area settled



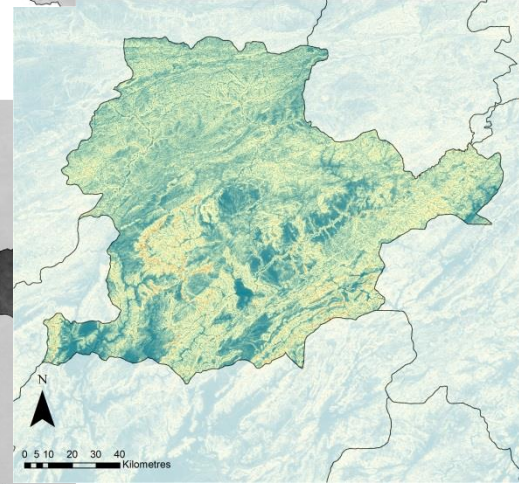
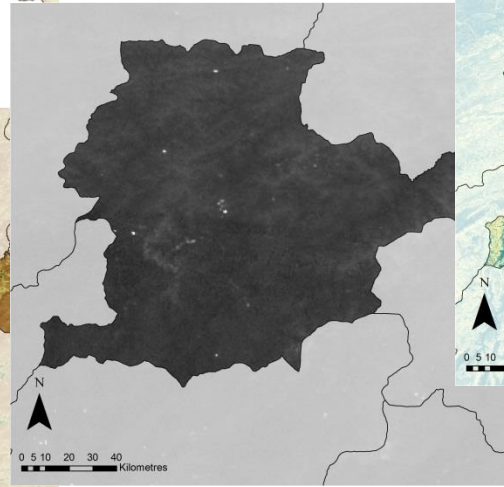
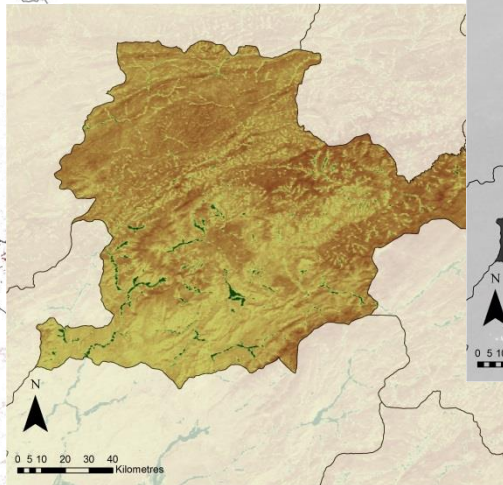
Vegetation index



Night-time lights



Slope

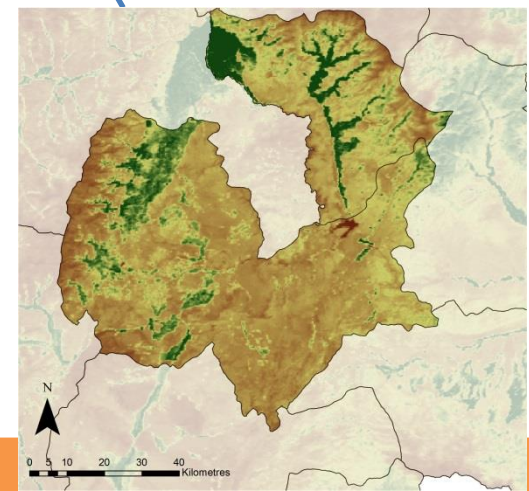
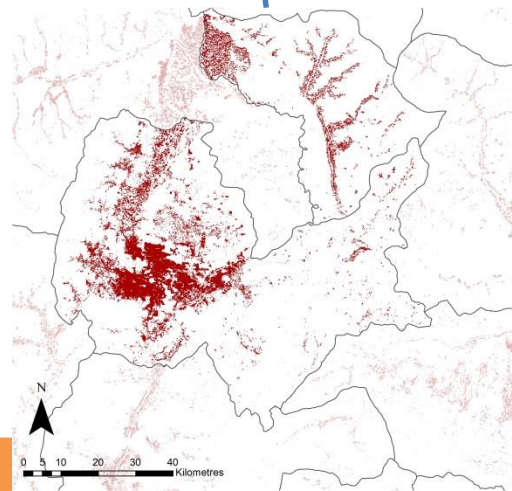
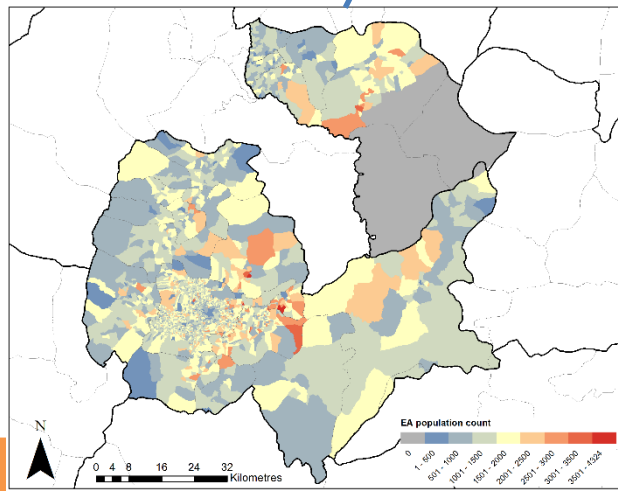


2. Predicting population numbers

Spatially explicit linear regression model selected for population prediction

$$Y_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_k x_{ki} + u_i$$

Where $Y_i = \text{Population Count}$ for EA i , α is the intercept, x_1 to x_k are the covariates with corresponding parameters β_1 to β_k , and u_i is a spatially structured random effect



Some of the variables with strong correlation

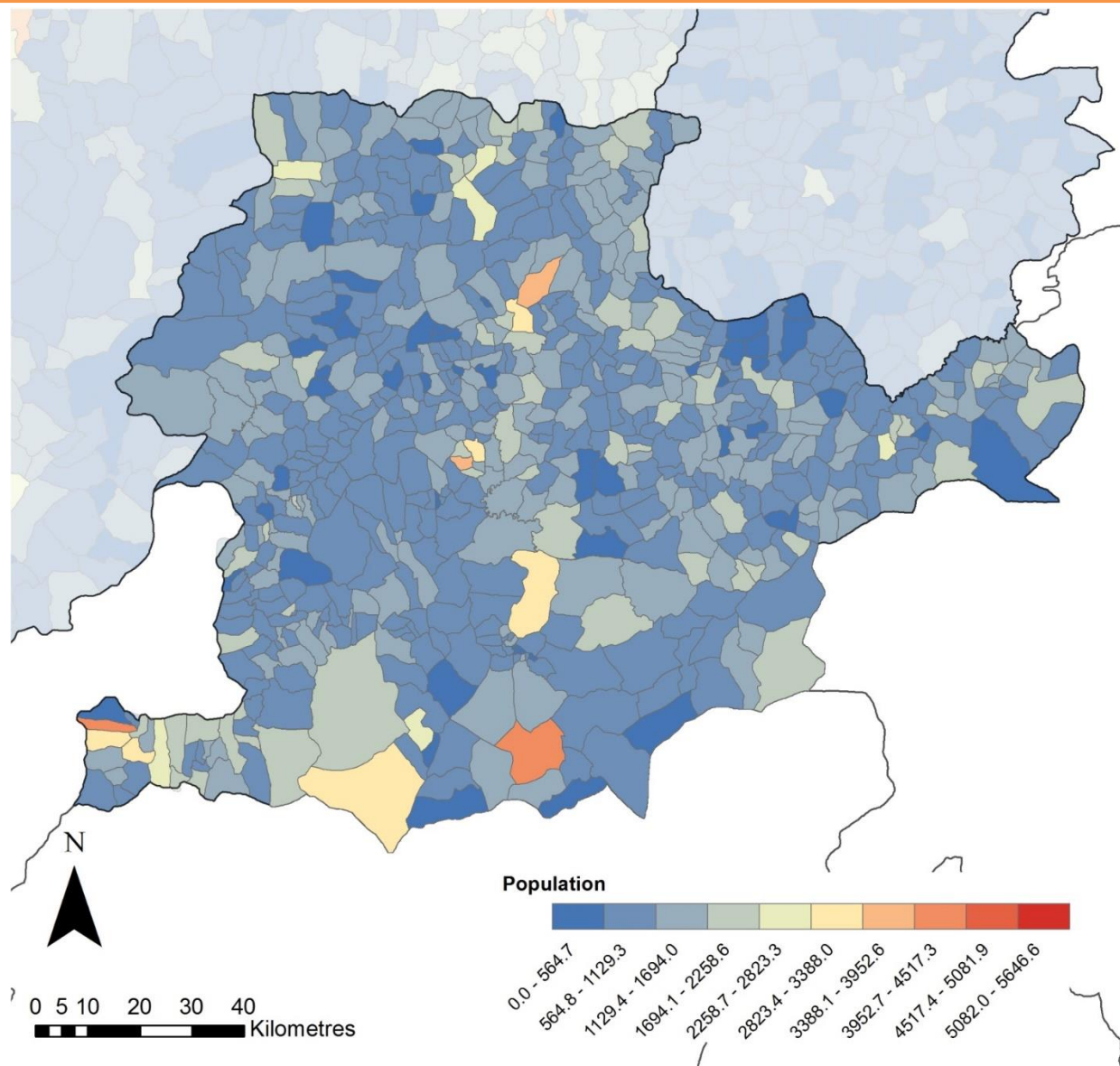
- Density of compound points within settled areas
- Proportion of the EA that is settled
- Enhanced Vegetation Index

3. Spatial disaggregation of estimates

EA-level population estimates



High-resolution spatially disaggregated population surface



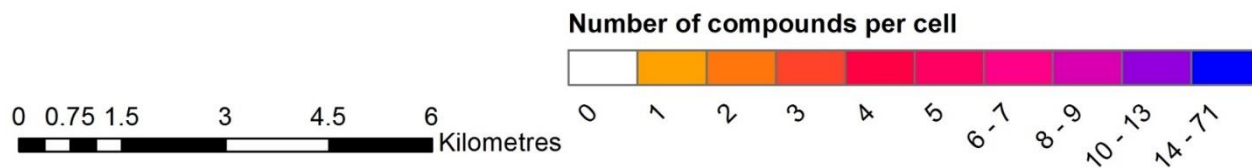
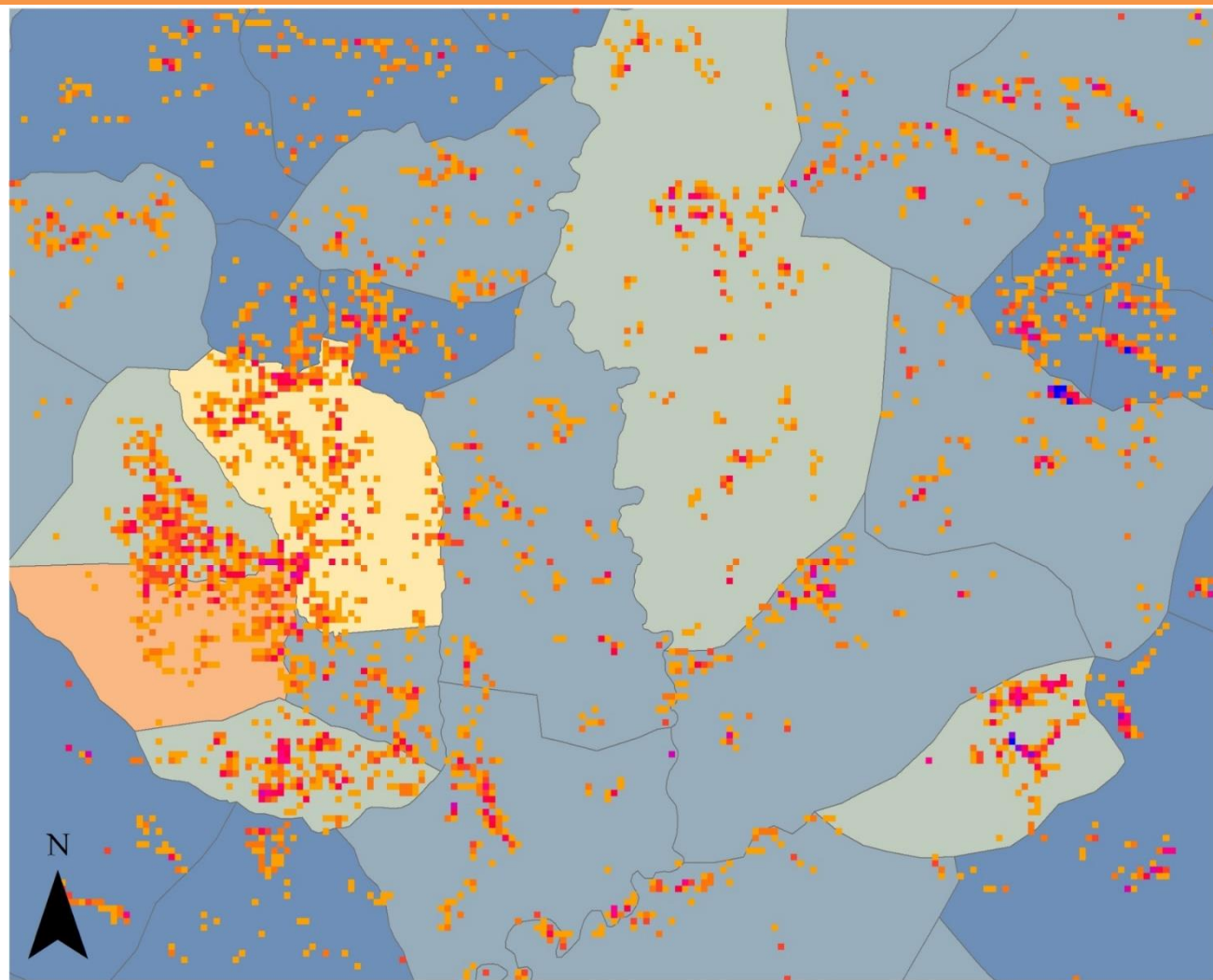
3. Spatial disaggregation of estimates

Population in each EA weighted by the number of compounds per grid cell.

No coloured cells = zero compounds/cell

Yellow cells = few compounds

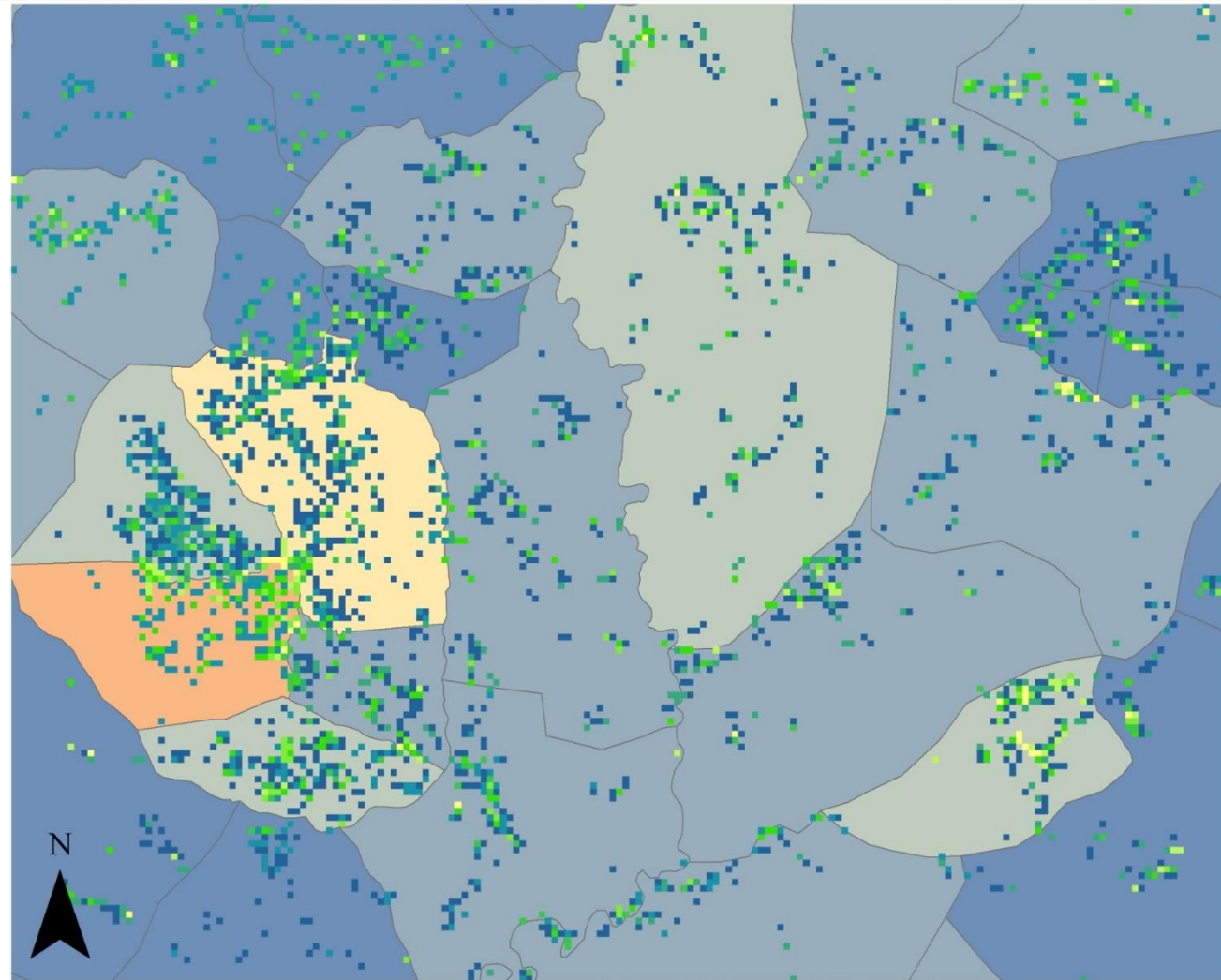
Purple/blue cells = many compounds



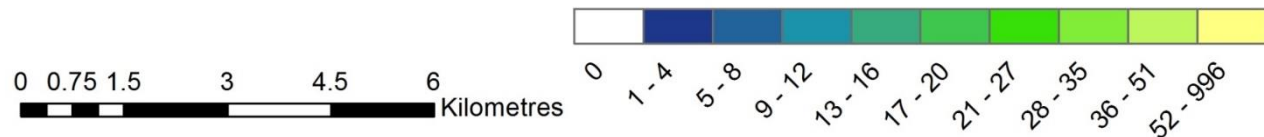
3. Spatial disaggregation of estimates

which gives....

Estimated
population
count per
hectare

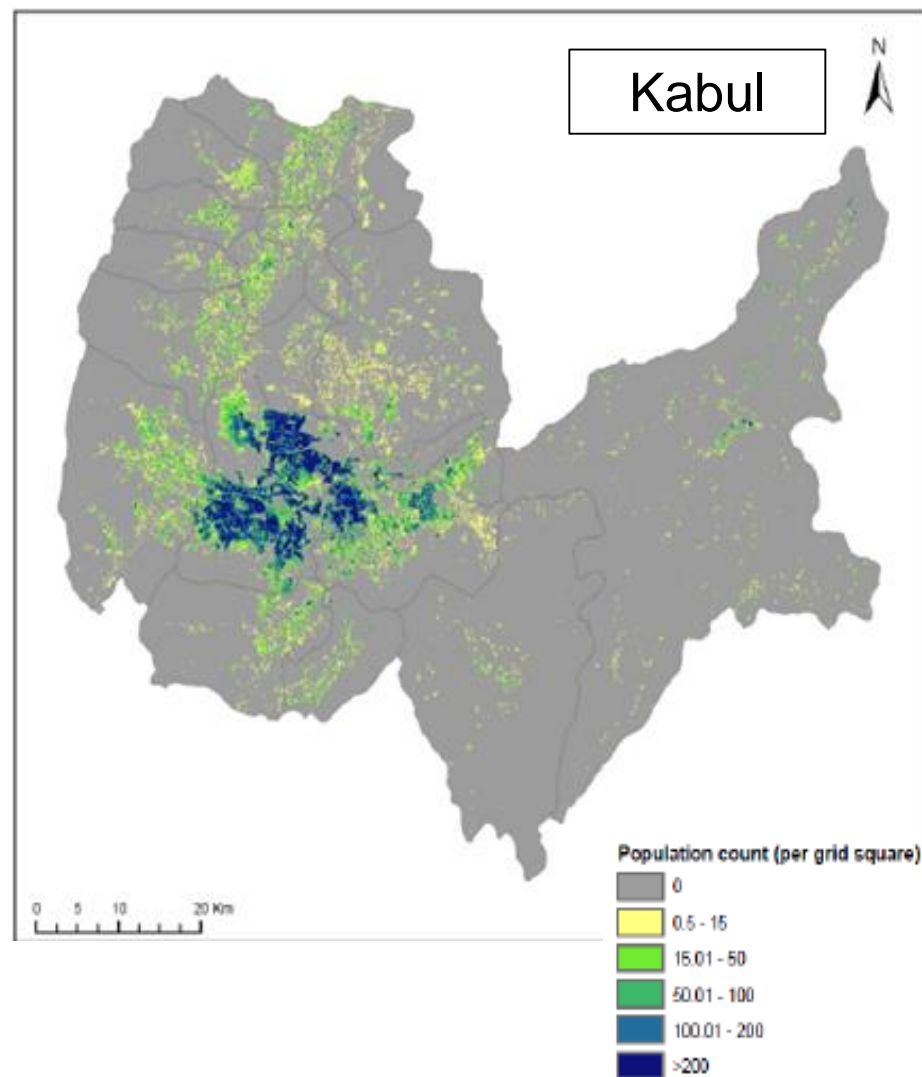


Estimated population per hectare

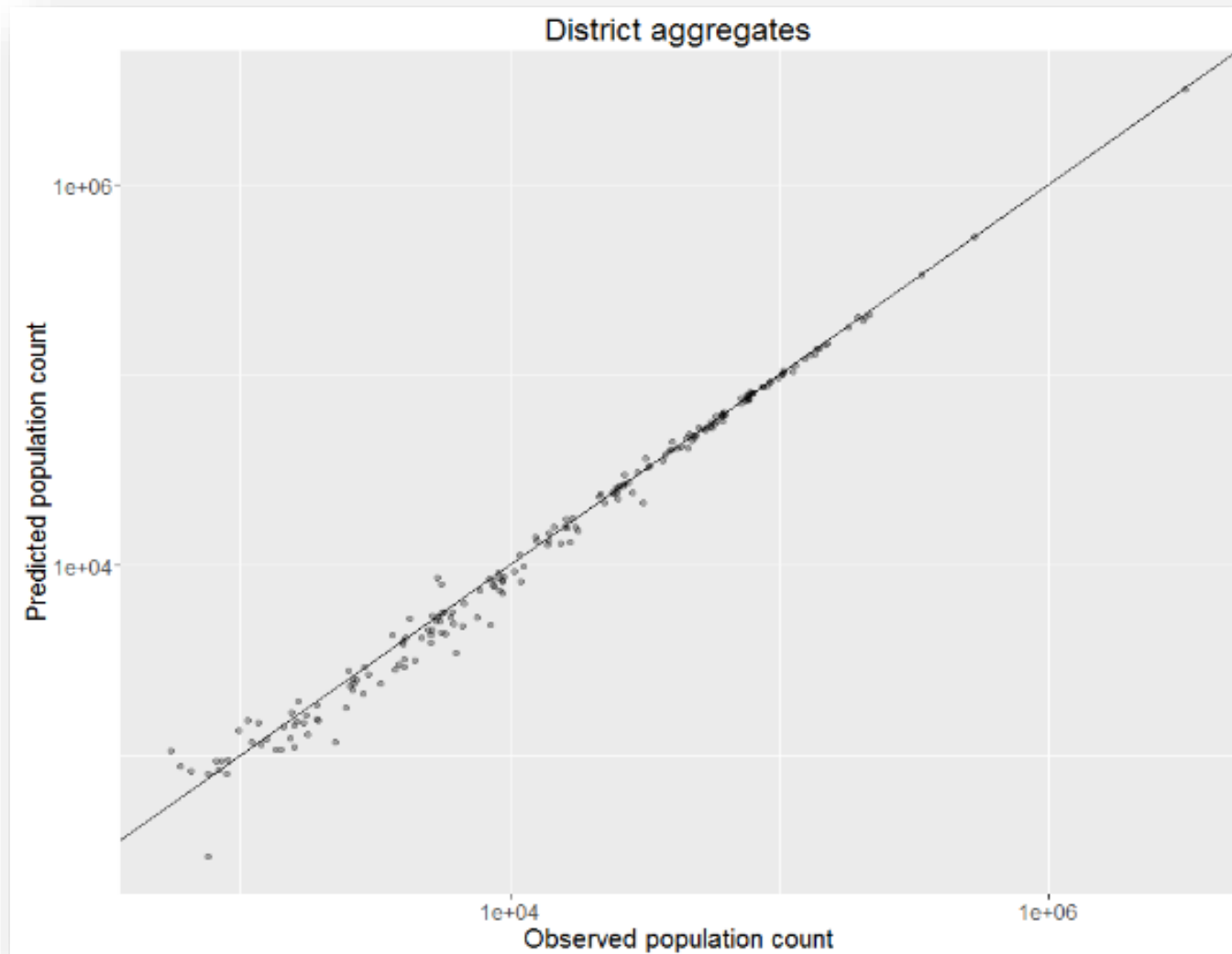


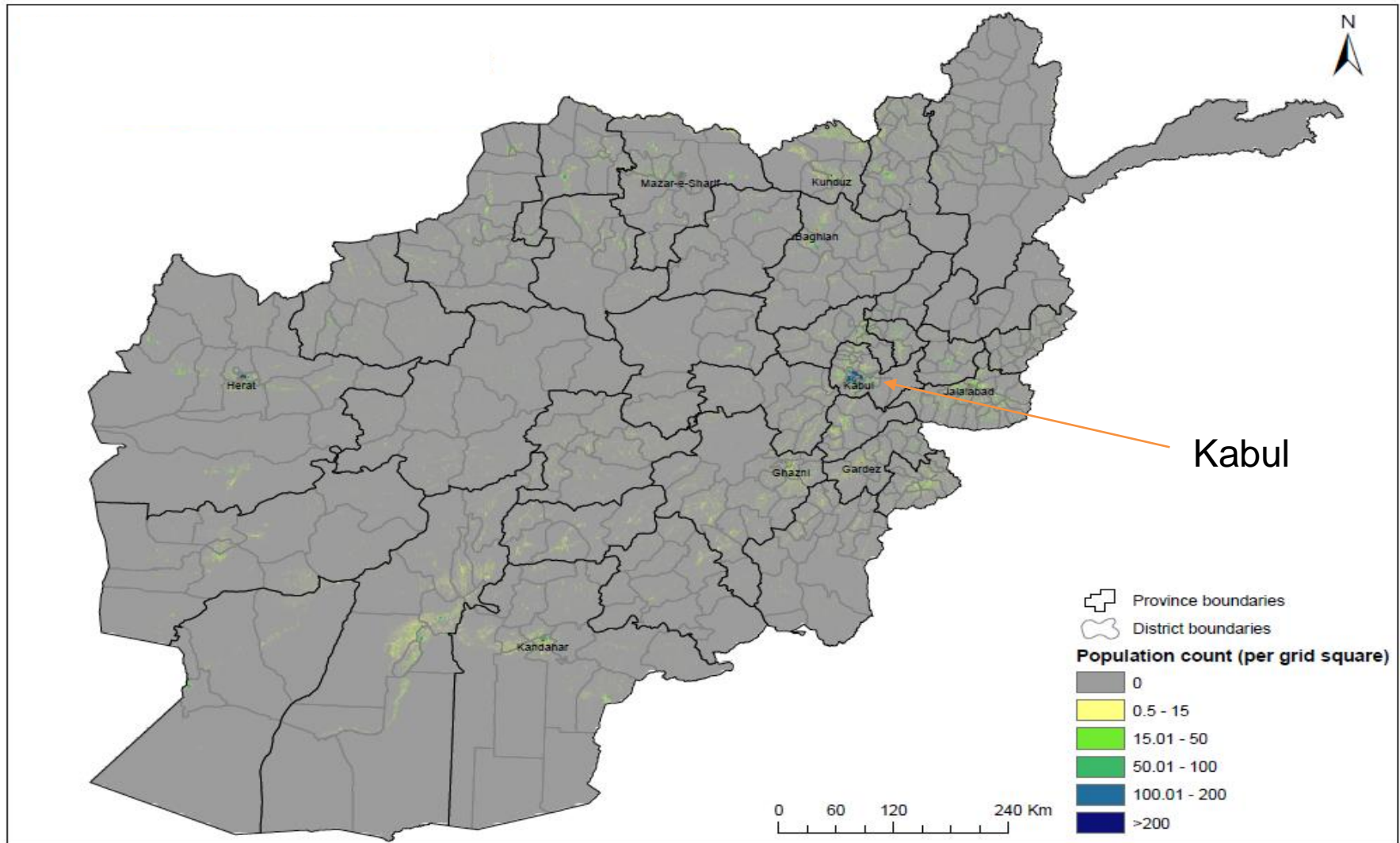
The dataset includes:

- Population counts at Enumeration Area level;
- 100m x 100m gridded population estimates;
- Population disaggregated by age and sex groups



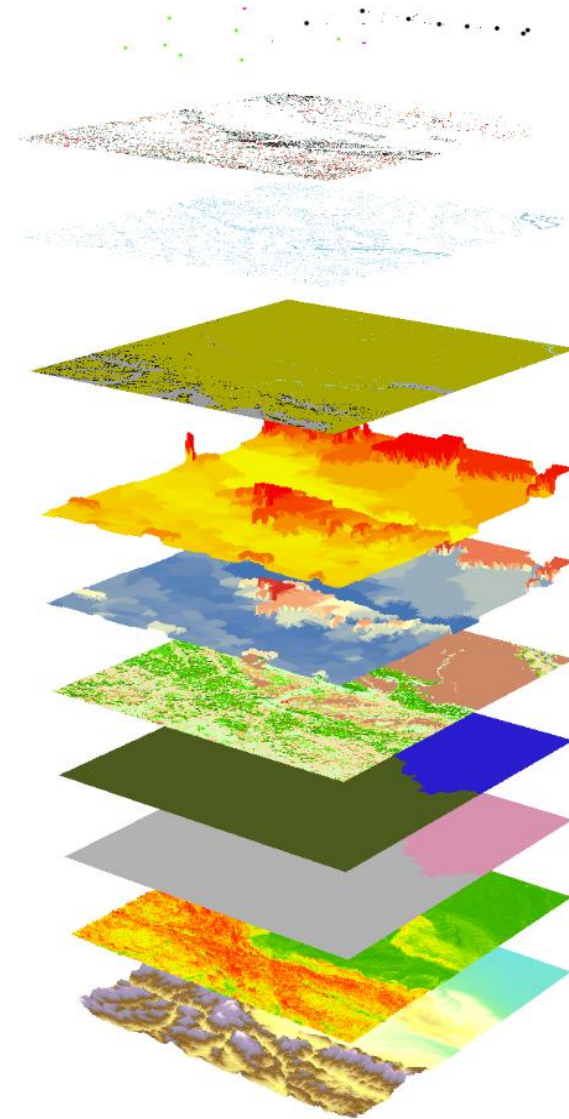
Initial Model Estimates show good predictive abilities





Next steps

- Testing different model forms to further improve accuracy
- Some recent additional datasets yet to be integrated
- Produce final country wide, age and sex-structured estimates



Thank you