Soil organic carbon contribution to GHG balance at cropping system scale

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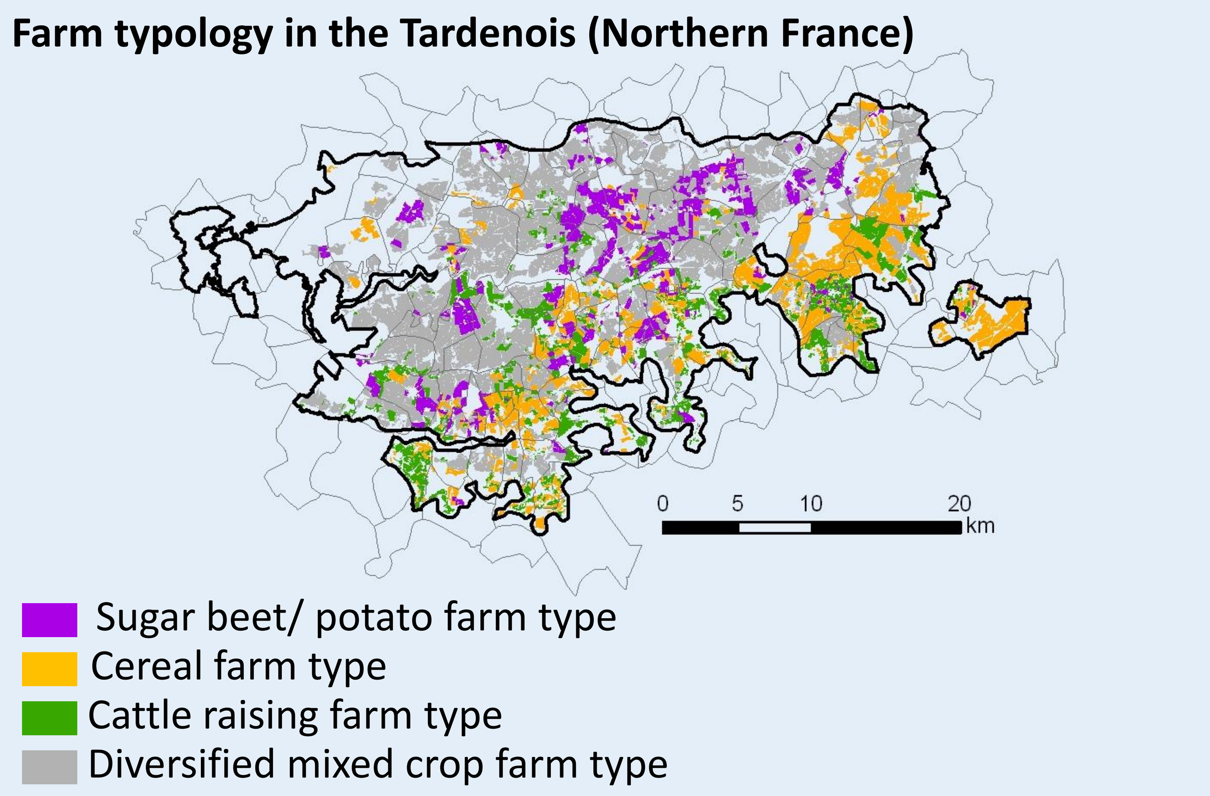
Introduction

Mitigating the greenhouse gas (GHG) balance at the scale of an agricultural territory implies to identify the situations combining cropping systems (i.e. crop rotations, management practices) and soil types that contribute more to GHG balance in the given climatic conditions of the local region. Nowadays, GHG balances usually do not take into account soil organic carbon (SOC) evolution with time, and so the influence of agricultural practices on the associated fluxes of C. The objective of the study was to develop a method accounting for those fluxes, making the most of local existing databases, by applying it to the territory of the Tardenois.

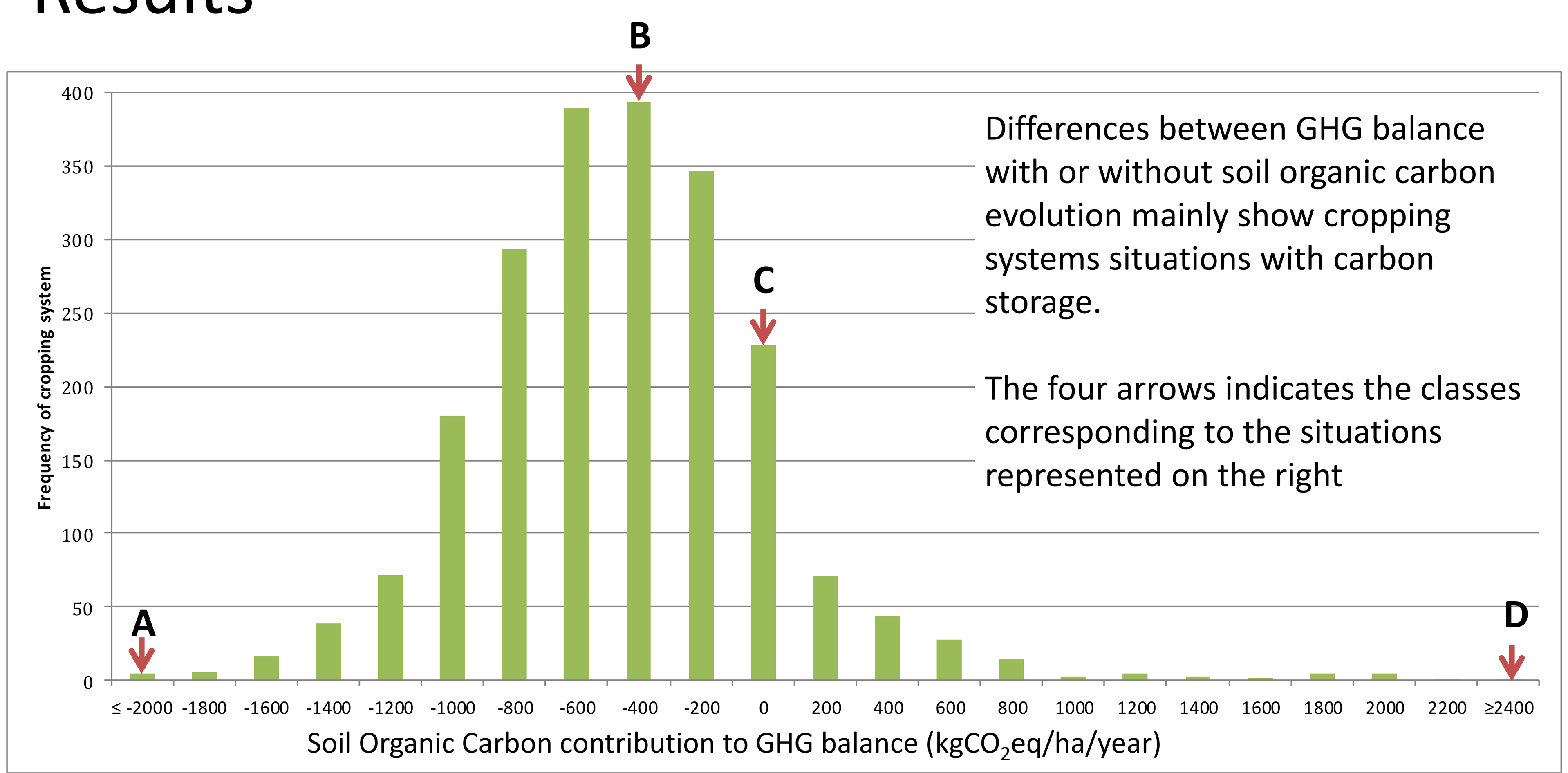


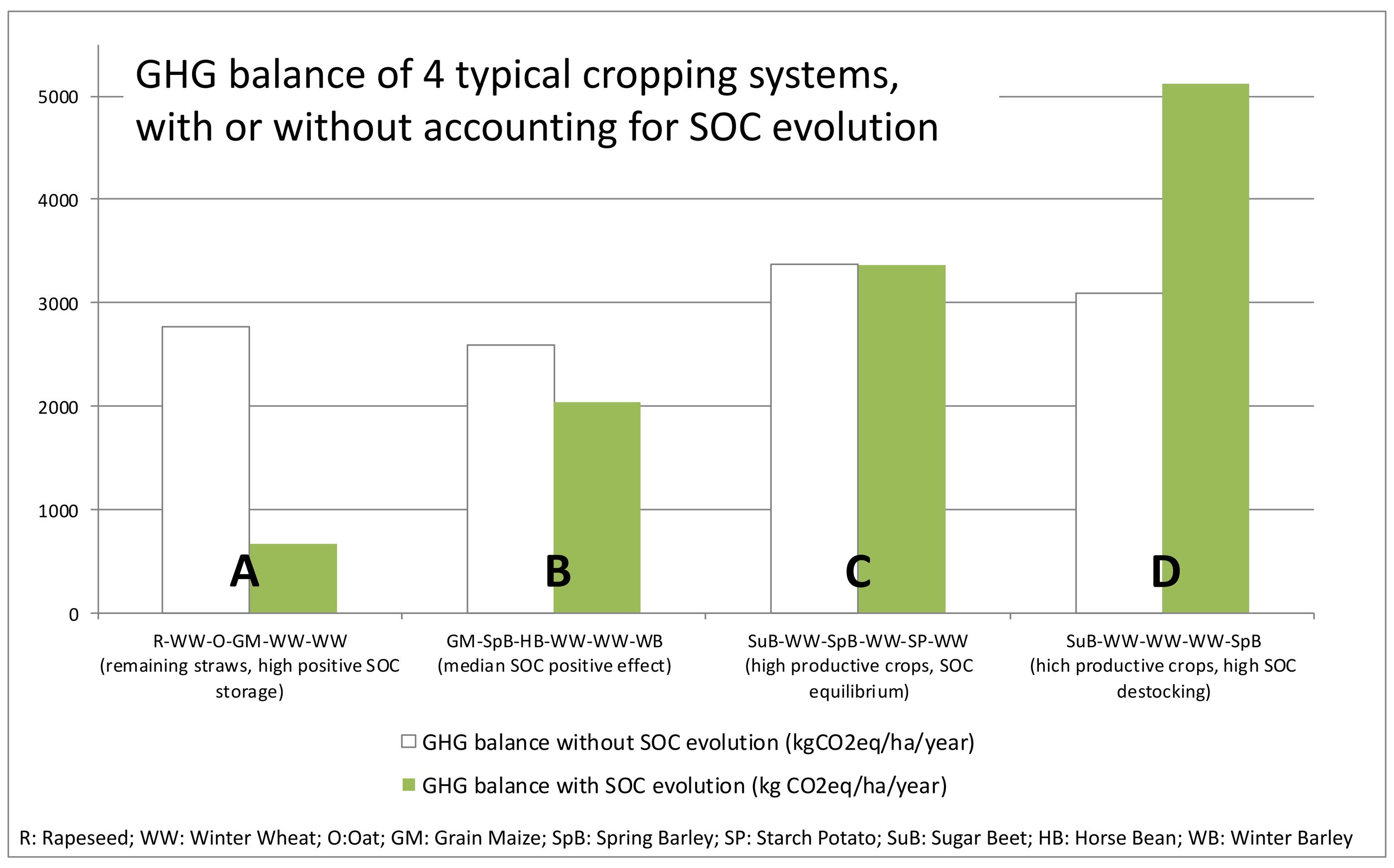
Method

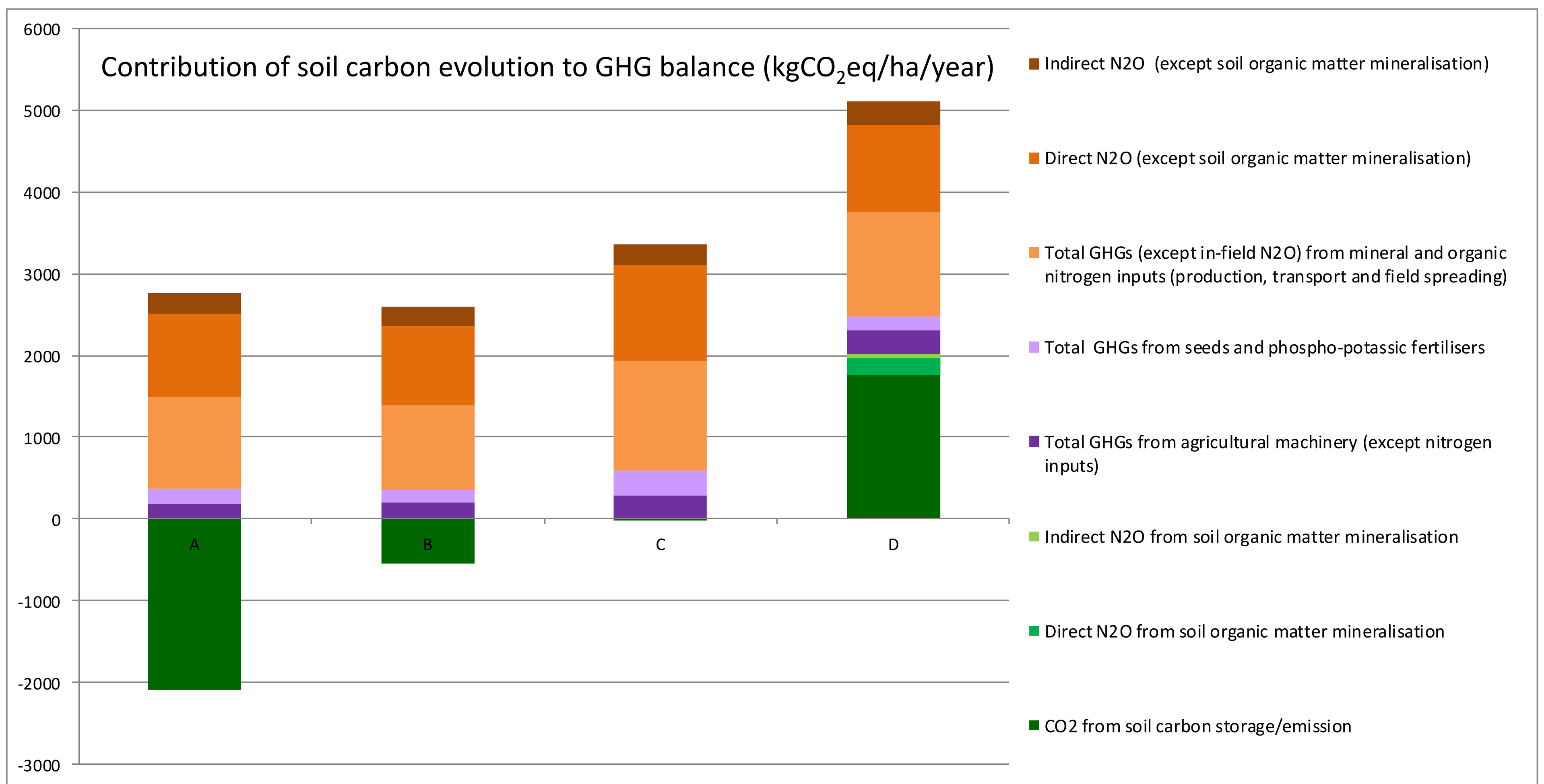
The studied system is the crop rotation from cradle to crop harvest. GHG balance accounts for the emissions from production, transport and use of crop inputs and machinery, as well as in-field N_2O emissions and soil organic carbon fluxes over a 20 year period.

GHG emissions	Assessment method	Data sources
Additional or avoided CO_2 emissions from soil C evolution	Simeos-AMG	• Agricultural practices database: LDAR-AZOFERT • Regional agronomic expertise
Indirect upstream GHG emissions (elementary cropping operations and inputs)	Agribalyse, Ecoinvent databases	Regional crop management sequence: regional agronomic expertise
Direct in-field GHG emissions due to machinery use		
Direct N_2O in-field emissions	IPCC, 2006	• N input dose: previsional N balance from regional expert group: regional agronomic expertise • N from organic matter decomposition: assessed from Simeos-AMG
Indirect in-field N_2O emissions	• Lixiviation: IPCC, 2006 • Volatilisation: EMEP/EEA, 2013	

Results







- Most of the 2154 assessed situations showed carbon storage
- Additional N_2O emissions from SOC mineralization showed limited contribution to total GHG emissions of cropping systems
- In the long term, SOC fluxes can increase the GHG balance of 1 ha up to 70% and decrease it up to 76%, under the combined influences of the cropping system and the soil type
- SOC fluxes can reach the same order of magnitude as emissions due to N fertilisation
- In the case of a SOC loss by mineralization, although in field additionnal N_2O emissions are low, they are similar in magnitude to the machinery (production and use) emissions.

References

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