

Decoupling Biodiversity Footprints of Food Consumption from Economic Growth Varies with the Wealth of a Country

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1. Introduction

Food systems pose a critical threat to global biodiversity, yet it remains unclear whether and under what circumstances biodiversity footprints can be decoupled from economic growth.

Here we quantify changes in land use-based biodiversity footprints of food consumption in 158 countries (1995 – 2020) to evaluate whether country-specific changes in the biodiversity footprints of food consumption are (de)coupled from economic growth.

2. Methods

- Select Food and Agriculture Biomass Input-Output database, covering 123 agricultural and food products [1].

- Include relative loss in global species richness (RSR-loss) as biodiversity indicator [2].

- Fit linear regression model, accounting for temporal autocorrelation, with the biodiversity footprint (BF) of food consumption in country r of year t as response variable and Gross Domestic Product per capita (GDP), expressed in standardized international dollar in 2017, as the explanatory variable:

$$BF_{rt} = \beta_0 + \beta_1(\ln GDP_{rt}) + \beta_2(\ln GDP_{rt})^2 + \varepsilon_{rt}$$

- Select the best model with corrected Akaike Information Criterion (AICc) score.

- Decoupling of the biodiversity footprint from economic growth occurs when the average slope $\beta < 0$; coupling when $\beta > 0$.

- Differentiate between income groups, impacts caused by land use type, and domestic vs imported biodiversity impacts.

3. Results & Discussion

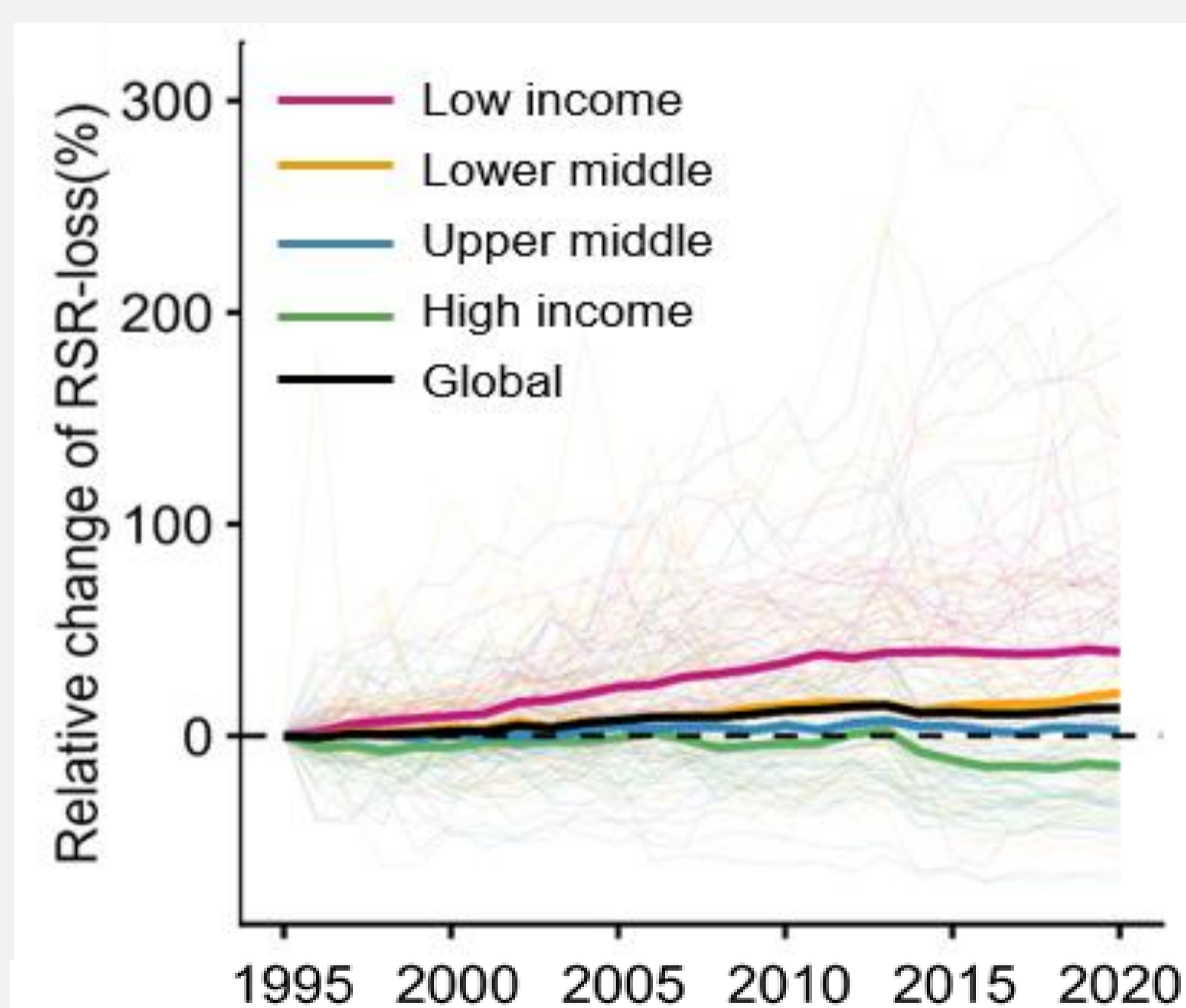


Fig.1: Trends in biodiversity footprints of food consumption

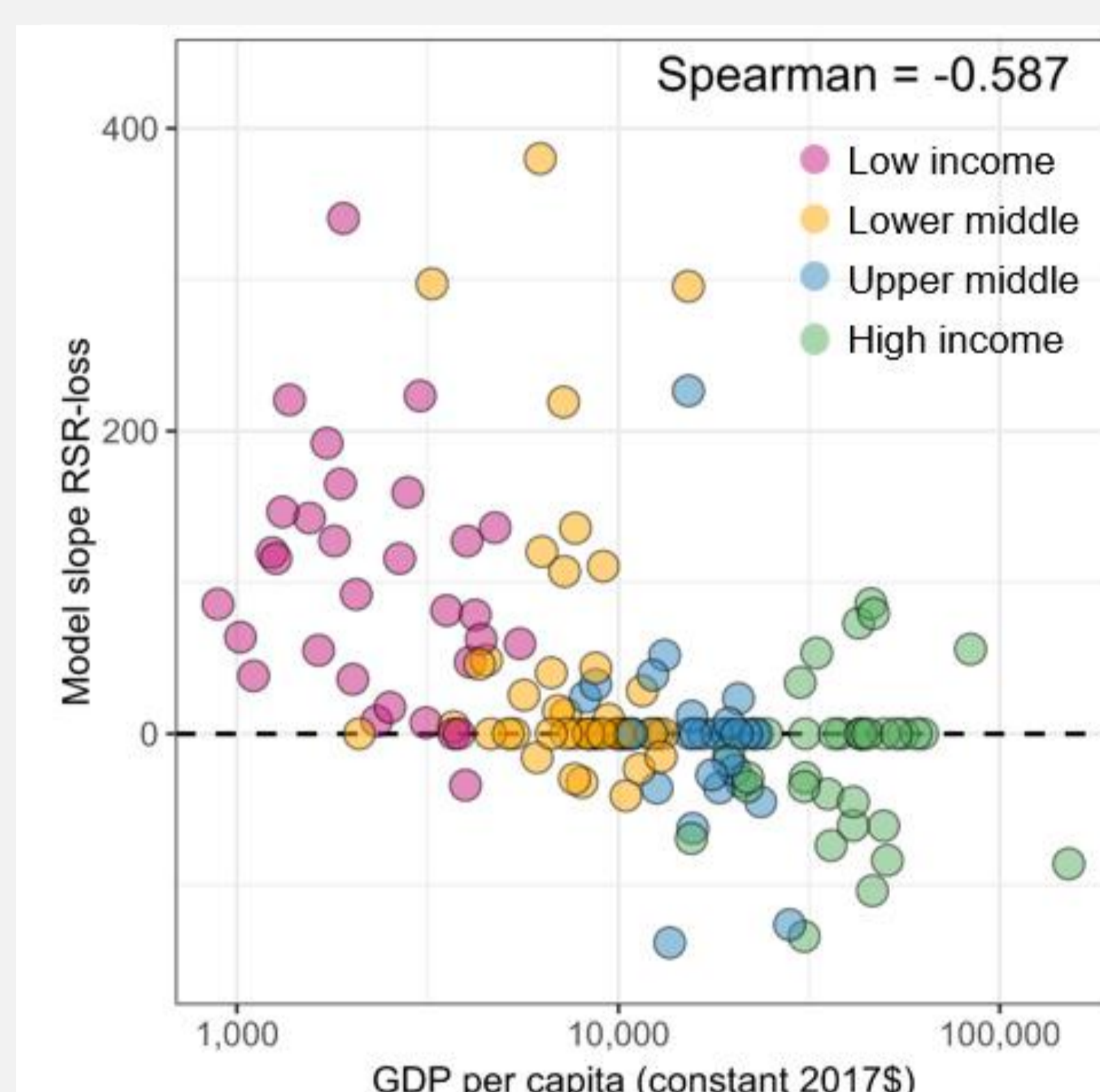


Fig.2: Relationship between countries' per capita GDP and biodiversity footprints of food consumption

- Globally, biodiversity footprints of food consumption increased by 13% between 1995 and 2020. Biodiversity footprints increased most strongly in low-income countries with an average increase of 38.6%. In contrast, high-income countries showed an average decline in biodiversity footprint by 14.3%.

- Our results reveal a significant negative correlation between GDP per capita and (de)coupling coefficients (i.e., the change in biodiversity footprints per change in GDP). This suggests that upper-middle and high-income countries are more likely to experience decoupling of biodiversity footprints from economic growth compared to lower-middle and low-income countries.

- Decoupling is most apparent for cropland and domestically sourced consumption.

- Current levels of decoupling are not yet sufficient to achieve global net reductions in biodiversity footprints.

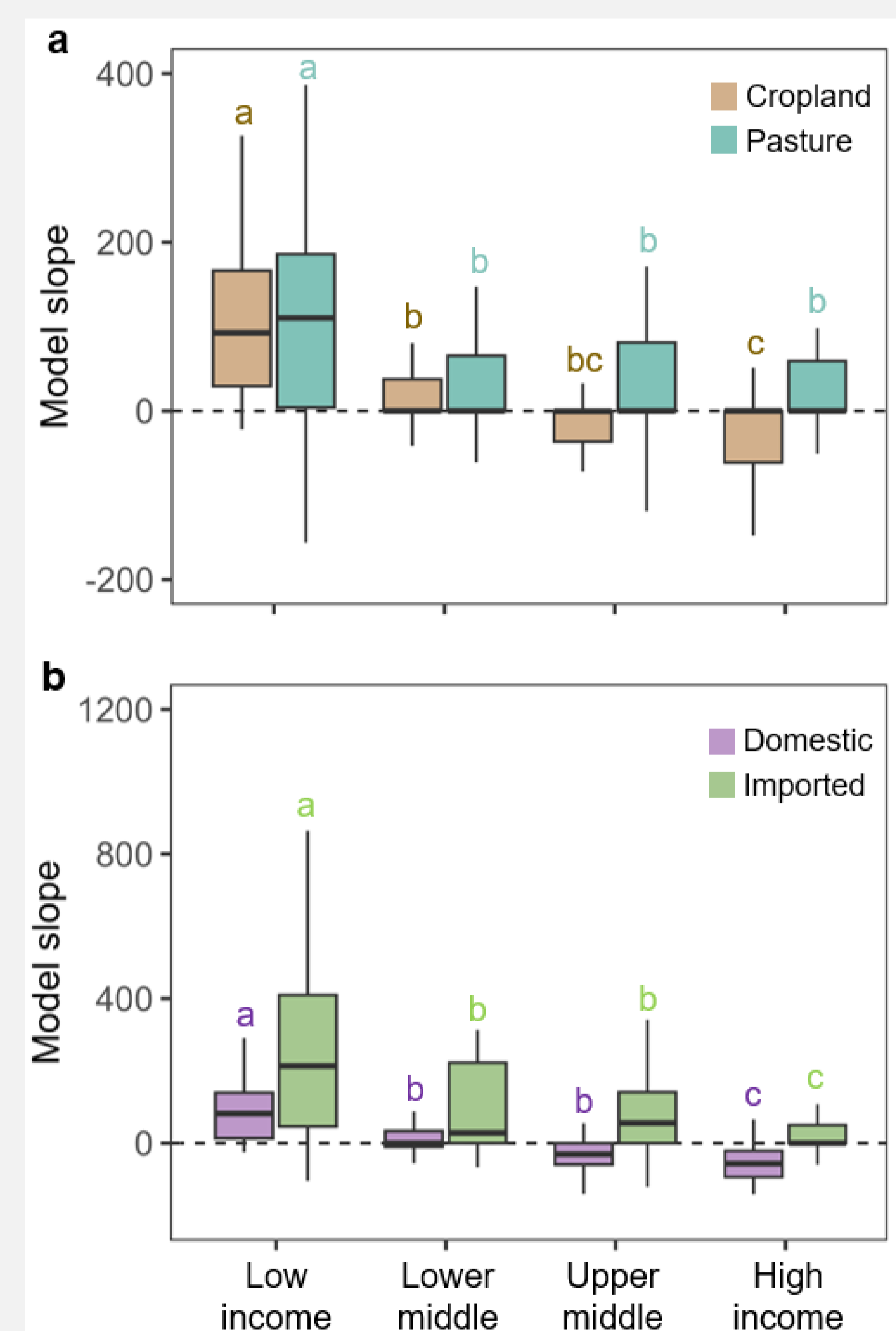


Fig.3: Relationship between countries' per capita GDP and biodiversity footprints of food consumption by land-use (a) and sourcing type (b) across income groups. Groups sharing the same letter are not significantly different, while groups with different letters are significantly different.

References

1. Bruckner, M. et al. Environ Sci Technol 53, 11302–11312 (2019).
2. Veronesi, F. et al. J Ind Ecol 24, 1201–1219 (2020).