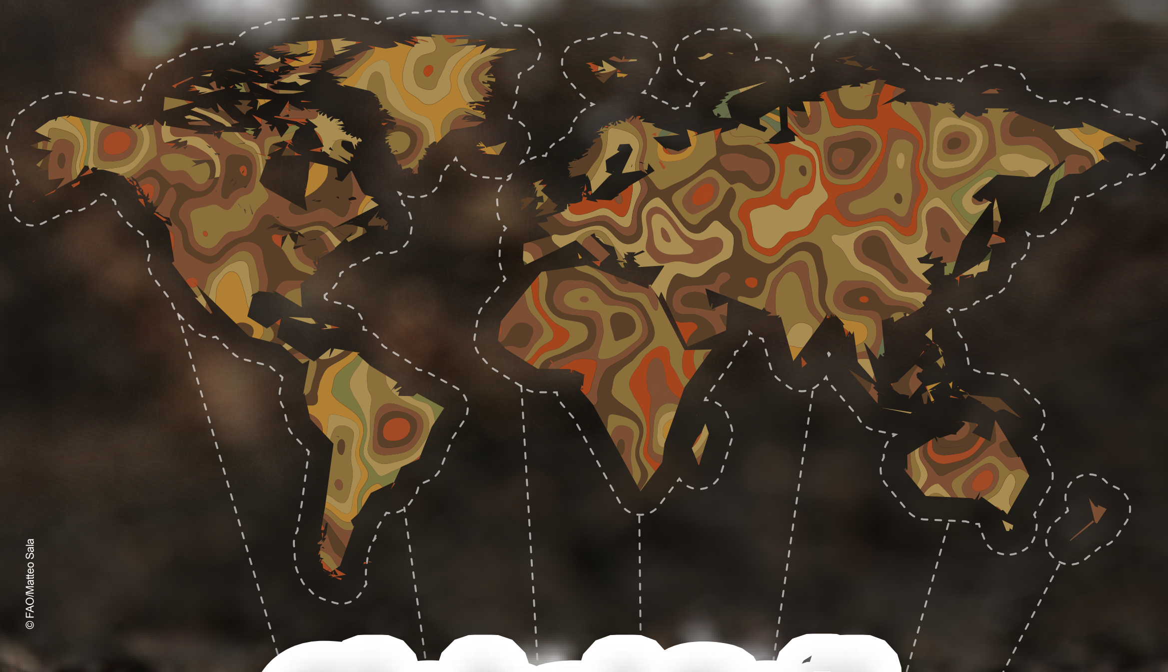
Food and Agriculture Organization of the United Nations



Global Soil Organic Carbon Sequestration Potential Map

GSOCseq

itps
INTERGOVERNMENTAL TECHNICAL PANEL ON SOILS

GLOBAL SOIL PARTNERSHIP

Why are soils our key ally in tackling climate change?

Climate change is one of the greatest environmental challenges our planet and people have ever faced. It poses a serious threat to the survival of life on Earth, exacerbating extreme weather events – from droughts, floods to heatwaves – and putting pressure on agri-food systems, and food security. Climate change requires immediate action from all relevant stakeholders, especially from the greenhouse gas (GHGs) emitters. The main challenge remains identifying cost-effective options for climate change mitigation and adaptation.

Sustainable soil management (SSM) practices centered on soil organic carbon (SOC) sequestration are one of the most cost-effective options for climate change adaptation and mitigation, for combating desertification, land degradation and food insecurity. SOC sequestration is also an important strategy to improve soil health and the provision of ecosystem services. A better management of soils can offset 5–20 percent of current global GHG emissions (IPCC, 2019).

- **SOC sequestration is defined as the increase and long-term (> 20 years) storage of carbon stocks in soil as stable forms of soil organic matter** (Chenu *et al.*, 2019).
- **Two billion hectares of land on Earth are degraded, affecting some 3.2 billion people, driving species to extinction and intensifying climate change.**
- **26 percent of the global population in 2019[1] was affected by moderate or severe food insecurity.**
- **Healthy soils can contribute to climate change mitigation and decarbonize the atmosphere. They can store carbon in its most stable forms, from decades to thousands of years and provide sufficient nutritious food** (FAO, 2019).

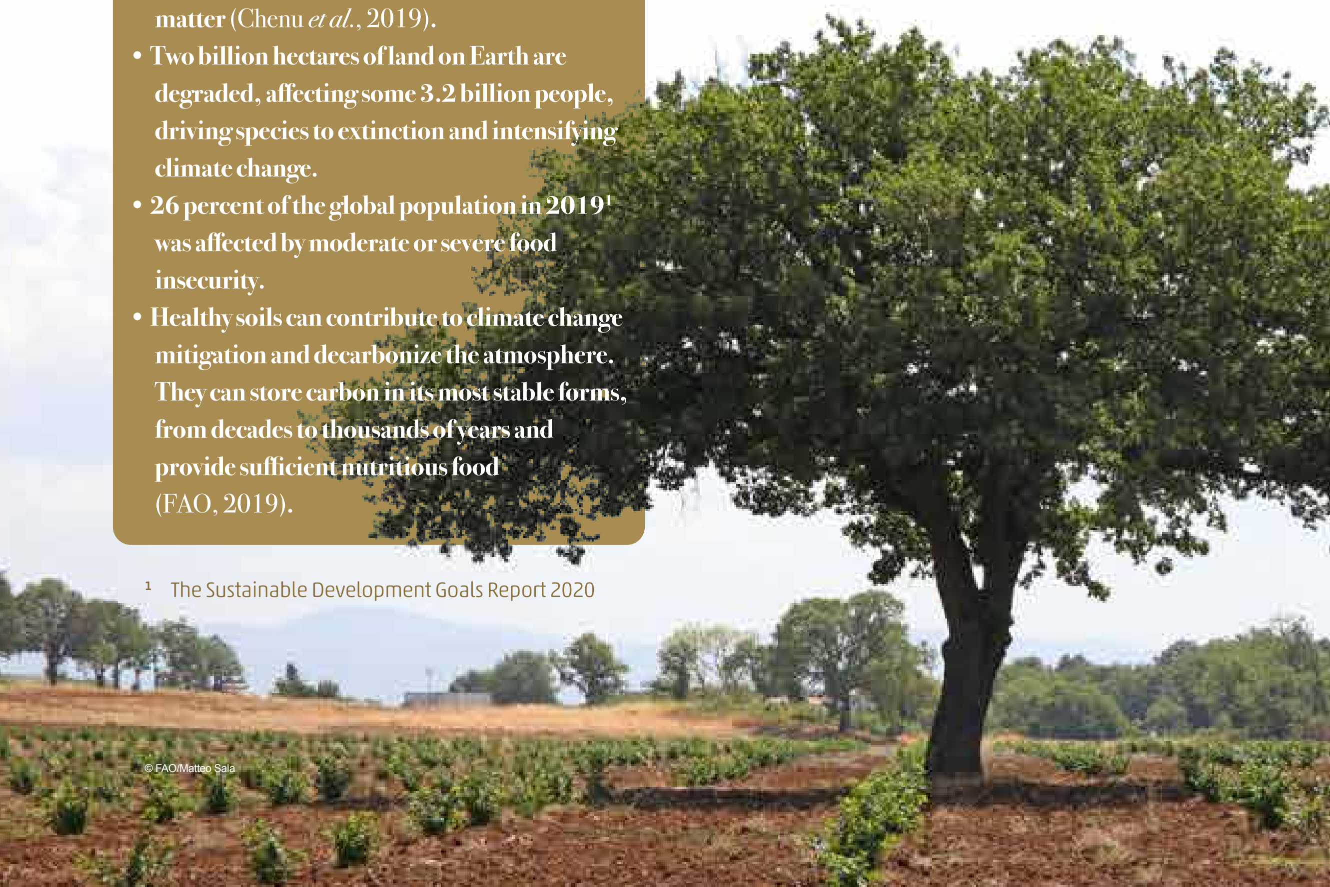
[1] The Sustainable Development Goals Report 2020

How to unlock the potential of soil organic carbon sequestration?

All soils emit CO_2 derived from the decomposition of organic matter. Unsustainable soil management practices accelerate this process and lead to SOC losses that contribute to speeding up climate change. Minimizing SOC loss through SSM is therefore crucial, and is often the easiest and most cost-effective option.

Soil's capacity to sequester carbon is very variable in space and time. SOC sequestration is usually a medium or long-term process and total carbon gains by SSM practices can only be detected after some years (from few to 20 years depending on the organic matter fraction measured and soil type). The sequestration rate of SOC greatly depends on local climate conditions, land cover/land use, soil type and adoption of SOC-centered SSM practices, as well as their scale of implementation through various incentives.

It is critical to identify regions, environments and agricultural systems that hold the greater potential to maintain and increase SOC stocks, and to establish priorities for the implementation of public and private policies on climate change mitigation and adaptation guidance to meet the Global Climate Action Agenda and the Sustainable Development Goals (SDGs).



How was the GSOCseq developed?

The Global Soil Organic Carbon Sequestration Potential Map (GSOCseq) represents the potential of SOC sequestration in agricultural soils where different SSM practices[2] aimed at increasing C inputs in soils are applied versus business as usual (BAU) practices. GSOCseq predicts SOC stocks and estimates annual SOC sequestration rates after 20 years of implementation of SSM practices in agricultural lands, with one-kilometer per one-kilometer soil grids resolution, at zero to 30 cm soil depth.

GSOCseq has been developed through a country-driven approach. The GSOCseq adopted the INSII database which collates the best available national datasets by using international standard procedures and applies process-based SOC modelling and modern techniques for digital soil mapping. Over 430 experts from 119 countries participated in 10 trainings sessions to enhance national/local technical capacities (Figure 1). GSOCseq is a living product and will be regularly updated in line with new and improved national datasets.

What does the GSOCseq represent in numbers?

- It is estimated that the global biophysical potential of SOC sequestration is between 0.14-0.56 gigatonnes of carbon (GtC) (equivalent to 140–560 Mt C) per year.
- The GSOCseq shows that the global adoption of SSM practices could potentially lead to a yearly mitigation of 8.6 - 33.8 per cent of GHG agricultural emissions.
- 15 countries hold more than 50 per cent of the global SOC sequestration potential.

[2] As cropping systems diversification, cover cropping, addition of organic manures, conservation tillage, mulching, fertility management, agroforestry, and rotational grazing, water management, among others.

How would the GSOCseq be translated into action on the ground?

The GSOCseq provides users with very useful information to prioritize areas where SSM practices can be adopted to enhance SOC stocks and improve soil health (achieving SDGs 2, 13 and 15). The map allows users to identify the regions, soil types and farming systems with greater potential to increase SOC stocks and enable the establishment of priorities for research and implementation of local, national, or international climate-change polices. It is also a key instrument for the RECSOIL programme, it serves as a planning tool to make evidence-based decisions for climate change adaptation and mitigation.

The GSOCseq can also contribute to the:

- Establishment of attainable and evidence-based national targets for SOC sequestration;
- Provision of a framework for countries to exchange soil data knowledge in a harmonized, interoperable and efficient way;
- Achievement of national commitments to the Land Degradation Neutrality (LDN) Target Setting Programme implemented by the United Nations Convention to Combat Desertification (UNCCD);
- Information of policymakers about suitable SSM practices that foster SOC sequestration at local/national scale and that can optimize the use of agrochemical inputs;
- Improvement of local/national technical capacities on SSM, soil data management, digital soil mapping and SOC sequestration modelling.

References

FAO. 2019. *Recarbonization of global soils: A tool to support the implementation of the Koronivia Joint Work on Agriculture*. Rome. 12pp.

IPCC. 2019. *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Shukla, P.R., Skea, J., Calvo-Buendia, E., Masson-Delmotte, V., Pörtner, H.O., Roberts, D.C., Zhai, P., Slade, R. *et al.*, eds.

Action on the ground
Monitoring sites to validate results
Implementation SSM practices
Country-driven GSOCseq
National Maps and Submissions
Request by FAO Members as a contribution to SDGs
(Zero Hunger, Climate Action, Life on Land)
2021
2020-21
2020
2019
6
5
1
4
2
3
Methodology
Through the support of the GSP's technical networks
Taking into considerations potential data and computational limitations
Capacity Building Program
Online Technical Manual
Online regional trainings
Technical specifications and country guidelines
Reviewed by INSII, ITPS, CIRCASA, 4 per 1000, UNCCD
Collection of feedback
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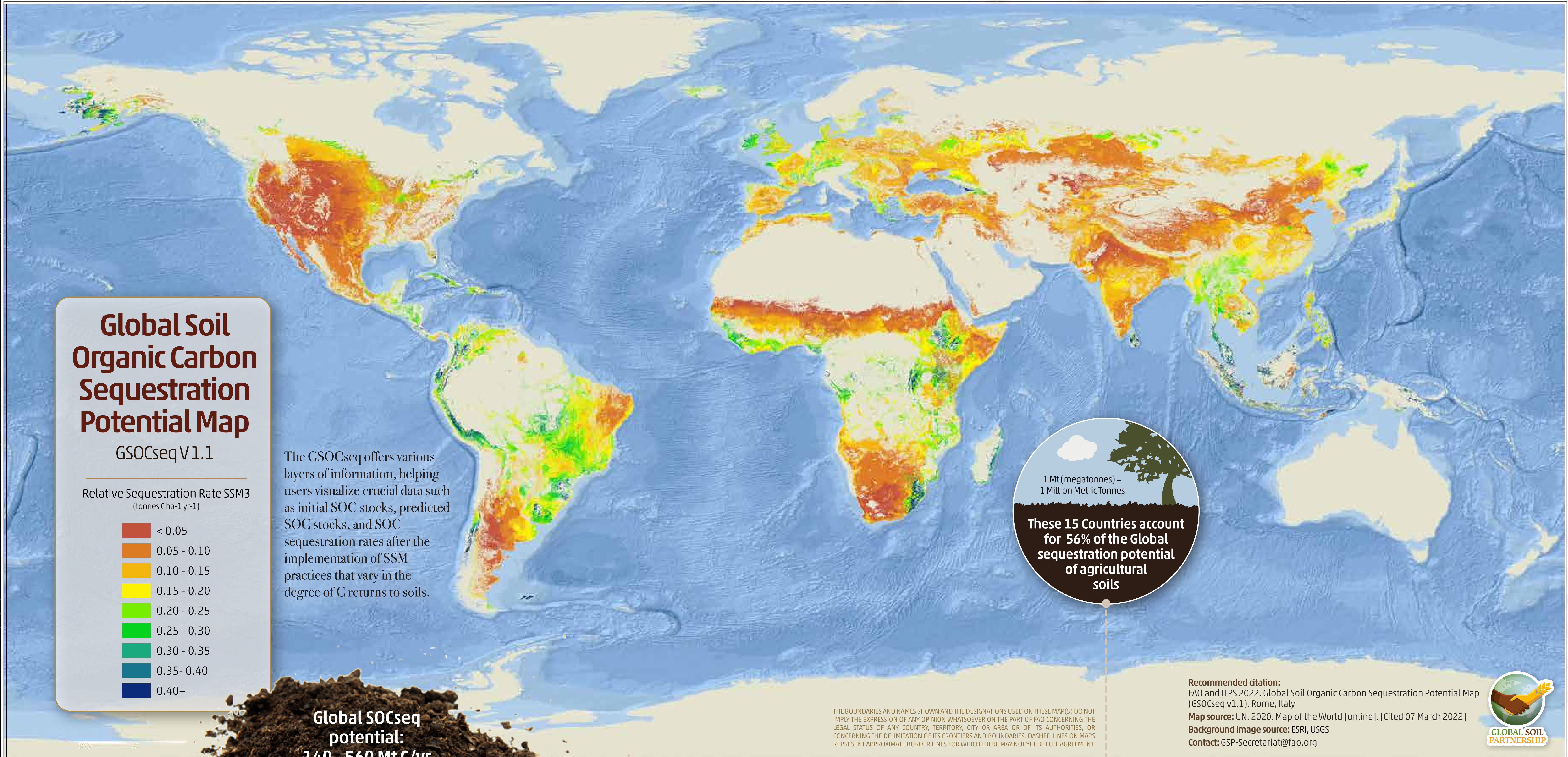
Global Soil Organic Carbon Sequestration Potential Map

GSOCseq V 1.1



The GSOCseq offers various layers of information, helping users visualize crucial data such as initial SOC stocks, predicted SOC stocks, and SOC sequestration rates after the implementation of SSM practices that vary in the degree of C returns to soils.

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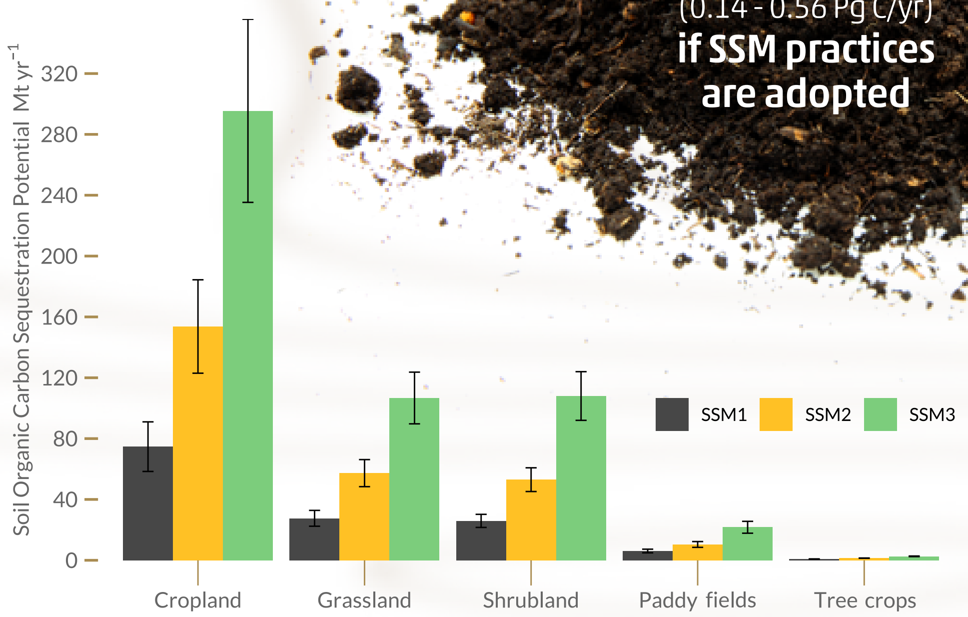
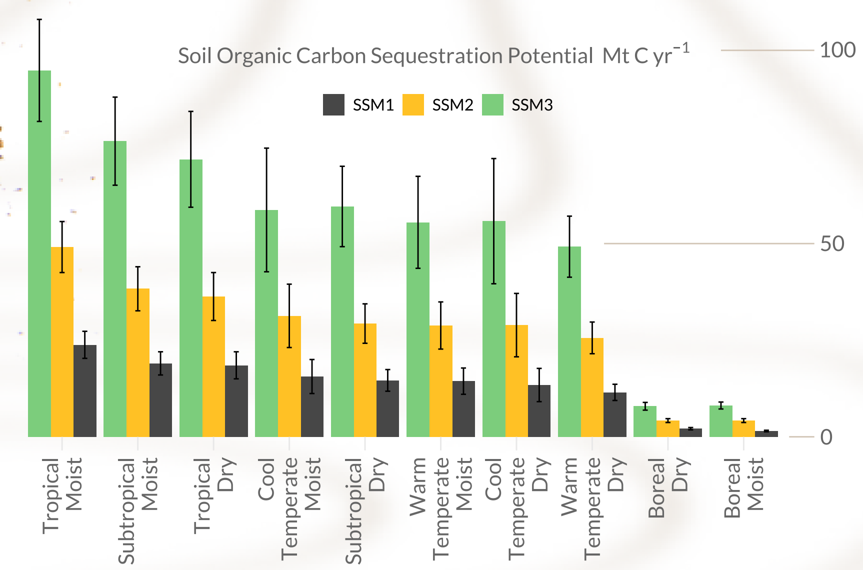
Background image source: ESRI, USGS

Contact: GSP-Secretariat@fao.org

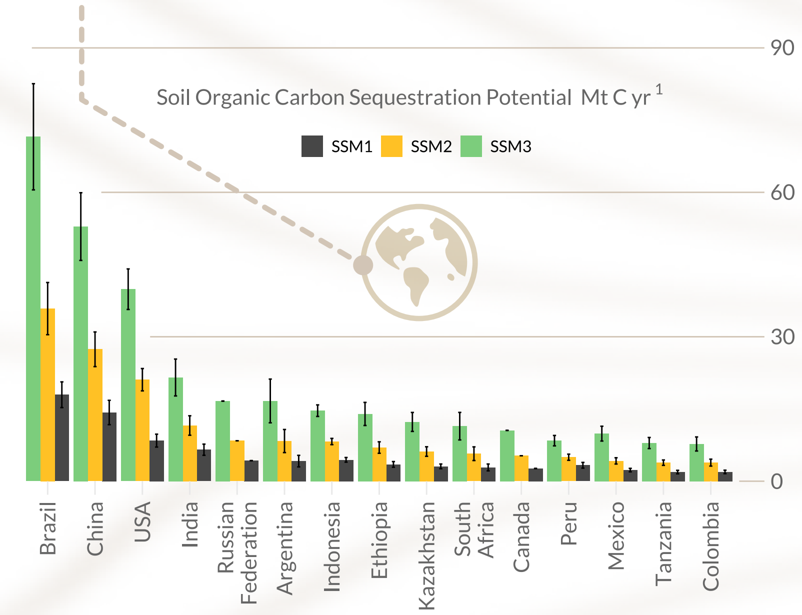
GLOBAL SOIL PARTNERSHIP



The GSOCseq unravels the potential of agriculturally managed soils to sequester carbon under three SSM scenarios that vary in the degree of C returned to the soil.



The GSOCseq unearths important trends on SOC sequestration potential globally. Due to their extent tropical agricultural soils lead in terms of total yearly SOC sequestration potential driven by the adoption of SSM practices.



Top 15 countries with the highest total additional yearly SOC sequestration potential under three SSM scenarios (SSM1: +5%; SSM2: +10%; and SSM3: +20% increase in annual C returns to soils).

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