Global soil organic carbon scenarios for a 2° trajectory

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Most mitigation scenarios derived by Integrated Assessment models (IAMs) heavily rely on Carbon Dioxide Removal (CDR), but have mainly focused on afforestation and bioenergy with carbon capture and storage (BECCS). Both are land-demanding terrestrial negative emission technologies (tNETs), increasing the pressure on the land system and hence affecting sustainable development.

The enhancement of soil organic carbon (SOC) on agricultural land represents a rather different tNET option. Large scale SOC enhancement may revert the general trend of declining SOC pools and soil quality, while not competing for land but rather providing co-benefits for agricultural production such as yield increases.

However, soil management is so far not well-represented in global land-use and integrated assessment models. In this analysis, we simulate SOC dynamics within MAgPIE, a modeling framework for global land-systems. MAgPIE combines socio-economic decision-making processes and spatial explicit biophysical constraints. We use the IPCC methodology of stock change factors to track SOC accumulation and decay on cropland and introduce SOC enhancement options such as cover crops.

Here we present future projections for SOC development without and with the inclusion of SOC management options for climate change mitigation. We show implications on sustainability indicators such as food prices, nitrogen pollution and deforested areas. First results indicate that SOC enhancement alone could not substitute BECCS and/or afforestation, but it could lower the pressure on land and water resources.