SAP FLOW, Leaf Water potential, Wood water content

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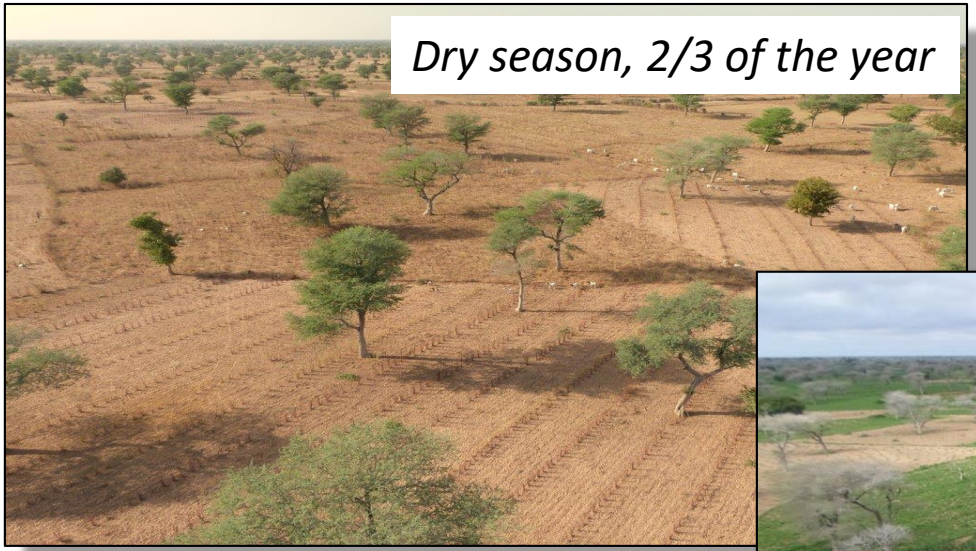
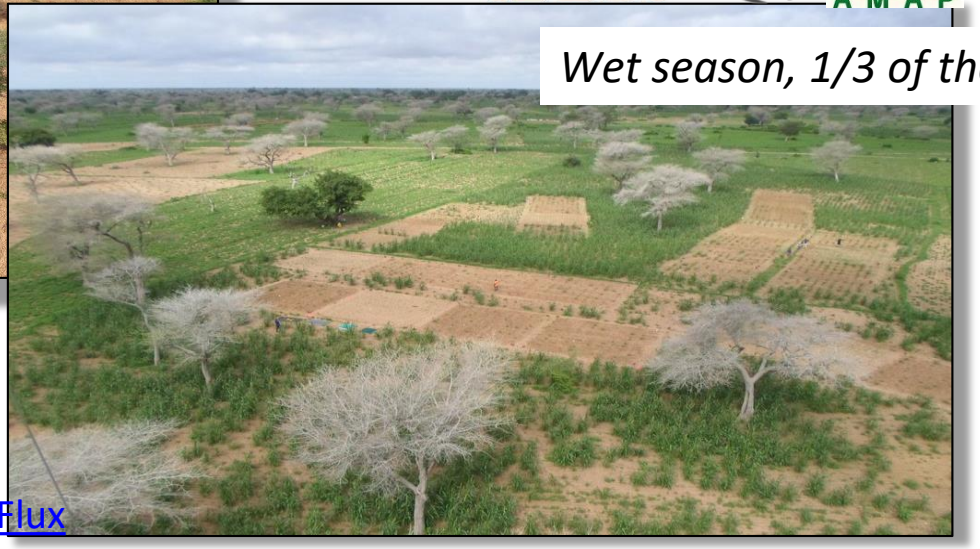
"*Faidherbia-Flux*": A long-term Collaborative Observatory on food security, GHG fluxes, ecosystem services, mitigation and adaptation in a semi-arid agro-silvo-pastoral ecosystem (groundnut basin in Niakhar/Sob, Senegal)





"Faidherbia-Flux" Web site :
https://lped.info/wikiObsSN/?Faidherbia-Flux

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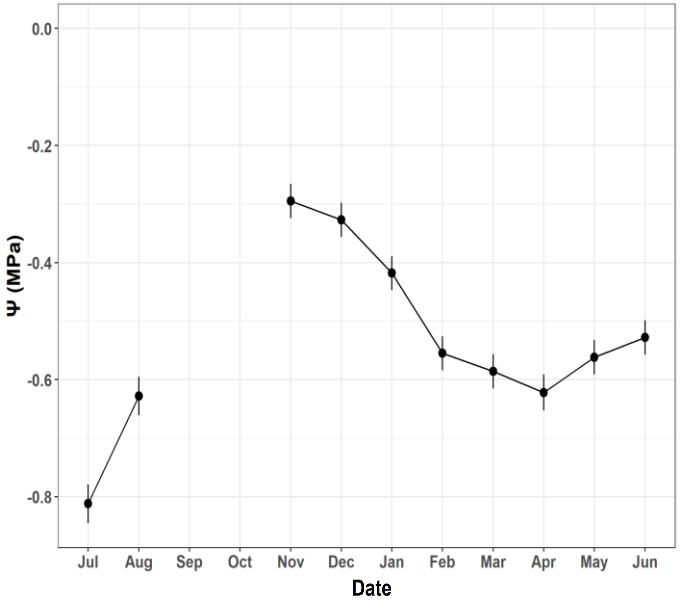
Variation of leaf water potential



- High LWP in Nov and Lowest in July
- Missing values denote leafless periods

Fig. 2: Seasonal variation of leaf water potential from July 2019 to June 2020

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Variation of the water content of the sample (Section branch)

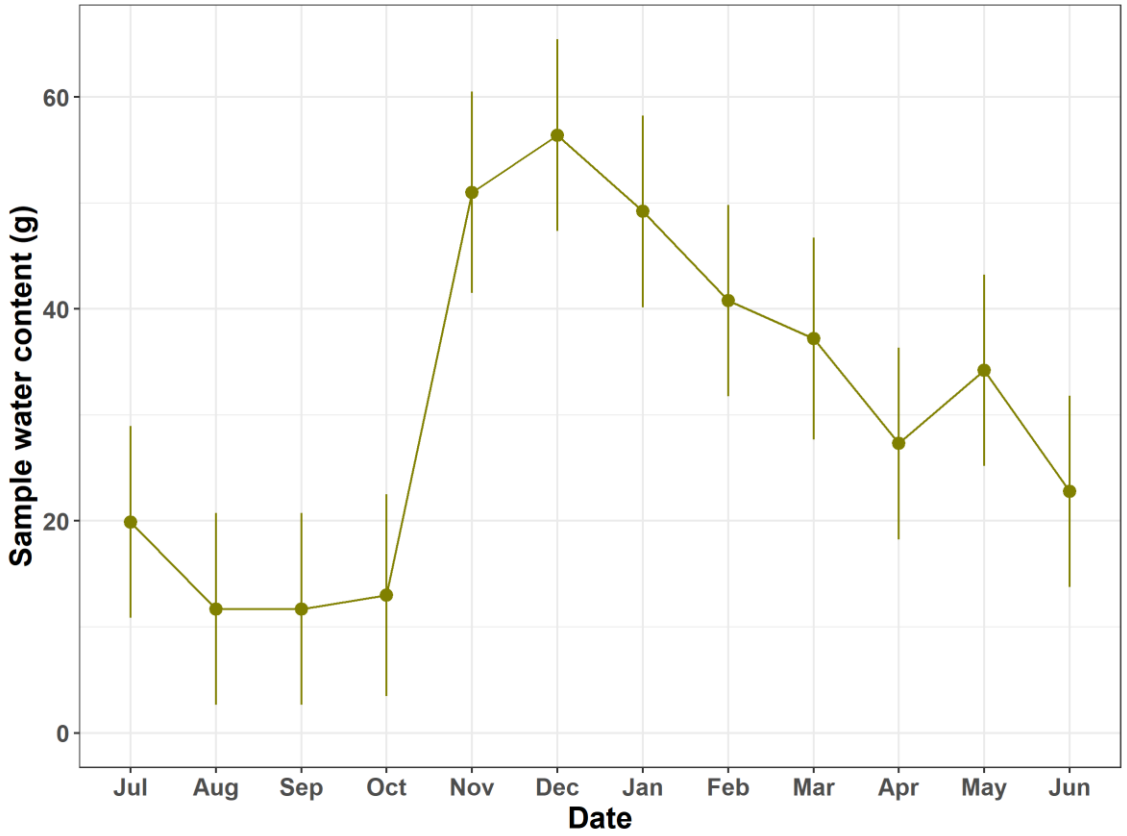

Fig. 3: Variation of sample (branch + leaves) water content from July 2019 to June 2020

- Water content increased from rainy to dry season

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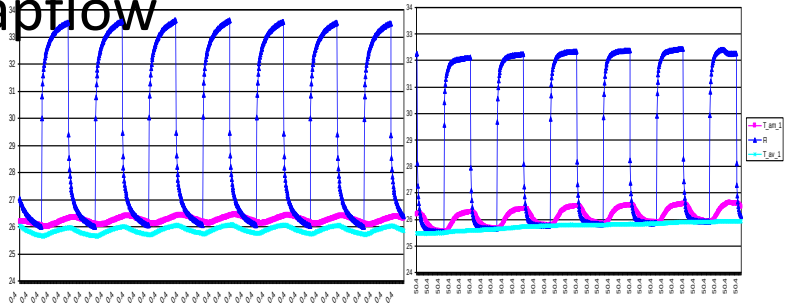
SAPFLOW (directional) and Hydraulic Redistributions (HR)

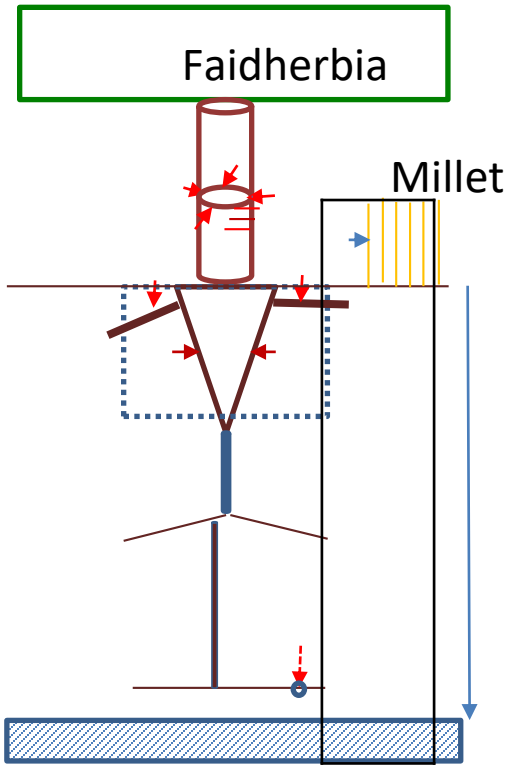
Transient thermal dissipation sapflow

- Sapflow velocity
- Xylem water content and potential
- Directional sapflow



Zero flow

flow (2.5 l dm^{-2} h^{-1})



- Sap nutrient content

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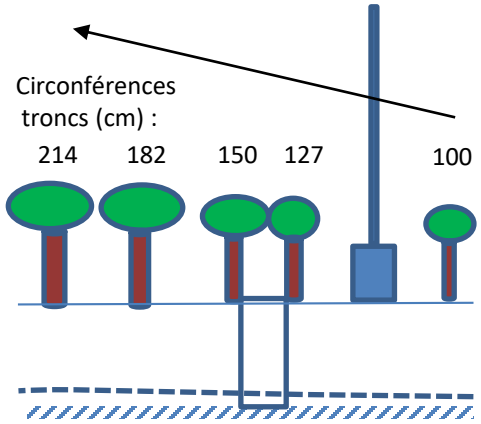
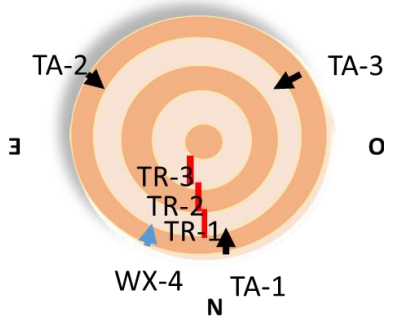
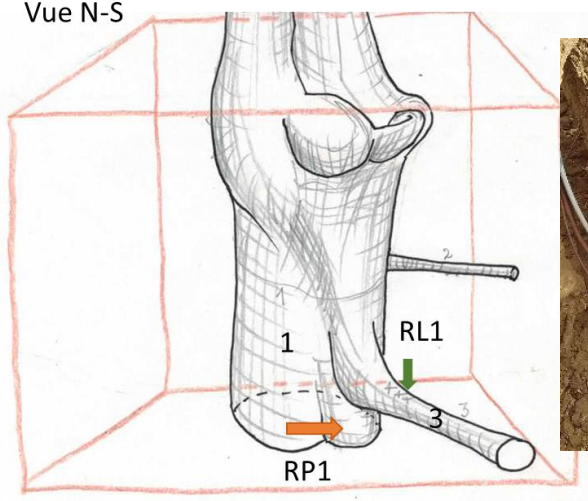
Sap Flow: Assessment of tree water uptake and Root hydraulic redistributions

Hydroseve set up





Vue N-S



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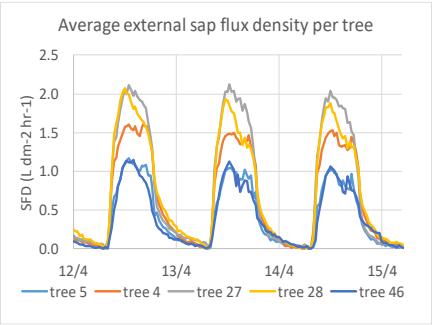
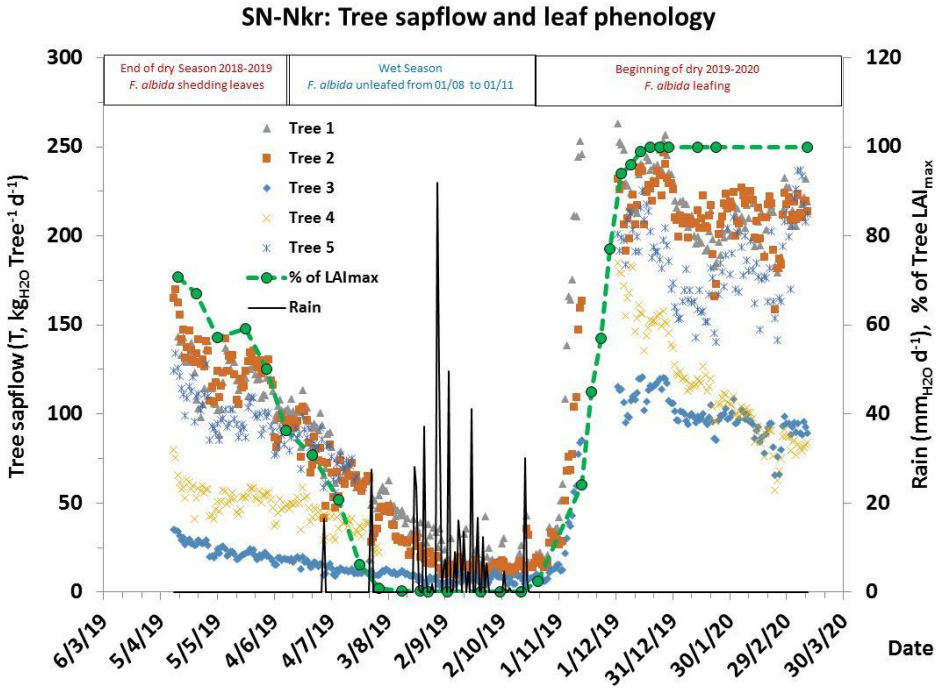
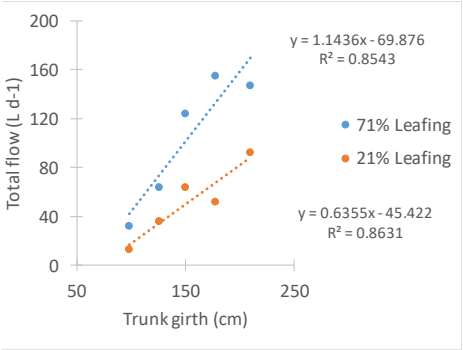
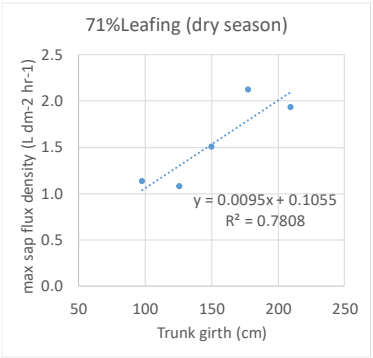
Eco&Sols : A. Rocheteau, O. Roupsard, C. Jourdan, D. Orange

Daily tree water uptake estimated by xylem sap flow



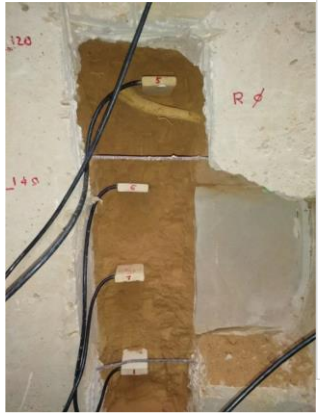


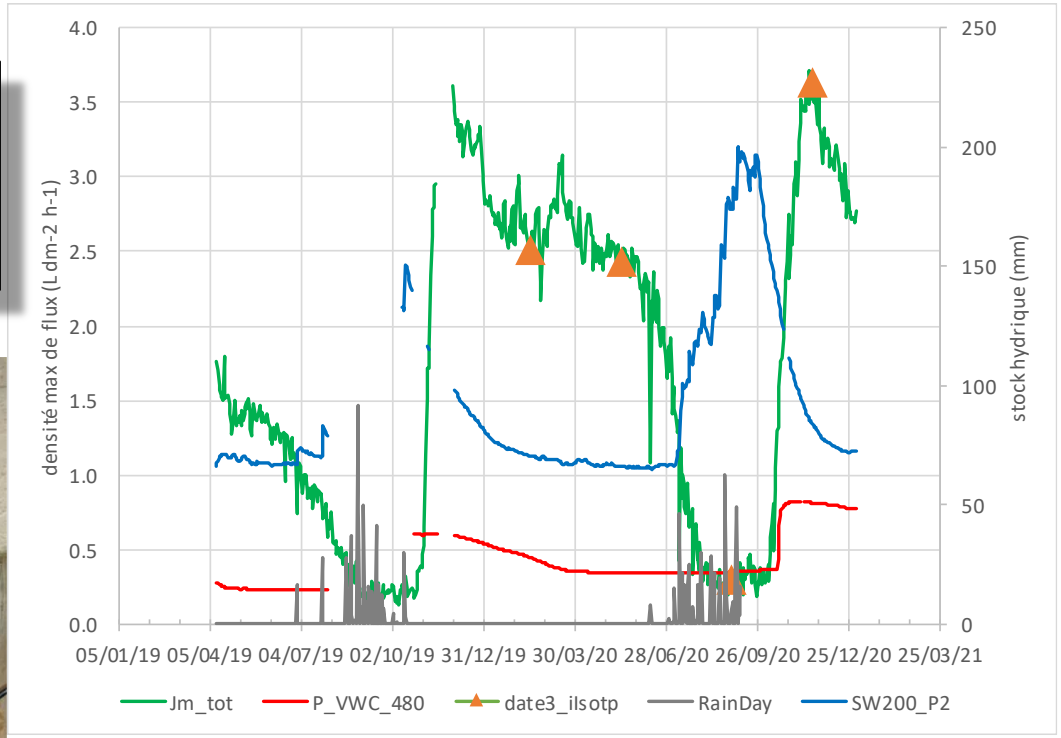




- Large maximal water use of individual tree (up to 250 l d-1)
- Small fraction of the water balance (0.1 mm d-1) due to low tree density (6.9 tree ha-1)
- Strong seasonal variation related to tree phenology , no concurrence with crops
- Large between-tree variability apparently related to tree size

Seasonal daily max sap flux density and soil water stocks





RainDay: daily rainfall

Jm_tot: daily max sap flux density (average of 5 trees)

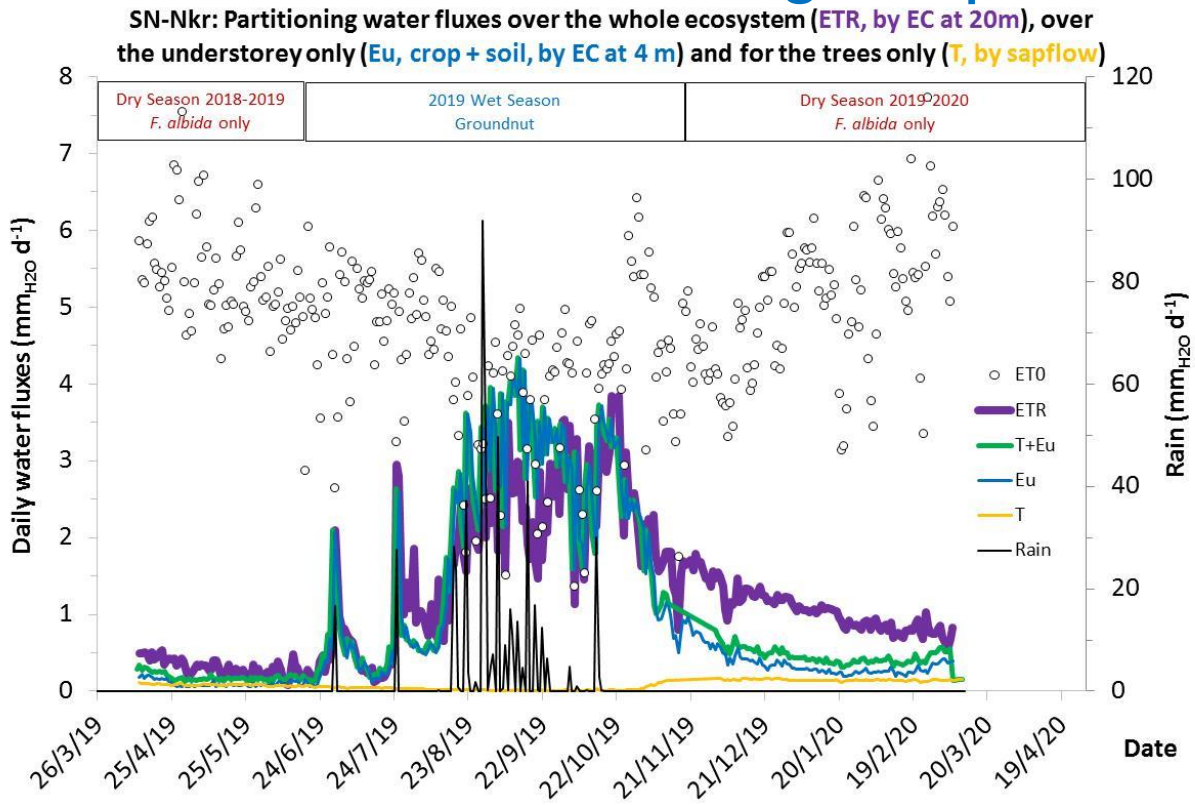
SW200: soil water stock 0-200 cm

P_VWC_480: apparent water content at 480 cm above the water table

Date3_Isotop: planned dates of water collection for stable isotopes analysis in 2021 (xylem,soil profile,rain, water table)

High asynchronism between soil surface water stock and tree water uptake
Survey to continue up to 2023 with increased tree sampling (7 trees)
Root hydraulic redistributions: on going analyses

Partitioning evapo-transpiration



Fluxes at ecosystem level, above tree crowns: 20m high

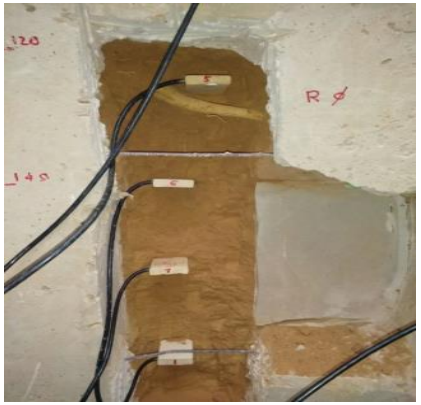
Fluxes above crop, below tree crowns: 4.5 m high

Potential evapotranspiration (ET0) decreased during the wet season, while remaining high, around 4 mm $_{H2O}$ d^{-1}. Whole plot evapo-transpiration (ETR: tree + understorey + soil) measured by EC at 20 m high on the tall antenna tended to nil by the end of the first dry season, while the surface soil was extremely dry and *F. albida* trees de-leafed. When rainfall resumed, ETR increased sharply, as the result of soil evaporation, first, and second of crop (here groundnut in 2019) transpiration, altogether measured as E_u by EC. After the end of the wet season, the crop was harvested and ETR decreased slowly, as the result of soil evaporation mainly., with little contribution of tree transpiration (T, by sapflow) . It can be seen that T remained a small fraction of the water balance all year-long, according to its low canopy cover (< 10%). Soil evaporation appeared to be a major component of the water balance., but the relative contribution of the crop to Eu was not assessed. Although the energy balance was well closed in this site (see previous graphs), and although there was good consistency between ETR_{may} , ETo and $T+E_u$ during the wet season, T+Eu was only ca. 50% of ETR at the beginning of the next dry season. More data analysis is required to explain this.

Perspectives

1 .Water uptake by FA trees: com & publication, model of estimation over the whole year based on simple indicators, deeper analysis of size effect (increased tree sampling)

2. Root Hydraulic Redistribution (RHR): on going analysis



Thanks for your attention!

Sap flow measurement sampling increased to 7 trees

« Sap flow trees » in agroforestry parkland with mixed crops : harvested groundnut and Bissap rows

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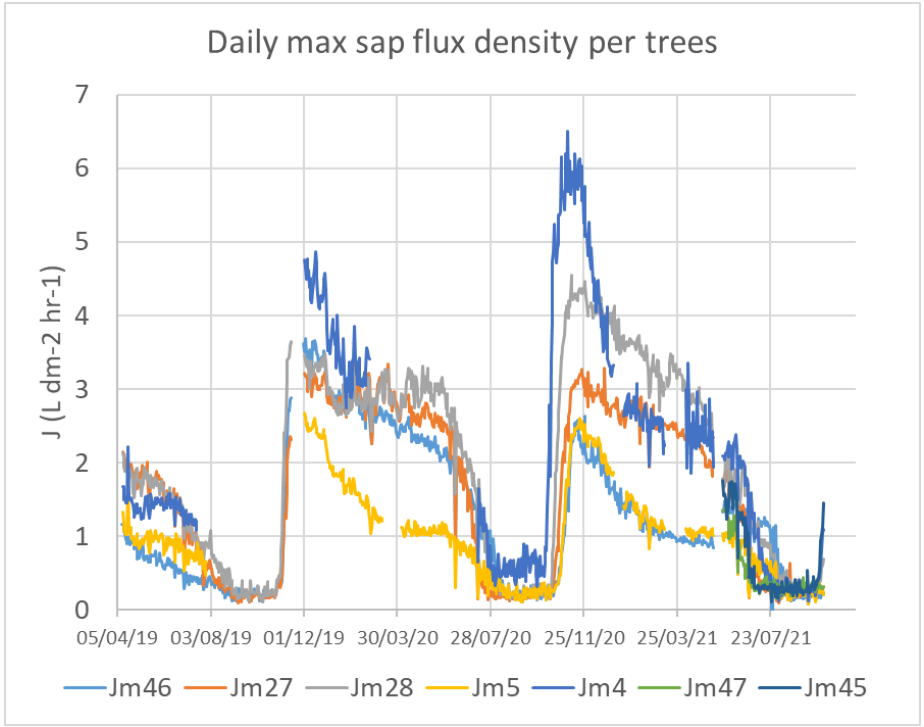
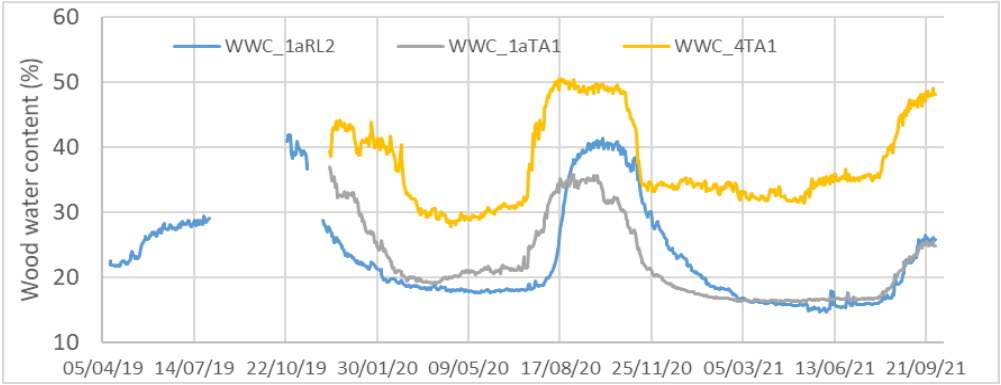


Wood water content

Recorded with GS3 meter probe
« not yet calibrated for wood »



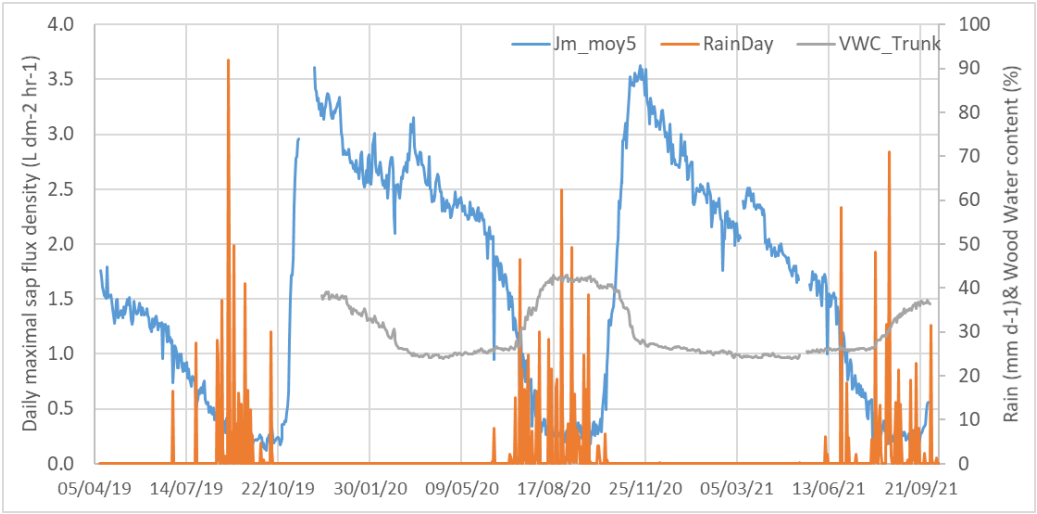


Fig above: seasonal course for 3 probes: one proximal root and two trunks
Fig below: on average trunk wood hydration increases in rainy season at the time of defoliation and low sap flow

Articles

Communications

- Diouf K., M.S. Sarr, A. Rocheteau, O. Roupsard, D. Orange, C. Jourdan, I. Diedhiou, J. Seghieri, F.C. Do, 2021. Water uptake by *Faidherbia albida* A. Chev. in an agroforestry parkland in Senegal. 3rd Conference Intensification Durable 2021 November 24-26, Dakar, Senegal. Oral communication.
- Do F.C., M.S. Sarr, K. Diouf, S. Sow, D. Diongue, A. Rocheteau, I. Diedhiou, J. Seghieri, G. Le Maire, O. Roupsard, 2022. Faidherbia albida transpiration and canopy conductance in a reference agroforestry system of West Africa. 5th World Agroforestry Congress, July 17-20, Quebec city, Canada (oral com.)

Academic Reports

- Diouf, K., 2020. Evaluation de la transpiration par mesure du flux de sève chez l'espèce agroforestière Faidherbia albida (Del.) A. Chev. dans un site semi-aride du bassin arachidier au Sénégal. Senegal, Diplôme d'ingénieur agronome de l'Université de Thiès-ENSA, option Productions Végétales. ENSA, Thiès, Senegal. 13 juillet 2020, p. 55.

Shared databases

Faidherbia-Flux_Collaboratif\Database
https://baobab.sedoo.fr/