

Food system drivers of deforestation: Analyzing deforestation as an outcome of the food system

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INTRODUCTION

- Agricultural expansion is the greatest direct driver of deforestation, accounting for ~90% of global deforestation during 2000–2019 [1].
- Despite this, limited research has examined deforestation as an outcome of the food system.
- Thus, little is known about which dimensions of the food system are most influential in driving forest cover loss.
- Such insights are needed to design effective strategies and policies to achieve zero deforestation while securing food security and nutrition.
- This study takes a food systems approach to understand how drivers related to the three dimensions of the food system—(1) consumption/demand, (2) production/supply and (3) trade/distribution dynamics—contribute to explaining tropical deforestation at global and continental scales.

METHODS

Machine learning used to model drivers corresponding to the three food system dimensions

Data for:

- 2004–2021
- 40 high-deforestation countries
- 12 driver predictor variables
- Tree cover loss (TCL) from the Terra-i monitoring system as response variable

Modeling:

- Extreme Gradient Boosting (XGBoost)
- Importance of drivers in explaining variation in TCL
- Models at global scale and for Africa, Asia & Oceania and Latin American & the Caribbean (LAC)
- Spearman's correlations used to assess directional relationships

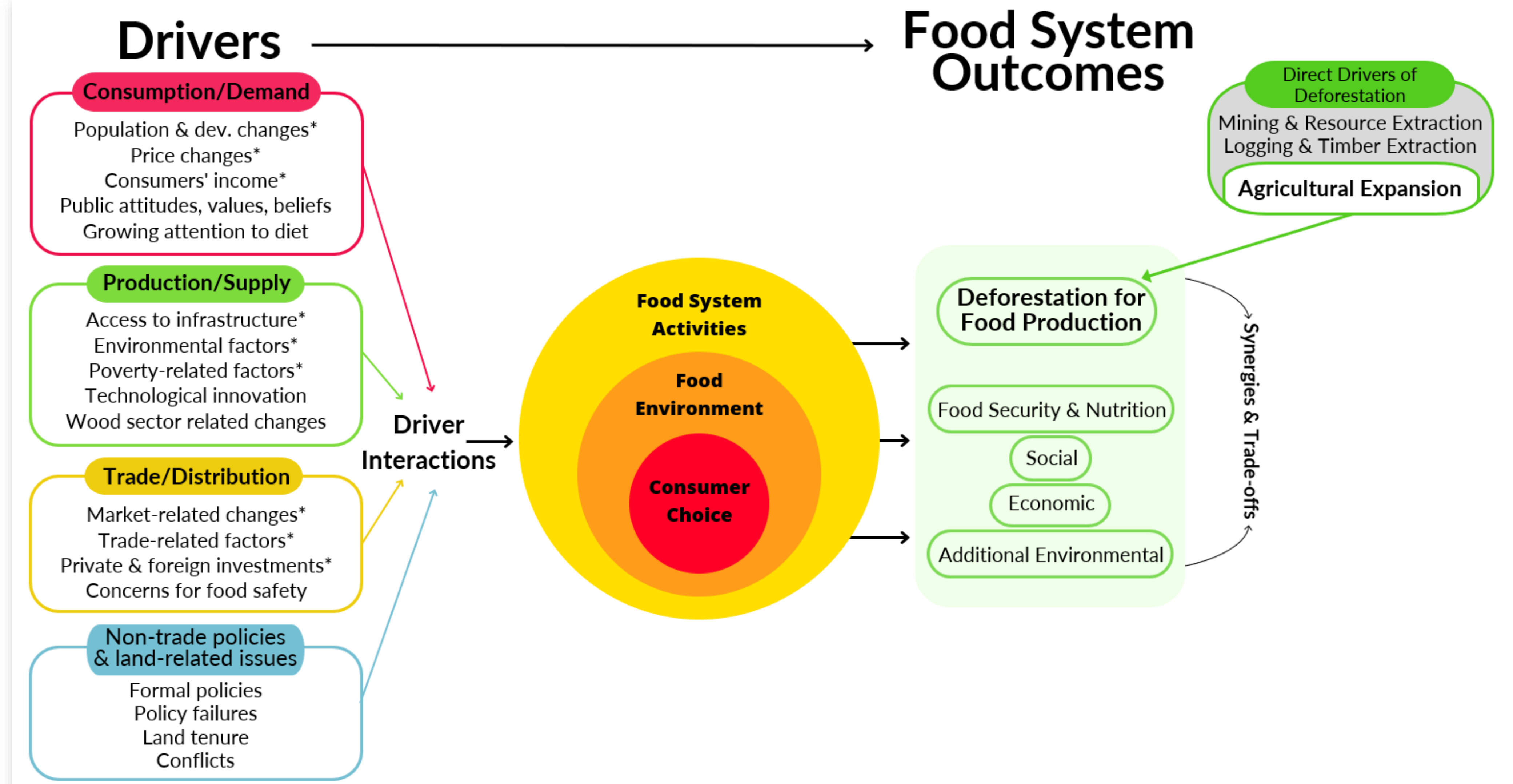


Fig. 1. Conceptual framework for food system drivers of deforestation. The three dimensions of the food system are shown with their associated drivers. Drivers with an asterisk (*) indicate those represented in models, which depended on data availability for the different proxies. A fourth category (non-trade policies & land-related issues) is shown to account for drivers of land systems that can interact with food system dynamics to drive deforestation for food production.

RESULTS

- Tree cover loss (TCL) explained by models:
 - Global (74%), Asia (81%), LAC (73%), Africa (30%)
- 3 variables strongly correlated with TCL at every scale:
 - Foreign direct investments (positive), rural population (negative) and GDP per capita (positive except Africa)
- **Global scale:** Rural population (consumption/demand variable) and foreign direct investments (trade/distribution) explained 24% and 17% of TCL, respectively.
- **LAC:** Trade/distribution variables—GDP of exports (27%, negative corr.) and foreign direct investments (22%)—most explained TCL.
- **Asia & Oceania:** Rural population (consumption/demand) and elevation (production/supply) each explained 23% of TCL.
- **Africa:** Weaker explanatory power of model; food exports and population growth each explained 15% of TCL.

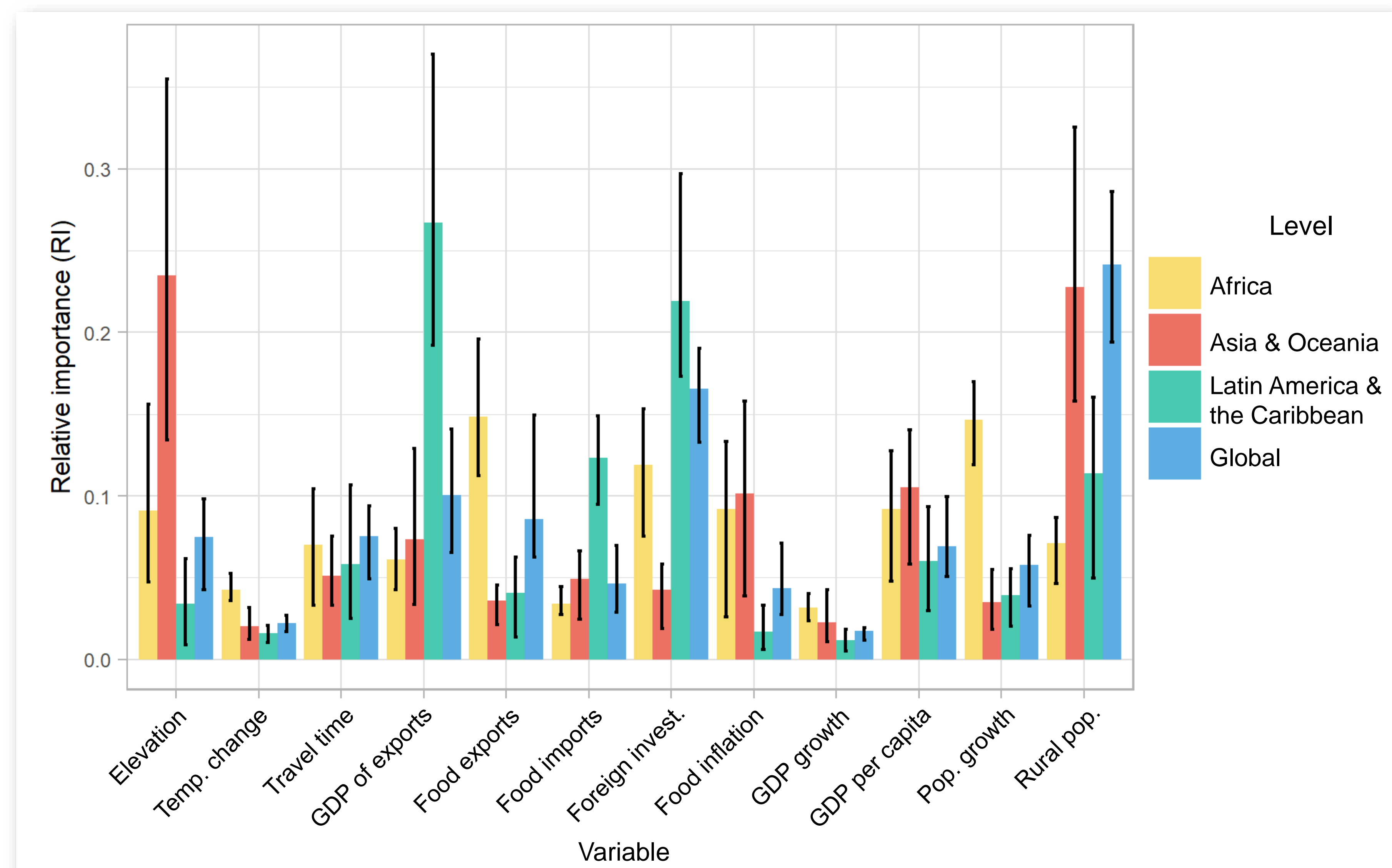


Fig. 2. Results of XGBoost models. RI values indicate the % of variation in tree cover loss explained by the variables at different scales.

CONCLUSIONS

- Deforestation as an outcome of the food system driven primarily by consumption/demand and trade/distribution drivers
- Rural population decline (i.e. increasing demand in urban areas) and foreign direct investments (FDI) contributed the most to explaining global deforestation
- Export-driven economies in Latin America were associated with lower deforestation
- To effectively halt deforestation, supply chain and export-focused policies must be paired with measures targeting domestic/urban consumption
- Further research is needed to understand how FDI shapes land use changes, enabling the development of investment safeguards and regulations

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Citation

[1] FAO. 2022. FRA 2020 Remote Sensing Survey. FAO Forestry Paper 186. Rome.

