

Is “regeneration” possible? The drivers of plant diversity inside West and Central African cocoa plantations

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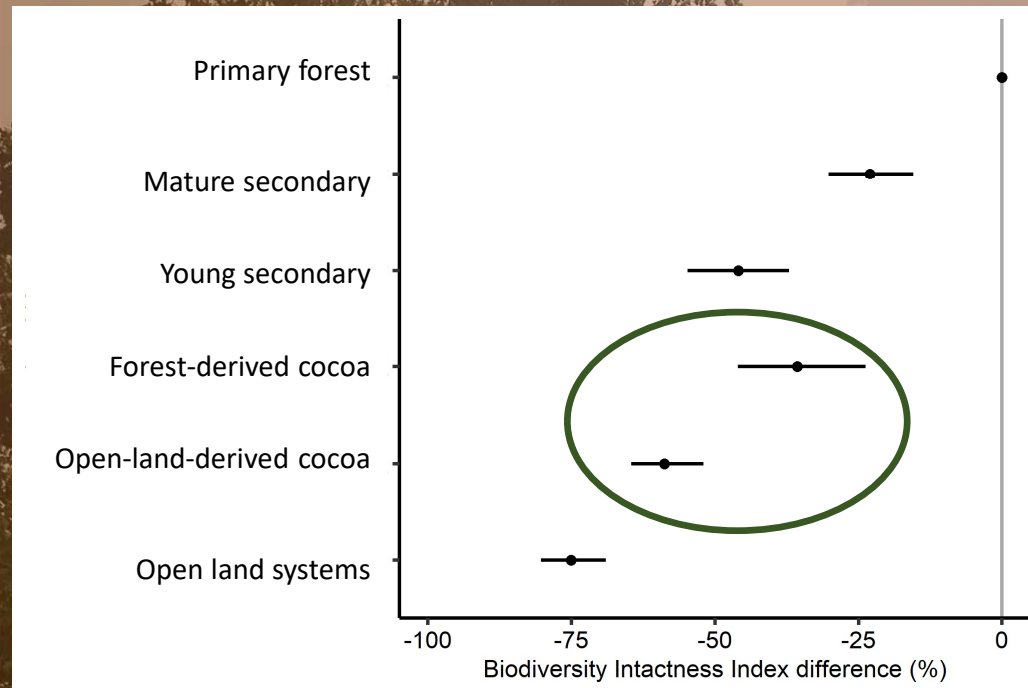
Background: biodiversity in cocoa

What biodiversity is in cocoa?

- Some debate – though see our paper for a synthetic summary
- Linked to system design, landscape, and historical context

Why biodiversity in cocoa?

- Climate biodiversity co-benefits
- Connectivity/refugia for vulnerable species
- Ecosystem services to farmers & beyond



Maney, Sassen, and Hill, 2022

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Our Ambition

As part of our goal of sourcing 100% of our cocoa through our Responsible Cocoa program by 2025, we aim to achieve a deforestation and conversion-free supply chain (as defined by the [Accountability Framework Initiative \(AFI\)](#)).

More specifically, we will continue to work with our suppliers, partners, and government so that

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Growing cocoa in a forest environment

Cocoa plants grow better and produce better crops when grown beneath the canopy of larger trees, which cast shade on the cocoa.

As part of our Net Zero Roadmap and Income Accelerator Program, we are encouraging farmers to plant more forest and fruit trees to protect their crops from heat stress and excessive rainfall. These trees also help to improve water management, local biodiversity, soil organic matter and carbon sequestration, while potentially providing additional income sources for farmers.

We are helpi

resources ar Through the *Nestlé Cocoa Plan*, we distributed 1.47 million forest and fruit trees globally. schools and by individual coaching.

cocoa?

In addition, our *Cocoa Life* program is a global cocoa sustainability program we pioneered to tackle the complex challenges farmers and their communities face. To start, we invested \$400 million over ten years to empower 200,000 cocoa farmers and improve the lives of one million people living in these communities. We have also been partnering with the United Nations Development Program in Ghana (since 2013) on a pioneering program to distribute and register economic trees. Economic shade trees – those planted for purposes other than producing cocoa – diversify the cocoa farms, provide alternate revenue streams, and also make forests more resilient to the risk of pests and disease.



that degraded cattle
forestry cocoa model. It is
Over the last two years, the
ill, in turn, contribute to
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Conceptual framework: what drives biodiversity?

Plantation design & management



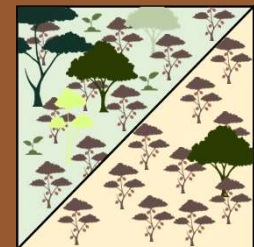
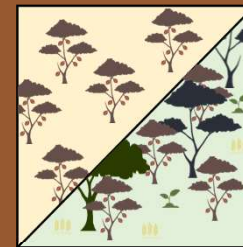
Tree species richness

Supporting services

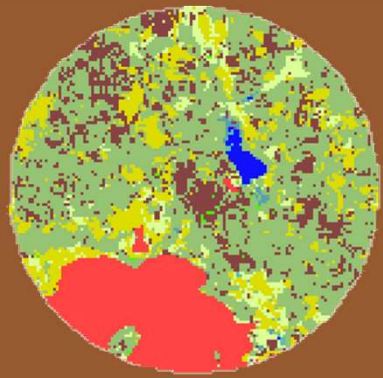
Functional diversity

Understorey plant diversity

Vegetation structure



Land-use history



Landscape effects

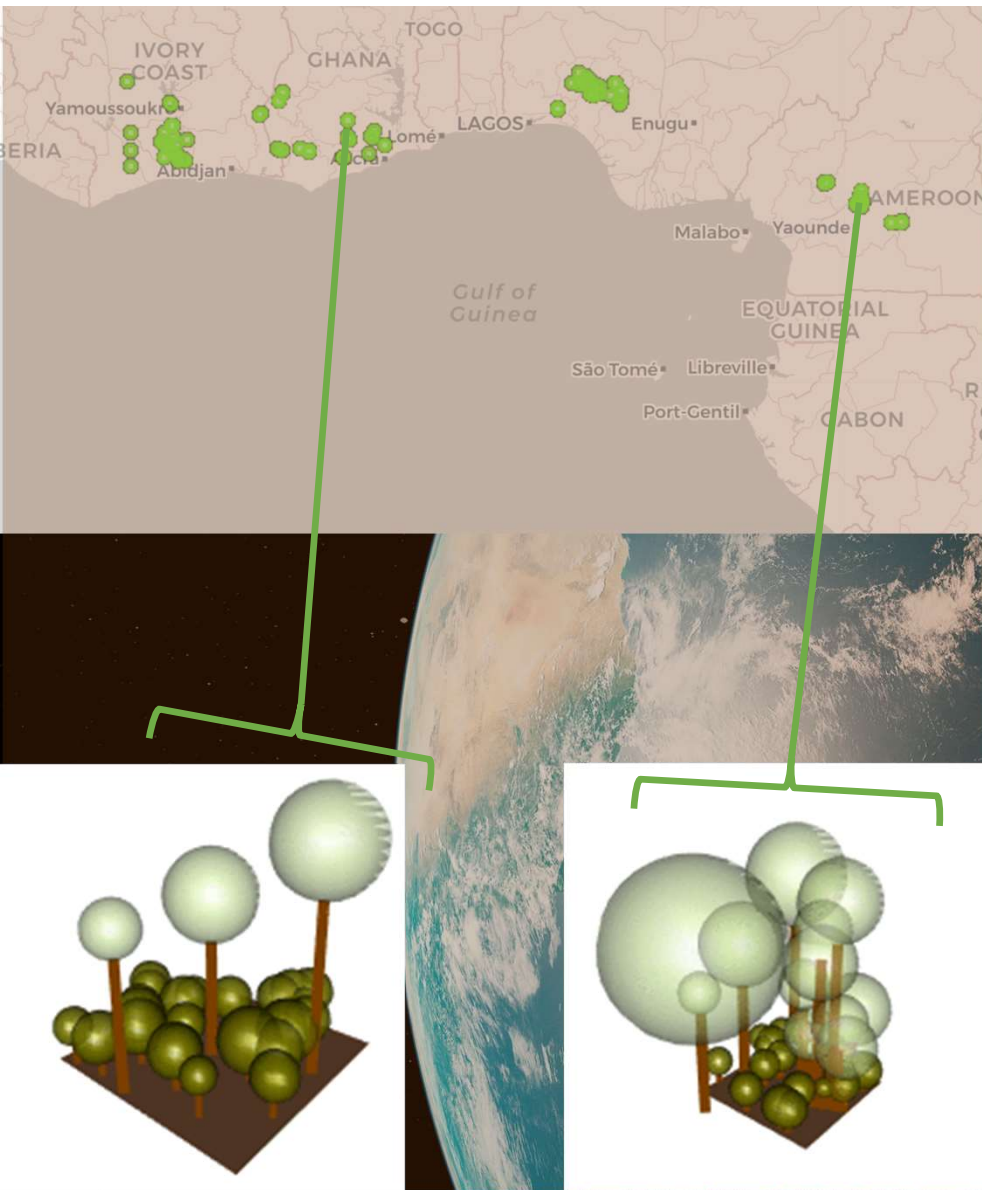
This work

Biodiversity surveys in cocoa are often small-scale, at a few locations and within one climatic zone/country

Agronomic information (management, conditions, outcomes) is often not available to pair with ecological information

“Piggy-backing” on an existing agronomic study to co-measure agricultural information, biodiversity surveys, interviews





Survey locations

Total farms – 169; 49 in Côte d'Ivoire, 38 in Ghana, 40 in Nigeria, 42 in Cameroon

Selection stratified by

Region

Rainfall

Landscape tree cover

(Practicality!)

Surveys at each site

Tree survey

Understorey plant survey

Leaf litter measurements

Interviews

Basemap: OpenStreetMap.

The designations employed and the presentation of material on the above map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

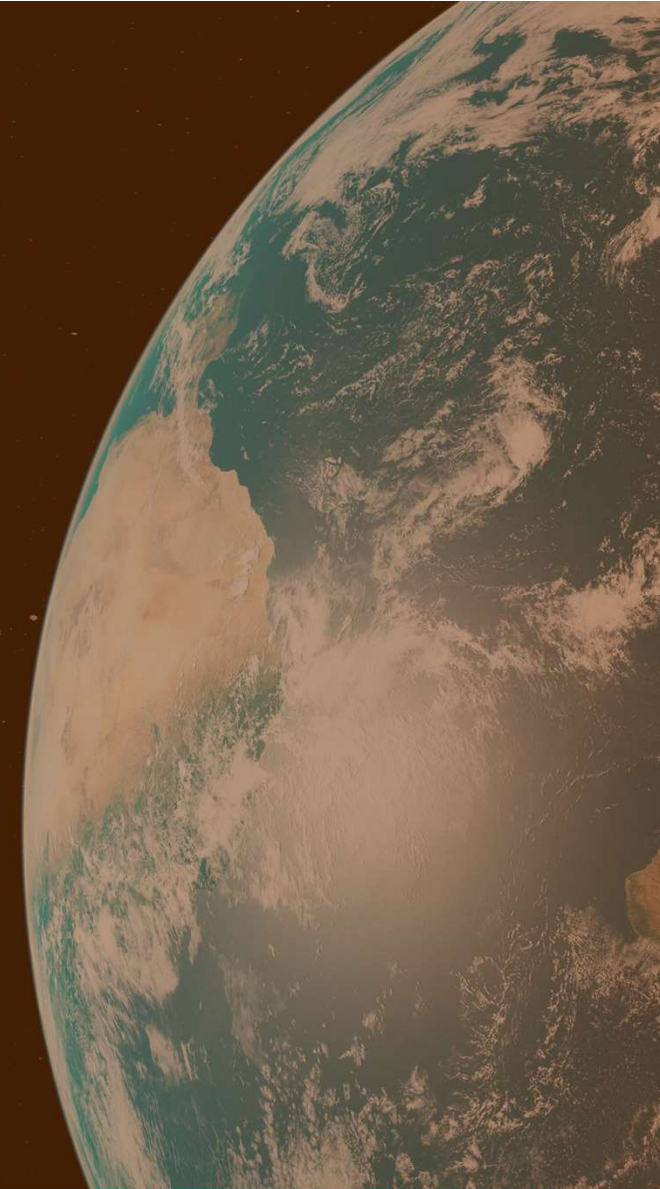
Approach: modelling

Path analysis approach – identify direct and indirect effects on biodiversity

Piecewise SEM (local estimation)

Hypothesis-based approach, starting with most confident/direct relationships and building up.

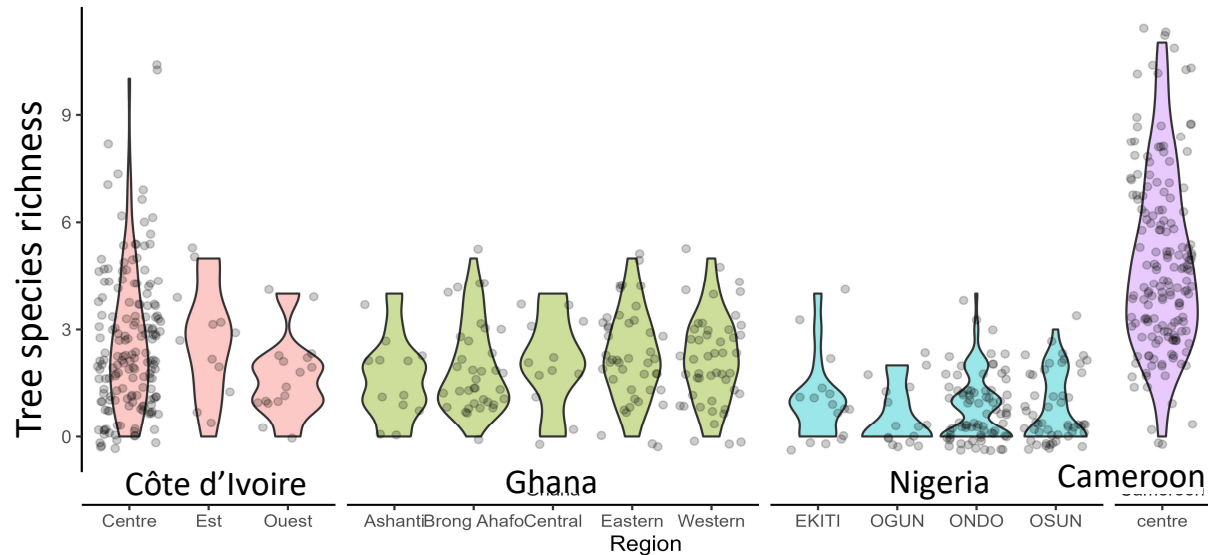
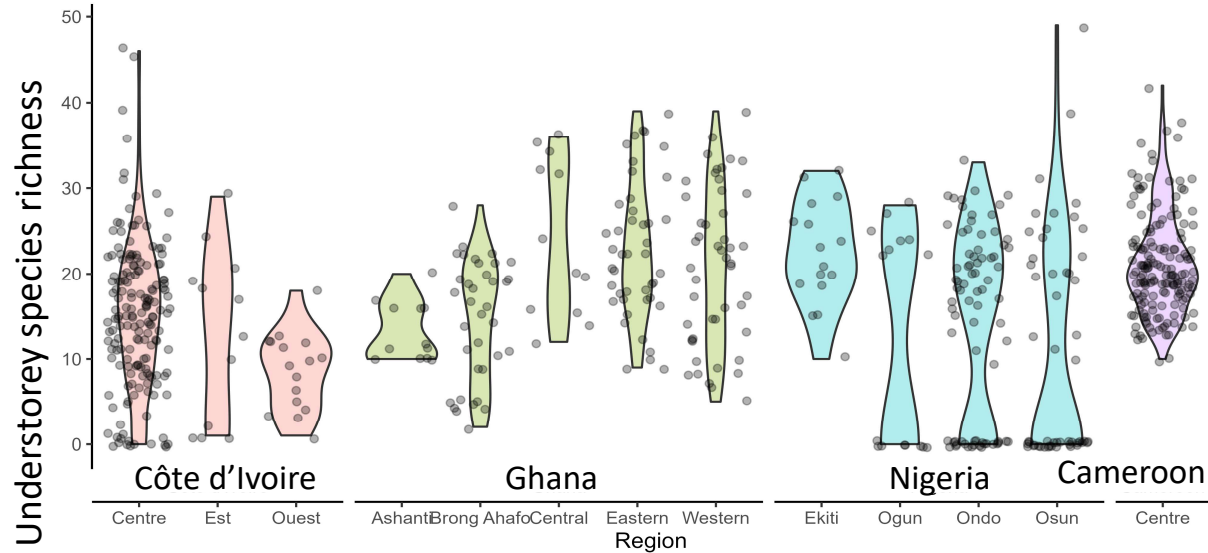
1. Biodiversity reinforcing
2. Abiotic conditions
3. Landscape effects
4. Management interventions
5. Land-use history mediation



Results: biodiversity patterns

Understorey diversity differed less among countries, though Nigeria had a larger proportion of samples with no understorey plants present.

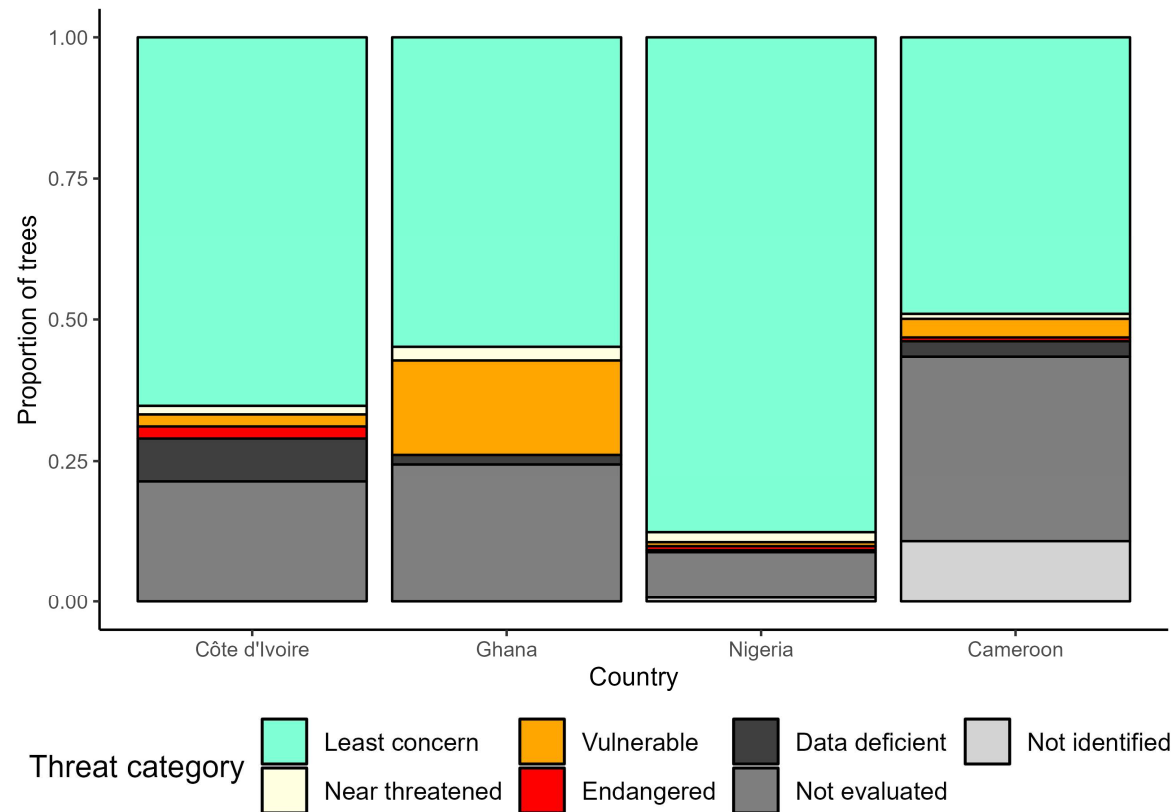
Tree biodiversity was richest in Cameroon. Côte d'Ivoire and Ghana had intermediate tree richness, with the Central region particularly rich. Nigeria had relatively low tree richness.



Results: biodiversity patterns

24+ tree species are threatened to some degree

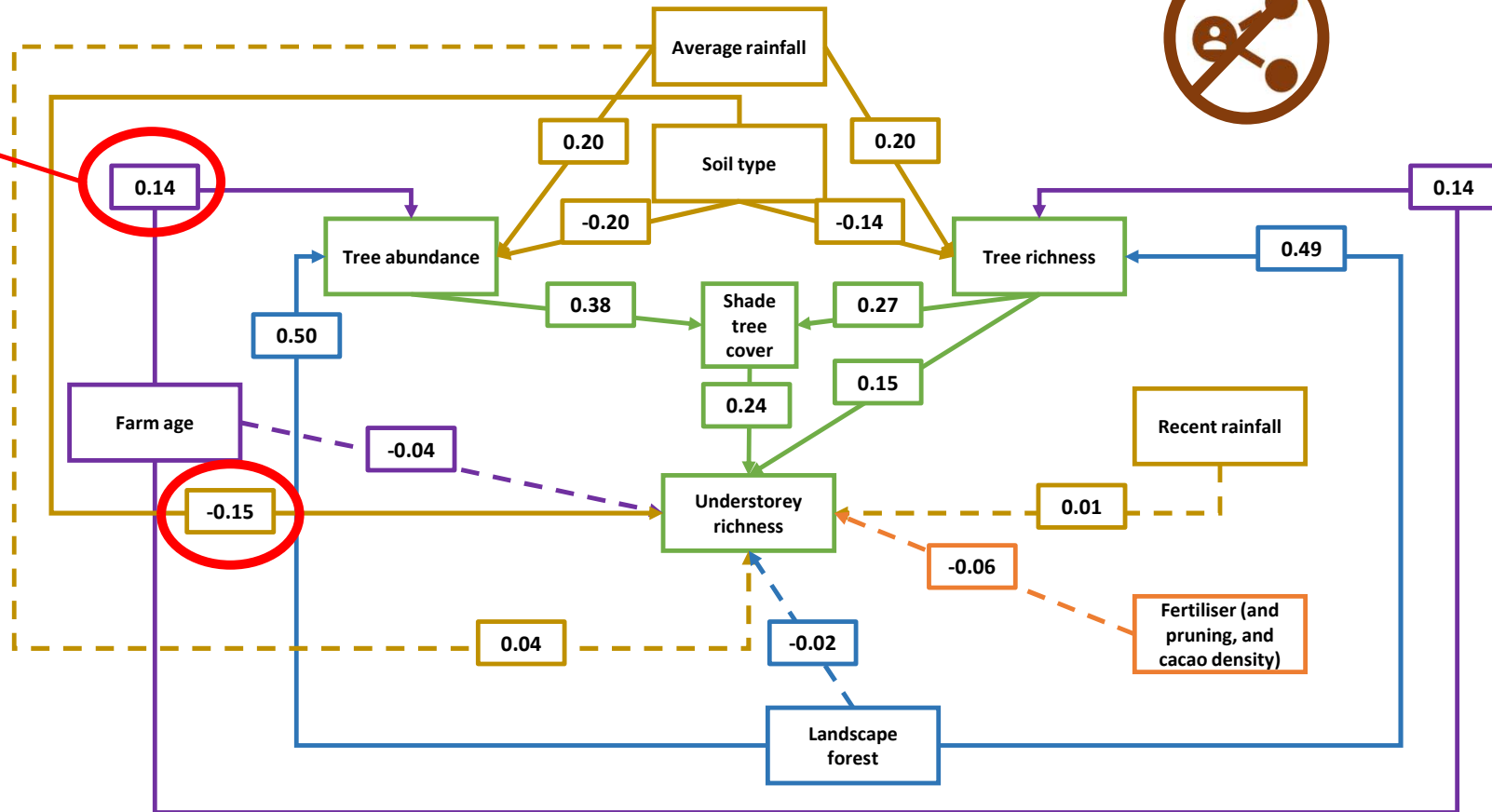
Terminalia ivorensis, *Entandrophragma angolense*, and *Sterculia oblonga* were among the most prevalent threatened tree species.



Model results



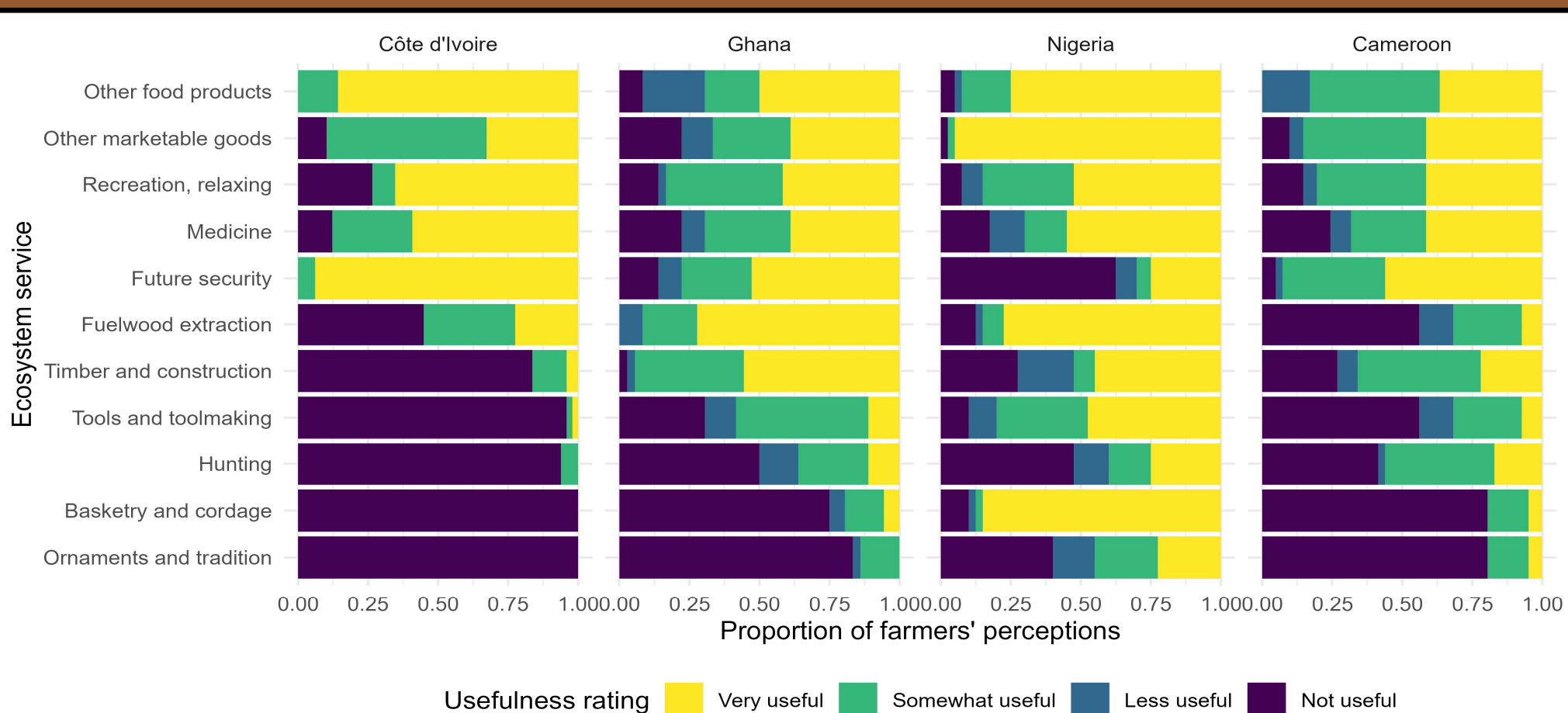
Positive in open-land-system-derived agroforests; negative in forest-derived agroforests.



Interventions?

Why? Underlying drivers

What types of multifunctionality are important to farmers in each country?



Takeaways and extensions

We can picture what “biodiversity-friendly” cocoa looks like in terms of design and management, landscape and connectivity, and context-specificity.

“Regenerative” practices need to be cocoa- and context-specific if they are to have biodiversity benefits.

What’s next: capitalising on agro-eco study to connect tree species, plant species to services, disease and yield.

Extension: going beyond plants now may tell us more about contributions to ecosystem services.

Thought: what are the implications of the EU Deforestation Regulation for cocoa and biodiversity?



Thank you!

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