



Food and Agriculture
Organization of the
United Nations

19th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)

Soil Information and Data

GSP – Soil Information and Data (SID)

13-15 November 2023
Online meeting

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS



Overview

INSII

GSP Plenary Assembly 2023

GloSIS

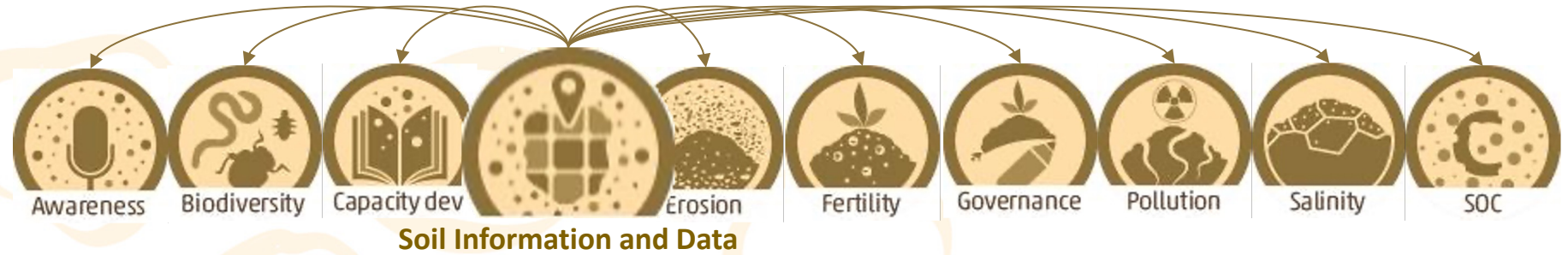
Country Driven Global Maps

SoilSTAT

HWSD v.2.0

Capacity Development

Global symposium '24



International Network of Soil Information Institutions

- GSPs **first** technical network, established in 2016
- Implements the activities under the GSP Area of Work: **Soil Information and Data**
- **122** FAO Member Countries + European Union
- Chaired by Mr Luca Montanarella (EU)
- INSII develops GloSIS, National Soil Information Systems and Country-Driven Global Data Products
- Supported by GSP Secretariat, ITPS, Thematic Working Groups



Overview

❖ **INSII in numbers**

GSP Plenary Assembly 2023

GloSIS

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Global symposium '24

INSII in Numbers 7+ Years

122

FAO Member Countries & EU

122

Soil Information Institutions

Global Data Products



36 Map Layers

+2 ongoing

System Development



National Soil Information Systems

1 in 2023 (LibSIS)
22 ongoing*

Capacity Development



Training Workshops

127 countries

Capacity Development



National Experts

400 in 2023

Publications



Key Publications

+1 In 2023

*Caribbean (SoilCARE), Asia (AFACI), Azerbaijan

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GSP Plenary Assembly 2023 - INSII

- **The PA welcomed and praised ...**
 - the **progress** made in establishing soil information systems under the framework of the Global Soil Information System (**GloSIS**)
 - INSII's contribution to unlocking and **raising awareness** on the importance of soil data
- **The PA underscored INSII's role** in the development of a key performance indicator system for the **GSP Action Framework 2022-2030** and global soil health index (**GSHI**) in line with **SoilSTAT**
- **The PA encouraged** the network to **actively contribute** to the work of the indicator system of the GSP Action Framework (**ISAF**) working group



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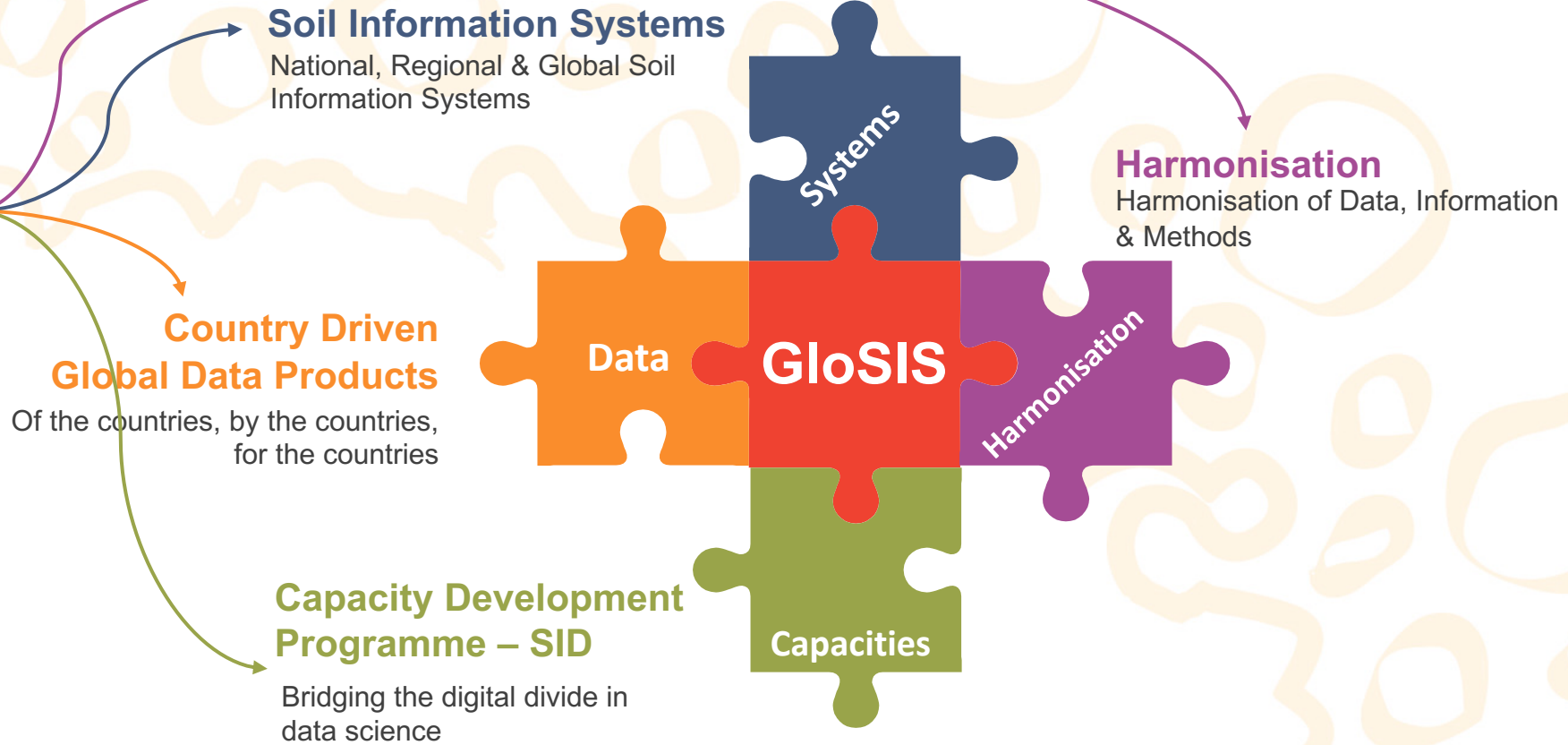
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INSIIs Contribution to Data Driven Decision and Policy Making at all Scales




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GloSIS Discovery Hub (online)

Home / Organizations / Global Soil Partnership



Global Soil Partnership
The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our... read more

Followers: 2 Datasets: 44

Organizations: Global Soil Partner... 44

Groups: There are no Groups that match this search

Tags

Datasets Activity Stream About

Search datasets...

44 datasets found Order by: Relevance

Soil Workability (HWSD)
On the basis of soil parameters provided by the Harmonized World Soil Database (HWSD) seven key soil qualities important for crop production have been derived, namely: nutrient...
[PDF](#) [WMS](#)

Topsoil CEC (CLAY)
This field gives the cation exchange capacity of the clay fraction in top-soil. The type of clay mineral dominantly present in the soil is often characterizes a specific set of...
[PDF](#) [WMS](#) [if](#)

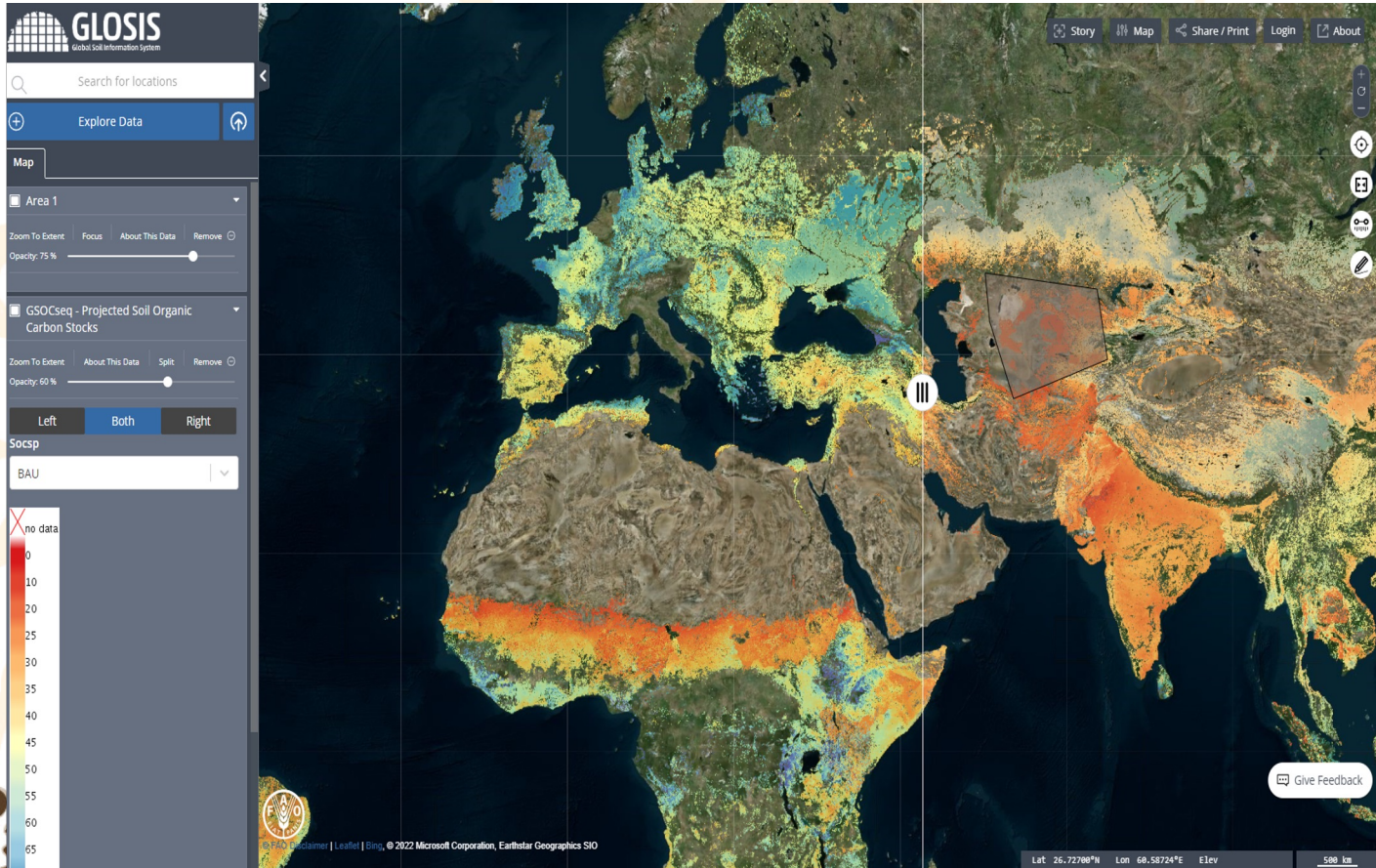
Topsoil Clay Fraction
Percentage clay respectively in the in the topsoil. Clay is naturally occurring firm earthy material, composed primarily of fine-grained (diameter less than 0.002mm) that is...
[PDF](#) [WMS](#) [if](#)

Topsoil Gravel Content
Volume percentage gravel respectively in the topsoil. Gravel stands for the percentage of materials in a soil that are larger than 2 mm. Data publication: 2012-03-01 Citation:

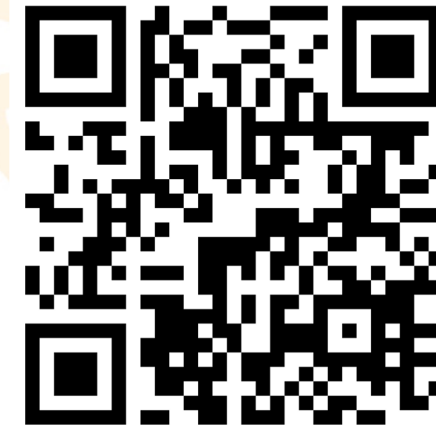
GloSIS Data Catalogue

- Global Data (Global Maps)
- NSIS will be connected (2023)
- SISLAC will be connected (2023)

GloSIS Map Service (online)

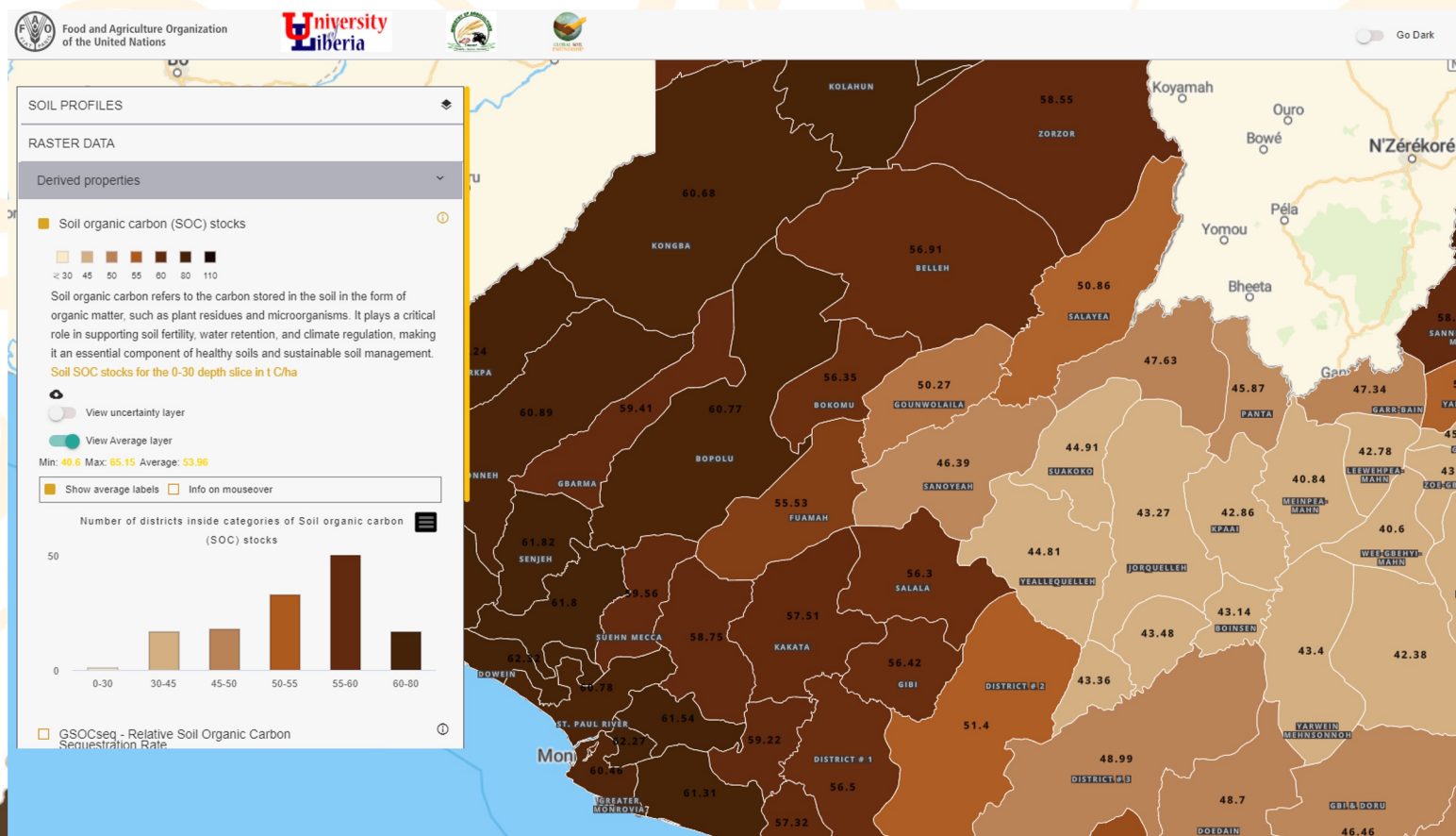


- GloSIS Map Services
- Connected to GloSIS Discovery Hub
- Advance Features
 - Compare, Download, Export, Share, Map Stories

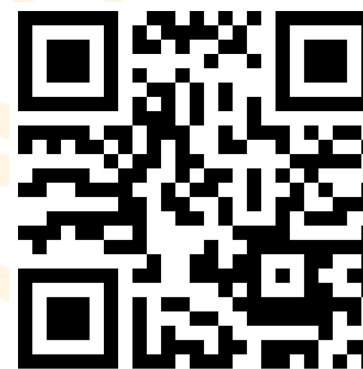


<https://data.fao.org/GloSIS/>

NEW - Liberian Soil Information System – [LibSIS](#)



Result of a TCP Project
(Launched in August 2023)



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of the countries, by the countries, for the countries

Kick-off

25%

50%

75%

100%



GSOCmap

v1.0 (2017) >> ...v1.6 (2022)

Global Soil Organic Carbon Map



GSOCseq

v1.0 – (2021) >> v1.1 (2022)

Global Soil Organic Carbon Sequestration Potential Map



GSASmap v1.2 (on hold)

Global Salt Affected Soils Map



GBSmap v1.0 (2022)

Global Black Soil Distribution Map



GSNmap

Global Soil Nutrient and Nutrient Budget Maps



GSERmap

Global Soil Erosion Map (on hold)



GSNmap

Country-driven mapping



GLOBAL SOIL
PARTNERSHIP

GSP Members
request for
GSNmap

Two-phase initiative

Phase I: Nutrient maps (current status)

Phase II: Nutrient budget maps



Methodology

Definition of a methodology through the support of the GSP's technical networks, International Network on Soil Information Institutions (INSII),



Technical specifications and country guidelines

Publication and divulgation to define a standardized approach



Capacity Building Program

Online Technical Manual
Online regional training & follow-up one to one technical sessions with National Experts



National Submission

Quality assessment and quality check of the submitted maps
31 August 2023



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Working groups and the ITPS

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SoilSTAT

- As stated in the new GSP Action Framework 2022–2030, **INSII's role in the development and subsequently monitoring and reporting of key performance indicators will be central.**
 - SoilSTAT Soil Health Indicators;
 - Global Soil Health Dashboard;
 - GSP AF Indicator System

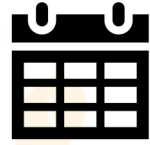
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Tomorrow



- GSP Action Framework
- Soil Health Indicators &
- Key Performance Indicators
- Soil Health Dashboards

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GloSCountry Driven Global Maps

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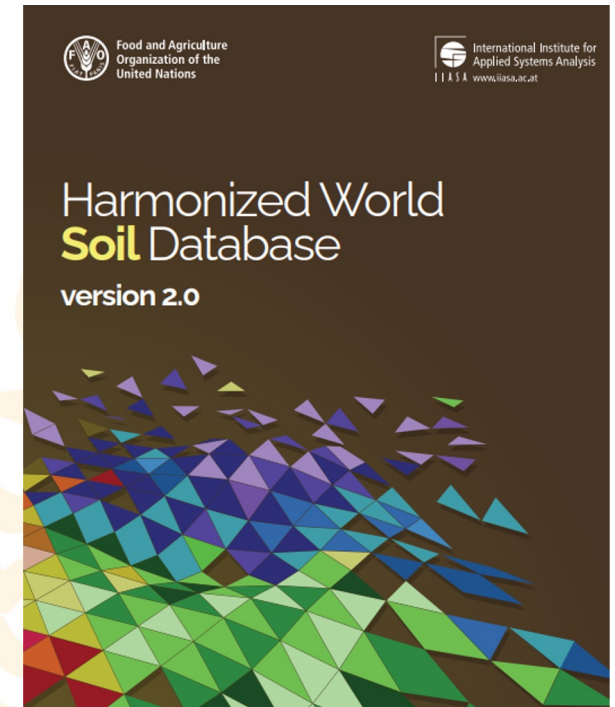
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Harmonized World Soils Database version 2.0

- The Harmonized World Soil Database (HWSD) was launched in 2008
- the result of a collaboration between the FAO with IIASA, ISRIC-World Soil Information, Institute of Soil Science, Chinese Academy of Sciences (ISSCAS), and the Joint Research Centre of the European Commission (JRC)
- HWSD underwent updates in 2013 (HWSD v1.2) and 2023 (HWSD v2.0).
- HWSD v2.0 represents the latest version, with improvements in several key areas:
 - Expanded data sources, now incorporating multiple national soil databases.
 - Enhanced availability of soil attributes for seven different depth layers, as opposed to two in HWSD v1.2.



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INSII in numbers

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SoilSTAT

HWSD v.2.0

❖ Capacity Development

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CAPACITY DEVELOPMENT – SOIL INFORMATION and DATA



Capacity Development

1800+



National Experts

78+



Training Workshops



127+ Countries
All GSP Regions

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Tomorrow



GSID'24

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GSNmap Progress



Marcos

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- **Global Soil Nutrient and Nutrient Budget Maps (GSNmap)** is a initiative of INSII and the GSP with the intent of developing **current state maps of nutrients (NPK)** and their budgets.
- Based on **country-driven** approach
- **Phase I:** maps of soil nutrient and soil fertility properties
- **Phase II:** NPK budget maps

The challenge of nutrient balance

A judicious use and management of fertilizers... is essential to soil health and food security

Nutrient-depleted soils

- Plant nutrient deficiencies
- Less nutritious food
- Low yields
- Crop failure

Nutrient-overloaded soils

- Crops more prone to diseases
- Plant lodging
- Human and animal nutrient deficiencies
- GHG emissions warming the planet

SOILS: WHERE FOOD BEGINS

Food and Agriculture Organization of the United Nations

GLOBAL SOIL PARTNERSHIP



Methodology

- **Phase I: Digital Soil Mapping** based on a machine learning algorithm (Quantile Regression Forest)
- **Phase II: N, P, K nutrient budgets**



Extent

- Scale: **National (Croplands)**
- Depth: **0-30 cm**
- Resolution: **250 x 250 m**



Process

- **Country-driven** (global map based on national submissions)
- Updated following a **Versioning system**



 Mandatory products

- **total N**
- **available P**
- **available K**
- *CEC*
- *pH*
- *clay, silt, and sand*
- *soil organic carbon*
- *bulk density*



GSNmap

Country-driven mapping



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GSNmap

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GSNmap

Country progress



- Submitted
- In progress

19 Countries submitted

13 Countries in progress

First deadline: 31 August 2023

Submitted	In progress
Armenia	Argentina
Bhutan	Bangladesh
Brazil	Cambodia
Colombia	Kazakhstan
Cuba	Kyrgyzstan
Ecuador	Laos
France	Mongolia
Ghana	Myanmar
Greece	Nepal
Lesotho	Sri Lanka
Liberia	Thailand
Mexico	Ukraine
Nigeria	Vietnam
Panama	
Philippines	
Senegal	
Syria	
Thailand	
Türkiye	

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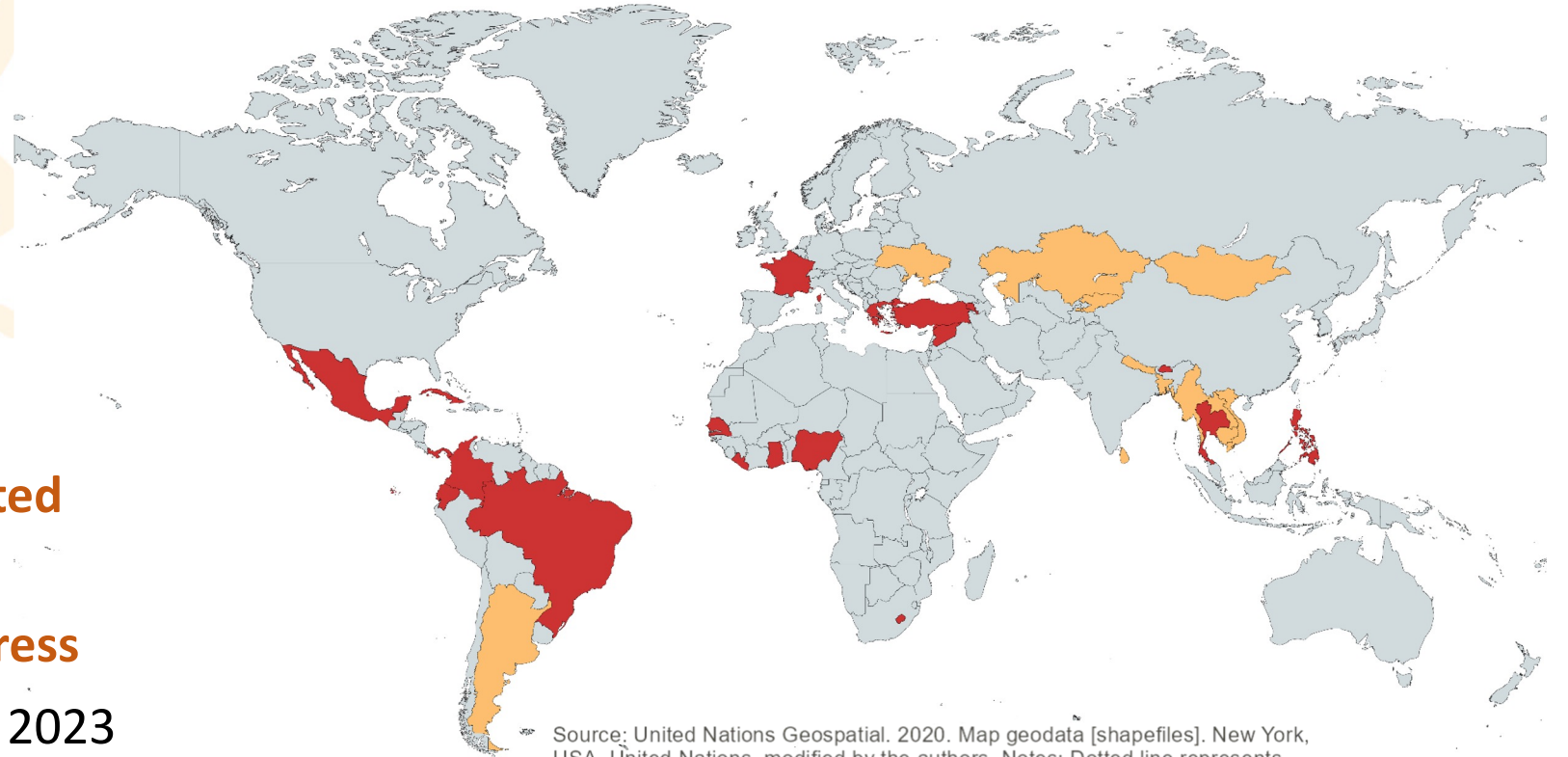


- Submitted
- In progress

19 Countries submitted

13 Countries in progress

First deadline: 31 August 2023



Source: United Nations Geospatial. 2020. Map geodata [shapefiles]. New York, USA, United Nations, modified by the authors. Notes: Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Created with mapchart.net





Gap-filling approach



Global Soil Nutrient and Nutrient Budget Maps

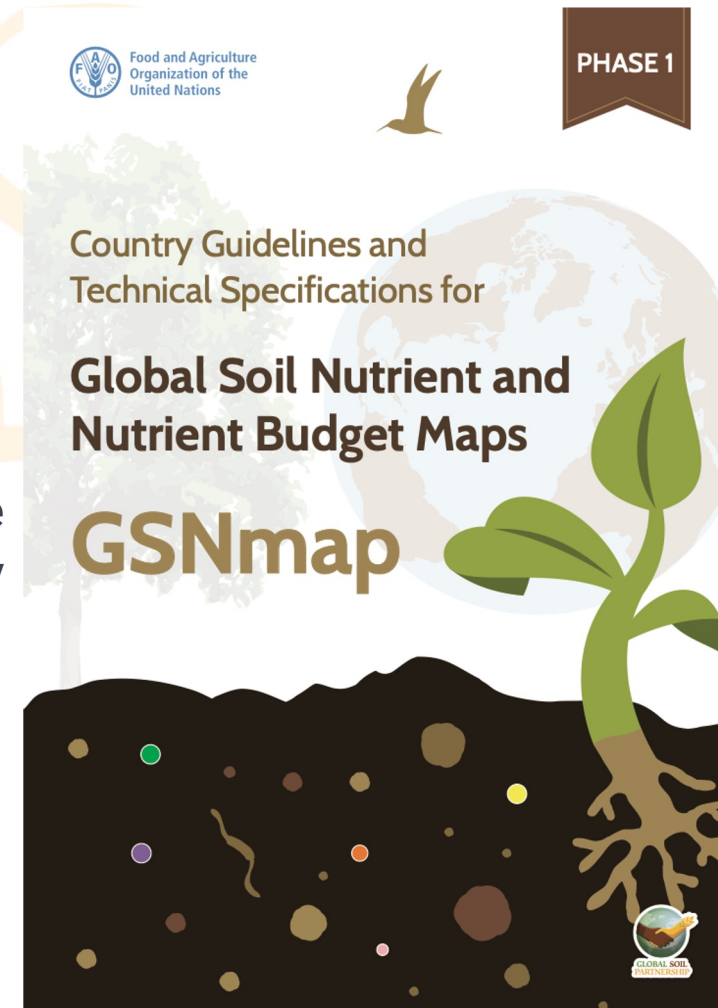
GSNmap version 1.0:

Step 1: National Submissions (deadline **August 31st, 2023**)

Step 2: Countries that did not submit on time.

- Gap-filling using a top-down approach with the methodology and covariates described on the Country Guidelines document (GSP-Secretariat).

- Leave the country blank.



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Global Soil Nutrient and Nutrient Budget Maps

GSNmap version 1.0:

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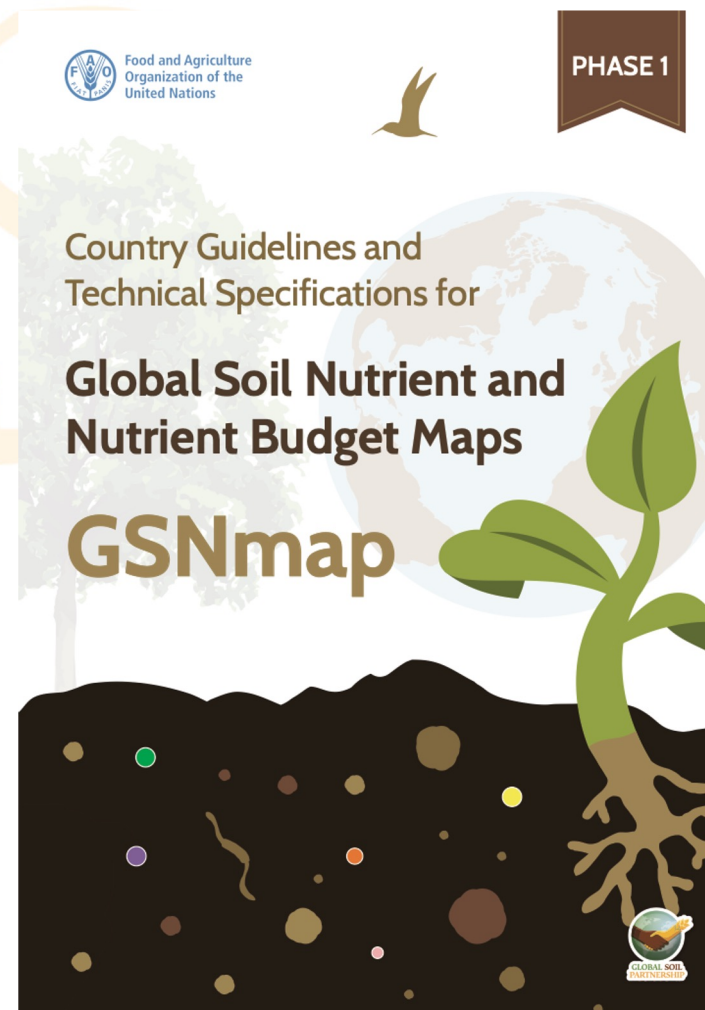
Extended

Step 2: Countries that did not submit on time.

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- Leave the country blank.

Launch: 12th GSP Plenary Assembly 2024 (June)



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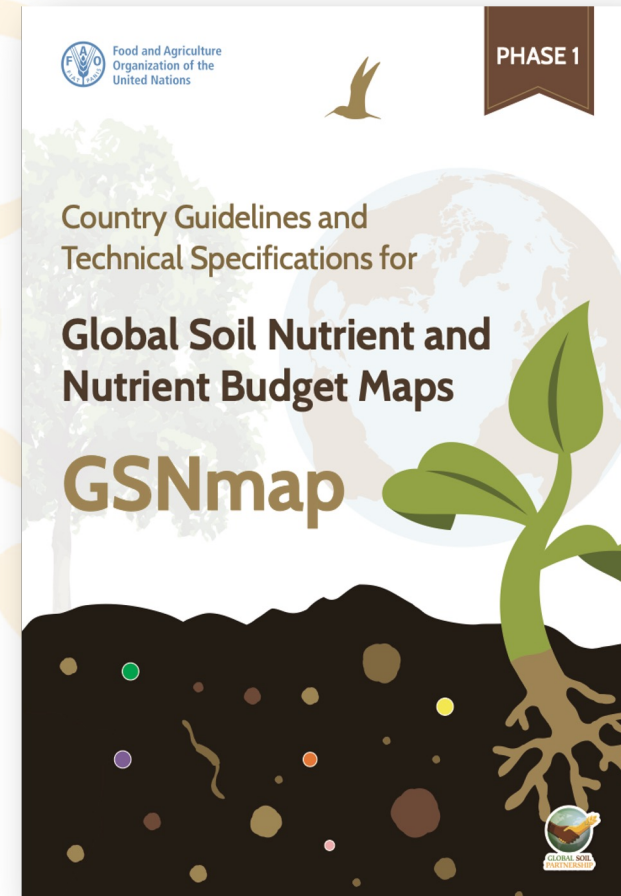
Gap-Filling - Soil Nutrient Maps

Gap-filling is the process of estimating missing or incomplete country data within a raster map.

The selection of the Gap-filling method depends on data characteristics.

Common approaches for gap-filling:

- i. Data Completion
- ii. Interpolation
- iii. Machine Learning Approaches



GSNmap - Nutrient Budgets

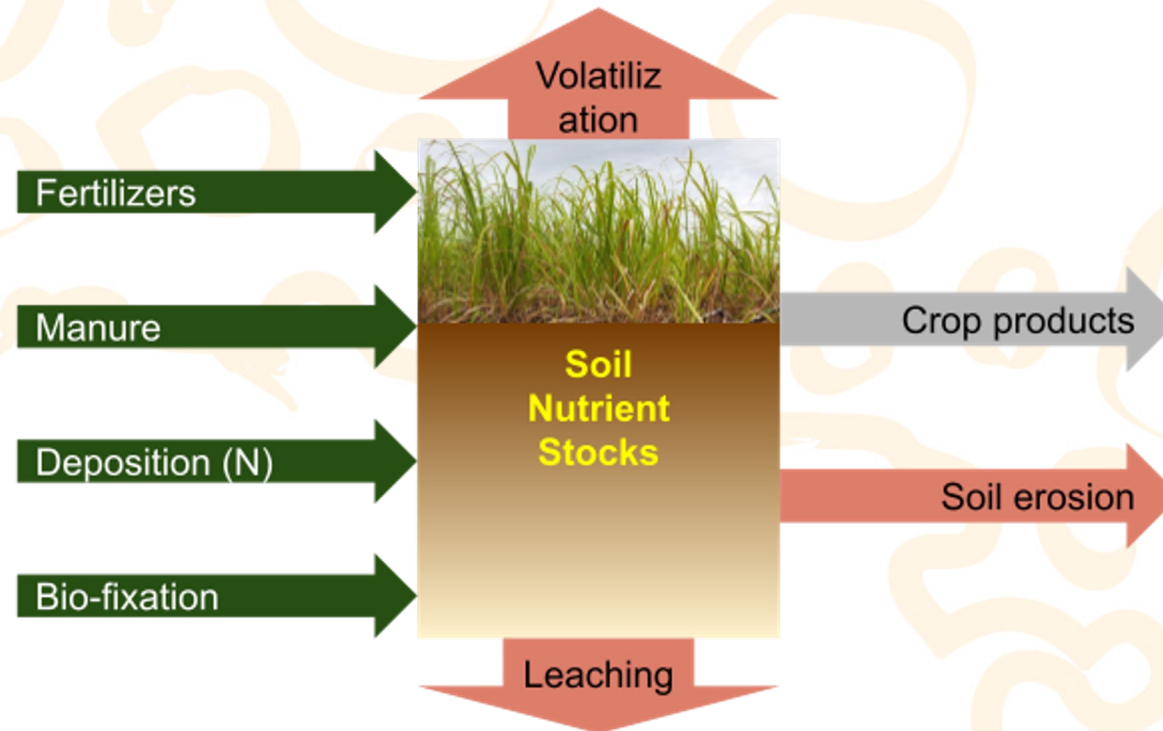
- Traditional data providers like FAOSTAT, IFA, and IFRI have set the stage for nutrient dynamics on a global scale, offering national and annual data.
- Yet, this data lacks the granularity to reflect subnational spatial variations and the actual status of soil nutrients.

Objective

- Advance the understanding of global soil nutrient budgets by incorporating assessments of soil nutrient stocks and the impact of erosion and leaching under a country-driven approach.

Nutrient budget framework

- Zhang et al., 2021
- FAOSTAT, 2022
- Lesschen et al., 2007



$$SNB_y = \sum_{i=1}^n (SF_{i,y} + MAS_{i,y} + ND_{i,y} + BF_{i,y}) - \sum_{i=1}^n (CR_{i,y} + NL_{i,y} + NLO_{i,y} + ER_{i,y}) \quad (Eq. 1)$$

Follow-up

- 1 Technical specifications and country guidelines to be finalised and sent to INSII on the first half 2024
- 2 INSII will review and approve it
- 3 Kick-off second phase during the second half 2024

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Luca Montanarella
INSII Chairperson

SID Team - GSP Secretariat



Yusuf



Marcos



Isabel



Newton

Thank You...



122 Soil Information Institutions Thematic Working Groups

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