Food and Agriculture Organization of the United Nations

5th Meeting of the
Latin American Soil Laboratory Network
(LATSOLAN)

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How SOPs are harmonized

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LATSOLAN
LATIN AMERICAN SOIL LABORATORY NETWORK

GLOBAL SOIL PARTNERSHIP

SOP = Standard Operating Procedure

- Globally harmonized
- Ensures the replicability of a measurement and the credibility and traceability of data
- Available online, <u>for free</u>
- Step-by-step instructions
- Includes sections on health and safety, quality assurance and quality control (QA/QC) – and in some cases sampling guidelines

Global harmonization process

1. Decide which SOP to harmonize (parameter + method)

Regional Soil Laboratory Networks (RESOLANs) discussed during their annual meetings and share proposals to GLOSOLAN

During the GLOSOLAN annual meeting, network members discuss on which SOPs to include in the GLOSOLAN work plan

SEALNET
ASIAN SOIL LABORATORY NETWORK

AFRILAB
AFRICAN SOIL LABORATORY NETWORK

EUROSOLAN
EUROPEAN AND EURASIAN SOIL LABORATORY NETWORK

LATSOLAN
LATIN AMERICAN NETWORK OF SOIL LABORATORIES

NENALAB
NEAR EAST AND NORTH AFRICAN SOIL LABORATORY NETWORK

ASPAC
PACIFIC SOIL LABORATORY NETWORK

GLOBAL SOIL PARTNERSHIP

Global harmonization process

2. Establishment of the working group and the review panel:

- 1 global leader
- Experts from all regions

→ Developing of the **matrix**

↓

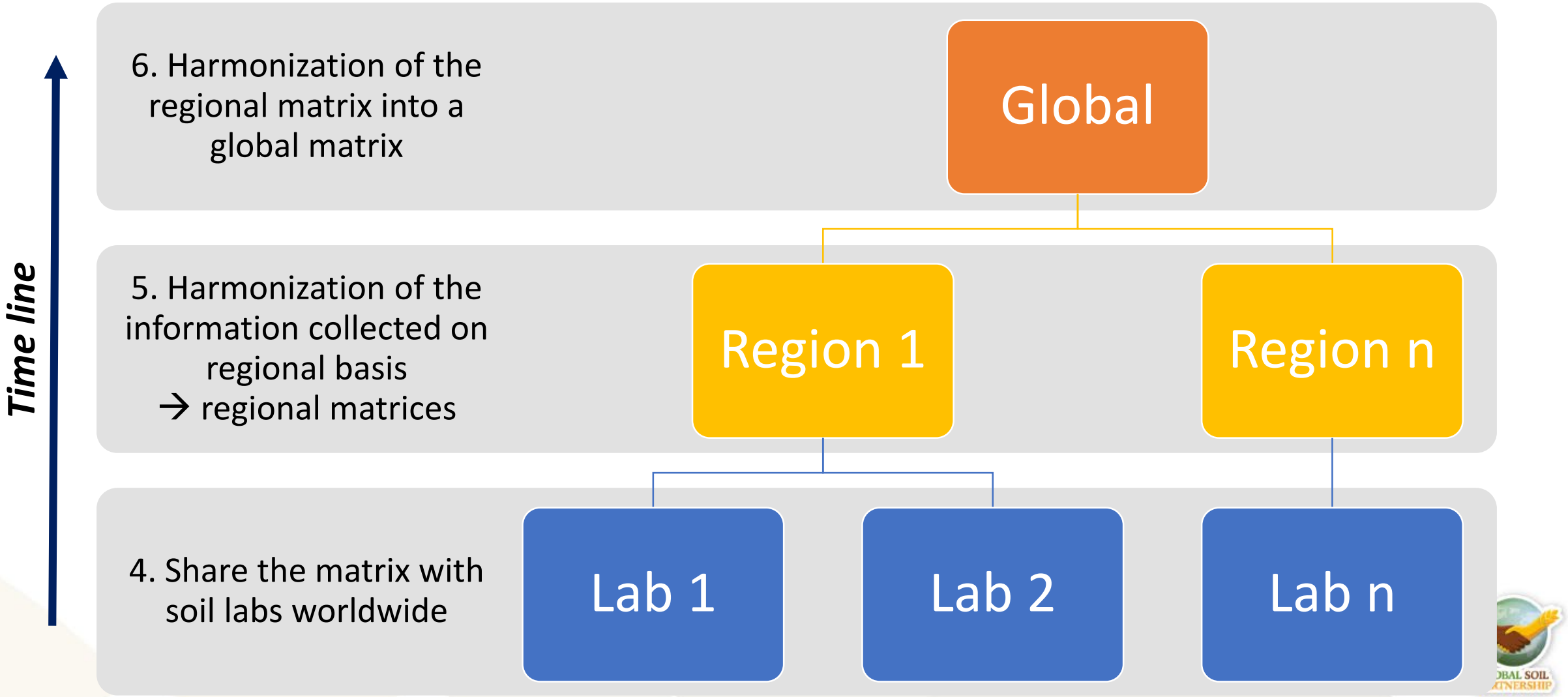
Laboratory Submission Forms

Please provide the following information on the procedure you are using to assess **Bulk Density (Core Method).**
Complete only the information corresponding to the method / equipment used in your laboratory.
Please do not complete the form if you are not using this method in your laboratory
Deadline: 28 February

Name and Last name	Email address	Country	Institute name	Sample Condition (disturbed or undisturbed)	Core sampler size	Volume of sample	Equipment	Fresh Sample	Oven Drying time	Oven-dried sample	Computation	Report unit	Quality Control Measures	Number of decimals	Reference
XXXX	XXXX	Philippines	Bureau of Soils and Water Management	Undisturbed	d= 4.2 cm h=5.5 cm	100 cm3	1. Drying oven 2. weighing balance 3. dessicator	Weighing of undisturbed sample before oven-drying	24 hours	Weighing of oven -dried undisturbed sample	$\text{Bulk Density} = \frac{\text{Dry Soil Weight (g)}}{\text{Volume of core } (cm^3)}$	g/cm3	1. Control chart 2. Precision Test	One decimal	I.C. Gupta, N.P.S Yaduvanshi and SK Gupta, Standard Methods for Analysis of Soil, Plant and Water

Excel file, reporting all the steps of the procedure, from sample preparation to QA/QC and interpretation

Global harmonization process



Global harmonization process

7. Transform the matrix into a text → template https://www.fao.org/3/ca7215en/ca7215en.pdf

8. Review
(members of the review panel + GLOSOLAN Technical Committee
+ experts from other GSP Technical Networks)

9. Publication of the SOP

10. Translation of the SOP
in multiple languages

The methods to quantify SOC already harmonized by GLOSOLAN are the following:

SOP Walkley-Black method – titration and colorimetric method (**EN** | **ES** | **RU**)

Soil organic carbon – Tyurin spectrophotometric method (**EN** | **RU**)

Training video: Walkley and Black - **titration** and **colorimetric** method

Training video: **Tyurin method**

Global harmonization process

11. Publication of the information on the sustainability of methods

Aim: **promote the transition to more sustainable methods**

The following information are provided per each SOP:

- Risk to human health (related to the use of chemicals and the overall implementation of the procedure by staff)
- Environmental risk (related to waste disposal)
- Level of technology required to perform the analysis
- Average duration of the test

Soil Nitrogen methods : Sustainability of methods

Method	Risk for human health related to the use of chemicals and the overall implementation of procedure by staff	Environmental risk (waste disposal)	Level of technology required	Average duration of the analysis	Global median price of the analysis (for the customers)
Kjeldahl	High	High	Medium	> 1 working day	7.5 USD
Dumas	Low	Low	High	Up to half working day	11.6 USD
Distillation method	Medium	Medium	Medium	Up to one working day	8.3 USD

Global harmonization process

1. Decide which SOP to harmonize (parameter + method)
2. Establishment of the working group (experts from all regions)
3. Developing of the matrix
4. Share the matrix with soil labs worldwide
5. Harmonization of the information collected on regional basis → regional matrices
6. Harmonization of the regional matrix into a global matrix
7. Transform the matrix into a text
8. Review
9. Publication of the SOP
10. Translation of the SOP in multiple languages
11. Publication of the information on the sustainability of methods

especialmente a los parámetros biológicos del suelo o análisis menos solicitados

Special cases

- Few experts on the topic (e.g. biological parameters)
- Not many laboratories perform such procedures

Slow down the harmonization process
(make it not applicable)

New way to harmonize SOPs

The working group prepares the text of the SOP (no circulation of the matrix)

1. Decide which SOP to harmonize (parameter + method) by the joint working group, according to the proposal received from both GLOSOLAN and NETSOB members
2. Establishment of the working group (experts from all regions, from both networks)
3. Develop the text of the SOP, even starting from already-published SOPs
4. Share the text with soil labs worldwide
5. Collection of the inputs from all regions
6. Review
7. Publication of the SOP
8. Publication of the information on the sustainability of methods
9. Translation of the SOP in multiple languages

Template

https://www.fao.org/3/ca7215en/ca7215en.pdf

Contents

1. Brief introduction to the topic
2. Scope and field of application
3. Principle
4. Apparatus
5. Materials
6. Health and safety
7. Sample preparation
8. Procedure
9. Calculation
10. Quality assurance / quality control
11. Reference documents (if any)
12. Appendix I - Results of inter-laboratory comparison
13. Appendix II – Acknowledgments
14. Appendix III - List of authors
15. Appendix IV - Contributing laboratories

If needed, include also:

- Sample collection
- Sample storage

SOPs harmonized so far

	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), Nematodes trophic groups (wet extraction), QBSar, ISO-TSBF

Requests from LATSOLAN

Is there any method used only in the region/few countries?

- Chemical:
- Physical:
- Biological:

Requests from the other regional networks

Suggestions from **AFRILAB**

- Mineral nitrogen – ammonium and nitrate nitrogen (plant available N) by KCl
- Resin extractable P
- K sat
- Aggregate stability
- DNA extraction
- Earthworms sampling and identification
- Ryzobia classification

Suggestions from **EUROSOLAN**

GLOBAL:

- Mineral N – to be combined with available N by calcium chloride extraction;
- Textural determination by laser diffraction;
- DNA extraction;

REGIONAL:

- *CEC and exch. Cations by hezammine cobalt trichloride extraction;*
- *Available anions and cations by calcium chloride extraction;*
- *P-AL/ammonium lactate – acetic acid buffer;*

Suggestions from **NENALAB**

- soluble anions (sulphate, chloride, carbonate, bi-carbonate) by titration method
- soluble cations (calcium, magnesium) by titration method + sodium and potassium using flamephotometer
  include standards on the **interpretation** of results in these SOPs
- SOP on UNDISTURBED soil collection, transportation and storage
- Field capacity by cylinder method
- Aggregate stability
- DNA extraction;
- earthworm sampling and identification

Suggestions from **SEALNET**:

- DNA extraction
- Laser granulometry method and PARIO method

LATSOLAN request in 2021

Chemical parameters

- Exchangeable acidity by KCl 1M. Regional leaders: Daniel Vidal (Brazil), Floria Bertsch (Costa Rica);
- A transfer function to link between electrical conductivity by saturate paste with EC 1:5. Regional leader: Jorge Etchevers (Mexico).

Physical parameters:

- Water retention (pF). Regional leader: Laura Casas (Colombia);
- Bulk density for fine particles. Regional leader: Jorge Etchevers (Mexico);
- Aggregate stability. Regional leader: Ana Silbermann (Uruguay).

Biological parameters:

- Nitrifying bacteria. Regional leader: Laura Casas (Colombia).

Revision of already published SOPs. Do they work? Do they have any error?...need to organize a **global PT** only with labs using the GLOSOLAN SOPs and that demonstrated to have a good proficiency in soil analysis by participating to previous GLOSOLAN PTs.

Published SOPs **already under revision**: pH, EC and saturated paste (with INSAS)

Published SOPs that we have to review for sure: Walkley & Black

The SC of LATSOLAN to meet and prepare a survey to decide what SOPs to harmonize within the network. Points for reflection from the meeting:

- Chemical:
  - A transfer function to link between electrical conductivity by saturate paste with EC 1:5. Regional leader: Jorge Etchevers (Mexico).
  - Mineral nitrogen – ammonium and nitrate nitrogen (plant available N) by KCl
  - Cd
- Physical:
- Biological:
  - Nitrifying bacteria. Regional leader: Laura Casas (Colombia).

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Thanks for your attention

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