

# Tree Shade Effects on Soils and Environmental Factors in a Savanna of Senegal

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## Abstract

The influence of tree shade on soils and microclimatic features was investigated in a Sahelian savanna of Ferlo, Senegal, in West Africa by measuring soil and environmental parameters under trees (i.e. shade) and in the open. Moisture content and the levels of carbon, nitrogen and phosphorus were greater in the surface soil layers (0–10 cm) under trees than in the open. Air temperature and incoming radiation were lower under trees, which contributed to a lower level of evaporation compared to the open. Water interception and stem-flow were associated with more water in the soil, hence, an increased available water.

## Introduction

Savannas include a wide range of vegetation types and can be characterized by more or less continuous herbaceous undergrowth and an intermittent cover of shrubs and trees. The herbs, shrubs and trees are of economic importance to livestock and crop production.

Many authors including Vetaas (1992) have shown that in dry seasons trees influence the diversity and productivity of herbaceous plants as well as properties of the soil environment. For example, distribution of water between trees and grasses is very vital in the structure and in designing management practices in savannas (Belsky, 1990).

In the semi-arid regions of Africa, the effects of trees on environmental factors have mainly been studied in agroforestry context (Akpo & Grouzis, 1996a). It has been shown in northern Senegal, which is characterized by a long dry season (9–10 months) alternating with a short rainy season

(2–3 months), a low annual rainfall (<300 mm), which falls mainly between 16–25 days, high solar radiation (the daily mean insolation is 8–11 h/day), and a high temperature, that trees have favourable effects on exuberant flora, lengthening of the period of plant development, and consequently, biomass production of the herbaceous undergrowth (Akpo, 1993; Akpo, & Grouzis 1993; Grouzis & Akpo, 1997).

The present study was undertaken to identify differences in micro-environmental factors (microclimate and soil properties) which could be the causes of changes observed in herbaceous undergrowth. In order to ascertain whether soil fertility is improved by the presence of trees in the study area, a semi-arid climate, we investigated physical, chemical and hydraulic properties of soils under trees and in the open. This study was important because the dominant management practice in these agro-pastoral systems is removal of