Comparison of the transpiration of two types of vegetation cover in Northern Benin : an insight into the impacts of land conversion

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Abstract

Sudanese Africa population growth is average 3% per year resulting in a significant increase in cultivated areas at the expense of fallows and forests. This land cover change is not without affecting the exchange of energy and water between soil, vegetation and atmosphere. For centuries, Sudanese rural population have been practicing agroforestry dominated by shea (*Vitellaria paradoxa*) parklands. We asked to what extent this practice can buffer the impact of the deforestation on the recycling of the water and therefore on the hydrological cycle. This preliminary study concern the woody cover only. Specifically, we compared transpiration of *Vitellaria paradoxa* (shea) that dominates agroforestry systems and of *Isoberlinia doka* that dominates forest, as indicator of shea water needs, at the tree and cover scale. Sap flow density (SFD) was measured by the transient thermal dissipation method from which transpiration of the tree was deduced then extrapolated at the species covers scale. Over the three-year of the study period (2011-2013), daily tree transpiration of *V. paradoxa* increased from 4 to 27 l/day according to tree diameter (8 to 38 cm respectively), while that of *I. doka* trees (diameters: 20 to 38 cm respectively) varied from 10 to 93 l.day-1. Transpiration varied lowly between wet and dry seasons in both species,

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suggesting that water is not the limiting factor, except a sharp drop during the period of leaves renewal (February-March). Transpiration of the cover of *V. paradoxa* was very low (0.03±0.01mm/day), corresponding to 0.42 à 1.32 % of the atmospheric demand estimated by reference evapotranspiration Eto, and 1.15 % of the annual rainfall, while that of the *I. doka* cover was 1.02±0.42 mm/day, corresponding to 7 to 74% of the atmospheric demand Eto, and 39.32 % of the annual rainfall. Our results indicates that agroforestry systems contributes more weakly to local evapotranspiration than the forest therefore the conversion of forests to fallow or agroforestry parkland could change the hydrological cycle. Thus, natural vegetation restoration efforts should be encouraged through reforestation campaigns in degraded areas to avoid droughts, water scarcity and the threat to food security.

Keywords: Benin, Forest, Hydrological cycle, Sap flow, Transpiration, Woody species