Food and Agriculture Organization of the United Nations

2025 Status of the World’s Soil Resources Working Group Meeting

March 18 2024

GLOBAL SOIL PARTNERSHIP

Overview of Progress and the Path Ahead

Review of Condensed Table of Contents

1) Introduction (2 pages)
2) Soil functions and their contributions to life on earth (10 pages)
3) Threats to soil functions (48 pages)
4) Direct and indirect drivers (10 pages)
5) Sustainable soil management in support of SDGs (30 pages)
6) Facilitating the adoption of SSM (10 pages)
7) Seven Regional Assessment chapters (25 pages each)
8) Conclusions (2 pages)

RA Review and Approval Timetable

Compilation of the Regional Assessment Chapter

Once the editorial revisions for the subregions/subsections have been completed, the Review Editor submits the material to the ITPS Coordinating Lead Author(s) for the region. The ITPS Coordinating Lead Author(s) reviews the scientific credibility of the subregions/subsections submission and may request revision and re-submission by the original authors. All revisions at this stage should be completed by February 28, 2024.

RA Review and Approval Timetable

Compilation of the Regional Assessment Chapter

- The ITPS Coordinating Lead Author(s) will compile a draft of the Introduction, Drivers and Subregions/Threats section of their chapter by March 30, 2024 and circulate it to the other ITPS members in their region.

- The ITPS members from the region will complete the graphical summary of state and trend by April 10, 2024.

RA Review and Approval Timetable

- The ITPS Coordinating Lead Author(s) will compile a complete draft of the Regional Assessment chapter (including the Conclusion) and send it to the Secretariat (at SWSR@fao.org) by April 15, 2024.

RA Review and Approval Timetable

- The ITPS Coordinating Lead Author(s) for the region will suggest two reviewers for a review of the scientific credibility of the chapter. The review editor will select the final reviewers and the secretariat will send the chapter to two reviewers by April 24, 2024.
- The reviewers will submit their comments by May 31, 2024.

RA Review and Approval Timetable

- Once both reviews have been received, the Review Editor will assess and resolve referee comments in consultation with the Managing Editor, ITPS Coordinating Lead Author(s), and reviewers as needed by July 31, 2024.

- All regional chapters will be reviewed and approved by the ITPS at the November 2024 ITPS meeting.

Introduction for the RAs

- <u>1.1 Characteristics of region and subregions (1.5 pages)</u>
- *Give a concise introduction to the key features of the region.*

<JRC atlases excellent source of information>

- *The maps presented here will be referred to the sections on specific threats. The following maps will be included:*

1) Location diagram showing extent of region, main biogeographical areas, and subregions if they are used.

Introduction for the RAs

- 1.1 Characteristics of region and subregions (1.5 pages)
- *Give a concise introduction to the key features of the region. The maps presented here will be referred to the sections on specific threats. The following maps will be included:*

1) Location diagram showing extent of region, main biogeographical areas, and subregions if they are used.
2) Map at the Reference Soil Group scale in WRB (or alternative).
3) Land cover (FAO Global Land Cover – SHARE (GLC-Share)).

- 1.2 Summary of status from 2015 SWSR Report (0.5 pages)

Introduction for the RAs

2) Map at the Reference Soil Group scale in WRB (or alternative).

Europe (2005): Israel not included

Africa (2013): includes North Africa

Latin America and the Caribbean (2014)

Asia (2023); includes Near East and Eurasia except for:

Belarus, Georgia, Republic of Moldova, Armenia, Azerbaijan (other sources?)

Approach JRC for maps from atlases?

North America, Southwest Pacific: use national soil maps?

Introduction for the RAs

- 1.1 Characteristics of region and subregions (1.5 pages)

3) Land cover (FAO Global Land Cover – SHARE (GLC-Share)).

- 1.2 Summary of status from 2015 SWSR Report (0.5 pages)

Emphasize the top ranked threats from Soil paper

2: Direct and Indirect Drivers

Information on Drivers from Chapter 2 has been (in part) redistributed to RAs; length of Chapter 2 will be correspondingly reduced.

All information on drivers presented by country; provides information on all countries in the region even if they did not participate providing content for the chapter (gap filling).

UN main source (FAOSTAT and United Nations Department of Economic and Social Affairs) ; if possible, data will be updated in early 2025 to include 2022 data.

2: Direct and Indirect Drivers

Indirect

1) Total population growth and urban population growth.

Direct

Land use change:

1) Change in agricultural land: cropland and permanent meadows and pastures.
2) Change in forest land.
3) Popatov et al. (2021): Global map of land use transitions

Table 2 | Relative importance of different types of land-use conversions for cropland establishment (gain) and abandonment (loss), estimated from sample reference data

	AFR	SWA	ANZ	SEA	ENA	NAM	SAM	World
Cropland gain (%)								
Replacing pastures and recultivation of abandoned agricultural lands	17 (12)	47 (12)	91 (13)	29 (11)	97 (14)	75 (13)	61 (12)	51 (5)
Dryland irrigation	3 (13)	15 (12)	0 (0)	10 (12)	0 (0)	9 (12)	0 (0)	5 (5)
Conversion of natural vegetation or tree plantations	79 (13)	37 (12)	9 (13)	61 (12)	3 (12)	16 (12)	39 (11)	43 (5)
Cropland loss (%)								
Cropland abandonment or conversion to pastures	42 (12)	57 (12)	65 (12)	9 (11)	78 (13)	48 (11)	63 (12)	52 (5)
Conversion to other intensive agriculture	6 (14)	15 (12)	15 (13)	28 (11)	5 (11)	10 (11)	17 (11)	13 (5)
Construction, infrastructure and mining	17 (13)	10 (12)	6 (13)	35 (11)	10 (11)	17 (11)	8 (11)	16 (5)
Flooded land (natural and water reservoirs)	6 (14)	3 (12)	2 (13)	6 (11)	1 (11)	2 (11)	5 (11)	3 (5)
Restoration of natural vegetation, tree plantations	29 (13)	15 (11)	13 (13)	23 (11)	6 (11)	23 (11)	7 (11)	16 (5)

The analysis was restricted to mapped cropland loss and gain areas. The values in the table represent the percentage of each conversion type from the total cropland loss or gain area in each region and globally (with s.e.m. in parenthesis). AFR, Africa; SWA, south-west Asia; ANZ, Australia and New Zealand; SEA, south-east Asia; ENA, Europe and North Asia; NAM, North and Central America; SAM, South America.

nature food ARTICLES
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Global maps of cropland extent and change show accelerated cropland expansion in the twenty-first century

Peter Potapov[1]✉, Svetlana Turubanova[1], Matthew C. Hansen[1], Alexandra Tyukavina[1], Viviana Zalles[1], Ahmad Khan[1], Xiao-Peng Song[2], Amy Pickens[1], Quan Shen[1] and Jocelyn Cortez[3]

2: Direct and Indirect Drivers

Direct

Adoption of management:

4) Conservation Agriculture: Kassam, Friedrich and Derpsch (2022)

5) Agroforestry: Global Forest Resources Assessment (FAO, 2020)

Nutrient Management:

6) N, P and K budgets: Average from FAOSTAT 2017 to 2021.

7) Accumulated P residual: Zou, Zhang and Davidson, 2022

2: Direct and Indirect Drivers

1: A very low nitrogen surplus (< 20 kg/ha/yr) may be associated with nutrient mining (EU Nitrogen Expert Panel (2015)

2: Negative values for N Nutrient Balance indicate mining of N from soil organic matter; N surpluses greater than 80 indicate high risk of N pollution.

3: Negative values for P Nutrient Balance indicate mining of P from soil. Values of P surplus in excess of 6.9 kg P /hectare/year may indicate unsustainably high rates of P surplus (Zou, Zhang and Davidson, 2022).

4: Negative values for accumulated P residual indicate depletion of soil P reservoir since 1961; positive values indicate surplus of P additions (Zou, Zhang and Davidson, 2022).

5: Negative values for K indicate mining of K from soil.

Gap Filling

- Drivers provide information on all reporting countries in each region
- Can use boxes to present missing data or topical data not mentioned in text.

necessary to determine a particular outcome, but that same outcome can also be achieved by different combinations of factors – for example different processes of forest transition (see below).

Indirect drivers commonly combine to result in complex reinforcing and dampening effects that in turn produce the enabling and disenabling conditions that shape direct drivers of degradation and restoration (Geist & Lambin, 2002, 2004) (**Box 3.3**). In a landmark review of the underlying driving forces of tropical deforestation, Geist *et al.* (2002) found that often 3-4 indirect drivers (e.g., economic, technological and institutional factors) underpinned the majority of direct drivers (e.g., agricultural expansion, infrastructure development and timber extraction). The same authors came to similar conclusions when assessing the drivers of dryland degradation (Geist & Lambin, 2004). The fact that land degradation processes are so commonly underpinned by a number of interacting drivers challenges popular single-factor explanations that place much of the blame for land degradation on, for example, high densities of rural poor – an interpretation that can be easy to reach when only assessing surface patterns (e.g., population density in South Africa) (Hoffman & Todd, 2000) or property sizes in the Brazilian Amazon (Michalski *et al.*, 2010), at the expense of a deeper analysis of underlying factors that may have resulted in those patterns. For example, corruption is often an important institutional driver of land degradation, as the prospects of the money that can be gained by political and administrative officials from extractive activities through corruption can encourage them to overlook or even support these activities (Cerutti *et al.*, 2013). But another study on South America showed that improvements in general indicators of governance, including corruption, can promote deforestation, likely by providing an environment more conducive to business investments (Ceddia *et al.*, 2015).

Natural environmental variability interacts with underlying human causes of land degradation and restoration in important ways. In particular, the spatial variability in environmental resources has a strong moderating effects on human activities – as manifested for instance in the patterns of road expansion into areas that are more suitable for agriculture (Chomitz & Gray, 1996). Sometimes variability in natural conditions can override the influence of socioeconomic variables. For example, Redo *et al.* (2012) found that environmental variables such as temperature, precipitation and elevation are consistently associated

Box 3.3 Synergistic interactions between indirect drivers of land degradation.

It is possible to distinguish three modes of underlying causation of land degradation: (1) **single-factor causation** (one individual underlying factor driving one or more direct drivers); (2) **concomitant occurrence** (independent, separate operation of factors); and (3) **synergistic causation** (several interlinked factors acting together) (Geist & Lambin, 2004). In their meta-analyses of the drivers of deforestation and dryland degradation Geist and Lambin (2002, 2004) identified extremely few cases where it is possible to isolate a dominating influence of one indirect driver that is responsible for determining human activities that result in land degradation, concluding instead that the most common type of causation is due to synergistic interaction between multiple drivers.

In many situations indirect drivers operating at multiple spatial scales, and in different geographies, combine to shape the activities of a particular land-use sector and its implications for land degradation and restoration outcomes. Liu *et al.* (2013) reviewed the iconic case of the soybean trade between Brazil and China which provides an illustrative example of this. A superficial analysis identifies the strong demand for soy bean products, including animal feed (mostly pigs) in China as being the dominant indirect driver. However, interacting with this demand are the political influences of the Chinese government in pursuing foreign investments and the Brazilian government in developing an export market. Strong cultural preferences for soybean products underpins the economic demand from China, whilst landmark developments in agricultural technology and selective breeding by Embrapa, Brazil's agricultural research institution, were critical in enabling Brazilian farmers to plant soy in the otherwise infertile soils of the Brazilian cerrado.

A frequently encountered situation of dryland degradation can be seen in the creation of water-related infrastructure resulting in the expansion of irrigated croplands and pastures. Underlying this expansion is a set of political, economic and technological factors that, in developing countries, are often underpinned by national policies aimed at consolidating territorial control over remote, marginal areas and attaining self-sufficiency in food and clothing (Geist & Lambin, 2004). Some of the most powerful examples of this can be found in Central Asia. For example, in Turkmenistan agriculture is almost entirely dependent on irrigation, initially established in the Soviet era and driven, in particular, by a desire to rapidly expand the production of cotton. However, flaws and inefficiencies in the design of these irrigation systems has led to widespread soil and water degradation due to waterlogging and salinization with significant implications for the country's plans to diversify its agricultural base and enable its food requirements to be met (O'Hara, 1997). This same pattern can be found across the Aral Sea drainage basin, encompassing much of Turkmenistan, Uzbekistan and Tajikistan and leading to one of the world's worst examples of desertification (Saiko & Zonn, 2000).

Boxes useful for presenting cross-cutting information or highlighting key issues

Identify topics for boxes after main review of RAs

Content for boxes provided between July and end of September 2024

Authors included as Contributing Authors in report

Introduction for the RAs

- 1.1 Characteristics of region and subregions (1.5 pages)

3) Land cover (FAO Global Land Cover – SHARE (GLC-Share)).

- 1.2 Summary of status from 2015 SWSR Report (0.5 pages)

Emphasize the top ranked threats from Soil paper

Assessment of State and Trend

Each Regional Assessment chapter will include a graphical assessment of the state and trend of soil threats in that region.

For regions with subregions the assessments will initially be done on the state and trend of threats in the subregion and then a region-wide assessment will be completed.

Assessment of State and Trend

The assessment of state and trend will be made by the ITPS members for that region. The ITPS members may solicit input from other experts but the final assessment will be by the ITPS members. According to the "Process for ITPS Review and Approval of the 2025 Status of the World's Soil Resources Report":

The ITPS members from the region will complete the graphical summary of state and trend by 10 April 2024.

What is being assessed?

For agricultural, urban and managed forested lands, the assessment is of the management practices that have been in place through time, specifically how sustainable these practices are according to the definitions and guidelines previously established by the Intergovernmental Technical Panel on Soils.

What is being assessed?

Many soils without active management (for example, Arctic and tundra area) are threatened by human-induced global warming. A separate assessment of threats to soil functions posed by global warming and the regions where the threats are greatest will be completed as part of the report.

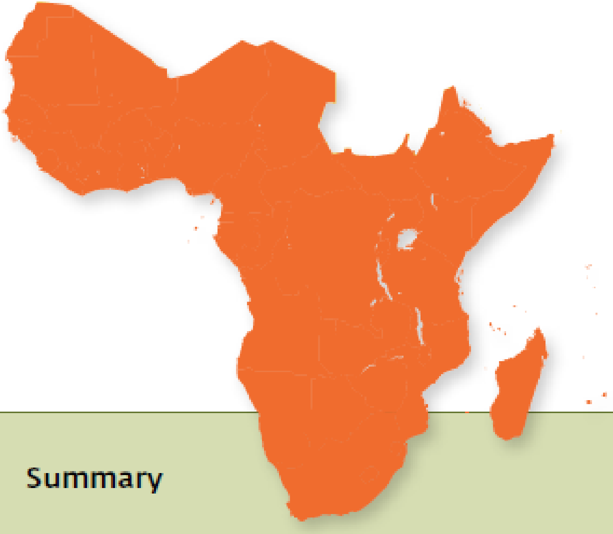
What is being assessed?

The assessment of state for managed soils is made for the period from 1975 to 2015, with greatest weight given to the 1995 to 2015 period. The assessment of trend is for the period from 2015 to the time of the assessment.

What is being assessed?

State	Description
Very Poor	The management practices in place were very ineffective in minimizing soil erosion.
Poor	The management practices in place were ineffective in minimizing soil erosion.
Fair	The management practices in place were mixed in their effectiveness in minimizing soil erosion.
Good	The management practices in place were effective in minimizing soil erosion.
Very Good	The management practices in place were highly effective in minimizing soil erosion.

Table 1 | Summary of soil threats (listed in order of importance), condition, trends and uncertainties for Africa South of the Sahara



Threat to soil function	Summary
Soil erosion	Soil erosion constitutes > 80% of land degradation in SSA, affecting about 22% of agricultural land and all countries in the region. The majority of causes related to the exposure of the bare soil surface by cultivation, deforestation overgrazing and drought.
Organic carbon change	The replacement of the natural vegetation reduces nearly always the soil carbon level. Further carbon release from the soil is caused by complete crop removal from farmlands, the high rate of organic mater decomposition by microbial decomposition accentuated by high soil temperature and termite activates in parts of SSA.
Nutrient imbalance	Nutrient imbalance, which is generally manifested by the deficiency of key essential nutrients is mainly due to the fact that fertilization has not been soil and crop specific, farmers are unable to pay the price for fertilizers and the inability to follow the rates that are recommended. Nearly all countries in the region show a negative nutrient balance.
Loss of soil biodiversity	SSA suffers the world's highest annual deforestation rate. The areas most affected are the in the moist areas of West Africa and the highland forests of the Horn of Africa. Cultivation, introduction of new species, oil exploration and pollution reduce the population of soil organisms thus reducing faunal and microbial activities.
Soil acidification	Over 25% of soils in Africa are acidic. Most of these occur in the wetter parts of the continent. In South Africa it poses as a serious chemical problem and the greatest production-limiting factor.
Waterlogging	Most waterlogging threats are due to rise in water table due to poor infiltration/drainage or occurrence of impervious layer in the subsoil. Waterlogging generally reduces crop productivity, but in paddy fields is deliberate and beneficial.
Compaction	The major cause of compaction is pressure on the soil from heavy machinery. It is more serious in forested regions where land clearing (and even other cultivation activities) cannot be done without mechanization.

Also need text to highlight specific locations with highest potential Threat

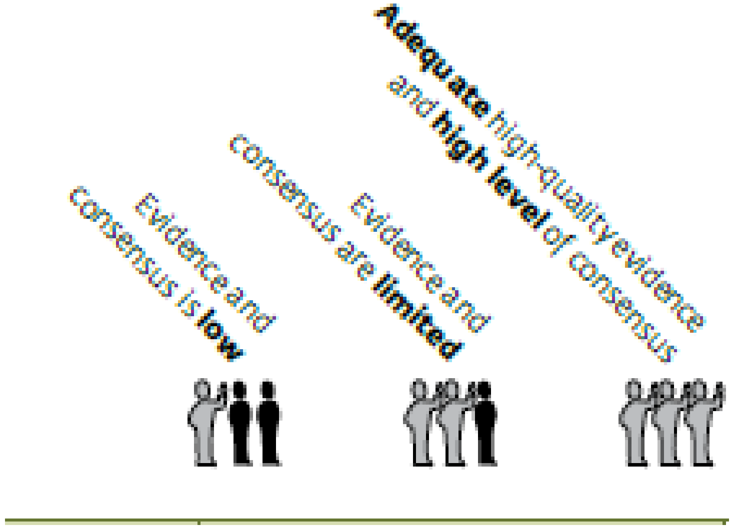
In 2015 ranked by severity

What is being assessed?

Trend	Description
Stable	Widespread adoption of sustainable soil management practises occurred prior to the assessment period and they continued to be used during the assessment period.
Improving	Widespread adoption of sustainable soil management practises occurred during the assessment period.
Deteriorating	Continued widespread use of management practises known to accelerate risks to soil functions occurred during the assessment period.
Variable	No clear trend in adoption of sustainable soil management practises was evident during the assessment period

Assessment of Uncertainty (Confidence)

In the SWSR 2015 report there was an estimate of uncertainty (confidence) made for state and for trend for each risk to soil functions. Three classes of uncertainty were used: evidence and consensus are low; evidence and consensus are limited; and adequate high-level evidence and high level of consensus.



Assessment of Uncertainty (Confidence)

The assessment of uncertainty for state and for trend will be completed by the ITPS in consultation with other experts. The assessment should be based on the material presented in the section.

Other sections of the Conclusions

Material should be drawn from chapter

4.2 Progress and Impediments to adoption of sustainable soil management (0.5 pages)

4.3 Recommendations for future priorities for action (0.5 pages)

Review Process for RAs

ITPS Review and Approval Procedures

Report is a product of the ITPS and must be approved by ITPS

ITPS Review and Approval Procedures

Third meeting of the Global Soil Partnership Plenary Assembly. 22-24 June 2015. GSPPA-III/15/Report

“In conclusion, the Assembly *took note with appreciation* of the SWSR as a unique store of information to serve as a basis for discussion and consultation, particularly for enhanced understanding of soil issues and scope for improvement measures. (p.8)

The Assembly agreed that its own endorsement of the full and summary reports was not required, and that the report would be a major technical output of the ITPS. (p.8)”

ITPS Review and Approval Procedures

Report is a product of the ITPS and must be approved by ITPS

ITPS Review and Approval Procedures

Report is a product of the ITPS and must be approved by ITPS

ITPS Review and Approval Procedures

All parts of the report must be reviewed by ITPS members prior to presentation of the full report at the March 2025 ITPS meeting.

Review process for RAs previously discussed.

ITPS Review and Approval Procedures

Literature Review Chapters

The external review process for the literature review chapters have been previously approved. Briefly the individual sections from the chapters are sent to two or more external reviewers under the supervision of the Review Editor. Upon submission of the reviews, the Review Editor works with the Managing Editor to resolve issues and prepare a second draft of the text.

ITPS Review and Approval Procedures

Literature Review Chapters

Based on preliminary discussions at the 2025 SWSRR WG Executive, the suggested approach for review by the ITPS is to have three-person teams of ITPS members assigned to each section/chapter to review the content. The ITPS team members could request revisions to the material and the Managing Editor and Review Editor would respond to these requests.

Ultimately the ITPS teams would recommend acceptance of the section/chapter to full ITPS at the March 2025 meeting.

Summary for Policymakers

The Summary for Policymakers is the principal means by which the information in the full report will be communicated to policy makers and soil managers.

The Summary for Policy makes will be translated into the six official UN languages; the main report would only be available in English.

Summary for Policymakers

The Summary will..

- be no more than 20 pages of text.
- emphasize new information on the efficacy of sustainable management practices published since 2015.
- include graphical summaries of the state and trend for the seven regions and the subregions.
- not include references but will instead provide links to the relevant sections of the main report.

Process for creating SFP

- The graphical summaries of the state and trend for the regions will be developed as part of the regional assessment chapters.

- The ranking of the threats will be done by the ITPS members for the region, the Lead Authors for the regional chapter and the Chair of the Regional Soil Partnership for that region. This ranking will take place after completion of the regional assessment review process (approximately between July and September, 2024).

Process for creating SFP

- Brief summaries of the literature review sections of the report will be prepared by the Editorial Team and provided to the ITPS members who are overseeing the review and approval process for the literature review sections.

- The ITPS members will write the material for the Summary for Policymakers for the sections they are responsible for (i.e. those that they reviewed) between November 1 and December 15, 2024.

Process for creating SFP

- The Editorial Team will compile the information into a final draft of the Summary for Policymakers (January 2025) and submit the summary to the FAO review process (February 2025).
- The Summary for Policymakers will be submitted to the ITPS for approval at the March 2025 ITPS meeting.