

A global agenda for collective action on soil carbon

Policymakers and investors have perceived securing soil organic carbon as too difficult, with uncertain returns. But new technical, policy and financial opportunities offer hope for rapid progress.

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Growing visibility and international frameworks for soil organic carbon are not yet matched by investment and action at scale. Soils, mostly privately owned but delivering public goods, are managed under a miscellany of governance arrangements, from local to global¹. While there have been compelling calls for action on soils, diverse protagonists across business^{1,2}, governments and civil society who seek to secure soil organic carbon recognize barriers beyond their individual reach — and hence an urgent need for a cross-sectoral global agenda.

Soils rich in organic carbon are associated with enhanced biodiversity, water cycling, agricultural productivity, and climate change mitigation and adaptation^{3–5}. The global carbon pool in soils to a depth of 2 m is triple that of the atmosphere (~3,000 Gt C compared to ~830 Gt C)⁶. In this context, both increases in soil organic carbon and protection against losses from this pool are important strategies for environmental and human well-being. Management practices that raise soil organic carbon are largely low in cost compared to alternative greenhouse gas abatement⁷. Co-benefits at the farm and landscape levels, such as greater productivity and resilience, can in turn deliver a range of positive societal outcomes, particularly to food security and sustainable rural development⁸.

Momentum for action on soil organic carbon is growing in political, financial and technical circles to address multiple sustainability goals. Full alignment among parallel global processes is difficult, but the Global Soil Partnership is renewing coordination efforts¹. Political headway at the global level is growing through avenues such as the 4 per 1,000 Initiative, the UNFCCC Koronivia joint work on agriculture that explicitly provides for the inclusion of soil carbon, and the central role of soils in the UN Sustainable Development Goals target 15.3 on land degradation neutrality,

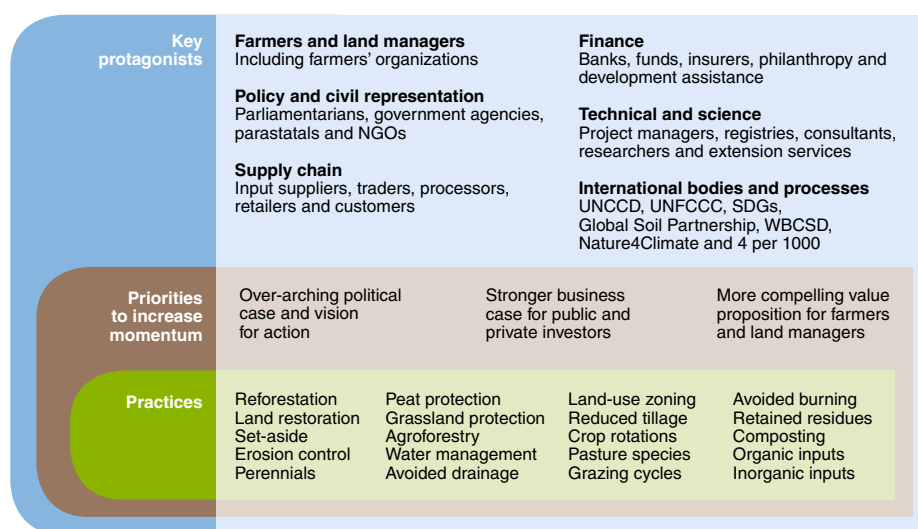


Fig. 1 | Key protagonists and practices for soil organic carbon.

which links to the UNCCD. Under the UNFCCC, only eight Nationally Determined Contributions (NDCs) present targets for soil organic carbon within their intended mitigation options (Armenia, Burkina Faso, China, Japan, Malawi, Namibia, Uruguay and Zambia)⁹. Yet many countries have policies that support stronger action, ranging from Canada, which recognizes the potential of soil organic carbon under conserved forests and wetlands, to Bhutan, with its sustainable soil policy.

New financing instruments are emerging to support better environmental management of soils beyond climate concerns, such as funds (for example, the Land Degradation Neutrality Fund, managed by Mirova, and Clarmondial's Food Securities Fund) and loan programmes (for example, the Rabobank and UNEP Kickstart Food programme). Technical momentum includes substantial work on mapping soil organic carbon, sharing information and developing cost-effective measurement systems^{5,10–12}.

Pioneering initiatives around the world, a mix of regulatory and voluntary initiatives at national and sub-national levels, provide evidence of economic viability and rapid results at the local level. Early adopters of market-based approaches to raising soil organic carbon include Australia and California. Australia's Carbon Farming Initiative, a legislated voluntary offsets scheme implemented by the Emission Reduction Fund, has awarded contracts with an approximate value of A\$200 million to landholders and farmers to earn carbon credits from soil organic carbon projects on degraded land, supporting a wide range of activities from rotational grazing to reduced tillage. Credits are paid on the basis of measured results: verified increases in soil organic carbon over a ten-year period¹¹. Farmers' returns from productivity increases are around four times the value of the credits (M.W., manuscript in preparation).

Yet investment and action to bring soil organic carbon gains to scale are slower than

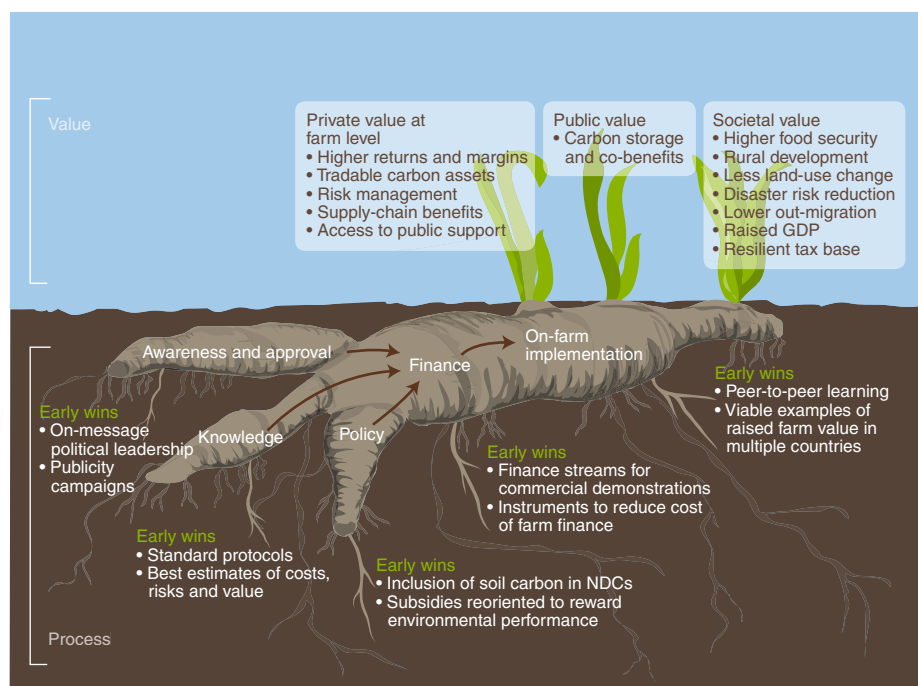


Fig. 2 | A global agenda for action on soil organic carbon.

hoped. Fewer than 60 projects (half of them in Australia) that address soil organic carbon in croplands, pasture, peatlands or wetlands are currently registered under compliance or voluntary carbon markets, providing under 50 thousand tonnes of carbon removals per year globally. This is a trifle compared to 1,500 projects covering 12 m hectares of land in the forest sector¹³.

A fundamental problem is that while practices that retain and increase soil organic carbon are well established⁵, there is much less understanding or consensus on how to bring those practices to scale. Diverse protagonists are key to progress (Fig. 1), but many perceive obstacles beyond their own sphere of influence that impede meaningful progress. To develop a collective global agenda for action that can effectively address these cross-sectoral barriers, we brought together scientists with decision-makers from the full range of relevant sectors, including government and corporate, and finance, development and farm organizations with global representation. Through dialogue this group identified priorities for breaking through current barriers to reach a substantial positive impact on the global carbon balance in soils.

The three top-ranked priorities for the global agenda, as identified by this group are: an over-arching case and vision for action, led by political champions; a stronger business case and track-record of success among public and private

investors; and a more compelling value proposition for farmers and land managers. Drilling down into the detail of feasible and significant actions within each of these priorities leads to a global agenda, represented by an underground stem that links the 'how' (processes for change in awareness, knowledge, policy, finance and implementation) with the 'why' (delivery of value at private and societal levels) (Fig. 2). While the processes for change are concurrent and interlinked rather than sequential, we identify that awareness, knowledge and policy drive implementation, creating a collective route to action through their influence on finance. Below we examine actions under each of the three top-ranked priorities, with an emphasis on proposed early wins to scale up investments in soil carbon.

To create an over-arching political case and vision for action (Priority 1), progressive countries that already prioritize soils in national policies, such as Australia, Bhutan, Canada, Ethiopia and Uruguay, are likely future leaders. From these types of countries, political champions, particularly parliamentarians and senior civil servants, and ambassadors across civil society and business could spread learning and provide impetus for wider global change. The key need is to generate far wider awareness of soil organic carbon — to unlock the black box. Persuasive narratives and campaigns might link soil health and carbon storage to broader societal outcomes with wider

political traction (Fig. 2). These include double-digit increases in yield potential, particularly on degraded lands, higher household and national food security, reduced risks from disasters, improved water quality and lower rates of displacement and migration. From a climate perspective, some countries would be more interested in the role of soil organic carbon in climate change adaptation, while others would be motivated by the untapped potential for meeting national mitigation targets. A near-term priority is to put soil organic carbon at the centre of discourses on sustainable agriculture from which it has been largely absent, such as the 'climate-smart agriculture' platform.

A stronger business case among public and private investors (Priority 2) will help to generate the level of finance that will bring improved soil management to scale globally. The World Business Council for Sustainable Development is developing a corporate business case for investing in soil health².

A growing number of companies are including soil organic carbon within their set of options to build resilience and long-term profitability of agricultural value chains. Danone, Mars, Bayer, Coca Cola, Fonterra, Diageo and Olam are multinational examples. One early win to promote action at a wider scale would be to create small-scale funds to flow to commercial demonstrations of soil organic carbon that can then be ready for widespread proliferation (Fig. 1). Seed funding of these commercial demonstrations would build a track record of success, which in turn could drive transitional funding of early-stage commercialism needed to achieve scale. Blended sources of public and private finance, such as the Land Degradation Neutrality Fund, spread risk and open new opportunities for land managers to invest in managing soils.

For farmers and land managers, a more compelling value proposition (Priority 3) would provide the incentives to incorporate building soil organic carbon within their day-to-day management activities. Experience with on-farm soil projects in USA and Australia shows that tradable carbon assets are unlikely alone to provide a strong value proposition on-farm¹⁴. Investments in soil organic carbon only create value when they combine several of the following five elements: (1) enhanced productivity, (2) improved risk management (for example, resilience to drought), (3) superior market access (for example, certified value chains), (4) financial returns to carbon assets, and (5) government support (for example, environmental subsidies). From a farmer's perspective, an

attractive business case does not necessarily need to deliver near-term cash, but must add value to the farm over a multi-year planning horizon. Soil organic carbon can also deliver private value beyond the farm, for example by influencing residential property values.

The underdevelopment of knowledge, particularly the absence of standard measurement protocols, is regularly identified as a barrier to investment in soil organic carbon. Natural scientists can contribute by demonstrating that issues perceived to impede investment, such as accurate measurement, additionality, geographic variability, and permanence of emissions removals, are readily resolvable through emerging robust methods¹⁵. One priority is to move beyond stand-alone protocols by building soil organic carbon into existing frameworks from which it is absent, such as UNCCD, UNFCCC, Ramsar and the Global Reporting Initiative. The Global Soil Partnership and the Intergovernmental Technical Panel on Soils¹ could broaden their remit beyond soil's agricultural functions. As an imminent next step, providing input on soils for the global stocktake exercise in the framework of the UNFCCC and helping countries create 'soil windows' within their NDCs (the next round of NDCs is due in 2020), seems of particular importance.

Further important topics for policy attention to support management of soil organic carbon include: (1) legal provisions to resolve controversies over land and carbon tenure, in ways that allow protection of carbon assets from counter-claims (including by the state); (2) policy and fiscal framework to enable more payment-for-ecosystem-service programmes that include farmers and mobilize additional investment, in particular in emerging markets and among small-scale farmers; and (3) consistency in supply chain contracts and public policy to enable the long-term management changes expected of farmers. These issues are priorities for social scientists' research. Repurposing of farm subsidies to support environmental

outcomes is under exploration in several countries, including Colombia and the UK. Additionally, better practices or performance on soil carbon could be rewarded in financial markets by higher land values, lower interest rates on loans, or lower insurance premiums, for example in US federal farm insurance¹⁶. Incentives for connectivity and collective action among neighbouring, or like-minded, farmers are also likely to accelerate scaling-out of management practices that favour soil organic carbon.

As momentum builds, protagonists are starting to coordinate efforts on different parts of the global agenda, linking through processes like the 4 per 1,000 Initiative's advocacy towards an aspirational global goal for soil organic carbon⁶ or the growing movement on land restoration linked to the UNCCD and Sustainable Development Goal 15⁸. A clear focus on early wins and on continued collaboration will lay the ground for gains in soil organic carbon at scale within an urgent timeframe. □

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Competing interests

The authors declare no competing interests.