Tropentag, September 16-18, 2026, hybrid conference

"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

Economic, environmental, and social impacts of silvopastoral systems: Evidence and scaling pathways from Colombia

Stefan Burkart[1], Danny Fernando Sandoval[2]

[1] *The Alliance of Bioversity International & CIAT, Trop. Forages Program, Colombia*
[2] *The Alliance of Bioversity International & CIAT, Trop. Forages Program, Colombia*

Abstract

Colombia's cattle sector is a cornerstone of rural livelihoods and national agricultural output, yet it is also a major driver of deforestation, land degradation, and greenhouse gas emissions. Silvopastoral systems (SPS), which integrate trees, forage, and livestock, have emerged as a promising pathway toward more sustainable and climate-resilient cattle production. This study assesses the potential of SPS to transform Colombia's cattle sector by synthesizing evidence on their economic, environmental, and social impacts, as well as the enabling conditions required for large-scale adoption. A systematic literature review of 185 sources published between 2000 and 2025 was conducted, including peer-reviewed articles, institutional reports, and policy documents. The analysis applies frameworks on technology adoption, scaling of innovation, and sustainable finance to evaluate SPS performance and identify barriers and opportunities for expansion. Results show that SPS can significantly enhance productivity and profitability, with reported internal rates of return often exceeding 20 % and reduced payback periods compared to conventional systems. Documented environmental benefits include carbon sequestration, reduced methane emissions, improved soil health, and increased biodiversity, positioning SPS as a climate-smart land-use strategy. Socially, SPS support rural livelihoods, strengthen resilience among smallholders, and contribute to food security and inclusive development. Despite these advantages, adoption remains limited due to persistent barriers such as high upfront investment costs, long and uncertain payback periods, insecure land tenure, limited access to tailored financing, and weak institutional support. The findings highlight the importance of integrated scaling strategies that combine financial innovation, policy alignment, technical assistance, and market development. Promising mechanisms include blended finance, payments for ecosystem services, carbon markets, and sustainability-linked value chains. Colombia's experience provides valuable insights for scaling sustainable livestock systems across the tropics. Unlocking the full potential of SPS requires coordinated public–private action, targeted investments, and enabling policy environments that address systemic constraints. By aligning economic incentives with environmental and social outcomes, SPS can contribute to transforming cattle production into a more sustainable, productive, and inclusive sector.

Keywords: Agroforestry, climate-smart agriculture, ecosystem services, scaling innovations, sustainable cattle farming, sustainable finance, technology adoption

Contact Address: Stefan Burkart, The Alliance of Bioversity International & CIAT, Trop. Forages Program, km 17 recta Cali-Palmira, 763537 Cali, Colombia, e-mail: s.burkart@cgiar.org