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Relationship between the herbaceous and woody vegetation caracteristics and biological soil crusts distribution in fallow and rangeland across a latitudinal gradient in Sahelian Western Niger

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Biological soil crusts (BSC) are common soil feature in the Sahel, in Western Niger. They occur in association with various types of physical soil crusts in fallow, rangeland and 'tiger bush' biomes (landscape with a typical pattern consisting of alternating dense thicket bands composed of shrubs and small trees, and bare soil bands). Despite their widespread occurrence, little research has focussed on the spatial extent of microbiotic soil crusts at regional scale in Sahel. Moreover, little is known about the interrelations between the occurrence of those crusts and the characteristics of the vegetation. In this paper, field data on the distribution of biological soil crusts and some characteristics (cover, composition, mass) of herbaceous and woody vegetation co-occurring in fallows and rangelands are presented and analysed.

The study was performed in ten sites selected in Western Niger along a south-north climatic gradient between 650 to 300 mm of annual rainfall. The soil surfaces features, specifically physical and biological soil crusts, were surveyed twice in july-october 2009 and October-november 2011. The second survey combined the assessment of soil surfaces features with systematic observations of vegetation. Herbaceous cover, mass and species composition were assessed by stratified sampling along a 200 meter axis. PCQ distance method was used to characterise the density, cover and species composition of the woody plant population.

The extends of BSC observed in the 10 sites in 2011 are in the same order as those observed in 2009, i.e. ranging between 4 and 59% in 2009 vs 1.5 and 48 % in 2011. The results showed a significant increase of BSC coverage with increasing annual rainfall towards the south of the gradient. The actual cover of herbaceous vegetation, taking the extends of bare soil patches in account, averages 14.2 % over the different sites. Similarly to BSC repartition, a slight increase of herbaceous cover is observed from the northern dryer sites to the southern wetter sites. Globally xerophytes are more common in the dryer Northern sites, while hydrophytes and sciaphytes are more common to the wetter south. Woody plant crown cover is in average slightly superior to herbaceous cover (although herbaceous cover was already diminished by grazing at the date of observation). The similar trend observed along the climatic gradient revealed that soil moisture condition is the major factor driving the distribution of both BSC vegetation cover at regional scale. Further data analysis of the relative distribution of BSC and vegetation within site should help better understanding of mutual interactions between plants and microbiotic soil crusts.