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## **”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.

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# 4th World Congress on Agroforestry

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## Book of Abstracts



### “*Faidherbia-Flux*”, an open observatory for GHG balance and C stocks in a semi-arid agro-sylvo-pastoral system (Senegal)

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

<sup>1</sup>CIRAD, Dakar, Senegal; <sup>2</sup>IRD, Dakar, Senegal; <sup>3</sup>ISRA, Dakar, Senegal; <sup>4</sup>CIRAD, Montpellier, France; <sup>5</sup>CNRS, Toulouse, France; <sup>6</sup>IRD, Toulouse, France; <sup>7</sup>UPS, Toulouse, France; <sup>8</sup>LMI IESOL, Dakar, Senegal; <sup>9</sup>IRD, Abidjan, Côte d'Ivoire; <sup>10</sup>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, CO<sub>2</sub> balance and evapotranspiration for one full year. The mosaic ecosystem displayed low but significant CO<sub>2</sub> and H<sub>2</sub>O fluxes during the dry season, owing to *Faidherbia* in leaf (Fig. 1). When rains resumed, the soil bursted a large amount of CO<sub>2</sub>. Just after the raising of millet, CO<sub>2</sub> uptake by photosynthesis increased dramatically, then stabilized before harvest. However, this was compensated by large ecosystem respiration. The annual ecosystem CO<sub>2</sub> 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.

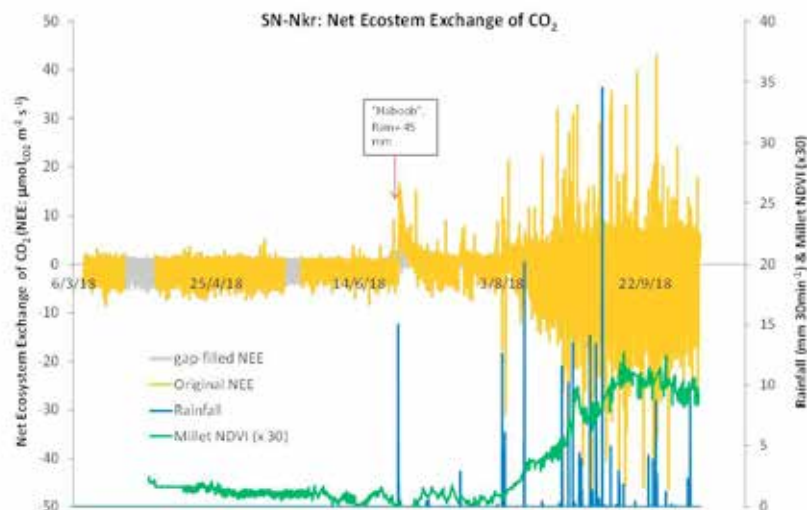


Fig. 1: The Net Ecosystem Exchange (NEE) of CO<sub>2</sub> (or CO<sub>2</sub> flux, negative = uptake during the day; positive = release at night) was very weak during the dry season, maximum photosynthesis (GPP) around 10 mmolCO<sub>2</sub> m<sup>-2</sup> s<sup>-1</sup> and maximum ecosystem respiration (Re) around 1.5 mmolCO<sub>2</sub> m<sup>-2</sup> s<sup>-1</sup>. GPP was from *Faidherbia* trees only at that time. Just after the “Haboob”, a large CO<sub>2</sub> burst was recorded with slow decay during more than one week or so. Other CO<sub>2</sub> peaks in July correspond to smaller rain events. Early August, millet NDVI took off, followed by a large CO<sub>2</sub> 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:

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