

# GEODESY AND GEOMATICS IN THE SUPPORT OF THE SUSTAINABLE DEVELOPMENT GOALS (SDGS)

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**Abstract:** The achievement of the 17 sustainable development goals (SDGs) and related targets is monitored through a set of indicators at the global, regional and national level. Indicators are classified into three levels based on the methodology and availability of data for their calculation. A large number of indicators supporting individual goals and targets are based on geospatial data. Geospatial technologies significantly contribute to the fulfilment of many SDGs. Together with digital technologies, they have a big potential for accelerating human progress, bridging the digital divide, developing knowledge societies and serve as a support structure for all goals and more importantly in measuring, monitoring and reporting progress so far. The development of platforms for remote sensing such as unmanned aerial vehicles and satellites, together with measuring sensors and technologies through cloud computing and artificial intelligence, additionally help in achieving progress towards the achievement of goals. This is evident especially in the fields of energy, agriculture, health, climate change, etc. This paper aims to present the role of geodesy and geomatics in the achievement and monitoring of SDGs through the measuring, processing and use of geospatial data.

**Keywords:** geodesy and geomatics, geospatial data, sustainable development goals (SDGs), SDG indicators

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Review paper

## 1. INTRODUCTION

The 69th session of the United Nations (UN) General Assembly in 2015 adopted 17 Sustainable Development Goals (SDGs), with 169 specific targets, as part of the document “Change Our World: The 2030 Agenda for Sustainable Development” (UN 2015). Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. For sustainable development to be achieved, it is crucial to harmonise three core elements: economic growth, social inclusion and environmental protection. These elements are interconnected and all are crucial for the well-being of individuals and societies.

The SDGs (Figure 1) are global and apply to all countries, rich and poor. Although the targets are not legally binding, UN member states are expected to establish a system to integrate them into national policies and monitor implementation through agreed indicators. Each UN Member State should develop its national programme for their implementation. Many scientists, institutions, ministries, agencies, associations and citizens are involved in the implementation of national programmes.

In 2017, the UN Statistical Commission (UNSD) adopted a framework of 231 unique global indicators (URL 3) at the proposal of an interagency expert group (IAEG-SDG). The purpose of the indicator is to monitor the progress of individual goals and targets at the global, regional and national level.

Indicators are calculated and monitored at global, regional and national level. From the perspective of geodesy and geomatics, it is interesting that a large number of indicators are based on geospatial data. In this paper, we aim on stressing the role of geodesy and geomatics in the calculation of the indicators. The paper continues in Section 2 with the short overview of the geodesy and geomatics profession together with relevant initiatives. In the Section 3 we are providing an example of the calculation of monitoring indicator. Finally, in the Section 4 we provide our discussion points and concluding remarks.

## 2. GEODESY AND GEOMATICS PROFESSION

Geomatics refers to the methods and technologies used to collect, distribute, store, analyse, process, and present geospatial data. Geomatics encompasses the fields of geodesy, geoinformation systems (GIS), global navigation positioning systems (GNSS), hydrography, mapping, photogrammetry, remote sensing, geomonitoring, and surveying (Figure 2).

Geomatics is an information technology-oriented discipline whose objective is to integrate and deliver multiple sources of geolocated data to a wide range of users (Claramunt and Lotfian 2023). The range of sensor-based technologies involved in geomatics is continuously expanding thanks to the emergence of high-resolution satellite images, 3D radars, airborne laser and camera systems, unmanned aerial systems, underwater acoustic systems and intelligent location-based sensors.



Figure 1 The Sustainable Development Goals (UN 2015)

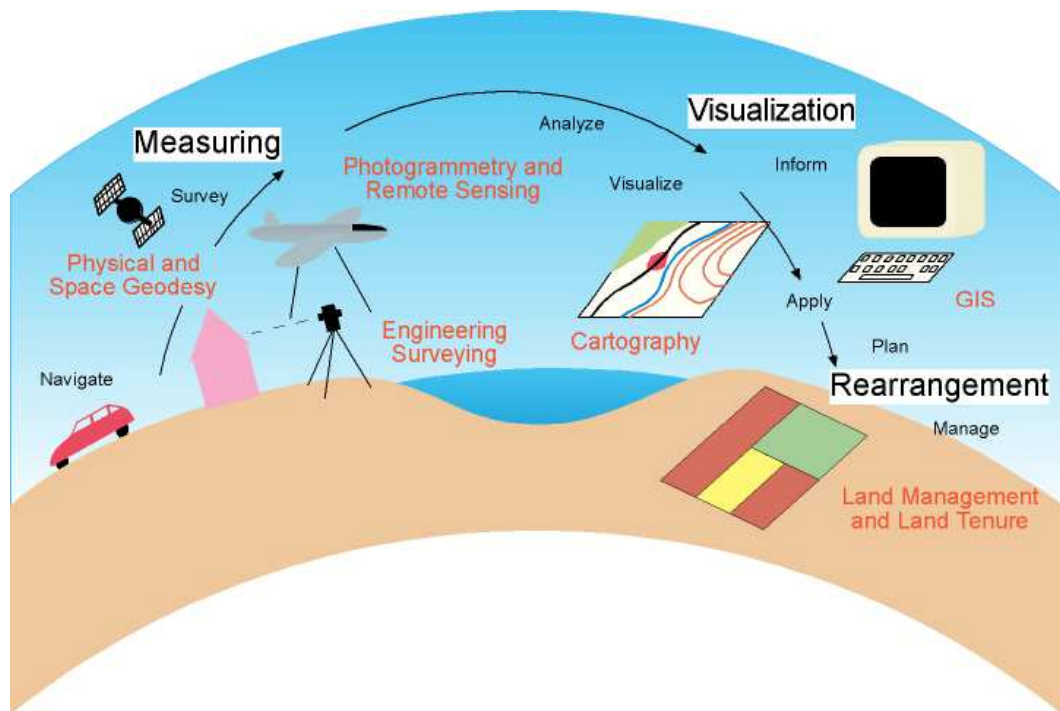


Figure 2 Geodesy and geomatics

## 2.1. UN-GGIM

The importance of geodesy and geomatics profession was recognised on the global level by United Nations (UN) with the establishment of the Committee of Experts on Global Geospatial Information Management (UN-GGIM 2023). UN-GGIM is one of the nine expert groups of the United Nations Economic and Social Council (ECOSOC) to foster the global development of geospatial information. Led by United Nations Member States,

UN-GGIM aims to address global challenges regarding the use of geospatial information, including in the development agendas, and to serve as a body for global policymaking in the field of geospatial information management.

The UN-GGIM: Europe was established in 2014 with the aim to address European issues relevant to geospatial information and makes recommendations globally to maximise the economic, social and environmental benefits of geospatial information in Europe (UN-GGIM: Europe 2023). The UN-GGIM Europe currently has following working groups (2022-2025 work plan):

- Data Integration
- Sustainable Development Goals
- Integrated Geospatial Information Framework
- Data Strategy and Policy
- Geodetic Reference Frames– Europe

In the work plan 2015-2022 the working group Core Data was active with the aim to define and develop specifications for geospatial data in Europe in support of the SDGs as well as methodologies for calculating individual indicators based on spatial data.

In 2016, the working group on Core Data published Core Data Scope with the aim of determining the scope of the basic geospatial data in the support of UN SDGs. INSPIRE data themes (INSPIRE 2023) were taken as a basis for identifying the users' data needs. The analysis carried out aimed to identify basic data sets for the purpose of monitoring the SDGs. Initially, it was necessary to identify for which objectives and targets spatial data are used (Figure 3).

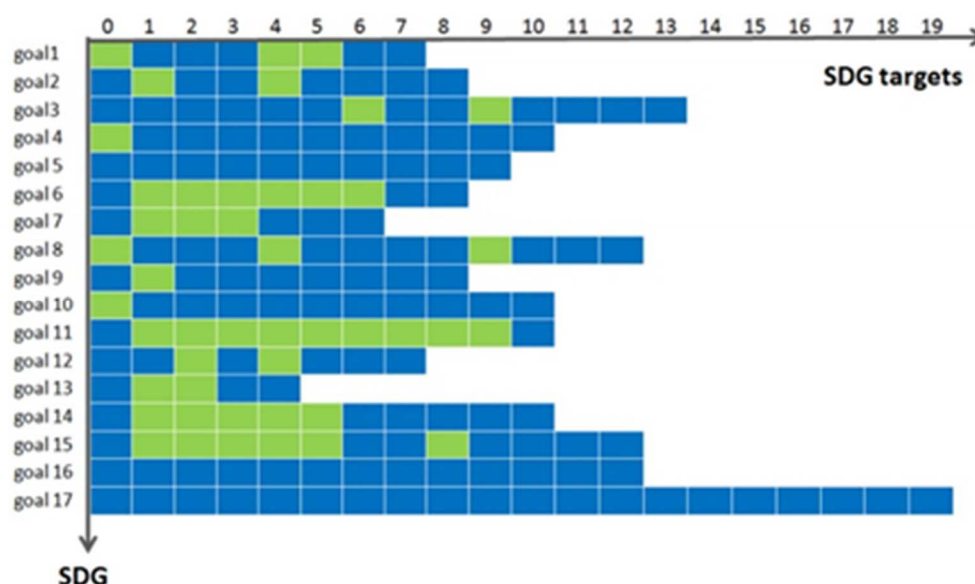


Figure 3 The SDG targets consuming geospatial data (UN-GGIM: Europe 2016)

The SDG goals are represented in the header column and their related targets in the first header row. The “0” value stands for the whole SDG (without considering any specific target). The targets consuming geospatial data are represented in green. In some cases, although the whole objective uses geospatial data (e. g. objective 8), some sub-objectives (8.4 and 8.9) use additionally specialised geospatial data. The goals that use geospatial data are:

- Goal 1. No Poverty
- Goal 2. Zero Hunger
- Goal 3. Good Health and Well-Being
- Goal 4. Quality Education
- Goal 6. Clean Water and Sanitation
- Goal 7. Affordable and Clean Energy
- Goal 8. Decent Work and Economic Growth
- Goal 9. Industry, Innovation and Infrastructure
- Goal 10. Reduced Inequalities
- Goal 11. Sustainable Cities and Communities
- Goal 12. Responsible Consumption and Production
- Goal 13. Climate Action
- Goal 14. Life Below Water
- Goal 15. Life on Land

After defining the goals and targets that use spatial data, the selection of INSPIRE data themes that meet the needs of individual objectives and sub-targets was approached based on selected use cases. In this way, 14 core data themes have been defined to support the SDGs:

- INSPIRE Annex I: Geographical names, Administrative units, Addresses, Cadastral parcels, Transport networks, Hydrography
- Group II INSPIRE: Elevation, Land cover, Ortho-imagery
- Group III INSPIRE: Statistical units, Buildings, Land Use, Utility and Governmental Services, Area management/restriction/regulation zones and reporting units

For each of the above topics, production specifications were produced, which should help manufacturers to produce basic spatial data at European and national levels. The product specifications are an upgrade to INSPIRE data specifications and take into account the specificities of the end product or data set.

The above specifications in the development of different pan-European datasets in Europe are used by:

- Eurogeographics (<https://eurogeographics.org/>)
- DG Eurostat GISCO (<https://ec.europa.eu/eurostat/web/gisco>)
- European Environment Agency (<https://www.eea.europa.eu/>)

## 2.2. Example

The UN-GGIM: Europe Working Group on Data Integration deals with the definition of data sources and the methodology for calculating indicators at European level. In the publication: The territorial dimension in SDG indicators: geospatial data analysis and its integration with statistical data (UN-GGIM: Europe 2019), examples are given for several selected indicators at European and national level that are using geospatial data:

- 11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
- 11.3.1 Ratio of land consumption rate to population growth rate
- 11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
- 15.1.1 Forest area as a proportion of total land area (**Figure 4**)

<b>SDG Indicator Name</b>	Forest area as a proportion of total land area
<b>SDG Target Addressed</b>	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.
<b>Definition of SDG Indicator</b>	The indicator is already included among the indicators for the Millennium Development Goals (MDG) (indicator 7.1 "Proportion of land covered by forest"). In order to provide a precise definition of the indicator, it is crucial to provide a definition of "Forest" and "Total Land Area". According to the FAO definitions, Forest is defined as "land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use". More specifically: Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters. It includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of at least 10 percent and tree height of 5 meters or more. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used. It includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or

**Figure 4** The SDG indicator 15.1.1

In this example (**Figure 4**), in order to calculate the indicator 15.1.1, it is necessary to calculate both: total land area and forest area. Such calculations are easily performed by geodetic and geomatics professionals.

### 3. MONITORING OF THE SDG INDICATORS

#### 3.1. The main rules

Indicators are calculated and monitored at global, regional and national levels. In the European Union (EU), the European Commission's Directorate-General for Statistics (Eurostat) is responsible for monitoring the indicators at the European level. Monitoring of indicators is carried out regularly on the basis of a set of indicators developed in cooperation with a large number of partners and other stakeholders. At the EU level, the set includes more than 100 indicators distributed over 17 SDGs. 36 indicators are multifunctional and track more than one goal. An overview of progress and trends in achieving the SDGs over the last 5 years in the EU is presented in detail in a recent publication: Sustainable development in the European Union — Sustainable development in the European Union – Monitoring report on progress towards the SDGs in an EU context – 2023 edition ([Eurostat 2023](#)).

#### 3.2. Monitoring of the SDGs in Croatia

In January 2018, the Croatian government adopted a decision on the establishment of the National Council for Sustainable Development, whose task is to monitor and coordinate the implementation of the SDGs. The Croatian Bureau of Statistics has published the portal of indicators of SDGs ([RH portal indikatora 2023](#)). The portal is used to coordinate national activities of development, production and dissemination of indicators of the sustainable development goals in Croatia. The portal allows to see the status of each individual indicator for a specific target, data sources and metadata.

The status of the data varies greatly from indicators for which data have been published (e.g., indicator 2.4.1 — Share of agricultural land in productive and sustainable agriculture) to those for which data are not published (e.g., 15.1.1 Forest area as a proportion of total land area) collected, explored or need to be improved. By further review of individual indicators, it can be seen that the data for many indicators are mostly unavailable and that activities in determining the indicators of sustainable development at the national level are only in its infancy. This creates a big opportunity for geodetic and geomatics profession, especially for indicators whose computation requires geospatial data.

### 4. CONCLUSION

To protect the planet, eradicate poverty, reduce inequalities and ensure progress for all, the UN adopted 17 Global Sustainable Development Goals (SDGs) with 169 specific targets. The SDGs provide a comprehensive way to address global challenges and build a more inclusive, progressive and sustainable world. Various stakeholders, including governments, international organisations, non-governmental organisations, and private sector entities, play a role in advancing the SDGs through the policy development, resource allocation, and implementation of sustainable practices.

In order to monitor progress towards these goals and achieve the targets, a set of indicators has been defined, which are defined and monitored at global, regional and national levels. For some indicators there is data available and the methodology for their determination is clear, but there are a lot of them that are still not available and/or methodology is not clear yet.

Many SDG goals and targets rely on the geospatial data needed to be able to determine or calculate an individual indicator. Creating, collecting and integrating geospatial data with other data is certainly one of the challenges for the geodetic and geomatics profession at universities, private and public sector, but also a great future opportunity for new jobs and business processes. Accurate and reliable geospatial data supports many aspects of sustainable development and helps in the creation of policies and decision-making processes at local, national and global level.

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