

Estimating soil carbon emission and sinks for ARD and FM lands of Kyoto protocol - case Finland

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more info: www.metla.fi/ghg

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Why reporting soils ?

- Land use, land-use change and forestry, Decision 16/CMP.1
- *Each Party included in Annex I shall account for all changes in the following carbon pools: above-ground biomass, below-ground biomass, litter, dead wood, and soil organic carbon. A Party may choose not to account for a given pool in a commitment period if **transparent and verifiable** information is provided that the pool is not a source.*

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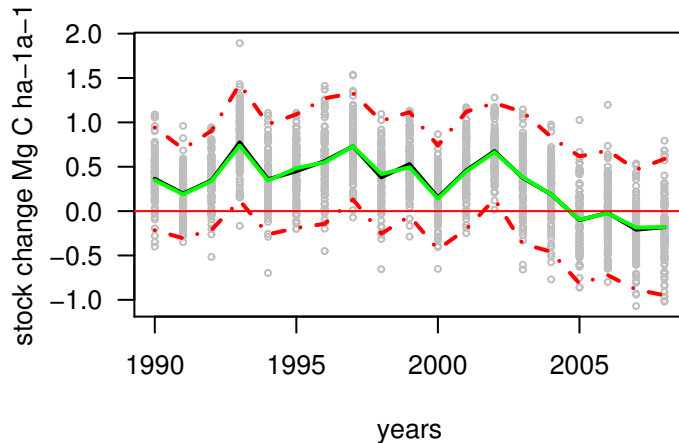
Do we have evidence that our soils are sink?

- Simulations with NFI data and Yasso07 model
- NFI data translated to biomass and litter with similar methods as in GHG inventory
- Differences compared to GHG inventory
 - Application annual weather data, not mean 1970-2009
 - New model version applied (Yasso07) that includes parameter uncertainty

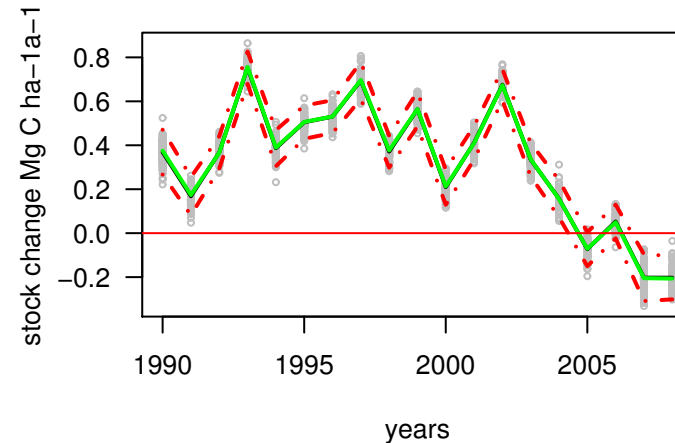
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Do we have evidence that our soils are sink?

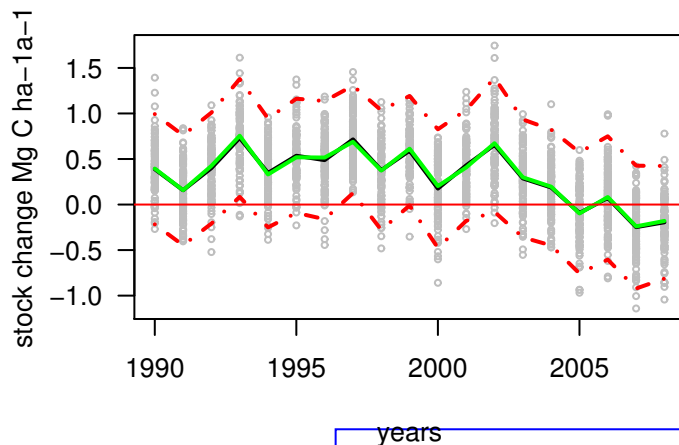
SF, uncertainty of biomass + lab & model par.



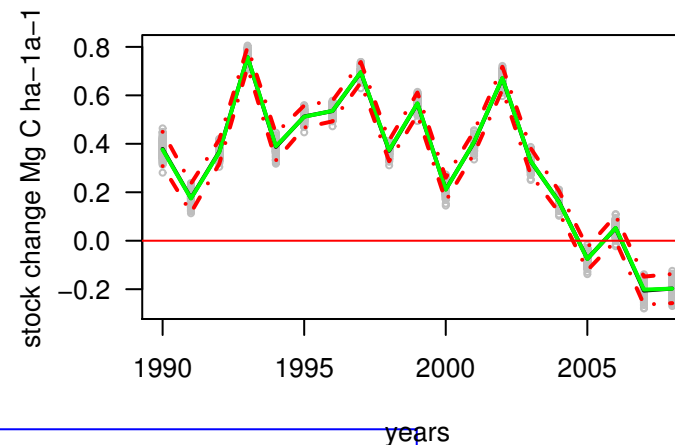
SF, uncertainty of lab & model par.



SF, uncertainty of biomass & model par.



SF, uncertainty of model par.



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Do we have evidence that our soils are sink?

- Not really, if we include uncertainty bounds we don't know if soils are sink or not ?
- Similar findings with Biosoil sample plots, uncertainties are higher than change
- Finnish solution: reporting for soils C change with **process based** modelling
 - www.ymparisto.fi/syke/yasso/
 - Previous research: empirical models are not able estimate soil C change

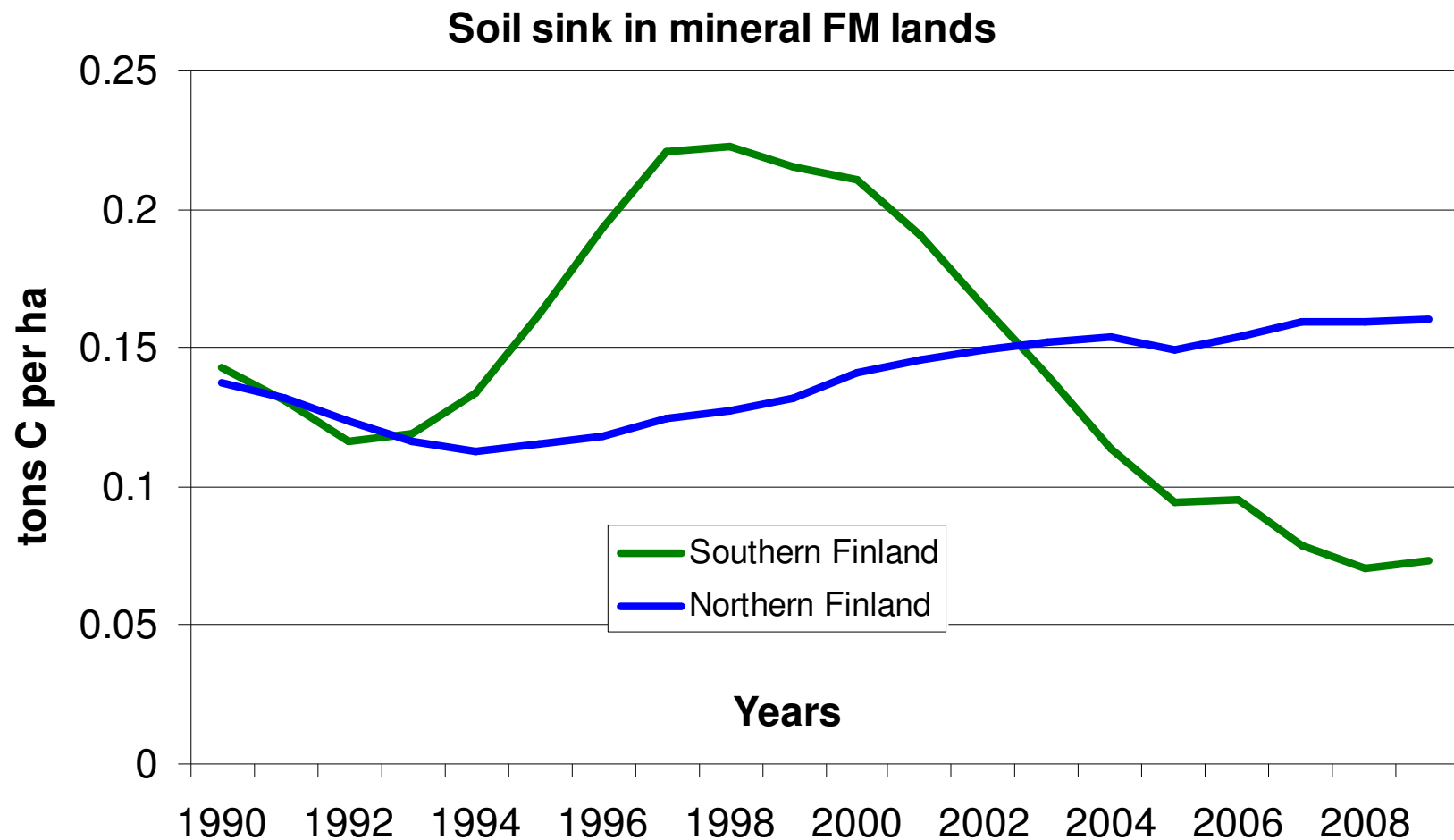
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Reporting soil carbon change for KP 3.4 (FM)

- Using NFIs 7-10 to estimate litter input for the Yasso model for 1970 - 2009
 - Litter also from understorey vegetation, loggings and natural mortality
- Steady-state with mean 1970-1972 input and with 1961-1990 climate
- Actual simulation with 1970-2009 average weather
- Result: sink of soil carbon of 0.1-0.2 tons C per ha

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Reporting soil carbon change for KP 3.4 (FM) - mineral soils



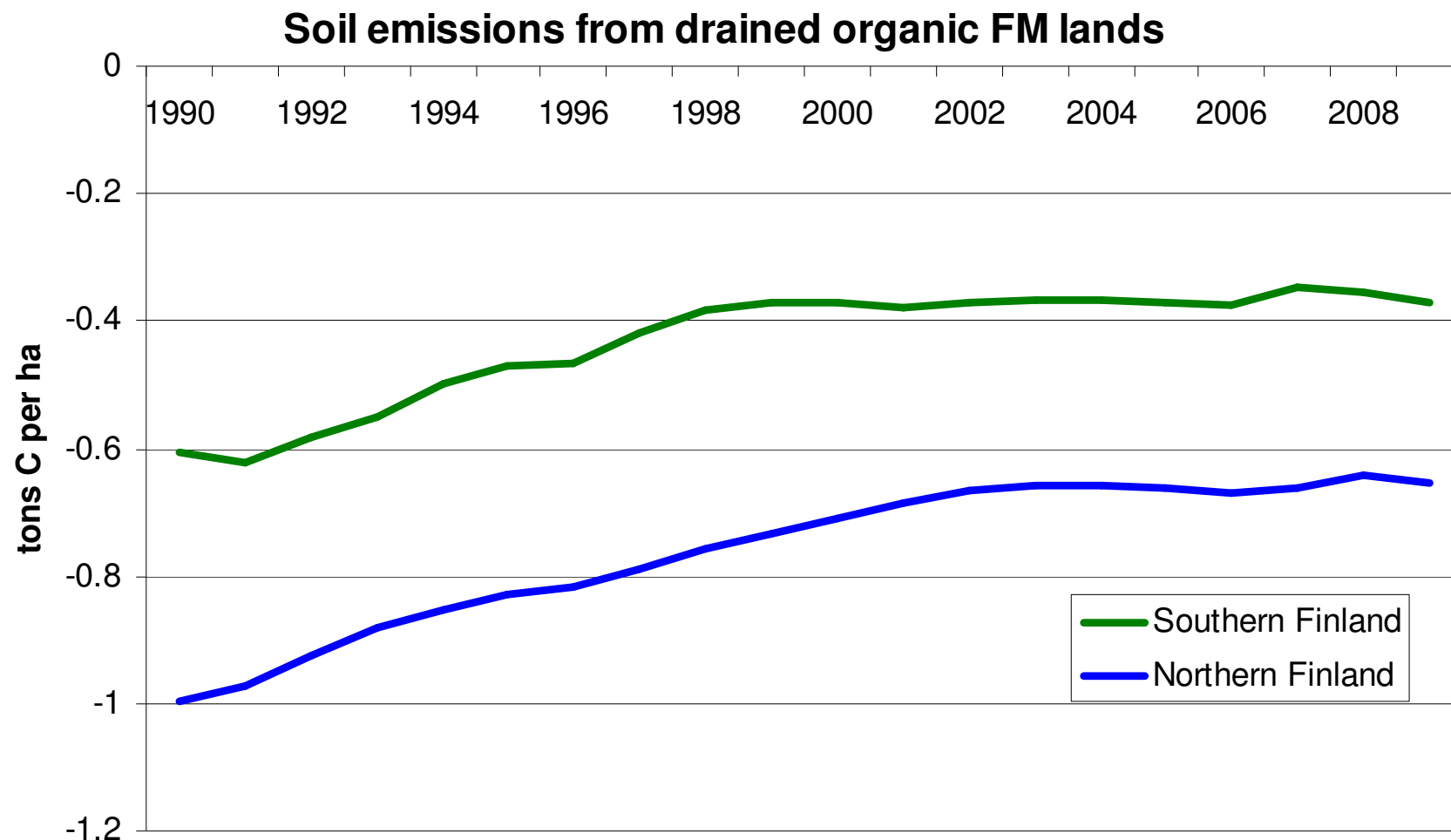
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Reporting soil carbon change for KP 3.4 (FM) - organic drained soils

- Emissions factors for peat decomposition by fertility types
- Modelling underground litter input (understorey + trees)
- Emissions = Emissions from peat decomposition ***minus*** underground litter production

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Reporting soil carbon change for KP 3.4 (FM) - organic drained soils



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Reporting soil carbon change for KP 3.4 (FM)

- Ongoing development work
 - Testing the validity of the Yasso07 soil carbon model
 - Testing Yasso07 model against BioSoil data
 - Application of different parameterizations of Yasso07 (European, Northern European, ...)
 - Testing C-MON data for modelling emissions from drained organic soils

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Reporting soil carbon change for KP 3.3 (ARD)

- Similar approach as on lands under FM
- Litter input derived from the NFI data (AR lands) + understorey vegetation
- Initial carbon stock for agriculture provided by the MTT Agrifood
- For Settlements
 - unvegetated soils, initial stock zero
 - vegetated soils, assumption of steady state
- Soil carbon model Yasso07 applied
- Average weather data for 1970 - 2009 applied

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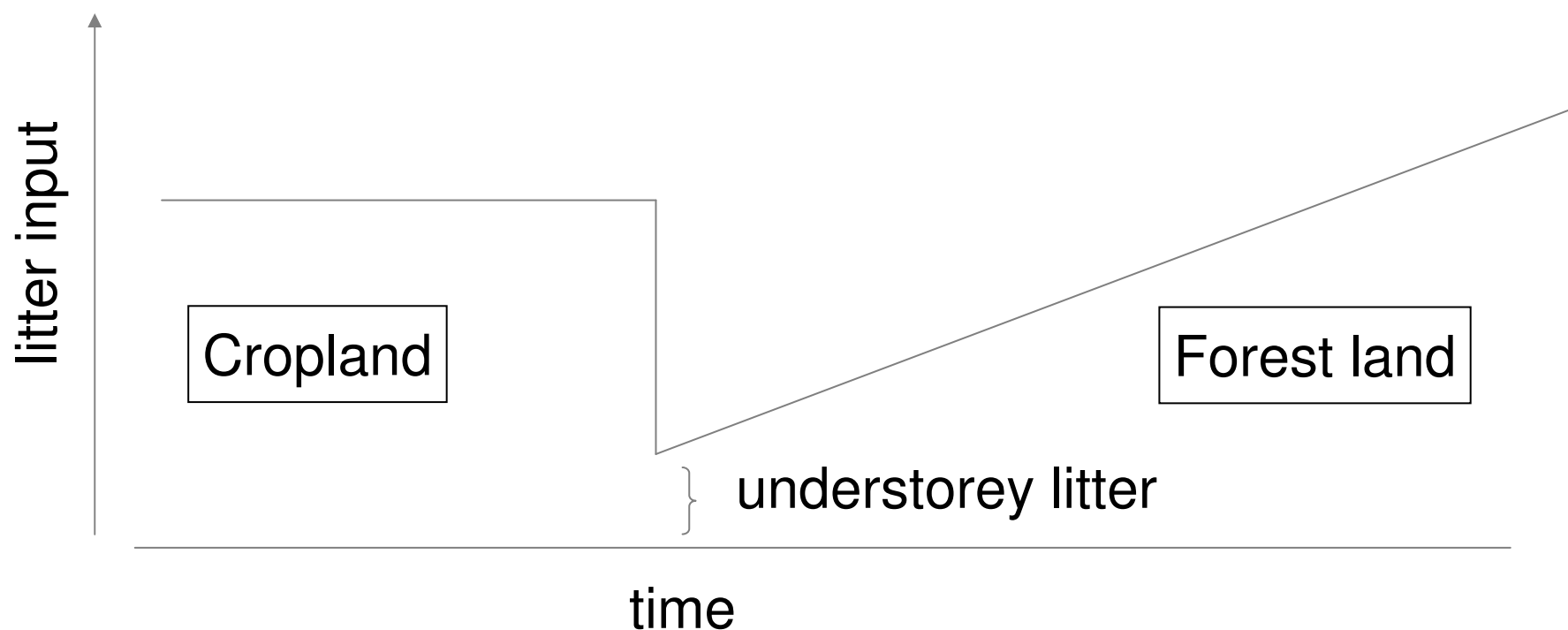
Reporting soil carbon change for KP 3.3 (ARD)

- Organic soils
 - emissions from previous land use are modified with underground litter input of AR forests
- Deforestation
 - mainly from forest to agriculture and to settlements
 - Soil C estimation for D lands (FL->CL/GL) done by the MTT Agrifood with similar methods than AR lands by Metla

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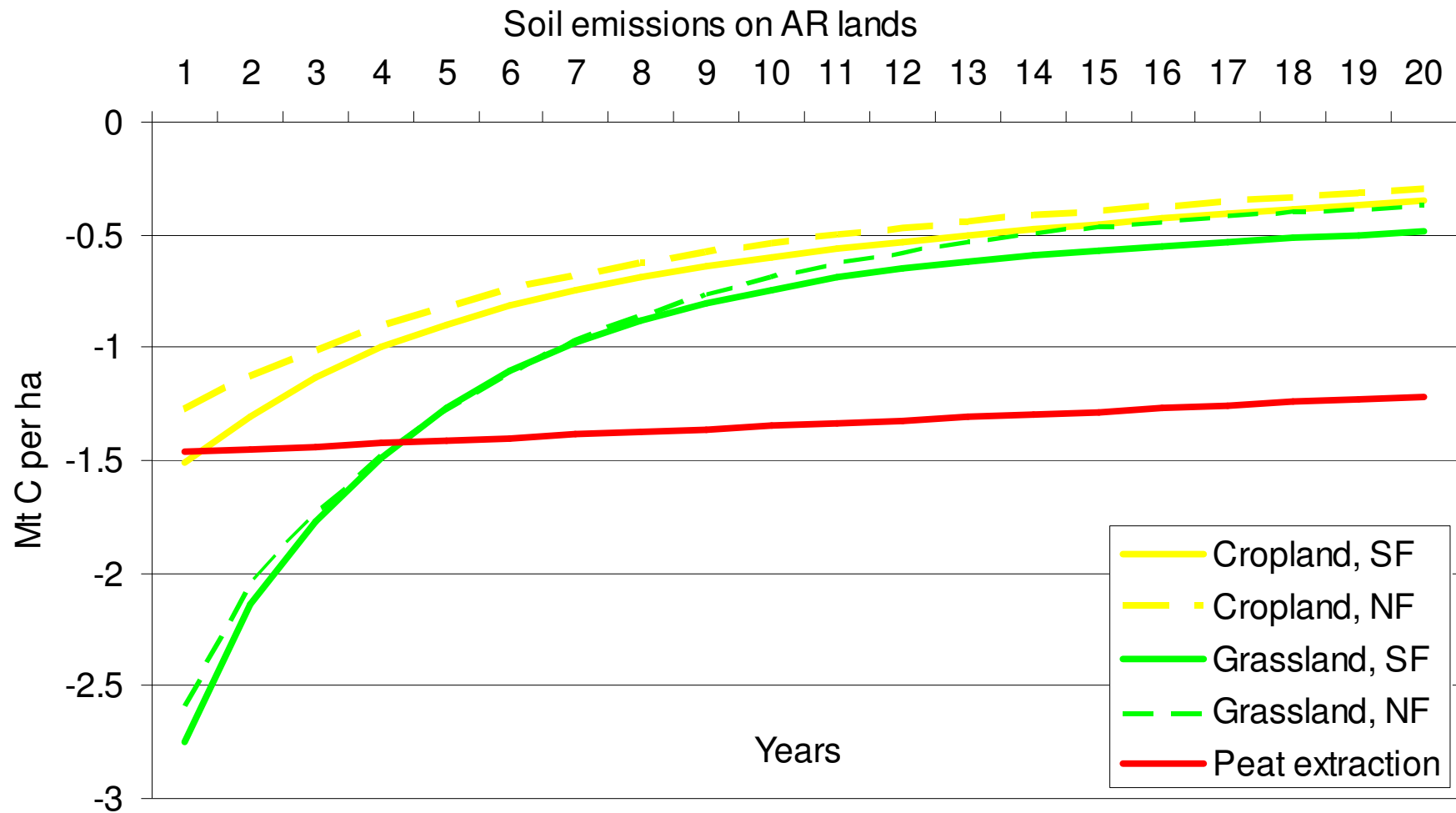
Results - afforestation & reforestation on lands: litter input to soil

- **Litter input:** e.g. CL -> FL, before from agriculture and then from forest



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Results - afforestation & reforestation on lands




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Conclusions

- Verifying that soils are not a source of carbon, really challenging if you include uncertainty bounds (with models / measurements)
 - Under KP FM, often key category -> higher tier methods, meaning advanced modelling / appropriate repeated soil c sampling should be used
 - Often arguments that soils are carbon sinks really weak by Parties -> Parties taking high risks of loosing eligibility.....

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An aerial photograph of a forest landscape. The image shows a mix of green and brownish-red colors, likely representing different types of vegetation or land use. A prominent red overlay is visible, tracing a path or boundary through the forest. The text "Thank you !" is written in green in the upper left quadrant.

Thank you !

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