Statistics Netherlands

Report

Expert panels on mineral fertiliser statistics and nutrient budgets

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1. Abstract

The European Union co-funded through a grant Statistics Netherlands (Dutch: Centraal Bureau voor de Statistiek, CBS) to set up expert panels for mineral fertiliser statistics and nutrient budgets. The objective of this project is to improve and harmonise statistical data in the Netherlands relating to fertiliser statistics and nutrient budgets. CBS also has a strong interest in adapting the compilation and dissemination of the soil surface balance to the current needs of data users.

In total, five meetings were held with experts from various stakeholder institutes between June 2015 and May 2016. Important stakeholders were: Wageningen University & Research centre (WUR; with the institutes Alterra, LEI and PRI), the National Institute for Public Health and Environment (Dutch: RIVM), Fertilisers Netherlands (Dutch: Meststoffen Nederland) and CBS. A great amount of knowledge and expertise has been exchanged among the panel members. Differences in data and methodology for both the fertiliser statistics and nutrient balance calculations were discovered. Explanations were found and necessary corrections were implemented. Furthermore, confirmation was reached in cases where the existing approach appeared to be the optimal one. The panel meetings were very valuable as a platform to exchange ideas and experiences. More facts about the panels are shown summarised in Table 1.

Table 1: Panel facts; until May 2016 (see Section 4.2 for more details)

	Total	CBS	Alterra	LEI	PRI	RIVM	Fertilisers NL	LTO	NMI	Ministry[1]
Number of meetings	5									
Average number of participants	8.6	2.6	1.0	1.2	1.0	1.8	0.4	0.2	0.2	0.2
Number of presentations	14	5	3	3	1		2			
Number of actions[2]	11	8	3	8	4	2	1	1		

[1] Ministry of Economic Affairs.

[2] Often multiple stakeholders are involved in the same action. A rough impression is given of the involvement of the panel participants based on the numbered list of actions in chapter 6. Every action counts as one, independent of the amount work needed to complete an action.

Some major steps have been taken to improve and harmonise the fertiliser statistics. The most important ones are mentioned below:

- LEI and Fertilisers Netherlands are working on a joint survey for fertiliser statistics, in order to avoid work overlaps and to improve the quality of the statistics. They will review their own statistical processes by taking into account user needs. It is expected that the new questionnaire will be implemented in June 2017. The first results of the joint survey will be available in December 2017.

- CBS used two separate definitions of nutrient surpluses showing more or less the same trends, but with different magnitude. The differences between these two surpluses led to unnecessary confusion. To avoid this, CBS will no longer disseminate the surplus according to the sectoral approach (second concept), which is less well-timed in its release and also seems to be less accurate. Moreover, supported by panel expertise the nutrient surplus based on the soil surface balance has been improved further and a new flow chart has been created which is based on harmonised concepts and official data from manure statistics (see Figure 4 in Section 5.3.2).

- Alterra will compose a decision tree, a kind of manual, to clarify for the data users which type of nutrient budget approach (soil surface balance and farm gate balance) and/or

which balance sheet item is most suitable for a specific purpose. This will be done in consultation with the other stakeholders. The decision tree will be published on the Internet, e.g. on the Agro & Food portal of LEI (http://www.agrimatie.nl/) and/or via one of the CBS dissemination channels (https://www.cbs.nl/).

At the meeting in April 2016, the panel members decided to continue these valuable panel consultations and meet once a year in order to ensure more coherence and consistency in fertiliser statistics and nutrient budgets. CBS will coordinate this annual meeting and will invite the same experts (or their colleagues of the same stakeholder institutes) who took part in this project. The annual meeting will be scheduled in October.

2. Introduction

This report describes the work undertaken for the EU grant project “Setting up discussion groups for mineral fertiliser statistics and nutrient budget statistics”. The action is entitled “Improving the availability of data on nutrient flows in agriculture, especially the ones needed for the Gross Nutrient Budgets (GNB)”[1]. This project lasted 18 months and ended on 25 May 2016.

Besides improving the availability of data, much attention was given to the harmonisation of statistical concepts, methodology and data inputs. Without such harmonisation, the different compilations of indicators like fertiliser use and nutrient surpluses may lead to different interpretations by Dutch and European policy-makers. The ultimate aim is to provide indisputable indicators.

The report starts in chapter 3 with a short description of the objective of the project. This is followed in chapter 4 by an outline of how the expert panels were set up and organised. Chapter 5 describes the stakeholders in the panels, their statistics and the most relevant panel discussions. Chapter 6 presents a list of actions and a short discussion on future panel activities The report ends with some concluding remarks in chapter 7. The final chapter provides an overview of the abbreviations and acronyms used in this report.

[1] The grant agreement No 08413.2014.005-2014.685 was signed on 27 November 2014, by Statistics Netherlands and the Commission (Eurostat).

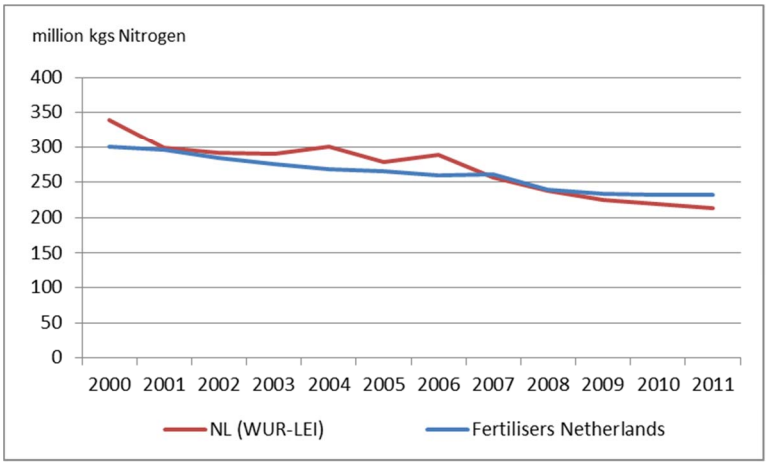
3. Objective

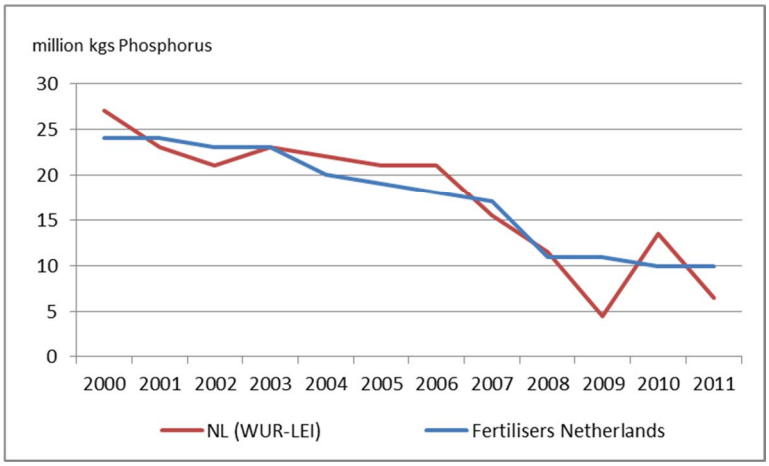
The objective of the project is to improve and harmonise statistical data in the Netherlands relating to fertiliser statistics and nutrient budgets.

There are two fertiliser statistics in the Netherlands, which show some remarkable differences. One statistic is compiled by Wageningen University's Agricultural Economics Research Institute (Dutch: Landbouw-Economisch Instituut, acronym: LEI) and another one by Fertilisers Netherlands (Dutch: Meststoffen Nederland). Figure 1 clearly shows why harmonisation and improvement of the Dutch fertiliser statistics are necessary.

The source data for Figure 1 were disseminated by Eurostat on March 2012[2]. The data from LEI and Fertilisers Netherlands both refer to total consumption in the Netherlands, whereas the current data transmission by CBS to Eurostat refers to the mineral fertiliser consumption by the agricultural sector only (i.e. 92 - 96 percent of fertiliser consumption in the LEI statistic).

Figure 1: Mineral fertiliser consumption in the Netherlands (the upper figure shows nitrogen and the lower figure phosphorus)



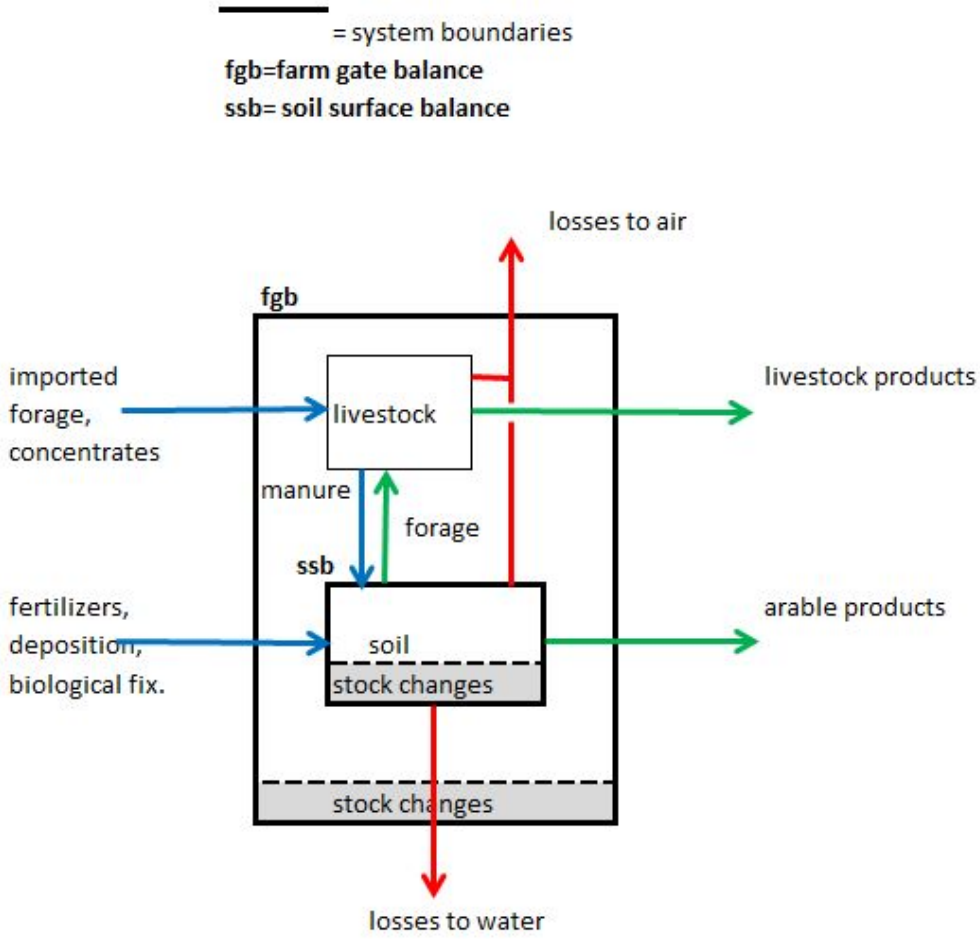


[2] See Excelfile at the end of http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_mineral_fertiliser_consumption (planned update: September 2016).

For the compilation of nutrient budgets, a variety of approaches exist in the Netherlands. The outcomes of nutrient budgets at Statistics Netherlands, LEI-WUR and Plant Research International Wageningen UR (PRI) may all vary due to 1) different system boundaries, 2) inclusion or exclusion of specific input and output terms, 3) adopting different numerical values (coefficients) for these terms, and 4) a combination of these three factors. Two major types of budgets are distinguished in the Netherlands: farm gate balances and soil surface balances. Figure 2 shows where the two differ and where they do not.

The nutrient budgets are used by Dutch (RIVM, PBL, WUR) and international organisations (Eurostat, EEA, OECD, UN) for several agri-environmental indicators, such as gross nitrogen balance, ammonia emissions and risk of pollution by phosphorus. Statistics Netherlands has a strong interest in adapting the compilation and dissemination of the soil surface balance according to the current needs of the data users.

Figure 2: Nutrient budgets



The main project achievement was to set up national expert panels on both mineral fertiliser statistics and nutrient budgets. The objectives of these panels were to:

a. define and clarify the responsibilities and roles of the different stakeholders (e.g. policy, science, statistics) in the discussion group;
b. compare the different statistics and published results;
c. discuss the quality of existing and new data sources and the calculation methods;

d. take into account the current scientific knowledge and new developments in methodology or statistical process;
e. identify user needs (like relevance for policy measures) and adapt the dissemination of official statistics accordingly;
f. ensure coherence and consistency among the different reporting requirements;
g. agree to make changes;
h. coordinate the activities needed to implement the requested changes.

Some improvements initiated by the panels have been implemented before the end of the project. Other requested changes will be included in an assessment/improvement plan (see chapter 6, list of activities), which will serve as a basis for further panel activities.

4. Method

This chapter describes the method being used to set up expert panels according to the objective of the project to harmonise and improve the fertiliser statistics and nutrient budgets.

4.1 Expert panels

Statistics Netherlands has set up two national panels with experts from different stakeholders: one panel on fertiliser statistics and one on nutrient budgets.

The stakeholders of the 'fertiliser statistics' panel are:

- Statistics Netherlands (CBS), represented by Arthur Denneman and Kathleen Geertjes;
- Alterra Wageningen University & Research centre (Alterra-WUR), represented by Gerard Velthof;
- Agricultural Economics Research Institute Wageningen UR (LEI-WUR), represented by David Verhoog;
- Plant Research International Wageningen UR (PRI-WUR), represented by Jaap Schröder;
- National Institute for Public Health and the Environment (RIVM) as represented by Stephanie Oude Voshaar and Jan Vonk;
- Fertilisers Netherlands (Meststoffen Nederland) as represented by Jo Ottenheim (at 2nd and 3rd meeting).

The stakeholders of the 'nutrient budgets' panel are:

- CBS as represented by Arthur Denneman, Ad Hoefnagel and Kathleen Geertjes;
- Alterra-WUR, represented by Gerard Velthof;
- LEI-WUR, represented by Harry Luesink;
- PRI-WUR, represented by Jaap Schröder;
- RIVM, represented by Stephanie Oude Voshaar and Jan Vonk;
- Nutrient Management Institute (NMI), represented by Wim Bussink (only at 1st meeting);
- Dutch Federation of Agriculture and Horticulture (LTO Nederland), represented by Wiebren van Stralen (only at 2nd meeting).

In total, five meetings were organised:

- 29 June 2015 – 1st meeting on fertiliser statistics;
- 6 October 2015 – 1st meeting on nutrient budgets;
- 7 December 2015 – 2nd meeting on fertiliser statistics;
- 4 February 2016 – 2nd meeting on nutrient budgets;
- 4 April 2016 – 3rd meeting on fertiliser statistics and nutrient budgets (joint meeting).

For the WUR participants of LEI and PRI, an extra budget was arranged by the Dutch Ministry of Economic Affairs (the so-called WUR helpdesk). This was used to finance their active participation in the meeting (preparing presentations and other activities). Financing from the EU grant budget was not allowed, since this budget aims to support organisations that are part of the national statistical system (Statistics Netherlands/CBS).

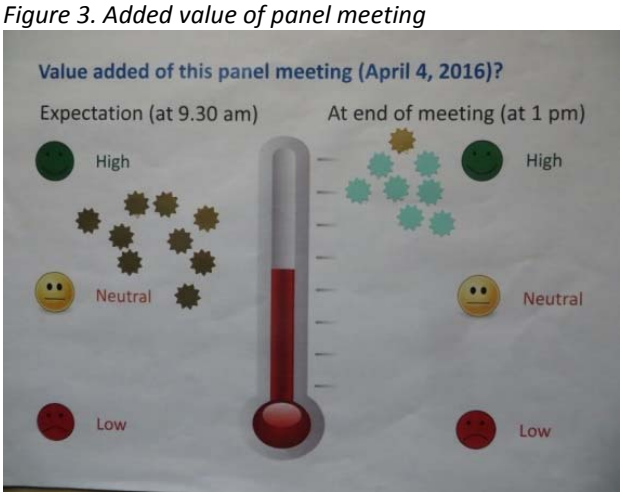
Leo Oprel of the Ministry of Economic Affairs attended the 3rd meeting as a budget provider for WUR participants, while also being involved in the discussion on how to proceed with these panels after the EU grant project is terminated on 25 May 2016.

4.2 Meetings

At every panel meeting, several participants presented their data and methodologies, and talked about the role of their statistics and indicators within their own organisation, also including the needs of data users. A great deal of expertise was shared and questions were answered. Discussions took place on various topics: different perceptions of stakeholder institutes, missing data, the sources used, the possibilities of a new source, the calculation method, timing aspects, comprehensive flow charts, availability of (meta)data, etcetera. Panel meetings are very helpful to facilitate the sharing of expertise and knowledge among the panel participants.

Prior to every meeting the participants were asked if they have a low, medium or high expectation of the meeting. At the end of the meeting, they were asked with the same 'thermometer' whether the meeting had a low, medium or high added value. Figure 3 shows the thermometer of the last meeting. The thermometers of the other panel meetings showed a similar appreciation.

Figure 3. Added value of panel meeting



Of each meeting a detailed report was created and this report was sent to the participants. The meetings were followed by some homework. Actions were drawn up and people were designated to work out the actions. After a meeting there was often an e-mail exchange between the members of the panel. Depending on the work involved in a follow-up task, the activity was performed in the short, medium or possibly the long term.

The second and third meeting monitored the actions as established during the previous meeting. Priorities were set, using interactive workshop techniques. Some actions are not carried out for the time being, because first alternatives from other actions will be examined. An important agenda item at the third joint meeting was how to proceed after completion of this project. Further facts on panel meetings can be found in Table 2.

Table 2: Panel facts; until May 2016

	Total	CBS	Alterra	LEI	PRI	RIVM	Fertilisers NL	LTO	NMI	Ministry[1]
Number of meetings	5									
with regard to fertilisers	2									
nutrient budgets	2									
both topics	1									
Average number of participants	8.6	2.6	1.0	1.2	1.0	1.8	0.4	0.2	0.2	0.2
with regard to fertilisers	8.2	2.2	1.0	1.2	1.0	2.0	0.6			0.2
nutrient budgets	9.0	3.0	1.0	1.2	1.0	1.6	0.2	0.4	0.4	0.2
Number of presentations	14	5	3	3	1		2			
with regard to fertilisers	7.5	2.5	2	1			2			
nutrient budgets	6.5	2.5	1	2	1					
Number of actions[2]	11	8	3	8	4	2	1	1		
with regard to fertilisers	5	3	1	5	1	1	1			
nutrient budgets	6	5	2	3	3	1		1		

[1] Ministry of Economic Affairs.

[2] Often multiple stakeholders are involved in the same action. A rough impression is given of the involvement of the panel participants based on the numbered list of actions in chapter 6. Every action counts as one, independent of the amount work needed to complete an action.

In harmonising and improving statistics and indicators like the nitrogen surplus, the first step in general is to find out the differences among the approaches. The next step is to find a solution for the differences. If harmonisation and/or improvement turn out to be possible, consensus should be reached on the needed adjustment. Regular panel meetings facilitate this enormously.

5. Results of the meetings

This chapter describes the results of the meetings by discussing the responsibilities and roles of the stakeholders in Section 5.1, and by focusing on fertiliser statistics and nutrient budgets in Sections 5.2 and 5.3, respectively.

5.1 Responsibilities and roles of the stakeholders

This section contains an overview of the most important roles and responsibilities of each stakeholder during the panel meetings.

Statistics Netherlands (CBS) compiles nutrient budgets including the soil surface balance and the sector balance (official statistics for the agricultural sector, although nutrient budgets are also being produced for the other sectors). Results of the nutrient budgets are published on the CBS website in the StatLine databank (statline.cbs.nl/Statweb/?LA=en) and results of relevant indicators are also published in the Environmental Data Compendium (EDC, Dutch: Compendium voor de Leefomgeving); see for instance an indicator on the manure surplus in agriculture, 1970-2014 (www.compendiumvoordeleefomgeving.nl/indicatoren/en0096). Every two years, CBS transmits nutrient budget data to Eurostat and these data are furthermore presented in reports which are prepared every four years in accordance with the EU Nitrates Directive.

Institutes of Wageningen UR (WUR) conduct scientific research and produce many key figures for agricultural and environmental policies as well (see www.wageningenur.nl/en/Expertise-Services/Research-Institutes.htm).

- Agricultural Economics Research Institute (LEI) is the socio-economic research institute of Wageningen UR. The institute compiles the national fertiliser statistic as well as nutrient budgets and farm gate balances for dairy and arable farming, which include regional data. The farm gate balances are part of the Dutch Minerals Policy Monitoring Programme (Dutch: Landelijk Meetnet effecten Mestbeleid, LMM), in which the mineral data of the farms with at least 10 hectares of agricultural area are recorded and analysed. These farms are also included in the Dutch Farm Accountancy Data Network (FADN, Dutch: Bedrijven-Informatienet, BIN). LMM aims to monitor the effectiveness of the manure policy at dairy and arable farms by relating the quality of ground and surface water measured on farms to the business operations of these companies.
  The models MAMBO (LEI) and STONE (Alterra) are used for the evaluation of the national manure policy. MAMBO provides insight into applications of manure by region (NUTS 2; per crop, soil type and phosphate class) and STONE into the emissions of nitrogen and phosphorus to soil and groundwater.
- Plant Research International (PRI) participates in the research project Annual Nutrient Cycling Assessment (ANCA, Dutch: KringloopWijzer) for dairy and arable farming. ANCA is intended as a tool for developing and testing the comparison of farms in terms of their losses of nitrogen, phosphate and carbon, to ensure a more efficient use of nutrients (farm budgets). The technical performance, such as crop yields and environmental performance (surpluses, emissions and excretions), can be compared across farms using ANCA.
  PRI has also developed the so-called WOG-WOD forecast model. This model is used to calculate environmentally sound application standards for manure and mineral fertilisers. These standards can be determined assuming a target figure for N- or P-surplus and an

assumed nutrient uptake by the crop (according to crop-specific response curves). PRI also coordinates the project 'Cows and opportunities' (Dutch: Koeien en Kansen, KeK); see www.wageningenur.nl/en/project/Cows-and-opportunities.htm for more details.

- Alterra is the Dutch research institute for the green living environment. The institute investigates sustainable soil use and is participating in the National Emission Model for Agriculture (acronym: NEMA), a model for the inventory of ammonia and greenhouse gas emissions from agriculture in the Netherlands. Almost all the participants in this project are also involved in the NEMA working group (Alterra, CBS, LEI, PRI and RIVM). It is chaired by Alterra while the NEMA database is managed by CBS. The NEMA working group is a leading party for many decisions about sources and methods which will be used relating to emissions in agriculture. Alterra is the owner of the STONE model, which calculates leaching of nitrogen and phosphorus.

National Institute for Public Health and the Environment (RIVM) co-ordinates the Dutch Pollution Release and Transfer Register (see www.prtr.nl). The PRTR contains the yearly releases of more than 350 pollutants to air, soil and water. The PRTR project covers the whole process of collecting, processing and reporting of the emission data in the Netherlands. Over 70 emission experts from 10 institutes are involved in the annual update of the PRTR; for the task force on agriculture the organisations RIVM, PBL, WUR, CBS and TNO are participating. RIVM also participates in the National Emission Model for Agriculture (NEMA). Data from several statistics are used such as the fertiliser statistic from LEI and agricultural statistics from Statistics Netherlands. First, national data are compiled; all institutes agree to use the same national data, stored in a central database, from which all the national and international reporting (e.g. to UNFCCC, EEA, EMEP, E-PRTR) takes place. Second, the national data are spatially allocated (point sources like companies or facilities and diffuse sources such as agricultural activities).

Fertilisers Netherlands is a branch organisation representing the interests of the Dutch producers and distributors of fertilisers (see www.meststoffennederland.nl). The organisation compiles a fertiliser statistic for their members and transmits data to Fertilizers Europe.

The Dutch Federation of Agriculture and Horticulture (LTO Nederland) represents the interests of nearly 50,000 farmers and is committed to their economic and social position (see www.lto.nl). From January 1, 2015 onwards, all dairy farmers with a phosphate surplus are required to provide data to ANCA, and using ANCA will be compulsory for all dairy farmers as of next year. With this instrument farmers can optimise their business operations and develop their company in a responsible way within the set environmental pre-conditions.

Nutrient Management Institute (NMI) is an organisation geared to research and consultancy on soil quality in relation to rural land use (see www.nmi-agro.nl/en/mission).

5.2 Discussion on fertiliser statistics

This section describes the most relevant discussions about sources and methods for fertiliser statistics.

5.2.1 The LEI fertiliser statistic

The LEI fertiliser statistic is used widely in the Netherlands for research and policy purposes, by organisations such as CBS (to transmit as official data to Eurostat), RIVM, PBL, Ministries and the institutes of Wageningen UR. The source data are obtained from a survey among manufacturers and traders of fertilisers in the Netherlands. Some necessary data are missing; data on lime fertilisers were outdated. For urea more details are needed, because the use of urea is increasing and the different types of urea (with/without urease inhibitor, acid or coating) have different emissions of ammonia. For the users of the fertiliser statistic, it is important that the data are undisputed, available on time and easily accessible.

Action
LEI will disseminate fertiliser data on their website Agrimatie (www.agrimatie.nl) in 2016. It will be updated every year.

5.2.2 Differences with similar statistics by Fertilisers Netherlands

As mentioned in section 3, there are two fertiliser statistics in the Netherlands: by LEI and by Fertilisers Netherlands. Fertilisers Netherlands takes a survey among the five largest distributors of fertilisers in the Netherlands. The statistical data are provided to their members and to Fertilizers Europe.
The surveys by LEI and by Fertilisers Netherlands are different in terms of the companies and questionnaires used. This causes differences in observed population and observed fertilisers. Fertilisers Netherlands aims to improve the data reported to Fertilizers Europe. At present, they do not have suitable information available about the application per hectare, which is needed for the forecast of fertiliser use.

Actions
In order to resolve the discrepancies, LEI and Fertilisers Netherlands have agreed to explore the possibilities for a joint survey. Fertilisers Netherlands have already consulted their members and the initial comments are positive. In order to obtain a relevant questionnaire, LEI and Fertilisers Netherlands asked the NEMA working group to list the required data: which kinds of fertilisers, what types of marketing data, and what types of marketing channels. The NEMA working group should also provide information about the appropriate timing requirements for fertiliser data. Depending on which data the manufacturers and traders can provide, a new questionnaire will be set up by LEI and Fertilisers Netherlands. The joint survey is expected to be implemented in June 2017.
Questions about the sales of lime fertiliser and different kinds of urea will be asked at an earlier stage, i.e. in the questionnaire of Fertilisers Netherlands in December 2016.
In 2016, Fertilisers Netherlands will start using LEI's FADN data on the average application per hectare of fertilisers on agricultural land as a source for the forecasting of fertiliser use (to be transmitted to Fertilizers Europe).
The NEMA working group will provide new ammonia emission factors for the different types of urea fertilisers.

5.2.3 Differences in fertiliser use according to FADN

The Dutch Farm Accountancy Data Network (FADN) and the Dutch Minerals Policy Monitoring Programme (LMM; a subset of farms in FADN) provide information about the use of manure and mineral fertilisers on dairy and arable farms. According to LMM, the use of fertilisers increased in 2013 while LEI's fertiliser statistic (based on a survey) showed a decreasing trend. There is no sound explanation for the differences in trends. It should be noted, however, that FADN and LMM data on fertilisers cannot be used as a proxy for total use, since FADN and LMM are incomplete in the sense that use of fertilisers in greenhouse horticulture and in non-agriculture are not included.

Decisions
It takes time and budget for LEI to further analyse the differences in trends between FADN data on fertilisers and the official LEI fertiliser statistic. Given that there is no funding at the moment, this task has been put on hold. The panel has decided that the official fertiliser data (as transmitted by CBS to Eurostat), based on the LEI fertiliser statistic, will be used for reporting at a national level and that fertiliser data of FADN and LMM will only be used for reporting at a sectoral level (e.g. dairy and arable farming).
Funding is not available and also not urgently needed to improve on the exhaustiveness of FADN and LMM by expanding the sample of FADN and LMM with additional companies.

5.2.4 MAMBO for regional data

Using LEI's MAMBO model, fertiliser use per province (NUTS 2) can be calculated. MAMBO calculates the distribution of manure and fertilisers based on economic principles. Once every five years, RIVM reports regional emissions to the European Commission based on fertiliser use per province as calculated by LEI. These data are not disseminated.

Action
According to the current gentleman's agreement, CBS only has to provide Eurostat with annual national data on fertiliser use. Transmission of regional data, at NUTS 2 level, is voluntary. It appears possible to provide NUTS 2 data every five years based on fertiliser use data available at RIVM and/or LEI.

5.2.5 Possible new sources

To supplement or verify the current fertiliser data, a number of options are being discussed:

- Inclusion of questions about fertiliser use in the Farm Structure Survey;
- Unlocking data from the Annual Nutrient Cycling Assessment (ANCA, Dutch: KringloopWijzer) about fertiliser use in dairy farming. ANCA includes a full registration of fertiliser use on grassland and maize in the Netherlands. The data are not yet available for statistical purposes, but this might change in the near future.
- Unlocking data from CRV Mineral. CRV is a Dutch cooperative cattle improvement organisation which has a module 'manure policy' to provide cattle farmers insight into the minerals flows at their company. CRV Mineral might be a good alternative source until ANCA is available.

Decision
CBS will investigate whether using fertiliser data from CRV Mineral is meaningful for its own statistics and for the National Emission Model for Agriculture (NEMA).

5.3 Discussion on nutrient budgets

Nutrient budgets are produced mainly to determine the environmental impact and to calculate several standards of nutrient use. They are used widely by policymakers and researchers. The outcomes of nutrient budgets may vary due to 1) different system boundaries, 2) inclusion or exclusion of specific input and output terms, 3) adopting different numerical values for these terms, and 4) a combination of these three factors. Two major types of budgets are distinguished: farm gate balances and soil surface balances (see Figure 2 in Section 3).

System boundaries may pertain to the soil, the farm, a specific sector (e.g. dairy), the region or the country as a whole. The budget outcomes may also vary in terms of the units (tons, kgs per hectare). As for the inclusion of terms, it must be noted that the nutrient budgets transmitted to Eurostat are based on inputs without a subtraction of the N losses to air (gross inputs), whereas Statistics Netherlands disseminates the same kind of data as net inputs by subtracting N losses to air beforehand. Furthermore, comparability of the various approaches might be increased by reducing the uncertainties in the used data sources to calculate the balance sheet items and by using the same data and methodology, as much as possible.

The panel members agree that it is important to harmonise the statistics as far as possible by focusing on all kinds of calculation aspects and to agree on the 'best practices'. At the panel meetings there was discussion on: 1) the different approaches to compiling of nutrient budgets, 2) the bookkeeping differences of the balance sheet items on the input and output side, and 3) the differences in data sources and methodology used to calculate the balance sheet items.

The discussion was initiated by first making an inventory of what kind of nutrient budgets are compiled by the stakeholders mentioned in Section 5.1. Then the panel members started comparing the different approaches to the balance sheet items on the input and output side. The next step was exchanging information about the sources and methodology which were used to calculate these items. In Sections 5.3.1 – 5.3.3 a description is given of some relevant issues that were mentioned in the discussions at the panel meetings. The proposed and assigned actions are listed in Section 6.2, also for the many other discussions on nutrient budgets that are not described in Chapter 5.

5.3.1 Which nutrient budgets approach for what purpose?

It is important to know the system boundaries of a nutrient budget: the farm, the sector (dairy farming, arable farming), including or excluding the processing industry, the regions or country. The system boundaries strongly affect the use efficiencies, i.e. the ratios of outputs over inputs. The balances often serve different purposes. The national nitrogen surplus as reported by Statistics Netherlands is best suited for transmission to Eurostat. For information about the nitrogen surplus in an agricultural sector like dairy farming, the LEI nutrient budget based on LMM is best suitable. ANCA is preferred for a dairy farmer who wants to gain insight into the nitrogen losses on his own farm. These balance sheets do not have to be exactly the same, but it should be clear for what goal the calculated surplus can be used. Therefore a good

explanation of the approach used is required and such a description should be included in every report showing nutrient budget results.

Action
Alterra will compose a decision tree, i.e. a kind of manual to clarify which type of nutrient budget approach (soil surface balance and farm gate balance), and/or which balance sheet item is/are most suitable for a specific purpose. This will be done in consultation with other stakeholders. The decision tree will be published on the Internet, e.g. on the LEI Agro & Food portal (www.agrimatie.nl) and/or via one of the CBS dissemination channels (www.cbs.nl).

5.3.2 Two approaches at CBS to calculation of nutrient surpluses

Currently, CBS applies two different approaches towards the nutrient budgets: the soil surface balance and the sector balance. The nutrient surpluses of these balances showed more or less the same trends, but the absolute numbers were not exactly the same and this was confusing to the users: which one to use in policy decisions? The original flow chart tried to combine both approaches, including two different numbers for the nutrient surpluses. This flow chart was hard to read. The different surplus numbers also introduced some inconsistencies in the other numbers displayed on the charts.

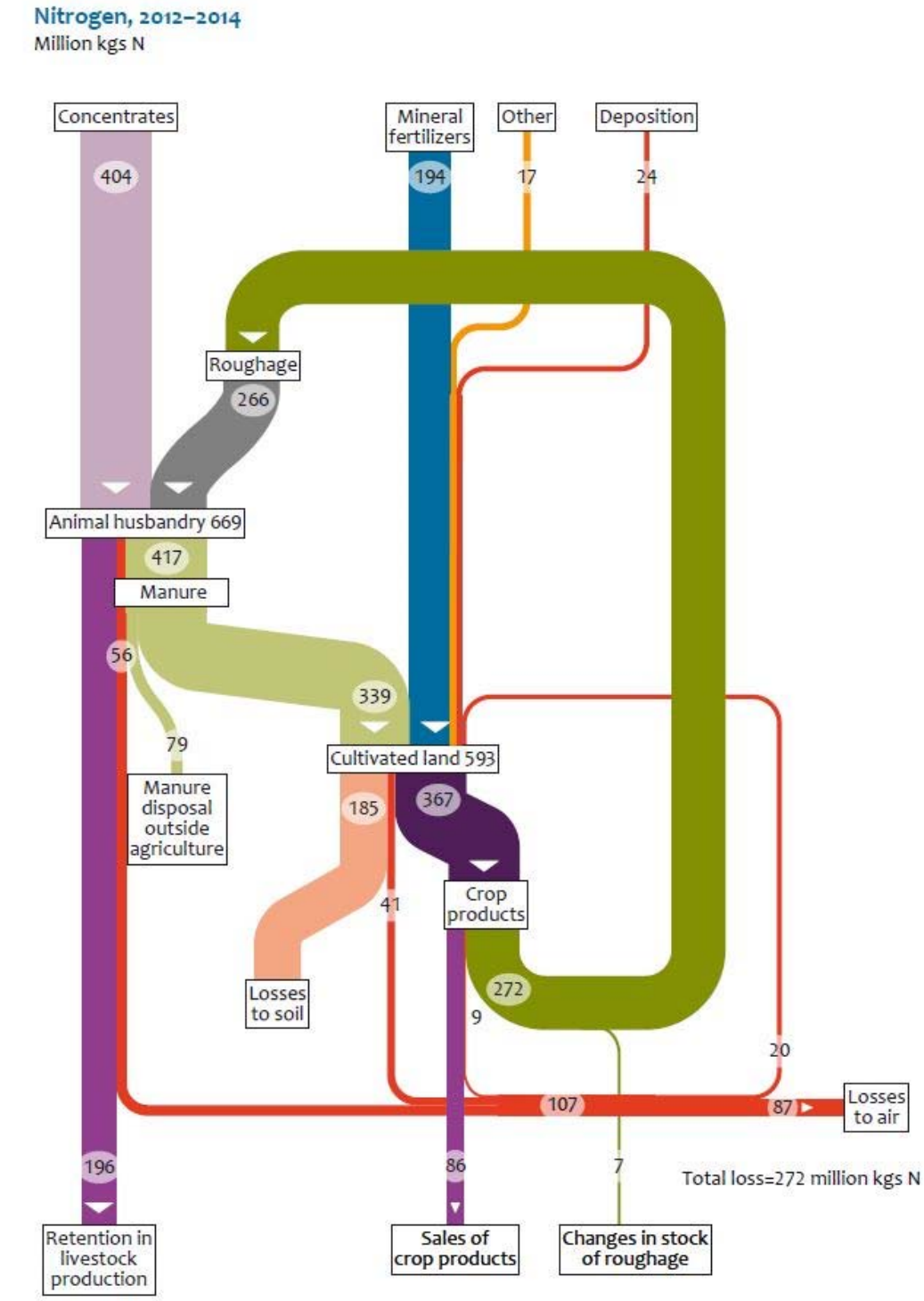
Decision
CBS will no longer disseminate the surplus according to the sectoral approach (second concept), which is not only less well-timed but also seems to be less accurate. Moreover, using panel expertise the nutrient surplus based on the soil surface balance has been improved further and a new flow chart is created. This flow chart is based on harmonised concepts and official data from manure statistics; it includes, in a consistent way, balances in both the soil surface and the animal husbandry (see Figure 4). The sector balance itself has become redundant and will not be compiled any longer.

5.3.3 Eurostat gross nutrient budget versus Dutch approach

CBS reports soil surface balances to Eurostat/OECD, in accordance with the guidelines in the Eurostat/OECD handbook on 'Nutrient budgets'. This is different from the soil surface balance CBS disseminates with respect to the bookkeeping of inputs and outputs. The Eurostat/OECD version compiles a gross nutrient budget; the N losses to air are subtracted afterwards.
The CBS approach is based on net inputs; the N losses to air are registered as negative inputs. Consequently, the N losses from the animal houses and from applying the manure are both excluded from the inputs to the soil surface, whereas they remain included in the Eurostat inputs. The different treatment of N losses leads to different results for indicators such as use efficiency.

The Eurostat/OECD gross approach also implies that the deposition from domestic agriculture should not be considered an input, since this equals the part of N losses to air that returns to the soil (double counting: in the gross approach these N losses are still part of the inputs; not subtracted yet). In the net approach these N losses are already subtracted from the inputs, so here no double counting occurs if deposition from domestic agriculture is considered as an input. The Eurostat/OECD approach should be modified on this aspect.

Figure 4. The new CBS flow chart for the nutrient budget of nitrogen, including balances at the soil surface and animal husbandry



Source: CBS.

By sharing knowledge and expertise, the panel discussions, have improved the quality of the CBS data to be transmitted to Eurostat. The estimates for biological nitrogen fixation and crop residues have been improved in particular. The panel has also discovered an error in the calculation of the N losses (volatilisation) during conservation of grass silage, green maize and hay. The panel was very valuable in harmonising the CBS and Eurostat/OECD approach of compiling the soil surface balance. Only the bookkeeping, gross versus net, still shows differences. Further harmonisation efforts are also needed concerning the different approaches to compiling nutrient budgets in the Netherlands (soil surface balances, farm gate balances).

6. List of actions

This section describes the actions undertaken and ongoing. Some work will be put on hold until funding has been arranged. Section 6.1 presents the actions as established by panel 1 on fertiliser statistics; Section 6.2 describes actions undertaken by panel 2 on nutrient budgets. In Section 3, the future panel activities are discussed.

6.1 Actions to improve fertiliser statistics

1. *In process*: LEI-WUR and Fertilisers Netherlands are working on a joint survey for fertiliser statistics. They review the current statistics, taking into account the user needs (NEMA working group), and will verify whether the producers and traders are willing to provide the requested data. It is expected that the new questionnaire will be implemented in June 2017. Then the first results of the joint survey will be available in December 2017.
   Questions about the sale of lime fertiliser and different kinds of urea will be asked at an earlier stage, i.e. in the questionnaire of Fertilisers Netherlands in December 2016.
   In 2016, Fertilisers Netherlands will start using LEI's FADN data on the average application per hectare of fertilisers on agricultural land as a source for the forecast on fertiliser use (to be transmitted to Fertilizers Europe).
   The NEMA working group will provide new emission factors for the different types of urea fertilisers.
2. *In process:* LEI will disseminate fertiliser data on their website Agrimatie (www.agrimatie.nl) in 2016, to be updated every year.
3. *On hold:* There are differences between fertiliser use according to FADN/LMM and the LEI fertiliser statistic. It takes time and budget for LEI-WUR to further analyse these differences. Without additional funding such action is put on hold.
   Decision: The panel has decided that the official fertiliser data (as transmitted by CBS to Eurostat), based on the LEI fertiliser statistic, will be used for reporting at a national level and that LMM fertiliser data will only be used for reporting at a sectoral level (e.g. dairy and arable farming). This will be mentioned in the decision tree; see the first two items in Section 6.2.
4. There are a few options to supplement or to verify the current fertiliser data:
   - *On hold:* Inclusion of questions about fertiliser use in the Farm Structure Survey.
   - *On hold:* Expanding the sample of LMM/FADN with additional companies to improve the reliability. This requires funding.
   - *On hold:* Unlocking data from ANCA about fertiliser use in dairy farming. ANCA includes a full registration of fertiliser use on grassland and maize in the Netherlands. The data are not yet available for statistical purposes, but this might change in the near future.
   - *In process:* Unlocking data from CRV Mineral. This will be a good alternative source until ANCA is available. CBS will investigate whether using fertiliser data from CRV Mineral is meaningful for its own statistics and for NEMA.
5. *On hold:* CBS may provide, every five years, regional fertiliser statistics (NUTS 2) to Eurostat. The data can be calculated by LEI using the MAMBO model and transmitted to CBS. Currently LEI calculates provincial fertiliser use once every five years for RIVM, which has to report regional emissions to the European Commission.

6.2 Actions to improve nutrient budgets

1. *In process:* Alterra will compose a decision tree, a kind of manual, so as to clarify for everyone which type of nutrient budget approach (soil surface balance and farm gate balance) and/or which balance sheet item is most suitable for a specific purpose. This will be done in consultation with other stakeholders. The decision tree will be published on the Internet, e.g. on the Agro & Food portal of LEI (www.agrimatie.nl) and/or via one of the CBS dissemination channels (www.cbs.nl).
2. *On hold:* In recent years, a difference is observed between the trend in the national nitrogen surplus according to CBS and that of the sector surpluses according to LMM (LEI): a decrease according to CBS and stabilisation according to LEI.
   In process: It will be mentioned in the decision tree (see first item) that CBS data are to be used for reporting at the national level and data based on LMM should be used for reporting at sectoral level.
3. *Decision:* CBS will no longer compile the surplus according to the sectoral approach (second concept), which is not only less well-timed but also seems to be less accurate. Moreover, using panel expertise, the nutrient surplus based on the soil surface balance has been improved further and a new flow chart has been created. This flow chart is based on harmonised concepts and official data from manure statistics and it includes, in a consistent way, balances at both the soil surface balance and the animal husbandry (see Figure 4 in Section 5.3.2).
   In process: Other improvements are:
   - N inputs from free-living bacteria, as part of the biological nitrogen fixation in the soil surface balance, will be removed.
   - CBS will not only disseminate nutrient budget data in tons but also in kgs per hectare.
   - CBS will disseminate improved nutrient budget data on inputs and outputs from outside agriculture; furthermore, the effects of both agriculture and non-agriculture surpluses on surface water will be estimated.
4. *In process:* CBS and the WUR institutes will try to harmonise the following balance sheet items:
   - The field, conservation and feed losses. PRI will send the calculation rules on the field, conservation and feed losses of ANCA to the panel members.
   - The crop production data and the nitrogen and phosphate contents in the several crops. CBS will send to the panel members: 1) a list of the contents as used in the soil surface balance for Eurostat and 2) the questionnaires used in the surveys on the production of harvested crops and fodder.
   - The biological nitrogen fixation by legume grass mixtures (clovers) and leguminous crops (pulses and lucerne).
   - Small balance sheet items such as seeds.
5. *In process:* The WUR institutes PRI and Alterra will take care of the needed adjustments in ANCA according to the adjustments in NEMA, shortly after publication of the NEMA report.
6. *In process:* CBS will investigate whether using yield data of roughage of 20 thousand farms in CRV Mineral is meaningful for the statistics of CBS and for NEMA.

6.3 Continuation in the future

At the last meeting (April 2016), the panel members were asked how to proceed with the initiated actions. After some discussion the panel members decided to organise a yearly meeting to ensure more coherence and consistency in fertiliser statistics and nutrient budgets.

This facilitates further harmonisation and improvement of these statistics. CBS will coordinate this annual meeting and will invite the same experts (or colleagues of the same stakeholders) as those who participated in this EU grant project. The agenda will be based on information from the panel members about observed differences, new sources etcetera. In addition, the on-going actions as proposed and assigned in the previous meeting will be discussed; in particular in the October 2016 meeting, the joint survey for fertiliser statistics by LEI and Fertilisers Netherlands will be on the agenda. The meeting will be scheduled in the first half of October, so that decisions can be implemented in the NEMA database just in time for the annual reporting of the NEMA emissions.

7. Concluding remarks

The first steps to improvement and harmonisation of fertiliser statistics and nutrient budgets have been taken by setting up two expert panels. The involvement and enthusiasm of the panel members was good in both panels. The atmosphere during the meetings was open and people were respectful to each other's work. This resulted in good discussions and the willingness to review and improve each other's work.

As a result of the discussions at the meetings, the urgent need for specific data became clearer, for example the use of lime fertilisers and different types of urea for the emission calculations.

One interesting conclusion was that nutrient budgets may differ from each other in their objective (approaches like soil surface balance and farm gate balance), but that underlying data and calculations should be harmonised as much as possible.

One key success factor of panel meetings is that the experts all meet in one room to discuss the statistics, propose changes and reach decisions. A pleasant outcome is that the participants of this EU grant project are willing to come together once a year to discuss the proposed actions and further developments. The panel will therefore be continued.

Many thanks to all participants for their contributions to this project.

8. Abbreviations and acronyms

ANCA	Annual Nutrient Cycling Assessment (Dutch: KringloopWijzer)
BIN	Dutch Farm Accountancy Data Network (Dutch: Bedrijven-Informatienet, BIN)
CBS	Statistics Netherlands (Dutch: Centraal Bureau voor de Statistiek)
EDC	Environmental Data Compendium (Dutch: Compendium voor de Leefomgeving)
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Programme
E-PRTR	European Pollutant Release and Transfer Register
EU	European Union
FADN	Dutch Farm Accountancy Data Network (Dutch acronym: Bedrijven-Informatienet, BIN)
GNB	Gross Nutrient Budgets
Kek	Cows and opportunities (Dutch: Koeien & Kansen)
LEI	Agricultural Economics Research Institute (Dutch: Landbouw-Economisch Instituut)
LMM	Dutch Minerals Policy Monitoring Programme (Dutch: Landelijk Meetnet effecten Mestbeleid)
LTO	Dutch Federation of Agriculture and Horticulture (Dutch: Land- en Tuinbouw Organisatie Nederland)
MAMBO	Model for Agricultural Mineral Flows for Policy Support (Dutch: Mest en Ammoniak Model voor Beleidsondersteunend Onderzoek)
N	Nitrogen
NEMA	National Emission Model for Agriculture
NMI	Nutrient Management Institute
NUTS	Nomenclature of Units for Territorial Statistics
OECD	Organisation for Economic Co-operation and Development
P	Phosphorus
PBL	Netherlands Environmental Assessment Agency (Dutch: Planbureau voor de Leefomgeving)
PRI	Plant Research International
PRTR	Pollution Release and Transfer Register (Dutch: Emissieregistratie)
RIVM	National Institute for Public Health and the Environment (Dutch: Rijksinstituut voor Volksgezondheid en Milieu)
STONE	Nutrient emission modeling system (Dutch: Samen Te Ontwikkelen Nutriënten Emissiemodel)
TNO	Netherlands Organisation for Applied Scientific Research TNO
UN	United Nations
UNFCCC	UN Framework Convention on Climate Change
UR	University & Research centre
WOG-WOD	Scientific group on underpinning of application standards and derogation (Dutch: Werkgroep Onderbouwing Gebruiksnormen en Werkgroep Onderbouwing Derogatie)
WUR	Wageningen University & Research centre