Assessment of the Impact of Climate Change and Land Management Change on Soil Organic Carbon Content, Leached Carbon Rates and Dissolved Organic Carbon Concentrations

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1. BACKGROUND & OBJECTIVES

Climate change is projected to significantly affect the concentrations and mobility of contaminants, such as metals and pathogens, in soil, groundwater and surface water. Climate- and land management-induced changes in soil organic carbon (SOC) and dissolved organic carbon (DOC) levels may promote the transport of toxic substances, such as copper and cadmium, and pathogenic microorganisms, ultimately affecting the exposure of humans and ecosystems to these contaminants.

2. METHODOLOGY

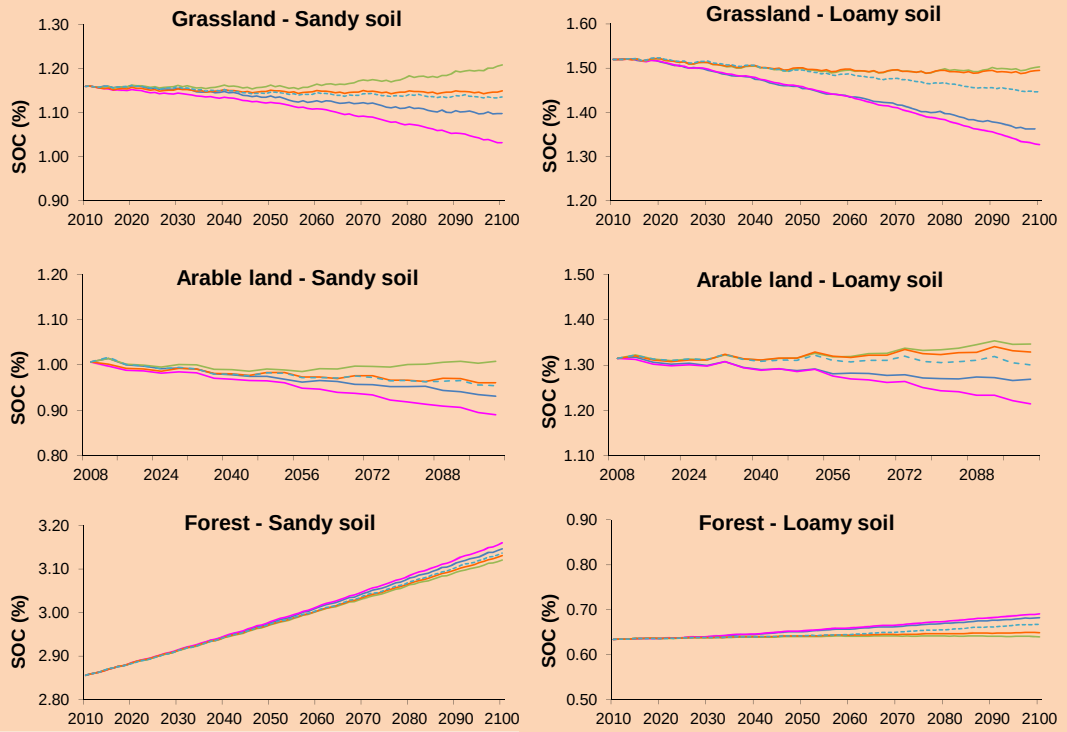
- The Century model was used to predict past, present, and future SOC and DOC levels
- We simulated a sandy and a loamy soil typical for Central and Western European conditions
- Three land use types (forest, grassland and arable land) were simulated
- Climate change scenarios were based on the KNMI'06 G+ and W+ scenarios from the Royal Dutch Meteorological Institute
- Land management scenario involved a reduction in the application rates of mineral fertilizers

3. RESULTS

Historic development (1900 – 2010):

The simulated SOC levels were generally in line with observed values derived by various Dutch soil databases for the different soil types and land use types.

Future development (2010 – 2100):



Scenarios	Land use type	Soil type	SOC2010, %	ΔSOC, %	Leached C,2010, gr/m2	Δ(Leached C), %
W+ cc changes in T, P	Grassland	sandy	1.2	-5	3.4	-14
		loamy	1.5	-10	1.6	-44
	Arable land	sandy	1.0	-7	5.7	-7
		loamy	1.3	-3	2.6	-24
	Forest	sandy	2.9	10	0.9	-8
		loamy	0.6	8	0.7	-17
G+ cc changes in T, P	Grassland	sandy	1.2	-2	3.4	-13
		loamy	1.5	-5	1.6	-28
	Arable land	sandy	1.0	-5	5.7	-7
		loamy	1.3	-1	2.6	-20
	Forest	sandy	2.9	10	0.9	-8
		loamy	0.6	5	0.7	-25

4. CONCLUSIONS & OUTLOOK

- Climate change scenarios resulted in SOC decrease for the agricultural systems, slight SOC increase for the forest systems and DOC decrease for all systems
- For SOC, the effect of temperature predominates over the effect of precipitation
- For DOC, the effect of precipitation predominates over the effect of temperature
- For the arable land systems, reduction in the application rates of mineral fertilizers led to a decrease in SOC stocks and leached carbon rates
- For the grassland systems, reduction in the application rates of artificial fertilizers had a negligible effect on SOC and DOC levels
- Reduction in SOC due to climate change leads to reduced binding of metals in soil
- Reduction in DOC leaching due to climate change reduces the mobility of metals
- Next step: use of a regression based partition-relations model to estimate metal partitioning and leaching at the river basin scale

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