# Progress on SSM related activities
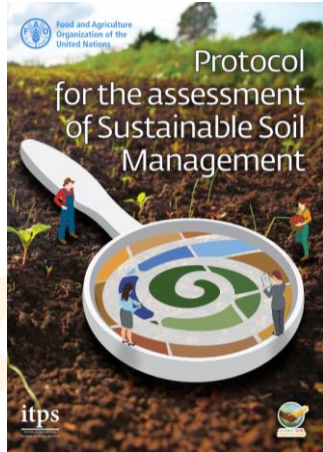
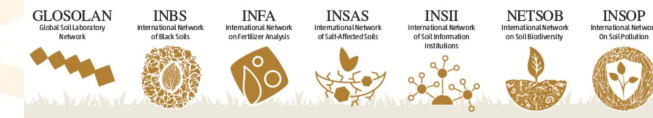- SSM Protocol User´s Manual
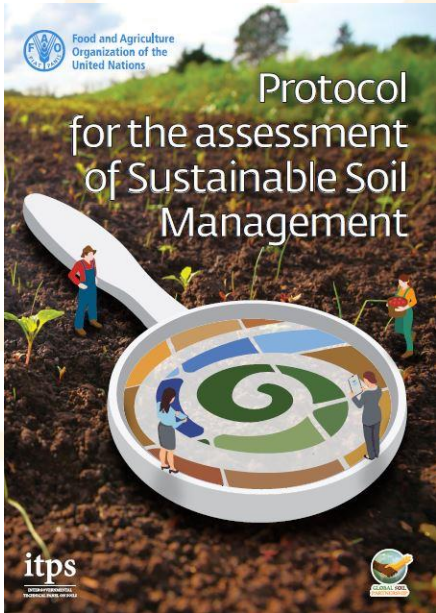  - Visual Soil Assessment and field exercises

- Global Soil Doctors Programme
  - Visual Soil Assessment and field exercises
  - SSM practices

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**GSP Networks**

# Assessing SSM compliance ~~/ monitoring soil health~~



Protocol for the assessment of Sustainable Soil Management

| Indicator | Parameter/ metric | Measurement methods[2] | Sample characteristics[3] |
|---|---|---|---|
| Soil productivity | Agricultural productivity or biomass in dry matter (t ha^{-1}year[-1]) | Dry weight of vegetation quadrats, or yield measurements | Quadrat method or yield measurement |
| Soil organic carbon | Organic carbon (%) | Walkley- Black method http://www.fao.org/3/ca7471en/CA7471EN.pdf or Dumas method http://www.fao.org/3/ca7781en/ca7781en.pdf | Representative soil sample |
| Soil physical properties | Bulk density (kg dm^{-3}) In some cases, bulk density can be complemented by available water capacity, or other relevant soil physical properties (See additional indicators) | The Core Method | Undisturbed representative sample with known volume |
| Soil biological activity | Soil respiration rate ($gCO_2$ m[-2] d^{-1}) Ideally combined with at least one other biological indicator (See soil biological activity p. 4 and 5) | Laboratory based soil respiration measurement (static or dynamic) The most common methods will be presented in the annex. | Representative soil sample to be analyzed within hours or refrigerated |

**Additional indicators for specific cases (based on soil threats)**

- ❖ Soil nutrients (P)
- ❖ Soil erosion
- ❖ Soil salinity (EC)
- ❖ Soil biological activity
- ❖ Soil biodiversity
- ❖ Soil pH
- ❖ Available water capacity
- ❖ Infiltration field test
- ❖ Penetration resistance field test
- ❖ Soil pollution

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# Implementing the Protocol: the User Manual

**Steps**

**Activities**

**Methods**

**Monitoring system**

Step 1. Description of the study area

- Definition and description of Assessment Units
- Description of current soil management
- Description of SSM

Step 2. Data collection

- Soil sampling and field observations
- Measurement of indicators

Step 3. Assessment

- ~~Evaluation of soil health: use of benchmark values~~
- Evaluation of SSM compliance: baselines and control plots

- Annex 1. List of SSM practices
- Annex 2. Soil sampling and observations
- Annex 3. Laboratory methodologies
- Annex 4. Additional indicators: screening questions for identifying soil threats
- Annex 5. Remote sensing tools
- Annex 6. Data collection forms
- Annex 7. Form for soil laboratory selection

**Soil Information System**

**Laboratory network**

**Decision making, Project evaluation, LDN reporting...**

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# Step 1 Description of the study area

Compilation of existing information

Definition and description of Assessment Units

Description of current soil management, SSM practices
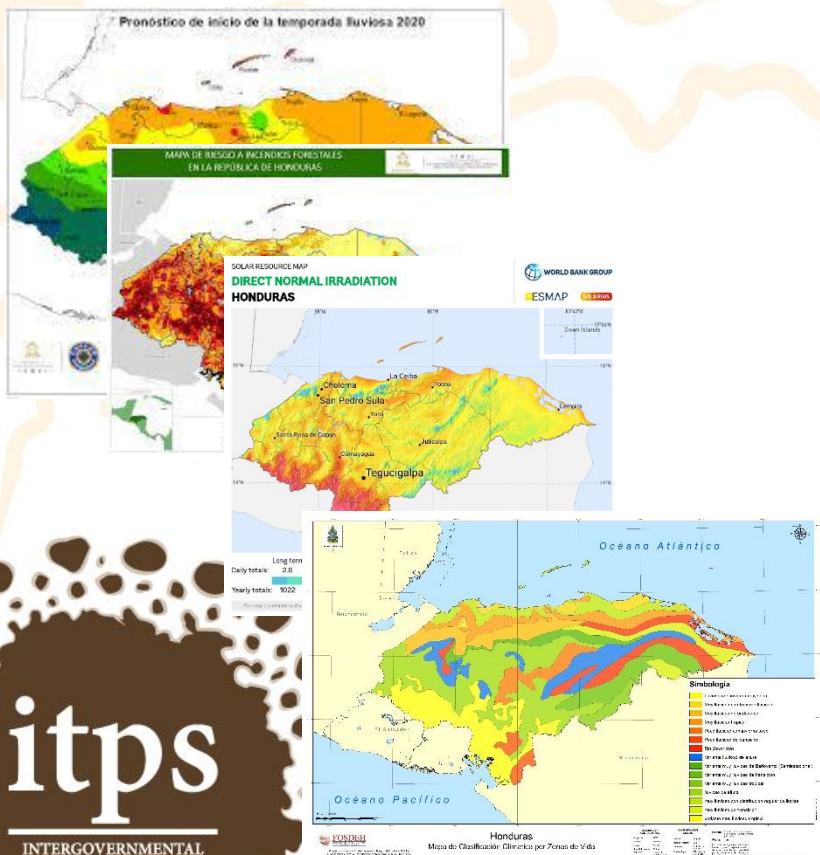


**Defining and using Assessment Units**

Each defined AU must be homogeneous in terms of:

- Land use before the intervention.
- Cropping system: one only crop, or association of crops or crop rotation.
- Geographical setting (landform or relief units: hill, valley, lowland; soil type; topographic characteristics: steepness, slope configuration, position, orientation; geographical position: proximity to water bodies, residential and urban development, etc.).
- Management history: past land use(s), crop sequences, crop yields, soil and crop management practices, etc. for, at least, the last 10 years.
- SSM practices to be assessed.

**Example:**

In the Venezuelan western plains, an area of approximately 150 ha has been split in 5 AUs of around 20-40 ha. The planned assessment aims to appraise how grazing affects soil properties depending on the proximity to the river (in blue) and on the proximity to forests, represented by AU5, with the goal of achieving an optimal adjustment of management.
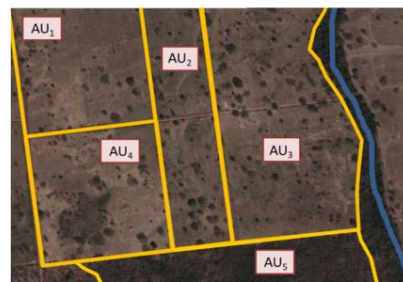
In the first case, AU1, AU2 and AU3 are sampled and compared, while AU1 and AU4 are compared in the second case. The area of each AU will determine how many sampling areas have to be defined for a representative sampling, with at least one sampling area covering 1 ha per each 10 hectares (details on how to define basic sampling areas are given in section 2 of this manual).

Data Box 1c: Information of each Assessment Unit

**Identification Code**

Area in Ha

Topography (slope, flat, depression)

Soil type (if known)*

Current Land Use**

Current management:    Farming system**

Cropping system **

Agricultural practices**

Management history during the last 10 years:

Land use(s) and duration**: _____ during _____ years

Farming system(s)** and duration: _____ during _____ years

Cropping system(s)** and duration: _____ during _____ years

Agricultural practices** and duration: _____ during _____ years

Other (previous buildings, earthworks, drained or restored area, etc.):

SSM practice(s) to be assessed***

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# Step 2: Data collection

- Sampling design based on homogeneity and required resolution

- Establishing the sampling plots

- Collecting representative composite samples for 10 Ha AU

- Collecting field observations



Baseline:
Without agroforestry – flat - Year 0 (2008)
Without agroforestry – medium slope – Year 0 (2008)

SSM assessment:
With agroforestry – flat - Year 10 (2018)
With agroforestry – medium slope – Year 10 (2018)



Sampling area: max 1 ha
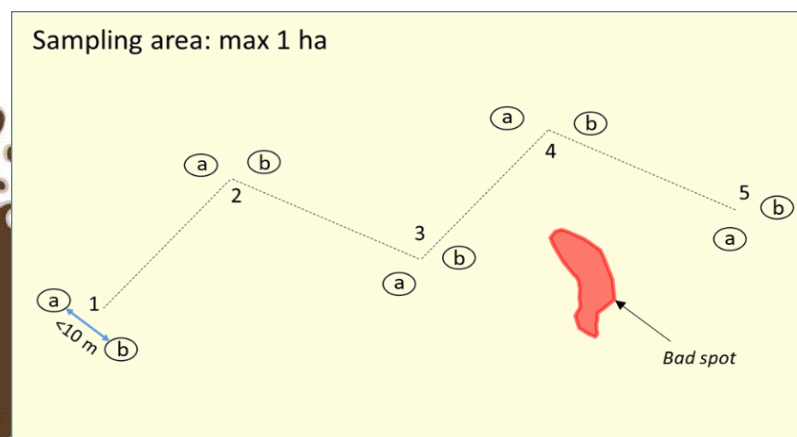
# Step 2: Data collection

- Standard Operational Procedures

- Chemical, physical and biological parameters: SOC, Bulk Density, Respiration, productivity.

- Additional indicators in relation to soil threats

# Step 3: Final assessment

Assessment of **soil health**: data are compared with local reference data and/or regional/global data:

| Soil indicator | Reference | Results (value of indicator *vs.* value of reference) | | |
|---|---|---|---|---|
| Productivity | | - / = | = / + | + |
| SOC | | - | = | + |
| Bulk density | | = / + | = | - / = |
| Respiration rate | | - / = | = / + | + |
| | | Results of the visual assessment* | | |
| Roots | | Poor | Medium | Good |
| Macroinvertebrates | | Poor | Medium | Medium /Good |
| Colour/Mottling | | Poor/ Medium | Medium | Good |
| Soil structure | | Poor | Medium | Medium /Good |
| SOIL STATUS | | DEGRADED | MODERATELY HEALTHY | HEALTHY |

Evaluation of the **effects of SSM**: data are compared to baselines. Compliance with the **VGSSM** (FAO 2017):

| COMPLIANCE | Trend (compared to baseline)* |
|---|---|
| NO | One or more indicators show a worsening trend |
| LOW | All indicators maintain the same values |
| MEDIUM | At least one indicator shows improvement and no indicators showing worsening |
| HIGH | All indicators improving |

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# Regional project in the LAC region

**Regional project**: Support to regional cooperation for climate management of agricultural ecosystems with emphasis on water and soil

*Argentina, Colombia, Costa Rica, Ecuador, Nicaragua, Paraguay, República Dominicana, Uruguay, Venezuela*

- SSM practices database
- Technical capacity building
- Pilots for the **validation of the SSM protocol Users´ manual**
- SSM practices scaling up strategy

# Regional project in the LAC region

| Country | SSM practice | Number | Picture | VGSSM compliance | | | |
|---------|-------------|--------|---------|:-:|:-:|:-:|:-:|
| | | | | NO | LOW | MEDIUM | HIGH |
| Argentina | Corp rotation / Cover Cropping/ direct seeding / Grazing management / | 17 |  | 1 | 4 | 9 | 3 |
| Colombia | Restoration of degraded grassland / Improved grazing management | 3 |  | | 1 | 1 | 1 |
| Costa Rica | Conserve permanent grassland / Agroforestry / Integrated crop-livestock systems | 16 |  | 1 | 1 | 13 | 1 |
| Ecuador | Crop rotations / Integrated soil fertility management / No-till/Zero-till/Direct seeding | 2 | | Not Reported | | | |

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# Regional project in the LAC region

| Country | SSM practice | Number | Picture | VGSSM compliance | | | |
|---------|--------------|--------|---------|------|------|--------|------|
| | | | | NO | LOW | MEDIUM | HIGH |
| Nicaragua | Crop rotations / Intercropping / Agroforestry | 6 |  | | | 2 | 4 |
| Paraguay | Cover cropping / Crop rotations / Organic mulch / Zero-till / Integrated soil fertility management | 3 |  | | | | 3 |
| Uruguay | Animal manures and slurries | 2 |  | | | 2 | |
| Venezuela | Agroforestry / Organic mulch / Integrated soil fertility management | 9 |  | | | 2 | 7 |

# Global Soil Doctors Programme

- Visual Soil Assessment and field exercises
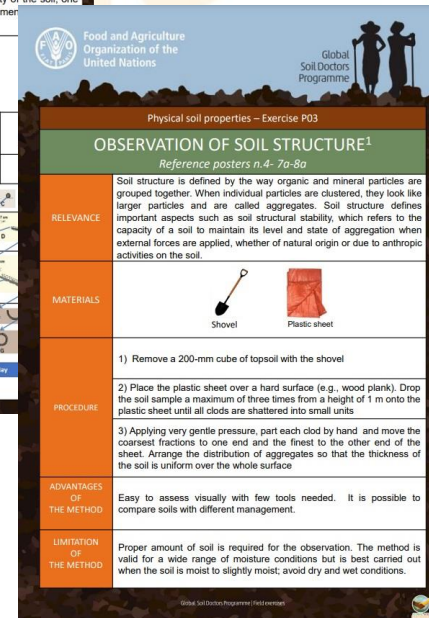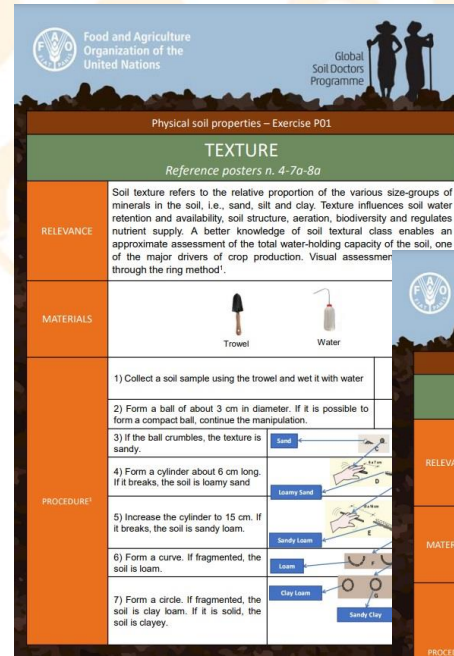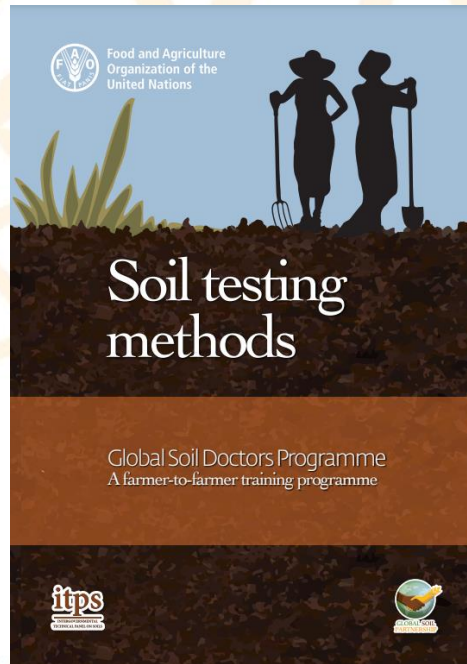


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# Global Soil Doctors Programme

- Visual Soil Assessment and field exercises

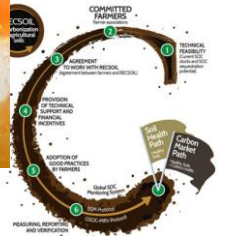Bolivia

Mexico

Colombia

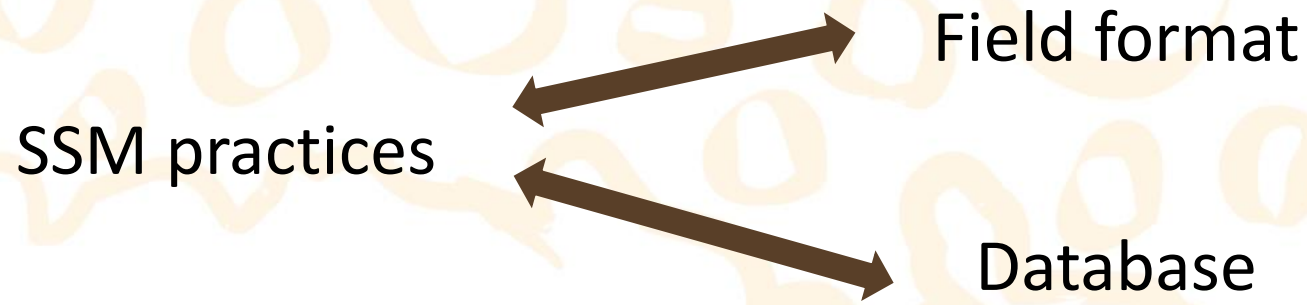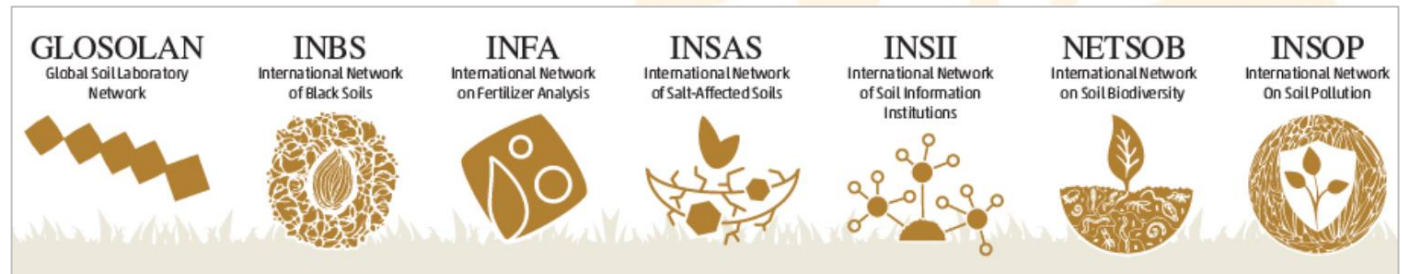Burkina Faso

Bangladesh

Kazaksthan

Togo

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# Global Soil Doctors Programme

Field format

SSM practices

Database

GSP
Networks



GLOSOLAN
Global Soil Laboratory Network

INBS
International Network of Black Soils

INFA
International Network on Fertilizer Analysis

INSAS
International Network of Salt-Affected Soils

INSII
International Network of Soil Information Institutions

NETSOB
International Network on Soil Biodiversity

INSOP
International Network On Soil Pollution

Thank you!

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