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The impact of land use on the net ecosystem CO_2 exchanges in the West African Sudanian Savannas

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The land surface in West Africa has been considerably changed within the past decade due to various anthropogenic measures such as an increased agricultural activity. However, the impact of these land use changes on land-atmosphere exchange processes such as net ecosystems exchange is not well known for this highly vulnerable region. To tackle this problem, the effects of land use on the net ecosystem exchange of CO_2 (NEE) along a transect of three contrasting ecosystems have been investigated on seasonal and annual time scales using the Eddy Covariance method. The ecosystems were grassland (GL), a mixture of fallow and cropland (CR) in the Upper East Region of Ghana, and a nature reserve (NR) near Pô in the Nahouri Province of Burkina Faso. The results for January to December 2013 showed that the ecosystems of the three sites served as net sinks of CO_2 during the rainy season (May to October) and net sources of CO_2 during the dry season (November to April). However, NR was a net sink of CO_2 during the wet to dry transition period (November to December). On an annual timescale, only NR served as a net sink of CO_2 from the atmosphere into the ecosystem, while the others were net sources of CO_2 into the atmosphere. Furthermore, the study revealed that the three contrasting ecosystems responded to environmental and physiological factors based on the ecosystem functional types. This suggests that land use and land use management may play a significant role in the diurnal to annual sequestration and efflux patterns of NEE and its composite fluxes, gross primary production (GPP) and ecosystem respiration (ER), over the West African Sudanian Savannas.