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Optimizing cocoa agroforests

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1   Introduction

Including shade-trees on farms provides a unique opportunity for climate-smart, sustainable agriculture. But shade-trees also come with costs (e.g. competition), which can reduce yields.

Therefore, how can we implement agroforests with: 1) **shade-tree cover**; and 2) **shade-tree types** that maximize benefits while minimizing costs?

2   Methods

Our study was done in a globally significant cocoa growing region in Ghana, West Africa.

Ghana

Along a gradient of **shade-tree cover** (0-80%), and separately under focal shade trees of three **shade-tree types** (with different economic uses), we measured factors related to:
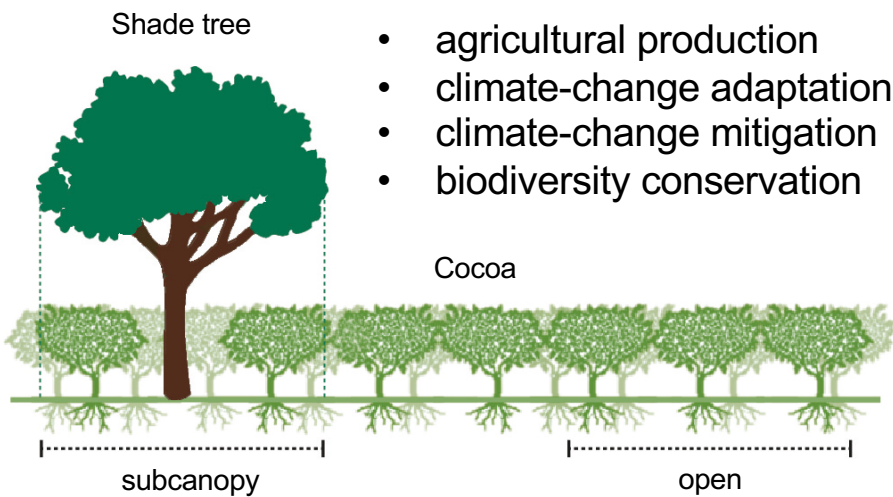
- agricultural production
- climate-change adaptation
- climate-change mitigation
- biodiversity conservation

Figure 1 Profile view of the study design around focal shade trees of different types, where we compared subcanopy and open sampling areas.

3   Results and discussion

Shade-tree cover: Agroforests can optimize the trade-off between agricultural yield and the provisioning of other ecosystem services at shade levels around 30% cover.
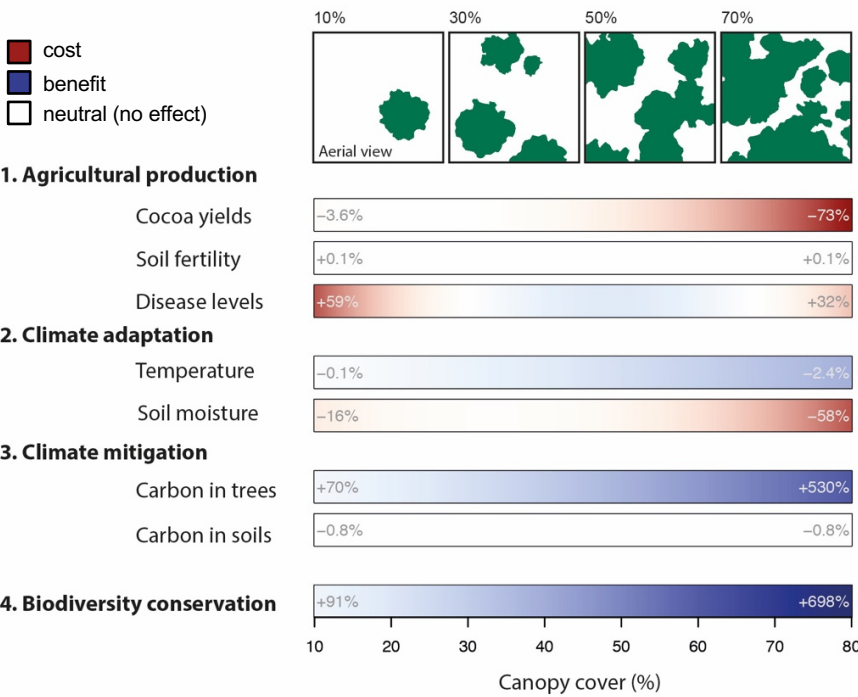

Figure 2 Costs (red) and benefits (blue) along a gradient of shade-tree cover (0-80%) relative to full-sun monocultures.

Shade-tree types: Timber trees are an ideal choice because they compete less for light and water, resulting in smaller negative effects on yields for the same level of shade-tree cover.
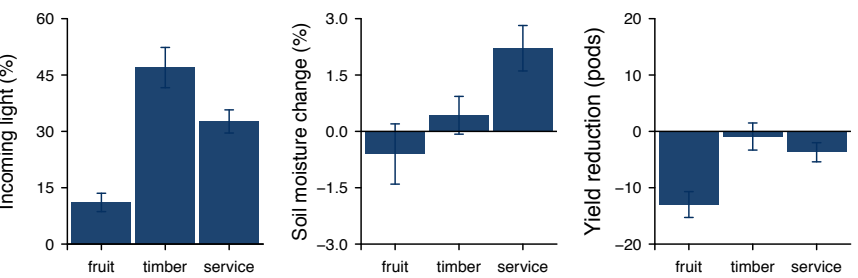

Figure 3 Effects of shade-tree types with different economic uses on light, water, and cocoa yields in their subcanopy relative to open sampling areas.

4   Conclusions

Agroforests with shade-tree cover around 30 %, and agroforests that prioritize timber trees, will yield better outcomes for smallholder cocoa producers and for the environment than full-sun monocultures.

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