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TRANSITIONS IN RURAL TERRITORIES

**RELATIONSHIP BETWEEN CLIMATE EXTREMES AND SOYBEAN  
PRODUCTION IN CENTRAL-SOUTHERN BRAZIL**

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Objective: This paper analyses how extreme weather events (EWEs) affect soybean production in Brazil, with particular emphasis on the Southern and Central-Western regions, addressing the gap in municipality-level evidence that jointly links extremes to production/productivity losses. Method: We integrate annual municipal production data (CONAB/IBGE) for 2000-2023 with INMET meteorological records, using climate variables through daily aggregation (precipitation totals; mean/max/min temperatures). Because station density is low relative to producing municipalities (1,539 with soybean records), we generate spatially representative daily climate series at municipal centroids via inverse distance weighting (IDW) using a 100 km representativeness radius and distance-decay power 2. We compute ETCCDI extreme indices (e.g., CDD,

Rx5day, SDII; and temperature extremes/frost-related measures) and align their windows with phenological calendars; these indices are then converted into discrete EWE indicators (drought, heavy-rain/flood-prone episodes, heat waves, cold anomalies/frost risk) at the municipality stage year level. Finally, we estimate pruned, cross-validated classification trees to map EWE features to outcome classes derived from municipality-specific production/yield anomalies (no loss and loss), prioritising interpretability and threshold discovery. Conclusions: The results indicate regional asymmetries: the Central-West shows greater yield stability, while the South exhibits higher volatility and sharper downturns, consistent with uneven socioecological vulnerability. The proposed pipeline delivers transparent, rule-based climate loss thresholds that can support territorially targeted adaptation and risk governance under compounding global crises.

Palavras-chave: soybean supply chain; climate extremes; socioecological transitions; rural territories; resilience.