Accuracy of built-up area mapping in Europe from the perspective of population surface modeling

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Abstract

Built-up area density, the degree of soil sealing or imperviousness represents (at least to a certain extent) the degree of intensity of human activity and can be used as a proxy for the presence of population. The land cover and land use datasets containing information on soil sealing are therefore frequently used as ancillary data in grid-based population surface modelling. Depending on the further information available about the impervious surfaces from the datasets, an ambient or residential/registered population can be modelled. Although they are traditionally referred to as "ancillary", they are in fact crucial in the whole modelling process and their accuracy largely influences the accuracy of the final population surface model, whether representing population density or another population characteristic.

"Fast track service precursor on land monitoring - Degree of soil sealing", or soil sealing layer (SSL) for short, is a land cover dataset developed within the Global Monitoring for the Environment and Security (GMES) programme and distributed by the European Environmental Agency (EEA) specifically to serve as a source of high spatial resolution land cover data for disaggregation of socioeconomic statistics. With the same coverage as the Corine Land Cover (CLC) dataset and much higher spatial resolution (20 x 20 m grid cell as opposed to 25 ha minimum mapping unit in CLC), SSL seems to be well suited to complement CLC in further development and improvement of the existing CLC-based population density grid provided by the EEA. While, for example, in Slovakia in 2006 (2,891 communes) there are about 15% communes with no CLC Category 1 "Artificial Surfaces" grid cells at 100 m spatial resolution, there are only less than 1% communes with no greater-than-zero SSL pixels at 20 m spatial resolution.

However, before the potential of SSL is harnessed, it is important to assess the accuracy of SSL and its possible influence on the accuracy of population surface modelling. The preliminary assessment of SSL suggests that it forces values of soil sealing out to the extremes (0% and 100%) by overestimating (usually, but not only) medium and larger soil sealing values and underestimating (usually, but not only) medium and smaller soil sealing values. This potentially results in overestimation of the share of impervious surfaces in areas with more compact settlement pattern (usually urban areas) and underrepresentation or complete omission of small and dispersed rural settlements.