

Title: Interaction Tree crop and agroforestry parkland Intermediate tree cover can maximize groundwater recharge in dry tropics

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Introduction: Plants constitute a primary conduit for returning terrestrial water to the atmosphere and also play an important role in the distribution of rain water via interception, infiltration, evaporation, runoff and transpiration. In Sahel, **Agroforestry parkland systems (AFP)** is a land use system in which woody perennial species are grown in association with annual crops or livestock. Although trees play key roles in farmed parklands, they can also compete with annual crops for growth resources. Objectives was: (i) **To elucidate the key competition-related factors limiting crop growth in AFP** (ii) **to understand water demands, rainfall interception, runoff and infiltration by trees** (iii) **optimum tree cover theory in which groundwater recharge is maximized at an intermediate tree density.**

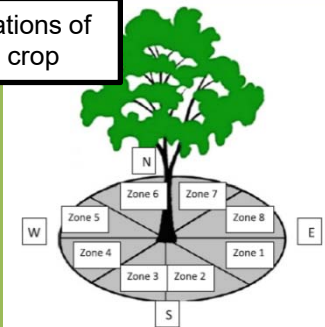
I-Interaction tree-crop in AFP

we assessed the effects of pruning, with and without applications of fertilizer and irrigation on the growth and yield of associated crop

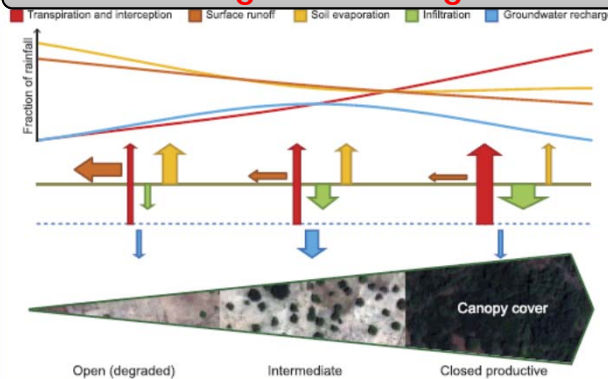
Methodology

Treatments: Crown Pruned and unpruned

O: Control
I: irrigation only
IN: Irrigation+ Nitrogen
IP: Irrigation+ phosphorus
INP: Irrigation + nitrogen+ phosphorus
N: Nitrogen only
NP: Nitrogen+ phosphorus
P: Phosphorus only



II- Water budget according tree density in AFP



Runoff-Interception- Infiltration

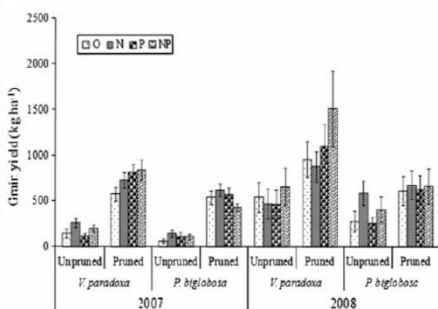


Sap flow

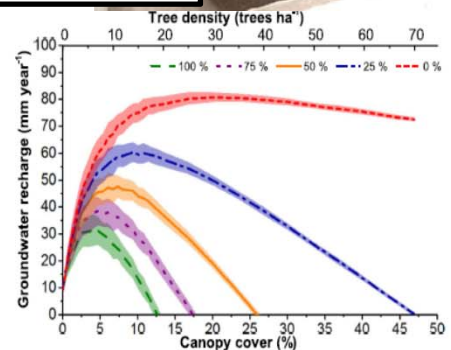
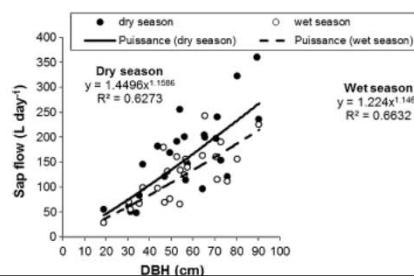


We modelled annual groundwater recharge in Simile v5.9 software. The model consisted of a spatial grid of 1 ha.

Results



I- Light is the most strongly limiting factor for crops more than competition for other resources in AFP.



II- Our results, based on groundwater budgets calibrated with measurements of drainage, runoff, interception and transpiration in AFP, demonstrate that groundwater recharge was maximised at intermediate tree densities.