Biodiversity – carbon relationships: Linking seed dispersal ecology to biodiversity conservation and climate change mitigation

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Introduction

- Biodiversity loss and climate change are two major global crises of the Anthropocene1.
- Biodiversity is the basis for securing the flow of ecosystem functions and services, such as carbon sequestration, that can contribute to climate change adaptation and mitigation2.
- However, the role of biodiversity has not always been considered at the heart of natural climate solutions3.
- An improved understanding of the explicit linkages between biodiversity and carbon is necessary to better integrate these solutions4.

1. Literature Review: Biodiversity – Carbon Relationships

To examine the relationship between biodiversity and carbon relevant for climate change mitigation.

Key findings

- Biodiversity underpins ecological processes for climate change mitigation.

A. Spatial prioritisation of high carbon ecosystems

- Mangroves, among the most carbon-rich forests in the tropics
- Ecological factors challenging to be incorporated at global scale

B. Spatial congruence of biodiversity patterns and carbon stock

- Positive relationships between carbon and tree diversity in tropical forests
- Relationships between carbon and other biodiversity elements e.g. animal species richness varied greatly

C. Direct role of biodiversity in the carbon cycle

- Plant–soil–atmosphere carbon pools
- Plant diversity, biomass and traits on carbon storage e.g. biodiversity–productivity relationships

D. Indirect role of biodiversity in influencing the carbon cycle

- Zoogeochemistry: role of wildlife in the carbon cycle
- Species interactions: key to a self-sustaining and resilient ecosystem
- Plant–animal interactions: Seed dispersal, pollination, seed predation, herbivory, nutrient cycling

E. Seed dispersal in tropical forests

- Large frugivore loss reduces carbon sequestration by up to 3.5%, with an impact of US$15.42 ha−1 year−15.
- Vital for maintaining plant diversity and regeneration of forests
- Animal-mediated seed dispersal as predominant form of dispersal in tropical forests

2. A Seed Dispersal – NbS Conceptual Framework for Tropical Forests

A. Community structure

Mutualistic network

- Plant–animal interactions

B. NbS, e.g.

Forest conservation

Forest regeneration & succession

Self-sustaining & resilient forest ecosystem

C. Climate change mitigation potential

Ecosystem service provision

- Carbon sequestration
- Carbon storage
- Co-benefits

Seed dispersal

Plant community

Confers resilience to disturbances, e.g.
- Biodiversity loss
- Climate change
- Land use change

Seed dispersers

Next steps:

- Investigate the seed dispersal network of tree species that are of particular interest for forest reforestation and carbon sequestration.
- Examine how the link between biodiversity and carbon would support conservation planning and contribute to sustainable implementation of natural climate solutions.

References


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Research objectives:

- Investigate the seed dispersal network of tree species that are of particular interest for forest reforestation and carbon sequestration.
- Examine how the link between biodiversity and carbon would support conservation planning and contribute to sustainable implementation of natural climate solutions.