



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems  
promoting climate resilient futures”

## Macaúba: Multi-criteria spatial assessment of alternative oil crop production systems in Brazil

SAI ANURAG NANDAGIRI<sup>1</sup>, RICARDO VARGAS-CARPINTERO<sup>1</sup>, THOMAS HILGER<sup>2</sup>

<sup>1</sup>*University of Hohenheim, Dept. Biobased Resources in the Bioeconomy, Germany*

<sup>2</sup>*University of Hohenheim, Inst. of Agric. Sci. in the Tropics, Acrocomia Hub, Germany*

### Abstract

The macaúba palm (*Acrocomia aculeata*) is increasingly recognised as a promising alternative oil crop in Brazil due to its ecological adaptability, high oil yields, and potential to generate co-products such as proteins and fibers. Unlike conventional tropical oil crops like African oil palm, macaúba can be established on degraded pasturelands in Brazil's Cerrado biome, offering opportunities for ecological restoration and rural development while reducing deforestation pressure on tropical forests.

This study applies an integrated multi-criteria decision analysis (MCDA) framework to three municipalities in the State of Minas Gerais, each hosting distinct macaúba cultivation and value chain initiatives. Spatial datasets were selected and organised into three MCDA pillars: (i) Biophysical-environmental feasibility combines a macaúba suitability map with pasture degradation layer, after masking protected areas to ensure legal compliance while avoiding conflicts with biodiversity conservation priorities; (ii) Techno-economic viability is represented by an infrastructure proximity index based on distances to warehouses, urban centers, and highways; (iii) Socio-institutional desirability is captured through a community rural density index as proxy for rural labour and social presence. Land-use and land-cover data are used to distinguish pasture and crop systems and assess where macaúba can be integrated via silvopastoral, agroforestry, or plantation configurations.

From these layers, a composite implementability index and a production system typology map were developed, classifying map cells as plantation, community silvopastoral, commercial silvopastoral, or agroforestry with coffee, soybean, or other annual crops. Results indicate that the municipality of João Pinheiro offers large contiguous areas suitable for plantation-oriented models, the region of Montes Claros supports a hybrid pattern combining plantations and community silvopastoral systems, and the territory of Patos de Minas presents a diversified mosaic where agroforestry and community silvopastoral typologies align with existing land-use and rural settlement patterns.

The study shows that macaúba expansion and value chain development in Brazil should be guided by typology-aware spatial analysis rather than climate suitability or investment opportunity alone. The three municipalities offer transferable templates for matching production models to territorial conditions and for designing regionally differentiated, socially inclusive, and environmentally robust macaúba value chains in Brazil.

**Keywords:** Agroforestry, Brazil, degraded pastures, diversification, GIS, innovative decision support approach, novel perennial oil crop, silvopastoral systems, sustainable land use

---

**Contact Address:** Sai Anurag Nandagiri, University of Hohenheim, Dept. Biobased Resources in the Bioeconomy, Schwerzstrasse 3, 70599 Stuttgart, Germany, e-mail: saianuragrameshkumar.nandagiri@uni-hohenheim.de