Dose-Response:
An International Journal
January-March 2022:1–2

DOI: 10.1177/15593258221075512
journals.sagepub.com/home/dos
SAGE

Nitrogen Critical Loads: Critical Reflections on Past Experiments, Ecological Endpoints and Uncertainties

Jaap C. Hanekamp[1,2] and William M. Briggs[3]

Keywords
critical loads, dose-response, nitrogen, uncertainty

In our paper *Nitrogen Critical Loads: Critical Reflections on Past Experiments, Ecological Endpoints and Uncertainties*, we tackle an important aspect of a fundamental ecological topic that hitherto has little been reflected upon within the environmental discourse. As a working definition, nitrogen critical loads (NCL) are believed to be the limits above which there is a risk of significant reduction in habitat quality, due to the eutrophication, acidification and pressures on biodiversity (species richness) from atmospheric nitrogen deposition. Nitrogen critical loads were and are regarded as *locus communis* on which labyrinthine edifices of science and policy are built.

One such scientific edifice of prime importance in the Netherlands is the model AERIUS. It models both emissions and deposition levels of nitrogen compounds (e.g. nitrogen oxides and ammonia) for nature areas, affected by new or expanding economic activities such as agriculture, traffic on newly planned roads and industry. As ecological points of reference, AERIUS contains nitrogen critical loads of deposition for each type of habitat.

Ultimately, NCL are nothing other than ecological dose-response outcomes created from observational and experimental studies that have been published in the past 3 or so decades. Although some of these studies are thus hardly recent, they define current 'nitrogen' science and policies in the Netherlands and beyond. Therefore, my colleague and I decided to assess the methodological quality of some paradigmatical ecological studies on NCL. The NCL we scrutinised are related to a certain class of habitats.

Overall, we show that NCL are not well defined, and are subject to hitherto unrecognised forms of uncertainty, which critically impact the precision and actionability of NCL. For one, the official definitions of what a critical load is are to some extent clear with respect to political goals, but not clear with respect to repeatable or consistent parameters. Also, we show that overall there is a lack of real-world study design in the assessed papers. Moreover, expert judgement, which plays a substantial role in the NCL discourse, remains unscrutinised; that is, the certainty in these judgements is too high, and their bases are ambiguous. There needs to be a way to verify the accuracy of these judgements, especially if and when costly decisions will be made relying on them.

The latter is particularly important, as the new Dutch government is willing to spend large sums of money on the reduction of nitrogen deposition as to ostensibly ameliorate ecological conditions of nature areas comprising in total 172 400 ha, which is 1724 km^2.[1] In the coalition agreement between the four political parties (15th of December 2021), 25 billion euros is specifically reserved on the topic of nitrogen deposition until 2035. Again, the purported necessity for these large public funds is closely related to the NCL and the manner in which these are understood with respect to ecological impact of nitrogen deposition.

Sadly, this is not perceived by most, if at all. For that reason, we encourage the scientific community active within this discourse to take notice of our study as it also proposes study designs as to improve best-estimates of NCL, which need substantial improvement, scientifically and otherwise, as we show in our contribution. More importantly, it is a call to self-reflectively

[1]Science Department, University College Roosevelt, Middelburg, Netherlands
[2]Department of Environmental Health Sciences, University of Massachusetts, Amherst, U.S.A
[3]Independent Researcher

Received 4 January 2022; accepted 4 January 2022

Corresponding Author:
Jaap C. Hanekamp, Chemistry, Roosevelt Academy, Lange Noordstraat 1, Middelburg NL-4331 CB, Netherlands.
Email: hjaap@xs4all.nl

expand our knowledgebase on the ecological consequences, good and bad, of atmospheric depositions of nitrogen.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Jaap C. Hanekamp https://orcid.org/0000-0002-6575-3658

References

1. Bij12. *Landelijke monitoringsrapportage Natura 2000 en Stikstof 2019*. Utrecht: BIJ12; 2020. https://www.bij12.nl/wp-content/uploads/2020/07/Landelijke-monitoringsrapportage-Natura-2000-en-Stikstof-2019.pdf. Accessed January 3, 2022