



HAL
open science

Combined effect of atmospheric nitrogen deposition and climate change on temperate forest soil biogeochemistry: a modelling approach

Noémie Gaudio, Salim Belyazid, Simon Rizzetto, Arnaud Mansat, Harald Sverdrup, Anne Probst

► To cite this version:

Noémie Gaudio, Salim Belyazid, Simon Rizzetto, Arnaud Mansat, Harald Sverdrup, et al.. Combined effect of atmospheric nitrogen deposition and climate change on temperate forest soil biogeochemistry: a modelling approach. 19th biennial ISEM Conference - Ecological Modelling for Ecosystem Sustainability in the context of Global Change, Oct 2013, Toulouse, France. hal-02746093

HAL Id: hal-02746093

<https://hal.inrae.fr/hal-02746093v1>

Submitted on 3 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Combined effect of atmospheric nitrogen deposition and climate change on temperate forest soil biogeochemistry: a modelling approach

Noémie GAUDIO^{1,2}, Salim BELYAZID³, Simon RIZZETTO^{1,2}, Arnaud MANSAT^{1,2}, Harald SVERDRUP⁴, Anne PROBST^{1,2}.

¹ Toulouse University; INP, UPS; EcoLab (Laboratoire écologie fonctionnelle et environnement)

ENSAT, Avenue de l'Agrobiopole
F-31326 Castanet Tolosan

² CNRS; EcoLab

F-31326 Castanet Tolosan

³ Belyazid Consulting and Communication AB

Österportsgatan 5C

S-21128 Malmö

⁴ Applied Systems Analysis and Dynamics Group, Chemical Engineering,

Lund University, Box 124

S-22100 Lund

Abstract

Anthropogenic activities highly contributed to increase nitrogen (N) and sulfur (S) atmospheric emissions since 1880. Since the 1980's, within Geneva Convention on Long-Range Transboundary Air Pollution, European countries have joined their efforts to abate atmospheric pollution. In France, atmospheric S emissions decreased by 80% whereas the decrease was less obvious for N. Thus, atmospheric deposition and effects of N on ecosystems remain a major research challenge during last decades.

Atmospheric N deposition is known to severely impacts forest ecosystem functioning by influencing soil biogeochemistry and nutrients balance, and consequently, tree growth and global forest health and biodiversity. To assess the impact of N deposition on ecosystems, the concept of "N critical loads", defined as the maximum N deposition that an ecosystem

can tolerate without any harmful effects and changes, was developed. Moreover, because climate influences greatly soil processes, climate change and atmospheric deposition must be conjointly taken into account to assess the evolution of forest ecosystem status over time.

To test different scenarios and their potential interactions on the long term, dynamic biogeochemical models such as ForSAFE have been developed. Here, we run this model to predict the combined effect of atmospheric deposition and climate change on two temperate French forest ecosystems dominated by oak and spruce, and more precisely on forest soil biogeochemistry, from nowadays to 2100. Two atmospheric N deposition scenarios were tested (CLE – Current Legislation in Europe – and MFR – Maximum Feasible Reduction) combined to three climate SRES scenarios from IPCC (current, A2 – the worst climate scenario – and B1 – the best climate scenario). After a step of calibration and validation, the changes in base saturation and N content in soil were compared between all these scenarios combinations and N critical loads were estimated and discussed. Thus, acidification and eutrophication recovery of the two forest ecosystems could be predicted up to 2100.