SUSTAINABLE LAND MANAGEMENT STRATEGIES FOR SOUTHERN AMAZONIA

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With respect to climate protection and biodiversity, the Amazon rainforest is one of the most important ecosystems worldwide. For decades, however, the forest area has been shrinking and has given way to pastures and soybean fields, particularly in Mato Grosso and Pará. Within the the research project CARBIOCIAL, scientists of 10 German and several Brazilian universities, UFZ, and ZALF have therefore analysed the development of land use under different socio-economic scenarios, and developed sustainable land management strategies for Southern Amazonia.

Soybean fields are replacing tropical rainforest in the Southern Amazon, Brazil.



In particular, the project partners investigated how more carbon can be stored in soils, how climate change will affect agricultural yields, and how different socioeconomic scenarios may influence land use. With their simulation of agricultural yields,

ZALF scientists have made an important contribution to the CARBIOCIAL project, serving as a link between climate and land use simulations. Applying their Model for Nitrogen and Carbon in Agro-ecosystems (MONICA), they produced high-resolution yield maps for soybeans, maize, and cotton. These maps show the consequences of climate change by the year 2040: strongly decreasing rainfall in the entire research region and declining yields, especially in the northern part of the Pará state. The results of the yield simulations served as input for the agent-based farm economy model MPMAS and for the LandSHIFT land use model, which was used to estimate land use changes for various socio-economic scenarios (trend continuation, legal and illegal intensification, and sustainable development). In cooperation with the University of Kiel, the ZALF scientists also discovered that the application of easily accessible organic materials such as eucalyptus leaves, sawdust, sugar cane filter cake, or passion fruit residues can increase organic carbon contents in the upper 30 cm of the soil by about 5 tons per hectare per year. Another highlight of the CARBIOCIAL project was the exploration of carbon being stored in deep soil layers. For this purpose, soil scientists excavated a 10-meter-deep hole in the pristine rainforest inhabited by the indigenous Kajapó people. The local population is involved in the international CO₂ trade under the REDD (Reducing Emissions from Deforestation and Forest

Degradation) program and can thus benefit from the results of the soil survey: about 50% of the carbon stock is stored more than one meter below soil surface; this means REDD does not account for this data.

Although not all of the initial objectives of the CARBIOCIAL project have been achieved, it is nevertheless a successful example of interdisciplinary and transdisciplinary research, combining integrated modeling approaches and socio-economic aspects to contribute to a better understanding of human-environmental interactions in the Amazon and to the development of sustainable land management strategies.

Project: Kohlenstoff-Sequestrierung, Biodiversität und soziale Strukturen in Süd-Amazonien: Modelle und Implementierung von Kohlenstoff-optimierten Landnutzungsstrategien (CARBIOCIAL) **Term:** 2011–2016 **Funding:** BMBF **Lead at ZALF:** C. Nendel (nendel@zalf.de) **Partners:** Georg August Univ. Göttingen, HU Berlin, Hohenheim Univ., FU Berlin, Innsbruck Univ., Federal Univ. of Mato Grosso, EMBRAPA Rice & Beans and more **ZALF contribution:** LSA http://www.carbiocial.de