

**Taller sobre la
implementación del Protocolo
de Evaluación del Manejo
Sostenible de los Suelos**

en América Latina y el Caribe



Protocolo para la evaluación del manejo sostenible de suelos

Indicadores y manual de implementación

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Organización de las Naciones
Unidas para la Alimentación
y la Agricultura



24 de octubre de 2024



Manejo sostenible de Suelos

- ✓ Adopción de prácticas de manejo sostenible de los suelos
- ✓ Evaluación de prácticas y co-beneficios



Figura 3. Los múltiples beneficios provistos por las prácticas de manejo sostenible del suelo con base en el COS.

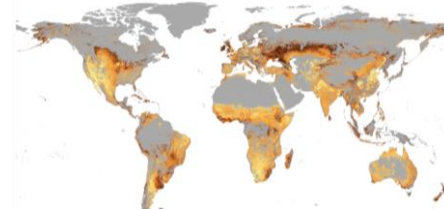
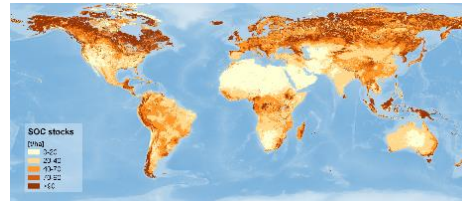


Organización de las Naciones Unidas
para la Alimentación y la Agricultura

Manejo sostenible de Suelos



Implementación



Mapa global de carbono
orgánico del suelo

Medición



Procedimientos de
Laboratorio

Divulgación



Protocolo para la evaluación del manejo sostenible de suelos

Indicadores

Indicadores recomendados

- Productividad del Suelo (ton /Ha / año)
- Carbono orgánico del suelo(%)
- Propiedades físicas (densidad aparente y capacidad de retención)
- Actividad biológica (respirometría) asociada a un indicador biológico adicional



Indicadores adicionales

- ❖ Nutrientes (P)
- ❖ Erosion
- ❖ Salinidad (EC)
- ❖ Actividad biológica (enzimas, biomasa)
- ❖ Biodiversidad del suelo
- ❖ pH
- ❖ Capacidad de retención de agua
- ❖ Prueba de infiltración en campo
- ❖ Prueba de compactación en campo
- ❖ Contaminación del suelo



Foto: Gilberto Murcia



Protocolo para la evaluación del manejo sostenible de suelos

Indicadores

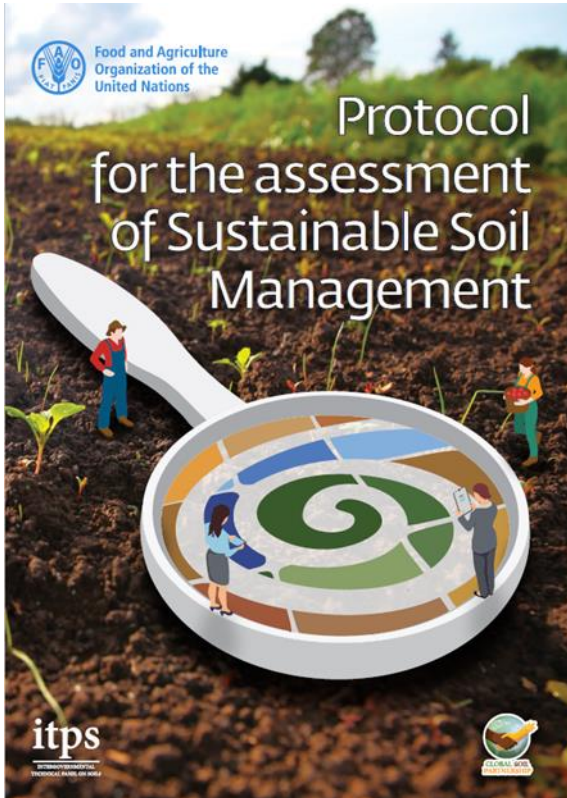


Table 1. Recommended indicators that can be monitored to assess Sustainable Soil Management¹

Indicator	Parameter/ metric	Measurement methods ^a	Sample characteristics ^b
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/c7471en/c7471en.pdf or Dumas method http://www.fao.org/3/c7781en/c7781en.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

Productividad

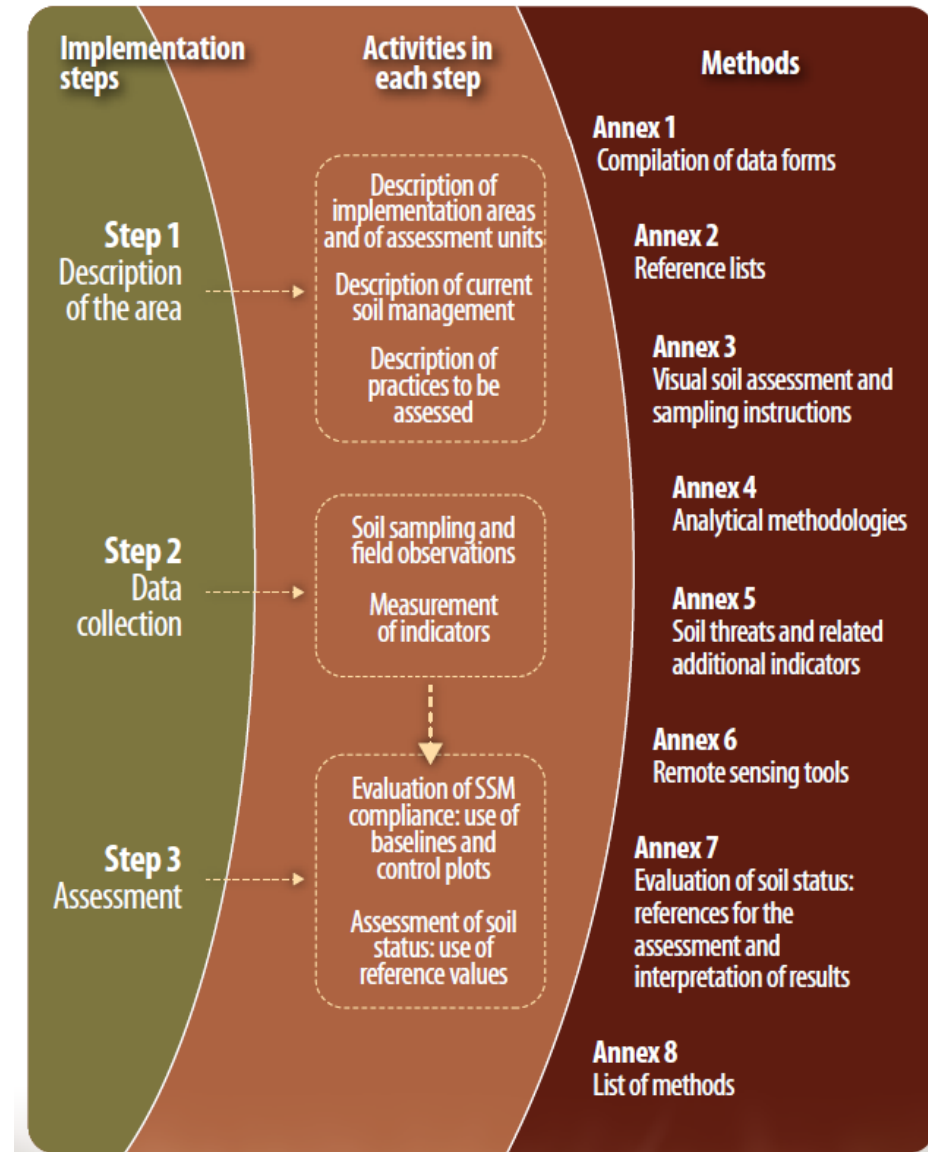
Carbono orgánico

Densidad aparente

Actividad biológica

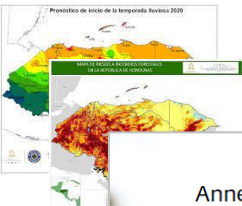
Protocolo para la evaluación del manejo sostenible de suelos

Indicadores y manual de implementación



Paso 1: Descripción del área de aplicación y definición de la unidad de evaluación

Recopilación de datos según formularios



Annex 1 | Compilation of data forms

Note that the data forms follow the same numbered structure as each of the three steps.

Step 1. Description of the study area

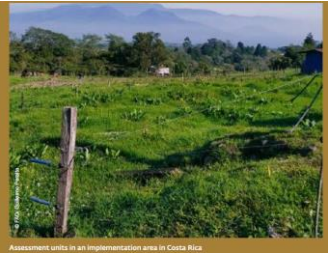
Data Form

A1.1a. Information on the project and the assessment

Project name/code	
Assessment date (dd/mm/yyyy)	
Goal of the SSM (mark all that apply):	
☐ Improve production (crop, fodder, wood/fibre, water, energy)	
☐ Avoid soil degradation/enhance soil health. List known current soil threat(s)*:	
☐ Conservation of current agroecosystem	
☐ Reduce risk of disasters (e.g. droughts, floods, landslides)	
☐ Other:	
Assessment strategy (mark all that apply. See an explanation of these concepts in Step 3 of this manual):	
☐ Baseline	
☐ Control location	
☐ Space for time substitution	
☐ Reference value or benchmark	

*The ten soil threats (SOC loss, erosion, salinization, nutritional imbalance, biodiversity loss, compaction, waterlogging, acidification, pollution and soil sealing) are defined in the Status of the World's Soil Resources report (FAO and ITPS, 2015).

Descripción del área de estudio



Data form

A1.1b. Characteristics of the study and implementation area

Name/code of the study area:	
Location of the study area (Department/district/province) (adapt for country context):	
Country	
Explain the wider context (including general geographical location, proximity to protected areas, known threats, etc.):	
Total hectares of the project	
Number of implementation units	
Name/code of the implementation unit	
Total hectares of the implementation unit	
Geographic coordinates implementation area	
General information of the area (land use, management, landform, etc.):	
Number of assessment units	
Number of AU(s) to be assessed	

Data form

A1.1c. Information of each assessment unit

Identification (ID) code (A name code + AU ID)	
Area of the AU in hectares	
Geographic coordinates or polygon	
Topography (slope, plain, depression...)	
Slope class ^a	
Soil type (if known)	
Soil depth (if known)	
Current land use ^a	
Current management:	Crop(s)
	Agricultural practices ^a
Management history during the last ten years:	
Land use(s) and duration ^a :	over years
Agricultural practices ^a and duration:	over years
Other (previous buildings, earthworks, drained or restored area, etc.):	
SSM practice(s) to be assessed ^a	

^aAs per lists in Annex 2. If the exact option(s) do not appear, choose the closest match(es) and give additional details.

Descripción de las prácticas de MSS



Annex 2 | Reference lists

This annex includes:

List of land uses

List of land uses as

Table

A2.1. General land use

IPCC Categories
1. Cropland (include
2. Grassland (perma
3. Forestland and for
4. Wetlands
5. Other

Table

A2.2. Specific land use

IPCC category
Agriculture

Table

A2.3. List of practices

Category of practice	Type of practices	Practice	Brief description of the practice
Soil preparation	Improvement of soil hydrological status	Subsoiling	Break up pans or compacted layers to facilitate water infiltration and loosen the subsoil with minimal disruption of the surface.
		Addition of hygroclay	Increase water available for roots in drought periods or low development stages.
		Terracing and land shaping	Modification of topography on hills and steep lands for reducing runoff, increase infiltration and preventing erosion by water.
		Subsurface drainage	Trench filled with permeable materials or use of interlayers of loose materials, to facilitate leaching.
	Surface preparation	Surface scraping	Scratching or raking the hard surface layer, for reworking and renewing the topmost soil layer for improved water infiltration and aeration, and/or for reducing evaporation from deeper layers through capillary rise.
		Deep ploughing	Deep tillage with horizon inversion and mixing, to facilitate the solubilization or dissolution of specific elements.
Minimization of soil disturbance	Use of reduced tillage	No-till/zero tillage, conservation tillage (non-inversion, reduced, superficial), localized tillage (strip, precision, zoned)	
	Controlled traffic farming	Reduction of the circulation of agricultural machinery, includes direct seeding, design of circulation ways.	
	Fallow area	Area left unseeded and un-tilled to regain fertility, for one or several years before it is cultivated again.	
Use of soil amendments	Mulching	Organic or inorganic materials, spread or left on the ground as protective covering.	
	Use of biochar	Biochar is a material rich in carbon that results from the pyrolysis of biomass materials, with the objective to store additional C in soil.	
	Liming and other mineral amendments	Calcium or magnesium-based amendments and enhanced weathering materials (e.g. basalt) to increase pH or to sequester soil inorganic carbon.	

Paso 2: Recolección de datos

- Diseño del muestreo en función de la homogeneidad y la resolución requerida.
- Recolección de muestras compuestas representativas y datos de campo
- Medición de indicadores

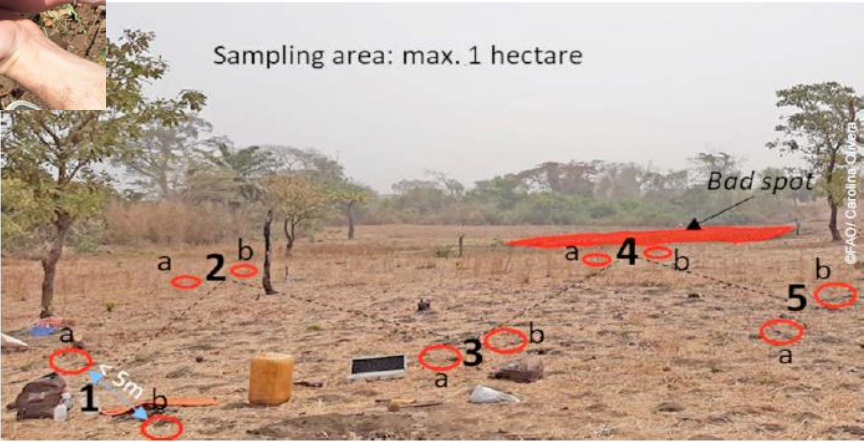
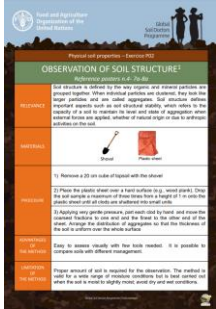


Figure 4. Schematic representation of a sampling area with sampling locations and position of subsamples

Data form
A1.2b. Results of the recommended indicators per sample

SSM indicator (methods given in Annex 4)	Method	Unit	Result
Productivity		tonnes/ha/year	
Soil organic carbon (SOC)		g/kg (%)	
Bulk density (BD)		kg/dm ³	
Respiration rate		gCO ₂ /g/day	



Data form
A1.2c. Results of the additional indicators

Additional laboratory indicator (suggested methods given in Annex 5)	Method	Unit	Result
Available water capacity		g/g	
Phosphorus (P)		mg/kg	
Electrical conductivity (EC)		dS/m at 25°C	
Pollution ^a		mg/kg	
Microbial biomass C		mgC/kg soil or % of SOC	
Enzyme activity ^a			
Soil biodiversity ^a			
pH			
Additional field indicator (suggested methods given in Annex 5)			
	Method	Unit	Result
Soil infiltration rate		mm/h	
Soil penetration resistance		MPa	
Soil loss		tonnes/ha/year	
Optional remote sensing indicators (suggested methods given in Annex 6)			
Normalized Difference Vegetation Index (NDVI)			Result
Bare soil index (BSI)			
Normalized Difference Water Index (NDWI)			

^aSpecify parameter of choice. A non-exhaustive list of possible indicators is given in Annex 4. Please note that the inclusion of a soil biodiversity indicator is suggested in all cases.

Paso 3: Interpretación de datos

Uso de líneas de base
y parcelas de control



Figure B3.1. Effects of agroforestry in sloping areas of Colombia

Sustitución espacio /
tiempo



Data form

A1.3 | Comparison of the indicators with baseline, control or reference values

It must be completed for each assessment unit Comparison of the four recommended indicators (and one additional indicator of soil biodiversity) with a baseline, control or reference values and results of the visual soil assessment, for evaluation of soil status and compliance with the VGSSM

Assessment unit (AU) identification

Soil indicator	Result of indicator	Compared with (baseline/ control/ reference value ^o)	Value of baseline, control or reference	The indicator is lower/equal/ higher than the baseline or reference		
				lower	equal	higher
Productivity						
SOC						
Bulk density						
Respiration rate						
Soil biodiversity ^{oo}						
Results of the visual assessment ^o				Poor	Medium	Good
Roots						
Macrofauna (macroinvertebrates)						
Colour/mottling						
Soil structure						

^o If a reference value or benchmark is used, please provide the corresponding citation.

^{oo} Additional indicator.

^{ooo} As per the field assessment methodology given in Annex 3.

Paso 3: Interpretación de datos

Evaluación de tendencias: cumplimiento de las Directrices voluntarias para la gestión sostenible del suelo (VGSSM).

Cuadro

2. Evaluación de la conformidad de la gestión sostenible del suelo con la VGSSM según la tendencia mostrada por los cuatro indicadores recomendados.

Conformidad	Tendencia (en comparación con la línea de base o el control)*.
NO	Uno o más indicadores muestran una tendencia al empeoramiento
BAJA	Todos los indicadores mantienen los mismos valores
MEDIO	Ningún indicador empeora y uno o dos mejoran
ALTO	Ningún indicador empeora y más de dos mejoran

*En el texto se explica qué debe considerarse mejora y empeoramiento para cada indicador.



Aplicación del protocolo de MSS

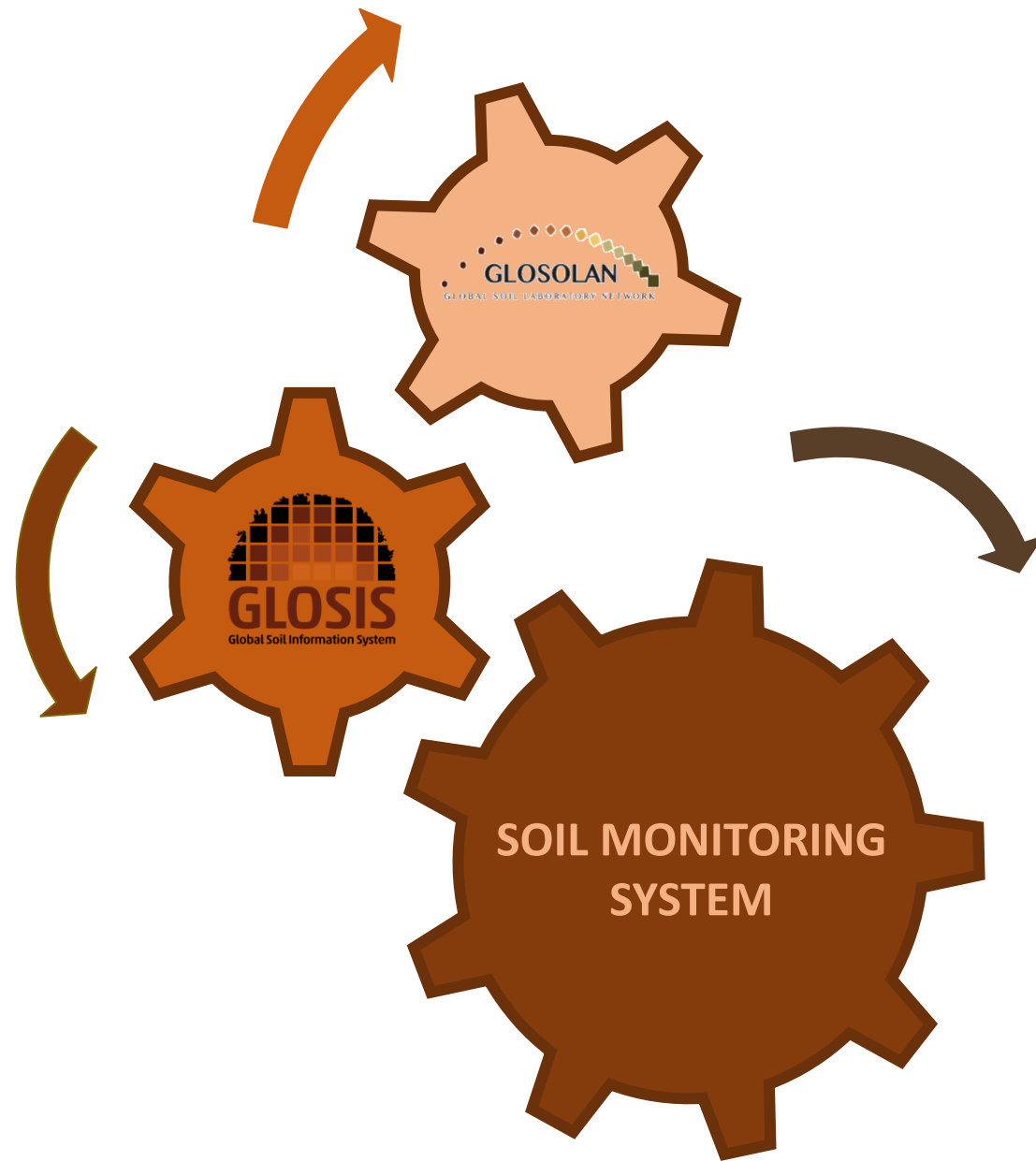
RECISOIL



Evaluación de proyectos, indicadores de impacto



LDN reporting, UNCCD



Gracias

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