A2. Transition to better water balance and light valorization

Faidherbia albida transpiration and canopy conductance in a reference agroforestry system of West Africa

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Faidherbia albida (*FA*) is an emblematic woody species of agroforestry systems in semi-arid Africa. It is phreatophyte and shows reverse phenology (leafless in rainy season) which avoids competition for soil water with associated crops. The root access to groundwater is assumed to prevent constraint on transpiration. However, the details of *FA* transpiration and canopy conductance under daily and seasonal conditions are poorly known.

The study was conducted at Faidherbia-Flux[1] station in the population-health-environment observatory of Niakhar, Senegal. Five mature trees were selected in the stand with a density of 6.9 tree ha^{-1}. Sap flow and soil water content were continuously recorded over a complete year with meteorological variables and measurements of leaf area index and leaf water potential.

Maximal transpiration estimated from sap flow peaked around 210 L $tree^{-1}$ day^{-1} in the early-dry season (December) for an average tree (DBH of 48.5 cm and 260 m² of leaf area). The transpiration slowly decreased up to June before a sharp decrease following intense defoliation at the beginning of the rainy season. Predawn leaf water potential ranged between 0.25 in early-dry season and 0.45 MPa in mid-dry season, indicating a low water constraint. However, the reference canopy stomatal conductance per leaf area (at 1 kPa of air vapour pressure deficit, VPD) decreased from around 100 in early-dry season to 50 mmol $m^{-2}s^{-1}$ in mid-dry season suggesting a significant regulation. Moreover, in both cases, the canopy stomatal conductance was highly sensitive to VPD with a 50% decrease at 3 kPa. These results support influences of soil surface water and air dryness on transpiration.

This study provides new bases for the modeling of transpiration and water uptake of *FA* trees. It is paving the way towards a more accurate water balance and a better assessment of *FA* parkland efficiency and sustainability.

1 Faidherbia-Flux: https://lped.info/wikiObsSN/?Faidherbia-Flux