



Food and Agriculture Organization  
of the United Nations

# Soil, Land and Water Digital Information Systems for informed decisions

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# Content

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1. Background

2. FAO in Action

3. Global Soil Information System

4. New tool: SoLaWiSe

5. Partnerships & synergies



# Background

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- Number of people facing hunger in the world increased 24% from 2019, up to 811 million people
- The number of people affected by acute food insecurity increased by a staggering 88% in countries with active conflicts
- Agricultural production needs to grow globally by 60% by 2050
- In February 2022, the FAO food price index rose 21% above its level of a year earlier reached an all-time high, up 2.2% from its previous peak in February 2011



# Background

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- 26% of the total damage and loss caused by climate-related disasters in agricultural sector happens in developing countries
- The increase in energy and fertilizer prices is putting the next global harvest at risk
- Natural resources are under increasing strain - conflicts, climate change and extreme events, economic downturns, pandemics, pollution, population growth and expansion, and degradation
- The urgency to increase production to meet local food demand is leading to the adoption of intensive agriculture and unsustainable practices → irreversible soil, biodiversity and water degradation



# Soil, land & water data and information

*Data is essential for...*

- Predicting global challenges, e.g. Earth-System Models
- National and regional data-driven **policy-making**
- Field operations, e.g. to optimize **fertilizer and pesticide applications, irrigation plans, crop**

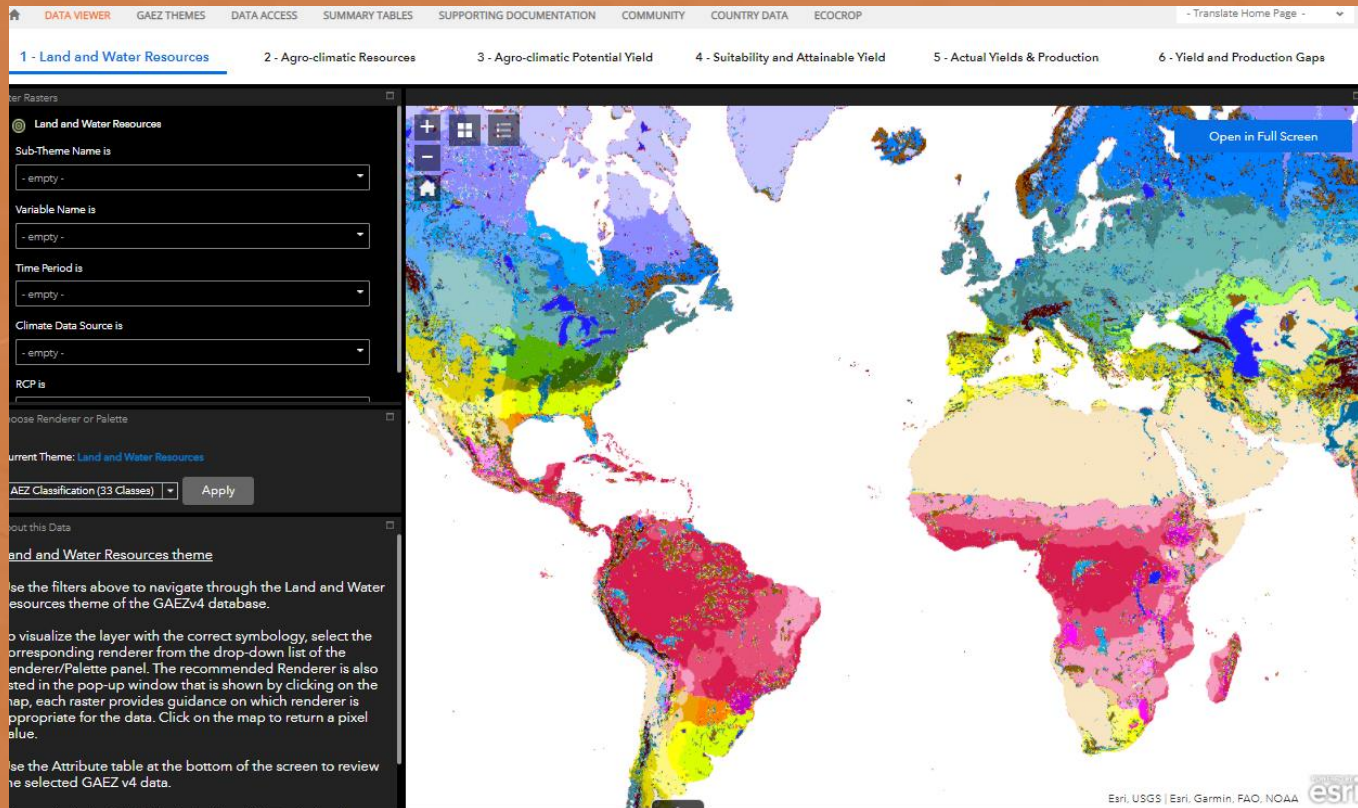
*However...*

*Data is...*

- **Not harmonized**
- **Not updated regularly**
- **Fragmented among and within Institutions**



# FAO in Action



- Hand-in-Hand Initiative Geospatial Platform
- Global Agro-Ecological Zones v4 (GAEZ v4)
- Crop Eco-physiological Characteristics and Environmental Requirements Database (ECOCROP)
- Global Soil Information System (GloSIS)
- Water Productivity Open-access portal (WAPOR)
- Global Information and Early Warning System on Food and Agriculture (GIEWS)

# Soil data starts in the labs

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- Soil maps = soil properties data and classification
- Soil labs worldwide provide different results for the same soil sample

## High uncertainty!

- Soil data has to be:
  - Reliable
  - Replicable
  - Harmonised



## The main goals of GLOSOLAN:

- to strengthen the performance of laboratories [...] towards the development of standards.
- harmonize the soil analyses to make soil information comparable and interpretable across laboratories, countries and regions.



# GSP - Soil Data and Information



Global Data  
Products

System  
Development

Capacity  
Development

Capacity  
Development

Publications



36 Map  
Layers



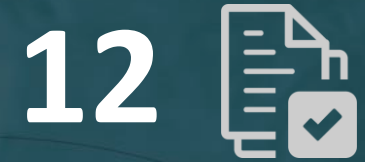
National Soil  
Information  
Systems (TCP)



Training  
Workshops



National  
Experts



Key  
Publications

Country  
Driven

Digital  
Transformation

DSM, Product  
Oriented

Large Expert  
Network

Technical,  
Scientific



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# GloSIS – Global Soil Information System

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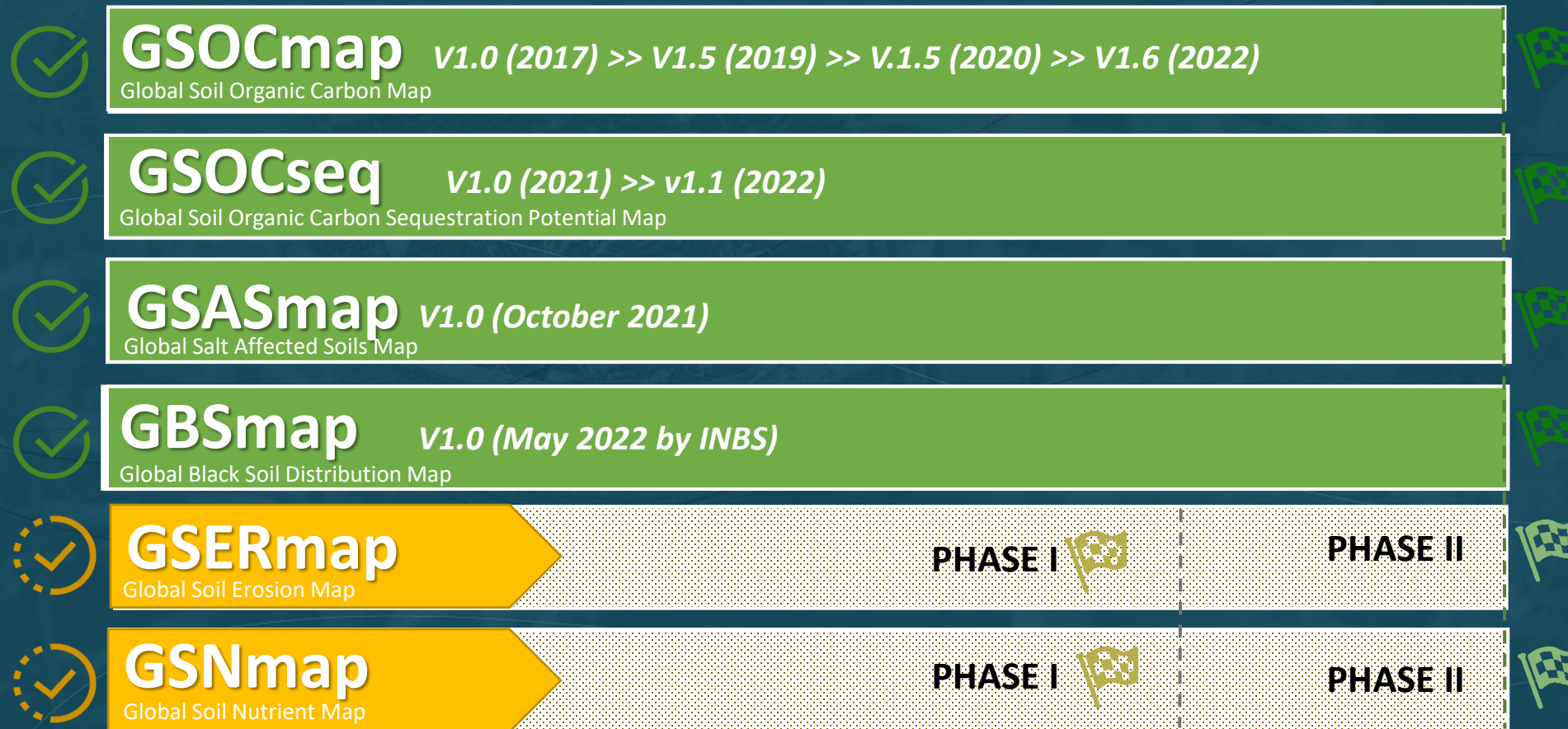


- GloSIS data hub online
- System of Systems (regional, national)
- Federated and populated by country driven global data products, national soil information systems
- GloSIS Discovery Hub –One-stop-Shop for soil information and data converging National/Regional Systems

# GloSIS: Country-driven Global Soil Data Products



*Of the countries, by the countries, for the countries!*



Kick-off

Technical Development

Capacity Development

Production


Launch



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 Search for locations:

Explore map data | Upload

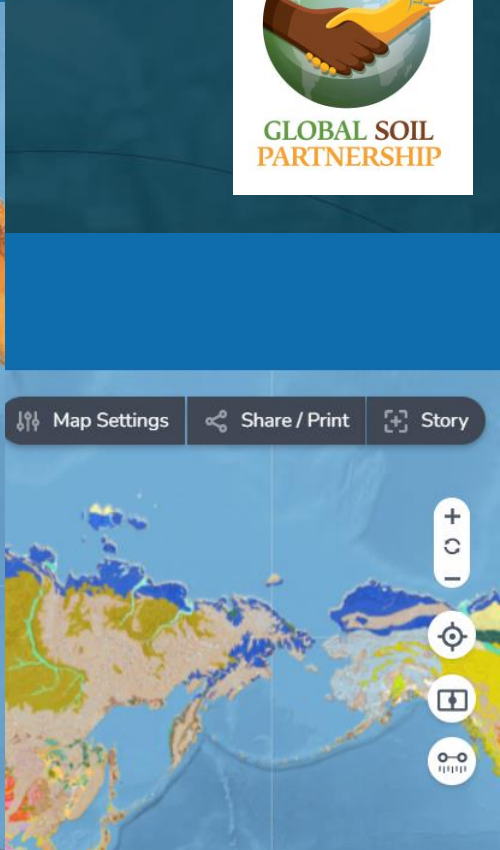
DATA SETS (1) | Remove All | Collapse All

GSOCmap V1.5.0

IDEAL ZOOM | ABOUT DATA

Opacity: 80%

5, 10, 15, 20, 25, 40, 50, 75, 100, 125, 140, 150, 183, 250, 750



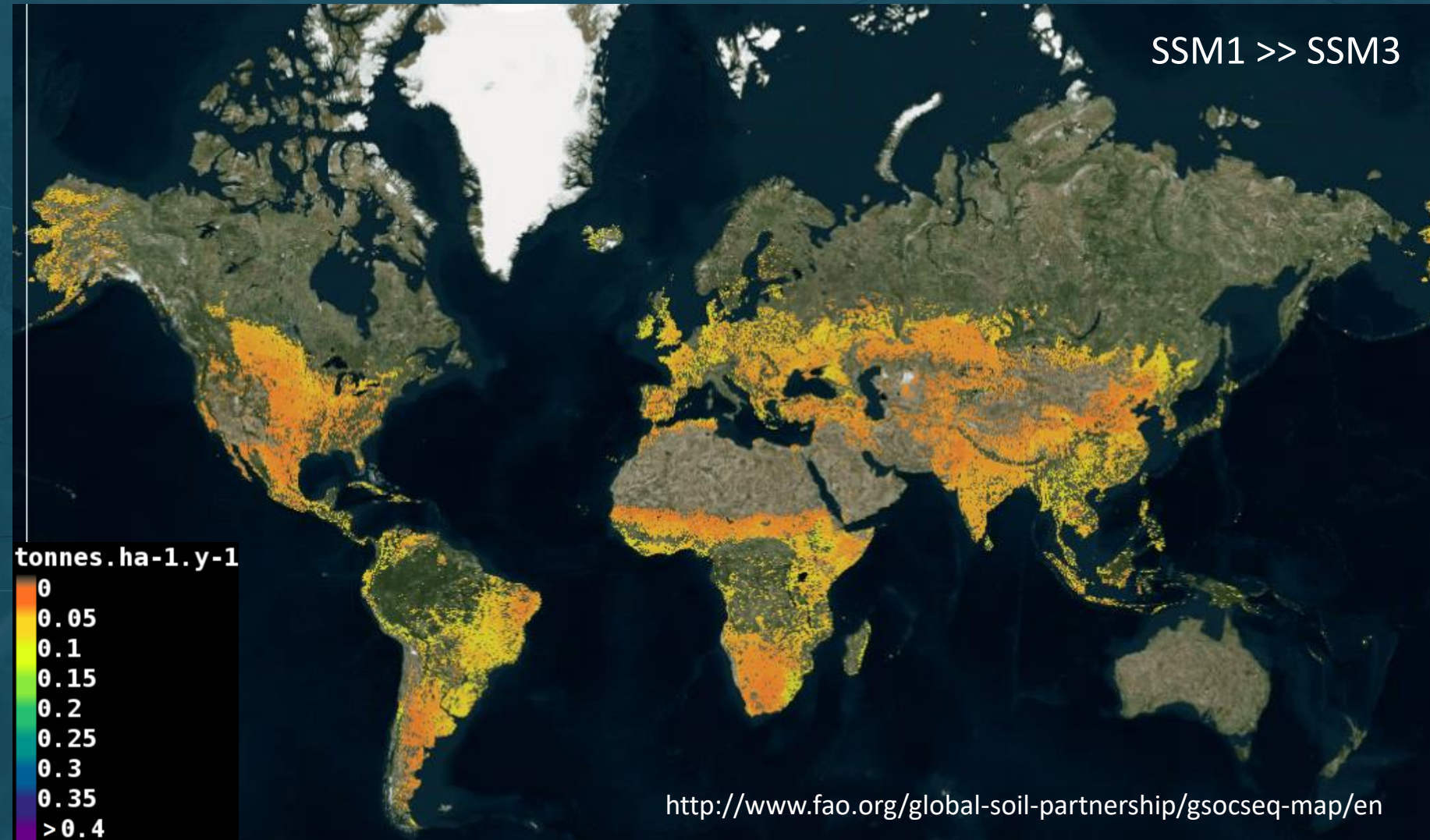
- Af-Ferric Acrisols
- Ag-Gleyic Acrisols
- Ah-Humic Acrisols
- Ao-Orthic Acrisols
- Ap-Plinthic Acrisols
- Bc-Chromic Cambisols
- Bd-Dystric Cambisols
- Be-Eutric Cambisols
- Bf-Ferralic Cambisols
- Bg-Gleyic Cambisols
- Bh-Humic Cambisols
- Bk-Calcic Cambisols
- Bv-Vertic Cambisols
- Bx-Gelic Cambisols
- E-RENDZINAS

# GSOCseq – Global Soil Organic Carbon Sequestration Potential Map



## GSOCseq v1.1

- ✓ SOC sequestration (tC/ha/yr)
- ✓ 4 Scenarios SSM1-2-3 & BAU
- ✓ Agricultural lands (croplands + grazing lands)
- ✓ 20-year period
- ✓ Depth: 0-30 cm
- ✓ 1 x 1 km

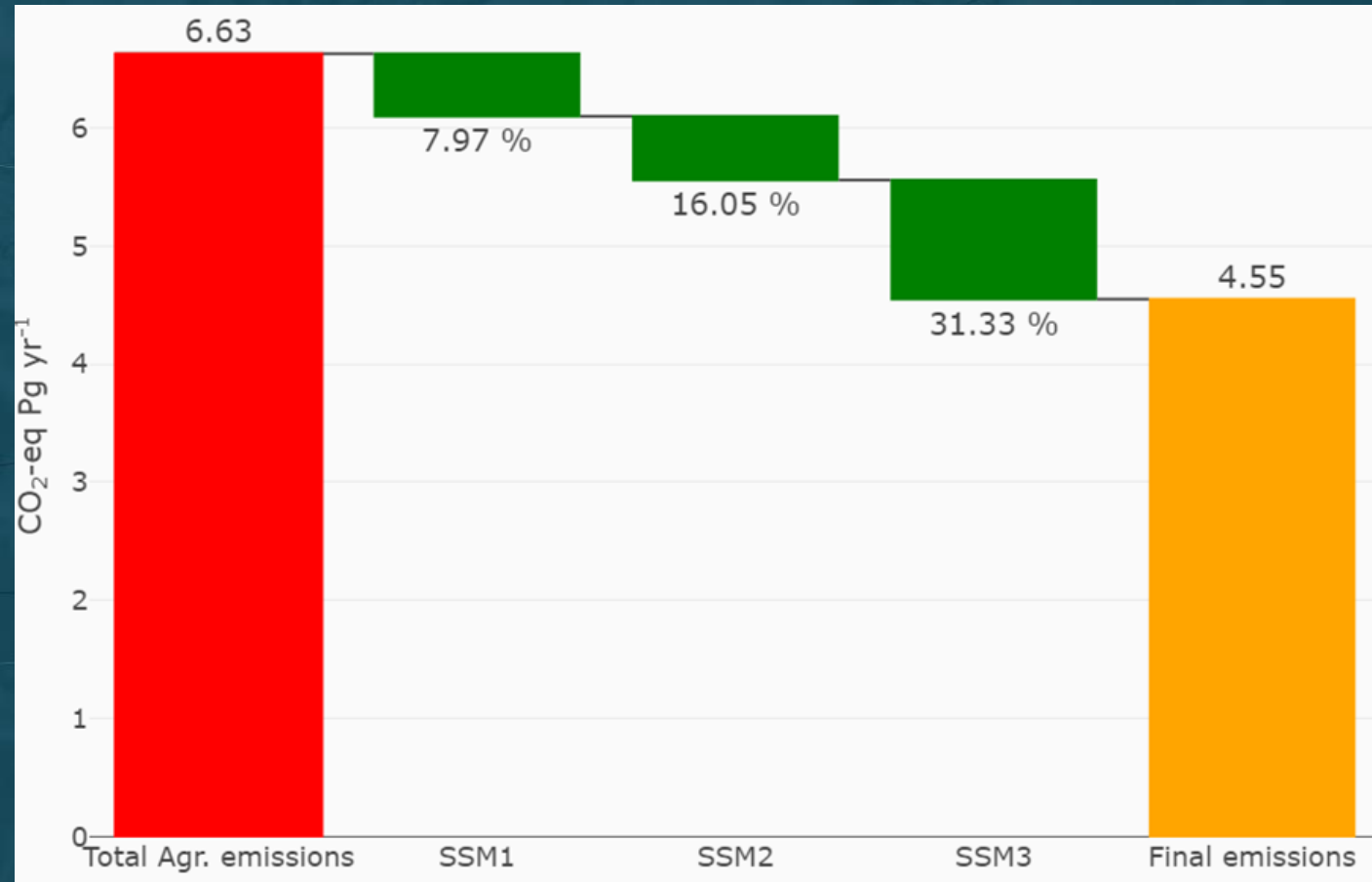


# Potential uses - Mitigation Potential\*

\*Excluding blank countries



**Agricultural soils play an important role in mitigating GHG emissions: yearly agricultural global emissions could be cut by 34% through C seq and maintenance**



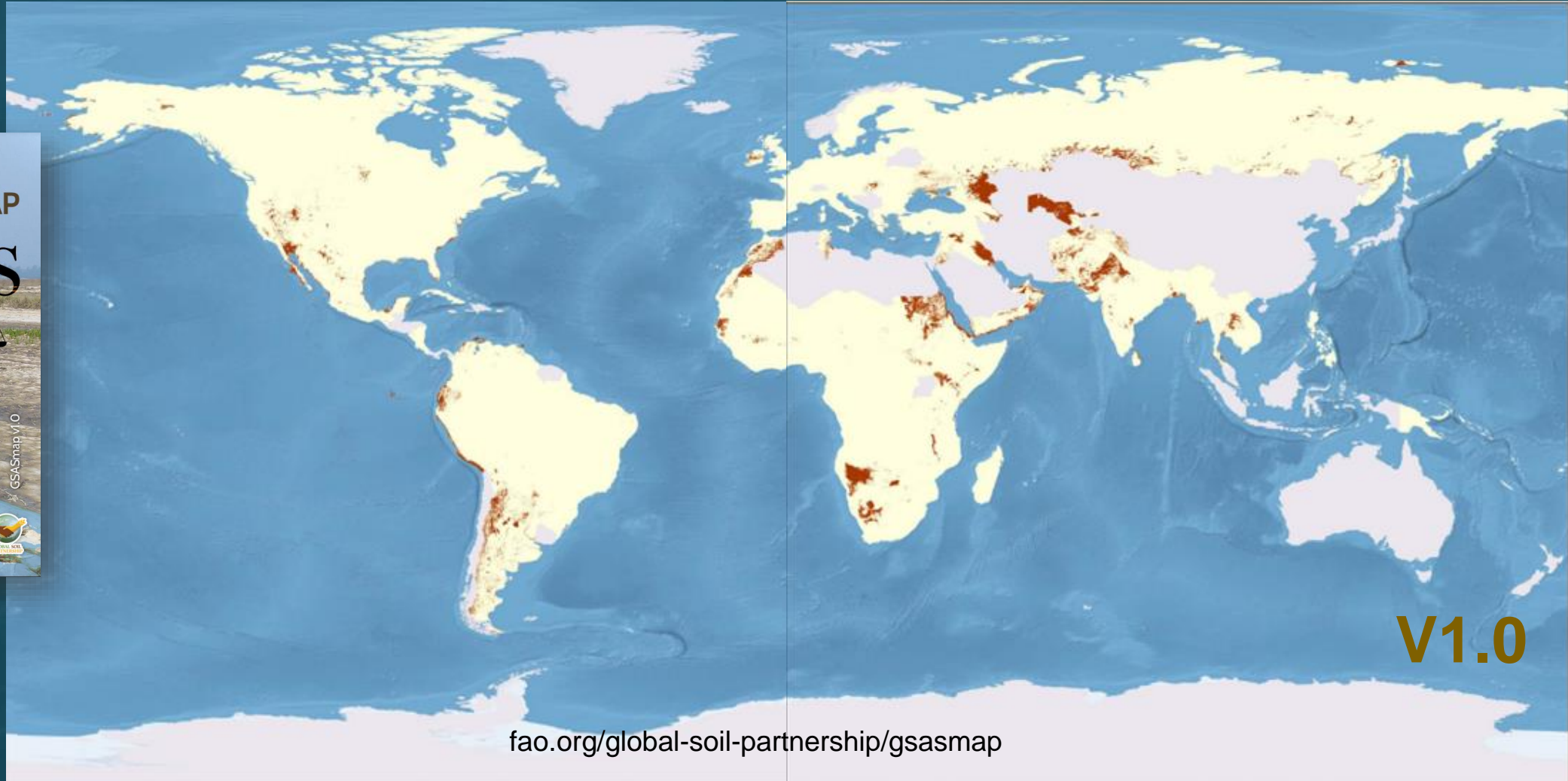
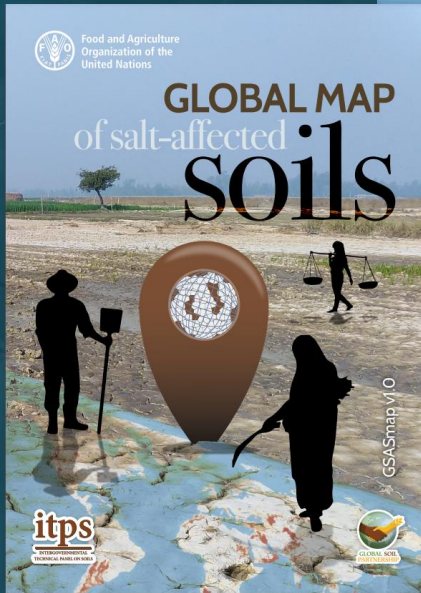
\*Total Agricultural Emissions from FAOSTAT (2019)



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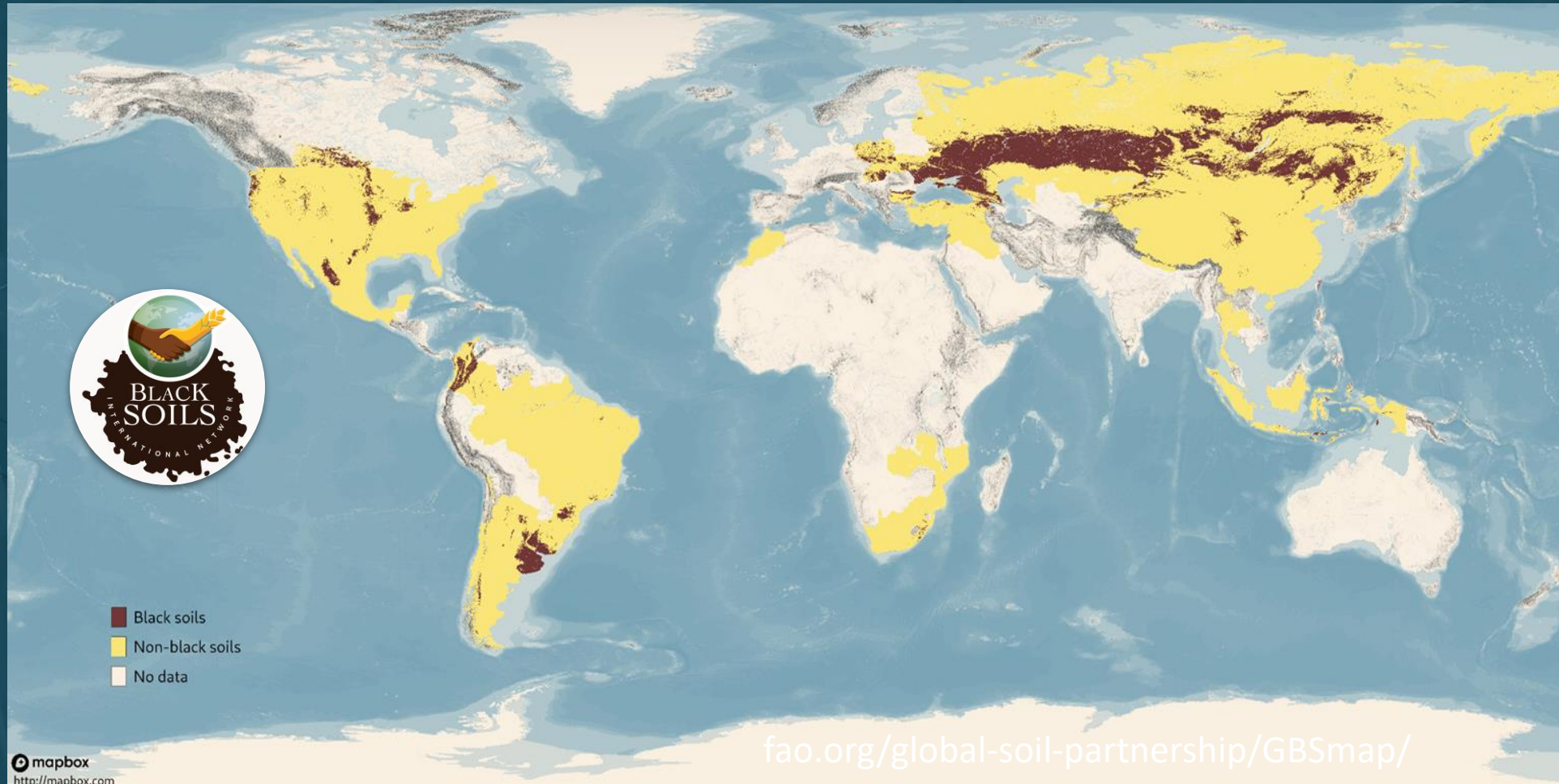
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# GSASmap – Global Salt Affected Soils Map



[fao.org/global-soil-partnership/gsasmap](http://fao.org/global-soil-partnership/gsasmap)

# Global Black Soil Distribution Map v.1.0



**V1.0 Coverage:**  
INBS Countries (32)

**V1.1 Coverage:**  
Global - soon

More Information,  
Statistics &  
Data Access:



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# The year ahead: Country Driven Data Products



## GSERmap Global Soil Erosion Map

- GSERmap Working Group (GSERmap WG)
- GSERmap Country Guidelines and Technical Specifications (INSII Endorsement)



### 2-Phase Approach

- **PHASE I** – National Soil Erosion Factor Databases/Data Repositories (**2022**)
- **PHASE II** – National Soil Erosion Modelling (**2023**)



## GSNmap Global Soil Nutrient & Nutrient Budget Maps

- GSNmap Working Group (GSNmap WG)
- GSNmap Concept Note (INSII Endorsement)



### 2-Phase Approach

- **PHASE I** – Individual nutrient maps (macro, micro nutrients, associated factors) (**2022**)
- **PHASE II** – Nutrient Budgets (**2023**)

GSOCseq, GSOCmap, GSASmap, GBSmap Updates (2022-2023)



# International Network on Soil Pollution (INSOP)



- INSOP focuses on six main areas of work under each of which various tasks will be carried out to achieve the overall goal of Zero Pollution
- It will work on improving knowledge on the full cycle of soil pollution, from assessment to remediation, as well as on the effect on environmental and human health and the provision of soil ecosystem functions and services
- Capacity building, awareness raising and knowledge and technology transfer are the key pillars



# SoLaWiSe platform

Crop

Geographic  
scope

Time

- Crop Requirements (soil, land, water)
- Global & local maps for >10 priority crops
- Local to global annual cropland extent maps at 10 m resolution
- Crop maps on a seasonal basis
- Yield gap analysis

Soil

Land

Water

Agro-climatic

Yield/  
Production

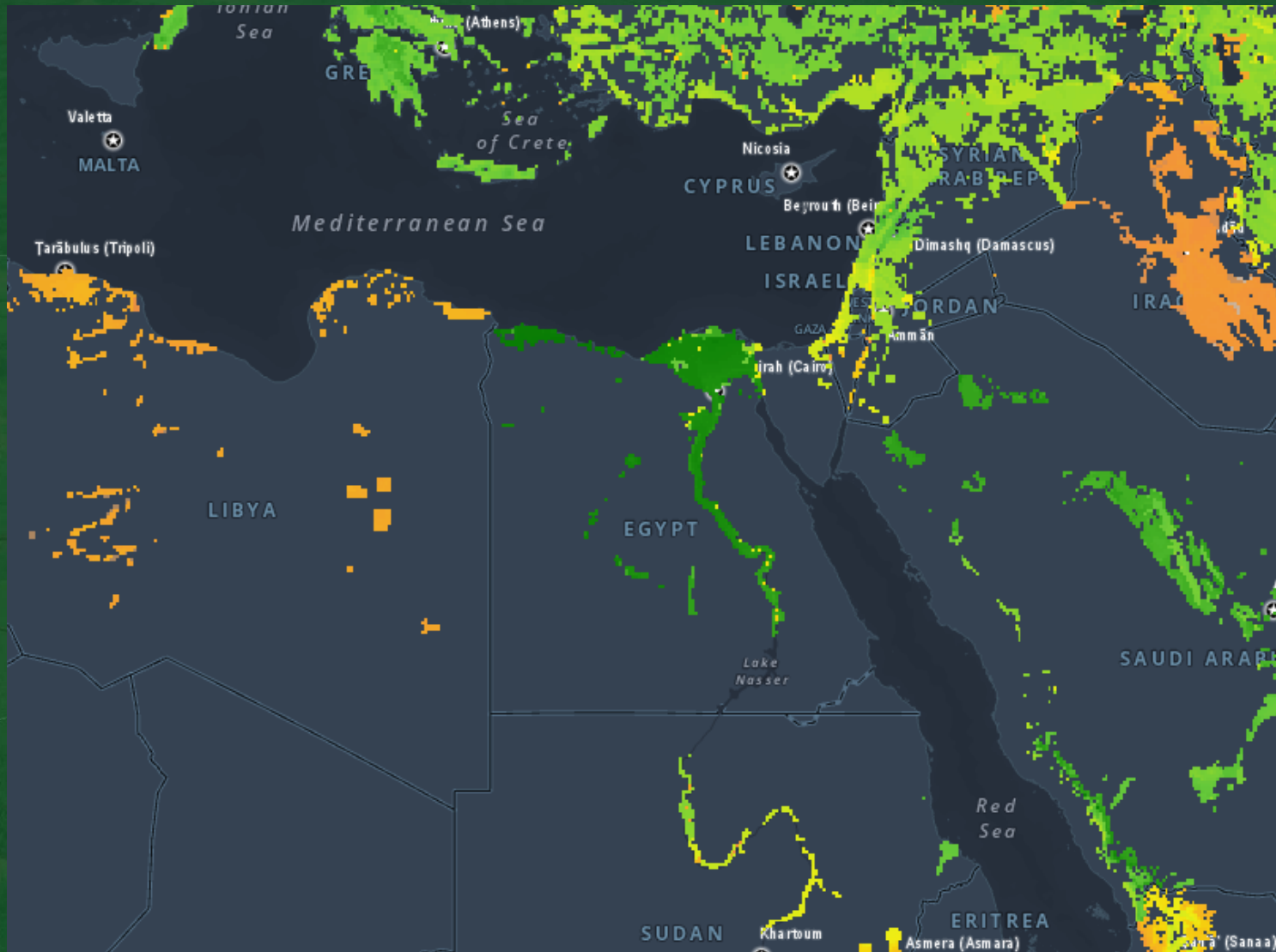


# SoLaWiSe platform - example

Wheat

Egypt

2021



Soil

Land

Water

Agro-climatic

Yield/  
Production

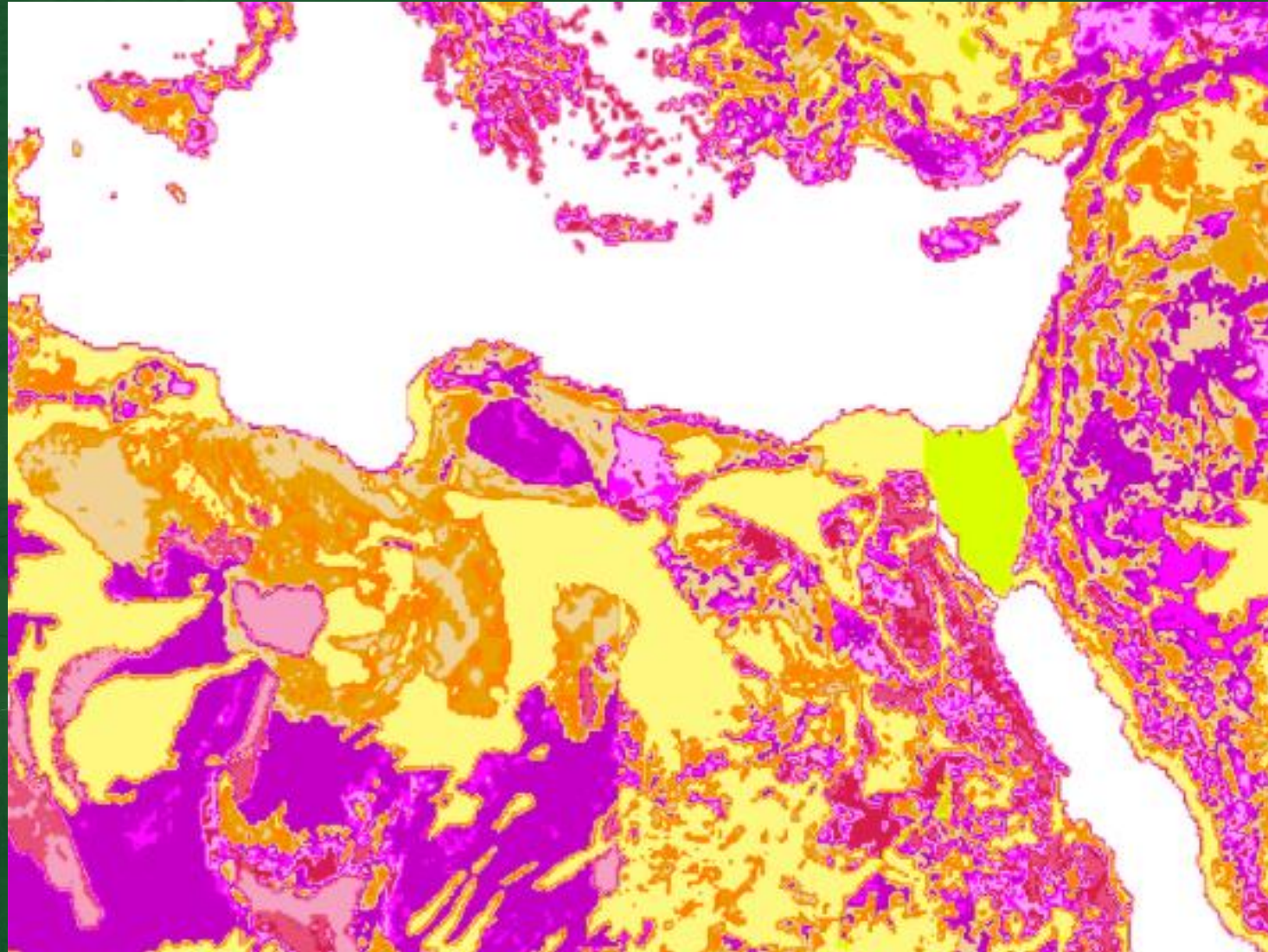


# SoLaWiSe platform - example

Wheat

Egypt

2021



Soil Water Index

Land

Water

Agro-climatic

Yield/  
Production



# SoLaWISe dashboard - example



# SoLaWISE development process

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- **Global SoLaWISE Implementation Plan (GSIP)** - internal working group, taskforces (Soil, Land and Water) and an external advisory group
- **SoLaWISE methodological approach**
- **SoLaWISE Decision Support System (DSS)** - provides data to regions, countries and farmers with an original focus on a dozen of priority crops and agro-ecological zones
- **SoLaWISE capacity development programme** - focuses on HiH countries and integrates various capacity development elements developed for different disciplines on soil, land and water
- **Regional/national customized SoLaWISE platforms** - developed in five representative countries in five regions (RAP, RAF, REUT, RLC, and RNE)



# Partnerships and synergies

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- Global Yield Gap Atlas (GYGA) – WUR & Nebraska
- WorldCereal by ESA
- Group on Earth Observations Global Agricultural Monitoring Initiative (GEOGLAM)
- Asia-Rice, as part of GEOGLAM
- ASAP - Anomaly Hotspots Of Agricultural Production (ASAP)- JRC
- Monitoring Agricultural ResourceS (MARS) – JRC





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# Thank you !

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