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Distinct N2O yields of AOB and AOA driven ammonia oxidation across a range of Oregon forest soils

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Ammonia oxidation, as the first and limiting step of nitrification, is a critical process in global N cycling and an important source of nitrous oxide (N2O). Previous studies reported strong contrasts in potential nitrification rates and niche separation of ammonia oxidizing bacteria (AOB) and archaea (AOA) in three acid Oregon forest soils depending on tree stands. In the present study we were interested in the potential contribution of AOB and AOA to nitrification-derived N2O in these soils. We performed soil slurry incubations amended with NH4+ and determined the specific N2O yields of AOB and AOA using inhibitor techniques. Despite large differences in edaphic factors, potential nitrification rates, and niche partitioning, AOB- and AOA-mediated nitrification displayed fairly stable and distinct N2O yields. The N2O yields ranged from 0.11 to 0.17% for AOB and from 0.03 to 0.08% for AOA, which is in agreement with findings of previous pure culture and soil studies. Nitrite accumulation was observed in only one soil, upon NH4+ stimulation of AOB growth, without showing any effect on the apparent N2O yield. The partitioning between AOB and AOA activity was strongly affected by soil pH and nitrogen status, but there was no effect of these variables on the group-specific N2O yield. Together, this suggests that N2O yields of different ammonia oxidizing microorganisms are under tight biochemical control and that the potential contribution of nitrification to N2O emission in acid forest soils can be predicted from AOB - AOA partitioning.