



Food and Agriculture
Organization of the
United Nations

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)

Towards 2030

SoilSTAT, GSP Action Framework
Indicator System and the
Global Soil Health Index (GSHI)

21-23 March 2023
Fao Headquarters
Rome, Italy

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS



The GSP Action Framework

A Stocktaking review of GSP (2020)

Recommendation 1: The Secretariat and ITPS should embark on the formulation of a revamped GSP Action Framework under the mantle: 'Healthy Soils to meet SDGs, Biodiversity and Climate Change Goals', including transforming the current Pillars into Outcome Areas for Soil Health. The framework could articulate required changes for action at global and national/regional level and illustrate cross cutting delivery mechanisms under the above



- The development of the “GSP Action Framework 2022-2030” was triggered by a stocktaking exercise conducted by independent experts in **2020**.
- The GSP AF has been prepared by an **Open Ended Working Group** over 4 working sessions,"
- It outlines the objectives for the Partnership’s actions to protect soils over the next ten years and will replace the Pillars of Action.
- The Action Framework was adopted by the 10th GSP Plenary Assembly, and endorsed by the 28th Session of the COAG.

The GSP Action Framework



Quantifiable Goals, Targets and Indicators

A clear ambition shared by all **GSP members and partners**, **quantifiable goals, targets and indicators** will enable the state of soils to be assessed and monitored and the progress made **GSP** in achieving the vision of healthy soils.

The GSP Action Framework



VISION STATEMENT:

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

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



GSP AF Indicator System

- Progress on the GSP Action Framework will be monitored & measured through an indicator system through **SoilSTAT**.
- The KPIs will be developed by a dedicated technical working group (GSP AF WG) and with the support of the ITPS and all GSP technical Networks.



high-level subset of metrics

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy

Metrics to be used to measure the KPIs

GSP Action Framework Says:

- Progress on the GSP Action Framework will be monitored & measured through an indicator system through ***SoilSTAT!***
- **Soil Health Index (SHI)** will be developed!
- The indicator system and the GSHI to be develop by a dedicated working group (ISAF WG)

TASK!

- Develop all (*SoilSTAT, GSP AF Indicators, GSHI*)
 - At once!
 - All connected!
 - All working together!

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



Who?

- A dedicated Working Group
- ISAF WG!
 - An open call to Focal Points, RSP Chairs, Technical Networks and the **ITPS**
 - **ISAF WG to develop**
 - **GSP AF Indicator System**
 - **SoilSTAT Indicator System**
 - **GSHI?**



GSER Secretariat to;

- Provide a “0” draft to the ISAF WG to start with!
- **Soil Health Indicator System (SHIS) (AKA SoilSTAT):** set of indicators used to assess the health and quality of soils at various scales, including the Global Soil Health Index (GSHI) and related maps and visualizations.
- **GSP Performance Indicator System (GPIS):** to measure the effectiveness and impact of the Global Soil Partnership's activities and programs, (e.g., Voluntary Guidelines for Sustainable Soil Management, CoCoFe etc.), and performance of its technical networks (e.g. INSII), outreach e.g., WSD) and its efforts in strengthening soil governance.
- **Global Soil Health Index (GSHI):** The Global Soil Health Index (GSHI) under the SoilSTAT concept will be critical to see the trend, monitor soil health, and visualize the results. The GSHI will provide a relative measure of soil health at different scale



SoilSTAT, GSP Action Framework Indicator System and the Global Soil Health Index (GSHI)

Working Document

GSP Action Framework Indicator System Working Group

Version 0.0 (GFP Secretariat)

1

This **document outlines** the development of the **SoilSTAT concept**, which serves as a platform for the **Global Soil Partnership (GSP) Action Framework indicator system**. The indicator system is aimed at monitoring soil health and tracking progress towards the goals of the Action Framework, which seeks to address soil degradation and improve soil health globally. The document provides an overview of the SoilSTAT concept, its **two indicator systems - the Soil Health Indicator System (SHIS) and the Global Soil Partnership Performance Indicator System (GPIS)**, and the proposed indicators for each system. The document also describes the development of **the Global Soil Health Index (GSHI)**

SoilSTAT: Global Soil Partnership Performance Indicator System (GSP-IS)

The Global Soil Partnership Performance Indicator System (GPIS) is a set of indicators developed to measure the progress of the Global Soil Partnership (GSP) towards achieving its goals and objectives.

SoilSTAT: Soil Health Indicator System (SH-IS)

SoilSTAT Soil Health Indicators



18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



GSP Performance Indicators (KPIs)

Target#	Domain	Indicator	Metric	Frequency	Unit	Code
1	SSM	Adoption of SSM Practices	# of farmers or beneficiaries adopting SSM Practices per unit area	2	Integer Number	GSPAF-SSM-01
2	SSM	Adoption of SSM in national programmes	# of countries that have included SSM in their national programmes	2	Integer Number	GSPAF-SSM-02
3	SSM	Proportion of degraded soils under SSM measures over total degraded soils.	Land area (ha) under SSM practices within GSP programmes, projects and initiatives.	2	ha	GSPAF-SSM-03
4	SSM	Proportion of black soils under protection measures over total black soil area	Land Area under black soil protection measures	2	ha	GSPAF-SSM-04
5	Soil Governance	Development of national and regional legal instruments focused on soil health	Number of countries technically supported to include rev-WSC and VGSSM principles into national policies and strategies	1	Integer Number	GSPAF-SG-01
6	Soil Governance	Implementation of the Fertilizer Code	Number of countries technically supported to include the Fertilizer Code principles into national policies and strategies.	1	Integer Number	GSPAF-SG-02
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 the UN Rio Conventions	1	Integer Number	GSPAF-SG-03
8	Knowledge and literacy	Capacity development programmes/courses on SSM	# of participants trained through the GSP's capacity development programmes	1	Integer Number	GSPAF-KL-01
9	Knowledge and literacy	Global assessments reports on the state of world's soils and soil threats	# of languages in which global assessments and reports are translated.	1	Integer Number	GSPAF-KL-02
10	Awareness Raising and Advocacy on Soil Health	Outreach of the World Soil Day	Engagement statistics for awareness raising campaigns, contests, social media, and public initiatives on soil health.	1	Integer Number	GSPAF-AR-01
.
14	Technical Cooperation	ITPS	# of key publications published under the guidance of the ITPS	1	Integer Number	GSPAF-TC-02

GSP Performance Indicators (KPIs)

Target#	Domain	Indicator	Metric	Frequency	Unit	Code
1	SSM	Adoption of SSM Practices	# of farmers or beneficiaries adopting SSM Practices per unit area	2	Integer Number	GSPAF-SSM-01
2	SSM	Adoption of SSM in national programmes	# of countries that have included SSM in their national programmes	2	Integer Number	GSPAF-SSM-02
3	SSM	Proportion of degraded soils under SSM measures over total degraded soils.	Land area (ha) under SSM practices within GSP programmes, projects and initiatives.	2	ha	GSPAF-SSM-03
4	SSM	Proportion of black soils under protection measures over total black soil area	Land Area under black soil protection measures	2	ha	GSPAF-SSM-04
5	Soil Governance	Development of national and regional legal instruments focused on soil health	Number of countries technically supported to include rev-WSC and VGSSM principles into national policies and strategies	1	Integer Number	GSPAF-SG-01
6	Soil Governance	Implementation of the Fertilizer Code	Number of countries technically supported to include the Fertilizer Code principles into national policies and strategies.	1	Integer Number	GSPAF-SG-02
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 the UN Rio Conventions	1	Integer Number	GSPAF-SG-03
8	Knowledge and literacy	Capacity development programmes/courses on SSM	# of participants trained through the GSP's capacity development programmes	1	Integer Number	GSPAF-KL-01
9	Knowledge and literacy	Global assessments reports on the state of world's soils and soil threats	# of languages in which global assessments and reports are translated.	1	Integer Number	GSPAF-KL-02
10	Awareness Raising and Advocacy on Soil Health	Outreach of the World Soil Day	Engagement statistics for awareness raising campaigns, contests, social media, and public initiatives on soil health.	1	Integer Number	GSPAF-AR-01
...
14	Technical Cooperation	ITPS	# of key publications published under the guidance of the ITPS	1	Integer Number	GSPAF-TC-02

Domain

Metric - quantitative measures

Unit

GSP AF Target#

KPI

Reporting Frequency

Indicator Code



Reporting Lines for the Performance Indicators

- The GSP Action Framework Indicator System Working Group (**ISAF**) will develop Indicator factsheets which will be used for reporting on the indicators. Each indicator will have an indicator factsheet which will be governing the data flow, harmonizing reported data and statistics.

ANNEX III. Proposed Indicator FactSheet Template for for SoilSTAT Soil Health Indicators

Domain: SSM

Indicator: Adoption of SSM Practices

Metric: # of farmers or beneficiaries adopting SSM Practices per unit area

Indicator Code: GSPAF-SSM-01

Compiling Agency: FAO, Global Soil Partnership

1. Contact	
1.1 Contact organization	Food and Agriculture Organization of the UN
1.2 Contact organization unit	Global Soil Partnership
1.3 Contact mail address	GSP-Secretariat@fao.org

2. Metadata	
2.1 Metadata Creation	15/05/202x
2.2 Metadata Endorsed	16/05/202x
2.3 Metadata Last Update	15/06/202x

3. Action framework target (until 2030)
Facilitate equality and inclusion of all people including youth and Indigenous People, in particular the poor and vulnerable people in accessing sustainable soil management practices.

4. Policy Relevance
The proposed indicator holds significant policy relevance in the context of sustainable agriculture. Sustainable Soil Management (SSM) practices, which include a range of farming practices like reduced tillage, cover cropping, and crop rotation, are crucial for maintaining soil health, reducing

SoilSTAT: Soil Health Indicator System



18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



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 aspects of soil health. The preservation of these soil services requires avoiding and/or combating all types of soil degradation (<https://www.fao.org/documents/card/en/c/cb1110en>).

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



SoilSTAT – 2017 ...

Domain	Indicator	Metric	Frequency	Unit	Spatial Unit	GSHI(Y/N)	Indicator Code/Link
Soil Organic Matter Decline	Soil Organic Carbon Stock	Predicted SOC Stocks	TBD	tonnes/ha	1x1km	Y	GSP-SH-01
Carbon Sequestration	Soil Organic Carbon Sequestration Potential	Predicted SOCseq Potential	TBD	tonnes/ha/yr	1x1km	Y	GSP-SH-02
Soil Salinisation	Electrical Conductivity	Measured or Predicted Electrical Conductivity (EC)	TBD	dS/m	1x1km	Y	GSP-SH-03
Soil Loss	Soil Erosion Risk	Area under severe risk of water erosion	TBD	ha	1x1km	N	GSP-SH-04
Soil Loss	Soil Erosion Rate	Predicted Annual Soil Loss	TBD	tonnes/ha/yr	1x1km	Y	GSP-SH-05
Soil Loss	Soil Sealing	Sealed area compared to the baseline	TBD	% of total land area sealed	1x1km	N	GSP-SH-06
Soil Nutrient Imbalance	Soil Nutrient Contents	Nutrient Concentrations (NPK)	TBD	kg/ha	1x1km	Y	GSP-SH-07
Soil Nutrient Imbalance	Soil Nutrient Budget	Predicted/Calculated Nutrient Budgets for NPK	TBD	kg /ha/yr	1x1km	Y	GSP-SH-08
Soil Biodiversity Decline	Soil Biodiversity	Soil microbial biomass carbon (MBC)	TBD	mg C/kg	1x1km	Y	GSP-SH-09
Soil Compaction	Soil Compaction	Bulk Density	TBD	g/cm ³	1x1km	Y	GSP-SH-10
Acidification	Soil Reaction	Soil pH	TBD	N/A	1x1km	Y	GSP-SH-11
Soil Pollution	Contaminated Sites	Number, type of site, type of main pollutant	TBD	Integer (#)	1x1km	N	GSP-SH-12
Soil Pollution	Heavy Metal Concentrations	Predicted/Measured Heavy Metal Concentrations	TBD	ppm	1x1km	Y	GSP-SH-13

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy

SoilSTAT – Soil Health Indicator System

Domain	Indicator	Metric	Frequency	Unit	Spatial Unit	GSHI(Y/N)	Indicator Code/Link
Soil Organic Matter Decline	Soil Organic Carbon Stock	Predicted SOC Stocks	TBD	tonnes/ha	1x1km	Y	GSP-SH-01
Carbon Sequestration	Soil Organic Carbon Sequestration Potential	Predicted SOCseq Potential	TBD	tonnes/ha/yr	1x1km	Y	GSP-SH-02
Soil Salinisation	Electrical Conductivity	Measured or Predicted Electrical Conductivity (EC)	TBD	dS/m	1x1km	Y	GSP-SH-03
Soil Loss	Soil Erosion Risk	Area under severe risk of water erosion	TBD	ha	1x1km	N	GSP-SH-04
Soil Loss	Soil Erosion Rate	Predicted Annual Soil Loss	TBD	tonnes/ha/yr	1x1km	Y	GSP-SH-05
Soil Loss	Soil Sealing	Sealed area compared to the baseline	TBD	% of total land area sealed	1x1km	N	GSP-SH-06
Soil Nutrient Imbalance	Soil Nutrient Contents	Nutrient Concentrations (NPK)	TBD	kg/ha	1x1km	Y	GSP-SH-07
Soil Nutrient Imbalance	Soil Nutrient Budget	Predicted/Calculated Nutrient Budgets for NPK	TBD	kg/ha/yr	1x1km	Y	GSP-SH-08
Soil Biodiversity Decline	Soil microbial biomass carbon (MBC)	Soil microbial biomass carbon (MBC)	TBD	mg C/kg	1x1km	Y	GSP-SH-09
Soil Compaction	Soil Compaction	Bulk Density	TBD	g/cm ³	1x1km	Y	GSP-SH-10
Acidification	Soil Reaction	Soil pH	TBD	N/A	1x1km	Y	GSP-SH-11
Soil Pollution	Contaminated Sites	Number, type of site, type of main pollutant	TBD	Integer (#)	1x1km	N	GSP-SH-12
Soil Pollution	Heavy Metal Concentrations	Predicted/Measured Heavy Metal Concentrations	TBD	ppm	1x1km	Y	GSP-SH-13

Domain

Metric - quantitative measures

Goes to GSHI Y/N?

Indicator

Years?

unit

Indicator Code



ANNEX IV. Proposed Indicator FactSheet Template for the SoilSTAT Global Soil Partnership Performance Indicators

Domain: Soil Erosion Risk

Indicator: Estimated soil erosion by water - area affected by severe erosion rate

Metric: Area under severe risk of water erosion

Indicator Code: GSP-SH-04

Compiling Agency: FAO, Global Soil Partnership

1. Contact	
1.1 Contact organization	Food and Agriculture Organization of the UN
1.2 Contact organization unit	Global Soil Partnership
1.3 Contact mail address	GSP-Secretariat@fao.org

2. Metadata	
2.1 Metadata Creation	15/05/202x
2.2 Metadata Endorsed	16/05/202x
2.3 Metadata Last Update	15/06/202x

3. Policy Relevance	
---------------------	--

Reporting on SoilSTAT Indicators

Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



GSHI

- **Global Soil Health Index:** The GSHI will provide a relative measure of soil health at different scales, helping policymakers and practitioners to prioritize interventions and allocate resources efficiently.

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



The conceptual approach for the Global Soil health Index (GSHI)

$$SHI = (SI_1 \times W_1) + (SI_2 \times W_2) + \dots + (SI_n \times W_n)$$

Soil Health Index

Score for the
Indicator

Score for the
Indicator

Weights

Weights

where:

•**SHI: SI_1, SI_2, \dots, SI_n** : Scores for each of the n soil indicators, classified into poor, fair, good, or excellent categories based on predetermined ranges or cutoff values. Scores are assigned values of 1 to 4, with 4 being the highest score for an excellent category, and 1 being the lowest score for a poor category.

W_1, W_2, \dots, W_n : Weights assigned to each soil indicator in the SHI equation, expressed as percentages of the overall SHI. The weights can be adjusted based on the specific needs and objectives of a given study or management practice

ANNEX Va. Example⁴ SHI Calculation (SHI: "Good")

A soil sample with the following values for each indicator:

- Predicted SOC Stocks: 60 tonnes/ha
- Predicted SOCseq Potential: 0.8 tonnes/ha/yr
- Electrical Conductivity: 1.5 dS/m
- Annual Soil Erosion: 1.2 tonnes/ha/yr
- Available K Concentration: 120 kg/ha
- Available P Concentration: 15 kg/ha
- Available N Concentration: 80 kg/ha
- Bulk Density: 1.3 g/cm³
- Soil Microbial Biomass Carbon: 100 mg C/kg
- Soil pH: 6.8

To calculate the SHI for this soil sample, we can use the classification table to assign a score to each indicator based on its category, and then multiply each score by its corresponding weight. The resulting weighted scores are then summed to give the overall SHI. Here's the calculation:

- Predicted SOC Stocks: Good (score = 3) x 20% weight = 0.6
- Predicted SOCseq Potential: Good (score = 3) x 10% weight = 0.3
- Electrical Conductivity: Good (score = 3) x 5% weight = 0.15
- Annual Soil Erosion: Good (score = 3) x 10% weight = 0.45
- Available K Concentration: Good (score = 3) x 10% weight = 0.3
- Available P Concentration: Fair (score = 2) x 10% weight = 0.2
- Available N Concentration: Fair (score = 2) x 10% weight = 0.2
- Bulk Density: Good (score = 3) x 5% weight = 0.15
- Soil Microbial Biomass Carbon: Fair (score = 2) x 15% weight = 0.3
- Soil pH: Excellent (score = 4) x 5% weight = 0.2

The sum of these weighted scores gives the overall SHI:

$$SHI = 0.6 + 0.3 + 0.15 + 0.45 + 0.3 + 0.2 + 0.2 + 0.15 + 0.3 + 0.2 = 2.25$$

The Soil Health Index for example is **2.25**, which falls in the "*good*" category, based on the scores and ranges in the classification table. This means that the soil sample has reasonably good soil health, but

⁴The example calculations provided here are for illustrative purposes only and are not intended to reflect any specific soil or environmental context. The weights, classifications to be developed, refined by the ISAF WG.

Example SHI Calculation (SHI: "Good")

ng Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



Non-soil factors?

The Non-soil factor would be added as an optional component of the Soil Health Index that represents any external factor that affects soil health, such as land-use and land-cover changes, human activities, environmental pollution, topography, or geology.

$$SHI = (SI1 \times W1) + (SI2 \times W2) + \dots + (SIn \times Wn) + (SI(n+1) \times W(n+1))$$

Soil Health Index

Score for the
Indicator

Score for the
Indicator

Weights

↓
Non-Soil factor?

• **$SI(n+1)$** : Score for the non-soil factor, such as land use or **management practices**, which can be classified into different categories based on their impact on soil health.

$W(n+1)$: Weight assigned to the non-soil factor in the SHI equation, expressed as a percentage of the overall SHI.

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



Classification of GSHI

A classification for the Soil Health Index (GSHI) based on scores (**Poor to Excellent**) will be used to provide a clear and intuitive way to communicate the overall health status of soil. This classification will help to identify areas where soil health is poor and action is needed to address the underlying causes of degradation.

Poor: SHI score < 1

Fair: $1 \leq$ SHI score < 2

Good: $2 \leq$ SHI score < 3

Excellent: SHI score ≥ 3

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



GLOBAL SOIL
PARTNERSHIP

Spatialized GSHI, Maps & GSHI Dashboard

- The Global Soil Health Index (GSHI) will be spatialized and represented in map format using a traffic light approach to provide a clear and easy-to-understand representation of soil health across different regions and scales.

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

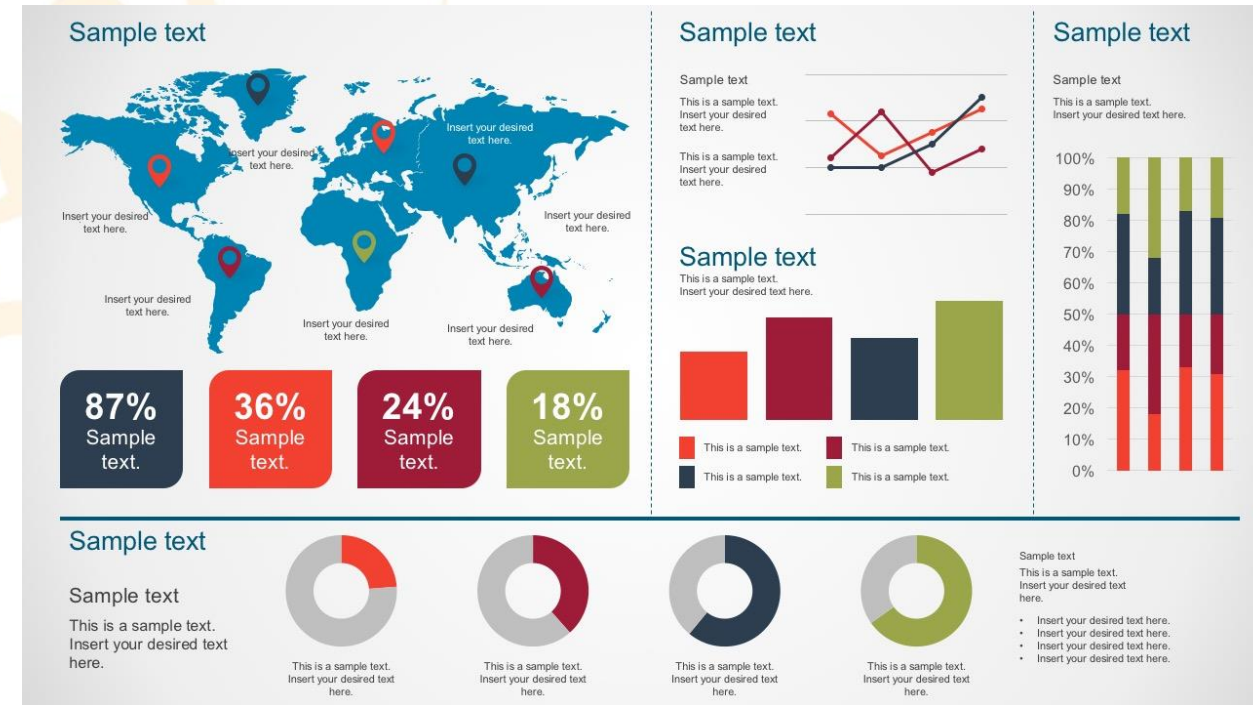
18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy



GLOBAL SOIL
PARTNERSHIP

GSHI Dashboard

- The Global Soil Health Index (GSHI) will be spatialized and represented in map format using a **traffic light approach** to provide a clear and easy-to-understand representation of soil health across different regions and scales.





Food and Agriculture
Organization of the
United Nations

itps

INTERGOVERNMENTAL
TECHNICAL PANEL ON SOILS

Thank you!

<https://docs.google.com/document/d/1-5GkzSYm8Hd94SOBZbZGTidz0jcV4e-AJ7ctD2BRv5k/edit#>

18th Working Session of the Intergovernmental Technical Panel on Soils (ITPS)
21-23 March 2023 | Fao Headquarters | Rome, Italy

