



Food and Agriculture  
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# Report of the eighteenth working session of the Intergovernmental Technical Panel on Soils

FAO headquarters, Rome, March 2023

**REPORT OF THE EIGHTEENTH WORKING SESSION OF THE  
INTERGOVERNMENTAL TECHNICAL PANEL ON SOILS**

**FAO headquarters, Rome, March 2023**

**Food and Agriculture Organization of the United Nations**

**Rome, 2023**

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## 1. Opening of the meeting

**Dr Rosa Poch**, Chair of the Intergovernmental Technical Panel on Soils (ITPS), opened the 18th working session of the ITPS by welcoming all ITPS members and acknowledging the effectiveness and importance of meeting in person.

**Mr Jippe Hoogeveen**, FAO Senior Technical Officer, addressed ITPS members on behalf of the Director of the Land and Water Division, Mr Lifeng Li. Mr Hoogeveen welcomed all ITPS members and thanked them for their commitment and willingness to move forward with the activities of the Global Soil Partnership (GSP).

**Dr David Lobb**, Vice-Chair of the ITPS, also welcomed all members and recalled that an ambitious agenda lay ahead that required the active participation of all members.

## 2. Adoption of the agenda and timetable

The agenda and timetable were both adopted without objection.

## 3. Election of rapporteur

**Dr Poch** requested a volunteer for the role of rapporteur. **Dr Adele Muscolo** put herself forward for the role.

## 4. Report of the work performed since the 17th working session

### *a. Progress on soil organic carbon-related activities (RECSOIL and GSOC-MRV)*

**Ms Lydiah Gatere**, from the GSP Secretariat, presented the progress on the RECSOIL initiative (recarbonisation of agricultural soils) and its implementation in Costa Rica, Ecuador, Mexico, and Togo. There were no comments or questions from ITPS members.

### *b. Progress on black soils-related activities (INBS updates)*

**Dr Lucia Anjos**, coordinator of the ITPS black soils working group, presented the main recommendations included in the report on the global status on black soils, launched in December 2022 as well as the main points to be discussed at the third workshop of the International Network on Black Soils (INBS) to be held in April 2023. Dr Anjos invited all ITPS members to disseminate the network and encourage their countries to participate in the INBS.

During the meeting, **Dr Sheleme Beyene Jiru** expressed concern about the absence of African countries from the INBS. He noted that the lack of membership from the continent meant that no data was being contributed to the products of the network. Sheleme stressed the need for the network to expand its membership to include African countries in the next version of the Global Black Soil Distribution map (GBSDmap). He also expressed his willingness to join the working group and would be responsible for encouraging his country, Ethiopia, to participate in the INBS.

The discussion also touched on the importance of including Vertisols in the black soil definition: a type of carbon-rich soil found in Africa. The experts noted that Vertisols have high natural fertility and a distinct colour. However, the lack of data on soil health and fertility in Africa makes it challenging to name them as black soils.

**Dr Georges Ndzana** also contributed to the discussion by highlighting the importance of soil health and fertility in Africa. He noted that the lack of data on black soils in Africa was a hindrance to the network's efforts to promote sustainable soil management. Georges emphasized the need for the network to encourage African countries to

participate in the INBS to address this gap. The experts agreed that the inclusion of African countries in the INBS would help address this issue.

***c. Progress on soil pollution-related activities (technical manual, International Network on Soil Pollution [INSOP] updates)***

**Dr Ravi Naidu**, Chair of the International Network on Soil Pollution (INSOP) and coordinator of the ITPS working group on soil pollution, presented the advances of the network since its launch in April 2022. Dr Naidu finished his presentation by encouraging ITPS members to join his call to the UN to create a technical panel on pollution mirroring the Intergovernmental Panel on Climate Change (IPCC).

**Dr David Lobb** inquired about the inclusion of radionuclides in the activities of INSOP and offered to invite experts from his laboratory to participate in the technical manual that INSOP is working on to cover orphan radionuclide indicators of soil pollution.

**Dr Lucia Anjos** brought up the issue of mercury (Hg) contamination caused by illegal gold mining, which is a worrying issue in many countries in Latin America and Africa. She stated that many actions are accident-driven, and that there is an urgent need to address this issue with simple and clear guidelines to help reduce the risk to local populations.

**Dr Saaed Saadat** discussed the mapping of soil pollution and whether it should only focus on hot spots or include diffuse pollution. He also mentioned the need to define regional threshold values and the fact that phosphorus (P) fertilizers are contaminated with cadmium (Cd), which is a cause for concern. He recommended that Cd contamination in P-fertilizers should be addressed.

**Dr Brajesh Singh** suggested the inclusion of soil pollution in the "One Health" approach, with a focus on bioavailability, and that INSOP should address this task in the framework of the UN quadripartite working group.

**Dr Jeyanny Vijayanathan** was interested in the collaboration between INSOP and the Global Soil Doctors Programme and how it can be used to address environmental issues by farmers.

**Dr Taina Pennanen** expressed concern about how to address the combination of contaminants in technical guidelines under development by INSOP and how they could have a more significant impact on the environment and human health than individual contaminants.

Finally, **Dr Giash Alloush** stated that the presence of uranium in P-fertilizers is also of concern and its assessment and control should be regulated along with Cd.

***d. Progress on soil salinity-related activities (INSAS updates, the Global assessment of salt-affected soils)***

**Dr Maria Konyushkova**, coordinator of the International Network on Salt Affected Soils (INSAS) at the GSP Secretariat, presented the progress made by the network over the past six months, the progress with the preparation of the Global assessment of salt-affected soil and the plans for the next semester. She also presented the agenda of the second INSAS meeting that will take place in Tashkent, Uzbekistan, from 22 to 26 May 2023.

After noting that members of ITPS had appreciated the progress and organization of the second annual meeting in person. **Dr Saadat** indicated that the Islamic Republic of Iran's salt-affected soils (SAS) map is ready, and that the country will officially submit it to FAO soon. However, he stressed that the use of electrical conductivity (EC) as a determinant variable is not appropriate in some cases, as soils with different EC will have different responses to management and recommended considering other variables for future updates of the global SAS map (GSASmap).

**Dr Rosa Poch** also asked whether future updates of the map will consider soil texture, as this is also a key property when managing salt-affected soils.

***e. Progress on mapping-related activities (progress on GSERmap, GSNmap, GloSIS)***

**Ms Isabel Luotto**, GSP Secretariat, presented the progress on the Global Soil Information System (GloSIS) data products and those made to produce the Global Soil Nutrient and Nutrient Budget Maps (GSNmap). She also presented the results of two regional projects carried out in the Near East and North Africa (NENA) region and Asia that have contributed to the preparation of national soil maps and the Soil Atlas of Asia. Finally, she introduced the EduSOILS platform that is being implemented and the next steps for its consolidation.

**Dr Anjos** asked whether biological N fixation will be considered as well as fertilizer inputs when preparing the GSNmap, as this is particularly relevant for some crops such as soybean. Ms Luotto remarked that fixation is not yet being considered, but that it has been discussed and is expected to be integrated into the methodology.

**Dr Sheleme Beyene Jiru** questioned the selection of the 0–30 cm depth, as in many countries soil fertility maps only go down to 20 cm and asked how this information could be integrated. **Dr Igué Attanda Mouinou** agreed with this approach and questioned that in sub-Saharan Africa, soil fertility is very low below 20 cm due to nutrient management. He suggested that different depths be considered for different regions. Dr Nopmanee concluded that the depth of the root system should be considered and that the map should differ according to crops. **Dr Nopmanee Suvannang** concluded that the depth of the root system should be considered and that the map should differ according to crops. Ms Luotto responded to these various questions by clarifying that the selection of 0–30 cm is mainly due to the inclusion of the Global Soil Organic Carbon Map (GSOCmap) as one of the mandatory information used to derive the GSNmap. The IPCC mandated FAO and the GSP in 2017 to develop the GSOCmap and in its guidelines soil organic carbon should be measured at that depth.

**Dr Gaius Eudoxie** indicated that the ITPS should agree on the depth at which global maps will be developed based on scientific criteria and lay the groundwork for these studies in a sound manner. In this regard, **Dr David Lobb** stressed that the purpose of the map needs to be considered, and that at the scale that these are currently produced they are mainly used to inform legislative decision-making, although he agreed with **Dr Eudoxie** on the need for the ITPS to agree on the limits of surface soil properties. **Dr Harsha Kumara Kadupitiya** highlighted that countries could be enabled to produce maps locally at different resolutions depending on the purpose, and that other depths adapted to regional and crop realities could then be included. **Ms Luotto** clarified that the role of the GSP is to develop a methodology adapted to the data realities of the countries, and that in view of this discussion a possible way forward to guide the discussion would be to prepare a global survey to find out how deep the countries' data is available.

Finally, **Dr Saaed Saadat** suggested that the Global Soil Monitoring Network (GSMN) should be established within the GSP to support countries to continue these soil mapping efforts and thus have trend data on soil health.

***f. Progress on soil analysis and laboratories-related activities (Global Soil Laboratory Network [GLOSOLAN] updates)***

**Dr Suvannang** presented the progress of the Global Soil Laboratory Network (GLOSOLAN), with special emphasis on the results of the latest proficiency test (PT).

**Dr Jiru** asked if the gender of the participants is considered when analysing the performance and capabilities of laboratory staff, as this can have an impact on the outcome. He also raised the problem that many technicians are paid very low salaries and therefore training efforts are sometimes futile. Dr Nopmanee responded that this is not

the mandate of GLOSOLAN to look into the salaries, but that the GSP should work with governments to bring these issues to the table and try to address them at the national level.

**Dr Claire Chenu** and **Dr Lucia Anjos** questioned the development of pedotransfer functions and the importance of preparing them regionally given the particularities and differences in soils. They also discussed the treatment of wastewater and other laboratory wastes, which are highly polluting, the need to establish guidelines for proper waste disposal and to ensure that laboratories have adequate sanitation systems. It was clarified that INSOP and GLOSOLAN are working together to develop guidelines for safe disposal of waste and contaminated soil samples in soil laboratories.

**Dr Nyambilila Amuri** asked ITPS members how governments could be engaged to carry out regular quality control and invest in laboratories, and that the only feasible way seems to be to make quality controls mandatory. It was asked whether GLOSOLAN plans to address rapid tests and their quality, as these rapid tests are fine for providing information and recommendations to farmers, but for other purposes more accurate data is needed.

**Dr Jeyanny Vijayanathan** asked about laboratory accreditation through GLOSOLAN and what GLOSOLAN is doing to facilitate the shipping of soil samples worldwide. It was clarified that FAO and GLOSOLAN are not certification bodies and cannot offer such certificates to laboratories, but instead work on capacity building so that they can then be certified by other accredited institutions. Both **Dr Lobb** and **Dr Naidu** indicated that national and regional accredited laboratories can be used that are able to provide this accreditation and provide standardized samples for PTs. It was also discussed whether and how GLOSOLAN can help in recommending fertilizers to farmers.

Finally, **Dr Naidu** highlighted the need to differentiate organic and inorganic C, and to consider other soil properties when measuring C as the results will be affected by using particularly the Walkley and Black method.

#### ***g. Progress on sustainable soil management-related activities (Sustainable soil management [SSM] protocol, Soil Doctors)***

**Ms Carolina Olivera**, GSP Secretariat, presented to the members the revised version of the User Manual of the Protocol for the assessment of sustainable soil management (SSM) and the Soil Doctors programme and how both relate to RECSOIL and the technical networks.

**Dr Adele Muscolo** indicated that benchmarking can be done in different ways, comparing baseline and subsequent measurements, or considering a control site. But she pointed out that reference values cannot be used because it is not available for all regions, types of soil and climatic conditions, and crops. Ms Olivera agreed and clarified that these two comparison options have been included.

**Dr Lucia Anjos** asked whether in the regional project carried out in Latin America and the Caribbean to verify the functionality of the protocol, partners were asked about the ease of analysing, interpreting, and transmitting the results to farmers. Ms Olivera confirmed that this aspect has been considered and that the final report of the project, which is under preparation, includes a section on the transfer of information to farmers.

Several ITPS members agreed that there is a need to include simple methods for soil biodiversity, not only for the SSM protocol but also for other GSP activities related to soil health monitoring.

**Dr Taina Pennanen** asked if the percentage of vegetation cover has been included in the indicators and Ms Olivera confirmed that it is included and that there is even a field exercise available within the Soil Doctors programme that explains the methodology in detail.

**Dr Sheleme Jiru** asked if liming for managing soil acidity is included in the protocol recommendations. Ms Olivera confirmed that this practice is included, although it was used in the Latin American project because there were no acidity problems in the few pilot sites that participated in the project.

**Dr Guillermo Studdert** recommended that the soil organic carbon units be revised as he detected some inconsistencies and **Dr Chenu** requested that references to GLOSOLAN harmonized protocols be clearly added. Members of ITPS welcomed the new version of the manual and approved its publication after correction of these two minor changes.

Regarding the Global Soil Doctors programme, ITPS members welcomed the developments in the programme with great interest. It was asked whether soil structure is included in the visual soil assessment and Ms Olivera clarified that it is one of the field exercises that is included because it is easy to perform and easy to interpret the data. Ms Olivera invited ITPS members to review the existing exercises and SSM practices and to send her any changes or suggestions for improvement. Finally, **Dr Anjos** asked about the steps to become a promoter and indicated that many universities in Brazil and other countries in the region are very interested in the programme. Ms Olivera shared the [programme's new website](#) and noted that the instructions and terms of reference for promoters are clearly indicated on the website and encouraged ITPS members to disseminate this information.

#### ***h. Progress on soil fertility-related activities (launch of the International Soil Fertility and Fertilizer Network [SOILFER])***

**Ms Vinisa Saynes**, from the GSP Secretariat, presented the main outcomes of the Global Symposium on Soils for Nutrition (GSOIL4N) held last year and the conclusions included in the outcome document and recalled the ITPS letter prepared with the cooperation of ITPS members. The main decision arising from the GSOIL4N was the establishment of the International Network on Soil Fertility and Fertilizer (INSOILFER) to advance technological solutions for improving soil fertility and nutrient use efficiency and to advocate for the implementation of the International Code of Conduct for the Sustainable Use and Management of Fertilizers.

**Dr Gaius Eudoxie** remarked his concern that the creation of another network will create silos in the GSP. It was clarified that the networks, being coordinated from the GSP Secretariat, are well interconnected and although each network covers specific aspects, they have a common vision and a common goal of improving soil health.

**Dr Ghiath Alloush** asked how it is planned to involve farmers in such a network and in the sustainable management of soil fertility and fertilizers. He also stressed that the use of biochar, which farmers can easily prepare and apply, should be promoted, and suggested developing an ITPS letter in this regard.

**Dr Harsha Kadupitiya** remarked that in some countries it may still be necessary to distribute fertilizers and that this action should be accompanied by a strong training programme to ensure correct use following the 4Rs. In this regard, **Dr Anjos** pointed out that in Brazil fertilizer is being distributed and that farmers are using far more fertilizer than necessary and agreed with Dr Harsha that better advocacy and training is needed to address this environmental and socioeconomic problem.

**Dr Taina Pennanen** asked about the potential of other sources for adding nitrogen (N) to soils and whether these are being considered by the GSP. Ms Saynes clarified that the use of legumes and biofertilizers is being promoted by the GSP and that more emphasis needs to be put on solid research to support their use. **Dr Braj Singh** insisted that the role of N-fixing organisms and crops should be stressed through INSOILFER, which in countries like Brazil can account for more than 80 percent of N inputs. A portfolio of solutions should be promoted, specifying in which regions and soils each works and where it does not.



### ***i. Progress on soil biodiversity-related activities***

**Mr Jacob John Parnell**, GSP Secretariat, presented the latest developments of the International Network on Soil Biodiversity (NETSOB) and the launch of the Global Soil Biodiversity Observatory (GLOSOB). He indicated that GLOSOB aims to respond to the soil biodiversity monitoring requirements adopted at the 2022 United Nations Biodiversity Conference of the Parties to the UN Convention on Biological Diversity (CBD COP15). He presented the main indicators being considered for inclusion in GLOSOB.

**Dr Anjos** indicated that X-ray soil mineralogy is too complicated to analyse and recommended that it be replaced by soil classification, although in that case the classification used should be harmonized.

**Dr Singh** asked for clarification on the role of NETSOB in GLOSOB, and whether it will be NETSOB that collects the data and filters it through GLOSOB and then reports back to the country. It was clarified that NETSOB is responsible for developing all the protocols, manuals and agreeing indicators, but that the data collection and reporting to countries will be through GLOSOB. In short, NETSOB are the decision-makers and provide the science behind GLOSOB, while GLOSOB is the data collection tool.

**Dr Chenu** asked how all the data collected by the different initiatives, networks and projects will be integrated to make the best use of the data. The GSP Secretariat clarified that reporting mechanisms will be established at different national or project levels, and that all information will be collected and reported in a consistent way. But it should be noted that reporting within the GSP is voluntary and therefore it will be up to the partners whether they wish to link their information to GLOSOB and GloSIS or not.

**Dr Jeyanny Vijayanathan** pointed out that the sequencing of applicons is also very expensive and that many countries will not be able to afford to report on these indicators. She asked if exotic species will be included as well as endemic species and whether changes in land use will be reflected in any way.

**Dr Rosa Poch** concluded the discussion by mentioning that there is no manual for improving soil biodiversity and that the GSP through NETSOB should work on this, as the indicators may be controversial, but farmers should be able to improve soil biodiversity by applying good practices. Mr Parnell indicated that NETSOB working group 2 is working on compiling beneficial soil management practices for soil biodiversity conservation.

## **5. Preparation for the Global Symposium on Soil and Water (GSOWA23)**

**Ms Janet Nabwami**, the GSP Secretariat, presented the plans for the organization of the next Global Symposium on Soil and Water (GSOWA) and clarified what the role of the ITPS is expected to be. ITPS members are invited to review the concept note for the symposium once the FAO water team members have provided their input. They are also invited to act as moderators of the different sessions and to be part of the scientific committee of the symposium.

**Dr Lobb** remarked that the concept note should put more emphasis on soil moisture, and that both too much and too little moisture is a problem for soil health and productivity, so management practices must be focused on addressing both problems. He also highlighted the need for clear links to soil threats such as erosion and pollution throughout the symposium.

**Dr Anjos** briefed the panel on the recently-published UN report on groundwater and noted that soils are rarely mentioned. She therefore suggested that it would be interesting to bring those responsible for this report to the symposium and to give more importance to soils when discussing groundwater quality and availability. **Dr Naidu**

agreed and asked to consider the connection of groundwater quality and soil pollution as well as solutions and impacts under theme 2.

**Dr Michael Castellano** stressed the importance of drainage for agricultural soils, and that the symposium should include a session on integrated land, soil, and water management as well as on circular economy to recycle drainage water. These aspects are of great importance for greenhouse gas (GHG) emissions and water management, so it would be interesting to invite experts from the IPCC who could highlight this soil–water–climate change link.

**Dr Rosa Poch** pointed out that the energy consumed to pump water for irrigation can make the balance of emissions achieved through SOC sequestration negative. This is particularly relevant in black soils that are drained or irrigated for cultivation, emitting more carbon than is sequestered. **Dr Pennanen** agreed to highlight the connection between drainage and GHG emissions, particularly when it comes to black soils, peatlands, etc. **Dr Chenu** asked to include climate change adaptation in theme 3 to address the connections between soil health and resilience. **Dr Lobb** remarked that consideration should also be given to soil and water management in a changing climate, and the impact that extreme events in the same year have on natural resource management. **Dr Nyambilila Amuri** suggested merging subthemes 1 and 3 and remarked that irrigation is a quick response to climate change resilience but can have unintended long-term consequences on water scarcity and quality.

**Dr Saadat** noted that he felt that the objectives of the symposium are still too broad and that there is a need to better define what the symposium is expected to achieve. He also asked why soil salinisation is not included, but it was pointed out that this topic was already addressed in the 2021 Global Symposium on Salt-affected Soils.

**Dr Vijayanathan** suggested including the link between integrated water and soil management and human health and other socioeconomic aspects of communities managing soil and asked to better highlight the role of the farmer in theme 4.

**Dr Eudoxie** suggested emphasising circularity and water recycling. He also suggested the idea of including expert panels and not limiting the symposium only to individual presentations.

## **6. Brainstorming for topics to be addressed at the Global Symposium on Soil Data and Information**

**Mr Yusuf Yigini**, GSP Secretariat, presented the concept and plans for the organization of the Global Symposium on Soil Information and Data (GSID24) as well as the role of ITPS.

**Dr Nopmanee Suvannang** asked that "data quality" was added to the title of the symposium as suggested by Thailand at the 9th Plenary Assembly of the GSP, when the decision to organize this symposium was taken.

This was followed by a general brainstorming for the themes of the symposium which can be summarized as follows:

- Change the order of the proposed themes and include theme 2 on soil data for sustainable decision-making and policy as theme 1 or 4, as it represents where we want to go.
- Provide an overview of existing large datasets in theme 4.
- Highlight the role of soil data for decision-making in the concept note. Soil data should be open and be considered by policymakers.

- The temporal component of soil information systems should be highlighted, as they often become obsolete and data are lost, so it is important to consider the role of institutional memory. It was suggested to include this aspect in theme 4.
- Soil information and data is broader than soil pit information, it includes topographic and landform data (different classifications, ranges, etc.) and this additional data will affect the modelling of soil properties. It is therefore key to consider and include such accompanying data in the information generation and harmonization processes.
- The lack of data on land use change and soil management must be highlighted if we are to address the Sustainable Development Goals (SDGs).
- Include new technologies and in particular artificial intelligence and machine learning as powerful tools for accessing large or dispersed datasets.
- The International Union of Soil Science (IUSS) centenary in 2024 will be considered when setting the dates for GSID24 to avoid overlap between the two events.

The discussion continued to address the themes of the next symposia in 2025, 2026 and 2027. The suggested topic for the 2025 symposium is soil sealing and compaction, but ITPS members agreed to recognize that soil sealing refers to physical changes and degradation or urbanisation, while soil compaction is mainly on agricultural soils due to overgrazing or use of heavy machinery, so it is necessary to separate the two topics. After a vote, it was agreed to suggest to the 11th GSP Plenary Assembly the following order and themes for the next global symposia:

1. Global Symposium on Soil Sealing and Urban Soils in 2025;
2. Global Symposium on Soil Compaction and Physical Degradation in 2026; and
3. Global Symposium on Soil Acidification in 2027.

Finally, **Dr Anjos** suggested that in view of the publication of the Status of the World's Soil Resources report in 2025 a symposium on the topic should be organized. After discussion among all members and the GSP Secretariat, it was agreed that a large global event and regional events will be organized, keeping the symposium planned for that year.

## 7. Preparation of ITPS letters on soil pollution, soil biodiversity, and soil awareness

This item saw an intense brainstorming process led by **Dr Rosa Poch**, who first presented the ITPS letters that have been agreed in previous sessions but are still pending preparation. The following themes were agreed for the ITPS charters and those responsible for preparing them:

| ITPS letter topics   | ITPS member      | GSP secretariat    |
|--|------------------|--------------------|
| Integrated soil erosion modelling, validation of erosion models, economics of soil erosion | David            | Yusuf              |
| Impact of soil pollution on groundwater  | Ravi             | Sergejus           |
| Soil and One Health (pollution, nutrition, micronutrients)                                 | Braj, Nyambilila | Natalia            |
| Soil monitoring  | Saeed            | Jacob/Yusuf        |
| Soil organic carbon dilemma, carbon emission problems                                      | Claire           | Nathalie/Guillermo |

|   |                 |                                    |
|---|-----------------|------------------------------------|
| Biochar                                 | Ghiath, Georges | Preliminary draft by previous ITPS |
| Fertilizer use efficiency               | Saeed, Sheleme  | Vinisa                             |
| Soil management under cover crops (CCs) | Mike            | Carolina                           |
| Land use change                         | Saeed           | Yusuf and SIDS team                |
| Soil awareness                          | Rosa            | Isabelle                           |
| Soil governance                         | Rosa            | Giacomo                            |

## 8. Review and endorsement of the *Protocol for assessing sustainable soil management*

The *Protocol for assessing sustainable soil management* (SSM protocol) and its user manual were approved by ITPS for publication.

## 9. Discussion and proposal of soil health indicators and key performance indicators of the GSP Action Framework

**Ms Natalia Rodríguez Eugenio**, GSP Secretariat, opened the item reviewing the GSP Action Framework 2022–2030 and its targets and recalled that the GSP Plenary Assembly mandated the ITPS to develop the key performance indicator system to measure progress towards the Action Framework as well as to develop a Global Soil Health Index (GSHI) that will serve to assess global, regional, and national trends in soil health and degradation. **Mr Yusuf Yigini**, GSP Secretariat, then presented the interactions between the indicator system of the Action Framework (ISAF), SoilSTAT and the GSHI. A working group to develop the ISAF has been established by the GSP Secretariat and is led by the ITPS Chair and co-led by the INSII Chair. The workplan of the ISAF WG and the working document to develop the soil health indicator system and GSP key performance indicator system were presented.

**Dr Lobb** commented on the ambitious nature of the work assigned to the working group, a concern shared by many other ITPS members. Several members mentioned that they disagreed with the proposed weights for the various parameters included in the GSHI and indicated that reaching consensus on the weights will take years. **Dr Claire Chenu** also indicated that there is a political component to this type of indicator that cannot be ignored. She recommended starting with concrete indicators for which setting thresholds is easier and developing a scorecard that allows to see trends of individual indicators, as has been done in the European Soil Observatory (EUSO). **Dr Lobb** recommended considering regional values for the individual indicators and the GSHI, which may be much easier to agree on and more relevant.

**Dr Lucia Anjos** asked for more time and opportunities to nominate experts to be part of this working group. She also mentioned that indicators cannot be weighted equally for all soil types, as for example Oxisols and other highly developed soils will always be poor even if they support a healthy forest and provide key ecosystem services.

**Dr Singh** remarked that the proposed indicators do not fit the ITPS definition of soil health, and that both climate and soil type should be considered in defining regional thresholds. He also suggested developing a soil quality index instead of soil health. **Dr Saeed** disagreed with the latter suggestion as soil health and soil quality represent different aspects. He also remarked that land use should be considered when setting threshold values and that the presence of pollutants or pollution should be included in the indicator, suggestions supported by other members.

**Dr Eudoxie** suggested considering the SDG indicators already agreed, as well as the SSM protocol indicators.

**Dr Castellano** suggested exploring the use of new data meta-analysis technologies such as Google that would allow for iteration of the variables to achieve a more representative weighting.

Some members asked whether the GSHI will be a qualitative or quantitative indicator, and after much discussion it was agreed that it should be qualitative, as there will never be a consensus on the weights, as it depends on land use and interest.

Finally, it was agreed that **Dr Adele Muscolo, Dr Claire Chenu, Dr Nopmanee Suvannang** and **Dr George Ndzana** will be permanent members of the working group while the other ITPS members will be kept informed of progress and will be consulted when decisions are made.

## **10. Preparation of the second edition of the Status of the World's Soil Resources report**

**Dr Dan Pennock**, Editor-in-Chief of the second edition of the Status of the World's Soil Resources (SWSR) report, presented the progress and agreements reached by the editorial committee, which meets weekly. Members of ITPS must choose between being lead authors or select lead authors. If subregions are defined, two levels are needed: lead authors for the subregions and lead authors for the region, so that the content is developed in a harmonized way. It was clarified that the Regional Assessment Panels include all ITPS members from that region and the Chair of the Regional Soil Partnership.

Members appreciated the progress and made some suggestions which are summarized here.

Firstly, it was suggested to consider the IPBES report on land degradation and the regions considered therein. There were suggestions as to who should be the lead authors and it was stressed that this is a decision for the ITPS members in each region to decide whether it should be them or someone from outside.

The group broke into regions to agree on the subdivisions and the agreements were as follows:

- North America will be divided by threats to the ground.
- Latin America and the Caribbean will be divided into five subregions:
  1. Mexico, Central America, and the Caribbean islands, ensuring sufficient space for Caribbean Small Island Developing States (SIDS);
  2. Amazon Basin;
  3. Andean and Patagonian countries;
  4. La Plata Basin; and
  5. Cerrado (Savanna) Basin.

Contributing authors will come from ASLAC and the Latin American Soil Science Society. Subregional meetings will be organized with countries and experts from these areas.

Sub-Saharan Africa will be divided into five subregions:

1. semi-desert
2. savanna
3. temperate forest
4. equatorial forest
5. islands

External experts will be invited to be regional lead authors.

Asia will be divided into three different subregions:

1. Southeast Asia
2. East Asia
3. South Asia

Lead authors will be members of ITPS. Subregional lead authors will be external authors nominated by the soil science societies. A charter will be prepared for the soil science societies.

- Europe will be subdivided into two chapters: Europe (15 pages) and Eurasia (10 pages).

Lead authors for Europe will be from the Joint Research Centre (JRC) of the European Commission. Special sections will be devoted to subregional Soil Partnerships (boxes).

The Pacific will be divided into Australia and New Zealand and SIDS. Authors from Australia and New Zealand will be invited through the soil science societies, while those from SIDS will be invited through Peter Wilson (PSP Chair) and by contacting known experts directly. Lead authors and contributors will be identified by the end of April 2023. Some additional threats, such as those affecting countries' economies, will be included.

Near East and North Africa will be divided into three subregions according to soil threats, with a special focus on soil salinity, and water and wind soil erosion. For salinity, experts from the International Center for Biosaline Agriculture (ICBA) will be invited. Erosion will be divided into wind and water erosion (mainly on the Mediterranean coast for which authors from the ACSAD institute will be invited) with different lead authors.

Members agreed that this second edition is more geared towards providing clear messages for policymakers but asked the Editor-in-Chief and the editorial panel to provide some guidance to answer questions in the summary for policymakers on how people will be affected by threats to soil and who will benefit from this.

Finally, there was a lively discussion on the threshold values for the different soil properties or hazards to be considered in the report, which overlapped with the previous day's discussion on GSHI. It was emphasized that these cannot be considered as single values, as they are not representative or applicable to all regions and soil types equally, and it was suggested to compare the status of soils with previous information or to compare a managed versus an unmanaged system.

It was agreed that the editorial panel will prepare a concept note on the approach and purpose of the report to ensure that all regions follow the same approach to the analysis of the available information.

The working paper should be ready by the end of June 2023 for presentation to the ITPS Plenary Assembly.

## **11. Development of ITPS work plan 2023–2024 and document to the GSP Plenary Assembly**

**Dr Rosa Poch** presented the draft document to be submitted to the eleventh GSP Plenary Assembly for consideration and endorsement, which includes the activities carried out in 2022/2023 as well as the work plan for 2023/2024. The document was approved without changes.

## **12. Any other business**

**Dr Saeed Saadat** suggested the establishment of an International Soil Monitoring Network. It was agreed to start with the preparation of an ITPS letter on the subject as well as a concept note that can be presented to the Plenary Assembly for consideration.

Members of ITPS requested the GSP Secretariat to update the GSP introductory presentation and pass it on to all ITPS members to facilitate understanding of the functioning and different networks and work streams.

Finally, **Dr Poch** and **Dr Lobb** remarked that their term will end in 2025 and that there will be no one on the panel with ITPS leadership experience and suggested that other members in their first term be encouraged to become vice-chairs to gain experience in this role. After some discussion and deliberation, it was agreed that **Dr Jeyanny Vijayanathan** and **Dr Michael Castellano** will serve as vice-chairs for this term.

## **13. Date and venue of the next meeting**

The nineteenth working session of the ITPS will be held in autumn 2023 in a virtual format. The GSP Secretariat will consult ITPS members well in advance of their availability in that period to set the date and ensure the maximum possible participation.

## **14. Closure of the meeting**

**Dr Rosa Poch** closed the meeting by thanking all members for their active participation and commitment to attend this three-day session.

## Annex I. List of participants

| <b>ITPS members</b>                           | <b>Region</b>               |
|---|-----------------------------|
| Georges Martial Ndzana (Cameroon)             | Africa                      |
| Igué Attanda Mouinou (Benin)                  | Africa                      |
| Sheleme Beyene Jiru (Ethiopia)                | Africa                      |
| Nyambilila Abdallah Amuri (Tanzania)          | Africa                      |
| Jin Ke (China)                                | Asia                        |
| Ranjan Bhattacharyya (India)                  | Asia                        |
| Jeyanny Vijayanathan (Malaysia)               | Asia                        |
| Harsha Kumara Kadupitiya (Sri Lanka)          | Asia                        |
| Nopmanee Suvannang (Thailand)                 | Asia                        |
| Taina Pennanen (Finland)                      | Europe                      |
| Claire Chenu (France)                         | Europe                      |
| Adele Muscolo (Italy)                         | Europe                      |
| Rosa Maria Poch (Spain)                       | Europe                      |
| Guillermo A. Studdert (Argentina)             | Latin America and Caribbean |
| Lucia Helena Cunha Dos Anjos (Brazil)         | Latin America and Caribbean |
| Jorge Dionisio Etchevers Barra (Mexico)       | Latin America and Caribbean |
| Gaius Eudoxie (Trinidad and Tobago)           | Latin America and Caribbean |
| Mohamed Abdelwareth (Egypt)                   | Near East and North Africa  |
| Saeed Saadat (Islamic Republic of Iran)       | Near East and North Africa  |
| Ghiath Ahmad Alloush (Syrian Arab Republic)   | Near East and North Africa  |
| David Allen Lobb (Canada)                     | North America               |
| Michael Castellano (United States of America) | North America               |
| Braj Singh (Australia)                        | Pacific                     |



Ravendra Naidu (Fiji)

Pacific

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| <b>Other participants</b>        | <b>Affiliation</b>         |
|----------------------------------|----------------------------|
| Ronald Vargas                    | GSP Secretariat            |
| Maria Konyushkova (online)       | GSP Secretariat            |
| Natalia Rodriguez Eugenio        | GSP Secretariat            |
| Carolina Olivera Sánchez         | GSP Secretariat            |
| Lydia Gatere (online)            | GSP Secretariat            |
| Vinisa Saynes Santillan (online) | GSP Secretariat            |
| Yuxin Tong                       | GSP Secretariat            |
| Jacob John Parnell (online)      | GSP Secretariat            |
| Janet Nabwami (online)           | GSP Secretariat            |
| Cruz Ferro (online)              | GSP Secretariat            |
| Isabel Luotto                    | GSP Secretariat            |
| Yusuf Yigini                     | GSP Secretariat            |
| Magdeline Vlasimsky              | GSP Secretariat            |
| Ms Isabelle Verbeke              | GSP Secretariat            |
| Giacomo Rocchegiani              | GSP Secretariat            |
| Nathalie Bjerneby                | GSP Secretariat            |
| Donghyuk Shin                    | GSP Secretariat            |
| Matteo Sala                      | GSP Secretariat            |
| Dan Pennock                      | Chief editor SWSR report   |
| Megan Balks                      | Chief reviewer SWSR report |

## **Annex II. Table of contents for the 2025 Status of the World's Soil Resources report**

Draft 3.3

07 April 2022

Approved by Editorial Board March 2022

Reviewed by the ITPS March 2022

### **Background**

*The first section is drawn from material adopted by the ITPS at its March and November 2021 meetings.*

The 2025 SWSR report has two objectives:

1. summarize new information (since 2015) on the major threats to soil functions; and
2. present an assessment of the regional distribution of the threats to soil functions.

The primary audience for the report is policymakers and soil managers who need science-based information about threats to soil functions and the ability of sustainable soil management to address these threats.

The report will have two parts: a summary for policymakers and a main report.

The summary for policymakers will be completed after main report is finalized.

The main report will have four sections. The first section will introduce the whole report. The second section will summarize new information on the major threats to soil functions. The third section will be a series of regional assessments of the status of threats to soil functions and of developments in sustainable soil management to address the threats in each region. The fourth and final section will summarize progress since 2015 and highlight research needs for the next ten-year period.

The summary of information on threats to soil functions (section 2) will primarily be authored by members of the GSP Secretariat and present and past members of the ITPS. This section will build upon the ITPS/FAO reports of the post-2015 period. The ITPS/FAO reports on soil pollution, organic carbon and recarbonization and soil biodiversity (with reports on salinization, Black soils, and erosion to come) have filled significant gaps in our knowledge. It will also draw upon pertinent reports by other UN organizations such as the Intergovernmental Panel on Climate Change, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services and the Committee on Science and Technology of the UN Convention to Combat Desertification. The Secretariat and ITPS have developed the expertise to produce these summaries and will complete the initial drafts of the compilations for the report.

The most important part of the 2025 SWSR report is the regional assessment of the state of soils (section 3). This is the unique contribution of the SWSR process as there are other compilations of individual threats to soil functions. The assessments will be completed by panels of experts from each region. The expert panels will draw upon the regionally distributed membership of the ITPS, the network of Regional Soil Partnerships (and the GSP itself), and the global reach of FAO. The structure of the expert panels will be determined by the ITPS at its meeting in the second half of 2022.

## **Table of contents: the 2025 Status of the World's Soil Resources**

*The table of contents has been designed to facilitate members of the primary audience (policymakers and soil managers) to locate pertinent information. Both the headings and the language used should be evaluated in this context.*

### **Main report**

#### **Section one: introduction**

1. Introduction
  - 1.1. Objective
  - 1.2. Structure of report

#### **Section two: update on threats to soil functions**

2. Soil functions and their contributions to life on earth
  - 2.1. Soil functions and ecosystem services
  - 2.2. Soils and the Sustainable Development Goals of the United Nations
    - 2.2.1. Food security and sustainable agriculture (SDG 2)
    - 2.2.2. Water security and resources (SDG 3 and SDG 6)
    - 2.2.3. Human-induced climate change (SDG 13)
    - 2.2.4. Soil pollution and human and ecosystem health (SDG 3, SDG 6, and SDG 14)
    - 2.2.5. Biodiversity (SDG 15)
    - 2.2.6. Sustainable use of terrestrial ecosystems (SDG 2 and SDG 15)
    - 2.2.7. Sustainable cities (SDG 11)
  - 2.3. Soils and human societies
    - 2.3.1. Local, traditional, and indigenous knowledge
    - 2.3.2. Soils as an archive for human and environmental history
3. Threats to soil functions

*Note: The structure for each threat (or subcategory of threats) will follow the same sequence of subheadings:*

1. *Definition of and processes responsible for the risk*
2. *Global and regional modelling*
3. *Climate change impact on the risk*
4. *Human and environmental impact of the risk*
5. *Economic impact of the risk*

- 3.1. Overview of threats to soil functions  
*Emphasize human-induced soil change*
- 3.2. Soil erosion
  - 3.2.1. Water
  - 3.2.2. Wind
  - 3.2.3. Tillage
  - 3.2.4. Mass movement
  - 3.2.5. Root crop harvesting

- 3.3. Soil carbon change
  - 3.3.1. Mineral soils
  - 3.3.2. Organic soils including wetland soils and permafrost
  - 3.3.3. Soil inorganic carbon
- 3.4. Soil biodiversity change
- 3.5. Nutrient mismanagement
  - Emphasize role of balanced nutrient management in food security*
  - 3.5.1. Nutrient surplus
  - 3.5.2. Nutrient mining
  - 3.5.3. Acidification
- 3.6. Salinization and sodification
  - 3.6.1. Irrigation and drainage
  - 3.6.2. Alteration of hydrological conditions
  - 3.6.3. Coastal waterlogging
- 3.7. Pollution
- 3.8. Soil sealing and urbanization
- 3.9. Physical degradation
  - Emphasize difference between compaction and sealing*

#### 4. Direct and indirect drivers of threats to soil functions

- 4.1. Overview of drivers
- 4.2. Direct drivers
  - 4.2.1. Cropland, pasture, and agroforestry management
    - 4.2.1.1. Change in extent (including wetland drainage)
    - 4.2.1.2. Tillage and residue management
    - 4.2.1.3. Agricultural inputs
    - 4.2.1.4. Irrigation and drainage
  - 4.2.2. Forest and tree plantation management
    - 4.2.2.1. Change in extent
    - 4.2.2.2. Silvicultural and harvest techniques
  - 4.2.3. Grazing land management
    - 4.2.3.1. Change in extent
    - 4.2.3.2. Stocking rate and rotation regimes
  - 4.2.4. Extractive industry development
    - 4.2.4.1. Pollutant discharge and spoil disposal
    - 4.2.4.2. Soil displacement
    - 4.2.4.3. Extraction of organic soil materials
  - 4.2.5. Urbanization and Infrastructure development
    - 4.2.5.1. Change in extent
- 4.3. Indirect drivers
  - 4.3.1. Demographic
  - 4.3.2. Economic
  - 4.3.3. Science, knowledge, and technology
  - 4.3.4. Institutions and governance

#### 4.3.5. Cultural

5. Sustainable soil management in support of the Sustainable Development Goals
  - 5.1. Food security and sustainable food systems (SDG 2, 11)
    - 5.1.1. Reducing agricultural soil erosion
    - 5.1.2. Optimizing nutrient sources and usage
    - 5.1.3. Closing yield gaps
    - 5.1.4. Reducing acidification
    - 5.1.5. Reducing salinization and sodicity
    - 5.1.6. Reducing loss of agricultural soil to urbanization
  - 5.2. Water security and resources (SDG 3,6)
    - 5.2.1. Reducing runoff, flooding, and sedimentation
    - 5.2.2. Increasing water use efficiency in agriculture
  - 5.3. Human-induced climate change (SDG 13)
    - 5.3.1. Increasing soil organic content of soils
    - 5.3.2. Reducing nitrous oxide and methane emissions from soil
    - 5.3.3. Reducing CO<sub>2</sub> emissions from soil inorganic sources
  - 5.4. Soil pollution and human and ecosystem health (SDG 3, SDG 6, and SDG 14)
    - 5.4.1. Reducing soil pollution and remediating polluted sites
    - 5.4.2. Reducing agrochemical pollution of water
  - 5.5. Biodiversity (SDG 15)
    - 5.5.1. Reducing loss of soil biodiversity
  - 5.6. Sustainable use of terrestrial ecosystems (SDG 2, and SDG 15)
    - 5.6.1. Reducing loss of wetlands and organic soils
    - 5.6.2. Reducing wind erosion and desertification
    - 5.6.3. Reducing mass movement
  - 5.7. Enhancing resilience to climate change
6. Facilitating the adoption of sustainable soil management
  - 6.1. Education and public awareness
  - 6.2. Soil and land governance
  - 6.3. Incentives for adoption
  - 6.4. Improved soil information systems
  - 6.5. Local, traditional, and indigenous knowledge systems

### **Section three: regional assessments of the status of soils in 2025**

*Section three will begin with a chapter outlining the assessment criteria used in the regional assessments. This chapter will be followed by seven regional assessments. Each regional assessment will follow the same structure. The Secretariat will provide each expert panel with data on changes in the direct drivers of threats to soil functions and the results of modelling of threats to soil functions for their region abstracted from global modelling studies. They will also be provided with a synopsis of the status of each risk from the 2015 report.*

7. Assessment criteria for regional assessments
  - 7.1. Assessment of state of threats to soil functions

7.2. Assessment of trend

7.3. Assessment of uncertainty

8. Regional assessment for region X

8.1 Regional overview

8.1.1 Characteristics of region and subregions

8.1.2 Summary of status from 2015 SWSR report

8.2 Changes in the direct and indirect drivers of threats to soil functions

8.2.1 Indirect drivers

8.2.2 Cropland, pasture, and agroforestry management

8.2.3 Forest and tree plantation management

8.2.4 Grazing land management

8.2.5 Extractive industry development

8.2.6 Urbanization and infrastructure development

8.3 Regional status and trend of threats to soil functions

8.3.1 Soil erosion

8.3.1.1 Water

8.3.1.2 Wind

8.3.1.3 Tillage

8.3.1.4 Mass movement

8.3.1.5 Root crop harvesting

8.3.2 Soil carbon change

8.3.2.1 Mineral soils

8.3.2.2 Organic soils including wetland soils and permafrost

8.3.2.3 Soil inorganic carbon

8.3.3 Soil biodiversity change

8.3.4 Nutrient mismanagement

8.3.4.1 Nutrient surplus

8.3.4.2 Nutrient mining

8.3.4.3 Acidification

8.3.5 Salinization and sodification

8.3.5.1 Irrigation and drainage

8.3.5.2 Alteration of hydrological conditions

8.3.5.3 Coastal waterlogging

8.3.6 Pollution

8.3.7 Soil sealing and urbanization

8.3.8 Other threats

8.4 Trends in sustainable soil management

8.4.1 Examples of promising trends in sustainable soil management (*by land use system*)

8.4.2 Impediments to adoption of sustainable soil management

8.4.3 Strategic roadmap for region X

## **Section four: conclusions**

### 9. Conclusions

9.1 Progress since 2015

9.2 Critical research gaps

9.3 Emerging technologies