

Insights into modelling of soil organic carbon from Irish grassland sites using ECOSSE model

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Introduction & Background

- Grassland represents the dominant land use in Ireland, and the estimation of soil organic carbon (SOC) stocks and changes for Irish grasslands requires further improvements.
- This study uses the ECOSSE 6.2b process-based model in site-specific mode (Smith et al., 2010) to predict SOC stocks and changes associated with different grassland management practices.
- The work presented here aims to provide preliminary insights into SOC modelling procedures.

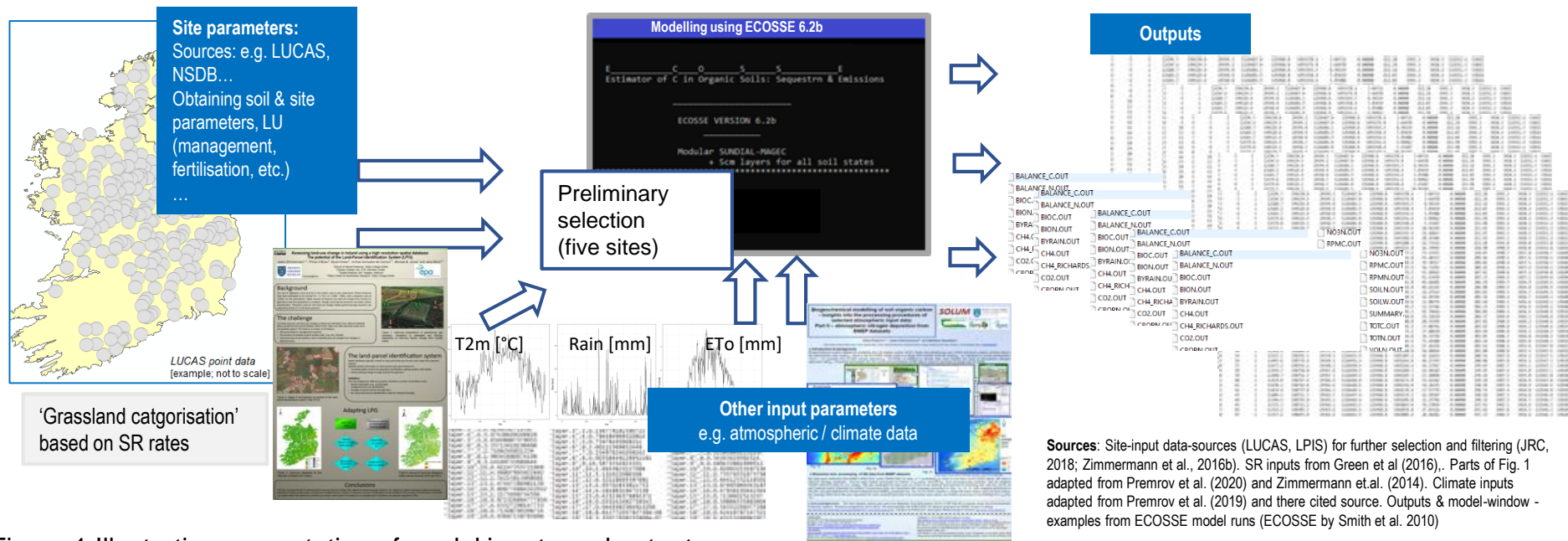


Figure 1 Illustrative presentation of model inputs and outputs

Methods

- Preliminary site selection: five Irish sites under different grassland management were selected from the 2009 LUCAS SOC database (JRC, 2018).
- The initial SOC values (SOC_{ini}) from the Irish NSDB database were assigned to 2002 (i.e. the start of simulation - due to the lack of repeated SOC measurements over time, the SOC_{ini} input values required for the simulation initialisation were assigned from the NSDB (EPA, 2007)). This was done based on the site-specific information from both databases such as distance and matching land-use.
- Information on management was obtained from the Irish Integrated Administration and Control System database, LPIS (Zimmermann et al., 2016), climate data were obtained from MÉRA (Met Éireann, 2018) and atmospheric N deposition from <http://www.emep.int> (Premrov et al. 2019).
- Fertilisation inputs were adapted from the literature and categorised based on stocking rates (SR) derived from Green et al. (2016), which resulted in following 'grassland categorisation':
 - 'High', - 'Medium High', - 'Medium', - 'Medium Low', - 'Low', - 'Reduced-Low' and - 'Minimal'.

[NOTE: not all of the 'grassland categories' are represented in the five preliminary selected sites – Fig. 2.]

Presented are only preliminary results; more detailed work on large number of sites including additional insights into model SOC_{ini} parameterisation is currently in preparation for a journal publication (link will be provided in future).

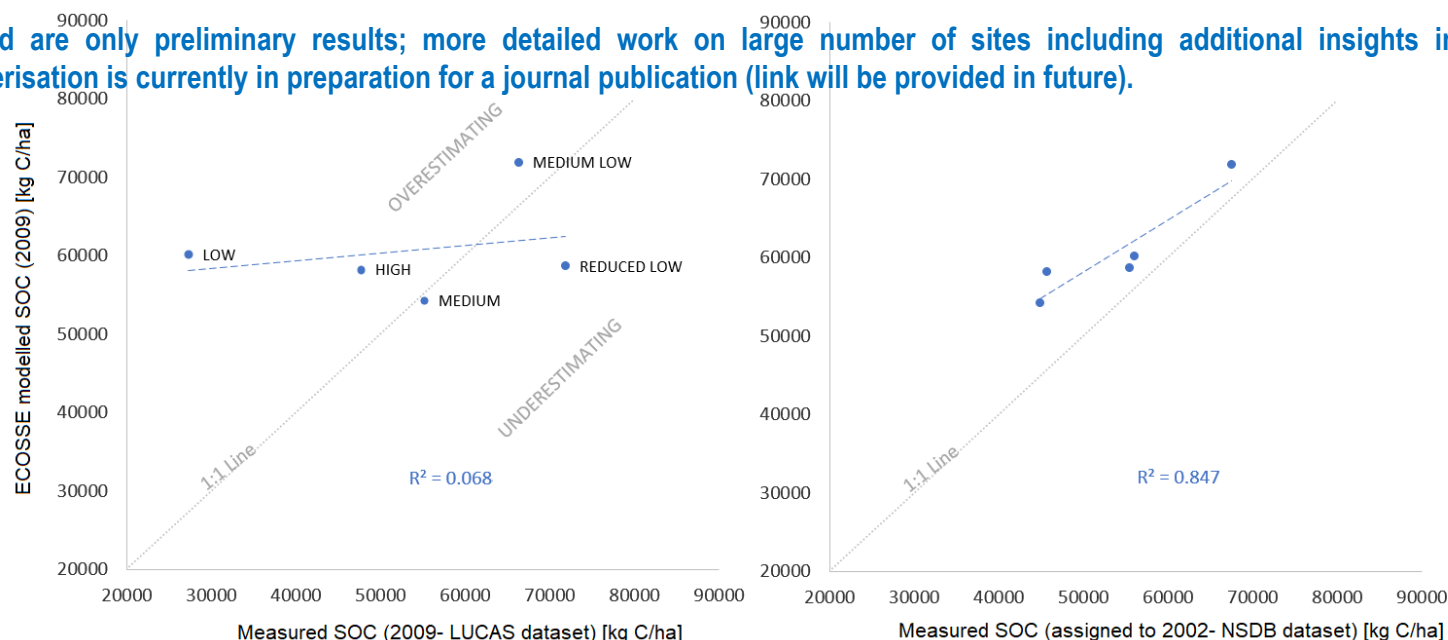


Figure 2 Preliminary results for five selected LUCAS sites- measured vs. ECOSSE modelled SOC

[NOTE: not all of the 'grassland categories' are represented in the five preliminary selected sites – Fig. 2.]

Results & Findings

- The 2009 yearly averaged SOC predicted values were compared to LUCAS (2009) measured SOC across five sites ($r^2 = 0.068$), showing over- and under-estimation of simulated SOC, which could be due to potential poor matching NSDB and LUCAS data.
- This result indicates that the repeated SOC field-measurements over the time are needed for proper model parameterisation.
- This finding was further supported by the observed strong relationship between initial SOC_{ini} inputs (from NSDB) and ECOSSE predicted SOC ($r^2 = 0.847$) indicating the high sensitivity of model SOC predictions to the initial SOC inputs.

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