**RRES PRESS RELEASE 5/12/23 Potential of soils to sequester carbon being seriously overestimated**

*A reality check is needed to avoid costly policy mistakes*

Some recent studies estimating the potential of farmland to store more carbon through innovative soil management are presenting an overoptimistic picture of what can be achieved and the analyses need to undergo a “reality check”, according to a group of leading researchers.

In a letter to the journal Global Change Biology, the group pointed out that estimates for the potential magnitude of soil carbon sequestration (SCS) vary dramatically, from very modest to very substantial. Estimates on the high end are “unrealistic” say the team and a more rigorous approach is needed.

“When organic material is added to fields, only about one third of carbon is incorporated into the soil itself in the first year – the rest is decomposed by soil microbes and ends up back in the atmosphere,” said Stephan Haefele, a soil scientist at Rothamsted and one of the letter’s authors. “To achieve a specified soil carbon increase that persists for 30 years its necessary to add about ten times that much. So, you need to add many tons of organic matter per hectare to increase soil carbon by 1 ton per hectare.”

Whilst boosting soil organic matter has many long-term benefits for soil structure and sustainability of cropping systems, say the authors, it is unlikely to have a substantial effect on mitigating climate change in the short term.

The team looked in particular at a recent study which estimated the carbon storage gains that could be achieved from various practices including adding biochar and compost to soils. Not only are substantial amounts of carbon lost during composting or biochar production, but there is also considerable uncertainty regarding availability of these organic resources. Given the logistics and production costs at global scales, it seems overly optimistic to promote these practices as major contributors to climate change mitigation in the short-term. Addition of compost, and in some situations biochar, can be beneficial for soil health and functioning. But in the context of mitigating climate change, they simply represent a redistribution of organic carbon already removed from the atmosphere by photosynthesis, not additional removal.

A new approach to carbon sequestration, termed enhanced rock weathering, is also being promoted. “Some early results look promising, but much remains to be understood. It seems premature to propose it to policymakers as a practical approach that can be applied immediately” says Haefele.

Overall, however, the authors were supportive of efforts to better understand the potential of SCS.

Gabriel Moinet, lead author of the letter and a soil expert at Wageningen University in the Netherlands said, “It is critical to quantify any potential trade-offs and to provide realistic evaluations of the practical, infrastructural, social, or financial limitations to the uptake of such practices. However overly optimistic estimates for current *technical*potential can be highly misleading for policymakers and may hamper rather than aid the fight against global warming.”

After the world’s oceans, soil is the world’s largest active carbon store, holding 80% of all terrestrial stocks, which is almost three times the amount held in the world’s atmosphere. However, sequestering carbon in soils has been described as slow, easily reversible and time limited. It is likely that the greatest and most rapid soil carbon gains can be achieved through land use change such as the conversion from arable land to grassland or woodland, although this clearly has implications for food production and the displacement or exporting of emissions.

The message on soil carbon is particularly timely given the ongoing COP28 climate conference in Dubai and this year’s World Soils Day (Dec 5). There is renewed urgency and prominence to the development and implementation of more sustainable food production systems that can both withstand climate shocks and contribute to mitigation strategies. For the first time since the climate meetings began, delegates will convene for a dedicated food day, and food, soils, agriculture and water will be the focus of at least 22 major events during the fortnight of the talks.

PUBLICATION

Moinet, G.Y.K., Amundson, R., Galdos, M.V., Grace, P.R., Haefele, S.M., Hijbeek, R., Van Groenigen, J.W., Van Groenigen, K.J. and Powlson, D.S. (2024), Climate change mitigation through soil carbon sequestration in working lands: A reality check. Glob Change Biol, 30: e17010. <https://doi.org/10.1111/gcb.17010>