

Link between nitrification activity and N₂O-emissions in tropical rain forest ecosystems

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Recently it was found that nitrification rates in temperate and tropical forest soils were much higher than previously estimated (0.01 to 21.0 mg N kg⁻¹ SDW d⁻¹). This magnitude of nitrification rates in forest soils indicates that nitrate cycling via the microbial biomass pool is inherent in these ecosystems. Therefore nitrification is a key factor that must be investigated to understand the nitrogen (N) cycling and N losses, e.g. N-trace gas emissions, at the ecosystem level. One montane and one lowland tropical rain forest site located in the region of the wet tropics, Queensland, Australia, were investigated in order to find out if variations in gross nitrification rates can explain the observed site and seasonal differences in N₂O-emission. For this intact soil cores from both sites were analyzed during different hygric seasons for their magnitude of gross nitrification rates using the Barometric Process Separation technique (BaPS). Pronounced seasonal variations of gross nitrification rates were found at both sites with highest values during the transition period between dry and wet season and significantly lower rates of gross nitrification during the dry and the wet season. Rates of gross nitrification were always higher at the montane site than at the lowland site, but the opposite was found for N₂O emissions. The results indicated that the high losses of N₂O at the lowland tropical rain forest site may be contributed largely by high denitrification activity due to its wetter and warmer climate as compared to the dryer and colder climate at montane tropical rain forest site. This conclusion was supported by analysis of cell numbers of microbes involved in N-cycling. Higher numbers of denitrifiers were present at the lowland site, whereas higher numbers of nitrifiers were found at the montane site.