SP 11: Model-based analysis of regional land-use changes and development of sustainable land-use strategies

Researchers

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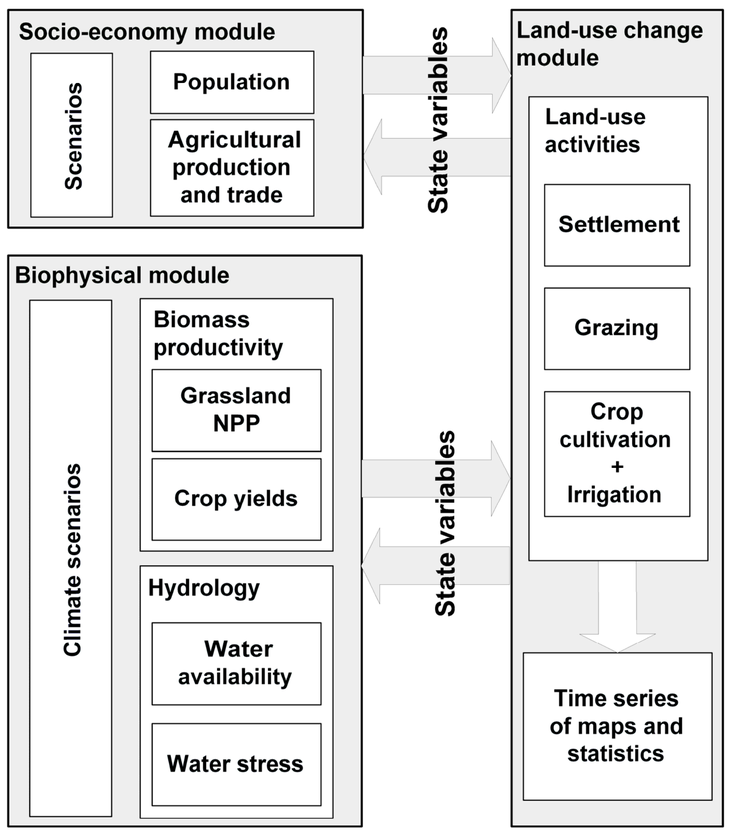
Objective

During the past decade Southern Amazonia has faced massive land-use changes. In Mato Grosso, the expansion of soybean has been identified as an important driver for deforestation and for the replacement of grazing land (Morton et al., 2006). Together with future climate change, this dynamics will have negative consequences on carbon sequestration both in vegetation and soil as well as on the emission of other greenhouse gases related to agricultural activities. The main objective of SP 11 is to assess the future dynamic of land-use change within the whole study area of the project (South Pará, North- and Central-Mato Grosso) and to contribute to the development of sustainable land-use strategies.

Figure 1: Block diagram of the LandSHIFT modelling framework.



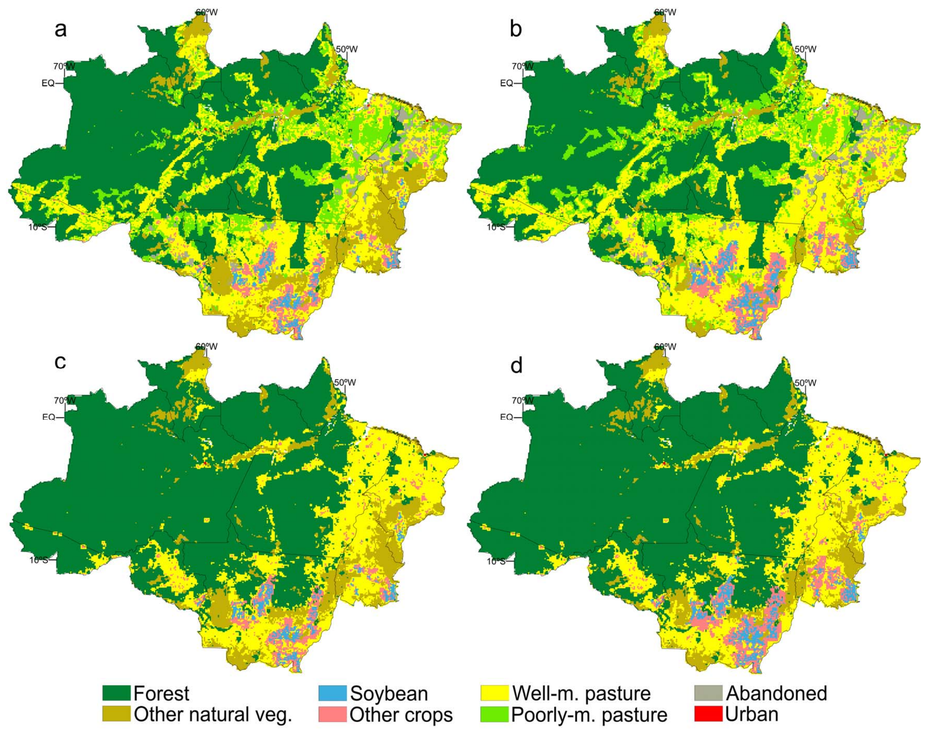
Methods

The analysis will be carried out with a newly developed land-use model that integrates the socio-economic and biophysical processes of the regional land-use system. Technological basis is the LandSHIFT framework (Figure 1). Here, land-use and land-cover changes are computed with a modified cellular automata approach, which considers the competition between different land-use activities such as settlement, crop cultivation and grazing for the available land resources (Schaldach et al., 2011). The basic idea is to allocate a set of land-use requirements in a consistent, systematic way to a uniform grid with 1 km² cells. The main model output consists of a time series of land-use maps that can serve as input to further analyses of environmental impacts.

Workplan

- Design and implementation of a regional land-use model that integrates project specific data and model output.
- Model-based scenario analysis up to the year 2030, considering changes of socio-economic and environmental drivers (e.g. climate change).
- Application of the model as part of the Carbiocial DSS to develop and test management strategies that help to reduce GHG emissions and to improve carbon sequestration.

Figure 2: Modeled land use and land cover in the Legal Amazon in 2050 under 'moderate' (a, c) and 'severe' (b, d) climate change scenarios; and under two deforestation-trend scenarios, Business as usual (a, b) and Conservation (c, d).



Expected Results

A major result of SP 11 will be a project-specific version of the LandSHIFT model. Together with a newly designed user-interface this model will be an integral part of the Carbiocial Decision Support System (DSS). With these tools a new set of land-use scenarios will be computed. Here we expect new findings to support the development of land-use strategies for an improved regional carbon management. Figure 2 illustrates the potential influences of changing land-use policies and climate conditions on the spatial extent of agricultural land in the Legal Amazon as calculated with a large-scale version of the LandSHIFT model.

References

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