

Innovative Approaches to Population Data: A Case Study of the DRC

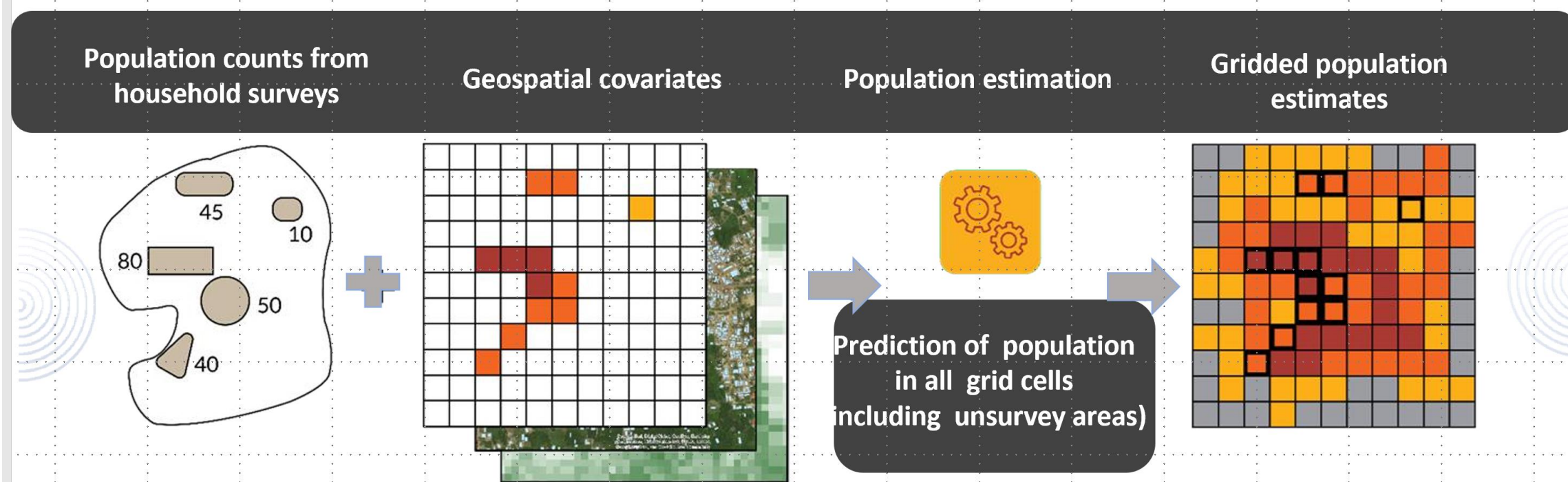
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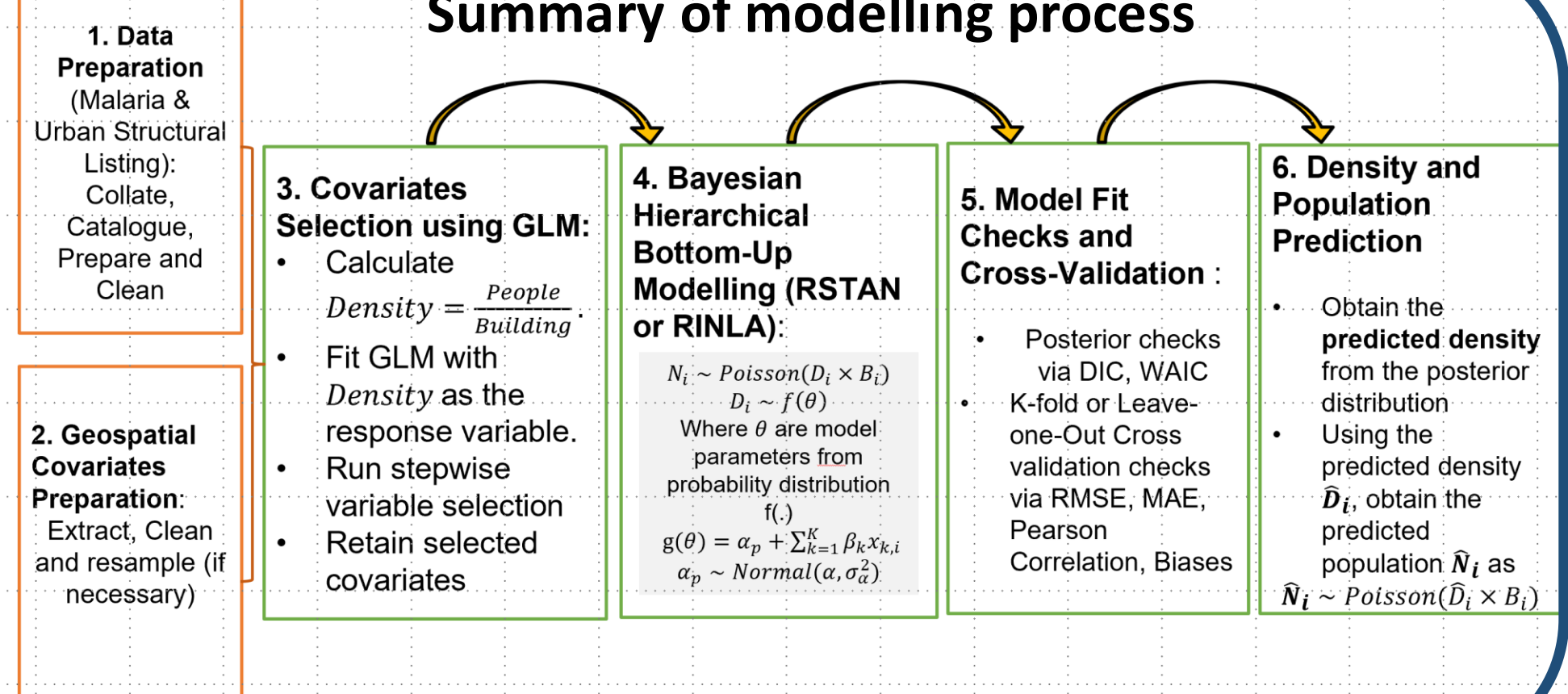
Summary

Our goal was to provide gridded population estimates for selected provinces in the Democratic Republic of the Congo (DRC). These estimates also included the number of people in various age and sex groups. The project team utilized data from the Pre-Distribution Registration Survey (PDRS) conducted by the National Malaria Control Programme (PNLP) during anti-malarial campaigns in the DRC. The campaign involved the distribution of mosquito nets to every household within the province and the collection of household information, including household sizes. The PNL dataset faced operational challenges, including the inflating of household sizes to obtain more bednet by the respondents and the failure to visit every household in the province. We used this data, along with settlement footprints provided by CIESIN and geospatial covariates, to model and estimate population numbers at the grid cell level using an innovative approach that corrects for systematic bias within the PNL dataset using a Bayesian statistical hierarchical modeling framework (Nnanatu et al. 2024; Boo et al. 2022). This approach allowed for the simultaneous consideration of multiple levels of variability within the data and enabled the quantification of uncertainties in parameter estimates.

Bottom-Up Population Modeling



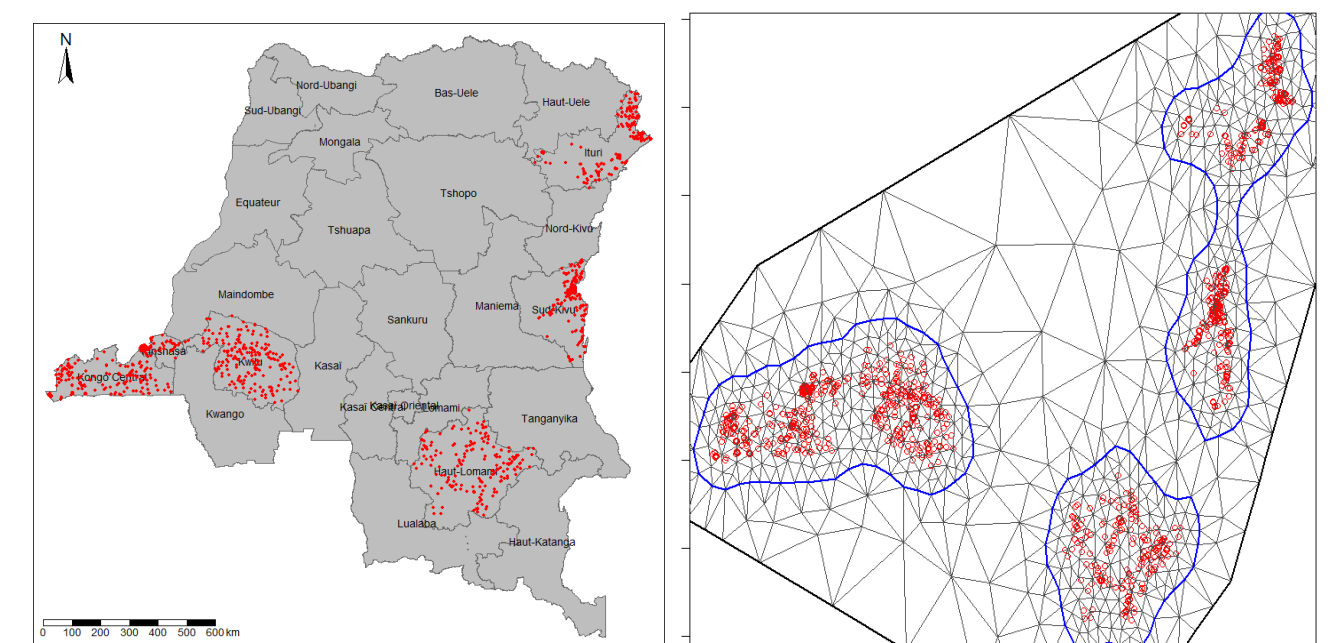
Summary of modelling process



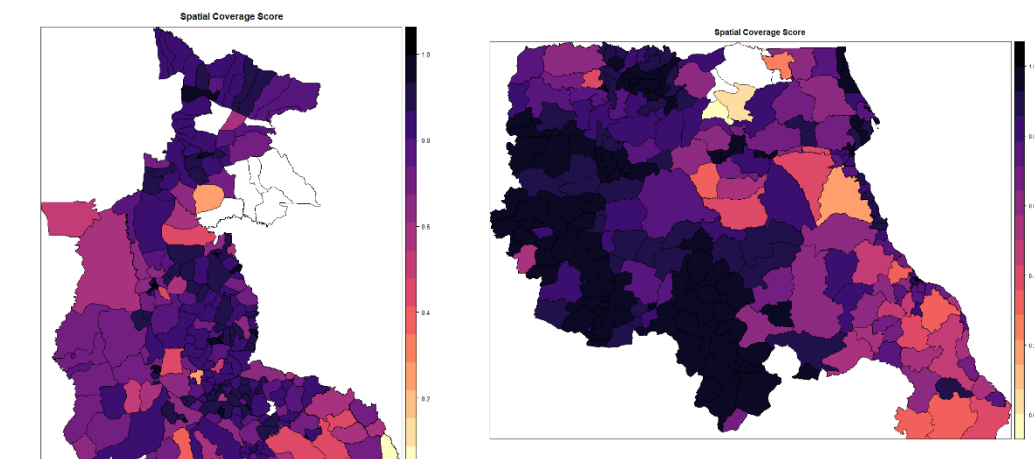
Statistical Modelling Approach

- Complementary Modelling Approaches:** Two methods were used: an **unscaled model** assuming no bias in PDRS data, and a **scaled model** acknowledging potential bias.
- Unscaled Model Approach:** This method assumes PDRS data provides unbiased population estimates without requiring bias correction.
- Scaled Model Approach:** This method accounts for potential systematic bias in PDRS data and applies a scaling factor for adjustment.
- Data Sources for Bias Adjustment:** The scaled model uses recent Microcensus data overlapping with PDRS data in six DRC provinces for bias correction.

Microcensus-PNLP Overlaps - INLA



PNLP Coverage in Maniema & Tanganyika Province

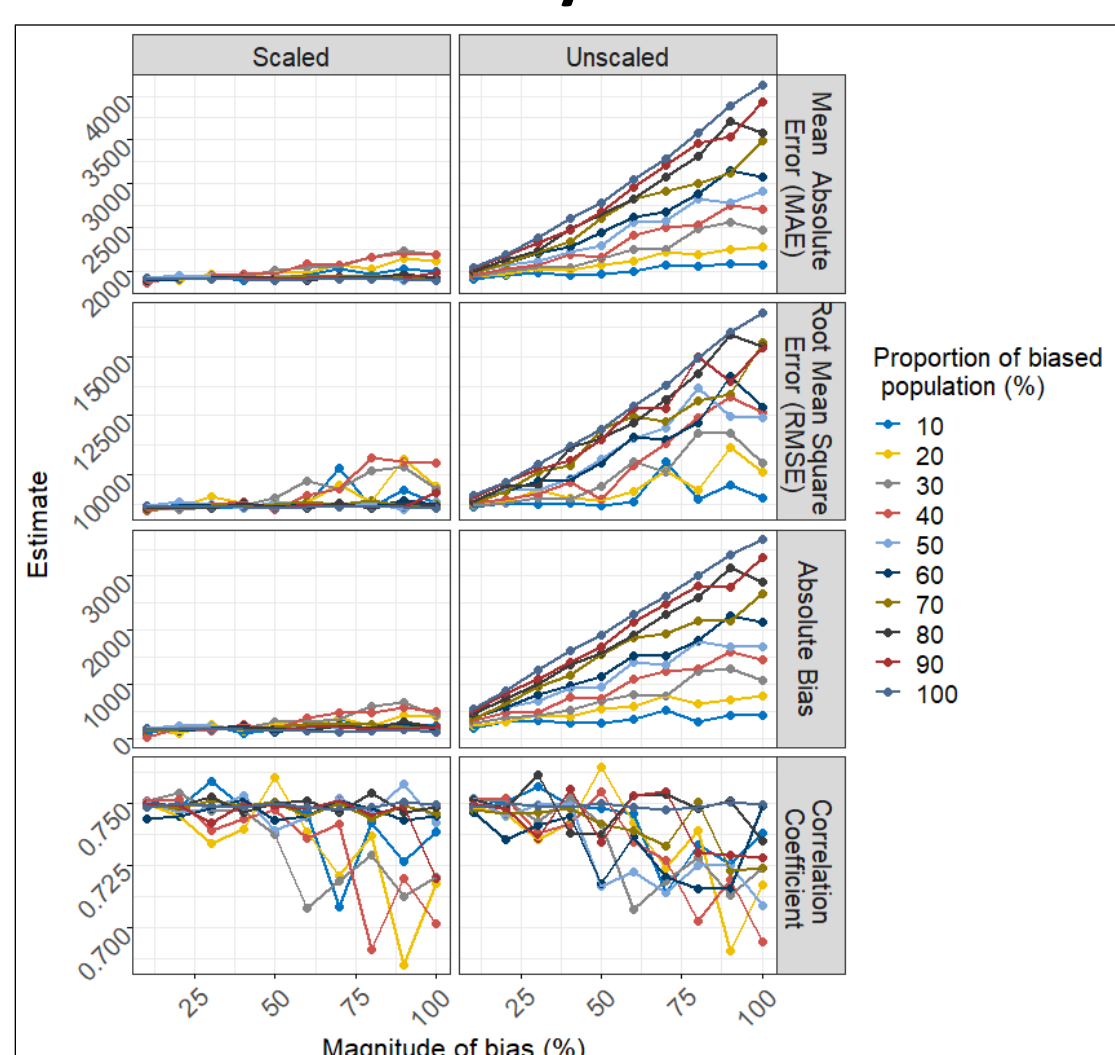


Simulation Study

- We performed a simulation study to assess the potential impact of bias in the PNL dataset.
- The study evaluated whether a scaling factor adjustment could effectively correct this bias.
- Simulated data with varying levels of bias were introduced.
- Both scaled and unscaled model approaches were applied to determine their ability to recover the true population estimates.

Results and Discussion

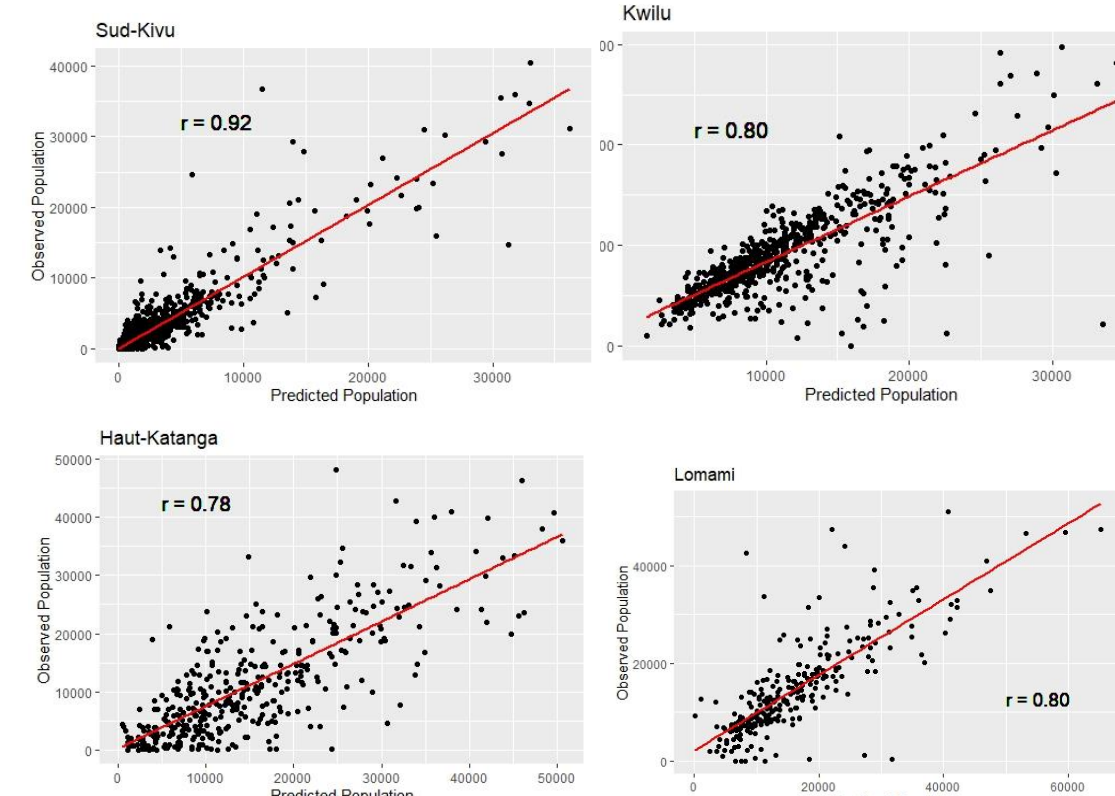
Simulation Study



- Results from the simulation study indicated that the Scaled model approach offered a relatively stable estimate across different magnitude of bias
- The estimate from the unscaled approach fluctuated with different magnitude of bias indicating that the unscaled data is more prone to errors as bias increases

Application to the DRC

Scatter plot of predicted vs. observed data for selected provinces



For more detailed information on these dataset, kindly scan this QR code



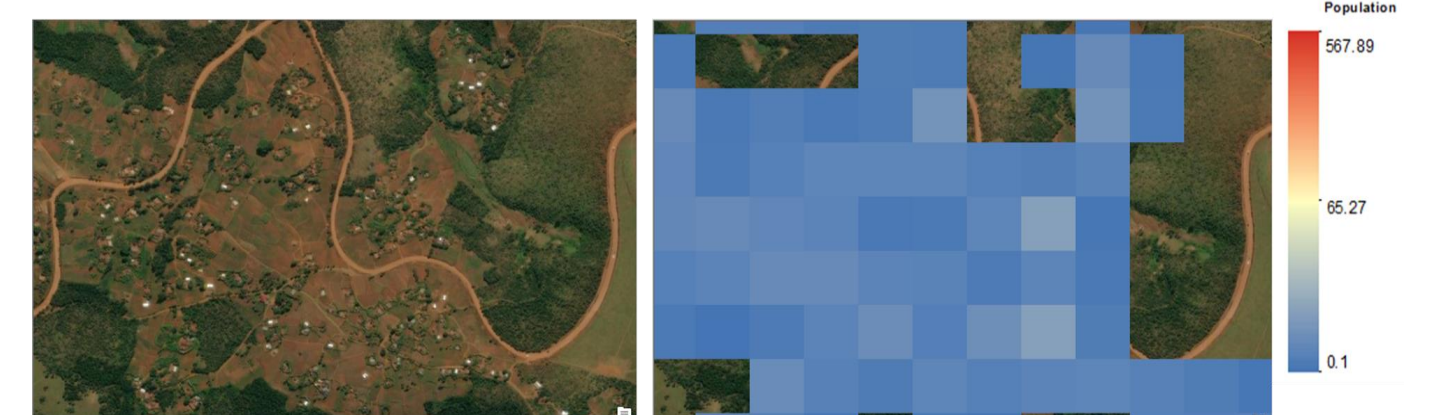
SCAN ME

Gridded Population Distribution for selected locations

Urban Cluster (Kwilu)
GPS Location (18.789441 -5.017971)



Rural Cluster (Sud-Kivu)
GPS Location (28.806993 -2.539756)



Village Cluster (Sud-Kivu)
GPS Location (28.806993 -2.539756)



Bibliography

- Boo, G., Darin, E., Leasure, D. R., Dooley, C. A., Chamberlain, H. R., Lázár, A. N., ... & Tatem, A. J. (2022). High-resolution population estimation using household survey data and building footprints. *Nature communications*, 13(1), 1330.
- Nnanatu C., Yankey O., Bonnie A., Abbott T. J., Chamberlain H., Lazar A. N., Tatem A. J. 2024. Bottom-up gridded population estimates for the Democratic Republic of Congo (2022), version 4.1. WorldPop. <https://wopr.worldpop.org/?COD/Population/v4.1>