

Response of N₂O emissions to logging residue piles of Norway spruce, Scots pine and silver birch

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As a result of modern harvesting technic, logging residues piles are created on the forest floor. Under these piles, soil nitrogen (N) cycling processes, especially net nitrification, can be accelerated on clear cut area. When N is transformed to more mobile form, the risk for N losses via nitrous oxide (N₂O) emissions from the forest floor may increase.

In our earlier study, we noticed stimulated net nitrification on the same site (Törmänen et al. 2018).

Here we studied how logging residue piles of three common tree species in Finland, Norway spruce (*Picea abies* (L.) Karst.), Scots pine (*Pinus sylvestris* L.) and silver birch (*Betula pendula* Roth.), influence gaseous losses of N after clear cutting.

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STUDY SITE

We had four treatments; three tree species treatments consisting of 40 kg m⁻² of fresh logging residues and control plot without residues as an additional treatment.

Effects of logging residue piles on N₂O emissions were monitored over 4 growing season. Simultaneously soil temperatures were recorded over 2 growing season. Soil denitrification activity and the contribution of nitrification and denitrification to N₂O production were determined in laboratory experiment (the acetylene (C₂H₂) inhibition method).



A Norway spruce dominated mixed stand on a mineral soil site was clear-cut and N₂O emissions were monitored with closed chamber technic.

RESULTS

- Logging residue piles lowered and balanced fluctuation of soil temperatures
- N₂O fluxes peaked under the piles during the second and third growing season after the establishment of the piles
- There was a positive correlation with soil net N mineralization and net nitrification (Törmänen et al. 2018, FORECO)
- The production of N₂O was driven by both nitrification and denitrification processes, the proportion depending on the tree species.

- Effect of logging residues of spruce, pine and birch were studied on a clear-cut
- Logging residue piles accelerate N losses as gaseous form; however Inconsistent fluxes tended to be low
- Spruce residues tend to stimulate N₂O emissions longer compared to other tree species
- Most of the N losses occur through soil percolation waters in the form of nitrate
- These results have implications for sustainable and productive forest management practices and nutrition of re-growing vegetation

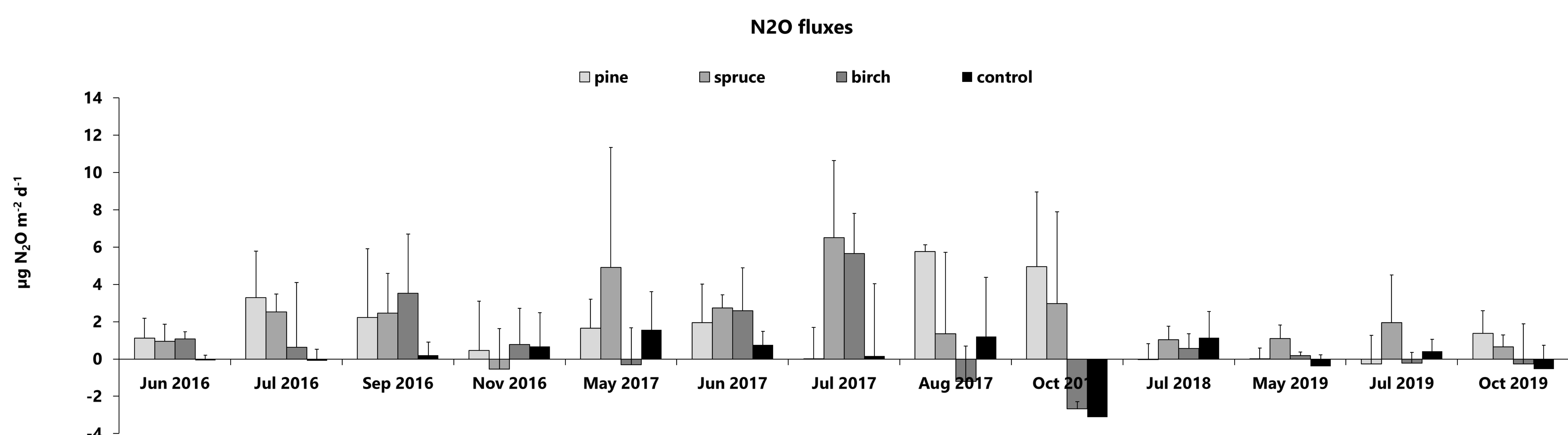


Figure 1. Average nitrous oxide (N₂O) fluxes in years 2016 – 2019 (n = 4) between all individual tree species and control treatments. N₂O fluxes were detected in the field with the closed chamber method.