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Laboratory study of the influence of land-use change on NO fluxes from semi-arid ecosystems and climatic gradient

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Nitrogen Oxides (NO_x= NO + NO_2) significantly influences the photochemical formation of ozone in the troposphere. NO_x is emitted into the atmosphere mainly through anthropogenic processes such as combustion of fossil fuels and biomass burning. However, soils can also act as a significant source for atmospheric NO_x. Especially in remote areas, biogenic NO loss can be substantial, and may be the major source of atmospheric NO on the local scale. Emission of NO also represents a loss of valuable nitrogen from both natural and engineered soil systems. Finally, there is still considerable uncertainty in the global NO_x budget; a lack of knowledge of the natural N cycling processes leading to NOx formation forms a major part of this uncertainty. The objectives of presented research were to study influence of land-use change on the NO fluxes from the soil and dependence of NO fluxes on soil temperature and soil moisture in shrubland and forest ecosystems.

Laboratory incubations of soils with different seasons and land-use histories, from the semi-arid zone in southern Israel (mean precipitation 280 mm), were performed. Soils from native shrubland (taken both under shrub canopy and in the inter-shrub areas), and from a 40-year old afforestation site (Yatir forest) were sampled. These sites are the location of other measurements into the N cycle, including inorganic N dynamics, *in situ* net mineralization and the measurement of nitrification rates. We also estimated NO emissions on samples from two other forest sites along a precipitation and climatic gradient in Israel; Judean hills (500 mm) and Carmel Mountains (650 mm).

NO fluxes from both the Yatir forest soils and surrounding shrubland showed strong seasonality: maximum potential NO emission was observed in soil samples from the summer and decreasing in samples from the start of the wet season. Nitrification potential measurements were good predictors of maximum NO flux. Maximum NO emissions decreased with increasing of canopy cover, irrespective of the canopy type (forest or shrub). The inverse negative relationship between laboratory NO flux and *in situ* net mineralization and nitrification does not entirely correspond to the conceptual "hole-in-pipe" model regarding NO fluxes. The decrease in potential NO fluxes with increasing canopy cover points to possible effects of land restoration and management on NO flux. Further work on modeling NO fluxes based on studies such as presented here (which include data from 5 distinct environments) will increase our understanding of ecosystem and ultimately global NO budget.