



Soil Protection and Rehabilitation

BACKGROUND



Healthy soils are the basis for human life. They are the foundation for a functioning ecosystem, providing essential services related to water, climate, food, and biodiversity. Soils are the second-largest carbon sink on Earth (storing more than 1,500 billion tons of carbon) after oceans and provide habitats for many different species, accounting for more than a quarter of the planet's biodiversity. Our agricultural production heavily depends on soils, with 95 per cent of our food originating from them. However, soil is a non-renewable resource, and unsustainable management leads to nutrient depletion and degradation. According to the United Nations Convention to Combat Desertification (UNCCD), more than 40 per cent of the Earth's arable land, equivalent to six million hectares, is affected by degradation. The Intergovernmental Panel on Climate Change (IPCC) estimates that by 2050, 90 per cent of the earth's topsoil will be at risk of degradation while the world population will reach 9.1 billion people, increasing the need for food production. This trend contributes to the trilemma of biodiversity, climate, and food and nutrition crises that are inherently connected. Ongoing losses of ecosystem services amount to an overall global cost of up to 10.6 trillion US-Dollars per year. At the same time, it takes up to 1,000 years to produce two to three centimetres of soil.

Increasing soil degradation is mainly caused and driven by unsustainable land management practices, such as the application of solely inorganic fertilizers, and climate change impacts, such as droughts and floods. Global processes like the African Fertilizer and Soil Health Summit (AFSHS) are addressing these worrying trends. An important milestone was reached in May 2024 in Nairobi, Kenya, with the adoption of the Soil Initiative for Africa (SIA), a 10-year action plan and a declaration signed by all African member states aiming to improve the health and productivity of Africa's soils.

THE GLOBAL PROGRAMMES ProSoil AND Soil Matters IN BRIEF

As part of Germany's Special Initiative "Transformation of Agricultural and Food Systems", the Global Programme "Soil Protection and Rehabilitation for Food Security" (ProSoil) supports and advises smallholder farmers in Ethiopia, Benin, Burkina Faso, India, Kenya, Madagascar and Tunisia on agroecological and climate-smart agricultural practices with a focus on sustainable land management. Stakeholders from the scientific community, civil society and the private sector are actively involved in the activities, in addition to the relevant government agencies in each country. Since the launch of ProSoil in 2014, soil degradation has been reversed on more than 981,000 hectares of land. This has resulted in an average yield increase of

44 percent, directly benefiting the livelihoods of more than 2.6 million people. More than 65 percent of the farmers reached are women. Through climate-smart soil management solutions, the carbon footprint has been reduced by around 1.74 million tonnes of carbon dioxide, as healthy soils are an important carbon sink. The Global Programme "Soil Matters – Innovations for Soil Health and Agroecology", launched in 2025, builds on the results of ProSoil and aims to develop and promote agroecological innovations in partnership with the private sector to scale up impact and support agricultural transformation processes. Soil Matters is active in Tunisia, India, Kenya, Ethiopia, Madagascar and Cameroon. Both Global Programmes, ProSoil and Soil Matters, are commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) and co-funded by the European Union (EU) and the Gates Foundation.

Soil degradation affects negatively:

- biodiversity support (habitat for organisms and microbial activities)
- biological processes (decomposition and nitrogen fixation)
- disaster risk management (erosion control and flood mitigation measures)
- climate and water regulation (greenhouse gas emissions such as carbon, methane, and nitrous oxide as well as water storage and filtration)
- agriculture production and nutrient cycling (declining yields, economic losses, and nutrient leaching)

Why Soil Protection and Rehabilitation is important

Soil protection and rehabilitation (SPR) aims to maintain and enhance soil functions and production capacity of soils by halting degradation and restoring degraded soils. Through soil rehabilitation unproductive and degraded land can be revitalized. Conservation measures not only preserve soil functions but also increase the production capacity of the land, while fostering biodiversity within the soil ecosystem. SPR approaches increase and stabilise yields by improving soil fertility

and productivity, thereby reducing the risk of economic losses for farmers. Consequently, SPR is fundamental and serves as a foundational strategy for sustainable agri-food systems, contributing to the Agenda 2030, particularly in relation to SDG 15.3, which addresses Land Degradation Neutrality. The three Rio Conventions – the United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC), and the Convention on Biological Diversity (CBD) – all play crucial roles in soil protection and rehabilitation.

Moreover, many SPR measures have a positive impact on climate mitigation. For instance, supplementing mineral fertilisers with organic fertilisers can enhance soil organic carbon (SOC) storage, which in turn improves soil fertility. Additionally, soil protection interventions can decrease the vulnerability of agro-food systems as well as ecosystems and minimize impacts of climate change. For example, measures that enhance water retention capacity can improve resilience against droughts. Practices such as stone bunds, cover crops, contour ploughing, and minimum tillage are effective strategies for limiting soil erosion caused by increasingly frequent intense rainfall events attributed to climate change.

Benefits of SPR:

- maintains soil health
- protects ecosystems and biodiversity
- increases income through higher stabilised yields
- increases food security
- creates independence of external inputs like chemical fertilizer
- strengthens climate adaptation and mitigation by improving climate resilience

Challenges for Soil Protection and Rehabilitation

The livelihoods of small-scale food producers are directly reliant on functioning ecosystems and the services they provide. Unsustainable land use and management practices have resulted in the degradation of land and soils on a global scale while also contributing to climate change. Conversely, the impacts of climate change, such as an increased frequency of extreme weather events,

exacerbate soil degradation and present challenges for the agri-food system, thereby threatening livelihoods and food security. This is particularly true for smallholder farmers who heavily depend on their own production but encounter significant barriers to adopting climate change adaptation measures.

To protect soils and increase food security, a transformation of the land use and the agri-food system is essential, which includes adapting farming systems, and practices. However, environmental, and socio-economic factors, as well as stakeholder dynamics, vary across agri-food systems, countries, and regions.

Farmers frequently encounter obstacles in implementing sustainable soil management practices due to limited access to knowledge, extension services, technologies, agricultural inputs, and financial resources. Additionally, existing legal frameworks, land tenure arrangements, and policies can pose challenges to the transition towards a sustainable agri-food system, for instance, by incentivising the overuse of external inputs.



A farmer in Ethiopia showcasing benefits of her home garden.

How to overcome the challenges:

To address the various environmental and social aspects associated with soil degradation, ProSoil and Soil Matters promote context-specific approaches that are tailored to the socio-economic circumstances and best suited to local soil and climate conditions. These integrated approaches are diverse, ranging from technical quick win interventions to long-term strategies, such as embedding agroecological practices within political and academic institutions with an increased emphasis on knowledge sharing. Techniques are shared and disseminated by farmers and partners and are integrated into new policies and governmental strategies.

Technical practices for Soil Protection and Rehabilitation:

- Crop management practices (minimum tillage, intercropping, crop rotation, green manure)
- Soil health inputs (compost (21), vermicompost, jeevamrut, animal manure/urine, biochar, bio slurry, terra preta, lime, biofertiliser, inoculants)
- Vegetative measures (vegetation stripes, hedges, agroforestry)
- Structural measures (micro basins, water-spreading weirs, stone/earth bunds, terraces, trenches/ditches)
- Land management practices (fire management, rotational grazing, fenced grazing, permanent area closure/reforestation, cut & carry)
- Complementary good agricultural practices (quality seeds, line sowing, small-scale irrigation/water harvesting, small-scale mechanization, climate-information, decision support tools for efficient fertilizer application)
- Integrated Soil Fertility Management (on time weeding/seeding, conservation agriculture, lime for soil pH regulation, enhanced rock weathering)

In addition to promoting technical approaches, agroecological measures need to be integrated into existing extension services. This ensures a proper supply of agroecological inputs and provides farmers with the necessary knowledge for the agroecological transition. Furthermore, ProSoil and Soil Matters develop business models centred around soil conservation measures that not only enhance soil protection but also stimulate the local economy by creating new jobs and income opportunities. Although soil protection requires economic investments by developing competencies, establishing

structures and reforms, and promoting interventions at the farm level (e.g. erosion-reducing infrastructure, mechanisation), evidence demonstrates their economic benefits at all levels. These benefits include increases in agricultural yields, improved food and nutrition security, and overall advantages such as improved human health and climate resilience.

Another objective is to improve framework conditions and establish incentives for soil protection and rehabilitation on a broader scale, for example, by supporting partner governments in developing national policies on the management of agricultural soils. Collaboration with local partners is fundamental to successfully implementing and scaling soil protection and rehabilitation (SPR) approaches. To ensure a just transition towards a sustainable agri-food system, including gender equality, interventions such as farmer trainings, often focus on women. Additionally, improving land rights ensures fair access to land, especially for socially disadvantaged and marginalised groups.

Outcomes

- More land made usable for agriculture again: On a global level, the Global Programme has protected or rehabilitated 981,820 hectares of land. Average yields have increased by nearly 44 per cent compared with reference areas.
- Small-scale farmers and women in focus: In total, more than 2.6 million people have directly benefited from improved soil and land management and 795,097 people (smallholder farmers and (agro-) pastoralists) were trained in sustainable agricultural practices, including 43 per cent women and 33 per cent young people. Social, economic, or legal situations of more than 220,000 female farmers were improved.
- Increased climate resilience: Since 2020 more than 1.74 million tonnes CO₂ equivalents were mitigated due to the application of SPR practices at farm and landscape level¹ (around 600,000t in 2023).
- All partner countries have been constantly advised regarding soil health and many implementation steps are formulated in strategies, plans or social agreements on various levels.
- Soil protection and rehabilitation is integrated into 59 courses in agricultural education and training institutes.
- Targeted learning experiences and innovations on soil protection and rehabilitation are made available for knowledge transfer at national and international level.

¹ Landscape-level means a heterogeneous area within a region that contains multiple and interacting land-uses, watersheds, and ecosystems.



Training programme for local communities in masonry work for the construction of WSW in Ethiopia's lowlands (Afar).

Example from the Field

The arid and semi-arid lowlands of Ethiopia are home to agro-pastoralist communities, where soil degradation poses a constant challenge. Climate change is resulting in longer periods of drought and increased flooding. This combination is the primary cause of the widespread degradation of soil, which is evident in weak vegetation cover and low soil infiltration capacity. Flash floods cause significant erosion, threatening the livelihoods of millions of people. This process has begun in most of the dry valleys, which were once covered with tall grass, leading to a loss of resilience to drought. In collaboration with regional and local government partners, GIZ has developed the 'Dry Valley Rehabilitation and Productive Use' (DVRPU) approach to transform dry valleys into

flourishing landscapes. At the heart of the DVRPU is a comprehensive package of measures that addresses social, technical, biological, economic, institutional, and administrative dimensions. The centrepiece of this technology is a cascade of water-spreading weirs (WSWs).

Constructed from stone and cement, in combination with dry stone walls and biological measures, these structures slow down the flow velocity of flash floods, allowing water to infiltrate the soil, sediment to be deposited, and vegetation to increase, thereby raising the groundwater level. This process creates highly productive land and improves food security. In the regions of Afar, Somali, and Oromia, more than 550 WSW and 350 dry stones walls have been constructed, resulting in the protection or rehabilitation of 55,619 hectares of land.

TESTIMONIAL

ProSOIL has collaborated with women's collectives in the rural areas of Madhya Pradesh to establish Community Nutrition Gardens (CNGs). The initiative has a twofold aim: to meet nutritional needs and to provide an economic cushion for women farmers. As part of the project, women farmers received technical knowledge on agroecological farming practices and nutritious diets during the meetings. One participant, Pinki Sant Das Panariya from Khuksar village, shared her experience with CNGs.

“We created a system that divides the garden into seven sections, allowing us to harvest seven different kinds of vegetables throughout the week. We utilise vermicompost and jeevamrut in the nutrition garden, along with a biopesticide. The variety of vegetables available through this system is crucial for women's health”, she explains.



An Indian farmer applying organic fertilizer on her field leading to healthier diets.

Key Messages

- Soil protection and rehabilitation are essential to ensure a transition towards a sustainable agri-food system.
- Sustainable land management enhances soil fertility, resulting in higher yields and directly contributing to food security.
- SPR interventions are currently high on the agenda of partner countries and need to be further featured in global and African processes. These efforts should be supported through regional and multilateral cooperation, thereby contributing to initiatives such as the UNCCD, UNCBD, UNCCC, CAADP (Comprehensive Africa Agriculture Development Programme) and the African Fertilizer and Soil Health Summit (AFSHS).
- Behavioural changes and the establishment of trust setting at the farm level take time, and many benefits, such as increased yields, are not immediately observable. Quick-win technologies, such as liming on acidic soils, are crucial for reducing complexity; they serve as an entry point and should be complemented by long-term, including Integrated Soil Fertility Management (ISFM)², regulated by political frameworks that create incentives to repurpose subsidies.
- Applied approaches and technologies must be adapted to local contexts and socio-economic conditions to be effectively adopted by farmers.
- Access to knowledge, data, extension service, finance, (digital) technologies and inputs needs to be facilitated to prepare farmers for their agroecological transition.
- An enabling environment, private sector involvement to develop business models, and appropriate political frameworks are essential for the sustainability and scalability of approaches aimed at agroecological transformation.
- Negative implications for farmers, such as increased workloads, must be considered in interventions. Strategies like small-scale mechanisation should be developed to address these challenges and ensure successful adoption.
- Accompanying research and rigorous impact monitoring are vital for generating evidence, particularly regarding economic benefits, to persuade decision-makers and secure their support. Approaches that reach large scales in terms of hectares serve as a proof of concept and demonstrate effectiveness.
- An agroecological transition can be more readily achieved more easily if farmers and extension workers are involved from the outset, allowing all parties to benefit from mutual learning within interdisciplinary research.

² ISFM describes a set of soil fertility management practices that necessarily include the use of fertilizer, organic inputs, and improved germplasm combined with the knowledge on how to adapt these practices to local conditions, aiming at maximising agronomic use efficiency of applied nutrients and improved crop productivity.

Further readings and sources

Theme | World Soil Day, 5 December | Food and Agriculture Organization of the United Nations (fao.org)

UNCCD (2022): *Summary for decision makers. Global Land Outlook second edition*. Available at: [GLO2_SDM_low-res_0.pdf \(unccd.int\)](#)

FAO (2022): *Saving our soils by all earthly ways possible*. Available at: [Saving our soils by all earthly ways possible | FAO Stories | Food and Agriculture Organization of the United Nations](#)

BMZ (2018) *Bodenschutz wirkt. Ausgewählte Grafiken und Bilder basierend auf Zahlen, Daten Fakten aus Projekten der deutschen EZ und internationalem Fachdiskurs*.

Intergovernmental Panel on Climate Change (IPCC). *Land degradation*. In: *Climate Change and Land: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. Cambridge University Press; 2022:345-436.

FAO – High Level Expert Forum 2009. Available at: [HLEF2050_Global_Agriculture.pdf \(fao.org\)](#)

EU Commission (2011): *Soil: the hidden part of the climate cycle*. Available at: [ENV-10-037_soil_MEP_EN.indd \(europa.eu\)](#)

Statista (2023): *Number of people facing food insecurity in Ethiopia 2023*. Published by Saifaddin Galal. Available at: [Food insecurity in Ethiopia 2023 | Statista](#).

Soil Atlas (2024): *Heinrich-Böll-Stiftung & others*. Available at: [Soil Atlas 2024: Facts and figures about a vital resource](#)

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Friedrich-Ebert-Allee 32+36
53115 Bonn
T +49 61 96 79-0
F +49 61 96 79-11 15

Programme:
Global Programme "Soil Protection and Rehabilitation
for Food Security" (ProSoil)
E soilprotection@giz.de
I ProSoil: <https://www.giz.de/en/worldwide/129677.html>

Global Programme "Soil Matters – Innovations for
Soil Health and Agroecology"
E soilprotection@giz.de
I Soil Matters: <https://www.giz.de/en/worldwide/207042.html>



Design/Layout
EYES-OPEN and weissbunt, Berlin

Photo credits:
© GIZ, 2024

This publication contains links to external websites.
Responsibility for the content of the listed external sites
always lies with their respective publishers.

This publication was produced with the financial support of the
European Union and the German Federal Ministry for Economic
Cooperation and Development (BMZ). Its contents are the sole
responsibility of GIZ and do not necessarily reflect the views of
the European Union and the German Federal Ministry for Economic
Cooperation and Development (BMZ)

Bonn, May 2025