

Measuring climate impact in European agriculture to contribute to NetZero targets

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The EC has set the ambition to become climate neutral by 2050. As not all greenhouse gas (GHG) emissions can be avoided, such as GHGs from biological processes in agriculture, carbon removal will become increasingly important to meet the neutrality targets set. Besides carbon capture and storage by industry, carbon sequestration in the land (the so-called Carbon Farming -CF) and emission reductions of agricultural activities will need to compensate for the remaining emissions. The presentation will give first an overview of the regulatory framework for agricultural sector, from international agreements to corporate reporting till voluntary carbon market (VCM), in order to understand “*how, what and how to measure climate impact of agriculture*”. In this respect, reliable yet cost-effective systems to measure, monitor, report and verify (MMRV) efforts by land managers become increasingly important because successful implementation of MMRV in CF programs is integral to achieving meaningful climate action. MMRV refer to the measurement, reporting and verification of CF practices and climate benefits outcomes on the farm (soil C removals and GHG reductions). In the second part the presentation will provide the *state-of-the-art*, giving a practical example, of the robust protocols that are currently being developed across Europe. Particular emphasis will be given to Operational Processing Chains (OPCs) where hybrid sampling + modelling MMRV protocols are designed to overcome scalability and cost-accuracy challenges in CF programs. By leveraging remote sensing (RS) and farm data assimilation and modelling frameworks, the simulation of Soil Organic C (SOC) stocks with such OPCs under baseline and CF scenarios can be conducted at high resolution across multiple scales to measure C removals. Remote-C OPC will be presented as a tangible example for a defined CF project domain. In the ex-ante phase, it establishes regional standardized baselines by combining RS-based SOC retrieval with Roth-C model simulations. On the enrolled fields, Roth-C is initialized using ESM-derived SOC stock data or maps obtained through smart soil sampling. In the ex-post phase, it quantifies parcel-level C removals using a calibrated Roth-C model fed by FMIS/IACS data, remotely sensed activity data (e.g., C-factor, tillage events), and plant C input data. The latter are calculated from crop yield values estimated using LUE model, which assimilates RS data for crop phenology and fAPAR estimation. At the end, the presentation will provide an overview of the activities to certify via independent verifiers the climate impact of a CF program. With this presentation the audience will recognize how MMRV systems will provide the foundation for transparent and accountable C accounting, paving the way for a more sustainable and resilient future in agriculture.