

# The tolerance of spatial statistics for methodological or conceptual ambiguities – exemplified by the degree of urbanization in Germany

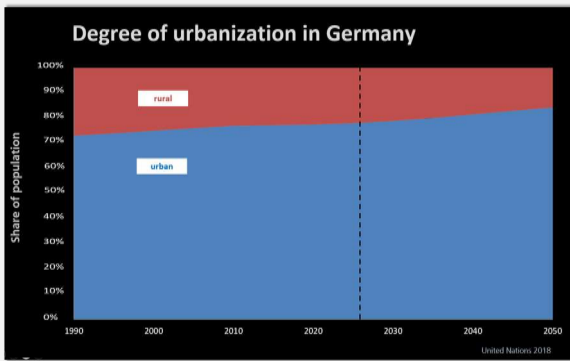
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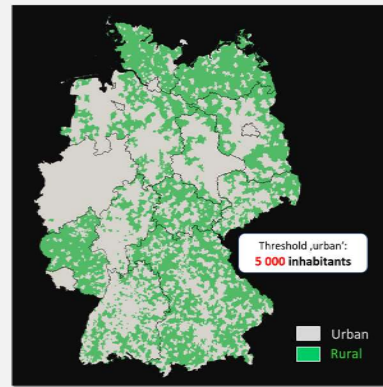
Background

## Official statistics on the degree of urbanization

Based on administrative units and a threshold > 5000 inhabitants.



## Cartographic illustration of official statistics



## Problem statement

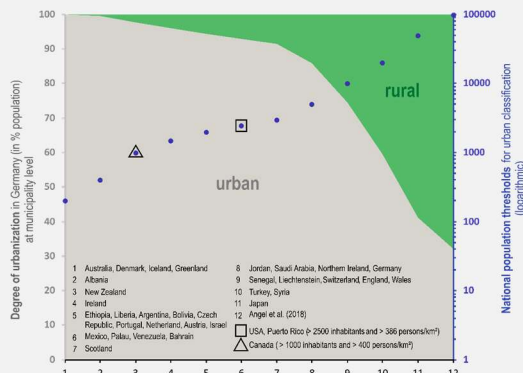
Differences between 'urban' and 'rural' areas in terms of population development have so far been mapped on the basis of administrative units. However, administrative units often integrate heterogeneous built and demographic densities within their territory, so that a clear binary classification is challenging and statistics get distorted through aggregation.

## Goal

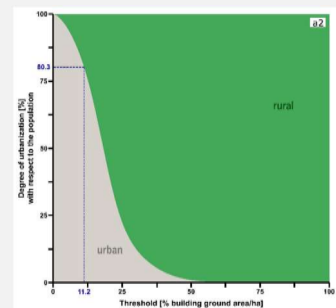
The delineation of 'urban' and 'rural' at higher spatial resolution not in a binary manner, but in a continuous way independent of admin units based on a data-driven approach using Earth observation and other geospatial data.

Concept

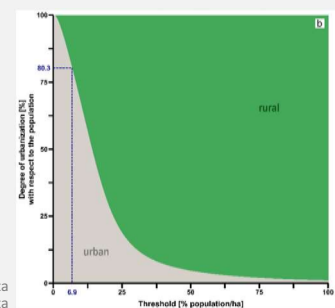
Application of different 'urban/rural' thresholds used in other countries applied to the administrative units in Germany.



We determine 'the urban' vs. 'the rural' at a spatially continuous and consistent grid of 100 x 100 m. Systematic tests of thresholds for the following variables are applied: building density, population density and the share of a certain building type. The combination of the various layers and thresholds allows for a probability-based, continuous measurement of the degree of urbanization.



On building density derived from EO data



On population data based on census data

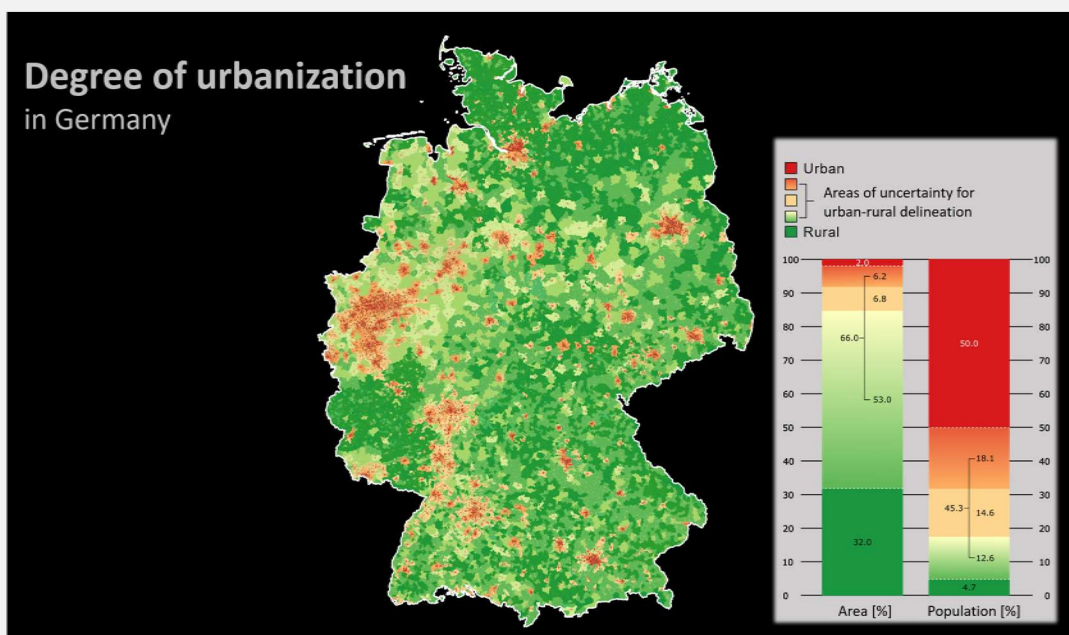
Results

## Key findings:

- 50.0% of the population in Germany is urbanized, 4.8% is rural. The range in between of 45.3% is fraught with uncertainty.
- Only 1.9% of Germany's land area has a clearly urban land cover. On this comparatively small area, almost 50% (41.59 million) of the population resides.
- 32% of the area, in turn, is clearly assigned to a rural land cover. However, only 3.95 million people (4.8%) live there.
- The 66.1% of the land area or the 45.3% (37.65 million) of the population between these clear classifications represent a kind of transition.

Empirical results reveal the degree of urbanization in Germany is between certainly 50.0% up to possibly 68.1% of the population. This means that the degree of urbanization in Germany is, lower than presented by other statistics.

## Degree of urbanization in Germany



References: Taubenböck H, Droin A, Standfuß I, Dosch F, Sander N, Milbert A, Eichfuss S & Wurm M (2022): To be, or not to be 'urban'? A multi-modal method for the differentiated measurement of the degree of urbanization. Computers, Environment & Urban Systems, vol. 95. Taubenböck H, Droin A, Standfuß I, Gähler M, Milbert A, Sander N, Eichfuss S, Dosch F & Wurm M (2023): Eine Differenzierung der Stadt-Land Dichotomie: ein wahrscheinlichkeitbasierter Ansatz. BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung im Bundesamt für Bauwesen und Raumordnung (BBR) (Hrsg.), Die Abgrenzung des ländlichen Raums – ein (un)mögliches Unterfangen?, S. 44-53.