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N-losses from Austrian forest ecosystems. A modelling approach using climate change and N-deposition scenarios.

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Increased nitrogen deposition has led to changes in the carbon (C) and nitrogen (N) dynamics in forest ecosystems, thereby possibly causing increased carbon sequestration. N deposition can also lead to increased nitrogen losses via soil gas emissions and nitrate leaching to the groundwater.
In addition to N deposition, climate has changed tree growth, and the soil carbon and nitrogen cycle. Soil warming may lead to enhanced loss of C and N via microbial respiration, nitrification and denitrification. The net effect of N deposition and climate change on N losses remains largely unknown.
In forests, large amounts of N that dominate N balances are related to N-gas production by soil microbes. The gases NO, N2O and N2 are produced by microbial processes in soils and are perhaps the least well-understood components of the N cycle. This is mainly caused by limitations in measuring techniques (especially for N2) and the high spatial and temporal variability of fluxes. Large uncertainty in N balances i.e. “missing N” has led to increased interest in soil N-gas production as an important N loss component. As an example, denitrification may be an important and underestimated term in N budgets of upland forests (1–24 % of atmospheric N inputs).
In this study, we are exploring possible future changes in forest C and N cycling and associated N-losses as influenced by N deposition and climate change. To do so first we use data from 8 long-term forest ecosystem monitoring stations in Austria to calibrate the process oriented ecosystem model LandscapeDNDC with detailed plant and soil process descriptions. Second we use the LandscapeDNDC together with climate and N-deposition scenarios for exploring changes in C and N cycling of different forest types until 2100.