A farm-level financial framework for sustainable cattle intensification: Evidence from Colombia's Altillanura

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Introduction

- Sustainable cattle intensification aims to increase productivity on existing agricultural land while reducing pressure on forests, soils, water resources, and the climate.
- However, empirical evidence on the private economic performance of integrated intervention packages remains scarce, particularly in Colombia's Altillanura region.

Objective

Validate a farm-level financial evaluation framework using evidence from two commercial cattle farms in Puerto Gaitán, Meta, Colombia (Figure 1).

Figure 1. Study area.

Methodology

- Two farm-level cases (Table 1 and Figure 2). An integrated intervention package (Figure 3) was implemented from 2021 onwards across a total of 60 hectares (30 ha on each farm).
- **What was implemented?:** Improved pastures, Rotational grazing, Water infrastructure, Silvopastoral components, Good cattle practices, Technical assistance + record keeping
- **Productive pathway:**
  - Improved forage, grazing and water management
  - Stocking rate + daily liveweight gain
  - Beef production + farm revenues
  - Financial returns + downside risk

Table 1. Two farm-level cases.

Indicator	Alejandrera	Altamira
Farm area (ha)	93	76
Intervened area (ha)	30	30
Stocking rate (AU ha^{-1})	2.5	2.5
Daily gain (kg AU^{-1} day^{-1})	0.59	0.50

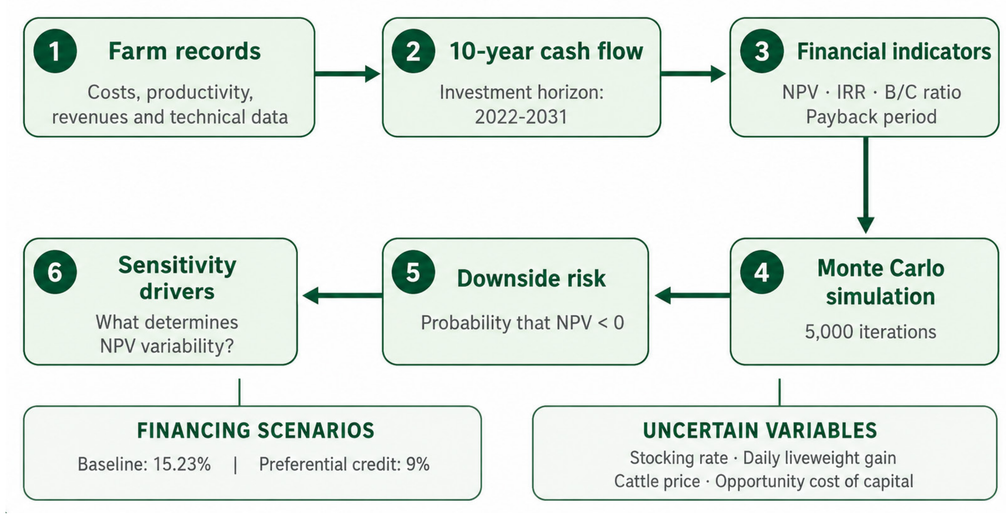

Figure 2. Farm-level financial evaluation framework.

Figure 3. The intervention in practice.

Results

- Financing scenarios (Table 2 and Table 3)
- Alejandrera achieved a higher daily liveweight gain (0.59 vs. 0.50 kg AU^{-1} day^{-1}), resulting in higher annual beef production, higher revenues, and a larger economic margin above the break-even threshold (Figure 4).

Table 2. Baseline financial performance (15.23%)

Indicator	Alejandrera	Altamira
NPV (US$)	43,634	25,156
IRR (%)	61	41
Benefit-Cost Ratio	1.57	1.32
Payback period (years)	2.39	3.31
Probability NPV<0 (%)	0	1.7

Table 3. Preferential finance (9%)

Alejandrera NPV	Altamira NPV
US$43.6k US$65.8k	US$25.2k US$41.2k

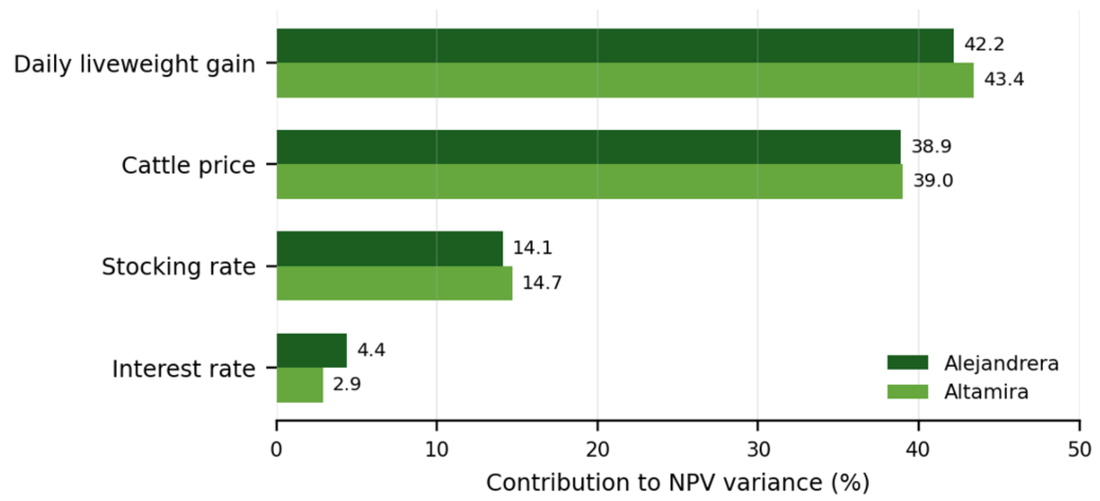

Figure 4. Daily liveweight gain and cattle prices together explained more than 80% of the NPV variability.

Conclusion

The pilot framework successfully captured expected financial returns, downside risk, and the main drivers of profitability. Both farms were financially viable under the evaluated conditions, although their performance depended on sustained animal productivity, favorable cattle prices, continued technical assistance, and access to appropriate financing. These findings provide illustrative evidence that sustainable cattle intensification can be economically viable under commercial farming conditions.

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Related work

Sandoval, D. F., Florez, J. F., Enciso Valencia, K. J., Sotelo Cabrera, M. E., & Burkart, S. (2023). Economic-environmental assessment of silvopastoral systems in Colombia: An ecosystem service perspective. Heliyon, 9(8), e19082. doi: 10.1016/j.heliyon.2023.e19082

Enciso, K., Charry, A., Rincón Castillo, Á., & Burkart, S. (2021). Ex-ante evaluation of economic impacts of adopting improved forages in the Colombian Orinoquía. Frontiers in Environmental Science, 9, 673481. doi: 10.3389/fenvs.2021.673481

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