

Introduction

Soils characteristics in savanna landscapes are the results of different pedo- and morphogenetical processes. In these processes vegetation cover and dynamic play an important role.

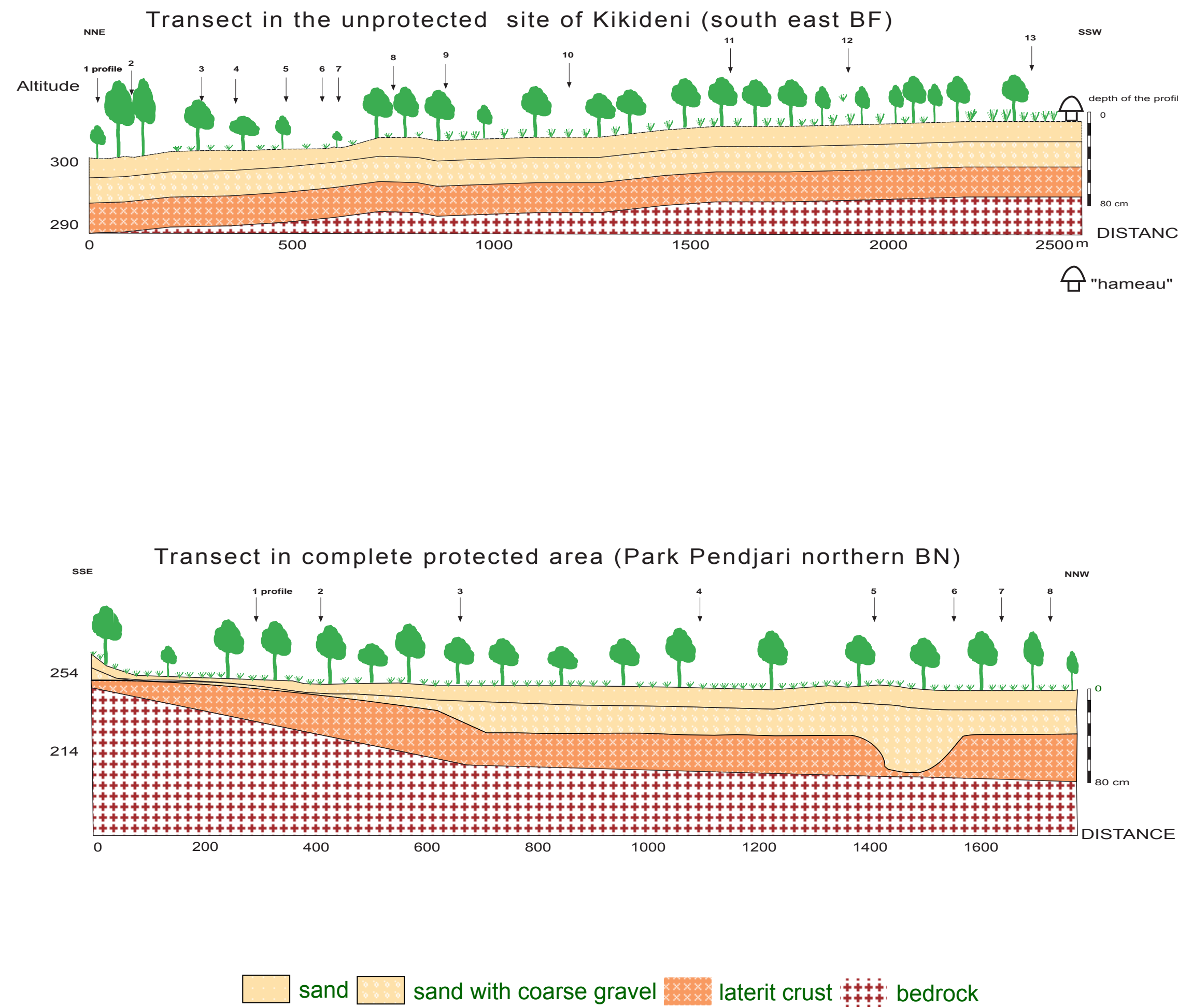
The present paper aims to analyse, in a pedomorphological approach the physical and chemical characteristics of the soils along catenas within protected and land used areas. Soils characteristics are then correlated with the diversity of woody plants in South East Burkina Faso and in North Benin.

Methodology

Morphopedological transects (catenas) are set up on biodiversity observatories of the BIOTA-WEST project in areas with pastoral and agricultural activity of SE Burkina Faso (Kikideni) and in protected zones of NW Benin (Pendjari) and SE Burkina Faso (Natiabouani). Main targets are to assess the structure, composition and physical and chemical properties of soils within the penepains and pediments relief of West Africa, and to investigate the woody diversity in these different sites.

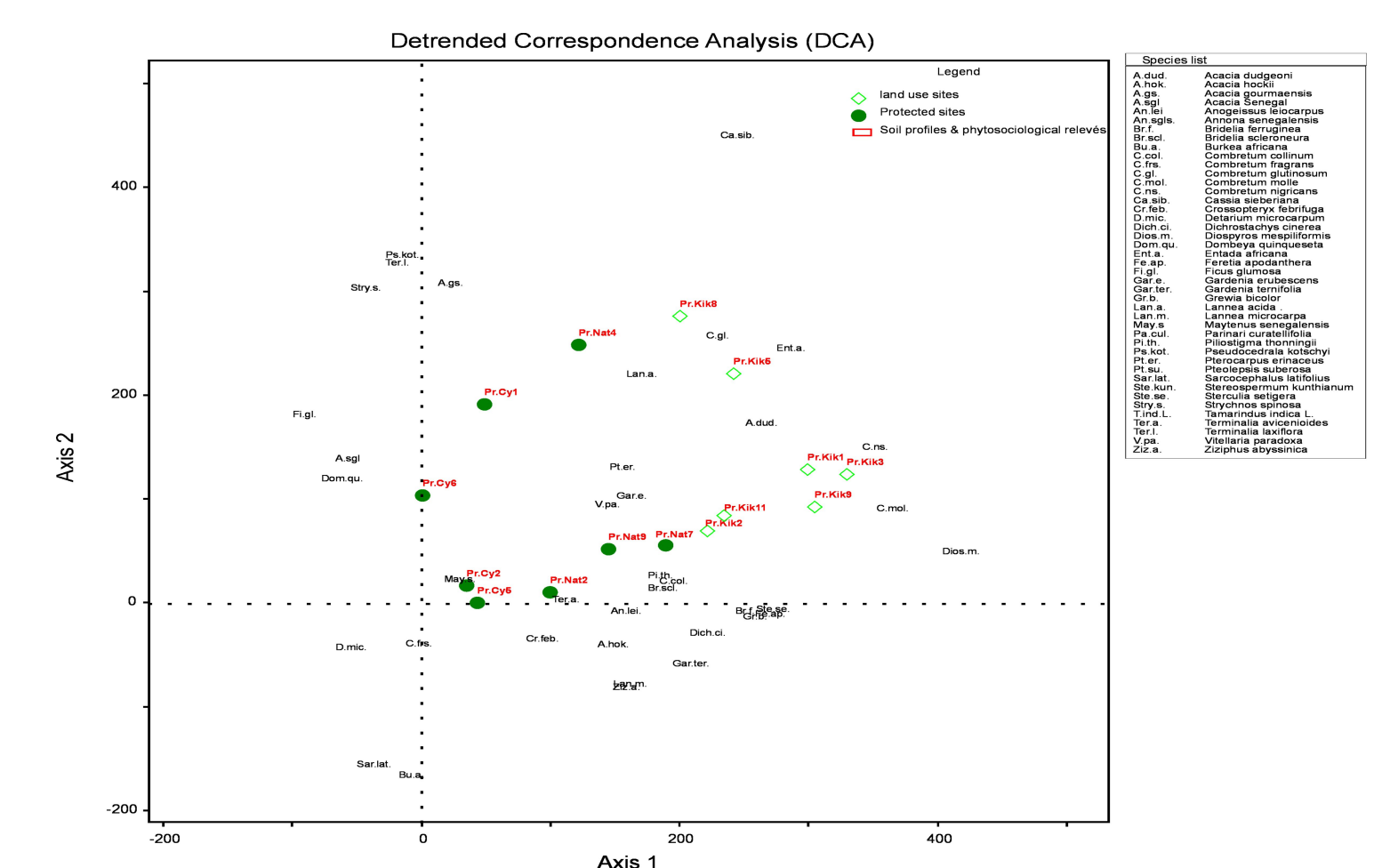
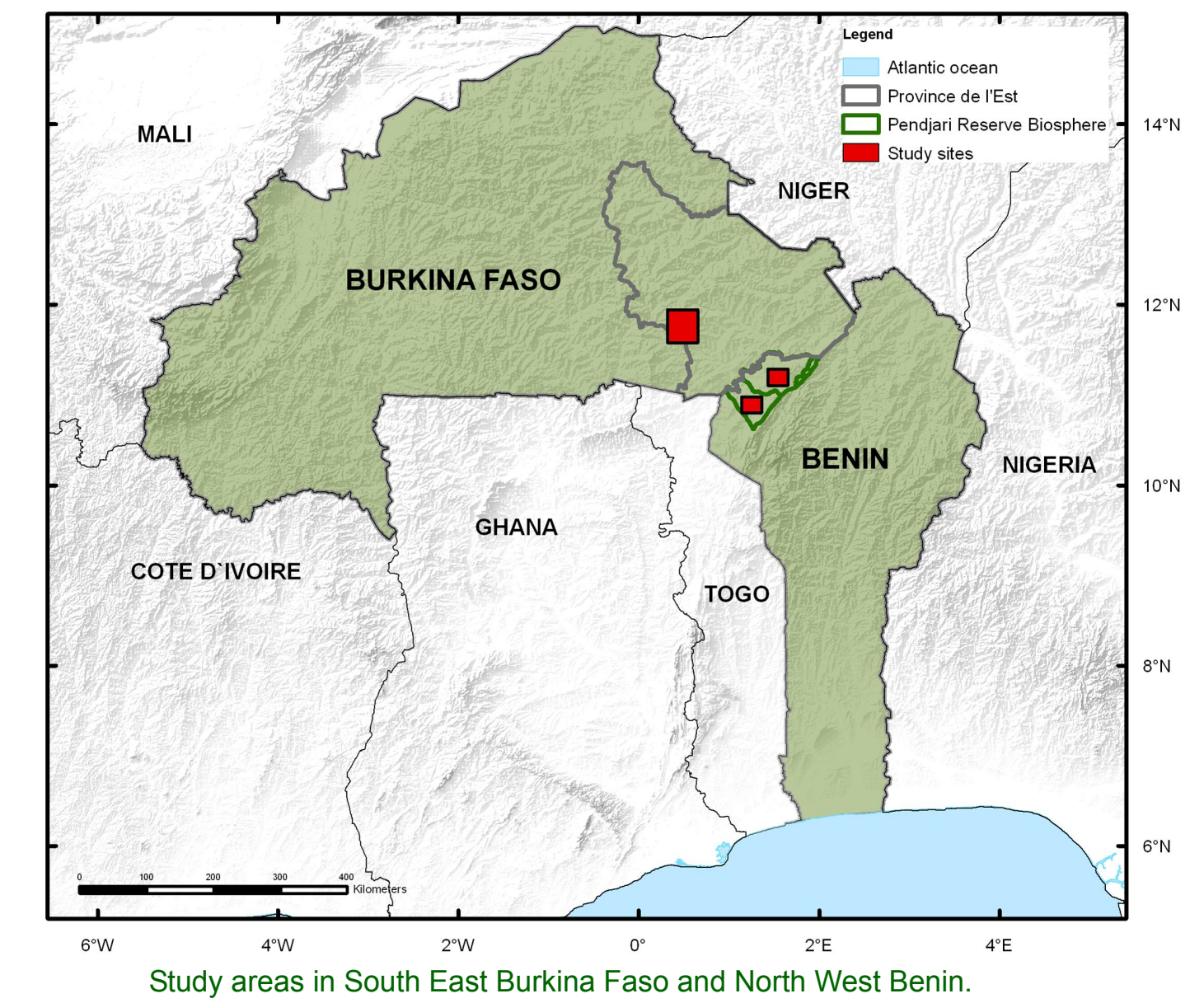
Soils have been surveyed along the catenas with a total of 191 soil samples for 69 profiles which have a standard depth of 80 cm. Soil samples are analysed on texture composition, organic matter, pH-values, C, N, P available, K etc.

Following the hypothesis of the chosen investigation pits, phytosociological relevés have been conducted. Thereby, environment factors such as degraded and hydromorphic zones, and topography have been taken into consideration. In order to determine the relationship between species distribution and environmental factors such as soils parameters, different ordination techniques such as Detrended Correspondance Analysis (DCA) and Canonical Correspondence Analysis (CCA) have been applied using the computer program PC-ORD 4.33. This analysis should contribute to a better understanding of the relation phytodiversity-soil properties in the study areas.

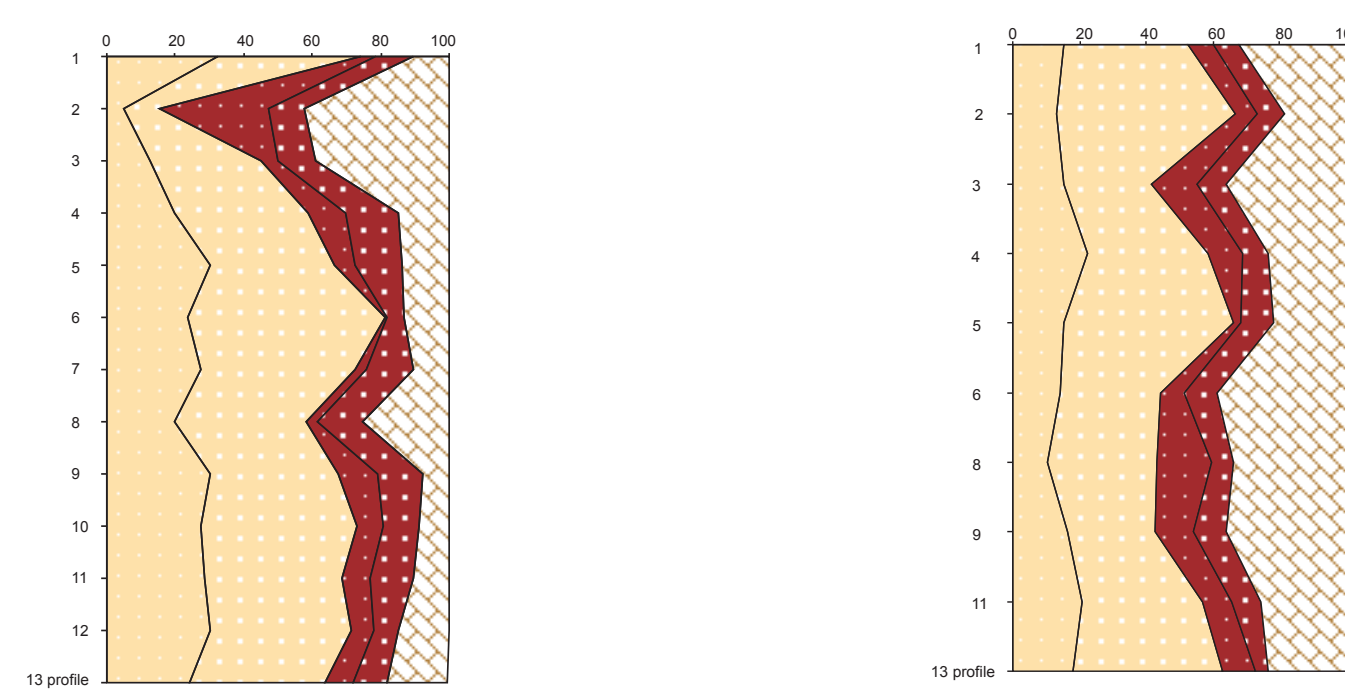


Study areas

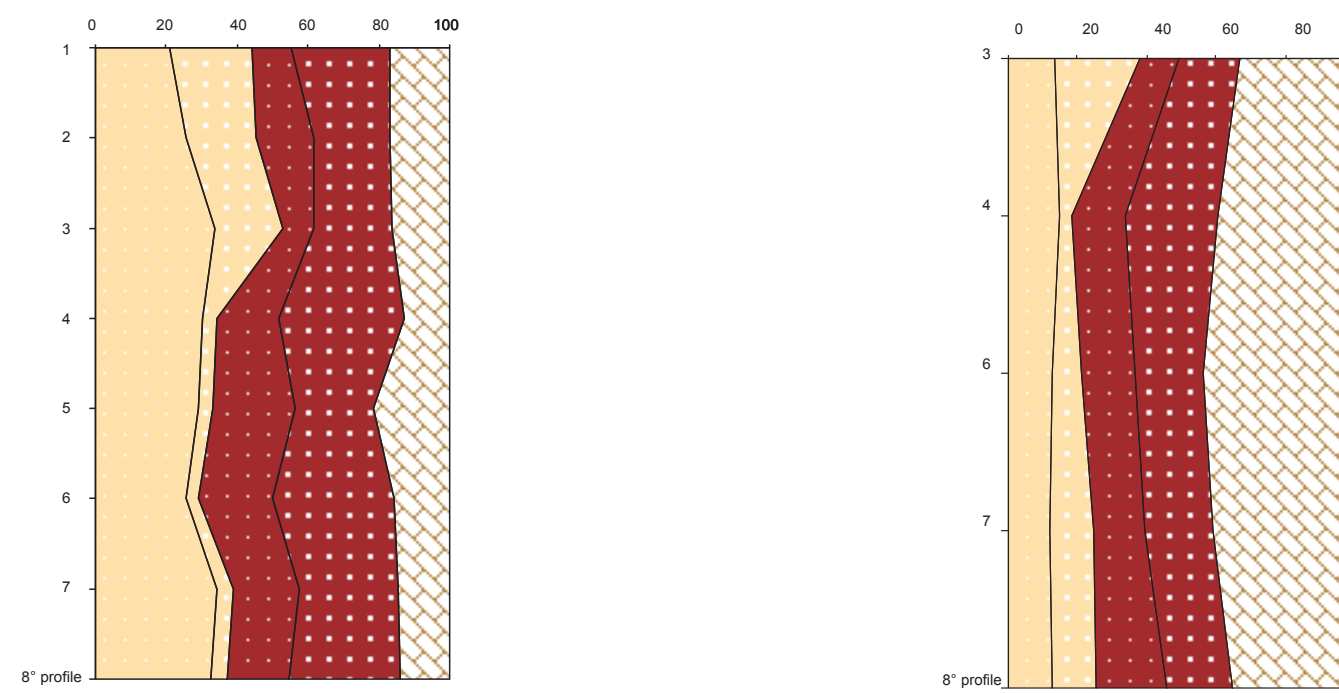
Biodiversity Observatories (BO) of Kikideni in SE Burkina Faso (province of Fada Ngourma), an unprotected area partly cultivated and pastured land on the one hand, and on the other the protected areas of Natiabouani (south of the Kikideni site) and the hectare plots in Pendjari park and in the hunting zone (zone cynergetique) in northern Benin.



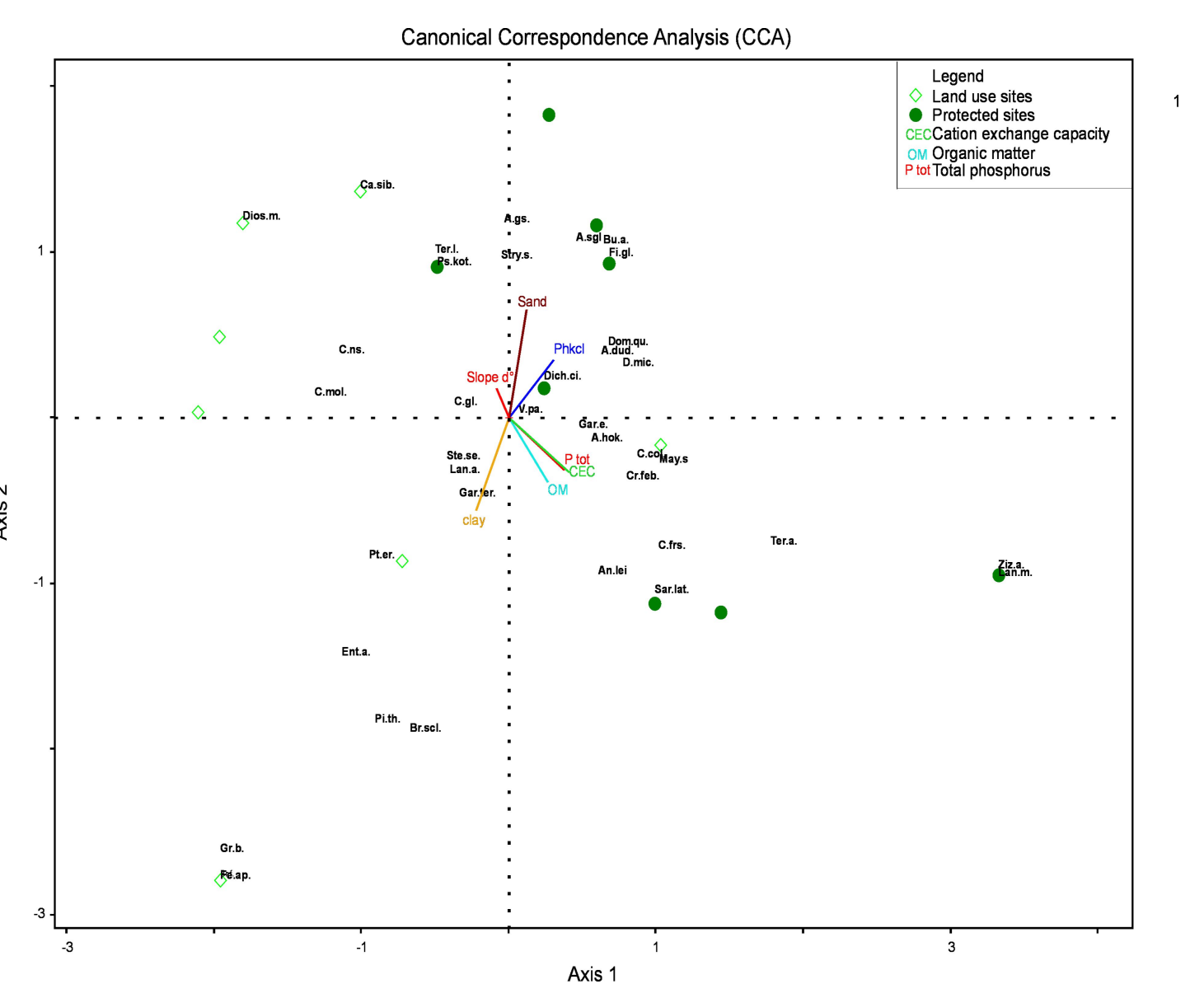
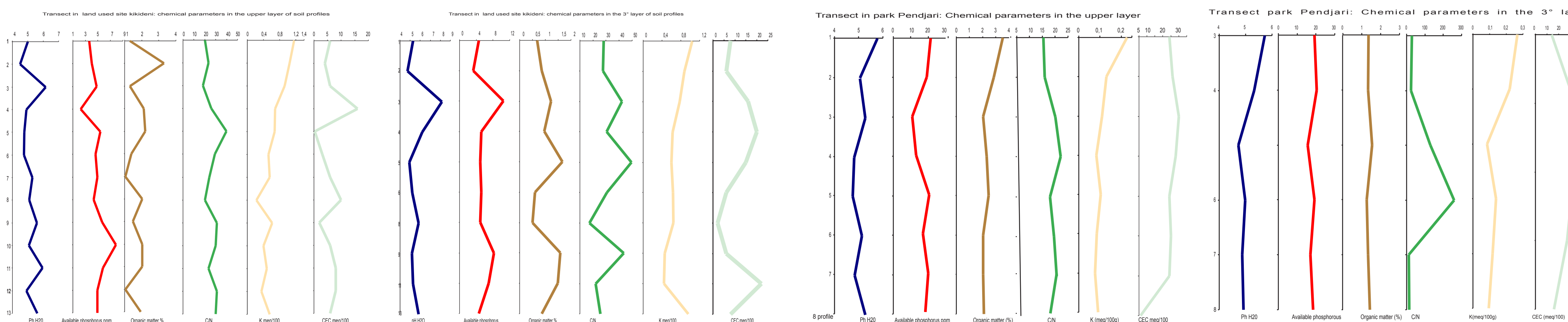
Transect Kikideni: particle size in the 1 layer and 3 layer



Transect Pendjari: particle size in the 1 layer and 3 layer



Fine sand Coarse sand Fine silt Coarse silt Clay



Ordination with PC-Ord program. DCA and CCA-Diagramm are represented with 44 species. Eigenvalues first/second Axis: 0.6/0.2 and length of gradient 3.2/2.5 which are indicator of floristic diversity are calculated. CCA arranges species along soil and environmental variables (pH/Kcl, organic matter etc).



Eroded surface at Kikideni: intensified rill erosion process that are results of hydric erosion and anthropogenic factors lead to loss of soil fertility.



Soil inspection pit in the savanna woodland of the protected and hunting zone Pendjari. In the front stands a termite mound.



Profile in the pediment along the transect in the Pendjari park: only one layer (15 cm) covers the local bedrock.

Results and outlook

The Kikideni transect, situated in the undulated interfluvial relief (penepains) of South East BF with low slopes (<1%) is strongly farmed. However, extending from a hill of the "collines du Buem" unit (parallel to the Atakora chain) to the floodplain, the transect in the hunting zone of Pendjari park is in protected area.

Along both transects in the protected and unprotected areas an enrichment of clay mineral content with the depth from the first to the third layer can be generally observed, except in the floodplain profiles of the Kikideni transect (2° and 3° profiles). Here clay mineral content decreases from 42 % (upper layer) or 49 % (2° layer) and in hydromorphic conditions to 18 % in the 3° layer of profile 3. Otherwise, clay minerals in the upsoil in Kikideni vary between 7 and 20 % and between 12 and 17 % in Pendjari.

In Pendjari the proportion of coarse sand decreases from profile 1, chosen on the pediment at the foot slope (see picture), to the last profile (8), while fine sand increases or is unvaried. In Kikideni, coarse sand is higher than fine sand at the surface. The lateral transport of fine material can be assessed in Pendjari due to the presence of significant difference in relief, while vertical

and less lateral transport of fine material is observed in Kikideni. Nevertheless, land use effects disturb the structure and texture of soil surface and significantly influence the properties of soils.

The pH (H₂O) values in upper layer along the Pendjari transect are low (< 5, 5 except in profile 1) and indicate the acidity of these soils, the same is observed in the cultivated site of Kikideni (pH between 4, 5 and 6, 15). The lower pH values in Kikideni influence the stability of soil structure, the available phosphorus for plant uptake (marginal in Kikideni: 6, 5-13 ppm and adequate in Pendjari 13-22 ppm in the 1° layer).

Organic matter is low in the transects and decreases with the depth particularly in the degraded zone of Kikideni. Nevertheless, OM values increase at the profiles influenced by hydromorphic conditions (2° profile transect Kikideni and 2° profile in Pendjari transect).

The vegetation type in the degraded site of Kikideni is mainly shrub savanna composed by *Combretum molle*, *C. nigricans* and *C. glutinosum* while in the hunting zone tree savanna dominates with species like *Vitellaria paradoxa*, *Detarium microcarpum*, *Burkea africana* etc. Species richness in Kikideni rises up to 7 species/1000 m² and 12, 3 species/1000 m² in Pendjari park.

The ordination diagram of DCA shows that along the Axis 1 a succession from left to right sites of the protected areas and land use areas along an anthropogenic gradient. CCA diagram shows a good correlation of parameters such as pH Kcl, total phosphorus to the Axis 1. Total phosphorus may play an important role in the composition of plant communities in the protected zone.

References

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