

Universiteit Utrecht

Modelling global nitrate leaching from natural ecosystems: impact of N deposition, climate, and CO₂ concentration Maarten Braakhekke¹, Karin Rebel¹, Stefan Dekker¹, Rens van Beek², Marc Bierkens², Ben Smith³, Martin Wassen¹

INTRODUCTION

Atmospheric N deposition has risen dramatically during the last century due to fossil fuel NOx emissions. The resulting increased N availability will stimulate productivity of natural ecosystems, which are mostly N limited.

Many ecosystems will become saturated with N, leading to increased nitrate leaching, which may cause groundwater pollution and eutrophication of aquatic ecosystems.

Nitrate leaching rates are difficult to predict since the ecosystem N balance is also influenced by atmospheric CO_2 concentration, which influences productivity, and temperature, which controls soil N mineralisation.

We aim to disentangle the effects of N deposition, climate, and CO₂ concentration on ecosystem nitrate leaching rates by means of a factorial simulation experiment with a dynamic global vegetation model.

Total global nitrate leaching for the five model **experiments** *Rising temperature stimulates nitrate* leaching due to increased mineralisation. Increasing CO₂ leads to lower leaching due higher vegetation uptake



Smith et al., 2001, Global Ecol. Biogeogr. Smith et al., 2014, Biogeosciences Lamarque et al., 2013, Atmos. Chem. Phys

land carbon, water and nitrogen fluxes.



true N deposition

1) Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, the Netherlands 2) Department of Physical Geography, Utrecht University, Utrecht, the Netherlands 3) Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden

Copernicus Institute of Sustainable Development, Environmental Sciences Group

Faculty of Geosciences Water, Climate, & Ecosystem project

Sim	N dep.	climate	CO ₂
1	constant	constant	constant
2	true	constant	constant
3	constant	true	constant
4	constant	constant	true
5	true	true	true
			1.5
			1
			0.5

< Different responses of ecosystems to changes in drivers

(

Shown are two ecosystems in W. Europe with similar drivers, but very different behavior related to their initial N status.

CONCLUSIONS

N leaching is mainly determined by N deposition and N mineralisation

Global warming and rising N deposition have a positive effect of comparable magnitude while rising CO₂ concentration has a negative effect

The combined effect of the three drivers is an increase of ~40% over the last century.

Depending on their initial N status ecosystems respond very differently to increasing N and temperature

m.c.braakhekke@uu.nl

