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Fire practice on Brazilian managed grasslands and its implementation in LPJmL 4.0

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Brazilian farmers follow varying management fire practices during the year, depending on climatic conditions and status of the vegetation. Although since the 1990s, the agricultural use of fire is prohibited in entire Brazil and fires are still used on a regular base to manage pastures, remove winter dead biomass or prevent wildfire events. With increasing agricultural areas, fire practices on agricultural land might play a significant role in fire seasonality, burnt area and GHG emissions. However, studies on fire practices are still insufficient to appropriately described fire purposes and spread. Such investigations provide the basis for political interventions as formulating strategies for reducing GHG emissions and enable future fire impact assessments.

In order to develop a tool for assessing future fire impacts on grasslands in a process-based way, we implement the SPITFIRE module on managed grasslands depending on seasonality, climate and vegetation conditions in Brazil. SPITFIRE is a process-based fire module implemented in the dynamic global vegetation model Lund-Potsdam-Jena managed land model (LPJmL 4.0) that simulates fire spread and intensity. Currently SPITFIRE computes natural and human-caused fires only in natural vegetation. We develop and test fire prescription scenarios depending on the ratio of burnt area or the date of setting fire. As validation data set, we use a combination of the Mapbiomas land use data set and the MODIS burnt area estimates. We analyse and compare the outputs provided by the two different LPJmL SPITFIRE versions and burnt area validation data like carbon emissions, vegetation cover and soil carbon content in Amazon, Cerrado and Pampas regions.

The comparison of the results from the SPITFIRE versions and the validation data set enables to distinguish the actual amount of each type of fire event. Moreover, in the context of main global warming, the scientific community favours strongly environmental protection and the reduction of GHG emissions from grassland fires. On the other hand, farmers prefer these practices because of economical concerns. The results of this study give a first overview of the actual human-caused fire impacts on managed grasslands including CO_2 emissions. This is an important first step for fire impact assessments, future projections and environmental impact studies on the global carbon budget in times when deforestation in combination with fire is increasing.