2023 ANNUAL SUMMARY

# The Earth Observations for the Sustainable Development Goals Initiative

*Produced by Corena Pincham and Lillian Schaeffer at Booz Allen Hamilton in support to NASA*

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# 1.0 Overview of EO4SDG

The Earth Observations for Sustainable Development Goals (EO4SDG) Initiative is a growing global network of leaders from national and local governments, academia, research networks, multilateral organizations, non-profits, and entrepreneurial firms who work to accelerate the use of Earth science information in support of the Sustainable Development Goals (SDGs). EO4SDG is organizing its efforts using a combined top-down and bottom-up approach. The top-down approach involves working with the United Nations (UN) Inter-Agency Expert Group on SDGs (IAEG-SDGs), i.e. Working Group on Geospatial Information (WGGI)) and SDG custodian agencies to support the development and refinement of EO-integrated indicator methodologies, or facilitate the definition of new SDG indicators/sub-indicators that can more effectively inform related goals and targets. The bottom-up approach involves applied research, feasibility testing, development, and operationalization of methods in partnership with countries, with the objective to enable the uptake of EO solutions into national SDG monitoring frameworks, and eventually development policies. Additional efforts involve improving the provision, access, discoverability, and applicability of Earth observations and derived knowledge with the SDGs through trusted portals across communities; engaging countries in capacity building and co-learning efforts (e.g., webinars, toolkits); and increasing awareness of the effective uses of Earth observations to achieve benefits and positive impacts, thereby encouraging nations and stakeholders to pursue uses themselves (e.g., awards, scientific workshops, special issues). The Initiative promotes, partners with, and leads projects, communities and programmes that support the EO4SDG mission. EO4SDG has a dedicated website (https://eo4sdg.org) and social media (Twitter, Facebook) accounts to convey achievements and quality stories about roles of Earth observations and GEO to serve development goals.

The below sections highlight key accomplishments carried about by the EO4SDG team of GEO Member Countries, Participating Organizations, and additional contributors in 2023.

## 1.1 EO4SDG Board

In 2022, EO4SDG formed its inaugural Board, initiating a call for nominations and following a review and evaluation process to select ten inaugural EO4SDG Board Members.

The EO4SDG Board provides support to the EO4SDG Initiative spanning strategic direction-setting to tactical aspects. Board members and the Board lead serve a two-year term with a maximum of two terms. Their duties range from supporting leadership decisions, actively supporting major Initiative activities and being present for Initiative-wide and Board meetings throughout the year, raising awareness about the Initiative's activities to their respective communities, and serving as ambassadors to other parts of the GEO Work Programme for SDG knowledge-sharing.

The Board is composed of the following members:

- Lisho C. Mundia, Ministry of High Education, Technology and Innovation, Government of the Republic of Namibia
- Marwa Farouk El-Kabbany, UK Ordnance Survey

- Sandra Liliana Moreno, National Administrative Department of Statistics of Colombia (DANE)
- Rafael Monge, Harvard Kennedy School
- Amadou Moctar Dieye, Centre de Suivi Ecologique, Senegal
- Lorenzo de Simone, United Nations Food and Agriculture Organization (FAO)
- Anusuya Datta, CarbonTerra
- Maryam Rabiee, United Nations Sustainable Development Solutions Network (SDSN)
- Monika Kuffer, ITC University of Twente
- Philip Thigo, Special Envoy on Technology, Republic of Kenya

*Lorenzo de Simone is the 2022-2024 Board Chair.

The Board reached its first anniversary in June 2023. Members gathered at four virtual meetings in 2023, which took place in March, June, September, and December. Key discussion themes throughout the year include assessment of the GEO Work Programme Survey on SDGs, the search for a 3rd EO4SDG Co-Chair, and broadening Board member engagement with various parts of the EO4SDG community.

## 2.0 Community Engagement

### 2.1 Whole Initiative Meeting

Members of our community were invited to a Whole Initiative meeting in October, which celebrated EO4SDG's 2023 milestones. Holding this event was critical for leadership, given that the last gathering of this kind had not taken place since March 2022. The EO4SDG team used this opportunity to share central achievements and interests of the past year with longtime and new affiliates. Commentary was made by the attendees about recent successes in the Earth observations and sustainable development communities, outreach opportunities, and new thematic ideas. A formal survey was also shared with the EO4SDG community to expand upon their thoughts and detail suggestions for advancement of the Initiative's goals.

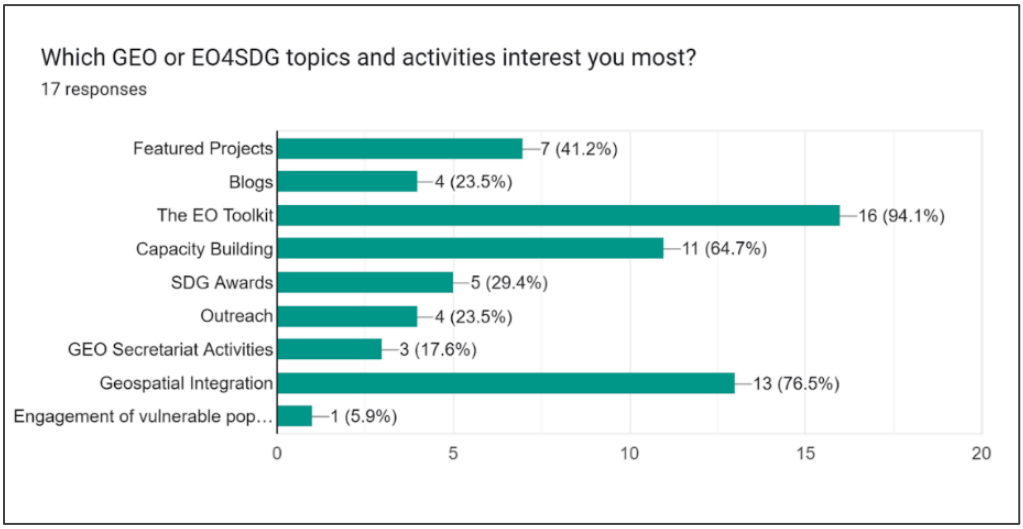


**Figure 1.** Bar graph of Whole Initiative survey results on topics and activities of interest.

Survey responders showed enthusiasm for the EO Toolkit, geospatial data integration efforts, and capacity building activities. The most beneficial resources that respondents felt the Initiative should prioritize are data toolkits akin to the resources of the EO Toolkit on Sustainable Cities and Human Settlements, knowledge-sharing events, and other training materials for EO product access and integration. Emphasis on strengthening relationships with national statistical offices, the UN Committee of Experts on Global Geospatial Information Management, and city-level practitioners was also prominent.

## 2.2 EO4SDG at GEO WEEK 2023

GEO Week 2023 was themed "The Earth Talks," which speaks to GEO's desire to respond to environmental calls for action with better-centralized data, innovative technology, and inclusive engagement. Plenary sessions introduced attendees to GEO's new website, and two new programmatic efforts–the GEO Global Heat Resilience Service and Global Ecosystems Atlas. The GEO Post-2025 Strategy "Earth Intelligence for All" was endorsed by GEO Members at the Ministerial Summit, and a Youth Declaration was presented for the first time to acknowledge the importance of empowering youth to explore EO and participate in the global movement to produce and distribute EO data.

### 2.2.1 EO4SDG Side Event

EO4SDG held a side event titled "Earth Observations in Support of the Sustainable Development Goals: Opportunities and Challenges" on the second day of GEO Week, November 7th, 2023. The event examined the role Earth observation and geospatial data play in promoting the Sustainable Development Goals (SDGs). GEO-connected organizations along with their tools and techniques were highlighted to communicate the opportunities and challenges as we approach the midpoint of the 2030 Agenda.

**Figure 2.** Group photo of GEO Week SDG workshop panel.

Featured presentations addressed the Copernicus ecosystems benefit to the SDGs and climate action, the design of SDGs-EYES (Sustainable Development Goals – Enhanced monitoring through the familY of copErnicus Services) to use Copernicus data for tracking of six SDG indicators, Esri's research and development into deep learning models that can map SDG's, the EO Toolkit portal and the ways it can be used to measure SDG 11 targets affecting urbanization, and the International Research Center for Big Data for Sustainable Development Goals (CBAS)'s goals to advance the SDG's through EO technologies such as big data.

## 2.3 EO4SDG at AGU2023

The Initiative convened an e-Lightning session at the American Geophysical Union Annual Conference in San Francisco, California in December. Corena Pincham represented EO4SDG at the session alongside co-conveners Sushel Unninayar, Danielle Wood, and Argyro Kavvada.

Titled “Earth Science and Observations for Advancing the Implementation of Sustainable Development Goals,” nine individuals showcased research projects on EO integration for quantitative SDG indicator assessment in support of policy making and effect natural resources management. The presenters represented NASA Goddard, Colorado State University, Korea University, MIT, University of Colorado, University of Delaware, Cornell University, and the Euro-Mediterranean Center on Climate Change.

**Figure 3.** Images of AGU session conveners and poster presenter.

## 3.0 2023 GEO SDG Awards


**Figure 4.** Group photo of the 2023 GEO SDG Award Winners.

This year, we recognized five organizations and countries for their exemplary work in three Sectoral and two Special Categories.

*SECTORAL CATEGORY AWARDS*
1. **SDG Custodian Agency:** Food and Agriculture Organization of the UN (FAO)
2. **GEO Participating Organization:** Committee on Earth Observation Satellites (CEOS) SDG Coordination Group
3. **Civil Society:** World Resources Institute (WRI)

*SPECIAL CATEGORY AWARDS*
4. **Statistical-Geospatial Integration:** Lesotho Bureau of Statistics and FAO Lesotho
5. **Innovation:** Politeknik Statistika

EO4SDG received 21 nominations this year in 8 of 9 award categories: Academia (1); Civil Society (4); Commercial (2); GEO Member Country (6); GEO Participating Organization (5); GEO Work Programme Activity (1); Inter-governmental (1); SDG Custodian Agency (1).

The nominations period ran from May 16 - July 2, 2023, with an extension through July 16, 2023. The EO4SDG team, in coordination with the GEO Secretariat, conducted a promotional campaign to help generate enthusiasm and interest ahead of the May 16 opening call for nominations.

A campaign to announce and advertise the opening of the 2023 EO4SDG awards included a NASA Applied Sciences Program news post, advertising through the community and member networks, and showcasing winner testimonials from previous years through social media platforms. Three winner testimonial posts on Twitter were made in the days leading up to the close of the nomination period to demonstrate the impact of the award program as encouragement to our audience to make submissions. These tweets received a fair amount of engagement from longtime affiliates of the Initiative, and individuals and organizations which follow the EO4SDG account. Individual promotion of our 5 winning projects on Twitter after the awards ceremony increased online engagement, bringing interest from the respective organizations' audiences.

## 3.1 Project Summaries

**SDG Custodian Agency:** Food and Agriculture Organization of the UN (FAO) - Monitoring land and water productivity by Remote Sensing, FAO WaPOR

FAO's WaPOR portal provides access to remotely sensed derived data, and monitors and reports on agriculture water productivity in near-real time from 2009 onwards. Earlier editions covered Africa and MENA countries, and its global edition was launched on 4 October 2023, during the FAO Rome Water Dialogue. In addition to data production (in partnership with eLEAF) and dissemination, FAO actively supports the user groups in target countries in acquiring capacities for using the data and developing tailored applications that meet users' requirements, in partnership with IHE Delft and IWMI.

The WaPOR data are several geographical datasets at multiple scales (ranging from 300 m to 20 m resolution) derived from satellite observations concerning agricultural land productivity and water consumption (evapotranspiration). The core is information on 'water productivity,' which refers to the amount of agricultural yield produced per unit of water consumed (kg/m³). This is also referred to as 'more crop per drop' and is relevant for reporting of SDG 6.4.1 on water-use efficiency, for which FAO is custodian agency. All data, methodology, algorithms, and scripts are openly available, and the data is also distributed through API to facilitate integration in existing platforms, tools, or applications.

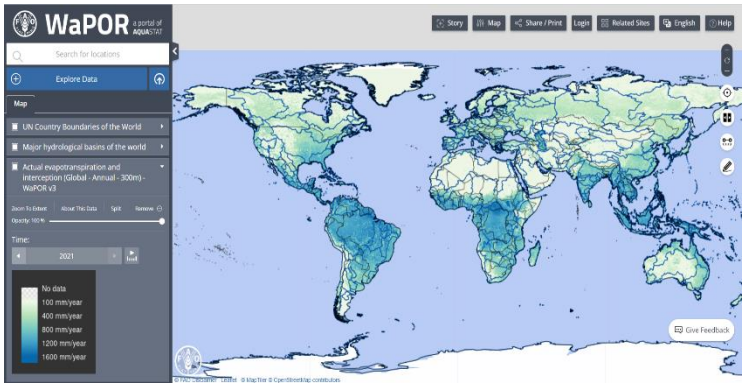


**Figure 5.** View of FAO's WaPOR dashboard.

**Figure 6.** Attendees of a WaPOR training workshop held with the Libya Ministry of Water Resources to empower women in water, agriculture, meteorology, and geospatial sciences.

**GEO Participating Organization:** Committee on Earth Observation Satellites (CEOS) SDG Coordination Group

The Committee on Earth Observation Satellites (CEOS) ensures international coordination of civil space-based Earth observation programs and promotes exchange of data to optimize societal benefit and inform decision making for securing a prosperous and sustainable future for humankind. Satellite


**Figure 7.** View of the CEOS SDG feature website.

Earth observations enable a unique view of our world and generate substantial amounts of data that facilitate new methods and provide new insights to quantify, monitor and assess Sustainable Development Goals and related Indicators.

Since 2016, CEOS has actively supported GEO with coordinating sustained efforts across Space Agencies to promote and facilitate easier data uptake for countries in support of the UNSDGs. The SDG Coordination Group (formerly known as 'ad hoc team on SDG,' SDG AHT) serves as the focal point on all SDG-related activities, to provide satellite Earth observation expertise to external partners including GEO and highlight the invaluable contribution of satellite-based monitoring to keep track and achieve SDGs. For instance, in collaboration with global SDG experts and Custodian Agencies, CEOS has produced a dedicated "EO Handbook on SDGs" (2018), and more recently has produced a series of invaluable resources for Indicator reporting, providing information on satellite data availability for specific Indicators, opportunities and methods, observation gaps and needs. In addition to this, CEOS helps to set global standards for EO use on SDG analytics, which is critical to improve SDG measurement consistency and validation across the globe.

**Figure 8.** The CEOS SDG ad-hoc team in 2017.

**Civil Society:** World Resources Institute (WRI) - Energy Access Explorer

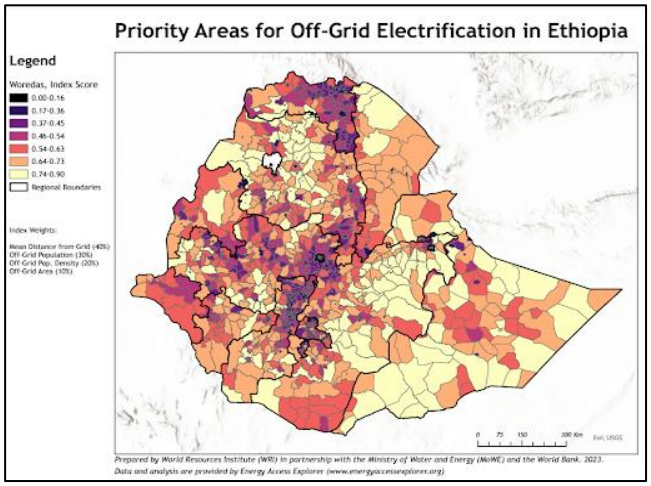


**Figure 9.** WRI map of off-grid electricity needs in Ethiopia.

Energy services are highly interconnected with socio-economic development and human well-being. Yet, life without reliable energy is a reality for more than 675 million people globally. Effectively expanding energy access requires proper energy planning and access to transparent analytical tools and data. To help address this challenge, WRI, in collaboration with partners developed the Energy Access Explorer (EAE), a data-driven, integrated, and inclusive approach to achieving universal access to energy for equitable, socio-economic development.

EAE is the first, open-source, online and interactive geospatial platform that enables

energy planners, clean energy entrepreneurs, donors, and development institutions to identify high-priority areas for energy access interventions. EAE functions also as a dynamic information system, reducing software engineering and data transaction costs for both data providers and users and facilitating data management and governance. This endeavor fostered the creation of cross sectoral EAE working groups which enable an integrated and inclusive approach to energy planning. This platform's achievements are visible through the use cases of Kenya, Zambia, Uganda, Nigeria, and Ethiopia.


**Figure 10.** Market analysis of Nigeria for the Clean Energy Africa Minigrid program.

**Statistical-Geospatial Integration:** Lesotho Bureau of Statistics and FAO Lesotho - EOSTAT: EO for monitoring land cover, ecosystems, and reporting on SDG 15.4.2

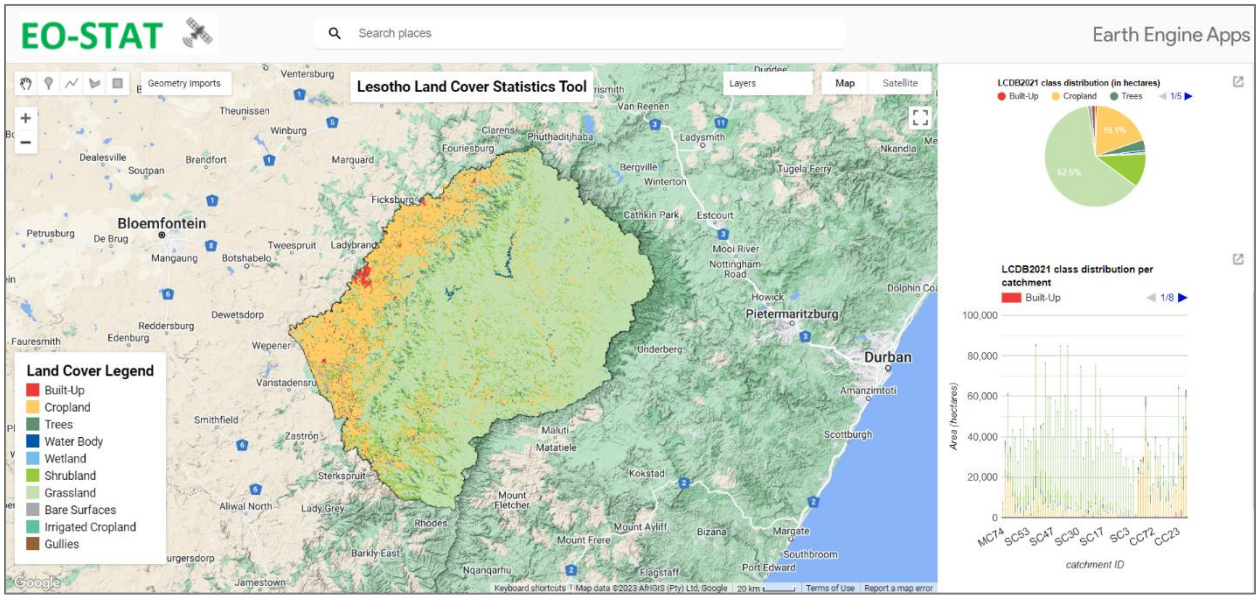


**Figure 11.** View of the EOSTAT Dashboard.

The Bureau of Statistics of Lesotho and the FAO Office of Lesotho developed a solution that allows for on-the-fly computation of the mountain green cover index (MGCI) at the national level. EOSTAT is disaggregated by elevation zones, using 10m resolution Sentinel-2 land cover data. Prior to implementation, there were no mechanisms in place to update the existing national LC baseline from 2015, which made reporting on SDG 15.4.2 unattainable. In this context, this robust EO-based solution has been a game changer, as it satisfies a multitude of reporting tasks through national land cover and

land cover change statistics. This allows for significant cost savings on field survey activities, and for pertinent data gaps to be filled with ensured accuracy, timeliness, and granularity.

Thanks to the big data infrastructure underpinning the solution, it was possible to integrate the Land Cover and SDG modules with specific ecosystem health indicators, simplifying the process to monitor ecosystem status in any area in the country at any time. EOSTAT is used by the National Meteorological Services to identify hotspots of vegetation degradation, monitor the impact of land restoration projects, and assess the impact of climate change on the status of ecosystems. The Ministry of Forestry, Range and Soil Conservation also uses the tool to monitor the health of rangelands in real time. This partnership with the national FAO office on the EOSTAT platform increased Lesotho's national capacity to produce SDG indicators, and fostered new possibilities for monitoring national ecosystem health and ecosystem services.


**Figure 12.** Attendees of a training held on the use of the EOSTAT dashboard in partnership with the ReNOKA Integrated Catchment Management Programme in 2022.

**Innovation:** Politeknik Statistika STIS - Granular Poverty Mapping from Space

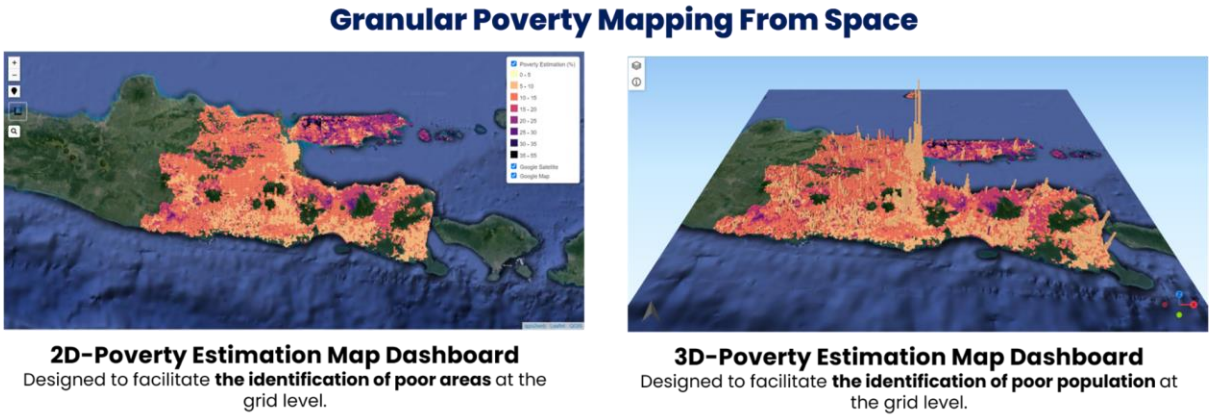


**Figure 13.** Granular Poverty Map Dashboard.

Official poverty data have been usually collected through on-the-ground household-based socioeconomic surveys. Unfortunately, data collection with such conventional methods is expensive, laborious, and time-consuming. Additional information that can describe poverty with better granularity in scope and at lower cost, taking less time to update, is needed for more effective decision-making on poverty alleviation (SDG 1). Politeknik Statistika STIS, Indonesia has played a leading role in the study of leveraging Earth observation big data for poverty mapping, especially in Indonesia. Various geographical perspectives related to impoverished areas are obtained by analyzing multi-source satellite imagery and other geospatial big data. A machine learning-based model for estimating poverty is then constructed to provide estimates of poverty up to the 1 km grid level. This promising field is then expanded in terms of its application for granular child poverty mapping in order to support SDG target 1.2. To maximize its use in supporting poverty decision-making, the mapping results are presented in a 2D and 3D dashboard that is accessible to non-technical users. The 2D dashboard is designed to facilitate the identification of granular impoverished areas, while the 3D dashboard is focused on poor population distribution identification.


**Figure 14.** Project presentation at the United Nations 7th International Conference on Big Data and Data Science for Official Statistics in 2022.

# 4.0 Achievements of the EO Toolkit

## 4.1 AmeriGEO and GEO Health Community of Practice Showcases

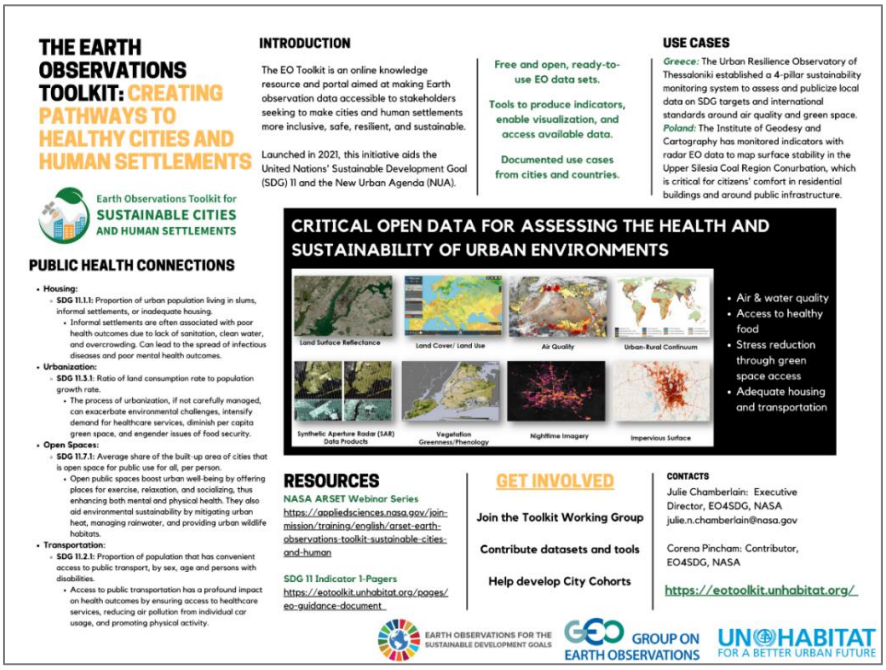


**Figure 15.** EO Toolkit poster from the AmeriGEO Week side event.

The EO4SDG team presented twice on SDG 11's connections to public health research and policy setting over the summer. A poster was presented at an AmeriGEO Week side event which highlighted the EO Toolkit's data resources that can support health assessments of urban environments. This was expanded upon in a presentation at a community teleconference hosted by the GEO Health Community of Practice, describing how the Toolkit portal can benefit analysts, policymakers at both national and city levels, commercial entities, and community organizations to improve urban health outcomes. Audiences of both presentations were encouraged to explore the EO Toolkit site and consider getting involved in the "city cohorts" project in development, an effort to foster collaboration between global cities to understand how EO data can enhance urban policymaking needs in their respective environmental contexts.

## 4.2 ArcGIS Learn Lesson on Degree of Urbanisation

EO4SDG and the EO Toolkit supported Esri in its production of an ArcGIS Learn Lesson tutorial on the Degree of Urbanisation methodology in the fall. Adopted by the UN Statistical Commission in 2020, this classification system allows for international statistical comparison of delineated cities, towns, suburbs, and rural areas. The progress of regions and countries towards SDG achievement can be more accurately monitored and reported through this standardized calculator for urbanization. The tutorial enables users to create population classification and built-up surface maps on the ArcGIS Pro software.

Esri Solutions Engineer Keera Morrish wrote about the Learn Lesson in a November blog post, highlighting the work of the EO Toolkit as a hub for tools such as this to assess human settlements at multiple scales.

# 5.0 Strategic Communications

## 5.1 Mapping Progress Blog Series

A thematic blog series was initiated in July as a new effort to broaden audience engagement. The major goals of the series are as follows:

- Showcase the EO4SDG community's thoughts on the current status and future of EO and the SDGs at a critical juncture.
- Help develop our perspective on the present and future of the EO4SDG Initiative.
- Highlight real-world projects and use cases from around the world.
- Highlight our community's diverse expertise.
- Drive traffic to our website/interest to our other projects.

Executive Director Julie Chamberlain leveraged the help of board member Anusuya Datta in crafting the writing guidelines and general questions prompted to interested writers. Thanks to her journalism background, Anusuya also worked with some of the guest authors on draft editing. Lillian Schaeffer became the lead editing coordinator in late 2023.
Four blogs were published for this series in 2023, all of which were written by affiliates of the Initiative:

- Marwa El-Kabbany wrote about the United Arab Emirates' achievement toward its sustainable development agenda through its Earth observation data portals.
- Anusuya Datta wrote about Earth observations data applications within the carbon market.
- Keera Morrish described the function and educational value of the 2023-debuted ArcGIS Learn Lesson on "degree of urbanization" classification for urbanization mapping.
  Aravind Ravichandran provided an overview of the commercial climate tech landscape.

## 5.2 New Featured Project – SDG 6


**Figure 16.** Website view of the SDG 6 Featured Project.

In November we published a new Featured Project on the EO4SDG website on water quality research done by Science Systems and Applications Inc (SSAI) and NASA Goddard Space Flight Center (GSFC) scientist Nima Pahlevan. In support of SDGs 6.3.2 and 6.6.1, Nima led the development of the Satellite-based analysis Tool for Rapid Evaluation of Aquatic EnvironMents (STREAM) with pilot partners Peru and Uruguay. Both countries sought to improve their water resource monitoring capacity, and this EO-based algorithm has helped them capture country-specific water quality data. The tool will be launched for public use in 2024, allowing users to assess "the proportion of waterbodies with good ambient water quality," and its temporal variability using EO data. STREAM's methodology and delivery development was done with insights from the UN Environment Programme to reflect the SDG reporting requirements set by Agenda 2030. Highlighting this NASA-funded research is important for EO4SDG's demonstration of innovative EO applications advancing countries towards SDG achievement.

*The full project report can be found here.

# 6.0 2023-2025 Strategic Implementation Plan and Looking Forward

EO4SDG updated its strategic implementation plan for the 2023-2025 period. Key items for consideration and EO4SDG priorities for the 2023-2025 period include:

1. The recognition of the need for a stocktake to evaluate where we are, mid-way to 2030, regarding the use of EO to track, monitor, report, and drive progress on the SDGs.

   a. Towards this end, EO4SDG is planning to conduct a mapping survey, in collaboration with the FAO, to identify and map how GEO Members are using – or planning to use – EO data for the SDGs, mid-way to 2030. Survey results will help gain insights on the current use of EO for SDG analysis and reporting, and to define areas where EO4SDG and GEO, in coordination with UN custodian agencies like FAO, should reinforce these efforts. Responses will also enable the documentation, and promotion, of case studies and best practice examples, updating a 2018-2019 EO4SDG survey led by Japan (JAXA), EO4SDG Co-chair.

2. EO4SDG's role during the post-2025 GEO Work Programme (WP), which will emphasize objectives of integration and collaboration, open knowledge, operationalization, and user orientation, as defined by the GEO Plenary-17. Collaboration with other GEO Work Programme activities to effectively support numerous SDG targets, while avoiding duplication of efforts, has always been at the core of the EO4SDG mandate. In addition, EO4SDG recognizes that EO supports the understanding of the interactions among different SDGs, which can help countries maximize synergies to achieve multiple SDGs and resolve existing trade-offs. Looking at SDG interactions, while integrating knowledge from different GEO WP activities to support multiple SDGs, will be a challenge that EO4SDG will handle in close collaboration with other GEO activities to be post-2025 ready, and to participate in the GEO strategic direction towards delivering more and broader impact.
   a. Towards this end, EO4SDG is planning to conduct a mapping survey in 2023 to gather information about GEO WP activities, with the scope of mapping their relationships, direct and indirect, with SDG work to help identify and enable cross-programme collaboration for delivering accelerated impact and avoid duplication of efforts and resources. This survey may also be used to develop recommendations on collaboration in nexus areas and to improve communication, as well as mapping of GEO's portfolio, in future GWP cycles.
   b. EO4SDG is planning to participate in the post-2025 incubators, including the Climate – Urban - Health and Nature-Based Solutions ones. We also plan to explore opportunities for engaging with the Ocean – Pollution incubator. A potential activity in 2023 includes the organization of an EO4SDG workshop to discuss EO4SDG's role and engagement with the post-2025 GEO Strategy.
   c. EO4SDG plans to continue to promote data and knowledge sharing and integrations for SDGs by offering "Toolkit bridge solutions." This includes continuing to expand the impact of the Earth Observations Toolkit for Sustainable Cities and Human Settlements (EO Toolkit) and collaborating across GEO to initiate new solutions in support of nexus areas (e.g., ocean – pollution – climate).