Abstract

Navigating Climate Challenges: Strategic Spatial Modelling as a Proposal to Prepare for *Coffea canephora* var. Robusta Plantations in Colombia [†]

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Abstract: Colombia, one of the world's leading coffee suppliers, is experiencing a decline in its production capacity due to climate change, resulting in fewer suitable areas for growing its mild coffee varieties. The traditional *Coffea arabica* cultivation regions in the Andes are surrounded by high biodiversity, which cannot and should not be replaced by other agricultural activities. This situation has led to the consideration of cultivating *Coffea canephora* var. Robusta in Colombia. Identifying areas with the highest productive potential under current and future climate scenarios is necessary. Our objective was to pinpoint regions with the greatest biophysical and socio-economic potential for Robusta coffee cultivation in Colombia. To achieve this, we utilized an integrated model that combines climate suitability assessment and crop yield projections under current and future climate scenarios while accounting for soil limitations, pest risks, and socio-economic conditions. Our results indicated that most potential areas are at elevations below 600 m, thus avoiding interference with traditional and established Arabica coffee regions in Colombia. Under current climate scenarios, potential areas are located in the foothills along the eastern Andean ranges, the high plains of the Orinoquía region, and the humid parts of the Caribbean region. Under a global warming scenario with a 2 °C temperature increase, significant negative impacts on productive potential are projected for the Caribbean region. Consequently, the foothills of the eastern Andes and the high plains of the Orinoquía region emerge as the most promising areas for cultivating *Coffea canephora* var. Robusta.

Keywords: biogeography; geospatial analysis; crop adaptation; climate resilience; Andean region

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