From Data to Knowledge using the GEOSS platform to support Sustainable Development Goals

Conference Paper *in* IOP Conference Series Earth and Environmental Science · July 2020

DOI: 10.1088/1755-1315/509/1/012020

7 authors, including:

Gregory Giuliani
University of Geneva
162 PUBLICATIONS **3,916** CITATIONS
SEE PROFILE

Paolo Mazzetti
Italian National Research Council
127 PUBLICATIONS **2,129** CITATIONS
SEE PROFILE

Mattia Santoro
Italian National Research Council
73 PUBLICATIONS **945** CITATIONS
SEE PROFILE

Stefano Nativi
MAECI
327 PUBLICATIONS **3,321** CITATIONS
SEE PROFILE

From Data to Knowledge using the GEOSS platform to support Sustainable Development Goals

From Data to Knowledge using the GEOSS platform to support Sustainable Development Goals

Gregory Giuliani[1,2], Paolo Mazzetti[3], Mattia Santoro[3], Stefano Nativi[4], Joost van Bemmelen[5], Guido Colangeli[5], Anthony Lehmann[1]

[1]University of Geneva, Institute for Environmental Sciences,66 Boulevard Carl-Vogt, 1205 Geneva, Switzerland
[2]GRID-Geneva, International Environment House, 11 chemin des Anémones, 1219 Châtelaine, Switzerland
[3]CNR, 10 Via Madonna del Piano, 50019 Sesto Fiorentino, Italy
[4]European Commission – Joint Reseach Center, Via Enrico Fermi 2749, 21027 Ispra, Italy
[5]European Space Agency/European Space Research Institute, Largo Galileo Galilei, 1, 00044 Frascati, Italy

Corresponding author email: gregory.giuliani@unepgrid.ch

Avoiding, reducing and reversing land degradation and restoring degraded land is an urgent priority to protect the biodiversity and ecosystem services that are vital to life on Earth. The latest Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Landmark Assessment Report highlighted that land degradation through human activities is undermining the well-being of at least 3.2 billion people [1]. Currently, more than 75 % of Earth's land areas are substantially degraded. If this trend continues, more than 90 % of land areas could become degraded by 2050, potentially exacerbating climate change, biodiversity loss and leading to mass migration, conflict and major food security issues.

In order to halt and reverse the current trends in land degradation, there is an immediate need to enhance national capacities to undertake quantitative assessments and corresponding mapping of their degraded lands, as required by the Sustainable Development Goals (SDGs), in particular the SDG indicator 15.3.1 ("proportion of land that is degraded over total land area") as well as by the adoption of Land Degradation Neutrality (LDN) targets under the auspices of the United Nations Convention to Combat Desertification (UNCCD) [2]. Indicator SDG 15.3.1 has been classified as a Tier 2 indicator requiring regular data production by countries to inform this indicator. Earth Observations (EO) can play an important role both for generating the indicator as well complementing or enhancing national official data sources.

Remotely-sensed Earth Observations (EO) acquired by satellites can be a reliable source for monitoring land cover change and biomass activity over long periods [3]. However, many countries, in particular from the developing world, have difficulties to access and/or generate the necessary information for monitoring land degradation from EO data. In 2015, UNCCD initiated an LDN target-setting pilot project with 14 countries to evaluate the utility of global data sets on Land Cover (LC) and Land Productivity Dynamics (LPD) derived from remotely-sensed EO data. Countries were able to use global datasets in combination with their national data to set their national targets [4].

To leverage the information power of EO data and resources for generating the SDG 15.3.1 indicator, various components of the Global Earth Observation System of Systems (GEOSS) platform [5] have been used to build an analytical workflow, following the Data-Information-Knowledge pattern [6], together with the Trends.Earth model [7]. It also implements additional components for model execution and orchestration (Virtual Laboratory), knowledge management (Knowledge Base), and visualization (Dashboard) [8]. As a result, the workflow is able to generate the SDG 15.3.1 indicator at different spatial and temporal scales using the GEOSS platform, the Google Earth Engine [9] and the Copernicus Data and Information Access Services (DIAS) for data provision and processing at global and regional scales; and the Swiss Data Cube [10] to generate medium to high spatio-temporal data necessary to generate the indicator at a country scale. This workflow is developedt in the frame of the EU-funded H2020/ERA-Planet GEOEssential project, that is aiming to address the need for trusted sources of data and information to monitor progresses made on environmental conditions towards different policy targets [11].

This advances the vision of (1) the establishment of federated collaborative platforms with high computing capacities and big data analytics tools that would allow countries to easily select, access, process, analyze, interpret and quality control large datasets associated with EO and geospatial information; and (2) capacity development at the country level and ensuring national ownership of EO data and information on the use of practical tools to support countries in accessing, interpreting and validating EO data.

References

[1] IPBES, "Summary for policymakers of the thematic assessment of land degradation and restoration," IPBES secretariat, Bonn, Germany, 2018.
[2] P. Chasek, M. Akhtar-Schuster, B. J. Orr, A. Luise, H. Rakoto Ratsimba, and U. Safriel, "Land degradation neutrality: The science-policy interface from the UNCCD to national implementation," *Environmental Science & Policy*, vol. 92, pp. 182–190, Feb. 2019.
[3] A. L. Cowie *et al.*, "Land in balance: The scientific conceptual framework for Land Degradation Neutrality," *Environmental Science & Policy*, vol. 79, pp. 25–35, Jan. 2018.
[4] K. Anderson, B. Ryan, W. Sonntag, A. Kavvada, and L. Friedl, "Earth observation in service of the 2030 Agenda for Sustainable Development," *Geo-spatial Information Science*, vol. 0, no. 0, pp. 1–20, Jun. 2017.
[5] S. Nativi, P. Mazzetti, M. Santoro, F. Papeschi, M. Craglia, and O. Ochiai, "Big Data challenges in building the Global Earth Observation System of Systems," *Environmental Modelling & Software*, vol. 68, no. 0, pp. 1–26, 2015.
[6] J. Rowley, "The wisdom hierarchy: representations of the DIKW hierarchy," *Journal of Information Science*, vol. 33, no. 2, pp. 163–180, Apr. 2007.
[7] M. Gonzalez-Roglich *et al.*, "Synergizing global tools to monitor progress towards land degradation neutrality: Trends.Earth and the World Overview of Conservation Approaches and Technologies sustainable land management database," *Environmental Science & Policy*, vol. 93, pp. 34–42, Mar. 2019.
[8] S. Nativi, M. Santoro, G. Giuliani, and P. Mazzetti, "Towards a knowledge base to support global change policy goals," *International Journal of Digital Earth*, vol. 0, no. 0, pp. 1–29, Apr. 2019.
[9] N. Gorelick, M. Hancher, M. Dixon, S. Ilyushchenko, D. Thau, and R. Moore, "Google Earth Engine: Planetary-scale geospatial analysis for everyone," *Remote Sensing of Environment*, vol. 202, pp. 18–27, 2017.
[10] G. Giuliani *et al.*, "Building an Earth Observations Data Cube: lessons learned from the Swiss Data Cube (SDC) on generating Analysis Ready Data (ARD)," *Big Earth Data*, vol. 1, no. 1, pp. 1–18, Nov. 2017.
[11] A. Lehmann *et al.*, "GEOEssential – mainstreaming workflows from data sources to environment policy indicators with essential variables," *International Journal of Digital Earth*, vol. 0, no. 0, pp. 1–17, Apr. 2019.