Geophysical Research Abstracts
Vol. 20, EGU2018-2546, 2018
EGU General Assembly 2018

Soil-atmosphere N_2O and CH_4 dynamics after land use change; from Eucalypt forest and pasture to urban lawn

Lona van Delden (1), David Rowlings (2), Clemens Scheer (2), Daniele De Rosa (2), and Peter Grace (2)

(1) University of Hohenheim, Soil Science and Land Evaluation, Biogeophysics, Germany (lona.vandelden@uni-hohenheim.de), (2) Queensland University of Technology, Institute for Future Environments, Australia

Increasing population densities and urban sprawl are causing rapid land use change from natural and agricultural ecosystems into smaller, urban residential properties, altering biogeochemical C and N cycles. However, the impact of urbanization on the soil-atmosphere exchange is largely unknown. This study quantified the soil–atmosphere N_2O and CH_4 exchange in three land uses representing typical land use intensification from a native Eucalypt forest to a well-established pasture and a fertilized turf grass lawn in the subtropical peri-urban region of Brisbane, Australia. Fluxes were measured continuously over two years using a high resolution automated chamber system to account for short-term and inter-annual variability. The fertilized turf grass had the highest temporal variation in N_2O emissions, dominated by extremely high fluxes immediately following establishment, while only small fluxes occurred in the forest and pasture (0.08 – 0.15 kg N_2O-N ha^{-1} y^{-1}). Apart from the high N_2O emissions in the turf grass during the establishment phase, there was little inter-annual variability in fluxes across all land uses, despite substantial rainfall variations between years. The high aeration of the sandy topsoil limited N_2O emissions while promoting substantial CH_4 uptake with all land uses being net CH_4 sinks. Native forest was consistently the strongest CH_4 sink (-2.9 kg CH_4-C ha^{-1} y^{-1}), while the pasture became a short-term CH_4 source after heavy rainfall when the soil reached saturation. On a two years average, land use change from native forest to turf grass increased the non-CO_2 Global Warming Potential (GWP) by 329 kg CO_2-e ha^{-1} y^{-1}, turning it from a net GHG sink into a source. The study highlights that urbanization can substantially alter soil-atmosphere exchange by increasing bulk density and inorganic N availability. However, on well drained subtropical soils, the long term non-CO_2 GWP of turf grass was comparably low to results reported from urbanized ecosystems in temperate climates.