Africa's woodlands in transition: Effects of climate change, land-use change on plant functional diversity and their carbon pools

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Introduction

Africa's woodland ecosystems:

- extend across 34 countries in the Sub-Saharan climate zone and represent the dominant vegetation type in these countries [1]
- are among those containing the main carbon pools and play a crucial role in Biodiversity Ecosystem Services [2]
- are currently experiencing a rapid transition caused by two main drivers: **climate change and land-use intensification** with direct negative consequences for carbon pool [3] and biodiversity affecting biodiversity ecosystem services

Aim of this study is to explore the effect of climate change and land-use intensification on biodiversity-ecosystem service (BES) relationships, particularly on carbon pools on West Africa's woodland.

Objectives

1. Disentangle potentially interactive effects of climate change and land-use change on carbon pools in woody vegetation.

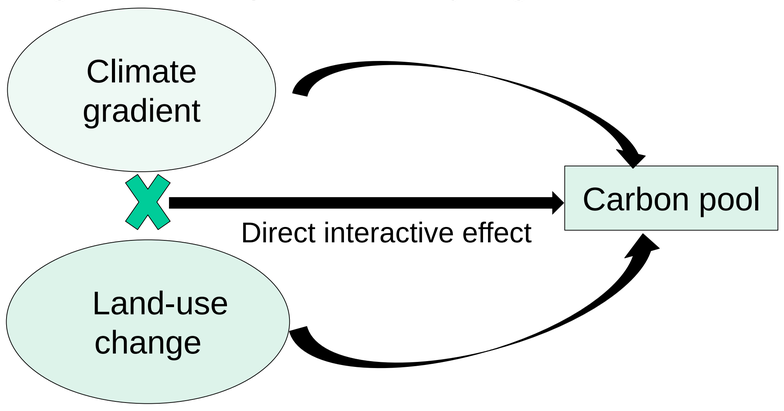


Fig 1: A graphical presentation of the effect of climate change and land-use on carbon pool

2. Assess the indirect effects of climate change and land-use change on carbon pools modulated by functional vegetation composition and diversity.

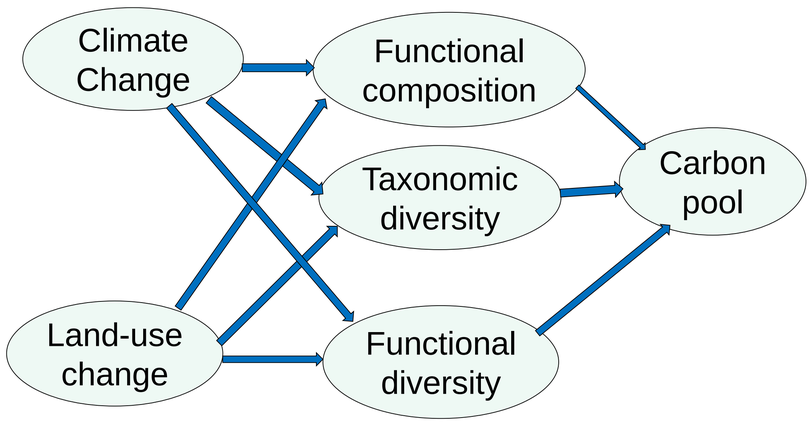
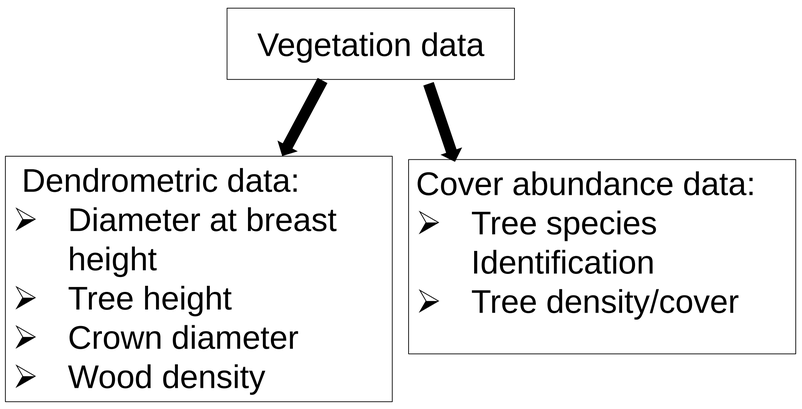


Fig 2: A graphical presentation of the effect of climate change and land-use change on carbon pools modulated by functional composition and diversity

Methods and Data collection

- Extraction of vegetation data from large existing vegetation database such as:
- ✓ GlobeAllome tree [4]
- ✓ The Global Wood Density database [5]



+ Climate variables, e.g. precipitation, temperature, humidity

Aboveground biomass (AGB) = $0.0673*(SWD*DBH^2*h)^{0.976}$ [5]
Aboveground carbon (AGC) = (AGB) * 0.5

Study Design (space-for-time substitution)

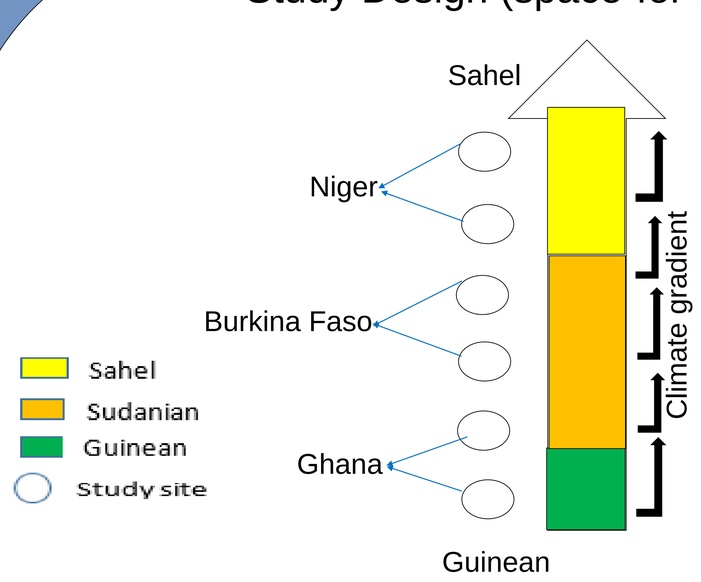


Fig 3: Study design along the sites spanning from Guinean zone to the Sahel zone where each step from south to north represents a space-for-time substitution

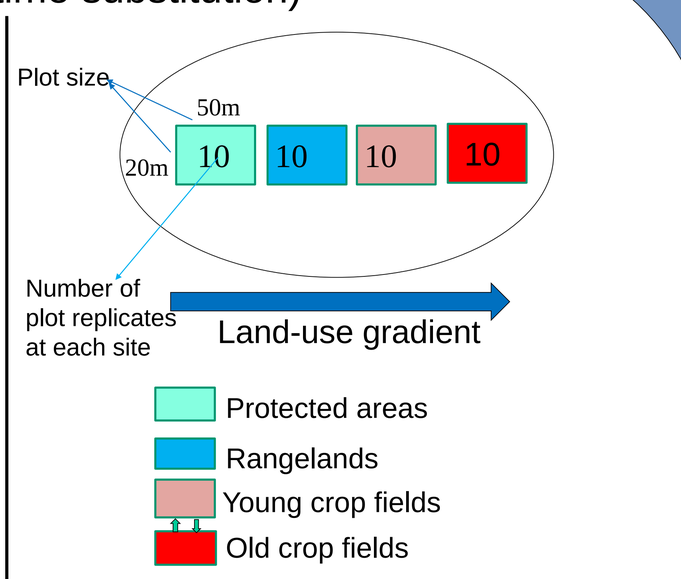


Fig 4: The study design of the land-use types spanning over a gradient from Protected areas to old crop fields where each step represents land-use intensification

Data Collection

Functional traits measurements:
- Specific wood density
- Height
- Diameter at breast height (Dbh)
- Leaf area
- Leaf specific area
- Leaf Dry matter Content

Dendrometric proxies:
- Specific wood density
- Height
- Dbh

Cover abundance data

Biodiversity and carbon measurements

1. Functional diversity
2. Taxonomic diversity
3. Functional composition/structure
4. Biomass estimation
5. Carbon estimation

Mode of measurement

1. Functional diversity indices
2. Taxonomic diversity indices
3. Community Weighted mean traits
4. Allometric model [6]
5. Estimated biomass * 0.5

Conclusion

This research is expected to reveal carbon pool dynamics on West Africa's woodlands as influenced directly by climate change and land-use change and the indirect effects as modulated by functional vegetation composition and diversity. The results will fill the gap of insufficient large scale overview of carbon pool dynamics in West Africa woodlands.

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