"Faidherbia-Flux": an open observatory for GHG balance and C stocks in a semi-arid agro-sylvo-pastoral system (Senegal)

Olivier Roupsard, Laurent Cournac, Christophe Jourdan, L. Tall, Maxime Duthoit, Laurent Kergoat, Franck Timouk, Manuela Grippa, A. Li, Laurent Lardy, et al.

▲ To cite this version:

Olivier Roupsard, Laurent Cournac, Christophe Jourdan, L. Tall, Maxime Duthoit, et al.. "Faidherbia-Flux": an open observatory for GHG balance and C stocks in a semi-arid agro-sylvo-pastoral system (Senegal). 4th World congress on Agroforestry, May 2019, Montpellier, France. hal-02563243

HAL Id: hal-02563243
https://hal.umontpellier.fr/hal-02563243
Submitted on 29 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
"Faidherbia-Flux", an open observatory for GHG balance and C stocks in a semi-arid agro-sylvo-pastoral system (Senegal)

Roupard O.,1 (olivier.roupard@cirad.fr), Courmac L.,2 Jourdan C.,1 Tall L.,3 Duthoit M.,4 Kergoat L.,5 Timouk F.,6 Grippa M.,7 Ly A.,8 Lardy L.,2 Masse D.,9 Vezy R.,4 le Maire G.,4 Chotte J.-L.10

1 CIRAD, Dakar, Senegal; 2 IRD, Dakar, Senegal; 3 ISRA, Dakar, Senegal; 4 CIRAD, Montpellier, France; 5 CNRS, Toulouse, France; 6 IRD, Toulouse, France; 7 UPS, Toulouse, France; 8 LMI IESOL, Dakar, Senegal; 9 IRD, Abidjan, Côte d’Ivoire; 10 IRD, Montpellier, France

The mitigation of climate change by agro-sylvo-pastoral systems is complex to assess or model, owing to high spatial and temporal heterogeneities.

We set a new long-term observatory up for the monitoring and modelling of microclimate, GHG and deep SOC in a semi-arid agro-sylvo-pastoral system (Niakhar, Sénégal), dominated by the multipurpose Faidherbia albida tree. Crops were mainly millet and peanut, under annual rotation. Transhumant livestock contributed largely to manure, SOM and soil fertility.

Early 2018, we installed 3 eddy-covariance towers above (i) the whole mosaic, (ii) millet and (iii) peanut and monitored energy, CO2 balance and evapotranspiration for one full year. The mosaic ecosystem displayed low but significant CO2 and H2O fluxes during the dry season, owing to Faidherbia in leaf (Fig. 1). When rains resumed, the soil bursted a large amount of CO2. Just after the raising of millet, CO2 uptake by photosynthesis increased dramatically, then stabilized before harvest. However, this was compensated by large ecosystem respiration. The annual ecosystem CO2 balance was close to nil.

This observatory is currently installing soil chambers for GHG fluxes, studying the horizontal variability of SOC by Vis-NIR and of deep soil roots and C using wells. Microclimate (land surface temperature, energy balance and gas exchanges) and light-use-efficiency will be mapped through 3D modelling (Charbonnier et al., 2017; Vezy et al., 2018).

This observatory is open for collaboration.

Fig. 1: The Net Ecosystem Exchange (NEE) of CO2 (or CO2 flux, negative = uptake during the day; positive = release at night) was very weak during the dry season, maximum photosynthesis (GPP) around 10 mmolCO2 m-2 s-1 and maximum ecosystem respiration (Re) around 1.5 mmolCO2 m-2 s-1. GPP was from Faidherbia trees only at that time. Just after the “Haboob”, a large CO2 burst was recorded with slow decay during more than one week or so. Other CO2 peaks in July correspond to smaller rain events. Early August, millet NDVI took off, followed by a large CO2 uptake, but also ecosystem respiration. [Fluxes filtered out for wet sensor, Planar-fitted, WPL and spectral corrected, quality checked. Gaps are due to power failure. Grey dots are from gap-filling according to Lasslop et al. (2010)]

Keywords: Eddy Covariance, Faidherbia albida, Millet, GHG balance, SOM.

References: