LITHUANIA‘S INFORMATIVE INVENTORY REPORT 2024

Air Pollutant Emissions 1990-2022

under the UNECE CLRTAP and the EU NECD

Part 5 – AGRICULTURE

Lithuanian Environmental Protection Agency

Contents

1. MANURE RELATED AGRICULTURE ACTIVITIES

In Lithuania this group of NFR sectors, covers the following activities:

- Manure management of dairy cattle, non-dairy cattle, sheep, swine, goats, horses, laying hens, broilers, turkeys, ducks, geese, other poultry and fur animals;

- Animal manure applied to soils;

- Urine and dung deposited by grazing animals.

Activity data

Annual average livestock population numbers were derived from the Statistics Lithuania data on livestock numbers at January 1st: annual average population number in n-th year = (livestock number at January 1st of n-th year+ livestock number at January 1st of (n+1)-th year)/2. The same data are used in the GHG inventory of Lithuania.

Methodological issues

NOx and NH3 emissions were calculated by the Tier2 method using N-flow tool provided by the European Environment Agency. Please refer to the attached Annexes "NIIR LT 1990-2022 3.B Cattle Swine N-flow tool - 1990-2022 – resubmission v2.0.xlsx" and "NIIR LT 1990-2022 N-flow tool except 3B1, 3B3.xlsx" for more details. NMVOC and PM emissions were estimated using the Tier 1 methodology (Emission factors in Table 3.4 and Table 3.5 provided in the EMEP/EEA air pollutant emission inventory Guidebook 2023, chapter 3.B Manure management). Emissions of NMVOC were calculated using EF with silage feeding for housed period and EF without silage feeding for grazing period. For calculation of PM emissions, only housed period was taken into account.

Parameters (length of housed period; amount of nitrogen (N) excreted in grazing, yards, housing; fraction of TAN deposited in housing as slurry; mass of straw; N added in straw) were derived / taken from data used in the GHG inventory and can be found in the attached Annex "NIIR LT 1990-2022 Annex 3B.xlsx". The initial GHG data can be found in the Annex "NIIR LT 1990-2022 Annex GHG agriculture input.xlsx"

Implementation of TERT recommendations

1) *Observation „LT-3-2023-0001 ;* 3 Agriculture, NH3, 1990-2021". *Recommendation* „The TERT recommends that in the next IIR submission i) Lithuania include additional explanation and source of the assumptions made on the impact of ammonia abatement measures (for example explicitly providing data on estimated penetration rates of measures over time and the assumed abatement efficiency of the different measures), and ii) where no actual data on penetration of measures of abatement efficiency are currently collected, Lithuania organise suitable data collection and document this improvement in the IIR."

Implementation: We understand that the direct application of the abatement efficiency estimates provided by the producers of the 2019 NAPCP which used the unclear methodology is the most trivial way to estimate real efficiency in the historic inventory. Our inventory compilation team is supported be a new specialist who will

specialize in the field of agriculture. We will try to develop an adequate methodology and to get all needed data to estimate the impact of the 2019 NAPCP measures to the historical emissions.

2) *Observation „*LT-3-2023-0002; 3 Agriculture, NOX, NH3, NMVOC, PM2.5, 1990-2021". *Recommendation: „*The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting recalculations, including a clear description of the rationale for the recalculations and a quantitative assessment of the impact for each pollutant and source category affected."

Implementation: Information is provided below under the corresponding NFR category description.

3) *Observation „*LT-3B-2023-0001; 3B Manure management, NOX, PM2.5, 1990- 2021". *Recommendation:* The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting the reason for all significant recalculations, including the results from error corrections.

Implementation: Information is provided below under the corresponding NFR category description.

4) *Observation „*LT-3B1a-2023-0001; 3B1a Manure management - Dairy cattle, NMVOC, 2000-2020". *Recommendation:* The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting recalculations, including a clear description of the rationale for the recalculations and a quantitative assessment of the impact for each pollutant and source category affected." *Implementation*: Information is provided below under the corresponding NFR category description.

5) *Observation „*LT-3B1b-2023-0001; 3B1b Manure management - Non-dairy cattle, NMVOC, 2000-2020". *Recommendation: "*The TERT recommends that in the next IIR submission Lithuania include a section in the IIR documenting recalculations, including a clear description of the rationale for the recalculations and a quantitative assessment of the impact for each pollutant and source category affected". *Implementation*: Information is provided below under the corresponding NFR category description.

6) *Observation „*LT-3B3-2022-0001; 3B3 Manure management - Swine, NH3, 2020". *Recommendation:"* The TERT recommends that in the next IIR submission Lithuania i) include additional explanation and source of the assumptions made on the impact of ammonia abatement measures (for example explicitly providing data on estimated penetration rates of measures over time and the assumed abatement efficiency of the different measures), and ii) where no actual data on penetration of measures of abatement efficiency are currently collected, Lithuania organise suitable data collection and document this improvement in the IIR." *Implementation*: Information is provided below under the corresponding NFR category description.

7) *Observation „LT-3B-2023-0002 3B Manure management, NMVOC, 1990-2021". Implementation*: will be implemented as a planned improvement.

8) All other recommendations will be implemented as a planned improvement.

Emissions

Manure related agriculture activities was and remains the biggest source of ammonia (NH3) anthropogenic emissions, but contribution of them in the national total has dropped from 87% in 1993 to 59% in 2022.

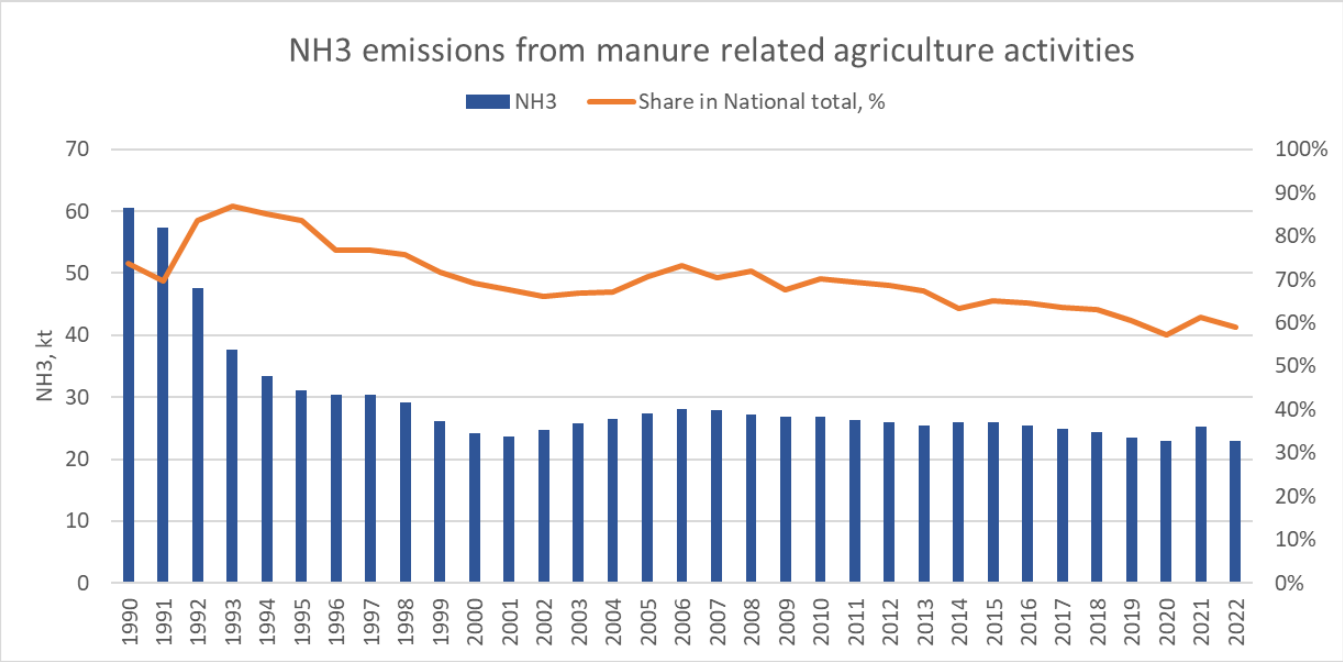


Figure 1. Ammonia emissions from manure related activities

NH3 emissions in this group of agriculture activities in 2022 decreased by 16,2% as compared with 2005.

1.1. Manure management - Dairy cattle (3.B. 1.a)

Activity

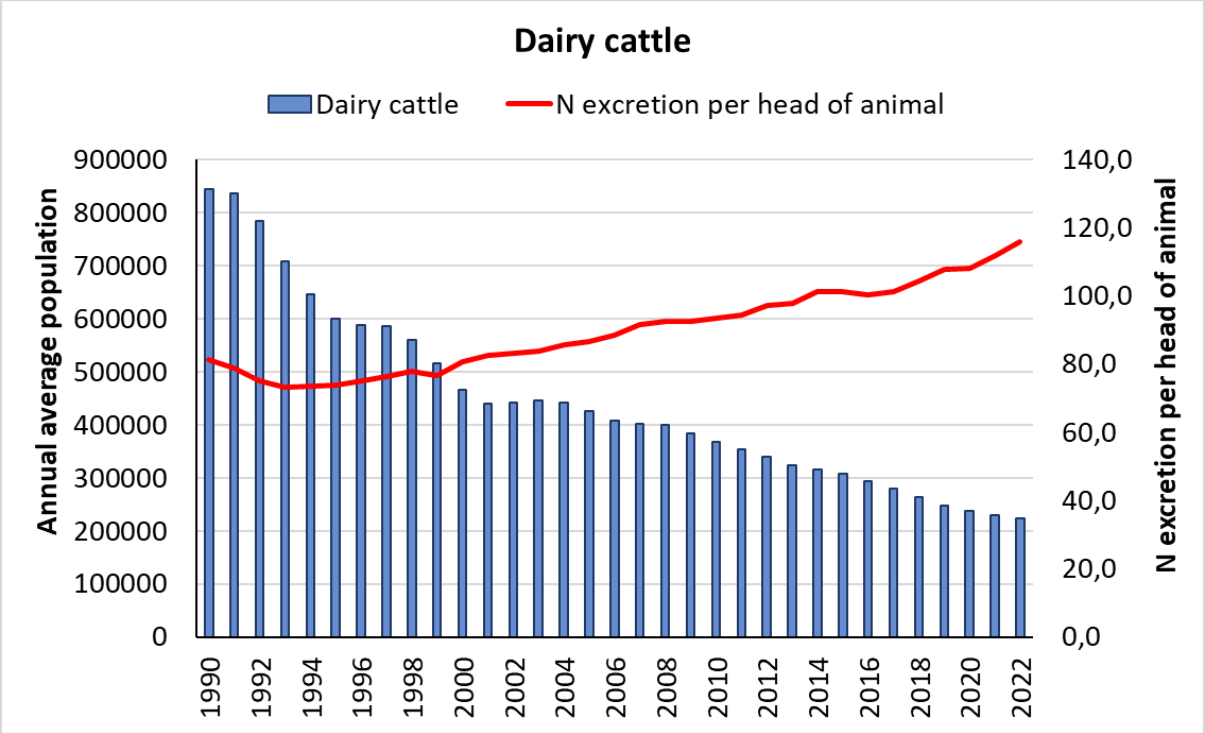


Figure 2. Dairy cattle: number of livestock and N excretion (kg) per head of animal

Parameters

The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B1a“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 3.B Cattle Swine N-flow tool - 1990-2022 – resubmission v2.0.xlsx“, sheet „Dairy cattle LT“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B1a“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B1a“)

1) The values of parameter „Housed period“ were changed according to the recommendation of the NECD review 2023 file „LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2“ for years 2005, 2020, 2021, 2022
2) The formula for evaluation of the fraction X_house_slurry was changed to „'X_house_slurry = fraction of Nex in MMS Liquid/(fraction of Nex in MMS Liquid+fraction of Nex in MMS Solid)“ instead of „'X_house_slurry = fraction of Nex in MMS Liquid“ in the 2023 submission; X_house_slurry values for years 2005, 2020, 2021, 2022 were taken from „LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2“;

3) The estimate of the parameter „Nitrogen in kg of Straw, g/kg“ was changed by the compiler of the Lithuanian 3B sectors inventory
4) The methodology for evaluation of the parameter „Straw, kg/animal/year“ has changed. In the 2024 submission it was equated to the values which were taken from the national study and were based on the Lithuanian national norms of amount of litter for dairy cattle. In the 2023 submission this parameter was calculated by the formula: „N_added_in_straw/ N content in straw“

Planned improvements

1) To apply the corrections provided during the 2023 NECD review in the file „LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2.xlsx“ for all years from 1990, not only for 2005, 2020, 2021, 2022;

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division.

4) To implement a Tier 2 methodology for NMVOC emissions

1.2. Manure management – Non-dairy cattle (3.B. 1.b)

Activity

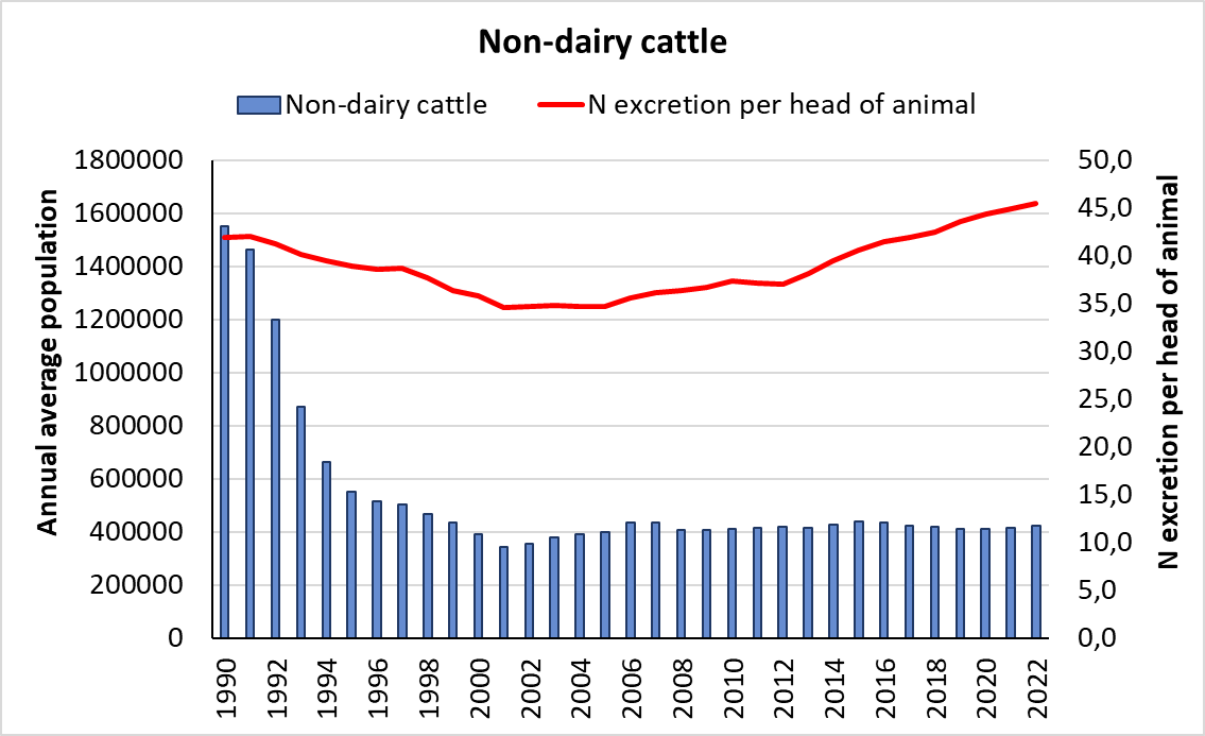


Figure 3. Non-dairy cattle: number of livestock and N excretion (kg) per head of animal

Parameters. The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B1b“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 3.B Cattle Swine N-flow tool - 1990-2022 – resubmision v2.0.xlsx“, sheet „Non-dairy cattle LT“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B1b“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B1b“)

1) Number of the animals is different from the previous submission because the animal scientists obtained an additional data from 1990.
2) The values of parameter „Housed period“ were changed according to the recommendation of the NECD review 2023 file „LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2“ for years 2005, 2020, 2021, 2022
3) X_house_slurry values for years 2005, 2020, 2021, 2022 were taken from „LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2“;
4) The estimate of the parameter „Nitrogen in kg of Straw, g/kg“ was changed by the compiler of the Lithuanian 3B sectors inventory

5) The methodology for evaluation of the parameter „Straw, kg/animal/year“ has changed. In the 2024 submission it was equated to the values which were taken from the national study and were based on the Lithuanian national norms of amount of litter for non-dairy cattle. In the 2023 submission this parameter was calculated by the formula: „N_added_in_straw/ N content in straw“

Planned improvements

1) To apply the corrections provided during the 2023 NECD review in the file „LT-3Da3-2022-0001 and LT-3-2022-0001 worked example_v2.xlsx“ for all years from 1990, not only for 2005, 2020, 2021, 2022;

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division.

4) To implement a Tier 2 methodology for NMVOC emissions

1.3. Manure management – Swine (3.B. 3)

Activity

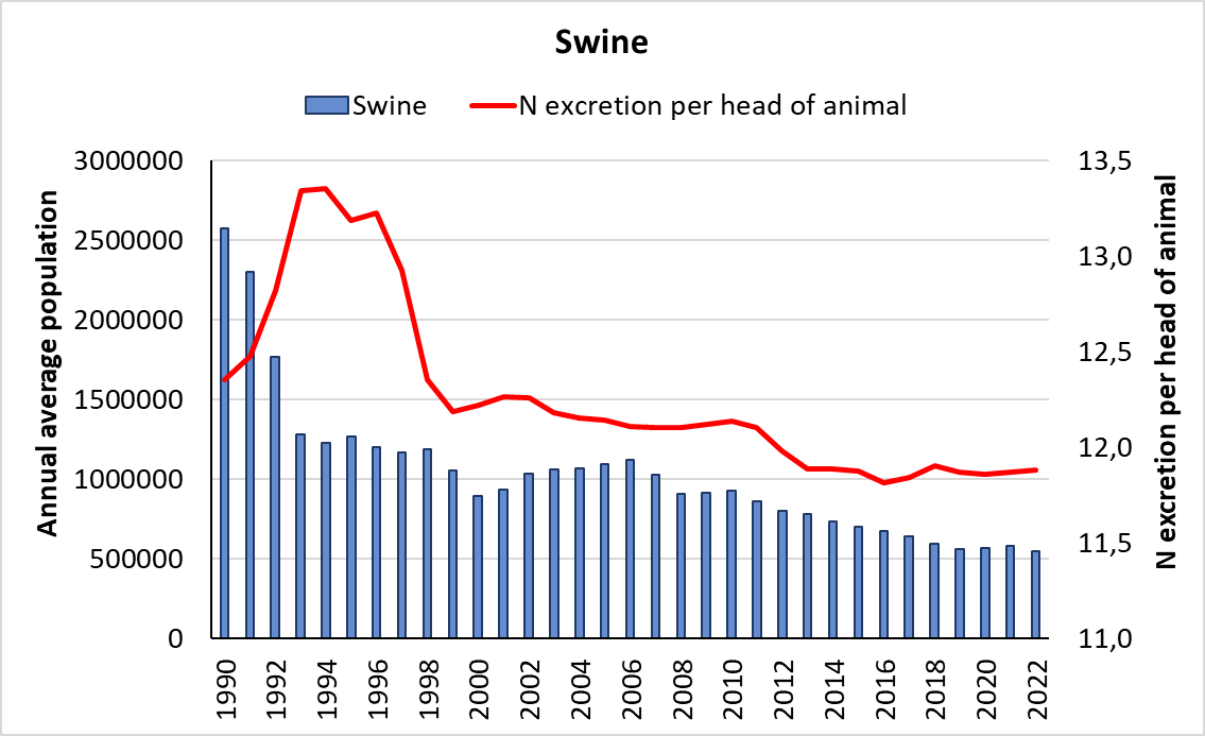


Figure 4. Swine: number of livestock and N excretion (kg) per head of animal

Parameters

The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheets „3B3“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 3.B Cattle Swine N-flow tool - 1990-2022 – resubmision v2.0.xlsx“, sheets „Swines LT“. Effect of applying of biostabilizator Poliflock BTS in the large farms was accounted on the basis of data provided by the farm operators. For year 2022, impact of implementing of the recommendations of the BAT Reference Document for the Intensive Rearing of Poultry or Pigs was estimated. For details please reffer „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B3“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B3“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheets „3B3“)

1) Nitrogen (N) excretion per head (kg N/head/year) data were taken from Lithuanian GHG inventory.
2) The values of parameter „X_house_slurry, fraction“ were equalled to GHG inventory data on MMS „Swine – Liquid“
3) The values of parameter „N_added_in_straw, kg/animal/yr“ were equalled to GHG inventory data

4) The methodology for evaluation of the parameter „Straw, kg/animal/year“ has changed. In the 2024 submission it was equated to the values which were taken from the national study and were based on the Lithuanian national norms of amount of litter for pigs. In the 2023 submission this parameter was calculated by the formula: „N_added_in_straw/ N content in straw“

Planned improvements. 1) To enhance the evaluation of the impact of recommendations of the BAT Reference Document;

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division.

1.4. Manure management – Horses (3.B. 4.e)

Activity

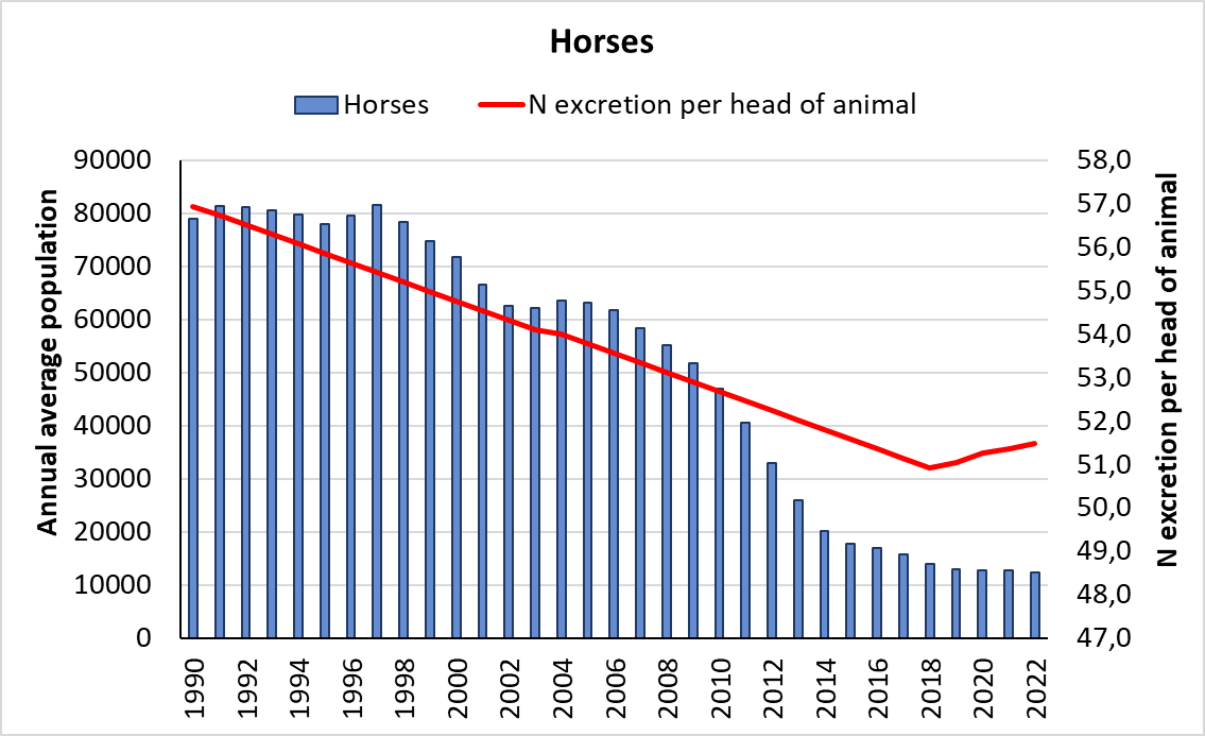


Figure 5. Horses: number of animals, N excretion (kg) per head of animal

Parameters

The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B4e“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 N-flow tool except 3B1, 3B3.xlsx“, sheet „Horses“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B4e“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B4e“)

5) The methodology for evaluation of the parameter „Straw, kg/animal/year“ has changed. In the 2024 submission this parameter was calculated by the formula: „N_added_in_straw/ N content in straw“

Planned improvements

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division.

4) To use the correct parameter „N_added_in_straw, kg/animal/yr“

1.5. Manure management – Sheep (3.B. 2)

Activity

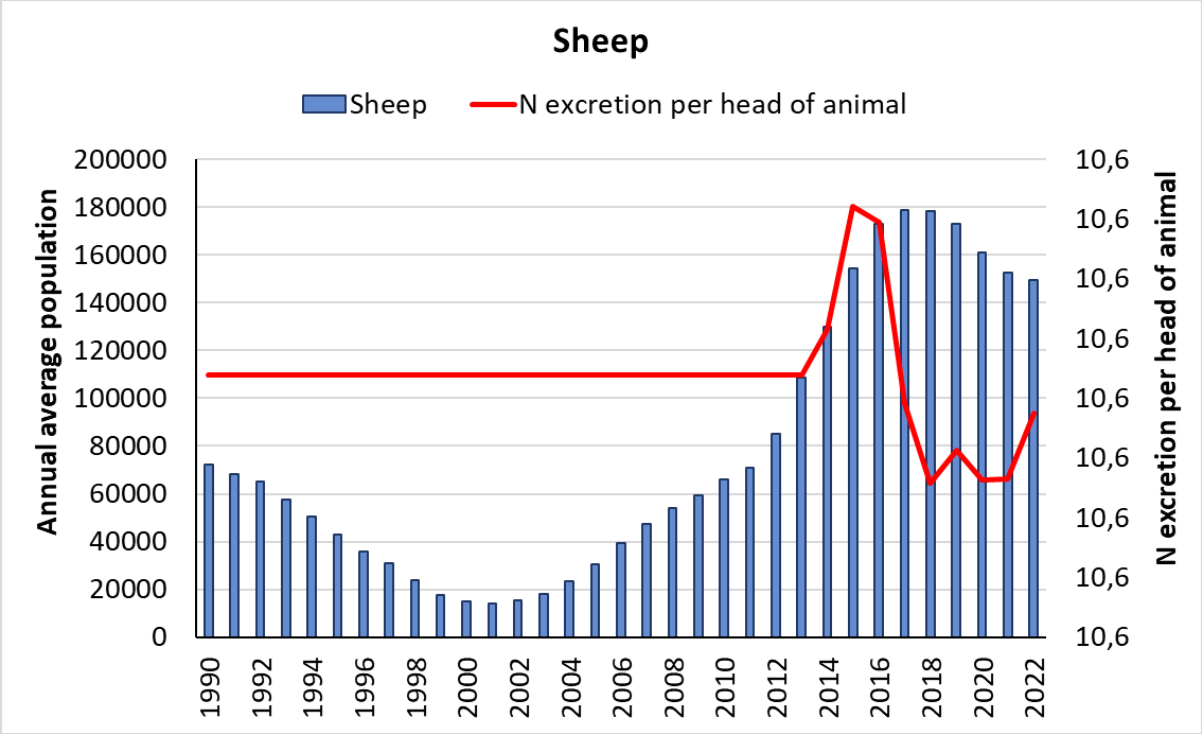


Figure 6. Sheep: number of animals, N excretion (kg) per head of animal

Parameters

The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B2“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 N-flow tool except 3B1, 3B3.xlsx“, sheet „Sheep“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B2“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B2“)

6) The methodology for evaluation of the parameter „Straw, kg/animal/year“ has changed. In the 2024 submission this parameter was calculated by the formula: „N_added_in_straw/ N content in straw“

Planned improvements

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division

1.6. Manure management – Goats (3.B. 4.d)

Activity

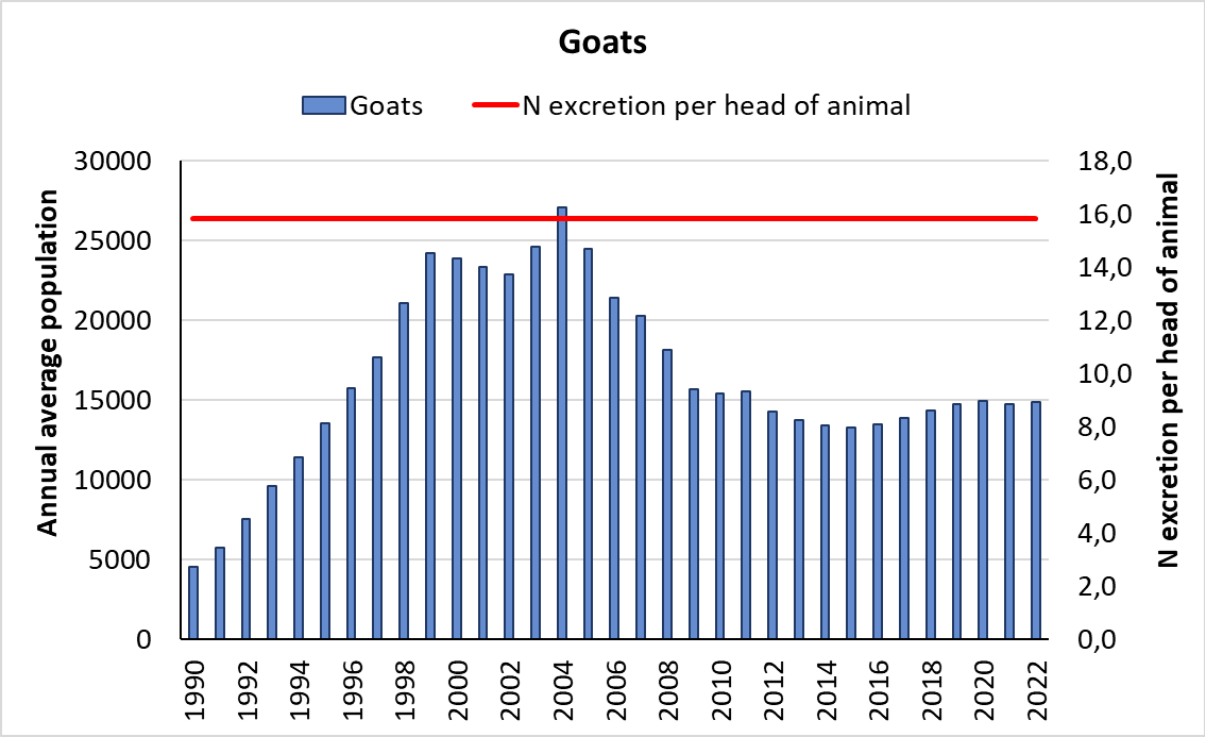


Figure 7. Goats: number of animals, N animals, (kg) per head of animal

Parameters

The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B4d“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 N-flow tool except 3B1, 3B3.xlsx“, sheet „Goats“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheet „3B4d“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B4d“)

Insignificant

Planned improvements

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division.

4) To use the correct parameter „N_added_in_straw, kg/animal/yr“

1.7. Manure management – Fur animals (3.B.4.h)

Activity

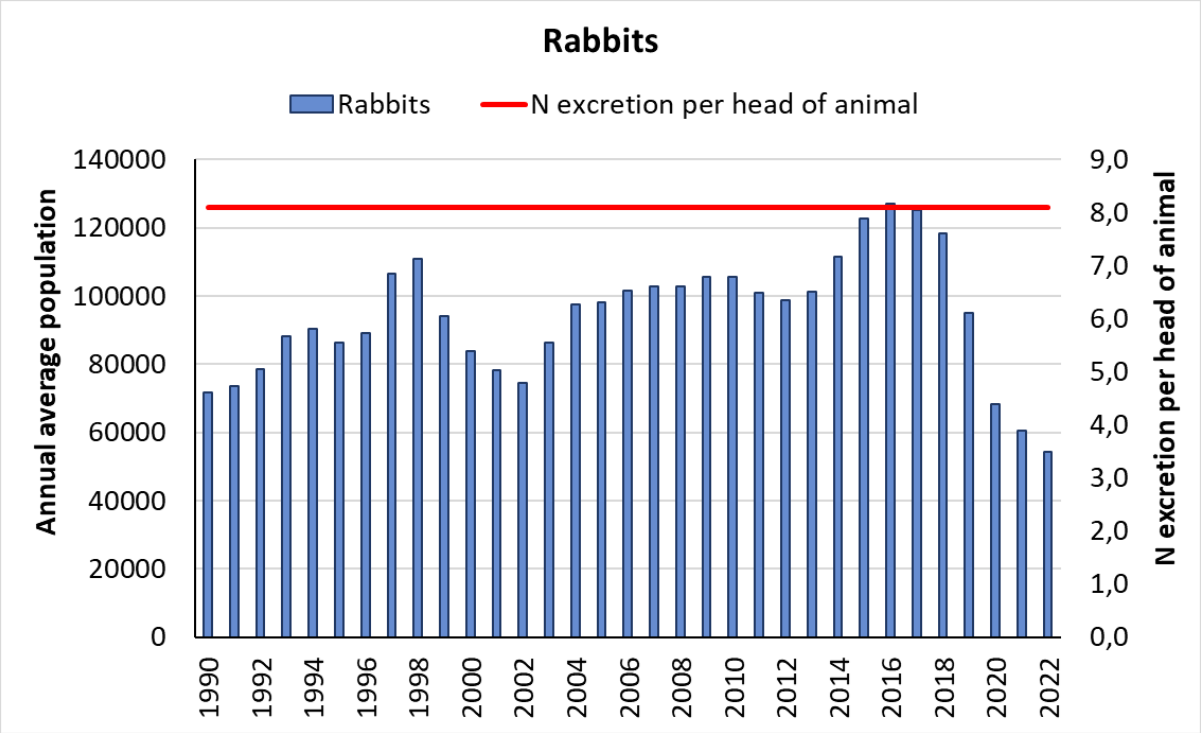


Figure 8. Rabbits: number of animals, N animals, (kg) per head of animal

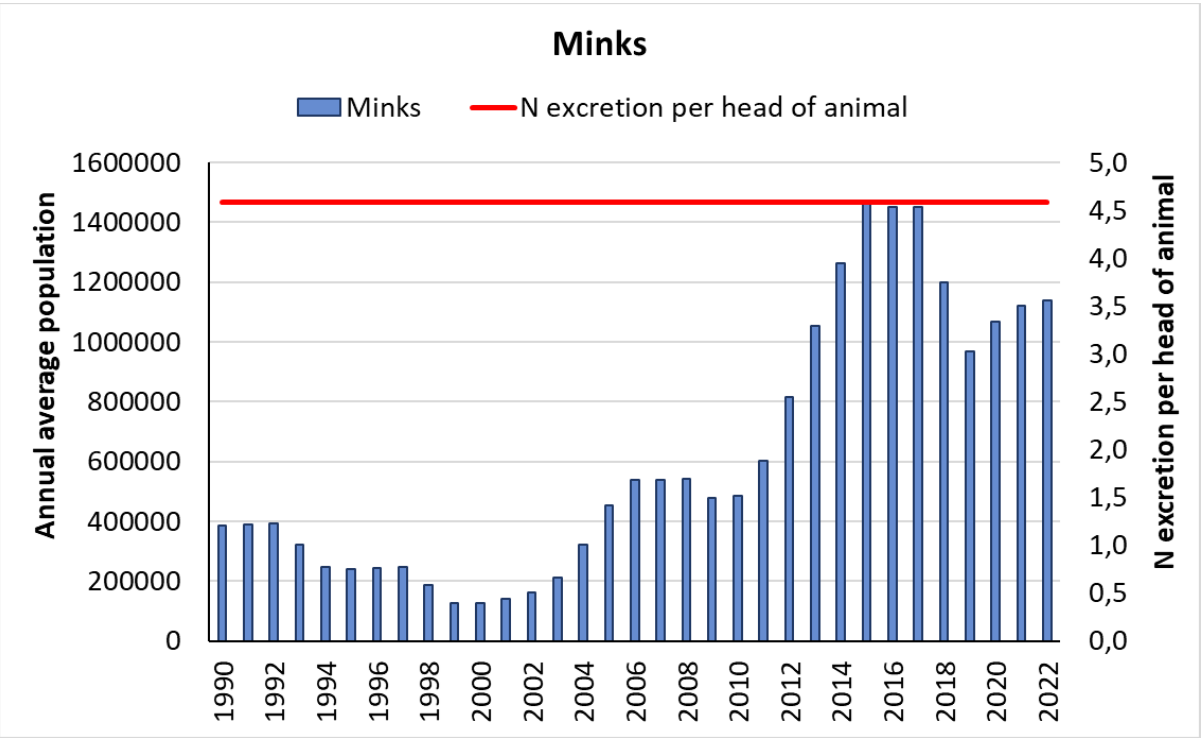


Figure 9. Minks: number of animals, N animals, (kg) per head of animal

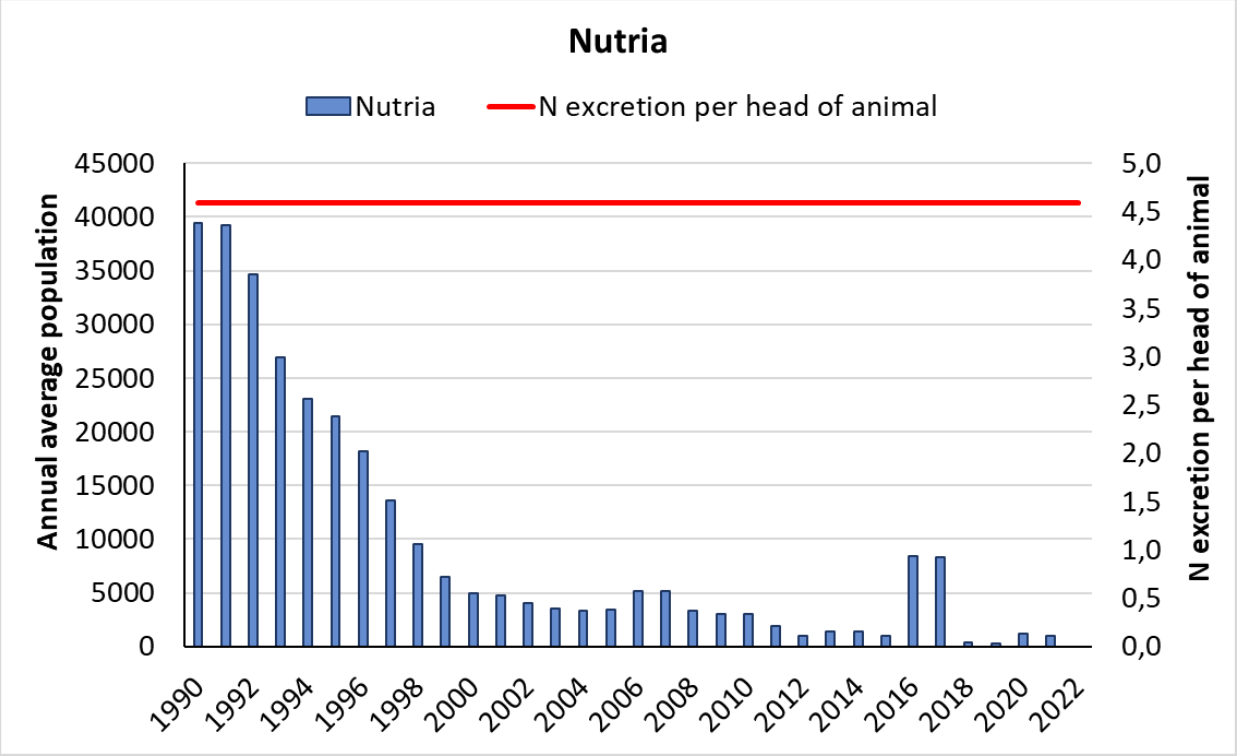


Figure 10. Nutria: number of animals, N animals, (kg) per head of animal

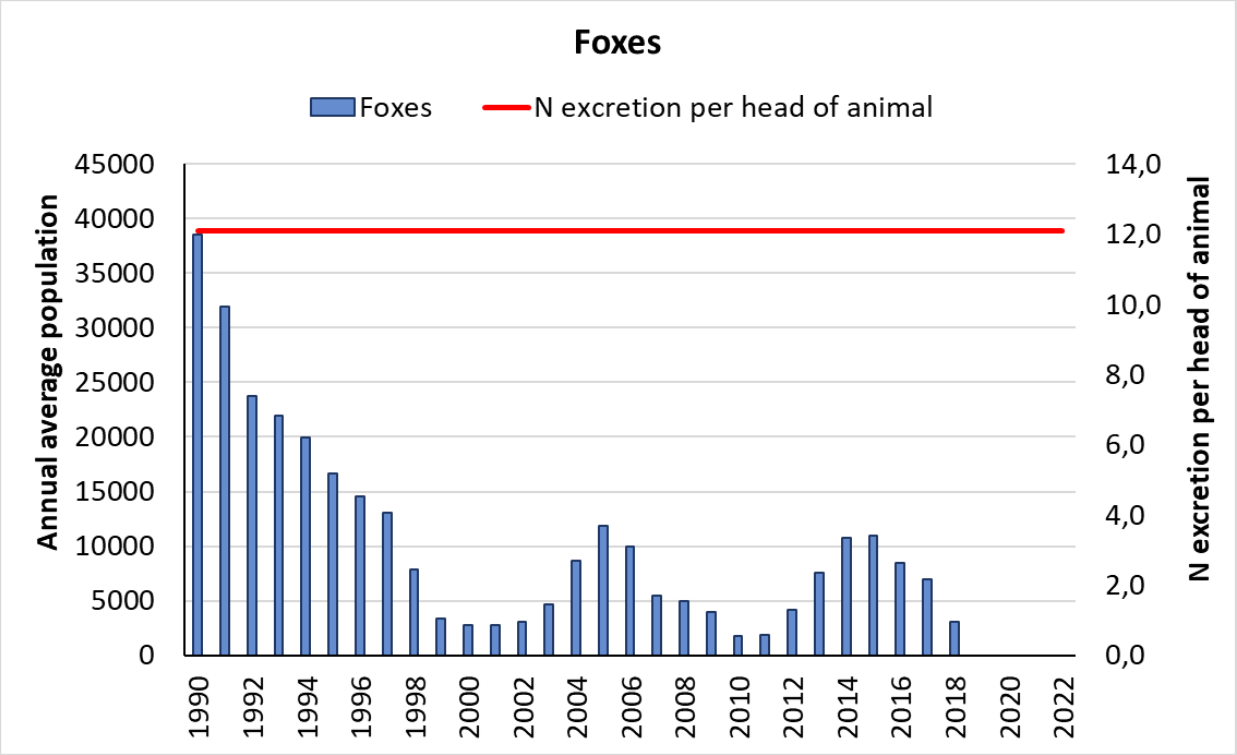


Figure 11. Foxes: number of animals, N animals, (kg) per head of animal

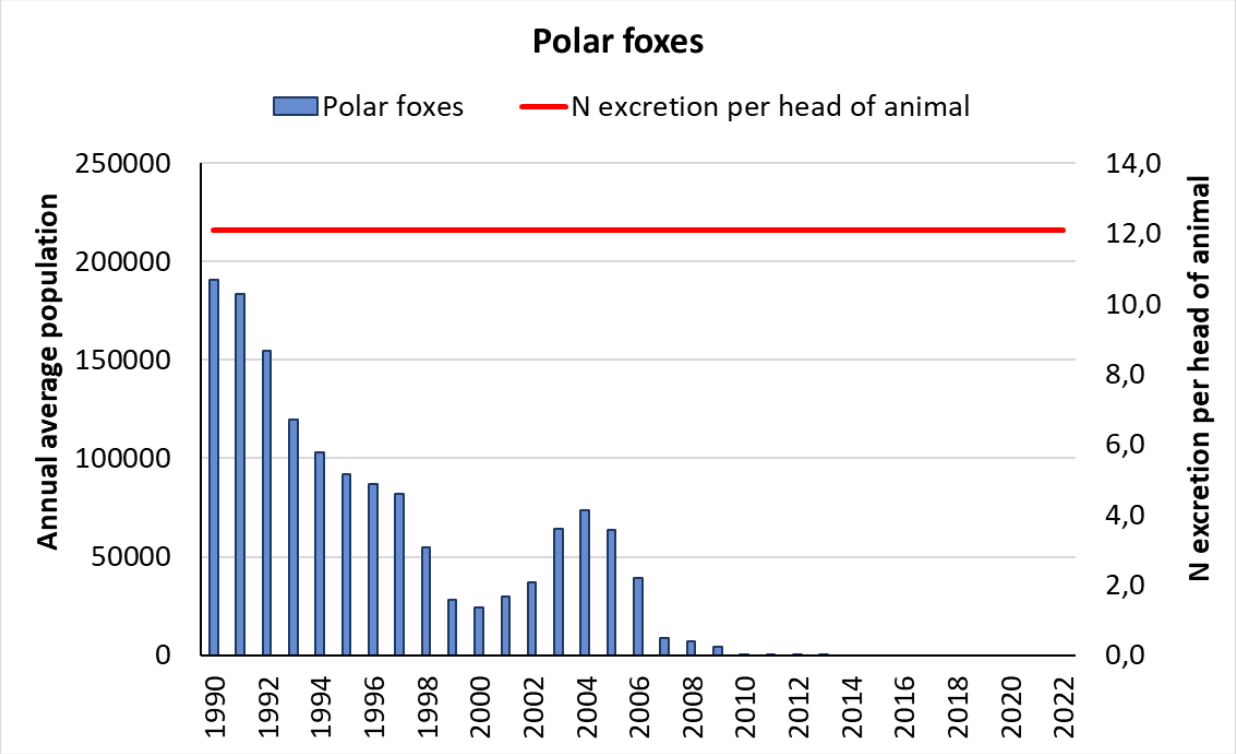


Figure 12. Polar foxes: number of animals, N animals, (kg) per head of animal

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 N-flow tool except 3B1, 3B3.xlsx“, sheet „Other animals (fur)“.

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheets „3B4h...“.

1.8. Manure management – Poultry (3.B.4.g)

Activity

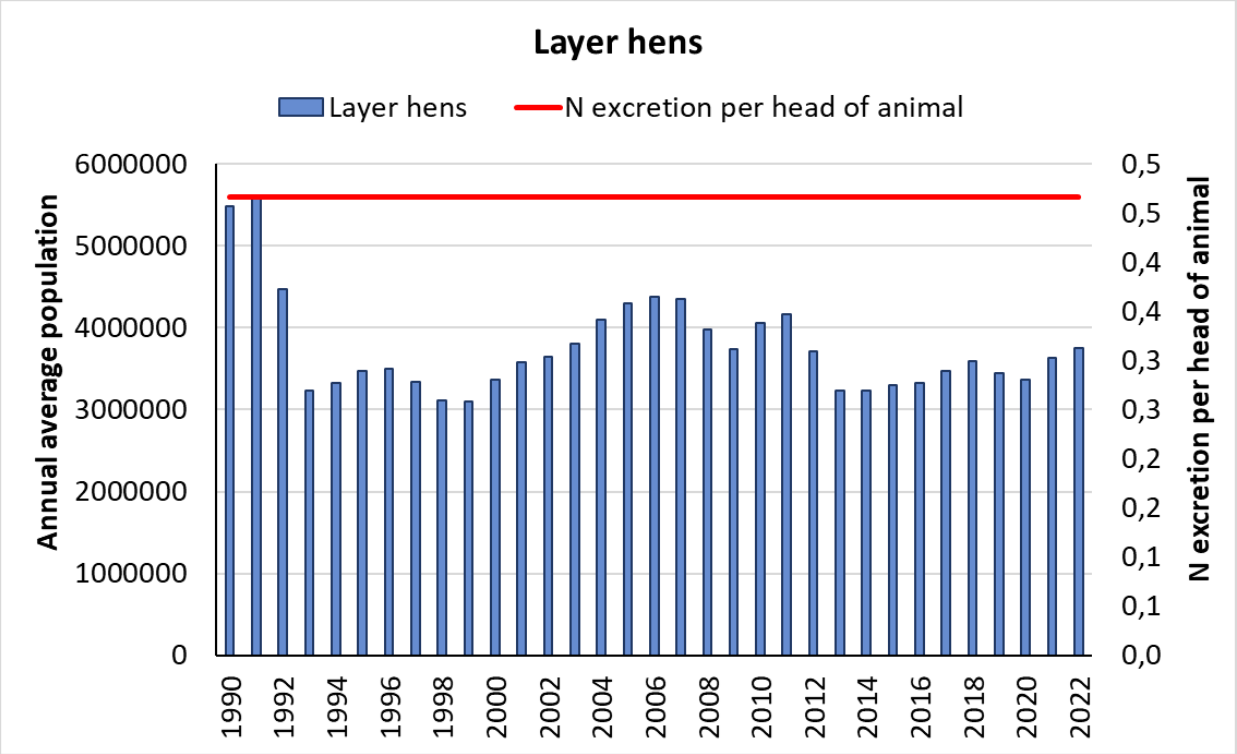


Figure 13. Layer hens: number of animals, N animals, (kg) per head of animal

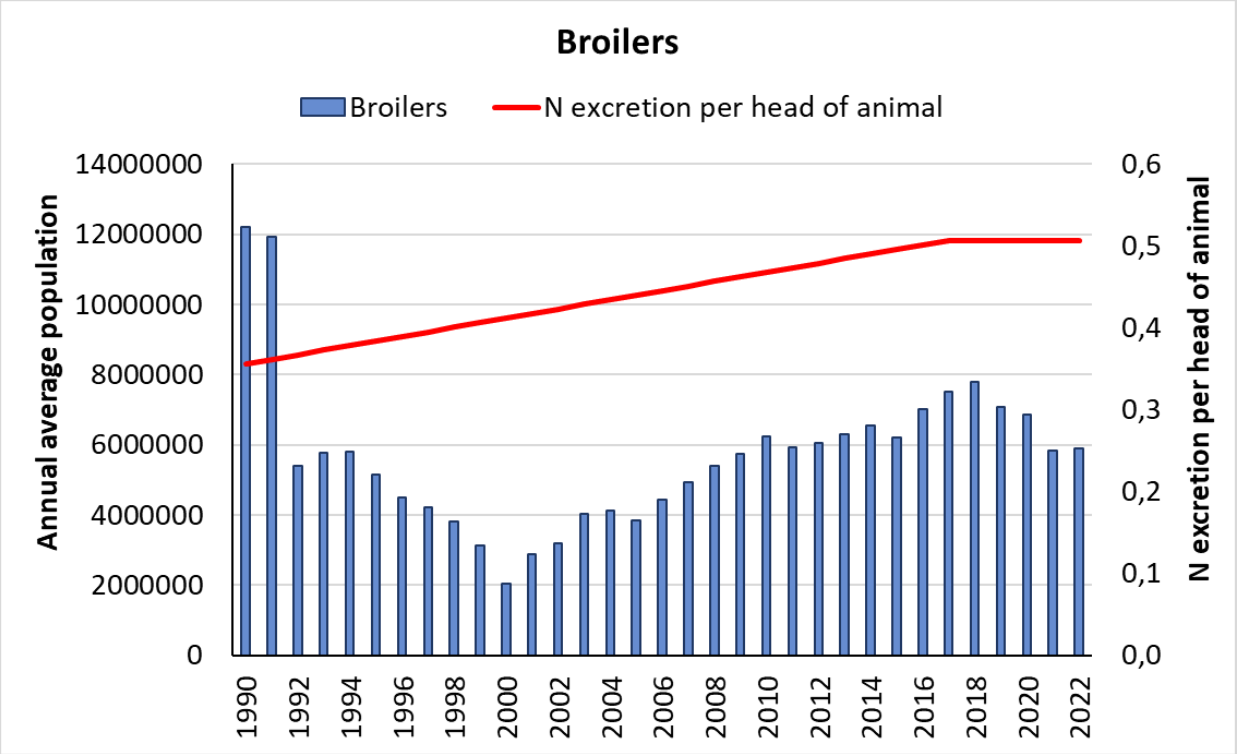


Figure 14. Broilers: number of animals, N animals, (kg) per head of animal

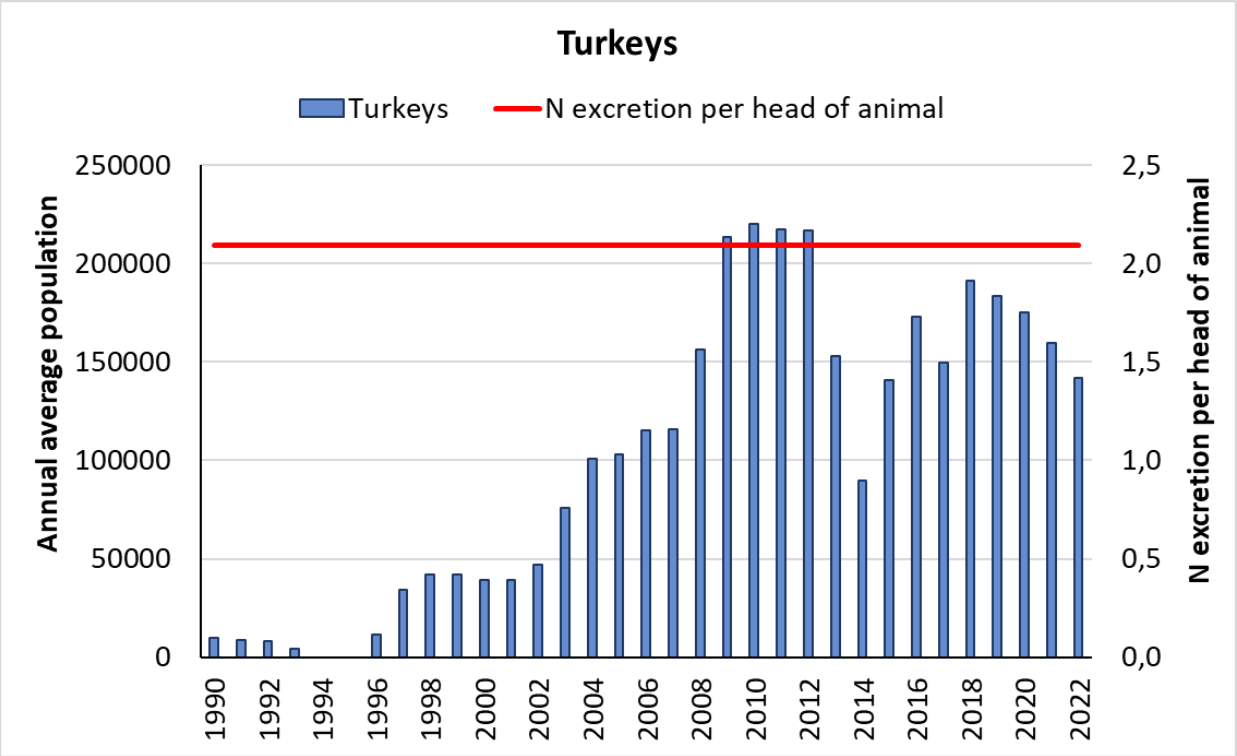


Figure 15. Turkeys: number of animals, N animals, (kg) per head of animal

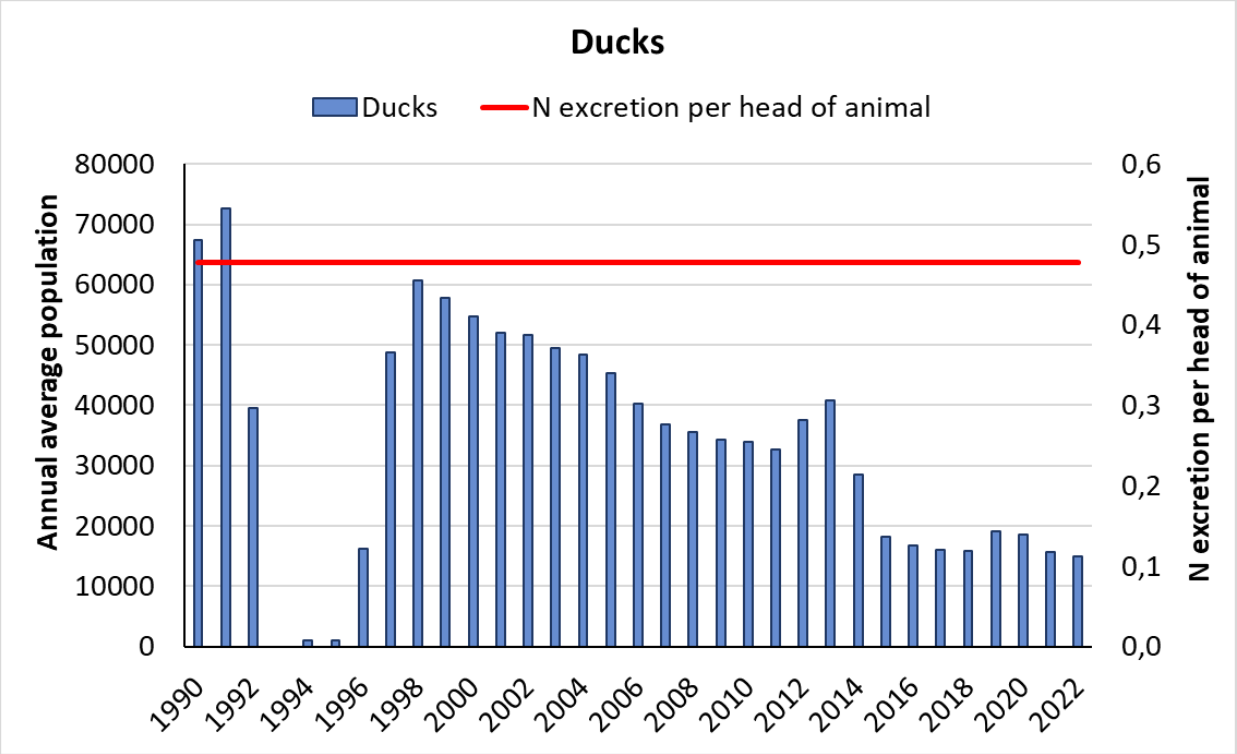


Figure 16. Ducks: number of animals, N animals, (kg) per head of animal

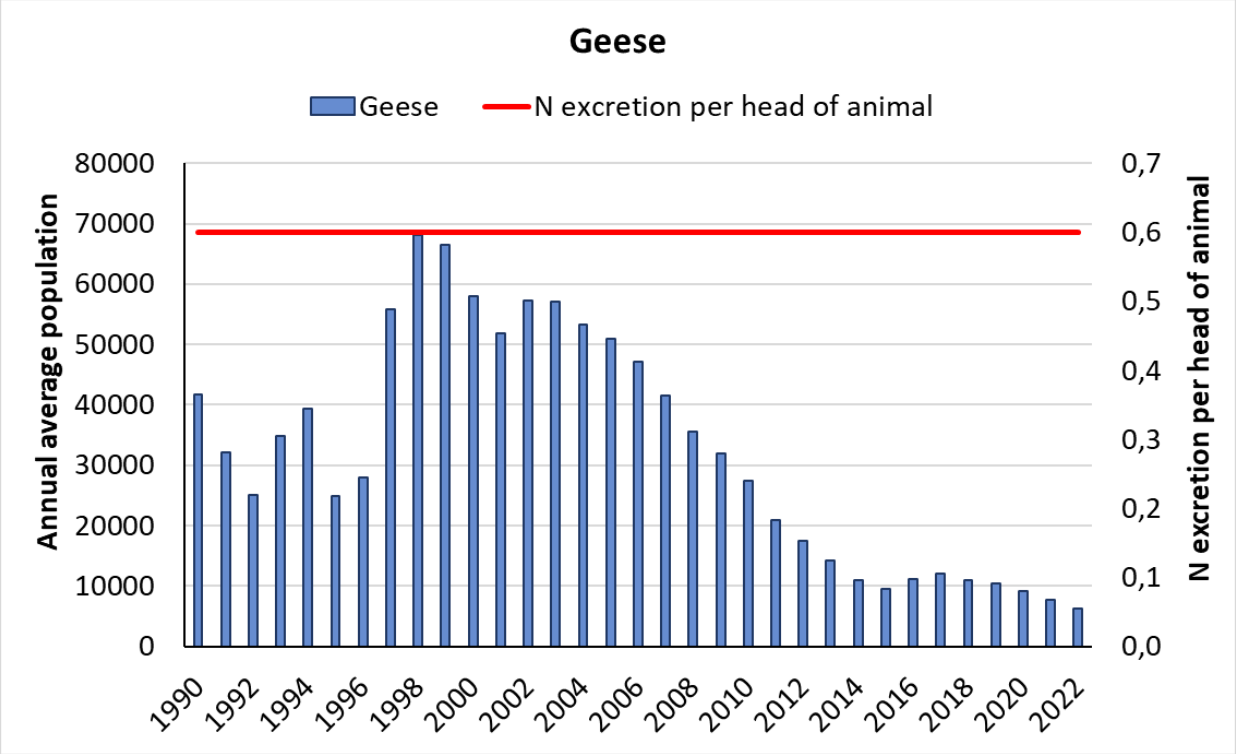


Figure 17. Geese: number of animals, N animals, (kg) per head of animal

Parameters

The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheets „3B4g...“.

Calculations of NH3 and NOx were performed using N-flow tool: „NIIR LT 1990-2022 N-flow tool except 3B1, 3B3.xlsx“, sheets „Laying hens“, „Broilers“, „Turkeys“, „Other poultry“. For year 2022, impact of implementing of the recommendations of the BAT Reference Document for the Intensive Rearing of Poultry or Pigs was estimated in the sectors of laying hens and broilers .

NMVOC and PM calculations were performed by the „NIIR INVENTORY NMVOC PM 3B 1990-2050.xlsx“ , sheets „3B4g...“.

Recalculations (The details are provided in the Annex „NIIR LT 1990-2022 Annex 3B.xlsx“ , sheet „3B4g...“)

Planned improvements

2) To evaluate the impact of the NAPCP (versions 2019 and 2022) using the adequate methodology.

3) To improve estimation of amount of straw used for litter in the collaboration with the GHG division.

1.9. Animal manure applied to soils (3.D.a.2.a)

Manure of all livestock categories (except fur animals) was applied to soils. NH3 and NO2 emissions were calculated using the EEA N-flow tool.

Recalculations. X_store_slurry, X_store_solid fractions from 0,5 were changed to 1, because MMS „Daily spread“ is not used in Lithuania.

1.10. Urine and dung deposited by grazing animals (3.D.a.3)

Grazing emissions occur from cattle, sheep, goats, horses. NH3 and NOx emissions were calculated using the EEA N-flow tool.

Recalculations. In the sectors 3B1a, 3B1b, parameter „Housed period, days“ for 2005, 2020, 2021, 2022 was corrected according to the recommendations of the NECD 2023 review.

Planned improvements. To correct the parameter „Housed period, days“ for all years from 1990.

2. Inorganic N-fertilizers (includes also urea application) (3.D.a.1)

General notes

Climate in Lithuania is cool (*source: Lithuanian GHG inventory*), soil pH is normal, soil with pH more than 7 do not occur in Lithuania (*source: Lithuania, MoE 1996, cited by: Soil Survey and available Soil Data in Lithuania, EUROPEAN SOIL BUREAU – RESEARCH REPORT NO. 9*)

IFA (International Fertilizer Association) data (N kt.)

Country	Product	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Lithuania	Ammonia dir. applic. (N)																		
	Ammonium sulphate (N)				12,5	16,8	10	9	10	8	12,6	35,8	35	45,1	37,7	41	43	39,1	39,68542
	Urea (N)				12,3	23	10	9	9	10	26	11,4	11,7	8,9	10,1	15	17	17,2	17,4575
	Ammonium nitrate (N)				50,5	54,5	60	62	63	61	56,9	56,1	58,4	51,3	55,4	47	55	43,2	43,84681
	Calc. amm. nitrate (N)				7,9	4,9	5	5	3	5	6	5,8	6,6	6,2	7,2	8	8	5,5	5,582349
	Urea Ammonium Nitrate (N)				15	5,4	20,2	20	20	20	16,8	30,9	31,5	33,5	35,5	40	50	47,2	47,9067
	Other N straight (N)																	0	
	Ammonium phosphate (N)				14,1	3,9	5	10	5	5	4	3,4	2,9	3,1	3,6	2	2	1,2	1,217967
	Other NP (N)				3	9,7	10	10	15	15	18,2	5,4	5,3	3,1	2,5	2	2	0,9	0,913475
	N K compound (N)																	0	
	N P K compound (N)				3	16,2	23	22	25	31	22,7	19	18,1	20,8	22,1	20	22	20,2	20,50244
	All				106	111,4	133,2	138	141	145	137,2	156,4	157,8	163,1	164	160	182	157,3	159,6552
	All				106	111,4	133,2	138	141	145	137,2	156,4	157,8	163,1	164	160	182	157,3	159,6552
	Urea (N)				12,3	23	10	9	9	10	26	11,4	11,7	8,9	10,1	15	17	17,2	17,45753
	Grand (N) Total				118,3	134,4	143,2	147	150	155	163,2	167,8	169,5	172	174,1	175	199	174,5	177,1127

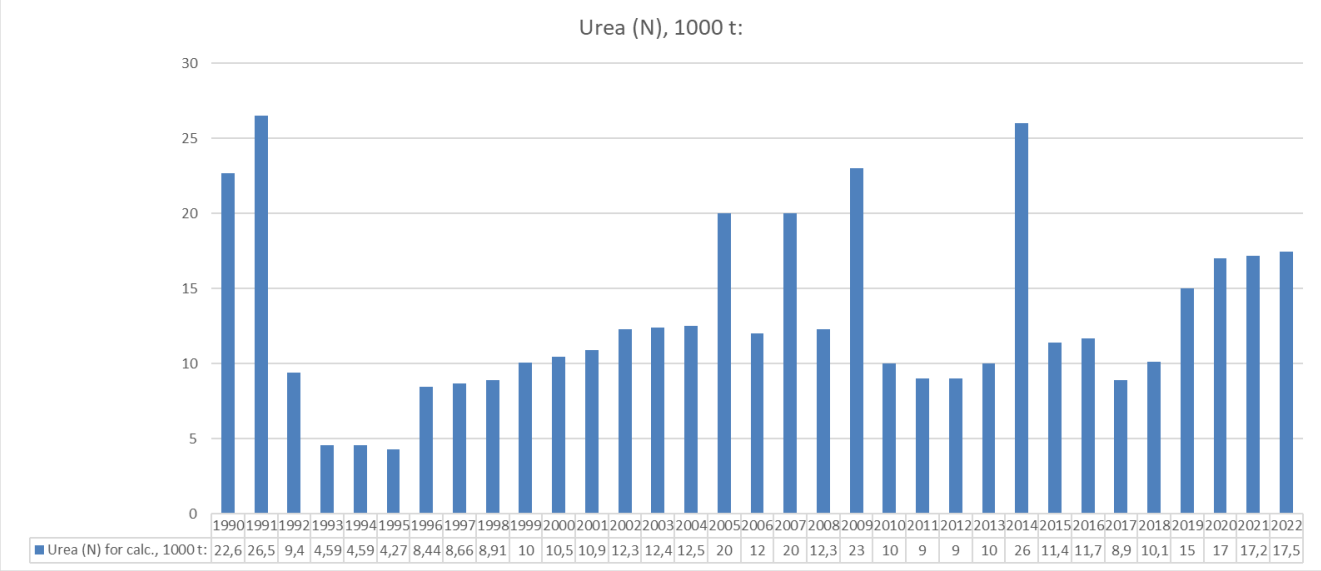
Table 3.2. 3.D Crop production and agricultural soils (GB2023) (EFs from the column “Normal pH” were applied)

Table 3-2 EFs for NH_3 emissions from fertilisers (in g NH_3 (kg N applied)$^{-1}$)		
	normal pH (a)	**high pH (b)**
Anhydrous ammonia (AH)	20	20
AN	24	52
Ammonium phosphate (AP) (c)	84	187
AS	84	187
CAN	24	52
NK mixtures (d)	52	52
NPK mixtures (d)	84	187
NP mixtures (d)	84	187
N solutions (e)	87	161
Other straight N compounds (f)	84	187
Urea(g)	195	206

(a) A 'normal' pH is a pH of 7.0 or below.
(b) A 'high' pH is a pH of more than 7.0 (usually calcareous soils).
(c) AP is the sum of ammonium monophosphate (MAP) and diammonium phosphate (DAP).
(d) NK mixtures are equivalent to AN, NPK and NP mixtures, which are 50 % MAP plus 50 % DAP.
(e) N solutions are equivalent to urea AN.
(f) Other straight N compounds and equivalent to calcium nitrate.
(g) Urea is an organic compound with the chemical formula $CO(NH_2)_2$.

NH3 emissions from Urea application

Urea (N) data for 1990-2007 were taken from the GHG inventory, for 2008-2021 from the IFA database, for 2022 from IFA database applying proportion in 2021 to all amount of N fertilizers in 2022. The Tier 2 NH3 emission factor was taken from the Table 3.2.



NH3 emissions from other N fertilizers in 1990-2004

All fertilizers (N) data for 1990-2004 were taken from IFA database.

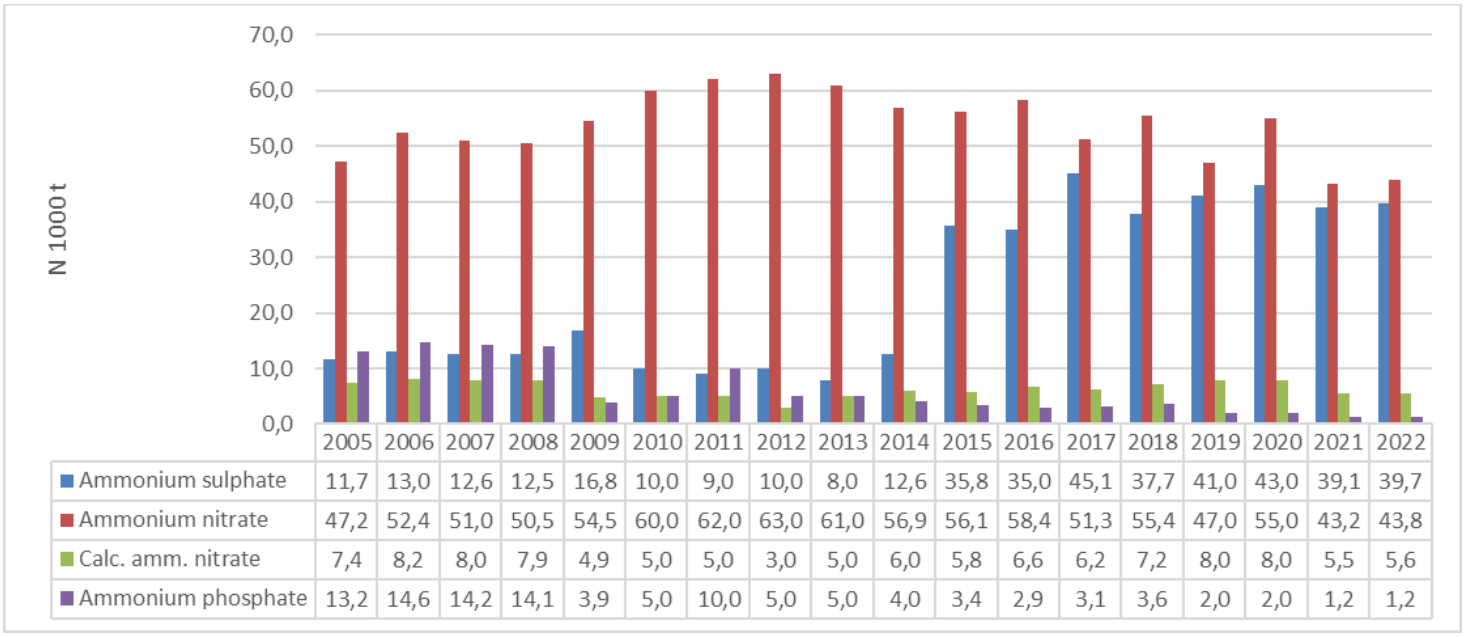
	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
All N fert. (N), 1000 t	212	248	88	43	43	40	79	81,1	83,4	94	98	102	115	116	117

Tier 1 NH3 EF 0,05 (kg NH_3/ kg fertiliser N applied) was used

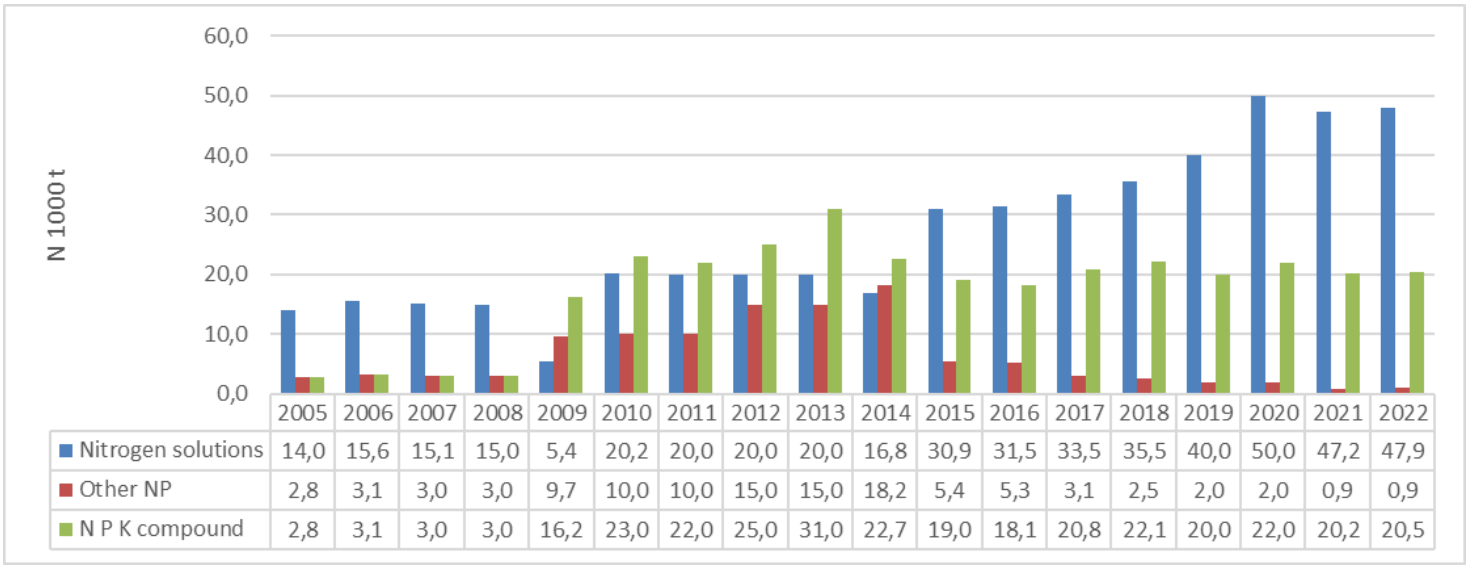
NH3 emissions from Ammonium sulphate, Ammonium nitrate, Calc. amm. Nitrate, Nitrogen solutions, Ammonium phosphate, Other NP, N P K compound from 2005

(N) data of these fertilizers for 2008-2021 were taken from the IFA database, for 2022 from IFA database applying proportion of 2021 to all amount of N fertilizers in 2022; for 2005-2007 from IFA database applying proportion of 2008 to all amount of N fertilizers in 2005-2007. The corresponding EF from Table 3.2 were used.

Amount of N-fertilizers by type used in Lithuania, N 1000 t



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Ammonium sulphate	11,7	13,0	12,6	12,5	16,8	10,0	9,0	10,0	8,0	12,6	35,8	35,0	45,1	37,7	41,0	43,0	39,1	39,7
Ammonium nitrate	47,2	52,4	51,0	50,5	54,5	60,0	62,0	63,0	61,0	56,9	56,1	58,4	51,3	55,4	47,0	55,0	43,2	43,8
Calc. amm. nitrate	7,4	8,2	8,0	7,9	4,9	5,0	5,0	3,0	5,0	6,0	5,8	6,6	6,2	7,2	8,0	8,0	5,5	5,6
Ammonium phosphate	13,2	14,6	14,2	14,1	3,9	5,0	10,0	5,0	5,0	4,0	3,4	2,9	3,1	3,6	2,0	2,0	1,2	1,2

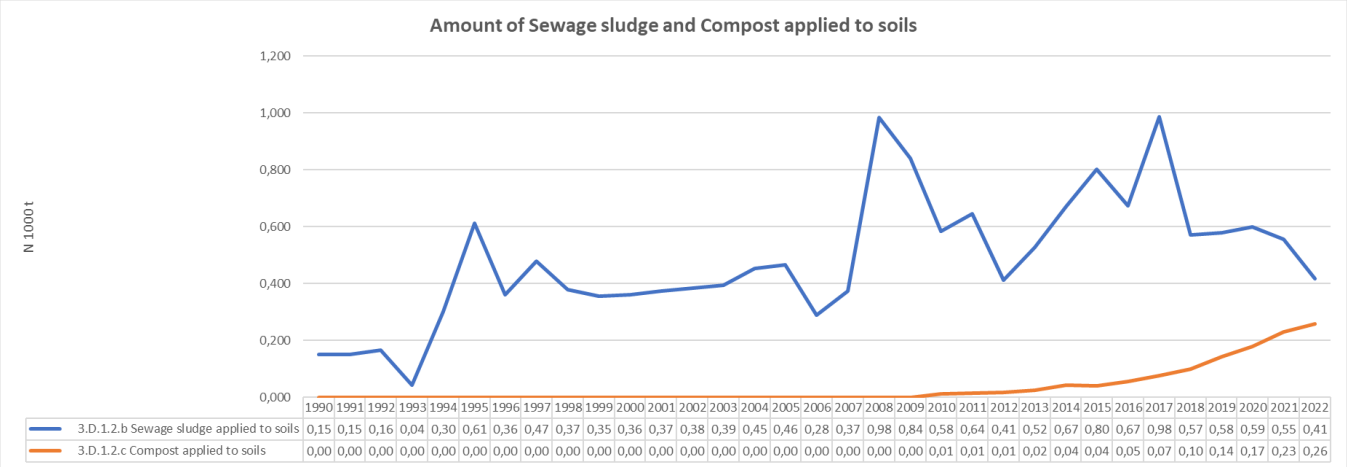


	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Nitrogen solutions	14,0	15,6	15,1	15,0	5,4	20,2	20,0	20,0	20,0	16,8	30,9	31,5	33,5	35,5	40,0	50,0	47,2	47,9
Other NP	2,8	3,1	3,0	3,0	9,7	10,0	10,0	15,0	15,0	18,2	5,4	5,3	3,1	2,5	2,0	2,0	0,9	0,9
N P K compound	2,8	3,1	3,0	3,0	16,2	23,0	22,0	25,0	31,0	22,7	19,0	18,1	20,8	22,1	20,0	22,0	20,2	20,5

NO2 emissions from N fertilizers in 1990-2021

Tier 1 NO2 EF 0,04 (kg NO2 / kg N applied) was used.

3. Other organic fertilisers applied to soils (3Da2b, 3Da2c)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
3.D.1.2.b Sewage sludge applied to soils	0,15	0,15	0,16	0,04	0,30	0,61	0,36	0,47	0,37	0,35	0,36	0,37	0,38	0,39	0,45	0,46	0,28	0,37	0,98	0,84	0,58	0,64	0,41	0,52	0,67	0,80	0,67	0,98	0,57	0,58	0,59	0,55	0,41
3.D.1.2.c Compost applied to soils	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,02	0,04	0,04	0,05	0,07	0,10	0,14	0,17	0,23	0,26

EFs for emisions from sludge: Tier 1 NH3 EF 0,13 kg NH3/ kg N applied, Tier 1 NO2 EF = 0,13*(0,002/ 0,0068)= 0,038235294 kg NH3/ kg N applied.

EFs for emisions from compost: Tier 1 NH3 EF 0,08 kg NH3/ kg N applied, Tier 1 NO2 EF 0,04 kg NO2 /kg waste N applied.

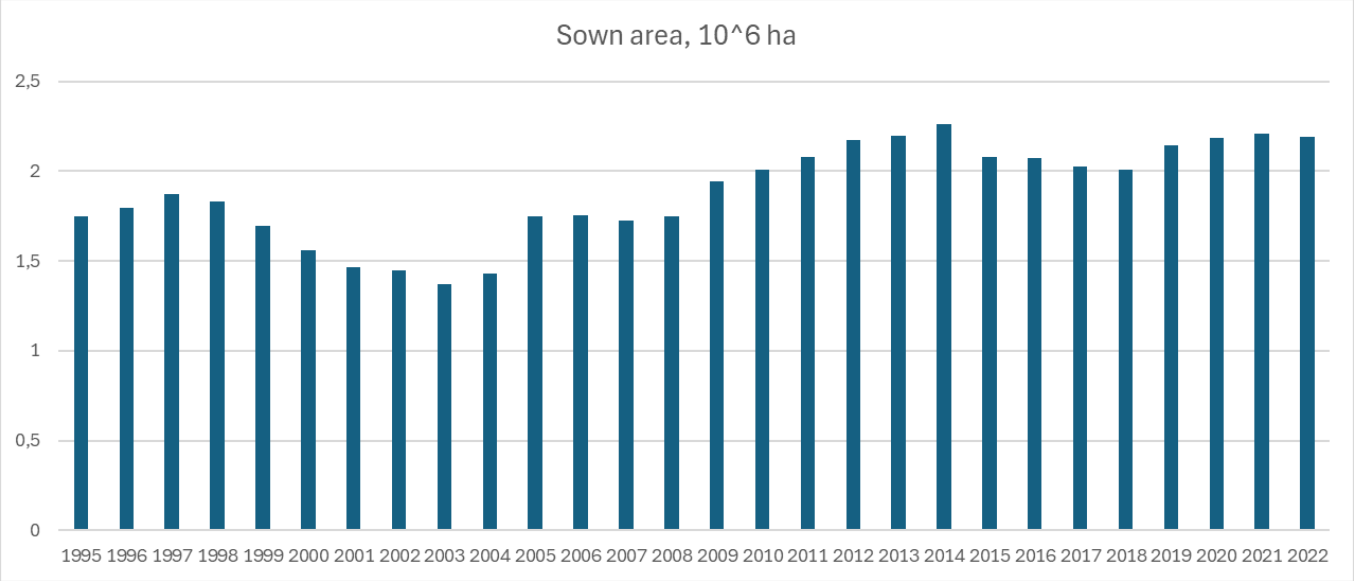
4. Crop residues applied to soils

The methodology is provided in GB2023 for estimating NH3 emissions, but the activity data were not prepared.

Planned improvements. 1) To prepare the activity data for the Tier 1 methodology; 2) to investigate the possibility to obtain an activity data for the Tier 2 methodology.

5. Farm-level agricultural operations including storage, handling and transport of agricultural products (3dc)

The Tier 1 methodology was applied. As activity data, following data were used:



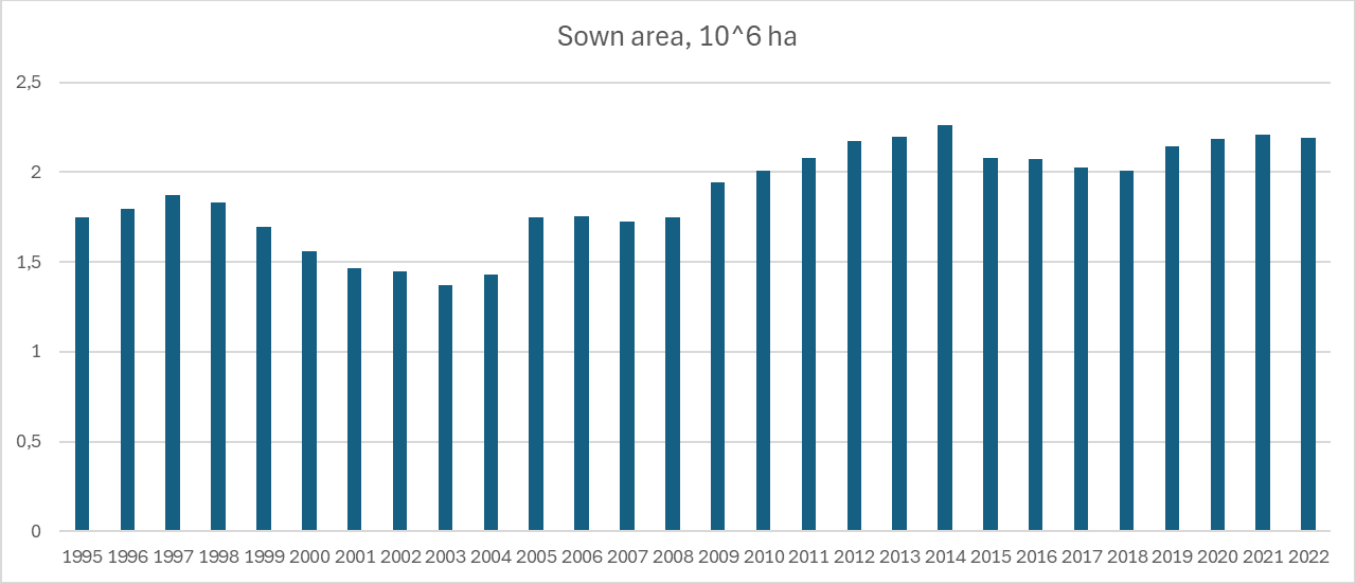
Source: Statistics Lithuania

TSP, PM10 Ef was 1,56 kg/ha; PM2.5 Ef was 0,06 kg/ha (Table 3-1 Tier 1 EFs for source category 3.D GB2023)

Planned improvements. 1) To implement the Tier 2 methodology.

6. Cultivated crops (3de)

The Tier 1 methodology was applied. As activity data for estimating NMVOC emissions from cultivated crops, following data were used:



Source: Statistics Lithuania

NMVOC from standing crops Ef was 0,86 kg/ha

Planned improvements. 1) To implement the Tier 2 methodology.

7. Use of pesticides (3Df)

Source category description

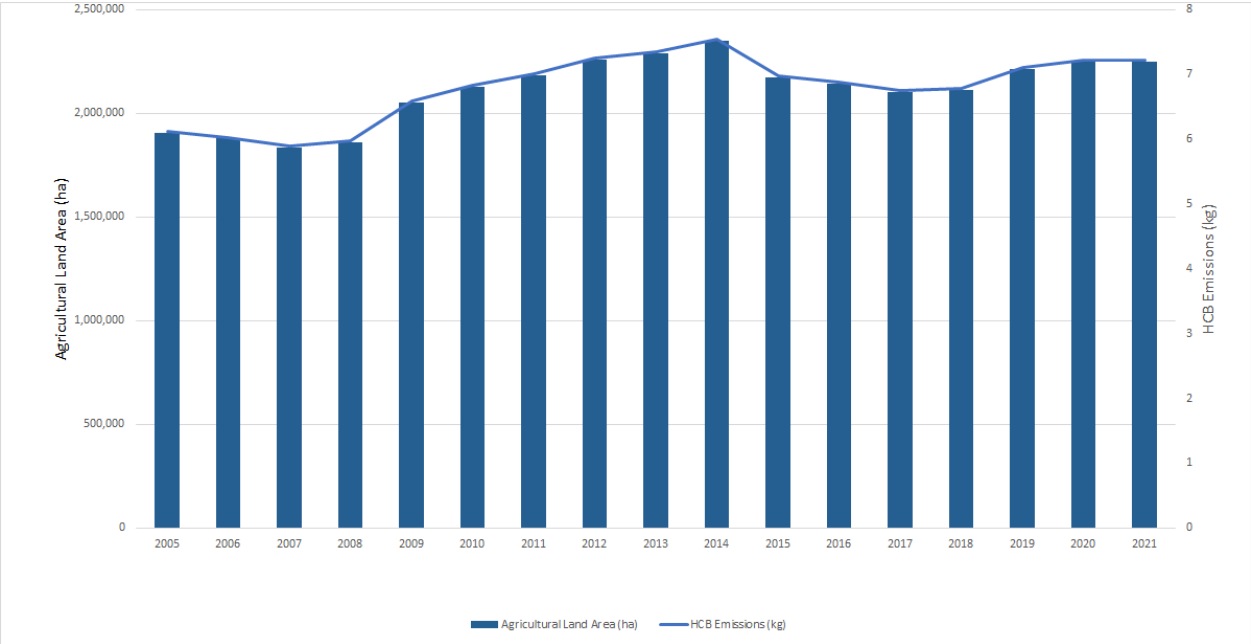
The sector of the use of pesticides (3.D.f) covers the usage of insecticides, fungicides, plant growth regulators, rodenticides, and herbicides for the agricultural purposes and their HCB emissions. The 2001 Stockholm Convention on Persistent Organic Pollutants (POPs) and Protocol to the Convention on LRTAP banned production and consumption of 11 specific POPs. In addition, there are multiple Directives concerning maximum levels of pesticide residues in fruits and vegetables (Directive 76/895/EEC), cereal products (86/362/EEC), food of animal origin (86/363/EEC), plant origin products (90/642/EEC), placing of plant products on the market (91/414/EEC), biocidal products in the market (98/8/EEC) and, maximum levels of pesticides in the animal food and feed (EC regulation No. 396/2005).

According to the latest study, most of the pesticides used in 2014 were herbicides (43%), fungicides (29%), plant growth regulators (26%) and insecticides (2%). [31] In the herbicide category, glyphosate (20.6%) and MCPA (16.8%) were the most common constituents in commercial herbicides. In the case of fungicide, the major constituent was tebuconazole (25.6%). In the case of insecticides, the major constituent was thiacloprid (45.5%), and only 5 active substances are being used in the plant growth regulators with major substance being chlormequat (84.3%).

90-95% of sugar beetroot, sweetcorn, rapes and cereal species are processed with pesticides, and in the case of other agricultural goods, only a smaller percentage of the harvest was treated with pesticides: potatoes (62%), vegetables (26%), and fruit and berries (23%). On average 1.08 kg of active ingredients were used for one hectare of agricultural land, with most of the active pesticides being used for berries and fruits (3.09 kg/ha) and least for the sweetcorn (0.38 kg/ha).

[1] https://osp.stat.gov.lt/informaciniai-pranesimai?articleId=3975263

Information on the amount of different pesticides used (i.e. insecticides, fungicides, herbicides, etc.) for the 1992-2014 period can be gathered from the Statistics Division of the Food and Agriculture Organization of UN (FAOSTAT). No national data on total or plant-specific pesticide consumption is available. In 2014 conducted study, we have shown that only HCB emissions occur from the use of pesticides (3.D.f).



Agricultural land area along with HCB emissions (kg)

Methodological issues

In 2014 we have conducted a study, where we proved that only HCB emissions occur from the use of pesticides (3.D.f). Pesticides which contain minor amounts of HCB as impurity were addressed. Only two chemicals, chlorothalonil and clopyralid, were identified to produce HCB emissions in small amounts. HCB emissions were estimated by using Yang (2006) emission factors (EMEP/EEA guidebook, 2019, 3.D.f, 3., table 3). For chlorothalonil and clopyralid the emission factors were 10 g/Mg and 2.5 g/Mg of pesticides used, respectively. The total amounts of chlorothalonil and clopyralid were obtained from statistical studies, and are equal to 5190.07 and 1359.65 kg, respectively.

Furthermore, no annual statistics in Lithuania are collected on the use of pesticides. Thus, HCB emissions from pesticide usage in 1990 were calculated based on reported HCB emissions by other countries. The average ratio of HCB emitted per agricultural land (kg of HCB per 1000 ha) was applied for agricultural area (3389 thousand ha) in Lithuania in 1992 (no data on agricultural land in 1990 is available at FAOSTAT database), and reported for 1990 on assumption that HCB emissions from this sub-sector were similar for years 1990 and 1992.

Country	Agricultural Land, 1000 ha (1990)	Reported HCB emissions from NFR 3.D.f (1990)	Ratio, kg/1000 ha
Denmark	2788	18.280	6.56E-03
Finland	2393	1.207	5.04E-04
Italy	16840	23.486	1.39E-03
Germany	18032	21.830	1.21E-03
United Kingdom	18203	116.326	6.39E-03
		Average	3.21E-03

Agricultural land (FEOSTAT Database), with reported HCB emissions and ratios by the country.

Activity data

As no statistics are collected on the use of pesticides, the agricultural land area was used for the HCB emission calculations. The statistics on the agricultural land area were taken from the National Lithuania Statistics database.

8. Other

3Db	Indirect emissions from managed soils	NE
3Dd	Off-farm storage, handling and transport of bulk agricultural products	NO
3F	Field burning of agricultural residues	NO