



A uniform calculation method for manure production and its nutrient content in the Netherlands

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Abstract

Since the early 1990s, the Dutch Working group on Uniform calculation of Manure and nutrients (WUM) has annually set standard factors for manure production and nitrogen, phosphorus, and potassium (NPK) excretion per animal category of farm animals in the Netherlands. This report provides an overview of the WUM calculation method for reporting years 1990-2024. The WUM originated from the need for standardized data on animal manure production, supported by producers and users of manure and nutrient data. Since 2021, the WUM has been a working group of the Scientific Committee on Nutrient Management Policy (CDM). The WUM currently consists of representatives from Wageningen Livestock Research (WLR), Wageningen Social & Economic Research (WSER) and Statistics Netherlands (CBS).

Samenvatting

Vanaf het begin van de jaren negentig stelt de Werkgroep Uniformering berekening Mest- en mineralencijfers (WUM) jaarlijks standaardfactoren vast voor mestproductie en stikstof, fosfor, en kalium (NPK) uitscheiding per diercategorie van de in Nederland gehouden landbouwhuisdieren. Dit rapport geeft een overzicht van de rekenmethodiek en de uitgangspunten die door de WUM zijn toegepast voor verslagjaren 1990-2024. De werkgroep is ontstaan vanuit de behoefte aan gestandaardiseerde cijfers over de productie van dierlijke mest, die gedragen worden door producenten en gebruikers van mest- en mineralencijfers. De WUM is sinds 2021 een werkgroep van de Commissie Deskundigen Meststoffenwet (CDM). De WUM bestaat nu uit vertegenwoordigers van Wageningen Livestock Research (WLR), Wageningen Social & Economic Research (WSER), en het Centraal Bureau voor de Statistiek (CBS).

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1. Introduction

The Netherlands maintains an inventory of the manure production and the excretion of nitrogen (N), phosphorus (P), potassium (K) by farm animals. This is done for several reasons, such as supporting environmental policy and meeting European reporting requirements. This inventory has been carried out since the introduction of the Fertilizers Act in 1986. After the Fertilizers Act came into force, various institutes started calculating NPK-excretion in livestock manure. Each institute had its own objectives and initial assumptions, which led to a wide range of different outcomes.

To address this, the Dutch Working group on Uniform calculation of Manure and nutrients (WUM) was set up in the early 1990s. Its main aim was to develop a standardized calculation method for estimating annual manure production and NPK-excretion in a consistent way. In 2006-2020, the working group was part of the Dutch Pollutant Release and Transfer Register (PRTR); in Dutch: Emissieregistratie (ER). From 2021 onwards the WUM has been a working group of the Dutch Scientific Committee on Nutrient Management Policy (CDM). The WUM currently consists of representatives of Wageningen Livestock Research (WLR), Wageningen Social & Economic Research (WSER) and Statistics Netherlands (CBS).

In short, the WUM calculation method assumes a NPK-balance per animal, where NPK-excretion is calculated from the difference between feed intake and retention in animal products. The consistent calculation method ensures that comparison between years and different animal groups is possible. Over the years, however, parameters have regularly been adjusted as a result of new scientific insights. This report describes the methodology used to calculate NPK excretion from 1990 through 2024.

Reader's guide

Chapter 2 covers basic aspects in the calculation of manure and nutrient production.

Chapter 3 describes the agricultural census as a data source for livestock numbers.

Chapter 4 describes data sources used to determine feed intake and its composition.

Chapter 5 describes data on retention in animal products.

Chapter 6 describes resulting quantities of NPK excretion (= feed intake – retention).

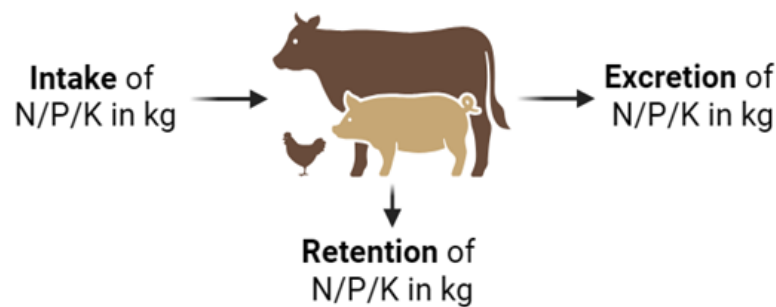
Chapter 7 describes data on total volume of produced manure (instead of NPK content).

2. Calculation method

2.1 NPK-excretion

NPK-excretion factors are calculated for nitrogen (N), phosphate (P_2O_5) and potash (K_2O) using a NPK-balance per animal (see Figure 2.1.1). The NPK-excretion equals the NPK-intake with feed minus the NPK-retention in animal products.

Figure 2.1.1: Graphical representation of the NPK-balance to calculate the excretion factor per animal. The excretion factors for N, P, and K are expressed as kg N, P_2O_5 , and K_2O per animal, respectively.



The principles of the calculation method are based on Coppoolse et al. (1990) and relies on a large variety of data sources, such as data on feed use (concentrate feed and roughage) and data on animal production (milk, eggs, wool, animal growth, and offspring). In addition, data are also required on N, P and K content in feed and in animal products.

The annually updated data are derived from statistics and administrative data, such as:

- Agricultural census, Netherlands Enterprise Agency (RVO) and Statistics Netherlands (CBS);
- Farm Sustainability Data Network (FSDN), Wageningen Social & Economic Research (WSER);
- Statistics on grassland management, Statistics Netherlands (CBS);
- NPK-content of roughage, Eurofins Agro (a Dutch laboratory on soil and crop analysis);
- NPK-content of concentrate feed delivered to farms, Netherlands Enterprise Agency (RVO) and Dutch Feed Industry Association (Nevedi);
- Milk production data, Netherlands Enterprise Agency (RVO);
- Cattle farming data, Wageningen Livestock Research (WLR);
- Pig farming data, Wageningen Livestock Research (WLR) and Agrovision;
- Poultry farming data, Wageningen Livestock Research (WLR) and FSDN;
- Data on wet by-products (including N, P, and K content), Circular Feed association (CFa).

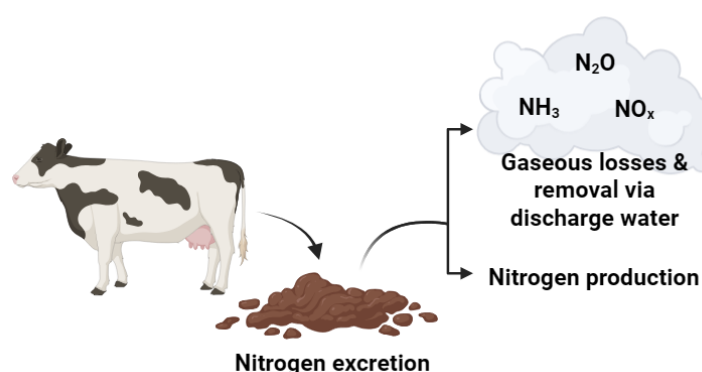
The retention of N, P and K in animal products depends on the production level of milk, wool, meat and eggs and the NPK-content of these products. Excretion factors are calculated per average number of animals present throughout the year. When calculating excretion, it is generally assumed that the livestock numbers recorded in the agricultural census reflects the average number of animals present throughout the year. By multiplying the excretion factors by the number of animals from the agricultural census, the total annual excretion for a specific animal category is obtained.

For an animal category with several production cycles per year or for an animal category where the production cycle lasts longer than one year, the excretion per production cycle is converted into an excretion on an annual basis by using a scaling factor. Dutch excretion factors per animal are calculated at national level, with the exception for dairy cows and female young stock, for which a distinction is made between two regions (North-West and South-East).

2.2 Gaseous losses and nitrogen production

The WUM model calculates the gross excretion, also referred to as “under the tail”. Net excretion is not calculated by WUM, but by National Emission Model for Agriculture. NEMA takes into account that during manure storage, the composition of the manure changes due to the breakdown of organic matter, ammonia volatilization, and the volatilization of other nitrogen compounds (N_2 , N_2O , NO) resulting from denitrification. After deducting the nitrogen losses occurring during storage inside and outside the barn, the remaining amount constitutes the net nitrogen excretion, also referred to as nitrogen production (see Figure 2.2.1). There is no volatilization of phosphate and potash. The quantity of phosphate and potash in manure produced remains the same.

Figure 2.2.1: Relation between nitrogen excretion, losses, and nitrogen production.



The nitrogen losses during manure storage are calculated with the National Emission Model for Agriculture (NEMA), as described in Van der Zee et al. (2026) and Van der Most et al. (2026). Within NEMA, the nitrogen excretion in the WUM model is divided into nitrogen production, gaseous losses occurring during storage, both inside and outside the barn, and the removal of nitrogen via the discharge water from air scrubbers. Data on nitrogen production (excretion minus losses) – along with data on

feed residues, manure transport and manure processing – are used by Statistics Netherlands (CBS) to calculate the use of animal manure in agriculture.

2.3 Manure production

The manure production per animal, the so-called manure production factor, comprises the amount of manure (in kilograms) present in the barn's storage system after several months of storage, including feed residues, cleaning water, spilled drinking water, and bedding material. For grazing animals, manure production also includes the amount of manure these animals produce while grazing. Manure production factors are revised on an irregular basis, as soon as new data becomes available.

3. Livestock numbers

3.1 Agricultural census

Livestock numbers used in the WUM model are based on the agricultural census (Landbouwtelling). This census is part of the annual combined survey (*Gecombineerde Opgave*), sent to all farmers in the Netherlands. It incorporates administrative data from the identification and registration (I&R) system for livestock. Livestock numbers in the agricultural census on the reference date April 1st are generally considered to be representative of the average number of animals throughout the year, with a few exceptions (see section 3.3).

The agricultural census describes the quantitative structure of the Dutch agricultural sector with data on farms, livestock, crops and other topics such as labor and multifunctional agriculture. Annual census data is used for research and policy purposes (national and international). To exclude the very small farms (such as a holding with only one dairy cow), the agricultural census only includes holdings with an economic size of 3,000 euro Standard Output (SO) or more. SO is a standardized economic measure for the size of an agricultural holding, based on the farm's crop areas and livestock numbers.

Since 2016, a business has been classified as an agricultural holding in the agricultural census if it is registered in the Dutch Trade Register (in Dutch *Handelsregister*) with an International Standard Industrial Classification (ISIC; in Dutch SBI) code for agriculture. This results in the closest possible adherence to the statistical regulations of Eurostat and the Dutch implementation of the concept of 'active farmer' from the Common Agricultural Policy (CAP).

Due to the application of the SBI-classification, horses, ponies and sheep kept by riding schools and petting zoos fall outside the definition of agriculture. According to the agricultural census there are, approximately 100 thousand horses and ponies at Dutch agricultural holdings, whereas the actual number present in the Netherlands is much higher (400-500 thousand). Since NPK-excretion is only calculated for animals on agricultural holdings, no excretion is calculated for animals kept on other types of holdings.

As of 2017, the agricultural census has increasingly used data from the Dutch Identification and Registration registers (I&R) to calculate the number of livestock for specific animal categories on the reference date April 1st. The I&R-registers fall under the responsibility of Netherlands Enterprise Agency (RVO) and are intended to enable rapid tracing of animals in the event of animal diseases, partly also for public health reasons. From 2017 onwards, the size of the cattle herd has been derived from I&R cattle data (Van Os, 2017). From 2018 onwards, the poultry, sheep and goats numbers has also been derived from the relevant I&R registers (Van Os et al., 2019 and 2020).

Registration of cattle, sheep and goats takes place directly at RVO. Poultry data are obtained via the Dutch Flock Information system Poultry (KIP) from Avined (a trade association for the egg and poultry sector). Avined transmits the data to the central database of RVO. For the other animal categories (pigs, horses, ponies, and rabbits), livestock numbers are taken from the agricultural census survey.

3.2 Animal categories

NPK-excretion factors and manure production are calculated in the WUM model for each animal category in the agricultural census, with the exception of animal categories that are kept in very small numbers such as donkeys, deer, and 'other poultry'. The share of these animal categories in the total manure production is negligible. Moreover, 'other poultry' consists of various sub-categories, for which separate animal numbers are not available, making it impossible to calculate total excretion for these categories. The relatively small number of water buffaloes in the Netherlands are part of the I&R registration for cattle. The water buffaloes are assigned to dairy or beef cattle depending on the production goal of the farmer, i.e., water buffaloes are not treated as a separate animal category.

For excretion calculations some animal categories in the agricultural census are combined into one WUM category to better match the available data on feed intake and animal production. For example, the weight classes for fattening pigs (<50 kg, 50-80 kg, 80-110 kg, and >110 kg) and the distinction between male and female animals – as adopted from the agricultural census – have been combined into a single WUM category for fattening pigs. Another example, the feed intake and retention of young bucks and lambs are included in the calculation of the excretion factor for the mother (dairy goat). Sometimes the opposite happens, e.g., the category 'bulls aged two years and older' in the agricultural census is split into two parts (based on farm type) in the WUM model: breeding bulls (dairy) and beef bulls.

3.3 Livestock numbers

The livestock numbers as used in the WUM model can be found in Table 3.3.1 (dairy and beef cattle), Table 3.3.2 (other grazing livestock), and Table 3.3.3 (housed animals). For certain animal categories and reporting years, livestock numbers on the agricultural census reference date (April 1st) were not representative of the average livestock population throughout the year. In such cases, the livestock numbers from the agricultural census were adjusted within the WUM model, as described in the paragraph below (special circumstances).

Table 3.3.1: Number of dairy and beef cattle in The Netherlands and in its North-West and South-East regions (1990, 2010, 2024) as used in the WUM model.

Livestock numbers (x 1,000)	The Netherlands			North-West **			South-East ***		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Female young stock < 1 yr	753	545	424	305	210	171	448	336	253
Male young stock < 1 yr	53	29	45	23	11	19	30	18	26
Female young stock 1-2 yrs	734	564	405	304	218	165	430	346	241
Male young stock 1-2 yrs	35	14	9	17	5	4	18	9	5
Female young stock ≥ 2 yrs	146	87	70	55	36	31	91	51	39
Dairy cows	1878	1479	1539	850	612	658	1028	867	881
Breeding bulls ≥ 2 yrs	9	8	6	4	3	2	5	5	4
Total dairy cattle	3607	2725	2498	1558	1095	1050	2049	1631	1448
Calves for white veal production	602	634	567	93	72	72	509	561	496
Calves for rosé veal production *		294	327		32	28		262	299
Female young stock < 1 yr	53	39	43	18	10	11	35	29	33
Male young stock (incl. bullocks) < 1 yr	255	49	44	37	9	8	218	40	36
Female young stock 1-2 yrs	57	43	42	21	11	11	36	32	31
Male young stock (incl. bullocks) 1-2 yrs	178	46	36	32	6	6	146	40	30
Female young stock ≥ 2 yrs	43	20	28	17	5	7	25	15	20
Male young stock (incl. bullocks) ≥ 2 yrs	12	9	9	3	2	2	9	8	7
Suckling cows incl. fattening/grazing ≥ 2 yrs	120	115	52	45	34	15	74	81	37
Total beef cattle	1319	1250	1148	266	182	160	1053	1068	988
Total beef and dairy cattle	4926	3975	3646	1824	1276	1210	3102	2699	2436

* The 1990 number for calves for rosé veal production is included in the 1990 number for calves for white veal production.

** North-West = Groningen, Fryslân, Utrecht, Noord-Holland and Zuid-Holland.

*** South-East = Drenthe, Overijssel, Flevoland, Gelderland, Zeeland, Noord-Brabant and Limburg.

Table 3.3.2: Number of other grazing livestock in The Netherlands (1990, 2010, 2024) as used in the WUM model.

Livestock numbers (x 1,000)	1990	2010	2024
Sheep – ewes *	790	558	475
Dairy goats ≥ 1 yrs *	37	222	451
Horses (on farms)	50	93	65
Ponies (on farms)	20	49	37

* Excretion of 'sheep – ewes' and 'dairy goats ≥ 1 yrs' includes the excretion from young and male animals.

Table 3.3.3: Number of housed animals in The Netherlands (1990, 2010, 2024) as used in the WUM model.

Livestock numbers (x 1,000)	1990	2010	2024
Fattening pigs	7025	5904	4681
Gilts and young boars	399	236	188
Sows	1272	984	735
Breeding boars	28	7	4
Total pigs, excluding piglets	8724	7131	5607
Weaned piglets	2794	3124	2901
Broiler breeders < 20 weeks *	2882	2896	2614
Broiler breeders ≥ 20 weeks *	4390	4448	4209
Laying hens < 18 weeks	11121	13008	9317
Laying hens ≥ 18 weeks	33199	36148	31836
Broilers	41172	44748	35101
Total chickens	92764	101248	83077
Ducks	1086	1087	378
Fattening turkeys	1003	1036	502
Rabbits – does **	41	39	32
Minks - female breeders ***	.	962	

* For 1990-2017 the cut-off value is 18 weeks instead of 20 weeks.

** Excretion of 'rabbits – does' includes the excretion from young and male animals.

*** In the Netherlands, the keeping of minks and other fur-bearing animals has been prohibited since the beginning of 2021. The exact number of mink in 1990 is unknown. In the WUM model, this figure was set to zero, even though the estimated number should be around half a million animals (based on available figures since 1991).

Special circumstances

In years with outbreaks of animal diseases or when other special circumstances occurred (see Table 3.3.4), the livestock numbers on the reference date of the agricultural census (April 1st) will deviate from the average livestock numbers throughout the year. This is taken into account by making the appropriate adjustments to the WUM model.

In 1997, 2001, and 2003 there were outbreaks of swine fever, foot and mouth disease, and bird flu respectively. In 2017, the Fipronil egg scandal led to the culling of laying hens and empty poultry houses. In addition, the size of the cattle herd decreased in the course of 2017 due to the Dutch Subsidy Scheme for Termination of Dairy Farming and the Ministerial Regulation Phosphate Reduction Plan. Introduction of phosphate permits on 1 January 2018 led to further reductions in the cattle herd during that year.

As a result of the covid pandemic, there were fewer veal calves on average in 2020 and 2021 than on April 1st, the reference date of the agricultural census. In recent years, manure policy has also led to a decrease of cattle numbers throughout 2023 and 2024.

Table 3.3.4: *Years with special circumstances*

Year	Situation	Adjustment in WUM model
1997	Swine fever	The 1997 manure production and NPK-excretion factors have been adjusted to apply per counted swine in the agricultural census, rather than per average swine throughout the year.
2001	Foot and mouth disease	Average cattle numbers were based on the culling numbers and the duration of the transport bans.
2003	Bird flu	The average size of poultry flocks per region was estimated using data on culling operations, the period that barns stood empty, and the situation following restocking. To ensure accuracy, the estimated average size of the poultry population at the national level was validated using production data for poultry meat and eggs from 2002 and 2003.
2017	Fipronil egg scandal	Three million chickens were culled in the second half of 2017. This has been taken into account in the WUM calculations.
2017	Phosphate reduction plan	Average cattle numbers were calculated using the data from the identification and registration (I&R) system for livestock.
2018	Phosphate permits	By using I&R data, the cattle numbers were adjusted.
2020/21	Covid	The number of veal calves has been adjusted by using the quarterly results from the I&R system.
2023/24	Manure policy	By using I&R data, the cattle numbers were adjusted.

Next to sporadic outbreaks of animal diseases, there may be other reasons why livestock numbers in the agricultural census differ from those in the WUM model. For instance, seasonal fluctuations in livestock numbers can occur (e.g., with sheep and goats, whereby numbers are higher in spring and summer than in winter).

Another important factor is the way livestock farmers (have to) report their animal numbers, particularly for animal categories involving multiple production cycles per year and intervening periods of vacancy (lasting a few days or weeks). In cases of vacancy on the reference date, the reported figure may represent the number of animal places or the number of animals usually present at the start of a production cycle, rather than the number of animals actually present on that date. In such instances, the agricultural census will overestimate the number of animals. This is verified (and corrected) by comparing data from the agricultural census (April 1st as reference date) with livestock data from the identification and registration (I&R) system (animal numbers recorded throughout the year).

4. Feed intake

4.1 Introduction

When calculating feed intake, a distinction is made between roughage and concentrates, each of which consists of several separate categories (see Figure 4.1.1). The roughage used in the Netherlands consists primarily of maize silage, grass silage and hay, and fresh grass. Concentrates include compound feed, single dry feed ingredients, wet by-products, and milk (powder). This chapter discusses the data sources used to determine feed intake and its composition.

Figure 4.1.1: *Roughage and concentrate categories*



For each type of feed, data is needed on its nitrogen, phosphorus, and potassium content. In some cases, these values also depend on the animal category. To calculate the extent to which feed category contributes to total energy requirements in ruminant animals, the energy value – expressed as VEM (in Dutch: Voeder Eenheid Melk; ‘Feed Unit Milk’) – is also determined.

There are significant differences in dairy cattle rations between areas with sandy soils and areas with peat and clay soils. Therefore, when calculating excretion factors for dairy cows and young female stock, the WUM model distinguishes between two regions in the Netherlands: North-West and South-East. The share of maize silage in the dairy cattle rations is relatively low in North-West Netherlands and relatively high in South-East Netherlands.

4.2 Roughage consumption

Table 4.2.1 presents roughage consumption for grass silage and hay, fresh grass, and maize silage. In these numbers, feed losses are included, based on the assumption that these end up in the manure. Lucerne is excluded due to its negligible share in total roughage consumption.

Consumption of grass silage and hay is derived from statistical data on their production and stock changes, collected through a Statistics Netherlands (CBS) survey on grassland use. For dairy cattle, fresh grass intake during the grazing season is calculated using a feed balance (as a residual value). In this balance, fresh grass intake corresponds to the

remaining portion of the energy requirement (VEM) after deducting energy intake from maize silage, grass silage and hay, and concentrates.

The consumption of maize silage is calculated from the gross yield per hectare as registered in the Farm Sustainability Data Network (FSDN) of Wageningen Social & Economic Research (WSER), minus 4% conservation losses (Schröder et al., 2018). Data on stock changes are not available in time for the calculation of consumption of maize silage. To avoid sharp and unrealistic fluctuations in calculated maize consumption, the WUM model uses the average yield per hectare over the past four years.

Table 4.2.1: Roughage consumption (including feed losses) in The Netherlands and in its North-West and South-East regions (1990, 2010, 2024) as used in the WUM model.

Roughage consumption (million kg dry matter)	The Netherlands			North-West *			South-East **		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Grass silage for cattle, goats, and sheep	4308	5137	5993	2327	2434	2761	1981	2703	3232
Hay for cattle, goats, and sheep	380	91	183	210	65	92	170	26	91
Grass silage for horses and ponies			86			30			56
Hay for horses and ponies	63	123	71	26	43	25	37	80	46
Grass seed straw for horses and ponies	9	17	11	4	6	4	5	11	7
Fresh grass for cattle and sheep	5362	2795	1990	2570	1335	998	2792	1460	992
Fresh grass for horses and ponies	67	134	91	27	47	32	40	87	59
Maize silage, total	2471	3553	2957	352	685	595	2119	2868	2362

* North-West = Groningen, Fryslân, Utrecht, Noord-Holland and Zuid-Holland.

** South-East = Drenthe, Overijssel, Flevoland, Gelderland, Zeeland, Noord-Brabant and Limburg.

4.3 Roughage composition

The levels of nitrogen (N), phosphate (P₂O₅), potash (K₂O), and VEM ('Feed Unit Milk') in roughage are based on data from Eurofins Agro (a Dutch laboratory for soil and crop analysis). This institute determines the nutritional value and NPK content of a large number of samples of maize silage, grass silage and hay, and fresh grass. The roughage composition (NPK and VEM) for cattle, sheep, and goats are shown in Table 4.3.1 and for horses and ponies in Table 4.3.2.

For cattle, sheep, and goats (and not for horses and ponies), the WUM model takes different NPK and VEM contents of roughage for the housing and grazing seasons. During the grazing season (May – mid October) the animals are fed grass and maize silage from the previous year. For the housing season a weighted average is used, i.e., from January through April animals are fed grass and maize silage from the previous year, and from mid October through December, silage from the current year.

The composition of grass silage in a reporting year is calculated by a weighted average of spring silage (40-50 percent), summer silage (40-50 percent) and autumn silage (10-20 percent). The N and P contents of grass silage and fresh grass are lower in case of

extensively managed grassland than for commonly managed grassland (Tamminga et al., 2009). For natural grassland, N and P levels in grass silage are even lower.

Table 4.3.1: Roughage composition for cattle, sheep and, goats in the Netherlands, during housing and grazing season, (1990, 2010, 2024) as used in the WUM model.

Roughage composition (NPK in g/kg dry matter; VEM per kg dry matter)	Nitrogen (N)			Phosphorus (P)			Potassium (K)			VEM ('Feed Unit Milk')		
	1990	2010	2024	1990	2010	2024	1990	2010	2024	1990	2010	2024
Housing season												
Maize silage	13.8	12.1	10.7	2.5	1.9	1.8	14.9	11.0	8.9	898	984	998
Grass silage and hay:												
Commonly managed grassland ¹⁾	30.4	27.8	26.7	3.6	3.9	3.7	28.2	33.0	30.7	901	902	904
Extensively managed grassland ²⁾		24.9	23.9		3.7	3.5		32.7	30.3		858	857
Natural grassland ³⁾			16.8			2.8			20.7			678
Grazing season												
Maize silage	13.1	12.3	10.2	2.5	2.0	1.9	14.9	11.0	9.0	912	975	1003
Grass silage and hay:												
Commonly managed grassland	30.4	27.6	27.8	3.6	3.9	3.8	28.2	33.0	31.6	901	905	912
Fresh grass:												
Commonly managed grassland ⁴⁾	42.9	32.2	31.0	4.3	4.2	4.2	35.9	35.0	32.9	975	947	949
Extensively managed grassland ⁵⁾		25.7	24.8		3.8	3.8		35.0	32.9		890	900

1) Applies for sheep (1990-2003), 'suckling cows incl. fattening/grazing ≥ 2 yr' (1990-1998), and other cattle and goats (1990-2024).

2) Applies for sheep (2004-2014) and 'suckling cows incl. fattening/grazing ≥ 2 yr' (2003-2024; 1999-2002: 50% commonly, 50% extensively). Extensively versus commonly managed grassland: 10 percent lower N-contents and 5 percent lower P-contents in grass silage.

3) Applies for sheep (2015-2024).

4) Applies for sheep (1990-2003), 'female young stock ≥ 1 yr' (1990-2002), and 'suckling cows incl. fattening/grazing ≥ 2 yr' (1990-1998), and other cattle and goats (19990-2024).

5) Applies for sheep (2004-2024), 'female young stock ≥ 1 yr' (2003-2024), and 'suckling cows incl. fattening/grazing ≥ 2 yr' (2003-2024; 1999-2002: 50% common, 50% extensive). Extensively versus commonly managed grassland: 20 percent lower N-contents and 10 percent lower P-contents in fresh grass.

Table 4.3.2: Roughage composition for horses and ponies in the Netherlands (1990, 2010, 2024) as used in the WUM model.

Roughage composition (g/kg dry matter)	Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Fresh grass	29.1	29.1	29.1	4.1	4.1	3.9	30.9	30.4	29.0
Grass silage			20.5			3.3			25.2
Hay	20.8	16.4	14.1	3.0	2.7	2.5	25.0	18.7	18.5
Grass seed straw	13.3	11.2	9.8	1.6	1.7	1.7	18.9	18.4	18.3

4.4 Concentrates: consumption and composition

Tables 4.4.1 and 4.4.2 show the consumption of concentrates (including feed losses) and its composition (NPK and VEM), respectively, broken down by feed type and animal category. Sometimes consumption is aggregated to a higher level, while composition is available at a lower level. For instance, Table 4.4.1 presents 'Rosé veal calves and beef bulls' as a single group, while Table 4.4.2 shows the composition for the underlying categories. Similarly, the composition of each of the poultry categories in Table 4.4.2 is a weighted average of underlying categories.

Table 4.4.1: Concentrates consumption (including feed losses) in The Netherlands and in its North-West and South-East regions (1990, 2010, 2024) as used in the WUM model.

Concentrates consumption (million kg)	The Netherlands			North-West *			South-East **		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Compound and single dry feed:									
Dairy cows	3403	2620	3645	1543	1084	1599	1860	1537	2046
Rosé veal calves and beef bulls	349	351	408	59	43	41	290	308	367
Other cattle	481	268	220	166	92	77	315	176	143
Goats	11	116	313						
Sheep	45	23	21						
Horses and ponies	27	53	37	11	19	13	16	34	24
Whole milk for rearing young stock	296	123	102						
Moisture-rich concentrate for cattle (dry matter)	441	566	599	157	208	226	284	359	373
Milk powder:									
White veal calves	407	416	283						
Rosé veal calves and beef bulls	10	15	12						
Goats	0	2	3						
Milk replacer mix for white veal calves	0	0	376						
Feed for housed animals:									
Fattening pigs	5311	4569	3946						
Sows (and piglets)	2179	1903	1632						
Other pigs	319	205	166						
Laying hens	1554	1802	1642						
Broilers (and breeders)	1532	1880	1484						
Other poultry	172	178	49						
Rabbits - does	17	17	16						
Minks - female breeders ***	136	212							

* North-West = Groningen, Fryslân, Utrecht, Noord-Holland and Zuid-Holland.

** South-East = Drenthe, Overijssel, Flevoland, Gelderland, Zeeland, Noord-Brabant and Limburg.

*** In the Netherlands, the keeping of minks and other fur-bearing animals has been prohibited since the beginning of 2021.

Nutrient content of concentrates is based on deliveries of compound and single dry feed ingredients as reported by feed suppliers to the Netherlands Enterprise Agency (RVO). Since 2024, data on the supply of compound feed – as reported to the Dutch Feed Industry Association (Nevedi) by feed producers – has also been used. Deliveries under the RVO scheme are recorded in two separate databases. The first contains data on deliveries of compound feed, specifying the animal group (dairy cattle, beef cattle, veal calves, pigs, chickens, ducks, turkeys, rabbits, and – until 2021 – fur-bearing animals). A further breakdown by underlying animal categories is obtained by linking RVO data on feed deliveries with agricultural census.

The second database from RVO contains data on single dry feed ingredients (in kg dry matter) and on roughage and wet by-products (not in kg dry matter), without specifying animal groups. This database is used exclusively for single dry feed ingredients. Deliveries of feed with low N and P contents (< 14 g N/kg; < 2.5 g P/kg) are excluded,

based on the assumption that these are consist of roughage or wet by-products rather than single dry feed ingredients. Deliveries of feed with unrealistically high N and P contents (> 150 g N/kg; > 230 g P/kg) are also removed. Animal categories are determined by linking feed deliveries to the animals present on the receiving farms, using agricultural census data.

Table 4.4.2: *Concentrates composition in The Netherlands (1990, 2010, 2024) as used in the WUM model.*

Concentrates composition (NPK in g/kg; VEM per kg)	Nitrogen (N)			Phosphorus (P)			Potassium (K)			VEM ('Feed Unit		
	1990	2010	2024	1990	2010	2024	1990	2010	2024	1990	2010	2024
Compound and single dry feed:												
Dairy cattle *	28.1	30.9	28.5	5.1	5.5	4.2	14.4	13.5	11.1	940	940	958
Rosé veal calves (rearing)		32.5	32.5		5.5	5.5		12.6	12.6			
Rosé veal calves (growth, finishing)		30.7	25.8		5.1	4.7		14.2	11.7			
Beef bulls (rearing)	34.3	34.8	41.7	6.0	6.2	5.4	14.4	12.9	12.6			
Beef bulls (growth, finishing)		30.0	23.7		5.8	4.0		13.3	11.7			
Goats	26.2	23.8	26.6	4.8	5.2	4.7	14.4	9.0	9.0			
Sheep	22.7	26.5	24.7	3.3	4.1	4.0	13.9	12.6	11.7			
Horses and ponies	18.7	18.7	22.3	5.3	5.3	5.5	7.6	7.6	11.7			
Whole milk for rearing young stock	5.4	5.5	5.6	0.9	1.0	1.0	1.6	1.6	1.6	280	280	280
Moisture-rich concentrate (dry matter):												
Dairy cattle	28.5	27.6	24.3	2.8	4.3	3.2	8.0	9.3	8.4	1000	1000	1000
Beef cattle	28.5	17.2	21.6	2.8	3.4	3.8	8.0	9.0	8.4			
Milk powder:												
White veal calves	32.1	29.7	27.0	6.8	5.6	5.9	14.7	16.5	15.6			
Rosé veal calves and beef bulls	32.1	35.0	33.0	6.8	8.0	5.9	14.7	21.5	20.4			
Goats	32.1	34.0	34.0	6.8	7.0	7.0	14.7	16.0	16.0			
Milk replacer mix for white veal calves			24.1			3.0			4.0			
Feed for housed animals:												
Fattening pigs	26.9	25.2	23.8	5.1	4.8	4.3	11.3	9.3	9.3			
Sows (and piglets)	27.4	24.9	23.4	6.6	5.4	4.9	11.3	9.3	9.2			
Other pigs	26.7	25.4	23.2	6.4	5.2	4.5	11.3	9.1	9.1			
Laying hens	27.1	26.2	25.1	6.1	4.9	4.5	8.4	7.0	7.1			
Broilers (and breeders)	33.8	28.8	27.5	5.9	4.6	4.2	10.1	7.0	7.2			
Other poultry (turkeys and ducks)	30.5	28.6	27.1	6.7	5.5	4.7	8.6	7.6	7.7			
Rabbits - does	29.4	25.8	24.9	6.8	5.3	5.0	8.9	15.0	15.0			
Minks - female breeders	17.5	11.7		5.2	2.7		0.8	2.6				

* Until 2022, a distinction was made between high-protein and low-protein feed for dairy cattle, but this is no longer the case.
For dairy cows and female young stock, the nutrient contents are different for the North-West and South-East regions of the Netherlands.

Wet by-products in the Netherlands are primarily generated by the agricultural, food processing, and beverage industries, such as beet pulp. The consumption and composition of wet by-products are derived from the Circular Feed association (Cfa). Organization Cfa provides an annual overview of the sales volume and dry matter contents of various moisture-rich concentrates, including the proportion of this feed intended for pigs and cattle. The NPK contents are from the Central Animal Feed Office in the Netherlands (in Dutch: Centraal Veevoeder Bureau; CVB).

It has been identified that some holdings with white veal calves prepare their own artificial milk using supplied raw materials, for which the dry matter content is unknown. Consequently, feed delivery data (RVO) cannot be used to calculate an average composition of the diet, which consists of artificial milk, milk replacer (pellets), and straw. These feed deliveries are not categorized by product type, and the dry matter content is unavailable. Therefore, N and P levels in the diet for white veal calves are based on data from the veal calf sector.

The P content of whole milk is updated annually with data from the Dutch Dairy Association (Dutch: Nederlandse Zuivel Organisatie; NZO).

5. Retention in animal products

Nutrient retention in livestock can occur through the increase in body mass of the animals (births and growth) and the production of milk, wool, and eggs. Most of the data in this chapter can also be found in a Dutch publication on ‘Manure and nutrients 2024’ (Statistics Netherlands, 2025), which also contains references to scientific publications regarding the data used.

5.1 Births and growth: grazing livestock

Table 5.1.1 shows the initial and final body mass of several grazing livestock categories, including the nitrogen (N), phosphorus (P), and potassium (K) content.

Table 5.1.1: Initial and final body mass of grazing livestock in the Netherlands (1990, 2010, 2024), including nutrient content, as used in the WUM model.

Body mass of the animal (kg) and nutrient content NPK (g/kg)	Body mass			Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024	1990	2010	2024
Cattle												
Calf(birth)	43	44	44	29.4	29.4	29.4	8.00	8.00	8.00	2.05	2.05	2.05
Female young stock (aged 1 year)	310	320	320	25.6	24.1	24.1	7.40	7.40	7.40	2.00	2.00	2.00
Female young stock (at first calving)	520	525	540	25.6	23.1	23.1	7.40	7.40	7.40	2.00	2.00	2.00
Dairy cow (final)	600	600	675	25.3	22.5	22.5	7.40	7.40	7.40	2.00	2.00	2.00
Male young stock (aged 1 year)	400	400	400	25.6	25.6	25.6	7.40	7.40	7.40	2.00	2.00	2.00
Breeding bull (final)	1100	1100	1100	25.3	25.3	25.3	7.40	7.40	7.40	2.00	2.00	2.00
White veal production (final)	230	245	271	30.2	27.3	27.3	7.60	5.90	7.20	1.91	1.67	1.67
Rosé veal production (final)	310	338	342	29.0	26.4	26.4	7.60	6.85	6.85	1.91	1.69	1.69
Male young stock (aged 1 year)	450	450	571	28.5	28.5	28.5	7.50	7.50	7.50	1.91	1.91	1.91
Beef bull (final)	577	674	825	27.0	27.0	27.0	7.40	7.40	7.40	1.91	1.91	1.91
Suckler, incl. fattening/grazing (final)	650	650	750	25.3	22.5	22.5	7.40	7.40	7.40	2.00	2.00	2.00
Other livestock												
Sheep - Lamb (birth)	4.00	4.75	4.75	25.0	26.9	26.9	6.00	5.20	5.20	1.70	1.70	1.70
Sheep - Beef lamb (final)	40	42	42	25.0	26.2	26.2	6.00	5.20	5.20	1.70	1.70	1.70
Adult sheep (final)	75	75	75	25.0	25.0	25.0	6.00	7.80	7.80	1.70	1.70	1.70
Goat - Lamb (birth)	3.00	3.00	3.25	24.0	27.4	27.4	6.00	6.30	6.30	1.70	1.70	1.70
Goat - Beef lamb (final)	5	10	9	24.0	24.0	24.0	6.00	6.30	6.30	1.70	1.70	1.70
Adult dairy goat (final)	70	70	75	24.0	24.0	24.0	6.00	7.90	7.90	1.70	1.70	1.70
Horse	540	540	540	29.9	29.9	29.9	7.50	7.50	7.50	2.00	2.00	2.00
Pony	285	285	285	29.9	29.9	29.9	7.50	7.50	7.50	2.00	2.00	2.00

The ‘annual scaling factor’ – which converts the increase in body mass over a specified period into an annual increase in body mass – is presented in Table 5.1.2. Multiplying annual scaling factor by body mass growth (final weight minus initial weight in Table 5.1.1) yields the annual increase in body mass. Annual scaling factor is equal to 1 when it takes exactly one year to grow from initial weight to final weight. For production cycles shorter than a year, the annual scaling factor is greater than 1. For example, 4 production cycles of 13 weeks in a year results in an annual scaling factor of 4.

In cases where the increase in body mass takes longer than one year, the annual scaling factor is less than 1. This can be based on the annual replacement factor (e.g., annual scaling factor is 0.25 when the entire group of animals is gradually replaced by a new group every 4 years) or on the proportion of the animal population that has not yet reached its final weight, divided by the number of years required to grow from initial weight to final weight (e.g., annual scaling factor is $0.20 = (1.00 - 0.40) / 3$ when it takes 3 years to grow from initial to final weight, while 40 percent of the animal population has already reached final weight).

Table 5.1.2: Annual scaling factor (not equal to 1) for grazing livestock in the Netherlands (1990, 2010, 2024) as used in the WUM model.

Annual scaling factor	1990	2010	2024
Dairy cows	0.42	0.28	0.25
Breeding bulls	0.27	0.27	0.27
Suckling cows, incl. fattening/grazing	0.25	0.25	0.20
Calves for white veal production	1.96	1.93	1.92
Calves for rosé veal production		1.49	1.51
Beef bulls	3.20	1.87	1.98
Sheep – ewes	0.25	0.25	0.21
Dairy goats *	0.31	0.31	0.31
Horse	0.071	0.071	0.071
Pony	0.050	0.050	0.050

* It also includes the replacement rate for a small number of bucks.

For cattle, body mass retention is the sum of birth weights and the increase in body mass up to the time of the animal's death. The first component (births) is calculated by multiplying the body mass of a newborn calf (Table 5.1.1) by the average number of births per cow, as shown in Table 5.1.3, and also multiplied by the corresponding livestock numbers (Table 3.3.1).

Table 5.1.3: Average number of births per cow in the Netherlands (1990, 2010, 2024) as used in the WUM model.

Average number of births per cow	1990	2010	2024
Female young cattle (1 year and older)	0.63	0.63	0.92
Dairy cows	0.83	0.68	0.72
Suckling cows, incl. fattening/grazing	0.75	0.75	0.70

The second component (growth) is calculated by multiplying the increase in body mass (Table 5.1.1) by the corresponding livestock numbers (Tables 3.3.1), and – if the annual scaling factor is not equal to 1 – also by the annual scaling factor (Table 5.1.2). Based on the figures for 2024 in Table 5.1.1, the annual increase in body mass amounts +276 kg (= 320 – 44) for female young stock (aged 1 year), +220 kg (= 540 – 320) for female young stock (at first calving), and +34 kg ($'135 = 675 - 540' \times 0.25$) for dairy cows.

Table 5.2.1: Initial and final body mass of housed animals in the Netherlands (1990, 2010, 2024), including nutrient content, as used in the WUM model.

Body mass of the animal (kg) and nutrient content NPK (g/kg)	Body mass			Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024	1990	2010	2024
Pigs												
Stillborn piglet	1.3	1.3	1.3	19.2	18.7	18.7	6.15	6.15	6.15	1.54	1.81	1.81
Early loss newborn piglet	2.8	2.8	2.8	19.2	23.1	23.1	6.15	5.36	5.36	1.54	2.64	2.64
Weaned piglet (initial) *			7.5			24.0			5.17			2.64
Piglet raised (initial for fattening pig)	25.5	24.9	25.5	24.0	24.8	25.3	5.14	5.32	5.25	2.32	2.42	2.42
Fattening pig (final)	108	118	125	23.2	25.0	25.0	5.03	5.36	5.25	2.10	2.28	2.28
Gilt (initial for sow)	124	145	140	23.2	24.9	24.9	5.36	5.78	5.78	2.10	2.25	2.25
Sow (final) *	176	230	230	26.0	25.0	25.0	4.00	5.35	5.35	1.70	2.04	2.08
Young boar (initial for breeding boar)	130	135	150	23.2	24.9	24.9	5.36	5.78	5.78	2.10	2.25	2.25
Breeding boar (final)	300	325	300	24.0	25.0	25.0	5.00	5.35	5.35	2.00	2.04	2.04
Chickens												
Broiler (final) – regular	1.79	2.20	2.50	28.0	27.8	28.3	4.70	4.40	4.43	1.54	2.40	2.40
Broiler (final) – slow growing **			2.60			28.3			4.43			2.40
Regular broiler breeders:												
Hen (aged 18-20 weeks)	1.80	2.00	2.37	33.4	33.4	33.4	4.90	4.90	4.93	2.50	2.50	2.50
Hen (final)	3.60	3.70	3.90	28.4	28.4	28.4	5.40	5.40	5.41	2.20	2.20	2.20
Rooster (aged 18-20 weeks)	2.35	2.75	3.00	34.5	34.5	34.5	5.40	5.40	5.46	2.50	2.50	2.50
Rooster (final)	4.80	4.80	5.00	35.4	35.4	35.4	5.70	5.70	5.68	2.50	2.50	2.50
Slow growing broiler breeders: **												
Hen (aged 18-20 weeks)			1.60			33.4			4.93			2.50
Hen (final)			2.20			28.4			5.41			2.20
Laying hen:												
With white eggs (aged 18-20 weeks)	1.214	1.285	1.200	28.0	28.0	35.7	6.10	5.50	5.50	1.91	1.91	1.91
With white eggs (final)	1.745	1.600	1.600	28.0	28.0	30.7	5.08	5.60	6.00	1.85	1.85	1.85
With brown eggs (aged 18-20 weeks)	1.396	1.520	1.400	28.0	28.0	35.7	6.40	5.50	5.50	1.65	1.65	1.65
With brown eggs (final)	2.090	1.800	1.700	28.0	28.0	31.6	5.39	5.60	6.00	1.85	1.85	1.85
Other animals												
Duck	3.1	3.2	3.2	25.9	29.5	29.5	5.70	5.07	5.07	2.00	2.49	2.49
Fattening turkey – hen	9.0	10.0	10.0	33.0	33.0	33.0	7.20	5.00	5.00	2.04	2.04	2.04
Fattening turkey – rooster	17.0	20.0	20.0	33.0	33.0	33.0	7.20	5.20	5.20	2.04	2.04	2.04
Rabbit – early loss (before weaning)	0.30	0.43	0.20	30.0	28.9	27.1	6.00	6.00	5.40	2.00	2.00	2.00
Rabbit – early loss (after weaning)	1.76	1.72	1.65	30.0	28.9	28.2	6.00	6.00	4.90	2.00	2.00	2.00
Rabbit – meat	2.46	2.58	2.65	30.0	28.9	28.2	6.00	6.00	5.20	2.00	2.00	2.00
Rabbit – doe		4.2	4.5	30.0	32.3	30.2	6.00	6.00	5.20	2.00	2.00	2.00
Mink	1.9	2.2		30.0	27.9		6.00	6.00		2.00	2.00	

* Since 2022, excretion for sows (including all piglets) are subdivided into two categories: 'weaned piglets' and 'sows, including piglets up to weaning'.

** Since 2023, broilers and their female breeders are subdivided into slow growing animals and regular ones. For 1990-2022, 'regular' represents an average.

Similar retention calculations are performed for sheep, goats, horses, and ponies. For instance, sheep retention is the sum of retention for ewes (based on final weight and replacement rate), retention for beef lambs, and retention associated with the early loss of newborn lambs.

5.2 Births and growth: housed animals

Table 5.2.1 shows the initial and final body mass of several categories of housed animals, including the nitrogen (N), phosphorus (P), and potassium (K) content. Apart from some minor differences in the calculation method, the approach for calculating retention in housed animals is the same as that for grazing livestock. For housed animals, too, the retention of body mass is the sum of birth weights and the increase in body mass up to the moment of the animal's death. The sum of birth weights excludes the offspring of chickens. This falls under egg production (Section 5.3).

Table 5.2.2 presents the annual scaling factor, based on annual replacement rates (< 1) or the number of production cycles in a year (> 1). Table 5.2.3 presents information on births for pigs (sows), rabbits (does), and female minks.

Table 5.2.2: Annual scaling factor for housed animals in the Netherlands (1990, 2010, 2024) as used in the WUM model.

Annual scaling factor	1990	2010	2024
Pigs			
Weaned piglets			7.65
Fattening pigs	3.17	3.12	3.38
Gilts and young boars	2.35	1.98	1.99
Sows	0.42	0.43	0.38
Breeding boars	0.67	0.67	0.67
Chickens			
Broilers – regular	8.46	9.01	8.69
Broilers – slow growing			6.50
Broiler breeders (young) – regular	2.90	2.61	2.61
Broiler breeders (young) – slow growing			2.61
Broiler breeders (adult) – regular	1.24	1.28	1.28
Broiler breeders (adult) – slow growing			1.12
Laying hens < 18 weeks	3.07	3.07	3.07
Laying hens ≥ 18 weeks	0.87	0.89	0.70
Other animals			
Ducks	7.30	7.93	8.11
Fattening turkey – hen	2.77	3.26	3.26
Fattening turkey – rooster	2.77	2.48	2.61

Table 5.2.3: Average number of births per animal (sow, doe and female mink) in the Netherlands (1990, 2010, 2024) as used in WUM model.

Average number of births per head	1990	2010	2024
Sow – Stillborn piglets		2.4	2.8
Sow – Early loss newborn piglets	3.1	4.7	4.3
Sow – Piglets raised	20.4	27.0	31.5
Doe – Early loss (before weaning)	8.9	7.3	5.2
Doe – Early loss (after weaning)	4.6	5.4	4.8
Doe – Pups raised (for meat)	41.8	46.7	52.9
Doe – Pups raised (for replacement)		1.5	1.8
Mink (female) – animals raised *	5.0	5.5	

5.3 Production of milk, eggs, and wool

Table 5.3.1 shows the produced quantities of milk, wool, and eggs per head, including their nitrogen (N), phosphorus (P), and potassium (K) content. The quantity of meat produced is not included, as this retention has already been accounted for in the growth towards final body weight (Sections 5.1 and 5.2).

Table 5.3.1: Produced amount of milk, wool, and eggs per head in the Netherlands (1990, 2010, 2024) as used in WUM model.

Animal products per head (kg) and nutrient content NPK (g/kg)	Animal products			Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024	1990	2010	2024
Milk from dairy cows (NL)	6003	8075	9115	5.38	5.52	5.61	0.90	0.97	1.01	1.60	1.60	1.60
North-West		7922	8889									
South-East		8184	9284									
Milk from suckling cows (NL)	2000	1700	1350	5.38	5.52	5.61	0.90	0.97	1.01	1.60	1.60	1.60
Milk from dairy goats (NL)	600	900	1150	5.00	5.03	5.03	0.90	1.12	1.12	2.00	2.00	2.00
Wool from sheep (ewes; NL)	3.25	3	3	122	122	122	0.11	0.11	0.11	0.30	1.45	1.45
Eggs from laying hens (≥18 weeks; NL)	17.6	18.0	19.8	19.2	18.5	18.5	2.00	1.70	1.70	1.20	1.20	1.20
Eggs from broiler breeders (adult; NL)	12.4	12.7	13.8	19.2	19.3	19.3	2.00	1.90	1.90	1.20	1.20	1.20

The total milk production is the sum of milk deliveries to dairy industry (based on data from the Netherlands Enterprise Agency, RVO) and the milk retained on the farm (a few percent) for, e.g., processing into dairy products and calf rearing, as well as losses due to milk that cannot be delivered because of mastitis and antibiotic use.

6. Excretion

The calculation of the excretion per animal (nitrogen, phosphorus, and potassium) is based on Figure 2.1.1. Specifically, this involves feed intake (Chapter 4) minus retention (Chapter 5). Without going into the details of the calculation, results for nutrient quantities per head are shown in Table 6.1 (dairy cows and female young cattle; subdivided by two regions), Table 6.2 (beef cattle, male young cattle, sheep, dairy goats, horses, and ponies), Table 6.3 (pigs, rabbits and minks), and Table 6.4 (poultry).

For grazing livestock (cattle, goats, sheep, horses, and ponies), the calculation of excretion is more detailed and complex than for housed animals (pigs, poultry, rabbits, and fur-bearing animals). This applies particularly to dairy cows and young female cattle, given their significant share in manure production. Feed intake differs between grazing animals and housed animals: both groups receive concentrates, but grazing animals also consume roughage. The initially unknown intake of fresh grass during the grazing season is calculated using a feed balance (as a residual value). Feed intake of grazing animals varies not only over time (grazing season versus housing season; see comments below Table 4.3.2), but also by region (North-West versus South-East; see Table 6.1).

The WUM model distinguishes between excretion during grazing and housing seasons, due to the difference of gaseous nitrogen losses from manure storage and manure deposited in the pasture. For dairy cattle, data on grazing are collected via the annual agricultural census on duration of the grazing season (in days), the share with no, partial, or full access to pasture, and number of hours spent grazing (partial access; 7 hours a day in 2024) and day-and-night (full access; 16 hours a day in 2024). For young female cattle similar data is available on duration of the grazing season and proportion with no and full access to pasture. For young female stock, with no milk production, full access is taken as 24 hours a day.

The excretion factors per head in Tables 6.1 through 6.4 can be multiplied by the corresponding livestock numbers in Tables 3.3.1 through 3.3.3 to obtain the annual quantity of nutrients in manure produced by the Dutch livestock. The quantities of phosphorus (P) and potassium (K) are converted into quantities of phosphate (P_2O_5) and potash (K_2O) based on the ratios of standard atomic weights. The conversion factor from P to P_2O_5 and from K to K_2O are 2.29 (= 142/62) and 1.205 (= 94/78), respectively.

The results for the total livestock population are shown in Table 6.5. The underlying results for grazing animals are shown in Table 6.6, and those for housed animals in Table 6.7.

Table 6.1: *Quantity of nutrients in feed intake, retention, and excretion per head, for dairy cows and female young cattle in the Netherlands and its North-West and South-East regions (1990, 2010, 2024) as used in the WUM model.*

Feed intake, retention and excretion (kg of nutrients per head)	Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
The Netherlands									
Dairy cows									
Feed intake	182.7	176.0	193.9	24.0	27.0	27.6	140.5	150.7	157.0
Retention	34.1	45.8	52.8	5.9	8.2	9.7	9.7	13.0	14.7
Excretion	148.6	130.1	141.2	18.1	18.8	17.9	130.7	137.7	142.2
Female young stock ≥ 1 yr (dairy and beef)									
Feed intake	100.4	78.3	72.9	11.3	11.3	10.5	86.5	96.5	84.2
Retention	6.2	5.2	6.0	1.8	1.7	2.0	0.5	0.5	0.5
Excretion	94.2	73.1	66.9	9.5	9.6	8.5	86.1	96.0	83.7
Female young stock < 1 yr (dairy and beef)									
Feed intake	48.5	42.4	38.2	6.1	6.4	5.6	39.6	41.8	36.1
Retention	6.7	6.4	6.4	2.0	2.0	2.0	0.5	0.5	0.5
Excretion	41.8	35.9	31.8	4.2	4.4	3.6	39.1	41.2	35.5
North-West region *									
Dairy cows									
Feed intake	191.1	187.6	197.4	24.3	28.5	28.4	149.1	170.0	169.7
Retention	34.1	45.0	51.5	5.9	8.1	9.5	9.7	12.8	14.4
Excretion	157.0	142.7	145.9	18.4	20.5	18.9	139.4	157.3	155.3
Female young stock ≥ 1 yr (dairy and beef)									
Feed intake	102.0	80.1	75.2	11.3	11.5	10.8	88.3	98.4	87.8
Retention	6.2	5.2	6.0	1.8	1.7	2.0	0.5	0.5	0.5
Excretion	95.9	74.9	69.2	9.5	9.8	8.8	87.9	98.0	87.3
Female young stock < 1 yr (dairy and beef)									
Feed intake	51.0	45.0	41.1	6.2	6.7	5.9	42.0	46.2	40.7
Retention	6.7	6.4	6.4	2.0	2.0	2.0	0.5	0.5	0.5
Excretion	44.3	38.6	34.7	4.3	4.6	3.9	41.5	45.6	40.1
South-East region **									
Dairy cows									
Feed intake	175.7	167.7	191.4	23.8	25.9	27.0	133.3	137.1	147.4
Retention	34.1	46.4	53.7	5.9	8.3	9.9	9.7	13.2	15.0
Excretion	141.7	121.3	137.7	17.9	17.6	17.2	123.6	123.9	132.4
Female young stock ≥ 1 yr (dairy and beef)									
Feed intake	99.3	77.3	71.4	11.2	11.2	10.3	85.3	95.3	81.9
Retention	6.2	5.2	6.0	1.8	1.7	2.0	0.5	0.5	0.5
Excretion	93.1	72.1	65.4	9.5	9.5	8.3	84.9	94.8	81.4
Female young stock < 1 yr (dairy and beef)									
Feed intake	46.8	40.7	36.4	6.1	6.2	5.4	38.0	39.1	33.1
Retention	6.7	6.4	6.4	2.0	2.0	2.0	0.5	0.5	0.5
Excretion	40.1	34.3	30.0	4.1	4.2	3.4	37.5	38.6	32.6

* North-West = Groningen, Fryslân, Utrecht, Noord-Holland and Zuid-Holland.

** South-East = Drenthe, Overijssel, Flevoland, Gelderland, Zeeland, Noord-Brabant and Limburg.

Table 6.2: *Quantity of nutrients in feed intake, retention, and excretion per head, for beef cattle and male young cattle, sheep (ewes), dairy goats, horses, and ponies in the Netherlands (1990, 2010, 2024) as used in the WUM model.*

Feed intake, retention and excretion (kg of nutrients per head)	Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Calves for white veal production									
Feed intake	21.8	22.6	29.9	4.6	4.2	5.0	10.0	13.6	11.4
Retention	11.2	10.2	11.6	2.8	2.0	3.0	0.7	0.6	0.7
Excretion	10.6	12.4	18.4	1.9	2.1	2.0	9.3	13.0	10.8
Calves for rosé veal production									
Feed intake		39.4	39.3		6.7	6.9		21.3	19.9
Retention		11.2	11.5		2.9	2.9		0.7	0.7
Excretion		28.2	27.9		3.9	4.0		20.6	19.1
Suckling cows incl. fattening/grazing ≥ 2 yrs									
Feed intake	123.2	94.3	85.5	13.7	14.0	12.9	104.3	125.0	110.0
Retention	12.5	11.0	9.3	2.3	2.1	1.9	3.3	2.9	2.3
Excretion	110.7	83.3	76.3	11.4	11.9	11.0	101.0	122.1	107.7
Male young stock (incl. bullocks) ≥ 1 yr (beef)									
Feed intake	81.5	63.9	69.9	12.9	11.4	10.7	48.1	37.6	32.1
Retention	8.9	10.1	12.0	2.9	3.0	3.6	0.8	0.8	1.0
Excretion	72.6	53.8	57.9	10.1	8.3	7.1	47.3	36.8	31.2
Male young stock (incl. bullocks) < 1 yr (beef)									
Feed intake	40.1	38.1	40.9	6.8	6.6	5.8	25.2	21.8	19.0
Retention	11.3	11.3	14.8	3.0	3.0	3.9	0.8	0.8	1.0
Excretion	28.9	26.8	26.1	3.9	3.6	1.9	24.4	21.0	18.0
Male young stock (≥ 1 yrs) and breeding bulls (dairy)									
Feed intake	95.2	88.1	84.5	11.7	12.8	12.0	85.5	98.8	91.5
Retention	4.7	4.7	4.7	1.4	1.4	1.4	0.4	0.4	0.4
Excretion	90.6	83.4	79.8	10.3	11.4	10.6	85.2	98.4	91.1
Male young stock < 1 yr (dairy)									
Feed intake	48.4	42.1	39.6	6.5	6.4	5.9	40.9	40.6	36.5
Retention	8.7	8.9	8.9	2.5	2.6	2.6	0.7	0.7	0.7
Excretion	39.6	33.2	30.7	4.0	3.8	3.3	40.2	39.9	35.8
Sheep – ewes									
Feed intake	27.6	16.4	15.7	2.9	2.4	2.4	23.1	21.3	19.7
Retention	2.6	2.2	2.2	0.4	0.4	0.4	0.1	0.1	0.1
Excretion	25.0	14.2	13.4	2.5	2.0	2.0	22.9	21.2	19.6
Dairy goats									
Feed intake	23.6	22.7	26.2	3.4	4.2	4.4	18.4	15.7	14.2
Retention	3.8	5.2	6.4	0.7	1.2	1.5	1.3	1.9	2.3
Excretion	19.9	17.5	19.7	2.7	3.0	2.9	17.2	13.8	11.9
Horses									
Feed intake	64.6	59.6	77.6	10.4	10.2	12.8	66.4	59.0	82.1
Retention	1.1	1.1	1.1	0.3	0.3	0.3	0.1	0.1	0.1
Excretion	63.5	58.4	76.5	10.1	9.9	12.5	66.3	59.0	82.0
Ponies									
Feed intake	34.7	32.4	36.0	5.4	5.2	5.8	36.9	33.4	39.1
Retention	0.4	0.4	0.4	0.1	0.1	0.1	0.0	0.0	0.0
Excretion	34.2	32.0	35.5	5.3	5.1	5.7	36.9	33.4	39.1

Table 6.3: *Quantity of nutrients in feed intake, retention, and excretion per head, for pigs, rabbits (does), and minks (female breeders) in the Netherlands (1990, 2010, 2024) as used in the WUM model.*

Feed intake, retention and (kg of nutrients per head)	Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Fattening pigs									
Feed intake	20.3	19.5	20.0	3.8	3.7	3.7	8.5	7.2	7.8
Retention	6.0	7.3	8.4	1.3	1.6	1.8	0.5	0.7	0.8
Excretion	14.3	12.2	11.6	2.5	2.1	1.9	8.0	6.5	7.1
Sows *									
Feed intake	46.9	48.2	28.7	11.3	10.4	6.7	19.4	18.0	12.5
Retention	13.1	18.0	6.9	2.8	3.8	1.5	1.3	1.7	0.7
Excretion	33.8	30.2	21.8	8.5	6.6	5.2	18.1	16.3	11.8
Weaned piglets *									
Feed intake			5.9			1.1			2.0
Retention			3.5			0.7			0.3
Excretion			2.4			0.3			1.7
Gilts and young boars									
Feed intake	19.3	21.3	20.1	4.6	4.3	3.9	8.2	7.6	7.8
Retention	5.4	5.9	5.7	1.3	1.4	1.3	0.5	0.5	0.5
Excretion	14.0	15.4	14.4	3.4	2.9	2.6	7.7	7.1	7.3
Breeding boars									
Feed intake	27.8	26.5	23.3	7.0	6.0	5.5	12.0	9.7	9.4
Retention	2.8	3.2	2.5	0.5	0.6	0.5	0.2	0.2	0.2
Excretion	25.0	23.3	20.8	6.5	5.4	5.0	11.8	9.5	9.3
Rabbits – does **									
Feed intake	12.1	11.7	12.4	2.8	2.4	2.5	3.7	6.8	7.5
Retention	3.4	4.0	4.4	0.7	0.8	0.8	0.2	0.3	0.3
Excretion	8.7	7.7	7.9	2.1	1.6	1.7	3.4	6.5	7.1
Minks – female breeders **									
Feed intake	4.4	2.6		1.3	0.6		0.2	0.6	
Retention	0.3	0.3		0.1	0.1		0.0	0.0	
Excretion	4.1	2.2		1.2	0.5		0.2	0.5	

* Since 2022, excretion for sows (including all piglets) has been derived from 'weaned piglets' and 'sows, including piglets up to weaning'.

** Includes excretion from young and male animals. Since the beginning of 2021, it has been prohibited in the Netherlands to keep minks.

Table 6.4: *Quantity of nutrients in feed intake, retention, and excretion per head, for chickens, ducks, and fattening turkeys in the Netherlands (1990, 2010, 2024) as used in the WUM model.*

Feed intake, retention and (kg of nutrients per head)	Nitrogen (N)			Phosphorus (P)			Potassium (K)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Laying hens ≥ 18 weeks									
Feed intake	1.10	1.14	1.16	0.25	0.21	0.21	0.35	0.31	0.33
Retention	0.35	0.34	0.37	0.04	0.03	0.04	0.02	0.02	0.02
Excretion	0.75	0.80	0.79	0.21	0.18	0.17	0.33	0.28	0.30
Laying hens < 18 weeks									
Feed intake	0.49	0.46	0.45	0.11	0.10	0.09	0.14	0.12	0.13
Retention	0.11	0.12	0.13	0.03	0.02	0.02	0.01	0.01	0.01
Excretion	0.38	0.34	0.31	0.08	0.07	0.07	0.13	0.12	0.12
Broilers									
Feed intake	1.04	1.04	0.97	0.17	0.16	0.14	0.31	0.25	0.25
Retention	0.42	0.54	0.54	0.07	0.09	0.09	0.02	0.05	0.05
Excretion	0.61	0.50	0.43	0.10	0.07	0.05	0.28	0.20	0.20
Broiler breeders ≥ 20 weeks *									
Feed intake	1.63	1.41	1.18	0.37	0.28	0.23	0.51	0.40	0.37
Retention	0.30	0.30	0.31	0.04	0.04	0.04	0.02	0.02	0.02
Excretion	1.33	1.11	0.87	0.33	0.25	0.19	0.49	0.38	0.35
Broiler breeders < 20 weeks *									
Feed intake	0.73	0.53	0.50	0.16	0.12	0.11	0.20	0.15	0.15
Retention	0.20	0.18	0.20	0.03	0.03	0.03	0.02	0.01	0.01
Excretion	0.52	0.35	0.31	0.13	0.09	0.08	0.18	0.13	0.14
Fattening turkeys									
Feed intake	3.16	3.31	3.13	0.66	0.63	0.50	0.85	0.83	0.78
Retention	1.19	1.39	1.43	0.26	0.22	0.22	0.07	0.09	0.09
Excretion	1.98	1.91	1.71	0.40	0.41	0.28	0.78	0.74	0.69
Ducks									
Feed intake	1.71	1.53	1.33	0.40	0.29	0.25	0.52	0.46	0.45
Retention	0.59	0.74	0.76	0.13	0.13	0.13	0.05	0.06	0.06
Excretion	1.12	0.79	0.57	0.27	0.17	0.12	0.47	0.40	0.39

* For 1990-2017 the cut-off value is 18 weeks instead of 20 weeks.

Table 6.5: *Quantity of N, P₂O₅, and K₂O in manure produced in the Netherlands (1990, 2010, 2024) as used in the WUM model.*

Excretion (million kg)	Nitrogen (N)			Phosphate (P ₂ O ₅)			Potassium (K ₂ O)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Cattle	451.8	298.5	298.4	120.8	96.2	86.1	482.1	398.8	366.6
Pigs	149.7	105.5	80.1	69.0	45.5	32.3	99.6	67.9	57.8
Chickens	61.6	61.7	47.6	31.3	27.7	20.3	32.1	27.5	23.7
Sheep, goats, ponies, and horses	24.3	18.7	21.5	6.0	6.8	7.4	27.5	26.5	25.8
Turkeys, ducks, rabbits, and minks *	5.8	5.3	1.3	3.4	2.7	0.6	1.8	2.4	0.9
Total livestock	693.2	489.7	448.9	230.5	178.9	146.7	643.1	523.1	474.7

* The WUM model excludes excretion from mink only for 1990. To ensure a consistent time series, however, it has been included here.

Table 6.6: Quantity of N, P₂O₅, and K₂O in manure produced by grazing livestock in the Netherlands (1990, 2010, 2024) as used in WUM model.

Excretion (million kg)	Nitrogen (N)			Phosphate (P ₂ O ₅)			Potassium (K ₂ O)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Cattle									
Dairy cows	279.0	192.5	217.3	77.9	63.6	63.2	295.9	245.3	263.8
Female young stock ≥ 1 yr (dairy and beef)	92.3	52.2	36.5	21.3	15.7	10.6	101.6	82.6	55.0
Female young stock < 1 yr (dairy and beef)	33.7	21.0	14.9	7.7	5.9	3.9	38.0	29.0	20.0
Calves for white veal production	6.4	7.9	10.4	2.6	3.0	2.6	6.7	9.9	7.4
Calves for rosé veal production		8.3	9.1		2.6	3.0		7.3	7.5
Suckling cows incl. fattening/grazing ≥ 2 yrs	13.2	9.6	3.9	3.1	3.1	1.3	14.5	17.0	6.7
Male young stock (incl. bullocks) ≥ 1 yr (beef)	13.8	3.0	2.6	4.4	1.1	0.7	10.9	2.5	1.7
Male young stock (incl. bullocks) < 1 yr (beef)	7.4	1.3	1.1	2.3	0.4	0.2	7.5	1.2	0.9
Male young stock (≥ 1 yrs) and breeding bulls (dairy)	3.9	1.8	1.2	1.0	0.6	0.4	4.5	2.6	1.6
Male young stock < 1 yr (dairy)	2.1	1.0	1.4	0.5	0.2	0.3	2.6	1.4	1.9
Other grazing livestock									
Sheep	19.7	7.9	6.4	4.4	2.6	2.1	21.8	14.3	11.2
Goats	0.7	3.9	8.9	0.2	1.5	3.0	0.8	3.7	6.5
Horses	3.2	5.4	4.9	1.2	2.1	1.9	4.0	6.6	6.4
Ponies	0.7	1.6	1.3	0.2	0.6	0.5	0.9	2.0	1.7

Table 6.7: Quantity of N, P₂O₅, and K₂O in manure produced by housed animals in the Netherlands (1990, 2010, 2024) as used in WUM model.

Excretion (million kg)	Nitrogen (N)			Phosphate (P ₂ O ₅)			Potassium (K ₂ O)		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Pigs									
Fattening pigs	100.5	72.0	54.3	40.7	28.9	20.1	67.8	46.5	39.8
Sows *	43.0	29.7	16.0	24.8	14.9	8.8	27.8	19.3	10.4
Weaned piglets *			7.0			2.2			5.8
Gilts and young boars	5.6	3.6	2.7	3.1	1.6	1.1	3.7	2.0	1.7
Breeding boars	0.7	0.2	0.1	0.4	0.1	0.0	0.4	0.1	0.0
Chickens									
Laying hens ≥ 18 weeks	24.9	28.9	25.2	15.9	14.8	12.4	13.0	12.4	11.6
Laying hens < 18 weeks	4.2	4.4	2.9	2.1	2.2	1.4	1.7	1.8	1.4
Broilers	25.1	22.4	15.1	9.1	7.6	4.2	14.1	10.8	8.5
Broiler breeders ≥ 20 weeks **	5.8	4.9	3.7	3.3	2.5	1.9	2.6	2.1	1.8
Broiler breeders < 20 weeks **	1.5	1.0	0.8	0.9	0.6	0.5	0.6	0.5	0.4
Other housed animals									
Turkeys	2.1	2.0	0.9	1.0	1.0	0.3	0.9	0.9	0.4
Ducks	1.2	0.9	0.2	0.7	0.4	0.1	0.6	0.5	0.2
Rabbits	0.4	0.3	0.3	0.2	0.1	0.1	0.2	0.3	0.3
Minks ***	2.1	2.1	0.0	1.5	1.2	0.0	0.1	0.6	0.0

* Since 2022, excretion for sows (including all piglets) has been derived from 'weaned piglets' and 'sows, including piglets up to weaning'.

** For 1990-2017 the cut-off value is 18 weeks instead of 20 weeks.

*** The WUM model excludes excretion from mink only for 1990. To ensure a consistent time series, however, it has been included here.

Manure production by animal category, as shown in Tables 6.6 and 6.7, can be further broken down into more detailed animal categories or regional data based on animal numbers from the agricultural census. For example, manure production from young female cattle (beef and dairy) can be subdivided into separate categories for beef and dairy, using the cattle numbers listed in Table 3.3.1. In Table 6.5, young female beef and dairy cattle are grouped together, as all underlying categories in the WUM model share the same feed intake and retention rates per head (see Table 6.1). In practice, the detailed calculation is performed only for young female dairy cattle, whereas for young female beef cattle – whose animal numbers are much lower – feed intake and retention per head are assumed to be the same.

7. Manure production volume

In Chapter 6, excretion is expressed in terms of nitrogen, phosphate, and potash quantities. This chapter presents the results of the total volume of manure produced. Data on manure production per animal – the so-called manure production factor – are revised on an irregular basis as soon as new information becomes available.

Depending on the type of housing and manure management, manure is classified as either slurry (liquid manure) or solid manure. The manure production factors are shown in Table 7.1. In the WUM model more detailed production factors are available: by region (North-West and South-East Netherlands), by time (grazing and housing season), and for dairy cattle during the grazing season, whether the excretion takes place in the pasture or in the animal house.

Multiplication of manure production factors in Table 7.1 with corresponding livestock numbers in Tables 3.3.1 through 3.3.3 leads to total volume of produced manure in the Netherlands, as shown in Table 7.2.

Table 7.1: Total volume of produced manure per animal in the Netherlands (1990, 2010, 2024) as used in the WUM model.

Manure production factor (kg per head)	Total			Solid manure			Slurry		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Cattle									
Dairy cows	23000	26000	30500				23000	26000	30500
Female young stock ≥ 1 yr (dairy and beef)	11500	12000	13000				11500	12000	13000
Female young stock < 1 yr (dairy and beef)	5000	5000	5000				5000	5000	5000
Calves for white veal production	3500	2800	2800				3500	2800	2800
Calves for rosé veal production	5000	4500	4100				5000	4500	4100
Suckling cows incl. fattening/grazing ≥ 2 yrs	15000	15000	15000	7000	7000	7000	8000	8000	8000
Male young stock (incl. bullocks) ≥ 1 yr (beef)	10000	10000	10000				10000	10000	10000
Male young stock (incl. bullocks) < 1 yr (beef)	4500	4500	4500				4500	4500	4500
Male young stock (≥ 1 yrs) and breeding bulls (dairy)	11500	12000	12500				11500	12000	12500
Male young stock < 1 yr (dairy)	5000	5000	5000				5000	5000	5000
Other grazing livestock									
Sheep – ewes	2325	2540	2540	325	140	140	2000	2400	2400
Dairy goats	1300	1300	1220	1300	1300	1220			
Horses	8500	8500	8500	5200	5200	5200	3300	3300	3300
Ponies	4200	4200	4200	2100	2100	2100	2100	2100	2100
Pigs									
Fattening pigs	1300	1100	1090				1300	1100	1090
Sows *	5200	5100	4500				5200	5100	4500
Weaned piglets *			330						330
Gilts and young boars	1300	1300	1200				1300	1300	1200
Breeding boars	3200	3200	3200				3200	3200	3200
Chickens									
Laying hens ≥ 18 weeks	47.1	19.1	18.1	9.0	18.8	18.1	38.1	0.4	0.0
Laying hens < 18 weeks	20.2	8.4	7.0	3.4	7.2	7.0	16.8	1.1	0.0
Broilers	10.0	10.9	9.7	10.0	10.9	9.7			
Broiler breeders ≥ 20 weeks **	25.3	20.6	17.6	25.3	20.6	17.6			
Broiler breeders < 20 weeks **	15.4	8.2	8.0	15.4	8.2	8.0			
Other housed animals									
Fattening turkeys	38	45	42	38	45	42			
Ducks	86	70	40	86	70	40			
Rabbits – does ***	377	377	350	377	377	350			
Minks – female breeders ***	104	155					104	155	

* Since 2022, excretion for sows (including all piglets) has been derived from 'weaned piglets' and 'sows, including piglets up to weaning'.

** For 1990-2017 the cut-off value is 18 weeks instead of 20 weeks.

*** Includes excretion from young and male animals.

Table 7.2: Total volume of produced manure per animal in the Netherlands (1990, 2010, 2024) as used in the WUM model.

Total volume of produced manure (million ton)	Total			Solid manure			Slurry		
	1990	2010	2024	1990	2010	2024	1990	2010	2024
Dairy cows	43.2	38.4	47.0				43.2	38.4	47.0
Female young stock ≥ 1 yr (dairy and beef)	11.3	8.6	7.1				11.3	8.6	7.1
Female young stock < 1 yr (dairy and beef)	4.0	2.9	2.3				4.0	2.9	2.3
Calves for white veal production	2.1	1.8	1.6				2.1	1.8	1.6
Calves for rosé veal production		1.3	1.3					1.3	1.3
Suckling cows incl. fattening/grazing ≥ 2 yrs	1.8	1.7	0.8	0.8	0.8	0.4	1.0	0.9	0.4
Male young stock (incl. bullocks) ≥ 1 yr (beef)	1.9	0.6	0.4				1.9	0.6	0.4
Male young stock (incl. bullocks) < 1 yr (beef)	1.1	0.2	0.2				1.1	0.2	0.2
Male young stock (≥ 1 yrs) and breeding bulls (dairy)	0.5	0.3	0.2				0.5	0.3	0.2
Male young stock < 1 yr (dairy)	0.3	0.1	0.2				0.3	0.1	0.2
Total – Cattle	66.2	55.9	61.2	0.8	0.8	0.4	65.4	55.1	60.9
Sheep – ewes	1.8	1.4	1.2	0.3	0.1	0.1	1.6	1.3	1.1
Dairy goats	0.0	0.3	0.6	0.0	0.3	0.6			
Horses	0.4	0.8	0.6	0.3	0.5	0.3	0.2	0.3	0.2
Ponies	0.1	0.2	0.2	0.0	0.1	0.1	0.0	0.1	0.1
Total – Other grazing livestock	2.4	2.7	2.5	0.6	1.0	1.0	1.8	1.7	1.4
Fattening pigs	9.1	6.5	5.1				9.1	6.5	5.1
Sows *	6.6	5.0	3.3				6.6	5.0	3.3
Weaned piglets *			1.0						1.0
Gilts and young boars	0.5	0.3	0.2				0.5	0.3	0.2
Breeding boars	0.1	0.0	0.0				0.1	0.0	0.0
Total – Pigs	16.4	11.8	9.6	0.0	0.0	0.0	16.4	11.8	9.6
Laying hens ≥ 18 weeks	1.6	0.7	0.6	0.3	0.7	0.6	1.3	0.0	0.0
Laying hens < 18 weeks	0.2	0.1	0.1	0.0	0.1	0.1	0.2	0.0	0.0
Broilers	0.4	0.5	0.3	0.4	0.5	0.3			
Broiler breeders ≥ 20 weeks **	0.1	0.1	0.1	0.1	0.1	0.1			
Broiler breeders < 20 weeks **	0.0	0.0	0.0	0.0	0.0	0.0			
Total – Chickens	2.4	1.4	1.1	0.9	1.4	1.1	1.5	0.0	0.0
Fattening turkeys	0.0	0.0	0.0	0.0	0.0	0.0			
Ducks	0.1	0.1	0.0	0.1	0.1	0.0			
Rabbits	0.0	0.0	0.0	0.0	0.0	0.0			
Minks ***	0.1	0.1					0.1	0.1	
Total – Other housed animals	0.2	0.3	0.0	0.1	0.1	0.0	0.1	0.1	0.0
Total Livestock	87.5	72.2	74.4	2.5	3.3	2.5	85.0	68.9	71.9

* Since 2022, excretion for sows (including all piglets) has been derived from ‘weaned piglets’ and ‘sows, including piglets up to weaning’.

** For 1990-2017 the cut-off value is 18 weeks instead of 20 weeks.

*** The WUM model excludes excretion from mink only for 1990. To ensure a consistent time series, however, it has been included here.

8. References

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