

# Meeting minutes

4 May 2018

**Contractor** Umweltbundesamt / Federal Environment Agency  
**Meeting date** 2 May 2018  
**Meeting venue** Umweltbundesamt, Bismarckplatz 1, Berlin  
**Participants** see Participants List of Workshop  
**Distribution list** Participants of Workshop

**Subject** **German Nitrogen Budget 2010-2014 (DESTINO project)**

## 1. Welcome, objectives of the project DESTINO and relevance for the Expert Panel on Nitrogen Budgets (EPNB)

Markus Geupel welcomes the participants and explains the dual function of the workshop:

- Presentation and discussion of the provisional results of the DESTINO project for the German Nitrogen Budget (today)
- Meeting of the EPNB including as main agenda point the feedback of the DESTINO team on the practicability of the Annexes to the Guidance Document for the development of the German National Nitrogen Budget (NNB).

Markus Geupel gives an [introduction to the DESTINO project](#). He shows nitrogen related environmental risks in Germany, nitrogen containing emissions to the atmosphere, exceedances of critical nitrogen load for eutrophication, exceedances for nitrate in ground-waters and coastal areas. He reviews the history of nitrogen activities in relation to NNB in Germany and gives a brief summary of NNB activities of EPNB and its implementation in legislation (EU Dir 2016/2284). Finally, he presents the current nitrogen activities in Germany in relation to the development of a nitrogen strategy.

## 2. Expert Panel on Nitrogen Budgets' (EPNB) Guidance Document and its annexes

Wilfried Winiwarter (IIASA Laxenburg) reviews the history of the Task Force on Reactive Nitrogen (TFRN) of the Guidance Document (GD) and the Annexes to the GD. He explains how the EPNB derived the structure of the pools and their sub-pools of the NNBs. The annexes are not yet completed: the draft for the pool Energy+Fuels has just recently passed a first review and is now available, the draft for the pool Waste is not yet complete.

Several countries have already a NNB (Germany, Denmark, Canada, Switzerland, China), in Japan and Australia NNBs are in progress, Sweden and Austria have declared interest for a

NNB. For the existing budgets Adrian Leip (JRC/Italy) carried out some comparison, which show significant differences between the countries.

W. Winiwarter presents the workplan of EPNB with ongoing tasks and gives a short introduction to the International Nitrogen Management System (INMS) and its activities.

(<https://clous.uba.de/index.php/s/A92YFoj8CW02fjW>)

### 3. Nitrogen Activities of the Federal Ministry for the Environment

Stefanie Wolter (BMUB) summarizes the activities of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) concerning nitrogen. The Federal Government has decided (Kabinettsbeschluss vom 31.05.2017) to develop an action programme for the reduction reactive nitrogen. This decision is published with the first nitrogen report of the federal government first nitrogen report "Stickstoffeintrag in die Biosphäre" (nitrogen load to the biosphere), an important milestone on the reduction path. The election in Germany and the long-lasting formation of the government, however, have delayed the schedule of implementation.

### 4. Reactive Nitrogen Flows in Germany 2010-2014 (DESTINO project)

Jürg Heldstab (INFRAS) thanks the UBA for the organisation of the workshop and introduces the DESTINO team. Martin Bach (University of Giessen) gives an overview about pools, sub-pools and flows of the German NNB. He explains how the flows have been calculated and shows first results. For all pools, he quantified inflows and outflows. If the data was complete and precise, inflows and outflows would be balanced or describe stock changes. However, the existing data have large uncertainties, and several flows are not known. He reports the pools Atmosphere, Energy+Fuels, Materials+Products, Humans+Settlements, Agriculture, Forest+semi-natural vegetation. Stephan Fuchs (Karlsruhe Institute of Technology) describes the pools Waste and Hydrosphere. They draw conclusions and Martin Bach ends up with a summary of import and export balances, sources and sinks. Biological processes (N fixation, denitrification in various media, soil N) are still very vague, and there are major gaps in solid waste management (N in waste categories?), N in consumption goods, N in conversion of crude oil to petrochemical products.

Keywords of the discussion

- Uncertainties turn out to be an important issue for NNB. The participants distinguish between obvious uncertainties, which can be treated by statistical methods (error propagation), and uncertainties, which have to do with information gaps and which may not simply

be treated by statistics. Uncertainties are important to better understand if a pool is fully described or not, if flows are missing, if numbers are precise enough, if modelling approaches were needed.

- Sources (creation of Nr by N fixation) and sinks (destruction of Nr by denitrification) of reactive nitrogen should be pointed out as they play a special role in the national budgets. They indicate nitrogen masses being transformed from non-reactive to reactive nitrogen or vice versa. The annexes do not emphasise sources and sinks so far. Note that they differ from stock changes which handle reactive species that accumulate or diminish in pools like the increase or decrease of biomass in forests.
- Input-output balances (import, export, emission and deposition) of e.g. the pool atmosphere do not properly match although they should. This is due to fact, that data stem from several sources, but there is not a single model which includes all flows: Import/export stem from EMEP source-receptor matrices, deposition from PINETI3 project, and emissions from UBA's emission modelling. If the uncertainties are properly attributed, the sum of inflows and outflows should balance to zero within the uncertainty range. The same applies to the other pools. Another imbalanced pool is the pool terrestrial ecosystems as a large amount of reactive nitrogen is assumed to leave Nr stock of the soil. It is recommended that the results of these budgets are discussed with specific experts such as atmospheric modellers or soil monitoring institutions.
- The question arises whether stocks of the NNB should be quantified. For some pools, the N stock might be useful for plausibility checks of flow calculations, especially for the plausibilisation of stock changes. However, data for the N stocks would be really hard to estimate (e.g. nitrogen in soils), and its benefits are discussed controversially.

The results achieved are appreciated.

## 5. Implementation and visualisation of the German Nitrogen Budget with the software STAN

Judith Reutimann (INFRAS) has [implemented pools and flows](#) in the software STAN, which is a freeware for material flow analysis. STAN allows to visualize the system graphically. By defining the system, she recognized that many flows are not yet fully defined in the Annexes to the GD. Typically, the flows are well characterized concerning their starting sub-pool, but do mostly not denote to which sub-pool they go. Therefore, interpretation was necessary for building up the system.

She concludes, that STAN fulfils all necessary requirements to build a NNB like the German Nitrogen Budget of the project DESTINO, including visualization, data import and export, option to include information for every flow, pool and sub-pool etc. Since STAN is a freeware and is continuously maintained by the TU Wien, the software might be useful for other countries to

prepare and visualize their NNB. For the reporting of NNB under the Convention of Long-range Transboundary Air Pollution (CLRTAP), a standardized table of flows as an interface between Excel and STAN could be prepared and offered to countries to use it for the future reporting of their NNBs to the UNECE secretariat. Together with the predefined pool structure, the NNB's could be visualized in a comparable form.

Since STAN allows to manage time series, subsequent NNBs could also be delineated. The discussion shows that the handling of non-reactive  $N_2$  flows in the NNBs, should be improved. A favourable possible solution that needs to be examined would be the creation of a stock of (infinite)  $N_2$  mass outside of the system boundary. Sources of  $N_r$  would then be flows out of this stock and sinks of  $N_r$  would be flows into that stock.

## 6. Software STAN

Oliver Cencic (TU Wien), developer and publisher of the software STAN [presents some advances features](#) of his tool. It is not primarily designed for visualization but rather as a tool that can calculate, is able to deal with uncertainties and help to optimize and reconcile incomplete flow analyses.

## 7. End of workshop

Markus Geupel closes the workshop and thanks the participants and the speakers for their contributions.

**Note:** The Workshop "German Nitrogen Budget" was organized back-to-back with the 16<sup>th</sup> meeting of the EPNB. While the first day focused on the project DESTINO (and EPNB's influence), the second day was devoted to EPNB and to the impacts that DESTINO results would have on the EPNB and EPNB work plan. Separate minutes are distributed to the participants of the second day.

J. Heldstab, J. Reutimann