



Structural diversity of rubber and cocoa systems in Côte d'Ivoire

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Introduction

- Extensive agriculture in Côte d'Ivoire, particularly the cultivation of cocoa and rubber, has significantly contributed to the degradation of forest cover by altering its structure (REDD+, 2016; Youan *et al.*, 2019).
- As these perennial crops play an important role in today's landscape, Cocoa and rubber farming supports the livelihoods of over one million people and creates numerous jobs in Côte d'Ivoire's secondary and tertiary economic sectors (ICCO, 2015).
- However, structural diversity contributes to the resilience of ecosystems by creating varied habitats for different species.
- The aim of this study was to understand the structural diversity of these systems in central-western (Oumé department) and southern (Grand-Lahou department) Côte d'Ivoire.

Methods

- Trees associated with crop diversity were inventoried in 18 rubber and cocoa plantations aged 7, 15 and 30 years in 2018, using the area survey method (400 m²).
- Six portions of forest were also surveyed as undisturbed areas, serving as a control environment in the study areas.



Figure 1. Overview of cocoa and rubber plantations and forest portion of the study zones.



Figure 2. Measurement of the circumference of a tree at breast height in a forest portion.

- Trees with a DBH ≥ 5 cm in each plot are inventoried
- Circumference of a tree at breast height are measured
- Trees richness specific and trees density, basal area were calculated.
- Tree diameter at breast height re classified in 11 groups
- Means are compared using parametric and non-parametric statistical tests, depending on whether the conditions of normality and homogeneity are met.

Results

- A total of 5 associated tree species, belonging to 5 genera and 4 families were recorded in rubber plantations while cocoa plantations home to 38 associated tree species.
- The 15-year-old plantations are home to the largest richness of associated tree species.

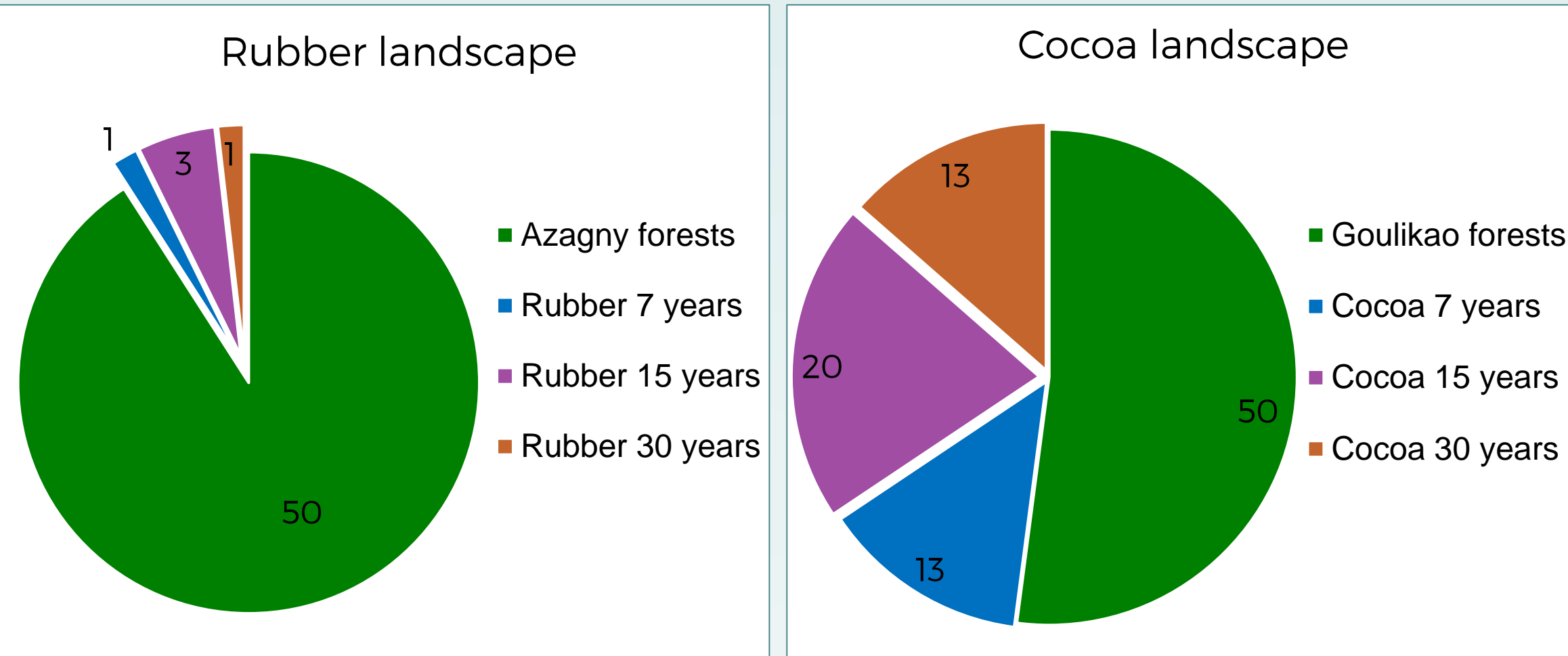


Figure 3. Trees species richness inventoried in rubber and cocoa landscapes

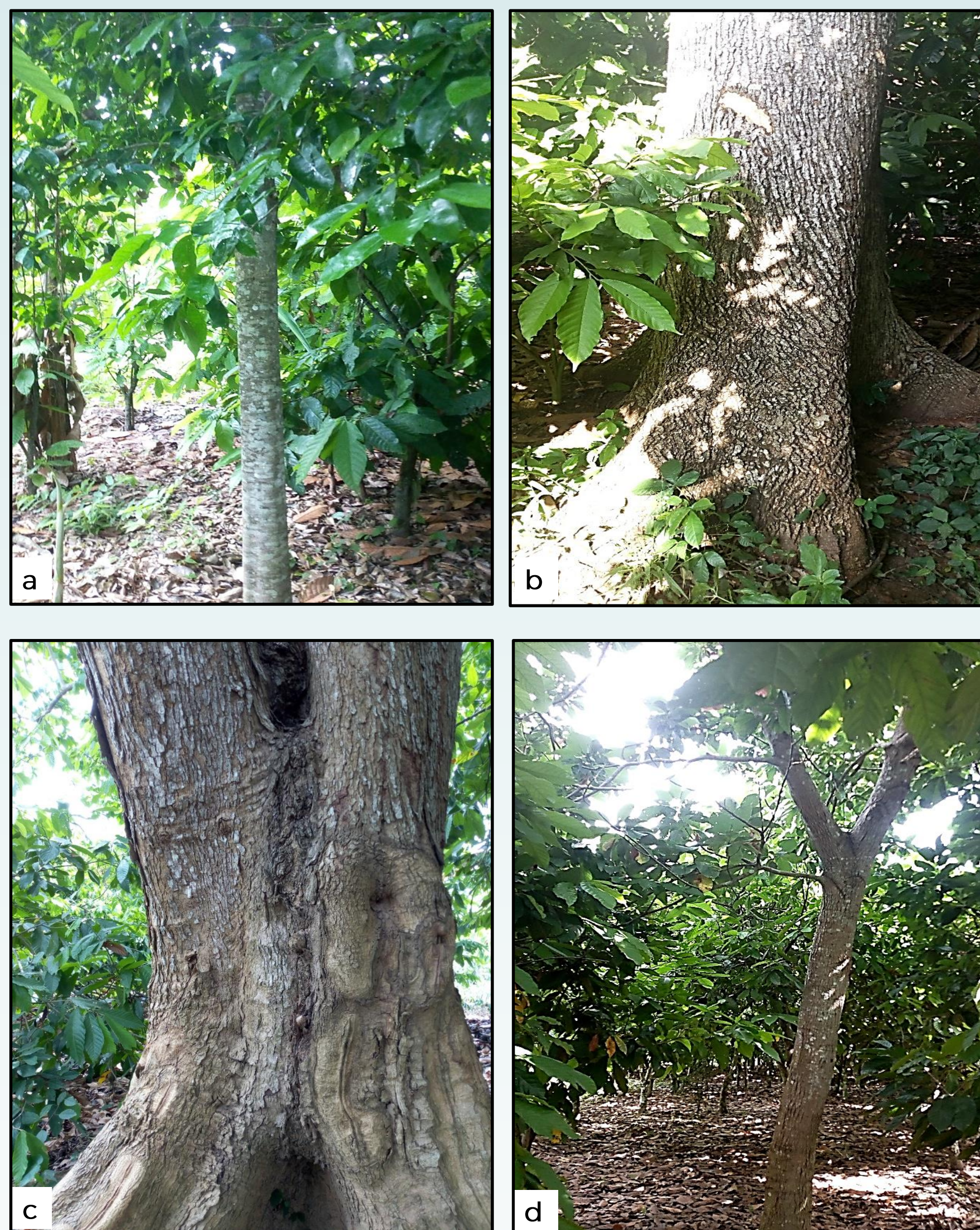


Figure 6 : Some associated trees with different diameters in cocoa plantations. (a) *Irvingia gabonensis* (b) *Milicia excelsa* (c) *Ricinodendron heudelotii* (d) *Persea americana*

- There are more trees in cocoa plantations than in rubber plantations, with an average density of 44 trees per hectare.

Table 6 : Associated tree density and basal area in rubber and cocoa landscapes

Habitats	Associated tree density (Stem.ha ⁻¹)	Associated tree basal area (m ² .ha ⁻¹)
Azagny Forests	1551.67 ^a	39.44 ^a
Rubber 7 years	1.67 ^b	0.08 ^b
Rubber 15 years	5 ^b	0.79 ^b
Rubber 30 years	1.67 ^b	0.17 ^b
Mean number of trees associated	2.78	0.21
Goulikao Forests	1228.33 ^a	22.69 ^a
Cocoa 7 years	35.96 ^b	0.99 ^b
Cocoa 15 years	39.44 ^b	7.04 ^b
Cocoa 30 years	56.84 ^b	3.78 ^b
Mean number of trees associated	44.08	3.94

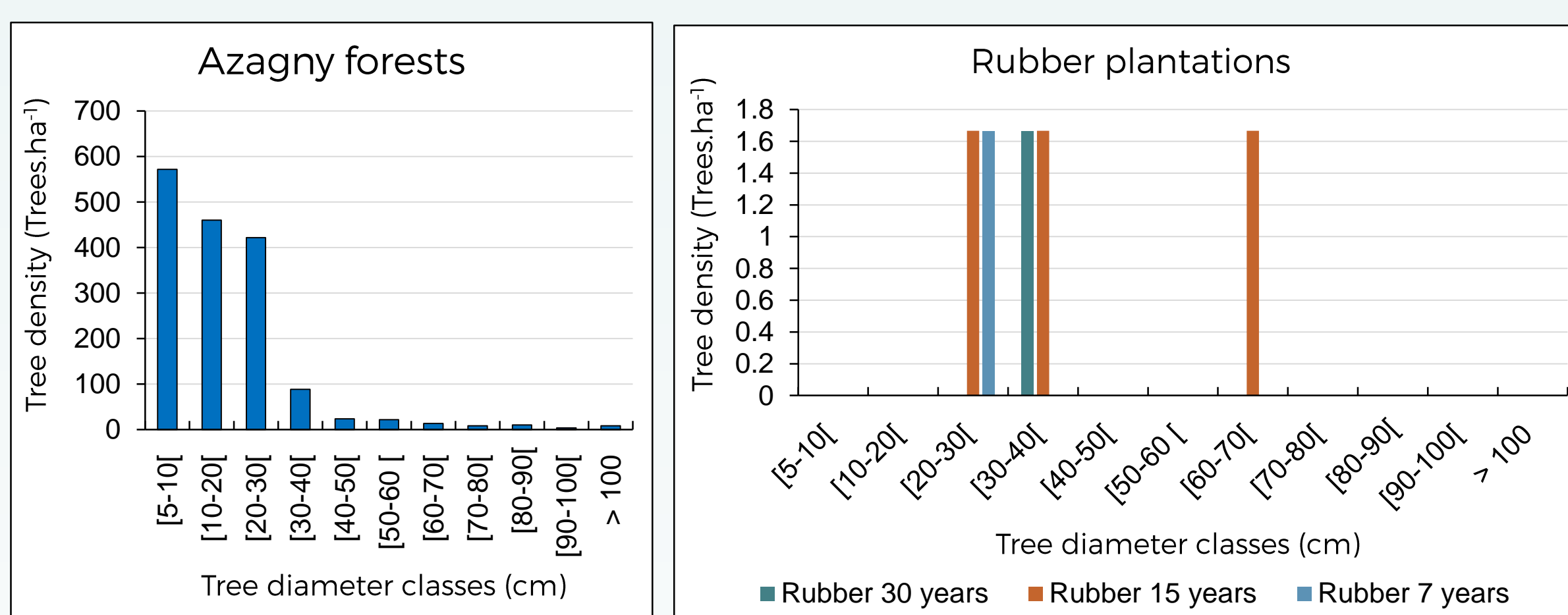


Figure 4 : Distribution of tree density by diameter classes in each habitat of rubber landscape.

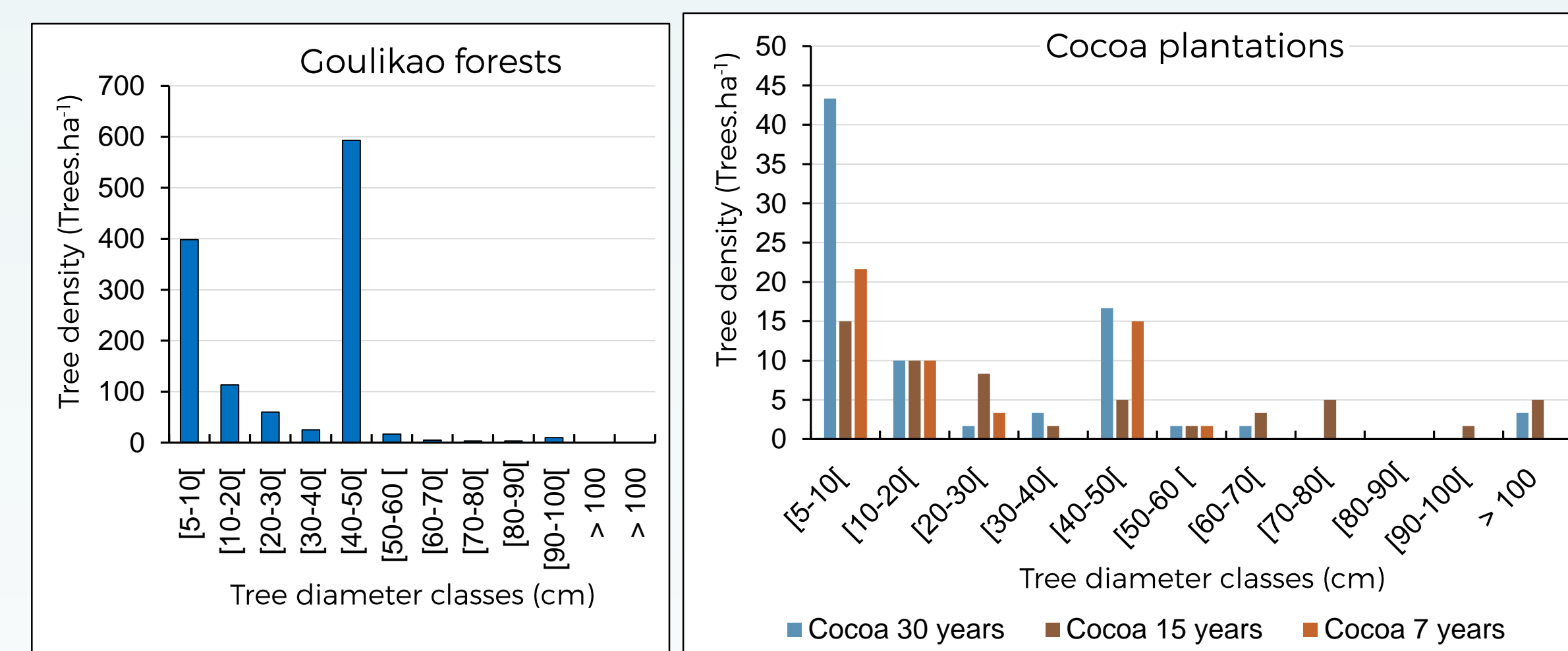


Figure 5 : Distribution of tree density by diameter classes in forests and cocoa plantations.

Highlight

- Associated tree diversity is higher in cocoa plantations
- Associated tree density increase with the increasing age of cocoa plantations
- The structural diversity of trees in cocoa plantations is close to that of forest environments.
- Therefore, the use of agroforestry would be beneficial in reproducing the structure of natural forests, thereby ensuring the health, sustainability and resilience of agricultural systems.



Figure 7 : *Glyphaea brevis* associated with cocoa plantation.

Acknowledgements

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Figure 8 : *Irvingia gabonensis* tree in cocoa plantation.

