

SP 13: Model-based yield assessment for agricultural crop rotations and grassland emanating from tropical rain forest conversion

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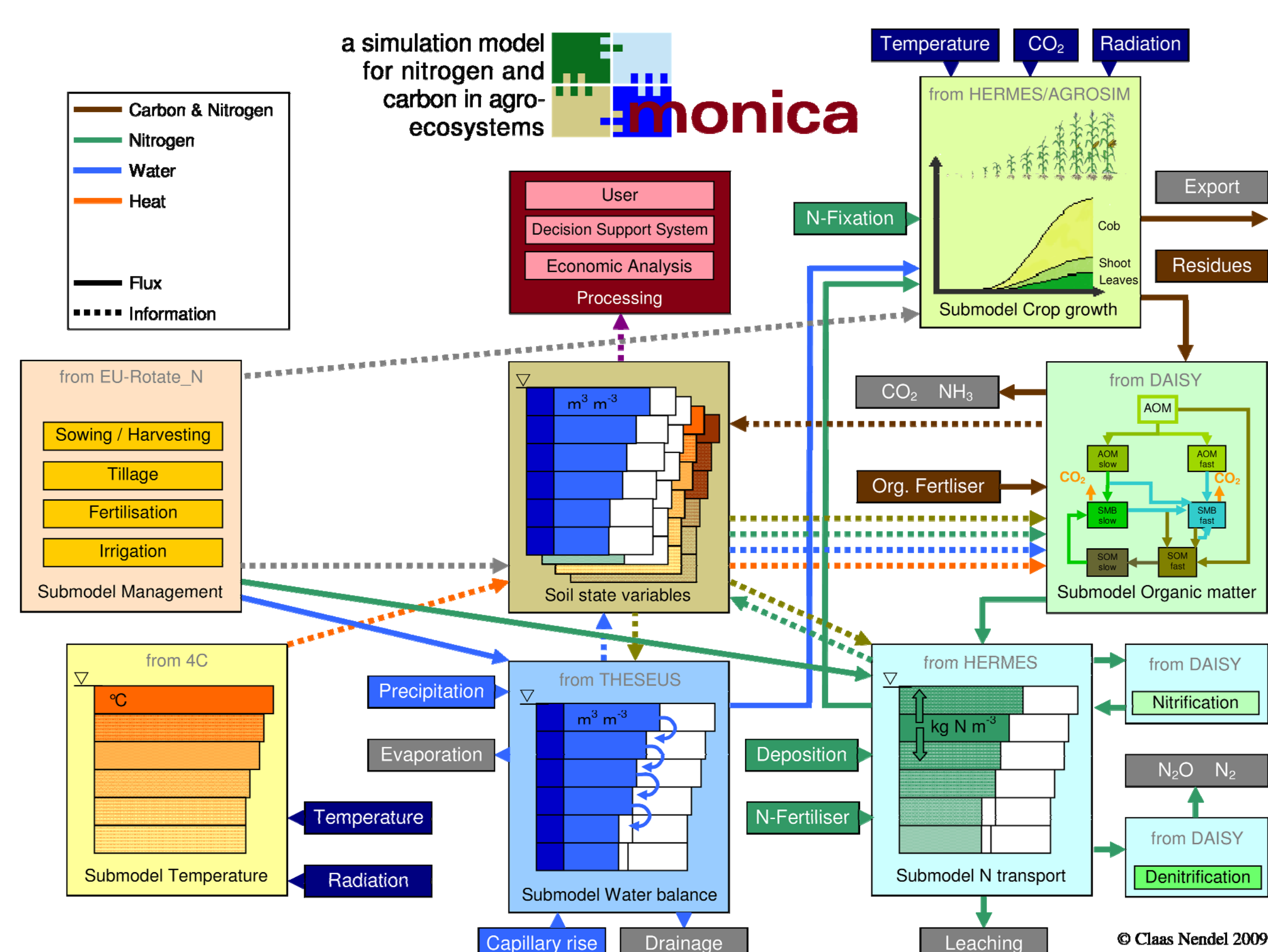
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Objective

In this project, simulations of biomass growth and yields in grassland and agricultural soil-plant-atmosphere systems under given climatic, economic and land-use change scenarios will be prepared as a basis for further evaluations of GHG emissions, C sequestration potentials and sector-based economics in partner projects.



Methods

The MONICA model (Nendel et al. 2011), a ZALF product, includes all relevant processes required for CARBIOICIAL. It will be parameterised for soy bean using the DSSAT, a simulation toolkit developed at the University of Georgia, USA (Jones et al. 2003), as a target to grow up to. In addition, a simulation model for grassland will be selected. Here, the Hurley Pasture Model or the much simpler FOPROQ32 may be used.

The Landcare DSS (Köstner et al. 2008) is a computer platform to (i) illustrate future climate information and (ii) to calculate future yields and other environmental variables at a user-defined area, down to plot scale. Within, the MONICA model is fully integrated. During the project, the Landcare DSS will be adjusted to Brazilian conditions and equipped with driving variables for the target area. With constant feedback from stakeholders, user demands will be additionally considered in the final version of the Landcare DSS Brazil.

Workplan

- Adjustment of existing simulation models (DSSAT, MONICA) mainly using available soil and crop data.
- Model performance tests against historical data sets in a hindcast simulation, covering the years from 1980 up until today.
- Model application under defined economic and climatic scenarios along a land-use change gradient to predict future yield and biomass growth up until 2030.
- Simulation of different crop management strategies for their sustainability and their potential to sequester carbon and to mitigate GHG emissions.
- Adaptation of an existing computer-based decision support tool to Brazilian conditions and stakeholder requirements and demonstration to potential users.

Expected Results

- (1) a readily parameterised and tested simulation model for any kind of climate change impact assessment related to crop and biomass production, which can be used in follow-up projects located in Brazil,
- (2) medium-term predictions for biomass and yield development in selected regions of Brazil which can be used for political or administrative strategy development also outside the project,
- (3) an analysis of pre-selected management options on their sustainability and mitigation potential at a range of soils and crop sequences and, based thereupon, a catalogue of recommendations to farmers and decision-makers
- (4) a computer-based decision support tool for policy-makers and educated farmers to illustrate the effect of climate change on biomass growth and yields.



Literature

- Nendel et al. (2011): The MONICA model: Testing predictability for crop growth, soil moisture and nitrogen dynamics. *Ecol. Model.* 222 (9): 1614-1625.
- Jones et al. (2003): The DSSAT cropping system model. *Eur. J. Agron.* 18: 235-265.
- Köstner et al. (2008): Land, Climate and Resources (LandCaRe) 2020 - Foresight and Potentials in Rural Areas under Regional Climate Change. *Ital J Agron / Riv Agron.* 3 (3) Suppl, 743-744.