



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Impacts of perennial plants diversity on carbon stock and bird species in Maradi city, Niger

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Abstract

Past studies have clearly pointed out the importance of residential urban forests to support carbon storage and food production. Only a few studies have focused on the presence of perennial plant species diversity on bird diversity in West Africa Sahel cities where the construction of homes is subjected to limited government regulation. Our study evaluated urban residents' perceptions of perennial plants (trees and shrubs) at their yards and evaluated their impact on carbon storage and bird biodiversity across different neighbourhoods in the city of Maradi, Niger. We surveyed 102 homes within 17 neighbourhoods with 6 houses per neighbourhoods then added a data set ($n = 21$) of one additional study providing a total of 123 household visits. All respondents were able to cite the local names of the perennial species. Shading was the main reason (54 %) for tree planting in housing areas ($p = 0.027$). A total of 583 perennial were inventoried. Collectively, there were 63 perennial species belonging to 52 genera and 23 botanical families. The carbon stock density resulted in a total of 25.8 t ha^{-1} and varied ($p \leq 0.001$) in each perennial species; *Azadirachta indica* (Neem) had the highest carbon stock density (13.4 t ha^{-1}) followed by *Terminalia mantaly* (3.3 t ha^{-1}), *Balanites aegyptiaca* (1.9 t ha^{-1}), and *Eucalyptus camaldulensis* (1.2 t ha^{-1}). Neem dominated in the 17 neighbourhoods within the city ($p < 0.05$) and was most visited by birds (9 bird species), followed by *Mangifera indica* (5 bird species). Ten bird species belonging to 8 families and 10 genera were observed, where the village weaver (*Ploceus cucullatus*, 31%) and the laughing dove (*Spilopelia senegalensis*, 20 %) were the most dominant. There was a pronounced difference between the number and diversity of bird species across the 17 neighbourhoods influenced by the number of perennial species ($p \leq 0.001$, each). The study recommends to increase planting of indigenous perennial species in the residential areas' tree planting programs and should be part of recommended actions to address climate changes and biodiversity loss in Niger. Knowing the urban tree and bird species diversity is connected to the Water-Energy-Food (WEF) nexus by acting as a foundational ecosystem indicator and active regulator.

Keywords: Bird diversity, carbon storage, green city, residential urban forests, semi-arid climates, urban trees

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