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LLI-49 Project

Optimal catch crop solutions to reduce pollution in the transboundary Venta and Lielupe river basins

Project acronym: CATCH POLLUTION

Joint Report on Activity AT1.1.

Environmental analysis: ecological status of Venta and Lielupe RBD water bodies and pollution reduction goals

Centre for Environmental Policy (AAPC)
Latvian Environment, Geology and Meteorology Centre

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Contents

Abbreviations

AAPC	Centre for Environmental Policy
AREI	Institute of Agricultural Resources and Economics
CART	Country Allocated (pollution) Reduction Target
EPA	Environment Protection Agency
LAMMC	Lithuanian Research Centre for Agriculture and Forestry
MAI	Maximum Allowable Inputs
N	Nitrogen
NO_3-N	Nitrate nitrogen
P	Phosphorus
PoM	Programme of measures
RBD	River Basin District
RBMP	River Basin Management Plan
totN	total nitrogen
totP	total phosphorus
VDU ŽŪA	Vytautas Magnus University Agriculture Academy
WFD	Water Framework Directive

Introduction

Water Framework Directive (WFD) is the main peace of the EU water legislation setting out the main principles for management of water resources. The WFD obliges all member states to manage water resources by individual river basin districts (RBD’s) and to achieve good ecological status of all water bodies by 2027 latest. The WFD encourages all countries that share RBDs’ to establish a strong cooperation in management of the common water resources and to join their efforts in solving transboundary water problems.

Lithuania and Latvia share to river basin districts - Venta and Lielupe.

The Venta river rises in Lithuania, enters Latvia in the southwest and flows north through the Kurzeme lowland to the Baltic Sea. Total area of the Venta RBD is 21 937 km^2 of which 6307 km^2 (29%) is in the territory of Lithuania and 15 630 km^2 (61%) in the territory of Latvia.

The Lielupe river rises in Lithuania, enters Latvia in the south and flows north to the Gulf of Riga. Total area of the Lielupe RBD is 17 760 km^2 of which 8917 km^2 (i.e. 50%) is in the territory of Lithuania and 8843 km^2 (50%) in the territory of Latvia.

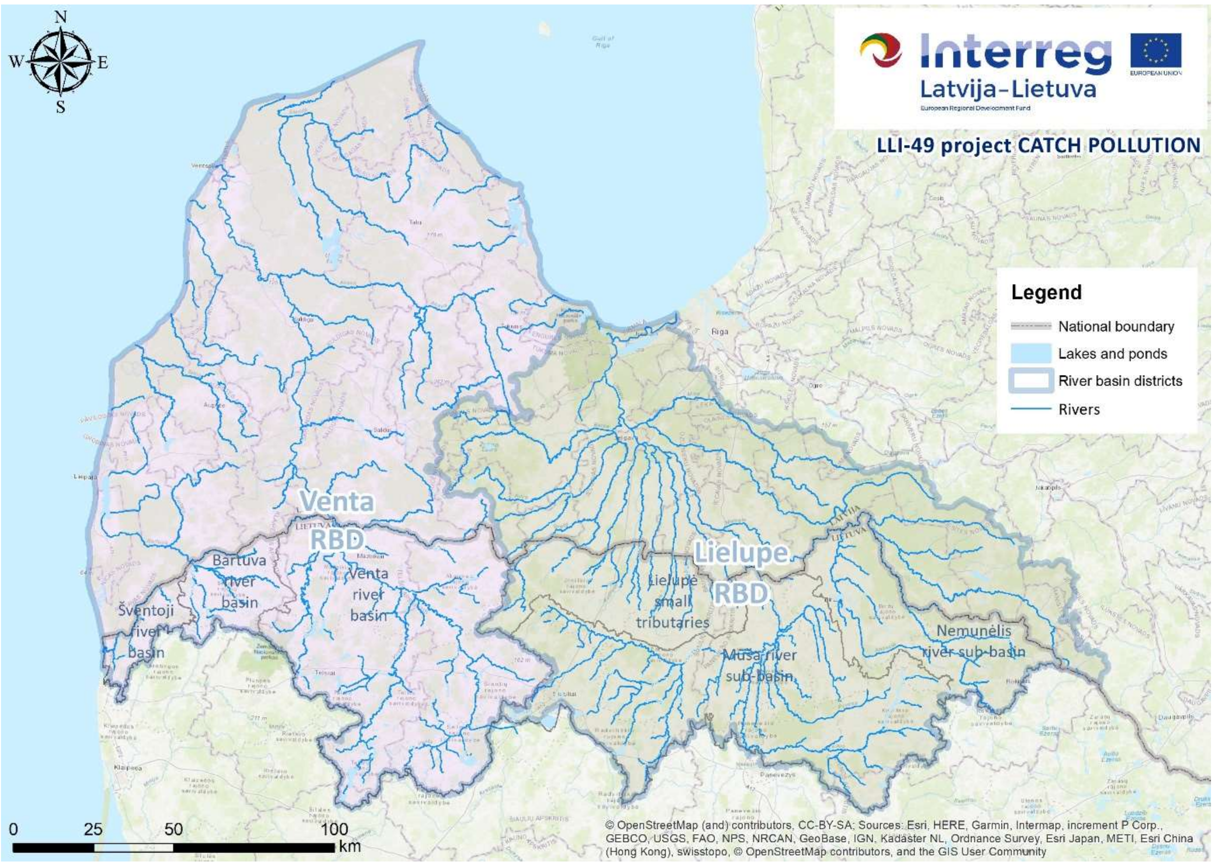


Figure 1. Venta and Lielupe RBDs

Over the last decade, in both countries, significant efforts have been devoted to reduce water pollution. Some types of pollution have decreased considerably. For example, urban wastewater treatment has reached levels in total compliance with the Urban Waste Water Treatment Directive. However, diffuse pollution (of agricultural origin) has not yet been tackled sufficiently.

Having almost equal shares of the RBDs area, both countries significantly contribute to diffuse pollution of the Venta and Lielupe RBDs’ rivers and excessive nutrient transport into the Baltic Sea.

Although some joint actions and measures to improve ecological status of water resources were initiated between Lithuania and Latvia during the first river basin management cycle (2010-2015), they were not sufficient, and diffuse pollution problems remained unsolved. There are little or no changes in ecological status of transboundary water bodies.

Agriculture is the major source of nitrogen pollution in the Venta and Lielupe river basin districts. Due to a very significant impact of agriculture, ecological status of rivers in the Lielupe river basin has been assessed as being the worst compared to the other river basins both in Latvia and Lithuania. In the Lithuanian part of the Lielupe RBD, 70 % of river water bodies fail to achieve good ecological status due to the impact of agricultural pollution. Significant amounts of pollution from Lithuania are transported across the border to Latvia, add to the local pollution, deteriorate river water quality and result in excessive loads into the Baltic Sea.

Growing of catch crops, having a big potential to bind nitrogen remaining in the soil after the harvest and prevent its leaching to the rivers, has been recognized as an efficient agri-environmental measure by a number of scientists and experts. In the Lithuanian Programmes of Measures for the Lielupe and Venta river basin districts, growing of catch crops was proposed as one of the main measures for reduction of agricultural pollution. However, due to insufficient knowledge of farmers and missing effective support schemes, potential of catch crops is still poorly utilised both in Latvia and Lithuania.

In this context, the project aims to provide a deeper insight into the catch cropping potentials to facilitate reduction of the agricultural pollution and to improve ecological status of the rivers in the Venta and Lielupe RBDs. The project brings together environmental and agricultural experts from both countries to investigate possible catch crop growing schemes, analyse associated costs and benefits, provide knowledge to farmers and encourage them to use catch crops and, finally, to elaborate recommendations for decision makers regarding application of catch crops for pollution control.

Ecological status of water bodies and pollution reduction objectives in the Lithuanian part of the Venta and Lielupe RBD

Lithuanian part of the Venta RBD covers three river basins: Venta river basin (5137 km^2), Bartuva river basin (749 km^2) and Šventoji river basin (390 km^2) (*see Figure 2*).

Lithuanian part of the Lielupe RBD covers sub-basins of the Lielupe river small tributaries (1750 km^2), Mūša river (5296 km^2), and Nemunėlis river (1900 km^2) (*Figure 3*).

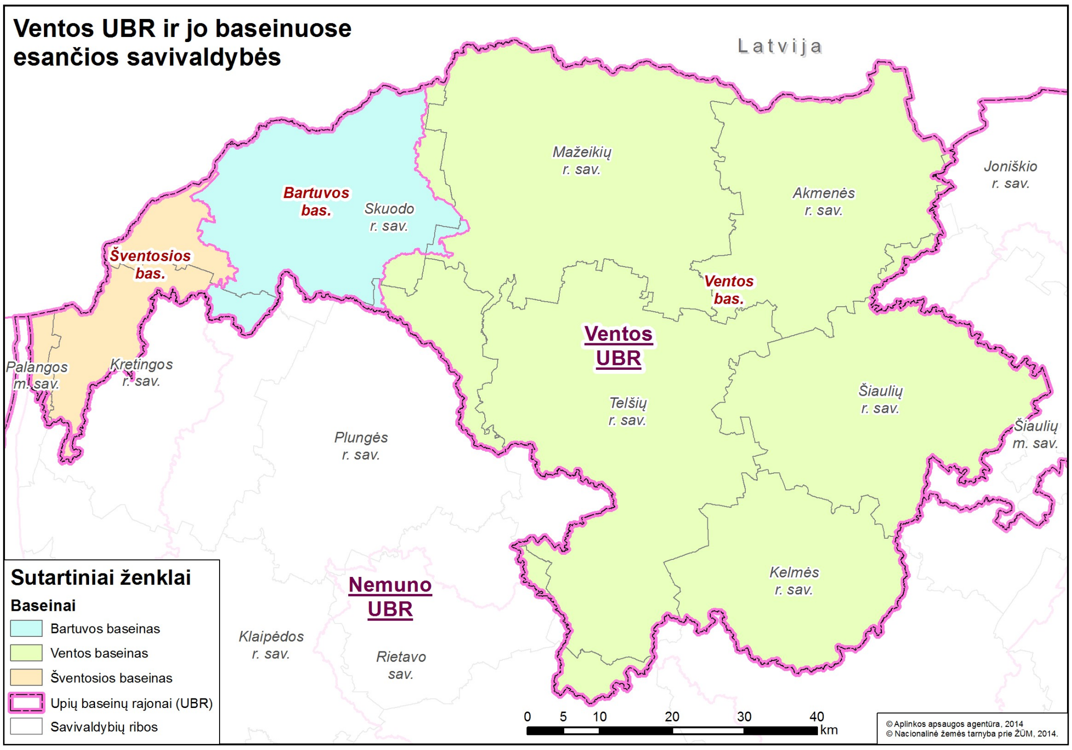


Figure 2. Lithuanian part of the Venta RBD

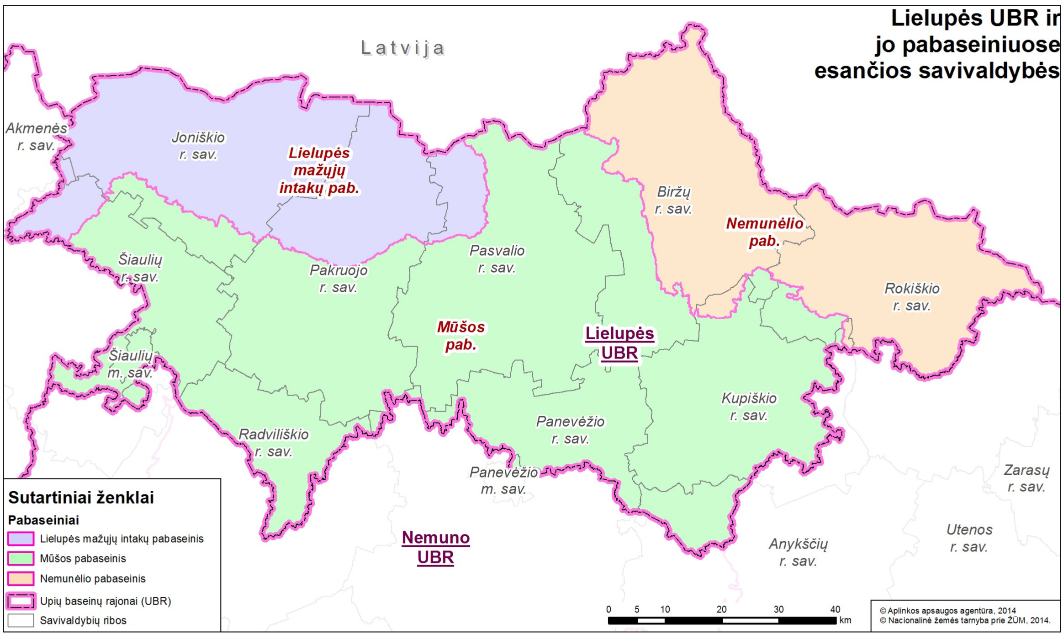


Figure 3. Lithuanian part of the Lielupe RBD

Ecological status problems resulting from the impact of agricultural pollution

Following the requirements of the WFD, first river basin management plans and programmes of measures were prepared and approved by the Lithuanian Government in 2010. Assessment of the ecological status carried out during the process of the preparation of the first RBMPs allowed to get a deeper insight into ecological problems of water resources and identify the main pressures having the largest impacts on the ecological status. Assessment of pressures and ecological status was updated in the 2nd RBMPs which, together with the respective Programmes of Measures (PoMs), were adopted by the Lithuanian Government in 2017.

Agricultural pollution is mainly characterised by the concentrations of nitrates-nitrogen (NO_3-N), total nitrogen (totN) and total phosphorus (totP). In Lithuania, the threshold values for good ecological status are the following:

- Average annual concentration of nitrates nitrogen ≤ 2.3 mg/l;
- Average annual concentration of total nitrogen ≤ 3 mg/l;
- Average annual concentration of total phosphorus ≤0.14 mg/l

It has been estimated that at the beginning of the 1st RBM cycle 59% of all delineated river water bodies in Lithuania were potentially at risk of not achieving good ecological status. Agricultural pollution, influencing ecological problems in 27% of river water bodies, was recognised as one of the most important anthropogenic pressures. The Lielupe RBD was found to be mostly affected by the agricultural pollution. Almost 81% of river water bodies in the Lielupe RBD were identified as being at risk due to the agricultural pollution, namely excessive concentrations of nitrates-N and total nitrogen. In the Venta RBD, agricultural pollution problems were not that severe – 11% of all river water bodies were classified as being at risk.

Although in the first PoMs measures for reduction of agricultural pollution were foreseen, they were either implemented poorly or not at all. Hence, at the end of the 1st RBM cycle no significant changes with respect to nitrogen pollution were observed. Updated assessment of the ecological status, which was carried out for the 2nd RBMP using monitoring data from 2010-2013 and results of the mathematical SWAT model, has revealed that 71% of river water bodies in the Lielupe RBD still suffer from significant agricultural pollution.

Load apportionment results (SWAT mathematical modelling) demonstrate that agriculture contributes approx. 83 percent of the total nitrogen load to the rivers of the Lielupe RBD and 79 percent – to the rivers of the Venta RBD.

With the purpose of investigating further pollution trends and needs for application of agri-environmental measures, such as growing of catch-crops, the latest data on nutrient concentrations in the Venta and Lielupe RBDs' rivers was obtained from the Lithuanian Environment Protection Agency (EPA). Received data from the period 2014-2016 demonstrate that the situation with regard to nitrogen pollution is not improving; it is even getting worse in many rivers.

The largest impact of the agricultural activities is observed in the rivers of the Lielupe small tributaries sub-basin. Total nitrogen concentrations, monitored in the rivers during the period of 2010-2016, vary from 5,6 mg/l to 14 mg/l. There are no rivers in this sub-basin where concentrations of the total nitrogen would meet the requirements for good ecological status. In most of the rivers threshold for good status is exceeded more than 3 times. The lowest concentration of total N (5,6 mg/l) has been measured in the Švitinys and the Švėtė rivers, while in the Beržtalis, Ašvinė and Audruvė concentrations of totN exceed 12 mg/l (bad status).

Situation in the Mūša river sub-basin is a little better. In 20% of the monitored water bodies, concentrations of totN meet requirements for good ecological status but most of the rivers are of the average and poor status. Mostly polluted rivers (of bad status) are Voverkis, Šiladis, Ramytė and Ežerėlė.

Unlike in the sub-basins of the Lielupė small tributaries and the Mūša river, agricultural pollution problems are not characteristic to the sub-basin of the Nemunėlis river. Here concentrations of total N are distributed within the threshold range for good and very good ecological status. Only two water bodies in the Agluona river are classified as water bodies at risk due to agricultural pollution (concentration of total N is not very high – 3,45 mg/l).

In the Venta river basin, agricultural pollution problems are not dominant, however in the water bodies of Ringuva, Dabikinė, Šventupis and Ašva concentrations of nitrogen are still above the allowed limit. The highest concentrations are measured in the Ringuva river (6 mg/l, i.e. 2 times higher than allowed); In the Ašva, the threshold for good status is exceeded not significantly (measured concentration of total N is 3.3 mg/l).

Agricultural activities do not have a significant impact on the rivers of the Bartuva and Šventoji basins. Here concentrations of the total nitrogen in all monitored rivers meet requirements for very good ecological status.

Pressures and impacts analysis, conducted during the preparation of RBMPs, has shown that agriculture has a minor impact on concentrations of total phosphorus. It was estimated by the mathematical modelling that agriculture, contributing approx. 50% of the total phosphorus load, usually does not make any big threats to river water quality. Based on the monitoring data from 2010-2016, concentrations of total phosphorus do not meet requirements for good ecological status in 3 water bodies of the Lielupė small tributaries sub-basin, 13 water bodies of the Mūša sub-basin, 5 water bodies of the Nemunėlis sub-basin, and 3 water bodies of the Venta sub-basin. Most of these water bodies, together with agricultural pollution, receive pollution from urban and non-sewered rural population.

Distribution of the average annual total N and total P concentrations, monitored during 2010-2016 in the rivers of the Venta and Lielupe RBDs, is presented in *Figure 4* and *Figure 5*.

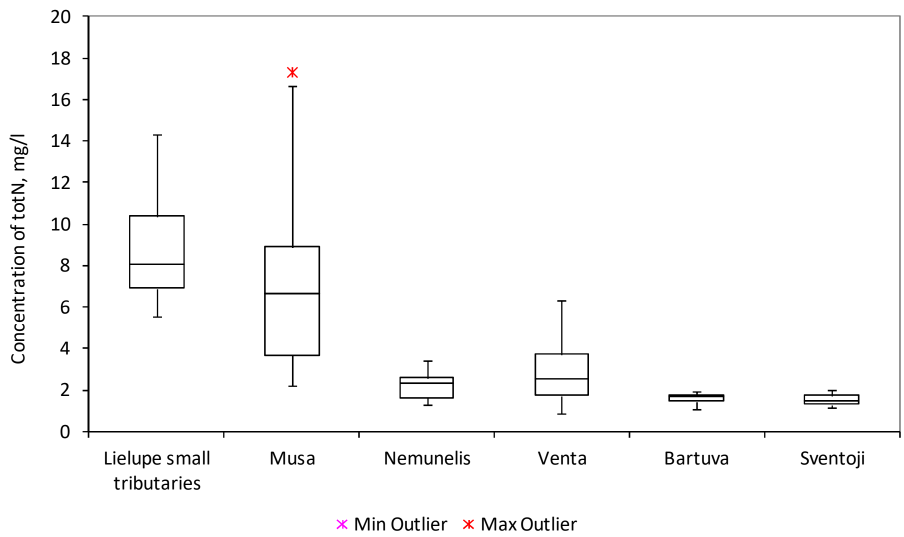


Figure 4. Distribution of total N concentrations in the rivers of sub-basins of the Venta and Lielupe RBD

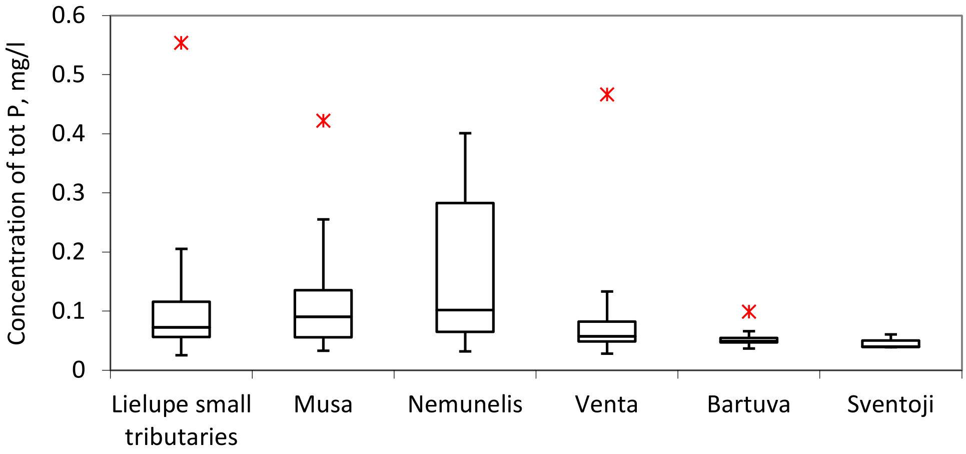


Figure 5. Distribution of total P concentrations in the rivers of sub-basins of the Venta and Lielupe RBD

Water bodies which have been classified as water bodies at risk due to the impact of agricultural pollution are listed in *Table 1*. *Table 1* summarises results from the first assessment, presented in the 1st RBMP, which was based on the monitoring data from the period of 2005 - 2009 and MIKE BASIN modelling results, assessment presented in the 2nd RBMP, which was based on monitoring data from the period of 2010-2013 and SWAT mathematical model results, and the latest assessment which is based on the monitoring data from 2010-2016.

As seen from the table, there have been some positive changes in the status of rivers. Good status with respect to concentrations of total N has been achieved in 5 water bodies of the Venta RBD (Venta basin) and 21 water bodies of the Lielupe RBD (15 water bodies in the Mūša sub-basin and 6 water bodies in the Nemunėlis sub-basin). These changes, however, are not substantial, because most of water bodies in the sub-basins of the Lielupe small tributaries and Musa still suffer from the significant impacts of agricultural activities and remain at risk.

Table 1. Water bodies at risk due to the impact of agricultural pollution (source: 1st and 2nd RBMP and state water quality monitoring data for 2010 – 2016)

WB code	RBD	Basin/sub-basin	River	Classified as water body at risk due to the impact of agricultural pollution			Average annual conc. of totN, mg/l 2010-2016
				in the first RBMP	in the second RBMP	according to the latest data	
300103801	Venta	Venta	Ringuva	Yes	Yes	Yes	6,0
300103802	Venta	Venta	Ringuva	Yes	Yes	Yes	6,3
300106101	Venta	Venta	Dabikinė	Yes			2,5
300106102	Venta	Venta	Dabikinė	Yes	Yes	Yes	5,1
300106103	Venta	Venta	Dabikinė	Yes	Yes	Yes	4,6
300106281	Venta	Venta	Šventupis	Yes	Yes	Yes	5,9
300106282	Venta	Venta	Šventupis	Yes	Yes	Yes	4,8
300107404	Venta	Venta	Virvyčia		Yes	Yes	3,4
300108253	Venta	Venta	Patekla			Yes	3,9
300108321	Venta	Venta	Tausalas		Yes		3,0
300111702	Venta	Venta	Vadakstis		Yes		2,4

WB code	RBD	Basin/sub-basin	River	Classified as water body at risk due to the impact of agricultural pollution			Average annual conc. of totN, mg/l 2010-2016
				in the first RBMP	in the second RBMP	according to the latest data	
300111811	Venta	Venta	Agluona	Yes			2,6
300112361	Venta	Venta	Ašva	Yes	Yes		2,8
300112362	Venta	Venta	Ašva	Yes	Yes	Yes	3,3
300112363	Venta	Venta	Ašva	Yes	Yes	Yes	3,9
400100101	Lielupė	Lielupe small tributaries	Yslykis	Yes	Yes	Yes	7,0
400100221	Lielupė	Lielupe small tributaries	Maučiuvis	Yes	Yes	Yes	8,1
400100331	Lielupė	Lielupe small tributaries	Plonė	Yes	Yes	Yes	6,5
400100461	Lielupė	Lielupe small tributaries	Beržtalis	Yes	Yes	Yes	13,3
400100462	Lielupė	Lielupe small tributaries	Beržtalis	Yes	Yes	Yes	13,2
400100463	Lielupė	Lielupe small tributaries	Beržtalis	Yes	Yes	Yes	7,6
400101101	Lielupė	Lielupe small tributaries	Švitinys	Yes	Yes	Yes	5,6
400101141	Lielupė	Lielupe small tributaries			Yes		NM
400101281	Lielupė	Lielupe small tributaries	Viršytis	Yes	Yes		NM
400101621	Lielupė	Lielupe small tributaries	Šeševėlė		Yes	Yes	9,33
400101701	Lielupė	Lielupe small tributaries	Virčiuvis	Yes	Yes	Yes	10,5
400101702	Lielupė	Lielupe small tributaries	Virčiuvis	Yes	Yes	Yes	10,2
400101811	Lielupė	Lielupe small tributaries	Ašvinė	Yes	Yes	Yes	12,8
400101941	Lielupė	Lielupe small tributaries	Audruvė	Yes	Yes	Yes	14,3
400102501	Lielupė	Lielupe small tributaries	Platonis	Yes	Yes	Yes	7,7
400102641	Lielupė	Lielupe small tributaries			Yes		NM
400102691	Lielupė	Lielupe small tributaries	Sidabra	Yes	Yes	Yes	9,1
400102692	Lielupė	Lielupe small tributaries	Sidabra	Yes	Yes	Yes	9,8
400103201	Lielupė	Lielupe small tributaries	Švėtė	Yes	Yes	Yes	6,5
400103202	Lielupė	Lielupe small tributaries	Švėtė	Yes	Yes	Yes	5,6
400103361	Lielupė	Lielupe small tributaries			Yes		NM
400103521	Lielupė	Lielupe small tributaries	Vilkija	Yes	Yes		NM
400103522	Lielupė	Lielupe small tributaries	Vilkija	Yes	Yes	Yes	6,8
400103721	Lielupė	Lielupe small tributaries	Švėtelė	Yes	Yes	Yes	7,7
410100011	Lielupė	Mūša	Mūša	Yes	Yes	Yes	8,3
410100012	Lielupė	Mūša	Mūša	Yes	Yes	Yes	7,2
410100013	Lielupė	Mūša	Mūša	Yes	Yes	Yes	9,7
410100014	Lielupė	Mūša	Mūša	Yes	Yes	Yes	5,2
410100015	Lielupė	Mūša	Mūša	Yes	Yes	Yes	4,8
410100016	Lielupė	Mūša	Mūša	Yes	Yes	Yes	4,6
410100301	Lielupė	Mūša			Yes		NM
410100601	Lielupė	Mūša			Yes		NM
410100701	Lielupė	Mūša	Vilkvedis	Yes	Yes	Yes	8,0
410101201	Lielupė	Mūša	Voverkis	Yes	Yes	Yes	13,3
410101501	Lielupė	Mūša	Tautinys		Yes		NM

WB code	RBD	Basin/sub-basin	River	Classified as water body at risk due to the impact of agricultural pollution			Average annual conc. of totN, mg/l 2010-2016
				in the first RBMP	in the second RBMP	according to the latest data	
410102101	Lielupė	Mūša	Kulpė	Yes	Yes		NM
410102102	Lielupė	Mūša	Kulpė	Yes	Yes	Yes	9,2
410102103	Lielupė	Mūša	Kulpė	Yes	Yes	Yes	8,0
410102104	Lielupė	Mūša	Kulpė	Yes	Yes	Yes	9,7
410102121	Lielupė	Mūša	Vijolė	Yes	Yes	Yes	4,1
410102131	Lielupė	Mūša			Yes		NM
410102901	Lielupė	Mūša	Šiladis	Yes	Yes	Yes	12,0
410102902	Lielupė	Mūša	Šiladis	Yes	Yes	Yes	13,7
410103601	Lielupė	Mūša	Pala	Yes			2,8
410104301	Lielupė	Mūša	Kruoja	Yes	Yes	Yes	9,4
410104302	Lielupė	Mūša	Kruoja	Yes	Yes		NM
410104303	Lielupė	Mūša	Kruoja	Yes	Yes	Yes	10,7
410104443	Lielupė	Mūša	Obelė	Yes	Yes	Yes	8,9
410104531	Lielupė	Mūša	Vezgė	Yes	Yes	Yes	8,0
410104532	Lielupė	Mūša	Vezgė	Yes	Yes	Yes	7,9
410105101	Lielupė	Mūša	Daugyvenė	Yes	Yes		NM
410105102	Lielupė	Mūša	Daugyvenė	Yes	Yes	Yes	4,0
410105103	Lielupė	Mūša	Daugyvenė	Yes	Yes	Yes	4,0
410105104	Lielupė	Mūša	Daugyvenė	Yes	Yes	Yes	6,6
410105191	Lielupė	Mūša			Yes		NM
410105261	Lielupė	Mūša			Yes		NM
410105311	Lielupė	Mūša			Yes		NM
410105381	Lielupė	Mūša	Ramytė	Yes	Yes	Yes	17,4
410105391	Lielupė	Mūša	Ežerėlė	Yes	Yes	Yes	6,7
410105392	Lielupė	Mūša	Ežerėlė	Yes	Yes	Yes	12,5
410105393	Lielupė	Mūša	Ežerėlė	Yes		Yes	8,3
410107301	Lielupė	Mūša	Mažupė	Yes	Yes	Yes	7,9
410107302	Lielupė	Mūša	Mažupė	Yes	Yes	Yes	8,4
410107441	Lielupė	Mūša	Meškerdys	Yes	Yes	Yes	6,3
410108201	Lielupė	Mūša			Yes		NM
410108501	Lielupė	Mūša	Lėvuo	Yes	Yes	Yes	3,7
410108502	Lielupė	Mūša	Lėvuo	Yes			2,7
410108503	Lielupė	Mūša	Lėvuo	Yes			2,4
410108591	Lielupė	Mūša	Mituva	Yes	Yes	Yes	3,3
410108592	Lielupė	Mūša	Mituva	Yes			2,8
410108871	Lielupė	Mūša	Kupa	Yes	Yes	Yes	3,5
410108872	Lielupė	Mūša	Kupa	Yes	Yes	Yes	3,4
410108992	Lielupė	Mūša	Skodinys	Yes	Yes	Yes	4,1
410109231	Lielupė	Mūša	Suosa	Yes			2,2

WB code	RBD	Basin/sub-basin	River	Classified as water body at risk due to the impact of agricultural pollution			Average annual conc. of totN, mg/l 2010-2016
				in the first RBMP	in the second RBMP	according to the latest data	
410109232	Lielupė	Mūša	Suosa	Yes		Yes	3,1
410109352	Lielupė	Mūša	Viešinta	Yes			2,6
410109353	Lielupė	Mūša	Viešinta	Yes			2,1
410109441	Lielupė	Mūša	Vašuoka	Yes			NM
410109442	Lielupė	Mūša	Vašuoka	Yes			2,9
410109443	Lielupė	Mūša	Vašuoka	Yes		Yes	3,0
410109621	Lielupė	Mūša	Marnaka	Yes			2,7
410109961	Lielupė	Mūša	Amata	Yes		Yes	5,6
410110291	Lielupė	Mūša	Žąsa	Yes	Yes	Yes	6,0
410110451	Lielupė	Mūša	Įstras	Yes			2,8
410110452	Lielupė	Mūša	Įstras	Yes	Yes	Yes	3,2
410110531	Lielupė	Mūša	Svalia	Yes			2,5
410111201	Lielupė	Mūša	Pyvesa	Yes			3,0
410111202	Lielupė	Mūša	Pyvesa	Yes	Yes	Yes	5,5
410111203	Lielupė	Mūša	Pyvesa	Yes	Yes	Yes	3,2
410111551	Lielupė	Mūša	Orija	Yes	Yes		3,0
410111552	Lielupė	Mūša	Orija	Yes	Yes	Yes	3,4
410112101	Lielupė	Mūša	Jiešmuo	Yes	Yes	Yes	5,0
410112102	Lielupė	Mūša	Jiešmuo	Yes	Yes	Yes	6,6
410112401	Lielupė	Mūša	Tatula	Yes	Yes	Yes	4,5
410112402	Lielupė	Mūša	Tatula	Yes	Yes	Yes	5,0
410112403	Lielupė	Mūša	Tatula	Yes	Yes	Yes	3,8
410112471	Lielupė	Mūša	Vabala	Yes	Yes	Yes	6,1
410112631	Lielupė	Mūša	Juodupė	Yes	Yes	Yes	5,3
410112751	Lielupė	Mūša	Upytė	Yes			3,0
410112752	Lielupė	Mūša	Upytė	Yes	Yes	Yes	4,3
410112871	Lielupė	Mūša			Yes		NM
410113301	Lielupė	Mūša	Kamatis	Yes	Yes	Yes	6,7
410114501	Lielupė	Mūša	Čeriaukštė	Yes	Yes	Yes	4,5
420100013	Lielupė	Nemunėlis	Nemunėlis	Yes			1,6
420100014	Lielupė	Nemunėlis	Nemunėlis		Yes		2,6
420100502	Lielupė	Nemunėlis	Laukupė	Yes			1,9
420101161	Lielupė	Nemunėlis	Beržiena		Yes		2,4
420105401	Lielupė	Nemunėlis	Apaščia		Yes		2,6
420105403	Lielupė	Nemunėlis	Apaščia		Yes		2,6
420105721	Lielupė	Nemunėlis	Agluona	Yes	Yes	Yes	3,5
420105722	Lielupė	Nemunėlis	Agluona	Yes	Yes	Yes	3,4

NM – not monitored

Table 2, *Table 3* and *Table 4* provide information about the number of water bodies under different classes of the ecological status with respect to concentrations of total nitrogen, nitrates-nitrogen (NO_3-N) and total phosphorus. Water body is classified as water body at risk if ecological status is classified as moderate, poor or bad.

Table 2. Number of water bodies under different classes of the ecological status with respect to concentrations of nitrates-nitrogen (classification is based on the monitoring data from 2010-2016; non monitored water bodies are not included).

RBD/Sub-basin	Number of monitored water bodies where concentrations of NO_3-N demonstrate				
	high ecological status	good ecological status	moderate ecological status	poor ecological status	bad ecological status
Lielupe River Basin District					
Lielupė small tributaries sub-basin	0	0	3	14	2
Mūš sub-basin	3	21	18	20	4
Nemunėlis sub-basin	10	4	0	0	0
Venta River Basin District					
Venta basin	12	8	8	2	0
Bartuva basin	8	0	0	0	0
Šventoji basin	3	0	0	0	0

Table 3. ***Number of water bodies under different classes of the ecological status with respect to concentrations of total nitrogen (classification is based on the monitoring data from 2010-2016; non monitored water bodies are not included).***

RBD/Sub-basin	Number of monitored water bodies where concentrations of total nitrogen demonstrate				
	high ecological status	good ecological status	moderate ecological status	poor ecological status	bad ecological status
Lielupe River Basin District					
Lielupė small tributaries sub-basin	0	0	2	12	4
Mūša sub-basin	0	14	26	21	5
Nemunėlis sub-basin	6	6	2	0	0
Venta River Basin District					
Venta basin	11	8	10	1	0
Bartuva basin	8	0	0	0	0
Šventoji basin	3	0	0	0	0

Table 4. ***Number of water bodies under different classes of the ecological status with respect to concentrations of total phosphorus (classification is based on the monitoring data from 2010-2016; non monitored water bodies are not included).***

RBD/Sub-basin	Number of monitored water bodies where concentrations of total phosphorus demonstrate				
	high ecological status	good ecological status	moderate ecological status	poor ecological status	bad ecological status
Lielupe River Basin District					
Lielupė small tributaries sub-basin	14	2	0	2	1
Mūša sub-basin	42	11	9	4	0
Nemunėlis sub-basin	7	2	1	4	0
Venta River Basin District					
Venta basin	24	3	1	1	0
Bartuva basin	8	0	0	0	0
Šventoji basin	3	0	0	0	0

Pollution trends

In a case of nitrates and total nitrogen, runoff is the main factor determining variation of concentrations through the year. As seen from the picture below, river discharge and concentrations of nitrates-N and total N vary through the year with the same pattern, i.e. highest pollutant concentrations in rivers are observed under the high water flow conditions and, respectively, concentrations decrease to their minimum at the low flow conditions. This variation pattern clearly indicates that nitrogen pollution is coming from diffuse sources, i.e. is washed out from the fields with the autumn rain and spring snow melt waters. In a case of point pollution, the highest concentrations would be observed during the driest months of the year when dilution capacities of rivers are the lowest.

For phosphorus, there are no clear trends of annual variation of concentrations and no correlation with river discharge. This indicates that concentrations of phosphorus are determined by more pollution sources and processes (such as point, domestic, accidental pollution, soil erosion, sediment-water interactions) than concentrations of mineral nitrogen.

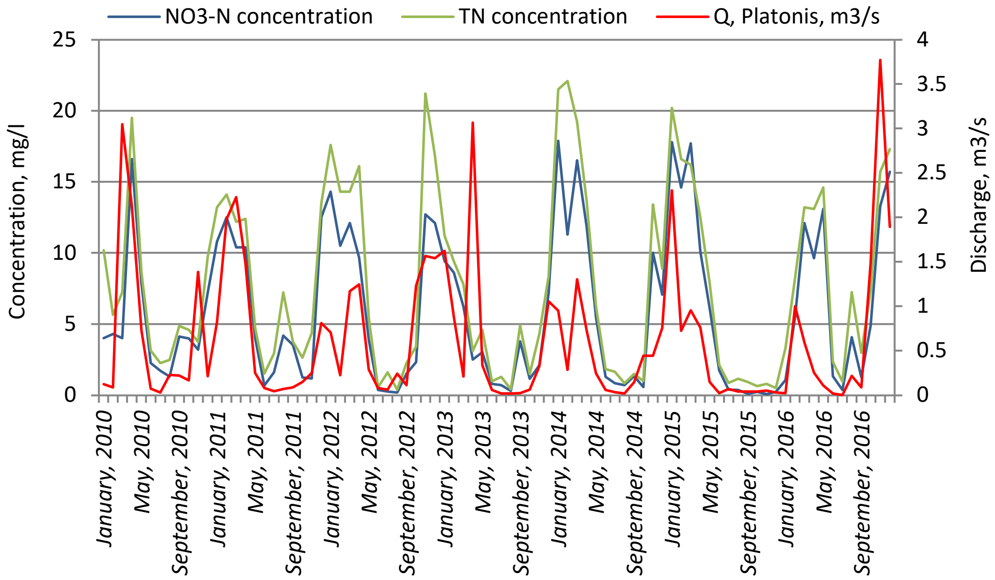


Figure 6. Annual variation of nitrates and total nitrogen concentrations in the Platonis river

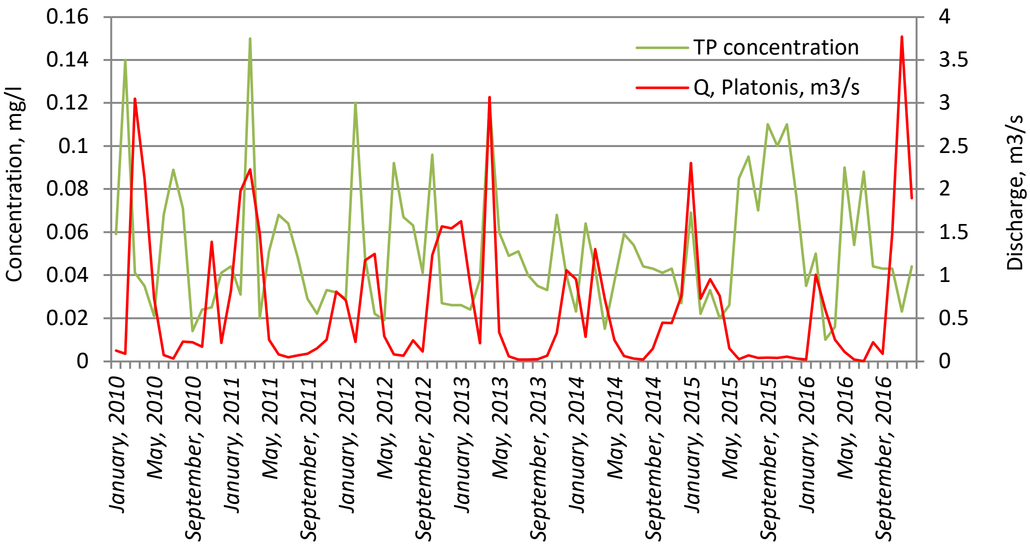


Figure 7. Annual variation of total phosphorus concentrations in the Platonis river

For the long term trend analysis of nutrient concentrations in the rivers of Venta and Lielupe RBDs, monitoring data from intensive monitoring stations was used. *Figure 8* and *Figure 9* present variations of annual nutrient concentrations in the period of 2001-2016.

Venta RBD. For the Venta RBD, two rivers were analysed – Venta, which is the main river, and Ašva, which is one of the most agriculture-impacted rivers in the Venta RBD (arable land makes approx. 45% of its catchment area).

As seen from *Figure 8*, concentrations of nitrates-N in the Venta river were more or less stable and below the threshold limit for good ecological status almost all the time except for 2016 when extremely high concentrations were flushed into rivers and pollution was significantly higher than in the previous years. In the analysed period, NO_3-N concentrations in the Ašva have been exceeding the threshold from time to time, with very significant violation in 2016; though, concentrations of total nitrogen were always above the allowed limit. If to ignore extremely unusual year of 2016, concentrations of the total nitrogen in the Venta river clearly demonstrate the decreasing trend. Starting from 2008, thresholds for good status were not violated. Considering that concentrations of nitrates-N remain stable, decrease in total nitrogen generally means decrease in concentrations of the organic nitrogen fraction. Similar decrease in organic nitrogen is observed in Ašva.

Figure 9 demonstrates that concentrations of total P in both Venta and Ašva are much below the threshold for good ecological status.

Lielupe RBD. For the Lielupe RBD, water quality monitoring data from 3 rivers was analysed – Mūša which is the main river, Platonis which represents intensively cultivated sub-catchment of the Lielupė small tributaries basin, and Daugyvenė which represents the upstream part of the Mūša sub-basin with significant agricultural impacts.

Data in *Figure 8* demonstrate that concentrations of NO_3-N, with exception of few years, have been exceeding the threshold for good ecological status in all analysed rivers. Limit concentrations of total N have been exceeded in all years as well. Variation patterns of total N and NO_3-N were similar. The highest concentrations of total N and NO_3-N in the Platonis river were observed in 2007, but generally concentrations remain at the same level, demonstrating that impact of agriculture is not decreasing and temporal variations of concentrations are mostly determined by the hydrological conditions but not by the changes in agricultural practices. Similar situation is in the Mūša river where concentrations of nitrogen remain more or less stable over the analysed period of time. Opposite to the Platonis river, concentrations of total N and NO_3-N in the Daugyvenė show an increasing trend. In 2016, concentrations of total N and NO_3-N in the Daugyvenė were the highest over the entire 16 year period. This is an indication that the level of agricultural impact is constantly increasing.

From *Figure 9* it is seen that starting from 2006 concentrations of total phosphorus in the Lielupe RBD rivers have never exceeded the allowed threshold for good ecological status. This demonstrate that agricultural activities having very big impact on the nitrogen pollution have little impact on phosphorus concentrations in the rivers.

Monitoring data from the last 16 year period demonstrate that in the areas of intensive agricultural activities no positive changes with respect to nitrogen pollution have occurred. Concentrations of NO_3-N and total N either remain stable or even demonstrate an increasing trend. That shows that all agri-environmental and greening measures implemented by now did not give a considerable effect and implementation of new effective measures is vitally important to reduce agricultural pollution to acceptable level.

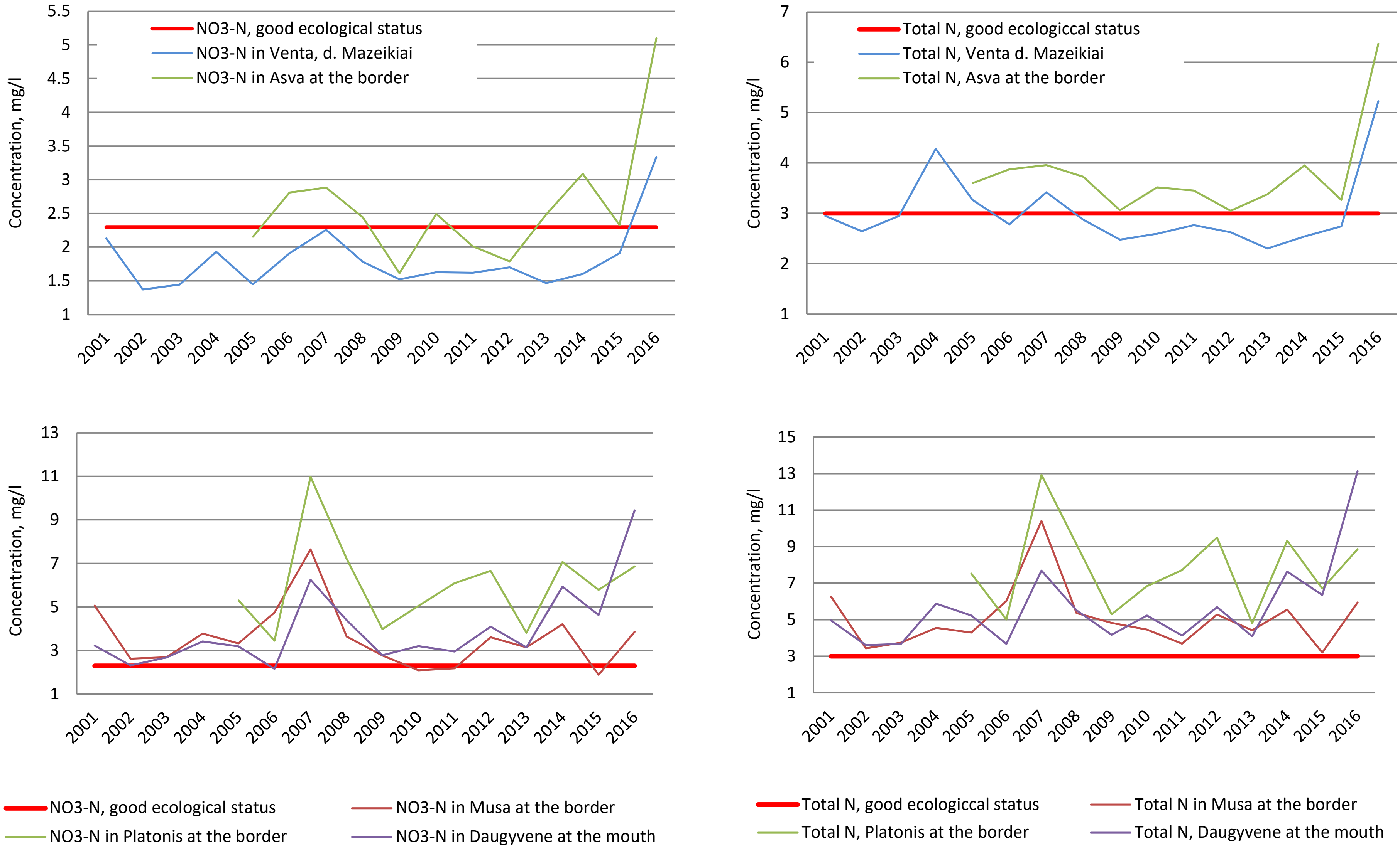


Figure 8. Concentrations of nitrates N and total N in the rivers of Venta and Lielupe RBD

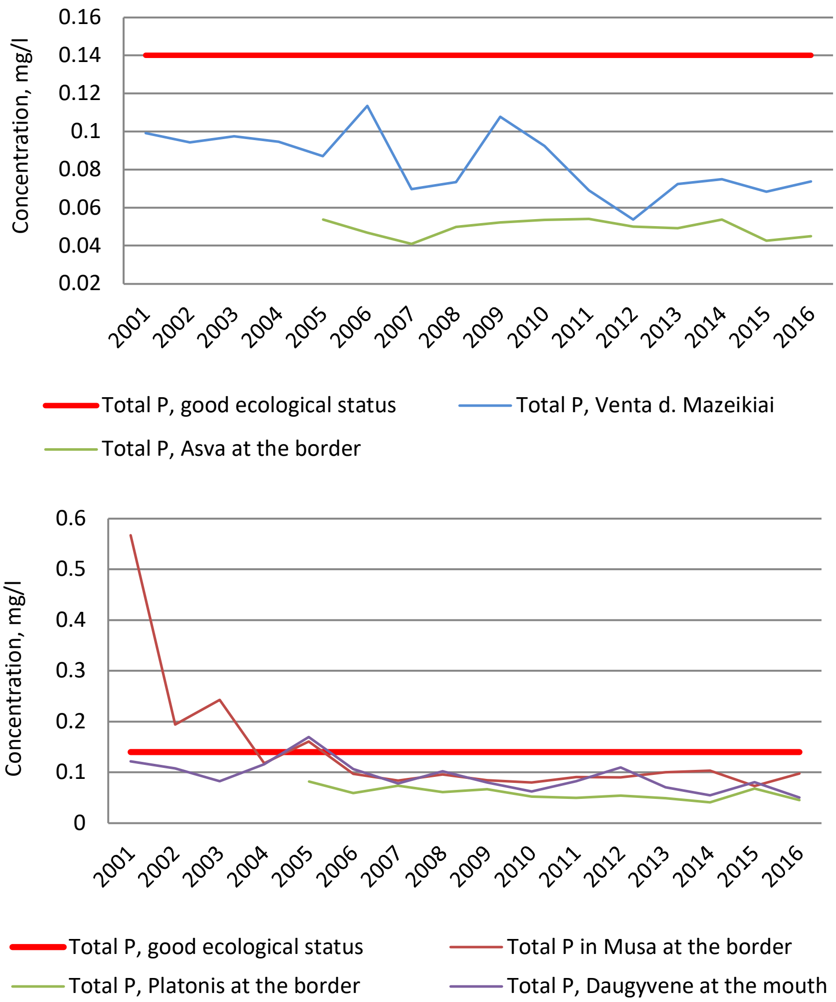


Figure 9. Concentrations of total phosphorus in the rivers of Venta and Lielupe RBD

Nitrogen accumulation in soil

Nitrogen losses from the soil are determined by various natural and anthropogenic factors and complex interaction processes among them. Natural conditions such as soil and landscape properties, hydrological and meteorological conditions predefine certain loss features, however anthropogenic activities, mostly farming practices, can substantially influence or even change nutrient loss patterns. Environmental problems are largely related to the nutrient surplus in the soil when excessive nutrients (especially mineral nitrogen) not used by plants during the vegetation period are washed-out to the deeper soil layers and water bodies. To avoid accumulation of excessive nutrients in soil, fertilisation should be planned not only considering crop demands but also amounts of nutrients available in the soil.

To help farmers in planning well balanced fertilisation and facilitate efficient use fertilisers, in 2005 ministry of Agriculture of Lithuania has initiated monitoring of agrochemical soil properties which twice a year is performed by the Agrochemical Research Laboratory at Lithuanian Research Centre for Agriculture and Forestry (LAMMC). Taking into account soil accumulated amounts of mineral nitrogen, scientists each year provide recommendations for farmers on the adjustment of fertilisation rates.

Annual reports of the agrochemical soil monitoring clearly demonstrate that the largest amounts of nitrogen accumulate in the soils of Mid-Lithuania as a result of the most intensive crop production in the country. Often large amounts of nitrogen are found in the soil in autumn what indicates over-fertilization of the winter crops and disregarding availability of soil accumulated nitrogen when planning fertilisation.

Granulometric composition of the soil is important factor for nitrogen loss. Heavy soils have larger accumulation potentials while soils of lighter composition are more susceptible to leaching.

The largest amounts of nitrogen remain after potatoes, rape, maize, and in the fields sown with the winter crop or rape.

Analyses in the fields under different fertilisation schemes demonstrate that fertilisation rate and scheme have crucial importance on the amount of nitrogen to remain in the soil by the autumn. After crop which received 180 kgN/year with mineral fertilisers without adding phosphorus and potassium, 119.3 kg/ha of mineral nitrogen was left in the soil in autumn of 2016. The same nitrogen fertilisation rate (180 kg/ha) adding additionally 90 kg of phosphorus and 90 kg of potassium, resulted in much lower amount (46.85 kg/ha) of mineral nitrogen in the soil. While the field not fertilised with any mineral fertilisers has got only 22.1 kg/ha[1].

Large amounts of mineral nitrogen remaining in the soil in autumn demonstrate that farmers use unreasonably high fertilisation rates in a result of what large amounts of nitrogen are not used by plants and stay in the soil as a subject to wash-out. Data shows that losses from soil during late autumn and winter months constitute from 10 to 30 kg/ha.

In contrary to nitrogen, amounts of phosphorus in soil are more stable and not so variant. During the last decade, in Pakruojis district, areas of soils which are relatively rich in phosphorus have increased by 23,7 percent. This is an indication of intensive use of fertilisers.

Table 5 provides data from the soil agrochemical monitoring carried out by the Agrochemical Research Laboratory at LAMMC. Results represent N surplus in the soil of the Mid Lithuanian lowland covering districts of Joniškis, Pakruojis, Pasvalys, Biržai, Panevėžys, Kėdainiai, part of Akmenė, Panevežys and Kaunas districts.

It can be seen from the table that large amounts of nitrogen were accumulated in the soil in autumn months of 2012, 2013, 2015. Consequently, large amounts of soil accumulated nitrogen resulted in high concentrations of total N and NO_3-N in the rivers in 2014 and 2016.

Table 5. N surplus in the soil; results of agrochemical soil monitoring carried out by the Agrochemical Research Laboratory at Lithuanian Research Centre for Agriculture and Forestry

	2010 spring	**2010 autumn**	**2011 spring**	**2011 autumn**	**2012 spring**	**2012 autumn**	**2013 spring**	**2013 autumn**
N surplus, kg/ha	60-70	ND	70-80	ND	80-95	90	60-70	70-80
	2014 spring	**2014 autumn**	**2015 spring**	**2015 autumn**	**2016 spring**	**2016 autumn**		
	60-70	60-70	50-60	70-80	ND	60		

ND – no data

Pollution reduction objectives

Two pollution reduction objectives can be distinguished:

- targeted at improvement of the ecological status of the Baltic Sea as set out by the HELCOM and
- targeted at achievement of good ecological status in water bodies as required by the WFD.

These pollution reduction objectives complement but do not replace each other.

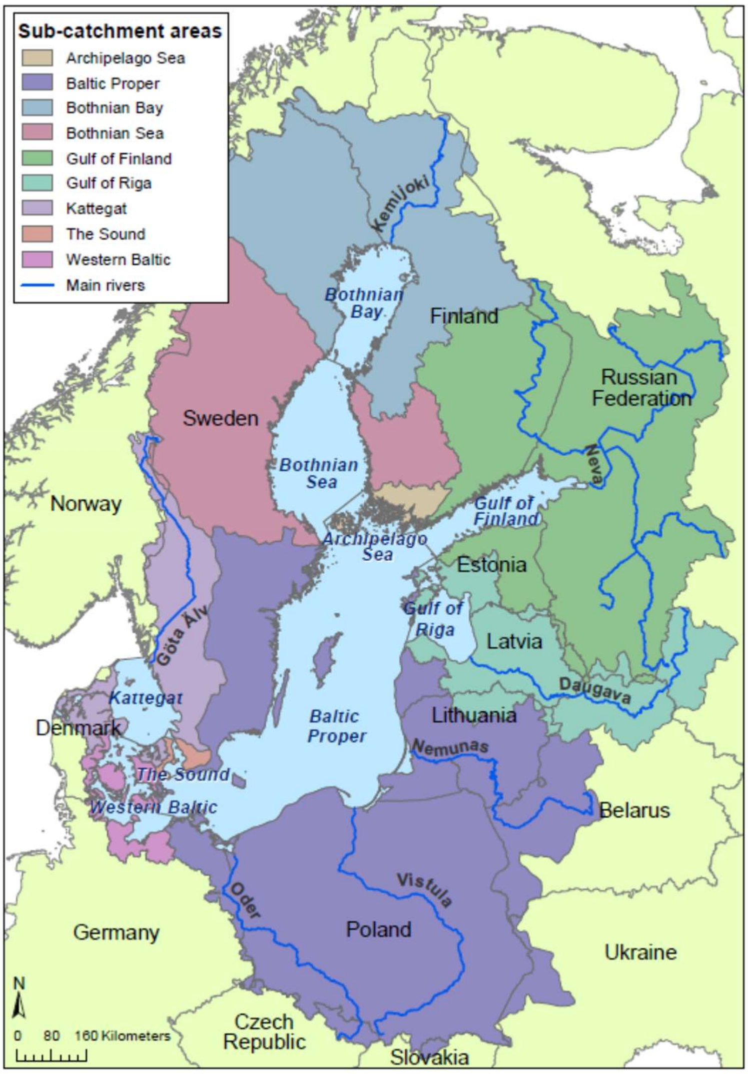
[1] *Ilgamečiai dirvožemių agrocheminių savybių stebėjimo tyrimai. Lietuvos agrarinių ir miškų mokslo centro filialas Agrocheminių tyrimų laboratorija. 2016*

HELCOM pollution reduction targets

The HELCOM Nutrient Reduction Scheme is a regional approach to sharing the burden of nutrient reductions to achieve the goal of a Baltic Sea unaffected by eutrophication, as agreed on by HELCOM[2]. With the purpose of defining the pollution reduction objectives, the Baltic Sea is sub-divided into individual sub-basins (*Figure 10*). For each sub-basin, maximum allowable inputs (MAI) of nutrients are derived taking into account its properties. Correspondingly, each country around the Baltic Sea contributing to the pollution of the respective sub-basin is allocated with the pollution reduction target (CART) to ensure that the total inputs into the sub-basin do not exceed the MAI. Pollution reduction targets are set out with respect to the reference period (1997-2003).

As seen from the *Figure 10*, Venta RBD belongs to the sub-catchment area of the Baltic Proper, Lielupe RBD – to the sub-catchment area of the Gulf of Riga.

The nutrient reduction scheme of the HELCOM Baltic Sea Action Plan was revised in the 2013 HELCOM Ministerial Meeting. The revision was based on a new and more complete dataset as well as an improved modelling approach. Updated pollution reduction objectives for the Baltic Proper and Gulf of Riga are presented in *Table 6*.



[2] *Summary report on the development of revised Maximum Allowable Inputs (MAI) and updated Country Allocated Reduction Targets (CART) of the Baltic Sea Action Plan. HELCOM, 2013*

Figure 10. ***The Baltic Sea catchment area and sub-basins as defined for PLC –Water.***

Table 6. ***Pollution reduction targets as revised by HELCOM in 2013***

Baltic Sea sub-basin	Maximum allowable inputs		Reference inputs 1997-2003		Needed reductions	
	TN, tonnes	TP, tonnes	TN, tonnes	TP, tonnes	TN, tonnes	TP, tonnes
Baltic Proper	325,000	7,360	423,921	18,320	98,921	10,960
Gulf of Riga	88,417	2,020	88,417	2,328	0	308

In *Table 7*, comparison of the input ceilings estimated for Lithuania by HELCOM and flow-normalised pollution loads calculated for the period of 2010-2016 are presented.

Loads transported to the Gulf of Riga are calculated by summing up average annual flow-normalised loads transported from the Lithuanian part of the Lielupe RBD and introducing retention coefficients proposed by HELCOM which are 0.27 for total N and 0.32 for total P.

Loads to the Baltic proper are calculated by summing up average annual flow-normalised loads from the Venta RBD and introducing the HELCOM proposed retention coefficients - 0.39 for total N and 0.58 for total P.

Table 7. Comparison of the HELOM defined nutrient input ceilings with actual flow-normalised pollution loads from the period 2010-2016

	Total N input ceiling, t/year	Total N, t/y 2010-2016	Total N reduction needed, t/y	Total P input ceiling, t/y	Total P, t/y 2010-2016	Total P reduction needed, t/y
BAP*	33093	2500**	-	831	27**	-
GUR	5795	6900	1105	166	50	-

** Loads to the Baltic Proper from the Lithuanian territory are transported from the Nemunas and Venta RBDs. The ceiling is one for both RDBs, thus pollution reduction objectives separately for Venta and Nemunas RBDs cannot be distinguished.*
*** Loads transported from the Venta RBD*

As seen from the table, Lithuania has to reduce nitrogen pollution load to the Gulf of Riga by 1105 t/year and, taking into account the retention, that means that pollution load from the Lithuanian part of the Lielupe RBD to Latvia has to be reduced by approx. 1500 t/year (or by 16% of the total load). This reduction objective is calculated using the load data from the period of 2010-2016. If to use data from the last 3 years, pollution reduction objective will be even higher, as pollution load of the total N in the Lielupe RBD has recently grew up (see *Figure 11*). Although the load of the total P from the Lithuanian part of the Lielupe RBD also demonstrates an increasing trend, it is still much lower than HECOM proposed input ceiling and thus no reduction objectives for total P are set.

For the Venta RBD no specific pollution reduction objectives are set, because HELCOM establishes one common goal for both RBDs (Venta and Nemunas) contributing to the pollution of the Baltic Proper.

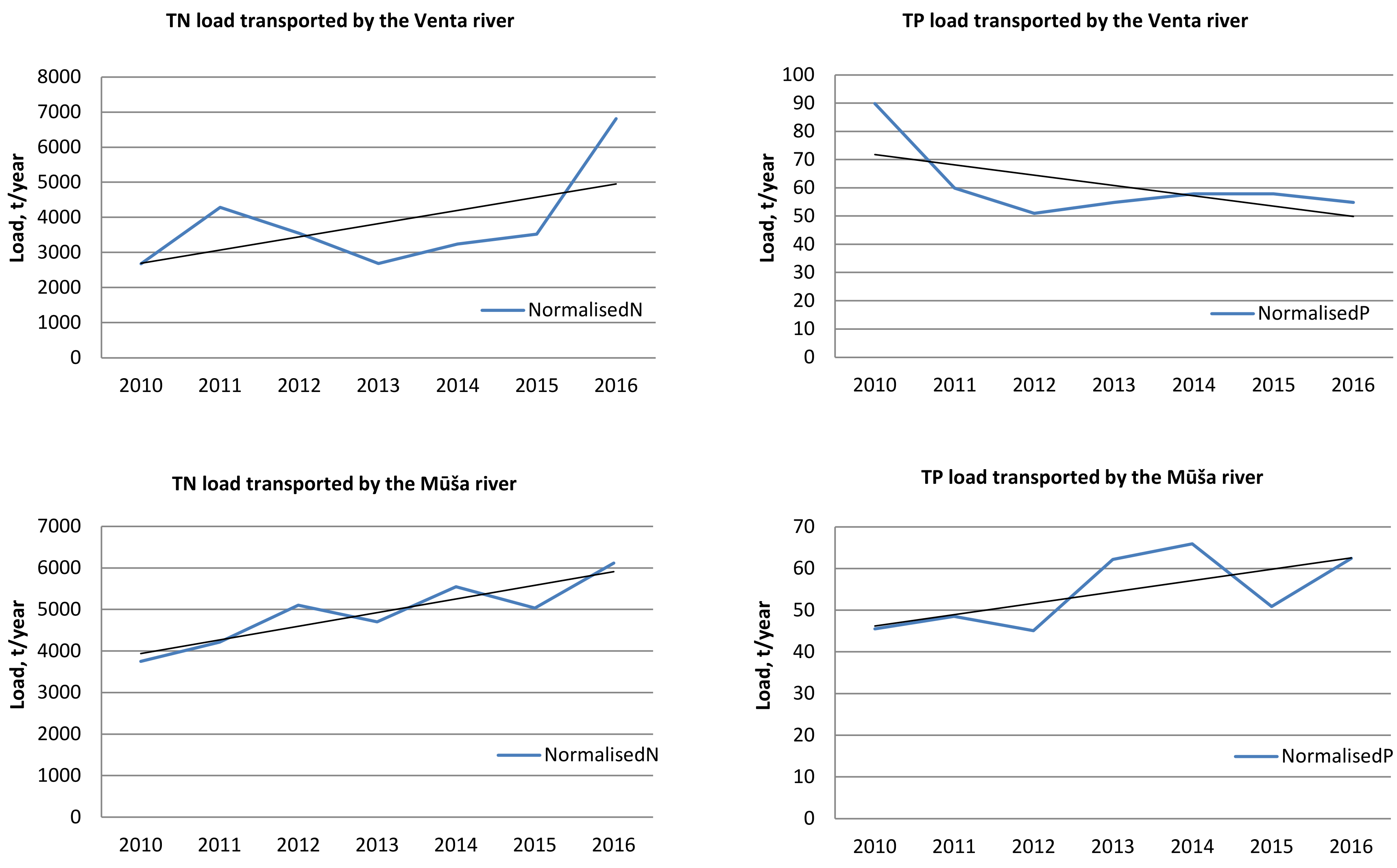


Figure 11. Flow normalised loads of total N and total P transported from the territory of Lithuania by the main rivers Venta and Mūša

Pollution reduction objectives to achieve good ecological status of all river water bodies

During the preparation of the 2nd RBMP, 91 river water bodies at risk due to the impact of non-point agricultural pollution have been identified in the Lielupe RBD. This makes 71% of all river water bodies. In the Venta RBD, the number of such highly affected water bodies was much lower – 12 water bodies or 13% of all water bodies. The latest data shows that situation is not improving and the number of water bodies at risk remains almost the same.

In order to select the most effective pollution reduction measures leading to the achievement of the environmental objectives, pollution reduction objectives have to be clearly defined for each water body at risk. Pollution reduction objectives for the agricultural sources have been calculated during the preparation of the 2nd Programme of Measures. In the frame of this project, calculations were updated using the latest monitoring data from 2014-2016.

Pollution reduction objectives were calculated individually for each catchment represented by the monitoring station. Pollution loads were calculated by multiplying monitored pollutant concentrations in the river and the average monthly river discharge estimated from the discharge measurement records in the representative gauging station.

In *Table 8* pollution reduction objectives calculated for the 2nd RBMP using monitoring data from 2010-2013 and results of mathematical modelling are compared with the latest estimates which are derived using water quality monitoring data from 2010-2016.

As seen from the table, for many water bodies updated pollution reduction objectives are stricter than those estimated for the 2nd RBMP. This can be explained by the fact that pollution loads during the last 3 year period have increased in many rivers. It also has to be noted that load reduction objectives for some water bodies are estimated with low level of confidence because assessment is made using monitoring data from one year only. Nevertheless, results for intensive monitoring stations are reliable and representative.

Total catchment area of water bodies at risk where pollution reduction objectives for total N are established is 90 thou ha in the Venta river basin (17% of the basin area), 383 thou ha in the Mūša sub-basin (72% of the sub-basin area) and 175 thou ha (all territory) in the sub-basin of the Lielupe small tributaries.

Updated assessment shows, that in order to achieve good status, leaching of the total N from the catchments of water bodies at risk in the Venta RBD has to be reduced by approx. 400 t/year; leaching from the catchments of water bodies at risk in the Lielupe RBD has to be reduced by 4800 t/year (1800 t/year reduction is needed in the sub-basin of the Lielupe small tributaries and 3000 t/year in the sub-basin of Mūša).

Table 8. Pollution reduction objectives for water bodies which are classifies as water bodies at risk due to agricultural pollution

WB code	River basin	River	Catchment area, km^2	Pollution reduction objectives calculated for the 2nd RBMP using river water quality monitoring data for the period 2010-2013 and results of the mathematical modelling, kg/ha		Updated pollution reduction objectives calculated based on the river water quality monitoring data for the period 2010-2016, kg/ha	
				NO_3-N	Total nitrogen	NO_3-N	Total nitrogen
400100101	Lielupė mažųjų intakų	Yslykis	82,7	4,2	7,9	4,6	7,3
400100221	Lielupė mažųjų intakų	Maučiuvis	62,3	4,5	7,8	6,2	9,4
400100331	Lielupė mažųjų intakų	Plonė	77,4	5,7	8,1	7,8	7,9
400100461	Lielupė mažųjų intakų	Beržtalis	88,2	3,1	5,1	12,6	15
400100462	Lielupė mažųjų intakų	Beržtalis	102,9	2,8	4,8	12,3	15,3
400100463	Lielupė mažųjų intakų	Beržtalis	143,9	5,2	9,6	5,6	11
400101101	Lielupė mažųjų intakų	Švitinys	138,6	2,2	5,0	6	7,3
400101141	Lielupė mažųjų intakų	Juodupis	50,4	2,2	5,0	n.d.	n.d.
400101281	Lielupė mažųjų intakų	Viršytis	88,8	2,8	5,2	n.d.	n.d.
400101621	Lielupė mažųjų intakų	Šešėvėlė	31,5	1,5	2,9	7,9	11,5
400101701	Lielupė mažųjų intakų	Virčiuvis	80,3	6,9	10,0	12,1	15,8
400101702	Lielupė mažųjų intakų	Virčiuvis	177,9	8,0	10,5	14,2	17,2
400101811	Lielupė mažųjų intakų	Ašvinė	80,9	9,5	14,4	15,9	22,6
400101941	Lielupė mažųjų intakų	Audruvė	97,7	8,4	13,3	15,4	22,5
400102501	Lielupė mažųjų intakų	Platonis	139,8	5,0	9,6	8,9	11,2
400102641	Lielupė mažųjų intakų	Vešėtinis	50,1	5,0	9,6	0	0
400102691	Lielupė mažųjų intakų	Sidabra	111,3	9,2	12,3	10,1	13,3
400102692	Lielupė mažųjų intakų	Sidabra	65,0	7,7	12,4	11,5	16,6
400103201	Lielupė mažųjų intakų	Švėtė	182,3	2,5	4,3	3,7	6,1
400103202	Lielupė mažųjų intakų	Švėtė	247,0	1,4	3,2	2,8	4,5
400103361	Lielupė mažųjų intakų	Žarė	37,4	1,6	3,0	0	0
400103521	Lielupė mažųjų intakų	Vilkija	65,7	4,4	7,3	0	0
400103522	Lielupė mažųjų intakų	Vilkija	116,2	4,6	7,5	5,1	8,4

WB code	River basin	River	Catchment area, km²	Pollution reduction objectives calculated for the 2nd RBMP using river water quality monitoring data for the period 2010-2013 and results of the mathematical modelling, kg/ha		Updated pollution reduction objectives calculated based on the river water quality monitoring data for the period 2010-2016, kg/ha	
				NO_3-N	Total nitrogen	NO_3-N	Total nitrogen
400103721	Lielupė mažųjų intakų	Švėtelė	38,1	2,5	4,6	5,9	9,3
410100011	Mūšos	Mūša	152,4	1,9	3,3	6,6	9,7
410100012	Mūšos	Mūša	371,6	3,9	6,0	5,5	7,7
410100013	Mūšos	Mūša	910,5	2,8	4,0	9,2	10,8
410100014	Mūšos	Mūša	2277,6	2,5	4,5	2,2	4,5
410100015	Mūšos	Mūša	3840,7	2,0	3,4	2	3,9
410100016	Mūšos	Mūša	4022,5	2,4	4,4	0,8	3,5
410100301	Mūšos	Einautas	34,8	2,6	4,9	0	0
410100601	Mūšos	Kūra	48,9	2,6	4,9	0	0
410100701	Mūšos	Vilkvedis	60,2	5,2	6,8	7,6	8,9
410101201	Mūšos	Voverkis	63,8	3,9	5,1	14,7	19,3
410101501	Mūšos	Tautinys	35,8	4,9	6,8	0	0
410102101	Mūšos	Kulpė	130,5	1,3	4,8	0	0
410102102	Mūšos	Kulpė	182,5	1,3	4,8	4,4	11
410102103	Mūšos	Kulpė	208,1	2,2	4,3	5,7	7,2
410102104	Mūšos	Kulpė	224,7	3,1	5,6	6,8	13,1
410102121	Mūšos	Vijolė	104,8	0,9	4,9	0	0
410102131	Mūšos	Švendrelis	85,2	0,9	4,9	0	0
410102901	Mūšos	Šiladis	35,9	2,3	7,3	7,2	14,2
410102902	Mūšos	Šiladis	114,4	3,6	5,7	18,7	23,5
410104301	Mūšos	Kruoja	76,3	5,9	9,2	10,4	12,5
410104302	Mūšos	Kruoja	134,4	4,7	8,9	0	0
410104303	Mūšos	Kruoja	351,7	2,9	4,7	12,9	17,9
410104443	Mūšos	Obelė	174,9	5,3	7,0	10,6	11,8

WB code	River basin	River	Catchment area, km^2	Pollution reduction objectives calculated for the 2nd RBMP using river water quality monitoring data for the period 2010-2013 and results of the mathematical modelling, kg/ha		Updated pollution reduction objectives calculated based on the river water quality monitoring data for the period 2010-2016, kg/ha	
				NO_3-N	Total nitrogen	NO_3-N	Total nitrogen
410104531	Mūšos	Vezgė	57,3	3,8	5,7	9,1	11,1
410104532	Mūšos	Vezgė	96,3	3,1	5,8	11,1	12
410105101	Mūšos	Daugyvenė	69,7	5,5	8,4	0	0
410105102	Mūšos	Daugyvenė	152,8	3,0	5,0	0,5	2
410105103	Mūšos	Daugyvenė	277,8	3,0	4,2	2,5	3,2
410105104	Mūšos	Daugyvenė	504,1	3,8	5,9	4,1	6,7
410105191	Mūšos	Niauduva	38,2	5,5	8,4	0	0
410105261	Mūšos	Šaka	39,2	5,0	7,4	0	0
410105311	Mūšos	Dubysa	36,3	5,0	7,4	0	0
410105381	Mūšos	Ramytė	49,6	6,6	9,7	21,5	27,4
410105391	Mūšos	Ežerėlė	66,3	4,4	7,0	4	6,2
410105392	Mūšos	Ežerėlė	125,8	8,2	9,7	12,1	12,8
410107301	Mūšos	Mažupė	100,8	5,3	6,6	5,8	8,8
410107302	Mūšos	Mažupė	163,0	4,4	6,1	7,3	9,6
410107441	Mūšos	Meškerdys	56,3	3,4	6,2	3,6	5,5
410108201	Mūšos	Ramojus	40,5	4,5	9,4	0	0
410108501	Mūšos	Lėvuo	80,1	1,0	1,3	0,6	1,1
410108591	Mūšos	Mituva	80,9	0	1,5	0	0
410108871	Mūšos	Kupa	76,2	0	0,7	0	0,9
410108872	Mūšos	Kupa	171,1	0	0,5	0	0,6
410108992	Mūšos	Skodinys	65,2	0	1,3	0	2
410110291	Mūšos	Žąsa	84,6	4,5	8,3	3,5	5,5
410110452	Mūšos	Įstras	113,1	0,6	1,3	0	0
410111202	Mūšos	Pyvesa	331,5	0	0	0	0

WB code	River basin	River	Catchment area, km^2	Pollution reduction objectives calculated for the 2nd RBMP using river water quality monitoring data for the period 2010-2013 and results of the mathematical modelling, kg/ha		Updated pollution reduction objectives calculated based on the river water quality monitoring data for the period 2010-2016, kg/ha	
				NO_3-N	Total nitrogen	NO_3-N	Total nitrogen
410111203	Mūšos	Pyvesa	513,5	0	0,4	0	0
410111551	Mūšos	Orija	76,7	0,5	1,2	0	0
410111552	Mūšos	Orija	111,3	0	0,1	0	1,4
410112101	Mūšos	Jiešmuo	49,5	3,3	4,9	2	4,4
410112102	Mūšos	Jiešmuo	63,2	5,2	7,1	7,6	9
410112401	Mūšos	Tatula	157,8	0,5	2,9	1,4	3,5
410112402	Mūšos	Tatula	185,1	2,2	5,1	3,2	6,9
410112403	Mūšos	Tatula	464,3	2,2	3,8	1,6	1,9
410112471	Mūšos	Vabala	50,2	3,8	5,2	4	6,6
410112631	Mūšos	Juodupė	81,4	3,0	6,6	4,8	7,4
410112752	Mūšos	Upytė	86,1	2,2	4,9	1,7	3
410112871	Mūšos	Ūgė	36,9	4,1	6,7	0	0
410113301	Mūšos	Kamatis	61,4	4,6	8,2	4,9	7
410114501	Mūšos	Čeriaukštė	70,3	3,2	10,1	0,6	3,5
420100014	Nemunėlio	Nemunėlis	871,8	0,5	0,6	0	0
420101161	Nemunėlio	Beržiena	58,5	0	0,2	0	0
420105401	Nemunėlio	Apaščia	219,1	0	1,4	0	0
420105403	Nemunėlio	Apaščia	403,4	0,9	1,5	0	0
420105721	Nemunėlio	Agluona	42,0	0	0,5	0	0
420105722	Nemunėlio	Agluona	85,9	1,1	2,6	0	0

Ecological status of water bodies and pollution reduction objectives in the Latvian part of the Venta and Lielupe RBDs

Monitoring data analysis

Data availability

To evaluate the concentrations of nitrate nitrogen (NO_3-N), total nitrogen (total N), and total phosphorus (total P) in river and lake water bodies of Lielupe and Venta river basin districts (falling within the territory of Latvia), analysis of water quality monitoring data has been performed.

For each water body, only the latest data was selected for the analysis. Nevertheless, it should be noted that, for a certain number of water bodies, available monitoring data come from the year 2013 and earlier. As can be seen in *Figure 12* for the Lielupe RBD, more than three quarters of water bodies have been surveyed within years 2013 – 2016. On the other hand, for Venta RBD, ca. 45% of water bodies have been surveyed in 2006 – 2012 (*Figure 13*), therefore it was decided to include 2006 – 2012 years' data into the analysis (for both RBDs).

For one lake water body (E080, Lielupe RBD) and two river water bodies (V026 and V082, Venta RBD) nutrients monitoring data was not available, and concentrations were defined according to the *overall* status class of these water bodies (obtained based on e.g. biological quality elements).

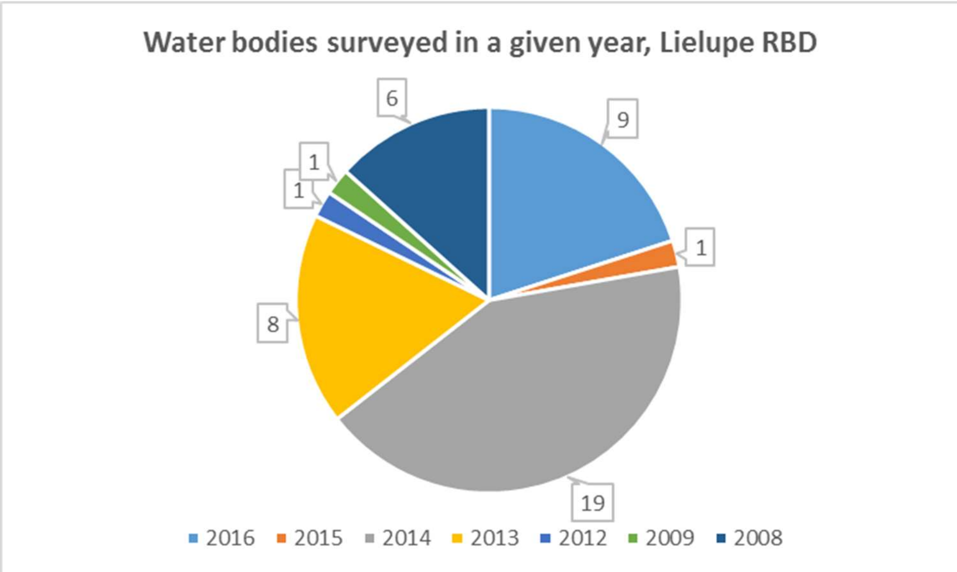


Figure 12. Number of river and lake water bodies, for which latest available data were obtained in a given year (Lielupe RBD, LV part).

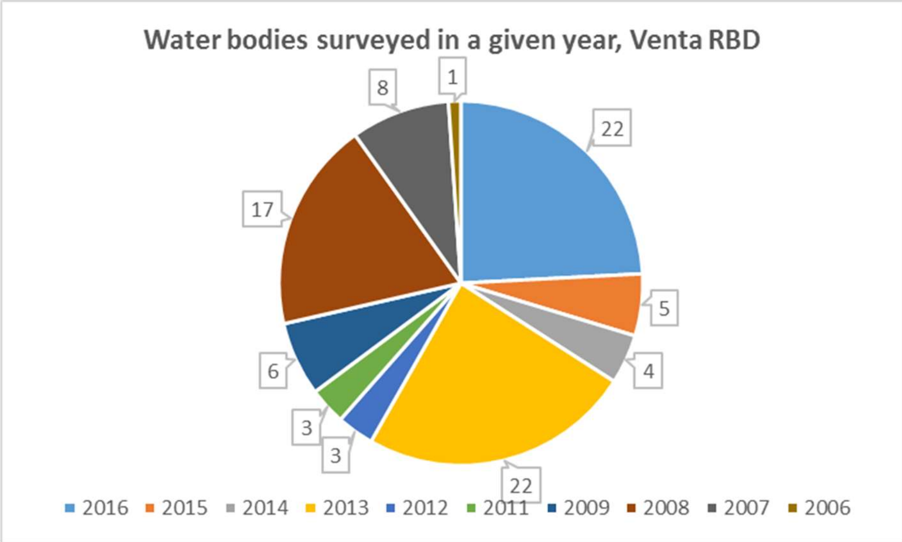


Figure 13. Number of river and lake water bodies, for which latest available data were obtained in a given year (Venta RBD, LV part).

Classification of status of water bodies by NO_3-N, total N, and total P

Latvian system for the classification of status of river and lake water bodies does not include physico-chemical quality element NO_3-N. In the frame of development of the 2nd river basin management plans for the Lielupe and Venta RBD, it was agreed to use Lithuanian classification system for the slow-running river types in the Lielupe and Venta RBD, to ensure coordinated setting of environmental objectives. Therefore, assessment of status by NO_3-N is available for these slow-running river types only. Assessment by total N and total P is available for all river and lake water bodies.

Classification of status has been performed for each of the above-mentioned nutrients separately, and in accordance with the requirements of EU Water Framework Directive: namely, parameter value is classified into one of the following 5 classes:

1 – high status (shown in blue colour);
2 – good status (green colour);
3 – moderate status (yellow colour);
4 – poor status (orange colour);
5 – bad status (red colour).

Classification results are shown in *Figure 14* and *Figure 15*.

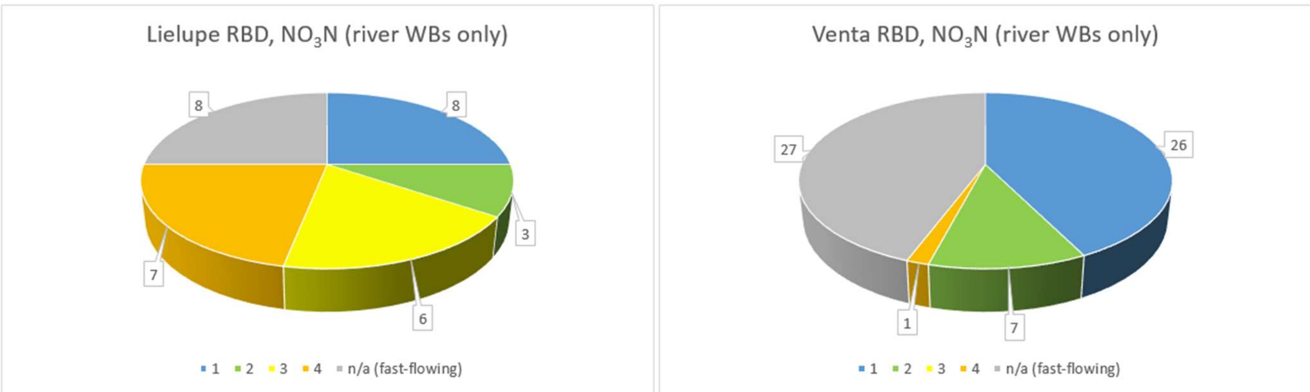


Figure 14. Classification results for NO_3 N in Lielupe and Venta RBD river WBs. In Venta RBD, there is larger number of fast-flowing rivers for which NO_3 N classification system is not available

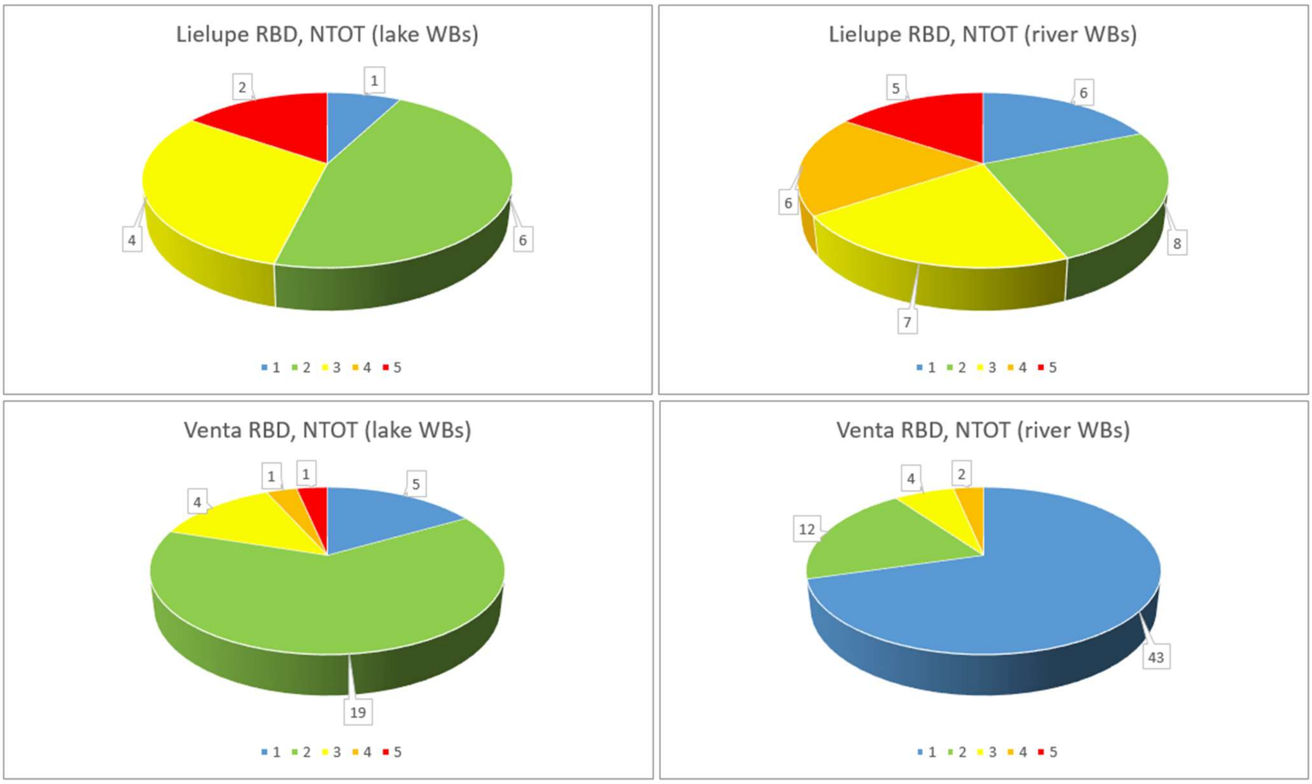


Figure 15. Classification results for total N in Lielupe and Venta RBD lake and river WBs

In the Lielupe RBD, 13 out of 24 river water bodies classified by NO_3-N belong to moderate or poor status class. In Venta RBD, all water bodies except V082 belong to high or good status class according to NO_3-N. It should be taken into account that V082 is one of the water bodies for which assumption had to be made regarding nutrient concentrations, i.e. there is no real nutrient monitoring data (see above).

There is also much higher proportion of water bodies below good status class in the Lielupe RBD, if classified by total nitrogen. Situation is different for total phosphorus, which falls below good status class in ca. 45% of Venta RBD lake water bodies and 23% of Venta RBD river water bodies. For 4 river WBs in Venta RBD, total P concentrations fall into poor or bad status class, while in Lielupe RBD no river water bodies are classified below moderate status. It should be noted that the majority of Venta RBD water bodies falling below good status by total P are fast-flowing rivers, for which more stringent classification criteria apply.

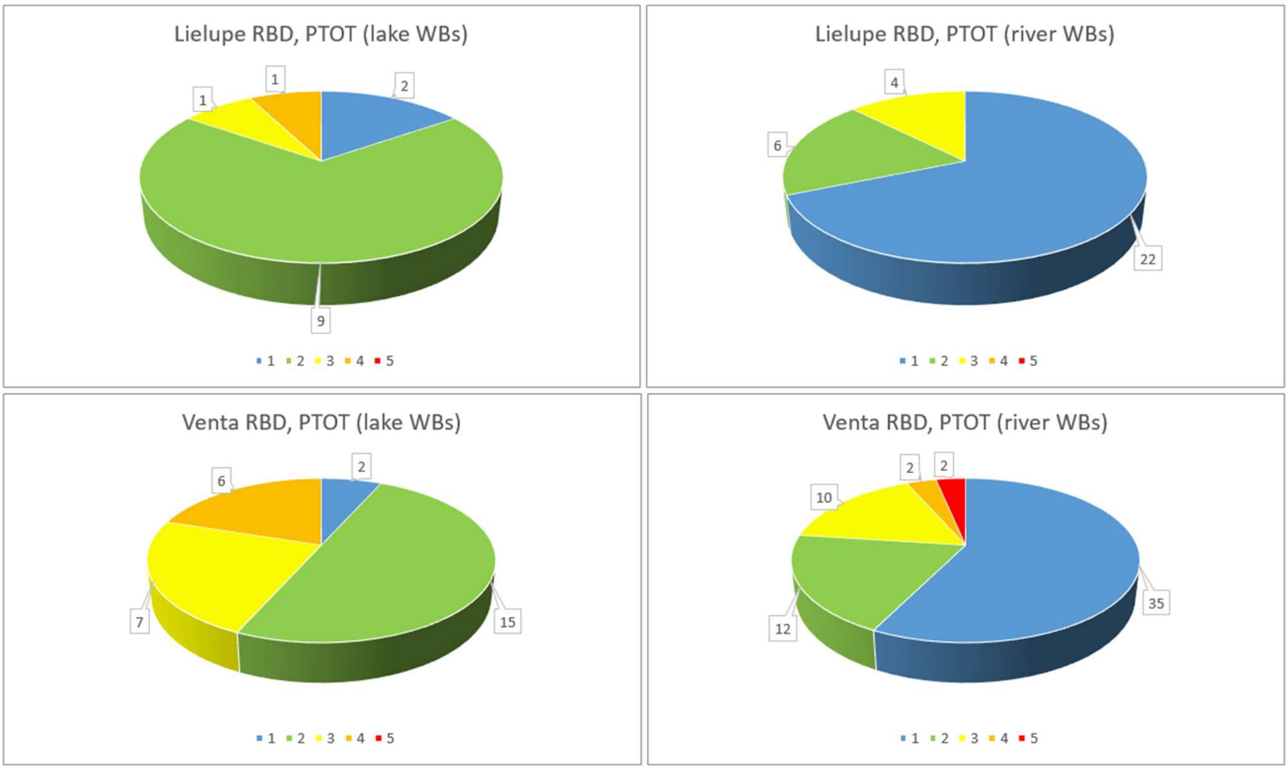


Figure 16. Classification results for total P in Lielupe and Venta RBD lake and river WBs

Concentration values of NO_3-N, total N, and total P

Unlike classification results by NO_3-N (that are available for slow-running river WBs only), concentration values of NO_3-N are available for all types of river and lake water bodies.

In the Lielupe RBD rivers, NO_3-N concentrations vary from 0.31 to 8.75 mg/l, max 9.5 mg/l in the water body L149 (see *Figure 17*). Concentration values are significantly lower in the Venta RBD rivers, varying from 0.03 to 2.19 mg/l, max 2.91 mg/L in the water body V062 and 4.51 mg/L in the WB V082 (which is an assumption, as explained above).

NO_3-N concentrations observed in lake water bodies are lower, and less different between the two river basin districts (see *Figure 18*). In the Lielupe RBD, concentrations vary from 0.07 to 1.31 mg/l, max 3.83 mg/l (water body E262). In Venta RBD lakes, values are 0.03 – 0.91 mg/l (max 0.91 mg/l in the water body E006).

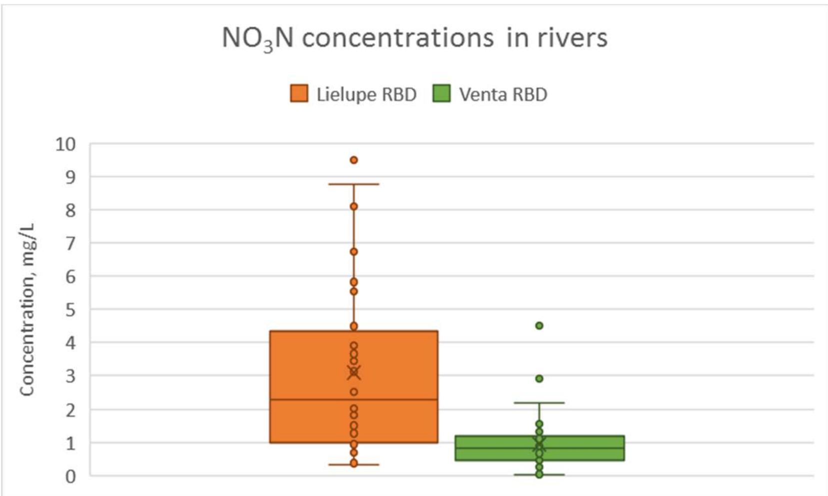


Figure 17. NO_3-N concentrations in river water bodies

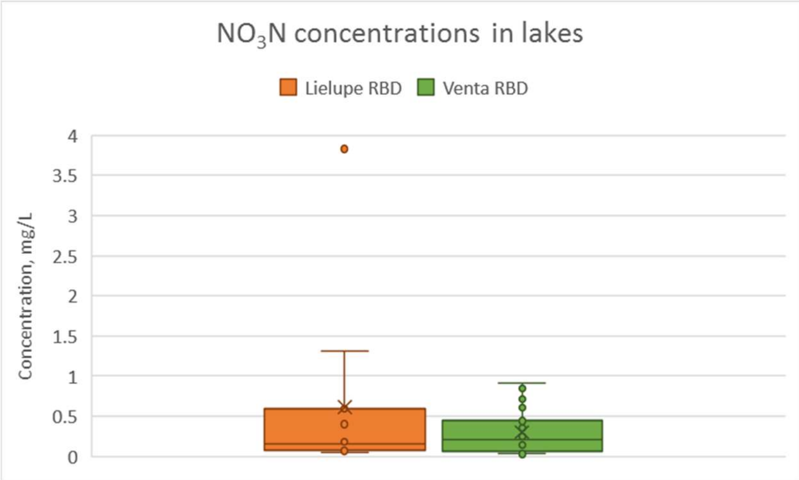


Figure 18. NO_3-N concentrations in lake water bodies

Total N concentration values follow the same pattern as NO_3-N concentration (see *Figure 19* and *Figure 20*). In the Lielupe RBD rivers, total N concentrations are within the range 1.0 – 10.5 mg/l, max 12.3 mg/l in the water body L153 and 13.05 mg/l in WB L149. In the Venta RBD rivers, total N values vary from 0.73 to 2.96 mg/l, max 3.99 mg/l in the water body V062 and 6.01 mg/l in WB V082 (assumption, see above).

In Lielupe RBD lake water bodies, total N values are 0.8 – 2.6 mg/l, max 5.72 mg/l in the water body E262. In Venta RBD lakes, concentration values vary from 0.6 to 2.0 mg/l, max 4.5 mg/l in the water body E007.

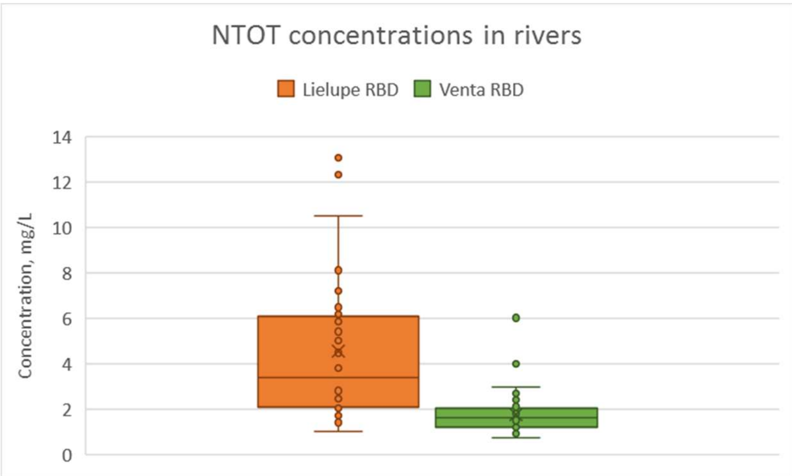


Figure 19. Total N concentrations in river water bodies

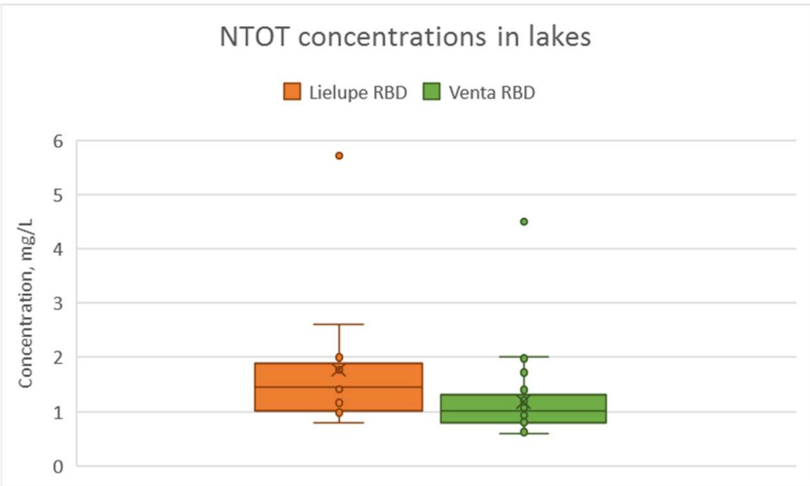


Figure 20. Total N concentrations in lake water bodies

On the other hand, observed total P values are higher in the Venta RBD, especially in lake water bodies (see *Figure 21* and *Figure 22*). While, for river water bodies, total P median and mean values are slightly higher for the Lielupe RBD water bodies and only maximum and outlier concentration values are higher in Venta RBD rivers, for lake water bodies both mean/median and also local maximum values are observed higher in the Venta RBD.

In the Lielupe RBD rivers, total P concentrations vary from 0.028 to 0.123 mg/l, max 0.178 mg/l in the water body L147 and 0.186 mg/l in WB L117SP. In the Venta RBD rivers, total P values are 0.031 – 0.126 mg/l, with 6 maximum outlier values: 0.14 mg/l WB V014 and 0.143 mg/l WB V043 (both belong to slow-running rivers; almost identical values – shown as one point on the chart); 0.153 mg/l WB V004 (slow-running type); 0.181 mg/l WB V049 (slow-running type); 0.231 mg/l WB V082 (assumption); 0.242 mg/l WB V058 (fast-flowing type).

It can be seen that, while higher total P concentrations in the Venta RBD are mostly observed in slow-running river types, *classification results* by total P are worse for fast-flowing river WBs, for which more stringent criteria are applied.

In the Lielupe RBD lake water bodies, total P values fall within the range 0.021 – 0.081 mg/l (max 0.081 mg/L in the water body E032SP). In the Venta RBD lakes, concentration values vary from 0.016 to 0.085 mg/l (max 0.085 mg/l in the water body E009).

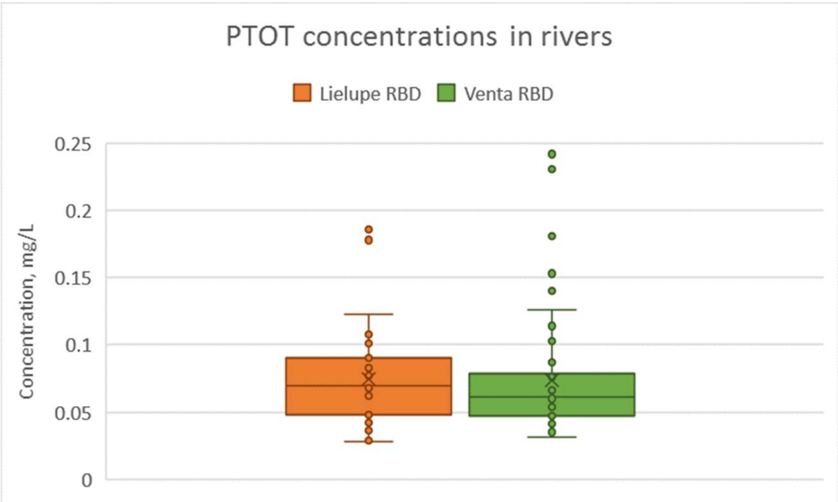


Figure 21. Total P concentrations in river water bodies

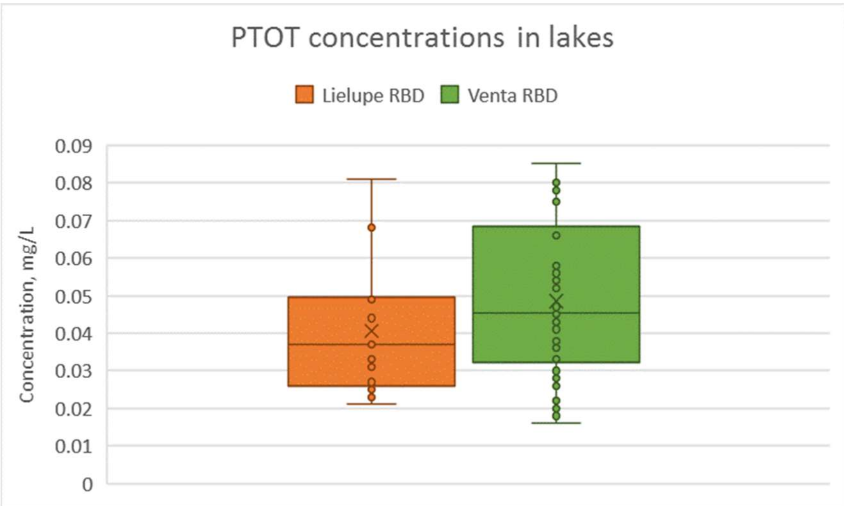


Figure 22. Total P concentrations in lake water bodies

Agricultural pressure analysis

Data available for the analysis

To assess impact of agricultural pressure on water quality, at first it is necessary to distinguish between the agricultural nutrient load coming from Lithuania, and the one originating in Latvia. For this purpose, calculations of the total amount of nutrients (total nitrogen and total phosphorus) coming to the Baltic Sea and the Gulf of Riga are needed, as well as the amount of transboundary pollution and overall load of nutrients into the environment.

Swedish Mass Balance model was used for determination of diffuse pollution from agriculture. Modelling was done for three years - 2006, 2013 and 2015 and was based on the following data, at the scale of a single water body:

- Discharge and runoff;
- Forest area, clear-cut area and ameliorated forest areas;
- Land use data obtained from Corine Land Cover 2012 (agricultural area, mires and wetlands, watercourses and lakes, urban areas, green urban areas and industrial areas);
- Area of winter grown land;
- Total number of animal units including dairy cows, leakage from manure;
- Total amount of aquaculture production;
- People connected to centralized sewage systems and people with individual sewage systems, pressure from wastewater treatment plants;
- Concentrations of total N and total P observed in a water body, and target concentrations;
- Upstream input from Lithuania and upper water bodies.

Based on this input data, model calculates the pollution load that comes from anthropogenic activities such as agriculture, forestry, waste water treatment plants, as well as natural pollution load from forests, wetlands etc. Results from Mass Balance modelling have been used for pollution load trend analysis and determination of water bodies at risk due to agricultural pollution, as well as for the analysis of necessary reduction of nutrients to lower pollution load to the Baltic Sea and the Gulf of Riga.

Data used for HELCOM reporting was also included in the pollution load analysis, trend analysis and assessment of meeting HELCOM objectives. It includes monitoring data of total N (t/y) and discharge (m^3/s) from 1995 until 2014, as well as data from unmonitored rivers. Unmonitored data is calculated by approved HELCOM methodology.

Agricultural pollution load

Diffuse pollution with total N occurs mostly from agriculture, forestry, aquacultures and from urban areas - sewage systems that are not connected to centralized wastewater treatment plants.

Based on HELCOM monitoring data, total pollution load was determined and agricultural pollution load was identified by Mass Balance modelling. Mass Balance model gives total agricultural load in a water body in tons per year. Taking into account arable land and pastures area, agricultural pollution was calculated in kg/ha per year.

Agricultural pollution load in the Lielupe RBD

Based on HELCOM monitoring data, the total pollution load in the Lielupe river basin in 2015 was 16807.2 t/y of total N and 161.73 t/y of total P. About 83 % of total N load comes from agricultural activities. *Figure 23* shows agricultural pollution load in agricultural areas in 2015 in the Lielupe RBD in kg/ha. Pollution load varies from 2.61 kg/ha in L165 *Zalvīte* to 7.77 kg/ha in L148SP *Sesava.* In 5 water bodies (E032SP, L100SP, L161, L162, L165) pollution load is lower due to less intensive agricultural activities. In 8 water bodies (L102, L107, L108SP, L127, L129, L132, L166, L169) pollution load is more than 3.5 kg/ha due to agricultural intensity increase. In 20 water bodies pollution load is more than 5 kg/ha and agricultural intensity is very high.

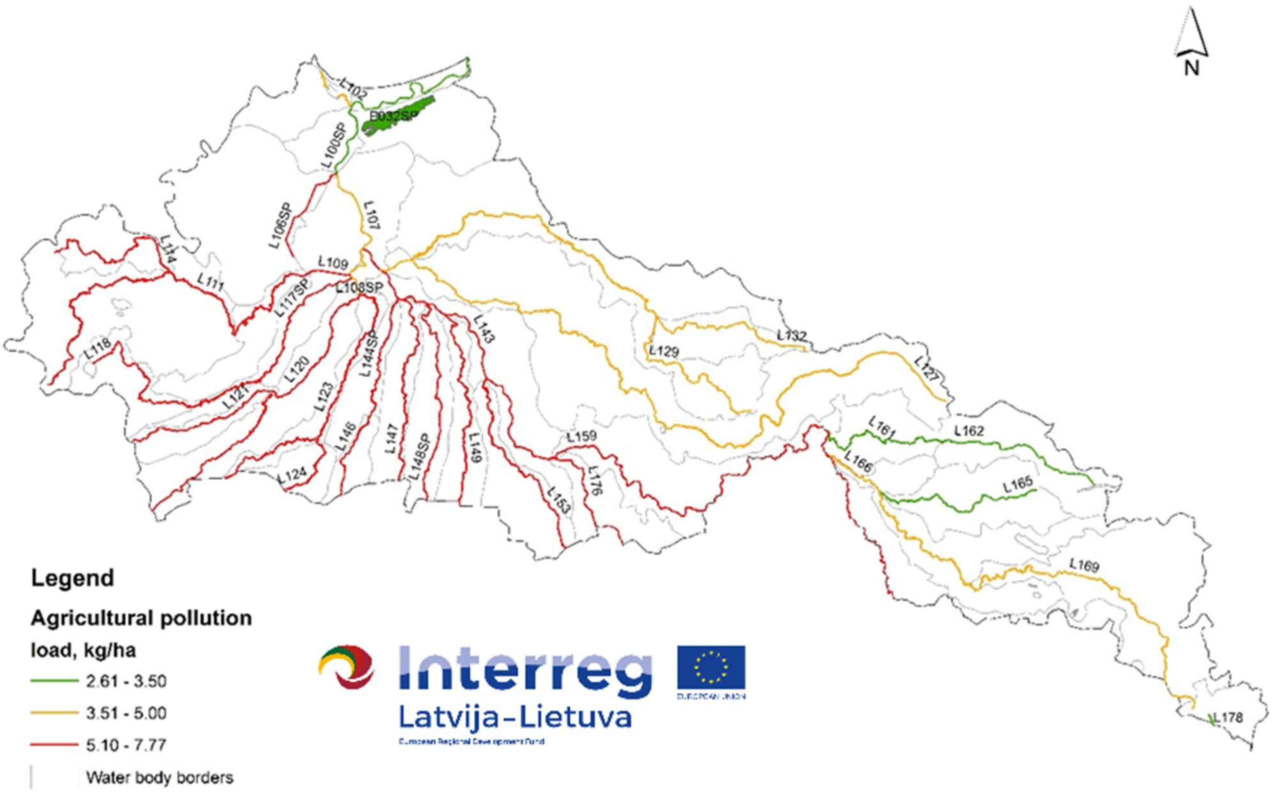


Figure 23. Agricultural pollution load in Lielupe RBD

In the Lielupe RBD, in most cases water bodies that show 70 % or more total N load from agriculture have higher percentage of arable land area. For example, in L100SP *Lielupe*, L108SP *Svēte* and L143 *Lielupe* agricultural pollution load does not exceed 10 %. It can be explained with the impact of cities. L100SP receives the most pollution load from Jūrmala city. L108SP and L143 receive the most pollution load from Jelgava city. In water bodies L107 *Lielupe* and L161 *Viesīte*, forestry is the cause of most total N load. In 2013, water body L176 *Mūsa* has received more pollution load from agriculture than in 2006 and 2015. The reason for this is that in 2013 cross-border pollution from Lithuania has been lower than in other years.

9 water bodies in 2015 have received more than 70 % of total N load from agricultural activities. Those are the areas with most intensive agriculture. The rest of water bodies in 2015 have received 10 - 60 % of total N from agricultural activities.

Agricultural pollution load in Venta RBD

Based on HELCOM monitoring data, total pollution load in Venta river basin in 2015 was 5849.5 t/y of total N and 124.81 t/y of total P. About 46 % of total N load comes from agricultural activities. *Figure 24* shows agricultural pollution load in agricultural areas in 2015 in Venta RBD in kg/ha. Pollution load varies from 2.92 kg/ha in 5 water bodies (V013SP, V026, V029SP, V067, V068) to 6.44 kg/ha in V043 *Venta.* In 10 water bodies (V001, V013SP, V022, V026, V029SP, V067, V068, V079, V080SP, V090) pollution load is lower due to less intensive agricultural activities. In 33 water bodies pollution load is more than 3.5 kg/ha due to agricultural intensity increase. In 18 water bodies pollution load is more than 5 kg/ha and agricultural intensity is very high. Agricultural areas with high intensity are not concentrated in one territory, but spread throughout the whole Venta RBD. In result of development of agricultural activities in Venta RBD, also previous unused agricultural lands are conversed into intensive used territories.

In the Venta RBD, agriculture is less intensive than in the Lielupe RBD. Within a given water body, there can be distinguished certain areas where agriculture is more intensive, but in general it does not make a significant pollution load. In most cases water bodies that show 70 % or more total N load from agriculture have higher percentage of arable land area. For example, in 17 water bodies (E023, E029, V006SP, V010, V013SP, V026, V027, V029SP, V043, V049, V056, V067, V068, V070, V076, V080SP, V089SP) agricultural pollution load is less than 10 %. It can be explained with other significant pressures in a water body - forestry, individual sewage systems and waste waters from wastewater treatment plants, for example, Ventspils, Kuldīga, etc. In 7 of those water bodies agricultural pollution load has decreased in period between 2013 and 2015 and is less than 10 % in 2015.

3 water bodies (V015 *Alokste*, V037 *Pūre*, V046 *Ēda*) in 2015 have received more than 70 % of total N from agricultural activities. Those are the areas with most intensive agriculture. The rest of water bodies in 2015 have received 10 - 60 % of total N from agricultural activities.

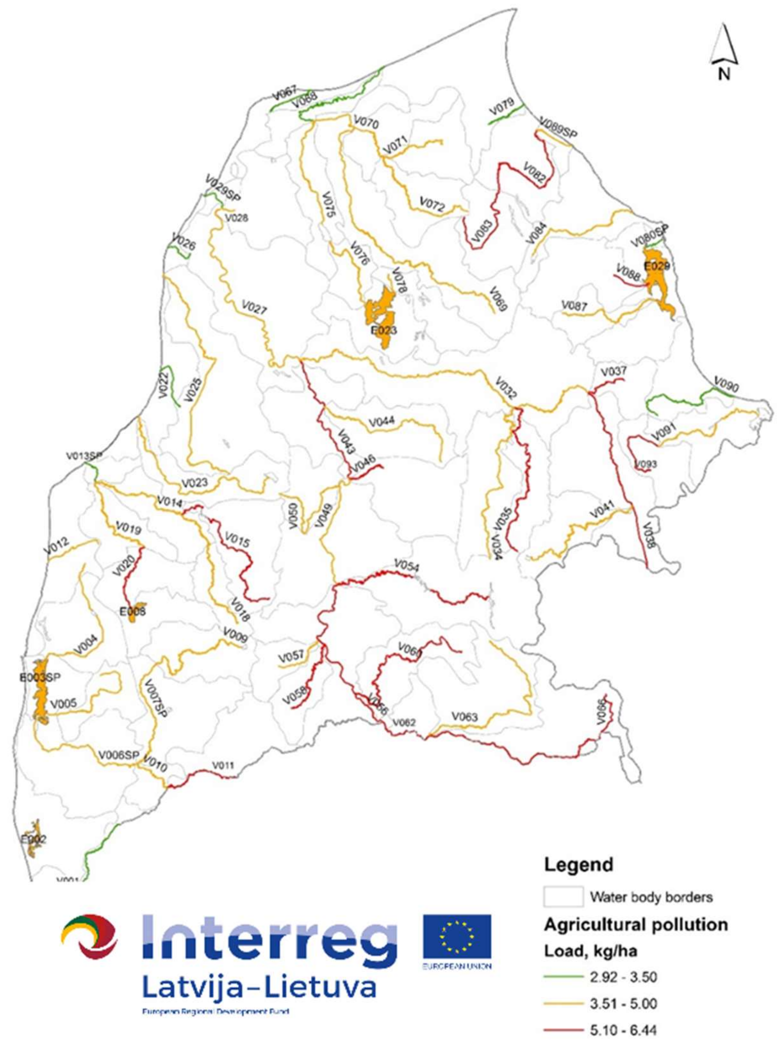


Figure 24. Agricultural pollution load in Venta RBD

Agricultural pollution trend analysis

For pollution trend analysis, data reported to HELCOM and also nutrient concentrations in water bodies per period 2006 - 2014 were taken into account. Agricultural pollution load per period 2006 - 2015 was identified by Mass Balance modelling. Data of the year 2006 differs from years 2013 and 2015. It can be explained with missing monitoring data and inconsistencies, as well as the fact that Corine Land Cover 2006 was used for modelling year 2006. For years 2013 and 2015, Corine Land Cover 2012 was used.

Both Venta river basin district and Lielupe river basin district are transboundary, with upstream in Lithuania and inflow into the Baltic Sea and Gulf of Riga on the territory of Latvia, therefore a brief analysis of transboundary impact was performed.

Trend analysis in Lielupe RBD

The overall trend between years 2006, 2013 and 2015 varies in different water bodies (*Figure 25*). In 11 water bodies (L108SP, L109, L117SP, L120, L121, L124, L127, L161, L162, L169, L178) agricultural pollution load has increased throughout the above-mentioned time period. Only in E032SP *Babītes ezers* agricultural pollution has decreased because of development of private house districts and agricultural land loss due to building of houses. In 18 water bodies (L102, L106SP, L111, L114, L118, L123, L129, L144, L146, L147, L148SP, L149, L153, L159, L165, L166, L176) agricultural pollution load has increased between years 2006 and 2013, but decreased in 2015. In two water bodies - L132 and L143 - agricultural pollution load has decreased between years 2006 and 2013, but increased in 2015. In L132 *Taļķe* agricultural pollution load is less than 50 % and in L143 *Lielupe* pollution load is less than 10 %, so the impact is not significant in these water bodies.

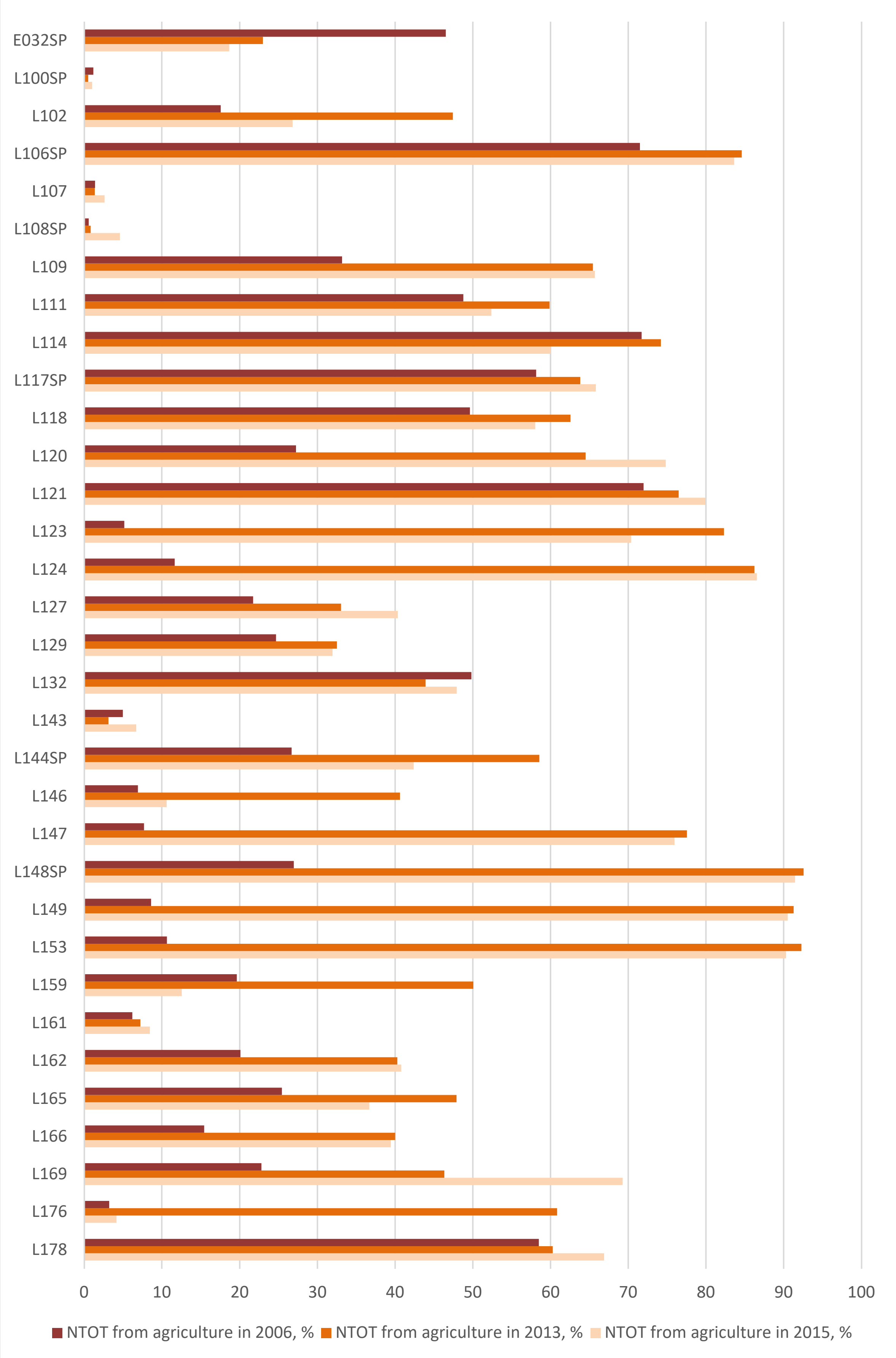


Figure 25. Total N pollution load from agriculture in Lielupe RBD in 2006, 2013 and 2015

Analysis of the data reported to HELCOM shows variability in total loads of total N into the Gulf of Riga (*Figure 26*), due to different hydrological conditions (runoff and discharge) in different years. The average amount of total N load is 16 955 t/y in period 1995-2014. Data for 2007 shows significant amount of total N load (twice as high as the period average), in this year concentrations of total N were also high. Trend analysis indicates very slight decrease in total amounts of total N, this could be explained by the decrease of water discharge in the above-mentioned period.

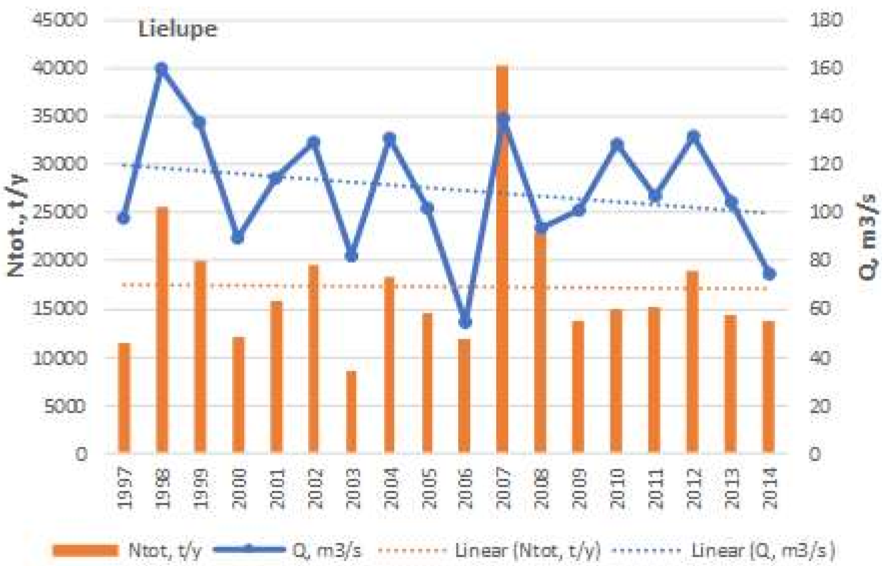


Figure 26.Total amount of total N (t/y) reaching Gulf of Riga from Lielupe RBD, and water discharge (m^3/s)

Amounts of total P load in the same period are also variable (*Figure 27*). The average amount of total P load from Lielupe RBD is 280 t/y in period 1995-2014. Overall amounts of total P show decreasing trend, which could be explained with decreasing trend of the Lielupe river basin discharge.

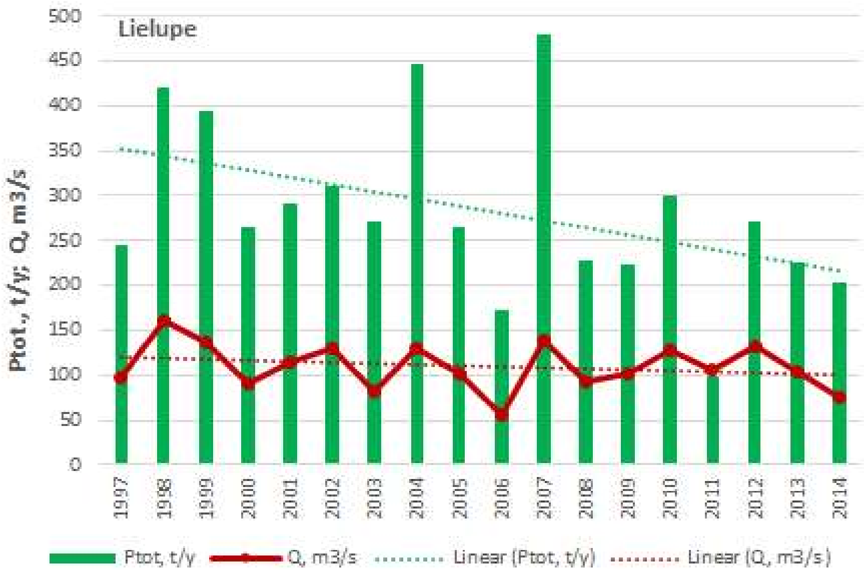


Figure 27. Total amount of PTOT (t/y) reaching Gulf of Riga from Lielupe RBD, and water discharge (m^3/s)

Trend analysis of the observed loads at station Lielupe-Kalnciems during 1995-2015 was performed by MAKESENS 1.0 software (Finnish Meteorological Institute, 2002). River discharge is decreasing by 0.66 m^3/s per year, but this trend is not statistically significant (test Z=-0.57, p>0.1). Load of total P has decreased by 4.99 t/year, and this trend is statistically significant (test Z=-1.90, 0.5<p<0.1). Load of total N shows a statistically non-significant (p>0.1) decrease by 39.01 t/year.

The total amount of total N and total P that reached the Gulf of Riga from the Lielupe river basin in 2015 was 16 807 t and 161.7 t, respectively. In the Lielupe river basin, almost one half of the total N is produced in the territory of Latvia - about 49%, but the most part of total P comes from the Latvian territory - about 76%.

According to HELCOM estimates (HELCOM Guidelines (2015)), retention rate of nutrients that enter Latvia from the territory of Lithuania is about 27% for total N and 32% for total P. This means that almost ⅓ of the total amount of nutrients is converted into other forms, used by plants and adsorbed /absorbed within the territory of Latvia.

Diffuse anthropogenic pollution accounts for 12 008 tons or 90% of all produced amount of total N in Lielupe RBD within the territory of Latvia (this includes all kinds of diffuse pollution sources, not only agriculture and forestry). However, because of retention, this anthropogenic load amount decreases till 7485 tons of total N (i.e. retention is 37%).

Analysis of monitoring data of annual average concentrations of total N, NO_3-N and total P in the Lielupe RBD showed that, in most cases, there were no strong trends detected due to very variable concentrations or insufficient data to set any trend. For total P, there were mostly decreasing trends identified, and for total N and NO_3-N there were mostly increasing trends (*Table 9*).

Table 9. Trends for total N, N-NO3 and total P concentrations in Lielupe RBD

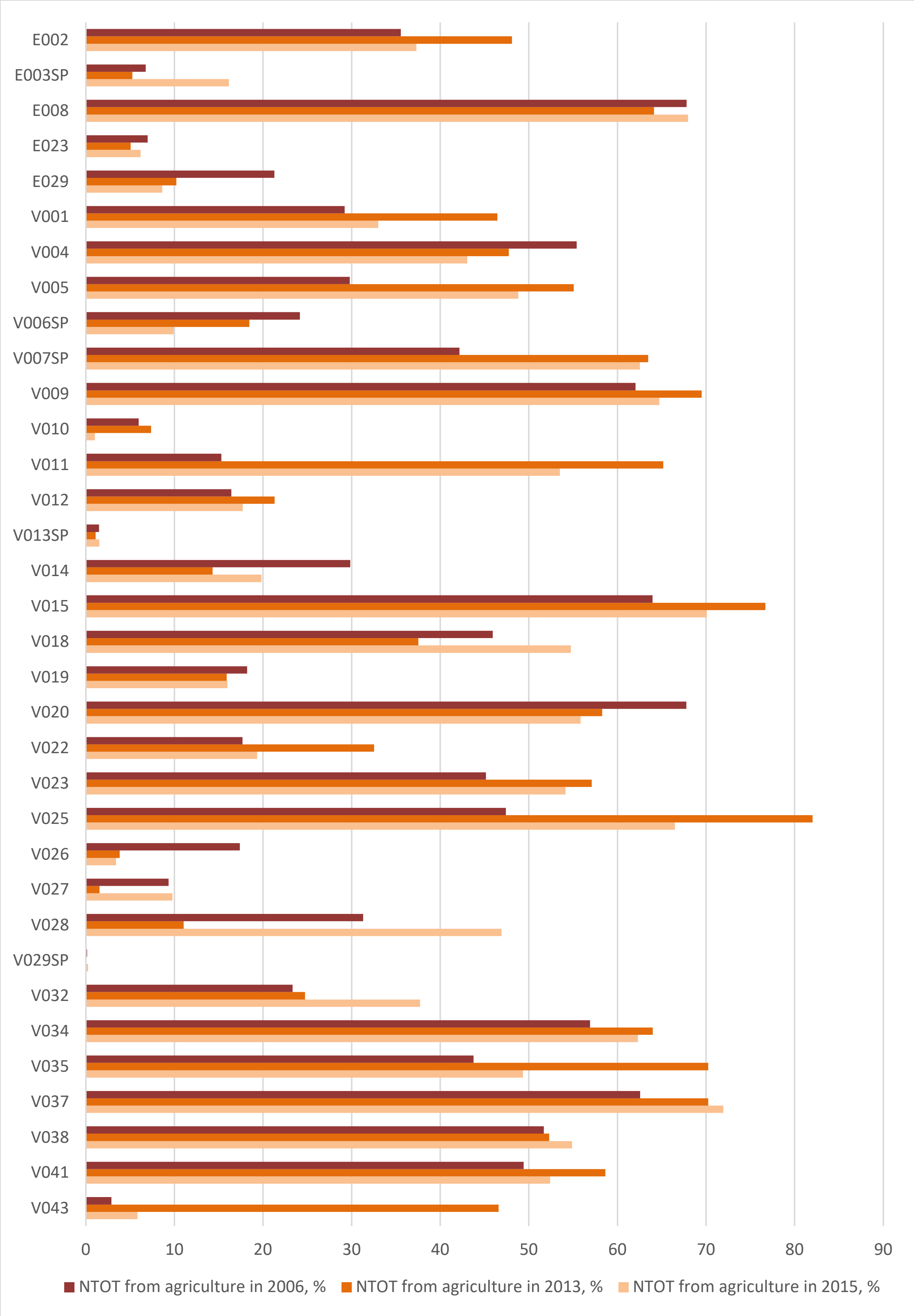
River basin district	Water body code	Water body name	Monitoring data	NTOT	N-NO3	PTOT
Lielupe	E032SP	Babītes ezers	2006-2013	N	N	↘
Lielupe	E033	Slokas ezers	2008-2014	↗	↗	↗
Lielupe	E034	Svētes ezers	2007-2014	↘	↗	↗
Lielupe	E035	Zebrus ezers	2008-2013	↘	↗	↘
Lielupe	E036	Lielauces ezers	2008-2014	↘	N	↘
Lielupe	E037	Pitka ezers (Ozolaines dīķis)	2006-2014	↘	↗	N
Lielupe	E038	Viesītes ezers	2006-2014	N	N	↘
Lielupe	E039	Saukas ezers	2006-2014	↘	N	↘
Lielupe	E040	Garais ezers	2006-2014	↘	N	N
Lielupe	E078	Krīgānu ezers	2008	N	N	N
Lielupe	E080	Aizdumbles ezers	*2017*	N	N	N
Lielupe	E081	Viņaukas ezers	2007-2012	↘	↘	↘
Lielupe	E262	Gulbju ūdenskrātuve	2008	N	N	N
Lielupe	L100SP	Lielupe	2006-2014	↗	↗	↘
Lielupe	L102	Vecslocene	2007-2009	↗	↗	↘
Lielupe	L106SP	Vecbērzes poldera apvadkanāls	2006-2013	N	N	↗
Lielupe	L107	Lielupe	2006-2014	N	N	↘
Lielupe	L108SP	Svēte	2008	N	N	N
Lielupe	L109	Bērze	2006-2014	↘	↘	↘
Lielupe	L111	Bērze	2006-2013	↘	↘	N
Lielupe	L114	Bikstupe	2007-2014	N	N	↗

River basin district	Water body code	Water body name	Monitoring data	NTOT	N-NO3	PTOT
Lielupe	L117SP	Auce	2006-2008	↗	↗	N
Lielupe	L118	Auce	2006-2014	N	N	↘
Lielupe	L120	Tērvete	2006-2014	↘	↘	↘
Lielupe	L121	Skujaine	2007-2013	N	N	↗
Lielupe	L123	Svēte	2006-2014	↗	↗	↘
Lielupe	L124	Vilce	2006-2013	↗	↗	↘
Lielupe	L127	Iecava	2006-2014	↗	↗	↘
Lielupe	L129	Misa	2006-2014	N	↘	↘
Lielupe	L132	Taļķe	2008-2014	N	N	N
Lielupe	L143	Lielupe	2006-2013	N	N	↘
Lielupe	L144SP	Platone	2006-2008	↗	↗	↘
Lielupe	L146	Platone	2006-2013	N	N	↘
Lielupe	L147	Vircava	2006-2008	↗	↗	N
Lielupe	L148SP	Sesava	2006-2012	N	N	N
Lielupe	L149	Svitene	2006-2014	↗	↗	↘
Lielupe	L153	Īslīce	2006-2014	N	N	↘
Lielupe	L159	Mēmele	2006-2014	N	N	N
Lielupe	L161	Viesīte	2008	N	N	N
Lielupe	L162	Viesīte	2008-2014	N	N	N
Lielupe	L165	Zalvīte	2008-2014	N	N	N
Lielupe	L166	Dienvidsusēja	2008-2014	N	N	N
Lielupe	L169	Dienvidsusēja	2008-2013	↘	↘	↗
Lielupe	L176	Mūsa	2006-2014	N	N	↘
Lielupe	L178	Kreuna	2008-2014	↗	↗	↗

↗ - increasing trend
↘ - decreasing trend
N - no trend

Trend analysis in Venta RBD

The overall trend between years 2006, 2013 and 2015 varies in different water bodies (*Figure 28*). In 13 water bodies (V029SP, V032, V037, V038, V044, V057, V058, V060, V062, V063, V078, V080SP, V088) agricultural pollution load has increased throughout the above-mentioned time period. In 10 water bodies (E029, V004, V006SP, V020, V026, V049, V054, V068, V075, V089SP) agricultural pollution has decreased because of development of private house districts and agricultural land loss due to building of houses. In 32 water bodies (V001, V005, V007SP, V009, V010, V011, V012, V015, V022, V023, V025, V034, V035, V041, V043, V046, V050, V056, V066, V069, V070, V071, V072, V076, V079, V082, V083, V084, V087, V090, V091, V093) agricultural pollution load has increased between years 2006 and 2013, but decreased in 2015. In 10 water bodies (E003SP, E008, E023, V013, V014, V018, V019, V027, V028, V067) agricultural pollution load has decreased between years 2006 and 2013, but increased in 2015.


E002
E003SP
E008
E023
E029
V001
V004
V005
V006SP
V007SP
V009
V010
V011
V012
V013SP
V014
V015
V018
V019
V020
V022
V023
V025
V026
V027
V028
V029SP
V032
V034
V035
V037
V038
V041
V043
0
10
20
30
40
50
60
70
80
90
NTOT from agriculture in 2006, %
NTOT from agriculture in 2013, %
NTOT from agriculture in 2015, %

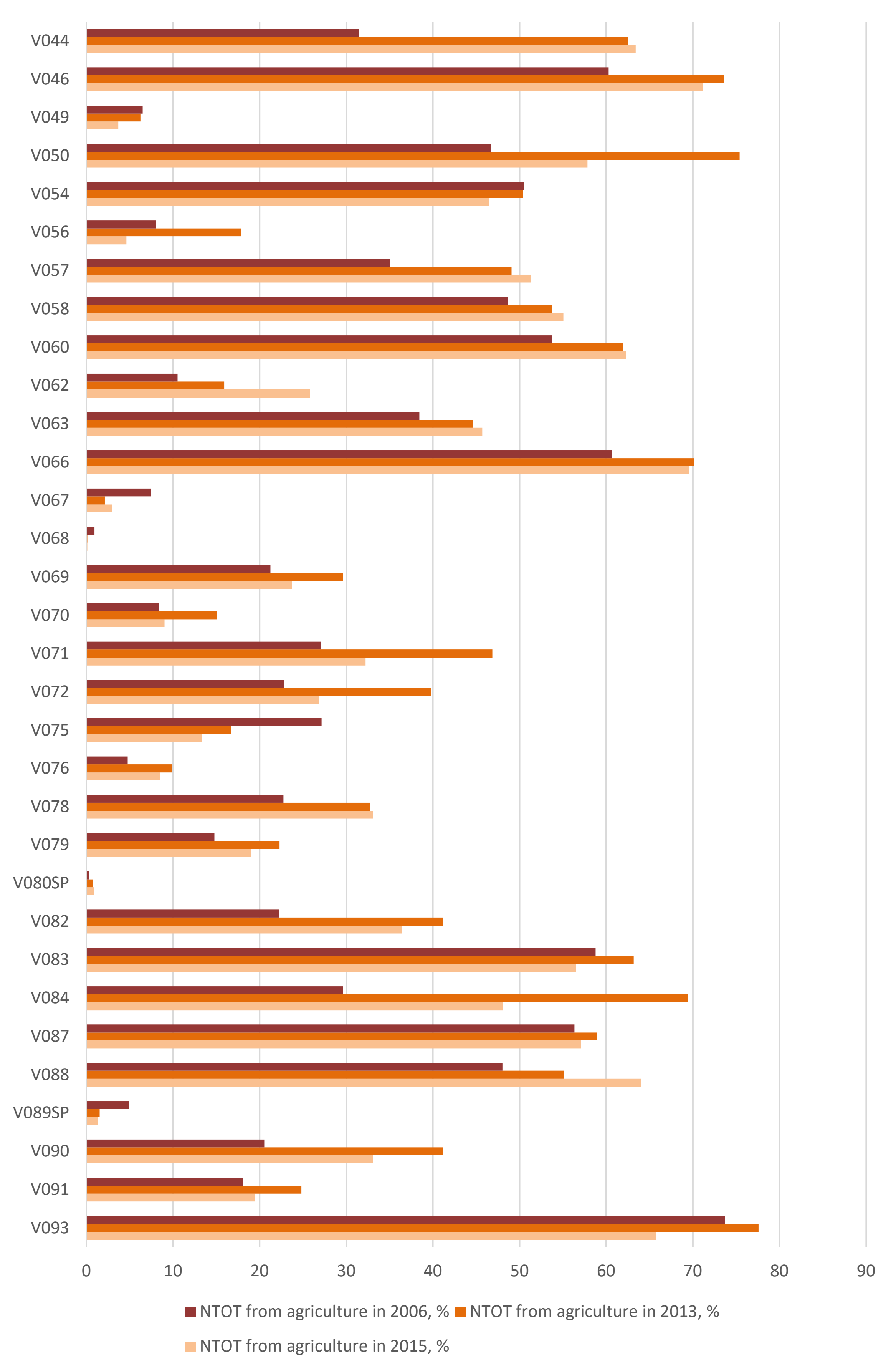


Figure 28. Total N pollution load from agriculture in Venta RBD in 2006, 2013 and 2015

Analysis of data reported to HELCOM shows variability in total loads of total N into the Baltic Sea and Gulf of Riga (*Figure 29*) due to different hydrological conditions (runoff and discharge) in different years. In Venta RBD, there are four main river basins: Venta (in *Figure 29* - Venta and Venta, not monitored), Bārta, Saka and Irbe, and also several smaller river basins. The average amount of total N load from the Venta RBD is 12 655 t/y in the time period 1998-2014. Overall trend of total N load amount is slightly increasing, which could be explained with slightly increasing trend of the Venta river basin discharge.

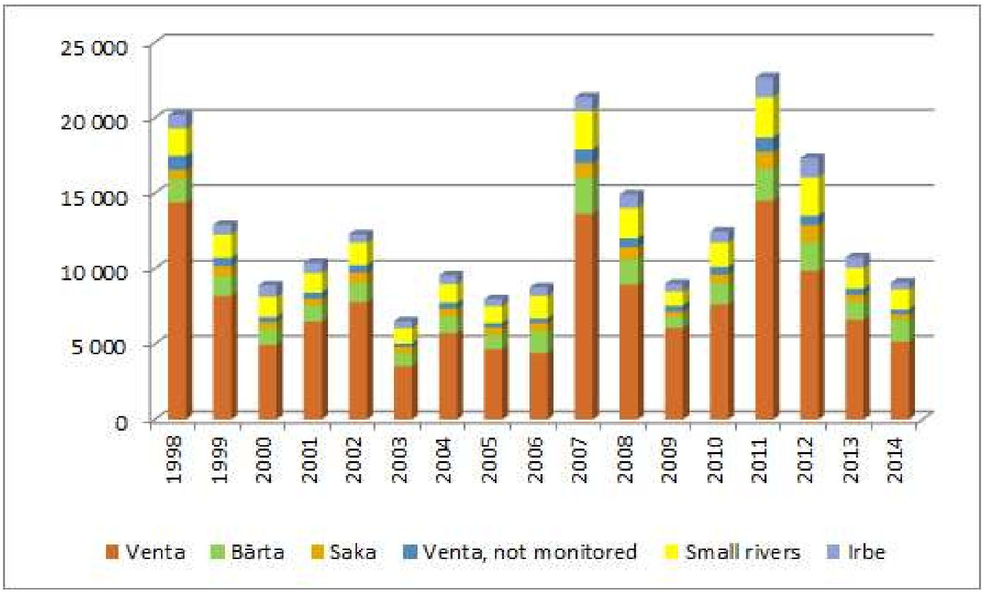


Figure 29. Total amount of total N reaching Baltic Sea and Gulf of Riga from Venta RBD, t/y per main river basins

Amounts of total P in the same period also vary (*Figure 30***Error! Reference source not found.**), the only exception is data for the year 2011 - this can be seen as an outlier (due to incomplete monitoring data and used method for interpolation of missing data, the calculated concentrations and amounts of total P are very high and may not indicate real situation). The average amount of total P load from the Venta RBD is 377 t/y in the time period 1998-2014 (if data from year 2011 are excluded, this amount decreases till 350 t/y). Also overall amounts of total P show slightly increasing trend, which could be explained with slightly increasing trend of the Venta river basin discharge.

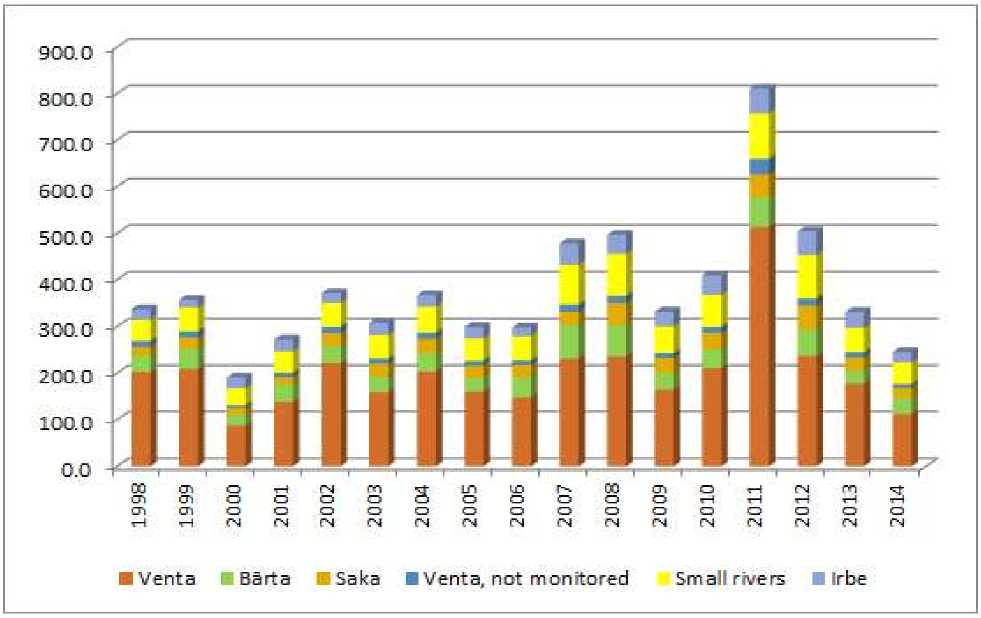


Figure 30. Total amount of total P reaching Baltic Sea and Gulf of Riga from Venta RBD, t/y per main river basins

Trend analysis of the observed loads at station Venta-Vendzava (Venta river basin) during 1998-2015 was performed by MAKESENS 1.0 software (Finnish Meteorological Institute, 2002), results are shown in *Figure 31*. River discharge is increasing by 0.66 m3/s per year, but this trend is not statistically significant (test Z=-0.61, p>0.1). Load of total P has increased by 1.227 t/year, but load of total N decreased by 23.85 t/year, however these trends are not significant (p>0.1).

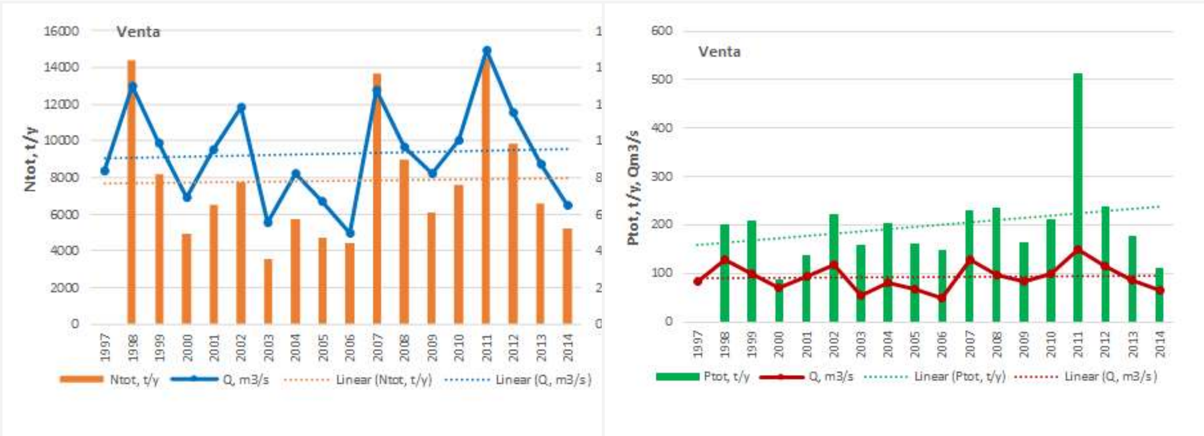


Figure 31. Trend analysis of NTOT and PTOT loads in Venta river basin, station Venta-Vendzava

Venta river is a major contributor of nutrient load to the Baltic Proper from the territory of Latvia. The total amount of total N and total P that reached the Baltic Sea from the Venta river basin in 2015 was 5849.5 t and 124.8 t, respectively. In the Venta river basin, nutrients are produced mainly within the territory of Latvia - about 72% of produced total N, and about 86% of produced total P.

According to HELCOM estimates (HELCOM Guidelines, 2015), retention rate of nutrients that enter Latvia from Lithuania is about 39% for total N and 58% for total P. This means that substantial amount of nutrients are converted into other forms, used by plants and adsorbed / absorbed within the territory of Latvia.

Diffuse anthropogenic pollution accounts for 5303.5 tons or 85% of all produced amount of total N in Venta RBD within the territory of Latvia (this includes all kinds of diffuse pollution sources, not only agriculture and forestry). However, because of retention, this anthropogenic load amount decreases till 3586 tons of total N (i.e. retention is 32%).

Analysis of monitoring data of annual average concentrations of total N, NO_3-N and total P in the Venta RBD showed that, in most cases, there were no strong trends detected due to very variable concentrations or insufficient data to set any trend. For total P there was similar amount of increasing and decreasing trends identified in different water bodies, and for total N and NO_3-N there were more decreasing trends identified (*Table 10*).

Table 10. Trends for total N, N-NO3 and total P concentrations in Venta RBD

River basin district	Water body code	Water body name	Monitoring data	NTOT	N-NO3	PTOT
Venta	E002	Papes ezers	2007-2015	N	↗	↗
Venta	E003SP	Liepājas ezers	2006-2013	N	N	↗
Venta	E004	Tosmares ezers	2007-2013	N	N	N
Venta	E005	Tāšu ezers	2007	N	N	N
Venta	E006	Prūšu ūdenskrātuve	2007-2013	N	N	N
Venta	E007	Sepenes ezers	2007	N	N	N
Venta	E008	Durbes ezers	2007-2012	N	N	N

River basin district	Water body code	Water body name	Monitoring data	NTOT	N-NO3	PTOT
Venta	E009	Alokstes ūdenskrātuve	2008-2013	N	N	N
Venta	E010	Vilgāles ezers	2008-2011	N	N	N
Venta	E011	Zvirgzdu ezers	2007	N	N	N
Venta	E012	Klāņezers	2007	N	N	N
Venta	E013	Lielais Nabas ezers	2006-2013	↘	↘	↘
Venta	E014	Mazais Nabas ezers	2007	N	N	N
Venta	E015	Slujas ezers	2006-2008	↗	N	N
Venta	E016	Remtes ezers	2007-2013	N	↘	N
Venta	E017	Pakuļu HES ūdenskrātuve	2007-2013	↘	N	N
Venta	E018	Cieceres ezers	2008-2013	N	N	N
Venta	E019	Puzes ezers	2008-2013	N	N	↗
Venta	E020	Gulbju ezers	2008	N	N	N
Venta	E021	Kleina ezers	2008	N	N	N
Venta	E022	Mordangas Kāņu ezers	2008-2012	N	N	N
Venta	E023	Usmas ezers	2006-2014	N	N	N
Venta	E024	Spāres ezers	2008-2011	N	N	N
Venta	E025	Būšnieku ezers	2007	N	N	N
Venta	E026	Lubezers	2008-2013	N	N	N
Venta	E027	Sasmakas ezers	2006-2013	↗	↗	↗
Venta	E028	Laidzes ezers	2006-2013	↘	N	N
Venta	E029	Engures ezers	2007-2014	N	N	↘
Venta	E030	Kaņiera ezers	2006-2009	N	N	N
Venta	E031	Valguma ezers	2006-2011	N	N	↘
Venta	V001	Sventāja	2008-2011	N	N	↗
Venta	V004	Ālande	2007-2013	N	N	N
Venta	V005	Otaņķe	2006-2008	N	N	↗
Venta	V006SP	Bārta	2006-2014	N	N	↘
Venta	V007SP	Vārtāja	2008	N	N	N
Venta	V009	Vārtāja	2008-2013	↘	↘	↘
Venta	V010	Bārta	2006-2014	N	N	↘
Venta	V011	Apše	2008-2009	N	N	N
Venta	V012	Bubieris	2008-2009	N	N	N
Venta	V013SP	Saka	2006-2014	↘	N	N
Venta	V014	Tebra	2006-2009	N	N	↗
Venta	V015	Alokste	2006-2009	N	N	↗
Venta	V018	Tebra	2006-2009	↘	N	N
Venta	V019	Durbe	2007	N	N	N
Venta	V020	Durbe	2007	N	N	N
Venta	V022	Pāžupīte	2008-2009	N	N	N
Venta	V023	Rīva	2008	N	N	N
Venta	V025	Užava	2007-2009	N	N	N
Venta	V026	Medoles strauts	*2018*	N	N	N
Venta	V027	Venta	2006-2014	↘	↘	↘

River basin district	Water body code	Water body name	Monitoring data	NTOT	N-NO3	PTOT
Venta	V028	Packule	2008	N	N	N
Venta	V029SP	Ventspils ostas teritorija	2006-2013	↘	↘	↘
Venta	V032	Abava	2006-2009	N	N	N
Venta	V034	Imula	2008	N	N	N
Venta	V035	Amula	2006-2015	N	N	↘
Venta	V037	Pūre	2006	N	N	N
Venta	V038	Abava	2008	N	N	N
Venta	V041	Viesata	2007-2013	↘	↘	↘
Venta	V043	Venta	2006-2013	N	↘	N
Venta	V044	Riežupe	2008	N	N	N
Venta	V046	Ēda	2007	N	N	N
Venta	V049	Venta	2007-2013	N	N	N
Venta	V050	Lējējupe	2008	N	N	N
Venta	V054	Ciecere	2006-2008	N	N	N
Venta	V056	Venta	2006-2014	↘	↘	↘
Venta	V057	Šķervelis	2008	N	N	N
Venta	V058	Lētīža	2006-2013	↗	↗	↗
Venta	V060	Zaņa	2007-2013	N	N	N
Venta	V062	Vadakste	2008-2014	N	N	N
Venta	V063	Ezere	2008	N	N	N
Venta	V066	Vadakste	2008	N	N	N
Venta	V067	Lūžupe	2008-2009	N	N	N
Venta	V068	Irbe	2006-2014	N	N	↘
Venta	V069	Stende	2006-2008	N	N	↗
Venta	V070	Lonaste	2008	N	N	N
Venta	V071	Pāce	2008	N	N	N
Venta	V072	Raķupe	2006-2008	↗	N	↗
Venta	V075	Rinda	2008	N	N	N
Venta	V076	Engure	2008	N	N	N
Venta	V078	Tirukšupe	2008	N	N	N
Venta	V079	Pilsupe	2007-2014	N	N	N
Venta	V080SP	Mērsraga kanāls	2007-2011	N	N	↗
Venta	V082	Roja	*2017*	N	N	N
Venta	V083	Roja ar Mazroju	2006-2012	N	↘	↗
Venta	V084	Grīva	2007	N	N	N
Venta	V087	Dursupe	2007	N	N	N
Venta	V088	Dzedrupe	2008	N	N	N
Venta	V089SP	Roja	2006-2013	↘	↘	↗
Venta	V090	Lāčupīte	2007	N	N	N
Venta	V091	Slocene	2008-2013	N	N	N
Venta	V093	Slocene ar Vašleju	2006-2013	N	N	↘

↗ - increasing trend ↘ - decreasing trend N - no trend

Water bodies at risk

To identify water bodies being at risk due to agricultural pollution, several aspects were taken into account:

1) water body is defined as being at risk due to agricultural pollution if produced amount of total N is 70% or more due to agricultural activities;
2) trend of agricultural impact throughout years 2006, 2013 and 2015 (increased / decreased);
3) ecological status of water body and trends of observed total N, N-NO3 and total P concentrations.

In case if a water body had increasing pollution load of total N, but it was less than 70 % and the increase from previous years was significant, as well as total N or NO_3-N concentration trends were going upwards, water body was defined as being at potential risk in the future.

Water bodies at risk in the Lielupe RBD

Risk water bodies compile 27 % of total number of water bodies in the Lielupe RBD (*Figure 32*). Water bodies at potential risk compile 18 %. Another 55 % of water bodies in Lielupe RBD were not identified as being at risk. In risk water bodies, supplementary measures should be implemented, such as buffer strips etc., but in potential risk water bodies supplementary measure implementation should be considered to improve water body status.

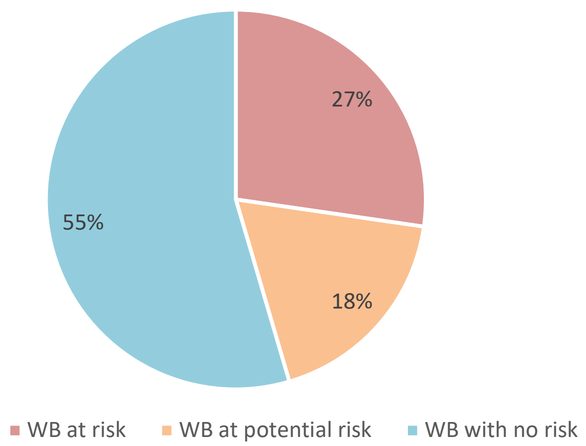


Figure 32. Percentage of water bodies at risk and potential risk due to agricultural pollution load in Lielupe RBD

In the Lielupe RBD, a total of 9 water bodies were defined at risk (*Table 11*) due to agricultural pollution and 6 water bodies at potential risk (*Table 12*) in the future.

Table 11. Water bodies at risk in Lielupe RBD

WB Code	WB name
L106SP	Vecbērzes poldera apvadkanāls
L120	Tērvete
L121	Skujaine
L123	Svēte
L124	Vilce
L147	Vircava
L148SP	Sesava
L149	Svitene
L153	Īslīce

In water body L106SP, agricultural pollution load is almost 84 % of the total N load. In L123 pollution load is 70 %, in L147 pollution load is almost 76 %, in L148SP pollution load is 91 %, in L149 almost 91 % and in L153 pollution load is 90%. In these water bodies agricultural pollution load has a tendency to decrease, but as its load is more than 70 %, they were defined as being at risk.

In water body L120 agricultural pollution load is 75 % of total N load. In L121 pollution load is 80 % and in L124 pollution load is 87 %. In these water bodies agricultural pollution load has a tendency to increase and its load is more than 70 %, so they are defined as being at risk.

Table 12. Water bodies at potential risk in Lielupe RBD

WB Code	WB name
L109	Bērze
L117SP	Auce
L127	Iecava
L132	Taļķe
L169	Dienvidsusēja
L178	Kreuna

Water bodies L109, L117SP, L127, L132, L169 and L178 are considered as being at potential risk in the future due to agricultural pollution load increase in time period 2006 - 2015. In water bodies L117SP, L127 and L178, NTOT and N-NO3 concentrations are also increasing. If basic measures are implemented to the full extent in these water bodies, it should be realistic in the future to decrease pollution and improve their ecological status.

Water bodies at risk in Venta RBD

Risk water bodies compile 5 % of total number of water bodies in Venta RBD (*Figure 33*). Water bodies at potential risk compile 21 %. Another 74 % of water bodies in Venta river basin were not identified as being at risk.

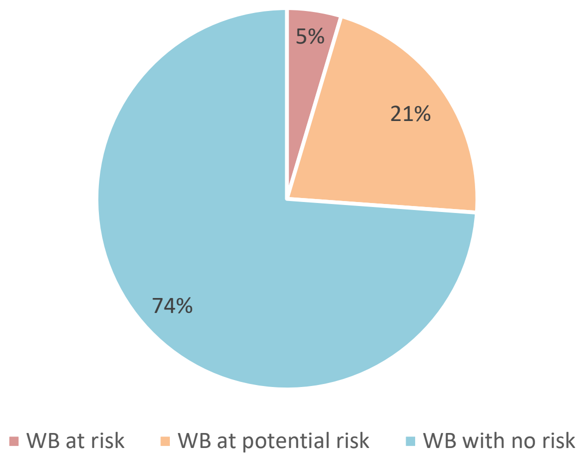


Figure 33. Percentage of water bodies at risk and potential risk due to agricultural pollution load in Venta RBD

In Venta RBD, a total of 3 water bodies were defined at risk (*Table 13*) due to agricultural pollution and 14 water bodies are at potential risk (*Table 14*) in the future.

Table 13. ***Water bodies at risk in Venta RBD***

WB Code	WB name
V015	Alokste
V037	Pūre
V046	Ēda

In water body V015 agricultural pollution load is 70 % of total N load, but it has a tendency to decrease. In V046 pollution load is almost 71 % with a tendency to decrease, but, as their load is 70 % or more, both are defined as being at risk. In V037 pollution load is 72 % with a tendency to increase.

Table 14. ***Water bodies at potential risk in Venta RBD***

WB Code	WB name
E008	Durbes ezers
V018	Tebra
V025	Užava
V028	Packule
V034	Imula
V038	Abava
V044	Riežupe
V057	Šķervelis
V058	Lētīža
V060	Zaņa
V063	Ezere
V066	Vadakste
V088	Dzedrupe
V093	Slocene ar Vašleju

Water bodies E008, V018, V028, V034, V038, V044, V057, V058, V060, V063, and V088 are defined as being at potential risk in the future, due to agricultural pollution load increase in the time period 2006 - 2015. In water body V058, total N and NO_3-N concentrations are also increasing. In water bodies V025, V066 and V093 agricultural pollution has decreased in 2006 - 2015, but they are defined as being at potential risk due to agricultural pollution load exceeding 66 %. If basic measures are implemented to the full extent in these water bodies, it should be realistic in the future to decrease pollution and improve their ecological status.

Environmental objectives

Environmental reduction targets in each water body were calculated with Mass Balance model. Model takes into account the target concentration of total N in each water body and it is compared with observed total N concentration in each water body. *Figure 34* shows that agricultural pollution needs to be reduced mostly in the Lielupe RBD. Reduction targets are applicable to agricultural areas and have been calculated for 18 water bodies. In the Venta RBD reduction targets have been calculated for 8 water bodies. Risk water bodies in both basins are included in calculation. In two water bodies (L147 and L176) reduction target is more than 5 kg/ha. Smallest reduction targets have been calculated for 8 water bodies (L100SP, L107, L118, L121, V026, V046, V084, V093) - less than 1 kg/ha.

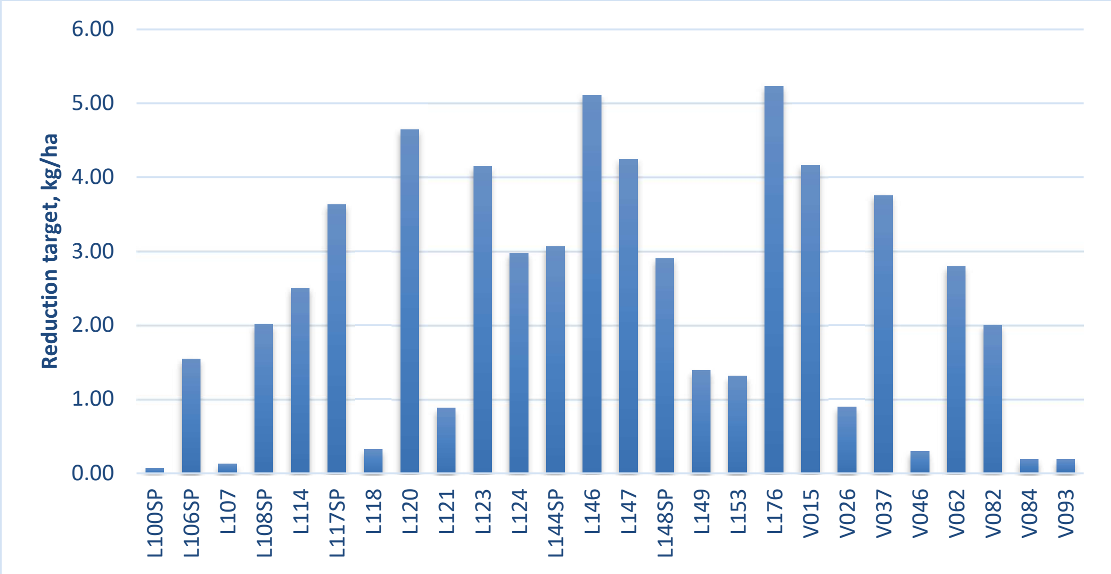


Figure 34. Agricultural pollution reduction targets in Lielupe and Venta RBD, kg/ha

Environmental objectives set by HELCOM

HELCOM convention countries have adopted the nutrient reduction scheme in 2007, in the frame of Baltic Sea Action Plan (HELCOM, 2007), and in 2013 it was revised by the Copenhagen Ministerial Declaration (HELCOM, 2013). The nutrient reduction scheme indicates to how much extent HELCOM countries need to reduce their nutrient inputs by 2021, compared to the reference period (1997–2003), to ensure good ecological quality of the Baltic Sea. For each sub-basin of the Baltic Sea, maximum allowable inputs (MAI) of total nutrient loads are set. These loads are distributed proportionally between the countries contributing to the total load of the respective sub-basin, and thus nutrient input ceiling for a given country is established. Each country has the Country-Allocated Reduction Targets (CART) that are loads to be reduced to reach MAI.

Comparison of the nutrient input ceiling and yearly average total flow-normalized inputs of nutrients in 2010-2012 from the territory of Latvia to the Baltic Sea is shown in *Table 15* Latvia still has to reduce considerably both riverine and airborne loads from its territory to fulfil CART requirements. E.g. if only loads in year 2012 are considered, then Latvia needs to reduce its load of total N to the Gulf of Riga (GUR) by about 35% and to the Baltic Proper (BAP) by 11%, and load of total P to GUR by 41% and to BAP by 78% to fulfil CART *(Svendsen et al., 2015)*.

It has to be taken into account that year 2011 data show notably high total N and total P loads (as mentioned before); in fact, these high values can be an artefact originating from the calculation method used to substitute insufficient monitoring data. Year 2015 data for total N and total P in Venta RBD does not show so high load amount any more.

Next HELCOM pollution load compilation and MAI/CART updates that include data up to year 2014 are expected in early 2018.

Table 15. Comparison of the nutrient input ceiling and total flow-normalized nutrient inputs (tones/year) from Latvia to the sub-basins of the Baltic Sea in 2010-2012 (after: Svendsen et al., 2015). Negative reductions indicate missing reductions. It should be noted that total N inputs include also airborne loads.

Basin	NTOT, t/y input ceiling	NTOT, t/y 2010-2012	NTOT, t/y Reduction	PTOT, t/y input ceiling	PTOT, t/y 2010-2012	PTOT, t/y Reduction
BAP	6091	9454	-3363	74	296	-222
GUR	53898	57876	-3978	541	676	-135

The most part of the Lielupe RBD is assigned as a nitrate vulnerable territory. Yearly average NO_3-N concentrations do not exceed the threshold value 11.3 mg/l; however, single concentrations exceeding 11.3mg/l are recorded in the Lielupe river basin during late autumn, winter and spring (*Figure 35*).

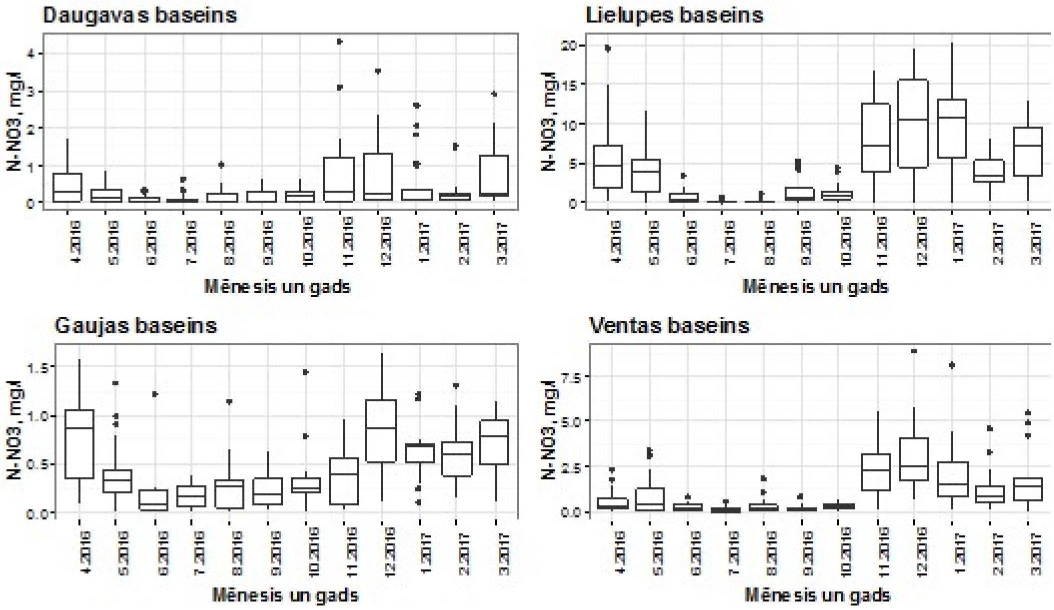


Figure 35. Seasonal variations of N-NO3 concentrations in river basin districts of Latvia: Daugava, Gauja, Lielupe and Venta, in 2016/2017 (LVĢMC, in prep.)

Summary

Performed analysis has revealed that considerable share of all surface water bodies in Venta and Lielupe RBDs still do not meet requirements for good ecological status with respect to nutrient (in particular nitrogen) concentrations in water. Despite of introduced greening requirements and EC efforts to integrate more environmental initiatives and actions into the Rural Development Programmes, agriculture remains the dominant source of nutrient pollution in both countries and especially in the Lielupe RBD.

On the Lithuanian side of the Lielupe RBD, 73% of river bodies monitored in 2010 – 2016 did not meet requirements for good ecological status with respect to concentrations of total nitrogen. In most of the rivers of the Lielupe small tributaries sub-basin concentrations of total nitrogen were exceeding threshold for good status more than 3 times. On the Lithuanian side of the Venta RBD, threshold for good status was exceeded in 27% of monitored river water bodies.

As agriculture is the major source of nitrogen pollution on the Lithuanian side of Venta and Lielupe RBDs, all water bodies where nitrogen threshold for good ecological status is exceeded are classified as water bodies at risk due to the impact of agriculture.

In Latvia, 56 % of all river water bodies and 46 % of lake water bodies in the Lielupe RBD do not meet requirements for good ecological status when classified according the concentrations of total nitrogen. In the Venta RBD, percentage of water bodies not meeting requirements for good status is considerably lower - only 10% for river and 20% for lake water bodies.

In Latvia, water body is defined as being at risk due to the impact of agricultural pollution if agricultural activities produce 70% or more of the total N load in the basin; additionally, ecological status of water body and trends of agricultural impact and observed concentrations of total N, NO_3-N and total P are taken into consideration. In cases when agriculture makes less than 70% of the total N load but pollution demonstrates an upward trend and increase from previous years is significant, total N or NO_3-N concentrations are going upwards, water body is defined as being at potential risk in the future.

Based on the latest classification, water bodies at risk due to the impact of agriculture comprise 27 % of the total number of water bodies in the Lielupe RBD in Latvia. Water bodies at potential risk comprise 18 %.

On the Latvian side of the Venta RBD, water bodies at risk due to the impact of agriculture comprise 5 % of the total number of water bodies. Water bodies at potential risk make 21 % of all water bodies.

In both countries nitrogen concentrations in the Lielupe RBD demonstrate an upward trend.

Results of the river ecological status classification according to the concentrations of total nitrogen are presented in *Figure 36*.

On the Lithuanian side, total catchment area of water bodies at risk where pollution reduction objectives for total N are established is 90 thou ha in the Venta river basin (17% of the basin area), 383 thou ha in the Mūša sub-basin (72% of the sub-basin area) and 175 thou ha (all territory) in the sub-basin of the Lielupė small tributaries. In order to achieve good status, leaching of the total N from the catchments of water bodies at risk in the Venta RBD has to be reduced by approx. 400 t/year; leaching from the catchments of water bodies at risk in the Lielupė RBD has to be reduced by 4800 t/year (1800 t/year reduction is needed in the sub-basin of the Lielupė small tributaries and 3000 t/year in the sub-basin of Mūša).

For the Latvian part of the Lielupe RBD pollution reduction objectives with respect to nitrogen were established for sub-catchments of 18 river water bodies being 600 t/year in total. In the Venta RBD, pollution reduction for 8 sub-catchments is needed, 120 t/year in total.

Pollution reduction objectives in individual sub-catchments of water bodies at risk are presented in *Figure 37*.

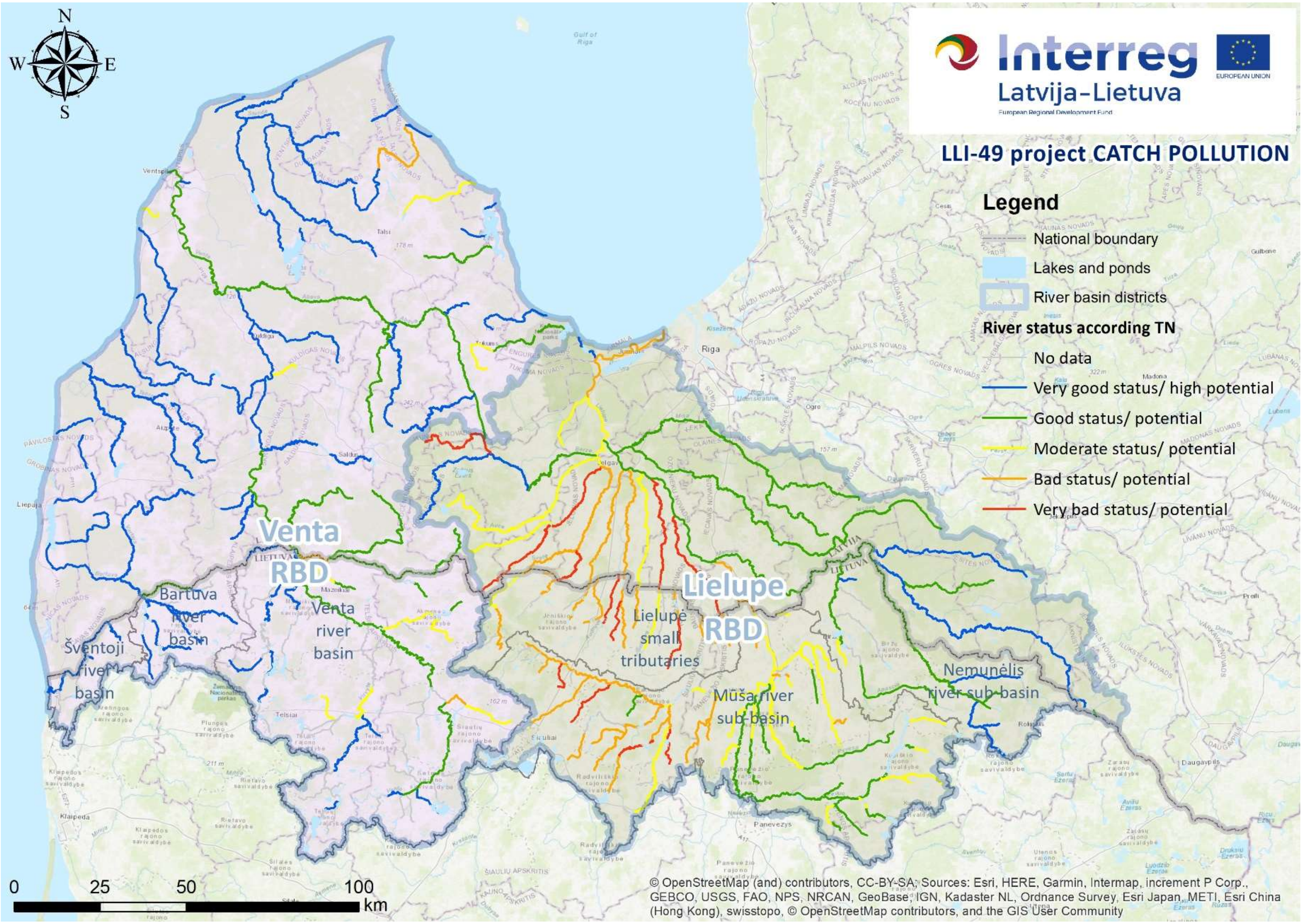


Figure 36. Classification of river ecological status according to concentrations of total nitrogen (based on monitoring data from 2014 – 2016 for Lithuanian rivers and data from 2006 – 2016 for Latvian rivers)

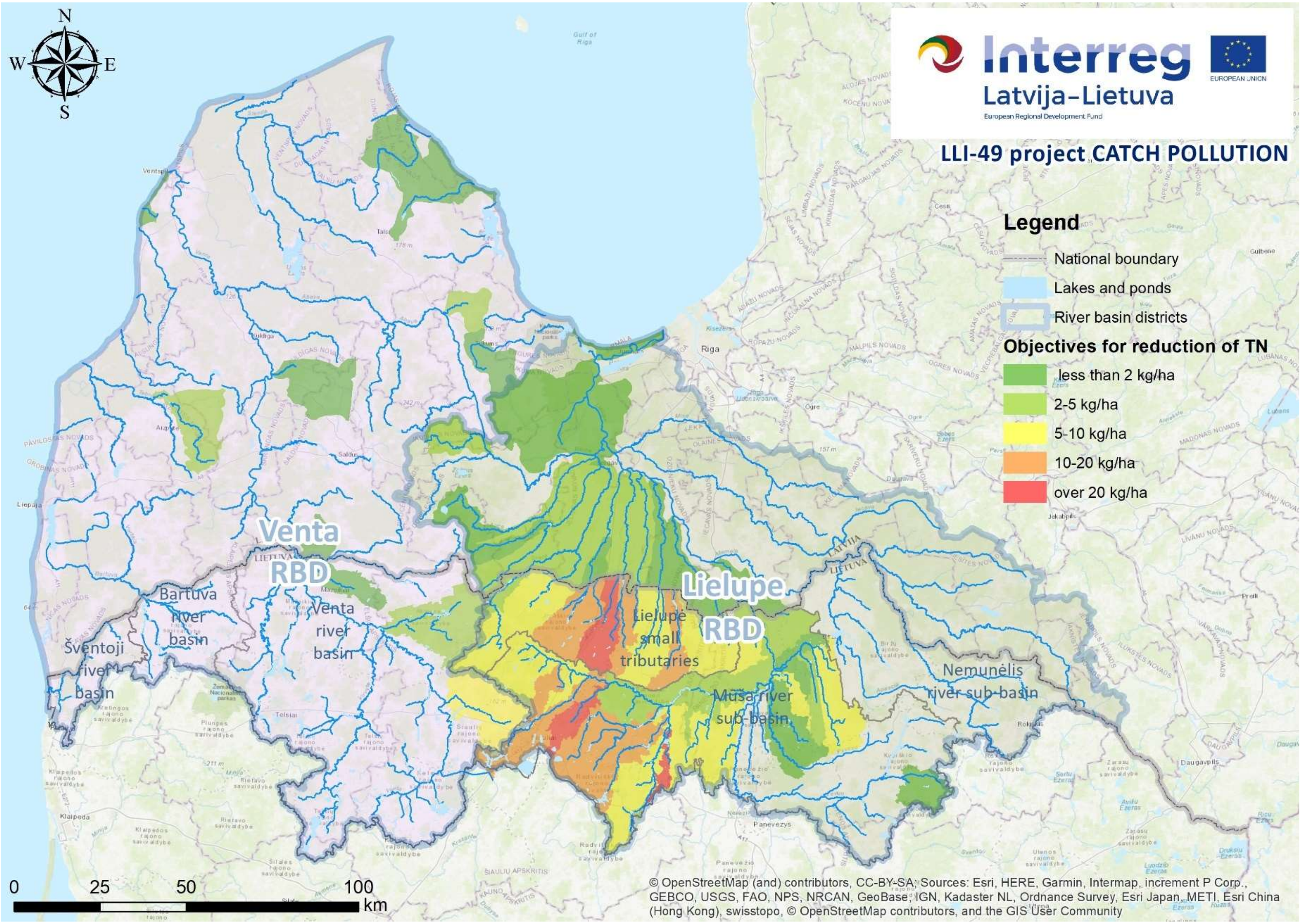


Figure 37. Objectives for reduction of total nitrogen loads in Venta and Lielupe RBDs

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Santrauka

Atliktas vertinimas atskleidė, kad nemažoje dalyje Ventos ir Lielupės UBR vandens telkinių biogeninių medžiagų (ypatingai azoto) koncentracijas vandenyje vis dar neatitinka geros ekologinės būklės reikalavimų. Nepaisant įvestų žalinimo reikalavimų ir EK pastangų į Kaimo plėtros programas integruoti daugiau aplinkosauginių iniciatyvų, žemės ūkis tiek Lietuvoje, tiek Latvijoje tebeišlieka svarbiausiu taršos azotu šaltiniu, ypatingai Lielupės UBR.

Lietuvos teritorijoje esančioje Lielupės UBR dalyje 73 proc. visų 2010 – 2016 m. tirtų upių kategorijos vandens telkinių neatitiko geros ekologinės būklės reikalavimų pagal bendrąjį azotą. Daugelyje Lielupės mažųjų intakų pabaseinio upių geros ekologinės būklės azoto koncentracijų riba buvo viršijama bent 3 kartus. Lietuvos teritorijoje esančioje Ventos UBR dalyje geros ekologinės būklės riba buvo viršyta 27 proc. visų tirtų upių.

Kadangi žemės ūkis Lietuvoje yra įvardijamas kaip pagrindinis taršos azotu šaltinis, visi upių kategorijos vandens telkiniai, kuriuose buvo nustatyti geros ekologinės būklės kriterijų viršijimai, yra priskiriami rizikos grupei dėl reikšmingo žemės ūkio taršos poveikio.

Latvijos teritorijoje, vertinant pagal bendrojo azoto koncentracijas, geros ekologinės būklės reikalavimų neatitinka 56 proc. visų Lielupės UBR upių ir 46 proc. ežerų kategorijos vandens telkinių. Ventos UBR geros ekologinės būklės reikalavimų neatitinkančių vandens telkinių dalis yra gerokai mažesnė nei Lielupės UBR – čia geros ekologinės būklės neatitinka 10 proc. upių ir 20 proc. ežerų kategorijos vandens telkinių.

Latvijoje rizikos grupei dėl reikšmingo žemės ūkio taršos poveikio vandens telkiniai yra priskiriami jei žemės ūkio veikla nulemia 70 proc. ar daugiau baseine susidarančios azoto apkrovos; taip pat yra atsižvelgiama į vandens telkinio ekologinę būklę, žemės ūkio taršos tendencijas, išmatuotas bendro azoto, nitratų azoto ir bendrojo fosforo koncentracijas. Jei žemės ūkio tarša sudaro mažiau nei 70 proc. bendrojo azoto apkrovos, tačiau stebima taršos augimo tendencija, bendrojo arba nitratų azoto koncentracijos auga, vandens telkinys priskiriamas potencialios rizikos vandens telkiniams.

Pagal naujausius klasifikavimo duomenis, rizikos grupei dėl žemės ūkio taršos poveikio Latvijoje priskiriama 27 proc. Lielupės UBR vandens telkinių, o potencialios rizikos vandens telkinių grupei - 18 proc.

Latvijos teritorijoje esančioje Ventos UBR dalyje rizikos grupei dėl reikšmingo žemės ūkio taršos poveikio priskiriama 5 proc. visų telkinių, o potencialios rizikos grupei – 21 proc.

Vertinimas parodė, kad taršos mažinimo poreikis pastaraisiais metais išaugo. Tą lėmė daugelyje upių 2014-2016 m. didėjusios taršos apkrovos. Nustatyta, kad Lietuvos teritorijoje azoto taršą reikia mažinti Ventos baseine, Lielupės mažųjų intakų ir Mūšos pabaseiniuose. Ventos baseine taršos mažinimas reikalingas teritorijoje, kuri apima 90 tūkst. ha (17 proc. viso baseino ploto), Mūšos pabaseinyje – 383 tūkst. ha (72 proc. viso pabaseinio ploto), o Lielupės mažųjų intakų pabaseinyje – 175 tūkst. ha (visame pabaseinio plote).

Apskaičiuota, kad norint pasiekti gerą visų paviršinio vandens telkinių ekologinę būklę, ***Lietuvoje azoto išsiplovimas į vandens telkinius Ventos UBR turi būti sumažintas 400 t/metus, o Lielupės UBR – 4800 t/metus*** (1800 t/metus tarša turi būti sumažinta Lielupės mažųjų intake pabaseinyje ir 3000 t/metus – Mūšos pabaseinyje).

Latvijos teritorijoje esančioje Lielupės UBR dalyje bendras azoto taršos mažinimo poreikis teritorijoje, apimančioje 18 vandens telkinių baseinėlius, ***sudaro 600 t/metus***. ***Ventos UBR bendrojo azoto taršos mažinimas*** reikalingas 8 baseinėliuose ir ***sudaro 120 t/metus***.

Kopsavilkums

Lauksaimniecība ir viens no galvenajiem barības vielu piesārņojuma (jo sevišķi piesārņojuma ar slāpekli Lielupes UBA) avots Ventas un Lielupes baseinā. Ņemot vērā ļoti nozīmīgo lauksaimniecības ietekmi, Lielupes baseina upju ekoloģiskais stāvoklis ir novērtēts vissliktāk salīdzinājumā ar citu Latvijas un Lietuvas upju baseinu stāvokli.

Ventas upe sākas Lietuvā, dienvidrietumos ietek Latvijā un plūst uz ziemeļiem, caur Kurzemes zemieni uz Baltijas jūru. Kopējā Ventas UBA platība ir 21 937 km^2, no kuriem 6276 km^2 (29 %) atrodas Lietuvas teritorijā un 15 630 km^2 (61 %) – Latvijas teritorijā. Lielupes baseina upes sākas Lietuvā, dienvidos ietek Latvijā un plūst uz ziemeļiem uz Rīgas jūras līci. Kopējā Lielupes UBA platība ir 17 760 km^2, no kuriem 8947 km^2 (proti, 50 %) atrodas Lietuvas teritorijā un 8843 km^2 (50 %) atrodas Latvijas teritorijā. Lielupei ir daudz pieteku, lielākās no tām ir Mēmele, Mūsa, Iecava un Svēte. Lietuvas daļā Lielupes UBA sastāv no trīs apakšbaseiniem: Mūsas upes apakšbaseina ar 5296 km^2 lielu platību, Mēmeles upes apakšbaseins ar platību 1900 km^2, kā arī Lielupes mazo pieteku apakšbaseina ar 1751 km^2 lielu platību.

Lauksaimniecisko piesārņojumu galvenokārt raksturo nitrātu koncentrācija – slāpeklis, kopējais slāpeklis un kopējais fosfors. Lietuvā ir noteiktas šādas laba ekoloģiskā stāvokļa robežvērtības:

- vidējā nitrātu slāpekļa koncentrācija gadā ≤ 2,3 mg/l;
- vidējā kopējā slāpekļa koncentrācija gadā ≤ 3 mg/l;
- vidējā kopējā fosfora koncentrācija gadā ≤ 0,14 mg/l.

Latvijā spēkā esošā sistēma upju un ezeru ūdenstilpju klasificēšanai neparedz NO_3-N izmantošanu kā fizikāli-ķīmiskās kvalitātes rādītāju. Lai izstrādātu otros upju baseina apsaimniekošanas plānus Lielupes un Ventas UBA un lai nodrošinātu savstarpēji koordinētu vides mērķu nospraušanu, projekta partneri vienojās izmantot Lietuvas klasifikācijas sistēmu lēnteces (potamāla tipa) upēm Lielupes un Ventas UBA.

Lietuvā lielākā lauksaimniecības darbību ietekme ir novērota upēs, kas ietilpst Lielupes mazo pieteku apakšbaseinā. Lauksaimniecības ietekmes rezultāts ir paaugstināta slāpekļa savienojumu koncentrācija. Kopējā slāpekļa koncentrācija, kas laika periodā no 2010. līdz 2016. gadam ir izmērīta Lielupes mazo pieteku apakšbaseinā esošajās upēs, svārstās no 5,6 mg/l līdz 14 mg/l. Šajā apakšbaseinā nav tādu upju, kurās kopējā slāpekļa koncentrācija atbilstu laba ekoloģiskā stāvokļa prasībām. Lielākajā daļā upju laba ekoloģiskā stāvokļa robežvērtība ir pārsniegta vairāk nekā 3 reizes. Zemākā kopējā slāpekļa koncentrācija (5,6 mg/l) ir novērota Sviteņa (Svitenes) un Švētes (Svētes) upēs, savukārt Beržtalē (Bērstelē), Ašvinē un Audruvē kopējā slāpekļa koncentrācija pārsniedz 12 mg/l (t.i., slikti ekoloģiskās kvalitātes rādītāji).

Ventas upes baseina Lietuvas daļā lauksaimnieciskā piesārņojuma problēmas nav dominējošās, tomēr Ringuvas, Dabiķines (Dabiķenes), Šventupes un Ašvas upēs slāpekļa koncentrācija joprojām pārsniedz atļauto līmeni. Augstākā koncentrācija ir izmērīta Ringuvas upē – 6 mg/l (proti, divreiz vairāk par atļauto līmeni). Ašvas upē laba ekoloģiskā stāvokļa robežvērtības ir pārkāptas nebūtiski – izmērītā kopējā slāpekļa koncentrācija ir 3,3 mg/l. Lauksaimniecības darbībām nav būtiskas ietekmes uz upēm Bartuvas (Bārtas) un Šventājas (Sventājas) apakšbaseinos. Visās šā apgabala monitorētajās upēs kopējā slāpekļa koncentrācija atbilst laba ekoloģiskā stāvokļa prasībām.

Latvijā 56 % upju ūdenstilpju un 46 % ezeru ūdenstilpju Lielupes UBA neatbilst laba ekoloģiskā stāvokļa prasībām, ja tās tiek klasificētas pēc kopējā slāpekļa koncentrācijas. Ventas UBA ūdenstilpju procentuālais daudzums, kas neatbilst laba ekoloģiskā stāvokļa prasībām, ir būtiski zemāks – tikai 10 % upju ūdenstilpju un 20 % ezeru ūdenstilpju.

Latvijas daļas Lielupes UBA upēs kopējā slāpekļa koncentrācija svārstās robežās no 1,0 līdz 10,5 mg/l. Augstākā koncentrācija ir novērota ūdensobjektos L153 Īslīce un L149 Svitene. Ventas UBA upēs kopējā slāpekļa vērtība ir no 0,73 līdz 2,96 mg/l. Augstākā koncentrācija ir konstatēta ūdensobjektos V062 Vadakste un V082 Roja.

Lielupes UBA upēs kopējā fosfora koncentrācija svārstās no 0,028 līdz 0,123 mg/l, augstākā fosfora koncentrācija ir konstatēta ūdensobjektos L147 Vircava un L117SP Auce. Ventas UBA upēs kopējā fosfora vērtības ir robežās no 0,031 – 0,126 mg/l, ar 6 maksimālajām izlecošajām vērtībām V014 Tebra un V043 Venta (abas ir lēnteces upes), V004 Ālande (lēnteces upe), V082 Roja, V058 Lētīža (straujteces (ritorāla tipa) upe).

Lai piemērotu pašus efektīvākos piesārņojuma samazināšanas pasākumus un tādējādi sasniegtu mērķus vides jomā, piesārņojuma samazināšanas mērķi ir noteikti katrai ūdenstilpei, kurā pastāv risks.

Novērtējums norāda uz to, ka šobrīd noteiktie piesārņojuma samazināšanas mērķi Lielupes UBA Lietuvas daļai ir pat stingrāki nekā upju baseinu apsaimniekošanas plānā norādītie. To var izskaidrot ar faktu, ka piesārņojuma slodze laika posmā no 2014. līdz 2016. gadam daudzās upēs ir palielinājusies.

Kopējais sateces baseins tām ūdenstilpēm, kurās pastāv risks un attiecībā uz kurām nosprausti kopējā slāpekļa piesārņojuma samazināšanas mērķi, Lietuvas teritorijā ir šāds: 90 tūkst. ha Ventas upes baseinā (17 % no baseina teritorijas), 383 tūkst. ha Mūsas apakšbaseinā (72 % no apakšbaseina teritorijas) un 175 tūkst. ha Lielupes mazo pieteku apakšbaseinā (visa teritorija). Lai sasniegtu labu ekoloģisko stāvokli, riskam pakļauto Ventas UBA ūdenstilpju sateces baseinos slāpekļa izskalošanās ir jāsamazina par aptuveni 400 t/gadā; slāpekļa izskalošanās riskam pakļauto Lielupes UBA ūdenstilpju sateces baseinos ir jāsamazina par 4800 t/gadā (1800 t/gadā liels samazinājums – Lielupes mazo pieteku apakšbaseinā un 3000 t/gadā – Mūsas apakšbaseinā).

Lielupes UBA Latvijas daļā slāpekļa piesārņojuma samazināšanas mērķi ir noteikti 18 upju ūdenstilpju sateces apakšbaseiniem – kopā 600 t/gadā. Ventas UBA piesārņojumu nepieciešamas samazināt 8 sateces apakšbaseinos – kopā 120 t/gadā.