

GLOSOLAN-II/18/Report



Food and Agriculture
Organization of the
United Nations



Report of the Second Meeting of the Global Soil Laboratory Network (GLOSOLAN)

Rome, Italy, 28-30 November 2018

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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1. Introduction

The second meeting of the Global Soil Laboratory Network (GLOSOLAN) was organized by the Global Soil Partnership (GSP) and held at FAO Headquarters in Rome, Italy on 28-30 November 2018. The meeting lasted three full days (see agenda in Annex I) and was attended by 54 participants from 34 countries (see list of participants in Annex II). Mr. Eduardo Mansur (CBL Director, FAO) and Ms. Nopmanee Suvannang (GLOSOLAN Chair) opened the meeting. They highlighted that evidence-based decisions made using harmonized and reliable data and information are critical to the achievement of sustainable soil management and food security and nutrition, a key objective in FAO's mandate. In the framework of coordinated actions to harmonize and standardize soil analytical data and soil analysis methodologies globally, GLOSOLAN was launched on November 1, 2017.

The potential of GLOSOLAN is substantial and goes beyond laboratory boundaries. Data generated from harmonized soil laboratory methods and procedures will assist countries with (1) improving or establishing a national monitoring system, (2) reporting on the achievement of the Sustainable Development Goals and other international programmes, (3) supporting decision making at both field and policy levels, (5) contributing to the development of international standards and indicators, and (6) interpreting soil resources for best use and management. GLOSOLAN will also support the establishment of National Soil Information Systems that can feed the planned Global Soil Information System (GLOSIS), another GSP priority.

Since the establishment of GLOSOLAN, about 200 laboratories worldwide have joined the initiative, and the Regional Soil Laboratory Networks (RESOLANs) for Asia (SEALNET) and Latin America (LATSOLAN) have been established. A first-ever global survey was launched to identify laboratory priorities and to assess regional differences in procedures and methodologies. The survey results shaped the goals of the second meeting: (1) to consolidate the structural organization of the network, (2) to discuss the soil laboratory data and information policy, (3) to agree on the execution of regional and global ring tests, and (4) to discuss the development of global and regional Standard Operational Procedures and guidelines.

Ms. Lucrezia Caon (as GSP GLOSOLAN coordinator) presented the agenda of the meeting and stressed the importance of developing a long-term work plan with clearly defined activity areas. Table 1 lists pending and eventual GLOSOLAN topic areas.

Table 1. Pending and eventual activities in GLOSOLAN

Activity Topic	Pending/Eventual
Objectives/impacts/indicators	Pending
Terminology	Pending
Data policy	Pending
Standard Operational Procedures (SOPs), including new technologies such as spectroscopy	Pending
Harmonization	Pending
Proficiency testing	Pending
Regional Soil Laboratory Networks (RESOLANs)	Pending

Interpretation and provision of recommendations	Eventual
Capacity building (e.g. trainings, exchange programmes, twinning, etc.)	Pending
Communication and information material	Ongoing
Certification	Eventual
Accreditation	Eventual
Creation of National Soil Laboratory Networks	Eventual
Harmonization of soil testing kits	Eventual

2. Work performed by GLOSOLAN since its launch

Ms. Suvannang informed participants on the main achievements of GLOSOLAN since its establishment:

- **About 200 laboratories registered in GLOSOLAN.** Registration is always open. Interested laboratories can register by sending an email to GSP-Secretariat@fao.org or to Lucrezia.caon@fao.org.
- The **Regional Soil Laboratory Networks** (RESOLANs) for Asia (SEALNET) and Latin America (LATSOLAN) were launched in November 2017 and March 2018, respectively. Discussions were undertaken to launch the RESOLANs for Europe, Eurasia and the Pacific regions.
- A concept note for writing a **Best Practice Manual** was submitted to and presented at the 6th GSP Plenary Assembly in June 2018.
- With the support of WEPAL, development began on a document about preparing soil samples for **proficiency testing**.
- Information on how to exchange soil samples for proficiency testing was presented at the 6th GSP Plenary Assembly in June 2018.
- During February-March 2018, GSP Secretariat conducted the first **GLOSOLAN online survey**. Results were made accessible; there were 111 submissions. Survey outcomes were viewed more than 700 times, and more than 300 laboratory managers provided follow-up responses. Key survey findings included:
 - o Most of the responding laboratories were not yet affiliated with any laboratory network or were affiliated only with a national network. As a result, international inter-comparability of data is currently difficult.
 - o The formal education of laboratory staff was highly variable. Therefore, there is a strong need for capacity building.
 - o Laboratories had a large percentage of temporary staff and were overall lacking in regular training programmes for their staff. Therefore, there is a strong need for establishing training plans and programmes.
 - o Laboratory infrastructure was not a limiting factor in obtaining high-quality data.

- Standard Operational Procedures (SOPs) were generally written in the local language but were highly variable. As a result, comparing global data results is difficult.
- Although quality control and quality assurance systems were established, the frequency of the control was low and laboratory certification and accreditation were not well established. As a result, guaranteeing the quality of the results is difficult.

Recommended actions included:

- Stimulating the development of SOPs within RESOLANs for key soil parameters;
- Building the capacity of laboratory staff by developing ebooks, videos and training programmes, which would be regularly updated;
- Assisting laboratories in preparing process control samples for internal quality control and to encourage the regular use of such samples;
- Organizing annual ring tests at regional and global levels to help laboratories assess their performance relative to that of other laboratories;
- Establishing one or two soil reference laboratories in each region;
- Setting up an online communication platform to facilitate communication between laboratories at the national, regional and global; and
- Developing and promoting the use of a certified quality assurance system for soil laboratories.

In conclusion, Ms. Suvannang reminded participants that these findings and recommendations came from the analysis of data and information provided by only 111 laboratory managers. Thus, the global scenario might be worse or better than the one presented. The decision was made to conduct additional and more detailed surveys.

3. GLOSOLAN's objectives, potential impacts and indicators of performance

To develop the GLOSOLAN work plan, the networks' objectives, potential impacts and indicators of performance were reviewed. This exercise ultimately helped (1) GLOSOLAN to establish Regional as well as National Soil Laboratory Networks, (2) individual laboratories to justify their commitment and investment in implementing GLOSOLAN's activities, and (3) the GSP Secretariat and the laboratories in GLOSOLAN to mobilize financial and other resources to implement GLOSOLAN's activities.

GLOSOLAN decided that:

- The **purpose** of GLOSOLAN is to improve the quality of soil laboratory data to support decision making at field and policy levels, in support of the overarching goals of eradicating hunger by achieving food security and improving nutrition, and ensuring environmental quality. In this context, the work of GLOSOLAN is connected to the GSP Pillars of Action.
- The **objectives** of the network are:
 1. To strengthen the performance of laboratories through use of standardized methods and protocols.
 2. To harmonize soil analysis methods so that soil information would be comparable and interpretable across laboratories, countries and regions.
 3. To provide a certification for technical competencies in laboratory analysis.

- The foreseen **impacts** of the network are:
 - o To support decision making at field and policy levels;
 - o To support countries in reporting on the Sustainable Development Goals and on other international commitments;
 - o To contribute to the development of international standards and indicators;
 - o To contribute to the establishment of the Global Soil Information System (GLOSIS);
 - o To contribute to the development of harmonized methods for the assessment and monitoring of degraded lands and/or lands affected by climate change and other threats, as identified in the Status of the World Soil Resources report;
 - o To improve the connection between soil chemistry, physics and biology;
 - o To contribute to and improve soil classification and description (in this regard, GLOSOLAN should work closer to the other components of Pillar 5);
 - o To assist companies manufacturing laboratory equipment in improving their products (and so also potentially open the path for new investments in the network);
 - o To expand the opportunities for technical and scientific cooperation;
 - o To strengthen the capability of extension services;
 - o To identify research needs; and
 - o To increase investments in research.

- The performance of the network will be assessed using the following **indicators**:
 - o Number of laboratories joining GLOSOLAN;
 - o Number of countries joining GLOSOLAN;
 - o Number of SOPs developed, adopted and implemented;
 - o Number of laboratories adopting the methods developed under GLOSOLAN;
 - o Number of analyses conducted following the SOPs developed by GLOSOLAN;
 - o Number of ring tests conducted;
 - o Number of laboratories participating in the ring test;
 - o The average number of outsiders as a result of the ring test;
 - o The coefficient of variation in the ring test;
 - o Number of laboratories trained on the preparation of reference material to use for internal quality control testing;
 - o Number of laboratories that get accredited or certified or that pass the ring test;
 - o Number of laboratories implementing Good Laboratory Practices (GLPs);
 - o Number of experts sent to the laboratory to check the data analysis (audit process);
 - o Number of National Soil Laboratory Networks established;
 - o Number of training programmes conducted at national and international levels;
 - o Number of staff that are trained;
 - o Number of laboratory facilities upgraded or enhanced to assess basic soil parameters as identified by GLOSOLAN (including inventories of equipment upgraded or enhanced);
 - o Number of laboratories increasing the number of physical, chemical and biological parameters they analyze;
 - o Extent of land (ha) monitored and assessed using harmonized soil parameters and methods;
 - o Number of participants in the upcoming GLOSOLAN surveys;
 - o Number of ebooks and videos produced by GLOSOLAN (outreach data will help in the analysis); and
 - o Number of SOPs implemented as accredited methods (to the extent GLOSOLAN provides for accreditation and certification).

Ultimately, GLOSOLAN will contribute to the assessment, monitoring and sustainable management of soil resources.

4. Regional Soil Laboratory Networks (RESOLANs)

Ms. Caon reminded participants that GLOSOLAN operates through Regional Soil Laboratory Networks (RESOLANs), which rely on the work of National Reference Laboratories. National Reference Laboratories are appointed by the national focal points to the GSP according to a list of suggested criteria. A National Reference Laboratory should preferably:

- Contain qualified, trained, and experienced staff,
- Contain appropriately calibrated and maintained equipment,
- Regularly apply adequate quality assurance and quality control procedures,
- Use appropriate (sub-)sampling practices,
- Contain sound testing and/or inspection procedures,
- Accurately record and report obtained data,
- Maintain an appropriate testing environment,
- Apply standards for safety and disposal of hazardous wastes, and
- If possible, be accredited or certified according to ISO 17025.

National Reference Laboratories are tasked to transfer the knowledge and competencies acquired in GLOSOLAN to other national laboratories by establishing National Soil Laboratory Networks. It was the decision of the 2nd GLOSOLAN meeting to provide laboratories in GLOSOLAN, and especially National Reference Laboratories, with a letter presenting GLOSOLAN, encouraging laboratories to join the network, and recognizing the role of National Reference Laboratories in establishing the National Soil Laboratory Network.

Ms. Caon briefed participants on the establishment of RESOLANs. Besides launching the RESOLANs for Asia (SEALNET) and for Latin America (LATSOLAN) in November 2017 and March 2018, respectively, the GSP Secretariat has working towards establishment of RESOLANs in Europe, Eurasia and the Pacific. The regional Chairs for Pillar 5 in Europe and Eurasia proposed that they work together under the same RESOLAN. A pre-meeting in Moldova was scheduled but did not happen, and the launch of this RESOLAN was postponed. In the Pacific, the idea to resurrect the South Pacific Agricultural Chemistry Laboratory Network (SPACNET) was considered and the Asia Pacific Network of Science and Technology Centres, Australasian Soil & Plant Analysis Council (ASPAC) agreed to participate in RESOLAN-Pacific. Note that each region names its own RESOLAN at the kick-off meeting of the network.

The launch of the RESOLAN for Africa and NENA was not discussed in 2018 due to the lack of financial resources to support those networks. The GSP Secretariat is looking for inputs from the United States and Canada on the possibility of launching a RESOLAN for North America or on ways to involve these countries in the activities of GLOSOLAN. In conclusion, the GSP Secretariat is pursuing the launch of all RESOLANs in 2019.

4.1 South-East Asia Soil Laboratory Network (SEALNET)

Ms. Gina Nilo, Vice-Chair for SEALNET, reported on the work performed by the network since its establishment in November 2017 (see Table 2).

Table 2. SEALNET work plan and status of implementation for 2017-2018

SEALNET work plan for 2017-2018	Status
Write regional guidelines for implementing and maintaining Good Laboratory Practices and quality management in soil laboratories	Proposal to integrate the guidelines into the Best Practice Manual by GLOSOLAN
Improve laboratory precision by implementing internal quality assessments using process control samples	Internal QC was discussed at the 2 nd SEALNET meeting
Improve laboratory accuracy by implementing an external quality assessment (ring test)	Executed
Develop Standard Operational Procedures (SOPs) for soil pH, organic C, exchangeable potassium and available phosphorus	Executed

Please see section 5 for more details on the SOPs discussed in SEALNET.

To open the path for SEALNET (and GLOSOLAN) to interpret data, each laboratory provided information on their rating scale for pH in water, organic carbon (OC), available phosphorus and exchangeable potassium. The 3rd SEALNET meeting is scheduled in Manila, The Philippines, at the end of October/beginning of November 2019.

Ms. Nilo also reported SEALNET's opinion of GLOSOLAN and recalled SEALNET inputs to the definition of GLOSOLAN's goals, objectives, impacts and indicators of performance. The inputs were ultimately integrated into Section 3. The SOPs developed by SEALNET and the results of its first regional ring test are discussed in Sections 5 and 7, respectively.

4.2 Red Latino Americana de Laboratorios de Suelos (LATSOLAN)

Mr. Rusbel Jaramillo represented LATSOLAN on behalf of Ms. Floria Bertsch, LATSOLAN Chair, and reported on the work performed by the network since its establishment in March 2018 (see Table 3).

Table 3. LATSOLAN work plan and status of implementation for 2017-2018

LATSOLAN work plan for 2017-2018	Status (% complete)
Establishment of the mission, function and responsibility of the Steering Committee and each of its members.	90%

Development of standard operating procedures (SOP) for soil pH, organic C, exchangeable potassium, calcium and magnesium.	100%
Organization of the 1st round of the Interlaboratory Comparison Test (ECI) of LATSOLAN	100%
Dissemination of the activities and integration of LATSOLAN in each of its member countries	95%
Preparation of an inventory of laboratories by country	70%
Designing of a permanent strategy to facilitate the sending of samples of proficiency testing	50%

The SOPs developed by LATSOLAN and the results of its first regional ring test are discussed in Sections 5 and 7, respectively.

In conclusion, Mr. Jaramillo informed participants that the 2nd LATSOLAN meeting will take place in March 2019 in Mexico. He also presented a series of activities to implement in 2019 (see Table 4).

Table 4. Proposed work plan for 2019

Proposed activities for 2019	Timeline
Follow-up to laboratories with problems	15 Feb
Execution of the 2nd round of the LATSOLAN Ring Test (ECI)	19 Mar
Development of a standard operating procedure (SOP) for soil samples in phosphorus, sodium and CEC	31 Jul
Adoption of the SOPs in each participating country	30 Dec
Search for a country of reference for the preparation of PT samples	30 Aug

4.3 RESOLAN Europe and Eurasia

Ms. Olga Yakimenko shared previous experiences on the harmonization of soil laboratory methods and results in the Eurasian region. A note was made on the regional challenges related to the implementation of GLOSOLAN activities. The challenges include the development and implementation of harmonized Standard Operational Procedures (SOPs), the transportation of soil samples for proficiency testing, and the availability of financial resources to implement the proposed activities. The suggestion was made to talk to the Ministry of Agriculture of each country and develop informal bonuses, such as certificates, to motivate laboratories to participate in GLOSOLAN.

Despite the proposal by the Chairs for Pillar 5 for Europe and Eurasia to get the two regions to work together, participants expressed conflicting opinions. Ultimately, it was decided to discuss this issue at the 6th meeting of the European Soil Partnership.

4.4 RESOLAN-Pacific

Mr. Rob De Hays, Pillar 5 Chair for the Pacific region, informed participants on the SPACNET and ASPAC networks. SPACNET, inactive since 2008, was a network funded by the New Zealand Agency for International Development (NZAID) through Landcare Research NZ Ltd., who provided consultancy services for the network. Laboratories in Fiji, Papua New Guinea, Tonga, Samoa and New Zealand were members of SPACNET.

ASPAC is a nonprofit international organization funded by membership fees and overseen by an executive committee of jurisdictional representatives. Members of ASPAC are companies, individuals and students in Australia, New Zealand and Asia. Through its activities, ASPAC promotes the adoption of appropriate field sampling protocols, uniform and reliable soil and plant analytical methods, sound interpretation guidelines, and reliable and appropriate advice to clients. To these ends, the network:

1. Conducts soil and plant inter-laboratory proficiency programs (global proficiency) allowing laboratories to get laboratory certification,
2. Offers an annual study travel award to attend conferences,
3. Publishes newsletters (typically quarterly) for members,
4. Sponsors workshops and conferences to facilitate the sharing of knowledge and expertise, and
5. Promotes discussion and advice through the “Reddit” forum.

Options for establishing RESOLAN-Pacific are:

1. South Pacific laboratories join ASPAC. There would be collaboration between governmental and commercial laboratories with no hierarchical structure.
2. South Pacific laboratories reform SPACNET and only use ASPAC ILPP for QA/QC.

The steps proposed to establish the network are as follows:

1. Contact all former SPACNET laboratories to gauge interest (engage New Zealand).
2. Find a champion to handle the administration and secretariat of the network.
3. Meet to establish the network’s governance and structure.
4. Develop an implementation plan and budgets.
5. Find sources of funding.

Because not all countries in the region have a soil laboratory, a note was made on the possibility of linking GLOSOLAN to the [Soil Doctors Programme](#) and promoting soil testing by implementing and improving soil testing kits.

4.5. RESOLAN-Africa

Participants expressed opinions and suggestions on the establishment of RESOLAN-Africa. In conclusion:

1. Because farmers need soil data immediately, the development of reliable mobile soil testing kits and the use of spectrometry are recommended.
2. The region experiences problems with the procurement system.

3. South Africa is suitable for hosting the first RESOLAN-Africa meeting.
4. Linking RESOLAN-Africa with the AfriSoil project should be considered.

Mr. Michael Watts from the British Geological Survey (BGS) and Ms. Marion Stoldt from the Physikalisch-Technische Bundesanstalt (PTB) informed the audience that their institutes are already implementing activities in some African countries. A proposal was made that the BGS and PTB coordinate their efforts for GLOSOLAN. Information on the laboratories trained and/or under training, as well as equipped by, the BGS and PTB will be shared with the GSP Secretariat. The GSP Secretariat will contact its national focal points and eventually ask for a reconsideration on the nomination of their National Reference Laboratory. Thus, laboratories that already benefited from BGS and PTB programmes would have the chance to become National Reference Laboratories in GLOSOLAN.

4.6 RESOLAN-NENA

Near East and North African participants expressed opinions and suggestions on the establishment of RESOLAN-NENA. In conclusion:

1. Reference material and the budget to prepare it are needed.
2. Training on new laboratory equipment, reagent preparation and soil biology is needed.

4.7 RESOLAN-NORTH AMERICA

Although North America is poorly represented in GLOSOLAN, North American laboratories can play a key role in GLOSOLAN, especially by sharing knowledge and experience. Mr. Richard Ferguson from the Kellogg Soil Survey Laboratory, NSSC-NRCS-USDA, informed participants that NSSC-NRCS-USDA is available to share its data and standards with GLOSOLAN, as well as to make available reference soil materials from its collection. Any contributions to GLOSOLAN would be free. In conclusion, information was provided on the presence of a well-established but informal national network of laboratories in the USA under the umbrella of the National Cooperative Soil Survey; participant facilities voluntarily implement decisions by NSSC-NRCS-USDA, which helps promote harmonization of data.

5. Standard Operational Procedures (SOPs)

Mr. Liphard opened the session on Standard Operational Procedures by introducing the topic and the work of the International Organization for Standardization (ISO). Building on the assumption that different methods give different results, ISO develops and publishes international standards in a process involving many stakeholders with expertise in the respective topic areas. All ISO material can be downloaded from the ISO website for a fee. Experts and laboratories interested in joining ISO should ask their National Standardization Body (NSB) to register for ISO/TC 190/SC3 and get them nominated for the programme.

Next, SEALNET and LATSOLAN presented the SOPs they developed at the regional level. During the first meeting of both RESOLANs, laboratory managers compared the methods they used to measure a set of selected parameters and decided to work on the harmonization of the most frequently used methods. The parameters selected by SEALNET and LATSOLAN and the methods identified for harmonization are reported in Table 5.

Table 5. SOPs developed by SEALNET and LATSOLAN in 2018

Soil parameter	SOPs developed by SEALNET	SOPs developed by LATSOLAN
pH water	Ratio 1:2.5 Unit of measure: N/A	
Organic carbon	Walkley-Black Unit of measure: % C airdry	
Total organic carbon	-	Dry combustion Unit of measure: %C airdry
Exchangeable potassium	Ammonium acetate Unit of measure: mg/kg or Cmol(+)/kg airdry	-
Exchangeable K, Ca, and Mg	-	Ammonium acetate Unit of measure: Cmol(+)/kg airdry
Available phosphorous	Olsen Unit of measure: mg P/kg airdry	-
Total nitrogen	-	Dumas-Kjeldahl Unit of measure: %N airdry

SEALNET endorsed the SOPs it developed during its second meeting (19-23 November 2018, Bhopal, India). It proposed the development of regional SOPs in 2019 but agreed to wait for GLOSOLAN to decide how to harmonize regional activities at the global level. In 2019, if left to decide alone, SEALNET will work on the development of the SOPs for cation-exchange capacity (CEC), electrical conductivity (EC), available phosphorous using the Bray I and Bray II methods, and soil moisture content. After 2019, SEALNET would align to the GLOSOLAN work plan, which should include the development of SOPs for soil micro- and macronutrients, biology, texture and others.

The consensus of SEALNET was that SOPs should be prioritized according to the following considerations:

1. The harmonizing of basic soil parameters,
2. The results of the first GLOSOLAN survey,
3. Pressing international needs (e.g. map development), and
4. The needs of GSP Pillars 4 and 5 (e.g. soil classification and the establishment of the Global Soil Information System (GLOSIS)).

For prioritizing SOPs, SEALNET requested GLOSOLAN to make its decisions using a holistic approach that includes all the above considerations.

SEALNET remitted to GLOSOLAN the proposal on how to harmonize SOPs developed by different regions at the global level and asked GLOSOLAN to decide whether or not to pursue ISO standards for accrediting and certifying GLOSOLAN laboratories. If GLOSOLAN will not collaborate with ISO, then it should consider providing its own certification and accreditation systems. SEALNET requested GLOSOLAN to develop a format for SOP reporting and publishing.

LATSOLAN was able to meet only once since launch, and its SOPs are still in development. It suggested that GLOSOLAN review and harmonize regional SOPs and that individual laboratory performance be assessed

through proficiency testing: harmonized protocols should be issued with data on the performance of the analysis. An evaluation of the technical capacities of each laboratory is needed.

In 2019, if left to decide alone, LATSOLAN will work on the development of the SOPs for phosphorus by Olsen, sodium (Na) by ammonium acetate, and the cation-exchange capacity (CEC). Moreover, the network proposed that the SOPs for microelements and electrical conductivity (EC) should be developed in 2020.

5.1 Plenary discussion and decision making

The GSP Secretariat facilitated the discussion by posing some questions for participants to consider:

Question 1: Is GLOSOLAN going to develop its own SOPs? What would the collaboration with ISO be?

It was the decision of GLOSOLAN to:

1. Use the approach adopted by SEALNET and LATSOLAN: That the SOPs in use in countries worldwide be reviewed and harmonized at the global level.
2. Ensure that GLOSOLAN SOPs are consistent with those already published by ISO: That GLOSOLAN SOPs be reviewed by laboratories that are registered in GLOSOLAN but are members to ISO.
3. Validate GLOSOLAN SOPs through proficiency testing.
4. Establish a Technical Working Group to develop or review and to validate GLOSOLAN SOPs.
5. Identify a pool of experts in each region to supervise the implementation of Good Laboratory Practices (GLPs) and provide training.

Question 2: What SOPs are we going to develop and how will we prioritize them?

In order to answer this question, the GSP Secretariat presented a few options for consideration. SOPs could be selected and developed based on:

1. GSP priorities in terms of mapping: erosion, salinity and carbon sequestration potential
2. Data need for the Global Soil Information System (GLOSIS) and SoilSTAT: [PHYSICAL PARAMETERS] available water capacity, bulk density, texture, coarse fragment, [CHEMICAL PARAMETERS] electrical conductivity (EC), nitrogen, pH, potassium, and organic carbon
3. Results of the first GLOSOLAN survey (see Table 6)

Table 6. Results of the first GLOSOLAN survey in terms of most frequently measured soil parameters (number of laboratories performing the measurement vs. number of analyses)

Parameter	Number of laboratories	Parameter	Number of analyses
pH in H2O	88	Available P_ other	335 480
Electrical conductivity (EC)	83	Organic Matter	272 927
Total Nitrogen	81	pH in H2O	239 293
Texture analysis	80	pH in KCl	224 857
Organic Carbon	78	Exch. K - NH4O-Ac	221 608
Organic Matter	72	Exchangeable acidity	214 755
Micro elements	67	Organic Carbon	189 948
N-NO3 and N-NH4	63	Texture analysis	180 213
pH in KCl	61	Micro elements	174 230
Trace elements	60	Electrical conductivity (EC)	166 600

It was the decision of GLOSOLAN to find a compromise among the three options and so contribute to global initiatives while using the data obtained through the first GLOSOLAN survey. Table 7 presents the soil

parameters that will be given priority by GLOSOLAN and the number of SOPs the network will develop for each.

Table 7. Priority soil parameters in GLOSOLAN and number of SOPs to develop

Soil parameter	#SOP	Note
Sample preparation	1	
Moisture content	1	
Organic C	2	Walkley-Black (not in USA) Dry-combustion
Inorganic C	1	CaCO ₃ equivalent
Bulk density	1	
Texture and coarse fraction	2	Pipette method Hydrometer
pH in water, CaCl ₂ and KCl	1	TBC (SOP survey)
Electrical conductivity (EC)	2	Saturated paste TBC (SOP survey)
Total nitrogen	2	Kjeldahl Combustion
Available phosphorus	3	Olsen Bray I/II Mehlich III Ammonium lactate
CEC and exchangeable cations	2 or more	Ammonium acetate/chloride (2) Cobalt Hexamine and BaCl ₂ TBC (SOP survey)
Total trace and major elements	1	Total digestion method (aqua regia + HF)
Quasi-total trace and major elements	1	Partial digestion method (aqua regia)
Extractable micronutrients (Zn, Fe, Mn, Cu, B)	3	DTPA EDTA Mehlich III
Extractable micronutrients (B)	1	Hot water/CaCl ₂
Chloride	1	Mohr method
Sulfur	1	Barium chloride

The 2019-2028 work plan of GLOSOLAN for the development of the SOPs listed above is reported in Table 8.

Table 8. GLOSOLAN work plan on SOP development for 2019-2028

SOPs (on average 3 per year)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
sample pre-treatment inorganic C (CaCO ₃ equivalent) OC Walkley-Black OC dry combustion										
moisture content electrical conductivity (saturated paste + 1 depending on countries' survey inputs) pH in water, CaCl ₂ and KCl										
texture and coarse fraction (pipette method and hydrometer) bulk density										
total nitrogen Kjeldahl total nitrogen combustion available P Olsen and Bray I/II										
available P Mehlich III and ammonium lactate CEC and exchangeable cations by ammonium acetate										
CEC and exchangeable cations by chloride plus survey in the regions total trace and major elements by total digestion method										
quasi-total trace and major elements by partial digestion method extractable micronutrients (Zn, Fe, Mn, Cu, B) by DTPA, EDTA and Mehlich III										
extractable micronutrients (Zn, Fe, Mn, Cu, B) by Mehlich III extractable micronutrients (B) by hot water/CaCl ₂ Chloride by Mohr method										
sulfur by barium chloride etc. [to be defined]										

Question 3: Who will develop the SOPs and how is GLOSOLAN going to manage SOPs developed by RESOLANs?

GLOSOLAN foresees the harmonization of SOPs developed by RESOLANs as an issue only in 2018. Regional SOPs will be treated as national ones in the process of developing global standards. In this regard, the approach to use for developing GLOSOLAN SOPs is the following:

1. RESOLANs will collect the SOPs used by registered laboratories in GLOSOLAN.
2. The Technical Working Group for GLOSOLAN will (i) analyze the SOPs collected and (ii) formulate the GLOSOLAN SOPs and modify them according to proficiency testing results when necessary.
3. Regional pools of experts will supervise and provide training for the implementation of the SOPs.

GLOSOLAN SOPs will be freely available and under the copyright of FAO-GLOSOLAN. Authors will be acknowledged in internal documents and on official GLOSOLAN reports. Information on the authors of each SOP was considered necessary to address eventual issues related to the use of the SOPs.

An SOP template will be prepared by the GSP Secretariat with the support of the GLOSOLAN Technical Working Group. In the public-facing document, the following information will be included:

- Prepared by GLOSOLAN Technical Working Group
- Reviewed on XX/XX/XXXX
- Approved on XX/XX/XXXX at the X GLOSOLAN Plenary Meeting

Question 4: For those laboratories that are not in the position of implementing GLOSOLAN SOPs, is GLOSOLAN going to work on the harmonization of their data results?

It was the decision of GLOSOLAN to provide a definition of “harmonization” and to include the definition in GLOSOLAN terminology. To harmonize historical databases and allow comparability between data produced using different methods (for those laboratories unable to implement GLOSOLAN’s SOPs), GLOSOLAN will develop conversion factors:

1. WEPAL and ASPAC will explore the possibility of having their databases analyzed (perhaps by a student).
2. When historical databases are not available, national institutes could provide their own conversion factors by comparing the data obtained using GLOSOLAN SOPs with that using their official methods.

Question 5: Will GLOSOLAN work on new technologies? If so, how?

It was the proposal of GLOSOLAN to launch a survey to identify laboratories working on spectroscopy and to establish a dedicated working group to develop an SOP for MIR and NIR. Ultimately, spectroscopy could become a SOP for different soil parameters.

In conclusion, GLOSOLAN decided that a definition for the term SOP should be provided in the GLOSOLAN terminology.

6. Best Practice Manual

During its first meeting (2017), GLOSOLAN proposed a Best Practice Manual (BPM), and a concept note was submitted to the [6th GSP Plenary Assembly](#). GLOSOLAN considered the BPM important due to the immense variability in methods, equipment, and quality control. The BPM would be a compendium of volumes for eventual publication; the number of volumes could increase depending on future needs. Flexibility may be needed to allow regional differences to be highlighted or summarized in annexes or different volumes. The 6th GSP Plenary Assembly endorsed the concept note and tasked GLOSOLAN to produce such a document.

During its second meeting (2018), GLOSOLAN proposed a table of contents for the manual (shown below). Note that GLOSOLAN included topics not directly related to laboratory analysis but that still pertain to data quality; for these topics, a reference to the responsible Pillar (or working group) was made.

Manual 1: Site characterization, sampling and sample pre-treatment

Volume 1.1 How to collect a soil sample for soil nutrient assessment: site selection and sampling

Information on equipment, sample transport and storage, and moisture conditions should be included. The writing of Volume 1.1 was assigned to Pillar 4.

Volume 1.2 Generic characterization of sites and samples

The writing of Volume 1.2 was assigned to Pillar 4.

Volume 1.3 Soil sample pre-treatment

Manual 2: Soil chemical analysis

SOPs developed by GLOSOLAN will be presented in here. For each method, information on its relevance/use, principle of measurement, apparatus, reagents, procedure, calculations, report and reference should be provided.

Volume 2.1 Organic carbon

Volume 2.2 pH

Volume 2.3 Available phosphorous

Volume 2.4 Available potassium

Volume 2.5 Total nitrogen

Volume 2.6 Exchangeable cations and CEC

Volume 2.7 Extractable microelements

Volume 2.8 Trace and major element analyses

Volume 2.9 Calcium carbonate content

Volume 2.10 Gypsum

Volume 2.11 Electrical conductivity and total soluble salt content

Volume 2.12 Soluble sulfate and chloride analysis

Volume 2.13 Special analysis for peats, mineral and organic soils, agriculture and forest
(The writing of Volume 2.12 should be further discussed.)

Manual 3: Soil physical analysis

SOPs developed by GLOSOLAN will be presented in here. For each method, information on its relevance/use, principle of measurement, apparatus, reagents, procedure, calculations, report and reference should be provided.

Volume 3.1 Bulk density

Volume 3.2 Coarse fragments

Volume 3.3 Particle-size distribution

Volume 3.4 Water retention curve

Volume 3.5 Porosity

(The writing of Volume 3.5 should be further discussed.)

Volume 3.6 Hydraulic conductivity function

Volume 3.7 Aggregate stability

Volume 3.8 Moisture content

Manual 4: Soil biological analysis

SOPs developed by GLOSOLAN will be presented in here. For each method, information on its relevance/use, principle of measurement, apparatus, reagents, procedure, calculations, report and reference should be provided.

Volume 4.1 Microbial biomass

Volume 4.2 Soil Respiration

Volume 4.3 Enzyme activity

Volume 4.4 Microbial identification

Manual 5: Data quality, management and validation

Volume 5.1 Data quality requirements

Volume 5.2 Data management and validation

Manual 6: Harmonization and correlation factors

Manual 7: Data processing: soil functions, classification and statistics

Manual 7 should be produced within Pillar 5 but not by GLOSOLAN.

Manual 8: Soil contaminants

Manual 8 will be produced by working group #2 on soil pollution. The GSP contact person is Ms. Natalia Rodriguez (Natalia.RodriguezEugenio@fao.org). GLOSOLAN will contribute by reviewing drafts and final documents.

Manual 9: Standards or maximum allowed levels of nutrients – interpretation and recommendations

The writing of Manual 9 should be further discussed.

Manual 10: Security in the laboratory

Manual 11: Good Laboratory Practices

In conclusion, GLOSOLAN decided to abolish the Regional Reference Centers (the establishment of these centers was proposed in the concept note submitted to the 6th GSP Plenary Assembly). The budget to write the Best Practice Manual should be revised as per the decisions of the 2nd GLOSOLAN meeting.

7. Proficiency test

The session on the proficiency test (PT) was opened by Ms. Winnie van Vark from the Wageningen Evaluating Programmes for Analytical Laboratories (WEPAL). Ms. van Vark introduced participants to PT preparation and execution, and to the WEPAL programme. WEPAL has been a PT provider since 1956 and has programmes on soil, plant, sediments, organic waste and biomass. For the purpose of guaranteeing the homogeneity of sample material, it started to work on International Soil Analytical Exchange (ISE) in 1988 and is accredited according to ISO 17043. WEPAL samples are prepared by drying the soil at 40°C, crushing (< 5-mm) and grinding (< 0.5-mm) it, bulk dividing it over buckets (homogeneity check), and barcoding it. WEPAL equipment is specially developed for and suitable to preparation of PT samples, guaranteeing a variation in the batch < 2 % and the possibility of producing large numbers of identical samples (> 10.000). It was noted that not all materials are suitable for PT (variation > 3.5 %) and that because different particles (i.e. sand and organic matter) have the tendency to separate it is difficult to mix them (for example, using just a cement mixer is not sufficient).

In 2017, WEPAL was active in 85 countries. Laboratories usually offer two options or modes for participating in the WEPAL programme:

1. PT Learning Mode: Samples with known concentrations are provided by WEPAL to interested laboratories to build their capacity (set up of analytical methods).
2. PT Performance Mode: Unknown samples are provided by WEPAL to interested laboratories so that they can proof their performance.

Looking at the potential collaboration of WEPAL with GLOSOLAN, Ms. van Vark argued that:

1. If the PT Learning Mode is chosen, the regional preparation and distribution of PT samples should be discussed. Although it is easier to prepare and locally distribute soil samples, the risks related to the uncertainty on the real value of parameters in distributed samples is higher. Still, the preparation of a homogeneous sample is only feasible for limited numbers of samples. The cost related to the use of certified reference samples is approximately 300 EURO per 50g of soil; these samples are not available for all GLOSOLAN parameters. The cost related to the use of samples with history in PT is approximately 60 EURO per 100 g of soil; these samples are available for all GLOSOLAN parameters.

2. If the PT Performance Mode is chosen, samples distributed at the regional level should manifest higher uncertainty compared with those distributed at the global level due to the larger number of participants in the analysis at global level. Using this mode, RESOLANs could discuss results and ways to further improve respective performances.
3. New parameters could be considered for PT if WEPAL is supplied with regional soils to prepare control samples with. Before that, GLOSOLAN must deal with the issue of standardization of methods, inter-method harmonization, and with shipment and import/export constraints. Laboratories participating in the WEPAL programme would quarterly receive four soil samples for analysis.

Problems to be considered when running an international PT concern the provision of sanitary certificates, certificate of domicile, certificate of origin, commercial invoice, sample definition, safety data sheet, etc.

Following Ms. van Vark, SEALNET and LATSOLAN presented the results of the PT they ran at the regional level. In LATSOLAN, 20 laboratories participated in the PT. Each laboratory was received (by hand at the 1st LATSOLAN meeting) three samples of 250 g each. Samples were analyzed using LATSOLAN SOPs and each laboratory's standard methods. In SEALNET, a set of 14 bags containing approximately 30 g of soil each was sent by mail to 16 participating countries. Samples were analyzed using the methods SEALNET agreed to develop SOPs on. Details on the results of the PT analysis for LATSOLAN and SEALNET are available in their reports on the first PT analysis of results (SEALNET and LATSOLAN). In both regions, the statistical analysis was done using the basic principles of quality chart and z score. Because mean value and sd are strongly affected by outliers, these were removed before making the statistical analysis.

7.1 Plenary discussion and decision making

The GSP Secretariat facilitated the discussion by posing a few core questions:

Question 1: How are we going to manage regional and global PT?

It was the decision of GLOSOLAN to think about a global approach first:

1. How to prepare the samples?
2. Who will prepare the samples? We need to identify a structure.
3. How to facilitate the entrance of soil samples into countries?

The GSP Secretariat presented two possible scenarios that refer to the PT modes presented by WEPAL:

1. GLOSOLAN will perform the PT in learning mode: (i) soil samples will be provided by an external and certified partner, (ii) samples will be sent to a few selected laboratories in each region, which would be identified based on their capability to coordinate and launch regional PTs, and (iii) PT results will be collected and analyzed by the GSP/GLOSOLAN. While the global PT is underway, selected laboratories will be trained on how to prepare PT samples and perform PT analysis so that they will be ready to coordinate and launch national and regional PTs. Other laboratories will join the global PT once they are ready. In this regard, the GSP Secretariat will constantly invest in capacity building.

2. GLOSOLAN will perform the PT in performance mode: soil samples will be provided by an external partner who will also handle the analysis of data results. This scenario poses concerns in terms of (i) budget (costs may be high), (ii) capacity building (individual laboratories will not be trained on how to prepare PT samples and analyze related data results), and (iii) data management (PT data will be stored and managed by an external partner, so the GSP could not assure data privacy).

GLOSOLAN decided to adopt scenario number 1, that is, perform the PT in learning mode. Note that to purchase samples the GSP Secretariat may have to open a call for tenders. Potential sample providers are WEPAL, USDA, ASPAC, ALP, ISP, NSC ISSAR, and BIPEA. Using different sample providers would allow work with more soil types.

The decision to run a global PT in 2019 was endorsed based on the assumption that quality control is a priority that cannot wait until all RESOLANs are established. In 2019, a call for interest in participating in the first global PT by GLOSOLAN will be made among National Reference Laboratories. Laboratories participating in this exercise will be selected based on a few criteria, which will be defined by the GLOSOLAN Technical Working Group.

Participating laboratories will use their own SOPs or those developed by SEALNET-LATSOLAN for measuring:

- OC Walkley-Black and dry combustion [unit of measurement: %C]
- pH in water (ratio 1:2.5) [unitless]
- EC by 1:5 [unit of measurement: dS/m]
- Exchangeable K in ammonium acetate [cmol(+)/kg] or mg/kg
- P in Olsen and/or Bray I/II [mg P/ kg]
- Total N by Kjeldahl and Dumas [%N]

Remarks:

- Air-dry samples should be analysed
- Only one analysis per sample, with no replications allowed
- Results should be submitted to the GSP Secretariat together with info on the SOPs used

The Technical Working Group will also advise on the soil samples to use in the PT. Unusual samples, such as volcanic soils and peatland, should be avoided. For future PTs, soil samples should be selected in agreement with the SOPs that laboratories are being evaluated for.

Question 2: How to facilitate the international exchange of soil samples?

As part of the recommendations provided by the 6th GSP Plenary Assembly, the proposal was made to write a technical document on the preparation of the samples for the PT and a resolution for facilitating the exchange of samples for research purposes. Both these documents should be presented at the 7th GSP Plenary Assembly in June 2019. Specifics for each are as follows:

- **Technical document.**—Because different sample providers use different methods to prepare the samples, the Technical Working Group should develop a GLOSOLAN protocol. National and regional trainings on PT sample preparation will be based on this document. GLOSOLAN advised contacting the World Health Organization and the World Customs Union to ensure that relevant information is included in the document and that it is written in an appropriate format.

- **Resolution.**—The overarching goal is to have this document endorsed by FAO member countries. The GSP Secretariat will assist in the process and will be in charge of initiating country-tailored discussions for putting the resolution into action.

Question 3: How to store and manage data collected through the PT?

It was the decision of GLOSOLAN to update the GSP Soil Data Policy. This assignment will be executed by the GLOSOLAN Technical Working Group and the GSP Secretariat.

8. Other

8.1 GLOSOLAN terminology

GLOSOLAN agreed on the need to agree on GLOSOLAN terminology, which will be prepared by the GLOSOLAN Technical Working Group.

8.2 Interpretation of overall laboratory results

It was the decision of GLOSOLAN that a definition for “interpretation” should be provided and included in the GLOSOLAN terminology. In the future, GLOSOLAN will revise and harmonize available guidelines on the interpretation of laboratory data results for the best use and management of soil resources. In this regard, GLOSOLAN will cooperate with the Global Soil Information System (GLOSIS).

8.3 Provision of recommendations

It was the decision of GLOSOLAN to cooperate with GSP Pillar 1 on the laboratories’ provision of recommendations to land users and farmers. Recommendations should lead to the implementation of the Voluntary Guidelines for Sustainable Soil Management and the sustainable use of fertilizers.

8.4 Capacity building

GLOSOLAN stressed the importance of capacity building at national, regional and global levels on:

- The implementation of GLOSOLAN SOPs and basic laboratory techniques,
- The use of laboratory equipment and new technologies,
- The preparation of reference samples for internal and external PTs,
- Statistical analysis for the evaluation of PT performance,
- Method validation and measurement of uncertainty (it was suggested that EURACHEM be contacted for support on this), and
- The implementation of Good Laboratory Practices and data management.

In addition to providing training on the above mentioned topics, GLOSOLAN will invest in capacity building by publishing the Best Practice Manual and producing ebooks and videos. Note that training on collection of soil samples and other activities outside the scope of GLOSOLAN should be provided by Pillar 4 and other technical groups.

To work effectively, information from laboratories already providing training will be compiled. GLOSOLAN partners investing in training laboratories (e.g. the British Geological Survey from the United Kingdom and the Physikalisch-Technische Bundesanstalt from Germany) will be invited to provide information on the laboratories they are or have been training as well as the type of trainings they currently provide. Ultimately, this will assist in promoting technical cooperation and will ensure that the most qualified laboratories have been appointed as National Reference Laboratories.

GLOSOLAN agreed on establishing twinning programmes between registered laboratories in the network. The programmes should become active at the end of 2020.

In conclusion, it was recalled that National Reference Laboratories should transfer the knowledge and experience acquired in GLOSOLAN to other laboratories by establishing National Soil Laboratory Networks and by organizing and implementing national trainings and activities.

8.5 Certificates

It was the decision of GLOSOLAN to provide recognition on the items listed in Table 9.

Table 9. GLOSOLAN certificates

Item	Recognition format	When to award	Notes
Position in GLOSOLAN (e.g. National Reference Laboratory or other)	Letter and certificate	When a laboratory registers in GLOSOLAN	
Participation in PT programmes	Certificate	Right after the execution of a PT	
Lab performance in PT	Certificate	Once PT results are analysed	
Implementation of GLP	Certificate	On a regular basis	Global auditors need to be selected and trained
Attendance at specific trainings	Certificate	After completion of the training	For laboratory staff
Participation in GLOSOLAN and RESOLAN meetings	Certificate	After completion of the meeting	
Participation in the preparation of specific volumes in the Best Practice Manual and training material (including videos)	Certificate	After completion of the assignment	The assignment will include the provision of original, high-resolution photos.
Participation in the work of the GLOSOLAN Technical Working Group	Letter	After completion of the assignment (Additional letters for internal clearance can be provided on request.)	Only for those experts that actively and substantially contribute

8.6 Accreditation

It was the decision of GLOSOLAN to leave the issue of accreditation to the countries, for now. In this regard, GLOSOLAN will focus on providing method-specific certifications based on proficiency testing. GLOSOLAN may provide its own accreditation only once a good certification system is developed and operational.

8.7 GLOSOLAN Technical Working Group

Ms. Caon informed participants that the composition of the GLOSOLAN Technical Working Group established during the 1st GLOSOLAN meeting should be reviewed. Note that only a few members of the working group were genuinely active, and increased participation whenever possible is encouraged.

The following decisions were made:

- Members of the working group must be from registered laboratories in GLOSOLAN.
- All experts in the working group should provide information on their field of expertise by completing a survey. This will help GLOSOLAN make the most of the contributions of experts.
- Members who are not active should expect to be replaced. The Secretariat will provide them with a written notice before replacing them.
- Equal representation of geographic areas and genders should be ensured as much as possible.
- The working group will always be open to new experts. To join the group, please send an email to the GSP Secretariat (gsp-secretariat@fao.org) and Ms. Caon (Lucrezia.caon@fao.org).

The updated list of experts in the GLOSOLAN Technical Working Group is available in Annex III.

8.9 Governance

Ms. Nopmanee Suvannang was confirmed as GLOSOLAN Chair. The position of GLOSOLAN Vice-Chair was associated with that of ITPS Chair for Pillar 5. Thus, Ms. Lucía Helena Cunha dos Anjos from Brazil took the place of Dr. Bhanooduth Lalljee from the Mauritius.

9. GLOSOLAN work plan for 2019

The GLOSOLAN work plan for 2019 is reported in Table 10.

Table 10. GLOSOLAN work plan for 2019

Activity	Responsible party	Deadline
Establishing the GLOSOLAN Technical Working Group	GSP Secretariat	NA
Developing/compiling GLOSOLAN terminology	GLOSOLAN Technical Working Group	15 April (for presentation at 7 th GSP Plenary Assembly)
Revising the GSP Soil Data Policy	GLOSOLAN Technical Working Group GSP Secretariat	15 April (for presentation at 7 th GSP Plenary Assembly)
Developing the template for reporting and publishing GLOSOLAN SOPs	GLOSOLAN Technical Working Group GSP Secretariat	3 rd GLOSOLAN meeting (for presentation)

Developing the GLOSOLAN SOPs for sample pretreatment, inorganic C (CaCO ₃ equivalent), OC Walkley-Black and OC dry combustion and writing the related volumes in the Best Practice Manual	GLOSOLAN Technical Working Group GSP Secretariat RESOLANs	3 rd GLOSOLAN meeting (for presentation)
Launching RESOLAN Europe-Eurasia, Pacific, NENA and Africa	GSP Secretariat	Before 3 rd GLOSOLAN meeting
Identifying regional pools of experts to: <ul style="list-style-type: none"> - Supervise the implementation of GLOSOLAN SOPs and GLP - Provide specific training as appropriate 	GSP Secretariat and RESOLANs	NA
Surveying laboratories that work on spectroscopy and establishing a dedicated working group to develop SOPs on NIR and MIR	GSP Secretariat	February 2019 for establishment of working group 3 rd GLOSOLAN meeting for presentation of progress on SOPs for NIR and MIR
Developing criteria for laboratories who want to join the global PT and criteria for samples to use in the PT	GLOSOLAN Technical Working Group GSP Secretariat	February 2019
Launching the first global PT	GSP Secretariat	May 2019
Writing a technical document on the preparation of samples to use in PT	GLOSOLAN Technical Working Group GSP Secretariat	15 April (for presentation at 7 th GSP Plenary Assembly)
Writing a resolution for the international exchange of soil samples for research purposes under GLOSOLAN	GLOSOLAN Technical Working Group GSP Secretariat	15 April (for presentation at 7 th GSP Plenary Assembly)
Initiating the work on harmonization	ASPAC WEPAL	3 rd GLOSOLAN meeting (for presentation)

	Other GSP Secretariat	
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10. Venue and time of the next meeting

The 3rd GLOSOLAN meeting will take place at FAO HQ in Rome from 30 October to 1 November 2019 in order not to interfere with the preparation of the World Soil Day celebration.

Annex I: Agenda



Food and Agriculture
Organization of the
United Nations



**Second meeting of the
Global Soil Laboratory Network (GLOSOLAN)**
28-30 November 2018
FAO HQ | Rome, Italy

Wednesday, 28 November 2018 - Malaysia room		
8:30 – 9:00	Registration	
9:00 – 9:20	Opening	Mr. Eduardo Mansur, CBL Director, FAO Ms. Nopmanee Suvannang, GLOSOLAN Chair
9:20 – 9:30	Endorsement of the Agenda	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
Review of the work performed since the 1 st GLOSOLAN meeting		
9:30 – 9:45	Tour de table <i>Each participant to introduce themselves and state why they are interested in GLOSOLAN and what are their laboratory/country needs</i>	All
9:45– 10:00	Item 1: Report of the work performed by GLOSOLAN since its establishment	Ms. Nopmanee Suvannang, GLOSOLAN Chair
10:00 – 10:30	Item 2: The added value of GLOSOLAN	Ms. Rosa Cuevas, GSP Chair for Pillar 5

		Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
10:30 – 11:00	Coffee break	
11:00 – 11:10	Item 3: Overview on the establishment of the Regional Soil Laboratory Networks (RESOLANs)	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
11:10 – 11:30	Item 4: Report from the Regional Soil Laboratory Network for Asia (SEALNET)	Ms. Gina Nilo, SEALNET Vice-Chair
11:30 – 11:50	Item 5: Report from the Regional Soil Laboratory Network for Latin America (LATSOLAN)	Mr. Rusbel Jaramillo, LATSOLAN
11:50 – 12:10	Item 6: Establishment of the Regional Soil Laboratory Network for Europe and Eurasia	Ms. Olga Yakimenko, GLOSOLAN Russia
12:10 – 12:30	Item 7: Establishment of the Regional Soil Laboratory Network for the Pacific	Mr. Rob Dehayr, Pillar 5 Chair for the Pacific region
12:30 – 13:00	Item 8: Plenary Discussion <ul style="list-style-type: none"> • Q&A 	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
13:00 – 14:30	Group picture in the FAO atrium and Lunch break	
14:30 – 17:00	Item 8: Plenary Discussion (continuation)	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO

Thursday, 29 November 2018 - Malaysia room		
Standard Operational Procedures (SOPs)		
8:30 – 9:00	Item 9: Wrap up on the SOPs developed by RESOLANs	Ms. Nopmanee Suvannang, GLOSOLAN Chair Ms. Gina Nilo, SEALNET Vice-Chair Mr. Rusbel Jaramillo, LATSOLAN
9:00 – 9:30	Item 10: One world – one standard: the ISO approach	Dr. Klaus Liphard Consultant for Energy and Environment
9:30 – 10:30	Item 11: Plenary Discussion and Decision Making <ul style="list-style-type: none"> • What is the objective of the SOPs? • How many SOPs are we going to develop under GLOSOLAN? • Who to develop them? • How to manage SOPs developed at the regional level in GLOSOLAN? • How to work on harmonization? • How to work with new technologies like spectroscopy? • Role of ISO • Work plan development 	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
10:30 – 11:00	Coffee break	
11:00 – 13:00	Item 11: Plenary Discussion and Decision Making (continuation)	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
13:00 – 14:00	Lunch break	
14:00 – 16:00	Item 11: Plenary Discussion and Decision Making (continuation)	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO

16:00 – 17:00	<p>Item 12: Decision on the writing of “Best practice manual” (reference: GLOSOLAN roadmap, 1st GLOSOLAN report).</p> <ul style="list-style-type: none"> • Is it needed or would it be a repetition of existing work? • Objectives • Timeline • Leading authors 	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
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Friday, 30 November 2018 - Malaysia room		
Ring test and Data Policy		
8:30 – 9:00	Item 13: Proficiency test: preparation, execution and benefit	Winnie van Vark, WEPAL
9:00 – 9:30	Item 14: Wrap up on the ring tests carried out in Latin America and Asia, and requests from the 6 th GSP Plenary Assembly	<p>Ms. Nopmanee Suvannang, GLOSOLAN Chair</p> <p>Ms. Gina Nilo, SEALNET Vice-Chair</p> <p>Mr. Rusbel Jaramillo, LATSOLAN</p> <p>Ms. Rosa Cuevas, GSP Chair for Pillar 5</p> <p>Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO</p>
9:30 – 10:30	<p>Item 14: Plenary Discussion and Decision Making</p> <ul style="list-style-type: none"> • How are we going to manage regional and global ring tests? Regional ring tests need to be harmonized! • Capacity building at the national and regional level: who, when and how? Definition of a training programme • How should data be stored and managed? (link to the GSP Soil Data Policy) • Budget • The issue of soil data results interpretation: how and when are we going to deal with it? • Implementation of the 6th GSP Plenary Assembly decisions 	<p>Ms. Rosa Cuevas, GSP Chair for Pillar 5</p> <p>Ms. Nopmanee Suvannang, GLOSOLAN Chair</p>
10:30 – 11:00	Coffee break	
11:00 – 13:00	Item 14: Plenary Discussion and Decision Making (continuation)	<p>Ms. Rosa Cuevas, GSP Chair for Pillar 5</p> <p>Ms. Nopmanee Suvannang, GLOSOLAN Chair</p>
13:00 – 14:00	Lunch break	
Decision and conclusions		
14:00 – 15:30	<p>Item 15: Other</p> <ul style="list-style-type: none"> • Accreditation • Certification 	Ms. Nopmanee Suvannang, GLOSOLAN Chair

	<ul style="list-style-type: none"> • Terminology • Capacity building 	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
15:30 – 16:00	Item 16: GLOSOLAN working group: composition and criteria for joining	Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
16:00 – 17:00	Item 17: Review of the GLOSOLAN work plan: targets, deliverables and timeline	Ms. Nopmanee Suvannang, GLOSOLAN Chair Ms. Lucrezia Caon, GLOSOLAN coordinator, FAO
17:00	Closure of the meeting	

Annex II. List of participants

Nopmanee Suvannang, GLOSOLAN Chair, Thailand

Agnes Nagy, Food Chain Safety Centre Non-profit Ltd. Soil Conservatory Laboratory, Hungary

Ali Adbelmagid Elmobarak, Agricultural Research Corporation, Sudan

Anne Muriuki, Kenya Agricultural & Livestock Research Organization, Kenya

Armando Guerrero-Peña, Colegio de Postgraduados, Mexico

Arne Heidkamp, Thuenen-Institut, Germany

Aurore Degré, ULiège - Gembloux Agro-Bio Tech, Belgium

Carlo Jacomini, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Italy

Christian Hartmann, IRD, France

Christophe Fripiat, ISSeP, Belgium

Cleotilde Nicolas, Department of Agriculture Special Technical Assistant, Philippines

Edna Lynn Floresca, Bureau of Agriculture and Fisheries Standards, Philippines

Egon Hirvesoo, Estonian Agricultural Research Centre, Estonia

Francesco Bigaran, Federazione Trentina Biologico e Biodinamico (FTBio), Italy

Gina Nilo, Bureau of Soils and Water Management, Philippines

Giorgi Ghambashidze, Scientific-Research Centre of Agriculture, Georgia

Giorgi Kentchiashvili, Scientific-Research Centre of Agriculture, Georgia

Gluztavelle Judeen Mercado, Bureau of Soils and Water Management, Philippines

Jiri Zbiral, UKZUZ, Czech Republic

João Coutinho Mendes, UTAD, Portugal

Karim Shahbazi, Soil and Water Research Institute (SWRI), Iran

Kristof Tirez, VITO, Belgium

Lady Rachelle Casareno, Bureau of Soils and Water Management, Philippines

Lauris Leitāns, State Plant Protection Service, Latvia

Maia Tarkhnishvili, Scientific-Research Centre of Agriculture, Georgia

Malgorzata Suska-Malawska, University of Warsaw, Poland

Marion Stoldt, Physikalisch-Technische Bundesanstalt, Germany

Michael Watts, British Geological Survey, UK

Miguel Aran, Sociedad Española de Ciencia del Suelo, Spain

Misi Manyanga, Chemistry and Soil Research Institute, Zimbabwe

Nabeel Bani Hani, National Agricultural Research Center (NARC), Jordan

Naira Kenchiashvili, Scientific-Research Centre of Agriculture, Georgia

Nuha Khamis, Agricultural Research Corporation, Sudan

Olga Yakimenko, Soil Science Faculty, Moscow State University, Russia

Patrice Kuitekam Dongo, Ministry of Agriculture and Rural Development of Cameroon, Cameroon

Richard Ferguson, Kellogg Soil Survey Laboratory, NSSC-NRCS-USDA, USA

Robert De Hayr, Department of Environment and Science, Australia

Rusbel Jaramillo, Agencia de Regulación y Control Fito y Zoo Sanitario del Ecuador – AGROCALIDAD,
Ecuador

Sadeq Dwenee, Directorate of Agricultural Researches, Soil and Water Resources Center, Iraq

Sanita Vucane, State Plant Protection Service, Latvia

Somsak Maneepong, Walailak University, Thailand

Špela Velikonja Bolta, Agricultural Institute of Slovenia, Slovenia

Takata Yusuke, National Agriculture and Food Research Organization, Japan

Tea Meskhi, Scientific-Research Centre of Agriculture, Georgia
Ülle Tali, Agricultural Research Centre, Estonia
Winnie van Vark, WUR – WEPAL, Netherlands
Yvette Clarisse Mfopou Mewouo, Institute of Agricultural Research for Development (IRAD), Cameroon

Online participants

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