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# The cartographic methods of visualising Sustainable Development Goals (SDGs) indicators elaborated based on Earth Observation data

Anna Markowska [a,*], Dariusz Dukaczewski [a]

[a] *Institute of Geodesy and Cartography Warsaw Poland, anna.markowska@igik.edu.pl*
[a] *Institute of Geodesy and Cartography Warsaw Poland, dariusz.dukaczewski@igik.edu.pl*

* Corresponding author

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**Abstract:**

Monitoring the achievement of the Sustainable Development Goals (SDGs) is an important topic that can be assisted by using indicators elaborated based on Earth Observation data. The United Nations Sustainable Development Goals (SDGs) are global development targets adopted in 2015. All countries have agreed to work towards achieving them by 2030 (UN General Assembly, 2015). The 17 SDGs are integrated – they recognize that action in one area will affect outcomes in others, and that development must balance social, economic, and environmental sustainability. To make the 2030 Agenda a reality, broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement the global goals. Every year, the UN Secretary General presents an annual SDGs Progress report, which is developed in cooperation with the UN System, based on the global indicator framework and data produced by national statistical systems and information collected at the regional level (UN DESA 2024). These reports contain information on the realization of particular SDG goals, targets, and indicators, part of which is presented on maps. Statistics Poland (SP) is responsible for presenting the implementation of the SDGs in Poland. On the Institution's website, it is possible to find information about 250 global indicators with data for Poland for monitoring the Sustainable Development Goals (SDGs).

The compilation of selected Sustainable Development Goals (SDG) indicators requires the collection of data at the municipal level, for instance, regarding the extent of green areas. These data are typically obtained through self-reported forms completed by local authorities; however, they are often outdated or based on rough estimations, which hinders accurate monitoring of temporal changes. In this context, Earth Observation (EO) data, such as that provided by the Copernicus Programme with a spatial resolution of 10 metres, offer a valuable alternative, enabling more standardised and objective assessments of environmental conditions (Figure 1; Panek-Chwastyk et al., 2024).

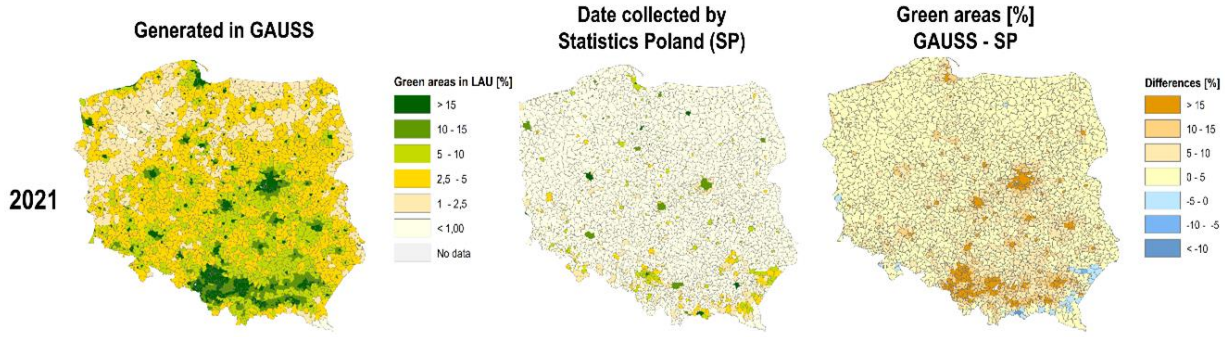


Figure. 1. Extent of green areas at a 10-meter resolution at the commune level in Poland (2021) – choropleth maps (Panek-Chwastyk et al. 2024). Left map – data generated based on Earth Observation products (project GAUSS), central map – data collected by Statistics Poland (communes fill-in forms), right map – differences between the map based on EO data and data collected by Statistics Poland.

Generally, choropleth maps are used in the elaboration of the SDGs indicators' implementation maps divided into administrative units (voivodeships, districts, or communes). During the presentation, the authors intend to review other cartographic presentation methods that are suitable for monitoring changes in SDGs indicators developed from EO data.

The study presents indicators related to SDG11 (Goal 11 - Sustainable cities & communities), and SDG13 (Goal 13 - Climate action). As a preliminary step, the following targets and indicators were selected for analysis:

- Target 11.6: Reduce the environmental impacts of cities:
  - Indicator 11.6.2 – Annual mean levels of fine particulate matter;
- Target 11.7: Provide access to safe and inclusive green and public spaces:
  - Indicator 11.7.1 – Average share of the built-up area of cities that is open space for public use for all;
- Target 13.2: Integrate climate change measures into national policies, strategies, and planning :
  - Indicator 13.2.2 – Total greenhouse gas emissions per year.

This presentation examines two selected cartographic methods employed for monitoring changes in Sustainable Development Goal (SDG) indicators using Earth Observation (EO) data: dasymetric maps and cartograms. The objective is to assess the respective advantages and limitations of these approaches in the context of tracking progress toward the SDGs.

The dasymetric map is a cartographic presentation method that uses area symbols to visualise a geographic field by refining a choropleth map with additional information about the distribution of a variable. The dasymetric map is a hybrid product that combines the strengths and weaknesses of choropleth and isoline methods (Slocum et al. 2009, Figure 2. – https://eo-toolkit-guo-un-habitat.opendata.arcgis.com/pages/poland-use-case).

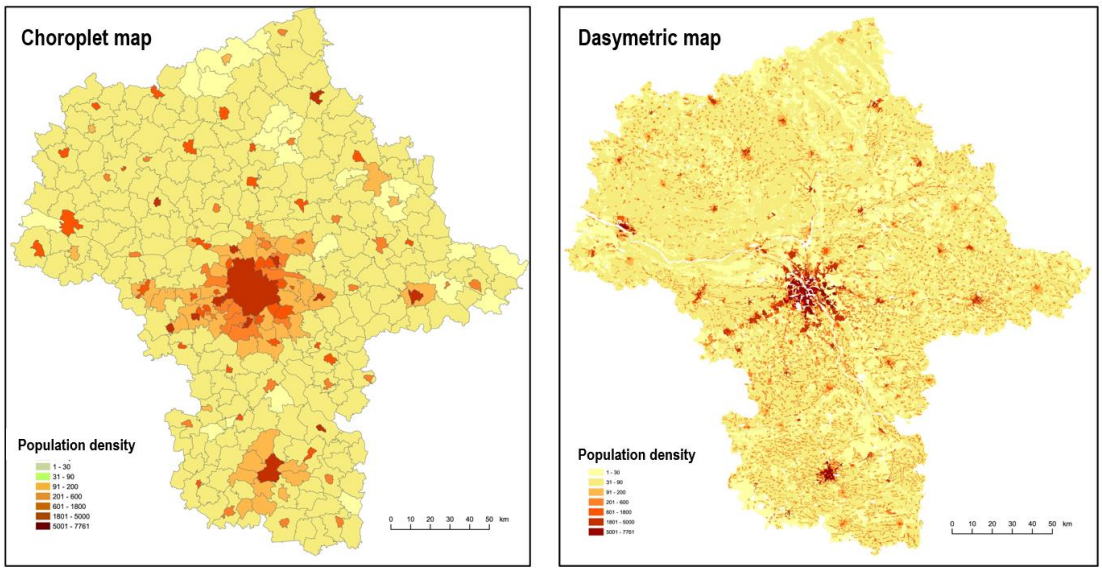


Figure 2. Population density in Mazowieckie Voivodeship choropleth map (left) and dasymetric map (right).

The cartogram is a map on which one feature – distance (distance cartograms) or area (area cartograms) is distorted proportionally to the value of a given phenomenon (Markowska 2019). This presentation addresses selected area cartograms, placing special emphasis on automatically generated rectangular cartograms.

The appropriate method of visualising the SDGs indicators supports the monitoring of the implementation of the Agenda 2030 goals at the communal or voivodeship level. At the same time, it provides an opportunity to better communicate sustainability topics to stakeholders, highlighting more explicitly the areas that still need to be addressed.

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