

**Dutch Disaster.****Or: how to prevent significant effects of nitrogen deposition on nature (and politics).**

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**Abstract**

Since the 1980's the need for ecological measures to counteract the effects of nitrogen deposition has been recognized in The Netherlands. Since 1989 the government subsidizes both the scientific research needed (restoration ecology) and the implementation of measures in nature reserves. The strict protection of habitats in Natura 2000 sites made this program even more important. Especially since the Council of State's judgments that no permits can be issued for projects that will cause a further exceedance of critical loads in Natura 2000 sites. The only way out was to relate a permit to both source-oriented measures to reduce the exceedance and appropriate ecological measures to maintain (or even improve) the quality of habitats. This integrated approach was called the Programmatic Approach to Nitrogen; it got a legal status in 2015. It was designed in such a way that it would be the right answer to the strict protection of Natura 2000 sites as required by the Habitats Directive. It provided - among other things - an appropriate assessment for all Natura sites. It is believed to be the strictest implementation of the Habitats Directive to date, but not strict enough according to the European Court of Justice and the Dutch Council of State. They stressed the importance of scientific certainty. This led to a political crisis in The Netherlands.

Some lessons learned are pointed out and an update is given of the difficult situation with regard to permit procedures (how to avoid significant effects in combination with other projects?) and the need for drastic nitrogen emission measures.

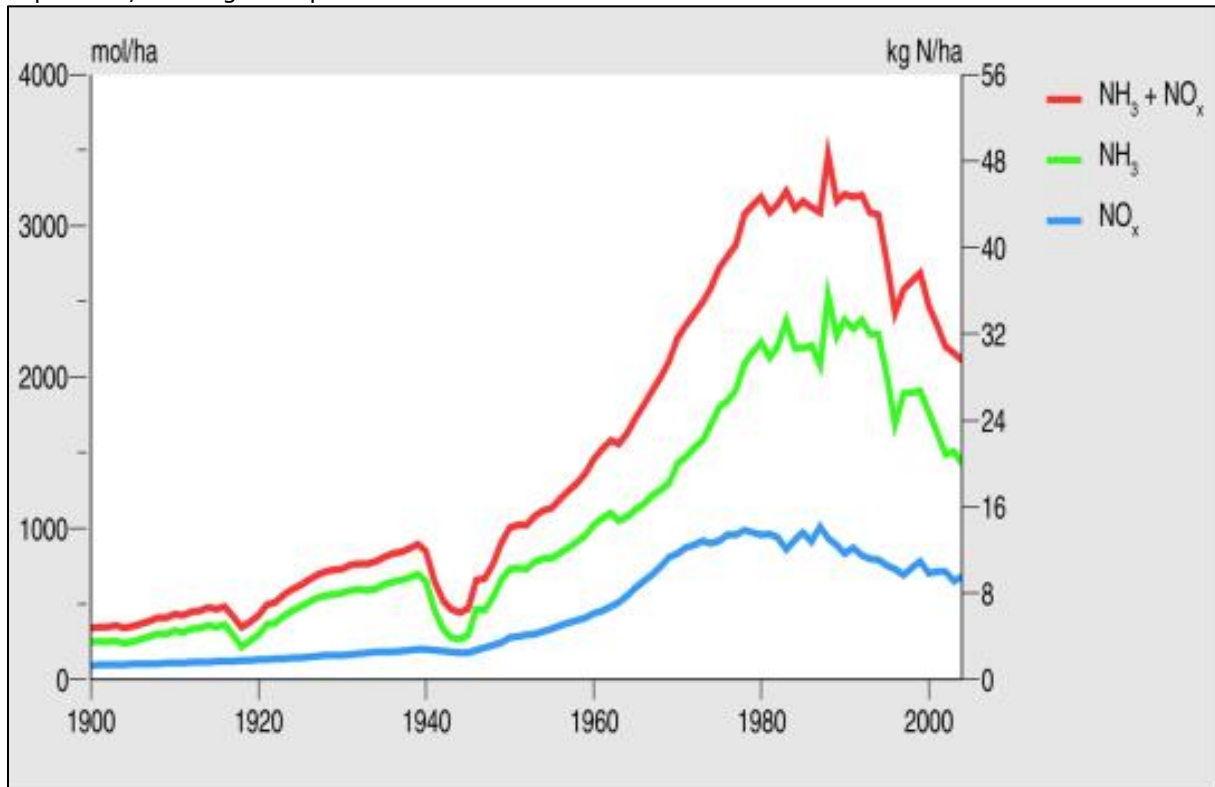
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Dear non-continental Europeans,

I'm glad that - although the political situation has been slightly altered recently - I can share with you some experiences regarding the impact of the Habitats Directive in relation to nitrogen deposition. I hope you can learn something from the Dutch, especially as our approach (which we thought was state of the art and very sophisticated) turned out to be a disaster.

In my contribution I will tell you about the huge nitrogen problems in my country: problems for nature protection and for politicians.

I will start with a short summary of the nitrogen problems that occur in The Netherlands. A large majority of the soils and natural vegetations in The Netherlands are sensitive to nitrogen deposition, causing eutrophication or acidification or both.

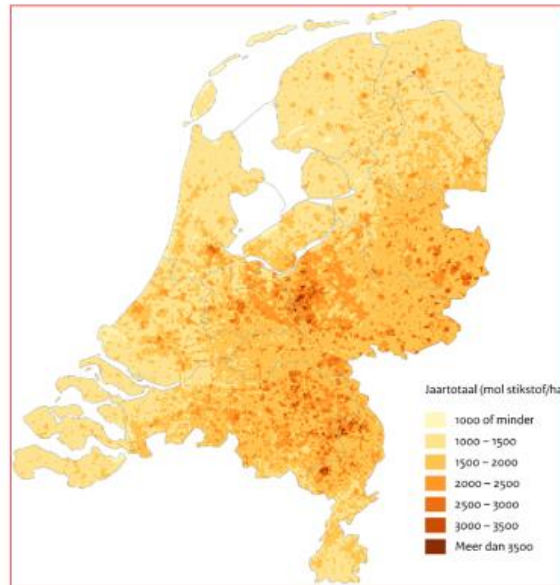


The total average deposition - the red line - exceeded the critical loads of heath pools and bogs already in 1920's. The critical loads of moderately sensitive habitats were exceeded since the 1950's. And the highest critical loads (more than 30 kilo's) were exceeded since 1970. In the 1980's deposition was at its peak. The need for drastic measures was identified and especially better agricultural techniques led to a marked decrease in deposition which is shown by the dropping of the green line representing ammonia.

## Nitrogen deposition (mol/ha/y)

from around 1000 (*coastal areas*)

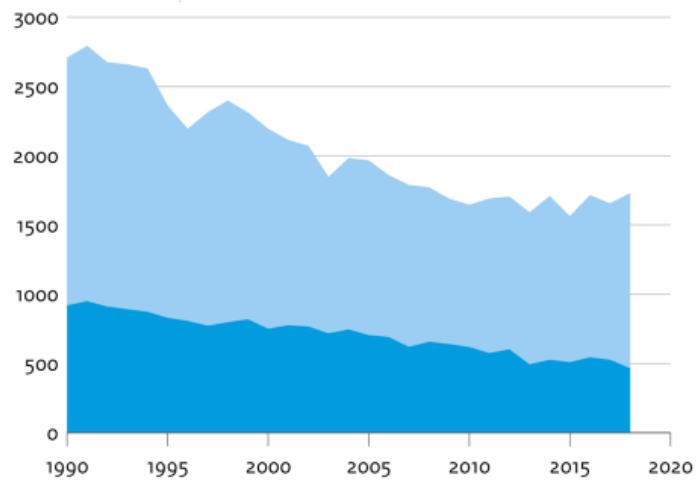
to over 3500 (*factory farming areas*)



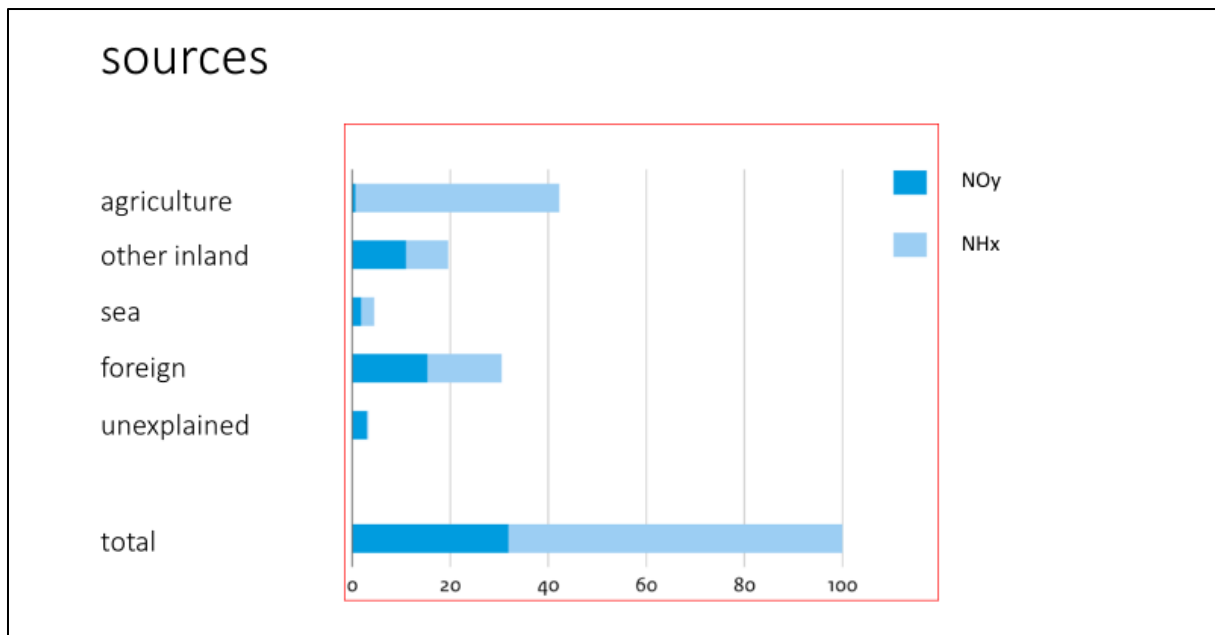
But The Netherlands is still the European country that suffers most from nitrogen deposition. Current nitrogen deposition levels are hardly ever below 1,000 mol per hectare per year and in some areas exceed 3,500 - especially where factory farming is present (in the centre, the east and the south of the country).

## trends

- reduced (NH<sub>x</sub>)
- oxidized (NO<sub>y</sub>)



Although deposition levels have dropped significantly, due to source-oriented measures in the sectors agriculture, traffic and industries, since 2010 total deposition is more or less stable, with nitrogen oxides still dropping and ammonia (from agricultural sources) increasing again.



More than 40% of nitrogen deposition originates from Dutch agriculture; some 30% comes from sources outside The Netherlands (also mainly from agricultural sources).

Since the 1980's the need for ecological measures to counteract the effects of nitrogen deposition has been recognized in The Netherlands. Since 1989 the government subsidizes both the scientific research needed - restoration ecology - and the implementation of restoration measures in nature reserves aiming at improvement of affected habitats. In recent years the provinces have taken the lead.

The strict protection of habitats in Natura 2000 sites made this research and implementation of measures even more important.

The Habitats Directive of 1992 made us aware of the importance of reaching Favourable Conservation Status for protected habitats and species on the long term. But on the short term article 6 of this directive is especially important: we have to avoid deterioration of every protected habitat and species at site level from the moment a site is protected.

Due to the precautionary principle, as a consequence there have been very strict Dutch court rulings. The Dutch Administrative Jurisdiction Division of the Council of State, comparable to the Administrative Court of the UK's High Court of Justice, concluded in 2008 that no permits can be issued for projects that will cause any further exceedance of critical loads in Natura 2000 sites. The reason for this is as follows.

Article 6 of the Habitats Directive says: "*Any* plan or project not directly connected with or necessary to the management of the site but *likely* to have a *significant effect* thereon, either individually *or in combination* with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives." And if these effects cannot be ruled out, a permit cannot be granted (unless the project must be carried out, in the absence of alternative solutions, for imperative reasons of overriding public interest, and only after taking compensatory measures).

To answer the question if a significant effect is likely, it is important to know on the one hand where critical loads in Natura sites are already exceeded (or are likely to be exceeded in the future). And on the other hand you have to predict whether or not the project will contribute to a further exceedance of the critical load. This seems simple, but a lot of information is needed to know for sure that a project will *not* contribute to such an exceedance.

In The Netherlands we use exact critical loads, no ranges, so that you can clearly calculate if there is an exceedance at a particular spot. The Council of State has adopted a specific report as the standard for critical loads. This report by Han van Dobben and others - including myself - was made in 2008 and revised in 2012 using both the European empirical ranges (published by the UNECE in 2010) and the results from simulation models. So there is no juridical discussion about whether or not there is a problem with nitrogen deposition when you know the critical load of a given habitat is exceeded.

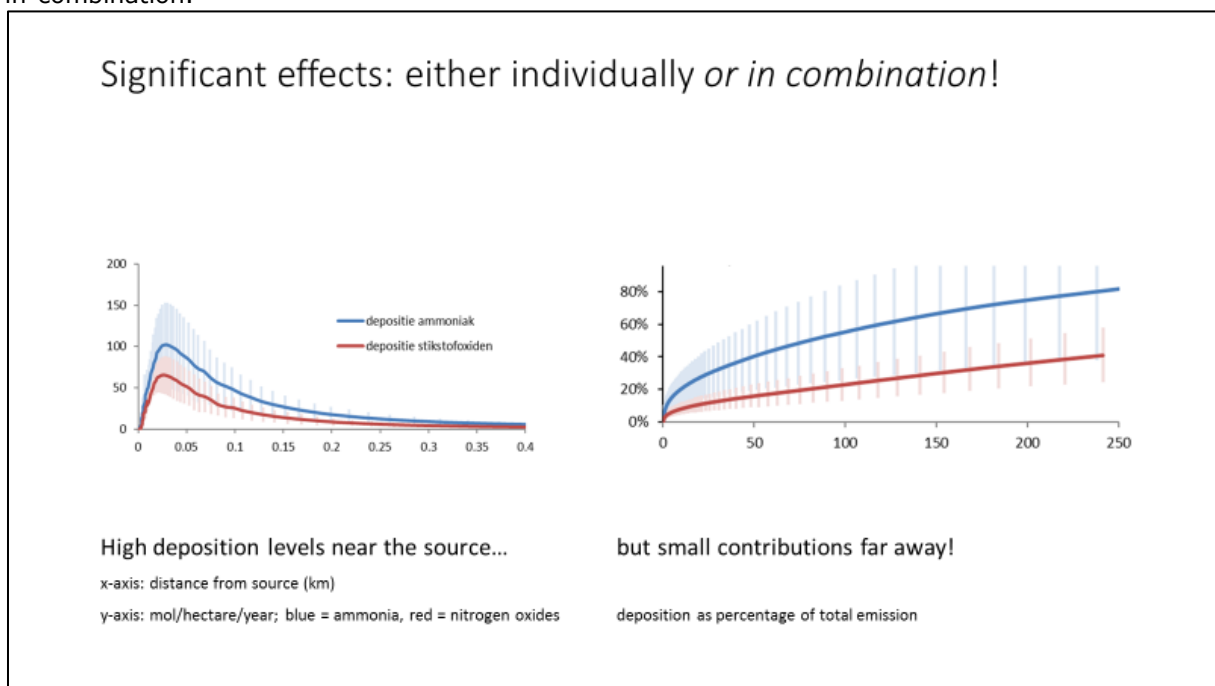
The most interesting part of the process, however, is determining the *contribution* of a project to the nitrogen deposition on a particular spot. As far as I know, in other countries there are problems

with implementing the requirement of the Habitats Directive to assess *cumulative* effects. Most projects do not cause such an amount of nitrogen deposition that measurable ecological effects on habitats will occur. But it is obvious that all projects *together* will contribute to those effects on *all* locations where the critical load is (or will be) exceeded. And that is exactly what the Habitats Directive requires when it says "is likely to have a significant effect [...] either individually *or in combination* with other plans or projects". So it is essential to recognize that also very small contributions are relevant in this respect. And that is exactly what has been concluded in the Dutch jurisprudence. The consequence is that it cannot be ruled out that for example an enlargement of one stable may have a significant effect - in cumulation - on a lot of Natura 2000 sites in several provinces.

This led to the conclusion that in most cases it would be impossible to grant a permit for a plan or project with nitrogen emissions. And that meant: a vast problem for farmers, industry, expanding motorways etcetera.

So, around the year 2008 there was an urgent need for solutions: both for nature and for the economy.

Because this aspect will get further attention during this conference, I would like to illustrate the difference between an assessment of the effect of an individual project and the effect of projects in-combination.



To the left you see the amount of nitrogen deposition from a source. As you can see, levels are high in the vicinity of the source. The blue line represents an average stable in The Netherlands, causing 100 mol (that is one and a half kilo) nitrogen per hectare per year at 30 meters from the stable. That will definitely lead to a significant effect on sensitive habitats. But after 100 meters it becomes increasingly difficult to determine whether or not this stable could cause a significant effect. But on the other hand, it is obvious that most of the nitrogen emitted will come down at large distances from the source, thus contributing to the overall problem of nitrogen deposition. Even at 80 kilometers from the source, only half of the nitrogen has come down, and 25% is still in the air after 200 kilometers. Note that the red line of nitrogen oxides is even lower: within 100 kilometers only slightly more than 20% has come down.

Juridically speaking you cannot ignore these scientific facts.

So from 2009 onwards in The Netherlands this problem was tackled in an integrated approach, supported by the European Commission. The only way out was to relate a permit to both *source-oriented measures* to reduce the exceedance and appropriate *ecological measures* to maintain or improve the quality of habitats. This integrated approach was called the Programmatic Approach to Nitrogen. It got a legal status in 2015.

The aim of the program was to combine nature protection and economic development. Politically speaking, this meant 'balancing the two goals'. But it is clear that the requirements of the Habitats Directive had to be decisive for the outcome.

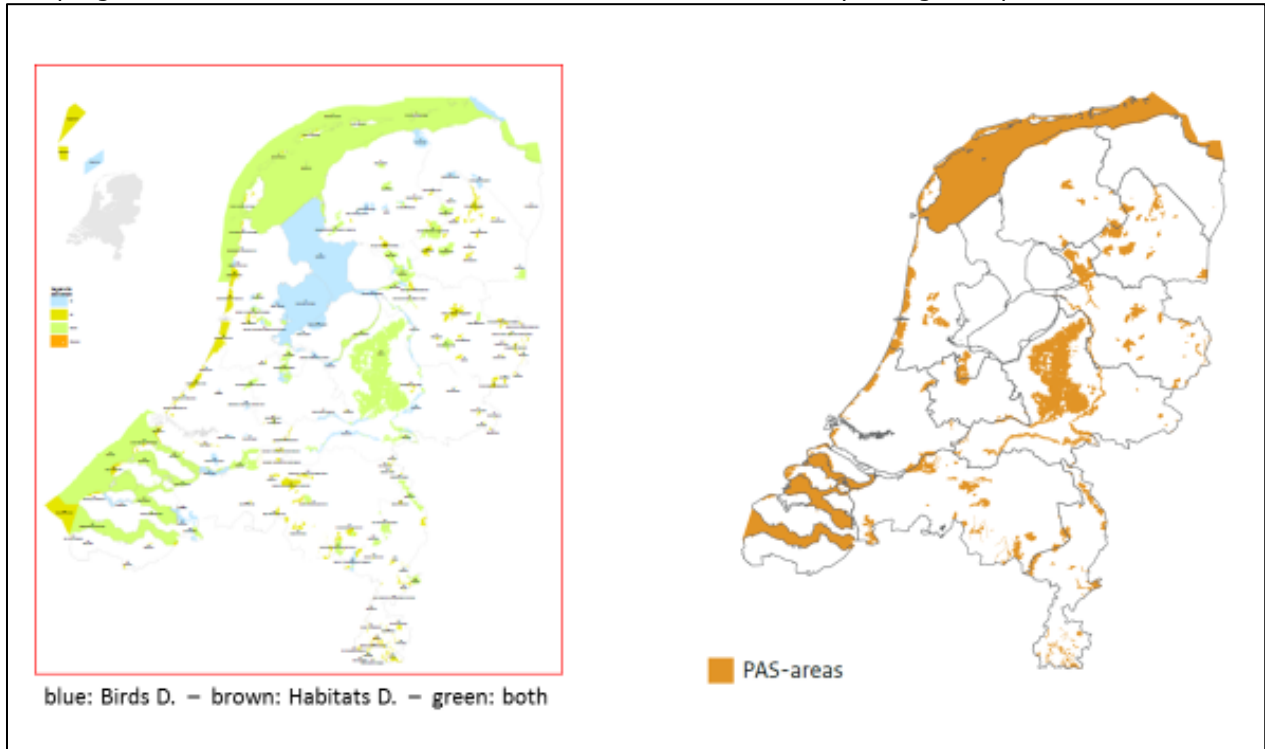
Permits could only be issued because the program formed the basis for both extra source-oriented measures, in combination with existing reduction on a European scale (the emission ceilings), and restoration measures for Natura 2000 sites.

It was regulated by law that the online calculation tool AERIUS has to be used for the permit application procedure.



This tool calculates how much deposition the project will cause on every hectare with critical load exceedance in all protected sites in our country. It takes into account the critical load of every habitat present and the current and expected total deposition. The tool will tell you then if it is possible to get the permit. In essence that was only possible if there was - what we called - room (or: scope) for development. This was determined by the expected deposition reduction on every hectare hexagon. A small portion of this reduction was available for the projects that needed a permit.

The program contained a list of Natura 2000 sites that are affected by nitrogen deposition.



If the critical load of just one habitat on just one hectare is exceeded, a site was relevant for the program. This was the case for 118 out of 162 Natura sites. Only 9% of the 130 sites with nitrogen sensitive habitats do not suffer from exceedance of critical loads.

As I said before, restoration measures were of the utmost importance for the programmatic approach and will be in the future. Deterioration cannot be stopped when critical loads are exceeded unless effective measures are being implemented.

So, in 2008 there was an urgent need for *scientifically* based *practical* information for all (!) nitrogen sensitive habitats. This information had to have the character of a medical handbook, so to speak. Because we had to know: what kind of treatment is possible? And that meant for each nitrogen sensitive habitat knowledge about:

- its ecological requirements
- the adverse effects of nitrogen deposition
- other circumstances that coincide
- possible measures against the adverse effects of nitrogen deposition
- possible measures for sustainable ecosystem recovery, and
- expectations about effectiveness of the measures

This scientific knowledge was needed for every nitrogen sensitive habitat, because if it would be uncertain how to counteract the effects of nitrogen deposition for just one habitat on one hectare in a Natura 2000 site, no deposition on that site can be permitted.

The question was then: how do we get the proper information?

It was obvious that the most important source of knowledge would be the OBN Knowledge Network. OBN is the Dutch abbreviation for Development and Conservation of Nature Quality. This network is also known as Knowledge Network for Nature Restoration and Management. Over the decades many reports were written about restoration ecology, based on thorough scientific research. But these results were not available in a ready-made form. The available information was very scattered and not fit to the requirements of the Habitats Directive. So 50 authors and many other scientific and field experts had to work together to make an overview of about 1800 pages, with a huge task for the editors like myself. In this overview obviously also knowledge from outside the network has been used, from both national and international experts. There were lots of discussions in groups and between authors and editors before we could conclude that we had appropriate measures for every nitrogen sensitive habitat.

The complete report was reviewed by outstanding independent scientists from three countries in three rounds. And after that, the report was published in 2014 as 'Recovery strategies for nitrogen-sensitive habitats'.

In the report a large comprehensive table is presented with all available measures and their applicability in the 75 habitats.

### The comprehensive table in part 1

The character of the measures can be described as follows.

Firstly there are measures directed against the adverse effects of nitrogen deposition, like:

- sod cutting
- (more frequent or additional) mowing and grazing
- removing encroaching shrubs and trees
- liming

These measures only treat the symptoms by removing excess nitrogen, removing excess vegetation or artificially neutralizing acidified soils and ground water bodies.

Secondly there are measures aiming at sustainable ecosystem recovery, like:

- reshaping the landscape by wind erosion and sedimentation in coastal dunes
- or restoring the hydrological circumstances and relations in brook valleys and raised bogs

### Status of the measures

- Proven (*B*)
- Rule of thumb (*V*)
- Hypothesis (*H*)
- Grey: unknown
- Black: not applicable



The status of the measures is categorized as follows:

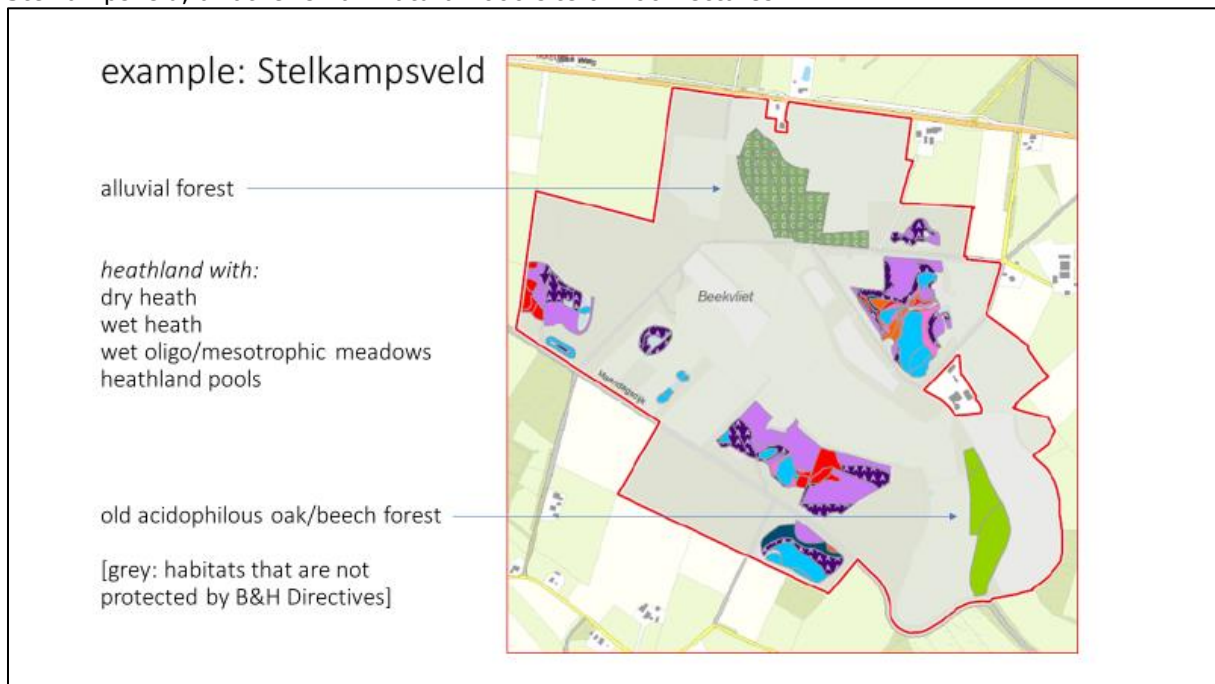
- a proven measure has the highest status
- rule of thumb means that the measure may in many cases have the positive effect described in the text, but this is not certain.
- a hypothesis means that by logical thinking, a measure has been formulated that has not, or hardly, been tested, but which would be very useful to test because it could prove very effective. The hypothesis may be based on analogies (the measure is a rule of thumb or a proven measure in a closely related habitat type) or by processes we think we understand well, but which have not yet been tested in practice.

All three categories were applicable in the context of the Programmatic Approach. But other measures were not, including the black cells in the table.

All this information has been used in a webtool for all those people who had to use it in so called site analyses. These documents are in fact ecological assessments for each site that was dealt with in the program, with an analysis of the quality of the habitats, an analysis of the problems caused by nitrogen deposition, and a management plan for the site using the officially approved ecological measures from the report. They are also part of the Natura 2000 management plans.

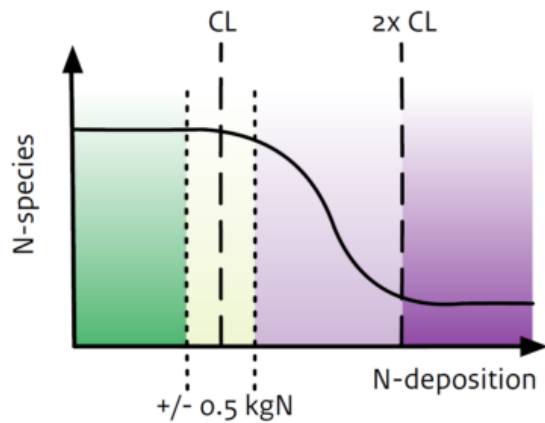
The implementation of ecological measures has been immensely intensified with the start of the Programmatic Approach. The effects are being monitored, because we want to be sure that will happen what we believe will happen: successful restoration or at least no further deterioration.

I will show you an example of the type of information you can find in a site analysis of the Stelkampsveld, a rather small Natura 2000 site of 100 hectares.



The protected habitats are alluvial forest, dry heath, wet heath, wet oligo/mesotrophic meadows and heathland pools, and old acidophilous oak/beech forest.

## Exceedance of critical loads



On maps we present the exceedance of critical loads in four classes, although the exact figures are used in the calculation tool AERIUS. The figure shows a simplified dose effect curve. Green means: no exceedance, grey means: half a kilo below or above the critical load (which is treated as: the critical load is exceeded), lilac means: not more than twice the critical load and purple means: severe exceedance: more than twice the critical load.

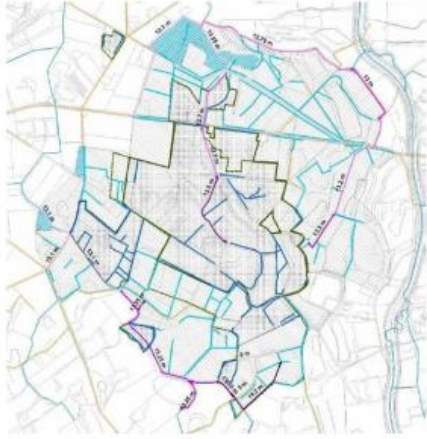
## CL-exceedance 2014 and 2030 per hectare-hexagon



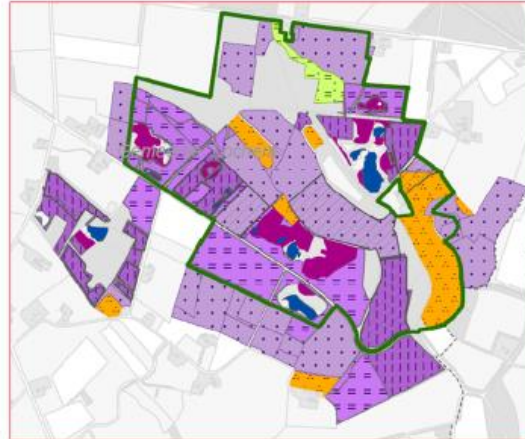
These maps show the exceedance per hectare in hexagons at the start of the program (2014) and in 2030. Note that some hexagons turn grey or even green due to source-oriented measures in The Netherlands and abroad.

## internal and external measures

related to water courses and ground water



dredging, removal of encroaching trees/shrubs, nature development



And here you see some maps with internal and external measures that had to be implemented in the first period of the program, like hydrological measures on the one hand, and on the other hand dredging of heathland pools and removal of encroaching trees and shrubs, complemented by nature development.

## Going to court



We thought that this approach was sophisticated and state of the art. It could turn out to be good for nature protection and good for the economy. But the program was challenged in court. The Dutch Council of State thought that the program complied with the requirements of the Habitats Directive, but they were not completely sure, because several elements were never tested in court at the European level. So they asked the European Court of Justice to answer several questions. These answers came in November 2018 and surprised us - and you, I suppose.

The court ruled that

- A *national program* which allows to authorize projects on the basis of a comprehensive and thorough 'appropriate assessment' for all affected sites at the same time is compatible with article 6, third paragraph, of the Habitats Directive.

- And it is possible to exempt projects which do not exceed a certain *threshold value* (in terms of nitrogen deposition) from the requirement for individual approval, if significant effects are ruled out in the appropriate assessment of the national program. - So far the good news. But:
- *Grazing* of cattle and the application of *fertilizers* may be classified as a 'project' and thus have to be *appropriately assessed* (according to article 6, third paragraph, of the Habitats Directive), because it can not be ruled out that they cause a significant effect by nitrogen deposition on Natura sites. Such an activity may only be exempted from a new authorization procedure, in so far as it constitutes a single operation characterized by a common purpose, continuity and the location and the conditions in which it is carried out being the same - and thus causing no more nitrogen deposition than at the moment the affected sites became protected.
- And finally: an appropriate assessment may *not take into account* the existence of 'conservation measures' within the meaning of paragraph 1 of article 6, 'preventive measures' within the meaning of paragraph 2 of that article, [protective] measures specifically adopted for a program or 'autonomous' measures if the expected benefits of those measures are *not certain at the time of that assessment*.

Following this ruling, the Dutch Council of State ruled, among other things, that

- The program does not meet the specific requirements of the Habitats Directive as clarified by the European court.
- Grazing of cattle and the application of fertilizers have to be appropriately assessed.
- The thresholds, below which a permitting procedure was not necessary, were not assessed appropriately, which means that no threshold whatsoever is in place from now on.
- The source-oriented and ecological measures of the program are important as an implementation of paragraph 2 of article 6, but cannot be taken into account in the appropriate assessment.
- Only measures whose effects are *certain* may facilitate permitting new projects which cause nitrogen deposition and only if they are *not needed for the conservation objectives* of the sites.
- And those measures have to be *clearly linked to the projects* which need a permit.

## Protests and political crisis



- Farmers demonstration in The Hague
- Cabinet announces speed reduction on motorways to lower nitrogen deposition facilitating permits for building houses (causing extra deposition)



The ruling of the council was a disaster for all economic sectors that produce nitrogen by combustion and for the agricultural sector. From one day to the other no permits could be granted anymore, while the absence of applicable thresholds resulted in the need for permit procedures even for projects which produce only very small amounts of nitrogen.

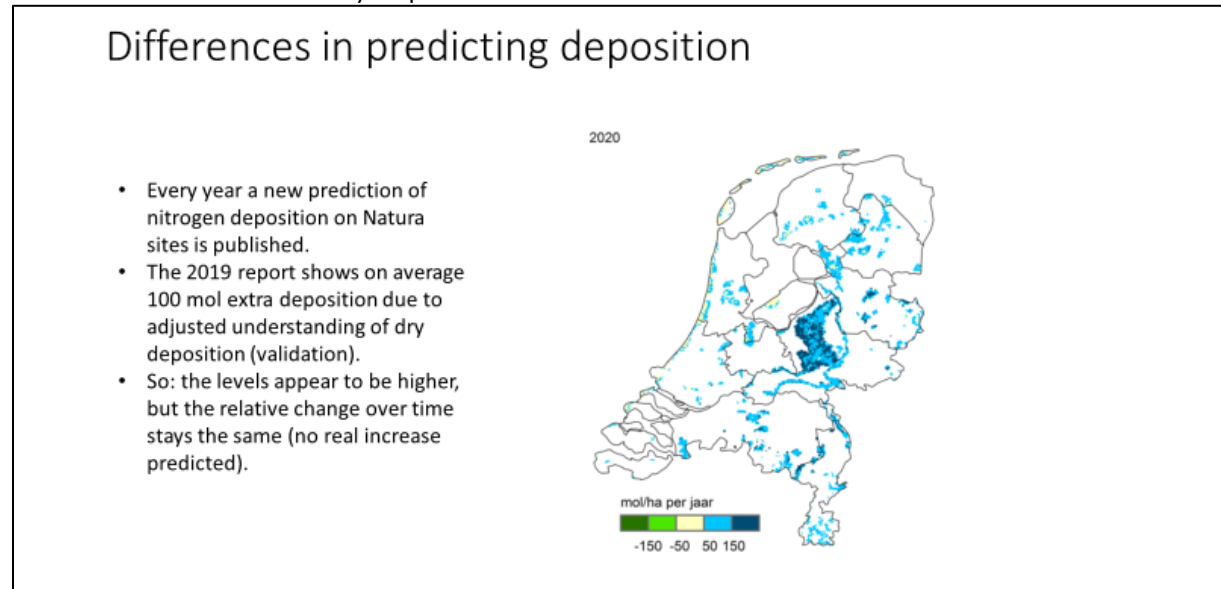
This led to massive demonstrations in The Hague. The farmers came first and later the construction companies, both with intimidatingly large material.

Prime minister Rutte said this was the worst crisis in his political career. Since last summer the ministries and the provinces are working feverishly to make it possible again to grant permits for all economic sectors, starting with the construction sector, because there is an urgent need for houses. Therefore the cabinet announced last November a speed reduction to 100 km/h on all motorways to lower nitrogen deposition from traffic, facilitating permits for the construction of houses (causing extra deposition).

In the mean time several old discussions pop up again. Like: is nitrogen really as bad as they say? But also more serious discussions take place, for example about the reliability of modelling nitrogen deposition. An official advisory committee will this month give an advice about improving the measuring and modelling of nitrogen deposition.

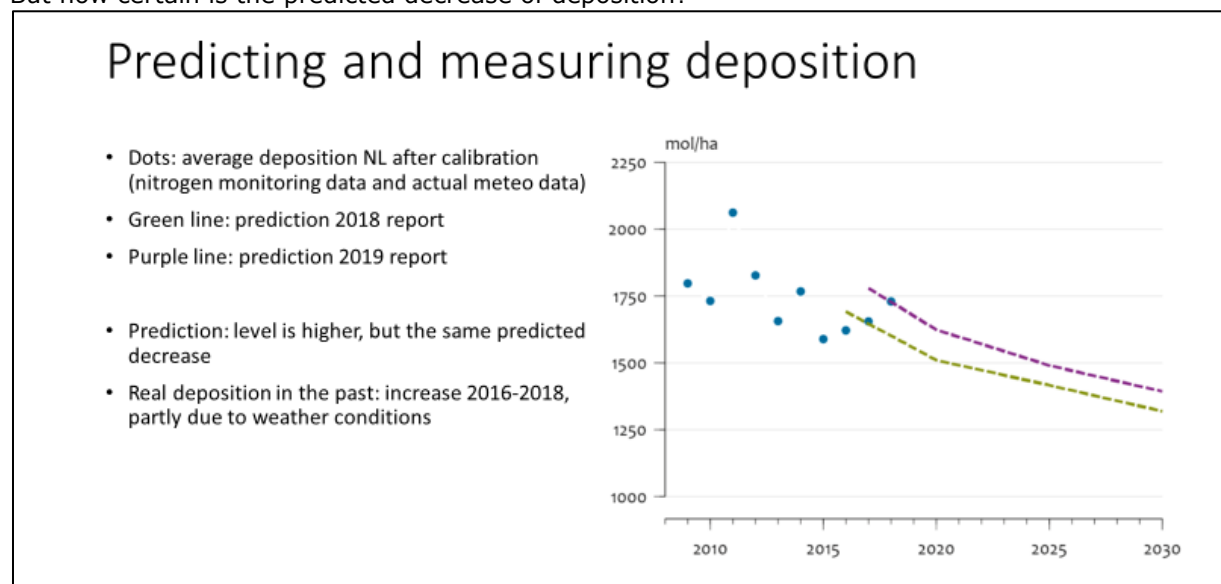
One of the issues the committee has to tackle is: how can you rule out the effect of nitrogen deposition far away from a source? Is the outcome of the AERIUS model certain enough to refuse a permit? But on the other hand: is this the right question? You have to refuse a permit if effects can not be ruled out, so: the question of evidence should work the other way around - is there evidence that the extra nitrogen does not lead to a significant effect?

Another issue is the reliability of predictions.



I can illustrate this with this map of Natura sites. Every year a new prediction of nitrogen deposition on Natura sites is published. The 2019 report shows on average 100 mol extra deposition compared to the 2018 report, due to an adjusted understanding of dry deposition caused by the validation of the model using field monitoring results. So: the deposition levels appear to be higher, but the relative change over time stays the same. That means that no real increase is predicted.

But how certain is the predicted decrease of deposition?



In this figure the dots represent the average deposition in The Netherlands after calibration by using nitrogen monitoring data and actual meteorological data. The green line is the prediction of the future decrease according to the 2018 report and the purple line the prediction according to 2019 report. As you can see, the predicted level is higher in the 2019 report, but the decrease is the same. The dots show the real deposition in the past: not the previously predicted decrease, but

an increase from 2016 onward, partly due to weather conditions (hot and dry summers). So the judges were right in saying that predictions are not certain!

There is also another advisory committee at work. This committee has already issued a first advice with a clear message: "not everything is possible", meaning: we can not continue to produce so much nitrogen. There is a need for drastic nitrogen emission reduction.

So we are now working on two ambitious policy programs:

- one on nitrogen emission reduction for the next 30 years, aiming at solving the problem in 2050;
- and one on nature restoration and improvement, aiming at reaching favourable conservation status for all protected habitats and species in 2050.

Dear participants of this conference, I'd like to end my speech with some key messages:

- 'Death by a thousand wounds' is, according to the advocate general of the European Court, the key problem of nitrogen. Therefore, assessing a project "in combination with other plans or projects" is needed. The Dutch approach was very strict compared to other countries, but not strict enough according to the judges. This raises the question: where does this end?
- The critical load is also a key factor. It is important not to question the importance of using it in juridical procedures. But on the other hand it is necessary to find a (new) way of using the implementation of both nitrogen emission measures and ecological measures (on the site level) to facilitate the permitting process.
- Article 6.3 of the Habitats Directive appears to be stricter than most of us thought. What does this mean for the (new) situation in the UK? I can not answer this question for you, perhaps we can come back to this in the discussion this afternoon.

Thank you for your attention.