Guidelines

# Biotic and abiotic controls over greenhouse gas and air pollution precursor emissions from sub-Saharan Africa

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**Abstract.**
Emissions of the greenhouse gas nitrous oxide ($N_2O$) and nitric oxide (NO; a precursor to tropospheric ozone, which is a greenhouse gas and air pollutant) are largely mediated by the microbial processes of nitrification and denitrification; microbes also contribute to many important ecosystem services. Agricultural NO emissions can drive ozone formation in rural areas, and recent modeling and remote sensing studies suggest that soils are a major driver of ozone production following precipitation pulses in western Africa. Massive increases in nitrogen (N) additions--over an order of magnitude--are underway in parts of sub-Saharan Africa, and can be expected to lead to increases in $N_2O$ and NO emissions. Recent remote sensing studies have shown that the onset of the rainy season in the Sahel is responsible for large pulses of NO from soils. Here we propose using molecular and other techniques to investigate the biotic and abiotic mechanisms by which these fluxes are produced and to understand how agricultural intensification affects the structure of soil microbial communities. Central to this project is using quantitative PCR for genes and mRNA involved in nitrification and denitrification to map the how these critical functional elements of the microbial community break dormancy at the onset of the rainy season.