



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

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INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS



2012 ... 2023 ... 2030

GSP Established

The Global Soil Partnership was established in December 2012 as a mechanism to develop a strong interactive partnership and enhanced collaboration and synergy of efforts between all stakeholders.

2012

.....

2022

GSP 11th PA

2023

2030

GSP Action Framework

The Action Framework was endorsed at the **10th GSP Plenary Assembly**, to leverage the scale and scope of sustainable soil management (SSM), improving the governance of the world's soil resources.

GSP 2030

A world in which soils are healthy and resilient, ensuring the sustained provision of ecosystem functions and services for all, leaving no one behind."

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The GSP Action Framework

The Action Framework was adopted by the 10th GSP Plenary Assembly and endorsed by the 28th Session of the COAG (2022).

Quantifiable Goals, Targets and Indicators

GSP AF has a clear ambition shared by all **GSP members and partners**, with the establishment of **quantifiable goals, targets and indicators that** will allow for the evaluation of the progress that the GSP is making towards its vision of healthy soils.



The GSP Action Framework

DESIGN PRINCIPLES

Structured Approach

The GSP Action Framework organizes **past and future** work of the Global Soil Partnership (GSP) in a structured manner.

Measurable Assessment

It incorporates **quantifiable indicators** to assess the effectiveness of GSP's soil management and conservation initiatives.

Tracking with KPIs

The framework establishes Key Performance Indicators (KPIs) to monitor progress and ensure accountability for the impact of GSP's activities.

Outcome Monitoring

The framework includes a monitoring component to track outcomes and provide valuable insights for decision-making and resource allocation.

Strategic and Sustainable

GSP's work aligns with SDGs, catalyzing meaningful change in sustainable soil management worldwide.

GSP AF Indicator Systems

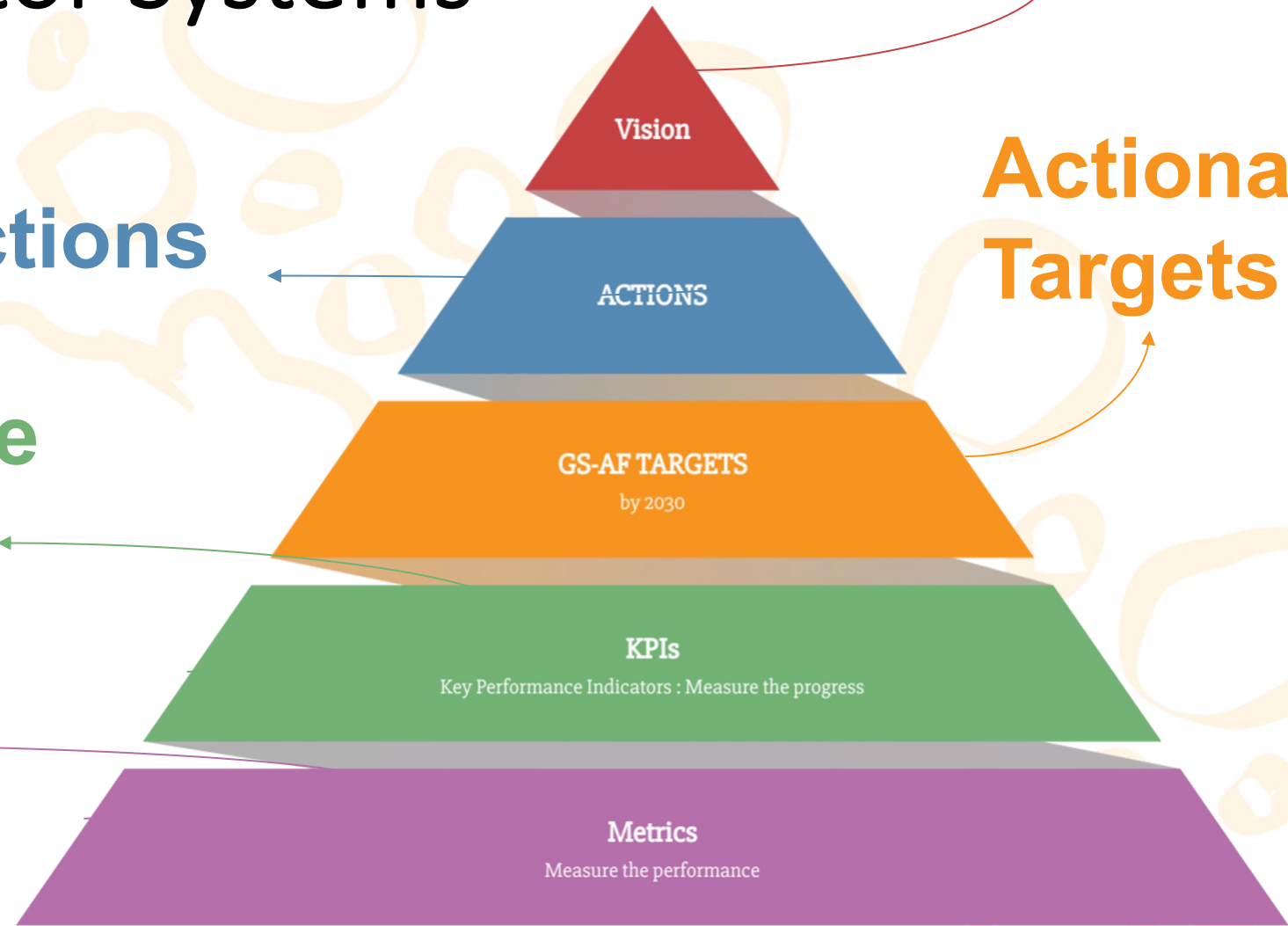
GSP - 2030

Actions

**Actionable
Targets**

**Performance
Indicators**

Metrics



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GSP Action Framework States:

- The progress of the GSP Action Framework will be monitored and measured through **SoilSTAT**.
- A **Global Soil Health Index (GSHI)** is to be developed.
- This crucial task is being carried out by a dedicated working group (**ISAF WG**).

Indicator System for the GSP Action Framework (ISAF)– open call



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Call for a Working Group to develop the Indicator System of the GSP Action Framework (ISAF)

Background

In May 2022, the 10th GSP Plenary Assembly (PA) adopted the new [GSP Action Framework 2022–2030](#) that was endorsed by the 28th Session of the FAO Committee on Agriculture (COAG). In this regard, “COAG encouraged FAO and all GSP members to implement the activities outlined therein, as well as tools and initiatives of the GSP including the Voluntary Guidelines for Sustainable Soil Management, the International Code of Conduct for the Sustainable Use and Management of Fertilizers, among others, as appropriate”.

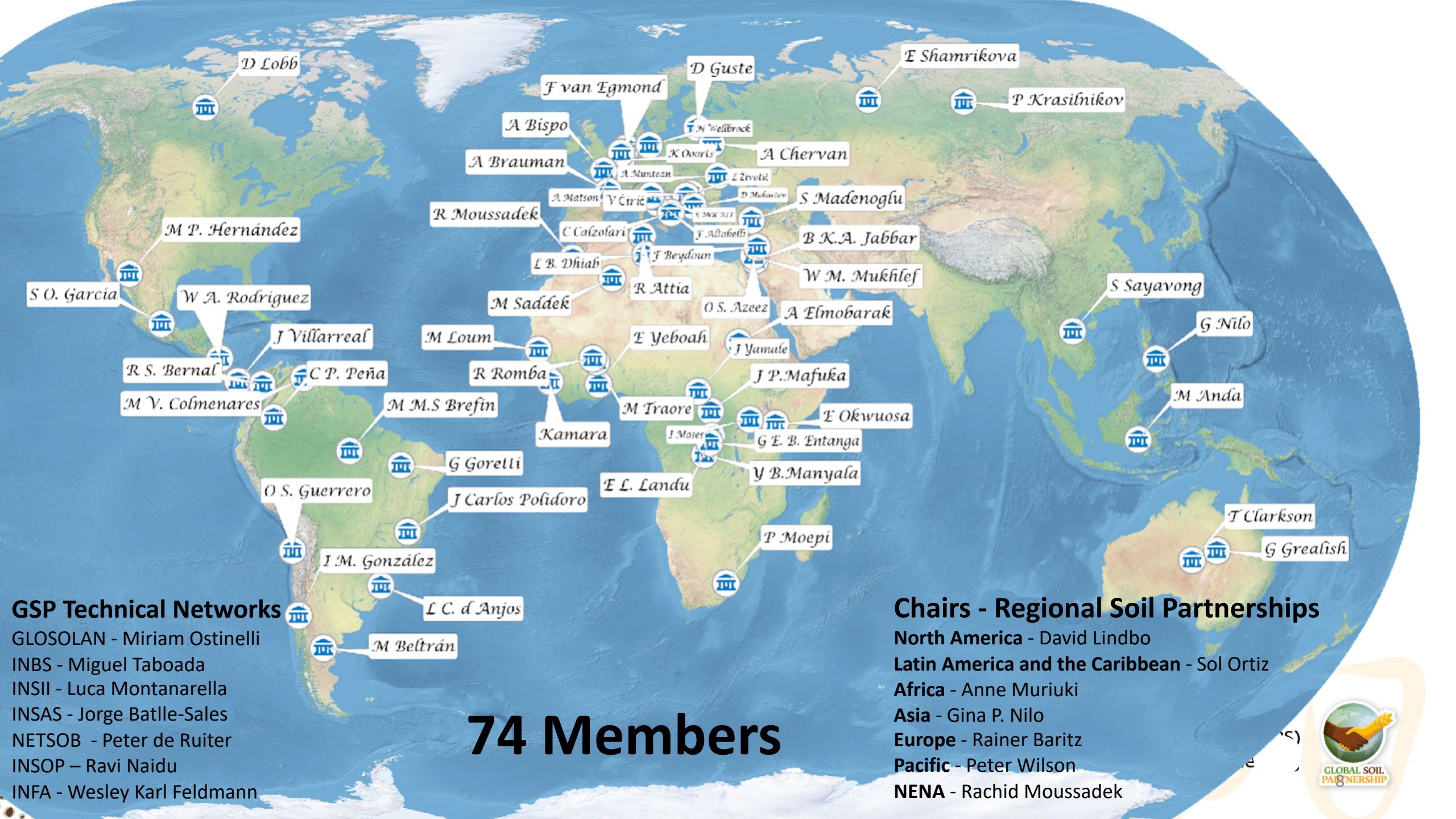
The overarching principle of the GSP Action Framework is that in a world in which soils are healthy and resilient, the provision of ecosystem functions and services by soils are sustained for all, leaving no one behind. The vision is that the GSP must work to improve and maintain the health of at least 50 percent of the world’s soils by 2030. To further develop the GSP towards a flexible action-oriented approach and meet this objective, Pillars of Action have been replaced by Action Areas linked to concrete actions, initiatives, and programmes.

- Action Area 1: Manage sustainably and restore soils for the provision of ecosystem services
- Action Area 2: Strengthen soil governance
- Action Area 3: Promote knowledge and literacy on soils
- Action Area 4: Promote awareness raising and advocacy on soil health
- Action Area 5: Assess, map, and monitor soil health in a harmonized way
- Action Area 6: Foster technical cooperation (including gender and youth)

Another novelty of the GSP Action Framework is the inclusion of concrete and quantifiable targets to measure the impact of actions at the global, regional, national and local levels. In this regard, the GSP Action Framework is made up by clear actions and targets focused on addressing the different global challenges – from food insecurity, climate change, pollution, land degradation and the loss of biodiversity – through the improvement and enhancement of soil health. Key performance indicators (KPIs) are to be developed and agreed upon with GSP members and partners to allow monitoring of activities and progress towards these targets.

The Action Framework also proposes the development of a Global Soil Health Index (GSHI), as a composite index including the indicators endorsed in the Protocol for the assessment of sustainable soil management (SSM Protocol) to provide a proxy on the soil health status at global level.

ITPS Chairperson & ITPS Members
Chairs of the Regional Soil Partnerships
Chairs of the GSP Technical Networks
Experts nominated by GSP National Focal Points
Global Soil Partnership Secretariat (facilitator)



D Lobb

F van Egmond

D Guste

E Shamrikova

P Krasilnikov

A Bispo

T.N. Wellbroeck

A Brauman

K Oorls

A Chervan

A. Matson

A. Muntean

L Životić

R Moussadek

V Čirić

D. Mubarek

S Madenoglu

M P. Hernández

C Caizolari

J. Altabelli

B K.A. Jabbar

S O. Garcia

W A. Rodriguez

L B. Dhiab

F Beydoun

W M. Mukhlef

S Sayavong

J Villarreal

M Loum

E Yeboah

J Yamale

G Nilo

R S. Bernal

C P. Peña

R Romba

M Traore

J P. Mafuka

M Anda

M V. Colmenares

M M.S Brefin

Kamara

I Moses

E Okwuosa

G Goretti

J Carlos Polidoro

E L. Landu

Y B. Manyala

O S. Guerrero

I M. González

L C. d Anjos

P Moepi

T Clarkson

G Grealish

M Beltrán

74 Members

GSP Technical Networks

- GLOSOLAN - Miriam Ostinelli
- INBS - Miguel Taboada
- INSII - Luca Montanarella
- INSAS - Jorge Batlle-Sales
- NETSOB - Peter de Ruyter
- INSOP - Ravi Naidu
- INFA - Wesley Karl Feldmann

Chairs - Regional Soil Partnerships

- North America - David Lindbo
- Latin America and the Caribbean - Sol Ortiz
- Africa - Anne Muriuki
- Asia - Gina P. Nilo
- Europe - Rainer Baritz
- Pacific - Peter Wilson
- NENA - Rachid Moussadek



Work of ISAF WG

1

GSP Performance Indicator System

monitoring Key Performance Indicators (KPIs) for soil-related activities and initiatives of the GSP

2

SoilSTAT Soil Health Indicator System

a comprehensive platform for monitoring key soil health indicators

3

Global Soil Health Index (GSHI)

Standardized metric to measure and track the soil health worldwide

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Timeline

9thINSII

Nov  We are here

April

May

June

July

Nov

1

2

3

F

Introduction, Zero Draft

development, drafting, revising

~~Final Draft~~ — 11th GSP PA

- **ISAF 1st Meeting** – April 2023 – Zero Draft
- **ISAF 2nd Meeting** – May 2023 – Draft
- **ISAF 3rd Meeting** – July 2023 – ~~Final Draft~~
- **11th GSP PA** – July 2023 – Progress Update
- **19th ITPS** – November 2023

3 x Working Sessions

- **Rigorous Process:** Each element of the concept has been subjected to thorough discussion and careful review.
- **Collective Knowledge:** The revisions and iterations reflect the consensus of a diverse group of experts.





Over 500 inputs! The Working Group has demonstrated an **extraordinary level of engagement** and **attention to detail** in the development.



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Joost Salomez 15:48 4 Jul
For some countries/regions (eg Flanders), this resolution is too coarse

Katrien Oorts 17:06 4 Jul
Indeed, it must be possible to deliver also maps at finer resolutions so that global maps can be made at the 1x1km resolution but that the finer resolution maps also are available where this is relevant or needed for a country.?

Y. Yigini 07:47 6 Jul
we add minimum resolution 1x1 km, countries would report at higher resolutions?

Lucia Anjos 00:05 7 Jul
For others this is the opposite. Amazon region an example. There is an extreme lacking of data, even in the agricultural even those poor estimates, with

Selected text | <1.2

Ingrid Martinez González 11:32 18 Apr
Volcanic soils have bd 0.5-0.7, values higher than 0.8, soils tend to be compacted. In Chile 50-60% are volcanic soils, Ecuador 30%, Colombia 11%, Japan 10%...

Moses Isabirye 14:16 18 Apr
Nice insight

Reply or add others with @

Oorts
e assessed? With measurements or sferfunctions based on other data? asurements are not realistic for the

Rosa M Poch 11:48 10 Apr
Not clear. The unit to apply the metrics should not be a region including several countries?

Miriam Ostinelli 04:10 18 Apr

David Lobb 13:37 7 Jul
Land Loss, rather

Selected text | Integer Number

Rosa M Poch 11:48 10 Apr
Not clear. The unit to apply the metrics should not be a region including several countries?

Miriam Ostinelli 04:10 18 Apr

abdelmagid elmobarak 10:03 13 May
Add: "Good Practice Guidance (GPG) SDG Indicator 15.3.1 (Proportion of land that is degraded over total la..."

Y. Yigini 16:38 30 Jun
Suggestion accepted

Reply or add others with @

Selected text | >200

Rosa M Poch 11:34 10 Apr
Might correspond to overfertilized (unhealthy) soils. N is also very variable along the can lead

Lucia Anjos 16:46 16 Apr
Marked as

Rainer Baritz 21:48 20 Apr
Build up a rationale:
- the global soil condition is declining at an alarming level (examples).
- the GSP has established a voluntary commitment to achieve healthy soils by 2050 (forget 2030 as unrealistic)
- to achieve this, targeted and effective SSM measures need to be incentivised, at locations where soils are degraded, and where measures are thus most needed and

Selected text | Soil pH: 6.8

Maria de Lourdes M Santo... 21:26 12 Apr
Not real to most of tropical soils

Reply or add others with @

Selected text | To achieve this

Rainer Baritz 21:48 20 Apr
Build up a rationale:
- the global soil condition is declining at an alarming level (examples).
- the GSP has established a voluntary commitment to achieve healthy soils by 2050 (forget 2030 as unrealistic)
- to achieve this, targeted and effective SSM measures need to be incentivised, at locations where soils are degraded, and where measures are thus most needed and

Add: "as well as for the establishment of different weighting factors depending on the considered ecosys..."

Maria Costanza Calzolari 15:58 17 Apr
see my previous comment about weighing factors

Y. Yigini 19:59 Yesterday
Suggestion accepted

David Lobb 13:39 7 Jul
If you mean water erosion, state Water Erosion, not Soil Erosion which includes wind, water and tillage erosion.

David Lobb 13:42 7 Jul
I suggest a Soil Erosion indicator that is a culmination of wind, water and tillage erosion

Reply or add others with @

Agreed Ok Thanks

Jorge Batlle 13:17 11 May
This parametric approach to elaborate an index has several inconvenients. 1. The main is that it is not allowed to operate with categorical (in this case ordinal) variables in algebraic manner (yes, I know that there are many indexes that do not respect this mathematic basic rule, but...). 2. The categorization procedure, assigning classes from 1 to 4 needs to be fixed, for avoiding subjective assignments. 3. The weights factors for each soil indicator, as redacted, are subjective "The weights can be adjusted based on the specific needs and objectives of a given study or management practice." 4. All models, as the proposed one, have to be calibrated and "validated" before to be widely proposed. Also variables cross-interaction and variables sensitivity should be explored. 5. There is an issue of the spatial representativity of the measurements used for mapping.

As POSITIVE comment I propose to elaborate the index using logical operations such as used in the classification of soils (Soil Taxonomy, WRB and others): "IF A is > 30, AND B > 5%, but NOT >20%, THEN --> class optimal". It could be four nowadays exist making complex unsupervised), and I think that challenge and elaborating the

Selected text | Good

Lucia Anjos 16:56 16 Apr
Even in fertilized soils and at the surface horizon we may NEVER reach these values in most Cerrado (savannah) soils of Brazil. If I consider natural values, it will be even worse. We have to discuss this central idea of assigning fixed values (or range) independent of the natural values.

Reply or add others with @

Selected text | GSPAF-TC-02

Sevinç Madenoğlu 20:33 10 May
National projects supported by the GSP on SSM?

Y. Yigini 09:37 12 May
noted, to be considered

Y. Yigini 16:41 30 Jun
Marked as resolved

Adding a comment will re-open this discussion...

Alain Brauman 11:56 7 Jul
ecosystem health ?

Y. Yigini 12:32 Yesterday
Marked as resolved

Fenny van Egmond 09:32 12 May
Governance on the framework, indicators, thresholds weights etc. and communication aligned with regional and national needs should be specified a

Selected text | SHI = (SI1 x W1) + (SI2 x W2) + ... + (SI...

Jorge Batlle 12:01 18 Apr
The categories are assigned to numbers, but they are NOT numbers, so algebraic operations are not possible.

Y. Yigini 19:59 3 May
Marked as resolved

Adding a comment will re-open this discussion...

Selected text | Soil

Katrien Oorts 14:04 4 Jul
N is also very variable agricultural soils, its use g results.

Y. Yigini 16:07 30 Jun
Marked as resolved

Adding a comment will re-open this discussion...

Selected text | Classification of potential soil indica

Maria Costanza Calzolari 16:06 17 Apr
Tricky question, as pointed out by Rosa and Lucia. Overall, threshold values can be reliable provided that they are tailored on different pedoclimatic areas (and ES, and management practices)

Reply or add others with @

Selected text | Adoption of S

Maria Costanza Calzolari 15:54 17 Apr
More than threshold according and man pedocloi

Reply

Selected text | Soil Loss

David Lobb 13:37 7 Jul
Land Loss, rather than soil loss to avoid confusion with soil erosion.

Reply or add others with @

The Final Draft:

Global Soil Partnership
Action Framework 2030

SoilSTAT

Development and Integration of Key Performance Indicators for
the Global Soil Partnership,
the Soil Health Indicator System, and the
Global Soil Health Index (GSHI)

Concept Note

ISAF Working Group

2023

1

Global Soil Partnership Performance Indicator System

2

SoilSTAT: Soil Health Indicator System

3

Soil Health Index and Global Soil Health Dashboard

+

+ Indicator Factsheets, Operational Aspects, Reporting Lines, Data Policy, QA/QC

1 GSP Performance Indicators

- **16** KPIs
- **6** Domains (SSM, Soil Governance, Knowledge and literacy, Awareness raising, Soil Information and Data, Technical Cooperation)

Target (GSPAF)	Domain	Indicator	Metric	(w/ (year)
1	SSM	Adoption of SSM Practices	# of farmers or beneficiaries adopting SSM Practices per unit area	2
2	SSM	Adoption of SSM in national programmes	# of countries that have included SSM in their national programmes	2
3	SSM	Proportion of degraded soils under SSM measures over total degraded soils.	Land area under SSM practices within GSP programmes, projects and initiatives.	2
4	SSM	Proportion of black soils under protection measures over total black soil area	Land Area under black soil protection measures	2
5	Soil Governance	Development of national and regional legal instruments focused on soil health	# of countries technically supported to include rev-WSC and VGSSM principles into national policies and strategies	1
6	Soil Governance	Implementation of the Fertilizer Code	# of countries technically supported to include the Fertilizer Code principles into national policies and strategies.	1
7	Soil Governance	Formalization of cooperation between the FAO/GSP and other relevant intergovernmental processes and monitoring frameworks	# of official agreements between FAO/GSP and relevant intergovernmental bodies	1
8	Knowledge and literacy	Capacity development programmes/courses on SSM	1) # of participants trained through the GSP's capacity development programmes 2) # of training sessions organised by the GSP	1
9	Knowledge and literacy	Global assessments reports on the state of world's soils and soil threats	# of global assessments and reports on soils published by the GSP..	1
10	Awareness raising and Advocacy on Soil Health	Outreach of the World Soil Day	1) Social Media Engagement Rate 2) Campaign Reach	1

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2 Soil Health Indicators

- **21** Soil Health Indicators
- **10** Domains (e.g., Soil Physical, Chemical and Biological Health; Soil Fertility; Soil Threats; Soil Organic Carbon Dynamics, Soil Pollution)

Domain	Indicator	Metric
Soil Organic Matter	Soil Organic Carbon Stock	Predicted SOC Stocks
Soil Organic Matter	Soil Organic Carbon Concentration	Soil Organic Carbon Concentration
Soil Carbon Dynamics	Soil Organic Carbon Sequestration Potential	Predicted SOCseq Potential
Soil Salinity	Electrical Conductivity	Measured or Predicted Electrical Conductivity
Soil Loss	Water Erosion Risk	Area under severe risk of erosion
Soil Loss	Tillage Erosion	Predicted Annual Soil Loss by Tillage
Soil Loss	Water Erosion Rate	Predicted Annual Soil Loss by Water
Soil Loss	Wind Erosion	Susceptibility to Wind Erosion
Soil Loss	Soil Sealing	Sealed area compared to the baseline
Soil Fertility	Available Nutrient Contents	Nutrient Concentrations (NPK)
Soil Fertility	Soil Nutrient Budget	Predicted/Calculated Nutrient Budgets for N
Soil Biological Health	Microbial Activity	Soil microbial biomass carbon (MBC)
Soil Biological Health	Soil Respiration	CO2 production
Soil Physical Health	Soil Compaction	Bulk Density
Soil Physical Health	Water Infiltration	Infiltration rate
Soil Physical Health	Soil Texture	Sand, Clay and Silt
Soil Physical Health	Available Water Capacity	Available Water Capacity
Soil Chemical Health	Soil Reaction	Soil pH
Soil Pollution	Contaminated Sites	Number, type of site, type of main pollutant
Soil Pollution	Heavy Metal Concentrations	Predicted/Measured Heavy Metal Concentrations
Soil Salinity	Exchangeable Sodium percentage	Predicted/Measured ESP or SAR

3

Soil Health Index



TOWARDS A DEFINITION OF SOIL HEALTH

The concept of what is a healthy soil has not been officially defined until now, although it has been widely used for more than a decade. Soil health refers to the performance or functioning of a soil, not its intrinsic physical/chemical/biological properties. Early definitions of healthy soils are rather anthropocentric and focus on soils in agro-ecosystems, such as those capable of supporting adequate production of biomass (food and fibre) for human needs, while maintaining other ecosystem services, such as climate regulation or biodiversity conservation (Kibblewhite, Ritz and Swift, 2008). Doran, Stamatiadis and Haberern (2002) have highlighted some of the ecosystem services, which are not limited to services provided to humans, by defining soil health as synonymous with soil quality, which is the constant ability of soil to function as a living system that determines land use systems and boundaries to support biological productivity, promote air and water quality, and maintain plant, animal, and human health. Although these two terms are strongly related, Lal (2016) makes a distinction between soil quality which refers to soil functions or what the soil does, and soil health, which presents the soil as a finite and dynamic living resource.

One of the complexities in defining soil health is the lack of agreement on indicators and threshold values due to the singularities and high spatial variability of global soils (Cardoso *et al.*, 2013; Fine, Es and Schindelbeck, 2017; Seaton *et al.*, undated). In addition, soil health indicators should be sensitive to management practices and reflect changes in resilience and adaptation (Stott, 2019; Zornoza *et al.*, 2015). The most recent proposals include biological indicators as key players in soil health and functioning (Franzuebbers, 2016; Gupta, 2020; Hermans *et al.*, 2017).

Soil health, as a dynamic concept, should also be applicable to natural and unmanaged soils, as they present different degrees of preservation of below- and aboveground biodiversity, regulation of water and of biogeochemical

cycles, and hence of climate, among other ecosystem services inherent to soils. Thus, a natural healthy soil would have a high level of adaptation to existing conditions as well as to a changing environment: i.e. a high buffering capacity; or in other words, a high resilience, maintaining the ability to sustain those services in the face of environmental alterations.

ITPS DEFINITION OF SOIL HEALTH

The Intergovernmental Technical Panel on Soils (ITPS) defines soil health as “the ability of the soil to sustain the productivity, diversity, and environmental services of terrestrial ecosystems”. In managed systems, soil health can be maintained, promoted or recovered through the implementation of sustainable soil management practices. As with human health, there is no single measure that captures all aspect of soil health. The preservation of these soil services requires avoiding and/or combating all types of soil degradation.

The ITPS coins this definition of soil health and hopes to be widely used and adopted by international organizations, institutions, governments, academia, etc. In line with the call for action issued by Lehmann *et al.* (2020), clear and comparable indicators should be defined to ensure that the world's soils are managed sustainably and that the ecological and socio-economic benefits of healthy soils are preserved for future generations. Consequently the ITPS and the Global Soil Partnership are working on the selection of indicators and harmonized laboratory methodologies that are applicable in all countries and enable the assessment, promotion, conservation and restoration of soil health.



SOIL HEALTH?

The Intergovernmental Technical Panel on Soils (ITPS) defines soil health as “the ability of the soil to sustain the productivity, diversity, and environmental services of terrestrial ecosystems”. In managed systems, soil health can be maintained, promoted or recovered through the implementation of sustainable soil management practices. As with human health, there is no single measure that captures all aspect of soil health. The preservation of these soil services requires avoiding and/or combating all types of soil degradation.

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3 Soil Health Index

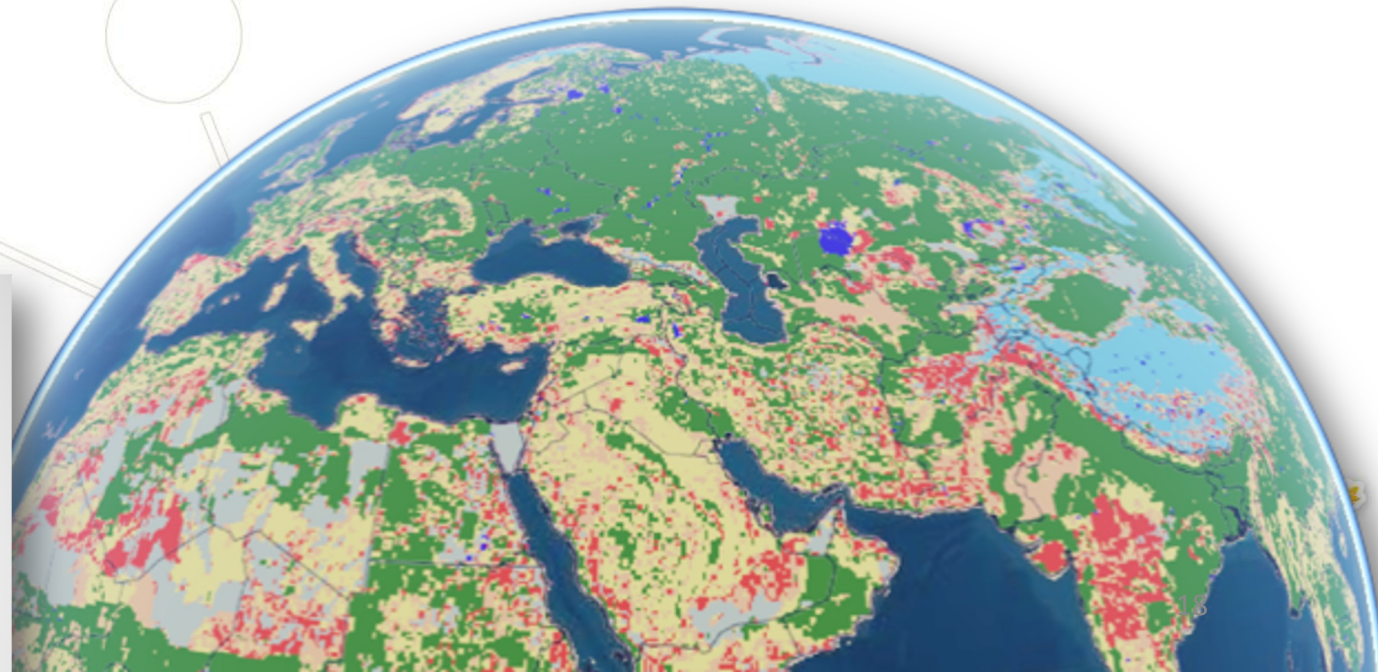
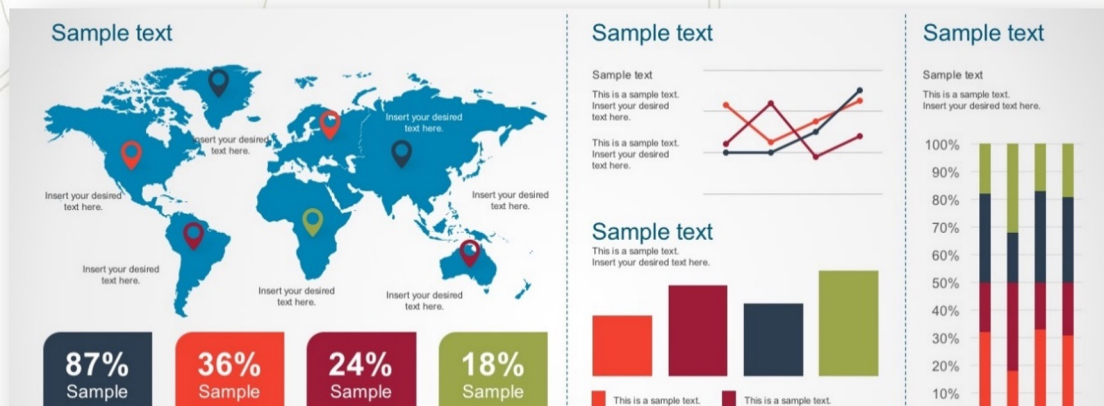
- **Approach:** Soil Ecosystem Services
- **Reproducible:** National Scale
- **Regionalized :** Agroecological Zones
- **15 of 21** Indicators to be used for the Global Soil Health Index
- **Initial Focus:** Agricultural Lands

$$SHI = \sum_{i=1}^n \left(\frac{1}{m} \sum_{j=1}^m SI_j \right)_i$$

Where,

- SHI: Soil Health Index,
- SI_j : Soil indicator for the ecosystem service i , (SI_j ranges from 0 to 1 using a fuzzy logic membership function, and the SHI ranges from 0 to n .)
- m : number of soil indicators for each ecosystem service,
- n : number of ecosystem services.

Global Soil Health Dashboard



Next Steps – November 2023 Onwards

- The work of the group **will continue** developing the concept for the indicator systems and the Global Soil Health Index & Dashboard
 - While the work of ISAF ongoing;
 - A new group, the SoilSTAT Working Group, will be established within INSII (a call will be shared soon)





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GLOBAL SOIL
PARTNERSHIP