Abstract

Expansion of commercial agriculture in equatorial regions has significant implications for regional nitrogen (N) budgets. Here we investigate changes in N availability and turnover in Southeast Asia following the replacement of tropical forest with oil palm plantations along a chronosequence of oil palm maturity (3-months to 15-year-old stands) and secondary to primary forest succession in Sabah, Malaysian Borneo. Ten sites were sampled during March and April 2012 and rates of gross ammonium (NH_4^+) and nitrate (NO_3^-) production (mineralisation and nitrification) and consumption (*n* = 8), potential denitrification and “anaerobic ammonium oxidation” (“anammox”) (*n* = 12) were determined using ^{15}N isotope additions to soil cores and slurries respectively. Gross mineralisation rates (0.05–3.08 g N m^{-2} d^{-1}) remained unchanged in oil palm relative to forests. However, a significant reduction in gross nitrification (0.04–2.31 g N m^{-2} d^{-1}) and an increase in NH_4^+ immobilisation disrupt the pathway to nitrogen gas (N_2) production substantially reducing (by > 90%) rates of denitrification and “anammox” in recently planted oil palm relative to primary forest. Potential nitrous oxide (N_2O) emissions were greater than potential N_2 production and remained unchanged across the chronosequence indicating a potentially increased ratio of N_2O:N_2 emission when soils were first disturbed. These results are an important precursor to studies that could yield improved estimates of regional N turnover and loss in Southeast Asia which will have global implications for N biogeochemical cycling.