



Tropentag, September 20-22, 2023, hybrid conference  
“Competing pathways for equitable food systems transformation:  
Trade-offs and synergies”

## Carbon dioxide emission rates in different land use types of the Letaba-catchment in Southern Africa

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### Abstract

Carbon dioxide (CO<sub>2</sub>) is one of the main greenhouse gases and thus, it is of paramount importance to monitor it and curtail its emission into the atmosphere. Although the highest CO<sub>2</sub> emissions are reported by industrial activities, agricultural fields contribute approximately 10–14% towards total emissions. However, the influence of land use type on CO<sub>2</sub> emission in Southern Africa is not well elucidated. This study is aimed at attaining a better understanding of the effect of land use type on the emission rate of CO<sub>2</sub> from the soil. In addition, information on how land use types interacts with seasons to influence CO<sub>2</sub> emission rate remains scant. The study was conducted at the Letaba catchment under the banana plantation (Ba), Eucalyptus grandis plantation (Eu), natural bush (Bu), communal maize field (Ma) and forest (Fo) land use types where in each land use type three plots were set up and carbon chambers were installed. The CO<sub>2</sub> and soil temperature data were measured in the carbon chamber every two weeks for a full year using a GMP343 probe fitted with infra-red sensor (CO<sub>2</sub>) and Pt1000 temperature sensor, while the volumetric moisture (%) of the soil was measured using a soil moisture meter. Soil CO<sub>2</sub> emission rates displayed seasonal fluctuations with maximum rates occurring in summer (0.11 tons/ha/day), minimum in winter and average rates occurring in autumn (0.08 tons/ha/day) and spring (0.05 tons/ha/day). Further, significant differences were observed among the five land use types ranking from highest to lowest in the following order: Fo (0.096 ton/ha/day) > Ba (0.073 ton/ha/day) > Ma (0.061 ton/ha/day) > Bu (0.057 ton/ha/day) > Eu (0.037 ton/ha/day). The emission rates of CO<sub>2</sub> were related with soil temperature and moisture content. The results displayed that the combined impact of soil temperature and moisture accounted for 46% of the variation in CO<sub>2</sub> emission rates under the banana land use and over 50% of the variation under the other land use types. The results also displayed soil moisture as the main driver of the variation in the rates of CO<sub>2</sub> emission in all the land use types except the banana land use.

**Keywords:** Carbon dioxide emission, land use type, soil moisture, soil temperature