Vegetation dynamic in a littoral savanna in Congo

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Context:

The grassland occupies a significant part of the land surface in the world (52.5 km2 ie 40.5% of the Earth surface, excluding Greenland and Antartica, World Resources Institute, 2000, based on IGBP data). Under tropics, the grasslands experience one or two dry seasons each year and they are frequently burnt (at least once a year) by the farmers. These high constraints have an impact on the dynamic of the vegetation of the grassland. For the grasslands that grow on poor soils, such as the sandy soil of the littoral region on Congo, the constraints are even higher. The study of the vegetation dynamic, as the supplement to the eddy-covariance tower in the savanna, was done from july 2006 to understand the effects of the environment on the grassland functioning.

Material and Methods:

Sixteen 7mx7m plots were selected randomly in a one ha area around the flux tower (figure 1). Each plot contained 16 sub-plots of 1m^2 (1 to 16; random pattern) where biomass was measured alternatively (one subplot is selected randomly at each date of sampling). A total of 15 field campaigns were done since September 2006 (every 6 weeks) corresponding respectively to 3 and 6 measurement points in dry and wet season. Aboveground biomass and necromass was totally harvested in the subplots. Species were considered individually. Belowground biomass was assessed from 4 auger cores (8 cm diameter). Soil samples were taken down to 0.7m deep (4 layers; 0-10 cm, 10-30 cm, 30-50cm and 50-70 cm) and bulked. Species were not considered independently for the belowground biomass.

Estimation of savanna root production was obtained from the in-growth cores method from december 2007 to october 2008. Five plots were installed in the studied stands (1' to 5') at the beginning of the study in order to sample the entire 11-month period covered by the study. 4 initial cores were sampled with the auger in each plot in three soil horizons (0-10, 10-30 and 30-50 cm). Root of each sample were removed from the soil and the hole was refilled with the root-free soil of the same horizon. Twenty in-growth cores were then sampled in each soil horizons at the same time than the field campaigns.

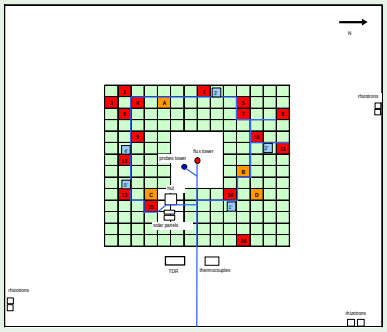

Figure 1: field pattern

Results:

BIOMASS

Above-ground biomass dynamic is linked to the rainfall, especially during the dry season and at the beginning of the rainy season (fig. 2). However, once the ears are mature, the vegetation made of 90% of grasses, stagnates and dries out. During this transition, the aerial necromass grows up and reaches its maximum at the beginning of the dry season (June).

In 2008, the necromass appeared earlier than in 2007, du to a long "short" dry season.

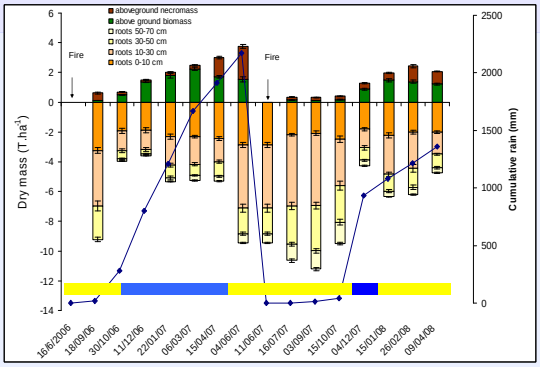

Fig 2: biomass

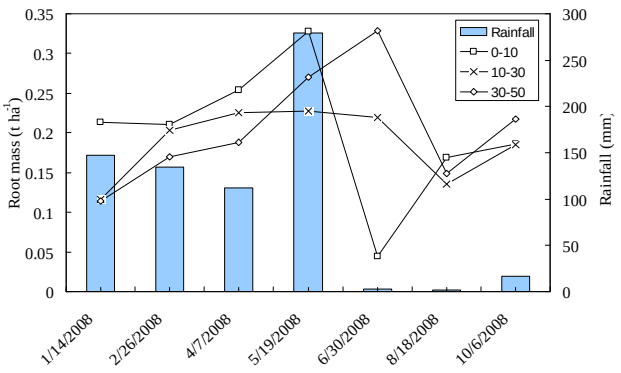

Fig 3: Root biomass in the ingrowth cores and the measured rain during the same period of observation

ROOT PRODUCTION

Ingrowth-core root biomass is high from January to may 2008 corresponding to the maximum of the aboveground biomass (fig 3). During dry season (june-September), root biomass remains high in the depth horizons, while it decreases in the shallow horizon probably due to a transfer and a stocking of the carbon in the depth roots (10-50cm). Total root production during all the experiment is almost identical for the three soils horizons (0.97, 0.91 and 0.99 t ha^{-1} per 11-month respectively for 0-10, 10-30 and 30-50 cm).

ROOT/SHOOT RATIO

The roots are the most important part of the total biomass. The ratio Root/Shoot ranges from 1.7 at the maximum vegetation (in April) to nearly 40 after the destruction by the fire of the aerial part (fig. 4)

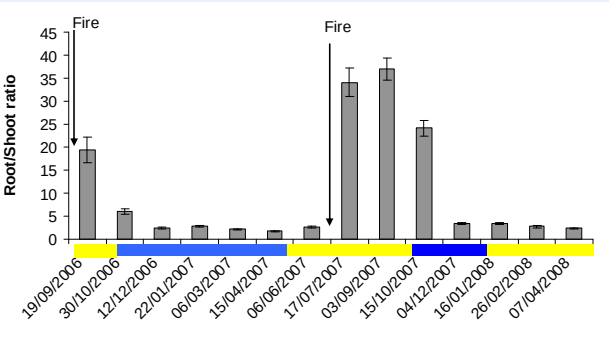

Fig 4: R/S ratio

Conclusion:

We highlight a strong effect of the season and the fire on the biomass production. The savanna seems to face the constraints by transferring and stocking the carbon in the depth roots (10-50 cm) during the long dry season. In reverse, this carbon is transferred to the above-ground biomass at the beginning of the rainy season.

These results will allow us to estimate the NPP at the end of the root dynamic survey.