**Agro-Climatic Suitability of Central Queensland Mining Region for Pongamia Plantation**

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# ABSTRACT

Pongamia trees, known for their resilience to diverse soil types and climatic conditions, offer potential for bioenergy, land rehabilitation and carbon sequestration. This study assesses the agro-climatic suitability of Central Queensland mining region for Pongamia plantation by evaluating climate, soil properties, and topography.

Climate analysis, based on 50 years of rainfall and temperature data (1960-2020), revealed annual rainfall ranging from 250 to 1400 mm, with a 10-year average of 500-800 mm. Rainfall was concentrated in 4-13 days/month, while temperatures fluctuated between -1.1°C and 44°C. Frost days were minimal, averaging three annually. These conditions are favourable for Pongamia growth, provided supplemental irrigation is applied during the establishment phase.

Soil assessments, utilizing spatial data from the CSIRO and Queensland Spatial Catalogue and 50 field survey points, identified Vertosols and Sodosols as the dominant soil types. Soil physical properties showed plant available water ranged from 5-30 mm in the topsoil (0-30 cm) to 20-55 mm in the subsoil. Bulk density values increased from 1.28 g/cm³ at the surface to over 1.66 g/cm³ at depth, necessitating land preparation to reduce compaction. Soil texture varied, with sandy topsoil (29-83% sand, 8.9-16.3% silt, 3-42% clay) transitioning to more clay-rich subsoil, which improves water retention. These physical properties align with Pongamia’s adaptability but highlight the necessity for tailored land management practices. Chemical properties, including pH (4.6-7.5 at surface), organic carbon (1.3-2.1% in topsoil), and cation exchange capacity (11-90 meq/100g), were within acceptable ranges for Pongamia establishment. However, nutrient deficiencies in deeper layers necessitate fertilization and soil amelioration to optimize growth.

Topographic analysis revealed predominantly flat terrain (<2° slope), conducive to plantation establishment with minimal leveling required. This study demonstrates the potential of Central Queensland mining region for Pongamia plantation, with strategic management interventions to address specific soil and climate challenges.