The Dutch integrated approach to monitor and calculate nitrogen deposition in Natura 2000 areas

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Abstract

The Netherlands have developed a tool to monitor the nitrogen deposition in Natura 2000 areas, called AERIUS. With the same tool, the impact of individual projects on the nitrogen deposition in Natura 2000 areas can be calculated. The tool accounts for both nitrogen oxides and ammonia. The unique combination of the monitoring function and the calculation function makes it possible to apply area-oriented approaches to reduce nitrogen deposition in Natura 2000 areas and to facilitate the spatial planning of economic activities.

Keywords: nitrogen, deposition, Natura 2000

1. Introduction

The Netherlands have been very successful in reducing nitrogen deposition. The national average nitrogen deposition was between 2,500 and 3,000 mol nitrogen per hectare in the early-1990s. This has steadily declined to current levels of about 1,600 mol nitrogen per hectare. This is still too much for many sensitive ecosystems. The AERIUS tool was developed for determining the level of nitrogen deposition in Natura 2000 areas and the contribution of new projects and development plans (Heer et al., 2017). In this way, the system combines two important functions: monitoring the nitrogen deposition and calculating impacts of individual projects on Natura 2000 areas.

2. Monitoring

The development of the nitrogen deposition in a Natura 2000 area can be followed in time with the monitoring tool: AERIUS Monitor. This tool contains information about the sensitive ecosystems within the Natura 2000 area, i.e. the exact location of the sensitive plant species, the critical loads for the plant species, distance to the critical load, etc. as shown in Figure 1 for Natura 2000 area 'Naardermeer' in the Netherlands. In this way, detailed information about each nitrogen-sensitive Natura 2000 area in the Netherlands is publically available.

Fig. 1: Example of the information that is available for a nitrogen-sensitive ecosystem in Natura 2000 area 'Naardermeer' in the Netherlands.

This tool also gives insight in the contribution of different

emission sources to the total nitrogen deposition in the Natura 2000 area as shown in Figure 2.

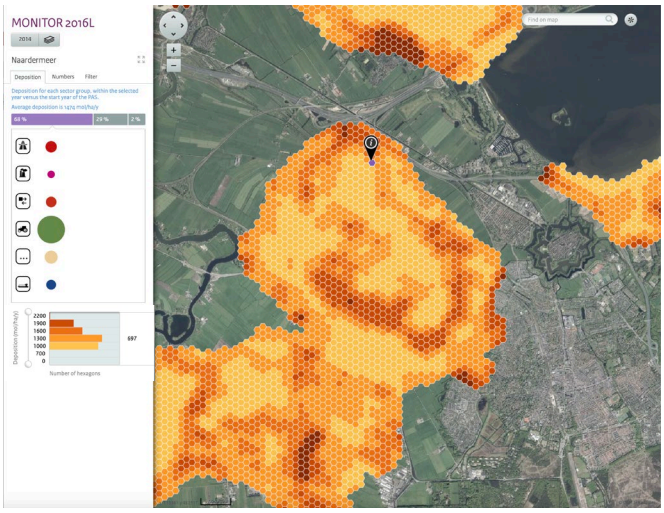

Fig. 2: Example of the total nitrogen deposition in Natura 2000 area 'Naardermeer' in the Netherlands.

The figure shows that the deposition in this nature area is rather variable ranging from 1000 to 2200 mol/ha, mainly due to the presence of very different vegetation types including several nitrogen-sensitive habitat types.

3. Calculating

The AERIUS tool also contains a module to calculate the change in nitrogen deposition due to individual projects: AERIUS Calculator. In the example shown in Figure 3, a traditional dairy farm with 200 cows is replaced by a modern low-emission dairy farm with 200 cows. Only the nitrogen deposition on nitrogen-sensitive habitat types is shown. As expected, the largest reduction in nitrogen deposition is close to the farm.

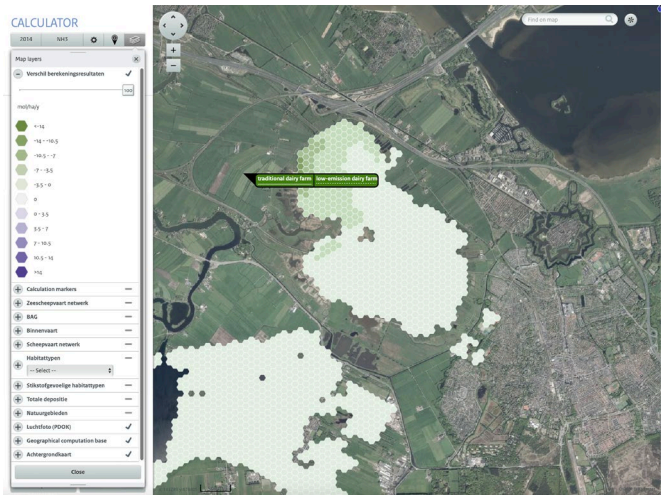

Fig. 3: Example of a calculation with AERIUS Calculator.

4. Further use and development

In this we demonstrate the possibilities with the AERIUS-tool. With the tool the contribution of various sources of nitrogen, e.g. traffic, agriculture, industry, to the deposition on specific ecosystems can be determined. The tool makes it possible for policymakers to decide what activities are possible at a local scale and what should be accomplished via generic policy to achive a reduction in the nitrogen deposition on the sensitive ecosystems. The AERIUS-tool will be expanded for calculating air quality such as NO_2 and particulate matter concentrations. In the future we are aiming for coupling AERIUS to an agricultural emission model so that the nitrogen issues associated to air, soil and water can be combined.

References

Heer, M. de, F. Roozen, R. Maas, 2017. The Integrated Approach to Nitrogen in the Netherlands: A preliminary review from a societal, scientific, juridical and practical perspective. Journal for Nature Conservation 35, 101-111. https://doi.org/10.1016/j.jnc.2016.11.006