July 2023

E

Food and Agriculture Organization of the United Nations

GLOBAL SOIL PARTNERSHIP

Global Soil Partnership
Plenary Assembly

Eleventh session

Hybrid, 12–14 July 2023

Progress of the GSP technical networks (GSPPA: XI/2023/9)

Executive summary

- The international technical networks of the Global Soil Partnership (GSP), except for the International Network of Soil Information Institutions (INSII) and the Global Soil Laboratory Network (GLOSOLAN), have been established mainly as a concrete follow-up action of the global symposia. They constitute the technical arms of the GSP and it is expected that all FAO Members can take an active part in them.
- The GSP Secretariat and INSII have successfully developed and implemented a country-driven approach to the development of global soil data products. This approach emphasizes country-level activities and soil information and data ownership. The Global Soil Information System (GloSIS) country-driven global datasets currently include the Global Soil Organic Carbon Map (GSOCmap), the Global Salt-affected Soils Map (GSASmap), the Global Soil Organic Carbon Sequestration Potential Map (GSOCseq), and the Global Black Soil Distribution Map (GBSmap). The Global Soil Nutrient and Nutrient Budget Maps (GSNmap) and the Global Soil Erosion Map (GSERmap) are currently under development.
- At the sixth GLOSOLAN meeting in November 2022, a new procedure for the selection of national reference laboratories (NRLs) was approved and a performance monitoring system was established. Training activities have attracted more than 2 000 participants in 2022. A global proficiency test (PT) focusing on soil organic carbon, available phosphorus, and nitrogen was launched in 2021 and 2022. Some 230 laboratories from 100 countries participated and received individual certificates of participation and reports on their results.
- The International Network on Soil Fertility and Fertilizers (INSOILFER) was launched in June 2023 and aims to support the implementation of the International Code of Conduct for the Sustainable Use and Management of Fertilizers.

- The International Network on Black Soils (INBS) launched the Global State of Black Soils report on World Soil Day 2022. The GBSmap and the report are reference publications for the sustainable management of black soils globally. The network held its fourth workshop in April 2023.
- The working groups of the International Network of Salt-Affected Soils (INSAS) have made progress in the development of the template for sustainable soil management practices and the revision of standard operating procedures (SOPs) for salt-affected soils. The second meeting was held on 22-24 May 2023 in Tashkent, Uzbekistan.
- The International Network on Soil Biodiversity (NETSOB) has advanced the compilation of practices for the sustainable use, management, and conservation of soil biodiversity and launched the Global Soil Biodiversity Observatory (GLOSOB) in December 2022 at the 5th Conference of the Parties to the Convention on Biological Diversity (CBD COP15), held in Montreal, Canada. NETSOB organized a workshop during the third Global Soil Biodiversity Conference on 13-15 March 2023 in Dublin, Ireland.
- The International Network on Soil Pollution (INSOP) has focused on developing technical guidelines for assessing, mapping, monitoring, and reporting on soil pollution and raising awareness of the different aspects and sources of soil pollution through the organization of webinars. The second annual meeting of INSOP will be held mid- June 2023 to agree on the work plan for 2023/2024.

Suggested actions by the GSP Plenary Assembly

The Plenary Assembly may wish to:

- welcome the efforts made by the GSP technical networks to advance in the implementation of their work plans and encourage all members to continue contributing to the best of their ability to the development of key documents, products, and projects for sustainable soil management and conservation;
- invite FAO Members and GSP partners to nominate experts to contribute to the development of activities and products promoted by the GSP's networks in response to the decisions of this Plenary Assembly and their work plans, as well as to contribute to the dissemination of information on the networks in their respective countries;
- invite resource partners to support the activities of the networks and to carry out field activities through specific projects on the various themes;
- invite the International Network of Soil Information Institutions (INSII) to lead the working group for the development of key performance indicator system for the GSP Action Framework 2022-2030 and global soil health index in line with SoilSTAT reporting objectives and consider approval of the document prepared by the working group at the 9th session of the INSII in November 2023;
- invite FAO Members to establish national soil information systems in accordance with INSII guidelines and with the support of the GSP Secretariat; and
- welcome the establishment of the Global Soil Biodiversity Observatory (GLOSOB) during the fifteenth Conference of the Parties to the Convention on Biological Diversity (CBD COP15) and encourage FAO Members and resource partners to join and support the development of GLOSOB for monitoring soil biodiversity and soil health.

9.1 International Network of Soil Information Institutions (INSII)

1. The International Network of Soil Information Institutions (INSII) facilitates the development of national soil information systems and country-driven soil data products to support evidence-based decision making by establishing the Global Soil Information System (GloSIS) and SoilSTAT.

2. The eighth INSII meeting was held from 2-4 November 2022. The meeting reviewed the progress and status on the implementation of relevant activities, GloSIS and its data products, and discussed the implementation of future activities.

3. The main results of the INSII in 2022/2023 were as follows:

    a. Update of the Global Soil Organic Carbon Map (GSOCmap) to v1.6. The GSP Secretariat has been taking necessary steps for a major GSOCmap update to version 2.0 that will include additional depths, higher resolution, better uncertainty assessment, a single digital soil mapping approach, simplified data processing, and new sets of covariates.

    b. Update of the Global Soil Organic Carbon Sequestration Potential Map (GSOCseq) to v1.2. The GSP Secretariat has been taking necessary steps for a major GSOCseq update to version 2.0 that will include an improved uncertainty assessment as well as management-based scenarios.

    c. Launch of the regional and national capacity development process to develop the global soil nutrient and soil budget maps (GSNmap). Five regional online trainings on the preparation of the GSNmap were organized for Africa, Asia, Eurasia, and the Near East and North Africa (NENA). During the trainings, 80 countries were represented. The trainings were attended by 274 experts. The Country guidelines and technical specifications for global soil nutrient and nutrient budget maps - GSNmap: Phase 1 have been published.

    d. Launch of the new GloSIS platform that includes all INSII data products (GSOCmap, Global map of salt-affected soils (GSASmap), GSOCseq, Global black soil distribution map (GBSmap), and Global soil nutrient map GSNmap).

    e. To date, more than 1 400 national experts from 122 countries were trained on soil data management, digital soil mapping, soil modelling following on-the-job training to prepare the various INSII products (GSOCmap, GSASmap, GSOCseq, GBSmap, and GSNmap).

    f. An in-person training was organized from 12-16 December 2022 in Bangkok, Thailand, in collaboration with FAO. The training focused on potential uses of the GSOCseq approach for complementing the reporting of carbon stock changes in greenhouse gas inventories.

4. As stated in the new GSP Action Framework 2022–2030, INSII's role in the development and subsequently monitoring and reporting of key performance indicators will be central. Accordingly, a working group to prepare the indicator system for the new GSP Action Framework was established and is developing a draft proposal for this indicator system (details can be seen in document GSPPA: XI/2023/2).

9.2 Global Soil Laboratory Network and its initiative on soil spectroscopy

5. The number of soil laboratories registered in the Global Soil Laboratory Network (GLOSOLAN) kept growing in 2022 and 2023 thanks to the organization of online meetings and training sessions, and the establishment of the National Soil Laboratory Networks (NASOLANs). The network currently counts around 950 members from 153 countries.

6. The sixth GLOSOLAN meeting was organized virtually in November 2022 to define its work plan for the year 2023 and to revise the network governance.

7. The annual meetings of the Regional Soil Laboratory Networks (RESOLANs) for Africa (AFRILAB), Asia (SEALNET), Europe and Eurasia (EUROSOLAN), Latin America and the Caribbean (LATSOLAN), NENA (NENALAB), and the Pacific (ASPAC) were successfully convened in virtual modality between September and October 2022, to revise the networks' work plans and positions in GLOSOLAN. Within each RESOLAN, members of the regional steering committee were tasked to identify and contact soil laboratories operating in countries of the above-listed regions and invite them to register in GLOSOLAN.

8. FAO Members were motivated to encourage soil laboratories from those countries to register in GLOSOLAN and to establish their NASOLANs to downscale GLOSOLAN activities and to develop country specific work plans. The implementation of this activity is led by the National Reference Laboratory (NRL) in GLOSOLAN as reported in the Terms of Reference of laboratories in GLOSOLAN.

9. The main results of GLOSOLAN in 2022/2023 were as follows:

    a. Harmonization of five standard operating procedures (SOPs) on soil respiration rate, soil moisture by gravimetric method, cation exchange capacity and exchangeable bases, available micronutrients (copper [Cu], iron [Fe], manganese [Mn], and zinc [Zn]) and heavy metals (nickel [Ni], lead [Pb], and cadmium [Cd]) by DTPA extraction method, quasi total elements in soil by acid digestion including heavy metals. An additional four SOPs have been developed and are under publication, corresponding to the analysis of boron by hot water extraction, bulk density, particulate organic carbon by physical fractionation, and microbial biomass. Members of other GSP technical networks (INSAS, NETSOB, and INSOP) supported the harmonization process and the final review of these SOPs. Two SOPs already published (pH, and electrical conductivity in saturated soil paste extract) were revised thanks to the support of experts from INSAS.

    b. Ten training workshops on the implementation of the GLOSOLAN SOPs, soil spectroscopy, quality control in the laboratory, and laboratory health and safety were organized in Arabic, English, French, and Spanish. These were attended by around 2 500 participants and counted on the support of ten experts from nine different countries from all regions that acted as trainers. Training topics focused on the main needs pointed out at the RESOLAN meetings, and the outcomes of the Global Soil Laboratory Assessment 2020 (laboratories capacities and needs). A new series of webinars is scheduled to take place starting from September 2023.

    c. Production of a matrix for risk assessment in the laboratory to advance activities on health and safety in the laboratory.

    d. An in-person training session on the analysis of parameters related to salt-affected soils (electrical conductivity, pH, boron, total soluble salts and sodium adsorption ratio) was held in Uzbekistan in May 2023 in the framework of the second INSAS meeting.

e. A global proficiency test (PT) to assess the quality of the analytical performance of the laboratories when implementing the GLOSOLAN SOPs was organized in 2021 and 2022 involving around 230 soil laboratories from 106 different countries. Targeted soil parameters were soil organic carbon, available phosphorus, and total nitrogen. All participants received individual certificates of participation and reports on their performance. The outcomes of the GLOSOLAN PT 2021–2022 revealed that many laboratories have insufficient precision and need to develop internal quality control. Moreover, the comparability of results depends on the method adopted, demonstrating the relevance of GLOSOLAN´s work on harmonization of methods and capacity development.

f. The Soil Import Legislation (SIMPLE) database was revised and updated in order to support laboratories on the organization of regional and national PTs.

g. Publication of a poster on the positive impact of soil laboratories to raise awareness of stakeholders on the role played by soil laboratories in producing reliable and comparable soil data, essential to develop plans of actions to promote sustainable soil management.

10. The GLOSOLAN initiative on soil spectroscopy (GLOSOLAN-Spec) held its third plenary meeting in November 2022. Around 160 experts from 80 countries met to revise the objectives and the governance of the initiative, and to define the work plan of the network for 2023.

11. Several leading institutes and research groups dealing with soil spectroscopy are gathered under the GLOSOLAN-Spec to further develop soil spectroscopy at the country level, known as the International Capacity Development Group on Soil Spectroscopy (SoilSpecNet).

12. The main results of GLOSOLAN-Spec in 2022/2023 were as follows:

a. The beginner-level training material A Primer on Soil Analysis Using Visible and Near-Infrared (vis-NIR) and Mid-infrared (MIR) Spectroscopy was translated into Russian and Chinese.

b. Training video courses on *Using R software for soil spectral analysis* were developed as part of the GLOSOLAN-Spec national capacity development training programme 2022.

13. GLOSOLAN activities planned for the second half of 2023 are as follows:

a. A session on quality control, health and safety, and implementation of SOPs will be implemented in Dakar, Senegal, for the AFRILAB members in the second half of 2023.

b. A regional PT for the African and NENA regions will be implemented in the second half of 2023. Moreover, other regional PTs are under organization in Eurasia (under the leadership of the NASOLAN of the Russian Federation: RUSOLAN) and in Asia (under the leadership of the National Reference Laboratory of the Philippines). Other countries have already expressed interest in organizing independent PTs.

c. GLOSOLAN-Spec aims to provide a rapid, reliable and free soil organic carbon estimation service based on a spectroscopy estimation service platform (GlobeSpeX) with advanced machine-learning algorithms. This estimation service platform will largely reduce the cost and time for soil organic carbon analysis and facilitate soil carbon monitoring at global scale by regularly updating and improving current GSOCmap and GSOCseq. Estimated soil property data can be used to update national

soil maps in terms of spatial resolution and accuracy by national soil institutions. The estimation service will be further extended to other soil properties (such as soil texture and pH).

9.3 International Network on Soil Fertility and Fertilizers

14. Following the main recommendation of the Global Symposium on Soils for Nutrition organized in 2022, the International Network on Soil Fertility and Fertilizers (INSOILFER) network was launched in June 2023 to contribute to the implementation of the International Code of Conduct for the Sustainable Use and Management of Fertilizers, particularly addressing the underuse, misuse and overuse of fertilizers.

15. INSOILFER has integrated the already existing International Network on Fertilizers Quality Analysis (INFA), which counts about 165 members from 80 countries and is made up of three categories of laboratories displayed in the global map of INFA laboratories:

    i) laboratories that have the official mandate of their government to do fertilizer analysis;

    ii) laboratories that perform fertilizer analysis on a voluntary basis; and

    iii) laboratories which do not perform fertilizer analysis yet but are interested in the topic.

16. The third meeting of INFA took place in October 2022 where members agreed to focus on the harmonization of SOPs for mineral fertilizers, the development of video tutorials, and the gathering of information on fertilizer use and marketing.

17. A joint meeting between INFA and INSOP took place on 28 February 2023 to establish an expert working group for the development of SOPs for the quality assessment of mineral fertilizers, such as phosphates, to prevent agricultural soil pollution.

9.4 International Network of Black Soils

18. The International Network of Black Soils (INBS) held its fourth workshop in March 2023. At this meeting, INBS elected the new Chair, Miguel Angel Taboada from Argentina, and Vice-Chair, William May from Canada. The INBS work plan for 2023–2024 was approved and includes:

    i) the development of a legal guide for black soil member countries to develop a national law or regulation for sustainable management of black soils;

    ii) the development of a technical manual for the sustainable management of black soils;

    iii) the organization of trainings through the EduSoil platform;

    iv) the establishment of field trainings for farmers through the Soil Doctor programme;

    v) an update of the GBSmap; and

    vi) support for the development and revision of SOPs on soil organic carbon analysis, in cooperation with GLOSOLAN.

19. The main results of INBS in 2022/2023 were as follows:

    a. Launch of the report of the Global Status of Black Soils in December 2022 during World Soil Day. One hundred and eighty-eight soil scientists from 31 countries contributed to the report with their best available knowledge on status, challenges, management, conservation, and monitoring of black soils. The INBS is committed to

address the gaps identified in the report and map in order to conserve and protect black soils.

b. Update of the Black Soil Distribution Map (GBSmap).

c. Contribution to the preparation of the ITPS Letter "A call to protect the world's food basket soils: black soils" (see GSPPA: XI/2023/4).

9.5 International Network of Salt-Affected Soils

20. The International Network of Salt-Affected Soils (INSAS) aims to facilitate the sustainable and productive use of salt-affected soils (SAS) for current and future generations. The network is currently composed of 709 members from 125 countries.

21. The third annual meeting of INSAS was held on 22-26 May in a hybrid workshop in Tashkent (Uzbekistan). The meeting had the following outcomes:

i) the progress made by the network in the past two years (2021 and 2022) was reviewed;

ii) the priorities for the network were discussed and identified;

iii) the work plan for 2023 and 2024 was endorsed;

iv) cooperation among INSAS members was strengthened; and

v) trainings on salinity assessment were conducted to strengthen members' capacities.

22. The main results of INSAS in 2022/2023 were as follows:

a. The INSAS-SSM working group has reviewed and modified the template on sustainable soil management practices through several iterations.

b. The INSAS-Water working group developed the table of contents and selected the authors for the *Manual on sustainable water management in saline and sodic environments*.

c. The INSAS-GLOSOLAN working group has amended the SOPs on boron by hot water extraction and pH determination with the procedures specific to salt-affected soils. The SOP on saturated paste extract is being reviewed.

d. In 2022, INSAS together with its partners: FAO's Global Framework on Water Scarcity in Agriculture (WASAG), the Dutch Ministry of Agriculture, Nature and Food Quality, the Wageningen University Research (WUR), the Vrije Universiteit Amsterdam (VU) and the Asian Development Bank (ADB), initiated a joint call for action, *Climate-smart agriculture: sustainable saline agriculture as a contributor to climate adaptation and mitigation (in a resilient water-soil context)*. The document is aimed at stepping up and mainstreaming the opportunities offered by sustainable saline agriculture as an emerging component of integrated food systems.

e. INSAS has joined the Global Campaign on Salinization, launched at the 2023 UN-Water conference, thus contributing to the Water Action Agenda. There is a global growing trend in using brackish and sodic waters for irrigation which has a direct impact on soil health and quality. The collaborative actions from multiple stakeholders and specialists with diverse expertise (soil, agronomy, water, crop, governance, and economics) are needed to look for innovative, low-cost and environmentally friendly solutions to live with salinity and under freshwater scarcity which are sustainable and maintain soil health.

23. INSAS activities planned for the second half of 2023 are as follows:

    a. Publication of the *Global report on the status of salt-affected soils*. The responses to the questionnaire on the status, monitoring and management of salt-affected soils will serve as the main source of information from countries on the status of SAS. At present, the countries that submitted their responses are: Benin, Cameroon, Ghana, Mozambique, South Africa, Togo, and Zimbabwe from Africa; Pakistan and Thailand from Asia; Germany, Greece, Hungary, Israel, Spain, the United Kingdom, and Ukraine from Europe; Argentina, Brazil, and Colombia from Latin America and the Caribbean; and Iran and Lebanon from NENA. It is necessary to mobilize experts from other countries with salt-affected soils to submit their responses to this questionnaire.

    b. Organization of webinars on measurement, sampling, modelling, and management of salinity-affected soils. Twenty-four experts with demonstrated experience in SAS volunteered to become speakers for the INSAS webinar series (19 in total) to be held online in 2023 and 2024.

9.6 International Network on Soil Biodiversity and establishment of the Global Soil Biodiversity Observatory

24. The International Network on Soil Biodiversity (NETSOB) has the goal to promote the sustainable use and conservation of soil biodiversity. The network is currently composed of 978 members from 100 countries.

25. The Conference of the parties (COP) of the Convention on Biological Diversity (CBD) at its fifteenth session (COP15) adopted the Plan of Action 2020–2030 for the International Initiative for the Conservation and Sustainable Use of Soil Biodiversity as an instrument for supporting the implementation of the Kunming-Montreal Global Biodiversity Framework, on a voluntary basis and in accordance with national circumstances and priorities (Decision 15/28. Biodiversity and agriculture). The parties invited FAO, including through the framework of the GSP, to facilitate the implementation of the plan of action, involving parties, including their ministries of agriculture and environment at the national level, as appropriate. To this end, NETSOB will take the facilitation role to implement the actions of this important Initiative.

26. The main results of NETSOB in 2022/2023 were as follows:

    a. Launch of a global survey to assess the status of soil biodiversity initiatives and efforts that was responded to by nearly 2 700 stakeholders. Results of the survey are under publication.

    b. Launch of a call for contributions on current best practices to conserve soil biodiversity. To date, 40 case studies and 20 contributions to main chapters have been received.

    c. Organization of a workshop during the third Global Soil Biodiversity Conference that took place in Dublin, Ireland on 13 to 15 March 2023. The workshop was useful to review the progress made by NETSOB and the structure and components of GLOSOB. Accordingly, various modifications were made to the working groups of the network and to the way GLOSOB will be operating.

    d. Launch of the Global Soil Biodiversity Observatory (GLOSOB) at the COP15 Ministerial Dialogue and Breakfast on Soil Biodiversity in December 2022. The GLOSOB will monitor and forecast the condition of soil biodiversity and soil health and will serve as a framework for developing policies, promoting good practices, and

developing national capacities to assess and maintain state-of-the-art tools and collect soil biodiversity and soil health measurements.

9.7 International Network on Soil Pollution

27. The International Network on Soil Pollution (INSOP) aims to stop soil pollution and achieve the global goal of zero pollution. The network consists of 700 members from more than 90 countries.

28. INSOP has strong collaboration on soil pollution with the United Nations Environment Programme (UNEP) (UNEA3 and UNEA5).

29. The main results of INSOP in 2022/2023 were as follows:

    a. Two pilot projects were carried out in the eastern lowlands of Trinidad and Tobago and in the State of Manabí in Ecuador to evaluate and propose mitigation measures for the presence of cadmium in cocoa beans. In cooperation with its members Instituto Ekos Brasil (EKOS), NICOLE Latin America (NICOLE Latam), and NICOLE Europe, INSOP has developed a methodology and checklist for risk assessment and conceptual site model design and proposed a series of recommendations for management practices to reduce the bioavailability of cadmium and its entry into the food chain. The focus on cadmium in cocoa was triggered by EU Regulation 488/2014, which sets maximum levels of cadmium in chocolate and cocoa powder (up to 0.8mg/kg) (this regulation officially came into force on 1 January 2019), and the interest shown by participating countries in addressing the issue. The project report is in the process of being published and the results will be widely disseminated to GSP members and other interested stakeholders and will be followed by a second phase for the implementation of the recommendations and verification of their impact on soil health and crop quality.

    b. Collaboration was established with GLOSOLAN in the framework of the soil pollution assessment working group to develop and review SOPs on soil contaminants and safety contaminated soil samples and reagents waste disposal. The first meeting of this working group was held on 22-24 November 2022.

    c. An inter-network collaboration was launched with INFA on 28 February 2023 to work towards a safer and more sustainable use of fertilisers. Experts from both networks will work on the development and harmonisation of standard operating procedures for the assessment of the presence of contaminants in organic and mineral fertilisers, starting with multi-nutrient mineral fertilisers, rock phosphate, and triple superphosphate, and with a focus on total and bioavailable heavy metals.