

Roots of Resilience: Exploring the Impact of Agroforestry on Nutrition in Western Rwanda

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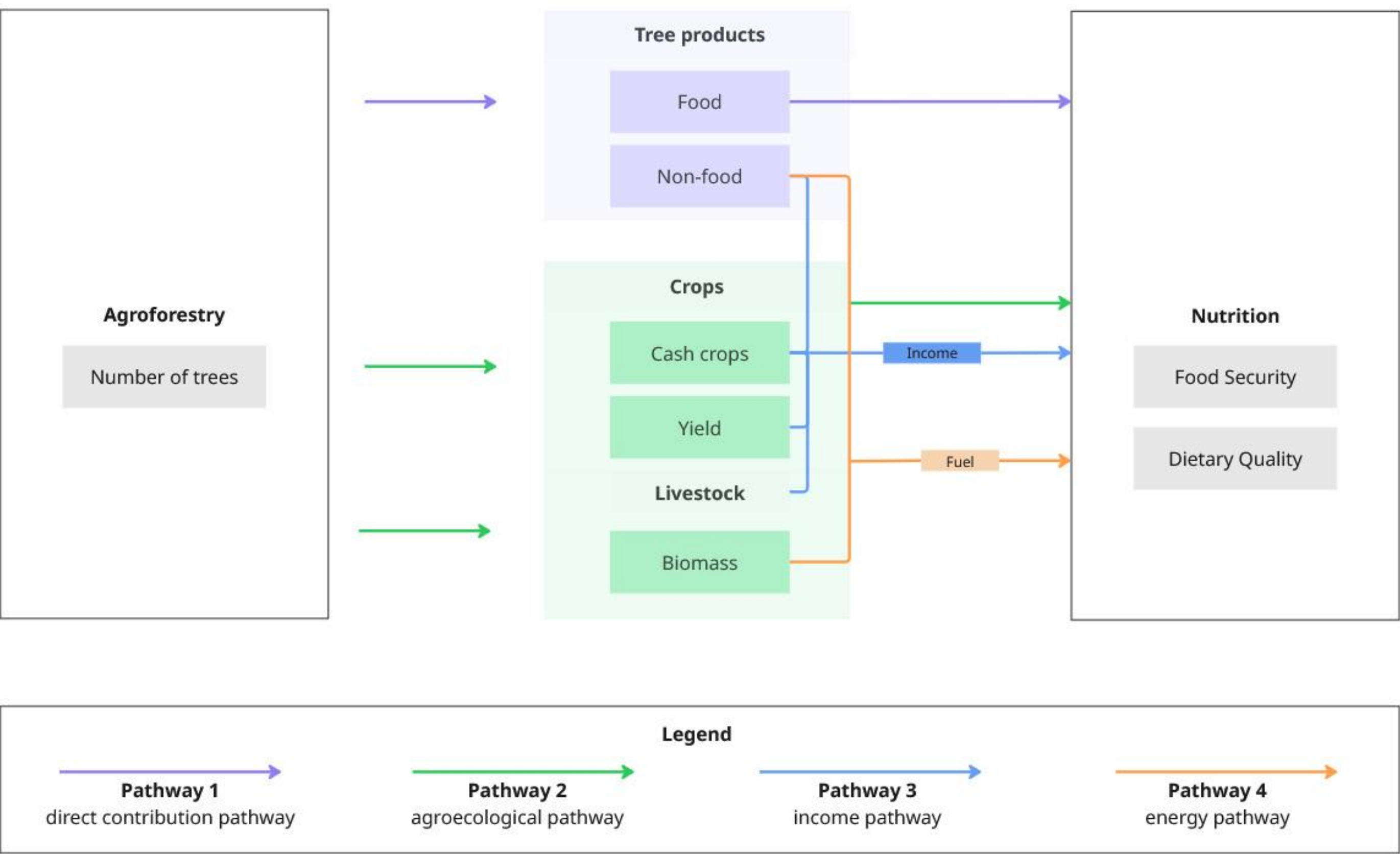
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Background and objectives

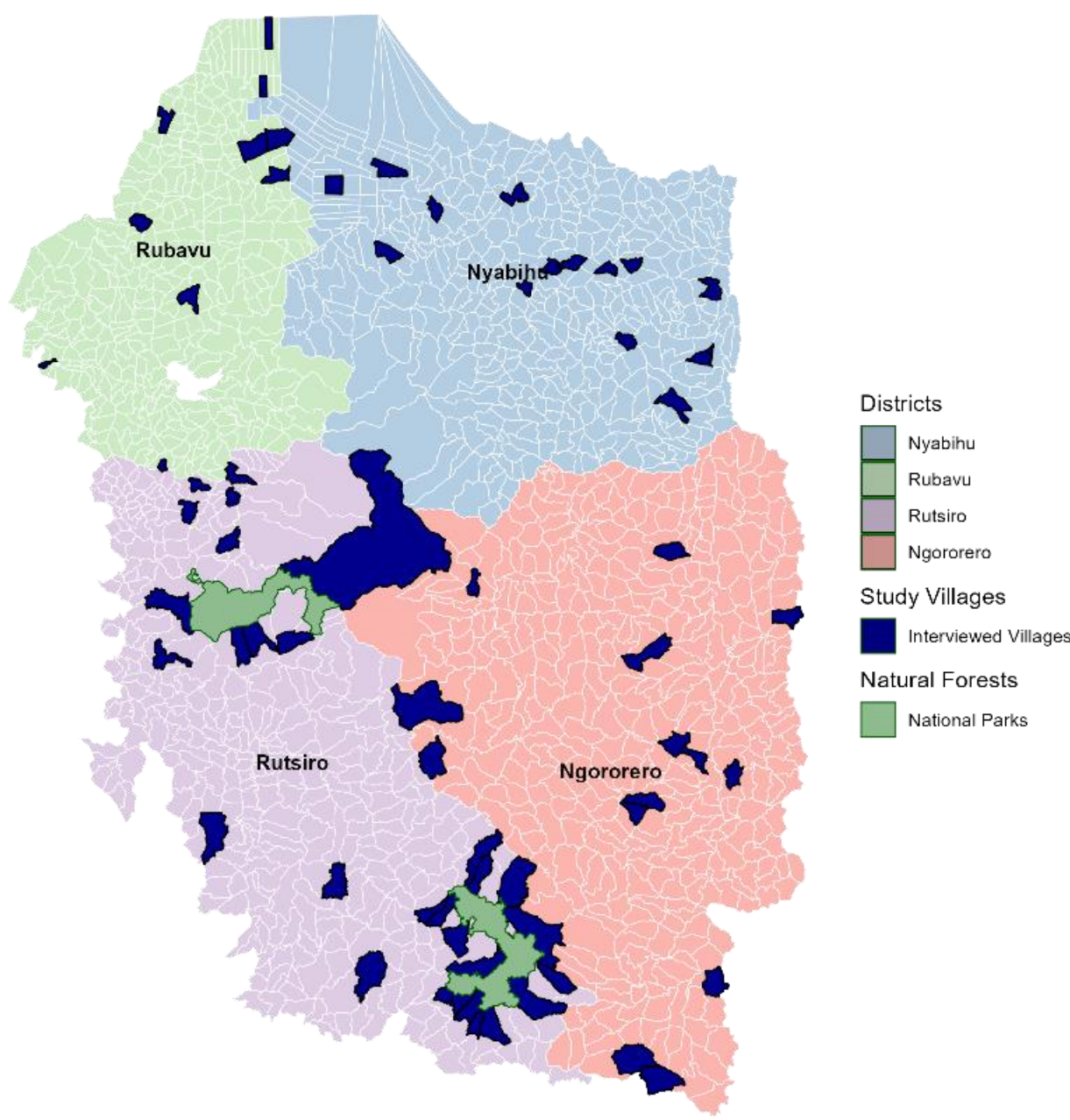
- Current focus on agricultural expansion is a prominent answer to issues of hunger and malnutrition. BUT:
 - Intensive farming has led to soil degradation, erosion, and nutrient depletion
 - This focus on productivity overlooks the potential of landscape diversity and wild resources
- **Agroforestry as solution:** Integrating trees into farming systems boosts productivity, profitability, and sustainability
- **RESEARCH QUESTION:** This study seeks to investigate how agroforestry practices in western Rwanda influence household food security and dietary quality. Critical research gaps are addressed by simultaneously examining not only income pathways but also consumption, agroecological and energy benefits

Framework



Materials and Methods

- Cross-sectional HH level data from 592 households across four districts of Rwanda's Western Province (Rubavu, Nyabihu, Rutsiro, Ngorero)
 - The average size of land is 0.78 ha of which 0.75 ha are under agricultural production
 - Of 592 households, 164 have no agroforestry and the average households has 42 trees
 - In our sample, 41.82% of households are considered severely food insecure, the average HDDS is 3.54
- IPWRA and simultaneous mediation analysis are applied to identify agroforestry's effect on household nutrition and uncover relevance of four different pathways investigated



Results

Table 1 Association of agroforestry with nutrition outcomes (n=592)

	Predicted Outcome (non-adopters)	Avg. Treatment effect ADPO ^A
HFIAS (food insecurity, 0-27)	7.777***	-1.608***
HDDS (dietary diversity, 0-12)	3.721***	0.100
Female DDS (dietary diversity, 0-12)	5.530***	0.582***

ADPO^A = Average Difference in Predicted Outcomes for agroforestry participants, comparing actual participation vs. hypothetical non-participation. Agroforestry adoption defined as medium-to-high on-farm tree density. HFIAS = Household Food Insecurity Access Scale; HDDS = Household Dietary Diversity Score; DDS = Dietary Diversity Score.

- Adopting agroforestry is associated with a **significant reduction of 1.6 points** in the Household Food Insecurity Access Scale (HFIAS) indicating **improved food security** compared to the hypothetical counterfactual
- Overall household dietary diversity (HDDS) shows no statistically significant change with agroforestry adoption
- However, **female dietary diversity scores improve significantly** among agroforestry adopters, highlighting an important gender-differentiated benefit

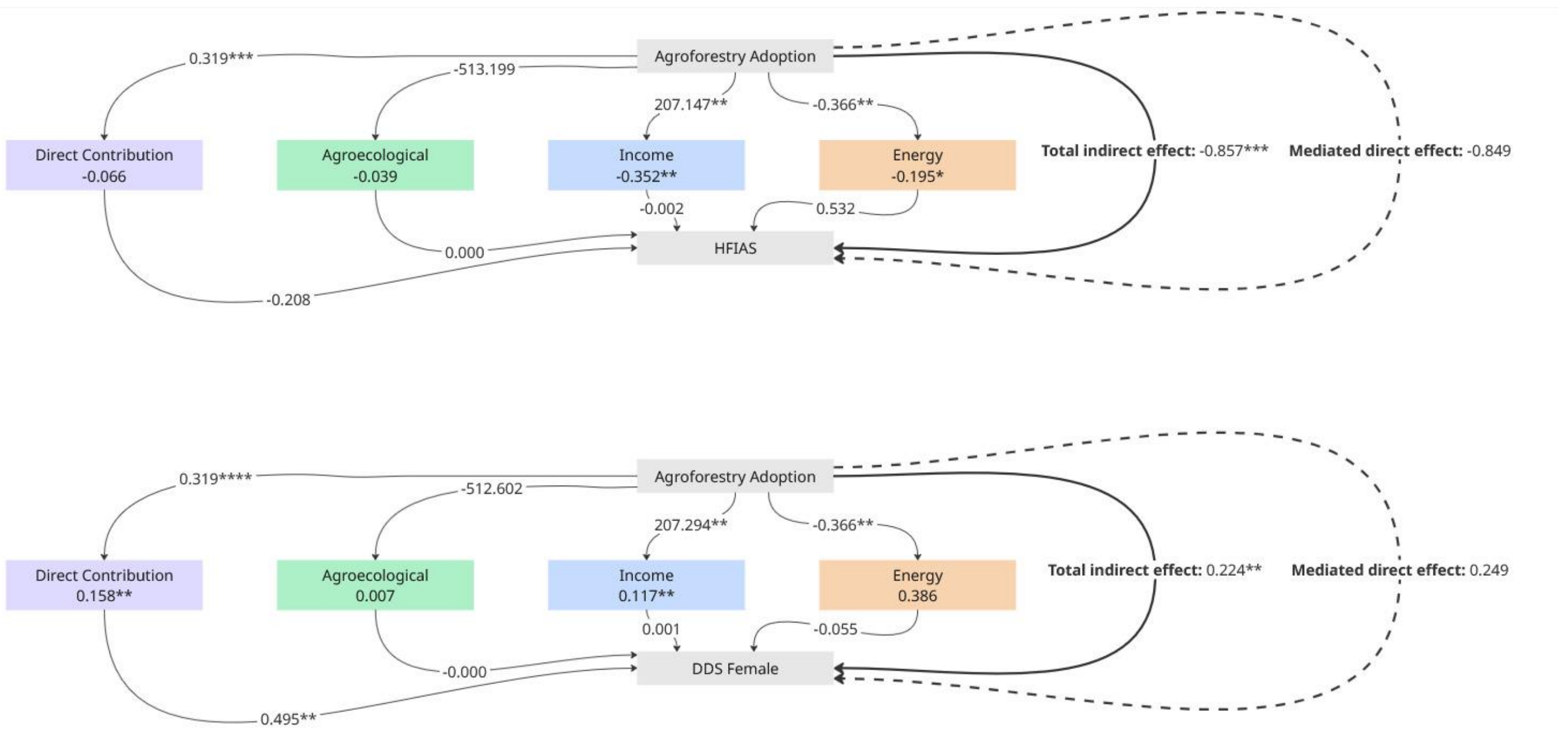


Figure 2 The four pathways as mediators for the effect of agroforestry on household food insecurity and dietary diversity of female respondents

- Agroforestry reduces food insecurity primarily through income and energy pathway
 - Higher agricultural income and reduced time spent on firewood collection are the two dominant channels through which agroforestry lowers household food insecurity
- Women's dietary diversity benefits through income and direct food contributions

Conclusion

- Agroforestry **significantly improves household food security and women's dietary diversity** in western Rwanda — driven by two key mechanisms:
 - **Income Pathway** Households generate additional income by selling tree products, strengthening their ability to access sufficient and more diverse food
 - **Energy Pathway** Agroforestry improves firewood availability, reducing energy poverty and enabling better cooking practices — freeing up time and resources for improved nutrition