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Potential agricultural soil carbon sequestration across Europe: a reality check

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To meet the Paris Agreement goal of limiting average global warming to less than 1.5°C above pre-industrial temperatures, European Union (EU) aims to reduce by 40% its domestic greenhouse gas (GHG) emissions by 2030 and in the longer term to become the world's first climate-neutral economy by 2050 ("Green Deal"). Today, 10% of the European GHG emissions derive directly from agriculture, and measures to decrease or compensate these emissions are required for achieving climatic goals. The role of soils in the global carbon cycle and the importance of reducing GHG emissions from agriculture has been increasingly acknowledged (IPCC, 2018, EEA report 2019). The "4 per 1000" initiative (4p1000) has become a prominent model for mitigating climate change and securing food security through an annual increase in soil organic carbon (SOC) stocks by 0.4 %, or 4‰ per year, in the first 0-40 cm of soil. However, the feasibility of the 4p1000 scenario and more generally the capacity of European countries to implement soil carbon sequestration (SCS) measures are highly uncertain.

As part of the EJP Soil project, we collected country-specific information on the available knowledge and data of achievable carbon sequestration in mineral agricultural soils (cropland and grassland) across Europe, under various farming systems and pedo-climatic conditions. With this bottom-up approach, we provide a reality check on whether European countries are on track in relation to GHG reductions targets and the "4p1000" initiative. First results showed that the availability of datasets on SCS is heterogeneous across Europe. While northern Europe and central Europe is relatively well studied, references are lacking for parts of Southern, Southeastern and Western Europe. Further, this stocktake highlighted that the current country-based knowledge and engagement is still poor; very few countries have an idea on their national-wide achievable SCS potential. Nevertheless, national SCS potentials that were estimated for 13 countries support the view that SCS can contribute significantly to climate mitigation, covering from 1 to 28, 5 % of the domestic GHG emissions from the agricultural sector, which underpins the importance of further investigations.