Geophysical Research Abstracts
Vol. 21, EGU2019-7066, 2019
EGU General Assembly 2019

Assessing the biogeochemical and biogeophysical mitigation potential of cover crops adoption.

Emanuele Lugato, Grégory Duveiller, Guido Ceccherini, Alessandro Cescatti, and Arwyn Jones
European Commission - Joint Research Centre, Ispra, Italy

Land management actions that can increase carbon storage and avoid greenhouse gas emissions are receiving increasing attention due to their potential contribution towards the Paris Climate Agreement goals. These management options are often only evaluated in term of their carbon sequestration potential, without considering the possible impact on the radiative forcing related to the change in land cover properties such as albedo. This is especially relevant in the agricultural context in which soils are often left temporarily uncovered between consecutive crop growing cycles, making them prone to soil respiration while also resulting in a change in albedo. A land-based management option is to plant cover crops during this period, thus increasing net carbon intake, protecting the soil and changing the surface albedo (Carrer et al., 2018). However, there is still a large uncertainty in the spatial variability of the net benefit from the combination of both biogeochemical and biogeophysical effects. In this study we integrated a biogeochemistry model framework, running on approximately 8,000 soil sampling locations in the EU (Lugato et al., 2018), with time series of albedo measurements for those locations derived from satellite remote sensing. The main aim was to simulate a scenario with the introduction of cover crops with respect to a baseline without it, in order to assess the mitigation potential both in term of change in biogeochemical fluxes (CO_2 and N2O) and albedo radiative forcing. We found that carbon sequestration was the dominant mitigation effect with 0.18 Mg CO_2e ha-1 y-1 on average, slightly offset by higher N2O emissions only in the long-term. The change in albedo, due to the change in land use by covering up the soil with cover crops, resulted in an additional mitigation capacity in the order of 0.06 Mg CO_2e ha-1 y-1, on average. However, the effects were highly heterogeneous across the EU, with some areas showing higher mitigation potential from the albedo induced-change rather than from the biogeochemical budget. In conclusion, this framework based on both modelling and observations, and tackling both biogeochemical and biogeophysical effects, shows strong potential for guiding policymakers towards promoting the most effective ‘climate-smart’ agriculture actions at local level.

References

Carrer D. et al. (2018). What is the potential of cropland albedo management in the fight against global warming? A case study based on the use of cover crops. Environ. Res. Lett. 13 044030

Lugato, E., Leip, A., Jones, A. (2018). Mitigation potential of soil carbon management overestimated by neglecting N2O emissions. Nature Climate Change, 8 (3), pp. 219-223.