Tropentag, September 20-22, 2023, hybrid conference

"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

Feasibility of improved silvopastoral systems in the Caribbean region of Nicaragua

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Abstract

In Nicaragua, land use change and agriculture cause 80 % of total greenhouse gas emissions, of which more than half are from livestock. Livestock farming occupies almost 50 % of total land area and is a major cause of forestland conversion, especially in the Caribbean region covering over half of the national territory, with 89 % of the country's forests and the highest proportion of poor people. The conversion of forests to agricultural land uses and inadequate pasture management have severe environmental impacts, including land degradation, biodiversity loss and exacerbation of flood-drought cycles.

FAO requested a feasibility study of different scenarios (Business as Usual-BAU versus silvopastoral interventions-SPS) of investments in silvopastoral components (such as Iive fences, fodder banks, regeneration of trees in pastures) and improved pastures of small and medium livestock farms. For each scenario the biophysical, environmental and climate impacts - nitrogen balance, land and water requirement, greenhouse gas (GHG) emissions and carbon stock changes - were analysed using the rapid ex-ante assessment tool "CLEANED". Net income from livestock production and costs of silvopastoral systems with different tree types and densities were assessed. Internal rate of return (IRR) and payback period were calculated based on an investment life of 12 years.

All SPS scenarios show increased carrying capacity, productivity (by 30–50 %) and reduced GHG emission intensities (by 25–50 %). The increased productivity in SPS scenarios potentially frees land by up to 25 % (mainly pastures) for restoration and/or reforestation. Water use per kg of milk decreases by 50. The proposed investments lead to an increased carbon accumulation of 5.1 to 7.8 t CO_2 e ha^{-1} and an IRR of 9 % to 28 %. Carbon sequestration in small farms exceeds emissions by almost 4 t CO_2 e ha^{-1} and fully compensates emissions in medium farms.

The proposed interventions do not provide sufficient nitrogen to substitute the increased nutrient uptake by grasses and other crops, leading to increasingly negative nitrogen balances of up to 53 kg ha^{-1}. To ensure long-term sustainability, this will have to be compensated with nutrient input into the systems, like increasing the proportion of leguminous trees and associating grasses with herbaceous legumes.

Keywords: Caribbean region, CLEANED tool, feasibility study, improved silvopastoral systems, Nicaragua

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