



Issue 35

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NEWSLETTER

Smart & Net-Zero Project

The Smart Net-Zero (SNZ) project team under the Food and Fertilizer Technology Center (FFTC) for the Asian and Pacific Region regularly collects and shares information related to sustainable agri-food systems and climate-smart agriculture, including research, news, policy, data and event updates around the world on the project website.



Overview

Scaling Soil Carbon Sequestration: Integrating Management, Modeling, and MRV

Soil tillage and carbon sequestration management are central to climate-smart agriculture (CSA), but their mitigation value depends on net GHG outcomes and credible monitoring. In **Research**, the main review synthesizes how conservation practices influence soil organic carbon (SOC) and how simulation models and remote sensing can strengthen MRV. Supporting studies quantify the carbon storage role of rice paddies, examine SOC and methane trade-offs in lowland systems, assess long-term diversification benefits for soil-related ecosystem services, and demonstrate the need for tailored, multi-objective carbon farming strategies.

News cover AI-enabled agriculture, low-emission rice technologies, adaptation finance gaps, soil carbon markets, and Taiwan’s carbon tracking efforts. **Policy** reviews soil carbon incentives, cover crop integration into NDCs, grassland SOC targets, and regenerative agriculture finance, while **Open Data** features the EU Soil Observatory for soil monitoring and reporting.

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RESEARCH

01 THEME: Carbon Sequestration; MRV (Measurement, Reporting, Verification)

Impact of agricultural management practices on soil carbon sequestration and its monitoring through simulation models and remote sensing techniques: A review

August 27, 2020 | [Critical Reviews in Environmental Science and Technology](#) |

Introduction: Led by an India-based team from Bidhan Chandra Krishi Viswavidyalaya, the Indian Institute of Remote Sensing (IIRS)-ISRO, and Punjab Agricultural University, the authors synthesize evidence on how common agronomic practices influence soil organic carbon (SOC) stocks and evaluate how process-based models (e.g., RothC, Century, DNDC) together with satellite and airborne remote sensing can support scalable SOC assessment.

Key findings: Across the literature reviewed, conservation-oriented practices such as reduced or no tillage, residue retention, diversified rotations or cover crops, balanced fertilization, and organic amendments are consistently associated with higher SOC accumulation, although effect sizes vary with climate, soil texture, baseline SOC, and duration of adoption. SOC gains are often concentrated in the topsoil, which may overestimate whole-profile sequestration if deeper layers are not measured or modelled. For monitoring, the authors emphasize that process-based models can estimate SOC trajectories and distinguish management effects from climate variability, but they require well-calibrated inputs and long-term field validation. Remote sensing is most useful for mapping indicators related to SOC dynamics, including vegetation productivity, residue cover, and soil moisture, and for scaling model outputs rather than directly measuring SOC from space. The review concludes that robust MRV requires integrated workflows combining field sampling, modelling, and remote sensing, together with transparent uncertainty reporting to support carbon credit or results-based policy programs.

Graphical abstract



02 THEME: Carbon Sequestration; GHG Emission Reduction

Rice paddy soils are a quantitatively important carbon store according to a global synthesis

August 06, 2021 | [Communications Earth & Environment](#) |

Introduction: Rice paddies are widely discussed for methane emissions, but their role as carbon stores is less consistently quantified. Led by Chinese researchers from Shenyang Agricultural University and comprising a cross-disciplinary team from across Europe, this study compiles a global dataset to quantify carbon stocks in paddy soils and evaluate their significance within the global soil carbon pool.

Key findings: Using a global synthesis, the authors estimate that rice paddy soils store roughly 45 Mg C ha⁻¹ on average (to ~1 m depth) and that this stock is comparable in magnitude to carbon stored in other major soil categories. They further project that the area under rice cultivation could expand by >30% by 2050, implying that paddy soils will remain a substantial global carbon pool even as mitigation efforts target rice CH₄ emissions. The paper’s policy relevance is that mitigation strategies in rice systems should be evaluated on net climate outcomes: practices that reduce CH₄ but erode soil carbon could undermine long-term benefits, while approaches that protect/raise SOC can complement CH₄ reductions. A key limitation is spatial data unevenness (some regions and soil depths are underrepresented), which affects uncertainty in global upscaling; the authors’ synthesis underscores the need for more standardized, depth-resolved SOC measurements in rice landscapes to improve national inventories and MRV.

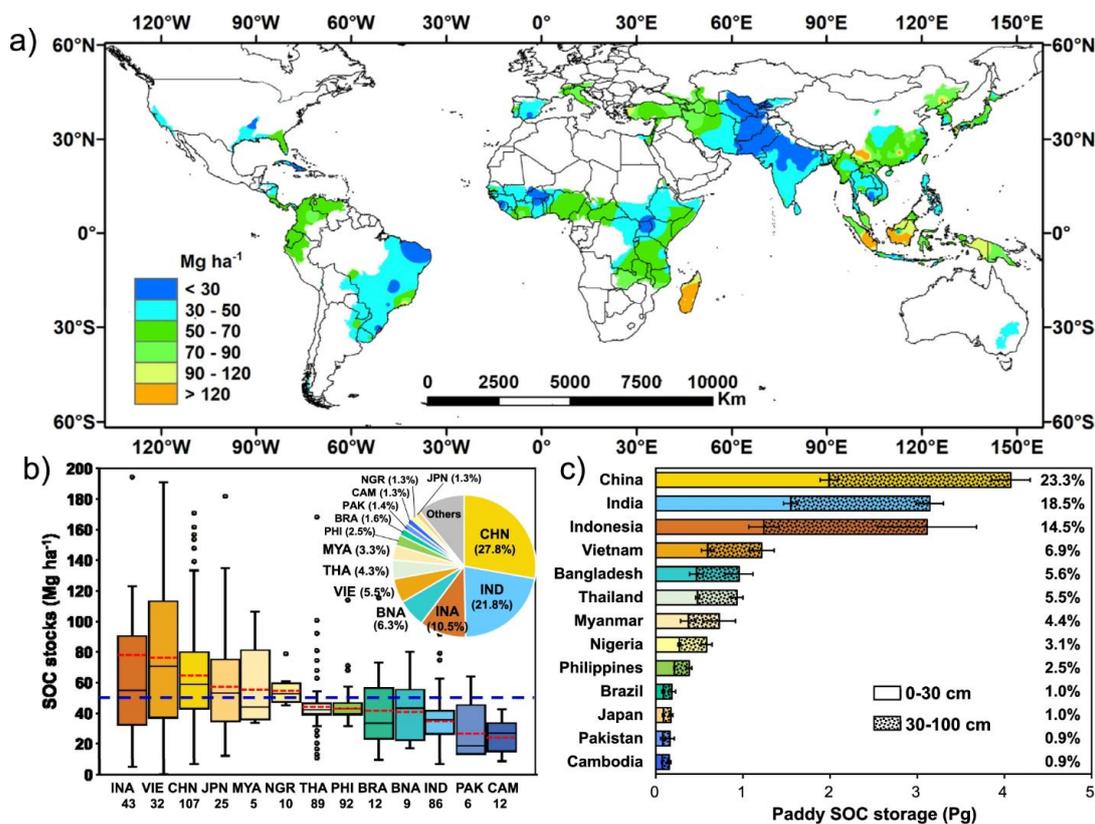


Figure | Map view and soil organic C stocks of the main rice-producing countries.

03 THEME: Carbon Sequestration; GHG Emission Reduction

Potential soil organic carbon sequestration vis-a-vis methane emission in lowland rice agroecosystem

August 26, 2023 | [Environmental Monitoring and Assessment](#) |

Introduction: Lowland rice systems present a well-known climate trade-off, as management practices that increase soil organic carbon (SOC) inputs can also stimulate methane emissions under flooded conditions. This study evaluates SOC sequestration potential alongside methane emissions under different management options in lowland rice, led by Indian researchers from the ICAR–National Rice Research Institute, with a focus on management-relevant evidence rather than purely theoretical potential.

Key findings: The study shows that management can deliver climate benefits only when SOC and CH₄ are assessed together. Biochar stands out as a dual-benefit option in the reviewed evidence, with reported CH₄ reductions of approximately 45.2% to 54.9% alongside SOC gains, depending on feedstock type, application rate, and site conditions. In contrast, mid-season drainage can reduce CH₄ emissions but may also decrease carbon accumulation, with one cited finding indicating a reduction of about 60%, highlighting a potential SOC penalty if drainage is poorly timed or too frequent. The authors therefore recommend integrated management packages that combine improved water management, organic amendments with lower methanogenic potential, and optimized nutrient strategies, together with MRV approaches that track both SOC changes and CH₄ fluxes to avoid burden shifting. Limitations include heterogeneity across experiments and the need for longer-term field trials that assess SOC persistence and methane dynamics across multiple growing seasons.

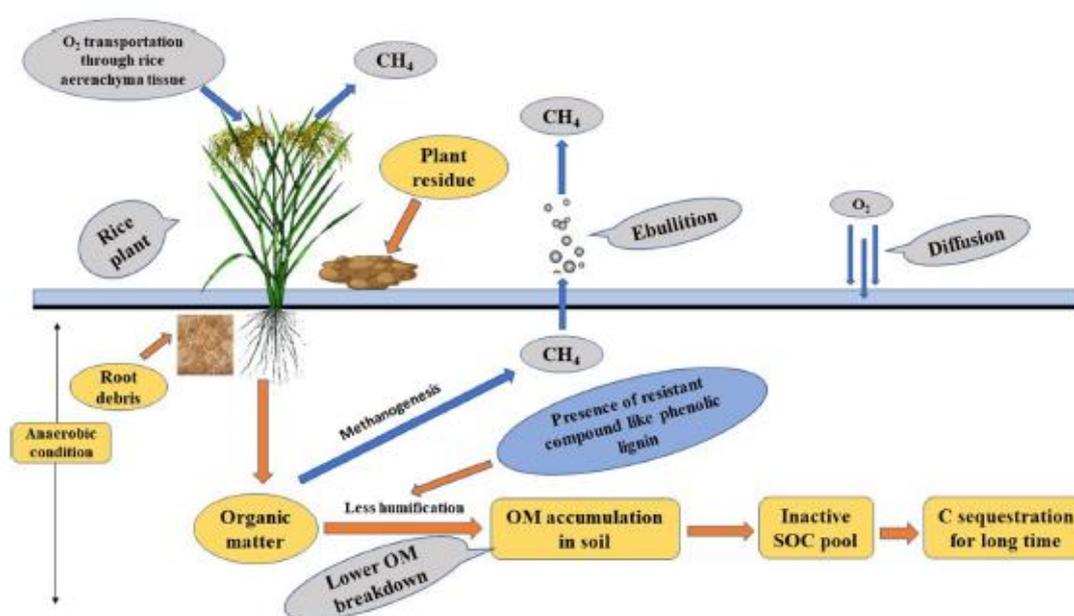


Figure | Schematic diagram of CH₄ emission and C sequestration in rice soil.

04 THEME: Carbon Sequestration; Others

Long-term agricultural diversification increases financial profitability, biodiversity, and ecosystem services: a second-order meta-analysis

January 26, 2026 | [Nature Communications](#) |

Introduction: While diversification is widely promoted for its multiple benefits, policymakers often question whether those benefits persist or increase over time. This second-order meta-analysis, led by researchers from Westlake University (China) and Swiss research institutes, synthesizes findings from 184 meta-analyses spanning up to 120 years to assess how diversification influences profitability, biodiversity, soil quality, and climate-related ecosystem services over time.

Key findings: The analysis concludes that diversification tends to generate bundled benefits that include economic, ecological, and ecosystem service gains rather than isolated improvements. This pattern is important for long-term persistence and real-world carbon outcomes because SOC benefits depend on sustained practice adoption. The study also highlights that diversification strengthens regulating services such as soil structure, nutrient cycling, and biological control, which are closely linked to SOC stabilization processes and reduced degradation risks. From a policy perspective, soil carbon strategies are likely to be more durable when embedded within diversification packages that farmers perceive as lowering risk and improving returns. However, program design must still account for contextual factors including baseline farming systems, climate constraints, and transition costs to avoid overstating expected outcomes.

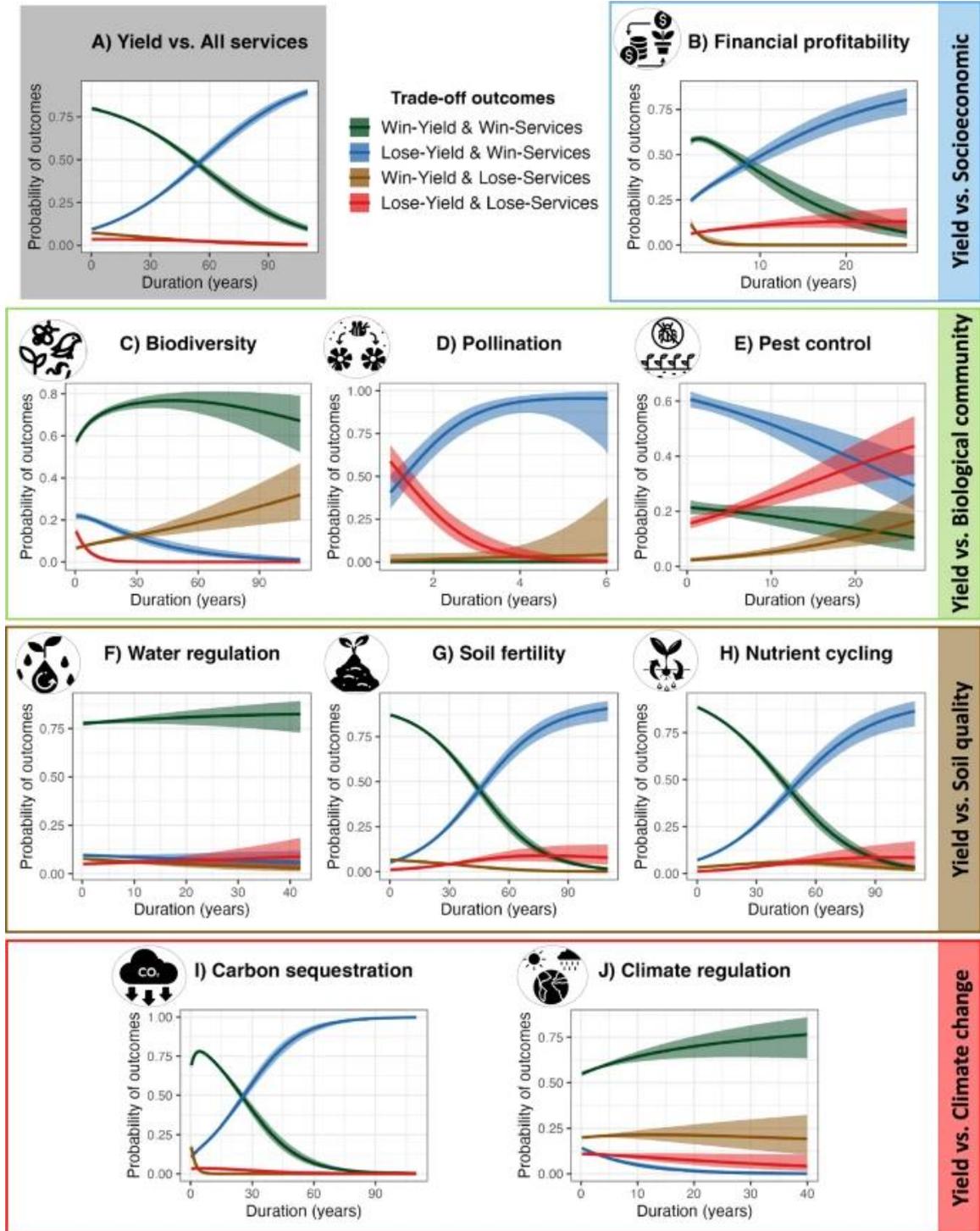


Figure | Effects of agricultural diversification on socioeconomic, biological community, soil quality, and climate change-related variables over time compared to non-temporal effects.

05 THEME: Policy Incentives, Financing, Pricing; GHG Emission Reduction; Others

Tailoring Australian carbon farming can realise greater co-benefits

January 20, 2026 | [Nature Communications](#) |

Introduction: This study, led by the Tasmanian Institute of Agriculture at the University of Tasmania (Australia) with participation from industry and research partners, co-designs and models farm interventions across southern Australia to evaluate which carbon farming options best balance net GHG reductions, profitability, and biodiversity outcomes under realistic constraints.

Key findings: The modelling shows clear trade-offs. Planting native trees delivers the largest overall abatement potential, but outcomes vary widely depending on baseline emissions and land availability. In one case, a farm becomes a net sink of 317 t CO₂e per year after tree planting, whereas another achieves only a 15% offset. Tree planting can also reduce gross margins by approximately 9% to 32% under low carbon and livestock prices due to fencing, maintenance, and foregone production, although higher carbon prices can partially offset these losses in some cases, with gross margin increases of 2% to 14%. Antimethanogenic feed supplements reduce net GHG emissions by about 19% to 32%, but high costs can substantially lower profitability, with reported gross margin declines of 63% to 115% under low price conditions. In contrast, antimethanogenic pasture renovation delivers moderate mitigation of about 14% to 25% net emission reductions and modest profit gains of 2% to 5% under low prices and 5% to 9% under high prices, making it one of the few relatively balanced options. The authors conclude that combining complementary interventions and evaluating outcomes against each farm's baseline are essential to avoid single-metric solutions that fail to gain adoption.

NEWS

01 THEME: ICT in Agrifood Sustainability

How AI is enabling agricultural intelligence and revolutionizing farming

January 12, 2026 | [World Economic Forum](#) |



Increase farm productivity, efficiency and cost reduction

Digital farming to better analyze and monitor soil conditions, climate, plant health, and other relevant factors to make more assertive decisions, reducing waste and production costs.

“It helps us make decisions, it helps us work more efficiently, it's useful to us today, and I think we'll continue to use it, and it does help us in our decision-making.”
- Farmer, France



Greater control and better farm management

Digital farming allows for more precise control over all stages of production, as well as process optimization and task automation, freeing up time for other activities.

“The first year I used GPS to apply agricultural pesticides, I saved 25% on pesticides. This led us to look for other technologies combined with our experience.”
- Farmer, Brazil



Security in decision-making

Digital farming for data-driven decision-making combined with farmers' expertise, resulting in better decisions.

“We can synchronize our planter to our satellite, and it can tell us, okay, over here we want to plant a certain hybrid. Over here we want to plant a different hybrid, because it's going to perform better.”
- Farmer, US



Keeping up with the market/ not being left behind

Digital farming as a natural path of evolution that promotes a sense of belonging among farmers.

“And if we don't invest don't improve, don't engage in some technology segment, we won't be able to keep up.”
- Farmer, Brazil

At the World Economic Forum Annual Meeting 2026, Syngenta CEO Jeff Rowe emphasized that feeding a global population of 10 billion by 2050 requires "agricultural intelligence"—the fusion of decades of agronomic expertise with AI and data analytics. This technology is currently accelerating plant breeding, molecule discovery, and precision farming, with the potential to boost agricultural GDP in low- and middle-income countries by \$450 billion annually. However, Rowe cautioned that bridging the digital divide and ensuring farmer ownership of data are critical for the responsible deployment of these tools.

02 THEME: GHG Emission Reduction

Innovative direct seeded rice tech debuts in Vietnam

January 7, 2026 | [The Consortium of International Agricultural Research Centres \(CGIAR\)](#) |

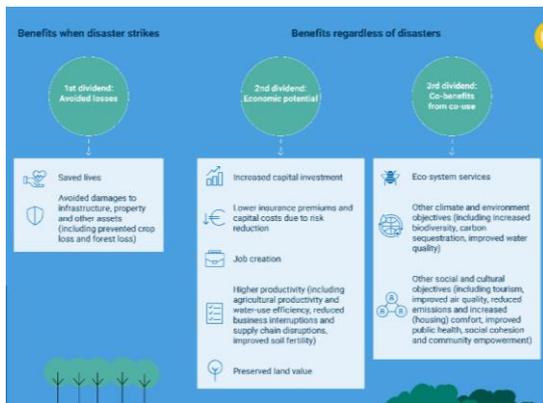
IRRI) has introduced an innovative all-in-one machine in Vietnam that integrates mechanized dry direct seeding (mDSR) with deep fertilizer placement. Field demonstrations in Dong Nai Province showed that the technology can reduce GHGs by 30% and water consumption by 50% while simultaneously increasing yields by over 5%. The machine is particularly suited for water-constrained regions and offers a compact solution for small- to medium-scale farmers to lower labor and fertilizer costs.



03 THEME: Policy Incentives, Financing, Pricing

Making agriculture, energy and transport climate resilient: how much money is required and what will it deliver?

January 13, 2026 | [European Environment Agency \(EEA\)](#) |



A briefing from the EEA warns that making Europe’s agriculture, energy, and transport sectors climate-resilient will require annual investments of €53 to €137 billion by 2050. Current committed funding stands at only €15–16 billion per year, leaving a massive gap that could quadruple if global temperatures rise by 3°C. The report highlights the "double dividend" of adaptation, noting that resilient agriculture through improved soil management and agroforestry can both safeguard food security and enhance carbon sequestration.

04 THEME: GHG Emission Reduction

Microsoft signs record soil carbon removal deal to cut emissions

January 15, 2026 | [ESG Dive](#) |

Microsoft has entered into a landmark 12-year agreement with Indigo Ag to remove 2.85 million metric tons of CO₂ via soil-based carbon removals—the largest deal of its kind by tonnage to date. The credits will be issued under the Core Carbon Principles (CCP) label, verifying that farmers have implemented regenerative practices such as cover cropping and reduced tillage. This long-term commitment is designed to provide farmers with the financial confidence to adopt sustainable practices while advancing the industrial-scale procurement of carbon removals.



05 THEME: ICT in Agrifood Sustainability

Cold storage refrigerant leaks identified as hidden emissions hotspot in vegetable carbon audits

January 22, 2026 | [OCAC News](#) (In Chinese) |

Taiwan’s Taoyuan District Agricultural Research and Extension Station (TYDARES) recently completed a lifecycle carbon footprint audit for 250g small-packaged organic bok choy, revealing that the manufacturing stage is the largest emission source at 30.4%. The study identified

refrigerant leakage from traditional cold storage and high electricity consumption as "invisible killers" of net-zero goals. To address these "hotspots," TYDARES recommends that collection and packaging centers implement periodic inspections, transition to low-GWP refrigerants, and adopt precision fertilization to prevent excess nitrogen from converting into greenhouse gases.



06 THEME: GHG Emission Reduction

Grass-covered cultivation boosts yields by 30% and emerges as a climate-friendly farming model in Taiwan

January 16, 2026 | [ETtoday News](#) (In Chinese) |

Taiwan's Ministry of Environment has officially announced the first soil carbon sink methodology tailored for organic and friendly-managed tea gardens, based on "grass cultivation". This method, which advocates for allowing natural vegetation to grow between tea plants, has demonstrated a 30% increase in yield over 8 years while sequestering approximately 0.5 tons of soil organic carbon (SOC) per hectare annually. The institutionalized system allows smallholders (minimum 0.1 hectares) to participate in carbon management, turning healthy soil into a measurable climate solution supported by corporate ESG partnerships.



POLICY

01 THEME: Nature-based Solutions

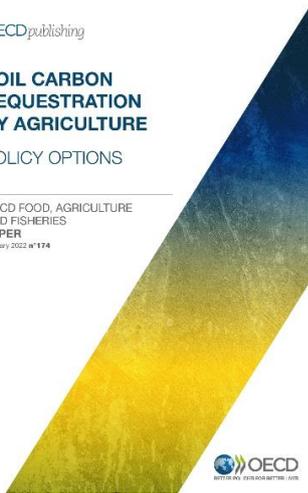
Soil Carbon Sequestration by Agriculture- Policy Options

Organisation for Economic Co-operation and Development (OECD) | [Source](#) | [Report](#) |

OECD publishing

SOIL CARBON SEQUESTRATION BY AGRICULTURE
POLICY OPTIONS

OECD FOOD, AGRICULTURE AND FISHERIES PAPER
January 2022 #174



Net soil carbon sequestration (SCS) on agricultural lands has the potential to offset 4% of annual global human-induced GHGs over the coming century. To unlock this, the OECD recommends a comprehensive policy package that includes regulations to prevent carbon loss from peatlands, knowledge transfer for "win-win" agronomic solutions, and voluntary market-based incentives. However, the report identifies critical hurdles for market-based instruments, specifically non-permanence of carbon stocks, additionality concerns, and high transaction costs, which can range from 3% to 85% of total credit value. To improve the integrity of carbon credits, policymakers are encouraged to adopt innovative contracting solutions, such as comprehensive accounting and buffer

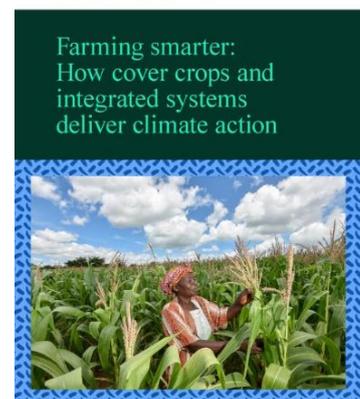
pools, to manage the risk of carbon being returned to the atmosphere due to climatic events like droughts or floods.

02 THEME: Climate Smart Agriculture

Farming Smarter: How Cover Crops and Integrated Systems Deliver Climate Action

The Consortium of International Agricultural Research Centres (CGIAR) | [Source](#) | [Report](#) |

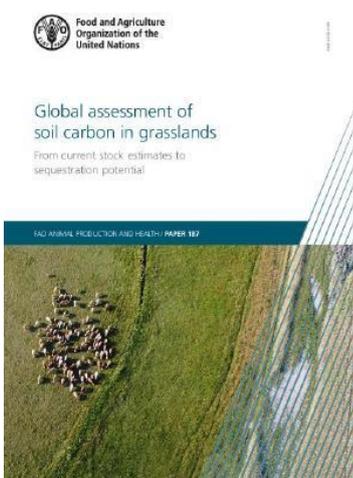
Integrated farming systems using cover crops offer immediate, practical solutions to build soil carbon and stabilize yields under climate stress. This CGIAR issue brief emphasizes that these practices should be formally embedded into Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) to operationalize Global Stocktake guidance. Scaling these systems requires concessional finance for seed systems and the deployment of digital advisory services to reach smallholders in regions like sub-Saharan Africa and South Asia. Furthermore, the brief highlights that a just transition must ensure inclusive access for women and youth, empowering them as delivery agents for climate-resilient agriculture.



03 THEME: Climate Smart Agriculture; Nature-based Solutions

Global Assessment of Soil Carbon in Grasslands: From Current Stock Estimates to Sequestration Potential

Food and Agriculture Organization (FAO) | [Source](#) | [Report](#) |



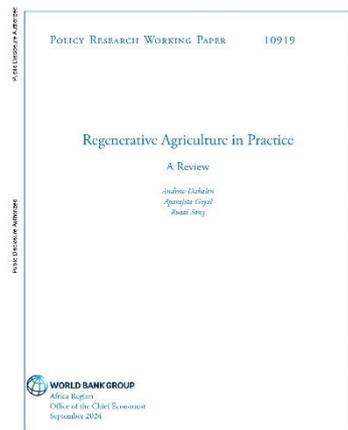
Grasslands cover nearly 1/3 of the Earth's terrestrial surface and store 20% of global soil organic carbon (SOC), yet they are increasingly vulnerable to degradation from intensive livestock grazing. This FAO study provides a spatially explicit baseline for SOC, noting that improved grasslands require higher carbon inputs (2.1 tons C/ha/year) to maintain current stocks compared to unimproved systems. The report advocates for the inclusion of specific SOC targets in NDCs to improve transparency and policy tracking. Management recommendations focus on protecting carbon-dense areas and implementing rotational grazing or manure incorporation to potentially meet 17% of the aspirational "4p1000" target.

04 THEME: Climate Smart Agriculture

Regenerative Agriculture in Practice: A Review

World Bank Group | [Source](#) | [Report](#) |

Regenerative agriculture focuses on restoring soil health through practices like no-till, intercropping, and livestock integration to achieve "triple wins" in productivity, resilience, and mitigation. While evidence of its impact is growing, this review cautions that farmers often face a significant trade-off between short-term transition losses and long-term gains. The World Bank suggests that Payments for Ecosystem Services (PES) and climate finance through carbon credits could provide the necessary financial incentives to encourage adoption among smallholders. Effective policy implementation requires local scientific support to tailor practices to specific climate conditions and the mitigation of market failures, such as limited credit access and insecure property rights.



OPEN DATA

01 THEME: Land Cover and Soil

EU Soil Observatory (EUSO)

European Commission |

The EU Soil Observatory (EUSO) is a soil knowledge platform hosted by the European Commission’s Joint Research Centre (JRC) through the European Soil Data Centre (ESDAC). It provides harmonized soil datasets, indicators, maps, and dashboards covering soil organic carbon, erosion, contamination, land use, and soil health status across the European Union. EUSO integrates field survey data, modelling outputs, and remote sensing products to support soil monitoring and policy reporting. The platform allows users to explore spatial indicators and download datasets for analysis, making it relevant for land cover assessment, soil carbon tracking, and environmental reporting applications.



EVENT

01

The International Conference on Agricultural Sciences (ICAS 2026)

March 27–29, 2026 | In-person | Can Tho, Viet Nam |



ICAS 2026 is organized by the College of Agriculture at Can Tho University under the theme “*Digital and Biotechnology Innovations for Sustainable Agri-Food Systems.*” The conference provides a platform to share research and practical developments related to climate-smart agriculture and resilient food

systems. Program topics include digital transformation in agriculture, biotechnology applications, low-emission production approaches, soil and plant health management, and eco-efficient livestock systems.

02

The 14th International Conference on Agro-Geoinformatics (Agro-Geoinformatics 2026)

July 13–16, 2026 | In-person | Sanya, China |



Agro-Geoinformatics 2026 is jointly organized by the International Society of Agromatics, the Hainan Institute of Zhejiang University, and the Center for Spatial Information Science and Systems at George Mason University. The conference focuses on the application of geospatial and digital technologies in agricultural systems, addressing sustainability, carbon accounting, and climate-related challenges from data collection and remote sensing to modelling and decision support. Topics include agricultural big data, digital twins, artificial intelligence and machine learning, Internet of Things applications, land use change, and greenhouse gas monitoring. Abstracts are due by March 15, 2026, and early author registration closes on May 15, 2026.

03

The 6th Edition of Global Conference on Agriculture and Horticulture

September 14–16, 2026 | Hybrid | Rome, Italy |

Organized by Magnus Group, AGRI 2026 is held under the theme “Frontiers and Advances in Agriculture and Horticultural Science.” The conference provides a platform for researchers, policymakers, and industry representatives to exchange developments in sustainable agriculture and food systems. Program topics include precision agriculture, agri-biotechnology, soil science, digital agriculture, and climate-smart practices, with sessions addressing sustainable farming systems and crop protection strategies.



04

2026 14th International Conference on Agriculture and Animal Science (ICAAS 2026)

September 18–20, 2026 | In-person | Tokyo, Japan |



ICAAS 2026 serves as a forum for presenting research advances in agriculture and animal science. The conference aims to facilitate communication among researchers and practitioners working on food security, agricultural innovation, and industry development. Major themes include agricultural biotechnology, precision farming, food safety, and animal health and welfare, with additional sessions on nanotechnology in agriculture, agricultural machinery, and livestock genetics. Accepted papers will be published in the Journal of Advanced Agricultural Technologies. The submission deadline is April 25, 2026, and registration closes on May 30, 2026.