

Le Corps professoral de
Gembloux Agro-Bio Tech - Université de Liège vous prie
de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

Monsieur NSENGIMANA Venuste,

Titulaire d'un diplôme de *Master of Science (biodiversity conservation)*,

présentera en vue de l'obtention du grade et du diplôme de

DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,
le 20 novembre 2018, à 15h30 précises (personne ne sera admis après cette heure),
en l'auditorium PhV (Physiologie végétale, bât. 48),
Avenue Maréchal Juin, 13 à 5030 GEMBOUX.

Cette dissertation originale a pour titre :

« Use of soil and litter arthropods as biological indicators of soil quality
in Southern Rwanda ».

Le jury est composé comme suit :

Président : Prof. P. LEBAILLY, Professeur ordinaire,

Membres : Prof. F. FRANCIS (Promoteur), Prof. D. NSABIMANA (Promoteur en cotutelle -
Université du Rwanda, Rwanda), Prof. F. VERHEGGEN, Prof. A. DEGRE, Prof. G. COLINET,
Prof. B. KAPLIN (Université du Rwanda, Rwanda).

Summary

To assess soil quality under different land uses by the use of soil and litter arthropods as biological indicators, a research was conducted in the Arboretum of Ruhande and the Rubona agricultural research station in southern Rwanda. Soil and litter arthropods were collected by pitfall sampling technique and identified to the family level. Ants (Hymenoptera: Formicidae) were identified to species level. Soil cores were collected and analysed for soil organic carbon, total nitrogen, available phosphorus, pH, aggregate stability, cation exchange capacity, electrical conductivity, silt, and clay and sand soil textures. C:N ratios were calculated from the mass of carbon to the mass of nitrogen. Higher levels of total nitrogen, soil organic carbon, and clay and silt soil texture were found in native and exotic tree species. Higher levels of cation exchange capacity, pH, and electrical conductivity were found in native tree species and banana plantations, while higher levels of available phosphorus, aggregate stability and sand soil texture were found in coffee and banana plantations. The analysis of the abundance of collected soil and litter arthropods indicated higher abundance of Formicidae, Julidae, and Isotomidae in native and exotic tree species. The family of Entomobryidae showed higher abundance in coffee plantations. Families of Scolopendridae, Trombiculidae, Eosentomidae, Formicidae and Staphylinidae showed strong correlation with soil physicochemical properties. Formicidae discriminated between clay, sand, aggregate stability, pH, available phosphorus, electrical conductivity and cation exchange capacity. The ecological functions of identified families contribute to the soil quality through predation, decomposition, bioturbation and phytophages that increase soil organic matter and facilitate water retention and soil aeration. The taxonomy of ants to species level indicated 30 species belonging to 14 genera, and four subfamilies, the Formicinae, Dorylinae, Myrmicinae and Ponerinae. These species correlated with soil properties in different ways, but their ecological functions that contributes to soil quality are not yet well documented. We recommend further studies to be replicated in other land uses and ecological zones of Rwanda, to include the impact of climate variability, altitudinal variation, functional diversity, metal and soil microbiology and the taxonomy of the entire community composition of collected soil and litter arthropods to species level in order to generalize these findings.