

# SPATIAL DYNAMIC MODELLING OF CHANGES IN THE SUGARCANE HARVESTING PRACTICES: ASSESSING SÃO PAULO MUNICIPALITIES' COMPLIANCE WITH THE AGRI-ENVIRONMENTAL PROTOCOL

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## Introduction

Brazil is the world biggest producer of sugar and ethanol derived from sugarcane. The estimated sugarcane cultivated area lies around 8 million hectares, 60% of which are found within São Paulo state, unevenly scattered throughout its territory. Since 2006, the National Institute for Space Research (INPE), in association with the São Paulo State Secretary for Environment (SMA-SP), has been monitoring the pre-harvest burning of sugarcane by means of remotely sensed images. In June 2007, the Sugarcane Industry Association (UNICA) and SMA-SP signed an Agri-Environment protocol, designed to anticipate the end of straw burning in areas with slope under 12% until 2014.

The objective of this article is to perform an analysis of São Paulo municipalities' compliance with the Protocol, considering the dynamics of burning practices, using spatial analysis techniques and spatial dynamic modeling. A cellular automata land use and land cover (LULC) model was adopted and applied to 2006 and 2008 real landscape maps. Four study areas were selected according to Moran's index in face of their importance regarding the current trends of sugarcane expansion and harvesting. This work attempted to identify clusters of areas in which burning was commonly practiced as well as to understand their constraints concerning proximity to urban areas, rivers, processing plants, and other factors. For the selected regions, stationary transition matrices and weights of evidence were calculated in accordance with each observed transition in the study period. Future scenarios were simulated according to the transition probabilities calculated by the stationary model. A second model, prescriptive, was drafted based on expert counselling.

## Results and Conclusions

The results showed that there are clusters where the compliance with the Protocol is higher, close to Barretos and Ribeirão Preto municipalities, while near Ourinhos and Jaú, the practice of burning is still regularly kept. However, the analysis showed that there is a strong tendency to reduce the pre-harvest burning in all study areas. According to the forecasts generated by the stationary model, the compliance of these regions would reach about 60%, while in the prescriptive model, this percentage would remain in considerably higher levels, around 80 and 92%.

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