



GLOSOLAN-VI/22/Report

Report of the sixth meeting of the Global Soil Laboratory Network (GLOSOLAN)

Virtual Meeting, 22–24 November 2022

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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1. Introduction

The sixth meeting of the Global Soil Laboratory Network (GLOSOLAN) was organized virtually using the Zoom Video Communications® platform. The meeting lasted three hours per day from 22 to 24 November 2022 (see agenda in Annex I) and was attended by 387 participants from 109 countries (see list of participants in Annex II). Miriam Ostinelli (GLOSOLAN Chair) opened the meeting recalling that in 2022, GLOSOLAN turned five years old and that its many achievements were made possible by the hard work of the GLOSOLAN members. In this regard, she invited all GLOSOLAN members and experts to continue joining efforts to improve the analytical capacity of their laboratories and to harmonize and improve the quality of the soil data they generate. A video recalling GLOSOLAN's achievements from 2017 to 2022 was played ([here](#)).

2. Report of the work performed by GLOSOLAN in 2021 and 2022

Miriam Ostinelli complemented the information reported in the 2017–2022 GLOSOLAN's main achievements video by informing participants on the implementation of activities in the GLOSOLAN 2021–2022 work plan.

Activities fully implemented:

- organization of webinars on several topics, in several languages;
- update of the soil import legislation database (SIMPLE);
- organization of the meeting between RESOLAN Chair, Vice-Chair(s) and Steering Committee;
- organization of the annual meetings of Regional Soil Laboratory Networks (RESOLANs) for Asia, Africa, Latin America, Europe and Eurasia, the Near East and North Africa, and the Pacific;
- update and create NASOLAN webpages as needed;
- contact with coordinators and Chairs of the International Network on Soil Biodiversity (NETSOB), the International Network on Black Soils (INBS) and the International Network on Salt-affected Soils (INSAS) to invite external experts to join GLOSOLAN SOP working groups to review already-published SOPs and to decide which soil biological parameters to target in 2022;
- publish the TORs for the position GLOSOLAN's Steering and Technical Committees on the GLOSOLAN website and inform GLOSOLAN members on the members of the Committees; and
- organization of regular meetings of the GLOSOLAN's Technical and Steering Committees.

Activities still under implementation:

- development of the GLOSOLAN terminology and its upload on the GLOSOLAN website;
- translation of the GLOSOLAN website and publications in several languages;

- monitor the performance of National Reference Laboratories (NRLs) (a survey was launched and data partially analysed: NRLs replies to the survey still have to be analysed by the Steering Committee of each RESOLAN);
- publish the results of the GLOSOLAN proficiency test (PT) 2022: writing of the report ongoing;
- organize regional PTs ongoing: they will be launched in 2023;
- publish the SOPs harmonized in 2021: most of the SOPs were published, some are still under review while others are in the FAO's publication system;
- harmonize and publish the SOPs for the methods agreed at the fifth GLOSOLAN meeting: most of the SOPs are under review while others are in the FAO's publication system;
- publish information on the sustainability of the methods harmonized in 2021 on the GLOSOLAN website: done for the majority of the SOPs;
- develop a plan on how to update the FAO Bulletin 74: a consultant is under recruitment under a FAO project to work on this assignment;
- write a policy brief on the importance of soil laboratories and soil analysis (link to waste management and policy support to laboratories): information to write the document started to be collected in 2022;
- review the GLOSOLAN work plan in the long term (the GLOSOLAN's Steering Committee wrote the draft document that need to be finalized and published);
- develop a policy strategy to support laboratories on lab maintenance, waste management
- the GLOSOLAN's Steering Committee wrote the draft document that need to be finalized and published; and
- INSII and GLOSOLAN to share contact information with information on laboratories providing data to digital soil mapping purposes collected by GLOSOLAN (information need to be processed and shared with INSII and connections between experts in the two networks need to be made accordingly).

Activities that were not possible to implement:

- the purchasing of equipment for high-performing laboratories in the GLOSOLAN PT 2021 (not applicable because the PT was ultimately launched in 2022);
- The inclusion reference values and range values to the GLOSOLAN SOPs harmonized so far and in those in the work plan 2021–2022;
- publishing the units of measure endorsed by GLOSOLAN at its fourth meeting and preparation of conversion tables (units of measure were published in the fourth GLOSOLAN meeting report, however, GLOSOLAN missed preparing specific material on the topic because of the lack of available people);
- preparing a quick-reference guide to building a transfer function for harmonization: this activity was in the GLOSOLAN's work plan 2021 and 2022 but not implemented because of the lack of experts available to work on it in the GLOSOLAN's Technical Committee; and

- writing of guidelines on soil sampling, storage and transportation: some draft material for the analysis of soil biological parameters was prepared in 2021 but needs to be improved (GLOSOLAN could not progress on the implementation of this activity because of the lack of available people).

2.1 Report of the GLOSOLAN Initiative on Soil Spectroscopy (GLOSOLAN-Spec)

Magdeline Vlasimsky, coordinator of the GLOSOLAN initiative on soil spectroscopy (GLOSOLAN-Spec) reported on GLOSOLAN-Spec progresses and achievements in 2022 on behalf of Eyal Ben Dor, GLOSOLAN-Spec Chair, reminding participants that the third GLOSOLAN-Spec meeting took place on the Zoom platform between 15 and 17 November 2022.

In 2022, GLOSOLAN-Spec was successful in organizing five online webinars attended by more than 1400 people out of the 2 800 people that registered. The video recording of each webinar is available on the [GLOSOLAN webpage on capacity development](#). The publication *A primer on soil analysis using visible and near-infrared (vis-NIR) and mid-infrared (MIR) spectroscopy* was published in English, Russian and Chinese and it will also soon be available in French on the GLOSOLAN-Spec website. Six video courses on soil spectral modelling in R programming language were prepared by the University of Sydney and published on the FAO webpage (see [here](#)). They will be uploaded on the GLOSOLAN-Spec webpage soon. The GLOSOLAN-Spec Steering Committee wrote and published an article on *Diffuse reflectance spectroscopy for estimating soil properties: a technology for the 21st century* in the *European Journal of Soil Science* to raise awareness of potential of soil spectroscopy.

GLOSOLAN-Spec still faced some challenges and issues on:

- publishing standard operating procedures (SOPs);
- collaborating with the IEEE;
- working with the private sectors on soil spectroscopy instruments procurement and training;
- the time-consuming nature of legal discussions on data ownership and soil spectral estimation platforms; and
- the lack of forum for discussion and support.

2.2 Report of the International Network on Fertilizer Analysis (INFA)

Wesley Feldmann, INFA Chair, informed participants that the International Network on Fertilizer Analysis (INFA) currently has 163 member laboratories from 83 countries and that the third INFA meeting took place in October 2022. In March 2022, INFA's working groups were established and their objectives were defined. The first working group works on the harmonization of methodologies for organic and inorganic fertilizer analysis. Several meetings were held between INFA and GLOSOLAN to learn about GLOSOLAN's experience in standard operating procedures (SOPs) and INFA currently has eight SOPs under

harmonization. The second working group works on capacity building. Its focus is on laboratory support to ensure that laboratories operate effectively to obtain accurate and reliable results for working group one. The working group is currently giving priority to the preparation of two documents on sample preparation for laboratory analysis, and quality assurance. The third working group works on governance, policy and regulation. It is currently working on a survey covering customs procedures to build a global database with the support of the [Soil Import Legislation platform \(SIMPLE\)](#) of GLOSOLAN.

The future work plan and objectives of the different working groups include:

- Working Group 1:
 - harmonization of protocols for nitrogen, phosphorus, potassium and organic fertilizers;
 - drafting of SOPs; and
 - review and final publication via FAO.
- Working Group 2:
 - drafting of best practice guidelines; and
 - planning for video material.
- Working Group 3:
 - collation of the data received;
 - communication with FAO focal points in respective countries;
 - review of data; and
 - construction of database.

In conclusion, Feldmann encouraged soil laboratories and other key stakeholders to join INFA and implement agreed activities including harmonization, policy and regulations.

3. Regional Soil Laboratory Networks (RESOLANs)

Filippo Benedetti, GLOSOLAN alternate coordinator, invited the chairs of the Regional Soil Laboratory Network (RESOLANs) to present the main outcomes of their annual RESOLAN meeting with a focus on regional main needs. RESOLAN inputs will serve to identify network priorities and define the GLOSOLAN work plan for 2022.

3.1 African Soil Laboratory Network (AFRILAB)

Lesego Mooketsi-Selepe, Chair of the African Soil Laboratory Network (AFRILAB) informed participants that soil laboratories in the African region are in need of in-person training on equipment, health and safety, quality control, the generation of local proficiency testing (PT) samples, and the broad interpretation of soil fertility and fertilizer recommendation. AFRILAB members also perceived the need to establish a regional soil laboratory to support the above needs and to serve as reference for the region. Efforts should be made to mobilize financial resources to support the implementation of national and regional projects on soil laboratories. Although there are a number of National Soil Laboratory Networks (NASOLANs) established in the region, the number of countries that are not taking actions to establish their national networks is still high.

In September and October 2022, AFRILAB members were asked to answer a survey that asked about:

- **Their contribution to advertising GLOSOLAN, EUROSOLAN and NASOLANs at international meetings and conferences:** 78 percent of respondents declared not to have had the opportunity so far; 18 percent of respondents said they had; 2 percent declared not to have done it because they did not feel like doing it, or they were not sure about the relevance and added value of GLOSOLAN; and 2 percent did not present about it because they did not know if they were authorized to do so.
- **GLOSOLAN, EUROSOLAN and NASOLANs discussion in articles published in national or international journals:** 37 percent of respondents declared that they did not know that they could talk about GLOSOLAN/RESOLANs/NASOLANs in scientific articles; 35 percent of respondents declared they had not published on scientific journals; 12 percent of respondents declared not to have discussed about GLOSOLAN/RESOLANs/NASOLANs in scientific articles so far, but to be in the process of writing or publishing an article citing them; 8 percent of respondents declared to have discussed about GLOSOLAN/RESOLANs/NASOLANs in the scientific articles they wrote; and 8 percent of respondents replied “*Other*” to this question.
- **The awareness of laboratory technicians on GLOSOLAN activities:** 77 percent of respondents reported that laboratory technicians were informed about GLOSOLAN but that the laboratory did not organize any internal, special meeting on it, so any information was spread by voice or email; Seventeen percent of respondents said that they organized regular internal meetings on GLOSOLAN to inform technicians on the new publications of the network and its latest training and job opportunities; and six percent of respondents said they kept information on GLOSOLAN at the management level.

In conclusion, AFRILAB members recommended GLOSOLAN to organize in person meetings, regional exchange visits and capacity building activities. The Global Soil Laboratory Network should also provide office equipment when funds permit and facilitate the organization of regional visits by governances.

3.2 Asian Soil Laboratory Network (SEALNET)

Gina Nilo, Chair of the Asian Soil Laboratory Network (SEALNET) informed participants that in September 2022, the network had 125 laboratories registered and that Mongolia, , the Philippines, Thailand and Viet Nam already established their National Soil Laboratory Networks (NASOLANs) while Myanmar is working on establishing it. The training of laboratory staff, the harmonization of SOPs, the adoption of more sustainable methods for soil analysis and the performance of quality control procedures (internal and external) are still among the priorities of SEALNET, that is also prioritizing training on SOPs, internal quality control and laboratory management.

In September and October 2022, SEALNET members were asked to answer a survey asking about:

- **Their contribution to advertising GLOSOLAN, SEALNET and NASOLANs at international meetings and conferences:** 65 percent of respondents said that they had not had the opportunity to do so; 15 percent of respondents said that they had; 16 percent of them declared not to have done it because they were not sure about the relevance and added value of GLOSOLAN or they did not know if they were authorized to do it; and four percent said that they did not feel like doing it.
- **GLOSOLAN, SEALNET and NASOLANs discussion in articles published in national or international journals:** 7 percent of respondents said that they had discussed GLOSOLAN, SEALNET and NASOLANs in national or international journals; 37percent of respondents declared that they had not published scientific articles; 22 percent did not know that they could talk about GLOSOLAN/RESOLANs/NASOLANs in scientific articles; 19 percent of respondents declared that they had not mentioned GLOSOLAN/RESOLANs/NASOLANs in scientific articles yet but to be in the process of writing or publishing an article citing them; and 15 percent of respondents replied “Other” to this question.
- **The awareness of laboratory technicians on GLOSOLAN activities:** 73 percent of respondents reported that laboratory technicians were informed about GLOSOLAN but that the laboratory did not organize any internal, special meeting on it, so any information was spread by voice or email; 15 percent of respondents said that they kept information on GLOSOLAN at the management level; and 12 percent of respondents said that they organized regular internal meetings on GLOSOLAN to inform technicians on the new publications of the network and its latest training and job opportunities.

SEALNET envisioned the establishment of a Centre of Excellence in Soil Laboratories (CESLab) so that it could: serve as reference for the region; support FAO in conducting training on the implementation of GLOSOLAN SOPs and other learning and development interventions; support FAO in providing proficiency testing samples for the region and world; share best practices in performing GLOOSLAN SOPs, such as the preparation of quality control materials and PT samples, the proper maintenance of laboratory equipment, quality assurance and quality control; and promote SEALNET and GLOSOLAN activities.

3.3 European and Eurasian Soil Laboratory Network (EUROSOLAN)

Ms Marija Romic, Chair of the European and Eurasian Soil Laboratory Network (EUROSOLAN) informed participants that as of November 2022, the network had 203 laboratories registered. In 2022, the network invested in establishing National Soil Laboratory Networks (NASOLANs) with the networks for Belgium (BESOLAN), Hungary (HUNSOLAN), the Russian Federation (RUSOLAN), and Türkiye (TADLAB) already established and those for Austria, Croatia, Greece, Italy, Kazakhstan, the Kingdom of the Netherlands, Slovakia, Spain, Turkmenistan, Ukraine and Uzbekistan under establishment. EUROSOLAN also worked on implementing NASOLAN activities and in disseminating information on NASOLANs, EUROSOLAN and GLOSOLAN on the internet, in research articles and at meetings and conferences. Flyers were also produced to support this activity.

However, additional efforts are still needed to:

- strengthen the collaboration and communication between laboratories and national focal points and governments;
- mobilize financial resources; and
- improve national soil legislation systems (such as soil import, waste management and disposal, and drainage systems)

In September and October 2022, EUROSOLAN members were asked to answer a survey that asked about:

1. **Their contribution to advertising GLOSOLAN, EUROSOLAN and NASOLANs at international meetings and conferences:** 89 percent of respondents said that they had not had the opportunity to do so; 9 percent of respondents said that they had; and 3 percent declared not to have done so because they did not feel like doing it or were not sure about the relevance and added value of GLOSOLAN.
2. **GLOSOLAN, EUROSOLAN and NASOLANs discussion in articles published in national and international journals:** 43 percent of respondents said that they had not published in scientific journals; 34 percent of respondents declared that they did not know that they could talk about GLOSOLAN/RESOLANs/NASOLANs in scientific articles; nine percent of respondents said that they had discussed about GLOSOLAN/RESOLANs/NASOLANs in scientific articles; and 3 percent of respondents declared not to have discussed about GLOSOLAN/RESOLANs/NASOLANs in scientific articles yet but to be in the process of writing or publishing an article citing them. Eleven percent of respondents replied “Other” to this question.
3. **The awareness of laboratory technicians on GLOSOLAN activities:** Seventy-four percent of respondents reported that laboratory technicians were informed about GLOSOLAN but that the laboratory did not organize any internal, special meeting on it, so any information was spread by voice or email; 17 percent of respondents declared that they kept information on GLOSOLAN at the management level; and 9 percent of respondents said that they organized regular internal meetings on GLOSOLAN to inform technicians on the new publications of the network and its latest training and job opportunities.

In conclusion, EUROSOLAN would like to collaborate more with other RESOLANs. This goes beyond the preparation of agreed SOPs. For example, it can be achieved by implementing joint scientific research and the subsequent writing of scientific articles like *Transferability between soil organic matter measurements methods for database harmonization*, published by EUROSOLAN, SEALNET and North American experts in 2022.

3.4 Latin American Soil Laboratory Network (LATSOLAN)

María Cristina Suárez Marte, Chair of the Latin American and the Caribbean Soil Laboratory Network (LATSOLAN) informed participants that the LATSOLAN Steering Committee meets on a regular basis to discuss how to increase laboratory engagement to GLOSOLAN and LATSOLAN specific activities in the region, how to better implement GLOSOLAN proposed activities, and to support countries in establishing

or strengthening their NASOLANs. LATSOLAN also has a very organized database that keeps track of the participation of all its member laboratories in LATSOLAN meetings and activities, and that includes note on their participation to PTs. In this regard, she showed some numbers around the participation of Latin American and Caribbean labs in the PTs organized by GLOSOLAN in 2018, 2019 and 2022, and around the implementation of GLOSOLAN SOPs. She also informed participants that 11 out of 23 countries in LATSOLAN had already established their NASOLAN and that one network intended to serve a group of Caribbean countries is under establishment.

In September and October 2022, LATSOLAN members were asked to answer a survey asking about:

- **Their contribution to advertising GLOSOLAN, LATSOLAN and NASOLANs at international meetings and conferences:** 69 percent of respondents said that had not had the opportunity to do so so far; 25 percent of respondents said that they had; and 7 percent declared not to have done it because they did not feel like doing it or they were not sure about the relevance and added value of GLOSOLAN.
- **GLOSOLAN, LATSOLAN and NASOLANs discussion in articles published in national or international journals:** 36 percent of respondents said that they did not know that they could talk about GLOSOLAN/RESOLANs/NASOLANs in scientific articles; 23 percent of respondents said that they had not yet discussed about GLOSOLAN/RESOLANs/NASOLANs in scientific articles but were in the process of writing or publishing an article citing it; 10 percent of respondents declared not to have published in any scientific journals; and only 5 percent of respondents declared to have discussed about GLOSOLAN/RESOLANs/NASOLANs in the scientific articles. Twenty-six percent of respondents replied “*Other*” to this question.
- **The awareness of laboratory technicians on GLOSOLAN activities:** 68 percent of respondents reported that laboratory technicians were informed about GLOSOLAN but that the laboratory did not organize any internal, special meeting on it, so any information was spread by voice or email; 19 percent of respondents said that they organized regular internal meetings on GLOSOLAN to inform technicians on the new publications of the network and its latest training and job opportunities; and 12 percent of respondents said that they kept information on GLOSOLAN at the management level.

To conclude, LATSOLAN reported the following challenges and needs:

- the creation of all NASOLANs;
- the adoption of quality control procedures;
- to motivate the participation of laboratories in PTs;
- the adoption of health and safety measures in the laboratory;
- improve infrastructure;
- the harmonization of SOPs and revision of harmonized SOPs;
- the provision of regular training on SOPs;
- the strengthening of communication between NRLs and focal points; and
- managing financing resources.

3.5 Near East and North African Soil Laboratory Network (NENALAB)

Riham Zahalan, Chair of the Near East and North African Soil Laboratory Network (NENALAB) informed participants that the majority of laboratories that attended the third NENALAB meeting reported that they lacked the support of their government and that this was a big limitation for the implementation of GLOSOLAN/NENALAB activities. The region also needed to put greater efforts into the translation of GLOSOLAN material into Arabic as this would increase the impact of the GLOSOLAN in the region.

In September and October 2022, NENALAB members were asked to answer a survey asking about:

- **Their contribution to advertise GLOSOLAN, NENALAB and NASOLANs at international meetings and conferences:** 67 percent of respondents said that they had not yet had the opportunity to do so; 20 percent of respondents said that they had done so; and 14 percent said that they had not done it because they did not feel like doing it (they did not know if they were authorized to do so) or that they were not sure about the relevance and added value of GLOSOLAN.
- **GLOSOLAN, NENALAB and NASOLANs discussion in articles published in national and international journals:** 44 percent of respondents declared that they did not know that they could talk about GLOSOLAN/RESOLANs/NASOLANs in scientific articles; 31 percent of respondents said that they had not published in scientific journals; 13 percent of respondents declared not to have discussed about GLOSOLAN/RESOLANs/NASOLANs in scientific articles yet but to be in the process of writing or publishing an article citing them; and 6 percent of respondents said that they had discussed about GLOSOLAN/RESOLANs/NASOLANs in scientific articles. Six percent of respondents replied “*Other*” to this question.
- **The awareness of laboratory technicians on GLOSOLAN activities:** 75 percent of respondents reported that laboratory technicians were informed about GLOSOLAN but that the laboratory did not organize any internal, special meeting on it, so any information was spread by voice or email; and 25 percent of respondents declared that they organized regular internal meetings on GLOSOLAN to inform technicians on the new publications of the network.

3.6 North American Soil Laboratory Network

Although no formally defined and monitored Regional Soil Laboratory Network currently exists in North America, GLOSOLAN mainly operates in the region through the United States Department of Agriculture (USDA). For this reason, Christopher Lee from the USDA (Natural Resources Conservation Service, Soil and Plant Science Division, National Soil Survey Center, Kellogg Soil Survey Laboratory [KSSL]) reported on KSSL contributions to GLOSOLAN in 2022. The KSSL was active in:

- contributing to the revision and editing of GLOSOLAN SOPs with other GLOSOLAN partners;
- participating with GLOSOLAN’s Technical Committee activities;
- participating with the GLOSOLAN PT;
- providing technical reference material and guidelines to GLOSOLAN members interested in KSSL methods and other topics of the soil health assessment;

- providing training and advice on soil spectroscopy;
- doing traditional and spectral analysis of soil samples from laboratories outside the United States of America (such as the Islamic Republic of Iran) that were interested in comparing methods of analysis with a special attention to inorganic carbon; and
- contributing to the development of a handheld near infrared spectrometer for field assessment of soil properties.

Lee concluded by expressing appreciation for GLOSOLAN, which he stated was an excellent platform to promote progressive and organized science.

3.7 Pacific Soil Laboratory Network (ASPAC)

Rob de Hayr, facilitator of the Pacific Soil Laboratory Network (PSLN), reminded participants about the link between GLOSOLAN and the Australasian Soil & Plant Analysis Council (ASPAC), and the role of the council in implementing soil laboratory activities in the region and in the Pacific Islands especially. The council is an incorporated not-for-profit international organization, funded by membership fees since 1990. It is overseen by an Executive Committee of jurisdictional representatives and supported by a part-time Executive Officer. It has four subcommittees: laboratory proficiency committee, methods committee, travel awards committee and fertcare.

The Australasian Soil & Plant Analysis Council had their annual general meeting on 1 November 2022 in which the new executive was elected and the following was concluded:

- inter-laboratory proficiency programme:
 - new contract with provider (Global Proficiency) negotiated;
 - all annual reports up to date and now available on website; and
 - no change to “Rule Book” and certification requirements.
- further negotiations required for revision of the “Green Book”;
- Fertcare Committee:
 - release of *Plant sampling guide* to compliment *Soil sampling guide*
- Methods Committee:
 - investigating colloidal P interference with molybdate blue reaction.

On 31 October and 1 November, the ASPAC Strategic Planning meeting also took place. It included:

- a meeting with regional stakeholders from research, funders and government, with the highlights and main conclusions being:
 - confirmation of funding support for Pacific labs to participate in ILPP and possible training;
 - support for Pacific participants to Soil Science Australia Soil Conference Darwin in June 2023; and
 - agreement to support paper to regional HOAFS/MOAF meetings for support of the Pacific Soil Partnership.

- the highlights and main conclusions of the training, which were:
 - two virtual training workshops webinars to be organized in early 2023;
 - a regional day session to be organized in association with the Soil Science Australia Soil Conference in June 2023;
 - a face-to-face training workshop to be organized in October or November 2023;
 - a survey being sent to laboratories to prioritize needs; and
 - a meeting with regional laboratories to be organized to provide details of content and timing.

4. Proficiency test (PT)

Christian Hartmann (IRD France) presented the outcomes of the GLOSOLAN proficiency test (PT) 2022 reminding participants that it is not possible to correctly manage what cannot be correctly measured. Thus, data provided by soil laboratories are essential for soil governance. Coordination among laboratories is essential to the implementation of coordinated actions on soil worldwide.

The GLOSOLAN PT 2022 was designed to assess data reliability (estimated through precision) and comparability (dispersion of results). The soil parameters considered were carbon, nitrogen and phosphorous because of their importance to climate change and soil fertility. The number of replicas proposed in the PT (six) were enough to make a statistical analysis but not sufficient to avoid a reduction in efficiency.

General observations and conclusions:

- **Carbon by Walkley and Black:** half of the laboratories provided precise results with some of them performing very well for a large range of carbon content. However, the remaining half of the labs showed to have some problems and a consistent number of labs have serious problems with analytical precision (see Figure 1 and Figure 2).

Figure 1. Laboratory performance in the global PT 2022. Precision. Soil parameter: carbon. Method: Walkley and Black

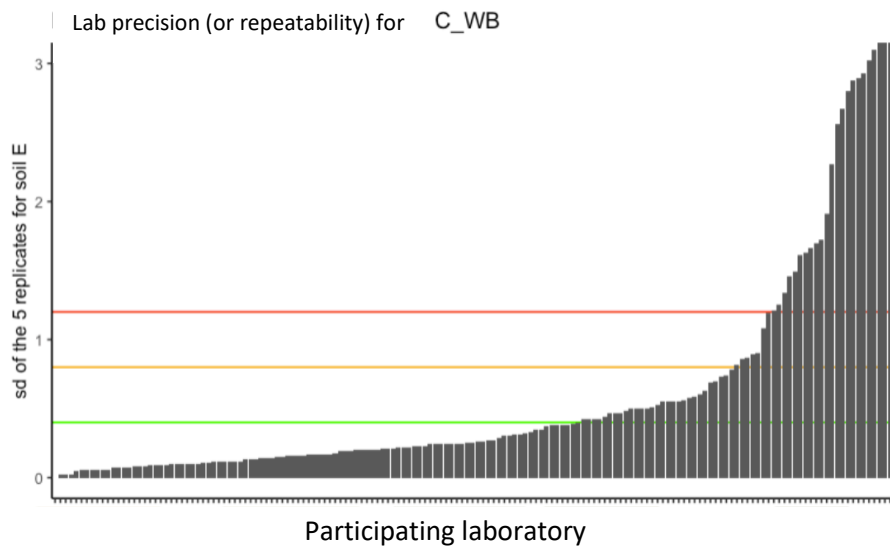
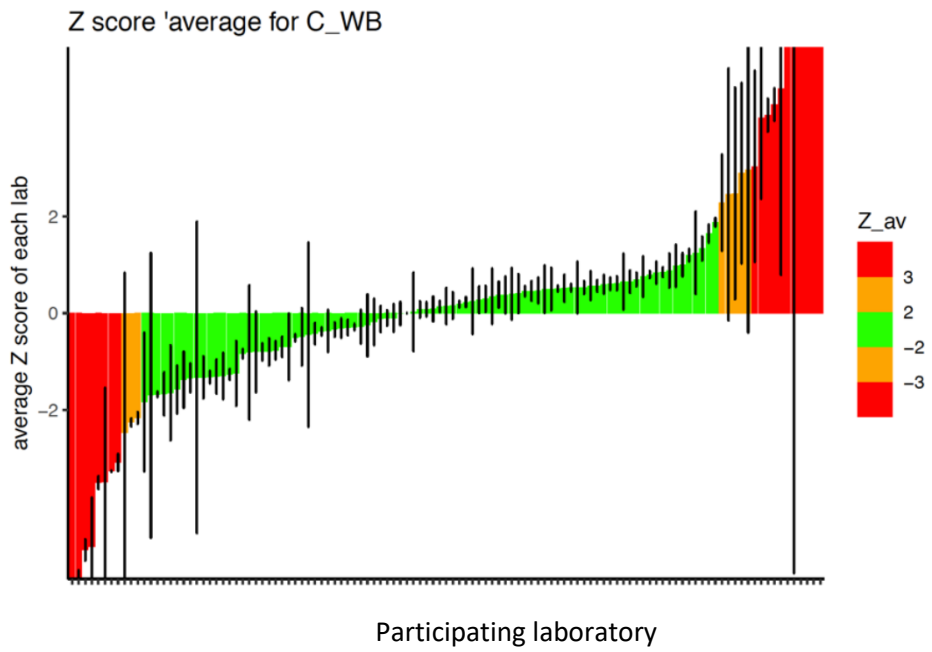


Figure 2. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: carbon. Method: Walkley and Black



- **Carbon by Dumas:** despite the use of high tech instruments, some laboratories had problems in measuring carbon by this method. This might be due to a human factor (see Figure 3 and Figure 4).

Figure 3. Laboratory performance in the global PT 2022. Soil parameter: carbon. Method: Dumas

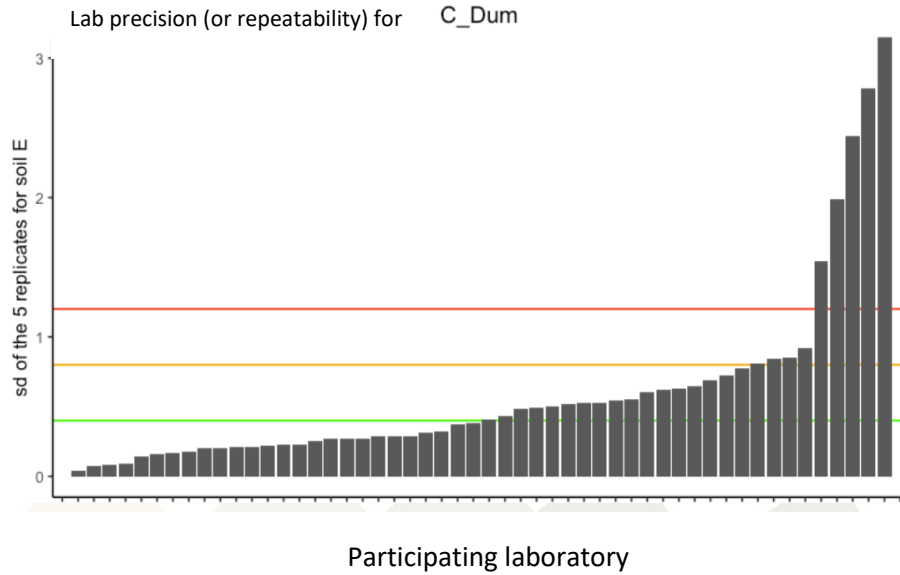
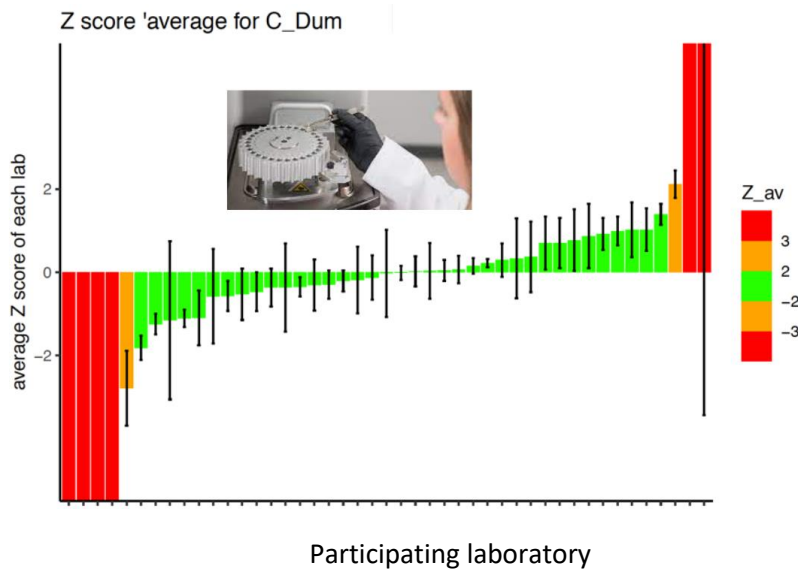


Figure 4. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: carbon. Method: Dumas



- Carbon by loss of ignition:** the majority of laboratories performed well on this method. However, the method is not very reliable for measuring carbon (see Figure 5 and Figure 6).

Figure 5. Laboratory performance in the global PT 2022. Soil parameter: carbon. Method: loss of ignition

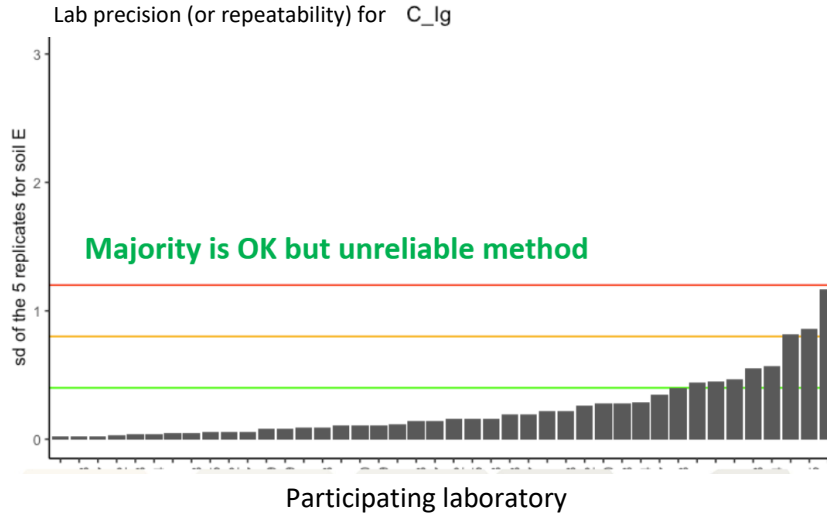
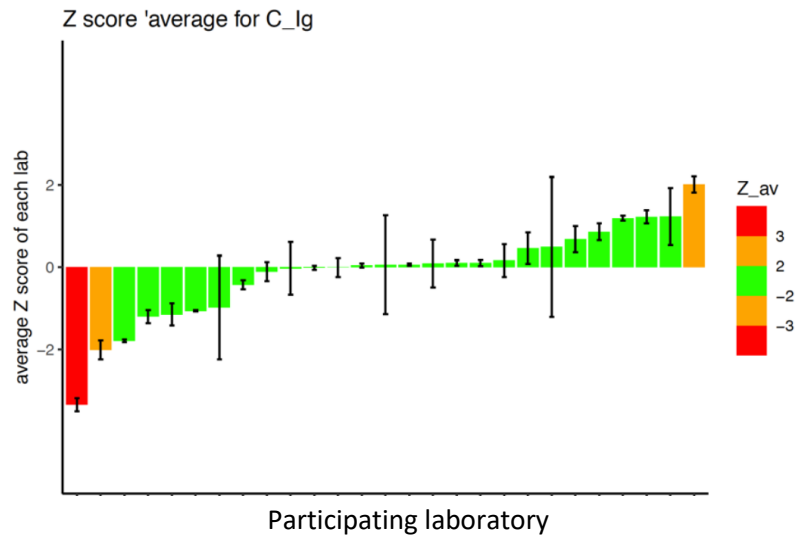


Figure 6. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: carbon. Method: loss of ignition



- Nitrogen by Kjeldahl:** half of the laboratories provided precise results. However, the remaining half of the labs showed to have some problems with a consistent number of labs having serious problems with analytical precision (see Figure 7 and Figure 8).

Figure 7. Laboratory performance in the global PT 2022. Soil parameter: nitrogen. Method: Kjeldahl

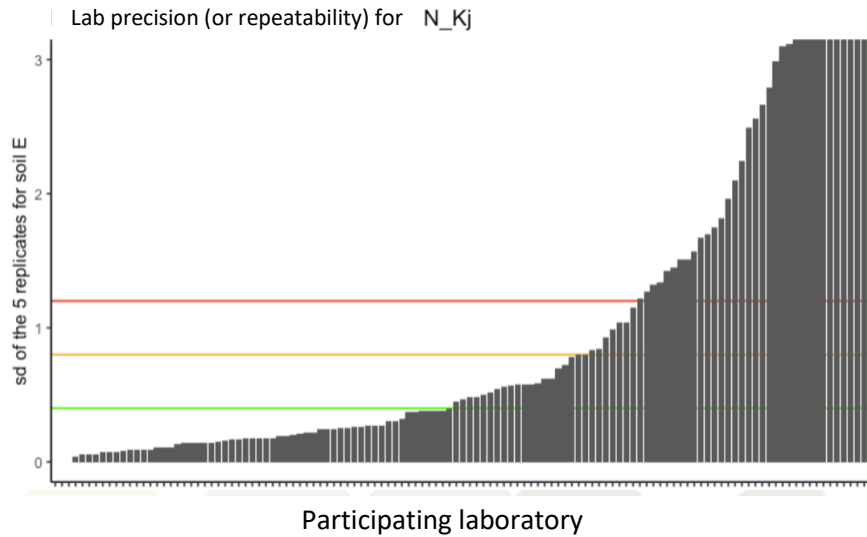
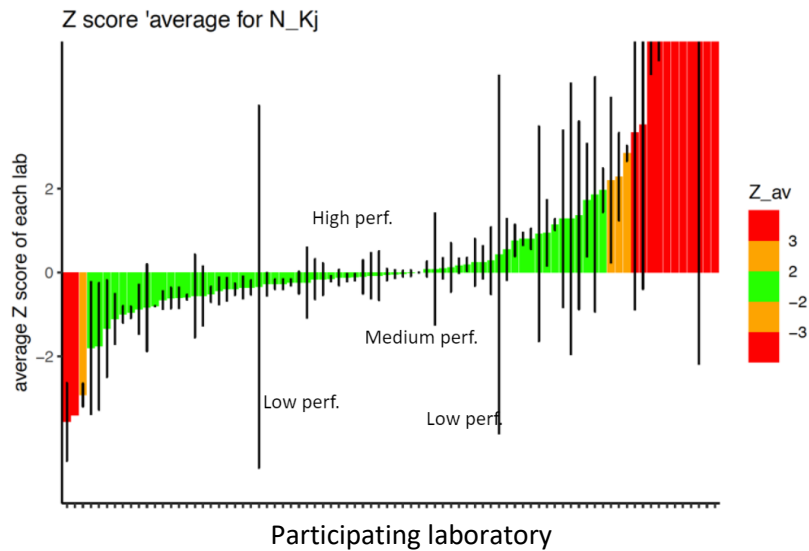


Figure 8. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: nitrogen. Method: Kjeldahl



- **Nitrogen by Dumas:** despite the use of high tech instruments, some laboratories had problems in measuring carbon by this method. This might be due to a human factor (see Figure 9 and Figure 10).

Figure 9. Laboratory performance in the global PT 2022. Soil parameter: nitrogen. Method: Dumas

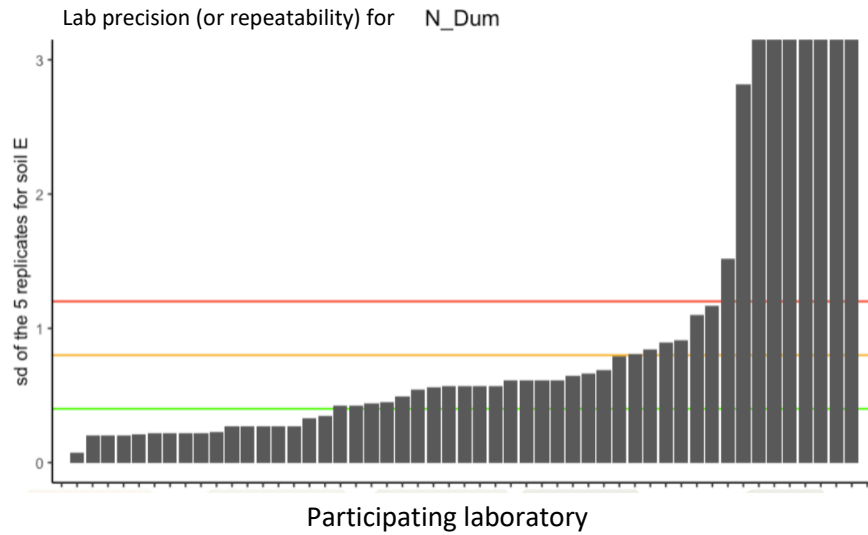
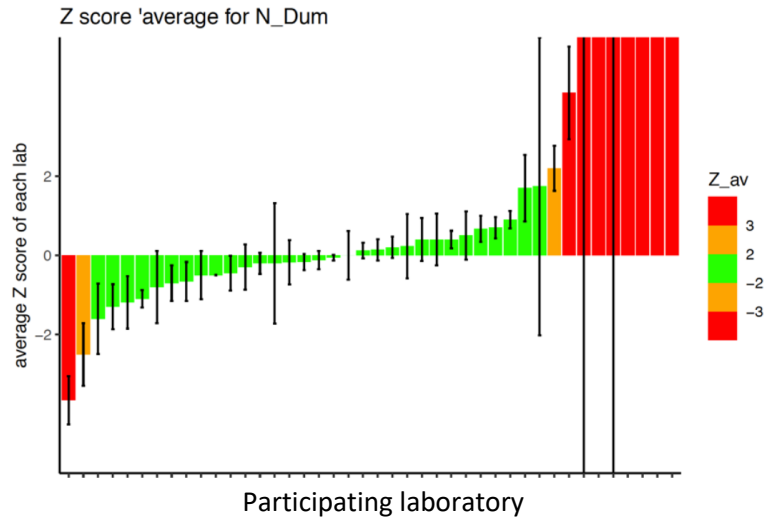


Figure 10. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: nitrogen. Method: Dumas



- **Phosphorus by Olsen:** the large majority of laboratories performed well on this method (see Figure 11 and Figure 12).

Figure 11. Laboratory performance in the global PT 2022. Soil parameter: phosphorus. Method: Olsen

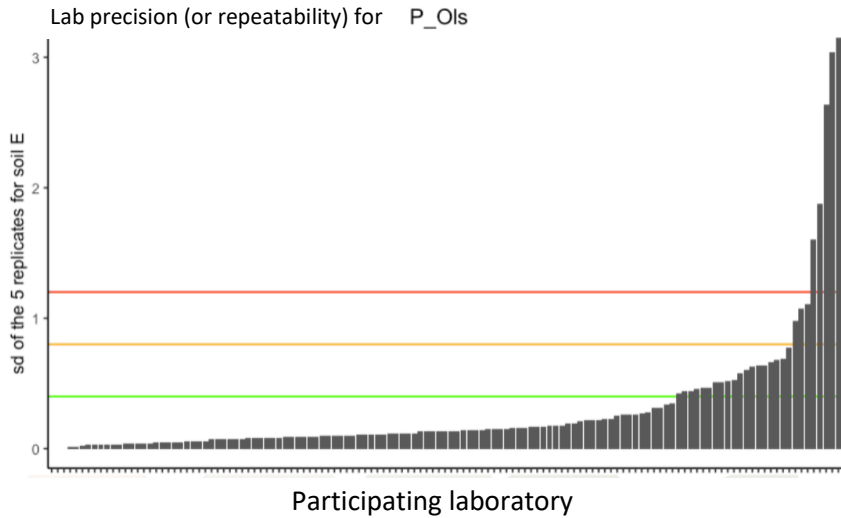
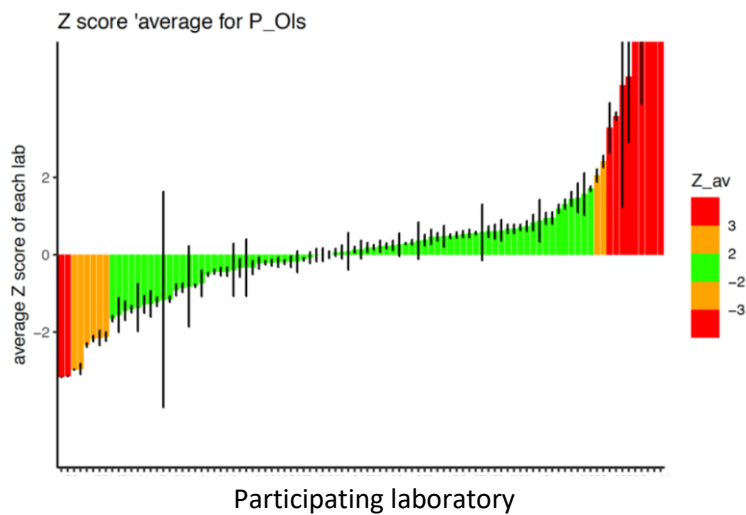


Figure 12. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: phosphorus. Method: Olsen.



- **Phosphorus by Bray I:** the large majority of laboratories performed well on this method (see Figure 13 and Figure 14).

Figure 13. Laboratory performance in the global PT 2022. Soil parameter: phosphorus. Method: Bray I

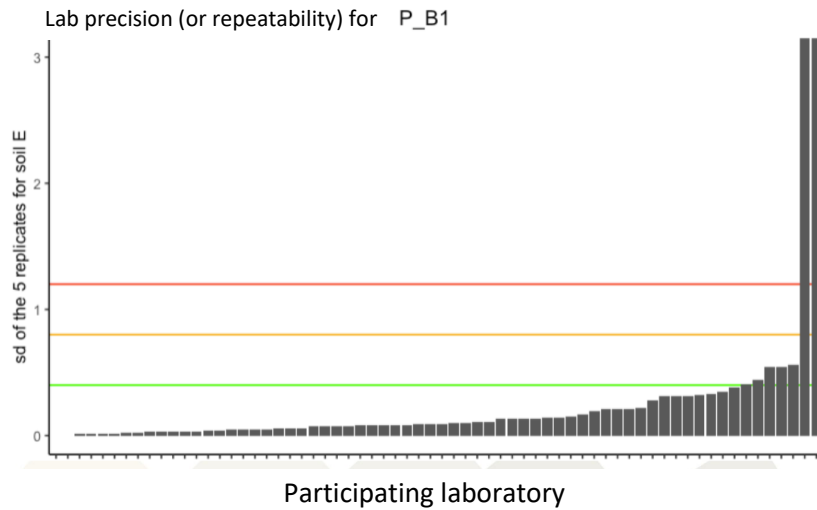
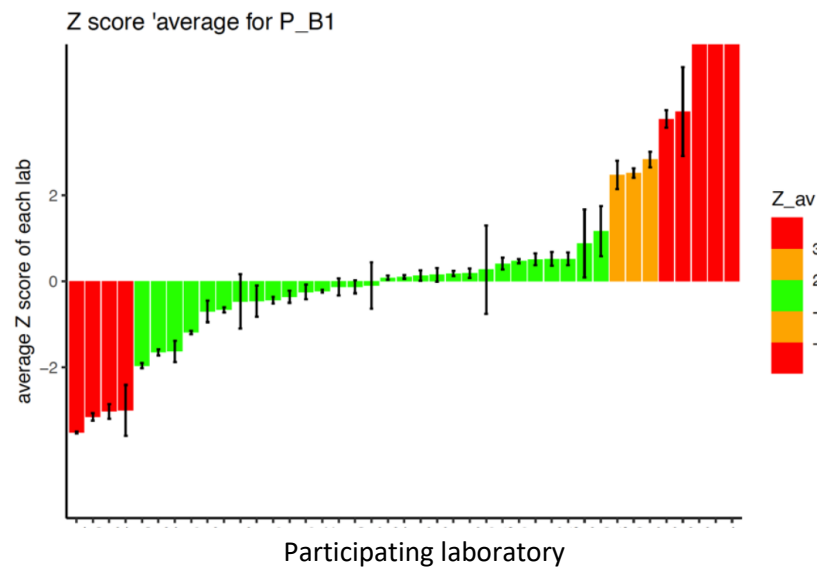


Figure 14. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: phosphorus. Method: Bray I.



- **Phosphorus by Bray II:** the large majority of laboratories performed well on this method (see Figure 15 and Figure 16).

Figure 15. Laboratory performance in the global PT 2022. Soil parameter: phosphorus. Method: Bray II

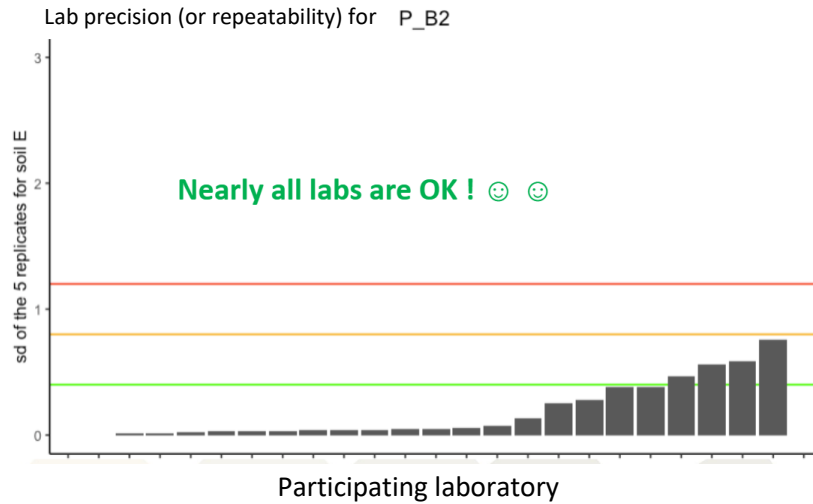
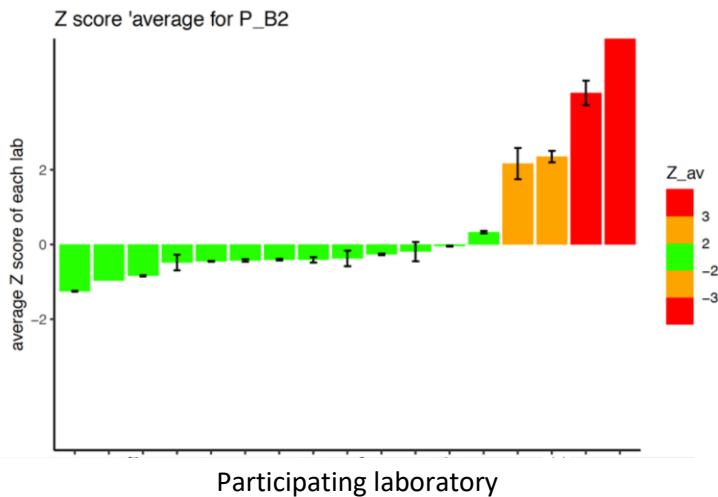


Figure 16. Laboratory performance in the global PT 2022. Comparability and accuracy (how distant or different are laboratory individual results from the consensus value). Soil parameter: phosphorus. Method: Bray II



In general terms, many laboratories have insufficient precision and need to develop international quality control. The comparability of results depends on the method used but even with high technology there were analytical problems or transcription mistakes. At the global scale, the consensus value was the reference value. GLOSOLAN needs to continue investing in harmonizing SOPs and assessing and monitoring laboratory performance through PTs. However, the network cannot organize PTs for all its member laboratories. Global PTs should involve only high-performing laboratories to assure accuracy and comparability. Therefore, laboratories participating to global PTs should participate in regional and national PTs that are necessary to downscale this activity and involve all GLOSOLAN members. In this regard, high-performing laboratories have a key role to play in helping and training less successful laboratories on a regular basis.

5. Standard operating procedures

In 2022, GLOSOLAN intensified the collaboration with the GSP technical networks reported in Table 1 to increase the quality of its harmonized SOPs and to produce other topic specific products.

Table 1. GLOSOLAN collaboration with other GSP technical networks

Network	International Network on Soil Pollution (INSOP)	International Network on Salt-Affected Soils (INSAS)	International Network on Soil Information Systems (INSII)	International Network on Black Soils (INBS)	International Network on Soil Biodiversity (NETSOB)
Networks cooperating on the:	<ul style="list-style-type: none"> • prioritization of SOPs on network's specific topics; • harmonization of SOPs; • data interpretation; • provision of recommendations to farmers; • capacity building; and • awareness raising. 				
Products jointly released in 2022	Guidelines on soil and reagent disposal.	Review of the GLOSOLAN SOP on soil pH determination and boron by hot water extraction.	N/A	N/A	Review of the GLOSOLAN SOPs for soil respiration rate and microbial biomass.
Ongoing activities	INSOP is providing a scientific	Review of the GLOSOLAN SOP on electrical	N/A	N/A	Harmonization of the SOPs for nitrogen

	<p>opinion on the environmental risk related to the disposal of reagents after the laboratory analysis.</p> <p>INSOP is generating standard threshold values for guidance at the national level and it is identifying and developing soil pollution indicators.</p>	<p>conductivity (EC) and saturated paste extract.</p>			<p>mineralization by incubation method, nematodes trophic groups by wet extraction and QBSar index and ISO-TSBF index.</p>
<p>Upcoming products and activities</p>	<p>Organization of joint webinars on soil pollution and pesticides lab analysis.</p> <p>Development of guidelines on soil sampling.</p> <p>Evaluation of gaps and awareness raising on laboratory analysis of soil contaminants.</p>	<p>Calibration between measurements of EC and total soluble salts (TSS).</p>	<p>Develop conversion factors between SOPs used to measure same soil properties.</p> <p>Promote exchange of soil data on national level between INSII institutions and GLOSOLAN laboratories/NASOLAN to develop national soil data products.</p> <p>Advise the use of pedotransfer functions (PTFs) for mapping and development of new PTFs.</p>	<p>Review of the GLOSOLAN SOPs on soil organic carbon, cation exchange capacity (CEC) and base saturation.</p>	<p>Organization of joint webinars on sample collection and storage for determination of soil biological parameters and on the SOPs implementation.</p>

In order to further strengthen the technical quality of GLOSOLAN's work, Aurore Degré was invited to talk about the soil programme on hydrophysics via international engagement (SOPHIE) and about the PT

organized among several European laboratories on soil water retention curve. Luis Wall from the University of Quilmes Bernal in Argentina was also invited to present the work done by his institute on soil health analysis. This started with the request of Argentinian farmers to characterize monocropping and crop rotation soils by developing biological indexes. The soil health lipid index presented by Wall is the result of 14 years of studies of the soil response (soil biology activity regeneration) to different managements.

Ultimately, participants were asked to decide what SOPs GLOSOLAN should harmonize in 2023. Caon reminded participants that GLOSOLAN already harmonized a large number of widely used SOPs over the years (see Table 2) and that RESOLANs were given the freedom to propose methods that they could harmonize regionally in 2023.

Table 2. SOPs harmonized by GLOSOLAN in the period 2019-2022

	2019	2020	2021	2022
Chemical	OC Walkley and Black, TC Dumas, calcium carbonate eq. (titrimetric and volumetric calcimeter methods)	Phosphorus (Bray I, Bray II, Olsen, Mehlich I), pH, electrical conductivity (in water and in saturated paste), nitrogen (Dumas, Kjeldah), carbon (Tyurin)	Particulate organic carbon (physical fractionation), Quasi-total elements (digestion using aqua regia and EPA), Exchangeable bases and CEC (ammonium acetate), available micronutrients (extraction using DTPA), boron (hot water extraction), Mehlich III for macro and micronutrients (including S and B)	Organic matter (loss of ignition), Available phosphorus (KCl), Exchangeable acidity + Exchangeable Al (KCl), Soil buffer capacity (KOH), Fe and Al oxides (ammonium oxalate)
Physical			Particle size distribution (hydrometer, pipette), bulk density, moisture content (gravimetric method)	Water retention (pF) curve, Particle density (pycnometer)
Biological			Microbial biomass C and N by chloroform fumigation-extraction, soil respiration	Microbial enzyme activities (B-glucosidase, arylsulfatase, dehydrogenase), N mineralization (incubation method), nematode trophic groups (wet extraction), QBSar, ISO-TSBF

Note: Different colours refer to the status of publication of the different SOPs.

Green: SOP published.

Orange: SOP under publication.

Red: publication of the SOP delayed.

Blue: SOP published but to be revised.

Pink: SOP published and reviewed already. Revised version available online soon.

In order to speed up the decision-making process on this agenda item, the GLOSOLAN Technical Committee met on 21 November to prioritize the SOPs to harmonize at the global level in 2023. Following the presentation of the GLOSOLAN Technical Committee proposal, participants agreed to work on the following SOPs in 2023:

- **chemical parameters:**
 - The exchangeable acidity by BaCl₂.
 - A general multielement suite of potentially toxic elements (PTEs). The elements to include will be discussed with INSOP that should discuss about the possibility to review the SOP on Quasi-total elements (digestion using aqua regia and EPA) in order to include As. Participants agreed on the need to organize a meeting with INSOP to also discuss the eventual harmonization of a SOP on pesticides.

- **physical parameters:**
 - aggregate stability by Le Bissonais; and
 - textural determination by laser diffraction.

- **biological parameters:**
 - greenhouse gases (GHGs) emissions in soil;
 - DNA extraction; and
 - Soil Health Lipidic Index.

A joint working group with other GSP technical networks will also be established to develop guidelines and SOPs on soil samples collection, storage and transportation.

The decision to let RESOLANs to decide what SOP to harmonize at the regional level starting from the proposals they made at the RESOLAN 2022 meetings was confirmed.

Because of the large number of methods already harmonized or under harmonization by GLOSOLAN, participants requested the network to focus more on transfer functions and activities on quality assurance and quality control.

6. Capacity building

Filippo Benedetti (GLOSOLAN alternate coordinator) informed participants that around 55 webinars in English, French, Arabic and Spanish were implemented in 2021 and 2022. Overall, these had increased the

knowledge of over 4 000 people on the implementation of SOPs, soil spectroscopy, quality assurance and quality control, sample preparation, and health and safety. The statistics associated to the implementation of these webinars had a high appreciation rate, with participants also requesting the organization of webinars on the following topics:

- **Instrument calibration.** Webinars on the topic will start from basic instruments: pH meter, oven, scale.
- **Data interpretation.** This webinar relies on the importance of laboratory data for decision making at all levels.
- **Data management.** This webinar will focus on how to store data in the laboratory (datasets building), data digitalization and data management applications (soil thematic maps and soil assessments). GLOSOLAN will collaborate with INSII on the organization of this webinar.
- **PT setting and participation.** This webinar will focus on how to set a PT (which soil parameters to target by which method, call for participants, sample preparation, sterilization and shipment, data collection, data processing – statistical analysis, results delivery and overall PT conclusions), actions to be taken in response to the participation to a PT, and other technical details. On this topic, participants were reminded about the existence of three GLOSOLAN documents: [general instructions on how to produce a sample for the GLOSOLAN PT](#), [basic guidelines on how to produce a soil sample for proficiency testing](#), and [basic guidelines for preparing a sample for internal quality control](#).

Participants to the GLOSOLAN meeting did not request any additional training topic for the year 2023. Filippo Benedetti encouraged them to record training videos for publishing on the GLOSOLAN website as per the guidelines available [here](#).

7. National Reference Laboratories

The position and role of the national reference laboratories (NRLs) to GLOSOLAN was discussed at the RESOLAN meetings in 2022 because of their importance in implementing GLOSOLAN activities at the national and local level. Not last, NRLs have a key role in establishing the National Soil Laboratory Networks and in organizing national PTs and training in local languages. Therefore, having active and proactive NRLs is critical to the successful scale down of GLOSOLAN.

To present, NRLs have been appointed by the GSP [National Focal Points](#), which made their decision based on the [Terms of Reference \(TORs\)](#) developed by GLOSOLAN in 2017. However, some countries have NRLs that are only partially or fully not compliant to their TORs. To solve this situation, RESOLANs proposed to establish a monitoring scheme for NRLs (such as through the online survey completed by them in 2022) and to have them elected by their NASOLAN instead of having them appointed by the GSP focal points. In this case, the GSP focal points will have the simple role of evaluating and endorsing the proposal made by NASOLANs. Participants endorsed these proposals.

Lucrezia Caon brought another issue to the attention of participants that refers to the low participation of NRLs to GLOSOLAN surveys, including those organized to monitor their participation in GLOSOLAN

activities. Only 69 out of 132 NRLs replied to the survey despite it being available in English, Spanish, French and Russian to break any potential language barrier. Given the time and work spent on translating this and other surveys for the whole GLOSOLAN community, Caon asked participants if it was worth continuing to invest on the translation of GLOSOLAN surveys. This question was of particular relevance considering that GLOSOLAN is soon to launch a survey for the writing of the Global Soil Laboratory Assessment 2023. Participants asked GLOSOLAN to continue investing in the translation of surveys.

Looking at the interaction between NRLs and GSP focal points, 41 percent of the NRLs Heads that completed the survey reported having regular exchanges with their GSP Focal Point and 15 percent of them reported to be GSP focal points themselves. Twelve percent of respondents did not know that they had to keep the GSP focal points informed, while seven percent of them reported not to know who their GSP focal point is, and three percent of them did not think that the GSP focal points were interested in knowing about laboratory activities. The fact that seven percent of respondents did not know who their GSP Focal Point was, was of concern to the GLOSOLAN Coordinator, who committed to talk to the Regional Soil Partnership coordinators to the GSP to clarify this situation. Based on the suggestion of LATSOLAN, national soil science societies can be involved in GLOSOLAN work to ensure some continuity of work and communication at the institutional level. This would be particularly useful in case of frequently changing focal points.

RESOLANs also proposed to prepare a brochure for national focal points and policymakers, showing the added value of GLOSOLAN in decision-making processes (decision-making-oriented content) and another brochure for soil laboratories aimed at motivating new laboratories to join GLOSOLAN and NASOLANs (technical content). Participants approved this proposal.

In 2022, GLOSOLAN received several requests for laboratories wishing to visit other laboratories in the network. However, GLOSOLAN has not yet been able to provide timely and precise responses to these requests. To help address these requests, participants endorsed the idea of establishing a database that can report laboratories available to host peers for capacity development. Based on the discussion that followed, the database should include the following information:

- Laboratory details are needed, including the full name of the lab, address and country;
- Is the laboratory accredited or not?. Note that accreditation does not guarantee quality, it just shows that people are doing what they say they should be doing. Adding information about research interests might be a plus and it might help when pairing organizations on aligned interests to gain research funds and is a practical way to deliver capacity strengthening;
- Is the lab open to training, or visits? For training, a good trainer is needed but for visits any laboratory can share whatever they have.
- Is the lab open to share experience on one or more of the following: quality control, implementation of SOPs, reagents preparation, personnel management, instruments calibration and maintenance, maintaining laboratory accreditation, health and safety, waste management, or development of transfer functions?
- Is the lab open to train head of the labs, or lab technicians?

- Which soil analyses are performed (chemical, physical, biological, plants, water, or food), and which methods and equipment are used? This part needs to be complemented with the laboratory performance in PT. Laboratories will be allowed to train other labs only on those analyses and aspects that they are competent on.
- What is the status of the lab facilities (excellent, good, fair, poor)?
- What is the availability of the lab for hosting peers?
- Is the lab open to peers globally or are there restrictions due to region, country or language barrier?
- What is the maximum number of peers that can be hosted at the same time?
- Is there accommodation and facilities available for visiting peers?
- Is there any financial support made available for peers?

The list of information to report in the database will be cross-checked and confirmed by the GLOSOLAN Technical Committee before the GLOSOLAN coordinators take action in establishing the database. GLOSOLAN members also requested to have a list of potential sponsors for these exchanges reported on the database webpage. The Royal Society and the Royal Society of Chemistry, Commonwealth Scholarship Council UK and TAIEX were already identified as potential sponsors during the meeting. Focal points, particularly those of developed countries, could provide information about the multiple opportunities offered by their countries to implement this activity.

8. National Soil Laboratory Networks

Magdeline Vlasimsky informed participants that GLOSOLAN put great effort in updating the NASOLAN database in 2022 and that NASOLANs are important for supporting the implementation of GLOSOLAN activities at the local level, bringing local challenges to the attention of GLOSOLAN that will develop strategies to address them, and for reaching a larger number of laboratories. All laboratories and NRLs especially were invited to consult the [TORs of NASOLAN](#) and the [guidelines on how to establish NASOLANs](#). Laboratories were also invited to help the GLOSOLAN coordinators in creating and keeping their NASOLAN webpage updated. NASOLAN webpages provide multiple advantages:

- They increase the visibility of the national network at the national, regional and global level.
- They ensure that all soil laboratories have access to their NASOLAN information.
- They allow projects and initiatives to connect with NASOLAN and its members. In this regard, soil laboratories can be easily contacted and involved in projects and initiatives independent from GLOSOLAN and the GSP.
- They bring NASOLAN and soil laboratories needs to the attention of donors.

During the update of the NASOLAN database the following common challenges and issues were noticed:

- For many countries, there are barriers between laboratories in different sectors (universities, government, private, etc.).
- There is a general lack of funds or support for activities.

- There are inactive NRLs or focal points with limited activities or formation.

Countries with fewer laboratories were invited to create joint networks like the one being established in the Caribbean (CARSOLAN) under the SOILCARE project.

9. Progresses, needs and way forward

Lucrezia Caon informed participants that the update of the FAO Soil Bulletin 74 *Guidelines for quality management in soil and plant laboratories* will be done by a consultant that the FAO is recruiting to implement a project in Azerbaijan. The consultant will base their work on the suggestions made by GLOSOLAN over the years and in consultation with interested members of the GLOSOLAN's Technical Committee.

GLOSOLAN has still failed to produce *Guidelines for the development of transfer functions within soil laboratories* because of the absence of a leading author or expert on the topic. Because of the extensive research work done on transfer functions by the NRL for the Russian Federation, Elena Shamrikova volunteered to help with this assignment. Because of the need to have transfer functions for the implementation of the RECSOIL project of the GSP, the GLOSOLAN coordinators will organize a meeting between the leading authors of the SOPs on carbon: Walkley and Black, Dumas, Tyurin and loss of ignition methods. The discussion will focus on the possibility to develop transfer functions between these methods, the associated costs and the expert or laboratory that can take over this work. During the meeting, Shamrikova informed participants that her laboratory is already developing the transfer functions between the loss of ignition and the Walkley and Black method, and between the loss of ignition method and the Tyurin method. The transfer function between the Tyurin method and the Walkley and Black method is already available.

10. GLOSOLAN work plan 2023

In conclusion, the GLOSOLAN work plan for the year 2023 was revised and endorsed. This is reported in Table 3.

Table 3. GLOSOLAN work plan for 2023

Activity	Responsible party	Deadline
Preparation and publication of the Global Soil Laboratory Assessment 2022. The online survey should be available in EN, ES, FR and RU.	GLOSOLAN Coordinators GLOSOLAN Technical and Steering Committees	June 2023
Publication of the revised FAO Bulletin 74.	Consultant (write)	December 2023

	GLOSOLAN Technical Committee (review)	
Write a policy brief on the importance of soil laboratories and soil analysis. Link to waste management and policy support to laboratories.	INSOP GLOSOLAN Technical Committee GLOSOLAN Coordinators	December 2023
Regional Soil Laboratory Networks (RESOLANs)		
Organization of the annual meetings of SEALNET, AFRILAB, LATSOLAN, EUROSOLAN, NENALAB and ASPAC (two hours virtual meeting on decision-making).	GSP Secretariat	June to September 2023
RESOLAN Steering Committees to support National Reference Laboratories in complying with their tasks, including the establishment of National Soil Laboratory Networks (NASOLANs).	RESOLAN Steering Committees National Reference Laboratories GLOSOLAN Coordinators	Continuous
National Reference Laboratories (NRL) and National Soil Laboratory Networks (NASOLAN)		
Establishment of a NRLs' monitoring system. Evaluation of the survey completed by NRLs in 2022. Reconfirm the position of the NRLs with the GSP national focal points. Following the decision that NASOLANs will elect their NRL, TORs for the position for the position of NRL need to be revised.	RESOLAN Steering Committees and GLOSOLAN Coordinators NASOLANs	December 2023
Preparation of brochures promoting GLOSOLAN at the national level: <ul style="list-style-type: none"> One brochure for national focal points and policy makers. The text should focus on the added value of GLOSOLAN for decision-making. Decision-making-oriented content 	GLOSOLAN Coordinators GLOSOLAN Technical and Steering Committees RESOLAN Chairs	June 2023

<ul style="list-style-type: none"> One brochure for laboratories, to motivate them to join GLOSOLAN and NASOLAN (technical content). 		
Establishment of a database reporting laboratories available to host peers for capacity development	GLOSOLAN Coordinators GLOSOLAN Technical and Steering Committees	March 2023
Update and create NASOLAN webpages as needed	GSP secretariat and National Reference Laboratories with the support of all GLOSOLAN members	Continuous
GLOSOLAN PT		
Publish the report on the GLOSOLAN PT 2022, the report on the GLOSOLAN PT 2019 and the cookbook on the statistical analysis of GLOSOLAN PTs.	GLOSOLAN Coordinator and PT experts	June 2023
Organize regional PTs: <ul style="list-style-type: none"> in Africa and NENA (leader: GSP); in Eurasia (leader: Russian Federation); and in Asia (leader: Philippines). 	GLOSOLAN Coordinator and National Reference Laboratories in the Russian Federation and in the Philippines. All labs in Africa, NENA, Eurasia and Asia to participate.	December 2023
Launch a survey for laboratories that experienced problems of performance in the PT to identify potential sources of errors.	GLOSOLAN Technical Committee. All GLOSOLAN members that participated to the GLOSOLAN PT 2022 and that did not perform as expected to complete	March 2023
Publish guidelines on how to identify potential sources of errors in laboratory analysis and on the actions to take when receiving PT results.	GLOSOLAN Technical Committee	April 2023
Update of SIMPLE.	GLOSOLAN coordinators with the support of GLOSOLAN members	Continuous
Standard operating procedures (SOPs)		

<p>Finish the publication of the SOPs harmonized in 2021 and 2022.</p>	<p>GLOSOLAN Coordinator</p>	<p>March 2023</p>
<p>Harmonize the SOPs for the methods agreed at the sixth GLOSOLAN meeting:</p> <ul style="list-style-type: none"> • globally harmonized SOPs: chemical, physical and biological parameters, SOP for quality management and SOP on samples collection, transportation and storage; and • organization of meetings to confirm the SOPs that will be harmonized at the regional level by RESOLANs. <p>Launch surveys to assess how many labs use specific methods first. Harmonization procedures will be defined based on surveys' results.</p> <p>Organize meetings with other GSP Technical Networks to discuss the review of GLOSOLAN SOPs or the writing of new SOPs.</p>	<p>SOP working groups, Review Panels and other networks and partners</p>	<p>December 2023</p>
<p>Publish information on the sustainability of the methods harmonized in 2022 and 2023.</p>	<p>GLOSOLAN Coordinator</p>	<p>December 2023</p>
<p>Include reference values and range values to the GLOSOLAN SOPs harmonized so far and in those in the work plan 2022–2023.</p> <p><i>This activity was in the GLOSOLAN work plan 2022 but it was not implemented.</i></p>	<p>SOP working groups (range values); working groups to be established with GSP Pillars of Actions and other Technical Networks (reference values).</p>	<p>December 2023</p>
<p>Prepare a quick-reference guide to building a transfer function for harmonization.</p> <p><i>This activity was in the GLOSOLAN work plan 2021 and 2022 but it was not implemented.</i></p>	<p>Technical Committee</p>	<p>December 2023</p>

Develop transfer functions between GLOSOLAN SOPs on carbon to support the implementation of RECSOIL.	Experts that worked on the harmonization of the considered methods	December 2023
Capacity building		
Publish the units of measure endorsed at the fourth GLOSOLAN meeting and prepare conversion tables. <i>This activity was in the GLOSOLAN work plan 2021 and 2022 but it was not implemented.</i>	Technical Committee and GLOSOLAN Coordinator	March 2023
Organization of webinars on instrument calibration, data interpretation, data management, and PT setting and participation in several languages.	GLOSOLAN Coordinators and trainers	Continuous
Translation of the GLOSOLAN website and publications in several languages.	GLOSOLAN Coordinators and translators	Continuous
GLOSOLAN Technical Committee		
Organization of regular meetings. Set up a fixed calendar of meetings.	GLOSOLAN Coordinator	Continuous
GLOSOLAN Steering Committee		
Organization of regular meetings. Set up a fixed calendar of meetings.	GLOSOLAN Coordinator	Continuous
Finalization and publication of the GLOSOLAN work plan in the long term.	Steering Committee and GLOSOLAN Coordinators	February 2023
Finalization and publication of a policy strategy to support laboratories on such things as lab maintenance, and waste management.	Steering Committee and GLOSOLAN Coordinators	February 2023
GLOSOLAN–INSII collaboration		
Connect INSII and GLOSOLAN members with the support of NASOLANs.	INSII and GLOSOLAN Coordinators	Continuous

Annex I. Agenda



Food and Agriculture
Organization of the
United Nations



Sixth meeting of the Global Soil Laboratory Network (GLOSOLAN)

22 - 24 November 2022

from 11:00 AM to 2:00 PM GMT +1

Online meeting – Zoom platform

Tuesday, 22 November 2022		
11.00–11.10 GMT+1	Opening.	Miriam Ostinelli, GLOSOLAN Chair
11.10–11.15 GMT+1	Endorsement of the Agenda and group picture.	Lucrezia Caon, GLOSOLAN coordinator, FAO
11.15–11.35 GMT+1	Item 1. Report of the work performed by GLOSOLAN in 2021 and 2022: <ul style="list-style-type: none"> • display of GLOSOLAN achievements video. 	Miriam Ostinelli, GLOSOLAN Chair
11.35–11.55 GMT+1	Item 2. 2021–2022 report of the GLOSOLAN Initiative on Soil Spectroscopy (GLOSOLAN-Spec).	Magdalene Vlasimsky, GSP Secretariat, GLOSOLAN-Spec coordinator, FAO
11.55–12.15 GMT+1	Item 3. 2021–2022 report of the International Network on Fertilizer Analysis (INFA).	Wesley Karl Feldmann, INFA Chair
Regional Soil Laboratory Networks (RESOLANs)		
12.15–12.50 GMT+1	Item 4. Regional priorities and needs, and presentation of progresses on the establishment of NASOLANs: <ul style="list-style-type: none"> • African Soil Laboratory Network (AFRILAB) by <i>Lesego Mooketsi-Selepe, AFRILAB Chair</i>; • Asian Soil Laboratory Network (SEALNET) by <i>Gina Nilo, SEALNET Chair</i>; • European and Eurasian Soil Laboratory Network (EUROSOLAN) by <i>Marija Romić, EUROSOLAN Chair</i>; • Latin American Soil Laboratory Network (LATSOLAN) by <i>María Cristina Suárez, LATSOLAN Chair</i>; • Near East and North African Soil Laboratory Network (NENALAB) by <i>Riham Zahalan, NENALAB Chair</i>; • North America by <i>Christopher Lee, KSSL-USDA</i>; and • Pacific Soil Laboratory Network (ASPAC) by <i>Rob de Hayr, ASPAC facilitator</i>. 	Moderator: Filippo Benedetti, Alternate GLOSOLAN Coordinator, FAO

12.50–13.50 GMT+1	Item 5. GLOSOLAN proficiency test.	Christian Hartmann, IRD France
13.50 –14.00 GMT+1	Wrap up and closure of the day.	

Wednesday, 23 November 2022		
Standard operating procedures		
11.00–11.50 GMT+1	<p>Item 6. GLOSOLAN subworking groups (10 min each max):</p> <ul style="list-style-type: none"> • Joint working group International Network on Salt-Affected Soils (INSAS)/GLOSOLAN by <i>Jorge Battle-Sales, INSAS Chair</i>; • Collaboration opportunities with the International Network on Soil Pollution (INSOP) by <i>Sergejus Ustinov, INSOP Coordinator, FAO</i>; • Digital soil mapping needs for data, International Network on Soil Information Institutions (INSII)/GLOSOLAN by <i>Marcos Angelini and Moritz Mainka, GSP Secretariat, FAO</i>; and • Collaboration opportunities with International Network on Black Soils (INBS) by <i>Yuxin Tong, INBS Coordinator, FAO</i>. 	<p>Moderator:</p> <p>Miriam Ostinelli, GLOSOLAN Chair</p>
11.50–12.30 GMT+1	<p>Item 7. Invited talks followed by open discussion:</p> <ul style="list-style-type: none"> • SOPHIE: Soil Programme on Hydro-Physics via International Engagement by <i>Aurore Degré, Gembloux Agro-Bio Tech ULiège</i>; and • Soil Health Analysis by <i>Luis G. Wall, Laboratory of Soil Biochemistry and Biology Centre of Biochemistry and Microbiology of Soils (CBMS) University of Quilmes Bernal, Argentina</i>. 	<p>Moderator:</p> <p>Abdourahaman Moustapha, GLOSOLAN Vice-Chair</p>

12.30–13.30 GMT+1	<p>Item 8. Decision on the SOPs to harmonize in 2021–2022:</p> <ul style="list-style-type: none"> • recap on the SOPs harmonized and under preparation; and • open discussion. 	Lucrezia Caon, GLOSOLAN Coordinator, FAO
13.30–14.00 GMT+1	<p>Item 9. Capacity building:</p> <ul style="list-style-type: none"> • video training recording: guidelines and work plan; and • upcoming webinars: <ul style="list-style-type: none"> ○ calibration; and ○ how to participate to a PT. 	Filippo Benedetti, Alternate GLOSOLAN Coordinator, FAO
14.00 GMT+1	Closure of the day.	

Thursday, 24 November 2022		
Policy and collaborations		
11.00–12.00 GMT+1	<p>Item 10. Strengthening National Reference Laboratories:</p> <ul style="list-style-type: none"> • NRL survey outcomes (focus on the interaction with the government); proposal from the regions: <ul style="list-style-type: none"> ○ monitoring schemes; ○ election of NRL vs direct appointment by GSP Focal Points; and ○ preparation of brochures (for both laboratories and governments); • establishment of a database reporting laboratories available to host peers for capacity development. 	Moderator: Lucrezia Caon, GLOSOLAN Coordinator, FAO
12.00–12.30 GMT+1	<p>Item 11. NASOLAN (successful stories and support opportunities):</p> <ul style="list-style-type: none"> • database updates; and 	Moderator: Magdalene Vlasimsky, GSP Secretariat, FAO

	<ul style="list-style-type: none"> a special case from the Caribbean (CARSOLAN). 	
12.30–12.50 GMT+1	<p>Item 12. Collaboration between GLOSOLAN and the International Network on Soil Information Institutions (INSII) (addressing data quality in maps production):</p> <ul style="list-style-type: none"> presentation of NRL survey outcomes; and open discussion. 	<p>Filippo Benedetti, GLOSOLAN Alternate Coordinator, FAO</p> <p>Marcos Angelini and Moritz Mainka, GSP Secretariat, FAO</p>
Technical Committee and other bodies		
12.50–13.45 GMT+1	<p>Item 13. Progress, needs and way forward:</p> <ul style="list-style-type: none"> Updates on the review of the FAO Soils Bulletin 74: Guidelines for Quality Management in Soil and Plant Laboratories; preparation of guidelines for the development of transfer functions within soil laboratories; development of transfer functions between GLOSOLAN SOPs: <ul style="list-style-type: none"> needs and opportunities; and introduction to RECSOIL by Natalia Rodriguez, GSP Secretariat, FAO. 	<p>Lucrezia Caon, GLOSOLAN Coordinator, FAO</p>
13.45–13.55 GMT+1	<p>Item 14. Endorsement of the GLOSOLAN work plan and decisions for the year 2023.</p>	<p>Lucrezia Caon, GLOSOLAN Coordinator, FAO</p>
13.55–14.00 GMT+1	<p>Wrap up and closure of the meeting and display of the GLOSOLAN birthday video.</p>	

Annex II. List of participants

From the Global Soil Partnership (FAO):

Lucrezia Caon, GLOSOLAN Coordinator

Filippo Benedetti, GLOSOLAN Alternate Coordinator

Magdeline Vlasimsky, Coordinator of GLOSOLAN-Spec

Natalia Rodriguez, GSP Secretariat

Maria Konyushkova, Coordinator of the International Network on Salt-Affected Soils (INSAS)

Yuxin Tong, Coordinator of the International Network on Black Soils (INBS)

Marcos Angelini, GSP Secretariat

Isabel Luotto, GSP Secretariat

Moritz Mainka, GSP Secretariat

Sergejus Ustinov, Coordinator of the International Network on Soil Pollution (INSOP)

Vinisa Saynes Santillán, Coordinator of the International Network on Fertilizer Analysis (INFA)

Full Name	Country	Laboratory
Mohammad Rafi Salihzada	Afghanistan	Parwan Province Soil Laboratory
Nizam Abdulwaris	Afghanistan	Nangrahar Research Soil Laboratory (NRSL)
Daniel Carreira	Argentina	LabIS Instituto de Suelos CIRN INTA
Guillermo Spika	Argentina	Argentine Mission to FAO
Hernan Farina	Argentina	National University Of Quilmes
Luis Wall	Argentina	Biösphere, Soil Biology and Biochemistry Lab, Centre of Biochemistry and Microbiology of Soil, University of Quilmes
Miriam Mabel Ostinelli	Argentina	Laboratorio Instituto de Suelos INTA
Rolando Aguirre	Argentina	Laboratorio de Suelo, Agua y Vegetales INTA, AIPAF Formosa
Brendon Costello	Australia	The University of Melbourne, TrACEES
Keren Wu	Australia	Soil group
Mano Veeragathipillai	Australia	Soil and Water Environmental Laboratory
Peter Fisher	Australia	The University of Melbourne
Qingmei Wang	Australia	School of Agricultural Sciences
Rob De Hayr	Australia	ASPAC
Scott Essam	Australia	The University of Melbourne, TrACEES
Vanessa Wong	Australia	Soil Science Australia
Xia Liang	Australia	The University of Melbourne
Andreas Baumgarten	Austria	AGES
Wolfgang Friesl-Hanl	Austria	Environment Agency Austria
Mohammad Jahangir	Bangladesh	Laboratory of Soil Physics
Mohammad Enayet Hossain	Bangladesh	Department of Soil, Water and Environment, University of Dhaka

Aurore Degre	Belgium	Uliège Gembloux Agro-Bio Tech
Benny Heirman	Belgium	Normec Servaco
Clémence Mariage	Belgium	GxABT
Stefaan De Neve	Belgium	Soil Fertility and Nutrient Management
Cossi Tiburce Brice Oussou	Benin	L2A2S2E
Alfredo Cáceres	Bolivia (Plurinational State of)	Laboratorio de Suelos y Aguas
Sergio Fernando Mendoza	Bolivia (Plurinational State of)	Laboratorio de Suelos y Riegos Facultad Ciencias Agrícolas y Forestales, Universidad Autónoma Juan Misael Saracho
Wilfredo Benitez Ordoñez	Bolivia (Plurinational State of)	La Boratorio de Suelos y Riegos, Facultad de Ciencias Agrícolas y Forestales, Universidad Autónoma Juan Misael Saracho
Amra Semic	Bosnia and Herzegovina	Sector for Soil Laboratory Research
Amira Solak	Bosnia And Herzegovina	Sector for Soil Laboratory Research
Emina Sijahovic	Bosnia And Herzegovina	PAM
Hadija Čivić	Bosnia And Herzegovina	PAM
Nura Murtic	Bosnia And Herzegovina	Sector for Soil Laboratory Research
Lesego Mooketsi-Selepe	Botswana	Soil and Plant Analytical Laboratory
Karabo Sebogisi	Botswana	BUAN SOIL LAB
Lisbeth Ltd	Botswana	Lisbeth
Trust Manyiwa	Botswana	Botswana International University of Science & Technology
Daniel Perez	Brazil	Embrapa/LASP
Harouna Harouna	Burkina Faso	BUNASOLS
Inoussa Ouedraogo	Burkina Faso	BUNASOLS
Mamoudou Traore	Burkina Faso	Burkina National des Sols
Jacques Tavares	Cabo Verde	LASAP
Sambo Pheap	Cambodia	Soil Science Laboratory
Mfopou Mewouo Yvette Clarisse	Cameroon	Laboratoire d'Analyses des Sols, Plantes, Eaux et Engrais (LASPEE) de l'IRAD
Gaëlle Manguele	Cameroon	LASPEE/IRAD
Laurette Ngo Nkot	Cameroon	Plant Biology

Zing Zing Bertrand	Cameroon	LASPEE
Aline Beatrice Nzeket	Cameroon	LASPEE
Joseph Sadrac Ondoua Oyono	Cameroon	Laboratoire d'Analyses des Sols, Plantes, Eaux et Engrais
Patrice Kuitekam Dongo	Cameroon	National Laboratory for the Diagnostic Analysis of Agricultural Products and Inputs
Wavel Mouaromba	Chad	Laboratoire d'Analyses de Sols, Plantes et Eaux
Liza Jofre	Chile	Laboratorio Agroanalysis UC
Manuel Araya	Chile	Estacion Experimental Agricola Sidal Ltda
Yasna Plaza	Chile	Lab De Suelos y Análisis Foliar PUCV
Hong Wang	China	Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences
Xuejing Zang	China	Jiangsu University
Gerardo Ojeda	Colombia	Universidad Nacional Abierta y a Distancia (UNAD): INFA
Laura Casas	Colombia	CAR -DLIA
Rosalina Gonzalez	Colombia	La Salle University
	Costa Rica	Laboratorio Suelos, Plantas y Aguas INTA
Yorleny Montero	Costa Rica	ICAFE
Ivana Zegnal	Croatia	Center for Soil
Marija Romić	Croatia	MELILAB
Zeljka Zgorelec	Croatia	University of Zagreb, Faculty of Agriculture, Agroecology Unit, Department of General Agronomy Analytical Laboratory (OPBLab)
Jiří Čuhel	Czechia	Central Institute for Supervising and Testing in Agriculture
Daniel Lunze	Democratic Republic of Congo	Laboratoire des Sols, INERA, Mvuazi
Elie Nsimba Ngembo	Democratic Republic of Congo	Unikin
Ayan Houssein Farah	Djibouti	Pédologie
Sougueh Cheik	Djibouti	Agronomy and Ecology Lab
Mohamed Egueh Walieh	Djibouti	CERD
María Cristina Suarez Marte	Dominican Republic	Laboratorio de Química de Suelos, LABOSUELOS-UASD
Maria Amparo Gilces Reyna	Ecuador	Agua y Suelo, Universidad Técnica de Manabí

Betty Janet Rivadeneira Moreira	Ecuador	Laboratorio de Suelos EET, Pichilingue, INIAP
Cristina Cuesta	Ecuador	Agrocalidad
Ahmed El Baroudy	Egypt	Tanta University, Egypt
Nader	Egypt	Soils, Water and Environmental Research Laboratory
Morena Cárcamo	El Salvador	Laboratorio de Fusades
Nidia De Landaverde	El Salvador	Laboratorio de Fusades
Rafael Jaco	El Salvador	Fusades
Samuel Bereket	Eritrea	Soil Research Laboratory
Ülle Tali	Estonia	Laboratory of Agrochemistry
Tõnu Tõnutare	Estonia	Estonian University of Life Sciences Soil Science Laboratory
Senzo Ntshakala	Eswatini	Soil Testing Unit
Simphiwe Madonsela	Eswatini	Triomf Eswatini Agriculture Laboratory (TEAL)
Enyew Adgo	Ethiopia	Soil and Plant Analysis Laboratory, Bahir Dar University
Lemma Mamo Haile	Ethiopia	Werer Agricultural Soil and Water Laboratory
Musefa Redi Abegaz	Ethiopia	HARC Soil Laboratory
Wakessa Miheretu Bedassa	Ethiopia	Holeta Soil Laboratory
Yenesew Anmaw	Ethiopia	Soil Laboratory
Doreen Pillay	Fiji	Sugar Research Institute of Fiji
Christian Hartmann	France	IRD
Eric Van Hullebusch	France	IPGP
Marie Tella	France	CIRAD
Mercedes Mendez	France	LOCEAN-Plateforme Alyses
Lazare Ossende-Essanga	Gabon	Soil Laboratory of ADAG
Neil-Yohan Musadji	Gabon	Laboratoire d'Analyse des Sols et Environnement
Rolf Gael Mabicka Obame	Gabon	Laboratoire d'Analyses des Sols et Environnement
Rolf Mabicka Obame	Gabon	Laboratoire d'Analyse des Sols et Environnement
Giorgi Ghambashidze	Georgia	Laboratory of Soil Fertility Research Service, Scientific-Research Centre of Agriculture
Bassirou Hassane	Germany	WASCAL
Moussa Diallo	Guinea	République
Carlos Irias	Honduras	FHIA
Eunice Aguilera	Honduras	Laboratorio de Suelos, Zamorano
Ágnes Nagy	Hungary	NÉBIH

Caleb Ocansey	Hungary	Soil science
Chetna Nimje	India	CRAL-ICRISAT
Guru Prasad Muppala	India	Soil science
Chakravorty	India	Soil Ecology Laboratory
Femida Patel	India	Agri Biochem Research Lab, Panoli
Manish Kumar	India	CPDM, IISc
Naga Madhuri Kandula	India	Soil, Plant, Water and Manure Analysis Laboratory, RARS, Tirupati, ANGRAU
Pushpajeet Choudhari	India	CRAL-ICRISAT
Sanjay Srivastava	India	ICAR IISS
Sreenivas Ch	India	Soil Laboratory, Maruteru, ANGRAU
Ahmad Mahdavi	Iran (Islamic Republic of)	Retired, access to private labs for sample analysis by payment
Karim Shahbazi	Iran (Islamic Republic of)	Soil and Water Research Institute (SWRI)
Meisam Rezaei	Iran (Islamic Republic of)	Soil and Water Research Institute (SWRI)
Mostafa Marzi	Iran (Islamic Republic of)	Soil and Water Research Institute (SWRI)
Taher Ahmadzadeh	Iran (Islamic Republic of)	KIMIA AB Environmental and Agricultural Consulting Laboratory
Ahmed Salman	Iraq	The Ministry of Sciences and Technology
Basim Al-Obaidi	Iraq	Soil Chemistry Laboratory
Sadeq Dwenee	Iraq	Soil Chemistry Laboratory
Elio Padoan	Italy	Bio soil
Chiara Cassinari	Italy	Laboratorio Ecosistemi
Lidia Vicentini	Italy	ERSA
Lidia Nicola	Italy	Laboratory of Mycology, University of Pavia
Nunzio Romano	Italy	Laboratory of Soil Hydrology, University of Naples, Federico II
Guy Fernand Yao	Ivory Coast	Laboratoire Central Sols-Eaux-Plantes (LCSEP) du Centre National de Recherche Agronomique (CNRA)
Jin Tanaka	Japan	UNISC International
Yuji Maejima	Japan	Institute for Agro-Environmental Sciences, NARO
Nabeel Bani Hani	Jordan	Soil Laboratory
Assel Rakhimova	Kazakhstan	Laboratory

Maira Kussainova	Kazakhstan	Laboratories of Natural Resource Management and Sustainable Development of Agroecosystems
Saparov Galymzhan	Kazakhstan	Analytic Complex Laboratory
Elvis Weullow	Kenya	CIFOR-ICRAF Soil Plant Spectral Diagnostics Laboratory
Frank Wesonga	Kenya	Pesticides
Hannah Karuri	Kenya	USL
Kip Robert	Kenya	Imara Analytical Laboratory
Lewis Kingori	Kenya	KALRO-NARL
Lilian Oduor	Kenya	National Agricultural Research Laboratory
Zampela Pittaki-Chrysodonta	Kenya	Soil Spectroscopy, ICRAF
Kevin Rono	Kenya	IMARA
Valmire Havolli	Kosovo	KIA
Bedanga Bordoloi	Kuwait	Lamor/DND/CDE/LABCO/MEL
Santi Kongmany	Lao People's Democratic Republic	Center of Excellence in Environment
Xaysatith Souliyavongsa	Lao People's Democratic Republic	Soil, Plant and Fertilizer Analysis Center
Andis Lazdiņš	Latvia	Laboratory of Forest Environment
Lauris Leitans	Latvia	State Plant Protection Service Agrochemical Laboratory
Abdel Kader El Hajj	Lebanon	Lebanese Agricultural Research Institute (LARI), Lebbaa
Amira Youssef	Lebanon	LARI, Hasbaya
Dany Romanos	Lebanon	LARI
Hala Abou Trabi	Lebanon	LARI
Marie Nabhan	Lebanon	LARI, Tal-Amara
Mira Mrad	Lebanon	Holy Spirit University (USEK)
Nissrine Abou Hamad	Lebanon	Water, soil, and oil analyses
Nour El Kreidy	Lebanon	LARI
Valerie Azzi	Lebanon	Soil & Soilless unit, LARI
Yara Khairallah	Lebanon	LARI
Zeina Abou Ibrahim	Lebanon	LARI, Hasbaya
Malefetsane Khesuoe	Lesotho	Soils Laboratory
Motlalepula Rasekoele	Lesotho	AgriSoilSolutions,_Matlab

Teboho Lekoala	Lesotho	DAR
Lionel Leydet	Luxembourg	ASTA
Simone Marx	Luxembourg	Administration of Technical Agricultural Services, Soil Department
Alick Mphembera	Malawi	ARET
Emmanuel Mbewe	Malawi	Soils and Plant Analytical Research Laboratory
Moses Munthali	Malawi	Chitedze Soils Laboratory
Wesley Feldmann	Malawi	Agrilab
Bella Anis	Malaysia	Asia (SEALNET)
Chuck Chuan Ng	Malaysia	XMUM
Faustina Sangok	Malaysia	Chemistry Division, Sarawak Tropical Peat Research Institute
Muhammad Izzat Ilmin	Malaysia	Laboratory Services Division, Doa, Malaysia
Teen Chin	Malaysia	ALS Technichem (M) Sdn Bhd
Souleymane Dambe	Mali	LPCM/LSEP
Cheikh Ahmed El Moctar	Mauritania	Pédologie et Fertilisation
Blanca Azucena García Santana	Mexico	Laboratorio Guzman
Aarón Jarquín Sánchez	Mexico	BioGeoQuímica
Alejandrina Ruíz- Bello	Mexico	Lab Física
Armando Guerrero- Peña	Mexico	LASPA
Claudia Moreno	Mexico	Fertilidad de Suelos y Química Ambiental
Eloy Camacho	Mexico	Laboratorio de Suelos, Fypa
Eva Isabel Estrada Martinez	Mexico	UNIFRUT
Hilda Rivas	Mexico	LASA
Jorge Etchevers	Mexico	fertilidad de suelos y quimica ambiental
José Manuel Cena Velázquez	Mexico	LabSueP-FCA
José Víctor Tamariz Flores	Mexico	Lab de Suelo, Agua y Planta de Centro de Investigación en Ciencias Agrícolas de la Benemérita Universidad Autónoma de Puebla
Juliana Padilla	Mexico	Fertilidad de Suelos y Química Ambiental
Mariela Deyta	Mexico	Laboratorio, Fypa
Octavio Arellano Almanza	Mexico	Laboratorio de Analisis de Suelo, Agus y Plantas, Tecnologico Nacional de Mexico-Roque

Rosa Martinez	Mexico	Laboratorio de Suelo, Agua y Planta del Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias. Campo Experimental Tecomán
Sandra Rocha	Mexico	LABSAP
Serghei Corcimaru	Moldova	The Institute of Microbiology and Biotechnology
Altantuya Ganbold	Mongolia	Institute of Plant and Agricultural Science (IPAS), Soil-AgroChemistry Laboratory
Khishigjargal Delgersaikhan	Mongolia	IPAS, Soil-Agrochemistry Laboratory
Munkhbat Batjargal	Mongolia	IPAS, Soil-Agrochemistry Laboratory
Nyamdavaal	Mongolia	Geopedology
Zandraagombo Dovchin	Mongolia	IPAS, Soil-AgroChemistry Laboratory
Zoljargal Khavtgai	Mongolia	Soil Laboratory, Institute of Geography and Geoecology
Abdelmjid Zouahri	Morocco	INRA Laboratory
Abdelmonim Elkanit	Morocco	OCP
	Mozambique	Laboratorio Regional de Analises de Solos e Plantas
Oscar Chichongue	Mozambique	IIAM, Laboratorio de Solos, Planta e Agua
Aung Kyaw Thu	Myanmar	Irrigation Water Quality Analysis Laboratory
Cho Mar Htwe	Myanmar	Department of Agriculture, Land Use Laboratory, Mandalay
Ni Tint	Myanmar	Soil and Plant Analysis Laboratory
Bradley Watkins	N/A	N/A
Ella Shiningaymwe	Namibia	Agricultural Laboratory
Kamal Sah	Nepal	National Soil Science Research Center
Fenny Van Egmond	Netherlands (Kingdom of the)	Wageningen Environmental Research
Martine Van Der Ploeg	Netherlands (Kingdom of the)	Soil Hydrophysics Laboratory, Wageningen
Paolo Di Lonardo	Netherlands (Kingdom of the)	Soil Biology WUR
Petra Van Vliet	Netherlands (Kingdom of the)	Eurofins Agro
Leonardo	Nicaragua	LABSA

Pedro Muñoz	Nicaragua	Laboratorio de Suelos y Agua, Comandante Fidel Castro Ruz
Abdourahaman Elh Moudi Moustapha	Niger	LASEVE
Amadou Illo	Niger	Quali-Control-Lab (QCL)
Hashim Yakasai	Nigeria	Centre for Dry Land Agriculture, Bayero University, Kano, Nigeria
Ibitoye Abel	Nigeria	Soil Chemistry Laboratory
Joseph Uponi	Nigeria	Analytical Service Laboratory IITA IBADAN
Mary Odukoya	Nigeria	Unilag Geochemistry Laboratory
Koleola Abidemi	Nigeria	Soil Science Laboratories, FUT Minna, Nigeria
Nokia Francis Chibueze Opara	Nigeria	Federal College of Land Resources Technology, Owen
Suleiman Garba	Nigeria	Phosphorus
Surajo M. Usaini Rimi	Nigeria	National Soil Testing Laboratory Complex, Kaduna
Williams Egbe	Nigeria	National Soil and Fertilizer Laboratory, Kaduna.
Hamood Al-Hashmi	Oman	Directorate General of Agriculture and Livestock Research
Abdul Jabbar	Pakistan	FAC Sheikhpura Laboratory
Babar Hussain	Pakistan	State Key Laboratory of Geohazard Prevention and Geoenvironment Protection, Chengdu University of Technology
Muhammad Irshad	Pakistan	Fauji Fertilizer Company (FFC)
Muhammad Faheem Shahid	Pakistan	FFC Soil & Water Testing Laboratory
Munir Zia	Pakistan	FFC
Raza Khan	Pakistan	SPNP, LRRI
Higinio Moreno Resquin	Paraguay	Suelo
Patricia Rojas Nerhot	Paraguay	FIA-UNE
Giuliana Shelly Lizana Flores	Peru	Microbiologia de Suelos
Juan Miguel Guerrero Lázaro	Peru	Laboratorio de Análisis de Suelos y Foliares
Aileene Millare	Philippines	Department of Agriculture, RFO-1-Regional Soils Laboratory
Annie Espiritu	Philippines	PhilRice, Agronomy Soils and Plant Physiology Laboratory
Babylou Magdaug	Philippines	Regional Soils Laboratory 6
Carleen Calimpon	Philippines	Regional Soils Laboratory
Elly Paul Tomas	Philippines	DA RFO 12 Regional Soils Laboratory

Florencio Mahinay	Philippines	Biophysical Laboratory Science Complex
Francis Rubianes	Philippines	Soils Laboratory, IRRI
Gerame Calapre	Philippines	Department of Agriculture RFO VII, Regional Soils Laboratory
Gina Nilo	Philippines	BSWM, Philippines Laboratory Services Division
Jhon Abrien Soliza	Philippines	SRA Soils Laboratory, LGAREC
Jobino De Dios	Philippines	PhilRice Soil Laboratory
Maria Kristina Ventura	Philippines	Private
Marife Rebalde	Philippines	Regional Soils Laboratory-7
Mary Elizabeth Banda	Philippines	REGIONAL SOILS LABORATORY DA RFO5
Olivyn Angeles	Philippines	IRRI Soil Research Laboratory
Rhodielyn Bacsarpa	Philippines	Regional Soils Laboratory - DA RFO 13
Rikko Jeremy Pedroza	Philippines	Department of Agriculture, Regional Soils Laboratory 9, Zamboanga Peninsula
Rosalie Laxamana	Philippines	Regional Soils Laboratory, Department of Agriculture RFO III
Nelsie Grace E. Gela	Philippines	Agro-Based Laboratory
Veronica Migo	Philippines	Environment and Bioprocess Engineering Lab (E3)
Monika Chmielewska	Poland	Laboratory of Biogeochemistry and Environmental Protection
Carmo Horta	Portugal	Lab-Solos/ESACB (Polytechnic Institute of Castelo Branco, School of Agriculture, Portugal)
João Coutinho	Portugal	Lab Solos, UTAD
Margarida Arrobas	Portugal	LaSP PT
Raquel Mano	Portugal	Laboratorio Quimico Agricola Rebelo da Silva (INIAV/SAFSV/LQARS)
Biljana Jordanoska Shishkoska	Republic Of North Macedonia	Scientific Institute of Tobacco, Laboratory for quality control of soil, water, fertilizers, and plant material
Hristina Poposka	Republic Of North Macedonia	Laboratory for Soil Testing, Fertilizers and Plants
Mihail Dumitru	Romania	Soil pollution
Denis Frolov	Russian Federation	Lomonosov Moscow State University
Elena Shamrikova	Russian Federation	Ecoanalytical Laboratory
Natalya Poroshina	Russian Federation	Laboratory of Technogenic Landscape Biogeochemistry

Elena Pivovarova	Russian Federation	NEOCHEM
Julia Sotnikova	Russian Federation	Soil Ecological Laboratory of RUDN University
Sylvere Sirikare N.	Rwanda	Analytical Laboratory for Soil and Plant
Aissatou Diouf	Senegal	ISRA
Diène Diégane Thiaré	Senegal	Photochemistry and Analysis Laboratory
Hanane Aroui	Senegal	IRD
Marie Pierre Tine	Senegal	LAMA DAKAR
Djicknack Dione	Senegal	Gamma Laboratory in the Institute of Applied Nuclear Technologies (ITNA)
Maja Manojlovic	Serbia	Laboratory for the Analysis of Soil, Fertilizers and Plant Material
Alie Kamara	Sierra Leone	NUQCL
Milan Kališ	Slovakia	Soil Science and Conservation Research Institute
Manja Potočnik	Slovenia	Agricultural Institute of Slovenia
Špela Velikonja Bolta	Slovenia	Agricultural institute of Slovenia
Merald Ajo	Solomon Islands	Solomon Islands National University, Faculty of Agriculture, Forestry, Environment & Fisheries
Abdirahman Ibrahim Mohamed	Somalia	Somali Agricultural and Livestock Institute development
Khalid Omar Ali	Somalia	AGRILABSOM
Adam Gudo	South Sudan	College of Engineering, University of Juba
José Matías Peñas Castejón	Spain	Universidad de Murcia
Marta García Acosta	Spain	GEDYSA
Sara Aparicio	Spain	Edafolab
Diego Baragaño	Spain	University of Oviedo
Fulgencio Contreras López	Spain	IMIDA
Jorge Battle-Sales	Spain	INSAS
Renuka Silva	Sri Lanka	Central Soil and Fertilizer Testing Laboratory
Varuna Madhusanka	Sri Lanka	CIC Soil, Plant & Water Analytical Laboratory
Wajira Balasooriya	Sri Lanka	ALGALAB Algae Research Unit
Kwesi Goddard	St. Lucia	NADF
Nuha Khamis	Sudan	Soil Analysis Laboratories Unit (SALU)
Riham Zahalan	Syrian Arab Republic	Chair of NENA Lab Network
Khaled Haider	Syrian Arab Republic	Damascus

Manhal Alzoubi	Syrian Arab Republic	Damascus
Solaf Hallwm	Syrian Arab Republic	Lattakia Laboratory
Jacob Lisuma	Tanzania	Soil and Water
Kobusinge Aloys Nyabwisho	Tanzania	TARI Mlingano Soil Laboratory
Sukunya Yampracha	Thailand	Soil Science Laboratory KMITL
Aunthicha Phommuangkuk	Thailand	Soil Chemistry and Fertility Laboratory
Chanida Charanworapan	Thailand	Office of Science for Land Development
Hutthaya Khongsuk	Thailand	Soil analysis group in Land Development Office Regional 1
Juthamard Kaiphoem	Thailand	Soil Technical Service Group
Jutharat Yimchaluay	Thailand	Office of Science for Land Development
Kittisak Prachumtong	Thailand	Land Development Regional Office 12
Lamai Srisawat	Thailand	Soil Environment Research Laboratory
Nopmanee Suvannang	Thailand	Land Development Department
Onanong Chomsiri	Thailand	Office of Science for Land Development, LDD
Oomara Klahan	Thailand	Soil Analysis Group region 4
Owat Yutthum	Thailand	Soil Analysis Group
Pawarisa Janudom	Thailand	Soil Analysis Group 1
Piyatida Makagul	Thailand	LDDR_06
„	Thailand	Land Development Regional Office 3
Sanlaya	Thailand	SRRC
Siriwan Dangpukdee	Thailand	Soil laboratory of LDD Regional Office-6.
Tana	Thailand	Soil Analysis Laboratory R.7
Thailand Ldd2	Thailand	Land Development Department
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