Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets

ISPRS Educational and Capacity Building Initiative 2022

27/02/2023

Final Report

A. Executive summary

The support of geospatial data and technologies to the United Nations Sustainable Development Goals (UN SDGs) framework has turned out to be critical for both the assessment and the monitoring of key indicators, revealing the trajectory of our planet and society towards sustainability.

The increasing availability of global open geospatial datasets - above all the global high-resolution land cover (HRLC) datasets - opens noteworthy opportunities for the computation and comparison of these indicators across different geographical regions as well as multiple spatial and temporal scales. The added value of these datasets is tangible, especially for developing countries, where often such information is only partially available from local authorities. Nevertheless, there are still several barriers to their proficient use due to the lack of data management and processing capacities using proper Geographic Information Systems (GIS) software tools.

In view of the above, the Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets project addressed the creation of an open training material covering the complete learning process of discovering, accessing and manipulating global open geospatial datasets for computing SDG indicators, with a focus on those directly connected to marine and terrestrial ecosystems, urban environment, and climate. To ensure the widest possible accessibility, the developed material leverages the Free and Open Source Software (FOSS) QGIS and it is released under a Creative Commons Attribution 4.0 License (CC BY 4.0).

The open online training material was published at https://isprs-gis-sdg.readthedocs.io. A technical note including the state-of-the-art in open and global HRLC suitable for the analysis of SDG indicators and the strategy used for training requirements definition is also provided.

B. Investigators

PIs

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- ISPRS Student Consortium (ISPRS SC)

Contributing WGs:

- ICWG IV/III: Global Mapping: Updating, Verification and Interoperability
- ISPRS WG IV/6: SDI: Internet of Things and Spatial Decision Support
- ISPRS WG V/1: Framework for Multi-level Education & Training Curriculum Development and Methodology

C. Project activities

The project's activities started in early January 2022 through both online and offline discussions among the project PIs and Co-Is. The initial phase focused on the definition of the strategies for determining the training requirements. Training requirements were outlined and assessed by the project's team through an open survey (https://forms.office.com/r/zswC9NhNYK), which was circulated among the PIs and Co-PIs contacts and the ISPRS SC media channels. The survey collected more than 100 responses.

Based on the results of the survey, the syllabus of the training material was drafted. Alongside the syllabus definition, a focused review of the scientific literature on the use of GIS and global HRLC datasets for SDG indicators analysis was carried out. Most relevant datasets were also identified and described. The results of this preliminary research were summarised in a technical note, together with a description of the training requirements and the syllabus. The technical note is attached to this report.

Based on the outcomes of the initial project's phase, the training material was designed and developed as an online book (web book), which consists of an introductory practical course on the combined use of open GIS and global HRLC as well as complementary datasets to compute SDG indicators. The web book was finally formatted using the Python Sphinx documentation generator and then published online by exploiting the open documentation hosting platform Read the Docs (https://readthedocs.org). To assist the project PIs and Co-Is in the training material development and publishing, a student assistant was recruited.

Finally, with the aim of promoting user involvement, public workshops were organised during which both project development works and outputs were presented. Details on the main outcomes and results of the project activities are reported in the next section.

D. Project outcomes

The main project outcomes are as follows.

- A technical note including a report on the state-of-the-art in open and global HRLC for SDG indicators, training requirements and the course syllabus. The technical note is attached to this report.

- An open web book composed of four main sections. The first section provides a theoretical/informative preamble to the SDGs and their connection to geospatial data and GIS. The second section reports sample lists, with references, descriptions and download patterns of principal open global HRLC and complementary datasets that can be used to compute SDG indicators. The third section outlines the main geospatial data processing functionalities of QGIS, which are critical for SDG indicators computation. Finally, the fourth section includes hands-on exercises on SDG indicator computation using some of the data that was profiled in the second section. The web book is published at https://isprs-gis-sdg.readthedocs.io while the source code is available at https://github.com/opengeolab/ISPRS_GIS_SDG. Sample data for the hands-on exercises were made available on Zenodo (10.5281/zenodo.7152401)

- Three workshops (two already completed, one planned).
  Workshop #1 focused on the preliminary project presentation, including survey outcomes, by seeking feedback from both potential users and domain experts on the outlined course syllabus. This activity was carried out through the participation of the project team at the Geospatial Information-enabled SDG Monitoring (GI4SDG) Forum Track of the XXIV ISPRS Congress held in Nice, France on June 7, 2022[1] (Figure 1).
  Workshop #2 was dedicated to the pilot presentation of draft web book content. This activity was carried out on February 8, 2023, and It consisted of an online seminar, participated by more than 25 potential users[2] (Figure 2).
  Workshop #3 is planned for April 20, 2023. It is conceived as an open blended lecture. During the workshop, the full web book content (theory and hands-on exercises) will be presented to the participants by the project team. The event will be hosted at the Politecnico di Milano campus (Milan, Italy). Recording of the workshops will be published online and linked in the web book to guarantee permanent access to any interested user.

[1] https://www.isprs.org/news/newsletter/2022-04/53_Forum_Track_Report_Final.pdf
[2] https://tinyurl.com/5cy94un5

Figure 1. Workshop #1 at the Geospatial Information-enabled SDG Monitoring (GI4SDG) Forum Track of the XXIV ISPRS Congress

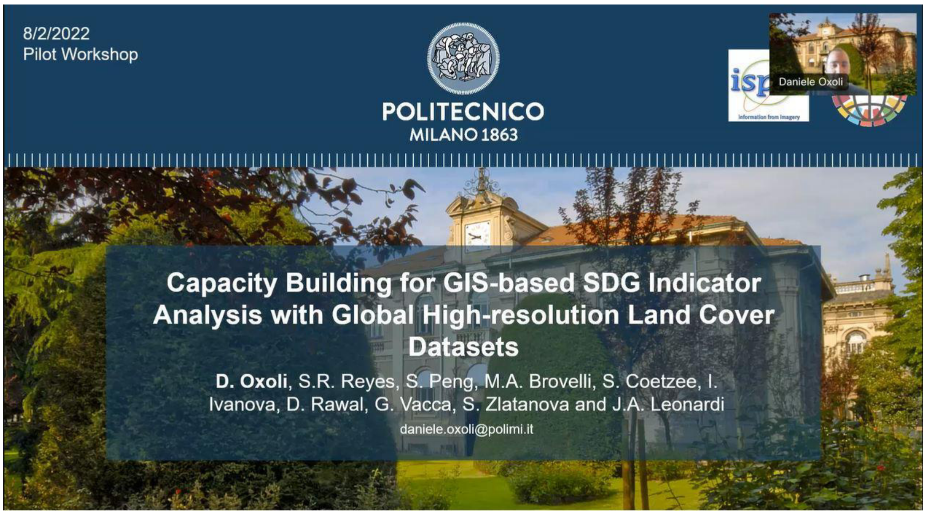

Figure 2. Workshop #2 online seminar

Despite some delays in the original schedule for the organisation of the workshops and the preparation of the web book, all the main project milestones were achieved.

According to the project plan, a scientific paper (ISPRS Archives) on capacity building for HRLC for SDG indicators computation using FOSS GIS is also being prepared for submission to the ISPRS Geospatial Week 2023.

E. Outlook and future work

The developed training material will be maintained and will remain accessible in the long-term. The ultimate goal is to enhance awareness of the connection between GIS and SDGs and engage, especially, GIS students and practitioners due to their potential key contribution to achieving Agenda 2030 in the next few years. To that end, advocating open data and software in this path is critical for maximising access to the required knowledge for students worldwide (without any economic barrier), which is critical for tackling such global challenges. The project was also a valuable input to initiating discussions on potential research activities among different ISPRS WGs in the field of geospatial science and SDGs, by also stimulating the involvement of the youth through the ISPRS SC.

Future envisaged activities will consist of further promoting the developed material across PIs and Co-Is network and beyond, as well as involving new active contributors to extend and improve the material, e.g., by including additional hands-on exercises or new books/web book sections. The amelioration of both content and format of the currently available material is ongoing to fit into real university course programmes. The preparation of Workshop #3 represents the first experiment in the above direction.

F. Attachments

Technical Note on State-of-the-art in global HRLC for SDG indicators, Training Requirements and Course Syllabus.

Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets

ISPRS Educational and Capacity Building Initiative 2022

Technical Note on State-of-the-art in global HRLC for SDG indicators, Training Requirements and Course Syllabus

REVISION HISTORY

Revision Number	Date	Comment
v.0.0	1/7/2022	Initial draft
v.0.1	21/10/2022	Final draft
v.1.0	21/12/2022	Revised final version

This report was produced jointly by D. Oxoli, S.R. Reyes, S. Peng with contributions from M.A. Brovelli, S. Coetzee, I. Ivanova, D. Rawal, G. Vacca, and S. Zlatanova.

Scope

In the framework of the United Nations Sustainable Development Goals (UN SDGs), the support of geospatial data and technologies has turned out to be critical for both the assessment and the monitoring of key indicators, revealing the trajectory of our planet and society towards sustainability. The increasing availability of global open geospatial datasets - above all the global high-resolution land cover (HRLC) datasets - opens newsworthy opportunities for the computation and comparison of these indicators across different geographical regions as well as multiple spatial and temporal scales. The added value of these datasets is tangible, especially for developing countries, where often such information is only partially available from local authorities. Nevertheless, there are still several barriers to their proficient use due to the lack of data management and processing capacity using proper Geographic Information Systems (GIS) software tools.

In view of the above, the *Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets* project will address the creation of open training material (web-book and workshops) covering the complete learning process of discovering, accessing and manipulating global open geospatial datasets for computing SDG indicators, with a focus on those directly connected to marine and terrestrial ecosystems, urban environment, and climate. To ensure the widest possible accessibility, the material will primarily leverage the Free and Open Source Software (FOSS) QGIS and it will be released under a Creative Commons Attribution 4.0 License (CC BY 4.0).

This document illustrates the rationale behind the project by providing a focused review of the state-of-the-art in global HRLC for SDG indicators, an analysis of training requirements and materials, the syllabus of the training material, and the plan for training and dissemination activities. Conclusions and outlook deriving from the project design and its preliminary results conclude the document.

1. State-of-the-art in global HRLC for SDG indicators

Despite the development of the Global SDG framework was originally based on traditional statistical data [1], many statistical offices and governmental agencies have recognised the need for geospatial data to augment non-spatial information and provide new and consistent data sources, which are critical to SDGs monitoring. In fact, It has been estimated that approximately 20% of the SDG indicators can be interpreted and measured either through the direct use of geospatial data itself or through integration with complementing statistical data [2]. GIS, Earth observations and global-coverage geospatial data provide an important link to enable consistent comparison among countries, provide granularity and disaggregation of the indicators and communicate their geographic dimensions [3][4].

Key global geospatial data products that cover major thematic areas of the biosphere and society (e.g. land cover, vegetation productivity, forests, wetlands, surface water, human settlements, etc.) are strongly supporting the methodological development and measurement of a number of SDG indicators [5]. Generally, national or local geospatial data provide (where available) a higher spatial and temporal resolution than coarser global products and - in turn - better capabilities for accurate monitoring of SDG indicators. However, the uneven availability of such data often prevents consistent assessment of SDGs progress across countries worldwide. In this context, the use of open global geospatial datasets represents a quick, efficient and cost-effective solution to provide a first comprehensive assessment before national data is produced and analysed [5].

A notable class of key global geospatial products, which plays a major role in many SDGs, is the class of high-resolution global land cover (HRLC) maps. The land cover stands for all the geospatial information describing the physical and biological cover of the Earth’s surface. Land cover data products at high spatial resolution have a critical role in many scientific and policy-making applications, including climate modelling, natural resources management, landscape and biodiversity preservation, urbanization monitoring, and spatial demography [6]. In the last two decades, the advancement of satellite land Remote Sensing as well as the availability of global coverage satellite imagery with high temporal resolution - available as free and openly-licensed data - have significantly promoted international coordination in SDGs monitoring and favoured production, access and usability of global and multi-temporal HRLC data products [7]. Accordingly, it has been assessed that currently available open and global HRLC data could potentially be exclusively used for measuring indicators from four of the SDGs (i.e. 6 Clean water and sanitation, 13 Climate action, 14 Life below water, 15 Life on land), and could be used to complement other data types for four other goals (2 Zero hunger, 9 Industry, innovation and infrastructure, 11 Sustainable cities and communities, 12 Responsible consumption and production) [8][9]. A comprehensive list of SDG indicators to which global HRLC data as well as geospatial information in general have a direct contribution is provided in [10].

This enhanced global HRLC data availability has led to a wealth of studies, applications and methodology guidelines connected to the use of such data in SDG indicators computing and monitoring [4][11][12]. Relevant examples in the literature include the analysis of land-cover efficiency [13][14], land consumption rate [15] [16], and forest cover [17], which are key thematic variables e.g. for SDG 15 and 11.

Open and global HRLC data provide different temporal coverages, spatial resolutions, thematic details (or classes), and accuracies. Therefore, the suitability (fit-for-purpose) of global HRLC data for each specific SDG indicator has to be assessed case by case. According to [3], fit-for-purpose global HRLC data should be characterized by a minimum spatial resolution of 1 km and a minimum temporal resolution of 3 to 5 years. The thematic detail is instead indicator-specific. Finally, the accuracy of global HRLC data generally varies across the globe and local validation is strongly suggested depending on study areas and the user-expected accuracy performances [18][19].

Some of the most popular and mature, openly available, fit-for-purpose global HRLC datasets are reported and detailed in Table 1.

Global HRLC Dataset	Temporal Coverage	Spatial Resolution	Thematic detail	Notes
GlobeLand30	2000, 2010, 2020	30 m	10 main classes: Cultivated land, Forest, Grassland, Shrubland, Wetland, Water bodies, Tundra, Artificial surfaces, Bare land and Permanent snow and ice	- Provider: National Geomatics Center of China - Access: http://www.globeland30.org (login requested) - CRS: WGS84 - UTM projection - Format: raster
Finer Resolution Observation and Monitoring of Global Land Cover (FROM-GLC)	2010, 2015, 2017	30 m	10 main classes: Cropland, Forest, Grass, Shrub, Wetland, Water, Tundra, Impervious, Bare land, and Snow/Ice	- Provider: University of Tsinghua - Access: http://data.ess.tsinghua.edu.cn (login requested) - CRS: WGS84 - Format: raster
Copernicus Global Land Cover	2015-2019 (every year)	100 m	10 main classes (cover fractions): Forests, Shrubland, Herbaceous vegetation, Moss & Lichen, Bare / Sparse vegetation, Cropland, Built-up, Snow & Ice, Seasonal inland water and Permanent inland water. 23 classes aligned with UN-FAO's Land Cover Classification System (https://www.fao.org/3/x0596e/x0596e00.htm)	- Provider: Copernicus Land Monitoring Service - Access: https://lcviewer.vito.be (login requested) - CRS: WGS84 - Format: raster
ESA-CCI-LC	1992 - present (every year)	300 m	22 classes aligned with UN-FAO's Land Cover Classification System	- Provider: ESA Climate Change Initiative - Access: a) https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-land-cover (login requested) b) http://maps.elie.ucl.ac.be/CCI/viewer/download.php (login requested) - CRS: WGS84 / Plate Carree - Format: raster (NetCDF)

The Terra and Aqua combined Moderate Resolution Imaging Spectroradio meter (MODIS) Land Cover Type	2001- present (every year)	500 m	Multiple classes and classification schemas (https://lpdaac.usgs.gov/documents/101/MCD12_User_Guide_V6.pdf)	- Provider: United States Geological Survey - Access: https://lpdaac.usgs.gov/products/mcd12q1v006 - CRS: MODIS Sinusoidal (SR-ORG:6974) - Format: raster (HDF4)
Global Human Settlement built-up surface (GHS-BUILT-S)	1975 - 2030 (every 5 years)	Up to 100 m (3 arc seconds)	Built-up	- Provider: European Commission, Joint Research Centre - Access: https://ghsl.jrc.ec.europa.eu/download.php?ds=bu - CRS: Mollweide - Format: raster
Freshwater Ecosystems Explorer	2000 - 2018	Up to 300 m	Permanent and seasonal surface water, Reservoir, Wetlands, Mangroves	- Provider: UN Environment - Access: https://www.sdg661.app/downloads - CRS: WGS84 - Format: raster

Table 1: Selection of most popular and mature open global HRLC datasets suitable for SDG indicators computation

Global HRLC data were also used in combination with complementary global geospatial information [3][12] demonstrating their capabilities of directly supporting the computation of indicators e.g. from SDG 2 [20], 6 [22], and 9 [21].

Actually, land cover is only one of the Global Fundamental Geospatial Data Themes to SDGs identified by the United Nations [23]. These Fundamental Themes include a variety of geospatial datasets which are necessary to spatially represent key phenomena and objects for the realisation of economic, social, and environmental targets identified by the SDGs. These datasets include - among others - demography, soil/vegetation parameters, administrative boundaries, infrastructures, transport networks, 2D/3D topographic maps, water bodies, etc. [4].

The suitability (fit-for-purpose) of complementary global geospatial datasets is difficult to assess globally for each specific SDG indicator or country. Spatial and temporal resolutions, thematic details and accuracies should be evaluated case-by-case, using recommendations valid also for the global HRLC data, and their use should be functional to the provision of baseline data in support of national SDGs reporting [24].

Table 2 contains information on popular global open geospatial datasets which might be employed in combination with global HRLC data for the computation of land cover-connected SDG indicators [24][25].

Global Dataset	Temporal Coverage	Spatial Resolution	Thematic detail	Notes

World Bank Official Boundaries	Annual	/	Administrative boundaries (and polygons) including international boundaries, disputed areas, coastlines, lakes	- Provider: World Bank - Access: https://datacatalog.worldbank.org/search/dataset/0038272 - CRS: WGS84 - Format: vector
WorldPop Population Counts	2000- 2020 (every year)	Up to 100 m (3 arc seconds)	Population	- Provider: WorldPop - University of Southampton - Access: https://hub.worldpop.org/project/categories?id=3 - CRS: WGS84 - Format: raster (Geotiff, ASCII XYZ)
Global Human Settlement population (GHS-POP)	1975 - 2030 (every 5 years)	Up to 100 m (3 arc seconds)	Population	- Provider: European Commission, Joint Research Centre - Access: https://ghsl.jrc.ec.europa.eu/download.php?ds=pop - CRS: Mollweide - Format: raster
GHS Urban Centre Database (GHS-UCDB)	2015, 2019	1 km (30 arc seconds)	Urban centres polygons	- Provider: European Commission, Joint Research Centre - Access: https://ghsl.jrc.ec.europa.eu/download.php?ds=ucdb - CRS: Mollweide - Format: vector (GeoPackage)
OpenStreetMap	/	/	Multiple (including transport networks)	- Provider: OpenStreetMap - Access: https://www.openstreetmap.org (provider's portal, login requested) http://download.geofabrik.de; https://overpass-turbo.eu (additional providers) - CRS: WGS84 - Format: vector

Table 2: Selection of popular global open geospatial datasets, complementary to global HRLC data, relevant to SDG indicators computation

The datasets and bibliographic references, identified in the above summary review, represent both the theoretical and the material background on which the *Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets* project is based.

2. Training Requirements

Despite the availability of fit-for-purpose and open global HRLC and complementary datasets, there are still several barriers to their proficient usage due to the lack of capacity in data management and processing using proper GIS software tools. The need for capacity-building actions in governance and technology regarding the use of geospatial information for the SDGs is advocated - indeed - by different UN working groups on SDGs [2][7][10][12].

According to the above, the *Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets* project aims to deliver up-to-date training material by leveraging open geospatial technology toolsets, specifically addressing the application of global HRLC and complementary datasets to SDG indicators. The ultimate goal is to support the reduction of the gap between the available datasets and their widest possible target audience (technicians, scholars, professionals, etc.) with a focus on developing countries.

Training requirements were outlined and assessed by the project's team through an open survey (https://forms.office.com/r/zswC9NhNYK), which was circulated among the PIs and Co-PIs contacts and beyond. These included also the media channels of the ISPRS Student Consortium, in agreement with the educational purpose of the project. Results of the survey facilitated the identification of the primary users' group and training needs while also collecting feedback on the initiative and an early list of individuals willing to participate in the training. Results are summarised in the following sections.

Training audience characterization

Survey respondents (as of May 2022) were 102 whose demographics are reported in Figure 1. Respondents' familiarity with SGDs, GIS and global maps was also investigated. The results are included in Figure 2. Finally, respondents' interest in training was also surveyed. The results are included in Figure 3.

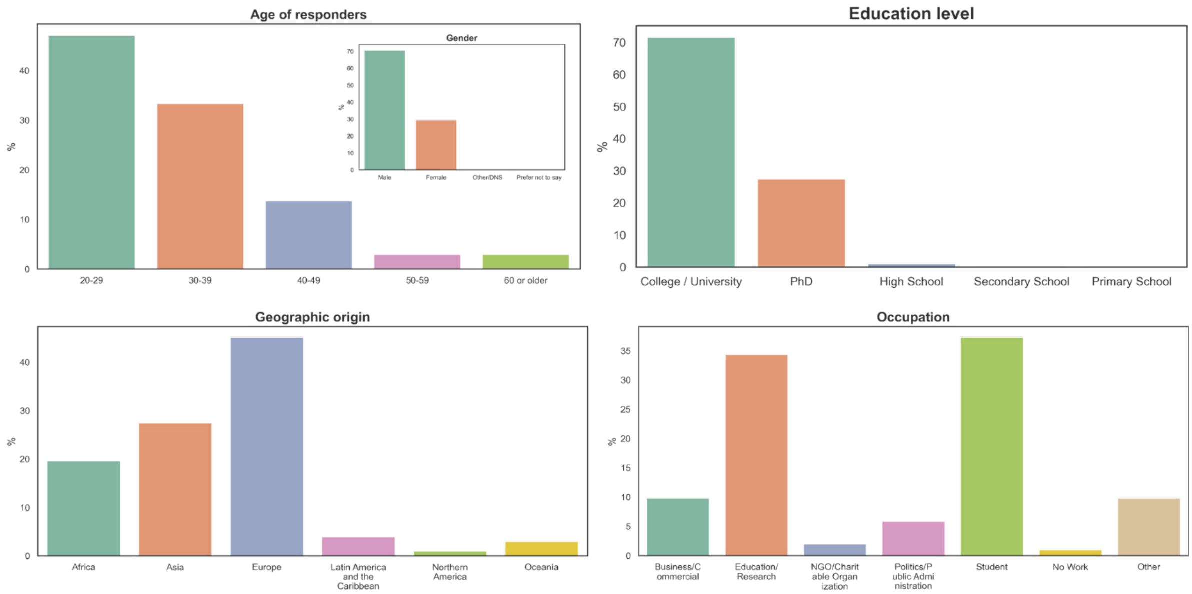

Figure 1: Demographics of survey respondents.

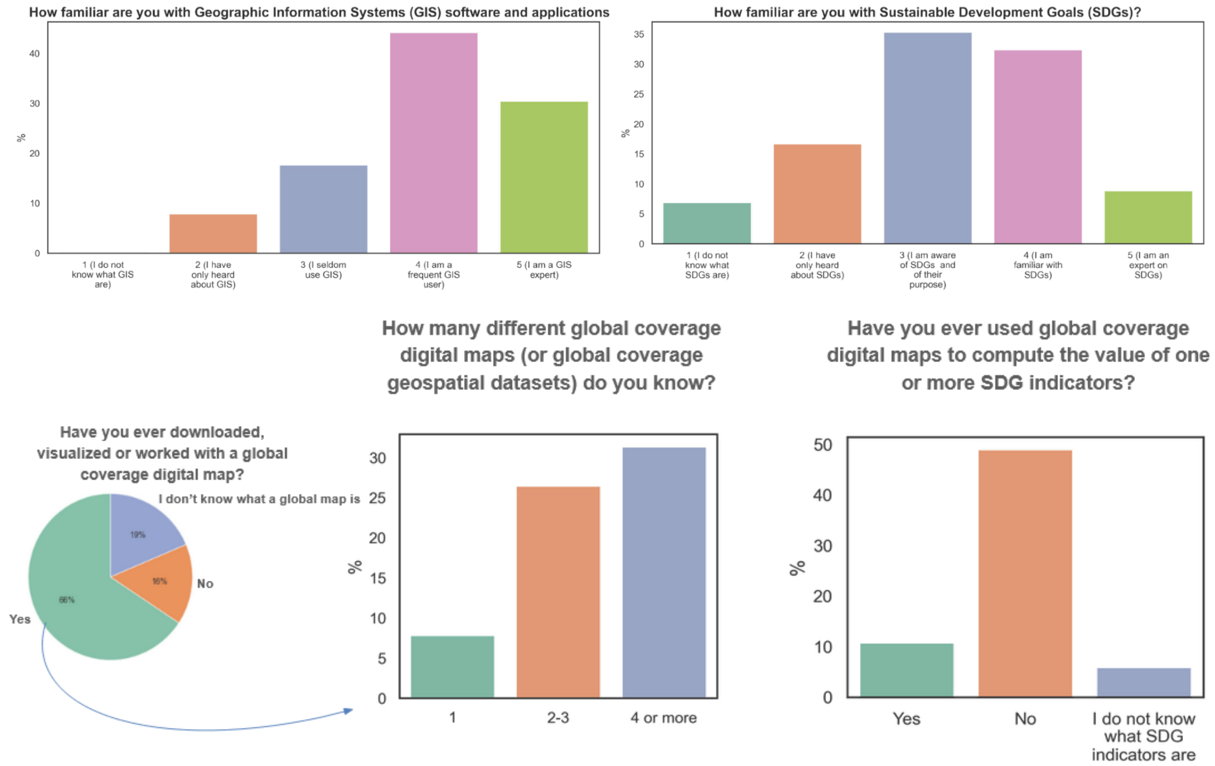

Figure 2: Familiarity of the survey respondents with SGDs, GIS and global maps.

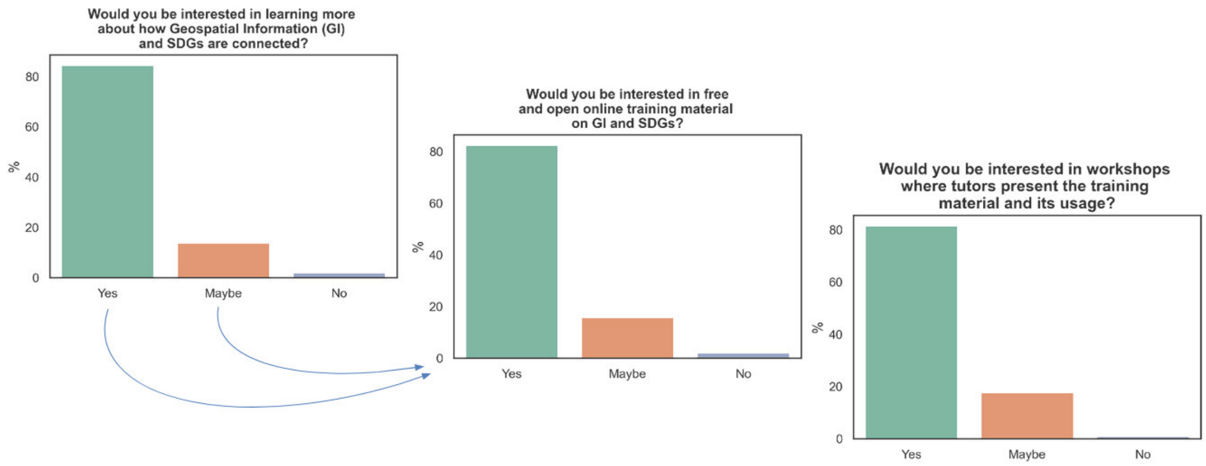

Figure 3: Survey respondents' interest in training material on SGDs, GIS and global maps.

The respondents' group was composed of mainly graduated students and both young researchers and professionals (Figure 1) who, accordingly, are considered the primary users' group for the project. Respondents declared a good knowledge of GIS and global maps while a generally lower familiarity with SDGs and, especially, with the use of global maps to compute SDG indicators (Figure 2). More than 70% of the respondents provided a personal email address to receive updates from the project and declared to be interested in open online training material as well as workshops on the project topics (Figure 3).

Training modality and materials

According to the heterogeneous geographical origin of the potential users' group (Figure 1), the interest in training materials and workshops on SGDs, GIS and global maps (Figure 3) and the expressed preference for workshop modality (Figure 4), the training material is conceived as online documentation (web book) while training workshops will be held in blended mode (and recorded).

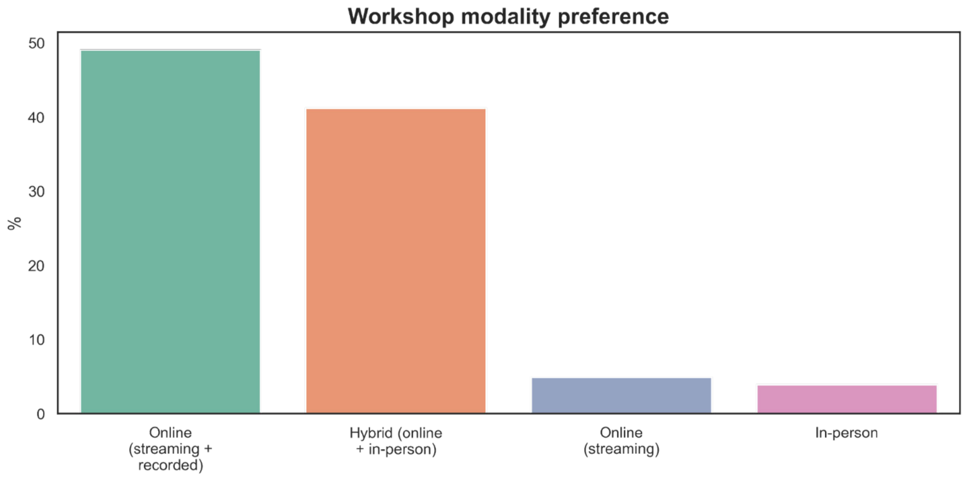

Figure 4: Survey respondents' workshops modality preferences

The openness of both data and software is considered key to the project Scope. To that end, the digital assets exploited in the development of material are selected as follows. The web book is based on the FOSS Python-Sphinx documentation generator (https://www.sphinx-doc.org). The web book source code is versioned on GitHub (https://github.com) in an online public repository at https://github.com/opengeolab/ISPRS_GIS_SDG, while the compiled version is published using the Read the Docs open hosting service (https://readthedocs.org) at https://isprs-gis-sdg.readthedocs.io. The web book is released under a Creative Commons Attribution 4.0 License (CC BY 4.0) which allows for free access, reuse and improvement of the content by any interested user. The content of the web book is described in Section 3.

In Section 2, some of the most popular and mature open global HRLC and complementary datasets - suitable for SDG indicators computation - are identified. These are primarily exploited in the development of the training material. Samples of these datasets for case study development are provided through the open online data repository Zenodo (https://zenodo.org) at https://doi.org/10.5281/zenodo.7152401.

The geospatial tools on which the training material is based reflect the usability and accessibility of open HRLC maps not to hinder their use in practical applications. FOSS GIS platforms should be preferred to proprietary software for educational and capacity-building actions as they guarantee fair access to cutting-edge analysis tools and replicable analyses [18]. Therefore, QGIS (https://qgis.org) - the most popular and complete FOSS GIS desktop platform [26][27] - was selected. QGIS provides users with plenty of core functionality for both raster and vector data processing and it has been already successfully tested to support specific SDGs mapping requirements [28].

3. Course Syllabus

The web book developed within the project is designed to include an introductory practical course on the combined use of open GIS and global HRLC and complementary datasets to compute SDG indicators. The course is made up of the following thematic sections. The first section provides a theoretical/informative preamble to SDGs and their connection to geospatial data and GIS. The second section reports sample lists, with references, descriptions and download patterns of principal open global HRLC and complementary datasets that can be used to compute SDG indicators. The third section outlines the main geospatial data processing functionalities of QGIS which are critical for SDG indicators computation. This section largely leverages available open documentation on the subject. Finally, the fourth section includes hands-on exercises on SDG indicator computation using some of the data that was profiled in the second section. Case studies for the hands-on exercises are selected by considering sample indicators which can be computed with the exclusive use of the identified open global HRLC and complementary datasets and, in principle, for any country or region worldwide. The outline of the course syllabus is provided as follows.

1. Background
   1.1 Introduction to SDGs
   1.2 Geospatial data and technologies for SDGs
2. Data
   2.1 Global High-resolution Land Cover datasets
   2.2 Other relevant global geospatial datasets for SDGs
3. Tools
   3.1 QGIS
   3.2 Key QGIS functionalities for SDG Indicators computation
4. Case studies
   4.1 SDG indicator 15.1.1 - Forest area as a proportion of total land area
   4.2 SDG indicator 9.1.1 - Proportion of the rural population who live within 2 km of an all-season road
   4.3 SDG indicator 11.3.1 - Ratio of land consumption rate to population growth rate
   4.4 SDG indicator 6.6.1 - Change in the extent of water-related ecosystems over time

Credits

Along with the proposed exercises, alternative data processing patterns, as well as insight into replacement data sources, are reported. Brief discussions on the limitations of the proposed datasets in computing the SDG indicators are also included to stimulate trainees' critical thinking on obtained numerical results and autonomous refinement/adaptation of the suggested procedures. To that end, an appendix section for the web book is envisaged to provide additional reference and resources including QGIS basics and SDG indicators map design, which is out-of-scope for the project but critical to SDGs effective communication.

4. Workshops and Events Planning

Workshops connected to the training material were envisaged by the project proposal and further justified by the survey responses, as discussed in Section 2. By taking into account the time extent of the project, the training requirement analysis process, and the goal of maximising users' involvement, three workshops are planned as follows.

Workshop #1 focuses on the preliminary project presentation, including survey outcomes, by seeking feedback from both potential users and domain experts on the outlined course syllabus. This activity was carried out through the participation of the project team at the Geospatial Information-enabled SDG Monitoring (GI4SDG) Forum Track of the XXIV ISPRS Congress held in Nice, France on June 7, 2022 [29].

Workshop #2 is dedicated to pilot testing of the draft web book content, including a showcase of the hands-on exercise, by collecting feedback which will be useful to adjust and complete the final version of the material. This activity is planned for the first quarter of 2023. It will consist of an online webinar and will involve pilot users.

Workshop #3 presents the final version of the web book and it is conceived as an open blended lecture. During the workshop, the full web book content (theory and hands-on exercises) will be presented to the participants by the project's team. This activity is planned for the first quarter of

2023. It will be hosted at the Politecnico di Milano campus (Milan, Italy) and advertised through PIs and Co-PIs contacts and media channels. Recording of the workshops will be published online and linked in the web book to guarantee permanent access to any interested user.

5. Conclusion and outlook

This technical note presented the design process adopted for the *Capacity Building for GIS-based SDG Indicator Analysis with Global High-resolution Land Cover Datasets* project. Accordingly, the main outputs were described together with their dissemination strategies. Besides the primary users' group identified for this project, it is expected that the wider GIS users community will also take advantage of the project results. To that end, the developed training material will be made publicly available online and will remain accessible in the long term.

The ultimate goal of the project is to enhance awareness of the connection between GIS and SDGs, especially, among GIS students and practitioners due to their potential key contribution to achieving Agenda 2030 in the next few years. To that end, advocating both open data and software in this path would maximise access to the required knowledge for students worldwide (without any economical barrier), which is critical for tackling such global challenges.

Finally, we believe that ISPRS as a whole will benefit from the Initiative as it represents a concrete action toward the furthering of geospatial technologies in sustainable development research and, more in general, toward the promotion of international cooperation in the development of spatial information sciences and their applications.

References

[1] United Nations (2017). Resolution adopted by the General Assembly on 6 July 2017. Technical Report A/RES/71/313.
https://documents-dds-ny.un.org/doc/UNDOC/GEN/N17/207/63/PDF/N1720763.pdf?OpenElement

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