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Ref.: General Scientific opinion on nitrogen measurements in soil and water bodies

To whom it may concern,

While not in the focus of my research expertise, I can pass a general scientific opinion on the need and validity of authentic and normed nitrogen measurements from environmental samples to determine a realistic environmental nitrogen deposition in comparison to simple extrapolation of data based on scenario models with few experimental data points for nitrogen determination.

Generally, the endogenous and exogenous nitrogen deposition (mainly from agricultural activity), is an issue causing excessive fertilization of soil- and water bodies, thereby changing the intrinsic biotic states, that negatively impacts biodiversity and may also drive climate change (<https://www.sciencedirect.com/science/article/abs/pii/S187734351100090X>; <https://www.sciencedirect.com/science/article/abs/pii/S187734351100090X>;  
<https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.1877>;  
<https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1001124>).

One example is nitrogen induced, excessive growth of microalgae resulting in release of toxins and death of invertebrate as well as vertebrates, such as fish in water bodies (<https://www.sciencedirect.com/science/article/pii/S1568988321000160>;  
<https://www.sciencedirect.com/science/article/pii/S2667010023000574>).



In most European states areal nitrogen deposition is not actively measured but extrapolated from theoretical models, which are commonly based on outdated data sets, that are only derived from few point samples (<https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2435.13063>; <https://acp.copernicus.org/articles/23/7091/2023/>; <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2005JD005825>).

However, the validity of these models intrinsically depends on the sample number, measurement validity and sample density to derive model accuracy. Hence to increase predictability and validity of the current models, there is an urgent need for more experimental sampling of nitrogen from environmental probes (<https://www.sciencedirect.com/science/article/pii/S0147651321002918>; <https://www.sciencedirect.com/science/article/abs/pii/S0269749118339009>).

Specifically, the measurement of nitrogen using normed methods would increase the model accuracy in Natura 2000 regions, which are impacted by endogenous and exogenous nitrogen sources. Hence nitrogen measurements would significantly improve countermeasures and general managements activities of these important ecosystems. Experimental nitrogen measurements provide exact data about air- and soil derived nitrogen concentrations. As areal nitrogen concentration can vary significantly between even close sampling sites, a tight sampling array will provide a more exact representation of the real environmental scenario (<https://www.sciencedirect.com/science/article/abs/pii/S0048969721035361>). This process will eliminate data gaps and potential model errors. This will also enable researcher and lawmakers to derive adequate management systems using a best practice approach (<https://www.sciencedirect.com/science/article/abs/pii/S0048969724011458>; <https://agupubs.onlinelibrary.wiley.com/doi/pdfdirect/10.1029/2020gb006711>).

Moreover, a regular measurement of nitrogen concentrations in a predetermined sampling array would allow early warning and a fast counter measurement response once nitrogen concentration exceed legal limits. This will prevent ecosystem damage and will allow for a better management and preservation of sensitive ecosystems. Further, regular nitrogen measurements will assist in determining the sources (i.e. Agriculture, Industry, Transport) of excessive nitrogen influx into the ecosystem, which will be the main action point to start countermeasures and political actions.



In specific cases, the experimental determination of nitrogen concentrations and the hereby identified external sources (i.e. agricultural or industry emitters) may provide the legal basis to enforce nitrogen limits with emitting entities, which in turns ensures their compliance with environmental protection laws and measures.

In summary, while determining nitrogen deposition using model based calculations is a current standard method, the regular-, normed- and precise measurement of nitrogen deposition from environmental samples in tight areal arrays will significantly enhance the model accuracy and will enable environmental managers and law makers to derive rapid countermeasures. Moreover, these experimental nitrogen measurements will empower environmental managers and law makers to identify external nitrogen sources and industry emitters, thereby enforcing environmental protection actions Natura 2000-regions and beyond.

Sincerely,

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