

Mapping Land-Use Conversion Pathways in Regions of Significant Rainfall Intensity and Frequency Trends: A Multi-Biome Assessment in Brazil

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Abstract

Land-use and land-cover (LULC) changes can modify land-atmosphere interactions and influence extreme precipitation, yet its hydroclimatic effects remain uncertain across large and diverse regions. Brazil offers a unique setting to investigate these interactions due to its climatic gradients, biome diversity, and rapid land transformation. This study provides an assessment of how LULC changes intersect with trends in extreme rainfall indices (Rx5day, R50, and R99PTOT) calculated using the CHIRPS dataset across Brazil's six biomes from 1987 to 2023. By integrating high-resolution (30 meters spatial resolution) MapBiomas data with statistically robust trend detection, we find that while agricultural expansion—primarily pasture-driven deforestation—is the dominant transition in areas of significant rainfall change, the hydroclimatic response is highly heterogeneous and biome-specific. The results reveal a spatial mosaic of wetting and drying signals, indicating that while LULC might disrupt evapotranspiration and surface roughness, its effects may be modulated by large-scale atmospheric circulation. Consequently, land-use change might act as a conditioning factor for regional susceptibility to extremes rather than a deterministic driver.

Keywords: Land-atmosphere interactions; Extreme rainfall indices; MapBiomas