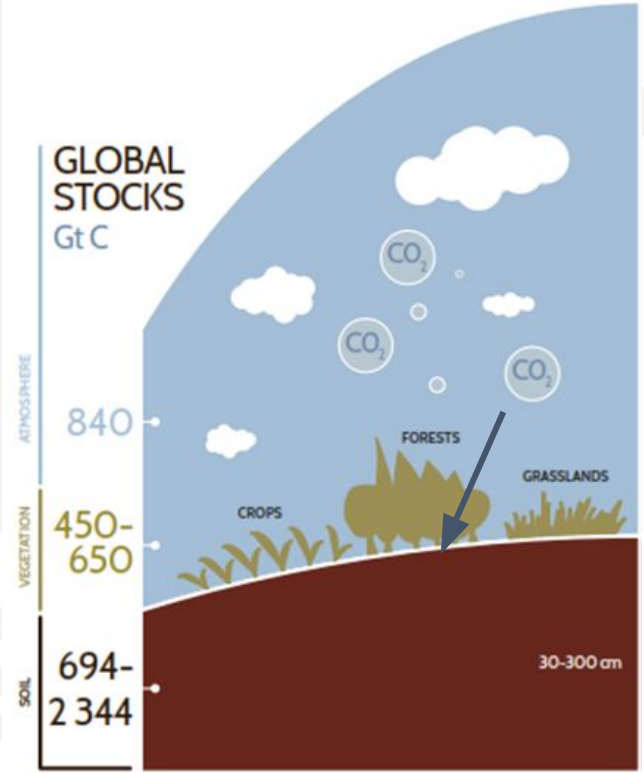
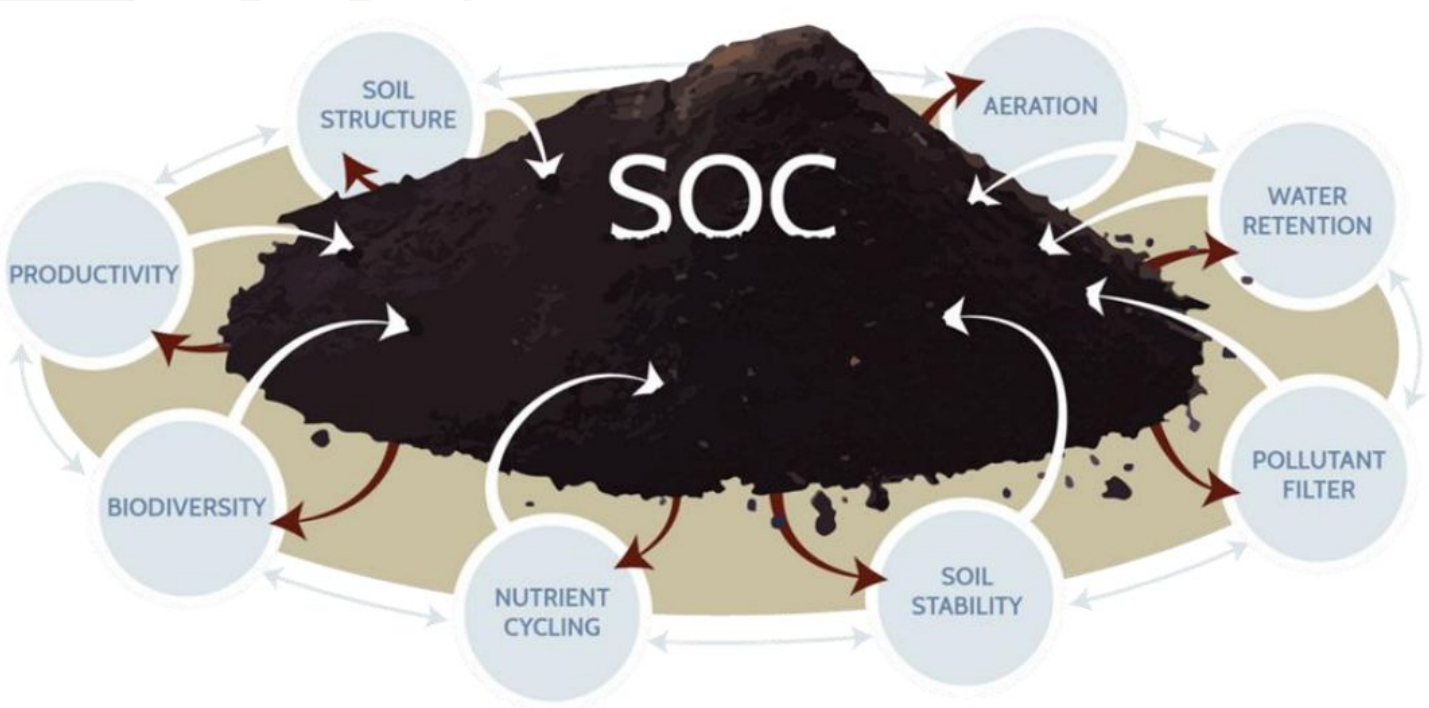

Food and Agriculture Organization of the United Nations
AFACI
Asian Food & Agriculture Cooperation Initiative
Rural Development Administration
EduSoils
GSOCseq v1.1
Information on objectives and methodology for upcoming training session
GLOBAL SOIL PARTNERSHIP

Soil organic carbon (SOC): Climate change



- **SOC** represents the **largest C pool** in terrestrial ecosystems
- Due to the magnitude, a small increase in SOC stocks can transform soils from greenhouse gas (GHG) **sources** to potential **sinks** (Paustian et al., 2016)
- **CO_2 sequestration** as SOC through sustainable soil management (SSM) practices has been outlined as one of the most cost-effective practices to mitigate GHG emissions (Smith et al, 2008; Lal et al., 2018; IPCC, 2019; Smith et al., 2020).

Soil organic carbon (SOC): Food security



Following FAO members request, Global Soil Partnership (GSP) started the GSOCseq initiative to:

1. **Set** attainable and evidence based **national targets for carbon sequestration**

2. **Identify areas** that have high SOC sequestration **for SSM projects**

3. **Improve technical capacities** on sustainable soil management, soil data management, digital soil mapping and modelling



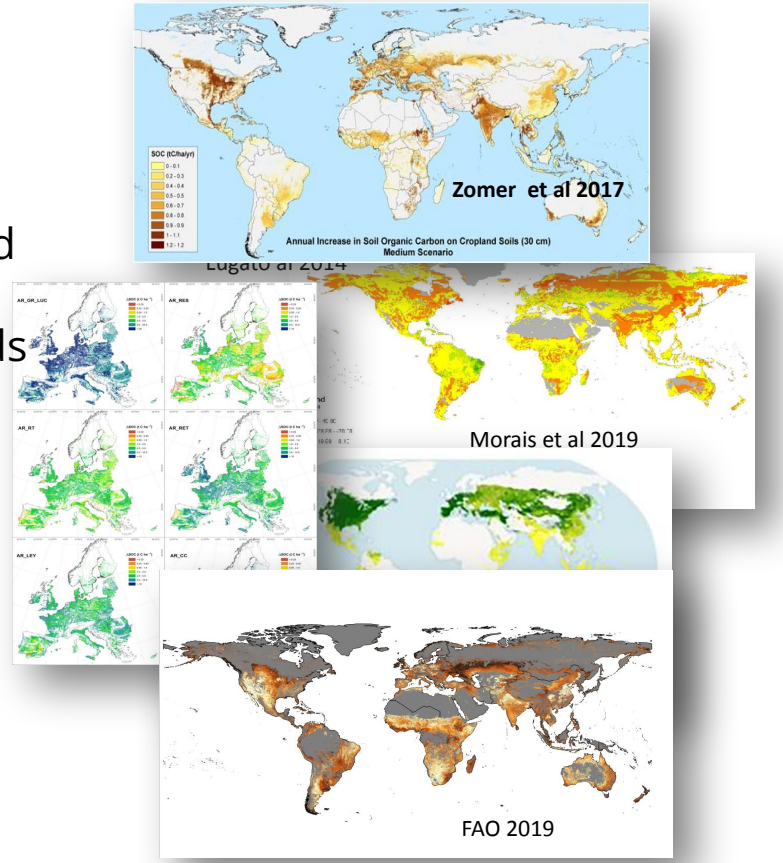



EduSoils | e-learning soil educational platform

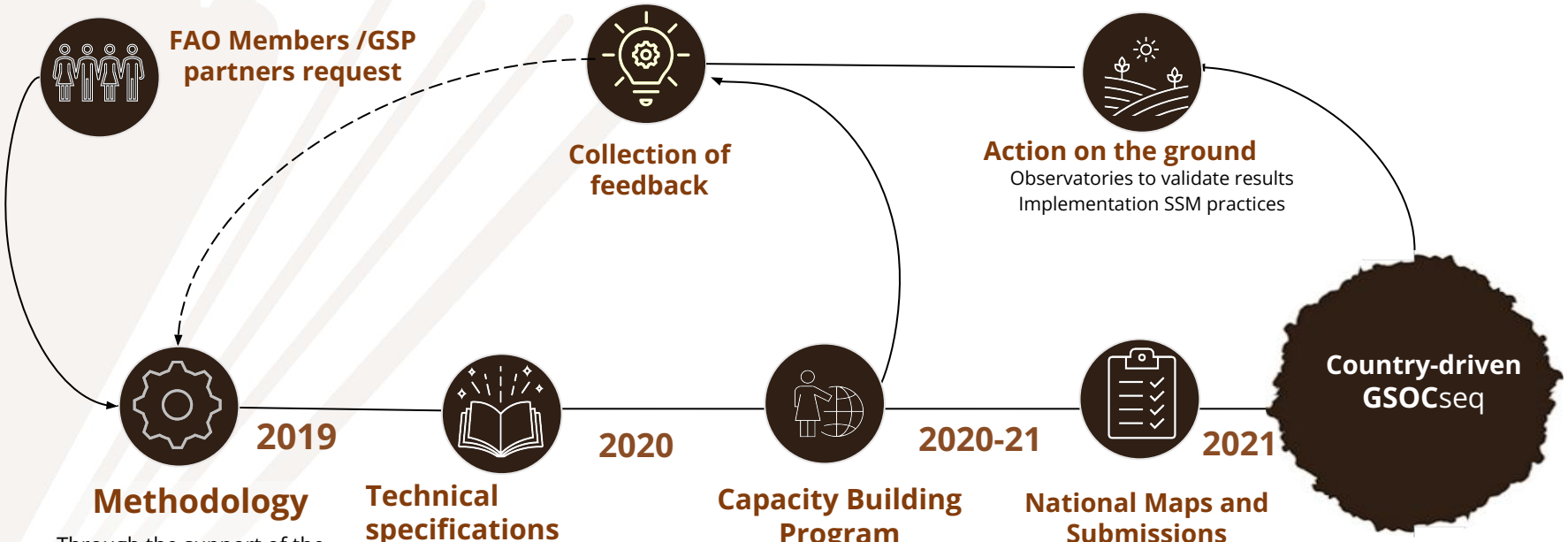
GLOBAL SOIL PARTNERSHIP

GSOCseq a Global Map based on country-driven (“bottom-up”) approach

- **Local expertise**, best available local data and local knowledge
- **Interaction** from experts from different fields and institutions
- Constitutes a **“living product”** being continuously updated and **improved**
- **Tool** to encourage SSM practices



How is the GSOCseq process?



EduSoils | e-learning soil educational platform

GSOCseq at glance

- 20-year projections of SOC sequestration potential in 2040
- Projections are based on a spatialized RothC version
- After the adoption of SSM that increase C inputs to the soil
- 0-30 cm Depth
- In current agricultural lands (Each country can model preferred land uses, restoration, etc.)
- Both projected SOC stock maps in t/ha and sequestration rates in t/ha/yr are outputted
- 1x1 km resolution

Why RothC as standard model?

- Standard method among countries (DayCent, Century, ICBM, YASSO,DAISY,AMG, CLM5, etc.)
- Fewer data requirements; data relatively simple to obtain;
- It has been applied across several ecosystems, climate conditions, soils and land use classes;
- Successfully applied at national, regional and global scales; e.g. Smith et al., (2005), Smith et al., (2007), Gottschalk et al., (2012), Wiesmeier et al., (2014), Farina et al., (2017), Mondini et al., (2018), Morais et al., (2019)
- It (or its modified/derived version) has been used to estimate carbon dioxide emissions and removals in different national GHG inventories as a Tier 3 approach; Smith et al., (2020): Australia (as part of the FullCam model, Japan (modified RothC), Switzerland, and UK (CARBINE, RothC).

RothC Data requirements

Climate

Climate Data

1. Monthly rainfall (mm)
2. Average monthly mean air temperature (ºC)
3. Monthly open pan evaporation (mm)/evapotranspiration (mm)

Soil

Soil Data

1. Total initial 0-30cm SOC stocks (t C ha^{-1})
2. Initial C stocks of the different pools (t C ha^{-1}): DPM, RPM, BIO, HUM, IOM
3. Clay content (%) at simulation depth.

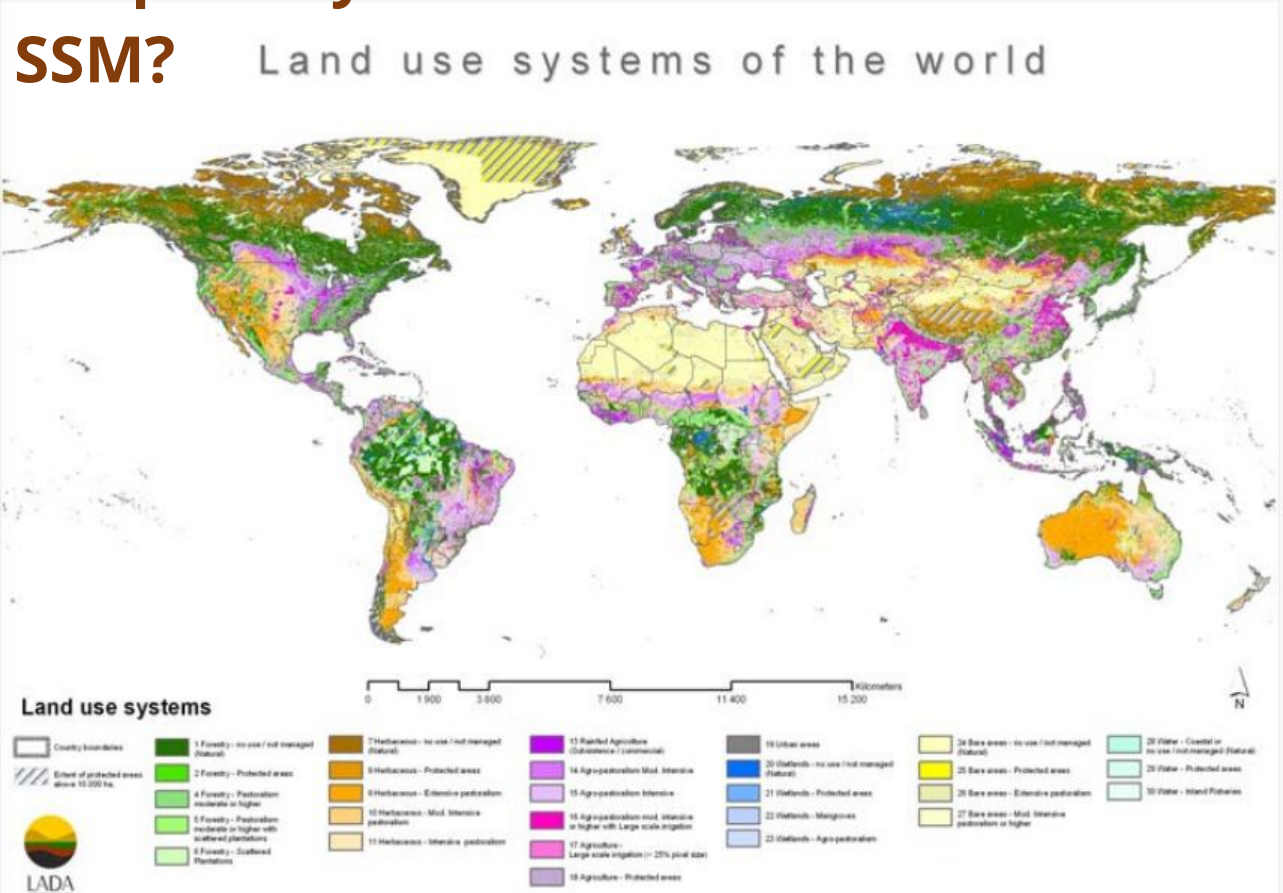
Management

Land Use- Management Data

1. Monthly Soil cover (binary: bare vs. vegetated)
2. Monthly Carbon inputs from plant residues (aboveground + belowground), (t C ha^{-1})
3. Monthly Carbon inputs from organic fertilizers and grazing animals' excretion (t C ha^{-1})
4. DPM/RPM ratio, an estimate of the decomposability of the incoming plant material

How to harmonize and model thousands of different practices, often combined? ...Especially with limited data

SSM?



... First stage...

Practices that increase C inputs

3 scenarios:

+5 % increase Ci

+10 % increase Ci

+20 % increase Ci

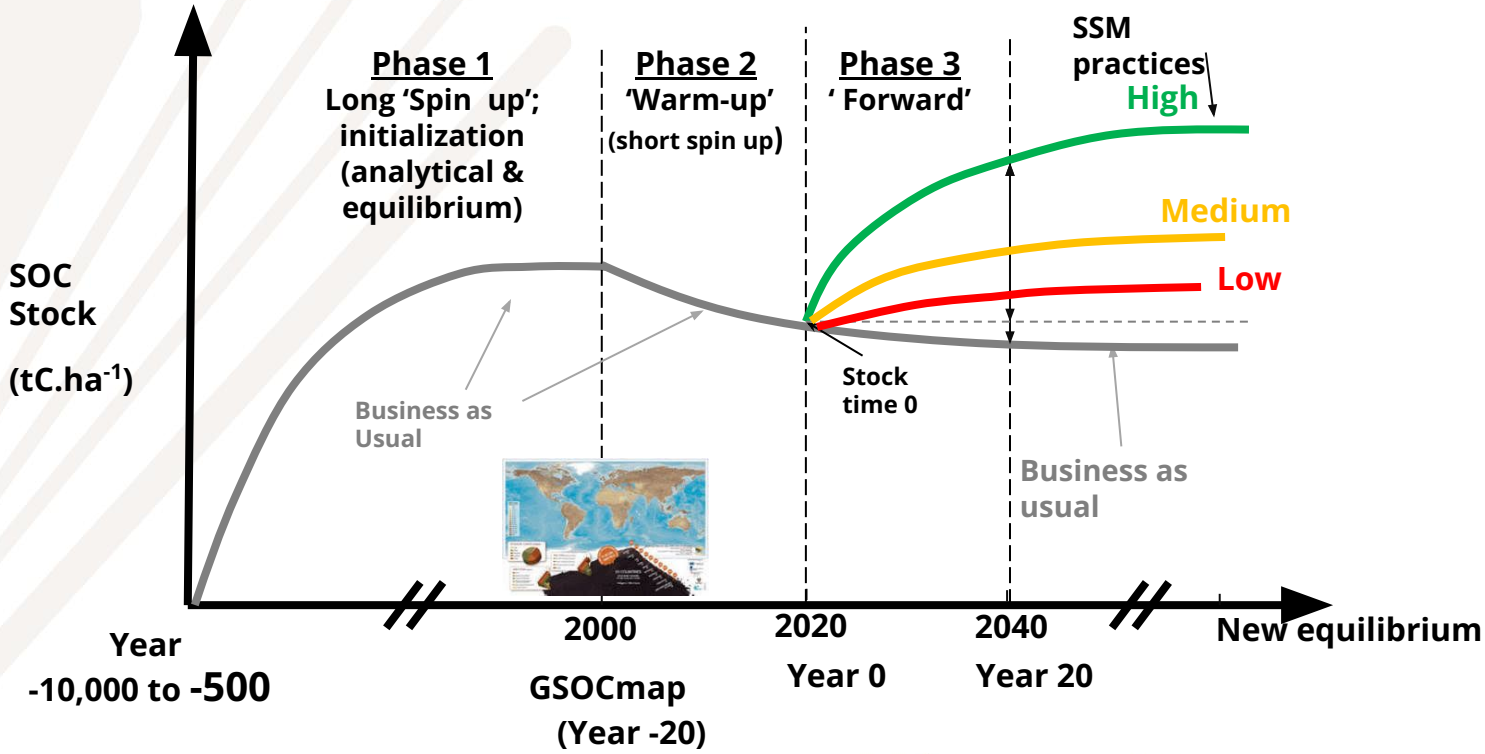
Conservative ranges...may be high for other systems

based on Smith, 2004; Wiesmeier et al., 2016

ing soil educational platform

GLOBAL SOIL PARTNERSHIP

For each 1 x 1 km pixel:



Approach based on Smith et al. (2006; 2008); Gottschalk et al. (2012)

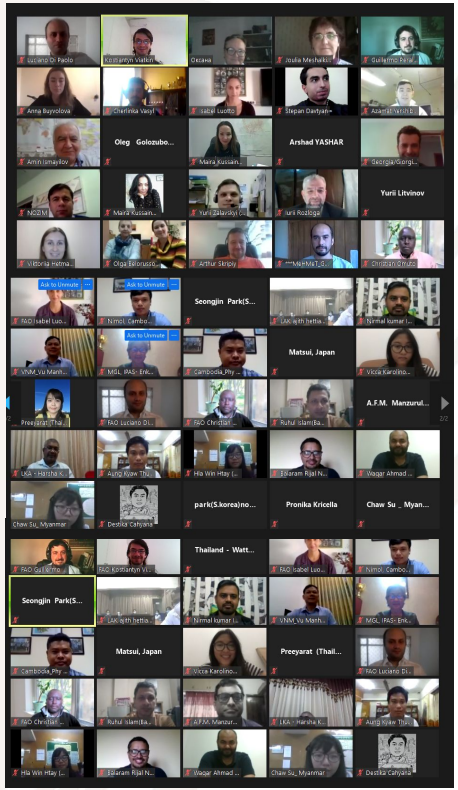
Uncertainty layers are estimated for each modeling unit and for each scenario:

- They're based on the uncertainties of the input data considering minimum and maximum values (corresponding to the limits of a 95% confidence interval)
- A set of predefined input parameters, considered to have the greatest influence in RothC modeling results (initial SOC stocks, carbon inputs, and soil and climatic variables) was selected

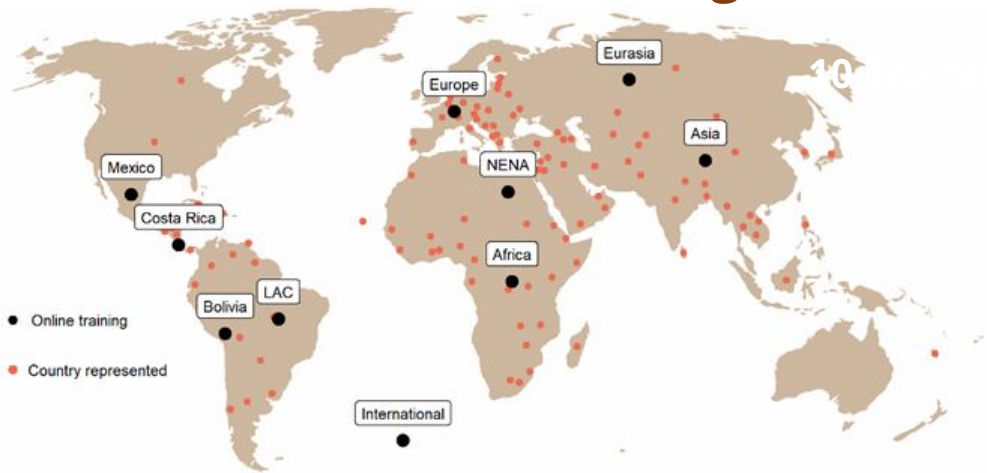
Each national submission is going through Quality Assessment/Quality Check (QA/QC)

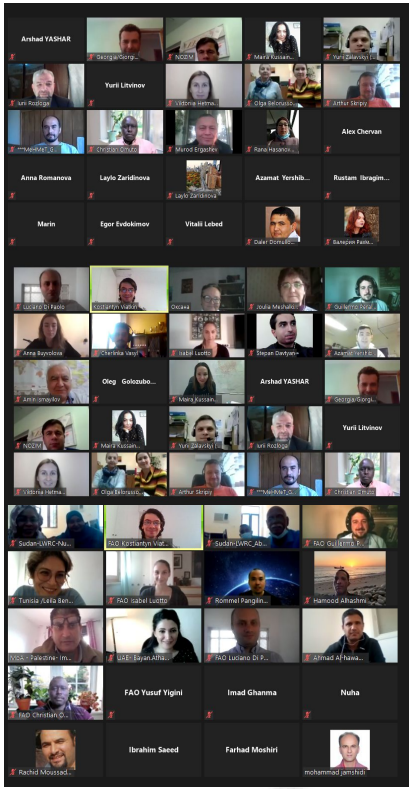
- The QA/QC protocol is available as an Annex on the Technical Manual: https://fao-gsp.github.io/GSOCseq/annex-ii-quality-assurance-and-quality-control.html

Capacity development

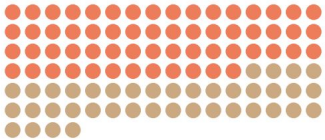


10 online trainings

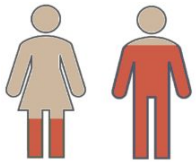




119 countries



433 participants

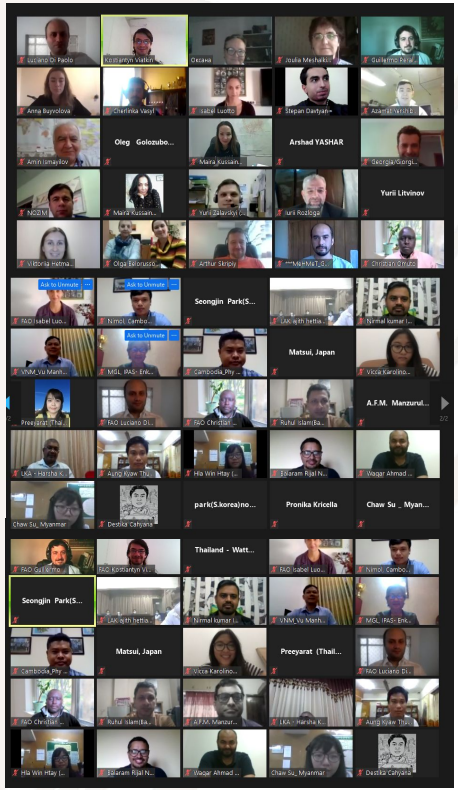


EduSoils | e-learning soil educational platform

GLOBAL SOIL PARTNERSHIP

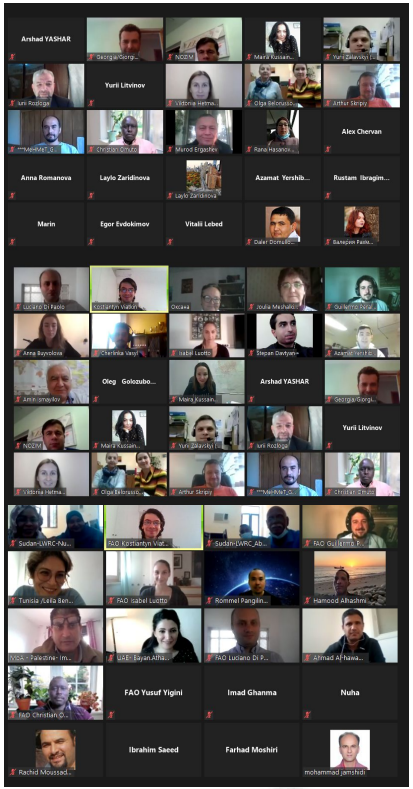
International Training on Digital Soil Property Mapping and Information Delivery, 15-19 November 2021, Yi Peng & Isabel Luotto

Contributions to date...



- **46 national submissions**
- **73 countries, map in progress** (temporarily filled using global layers)
- **69 no response**; no request to be blank; gap filled
- **9 countries blank**

Current version: 90% of the global agricultural area, being continuously updated



EduSoils | e-learning soil educational platform

GLOBAL SOIL PARTNERSHIP

http://54.229.242.119/GloSIS/

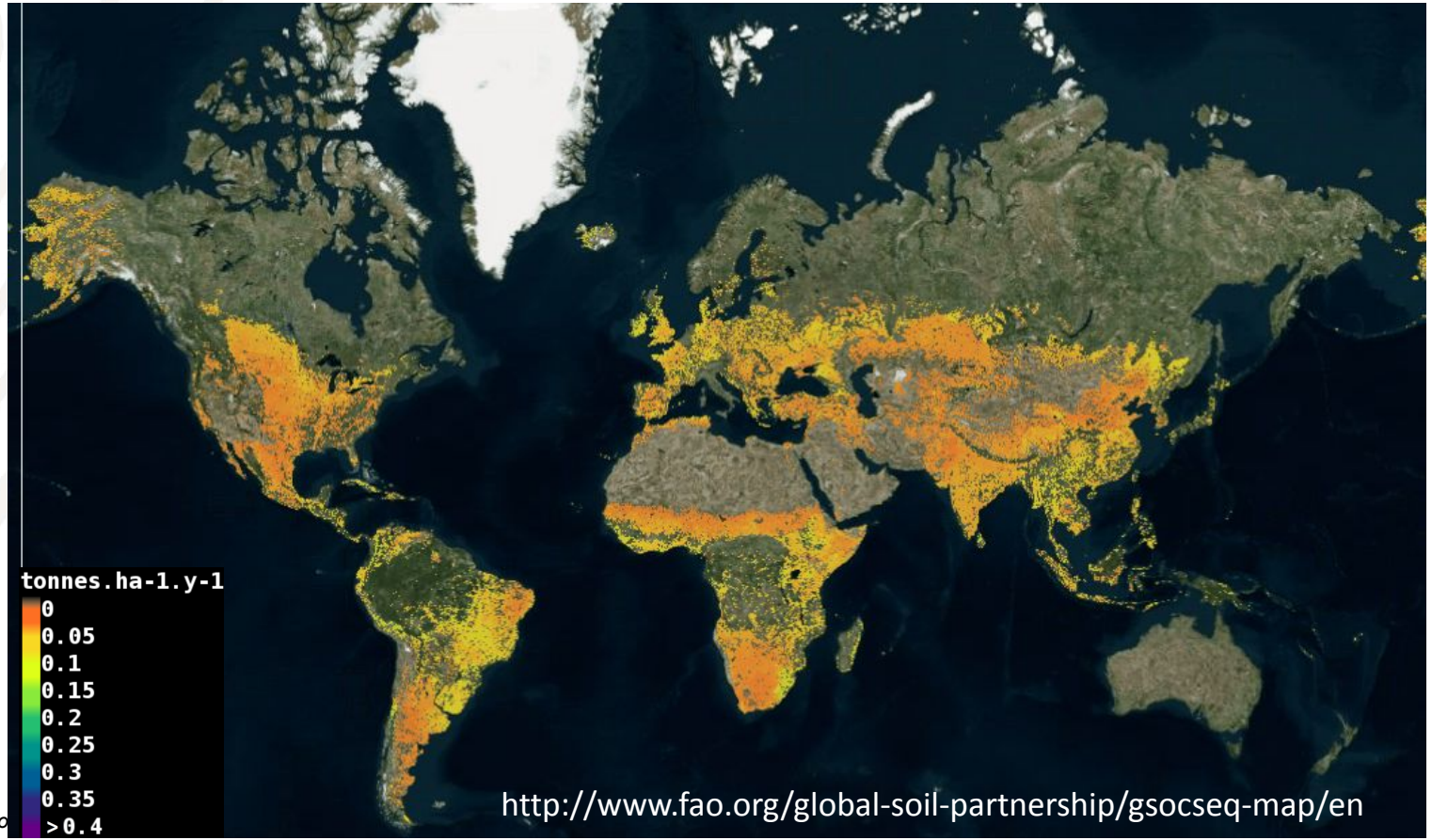
GSOCseq data platform

Relative sequestration rates tonnes.ha-1.y-1

SSM1 >> SSM3

GSOCseq v1.0.0

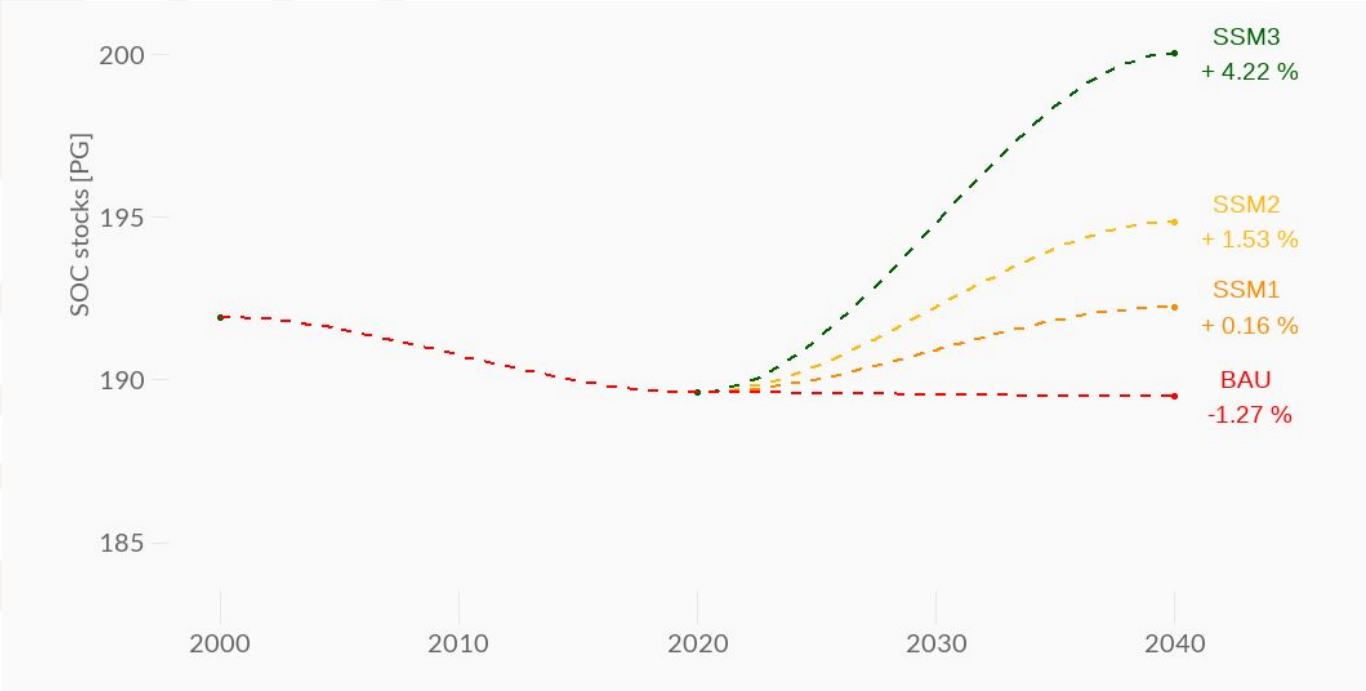
- SOC sequestration (tC/ha/yr) SSM 1-3
- Agricultural lands (croplands + grazing lands)
- 20-year period
- Depth: 0-30 cm
- 1 x 1 km resolution



GSOCseq v1.0.0 Uncertainties (%)

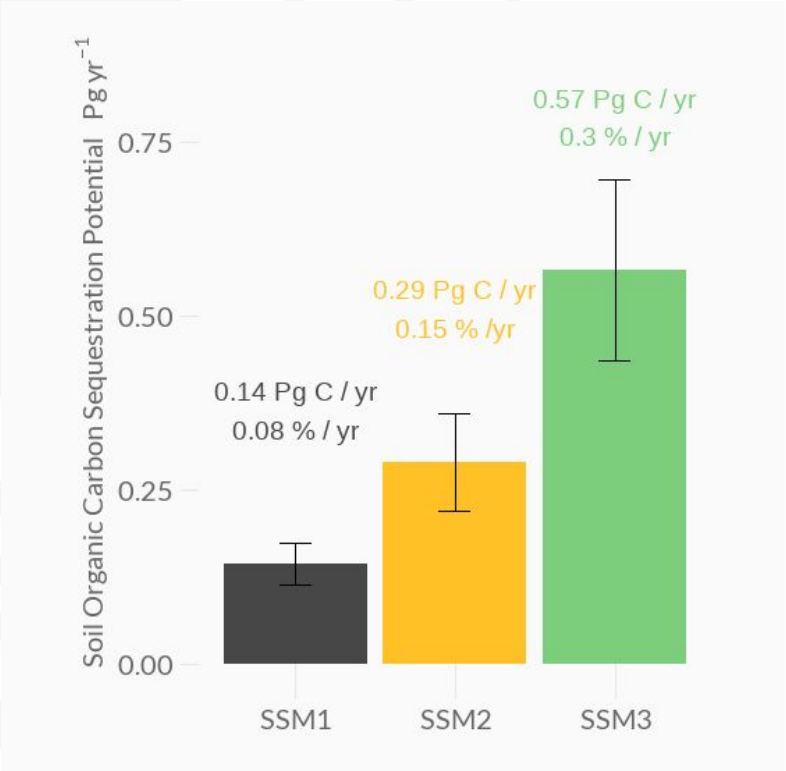
First results - Global SOC stocks*

***Excluding blank countries (GSOCseq v1.1)**



First results - Annual SOC sequestration*

*Excluding blank countries



Previous estimates

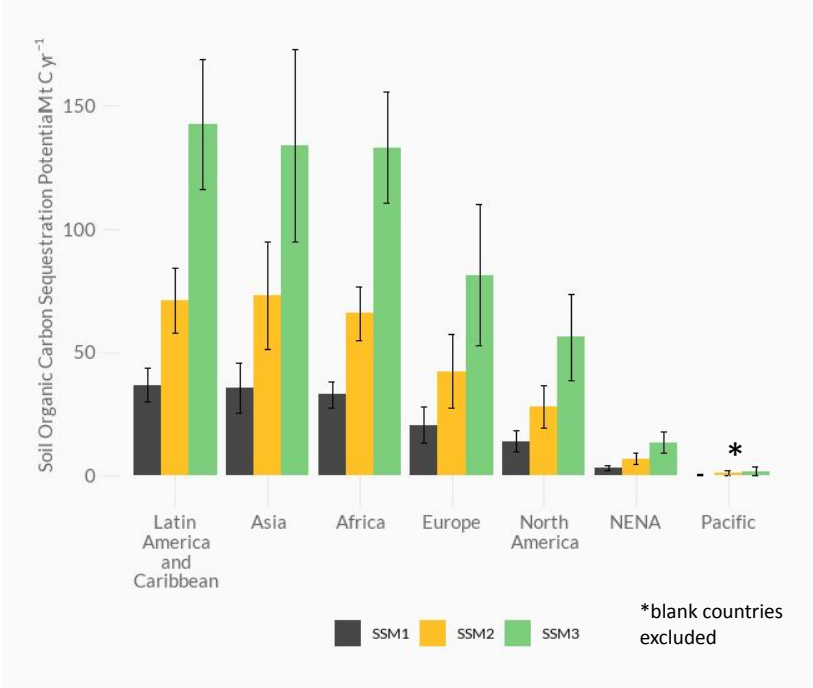
Source	Seq.rate Pg C.year^{-1}
Paustian et al (2004)	**0.44 - 0.88**
Smith et al (2008)	**0.44 - 1.15**
Sommer and Bossio (2014) (croplands+grasslands)	**0.37 - 0.74**
Batjes et al (2019)	**0.32 - 1.01**
Lal et al (2018) (croplands+grasslands/shrublands)	**0.48 – 1.93**
Fuss et al (2018)	**0.54 – 1.36**

EduSoils | e-learning soil educational platform

GLOBAL SOIL PARTNERSHIP

Potential uses - statistics

Which **climates**, **land uses**, **regions**, **countries** have greater SOC sequestration potential?

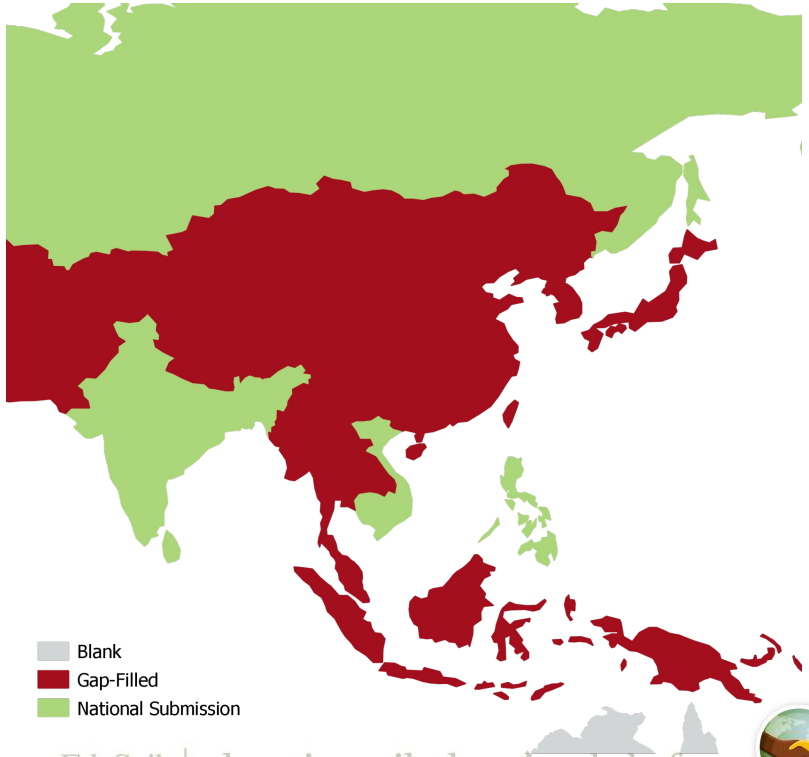


EduSoils | e-learning soil educational platform

GLOBAL SOIL PARTNERSHIP

AFACI countries: Way forward

- Additional trainings (December TBD)
- Support countries remotely (resume remote technical support sessions)
- Provide additional material to support countries is evaluating and interpreting the output layers
- Support countries in devising national SSM scenarios
- Support countries in using national SOCseq maps in implementing RECSOIL projects



EduSoils | e-learning soil educational platform

GLOBAL SOIL PARTNERSHIP

AFACI Training: GSOCseq | December TBD

GSOCseq Training

5 days (Training & Production)

->Hands-on practice with a training dataset
->Technical Support sessions in break out rooms