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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 A.T 1.1.

Agricultural practices in Venta and Lielupe River Basin Districts

aplinkos apsaugos politikos Centras
center for environmental policy

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Agroresursu un ekonomikas institūts

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Contents

Abbreviations

AAPC	Center for Environmental Policy
AREI	Institute of Agricultural Resources and Economics
CAP	Common Agricultural Policy
CC	Catch crops
CSB	Central Statistical Bureau of Latvia
EFA	Ecological Focus Area
FADN	Farm Accountancy Data Network
GP	Greening Payment
IACS	Integrated Administration and Control System
RBD	River Basin District
RDP	Rural Development Programme
RSS	Rural Support Service of Latvia
SO	Standard output
VDU ŽŪA	Vytautas Magnus University Agriculture Academy

Introduction

Agriculture has a certain impact on the environment, but its importance depends on a variety of factors. They relate to both the abiotic factors of the area (climate, soil, terrain, hydrology) and the type of agricultural activity. Intensity and structure of agricultural activities largely influence environmental situation in river basins. Intensive agricultural activities often result in high nutrient losses from the fields, hence the basins dominated by the intensive agriculture suffer from the elevated nutrient pollution and fail to achieve their environmental objectives.

Proper understanding of agricultural situation and factors influencing it is essential for planning further steps regarding reduction of nutrient pollution.

Indicators such as structure of agricultural land, farm structure, crop structure, livestock numbers, productivity etc. have been characterized and analysed to describe the situation in agriculture in Venta and Lielupe RBDs.

In view of the fact that the overall agricultural characteristics are mostly available in the classification of the administrative level, this report shows them in the section of the administrative units of Venta and Lielupe RBD's. On the other hand, the indicators for which spatial information was available, using the GIS approach were selected, analysed and displayed for the overall Venta and Lielupe RBD's.

Geomorphology and climate of the Venta and Lielupe River Basin Districts

Geography

Lithuania and Latvia share transboundary Venta and Lielupe River Basin Districts (RBDs).

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 6276 km^2 (29%) is in the territory of Lithuania and 15 630 km^2 (61%) in the territory of Latvia. In the territory of Lithuania, three river basins are distinguished in the Venta RBD: Venta river basin with the area of 5 137 km^2, Bartuva river basin with the area of 749 km^2, and Šventoji river basin with the area of 390 km^2. In Latvia, Venta RBD includes three basins: Venta river basin with the area of 6 730 km^2, coastal west basin with the total area of 5 100 km^2 which includes small river basins such as the Barta, Durba, Riva and Uzava which flow to the Baltic Sea at the west coast, and coastal north basin with the area of 3 800 km^2 which includes small river basins within the coastal lowland on the opposite shores of the Gulf of Riga such as the Irbe, Stende, Roja etc.

According to regulatory enactments, which is based on Water Framework Directive, Latvia has four River Basin Districts – Gauja, Daugava, Lielupe and Venta. Smaller-level units water bodies are defined, whose borders are based on the boundaries of the catchment areas of watercourses, river types and other characteristics in each of these areas of river basins. Venta RBD has a total 67 water bodies.

Lielupe RBD rivers mostly rises in Lithuania, enter 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 8947 km^2 (i.e. 50%) is in the territory of Lithuania and 8843 km^2 (50%) in the territory of Latvia. It has many tributaries, the most important being the Memele, Musa, Iecava and Svete. According Water Framework Directive 33 waterbodies are delineated in the Lielupe RBD in Latvia.

Lielupė RBD on the Lithuanian side consists of three sub-basins: Mūša river sub-basin with the area of 5 296 km^2, Nemunėlis river sub-basin with the area of 1 900 km^2, and sub-basin of the Lielupė small tributaries with the area of 1 751 km^2.

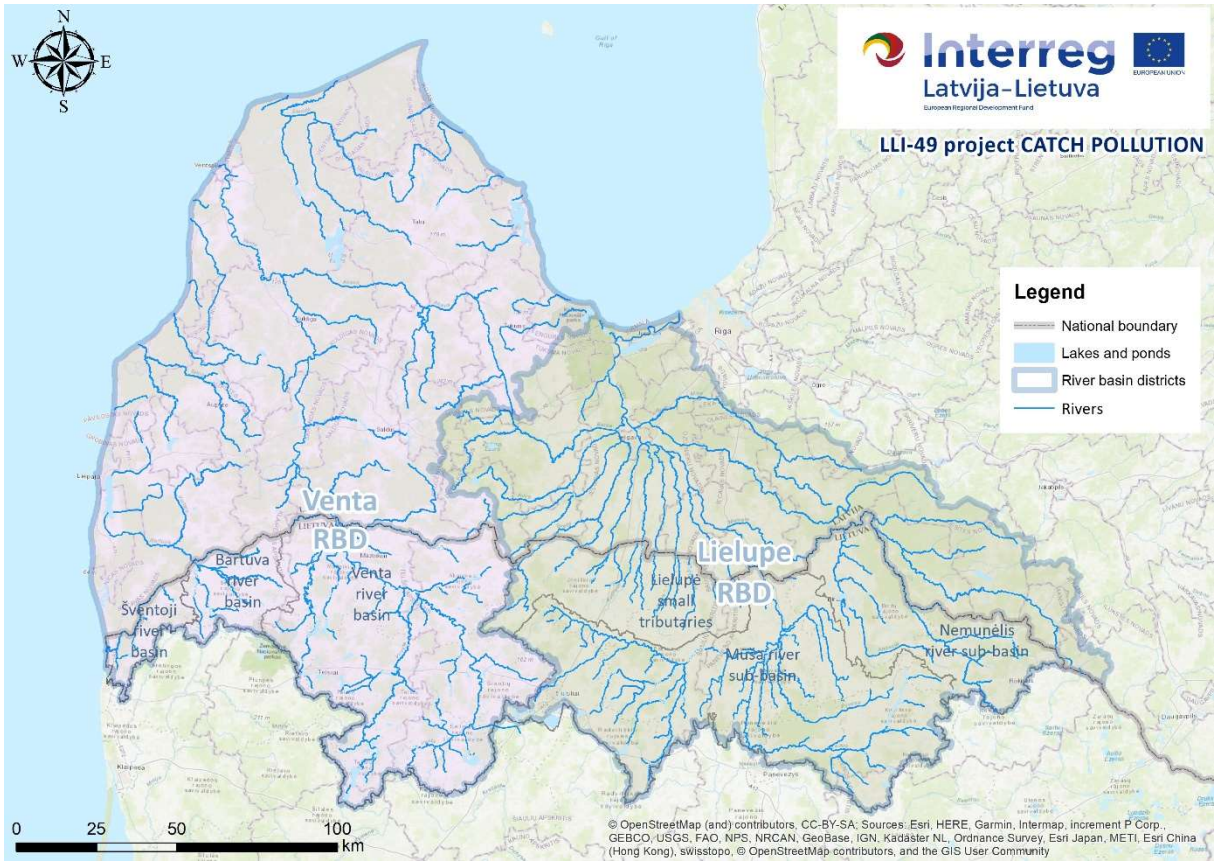


Figure 1. Venta and Lielupė River Basin Districts

Soils

Due to specific geomorphological features different bedding occurrences exist in Venta and Lielupe RBDs. Soil bedding material influences the context of soil aggregates and particle size fractions in the parent material. It also affects morphological properties of soils. Because Venta and Lielupe RBDs have different bedding, the cumulative particle-size distribution in the parent material of basins soil profile is also different (*Figure 2* and *Figure 3*).

On the Lithuanian side of the Venta RBD, medium clay loam texture is prevailing in the Šventoji and Bartuva river basins, while medium sandy loam texture - in the Venta river basin. In all sub-basins of the Lielupe RBD medium sandy loam texture prevails (*Figure 2*).

The distribution of soil granulametric composition groups in the agricultural lands of Venta and Lielupe RBD's in Latvia is shown in *Figure 3*. The most part of the Lielupe RBD is covered by Loam soils: Loamy sands cover – 30%, and Clay soils - 6%. According to FAO classification, most common soil subtypes in Loam soils are - Loam (L), Silt loam (SiL) and Silty clay loam (SiCL). The most common sub-type of Clay soils is Clay loam (CL). Conversely, soil subtypes loamy sand (LS), very fine sand (VFS), very fine sandy loam are most common of Loamy sand soils.

Also, majority of farmlands in the Venta RBD are dominated by Loam soils (58%). Loamy sands cover – 34%, and Clay soils - 4%. Most common soil subtypes in Loam soils are - Loam (L), Silt loam (SiL) and Silty clay loam (SiCL). The most common sub-type of Clay soils is Clay loam (CL). Conversely, soil subtypes loamy sand (LS), very fine sand (VFS), medium sand (MS) and very fine sandy loam are most common of Loamy sand soils.

Small areas of both RBDs in Latvia are covered with other soil types, including peat soils, but most of these soils are in the areas with permanent and sown grasslands.

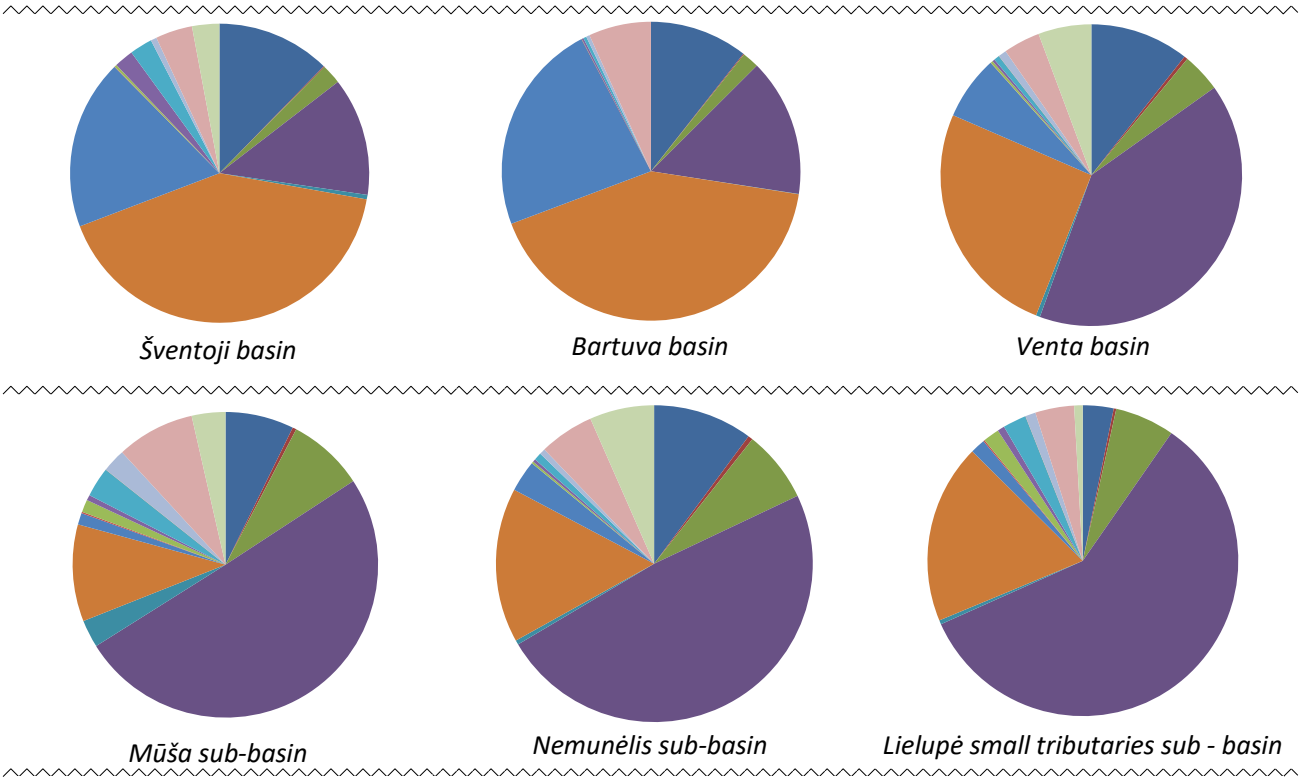


Figure 2. Distribution of soil texture classes (according particle-size) in the parent material of the Lithuanian part of the Venta and Lielupe river basins' soil profiles (adopted from www.geoportalas.lt database)

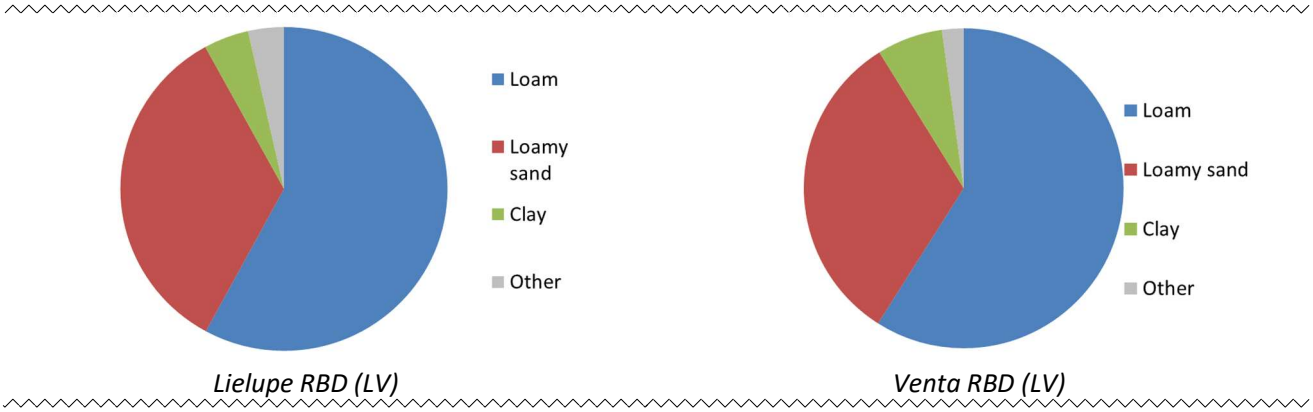


Figure 3. Distribution of soil texture classes (according particle-size) in agricultural lands of the Latvian part of the Lielupe and Venta RBDs (author's calculation from geolatvija.lv database)

As soil texture in soil profiles of Venta and Lielupe RBDs is different, distribution of soil types in the river basins differs as well. On the Lithuanian side of the Venta RBD, prevailing soils are *Luvisols*. Less spread are *Cambisols* (Venta basin) and soils developed in the presence of a high or strongly fluctuating water - *Gleysols* and *Albeluvisols* (Šventoji, Bartuva, and Venta basins). Distribution of soil types on the Lithuanian part of the

Lielupe RBD is not so variant. In the Lielupe RBD *Cambisols* are the most prevalent (especially in the sub-basins of Mūša and Lielupė small tributaries). *Luvisols* (in particular in the sub-basins of Mūša and Lielupė small tributaries) and *Gleysols* (in the sub-basins of Mūša and Nemunėlis) also make a significant share.

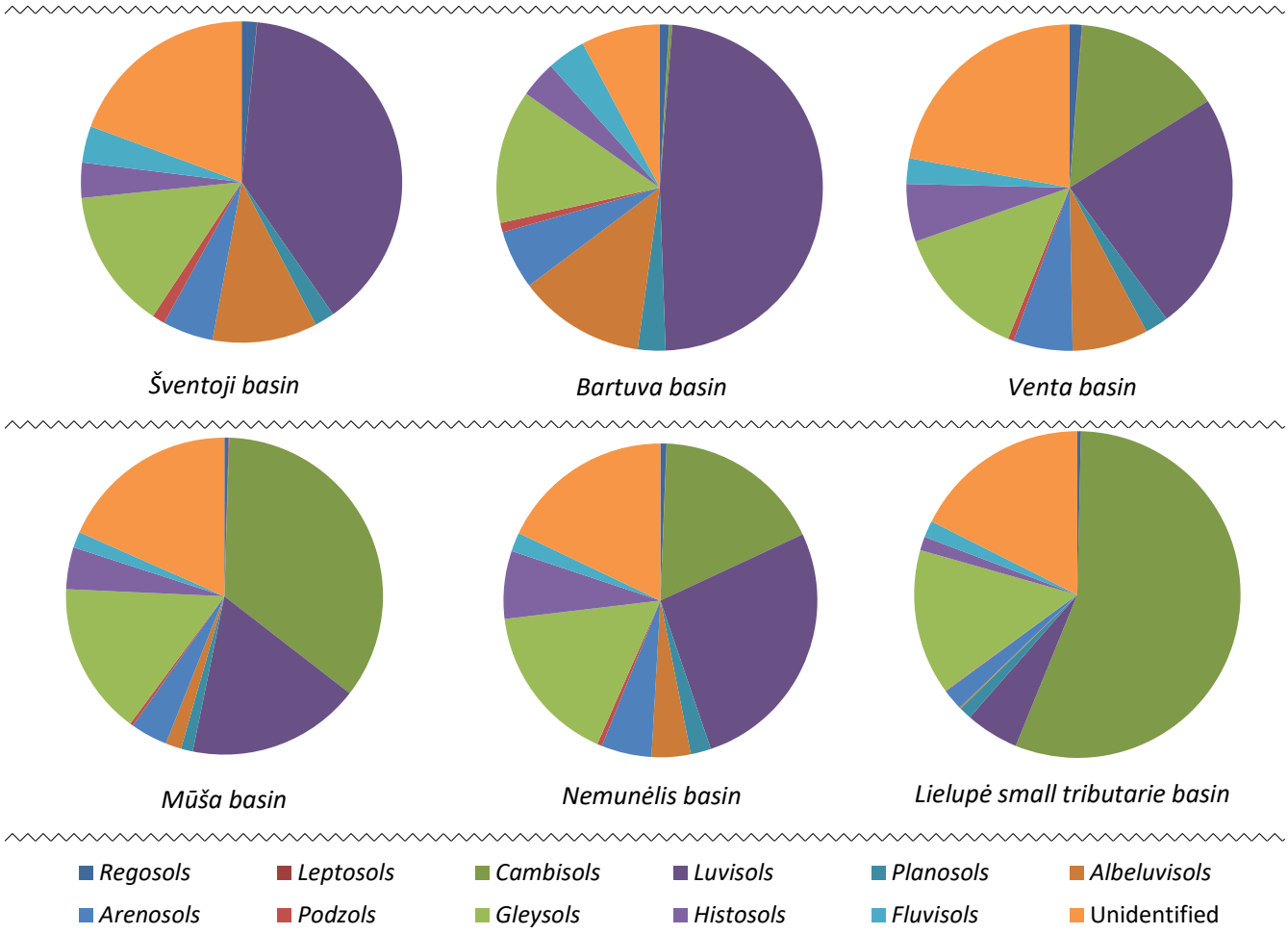
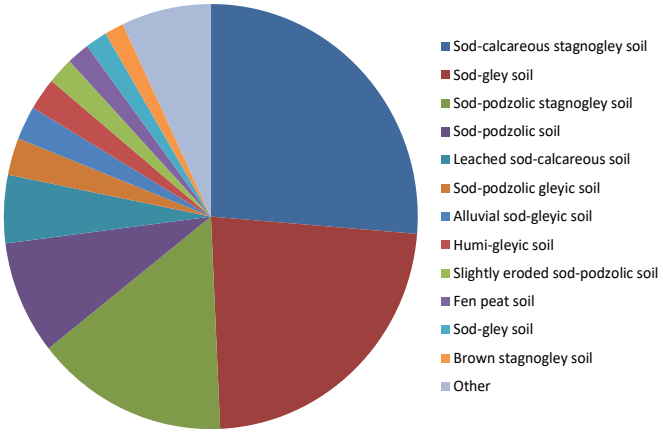


Figure 4. Distribution of soil type (according the World Reference Base for Soil Resources, 2014) in the Lithuanian part of the Venta and Lielupe river basins (adopted from www.geoportalas.lt data base)

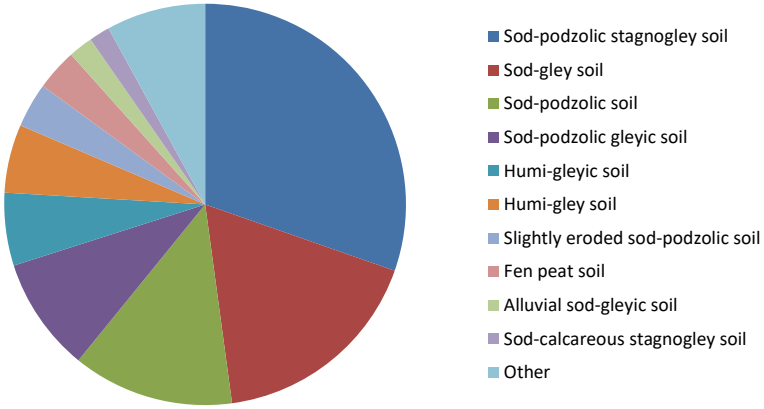
On the Latvian side, Podzolic soils are the most widespread in both Lielupe and Venta RBDs (*Figure 5*). Podzolic soils have developed on diverse parent materials, most often on coarse textured parent materials that once were calcareous but now at a depth above 60 cm carbonates have been weathered and leached out. Podzolic soils have developed under the influence of podzol-forming processes. On flat topography in Zemgale (Lielupe river basin) Sod-calcareous soils are widely distributed. In both river basins, Gleyish soils and Podzolic-gleyish soils occur. Brown soils are not widely distributed in Latvia. They mainly occur on flat topography in the Southern part of Zemgale (Lielupe river basin) and under forests in Kurzeme (Venta river basin). Brown soils have developed on diverse, chemically rich parent materials, most frequent on limnoglacial and moraine sandy loam which are low in carbonates. Brown soils are among the most fertile soils in Latvia.

When analysing distribution of soil types in Venta and Lielupe RBDs, it becomes evident that the territory underlying geomorphology (especially soil physical bases) closely correlate with soil fertility.

Soils with the score exceeding 42.1 are considered fertile and highly fertile and are used for intensive agriculture. Usually, in fertile soils intensive agriculture is followed by the intensive use of mineral fertilizers. Data on soil fertility allows predicting the level of agricultural pressure.



Lielupe RBD (LV)



Venta RBD (LV)

Figure 5. Distribution of soil types at the Latvian part of the Lielupe and Venta RBDs in agricultural lands (author's calculation from geolatvija.lv database)

Soil fertility in Venta and Lielupe RBDs varies in a quite wide range (*Figure 6*). On the Lithuanian side of the Lielupe RBD, a widest range of soil fertility scores is characteristic to the Mūša river sub-basin. The average soil fertility score in the Mūša sub-basin is about 45 and mostly represents fertile soils, though there are some territories where the score is below 27. Soils in the Lielupė small tributaries sub-basin are less varied, with the average soil fertility score of 49 being higher than in the Mūša sub-basin basin. Soil fertility score in some counties of the Lielupe small tributaries sub-basin reach even 55 and 57. Average soil fertility score in the Nemunėlis river sub-basin is only about 38. Soils of the Nemunėlis river sub-basin are less fertile in comparison to soils of the two other Lielupė RBD sub-basins.

In Latvia, soil fertility score exceeds 50 in the central part of the Lielupe RBD. The average fertility score in the Lielupe RBD is 41, but in 26 parishes soil fertility score is above 50, of which in 9 – above 60.

Soils in the Venta RBD are less productive than in the Lielupe. In Lithuania, average soil fertility score in the Venta basin is 38, in the Bartuva and Šventoji – 37. In the Latvian part of the Venta RBD soil fertility score averages to 34.

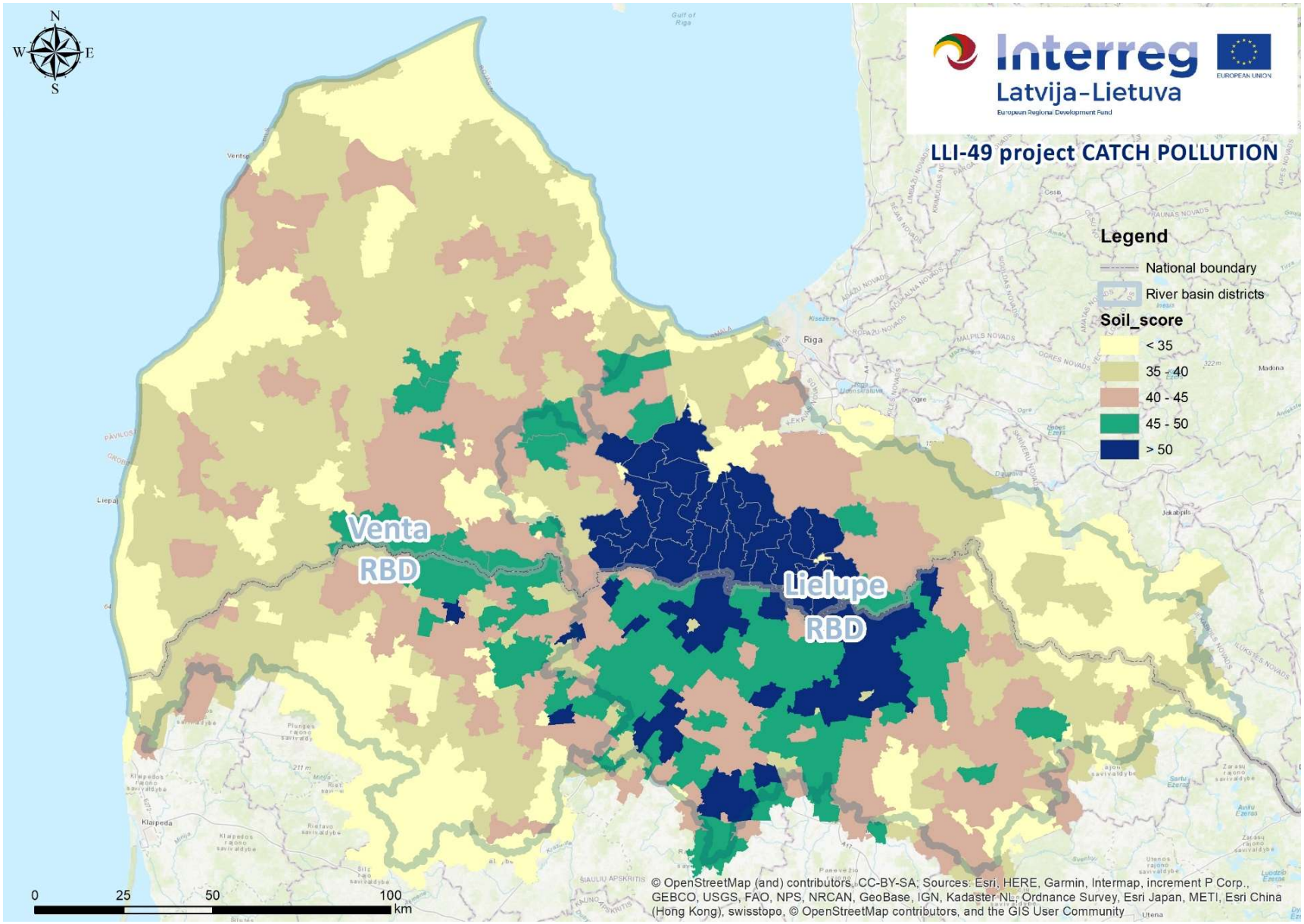


Figure 6. Soil fertility score in agricultural lands of Venta and Lielupe RBDs (adopted from www.geoportalas.lt and www.geolatvija.lv data bases)

Climate

In the territory of Lithuania the major part of the Venta RBD is attributed to the Samogitian climatic region with average annual air temperatures of 6,3-6,8 ^{0}C. Annual temperature in the region reaches its highest (17 -17.7 ^{0}C) in July, while the lowest temperature (-3.4 to -2.9 ^{0}C) is usually observed in January and February. Amount of the annual precipitation in the Venta RBD greatly varies: from 810-820 mm in the Samogitian highland to approx. 670 mm in the lowland of the Venta mid-course.

In the territory of Latvia, Venta RBD is attributed to the Kurzeme climatic region covering 17% of the country and including the inland part of the Kurzeme. The average annual precipitation in this region amounts to 700–850 mm. The temperature varies from -4°C in January to 16.5°C in July. Humidity is medium.

The Lielupė RBD in Lithuania belongs to the Mūša – Nevėžis climatic sub-region of the Mid-Lithuanian Lowland climatic region. Annual temperature in the sub-region averages at 6.5 – 7 ^{0}C with the highest values of 17.4 – 18.1°C reached in July and the lowest values of -3.4 to -3.1 °C in January. Average annual amount of precipitation in the sub-region usually varies from 560 to 700 mm.

In the territory of Latvia Lielupe river flows through the Zemgale plain which is in the coastal climatic region. The region is characterized with low humidity. The average annual precipitation amounts at 600 mm. The average temperature varies from -3 ^{0}C in January to 16.5 C in July.

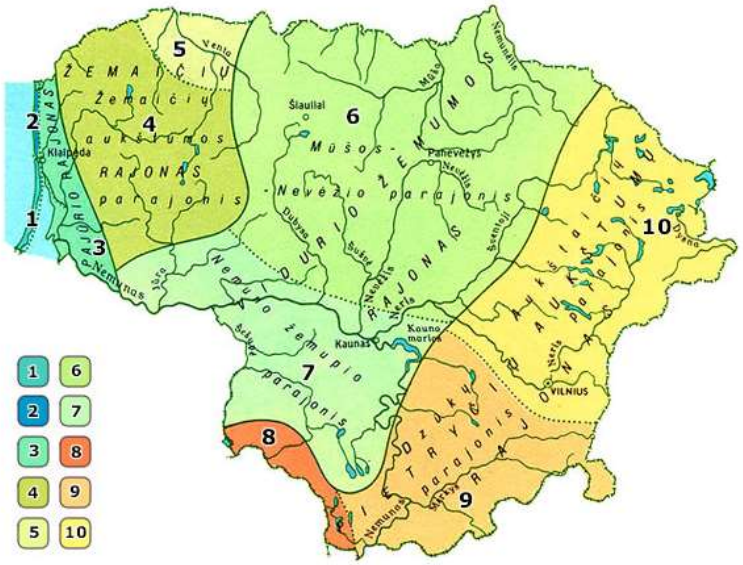
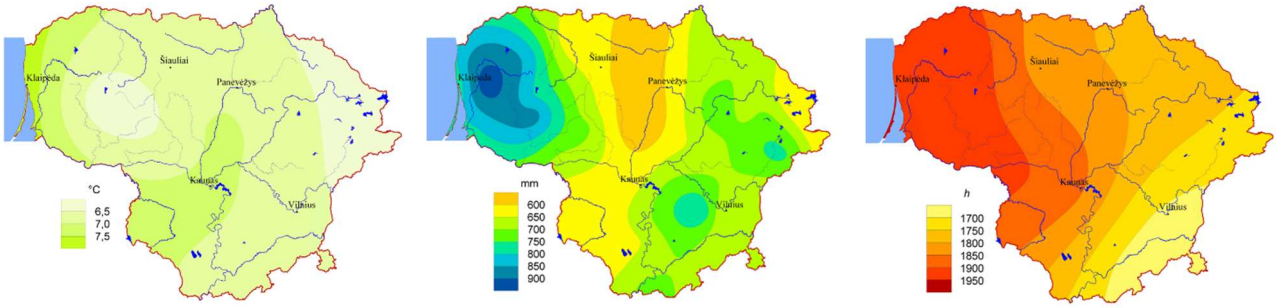


Figure 7. Climatic regions in Lithuania: Coastal Region: 1 – sub-region of Kuršių Nerija; 2 – sub-region of sea coast; 3 – subregion of coastal lowland; Žemaičių (Samogitian) Region: 4 – sub-region of Samogitian upland; 5 – sub-region of Venta mid-course lowland; Mid-Lithuanian lowland Region: 6 – subregion of Mūša – Nevėžis; 7 – sub-region of Nemunas lowland; South-eastern upland Region: 8 – Sūduva sub-region; 9 – Dzūkų sub-region; 10 – Aukštaičių sub-region (source: www.meteo.lt)



Mean annual air temperature *Mean annual precipitation* *Mean annual duration of sunshine*

Figure 8. The climatic conditions in Lithuania (adopted from www.meteo.lt data base; mean annual data is indicated for the period from 1981 to 2010)

Meteorological conditions in the Venta and Lielupe RBDs are summarised in *Table 1*.

Table 1. Meteorological conditions in the Venta and Lielupė RBDs

RBD	Country	Temperature, ^{0}C			Average annual precipitation, mm
		Average annual	Highest	Lowest	
Lielupė	Lithuania	6.5 - 7	17.4 – 18.1	-3.4	560 - 700
	Latvia	6.5 - 7	17.4 – 18.2	-3.5	600-700
Venta	Lithuania	6.3 – 6.8	17 – 17.7	-3.4	670 - 820
	Latvia	6.3 - 7	17 – 17.4	-2.5	650 - 850

Agricultural land and its structure

Soil fertility is one of the key factors determining intensity and structure of agricultural activities. Analysis of agricultural data reveals that there is a close correlation between soil fertility and percentage of the the agricultural land in administrative regions of Venta and Lielupe river basins.

In the region, on both Lithuanian and Latvian sides, most fertile soils are located in the Lielupe RBD (in particular, in the sub-basin of the Lielupe small tributaries on the Lithuanian side and southwestern part of the Lielupe RBD on the Latvian side). These territories dominated with high-fertility soils are intensively used for agriculture on both sides of the border.

Utilised agricultural land makes around 60 % of the total land area in the Lithuanian part of the Lielupe RBD[1] and around 40 % in the Latvian part[2]. In both countries, distribution of agricultural land is very uneven (see *Figure 9*). The share varies from over 80 % in some counties of the sub-basin of the Lielupe small tributaries in Lithuania to less than 20 % in the eastern and north-eastern part of the Latvian part of the Lielupe RBD.

In the Venta RBD, agricultural activities are much less developed than in the Lielupe RBD. Here, on the Lithuanian side, agricultural land makes about 50 % of the RBD area while on the Latvian side only 25 %. It can be seen from *Figure 9* that in the Latvian part of the Venta RBD there are only few parishes where the share of agricultural land exceeds 40%. In the Lithuanian part of the Venta RBD, intensity of agriculture is higher than in Latvia; in most counties of the Lithuanian part agricultural land makes over 40% of the total land area and in the Bartuva sub-basin even 60 – 70%.

Arable land dominates in the structure of agricultural land in both RBDs (*Figure 10*). The largest share of arable land is in the territories with fertile soils and large share of agricultural land. In the Lielupe RBD, on both sides of the border, in the territories dominated by fertile soils, arable land makes over 80% of all utilized agricultural land or even exceeds 90% in the areas with most fertile soils (i.e. in sub-basins of Mūša and Lielupė small tributaries in Lithuania and in the southern and southwestern part of the RBD in Latvia). In counties with less fertile soils, intensity of agriculture and percentage of arable land is lower. E.g. in the eastern part of the Lielupė RBD in Latvia arable land makes only less than 60% of the total agricultural land area.

Soil fertility in the Venta RBD is lower than in the Lielupe RBD and consequently intensity of agriculture and share of arable land is lower here as well. On the Lithuanian part of the Venta RBD arable land, on average, makes 64% of the total agricultural land area, and on the Latvian part – 67%. Though in some counties of the Venta river basin in Lithuania bordering with the Lielupe RBD and having fertile soils, arable land makes over 80 % of the agricultural land. In Latvia there are also few parishes with high percentage (>80%) of arable land.

[1] *Based on the field declaration data for 2017 from the Center of Agricultural Information and Rural Business.*
[2] *Based on the data of the Rural Support Service (RSS) from Integrated Administration and Control System (IACS) (mainly about the areas supported with area payments in 2016).*

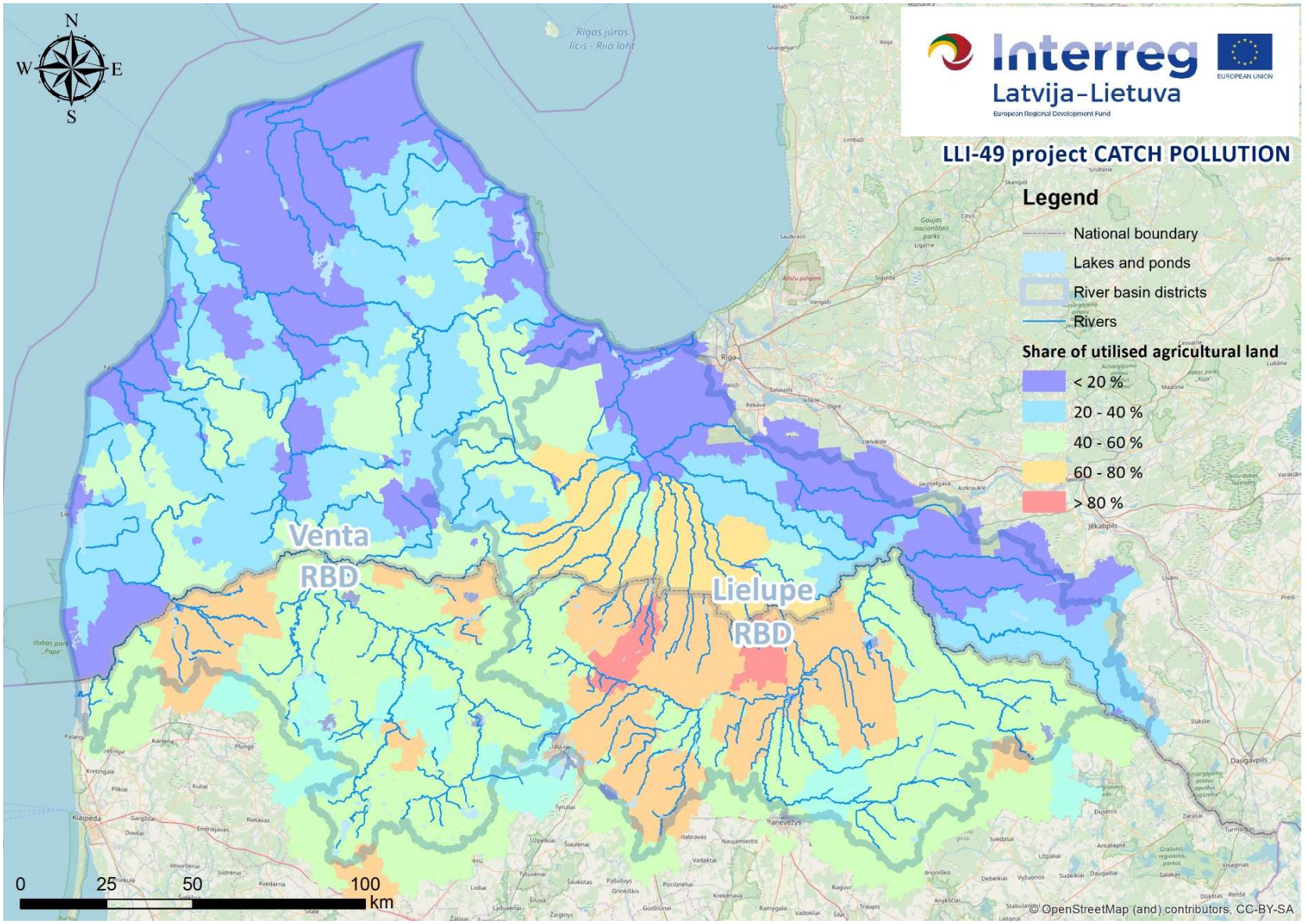


Figure 9. Percentage of the utilised agricultural land in Venta and Lielupe RBDs (data source: data for 2017 from the Center of Agricultural Information and Rural Business (for the Lithuanian part) and data for 2016 from the Rural Support Service (for the Latvian part))

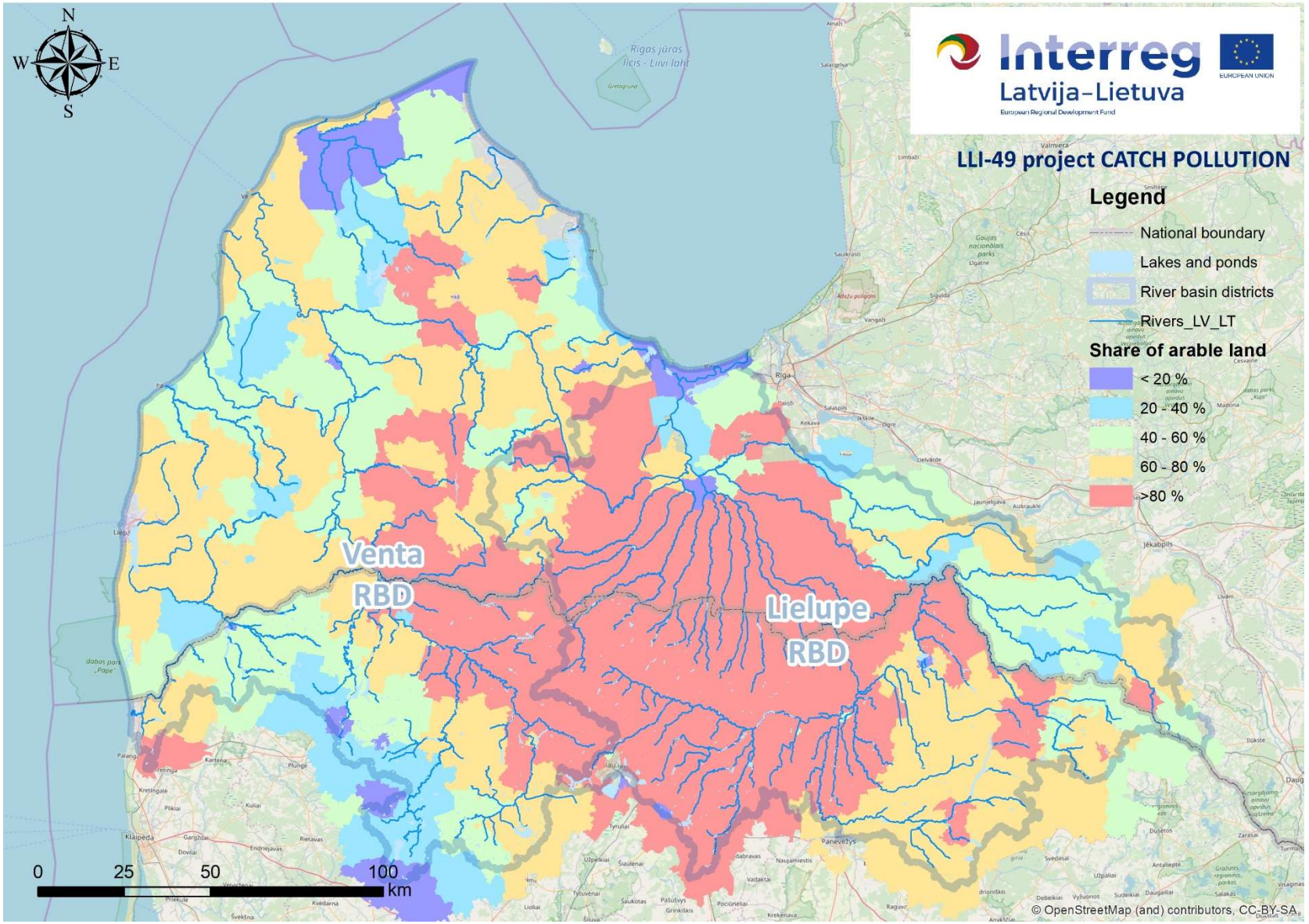


Figure 10. Percentage of arable land (of the total utilized agricultural land area) in Venta and Lielupe RBDs (data source: field declaration data for 2017 from the Center of Agricultural Information and Rural Business (for the Lithuanian part) and data for 2016 from the Rural Support Service (for the Latvian part))

Areas of meadows and pastures are mainly distributed in non-productive soils or even in dense relief areas where annual crop production cannot be expanded. In Latvia, permanent and/or temporary (sown) grasslands are more common in the municipalities with forest landscapes.

Data shows that in the territories with fertile soils perennial pastures and meadows make less than 5 % of the total utilised agricultural land area and in the most productive areas - even less than 3 %. In the Lielupe RBD, higher percentage of perennial pastures and meadows (20-30% of the total agricultural land) is grown in the eastern part of the RBD in both countries.

Venta RBD contains considerably higher percentage of perennial pastures and meadows than the Lielupė. In most of parishes of the Latvian part of the RBD perennial pastures make over 10% of the agricultural land and in some parishes in northern and western part of the RBD - 20-40% or even more. Similar percentage of perennial pastures and meadows (i.e. 20-40% of agricultural land) is also characteristic to the southern and western parts of the Venta RBD in Lithuania.

In all counties of the Lithuanian part of the Lielupe RBD temporal pastures and meadows (<5 years) cover less than 5% of the total agricultural land area. The situation is similar in southern and south-western part of the Latvian RBD where arable land dominates.

In the Venta RBD situation is better. Here the percentage of temporal pastures and meadows is higher. In the Bartuva sub-basin in Lithuania and in the middle part of the Venta RBD in Latvia temporal pastures and meadows cover 20-30% of the total agricultural land.

Data about agricultural land areas in Venta and Lielupė RBDs is summarised in *Table 2*.

Table 2. Agricultural land in Venta and Lielupė RBDs (data source: field declaration data for 2017 from the Center of Agricultural Information and Rural Business (for the Lithuanian part) and data for 2016 from the Rural Support Service (for the Latvian part))

RBD	Part of the RBD	Area, km²	Total area of utilized agricultural land, ha	Area of arable (crop) land, ha	Area of pastures and meadows (<5 years), ha	Area of perennial pastures and meadows, ha	Utilized agricultural land, % of the total land area	Arable (crop) land, % of the agricultural land area	Temporal pastures and meadows (<5 years), % of the agricultural land area	Perennial pastures and meadows, % of the agricultural land area
Lielupė	*Mūša sub-basin*	*5296*	*315541*	*268810*	*6786*	*34340*	*60*	*85*	*2*	*11*
	Lielupė small tributaries sub-basin	*1750*	*125538*	*118315*	*3060*	*4130*	*72*	*94*	*2*	*3*
	Nemunėlis sub-basin	*1900*	*91895*	*67775*	*2819*	*19430*	*48*	*74*	*3*	*21*
	Lielupe RBD (LT)	**8946**	**532974**	**454900**	**12665**	**57900**	**60**	**85**	**2**	**11**
	Lielupe RBD (LV)	**8843**	**338632[3]**	**270049**	**27536**	**41047**	**38**	**80**	**8**	**12**
Venta	*Venta basin*	*5137*	*252878*	*167350*	*23955*	*54040*	*49*	*66*	*9*	*21*
	Bartuva basin	*749*	*49035*	*24848*	*11005*	*11963*	*65*	*51*	*22*	*24*
	Šventoji basin	*390*	*16023*	*11275*	*2019*	*2700*	*41*	*70*	*13*	*17*
	Venta RBD (LT)	**6276**	**317936**	**203473**	**36980**	**68961**	**51**	**64**	**12**	**22**
	Venta RBD (LV)	**15630**	**393817[4]**	**265548**	**57511**	**70758**	**25**	**67**	**15**	**18**

[3] Based on the CSB data total area of agricultural land in 2016 was 381 141 ha but this data is not detailed and can not be used for calculation of agricultural structure; therefore data from rural support service is used.

[4] Based on the CSB data total area of agricultural land in 2016 was 429 030 ha.

Crop production

Crop structure

Soil fertility, natural conditions, and profits from agricultural production are usually the main factors influencing farmers' crop choices.

Crop structure analysis reveals that in the Lithuanian part of the Lielupe RBD winter crops take near 60 % of the total arable land area. The share of winter crops in the Venta RBD is less - about 50 %. There are substantial differences in the crop structure of individual river basins and these are mainly determined by the productivity of soils. In the most productive areas, in the sub-basin of the Lielupe small tributaries (Lielupe RBD), even 66% of the arable land is used for winter crops while the percentage of winter crops in less productive Bartuva and Šventoji river basins in Venta RBD is below 30%.

Winter wheat and winter rape are dominant winter crops in the Lithuanian part of the Lielupe RBD. These are cash crops ensuring good and constant income for farmers. The largest areas of winter wheat and winter rape are grown in the subabasins of the Lielupė small tributaries and Mūša (Joniškis, Pakruojis and Pasvalys districts). In this region very productive species requiring intensive cropping technologies are usually grown. The share of winter wheat and winter rape in the crop structure of the Venta RBD is smaller that in the Lielupė. The largest areas of winter wheat and winter rape are grown in the Venta river basin (Akmenė, Šiauliai, and Mažeikiai districts). Both in the Lielupė and Venta RBDs, in the areas with less fertile soils farmers invest in less productive crop species the intensity of growing technologies of which is proportional to the productivity of soil.

Litte demand on the local or international market determine little areas of other winter crops: winter rye, winter barley and winter triticale.

Summer crops dominate in the sub-basins with less productive soils. Except for the summer wheat and summer rape, growing technologies of summer crops are less intensive. In the Lithuanian part of the Lielupė RBD, the largest areas of summer crops are grown in the Nemunėlis basin (Biržai and Rokiškis districts).Variety of summer crops in the mentioned districts is large: farmers grow summer wheat, barley, oat, buckwheat, summer rape.

Summer wheat and summer barley are the most popular summer crops. Growing technologies of summer barley are not intensive. Due to constantly decreasing number of livestock, demand for the summer barley as forage decreases as well. In less productive soils abundant use of fertilizers and pesticides does not pay off, therefore growing technologies of summer wheat and summer barley are usually not intensive. In less productive soils good harvest of summer rape can be achieved when agrotechnical requirements are followed. Oats and buckwheat are grown in less productive soils and for this reason their growing technologies are not intensive as well.

Introduced greening requirements resulted in increased areas of legumes in the recent years. Legumes positivelly contribute to the achievement of environmental goals, reduce the demand for the application of mineral fertilizers. In the current crop structure, share of legumes is rather similar in all river basins and varies from 10 to 20 % (see *Figure 11 and Figure 12*).

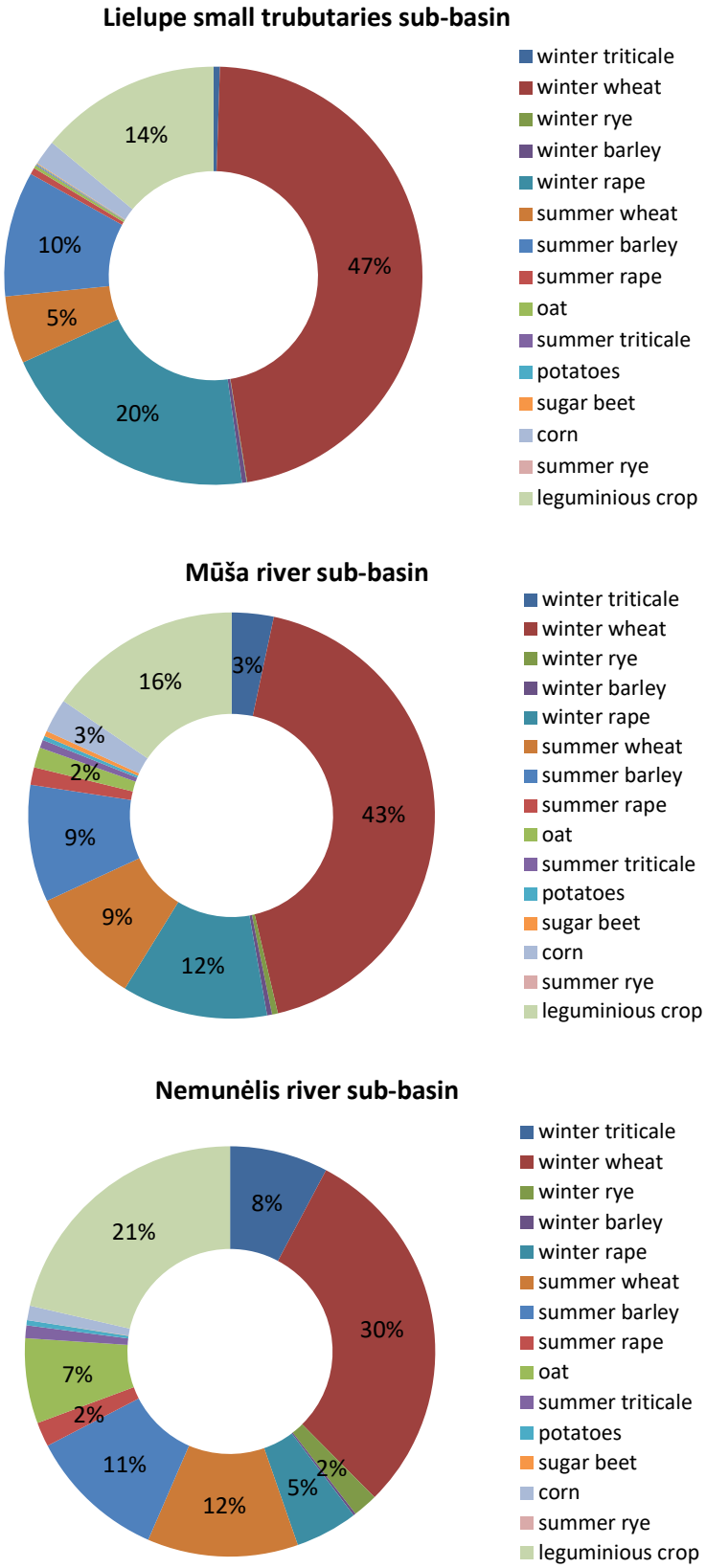


Figure 11. Crop structure in sub-basins of the Lielupė RBD in Lithuania (source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

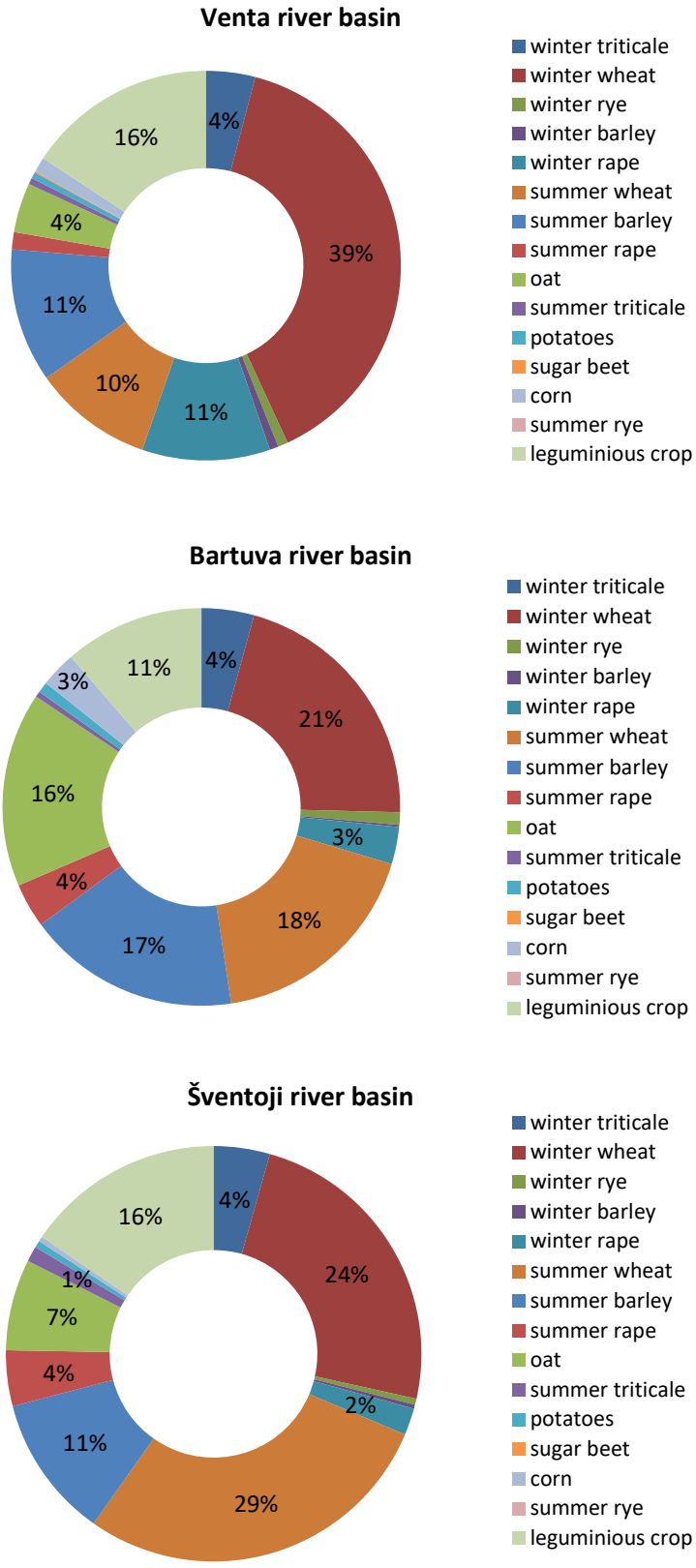


Figure 12. Crop structure in the sub-basins of Lielupė RBD (source: 2017 declaration data from the Center of Agricultural Information and Rural Business (LT))

In *Table 3* distribution of crops according the cultivation intensity in Lielupė and Venta RBDs in Lithuania is presented.

Table 3. Distribution of crops according cultivation intensity

Intensity of technology*	Crops	RBDs
Very intensive	Winter wheat, winter rape, spring wheat	Lielupė
Intensive	Winter triticale, winter rye, spring barley (malting), spring triticale, spring rape Winter rape, spring wheat	Lielupė, Venta Venta
Moderately intensive	Winter rye, oats, buckwheat, spring cereals for feed Pea, beans	Venta Lielupė, Venta
Extensive	Oats, spring barley for forage	Venta in livestock farms

*Note. *– classification according the intensity of land cultivation and use of fertilizers and pesticides*

IACS data shows that in the Latvian part of the Lielupe RBD winter crops take up to 69% of the arable land. Winter wheat dominates in the arable land of the Lielupe river basin, it was grown on 50% of the arable land in 2016 (*Figure 13*). Other important crops in the Lielupe river basin in Latvia are winter rape and summer wheat, with other crops taking up 25% of the arable land. As to the Lielupe river basin, the most common model from 2013-2016 cropping system is based on winter wheat, spring wheat and winter rape. Legumes occupied 6% of the arable land in 2016. Their areas have increased significantly since 2015 due to greening conditions.

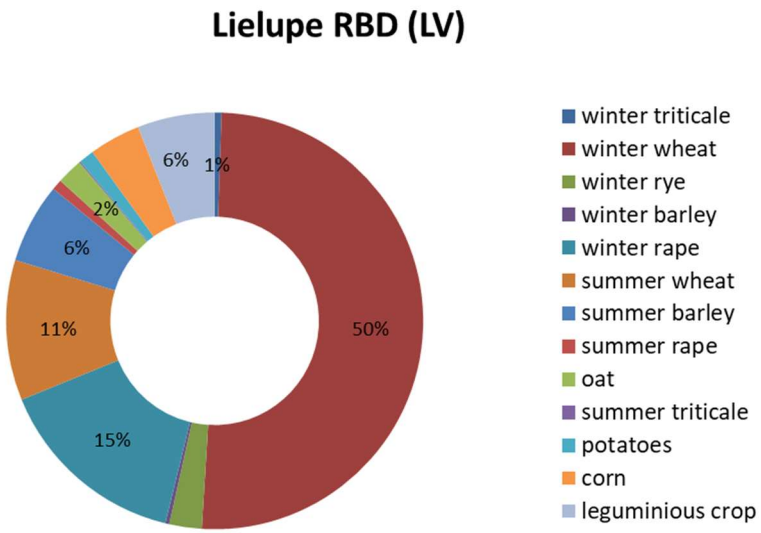


Figure 13. Crop structure in the Lielupe river basin in Latvia (source: author's calculation according to the RSS data 2016)

Winter crops covered 60% of the arable land in the Latvian part of the Venta river basin in 2016. Winter wheat takes the largest area of arable land in the Venta river basin - 43% (*Figure 14*). Other important crops in the Venta basin include winter rape (12%), summer wheat (16%) and summer barley (12%). The area of other crops comprises only 17% of the arable land area. Legumes took 4% of the arable land in 2016.

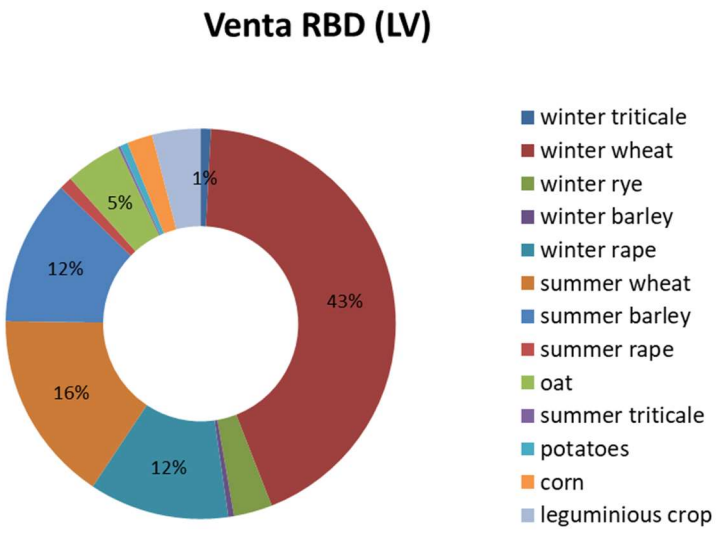


Figure 14. Crop structure in the Latvian part of Venta river basin (source: author's calculation according to the RSS data 2016)

Crop rotations

Leguminious crops are the main soil improving crops in the Lielupė RBD in both countries. In the Venta RBD, the role of soil improvement is played by both leguminious crops and perennial grasses. Soil improving crops are usually used as pre- crops for catch crops such as winter wheat and, partly, rape. Other crops (especially summer crops) are usually cultivated in less favourable conditions. The ratio between winter and summer crops depend on the intensity of farming and is very individual for each administrative district. The recent increase in legume areas has been determined by the changes in the scheme of direct payments and introduced greening requirements. After legumes winter wheat is usually grown. Large share of the winter wheat in the current crop structure (up to 47%) means that it is sown continuously. In the soils of lower productivity, which are not favourable for cultivation of the winter wheat, summer wheat is grown after leguminuous crops. Crop structure data reveals that in the farms of intensive crop production crop rotation consists of 3 fields: one field of leguminous crop, rape and other crops, and two fields of winter wheat and other cereals. At the end of the rotation, leguminous crops are replaced by rape and vice versa. When the share of leguminous crops and rape is larger, rotation is composed of 4 fields: rape is cultivated as a second or third crop in a sequence after cereals (usually winter wheat). In some farms winter rape is also grown after early harvest legumes (e.g. peas). When the share of leguminous crops and rape in the crop structure is small, continuous growing of cereals can not be avoided.

The most common crop rotation in the intensive farm in Lithuania is as follows:

1. Leguminous crops /rape/ other crops
2. Winter wheat
3. Winter wheat and other winter cereals/ summer cereals

The most common crop rotation sequence in the Lielupe RBD in Latvia is 3 years of winter wheat and rape in fourth year. Unlike Lithuania, there is no sugar beet in crop structure of farms in Latvia. Leguminious crops have entered Latvia thanks to *greening* conditions, but their share is still relatively low and significantly lower than in Lithuania.

The share of cereals in the crop structure of the Venta RBD is smaller than in the Lielupe RBD while the share of perrenial grasses is larger. Crop production intensity in the Venta RBD is considerbly lower too. In Lithuania, more intensive crop production is only characteristic to Akmenė, Šiauliai ir Mažeikiai districts. In Kelmė, Kretinga, Plungė, Skuodas, Telšiai districts where summer crops, perennial grasses and pastures dominate crop production intensity is low.

Perrenial grasses give a good rest for the soil, does not require intensive fertilization, and is good pre-crop for many agricultural crops. However ploughing of perennial grasses can increase mineralisation of soil organic matter and leaching of mobile nutrients. Depending on the intensity of farming, few types of crop rotations can be applied. The rotation commonly applied in livestock (or mixed farms) is as follows:

1. Perennial grasses (up to 5 years)
2. Summer cereals/ winter cereals (wheat, triticale)
3. Leguminuous crops/ rape/ other crops
4. Summer cereals/ winter cereals

It has to be noted that cereal – rape farms are attractive to young farmers because of subsidies, low investments and low labour demand.

Farmers do not have crop rotation plans as they are not obliged to by the EU regulation. Short rotations allow farmers to react faster in the hardly perdictible marked. Often the ratio between summer and winter crops is detremined by the autumn and winter period weather conditions. Current greening requirements for crop rotations in small farms (< 10 ha) claim for at least two crops to be grown in the rotation. In a result, crop rotations in the Lielupe RBD are composed of several cereals and in the Venta RBD – of cereals and greens.

Considering information about the crop structure and crop yields, it can be suggested that the intensity of nutrient leaching can be highly determined by the following technological aspects:

1) ploughing of grassland, pastures (up to 5 year) and perennial grasslands (relevant in the Venta RBD);
2) application of intensive cultivation technologies (relevant in the Lielupė RBD);
3) maintaining of arable land without catch crop / cultivation of spring crops (relevant in the Venta and in the Lielupė RBDs).

Crop yields and crop production

Average yields of the main crops in the basins and sub-basins of the Lithuanian part of Venta and Lielupe RBDs, as estimated from the statistical data of the Lithuanian Department of Statistics are presented in *Figure 15*.

Statistical data demonstrates that there is a big variation in typical yields in river basins of Venta and Lielupė RBDs in Lithuania. Crop productivity mainly depends on soil fertility and intensity of agricultural technologies, hence the highest yields are obtained in the sub-basins of the Lielupe small tributaries and the Mūša river having the most favourable conditions for crop production. The largest yields are obtained from the fields of winter cereals. In the period of 2014-2018, an average yield of winter cereals in the sub-basin of the Lielupė small tributaries was 5.4 t/ha. For comparison, in the basins of Nemunelis, Šventoji and Bartuva yields of winter cereals were about 30 % lower (3.7 t/ha).

Yields of summer cereals are on average by 20 % lower than those of winter cereals. Spring cereals are mainly cultivated in soils with low fertility, thus, farmers pay less attention to their agro technologies (pre- crops, fertilizers and pesticides). Average summer crop yields in the period of 2014 - 2018 varied from 4.2 t/ha in the most productive sub-basin of the Lielupe small tributaries to 2.7 – 2.9 t/ha in the basins with lower productivity (Nemunėlis, Šventoji, Bartuva). Depending on the geomorphological properties of river basins, yields of rape and leguminous crops varied from 3 – 3,3 t/ha in the most fertile regions to 2- 2,2 t/ha in less productive areas.

If to analyze yield trends over the period of last 5 years, it can be seen that yields of winter cereals have been gradually increasing, while the yields of summer cereals, rape and leguminous crops demonstrated a decreasing trend. The increase in winter cereal yields in the Lielupė RBD was more pronounced than in the Venta RBD and that, most probably, indicates improvement of agro-technologies and intensification of crop production activities in the Lielupė RBD. The decrease in the productivity of spring rapeseed in many municipalities (especially in the Lielupė RBD) could be attributed to the outbreaks of pests and diseases when intensive rapeseed cultivation has started. Stable or even decreasing yields of leguminuos crops can be explained by the fact that technologies (e.g. for cultivation of beans) are still not properly developed.

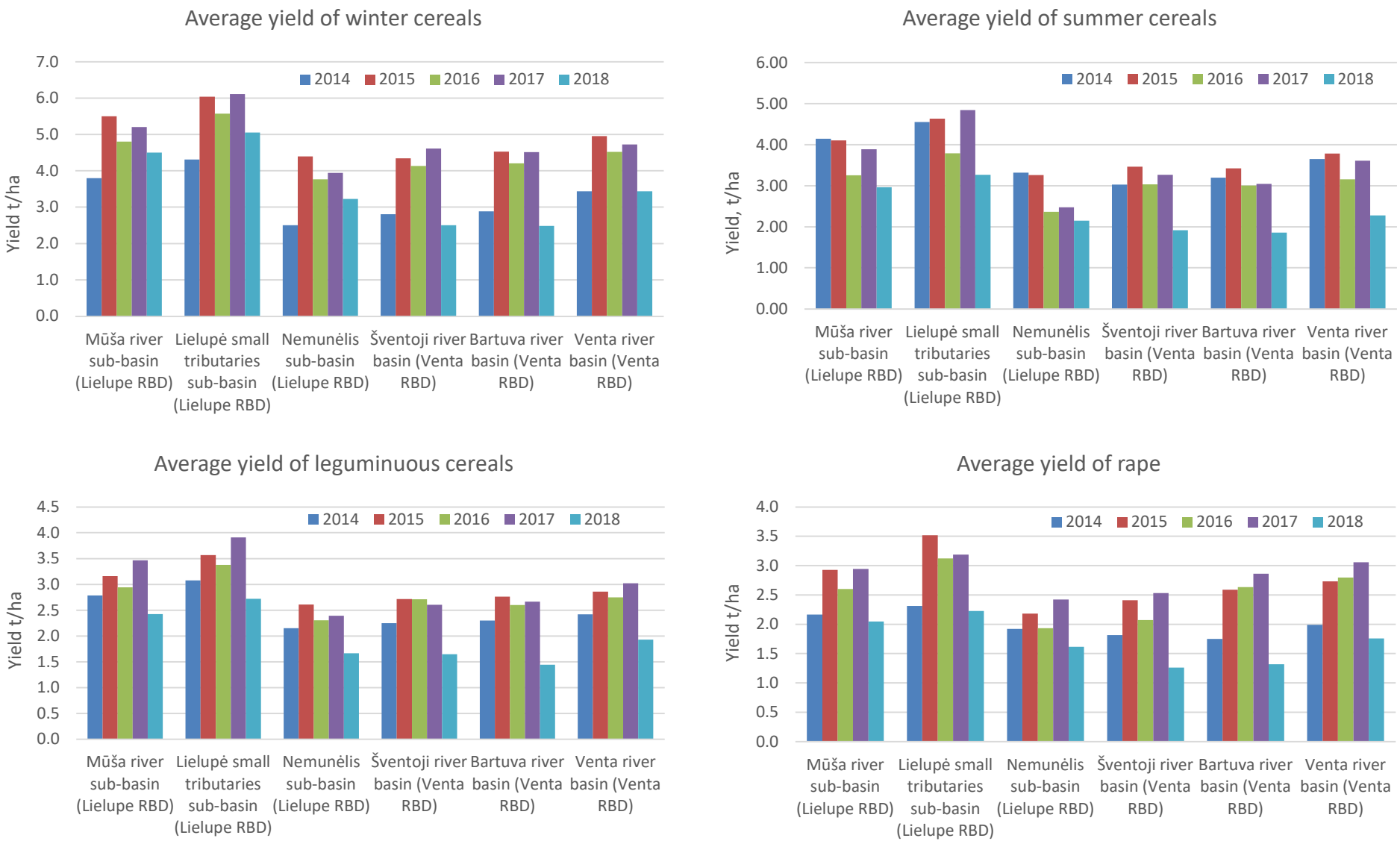


Figure 15. Yields of the main crops in the Lithuanian part of Venta and Lielupe RBDs, (data source: estimated from the data of the Lithuanian Department of Statistics)

Production volumes

Total crop production in basins and sub-basins of Venta and Lielupe RBDs in Lithuania is provided in *Table 4* and *Figure 16*.

It can be seen that with the exception of 2014, production of winter cereals is considerbly larger than production of summer cereals in both Venta and Lielupe RBDs. This is because of much larger areas sown with winter cereals and higher their yields in comparison with summer crops. Data shows that in the period of 2014 – 2018 production of winter cereals and leguminous crops was gradually increasing, while the production of summer cereals decreased. Production of rape remained nearly at the same level.

Largest amounts of winter grain on the Lithuanian side (more than 200 thou. t) are harvested in Joniškis, Pasvalys, Pakruojis and Šiauliai districts, all in the Lielupe RBD.

Production of spring cereals in the period of 2014 – 2018 has decreased nearly twice in both Venta and Lielupe RBDs. The largest producers of summer cereals are Panevėžys, Joniškis, Pakruojis and Radviliškis municipalities in the Lielupe RBD.

Winter cereal, legume and rape production in the Lielupe RBD makes about 30% of all Lithuanian production of the mentioned crops.

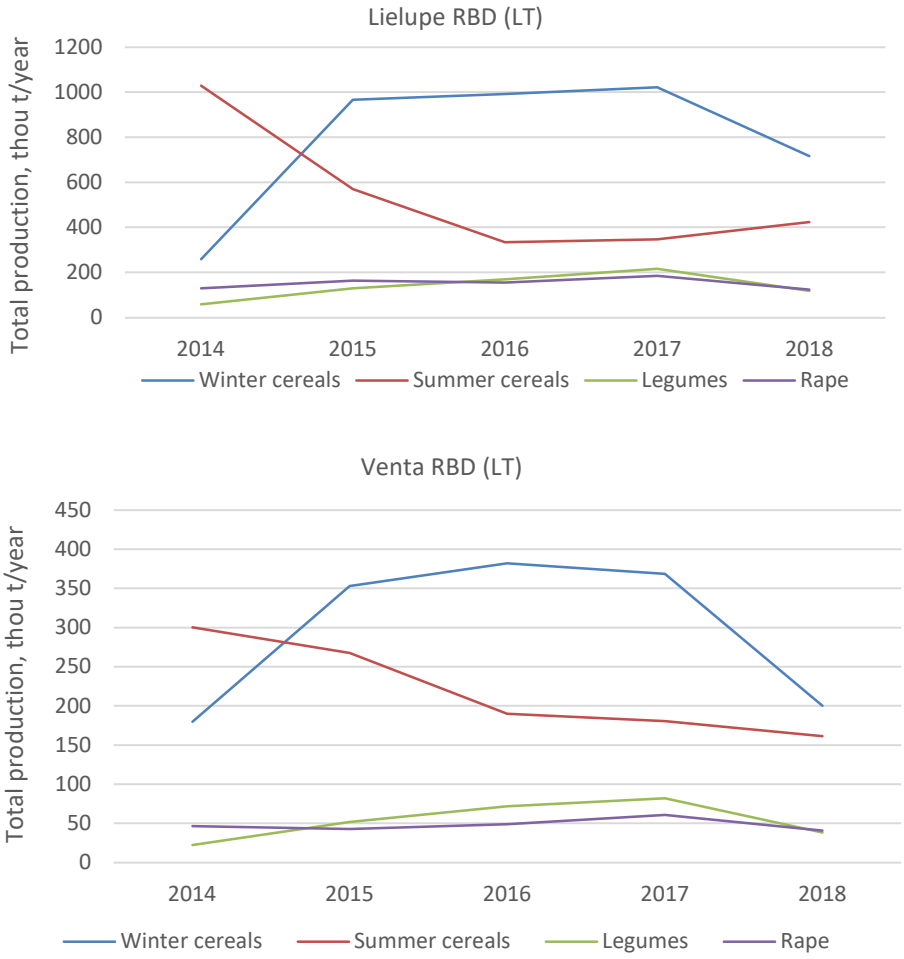


Figure 16. Crop production in the Lielupe and Venta RBDs in Lithuania

Table 4. Crop production in basins and sub-basins of Venta and Lielupe RBDs (data source: estimated from the data of Lithuanian Department of Statistics)

River basin/ sub-basin	Winter cereals, thou t/year					Summer cereals, thou t/year				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Mūša river sub-basin	162	576	586	599	389	584	333	192	201	259
Lielupė small tributaries sub-basin	88	303	312	331	277	303	133	86	94	89
Nemunėlis sub-basin	10	87	94	93	50	141	104	57	52	75
Lielupė RBD (LT part)	***260***	***966***	***991***	***1023***	***715***	***1029***	***570***	***335***	***347***	***423***
Šventoji river basin	3	10	13	16	5	21	23	16	17	13
Bartuva river basin	7	13	17	18	7	34	37	28	30	23
Venta river basin	169	330	351	334	188	245	208	145	133	126
Venta RBD (LT part)	***180***	***353***	***382***	***368***	***200***	***300***	***268***	***190***	***181***	***161***

River basin/ sub-basin	Rape, thou t/year					Leguminuos crops, thou t/year				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Mūša river sub-basin	80	87	86	100	70	29	72	95	124	69
Lielupė small tributaries sub-basin	37	69	62	76	46	13	35	46	64	32
Nemunėlis sub-basin	12	7	7	10	8	17	22	28	28	17
Lielupė RBD (LT part)	**130**	**164**	**155**	**186**	**124**	**59**	**129**	**169**	**216**	**118**
Šventoji river basin	1	1	1	2	1	2	4	5	5	2
Bartuva river basin	1	1	2	2	2	3	4	6	5	3
Venta river basin	45	41	47	57	38	18	44	61	72	33
Venta RBD (LT part)	**47**	**43**	**49**	**61**	**41**	**23**	**52**	**72**	**82**	**38**

Crop productivity trends in the Latvian part of Venta and Lielupe RBDs are very similar to Lithuanian. Because of geographical properties and better soil fertility, farms in the Lielupe RBD harvest larger amounts of all main crops (*Table 5*). Yields in the Lielupe RBD are also higher.

Table 5. Sown area and yield of the main crops in farms of Zemgale and Kurzeme regions, 2017 (data source: CSB)

RBD	Sown area, thsd ha			Production, thsd t		
	Cereals	Potatoes	Vegetables	Cereals	Potatoes	Vegetables
Zemgale (Lielupe RBD)	196.6	7.0	4.3	979.4	152.4	84.1
Kurzeme (Venta RBD)	165.3	2.9	0.5	705.9	53.5	9.9

Yield of crops depend on agro-climatic conditions and the region, e.g. yield of cereals from the fields in the Lielupe RBD during the last 5 years varied from 4.1 to 5.3 t ha^{-1}, while in the Venta RBD – from 3.3 to 4.5 t ha^{-1} (*Figure 17*).

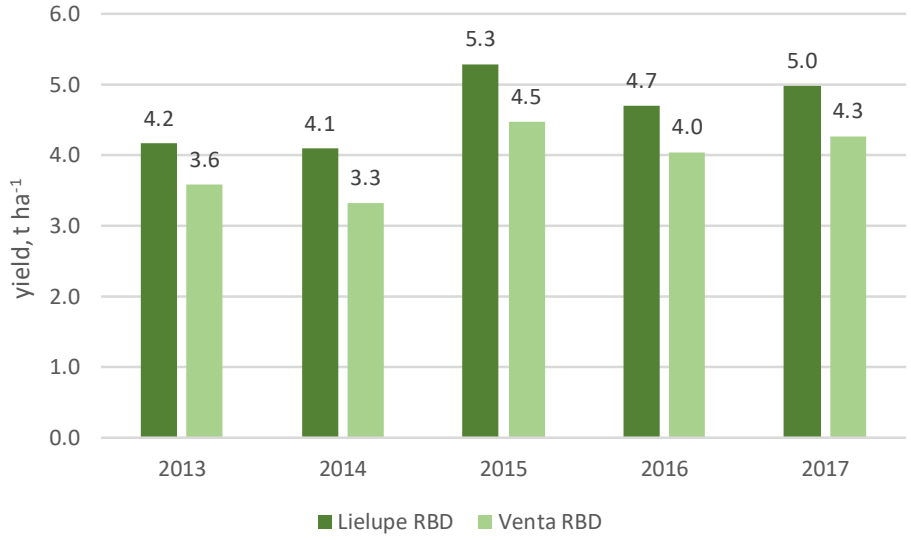


Figure 17. Dynamics of average cereal yield in the Lielupe and Venta[5] RBDs in 2013–2017 (data source: CSB)

Crop management practices, application of fertilizers

Biological properties of crops, potential yields, and production competitiveness on the market determine intensity of agrotechnologies. Consumption of mineral and organic fertilizers is one of the main factors increasing the yield of crops but at the same time it negatively affects the environment.

In Lithuania, farmers cultivating more than 10 ha of agricultural land, together with the field declaration, have an obligation to provide the data about mineral and organic fertilisers used in their farms. This, however, still has very little value in the assessment of real consumption of nutrients in crop production, because farmers declare absolute amounts of mineral fertilizers instead of providing the data on active ingredients. Thus, without information on the composition of used fertilisers, reliable assessment of how much nitrogen or phosphorus are applied is not possible. Real consumption of organic fertilisers is also unknown. There is a tendency that crop production farms buy manure from big livestock farms. Additionally, there are companies that import and sell organic fertilizers on the local market. In the recent years, companies producing energy from renewable resources were established where in the production process valuable biological fertilizers instead of waste are produced. These fertilizers are also not accounted for. In Lithuania, the use of manure is

[5] *Data for Zemgale and Kurzeme accordingly*

regulated, therefore farms that apply manure on more than 30 ha, have an obligation to prepare fertilisation plan.

On the Lithuanian side, the largest amounts of fertilizers are used on the most productive lands in the Lielupe RBD. The largest amounts of mineral fertilizers were declared in counties where large areas of intensively cultivated crops are grown. Farms in the counties with less productive lands declare much smaller amounts of fertilizers. Due to restrictions for application of fertilizers and relatively big number of organic farms, fertilizer use in the karst region is little as well. Application of mineral fertilizers, pesticides and other plant protection products is especially important for large, profit-oriented farms. Small farms often cannot afford mineral fertilizers at all.

Interviews with farmers reveal that striving for larger yields they continually increase rates of mineral fertilizers that consequently often exceed the crop demand. Nitrogen fertilizers are relatively cheap if to compare with the profit which can potentially be earned from the crop production. Application of mineral P and K fertilizers is rather limited, they are mainly used by large farms or companies. Farms (especially small) are not interested in performing soil agrochemical analyses and considering thereof results when planning fertilization. Farms that own less than 50 ha of land, which are not the main source of income for the farmer, usually use only mineral fertilizers (200-300 kg/ha). Family farms owing more than 100 ha of land usually use 200 kg/ha of complex (NPK and PK) fertilizers and 400-500 kg/ha of nitrogen fertilizers. Those farms are focusing on long term vitality of the farm and protection of soil productivity. Largest amounts of fertilisers are used in large farms and companies – 800 – 900 kg/ha (of that 600 kg/ha of nitrogen fertilizers). These farms have better potential to create a higher value-added by attracting external financial support, better management of such financial resources and increasing labour efficiency. In the areas which are less favourable for crop production, intensive farms usually owned by young and active farmers, use 100 – 200 kg/ha of complex fertilizers (NPK or PK) and 300 kg/ha of nitrogen fertilizers. Older farmers use little mineral fertilizers.

Short term contracts for the rent of land explain unresponisble behaviour of farmers and unsustainable use of mineral fertilizers.

From the environmental perspective, not only amounts of applied fertlizers are important but also their application (spreading, incorporation) and land management technologies which also affect losses of nutrients and soil erosion. No – till technology is often used for sowing of winter crops after rape and leguminuous crops. In this respect, situation is better in larger farms. Catch crops are usually grown in organic or advanced family farms.

Table 6. Counties in the Lithuanian part of Venta and Lielupe RBDs with the most intensive use of fertilizers

Fertilizers	RBD	Municipalities
Organic	Lielupe	Biržai Joniškis
	Venta	Kretinga
Mineral	Lielupe	Joniškis Pakruojis Pasvalys Šiauliai Panevėžys Rokiškis Radviliškis
	Venta	Akmenė Kretinga Šiauliai

In Latvia, depending on their possibilities, farmers use both mineral fertilizers and manure. Detailed data for the regions is not available, but in total 133.5 thou t of mineral fertilizers were used in Latvia in 2017. Industrially produced fertilizers used on agricultural crops for basic and additional fertilizing are expressed as 100% of nutrients

being in the form of easily deliquescent minerals. Use of mineral fertilizers per one hectare of sown area has increased as well – from 84 kg in 2010 to 110 kg in 2017, or by about 30% (*Figure 18*).

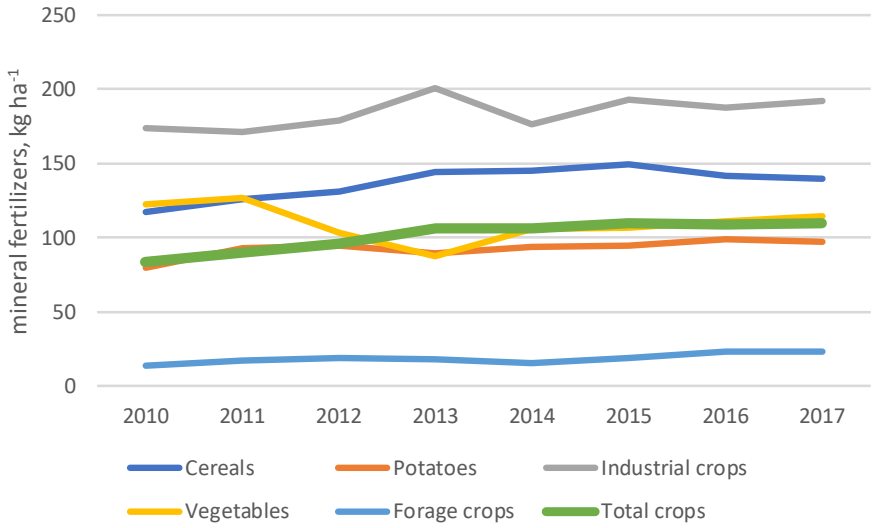


Figure 18. Use of mineral fertilizers (as 100% of nutrients) on agricultural crops per sown area in Latvia (source: CSB of Latvia)

Use of mineral fertilizers per one hectare of cereals has risen from 117 kg in 2010 to 140 kg in 2017, or by 19.7%. The volume of mineral fertilizers used per one hectare of industrial crops was 192 kg in 2017 and it has grown by 10.3%, compared to 2010. The use of mineral fertilizers per one hectare of potatoes has grown by 21.2%, while on open field vegetables it has slightly decreased. Mineral fertilizers were applied on about 60% of total sown area in Latvia.

There is a requirement that fertilization plan should be at the disposal of every farm in the Nitrates vulnerable areas, which take most part of the Lielupe RBD and a small part of the Venta RBD. Likewise, in Latvia fertilization plan and crop protection plan is required from farms applying for support from Rural Development Programme (RDP) 2014-2020 towards purchasing of technologies and machinery with the aim to reduce GHG and ammonia emissions. Fertilization plan is a “production tool” that plans the desired yield level and, accordingly, a fertilization program to achieve this yield level. Fertilization plans have been mandatory since 2004 for most of the Lielupe river basin farms. At the moment, fertilization planning should start becoming accustomed to farms throughout Latvia in terms of integrated cropping requirements.

In Latvia, same as in other countries, manure use should be enhanced, but the basis for its use both in practical farming and in regulation is not harmonized. Policymakers, authorities, farmers and advisory services lack a tool to improve manure use. There is a pressing necessity for guidelines for determining manure quantity and quality (i.e. manure standards).

Livestock production

Based on the farmers‘ livestock declaration data, there were approx. 80 thou livestock units (LU) in the Lithuanian part of the Lielupe RBD in 2018. This cooresponds to an average livestock density of 0.15 LU per hectare of agricultural land (*Table 7*). If to compare with 2014, livestock number in the Lithuanian part of the Lielupe RBD has decreased by 9 %. In Latvia, a decreasing trend in livestock numbers is observed as well, however the total livestock number and livestock denisty in the Latvian part of the Lielupe RBD remains

considerably higher than in Lithuanian. Based on the farmers' declaration data, there were approx. 100 thou LU in the Latvian part of the Lielupe RBD in 2016 what corresponds to 0.26 LU/ha (*Table 9*). Since 2013, livestock number in the Latvian part of the Lielupe RBD has decreased by almost 8%.

Livestock density in the Latvian part of the Venta RBD equals to approx. 0.25 LU/ha and is rather similar to that in the Lielupe RBD. Since 2013, livestock numbers in the Latvian part of the Venta RBD even slightly increased and amounted to 108 thou in 2016 (*Table 8*). In the Lithuanian part of the Venta RBD livestock numbers are still decreasing. In comparison to 2014, the decrease is 8 % but the livestock density still remains close to that in the Latvian part – 0.24 LU/ha (*Table 7*).

Table 7. Livestock unit numbers and density in Venta and Lielupė RBDs (data source: livestock declaration data for 2018 from the Center of Agricultural Information and Rural Business (LT))

River basin/sub-basin	Number of livestock units (LU)		LU density in agricultural land, AU/ha	
	2018	2014	2018	2014
Mūša river sub-basin	51787.6	56787.9	0.16	0.18
Lielupė small tributaries sub-basin	15590.3	15751.9	0.12	0.13
Nemunėlis sub-basin	13385.2	15903.4	0.15	0.17
Lielupė RBD (LT part)	**80 763.1**	**88 443.2**	**0.15**	**0.17**
Venta river basin	56486.2	61708.9	0.22	0.24
Bartuva river basin	15585.7	16801.2	0.32	0.34
Šventoji river basin	4369.9	4808.4	0.27	0.3
Venta RBD (LT part)	**76 441.7**	**83 318.5**	**0.24**	**0.26**

Table 8. Livestock unit numbers and density in Lielupe and Venta RBDs in Latvia (data source: CSB of Latvia, Farm Structure Survey)

River basin/sub-basin	Number of livestock units (LU)		LU density in agricultural land, LU/ha	
	2016	2013	2016	2013
Lielupe RBD (LV part)	100 913	109 085	0.26	0.29
Venta RBS (LV part)	108 256	104 267	0.25	0.25

Farm structure

Farm types

Farm type analysis reveals that currently more than half of farms in the Lithuanian part of the Lielupe RBD (approx. 55%) work exeptionally in the crop production and have about 58 % of all utilised agricultural land at their disposal (see *Table 9*). Crop production farms make the largest share in the Lielupe small tributaries sub-basin were 65 % all agricultural land is cultivated by farms specializing only in crop production. This farming pattern is not favourable to the environment because crop production farms are fully dependent of mineral fertilizers the intensive use of which negatively effects soil quality and enhance leaching of nutrients into water bodies.

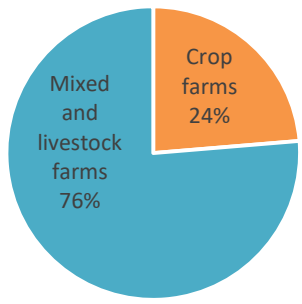
In the Lithuanian part of the Venta RBD farm structure with a larger share of mixed and livestock farms is more friendly to environment. Here crop production farms cultivate 40 % of all agricultural land and the remaining part is cultivated by mixed and livestock farms which can combine fertization with organic and mineral fertlizers and ensure more sustainable farming practices.

Table 9. Distribution of crop production and mixed/livestock farms in Venta and Lielupė RBDs in Lithuania (data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

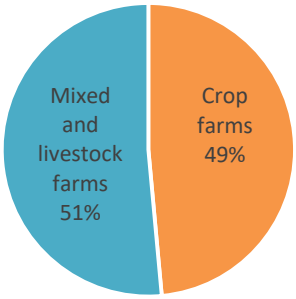
River basin/sub-basin	Crop production farms*		Livestock and mixed farms**	
	No	Area, ha	No	Area, ha
Bartuva	1091	11618	1524	37416,5
Šventoji	581	7778,41	417	8244
Venta	5138	107802	5852	145075
Total Venta RBD (LT)	**6810**	**127198,4**	**7793**	**190735,5**
Lielupė small tributaries	1520	81164	1079	44374
Mūša	4810	173987	4389	141554
Nemunėlis	2026	53218	1509	38677
Total Lielupe RBD (LT)	**8356**	**308369**	**6977**	**224605**

** farms which declared only crop fields*

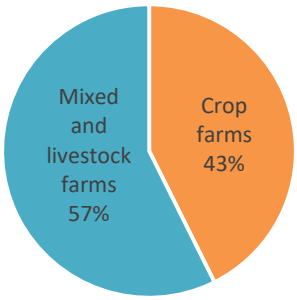
*** farms which declared crops and livestock*



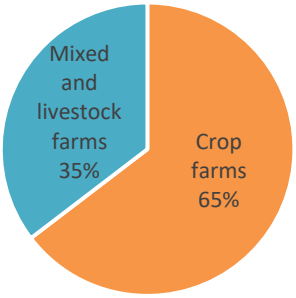
Bartuva river basin



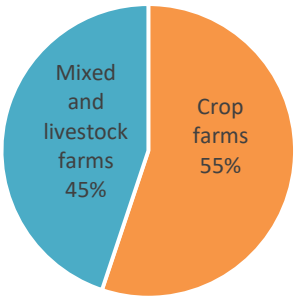
Šventoji river basin



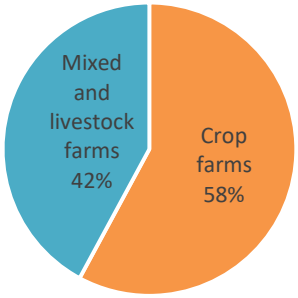
Venta river basin



Sub-basin of the Lielupe small tributaries



Mūša river sub-basin



Nemunėlis river sub-basin

Figure 19. The share of utilised agricultural land cultivated by crop production, mixed and livestock farms in river basins of the Venta and Lielupe RBDs in Lithuania (data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

In Latvia, field crop farms are also dominating in the farm structure of both Venta and Lielupe RBDs, representing 46% and 48% of the farm structure respectively (*Figure 20*). The second most important farming type is mixed cropping and livestock farms (14%), with the same share in both basins. Farms which are specialized in dairy farming have a 9% share in the Lielupe RBD and 12% share in the Venta RBD. Comparing the structure of existing farms with the situation in 2013, it can be concluded that the total number of farms continues to decrease.

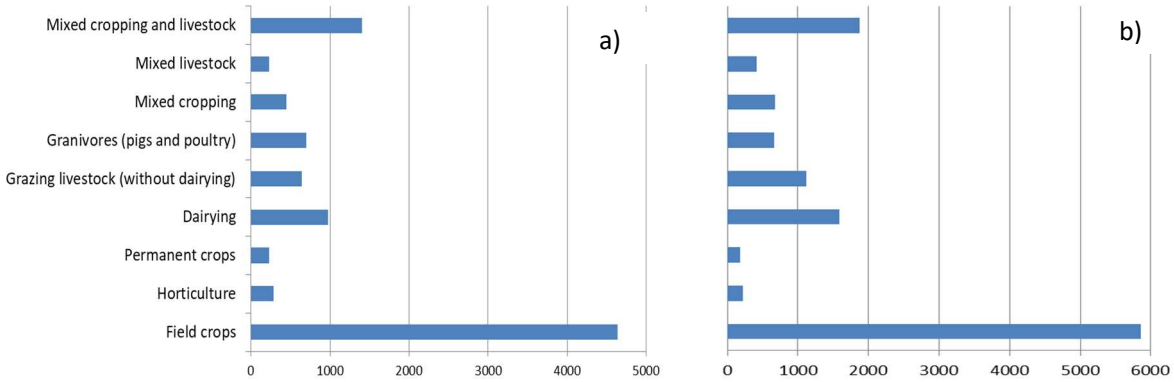


Figure 20. a) Farm structure and number of farms in breakdown by specialization in the Lielupe RBD; b) Farm structure and number of farms in breakdown by specialization in the Venta RBD (source: author's calculation according to the FSS 2016).

Viewing the farm specialization at municipality level, it is clear that in the Lielupe RBD majority of farms cultivate field crops as the main line of farming. Conversely, in the Venta river basin there are more farms with livestock and mixed farming as the main line of farming. There are sharp differences across municipalities.

Farm size

The major part of all farms in the Venta and Lielupe RBDs are small farms having less than 10 ha of agricultural land.

In the Lithuanian part of the Venta and Lielupe RBDs about 60 % of all farms are smaller than 10 ha. However, despite of the large number of such farms, only a small part of all agricultural land is under disposal of these (*see Table 10, Table 11, Figure 21, Figure 22*). In the Lielupe RBD, only 6% of all agricultural and 4% of arable land is cultivated by small farms of less than 10 ha. In the Venta RBD the percentage of area cultivated by the smallest farms is a little larger – 11% of all agricultural land and 7 % of the arable land. The largest share of agricultural land (60% in the Lielupe RBD and 40% in the Venta RBD) is owned by the farms larger than 150 ha though the number of such farms is relatively small (7% of all farm number in the Lielupe RBD and 4% - in the Venta RBD). The largest concentration of large farms is in Biržai and Joniškis municipalities in the Lielupe RBD. In each county of the Lielupe RBD there are at least 2-3 farms larger than 500 ha. In counties with fertile soils there can be 5 or more farms larger than 500 ha. Average farm size in the Lithuanian part of Lielupe RBD is about 35 ha and in the Venta RBD – 22 ha.

Big number of agricultural companies and large farms in the Lithuanian part of the Lielupe RBD are fully equipped with modern machinery, achieve high productivity and working efficiency. They constantly improve their results, generate good income, implement innovations, and invest in purchasing a new land. Well developed infrastructure of those farms reduces dependency on weather conditions and production buyers. However, large and modern farms are more specialised in growing only few crops, use more fertilisers and pesticides. Smaller crop farms (<20 ha) have limited resources, purchase used machinery and have little possibilities to increase their production (e.g. by purchasing more land). Small farms are not attractive to young people, because they can not satisfy the needs and expectetions of young families.

Table 10. Number of farms in different size groups (data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

River basin/sub-basin	Total no of farms	Number of farms in a size group							
		< 10 ha	10-20 ha	20-30 ha	30-40 ha	40-50 ha	50-100 ha	100-150 ha	>150 ha
Mūša	9199	5516	1124	451	253	233	648	319	655
Lielupė small tributaries	2599	1419	308	116	79	81	239	114	243
Nemunėlis	3571	2055	491	202	123	91	274	101	234
Total Lielupė RBD (LT)	**15369**	**8990**	**1923**	**769**	**455**	**405**	**1161**	**534**	**1132**
Venta	10990	6657	1788	672	367	260	634	239	373
Bartuva	2615	1444	463	225	113	72	159	52	87
Šventoji	998	640	110	56	25	18	52	31	66
Total Venta RBD (LT)	**14603**	**8741**	**2361**	**953**	**505**	**350**	**845**	**322**	**526**

Table 11. Area of agricultural land in farms of different size groups (data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

River basin/sub-basin	Total area of agricultural land	Area of agricultural land in farms in the size group							
		< 10 ha	10-20 ha	20-30 ha	30-40 ha	40-50 ha	50-100 ha	100-150 ha	>150 ha
Mūša	315541	20323	14154	9497	7116	8719	36101	28825	190806
Lielupė small tributaries	125538	5127	3892	2514	2498	2878	14250	11275	83104
Nemunėlis	91895	8045	5932	4065	3461	3186	14421	8490	44295
Total Lielupė RBD (LT)	**532974**	**33495**	**23978**	**16076**	**13075**	**14783**	**64772**	**48590**	**318205**
Venta	252878	26767	23148	14534	11022	9770	37442	24673	105522
Bartuva	49035	6201	5920	4642	3220	2517	7747	4766	14022
Šventoji	16023	2200	1274	842	489	271	1800	1957	7190
Total Venta RBD (LT)	**317936**	**35168**	**30342**	**20018**	**14731**	**12558**	**46989**	**31396**	**126734**

Table 12. Area of arable land in farms of different size groups (data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

River basin/sub-basin	Total area of arable land	Area of arable land in farms in the size group							
		< 10 ha	10-20 ha	20-30 ha	30-40 ha	40-50 ha	50-100 ha	100-150 ha	>150 ha
Mūša	268810	10553	8843	6392	5230	6535	29636	25393	176228
Lielupė small tributaries	118315	3767	3169	2252	2204	2677	13634	11044	79568
Nemunėlis	67775	2364	2852	2204	2004	2191	10418	6891	38851
Total Lielupė RBD (LT)	**454900**	**16684**	**14864**	**10848**	**9438**	**11403**	**53688**	**43328**	**294647**
Venta	167349	11074	9692	6683	5176	5167	22017	17813	89727
Bartuva	24849	2324	2405	2039	1349	1154	3688	2211	9679
Šventoji	11275	1032	709	476	330	142	1062	1257	6267
Total Venta RBD (LT)	**203473**	**14430**	**12806**	**9198**	**6855**	**6463**	**26767**	**21281**	**105673**

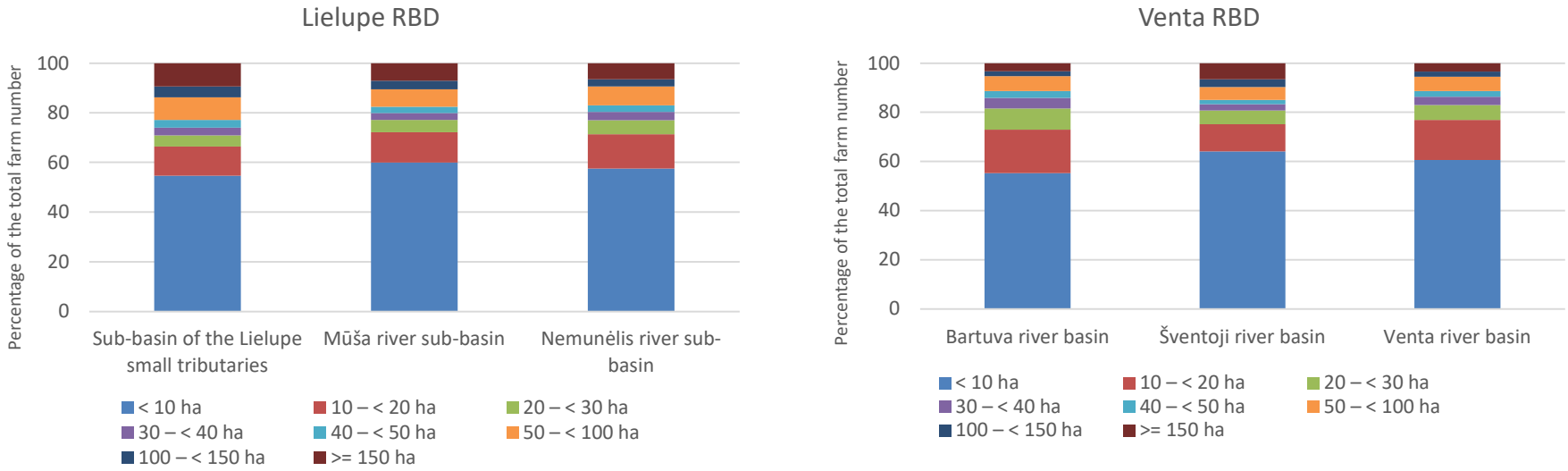


Figure 21. ***Distribution of the farm number in farms sizes groups*** *(data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)*

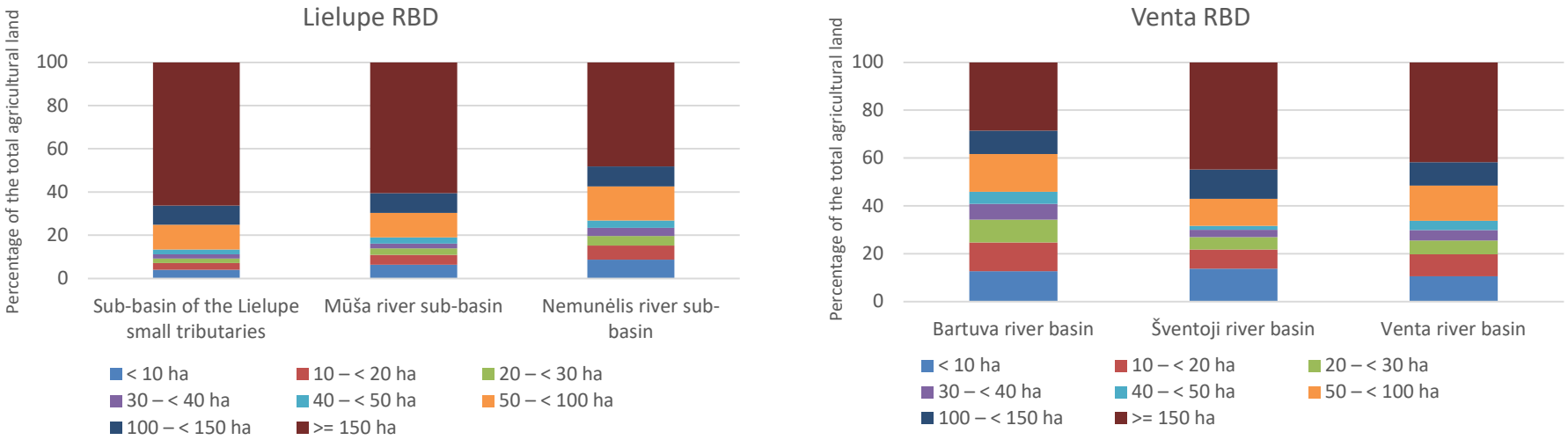


Figure 22. Percentage of the agricultural land at the disposal of farms of different size groups (data source: 2017 declaration data from the Center of Agricultural Information and Rural Business)

For Latvia, the analysis of farm groups by managed area shows significant differences. At least half of all agricultural land is managed by farms which have more than 250 ha per farm (*Figure 23*). However, in terms of number of holdings, 80% of all farms are smaller than 30 ha having only 12% of the agricultural land under management in the Lielupe RBD and 17% in the Venta RBD. It should be noted that the percentage of grasslands is higher in smaller farms. Thus, in order to reduce the potential pollution from agriculture most effectively, it is necessary to achieve involvement of the largest farms in catch crop cultivation. E.g. involvement of farms with over 30 ha of UAA would ensure environmentally-friendly farming in large part of the arable land of the Lielupe and Venta RBDs.

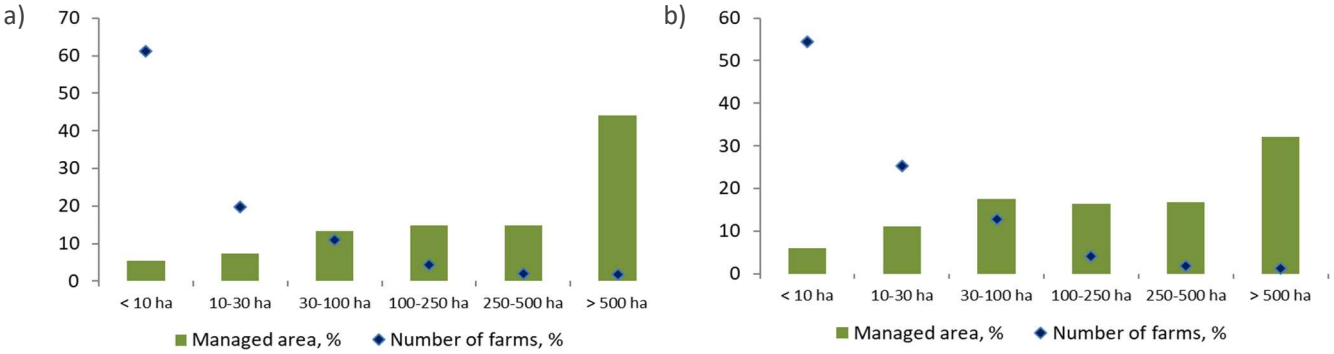


Figure 23. Percentage of farms and total managed area in farm groups - a) Lielupe RBD, b) Venta RBD (data source: authors calculations by Latvian Rural Support Service data)

Number of family farms and agricultural stock companies

The majority of farming systems in the Lithuanian part of Lielupe and Venta RBDs are family owned, number of agricultural stock companies is much lower (*Table 13*). The largest agricultural stock companies are operating in the areas with fertile soils, mainly in the Lielupe RBD.

Table 13. Structure of farms in Lielupe and Venta RBDs in Lithuani (percentage of family farms and agricultural stock companies), 2013 (source: Statistics Lithuania)

Lielupe RBD (LT)			Venta RBD (LT)		
municipality	**family farms, %**	**agricultural stock companies, %**	**municipality**	**family farms, %**	**agricultural stock companies, %**
Biržai	91.1	8.9	Joniškis	72.0	28.0
Joniškis	72.0	28.0	Akmenė	78.3	21.7
Pasvalys	71.2	28.8	Skuodas	95.1	4.9
Akmenė	78.3	21.7	Šiauliai	78.0	22.0
Pakruojis	60.3	39.7	Kretinga	94.3	5.7
Šiauliai	78.0	22.0	Plungė	96.4	3.6
Rokiškis	92.5	7.5	Telšiai	98.6	1.4
Kupiškis	94.3	5.7	Kelmė	96.0	4.0
Panevėžys	73.3	26.7	Rietavas	90.9	9.1
Radviliškis	75.7	24.3	Šilalė	N.D.	N.D.
Anykščiai	91.7	8.3	Mažeikiai	85.0	15.0
Mean	79.3	20.7	Mean	87.9	12.1

N.D. – no data

Age structure of farmers

In 2017, age structure of farmers in both Lielupe and Venta RBDs in Lithuania was rather similar. Data provided by the Center of Agricultural Information and Rural Business demonstrates that more than half farmers in both RBDs were older than 50 years.

Most of older farmers in Lithuania usually choose less risky activities and are not keen towards implementation of innovations which would allow their business to develop and better react to changes on the market. Older farmers usually own small farms, have lower education, work extensively and are not focused on the sustaining a long term vitality of their farms.

The smallest group of farmers in Lithuania are farmers younger than 29 years. They make only 5 % of all farmers in the Lielupe RBD and 4 % - in the Venta RBD. These farmers usually have agricultural education, implement innovations, apply advanced technologies for growing of traditional and non traditional crops, care about the environment where their families live.

According to the farm structure survey (FSS) carried out by the Central Statistical Bureau of Latvia in 2016, the farm managers' age structure is similar in Kurzeme and Zemgale regions: 51% in the Kurzeme region and 53% in the Zemgale region of the total number of farms are ran by managers aged 45-64. Compared to 2013, the structure of farms according to the age of their managers has not changed in the Kurzeme region, while in the Zemgale region the share of young farmers (up to 44 years old) decreased by 2%, on the other hand the share of farms headed by elder managers (age exceeds 65 years) has increased by 3% points.

In Zemgale region, 11% of farm managers have the highest agricultural education, including 31% of total number of the young farmers (up to 44 years old) are with a higher agricultural education. In the Kurzeme region, however, the total structure of such farms is only 7%, including 14% of the young farmers (up to 44 years old) have a higher agricultural education. In both Kurzeme and Zemgale, the management of farms based on a practical agricultural experience is still dominant (49% of the total number of farms).

Economic parameters of farms

Economic size of farms

The analysis of distribution of farms by their economic size is based on the methodology of Farm Accountancy Data Network (FADN). FADN is an instrument for evaluating the income of agricultural holdings and the impacts of the Common Agricultural Policy where a commercial farm is defined as a farm which is large enough to provide a main activity for the farmer and a level of income sufficient to support his or her family. In practical terms, in order to be classified as commercial, a farm must exceed a minimum economic size which for Latvia and Lithuania is 4 000 euro.

Standard output (SO) is the average monetary value of the agricultural output at farm-gate price of each agricultural product (crop or livestock) in a given region. The SO is calculated per hectare; farms are divided into such groups (*Table 14*).

Table 14. Standard Output groups

Group	Standard Output (SO)
I	4 000-15 000
II	15 000- 25 000
III	25 000- 50 000
IV	50 000- 100 000
V	100- 500 000
VI	More than 500 000

Analysis of the farm economy data shows that about half of all farms in Venta and Lielupe RBDs in both countries are of the smallest economc size with SO below 4000 EUR (see *Table 15*, *Figure 24*, *Figure 26*). Number of very large farms with SO exceeding 100 000 EUR account for only 5-6% in the Lielupe RBD and 3 - 4% in the Venta RBD, however these large farms have more than 50 % of all land in the Lielupe RBD in both countries and in the Latvian part of the Venta RBD. Only on the Lithuanian side of the Venta RBD the share of the land managed by the economically very strong farms is lower – 36%.

Since 2013, in Latvia there has been an increase in a number of farms in all economic size groups except of the group of the smallest farms. This shows that farms are becoming more competitive in both RBDs.

Table 15. Number of farms of different economic size classes in Lielupe and in Venta RBDs (data for January 1, 2017; data source: Center of Agricultural Information and Rural Busines (Lithuania) and CSB of Latvia, Farm Structure Survey)

River basin/sub-basin	Number of farms in SO group						
	0	I	II	III	IV	V	VI
Venta	6105	3057	510	589	397	295	37
Bartuva	1339	761	175	184	80	72	4
Šventoji	565	255	34	50	46	46	2
Venta RBD (LT)	***8009***	***4073***	***719***	***823***	***523***	***413***	***43***
Venta RBD (LV)	**6564**	**2 452**	**644**	**622**	**375**	**358**	**74**
Mūša	4596	2356	493	644	544	479	87
Lielupė	1122	646	163	239	208	177	44
Nemunėlis	1975	801	200	262	180	141	12
Lielupė RBD (LT)	***7693***	***3803***	***856***	***1145***	***932***	***797***	***143***
Lielupė RBD (LV)	**6757**	**2 772**	**605**	**671**	**416**	**427**	**106**

Table 16. Area of the agricultural land in farms of different economic size classes in Lielupe and in Venta RBDs (data for January 1, 2017; data source: Center of Agricultural Information and Rural Busines (Lithuania) and CSB of Latvia, Farm Structure Survey)

River basin/sub-basin	Area of agricultural land in farms in the SO group, thou ha						
	0	I	II	III	IV	V	VI
Venta	27.1	42.2	15.9	31.3	39.4	66.1	30.8
Bartuva	7.0	10.4	4.9	7.7	6.0	11.6	1.4
Šventoji	1.9	2.6	0.9	2.0	2.5	5.6	0.5
Venta RBD (LT)	***36.0***	***55.3***	***21.6***	***41.0***	***47.9***	***83.3***	***32.7***
Venta RBD (LV)	***42.2***	***38.6***	***21.3***	***33.3***	***41.7***	***106.4***	***87.5***
Mūša	16.0	26.1	14.3	32.0	49.5	99.9	77.8
Lielupė	3.3	6.8	4.6	11.8	19.1	37.7	42.2
Nemunėlis	8.7	10.6	7.0	14.05	18.0	29.0	4.5
Lielupė RBD (LT)	***28.0***	***43.5***	***25.9***	***57.8***	***86.7***	***166.6***	***124.5***
Lielupė RBD (LV)	***39.1***	***35.5***	***18***	***33.4***	***40.8***	***120.7***	***130.7***

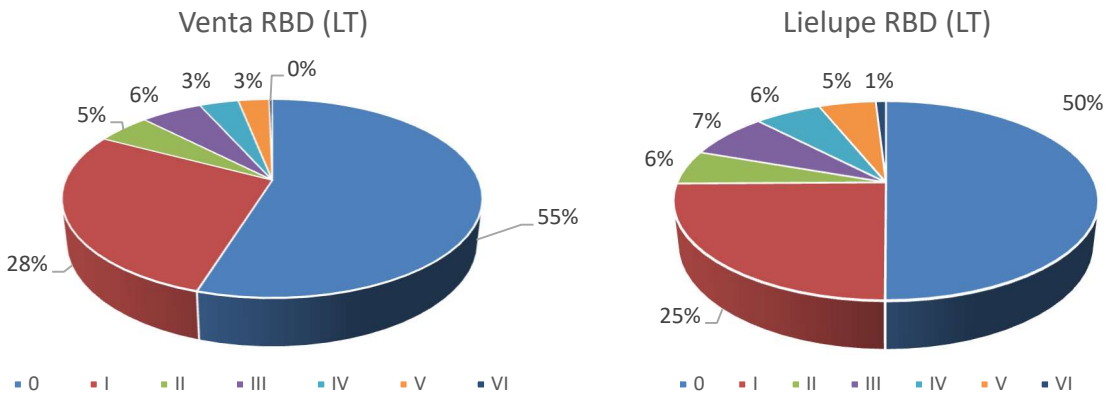


*Figure 24. **Number of farms of different economic size classes (according SO) in the Lithuanian part of Venta and Lielupe RBDs (data for January 1, 2017; data source:** Center of Agricultural Information and Rural Busines)*

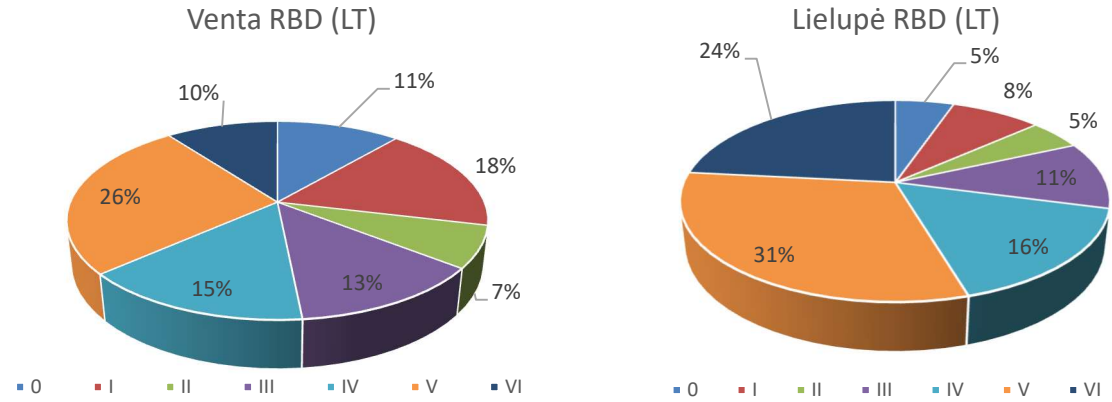


*Figure 25. **Area of the agricultural land in farms of different economic size classes (according SO) in the Lithuanian part of Venta and Lielupe RBDs (data for January 1, 2017; data source:** Center of Agricultural Information and Rural Busines)*

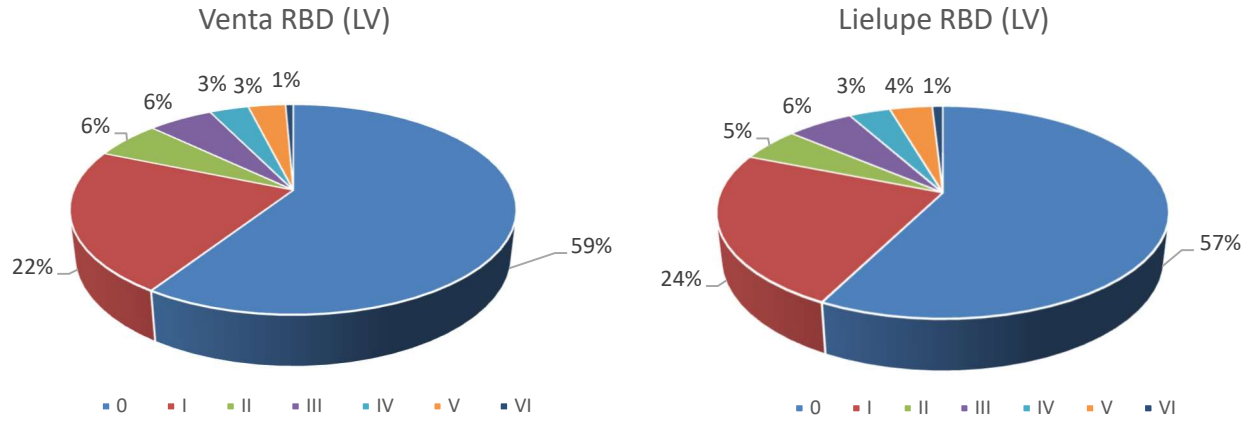


*Figure 26. **Number of farms of different economic size classes (according SO)** in Lielupe and Venta river basin (Latvia) (**data source:** CSB of Latvia, Farm Structure Survey)*

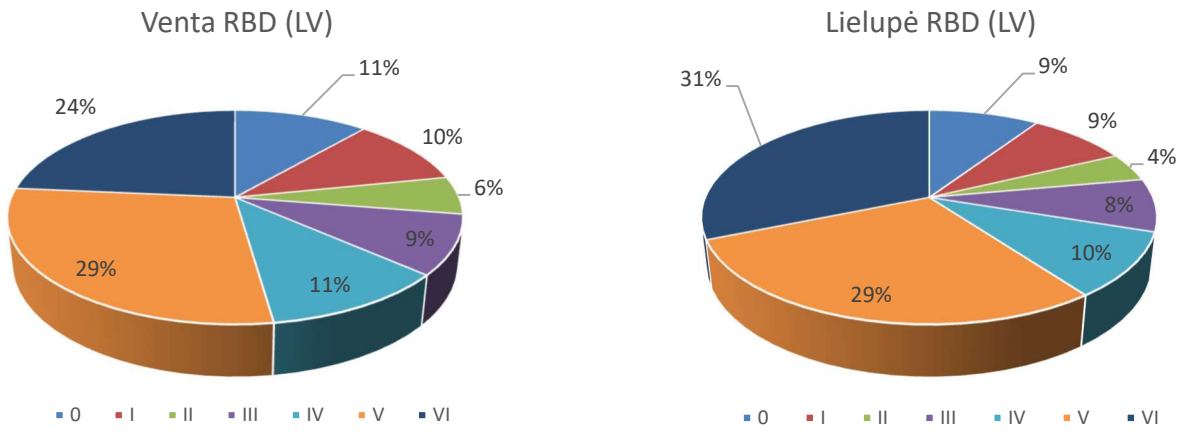


Figure 27. Area of the agricultural land in farms of different economic size classes (according SO) in Lielupe and Venta river basin (Latvia) (data source: CSB of Latvia, Farm Structure Survey)

Farm income and profit

Economic parameters of Lithuanian farms are presented in *Table 17*. It is seen from the table that in Lithuania the largest output is achieved by the smallest and largest farms but at the same time production costs in these farms are largest as well. All farms, except for the smallest ones, generate no profit from their activity. Their vitality is supported only by subsidies and VAT balance. The net income of the largest farms (> 150 ha) receives the lowest contribution from subsidies and VAT balance.

Table 17. Economic parameters (1 ha/UAA, Euro) according to farm size (Family Farms) (source: https://www.laei.lt)

Farm size, ha	Total output	Total inputs	Gross profit	Subsidies + VAT balance	Farm Net Income
< 10	1221	1204	17	416	433
10–< 20	641	829	-188	434	246
20–< 30	507	630	-123	580	457
30–< 40	500	598	-98	511	413
40–< 50	428	515	-87	389	302
50–< 100	477	537	-60	362	302
100–< 150	582	655	-73	286	213
>= 150	746	802	-56	220	164

In Latvia, according to the FADN farm economic results of 2016, the total output per ha of UAA is increasing by the farm size and so is the total input, but none of the farm groups is able to generate the revenues from the market that would exceed the total farm inputs. Only by the the support of subsidies farm income is positive, reaching the highest level in the smallest farm group, which also have the largest support payments per ha. Large farms have less net income per ha, but they employ scale for larger total income generation.

Table 18. Economic parameters (EUR per 1 ha of UAA) according to farm size in Latvia in 2016 (source: AREI (FADN) https://sudat.arei.lv/Login.aspx?ReturnUrl=%2fdefault.aspx)

Farm SO group	Farm average area, ha	Total output	Total inputs	Gross income	Subsidies and taxes balance	Net farm income
I	23	427	441	-15	338	323
II	35	460	521	-60	332	271
III	58	533	599	-65	259	193
IV	112	575	689	-113	243	130
V	286	779	864	-85	247	162
VI	1107	1641	1707	-65	283	218

Analysing how economic farm parameters are affected by the farmers age, it can be noticed that the most profitable are farms managed by the farmers younger than 40 years (*Table 19*).

Table 19. Economic parameters (1 ha/UAA, Euro) according to farmer's age (Family Farms) (data source: https://www.laei.lt/img/mime_icons/pdf_32px.png)

Farmer's age	Total output	Total inputs	Gross profit	Subsidies + VAT balance	Farm Net Income
< 40	512	576	-64	438	374
40–49	628	711	-83	295	212
>= 50	702	785	-83	288	205

If to analyse profitability of different types of farms, it grows in a following sequence: cereal – rape farms (175 Eur/haUAA) < mixed crop production and grazing livestock farms (295 Eur/haUAA) < dairy farms (342 Eur/haUAA) < crop production farms (394 Eur/haUAA) < grazing livestock farms (473 Eur/haUAA) < organic and other mixed farms (respectively 608 and 639 Eur/haUAA) < horticulture farms (756 Eur/haUAA) < pig and poultry farms (1085 Eur/haUAA).

Economic parameters of farms vary every year, depending on weather conditions, production quality, market prices. Cereal – rape farms are most sensitive to these variations.

In 2016, in Latvia, farms in the Venta RBD and on average in the country were similar in terms of economic size, output and utilization of production factors (*Table 20*).

Table 20. Characterization of farms according to utilization of production factors and output in the Venta RBD and Lielupe RBD in Latvia, in 2016 (source: author's calculations, FADN data 2016)

	Average farm in Latvia	Average farm in the Venta RBD	Average farm in the Lielupe RBD
Utilized Agricultural area (UAA), ha	70	69	114
Labour, AWU	2	2	3
Livestock units	20	18	28
Fixed assets, EUR	114,502	102,021	305,408
Economic size, EUR	47,604	48,330	90,617
Output, EUR	55,626	54,269	132,257

In Latvia, the Lielupe RBD farms are significantly larger both in terms of economic size and output (with more than twice higher output) than average farms in the Venta RBD or overall in the country. Farms in the Lielupe RBD have a higher material provision level: in 2016, long-term investment value per farm in the farms located in the Lielupe RBD on average was nearly three times as high as fixed assets at the disposal of one farm in the Venta RBD or overall in the country. Also, other production factor indicators (land, labour, farm animals) in 2016 in the Lielupe RBD farms on average were higher than those in the Venta RBD farms and overall in the country.

Over the past three years the economic efficiency has improved both on average in the country as well as in the Lielupe RBD and Venta RBD farms(*Table 21*).

In respect of efficiency in input use, in the Venta river basin district farms in 2016 it has improved by 2 percentage points over 2014; the situation is similar overall in the country. Labour productivity in the Venta RBD farms has increased by 32% over the past three years and in 2016 it was EUR 10,991 NVA/AWU, which, in terms of value, is lower than the country average (EUR 11,004 NVA/AWU). Over the past three years, efficiency of land use in the Venta RBD farms has been increasing more rapidly than on average in the country, by 36% and 27% respectively; in 2016 it was EUR 307 NVA/ha. Conversely, the efficiency in fixed asset use in the Venta RBD farms in 2016 has decreased by 23 percentage points over 2014: this could be related to the

fact that, owing to investment in fixed assets, over the past three years the material provision in the Venta RBD farms has increased by 31% on average.

Table 21. Performance of the Venta RBD and the Lielupe RBD farms in Latvia, on average in 2014-2016: economic dimension (source: author's calculations, FADN data 2014- 2016)

Criteria		**Efficiency in input use**	**Labour productivity**	**Efficiency of land use**	**Efficiency in fixed asset use**
Indicator		**Total output per total inputs (%)**	**Net Value Added per AWU (EUR)**	**Net Value Added per UAA (EUR)**	**Total output per fixed assets (%)**
Average farm in Latvia	2014	91%	8,286	237	55%
	2015	97%	10,650	301	53%
	2016	92%	11,004	301	49%
	average in 2014-2016	*93%*	*9,966*	*280*	*52%*
	2016/2014	+1%p.	133%	127%	-11%p.
Average farm in Venta RBD	2014	92%	8,327	226	69%
	2015	99%	10,832	308	60%
	2016	94%	10,991	307	53%
	average in 2014-2016	*95%*	*10,099*	*281*	*60%*
	2016/2014	+2%p.	132%	136%	-23%p.
Average farm in Lielupe RBD	2014	95%	10,035	269	57%
	2015	104%	15,538	407	49%
	2016	101%	14,870	372	43%
	average in 2014-2016	*100%*	*13,462*	*350*	*49%*
	2016/2014	+7%p.	148%	138%	-24%p.

Over the past three years, in the Lielupe river basin district farms in Latvia, the increase of efficiency in input use (by 7 percentage points) has been more rapid than on average in the country. Also, labour productivity and efficiency of land use in the Lielupe RBD since 2014 has been increasing more rapidly than on average in the country, by 48% and 38% respectively. Conversely, efficiency in fixed asset use, similar to the Venta RBD farms, demonstrated a fall in 2016 over 2014: most likely, due to the fast increase of the fixed asset value in the Lielupe RBD farms by 46% on average, resulting from long-term investment made over the period.

All in all, in the period between 2014 and 2016 the Lielupe RBD farms demonstrated a more rapid growth of economic efficiency compared to the Venta RBD farms. In terms of value, in 2016 both labour productivity as well as efficiency of use of UAA in the Lielupe RBD on average was by 20% higher than the calculated average labour productivity and land use efficiency in the Venta RBD. The improvement of both labour efficiency and land use efficiency indicators could possibly be related to investment in fixed assets both in the Venta RBD farms and Lielupe RBD farms.

Implementation of environmental measures: meeting the greening requirements and participation in agro-environmental schemes under the Rural Development Programme

Greening requirements

Greening payment (GP) for climate and environment favourable agricultural practices was introduced in 2015 as result of the CAP reform with a view to deal with the present impact of agriculture on the environment. Greening aimes at strengthening the capacity of soil and natural ecosystems and helping to achieve main EU targets in areas such as biodiversity and adaptation to climate change, also taking into account the fact that the market does not compensate farmers for their contribution to the environment and climate and provision of public benefit.

Direct greening payments account for 30% of EU countries' direct payment budgets. In 2016 the annual rate of payment in Latvia was 36.56 EUR/ha, in 2017 - 40.43 EUR/ha. In 2016, greening payment in Lithuania was 46.57 EUR/ha, in 2017 – 49.22 EUR/ha.

Farmers receiving an area-based payment have to make use of various straightforward, non-contractual practices that benefit the environment and the climate. These require action each year. They include:

- diversification of crops (rotations of at least 2 or 3 crops depending on the farm size),
- maintaining permanent grasslands,
- dedicating 5% of arable land to 'ecologically beneficial elements' ('ecological focus areas').

Crop diversification requirement applies to farms with over 10 ha of arable land. If the holdings' arable land is between 10 and 30 ha, then on this arable land:

- at least two different crops should be cultivated;
- the main crop area should not exceed 75% of the arable land.

If the farm has more than 30 ha of the arable land, then on this arable land:

- at least three different types of crops should be cultivated;
- the main crop area should not exceed 75% of the arable land;
- the area of two main crops should not exceed 95% of the arable land.

Farms with the arable land areas above 15 ha must ensure that at least 5% of such areas is an 'ecological focus area' (EFA) dedicated to ecologically beneficial elements. Ecological focus areas cover a broad range of features. It is up to national governments to draw up a list of ecological focus areas based on the provided common list and considering national priorities and farming features.

In Lithuania and Latvia, the following options can be used for ecological focus areas: fallows, nitrogen fixing crops, undersown grasses, short rotation plants, various landscape elements such as hedges, ponds and trees in a line.

In Latvia, special exemption is determined for ecological focus areas due to significant forest percentage in several municipalities of Venta and Lielupe RBDs. These municipalities need not comply with the requirements related to ecological focus areas (*Figure 28*).

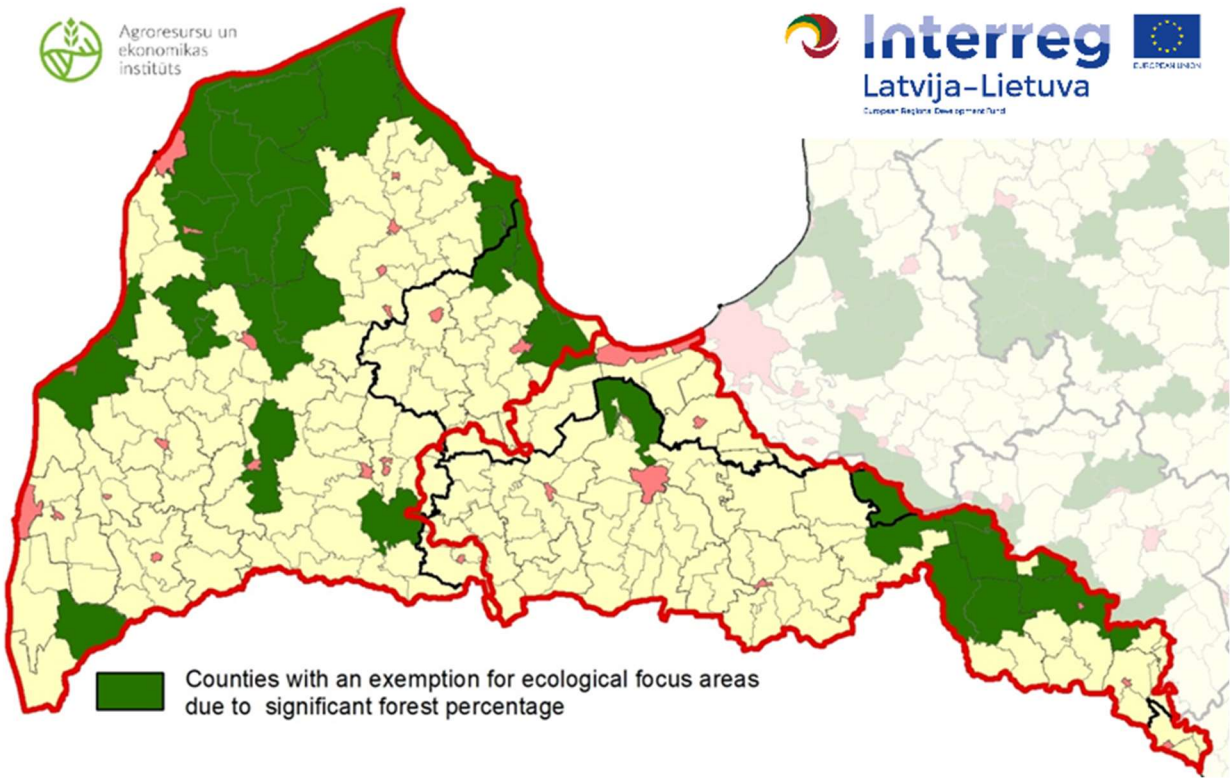


Figure 28. Counties with an exemption for ecological focus areas due to significant forest percentage (source: Created by the authors).

Fields which are sertified according the rules of organic farming automatically comply with the greening requirements. Greening payment is also payed for the farms operating in the areas where additinal restrictions related to the requirements of Birds (2009/147/EB), Habitats (92/43/EEB) or Water Framework directives apply.

Ecological focus areas declared in the Lithuanian part of the Venta and the Lielupe RBD in 2017 are presented in *Table 22 and Figure 29.*

Table 22. Ecological focus areas declared in the Lithuanian part of Venta and Lielupe RBDs, 2017 (data source: the Center of Agricultural Information and Rural Business; estimates for river basins/sub-basins made proportionally to the municipality area in the corresponding basin/sub-basin)

River Basin/sub-basin	Ecological focus areas in LT					
	Fallows, ha	N fixing crops, ha	Undersown grasses	Short rotation plants, ha	Landscape elements, ha	Total, ha
Mūša	2409	17502	6	455	5	20377
Lielupė small tributaries	372	7469	13	34	4.8	7892
Nemunėlis	3106	9563	4	317.39	0.2	12990
Total Lielupe RBD (LT)	***5886***	***34534***	***23***	***806***	***10***	***41259***
Venta	3560	14372	122	390	6.4	18450
Bartuva	136	662	0	33.93	0.08	832
Šventoji	248	851	0	55.23	0.10	1155
Total Venta RBD (LT)	***3944***	***15884***	***122***	***480***	***7***	***20437***

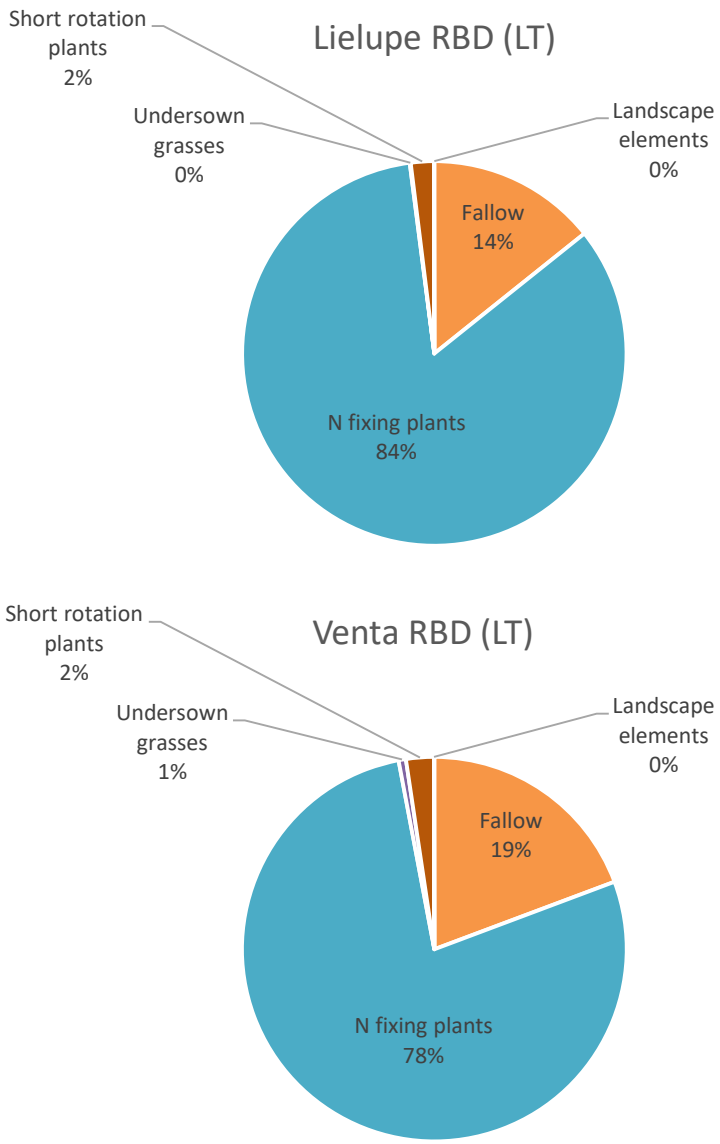


Figure 29. Ecological focus areas declared in the Lithuanian part of Venta and Lielupe RBDs (data source: the Center of Agricultural Information and Rural Business)

Declaration data shows that growing of nitrogen fixing plants was the most popular option for ecological focus areas in both RBDs in Lithuania in 2017, comprising 84 % of the entire area declared for EFA in the Lielupe RBD and 78 % - in the Venta RBD.

Since 2015, with the introduction of greening requirements the areas of legumes have increased significantly in the Latvian part of Venta and Lielupe river basins (*Table 24*).

Table 24. Ecological focus areas declared in the Latvian part of Venta and Lielupe RBDs, 2016 (data source: authors calculations by Latvian Rural Support Service data)

River Basin/sub-basin	Ecological focus areas in LV*			
	Fallows, ha	N fixing crops, ha	Undersown grasses	Total, ha
Total Lielupe RBD (LV)	8644	14770	1894	25308
Total Venta RBD (LV)	16344	9430	4316	30090

**-with exemption areas and without areas for short rotation crops and landscape elements*

Starting from 2018, application of plant protection products in the ecologic focus areas is baned in all around the EU. This complicates growing of peas and beans because a normal production of these crops without use of pesticides is nearly impossible. For this reason, farmers are now considering other alternatives for ecologic focus areas. Hence, it can be expected that in the nearest perspective EFA areas with nitrogen fixing plants will considerbly decrease.

Participation in agri-environmental schemes under the Rural Development Programme

Agri-environment and climate measures are a key element for the integration of environmental concerns into the Common Agricultural Policy (CAP). They are designed to encourage farmers to protect and enhance the environment on their farmland by paying them for the provision of environmental services. Farmers commit themselves, for a minimum period of at least five years, to adopt environmentally-friendly farming techniques that go beyond legal obligations. In return, farmers receive payments that provide compensation for additional costs and income foregone resulting from applying those environmentally friendly farming practices in line with the stipulations of agri-environment contracts.

Table 23 lists agri-environmental measures and their areas declared in Venta and Lielupe RBDs in Lithuania in 2018. Declaration data shows that there were 13 measures being implemented in Venta and Lielupe RBDs in 2018, the most popular of which were two: stubble fields in winter and cover (catch) crops in the arable land. In the Lielupe RBD, areas of stubble fields comprised 45 % of the entire area of agri-environmental measures, and the areas of cover(catch) crops – 21 %. In the Venta RBD areas of stubble fields and cover crops were respectivelly 41 % and 16 % of the total area of agri-environmental measures (*Figure 30*).

The coverage of agri-environmental measures in relation to the total area of agricultural land is, however, very little. In 2018, only about 3 % of the agricultural land in the Lielupe RBD and 2 % in the Venta RBD in Lithuania were under the contracts for agri-environmental measures. Cover crops, one of the most popular measure, was implemented on only 1% of the arable land in both RBDs. The measure for improving the status of water bodies at risk, which encompasses converting arable land to perennial grasslands, was implemented on only 0.2% of the arable land area in both Venta and Lielupe RBDs. This suggest that only very little environmental effect can be expected from the current implementation of agri-environmental measures because any environmental initiatives with such little coverage can not overweigh or significantly decrease effects of intensive farming.

*Table 23. Areas declared in the Lithuanian part of Venta and Lielupe under the 2014-2020 RDP measure Agri-environment and climate (**data source:** the Center of Agricultural Information and Rural Business; **estimates for river basins/sub-basins made proportionally to the municipality area in the corresponding basin/sub-basin)***

River basin/ sub-basin	Declared area of the measure, ha												
	Extensive management of grassland for grazing animals	Management of specific grassland	Extensive management of wetlands	Undersown perrenial grasses in arable land	Strips or fields of melliferous plants on arable land	Protection of water bodies against pollution and protection against soil erosion on arable land	Maintenance of reclamation ditches' slopes	Improving the status of water bodies " at risk"	Environmetally friendly fruits and vegetables cultivation system	Soil protection	Management of natural and semi-natural grasslands	Stubble fields in winter	Cover crops in arable land
Mūša river sub-basin	681	61	176	6	1	0	407	531	1215	88	40	3776	1779
Sub-basin of the Lielupė small tributaries	12	9	3	3	3	0	45	34	105	0	2	838	783
Nemunelis	548	24	46	2	0	1	312	518	365	100	52	2621	817
Total Lielupe RBD (LT)	***1240***	***94***	***226***	***11***	***4***	***1***	***764***	***1082***	***1685***	***188***	***94***	***7235***	***3379***
Venta river basin	754	77	322	2	1	0	416	347	367	332	52	2385	1049
Bartuva river basin	26	3	32	19	0	0	38	1	3	5	0	156	19
Šventoji river basin	64	13	154	3	0	0	11	1	0	29	1	418	70
Total Venta RBD (LT)	***845***	***92***	***508***	***24***	***1***	***0***	***465***	***349***	***370***	***365***	***53***	***2959***	***1138***

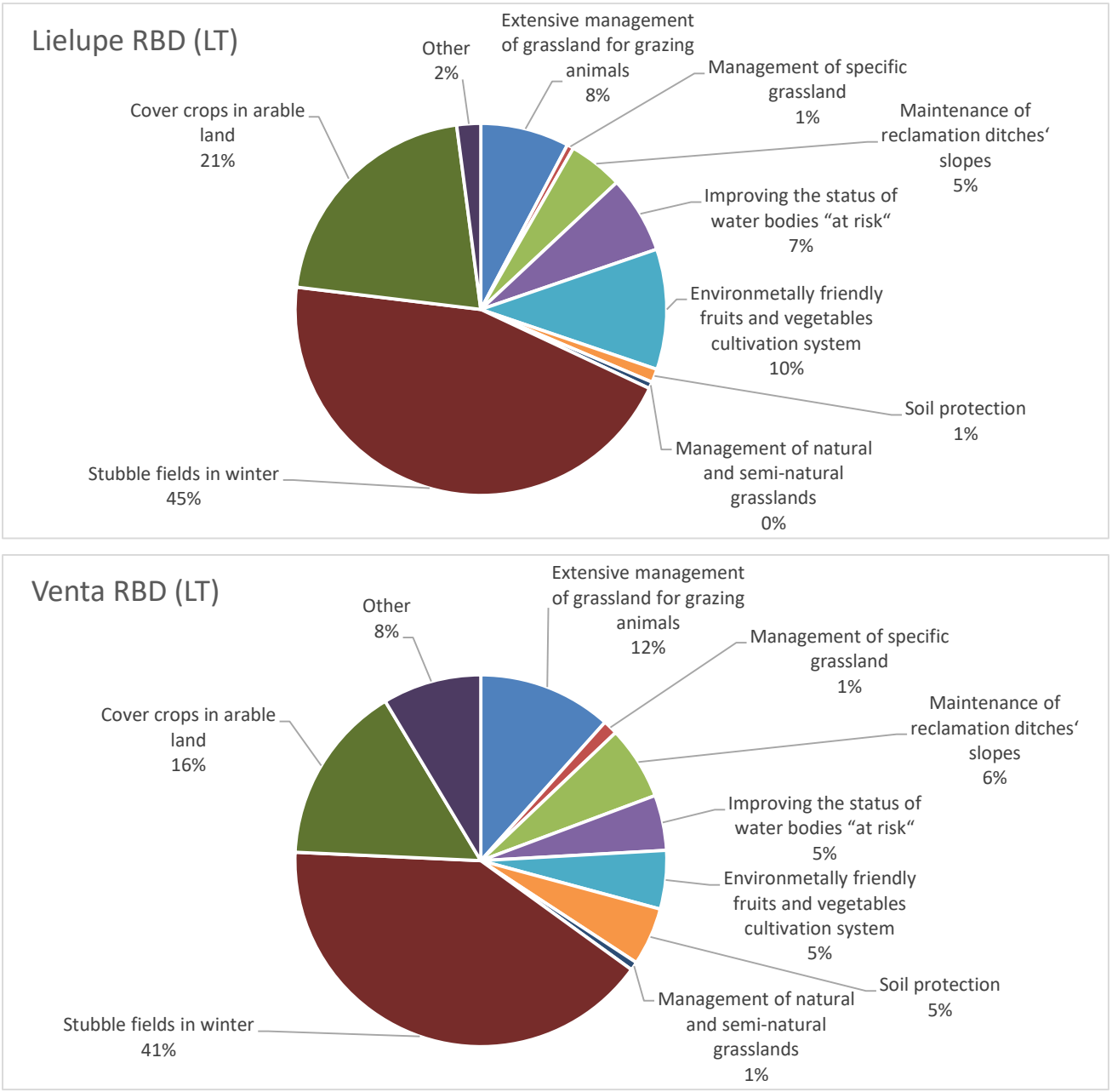


Figure 30. Agri-environmental measures in Venta and Lielupe RBD in Lithuania in 2018 (data source: the Center of Agricultural Information and Rural Business)

In Latvia, as well as in Lithuania, in Lielupe and Venta RBDs, agri-environmental measures are implemented in relatively small areas (*Table 24*). Supported areas under the agri-environment measure *Environmentally friendly horticulture* in both RBD's are below 1% of the agricultural area. *Stubble fields in the winter period* is the most important agri-environment submeasure of the RDP 2014-2020. Supported area under this submeasure in 2016 was 4% in the Venta river basin and 3% of agricultural land in the Lielupe river basin. In general, conventional agriculture is predominant in both basins and agri-environmental measures are implemented in small areas.

Table 24. Implementation of agri environmental measures of RDP 2014-2020 in the Venta and Lielupe river basins in Latvia (source: author's calculation according to the RSS data 2016).

	Venta river basin	Lielupe river basin
Measures under Agri-environmental scheme:		
Stubble fields in the winter period, ha	16859	9168
Stubble fields in the winter period, beneficeries	351	176
Environmentally friendly horticulture, ha	824	2460
Environmentally friendly horticulture, beneficeries	102	82

Organic farming

Production of organic agricultural products without use of synthetic fertilizers, pesticides and growth stimulators is the main objective of organic farming.

In the Lithuanian part of the Lielupe RBD, 6 % of the agricultural land is certified according the rules of organic farming. The largest areas of organic farms are in Anykščiai, Biržai, and Rokiškis districts. In the Venta RBD, 7% of the agricultural land is used for organic farming. The biggest number of certified organic farms is in Telšiai and Mažeikiai dirstricts.

This farming method is usually chosen by the farmers working in less fertile lands. In the disticts with fertile soils organic farming is less popular. Due to reduced payments, organic farming is loosing its popularity lately. The number of farmers engaged in organic farming decreases and those who remain in business enlarge their farms.

In Latvia, the area supported by RDP 2014-2020 measure *M11 Organic farming* take up to 11% of the utilised agricultural land in the Venta river basin and 5% in the Lielupe river basin. Two thirds of the organic farm areas are grasslands and only one third is arable land (*Table 25*).

Table 25. Areas under organic farming in Lithianian and Latvian parts of Venta and Lielupe RBDs

Basin/ sub-basin	Land area under organic farming, ha	Area of agricultural land, ha	Percent of agricultural land under organic farming
Mūša	15109	*309325*	5
Lielupė	1293	*124213*	1
Nemunėlis	14803	*96145*	15
Total Lielupe RBD (LT)	***31205***	***529683***	**6**
Total Lielupe RBD (LV)	***18089***	***338632***	**5**
Venta	18620	*250884*	7
Bartuva	2662	*48416*	5
Šventoji	1015	*16545*	6
Total Venta RBD (LT)	***22297***	***315845***	**7**
Total Venta RBD (LV)	***41651***	***393817***	**11**

Past and future trends of agriculture development

Large farms' focus on a fast profit has made them dependent on intensive use of fertilizers, pesticides and other chemicals. Continuous intensification of agricultural production and unresponsible use of chemicals has made an adverse effect on soil productivity, biodiversity, and sustainability of ecosystems. Increasing investments into modernization of farms resulted in increased intensity of farming.

Currently, cereal – rape farms dominate in the crop structure of Venta and Lielupe RBDs. Number of small farms is rapidly decreasing. Farmers are leaving economically not perspective small businesses. Though small farms were involved in the scheme of direct payments, they still remain not attractive to young farmers because they can not satisfy the needs of young families. Today, big part of farmers are older than 50 years and change of generations is not expected to improve the situation.

Both in Latvia and Lithuania, farm and crop structure has been changing during the last 5-7 years. For example, in 2016 the average size of agricultural holding in Latvia was by 15.5% larger than in 2013. For the near future experts expect similar tendencies. The total number of farms will continue to decrease at the expense of small farms, but the number of large holdings, especially in the crop sector, will increase. These trends are also affected by changes in the structure of agricultural land. Since 2007, the share of permanent grasslands has slightly increased and the area of temporary grasslands has decreased, while the area of arable land has increased most of all (*Figure 31 and Figure 32*). Also, in the coming years, a rise in arable land is expected, but it could be relatively small, as practically all agricultural land is already used in the Venta and Lielupe RBDs. Since it is expected that the intensity of agriculture will increase, also the need for agri-environmental measures such as catch crops will grow.

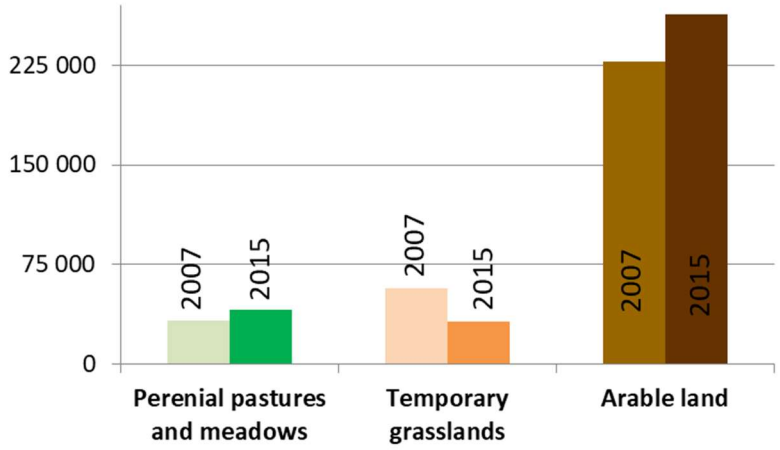


Figure 31. Changes of utilized agricultural land structure from 2007 to 2015 in the Lielupe river basin (Source: Author's calculation according to the RSS data 2007&2015)

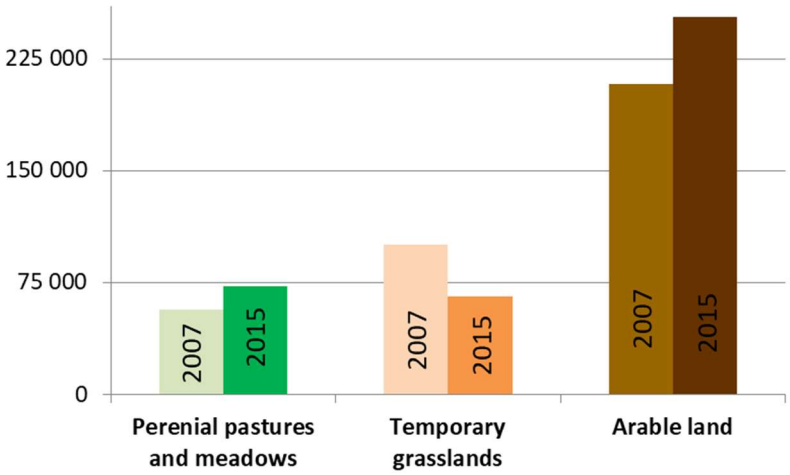


Figure 32. Changes of utilized agricultural land structure from 2007 to 2015 in the Venta river basin (Source: author's calculation according to the RSS data 2007&2015)

CAP reform which was started in 2014 initiates transferring from formation of the economically strong agriculture to support of measures which facilitate sustainability of ecosystems, social welfare but decrease economic performance of farms in a short time perspective. The effect of those measures is already seen. Crop structure is changing, crop diversity is increasing. Recently, an increase in the areas of legumes and undersown grasses is observed, areas of grasslands remain stable. It is expected that in a future increasing production or implementation of intensive cropping technologies will be followed by the measures which will prevent from damaging natural balance and allow responsible and sustainable use of resources.

Catch crop support in the Baltic states

Support for catch crops

Growing of catch crops is being increasingly supported in farmer support schemes in the EU countries – by different agri-environment and climate measures of the RDPs 2014-2020 and as a greening measure. The latter refers to the mandatory greening requirements introduced in 2015 regarding the preservation of permanent grassland, crop diversification and having ecological focus area, the observation of which allows receiving direct payments - basic payment alongside greening payment. The general rule is that farms with more than 15 ha of arable land have to ensure that at least 5% of their arable land is EFA. Areas with catch crops, or green cover established by the planting and germination of seeds was one of the options countries could choose to be considered as EFA. The weighting factor for catch crops is 0.3, i.e., 1 ha of catch crops is counted as 0.3 ha of EFA (Regulation 1307/2013).

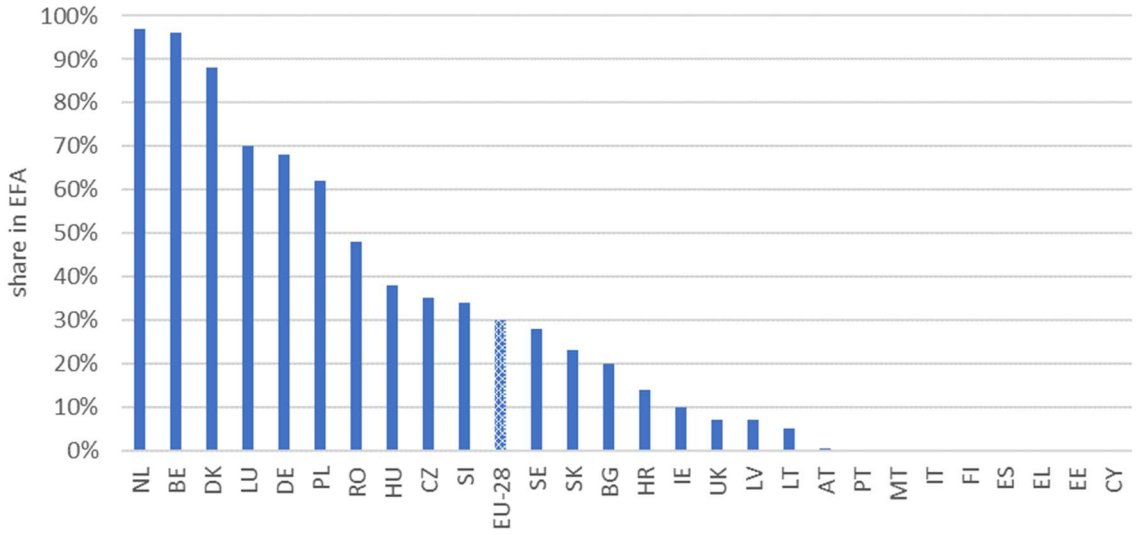


Figure 33. Share of catch crops and green cover in EFA in the EU countries in 2016[6]

The available data of 2016 indicate that area under catch crops accounts for 30% of the total area declared as EFA in the EU-28. While in some countries like the Netherlands and Belgium almost all EFA is comprised of catch crops and green cover, the share is very large also in Denmark, followed by Luxembourg and Germany. At the EU-28 level, only nitrogen fixing crops (47%) was more popular option than catch crops. These two choices both can be considered as productive options, what largely explains their popularity. When explaining the preference towards catch crops of German farmers, easy implementation, possibility to integrate in crop-rotation, continuing cultivation of the land, established management practices, erosion protection, maintenance of soil fertility, and land cover as shelter for wild animals were identified as the main arguments, with disincentives being reducing water availability and challenge to determine possible crop combination. In

[6] *DG Agri, https://agridata.ec.europa.eu/extensions/DashboardIndicators/Biodiversity.html*

the Netherlands, Belgium and Denmark the fact of established management practices could be the main explaining factor for the choice of catch crops as EFA. In Denmark this arises from the existence of mandatory catch cropping.

Overview of the catch crop support in the Baltic sea region countries (Latvia, Lithuania, Estonia, Poland, Sweden, Finland, Denmark and Germany) is presented below. *Table 26* summarizes the possibilities to declare area under catch crops as EFA in the respective countries.

Table 26. Catch crops as EFA in the Baltic Sea region countries (based on requirements for 2018)[7]

Country	Kind of catch crops	Variety of species	Sowing date	Termination date
Latvia	under-sowings, intercrops	under-sowing of grasses and/or legumes; mixture of a minimum of 2 intercrops[1]	by September 1 (intercrops)	after October 31 (intercrops)
Lithuania	under-sowings, intercrops	under-sowing of grasses or legumes; mixtures of a minimum of 2 intercrops[2]	from April 1 to June 30 (under-sowings); from June 30 to August 15 (intercrops)	after October 15 (or until sowing of winter crops (under-sowings); or 8 weeks after sowing of a mixture)
Estonia	-	-	-	-
Poland	under-sowings, intercrops	under-sowing of grasses or small-seed legumes; mixtures of at least 2 intercrops[3]	from July 1 to August 20 (stubble intercrops); from July 1 to October 1 (winter intercrops)	after October 15 (or 8 weeks after sowing of a mixture) (stubble intercrops); after February 15 (winter intercrops)
Finland	-	-	-	-
Sweden	under-sowings, intercrops	under-sowing of grasses and/or legumes; mixture of at least 2 intercrops[4]	before September 1 (intercrops)	from November 1
Denmark	under-sowings, intercrops	under-sowing of grasses and/or legumes; mixture of at least 2 intercrops[5]	by June 30 (under-sowings); from June 30 to August 1 or August 20 (intercrops)	from October 20 (or 8 weeks after the harvesting of maize (under-sowings))
Germany (Bavaria)	under-sowings, intercrops	under-sowings of grasses and/or legumes; mixture of at least 2 intercrops[6](max 60% for one crop; grasses max 60%)	by October 1 (intercrops)	after January 15; after February 15

[1] summer rape, Italian ryegrass, white mustard, oil radish, oats, phacelia, buckwheat, summer vetch, winter vetch, rye, beans, peas or fodder radish.
[2] listed in Regulation in direct payments (December 4, 2015 No. 3D-897)
[3] cereals, oilseeds, fodder, legumes and melliferous plants (mixtures cannot consist of cereals only)
[4] beet, red clover, buckwheat, oats (spring), phacelia, barley (spring), oil radish, Persian clover, bristle oat, ryegrass, rape (spring), turnip rape (spring), rye (spring), triticale (spring), radish, sunflower, subterranean clover, Sudan grass, tagetes, wheat (spring), vetch, white mustard, peas. The mixture must not contain any other than these crops.
[5] cereals, grasses, cruciferous plants, chicory and honeycomb (by August 1); spring barley, common rye, perennial rye, hybrid rye or oats, cruciferous plants, honeycomb (by August 20).
[6] listed in Appendix 3 of DirektZahlDurchfV (Regulation on the implementation of direct payments).

The overview of the support for catch cropping under agri-environment and climate measures of the RDPs 2014-2020 in the respective countries is provided in *Table 27*.

[7] based on the information on the support requirements from the national paying agencies

Table 27. Catch crops under agri-environment and climate measures of RDP 2014-2020 in the Baltic Sea region countries[8]

Country	Name of the measure	Crops	Support rate	Supported area	Min area	Sowing date - termination date
Latvia	-	-	-	-	-	-
Lithuania	*Growing of catch crops on arable lands*	oil radish, white mustard, clover, vetch and their mixtures	134 EUR/ha	arable land	-	by September 15 - after March 1
Estonia	*Support for environmentally friendly management (10.1.1)* - main activity (package of management requirements); - additional activity of water protection (one-year)	agricultural crops providing plant cover	- 50 EUR/ha; - 5 EUR/ha	arable land	- 30%; - 50%	by November 1 - after March 31
	Regional water protection support (10.1.2), 1) keeping land under winter vegetation (+ Support for environmentally friendly management (main activity))	agricultural crops providing plant cover	7 EUR/ha (+ 50 EUR/ha)	arable land in Nitrate Vulnerable Zones	60%	by November 1 - after March 31
Poland	*Sustainable agriculture (Package 1),* one of the requirements for land use	intercrops	400 PLN/ha (93 EUR/ha)	arable land	-	by October 1 - from February 15
	Protection of soils and waters (Package 2), Intercrops (Variant 2.1)	mixture of a minimum of 3 plant species (max 70% for dominant plant or cereals)	650 PLN/ha (151 EUR/ha)	arable land in target area[1]	-	by September 15 - from March 1
Finland	*Plant cover on arable land in winter (07)* (+ Balanced use of nutrients (01))	agricultural crops providing plant cover (including catch crops)	from 4 EUR/ha to 54 EUR/ha[2] (+ 54 EUR/ha)	arable land in target region and other regions	20%[3]	-
	Biodiversity in arable land environments (09), catch crops (+ Balanced use of nutrients (01))	catch crops (under-sowing, intercrops)	100 EUR/ha (+ 54 EUR/ha)	arable land	-	by August 15 - from October 1
Sweden	*Reduced nitrogen leakage*, activity - cultivation of catch crops	forage grass or forage grass in mixture with forage legumes (max 15%); white mustard; oilseed radish or radish; rye (autumn) or Italian ryegrass	1,100 SEK/ha (107 EUR/ha)	arable land in Nitrate Vulnerable Zones	-	no specific dates[4] - from October 10 (forage grass, white mustard and radish); from January 1 (rye and Italian ryegrass)
Denmark	-	-	-	-	-	-
Germany (Bavaria)	*Winter greening with catch crops/wild crops (B35/B36)*	catch crops (under-sowing, intercrops); wild crops (approved seed mixtures - wildlife-friendly catch crops)	70 EUR/ha; 120 EUR/ha	arable land	at least 5%; max 10 ha for wild crops	by October 1 - after February 15

[1] areas particularly at risk of water erosion, problem areas with low humus content and areas particularly exposed to nitrates from agricultural sources.

[2] 4 EUR/ha, if plant cover is 20%; 18 EUR/ha in the target region and 9 EUR/ha in other regions, if plant cover is 40%; 36 EUR/ha in the target region and 11 EUR/ha in other regions, if plant cover is 60 %; 54 EUR/ha in the target region, if plant cover is 80%.

[3] minimal share may be implemented also by reduced tillage; in other areas, plant cover may be implemented in full with reduced tillage.

[4] catch crops should be able to develop well and pick up nitrogen after harvesting the main crop.

[8] based on the information on the national RDPs for 2014-2020 and the support requirements from the national paying agencies

Latvia

There is no agri-environment support for catch crops in Latvia. But the area under catch crops can be declared as environmental focus area (EFA).

- ***EFA requirement of greening payment***

In Latvia, area under catch crops can classify for EFA. Catch crops can be grown as under-sowings in cereals or cereals and protein crops, or as intercrops. Under-sowings can consist of grasses and/or legumes. It is forbidden to use plant protection products for at least 8 weeks after the harvest of the main crop or till October 15 (if 8-week period ends before this date) or until the sowing of the next main crop.

Catch crops should be grown in a mixture of at least 2 intercrops: summer rape, Italian ryegrass, white mustard, oil radish, oats, phacelia, buckwheat, summer vetch, winter vetch, rye, beans, peas or fodder radish. Catch crops should be sown no later than September 1 and should be maintained at least till October 31. It is required that the main crop in the current and the next year would be different from the catch crop. There is a ban to use plant protection products on intercrops from September 1 till October 31.

Lithuania

Starting from 2018, growing of catch crops is supported under agri-environmental scheme of the RDP in Lithuania. Also, the area under catch crops is eligible for the fulfilling the EFA requirement.

- ***agri-environment scheme***

Agri-environment support measure *"Growing of catch crops on arable lands"* was introduced in Lithuania in 2018. Under the current support scheme only post-harvest catch crops (intercrops) can be grown: oil radish, oat, mustard, clover, phacelia, Italian ryegrass, alfalfa, lupine, cock's foot, birds trefoil, bean, sunflower, seradela, buckwheat, vetch, root radish, lupine and their mixtures. Catch crops should be sown by September 15 and be maintained till March 1. Catch crops cannot be mowed. The biomass of catch crops has to be incorporated in the land before sowing of the main crop. It is prohibited to use mineral fertilizers and manure on catch crops.

There are no specific target areas for the support, all farmers can apply for this payment. The support rate for catch crops is EUR 134/ha/year.

- ***EFA requirement of greening payment***

For the EFA requirement of greening payment, under-sowings and post-harvest crops (intercrops) can be grown in Lithuania. Catch crop area supported by agri-environmental scheme cannot be treated as EFA.

Estonia

In Estonia, growing of catch crops is promoted through two agri-environmental measures of the RDP. Catch crops are not defined as one of the categories eligible for fulfilling the EFA requirement.

- ***agri-environment scheme***

There is no directly targeted agri-environmental support for catch crops in Estonia, though catch crops are supported along other agricultural crops serving as a plant cover (including grassland on arable land) as one of the environmentally friendly practices under the measure *"Support for environmentally friendly management"***.** The measure anticipates that at least 30% of eligible land must be kept under winter vegetation consisting of crops from November 1 to March 31.

Other requirements of the main activity of this measure include: compliance with crop rotation requirements; preparation of fertilization plan; soil testing; prohibition of the use of glyphosate during the growing period of the main crops; growing of leguminous crops at least 15% of eligible land; use of certified cereal seeds on at

least 15% of the sowing area of cereals; participation in basic training regarding environmentally friendly management; requirement for grassland strips along public roads. The requirements for the main activity of the support for environmentally friendly management must be met as a full package during the five-year commitment period.

In addition to the main activity, it is also possible to select additional one-year activities, among which there is *"Additional activity of water protection"*, which requires that at least 50% of the eligible land is kept under winter vegetation consisting of crops from November 1 to March 31. The support rate for the main activity is EUR 50/ha/year, while the support for additional activity for water protection is EUR 5/ha/year. Eligible land is arable land (incl. grassland not older than four years).

Another agri-environmental measure *"Regional water protection support"* is a specific measure targeted at Nitrate Vulnerable Zones. The support is granted for 1) keeping land under winter vegetation and 2) keeping land as grassland. Requirement related to keeping land under winter vegetation stipulates that the applicant keeps at least 60% of the eligible land under winter vegetation consisting of crops from November 1 of the commitment year to March 31 of the subsequent commitment year. The applicant must apply also for the "Support for environmentally friendly management" (main activity). Also, the applicants must participate in water protection training organised by the Ministry of Rural Affairs. The support rate for keeping land under winter vegetation is €7/ha/year.

Poland

In Poland, growing of catch crops is promoted through two agri-environmental measures of the RDP. Also, area under catch crops can be used for the fulfilment of the EFA requirement.

- ***agri-environment scheme***

There is one catch crop specific agri-environment measure in Poland, while another measure stimulates growing of catch crops within a set of requirements for sustainable land management.

Package 2 *"Protection of soils and waters"* of Agri-environmental-climate action (M10) targets growing of catch crops by its Variant 2.1 *"Intercrops"*. In Poland, intercrops should be used only as a mixture of a minimum of 3 plant species, the dominant plant in the mixture or cereals used in the mixture may not exceed 70% of its composition.

Sowing of intercrops should take place by September 15, and agrotechnical procedures should not resume before March 1. No fertilization, use of pesticides and municipal sewage sludge is allowed for intercrops. The biomass of intercrops has to be incorporated in the land, excluding soil cultivation in no-tillage system. The main crop cannot consist of the mixture of the same plants. General requirements for the package provide an obligation to have an agri-environmental plan; a preservation of all permanent grassland and landscape elements; and the obligation to keep a register of agri-environmental activities.

The support is provided in designated areas particularly at risk of water erosion (about 8.2%), problem areas with low humus content (around 3.6%) and areas particularly exposed to nitrates from agricultural sources (7.4%). The payment is granted only to arable land, and the support rate is PLZ 650/ha/year (~ EUR 151). The payments are subject to a degressivity depending on the area declared (for example, in 2018, 75% of the basic rate was applied for an area of over 50 ha to 100 ha, 60% of the basic rate - for an area over 100 ha).

Package 1 *"Sustainable agriculture"* concerns diversification of agricultural crops under sustainable land management (minimum 4 crops should be grown). The requirements regarding the land use also anticipate that in one year additional practice such as growing of intercrops (sown by October 1, no agrotechnical procedures before February 15) should be implemented, as well as growing of intercrops can be chosen from additional practices that should be implemented in another year. The basic payment rate is PLZ 400/ha/year (~ EUR 93).

- ***EFA requirement of greening payment***

In Poland, areas with catch crops (*catch crops or green cover - winter catch crops*) can be classified as EFA. To classify for greening payment, catch crops should be grown as under-sowing consisting of grasses or small seed legumes or mixtures formed from at least 2 plant species from cereals, oilseeds, fodder, legumes and melliferous plants (mixtures cannot consist of cereals only). Due to the derogation, in 2018, farmers had the option of sowing an intercrop consisting of a single crop belonging to grasses or other forage plants instead of a compulsory mix of at least two plant species. The mixture grown as an intercrop cannot then be grown as the main crop in the year following the year of sowing. Winter plants usually sown in autumn for harvesting or grazing cannot be simultaneously declared as EFA.

Stubble intercrops should be sown from July1 to August 20 and maintained in the field at least until October 15 or, in case of individual approach, 8 weeks from the date of sowing. Sowing of winter intercrops should take place from July 1 to October 1, and they must be kept in the field at least until February 15.

It is forbidden to apply plant protection products during the period of the maintenance of intercrops, this ban applies to under-sowings from the moment of harvesting of the main crop for at least eight weeks or until the next main crop is sown. This ban also includes seed treatment.

To avoid double financing, agri-environmental and EFA requirements cannot be met with the same catch crop area - it is not possible to declare the same area of catch crops for agri-environmental support and as EFA at the same time.

Sweden

In Sweden, growing of catch crops is promoted through one agri-environment measure of the RDP. Also, area under catch crops can be used for the fulfilment of the EFA requirement.

- ***agri-environment scheme***

Within measures for environmentally friendly and climate-friendly agriculture, there is a targeted measure for growing of catch crops in Sweden – *"Reduced nitrogen leakage"* with its activity cultivation of catch crops.

The following plants can be grown as catch crops: forage grass or forage grass in mixture with forage legumes (maximum 15% of the seed mixture can consist of legumes); white mustard, oil radish or radish; rye (autumn) or Italian ryegrass. Grasses should be grown as under-sowing in the main crops (except potatoes and vegetables). White mustard, oil radish and radish can be grown as under-sowing and intercrop, in case of potatoes and vegetables – only as intercrop. Rye and Italian ryegrass can be used as intercrop only after potatoes and vegetables. The field must be located in a nitrate sensitive area.

There are no specific dates for when different catch crops must have been sown at the latest. However, there is a condition that catch crops should be sown at the time allowing them to develop well and pick up nitrogen after harvesting of the main crop. Catch crops should be sown with a seed quantity providing a good stock of biomass. Grasses, white mustard, oil radish and radish should not be terminated earlier than October 10, rye and Italian ryegrass - not earlier than January 1.

It is forbidden to use fertilizers or plant protection products after harvesting the main crop.

The compensation for growing of catch crop SEK 1100/ha/year (~ EUR 107).

- ***EFA requirement of greening payment***

In Sweden, it is possible to declare the area under catch crops as EFA. Under-sowings of grasses or legumes or mixture of these plants can be counted as EFA if they are not terminated earlier than November 1. The eligibility criteria for intercrops require that intercrops consist of at least 2 crops (beet, red clover, buckwheat, oats (spring), phacelia, barley (spring), oil radish, Persian clover, bristle oat, ryegrass, rape (spring), turnip rape (spring), rye (spring), triticale (spring), radish, sunflower, subterranean clover, Sudan grass, tagetes, wheat (spring), vetch, white mustard, pea), sown before September 1 and terminated not earlier than November 1.

It is prohibited to use plant protection products on catch crops from September 1 to October 31 (if the main crop is harvested before September 1, plant protection products cannot be used on under-sowing for 8 weeks).

In order to declare catch crops as EFA, it must not be on arable land for which agri-environmental compensation for reduced nitrogen leakage was granted.

Finland

In Finland, growing of catch crops is promoted through two agri-environment measures of the RDP. Catch crops are not defined as one of the categories eligible for fulfilling the EFA requirement.

- ***agri-environment scheme***

In Finland, growing of catch crops is supported through agri-environment measure *"Biodiversity in arable land environments (09)"*, which is a parcel-specific operation.

Catch crops may be grown as under-sowings (sown with the main harvest or at the sprouting stage at the latest) or intercrops, but they should be sown no later than August 15. Vegetation may not be tilled or ploughed in the autumn before October 1. Plant species and plant varieties that are suitable for the area should be grown, and the sufficient amount of seed should be used.

At the same time, farmers have to apply for the measure *"Balanced use of nutrients (01)"*. This farm-level operation is a precondition for making a commitment on parcel-specific operations and serves as a tool for planning and monitoring parcel-specific operations (cultivation plan, parcel-specific notes, training and various assessments of environmental conditions (i.e., soil quality)). The requirements of planning and record-keeping exceed the statutory standards. Minimum requirements concerning the use of nitrogen and phosphorus fertilizers and plant protection products stricter than the baseline requirements also have to be observed.

Payment rate for catch crops is EUR 100/ha/year. Payment for the mandatory farm-level operation is EUR 54/ha/year for eligible arable land area for arable crops.

There is another agri-environment support measure *"Plant cover on arable land in winter (07)"*, where growers of catch crops can benefit along other farmers providing plant cover in winter, if the vegetation is maintained until the following spring.

The parcel-specific operation is implemented in all parts of the country, but the requirements are more stringent in the target region for plant cover in winter. About 70% of the total arable land in Finland is located in the target region for plant cover in winter.

Farmer must maintain plant cover in an acceptable manner on 20% of the total eligible area. Farmer may increase the annual area covered by plants to exceed 20%, and the share exceeding the minimum of 20% may vary from one year to another. Payments are made in the target region if there is a plant cover on at least 20%, 40%, 60% or 80% of the eligible area. In other regions, payments are made if there is a plant cover on at least 20%, 40% or 60% of the eligible area. In target regions, the minimum share of the area (20%) under plant cover may be implemented by reduced tillage, while higher limits must be met with an actual plant cover. In other areas, plant cover may be implemented in full with reduced tillage.

When the area with plant cover is 20%, the payment is EUR 4/ha/year. When the area with plant cover is 40%, the payment is EUR 18/ha/year in the target region and EUR 9/ha/year in other regions.

When the area with plant cover is 60 %, the payment is EUR 36/ha/year in the target region and EUR 11/ha/year in other regions. When the area with plant cover is 80%, the payment is EUR 54/ha/year in the target region.

Germany

In Germany, growing of catch crops is promoted through the RDP agri-environment measures, as well, catch crops are defined as one of the categories eligible for fulfilling the EFA requirement.

- ***agri-environment scheme***

In Germany, rural development is implemented through 13 regional RDPs, which broadly correspond to the States (but with two joint programmes). Elements common to regional programmes are presented in a National Framework established at the federal level.

According to the National Framework, growing of catch crops is targeted in the measure *"Conservation of under-sowings and intercrops over the winter (M10.0003)"*. General requirements provide that the area under this measure occupies at least 5% of the arable land (but it is possible to deviate from this criteria); the States should fix a date until when catch crops remain on the field; catch crops may also be grown after this date, but then they should be only mechanically removed; there are restrictions on the use of fertilizers and plant protection products. The support rate is set at EUR 75/ha/year.

In Bavaria, which is the State with the largest arable land area, the corresponding measure *"Winter greening with catch crops/wild crops (B35/B36)"* is being implemented. It covers a) catch crops grown as under-sowings and intercrops; b) wild crops. The latter are specially approved seed mixtures - wildlife-friendly catch crops.

Catch crops must be sown by October 1 and not terminated before February 15. No plant protection products are allowed on catch crops. Termination of catch crops can only be mechanical.

The support rate for catch crops is EUR 70/ha/year, for wild crops - EUR 120/ha/year. Winter greening with wild crops is limited to maximum of 10 ha.

Growers of catch crops can benefit also in some specific cases. Measure *"Avoidance of intensive crops in water management sensitive areas (B39)"* provides support for the abandonment of the cultivation of winter wheat, oilseed rape, maize, potatoes, grain legumes and field vegetables replacing it by winter greening, which should be maintained till February 15. The support is targeted at specific areas. Amount of the payment is 250 EUR/ha/year. Eligible area is arable land. The eligible area is limited to maximum of 5 ha per applicant limited.

While measure *"Mulch/strip/direct sowing with row crops (B37/B38)"* combines the practices of mulch/strip/direct sowing of row crops with sowing of catch crops as greening (sown annually) after the harvest of the main row crop of the previous year. The support rate for mulch sowing is EUR 100/ha/year, and for strip/direct sowing EUR 150/ha/year.

- ***EFA requirement of greening payment***

Areas under intercrops and grass under-sowings can be declared as EFA in Germany. For intercrops, there is a requirement that it is a mixture of at least 2 species from a special list (Appendix 3 DirektZahlDurchfV)[9], no species can constitute more than 60%, total of grasses cannot exceed 60%. For grass under-sowing grasses and legumes are allowed.

According to the requirements in Bavaria, intercrops must be sown after the harvest of the main crop by October 1, Intercrop must have a decent stock (land cover over 40%) before the end of the vegetation. They must be kept on the field until January 15, followed again by the main crops, which are different from intercrops (however, the intercrops can serve as a greening for a following fallow land). Under-sowings may be used in the following year as the main crop, but then they are no more counted as EFA. Under-sowing must be left on the field till January 15 or at least until the following sowing of the next main crop, if it is sown before January 15. As greening, catch crops should be maintained at least until February 15. Previous rolling, shredding or hammering (Walzen/Häckseln/Schlegeln) of catch crops is permitted.

[9] *http://www.gesetze-im-internet.de/direktzahldurchfv/anlage_3.html*

No use of mineral fertilizers, pesticides or sewage sludge is permitted on catch crops, but they can be used as a pasture for sheep or goats. In the following year, grazing with cattle is also allowed. After January 15, any use of the growth is possible.

In order to avoid double counting, if the same catch crop area is declared for EFA and agri-environment measures, EUR 75 are deducted from the agri-environment payment.

Denmark

There is no direct agri-environment support for catch crops in Denmark, but the areas under the catch crops can be declared as environmental focus area (EFA). Catch crops are mainly the mandatory requirement by the Nitrate Directive in Denmark.

- ***Implementation of Nitrate Directive***

Since late 1980' several subsequent Action Programmes have been implemented in Denmark to reduce the losses of nitrogen and phosphorus to the aquatic environment, especially directed towards reductions in nitrate leaching from agricultural sources. The regulatory measures include nutrient-related measures, for example, mandatory fertilizer plans for each farm and improved utilization of nitrogen in manure as well as area-related measures, (among others) requirements for growing of catch crops. Therefore, Danish farmers have a long-term experience and are widely familiar with catch crops.

Farms with an annual turnover over DKK 50,000 from sales of crops production, livestock production or a combination of both and a total area of 10 hectares or more, shall establish a minimum area of catch crops (10% or 14% of the catch crop basis for farms according to the amount of the use of livestock manure). If farmers do not comply with the requirement, fertilizer quota for the farm is reduced correspondingly.

Pure grass (without clover); under-sowings of cruciferous crops and chicory; grains and grass sown by August 1; cruciferous crops, honeycomb, common rye, perennial rye, hybrid rye, spring barley, oats sown by August 20; or seed grass, which continues as a crop after harvest, can be used as compulsory catch crops. Catch crops should not be demolished, ploughed or otherwise destroyed before October 20.

Fertilizer standard of catch crops is 0 kg N per hectare and the N-quota of the following crop will be reduced with either 17 or 25 kg N/hectare. Farmers applying below 0.8 LU manure/ha must establish catch crops on 10% of the owned and leased area and the N-quota of the following crop will be reduced with 17 kg N/hectare. Farmers applying more than 0.8 LU manure/ha must establish catch crops on 14 % of the owned and leased area and the N-quota of the following crop will be reduced with 25 kg N/hectare. The percentage of the area must be calculated from "the catch crop basis area" which includes areas with annual crops with no nitrogen assimilation in the autumn, which does not include grassland.

There was a possibility to have winter crops in 100% of areas instead of catch crops to meet the requirement till 2016, but due to the problem that a winter green field does not give the same effect on the nitrogen leaching as catch crops, this was stopped, giving the farmers other alternatives to choose instead of establishing mandatory catch crops:

1) Reduction of the famers total N-quota: The reduction of the farm's total N-quota is calculated by multiplying a conversion factor with the number of hectares of catch crops that the farm is obliged to sow and withdraw this sum from the total N-quota.
2) Establishment of short time catch crops (between winter crops): a short time catch crop is a crop that must be established before 20th of July and at the earliest ploughed on 20th of September. It is allowed to sow and plough this crop before sowing the next winter crop. The short time catch crop must be either fodder radish or yellow mustard. Two hectares of short time catch crops equal to one hectare of catch crops.
3) Establishment of catch crop at another farm: the catch crop can be established at another farm. A written agreement must be made signed by both farmers.

4) Establishment of perennial energy crops: perennial crops can be grown at the farm, certain type of crops must be used: willow, poplar, alder, miscanthus. Perennial crops must only be placed on the field earlier in rotation and not at a former permanent grass. 0.8 hectares of perennial energy crops equal to one hectare of catch crops.
5) Land set aside, and especially set aside areas are welcomed along the lakes and streams (in general 1 hectare of set aside area is equal to 1 ha of catch crops, but for the areas along the lakes and streams the conversion factor is higher: 1 ha of set aside area equals to 4 ha of catch crops).
6) Early sowing of certain winter crops. Winter crops should be sown no later than September 7 to be considered as a replacement of a catch crop area. 4 hectares of early sown winter crops equal to one hectare of catch crops.
7) Separation and incineration of the fibre fraction of manure and processed manure: the farm can process the slurry and follow it by incineration of the fibre fraction. This can replace catch crops, because it is organically bound nitrogen that is leached over a long period of time. Organic fertilizer equivalent of 870 kg nitrogen convert to 1 ha of catch crops.

The farm can use mandatory catch crop areas to meet the requirement of environmental focus areas (EFA) while one should be aware that both sets of rules are being met. However, the alternatives cannot be used to fulfil the EFA requirement at the same time.

In addition to mandatory catch crops, there are two catch crop schemes included in the latest Danish Nitrate Action Programme: a general catch crop scheme for holdings using organic manure and intermediate targeted catch crop scheme in order to avoid an increase in nitrate leaching in sensitive areas after cancelation of the reduction of nitrogen application standards for farming.

1) A general catch crop scheme for holdings using organic manure

Livestock crops are designed to compensate for the additional leaching of nitrogen from organic fertilizers (since the leaching of nitrate from livestock manure is more pronounced than the nitrate leaching from commercial fertilizers), and are targeted to specific areas (catchment areas that drain into nitrate-sensitive Natura 2000 sites and coastal catchments with river basin management needs). The farm must lay out animal crops if it has over 10 ha crop size of property in target areas and has applied 30 kg N or more from organic fertilizer per ha. The livestock crop requirement is calculated annually based on the development in the use of organic fertilizers in the individual catchments. This means that the requirement in the individual catchments can vary from year to year, and that there will be areas where no animal crops should be laid out. This scheme is mandatory and catch crops under it are not compensated. The same rules apply to livestock crops as to the obligatory catch crops, and they are administered as a single claim. One can also use the same alternatives to livestock crops as to the obligatory crops (early sowing, fallowing, etc.). If farmers do not comply with the requirement, the total nitrogen quota for the farm is reduced in the same way as for the obligatory catch crops. Livestock crops may overlap with EFA crops. That is, an area used to meet the EFA requirement can at the same time be used to meet the livestock crop requirement. Livestock crops must not overlap with the mandatory crops and targeted crops.

2) Targeted catch crop scheme

The scheme is designed as a *de minimis aid* scheme for voluntary establishment of additional catch crops in order to avoid an increase in nitrate leaching as in 2015 Danish government cancelled the reduction of nitrogen application standards for farming. The scheme has been designed to ensure the necessary reduction of nitrogen loss to coastal waters and groundwater witch is determined for specific geographical areas in order to avoid groundwater deterioration within an area with nitrogen-reducing effort needs. The scheme has a voluntary part and in case of low efficiency – mandatory part of the implementation.

The voluntary catch crops must be additional to the national mandatory requirement for catch crops on 10 or 14% of the farms crop base area, and they may not be established on the same area used for catch crops to meet the EFA requirement under direct payments. The farmer's costs from laying out the voluntary catch

crops or a number of alternatives to catch crops are compensated through national de minimis aid (in 2019, the subsidy rate is DKK 529/ha/year).

Voluntary catch crops have the same requirements for crops, sowing and termination terms as mandatory catch crops. The alternatives allowed to substitute voluntary catch crops are also the same. The farm can apply for the subsidies for a continuous area of at least 0.01 hectares and voluntary catch crops should be followed by a spring crop in the following calendar year.

If the voluntary interpretation of catch crops or alternatives cannot ensure a sufficient reduction in the emission of nitrogen, a mandatory requirement for the establishment of catch crops can be introduced in area with nitrogen-reducing effort needs.

- ***EFA requirement of greening payment***

There are four types of EFA farmers can choose to meet the EFA obligations in Denmark, catch crops or green cover are one of them. The rules for EFA catch crops largely follow the rules of the mandatory crops and one can use the compulsory crops and livestock crops to meet the EFA requirements as long as they are complying with the requirements of both sets of rules.

Catch crops must appear as well-established on the area in order to be approved as EFA. The requirements can be met with catch crops established as mixtures, sown before or after harvest (the crop cannot be the main crop following year) or under-sowings of grass, legumes or mixtures thereof (for example clover grass) in a main crop (not grass) before harvest. MFO crops may not be the following year as a main crop.

It is allowed to graze and mow areas with EFA under-sowings in Denmark. However, the grass cover must still appear well established till October 20. If the grass is mowed or trimmed, it is forbitten to leave the cuttings on the field within the period to October 20. There are no restrictions for EFA areas after October 20.

Main findings of the analysis

- Structure and intensity of agricultural activities in Venta and Lielupe RBDs are determined by a number of factors such as climate, geomorphology, production demand and costs on the market, etc.
- Temperature regimes in Venta and Lielupe RBDs are quite similar with the lowest air temperatures of -3 – -4 ^{0}C in January and maximums of 16.5 – 18 ^{0}C in July, and average temperatures in Latvia slightly lower than in Lithuania. Venta RBD receiving 700 – 850mm of annual precipitation is more abundant in water than the Lielupe RBD which receives 600 – 700 mm.
- Venta and Lielupe RBDs are rather different in their geomorphological properties what consequently determines different patterns of soil productivity in both RBDs. Most fertile soils are found in the Lielupe RBD though soil productivity here varies in a quite wide range. The highest soil fertility score is characteristic to the sub-basin of the Lielupė small tributaries in Lithuania where it reaches 49 on average and even up to 55 – 57 in some counties (soils with the score exceeding 42.1 are considered fertile and highly fertile). The average soil fertility score in the Mūša sub-basin is about 45 and in the Nemunėlis river sub-basin - only about 38. Soil fertility score in the Latvian part of the Lielupe RBD varies from 27 to 67 with the average of 41 score. Most fertile soils are found on the southwestern part of the Latvian part of the Lielupe RBD. Soils in the Venta RBD are less productive than in the Lielupe RBD. In Lithuania average soil fertility score in the Venta basin is 38, in the Bartuva and Šventoji – 37. In the Latvian part of the Venta RBD soil fertility varies from 16 to 49 with the average of 34 score.
- There is a close correlation between soil fertility and intensity of agricultural activities in Venta and Lielupe RBD. Territories dominated with high-fertility soils are intensively used for agriculture on both sides of the border. Utilised agricultural land makes around 60 % of the total land area in the Lithuanian

part of the Lielupe RBD and around 40 % in the Latvian part. In the Venta RBD, agricultural activities are much less developed than in the Lielupe RBD. Here, on the Lithuanian side, agricultural land makes about 50 % of the RBD area while on the Latvian side only 25 %.

- Arable land dominates in the structure of agricultural land in both RBDs. The largest share of arable land is in the territories with fertile soils. In the Lielupe RBD, on both sides of the border, in the territories dominated by fertile soils, arable land makes over 80% of all utilized agricultural land. In counties with less fertile soils intensity of agriculture and percentage of arable land is lower. E.g. in the eastern part of the Lielupė RBD in Latvia arable land makes only less than 60% of the total agricultural land area. Soil fertility in the Venta RBD is lower than in the Lielupe RBD and consequently intensity of agriculture and share of arable land is lower here as well. On the Lithuanian part of the Venta RBD arable land, on average, makes 64% of the total agricultural land area, and on the Latvian part – 67%.
- Territories with most productive soils are used for crop production; percentage of meadows and pastures is very low there. Meadows and pastures are mainly distributed in non-productive soils or even in dense relief areas where annual crop production cannot be expanded. Hence, larger areas of meadows and pastures are characteristic to the Venta RBD.
- Crop structure analysis reveals that annual winter crops dominate in both RBDs in both Lithuania and Latvia. In the Lithuanian part of the Lielupe RBD winter crops take near 60 % of the total arable land area; the share of winter crops in the Venta RBD is about 50 %. In Latvia, winter crops take up to 69% of the arable land in the Lielupe RBD, and 60% in the Venta RBD. Of winter crops, winter wheat takes the largest areas in all river basins; winter rape is a second important winter crop. In the areas with most productive soils intensive cropping technologies are used for growing of winter wheat and winter rape. Summer crops dominate in the sub-basins with less productive soils. Summer wheat and summer barley are the most popular summer crops. Except for the summer wheat and summer rape, growing technologies of summer crops are less intensive.
- In the farms of intensive crop production crop rotation consists of 3 fields: one field of leguminous crop, rape and other crops, and two fields of winter wheat and other cereals. At the end of the rotation, leguminous crops are replaced by rape and vice versa. When the share of leguminous crops and rape is larger, rotation is composed of 4 fields: rape is cultivated as a second or third crop in a sequence after cereals (usually winter wheat).
- Crop productivity mainly depends on soil fertility and intensity of agricultural technologies. In Lithuania, the highest yields are obtained in the sub-basins of the Lielupe small tributaries and the Mūša river having the most favourable conditions for crop production. The largest yields are obtained from the fields of winter cereals. In the period of 2014-2018, an average yield of winter cereals in the sub-basin of the Lielupė small tributaries was 5.4 t/ha. For comparison, in the basins of Nemunelis, Šventoji and Bartuva yields of winter cereals were about 30 % lower (3.7 t/ha). In Latvia, the yield of cereals from the fields in the Lielupe RBD during the last 5 years varied from 4.1 to 5.3 t ha^{-1}, while in the Venta RBD – from 3.3 to 4.5 t ha^{-1}. In last 5 years yields of winter cereals in Lithuania have been gradually increasing. The increase in winter cereal yields in the Lielupė RBD was more pronounced than in the Venta RBD and that, most probably, indicates improvement of agro-technologies and intensification of crop production activities. Yields of summer cereals are on average by 20 % lower than those of winter cereals. Spring cereals are mainly cultivated in soils with low fertility thus, farmers pay less attention to their agro technologies (pre- crops, fertilizers and pesticides).
- Actual data on the use of fertilizers at the regional level is not yet available either in Lithuania or in Latvia. Interviews with Lithuanian farmers reveal that striving for larger yields they continually increase rates of mineral fertilizers that consequently often exceed the crop demand. Nitrogen fertilizers are relatively cheap if to compare with the profit which can potentially be earned from the crop production. Application of mineral P and K fertilizers is rather limited, they are mainly used by large farms or companies. Farms (especially small) are not interested in performing soil agrochemical analyses and considering thereof results when planning fertilization. Farms that own less than 50 ha of land, which are not the main source of income for the farmer, usually use only mineral fertilizers (200-300 kg/ha). Family farms owing more than 100 ha of land usually use 200 kg/ha of complex (NPK and PK) fertilizers

and 400-500 kg/ha of nitrogen fertilizers. Those farms are focusing on long term vitality of the farm and protection of soil productivity. Largest amounts of fertilisers are used in large farms and companies – 800 – 900 kg/ha (of that 600 kg/ha of nitrogen fertilizers). These farms have better potential to create a higher value-added by attracting external financial support, better management of such financial resources and increasing labour efficiency. In the areas which are less favourable for crop production, intensive farms usually owned by young and active farmers, use 100 – 200 kg/ha of complex fertilizers (NPK or PK) and 300 kg/ha of nitrogen fertilizers. Older farmers use little mineral fertilizers. National statistics in Latvia shows that use of mineral fertilizers per one hectare of sown area has increased as well – from 84 kg in 2010 to 110 kg in 2017, or by about 30%.

- In the Lithuanian part of the Lielupe RBD livestock density currently averages to 0.15 LU per hectare of agricultural land. If to compare with 2014, it decreased by 9 %. In Latvia, a decreasing trend in livestock numbers is observed as well, however the total livestock number and livestock density in the Latvian part of the Lielupe RBD remains considerably higher than in Lithuanian - 0.26 LU/ha. Since 2013, livestock number in the Latvian part of the Lielupe RBD has decreased by almost 8%. Livestock density in the Latvian part of the Venta RBD equals to approx. 0.25 LU/ha and is rather similar to that in the Lielupe RBD. Since 2013, livestock numbers in the Latvian part of the Venta RBD even slightly increased though in the Lithuanian part of the Venta RBD livestock numbers are still decreasing. In comparison to 2014, the decrease is 8 % but the livestock density still remains close to that in the Latvian part – 0.24 LU/ha.
- Farm structure analysis reveals that current farming patterns in Venta and Lielupe RBDs considerably differ. Farming in the Lielupe RBD with large intensive crop farms dominating in its structure is not favourable to the environment while more diverse farming patterns in the Venta RBD are more sustainable. Based on the field declaration data of 2017, in the Lithuanian part of the Lielupe RBD nearly 60 % of all agricultural land is at the disposal of farms specializing exceptionally in the crop production. 60 % of all agricultural land is owned by farms larger than 150 ha. As well as in Lithuania, the largest share of agricultural land in the Latvian part of the Lielupe RBD is managed by big farms. Based on the data of Rural Support Service, even 74% of the land is managed by farms larger than 100 ha with the largest share (44 %) being in the farms larger than 500 ha. Farm structure in the Venta RBD in both countries is more diverse with a larger share of mixed and livestock farms and lower percentage of land managed by large and intensive farms. In Latvia 65 % of the land in the Venta RBD is at the disposal of farms larger than 100 ha with even 32 % being in the largest farms with over 500 ha. In Lithuania, 40 % of the agricultural land in the Venta RBD is owned by the farms larger than 150 ha.
- There were 13 agri-environmental measures being implemented in Venta and Lielupe RBDs in 2018 in Lithuania, the most popular of which were two: stubble fields in winter and cover crops in the arable land. In the Lielupe RBD, areas of stubble fields comprised 45 % of the entire area of agri-environmental measures, and the areas of cover crops – 21 %. In the Venta RBD areas of stubble fields and cover crops were respectively 41 % and 16 % of the total area of agri-environmental measures. The coverage of agri-environmental measures in relation to the total area of agricultural land is very little. In 2018, only about 3 % of the agricultural land in the Lielupe RBD and 2 % in the Venta RBD in Lithuania were under the contracts for agri-environmental measures. Cover crops, one of the most popular measure, was implemented on only 1% of the arable land in both RBDs. The measure for improving the status of water bodies at risk, which is intended at converting the arable land to perennial grasslands, was implemented on only 0.2% of the arable land in both Venta and Lielupe RBDs. In Latvia, as well as in Lithuania, in the Lielupe and Venta RBDs agri-environmental measures are implemented in relatively small areas. *Rye field in the winter period* is the most important RDP 2014-2020 agri-environmental sub-measure in Latvia regarding improvement of water quqlity. Supported area under this sub-measure in 2016 was 4% in the Venta river basin and 3% of agricultural land in the Lielupe river basin.
- In the Lithuanian part of the Lielupe RBD, 6 % of the agricultural land is certified according the rules of organic farming. In the Venta RBD, 7 % of the agricultural land is used for organic farming. In Lithuania, organic farming is usually chosen by the farmers working in less fertile lands. In the districts with fertile soils organic farming is less popular. Due to reduced payments, organic farming is losing its popularity

lately. The number of farmers engaged in organic farming decreases, and those who remain in business enlarge their farms. In Latvia, the area supported by RDP 2014-2020 measure M11 Organic farming take up to 11% of the utilised agricultural land in the Venta river basin and 5% in the Lielupe river basin. Two thirds of the organic farm areas are grasslands and only one third is arable land.

- Only very little environmental effect can be expected from the current implementation of agri-environmental measures in Venta and especially in the Lielupe RBD, because any environmental initiatives with such little coverage cannot overweigh or significantly decrease effects of intensive farming. It is expected that the intensity of agriculture will increase in future, so the need for agri-environmental measures such as catch crops will grow.
- Growing of catch crops in the Baltic Sea States is becoming an increasingly common practice in various support schemes. In some countries (Denmark, Poland), catch crops are an essential part of crop rotation, but in Lithuania and especially in Latvia catch crop practices should be enhanced.

Santrauka

Žemės ūkio intensyvumas ir struktūra turi didelės įtakos Ventos ir Lielupės UBR vandens telkinių ekologinei būklei. Dėl intensyvios žemės ūkio veiklos, dirvožemyje lieka dideli maistinių medžiagų kiekiai, kurie vėliau yra išplaunami į vandens telkinius. Kaip rodo atlikta aplinkosauginės situacijos analizė, intensyvaus ūkininkavimo teritorijose esantys vandens telkiniai dažnai patenka į rizikos grupę dėl padidėjusių azoto junginių koncentracijų, juose nepasiekiami aplinkosauginiai tikslai.

Žemės ūkio veiklos intensyvumą ir kryptis Ventos ir Lielupės UBR lemia visa eilė veiksnių, tokių kaip klimatas, reljefas, dirvožemio savybės, produkcijos kainos ir paklausa rinkoje ir t.t.

Dirvožemio našumas

Analizuojant Ventos ir Lielupės UBR dirvožemių našumą, išryškėja gana dideli abiejų UBR skirtumai.

Derlingiausi dirvožemiai vyrauja Lielupės UBR, tiesa, dirvožemių našumas skirtingose UBR dalyse svyruoja gana plačiame intervale. Lietuvoje didžiausias našumo balas yra būdingas Lielupės mažųjų intakų pabaseiniui. Čia jis vidutiniškai siekia 49, o kai kuriose seniūnijose – net 55- 57 (reikėtų atkreipti dėmesį, kad dirvožemiai, kurių našumas viršija 42,1 balo yra vertinami kaip geros ir labai geros ūkinės vertės dirvožemiai). Vidutinis dirvožemio našumo balas Mūšos pabaseinyje siekia apie 45, o Nemunėlio pabaseinyje – tik 38. Latvijoje esančioje Lielupės UBR dalyje dirvožemio našumas kinta nuo 32 iki 58 balo, o derlingiausi dirvožemiai yra pietvakarinėje Lielupės UBR dalyje.

Ventos UBR dirvožemiai yra mažiau našūs. Lietuvoje vidutinis dirvožemio našumo balas Ventos baseine yra 38, Bartuvos ir Šventosios - 37. Latvijoje, vidutinis Ventos UBR dirvožemio našumas siekia 34 balus.

Žemės ūkio paskirties naudmenos ir jų struktūra

Dirvožemio našumas yra vienas svarbiausių žemės ūkio intensyvumą ir struktūrą lemiančių veiksnių. Žemės ūkio naudmenų analizė rodo glaudžią koreliaciją tarp žemės našumo ir dirbamos žemės plotų administraciniuose Ventos ir Lielupės UBR rajonuose.

Derlingiausi dirvožemiai, tiek Latvijos, tiek Lietuvos pusėje, vyrauja Lielupės UBR (Lietuvoje – Lielupės mažųjų intakų pabaseinyje, o Latvijoje – pietvakarinėje UBR dalyje). Abiejose šalyse teritorijos, kuriose plyti derlingiausios žemės, yra intensyviai naudojamos žemdirbystei. Lielupės UBR Lietuvos teritorijoje deklaruotos žemės ūkio paskirties naudmenos sudaro apie 60 proc. viso UBR ploto[10]. Tuo tarpu Latvijos pusėje žemės ūkio paskirties naudmenų dalis yra mažesnė – čia dirbama žemė sudaro apie 40 proc. šalyje esančio Lielupės UBR ploto[11]. Ventos UBR žemdirbystės apimtys yra gerokai mažesnės. Lietuvos dalyje dirbama žemė sudaro apie 50 proc. šalies teritorijoje esančio Ventos UBR ploto, o Latvijoje– vos 25 proc.

Ariama žemė sudaro didžiąją žemės ūkio paskirties naudmenų dalį. Didžiausia ariamos žemės dalis yra teritorijose, kuriose dominuoja derlingi dirvožemiai. Tiek Latvijoje, tiek Lietuvoje, teritorijose, kuriose vyrauja našios žemės, ariama žemė sudaro virš 80 proc. visų žemės ūkio naudmenų, o ten, kur vyrauja derlingiausi dirvožemiai (t.y. Mūšos ir Lielupės mažųjų intakų pabaseiniuose Lietuvoje bei pietinėje ir pietvakarinėje Lielupės UBR dalyse Latvijoje), - ir virš 90 proc. Seniūnijose, kuriose dirvožemio našumas yra mažesnis, ariamos žemės dalis atitinkamai taip pat yra menkesnė. Pvz., Latvijoje, rytinėje Lielupės UBR dalyje, ariama žemė tesudaro iki 60 proc. visų žemės ūkio naudmenų.

Ventos UBR dirvožemių derlingumas yra gerokai mažesnis nei Lielupės UBR, tad ir žemės ūkio intensyvumas bei procentinė ariamos žemės dalis čia yra mažesnė. Lietuvoje Ventos UBR ariama žemė vidutiniškai sudaro 64 proc. viso žemės ūkio paskirties žemės ploto, o Latvijoje – 67 proc.

[10] Remiantis Žemės ūkio informavimo ir kaimo verslo centro pateiktais 2017 m. pasėlių deklaravimo duomenimis.
[11] Remiantis Kaimo paramos tarnybos Integruotos administravimo ir kontrolės sistemos duomenimis apie 2016 m. deklaruotas naudmenas.

Žemdirbystės apimtys ir pasėlių struktūra

Pasėlių struktūros analizė atskleidžia, kad abiejuose UBR, tiek Lietuvoje, tiek Latvijoje, vyrauja vienmečiai žieminiai augalai. Lietuvoje Lielupės UBR žieminiai augalai užima beveik 60 proc. viso ariamos žemės ploto, o Ventos UBR - apie 50 proc. Latvijoje žieminių augalų pasėliai sudaro beveik 70 proc. viso ariamos žemės ploto Lielupės UBR ir apie 60 proc. Ventos UBR.

Iš žieminių augalų didžiausius plotus visuose baseinuose užima žieminiai kviečiai; antri pagal populiarumą yra žieminiai rapsai. Kviečių ir rapsų populiarumą lemia tai, kad jie yra prekiniai augalai kasmet garantuojantys nemažas ir pastovias pajamas ūkininkams. Dažniausiai derlinguose dirvožemiuose auginamos labai produktyvios šių žieminių augalų veislės, kurios reikalauja intensyvių augalų auginimo technologijų.

Vasariniai javai auginami mažiau produktyviose žemėse. Populiariausi vasariniai augalai – vasariniai kviečiai ir miežiai. Mažesnio derlingumo dirvose gausus trąšų ir pesticidų naudojimas neatsiperka, tad, išskyrus vasarinius kviečius ir vasarinius rapsus, kitų vasarinių augalų auginimo technologijos nėra intensyvios.

Pastaraisiais metais, įvedus žalinimo reikalavimus, labai išaugo pupinių augalų plotai. Remiantis 2016 m. pasėlių deklaravimo duomenimis, Lietuvoje pupinių augalų plotai Ventos ir Lielupės UBR sudarė atitinkamai 15 ir 16 proc. viso deklaruotų pasėlių ploto, o Latvijoje – atitinkamai 4 ir 6 proc.

Žemės ūkio augalų derlingumas daugiausia priklauso nuo dirvožemio našumo bei taikomų auginimo technologijų intensyvumo.

Lietuvoje didžiausias derlingumas yra būdingas Lielupės mažųjų intakų ir Mūšos pabaseiniams, kuriuose yra susiformavusios palankiausios sąlygos žemdirbystei. Didžiausi derliai yra gaunami iš žieminių javų pasėlių. Remiantis statistikos departamento duomenimis, 2014 – 2018 m. vidutinis žieminių javų derlingumas Lielupės mažųjų intakų pabaseinyje buvo 5,4 t/ha. Palyginimui, Nemunėlio, Šventosios bei Bartuvos baseinuose žieminių javų derlingumas buvo apie 30 proc. mažesnis (3,7 t/ha). Latvijoje javų derlingumas Lielupės UBR per pastaruosius 5 metus svyravo nuo 4,1 iki 5,3 t/ha, o Ventos UBR – nuo 3,3 iki 4,5 t/ha.

Faktinių duomenų apie mineralinių trąšų naudojimą regioniniu ar vietiniu lygiu nėra nei Lietuvoje nei Latvijoje. Atlikti interviu su Lietuvos ūkininkais atskleidžia, kad maksimalaus derliaus siekimas skatina juos naudoti vis didesnes azoto trąšų normas, kurios pranoksta augalų poreikius. Azoto trąšos yra sąlyginai pigios, palyginti su ekonomine nauda gaunama parduodant galimai maksimalų grūdų derlių. Mineralinės fosforo ir kalio trąšos naudojamos ribotai, neskaitant stambių ūkių ir žemės ūkio bendrovių. Ūkininkai (ypač smulkūs) nesuinteresuoti atlikti dirvožemio agrocheminių tyrimų ir jais tinkamai pasinaudoti. Iki 50 ha žemės valdantys ūkininkai, kurių pagrindinis pragyvenimo šaltinis nėra žemės ūkio veikla, dažniausiai naudoja tik mineralines azoto trąšas (200-300 kg/ha). Šeimos ūkiai, kurie sudaro didžiausią šalies ūkių struktūros dalį, valdantys virš 100 ha, dažniausiai tręšimui naudoja 200 kg ha^{-1} kompleksinių (NPK ar PK) ir 400-500 kg ha^{-1} azoto trąšų. Šie ūkiai yra orientuoti į ilgalaikį ūkio gyvybingumo, dirvožemio derlingumo išsaugojimą. Daugiausiai mineralinių trąšų yra naudojama stambiuose ūkiuose ir bendrovėse 800-900 kg ha^{-1} (iš jų 600 azoto trąšos kg ha^{-1}). Šiuose ūkiuose yra palankesnė terpė aukštesnės pridėtinės vertės sukūrimui, pritraukiant išorinį finansavimą ir užtikrinant efektyvesnį tokių lėšų valdymą, didinant darbo našumą. Mažiau palankesniuose ūkininkauti regionuose intensyviausiai ūkininkaujantys (ši dalis nėra didelė), dažniausiai tai yra aktyvūs, jaunesnio amžiaus ūkininkai, naudoja 100-200 kg ha^{-1} kompleksinių (NPK ar PK) ir 300 kg ha^{-1} azoto trąšų. Seniau ūkininkaujantys, vyresnio amžiaus ūkininkai trąšų naudoja nedaug.

Statistiniai duomenys rodo, kad 2017 m. Latvijoje iš viso buvo sunaudota 133,5 tūkst. t mineralinių trąšų. Nuo 2010 m. iki 2017 m. mineralinių trąšų (vertinant pagal veikliąją medžiagą azotą) sunaudojimas 1 ha pasėlių išaugo nuo 84 kg iki 110 kg, t. y. apie 30 proc.

Gyvulininkystė ir jos apimtys

Lietuvoje, Lielupės UBR vidutinis gyvulių tankis šiuo metu siekia 0,15 SG (sutartinių gyvulių) hektare dirbamos žemės. Lyginant su 2014 m., gyvulių skaičius lietuviškoje Lielupės UBR dalyje sumažėjo 9 proc. Latvijoje taip pat pastebima gyvulių skaičiaus mažėjimo tendencija, tačiau gyvulių tankis latviškoje Lielupės UBR dalyje yra

gerokai didesnis nei lietuviškoje ir siekia 0,26 SG/ha. Nuo 2013 m. gyvulių skaičius Latvijoje esančioje Lielupės UBR dalyje sumažėjo beveik 8 proc.

Gyvulių tankis latviškoje Ventos UBR dalyje siekia 0,25 SG/ ha ir yra gana artimas tankiui Lielupės UBR. Nuo 2013 m. gyvulių skaičius Ventos UBR Latvijoje netgi šiek tiek išaugo, tuo tarpu lietuviškoje Ventos UBR dalyje gyvulių skaičius nuo 2014 m. sumažėjo 8 proc. Gyvulių tankis lietuviškoje Ventos UBR dalyje siekia 0,24 SG/ha ir nedaug teatsilieka nuo tankio Latvijoje.

Ūkių struktūra

Ūkių struktūros analizė rodo, kad ūkininkavimo pobūdis ir tendencijos Ventos ir Lielupės UBR gerokai skiriasi. Lielupės UBR, kur dominuoja dideli, intensyvias žemdirbystės technologijas taikantys ūkiai, vykdoma veikla dažniausiai yra nedraugiška aplinkai, tuo tarpu gerokai įvairesnės ūkininkavimo praktikos Ventos UBR yra darnesnės ir palankesnės aplinkos atžvilgiu.

Intensyviausiai žemdirbystė yra plėtojama Lietuvos pusėje esančioje Lielupės UBR dalyje (ypatingai Lielupės mažųjų intakų pabaseinyje). Remiantis 2017 m. pasėlių deklaravimo duomenimis, Lietuvoje esančioje Lielupės UBR dalyje apie 60 proc. visos žemės ūkio paskirties žemės priklauso ūkiams, kurie specializuojasi išimtinai augalininkystėje. 60 proc. visos deklaruotos žemės ūkio paskirties žemės priklauso didesniems nei 150 ha ūkiams. Kiekvienoje Lielupės UBR seniūnijoje yra bent 2-3 didesni nei 500 ha ūkiai, o seniūnijose, kuriose vyrauja ypatingai našūs dirvožemiai tokių ūkių yra po 5 ar daugiau.

Latvijoje Lielupės UBR ūkių struktūroje taip pat dominuoja augalininkystės ūkiai, tačiau jų dalis lyginant su lietuviškąja UBR dalimi yra mažesnė – jie sudaro 48 proc. viso ūkių skaičiaus. Kaip ir Lietuvoje, didžioji dirbamos žemės dalis Latvijoje priklauso didiesiems ūkiams. Remiantis Kaimo paramos tarnybos duomenimis, net 74 proc. dirbamos žemės Lielupės UBR Latvijoje priklauso didesniems nei 100 ha ūkiams, o 44 proc. iš šio skaičiaus priklauso ūkiams, valdantiems daugiau nei 500 ha.

Ir Lietuvoje, ir Latvijoje Ventos UBR ūkių struktūra yra gerokai įvairesnė. Čia didesnę ūkių dalį sudaro mišrūs bei gyvulininkystės ūkiai, o dideli ir intensyvią veiklą vykdantys ūkiai valdo mažesnę dirbamos žemės dalį lyginant su Lielupės UBR.

Lietuviškoje Ventos UBR dalyje augalininkystės ūkiai dirba apie 40 proc. visų žemės ūkio naudmenų, tuo tarpu likusi dalis priklauso mišriems bei gyvulininkystės ūkiams, kurių veikla įprastai yra tvaresnė ir draugiškesnė aplinkai, nes jie gali derinti tręšimą organinėmis ir mineralinėmis trąšomis. Latvijoje augalininkystės ūkiai Ventos UBR sudaro 46 proc.

Remiantis KPT duomenimis, Latvijoje Ventos UBR didesniems nei 100 ha ūkiams priklauso 65 proc. dirbamos žemės, tame tarpe 32 proc. priklauso ūkiams didesniems nei 500 ha. Pasėlių deklaravimo duomenys rodo, kad lietuviškoje Ventos UBR dalyje apie 40 proc. dirbamos žemės priklauso didesniems nei 150 ha ūkiams.

Aplinkosauginių priemonių įgyvendinimas: atitikimas žalinimo reikalavimams bei dalyvavimas Kaimo plėtros programos (KPP) agrarinės aplinkosaugos ir klimato priemonėje

Žalinimo reikalavimai. Žalinimo išmoka už palankesnę aplinkos atžvilgiu žemės ūkio veiklą buvo įvesta 2015 m. įgyvendinus Bendrosios žemės ūkio politikos (BŽŪP) reformą bei siekiant sumažinti žemės ūkio daromą poveikį aplinkai.

Šią išmoką gaunantys ūkininkai kiekvienais metais tam tikrame ūkio plote turi imtis įvairių, nesudėtingų, aplinkai ir klimatui palankesnių žemės ūkio veiklų, kurios vykdomos ne kontrakto pagrindu. Žalinimo išmoka skiriama pareiškėjams, kurie laikosi šių reikalavimų:

- pasėlių įvairinimo;
- turimų daugiamečių ganyklų arba pievų išlaikymo (jei pareiškėjas neturi daugiamečių pievų – laikoma, kad šis reikalavimas įvykdytas);
- ekologiniu atžvilgiu svarbios vietovės (EASV) išskyrimo.

Tiek Lietuvoje, tiek Latvijoje didžiausi žalinimo plotai deklaruoti įgyvendinant pasėlių įvairinimo reikalavimą auginti bent 3 skirtingus augalus. Įgyvendinant žalinimo reikalavimus, tiek Lietuvoje, tiek Latvijoje, Ventos UBR

sėjomainoje pastaraisiais metais buvo auginama iki 5 augalų, tuo tarpu Lielupės UBR sėjomainos buvo gerokai trumpesnės susidedančios iš javų, rapsų, žirnių/pupų.

Pasėlių deklaravimo duomenys rodo, kad 2017 m. Lietuvoje didžiausią deklaruotų EASV plotų dalį abiejuose UBR sudarė azotą kaupiantys augalai. Lielupės UBR azotą kaupiantys augalai sudarė net 84 proc. viso deklaruoto EASV ploto, Ventos UBR – 78 proc.

2014 – 2020 m. KPP agrarinės aplinkosaugos ir klimato priemonės įgyvendinimas. Pagal pasėlių deklaravimo duomenis, Lietuvoje, Ventos ir Lielupės UBR 2018 m. buvo įgyvendinama 13 skirtingų agrarinės aplinkosaugos ir klimato veiklų, iš kurių populiariausios buvo „ražienų laukai per žiemą“ ir „tarpiniai augalai ariamojoje žemėje“. Lielupės UBR ražienų laukų plotai sudarė 45 proc. viso deklaruoto agrarinės aplinkosaugos veiklų ploto, o tarpinių pasėlių – 21 proc. Ventos UBR ražienų laukų ir tarpinių pasėlių plotai sudarė atitinkamai 41 ir 16 proc. viso priemonės įgyvendinimo ploto.

Lyginant su bendru pasėlių plotu, agrarinės aplinkosaugos ir klimato priemonės veiklų įgyvendinimo apimtys yra labai nedidelės. 2018 m. Lietuvoje agrarinės aplinkosaugos priemonės įgyvendinimo plotai Lielupės UBR tesudarė 3 proc., o Ventos UBR – 2 proc. viso deklaruotų pasėlių ploto. Tarpiniai pasėliai, kurių auginimas yra viena populiariausių agrarinės aplinkosaugos veiklų, užėmė vos 1 proc. deklaruotos ariamos žemės ploto. Rizikos vandens telkinių būklės gerinimui skirta veikla, kuri numato ariamos žemės vertimą pievomis ir ganyklomis, tiek Ventos, tiek Lielupės UBR buvo įgyvendinta vos 0,2 proc. ariamos žemės ploto. Šie skaičiai suponuoja, kad dabartinės agrarinės aplinkosaugos priemonės įgyvendinimo apimtys yra gerokai per mažos, kad duotų pastebimą aplinkosauginį efektą ir suteiktų atsvarą ar pastebimai sumažintų neigiamą intensyvaus ūkininkavimo poveikį.

Latvijoje, taip pat kaip ir Lietuvoje, agrarinės aplinkosaugos priemonės yra įgyvendinamos palyginti nedideliame Ventos ir Lielupės UBR plote. Populiariausia 2014 – 2020 m. KPP agrarinės aplinkosaugos priemonė yra ražienų laukai per žiemą. Latvijoje šios priemonės įgyvendinimo plotai 2016 m. sudarė 4 proc. Ventos UBR ir 3 proc. Lielupės UBR dirbamos žemės ploto. Ventos ir Lielupės UBR Latvijoje dominuoja tradicinis žemės ūkis, tad agrarinės aplinkosaugos priemonių įgyvendinama nedaug.

Ekologinis ūkininkavimas. Lietuvoje, 2016 m. Lielupės UBR pagal ekologinio žemės ūkio taisykles buvo sertifikuota 6% visų žemės ūkio naudmenų. Ventos UBR ekologinis žemės ūkis užėmė 7% dirbamos žemės ploto.

Šį ūkininkavimo būdą Lietuvoje labiau renkasi mažesnio dirvožemio derlingumo savivaldybių ūkininkai. Intensyvios žemdirbystės savivaldybėse ekologinis žemės ūkis yra mažai populiarus.

Latvijoje Ventos UBR ekologinių ūkių skaičius, lyginant su lietuviškąja dalimi, yra didesnis. Čia ekologiškai dirbama 11 proc. žemės ūkio naudmenų. Tiesa, Lielupės UBR ekologinių ūkių plotai sudarė mažesnę dirbamos žemės dalį nei Lietuvoje – 5 proc. Latvijoje du trečdalius ploto ekologiniuose ūkiuose sudaro pievos ir tik vieną - ariama žemė.

Pateikti duomenys rodo, kad pastebimo aplinkosauginio efekto dėl aplinkosauginių KPP priemonių įgyvendinimo Ventos ir Lielupės UBR tikėtis, deja, kol kas nėra pagrindo. Įgyvendinamos labai nedidelėmis apimtimis agrarinės aplinkosaugos priemonės negali atsverti intensyvaus ūkininkavimo daromo neigiamo poveikio aplinkai ar bent jį reikšmingai sumažinti. Prognozuojama, kad žemės ūkio intensyvumas ateityje augs, tad siekiant užtikrinti aplinkos balansą ir tvarų išteklių naudojimą, agrarinės aplinkosaugos priemonių, tuo pačiu ir tarpinių pasėlių, įgyvendinimo svarba tik didės.

Kopsavilkums

Lauksaimniecisko darbību intensitāte un struktūra būtiski ietekmē vides situāciju Ventas un Lielupes UBA. Intensīvu lauksaimniecisko darbību rezultāts ir barības vielu novadīšana no laukiem lielā apjomā, tādēļ baseinu teritorijas, kurās noris intensīva lauksaimniecība, bieži vien cieš no barības vielu piesārņojuma un nespēj sasniegt izvirzītos mērķus vides jomā. Lauksaimnieciskās darbības veidus Ventas un Lielupes UBA ietekmē vairāki faktori, piemēram, augsnes auglība, klimatiskie apstākļi, produktu ražošanas izmaksas, pieprasījums tirgū, u.tml.

Ventas un Lielupes UBA ģeomorfoloģiskās īpatnības ir atšķirīgas, kas attiecīgi nosaka arī atšķirīgas augsnes ražīguma tendences abos UBA. Visauglīgākās augsnes ir atrodamas Lielupes UBA, lai arī augsnes kvalitāte dažādās baseina daļās diezgan būtiski atšķiras. Lauksaimniecībā izmantotā zeme veido apmēram 60 % no kopējās zemes platības Lielupes UBA Lietuvas daļā un apmēram 40 % – Latvijas daļā. Ventas UBA lauksaimnieciskās darbības ir mazāk attīstītas. Lietuvas daļā lauksaimniecības zeme veido apmēram 50 % no UBA platības, savukārt Latvijas daļā – tikai 25 %. Lauksaimniecības zemes struktūrā dominē aramzeme. Gan Latvijā, gan Lietuvā auglīgākajās Lielupes UBA teritorijās aramzeme veido vairāk nekā 80 % no visas izmantotās lauksaimniecības zemes. Teritorijās, kur augsne ir mazāk auglīga, lauksaimniecības intensitāte un aramzemes procentuālā daļa ir mazāka.

Uztvērējaugu audzēšanas priekšnosacījumu izvērtēšanā būtiska ir kultūraugu struktūra un to maiņa. Kultūraugu struktūras analīze aramzemēs ļauj secināt, ka gan Lietuvā, gan Latvijā abos UBA dominē ziemāji. Lielupes UBA Lietuvas daļā ziemāji aizņem gandrīz 60 % no kopējās aramzemes platības; ziemāju procentuālā daļa Ventas UBA ir apmēram 50 %. Latvijā ziemāji aizņem līdz pat 69 % aramzemes Lielupes UBA un 60 % aramzemes Ventas UBA. No ziemājiem lielāko daļu teritorijas upju baseinos aizņem ziemas kvieši un tālāk seko ziemas rapsis. Ziemas kvieši un ziemas rapsis ir "pelnošākie" kultūraugi, kas lauksaimniekiem nodrošina labus un regulārus ienākumus. Šo kultūraugu audzēšanai parasti tiek izmantotas intensīvas augkopības tehnoloģijas.

Vasarāji dominē teritorijās, kurās augsne nav tik produktīva. Populārākie vasarāji ir vasaras kvieši un vasaras mieži. Vasarāju audzēšanas tehnoloģijas, izņemot vasaras kviešu un vasaras rapša gadījumā, ir mazāk intensīvas, jo mēslošanas līdzekļu un augu aizsardzības līdzekļu bagātīga izmantošana mazāk produktīvās augsnēs neatmaksājas.

Kopumā saimniekošanas tendences Ventas un Lielupes UBA būtiski atšķiras. Lielupes UBA dominē laukkopības saimniecības, kurās notiek intensīva kultūraugu audzēšana, savukārt Ventas UBA raksturīga daudzveidīgāka saimniekošana. Latvijā Lielupes UBA saimniecību struktūrā arī galvenokārt dominē augkopības produkcijas audzētāji, tomēr to procentuālā daļa no kopējā saimniecību skaita ir zemāka nekā Lietuvas daļā – 48 %. Tāpat kā Lietuvā lielāko daļu lauksaimniecības zemes Lielupes UBA Latvijas daļā apsaimnieko lielās saimniecības. Pamatojoties uz Lauku atbalsta dienesta datiem, saimniecības, kuras ir lielākas par 100 ha, apsaimnieko 74 % zemes un gandrīz puse no tām (44 %) ir saimniecības, kas ir lielākas par 500 ha. Saimniecību struktūra Ventas UBA abās valstīs ir daudzveidīgāka. Ventas UBA ir lielāka daļa saimniecību, kuras nodarbojas ar jauktu lauksaimniecību un mājlopu audzēšanu. Savukārt lielajām un intensīvās saimniekošanas saimniecībām pieder mazāka lauksaimniecības zemes daļa nekā Lielupes UBA.

Gan Latvijā, gan Lietuvā visbiežāk pielietotā zaļināšanas prakse ir saimniekošana, nodrošinot vismaz 3 dažādu kultūraugu rotāciju. Ventas UBA Latvijas daļā kultūraugu rotācija ietvēra līdz pat 5 lauku kultūraugiem, bet Lielupes UBA kultūraugu rotācijas ir bijušas īsākas, rotācijā izmantojot graudaugus, rapsi, zirņus/lauka pupas.

Agrovides pasākumu attiecība pret kopējo lauksaimniecības zemes platību kopumā tomēr ir ļoti zema. 2018. gadā Lietuvā līgumi par agrovides pasākumu piemērošanu noslēgti tikai par 3 % no Lielupes UBA esošās lauksaimniecības zemes un par 2 % no Ventas UBA esošās zemes. Uztvērējaugi, kas ir viens no populārākajiem agrovides pasākumiem, tika izmantoti tikai 1 % aramzemes abos UBA. Latvijā, tāpat kā Lietuvā, Lielupes un Ventas UBA agrovides pasākumi tiek īstenoti salīdzinoši mazās teritorijās. Latvijā „Rugāju lauks ziemas periodā" ir svarīgākā Lauku attīstības programmas 2014.–2020. gadam apakšaktivitāte. Šīs apakšaktivitātes

ietvaros 2016. gadā tika atbalstīta 4 % liela teritorija Ventas upes baseinā un 3 % no lauksaimniecības zemes Lielupes baseinā.

Latvijā platības, kuras ir saņēmušas atbalstu no LAP 2014.–2020. gadam pasākuma M11 „Bioloģiskā lauksaimniecība", veido 11 % no izmantotās lauksaimniecības zemes Ventas upes baseinā un 5 % Lielupes upes baseinā. Divas trešdaļas no bioloģisko saimniecību platības ir zālāji un tikai vienu trešdaļu veido aramzeme.

Veiktā datu analīze liecina par to, ka šobrīd no agrovides pasākumu īstenošanas Ventas UBA un jo sevišķi Lielupes UBA ir sagaidāma niecīga ietekme uz vidi, jo tik mazs vides iniciatīvu pārklājums nevar atsvērt vai būtiski samazināt intensīvās lauksaimniecības ietekmi. Sagaidāms, ka nākotnē lauksaimniecības intensitāte palielināsies un tādēļ pieaugs pieprasījums pēc agrovides pasākumiem, piemēram, uztvērējaugu audzēšanu, lai veicinātu atbildīgu un ilgtspējīgu resursu izmantošanu.

Ievērojot, ka uztvērējaugu ieviešana saimniecības īstenotajā augu maiņā var sniegt ieguvumus gan sabiedrībai kopumā, mazinot zemkopības radīto vides spriedzi, gan pašai saimniecībai – uzlabojot augsnes veselību, arvien plašāk Eiropas Savienības (ES) dalībvalstīs tiek īstenoti atbalsta vai citi pasākumi uztvērējaugu audzēšanas veicināšanai. Uztvērējaugu audzēšana galvenokārt tiek atbalstīta kā zaļināšanas pasākums, kā arī caur dažādiem agrovides un klimata pasākumiem, kas paredzēti dalībvalstu un to reģionu Lauku attīstības programmās (LAP). Savukārt, piemēram, Dānijā, Beļģijā un Nīderlandē uztvērējaugu audzēšana noteiktās vietās un gadījumos jau ieviesta kā obligāts nosacījums Nitrātu direktīvas izpildes kontekstā. Projekta "Optimāli uztvērējaugu izmantošanas risinājumi pārrobežu upju- Venta un Lielupe- baseinu piesārņojuma mazināšanai" (Catch Pollution) veicām apkopojumu par uztvērējaugu audzēšanu Baltijas jūras reģiona valstīs un sagatavojām ieteikumus uztvērējaugu audzēšanas ieviešanai Latvijā.

Viena no galvenajām zaļināšanas prasībām saimniecībām, kam ir vairāk nekā 15 ha aramzemes, ir nodrošināt vismaz 5 % ekoloģiski nozīmīgu platību (ENP) īpatsvaru no aramzemes. Lai izpildītu šo prasību, valstis varēja izvēlēties iespēju pie ENP veidiem iekļaut arī uztvērējaugus. Lielākajā daļā Baltijas jūras reģiona valstu tiek izmantota iespēja ENP prasības izpildei audzēt uztvērējaugus (izņēmumi ir Igaunija un Somija), un pieeja visās valstīs ir visai līdzīga. ENP ietvaros uztvērējaugus var audzēt pasējā, izmantojot graudzāles un/vai tauriņziežus, kā arī starpsējā, ko veido vismaz divu kultūraugu maisījums. Katrā valstī pastāv savs atbalstāmo augu saraksts, kurus var iekļaut starpsējā. Viselastīgākā kultūraugu sugu ziņā ir Polija, kur starpkultūrām atbilstošie kultūraugi ir definēti visai plaši (graudaugi, eļļas augi, lopbarības augi, pākšaugi un nektāraugi, bet maisījums nevar sastāvēt tikai no graudaugiem). Tāpat atbalstāmo augu saraksts salīdzinoši vispārīgi definēts arī Dānijā. Latvijā ENP prasības izpildei starpsējā var audzēt vasaras rapsi, viengadīgo aireni, baltās sinepes, eļļas rutku, auzas, facēliju, griķus, vasaras vīķus, ziemas vīķus, rudzus, pupas, zirņus vai lopbarības redīsus. Lielā daļā dalībvalstu, tajā skaitā Latvijā, starpkultūras ir jāsaglabā apmēram 60 dienas un šajā laikā ir aizliegts piemērot augu aizsardzības līdzekļus.

Kā zināms zaļināšana ir obligāta KLP prasība, taču visās ES dalībvalstīs LAP ietvaros tiek ieviesti arī agrovides un klimata pasākumi, kuros atbalsta saņēmēji brīvprātīgi var uzņemties izpildīt noteiktas papildu saistības, kas sniedz papildu labumu vides stāvokļa saglabāšanā vai uzlabošanā. Starp Baltijas jūras reģiona valstīm tikai Latvijā un Dānijā spēkā esošās LAP neparedz agrovides un klimata pasākumus uztvērējaugu audzēšanai. Tomēr gadījumi šajās abās valstīs ir atšķirīgi. Dānijas lauksaimniekiem ir nozīmīga pieredze uztvērējaugu audzēšanā, jo to ieviešana zemkopībā uzsākta jau kopš pagājušā gadsimta 80.-ajiem gadiem. Šajā periodā uzkrātās zināšanas un prakse politikas veidotāju vidū radījusi pārliecību par uztvērējaugu sniegtajām priekšrocībām gan videi, gan lauku saimniecību konkurētspējai, un Dānija ir viena no valstīm, kas uztvērējaugu audzēšanu noteiktos apstākļos noteikusi kā obligātu prasību Nitrātu direktīvas izpildei.

Arī Igaunijā nepastāv tiešs atbalsts uztvērējaugu audzēšanai agrovides un klimata pasākumu ietvarā, tomēr uztvērējaugi tur tiek atbalstīti kā viena no videi draudzīgām praksēm kopā ar citu lauksaimniecības kultūraugu audzēšanu aramzemēs, ar mērķi nodrošināt, ka augsne ir nosegta rudens un ziemas periodā. Atsevišķi agrovides un klimata pasākumi tieši uztvērējaugu audzēšanai ir pieejami Lietuvā un Zviedrijā. Lietuvā atbalsts uztvērējaugiem LAP agrovides un klimata pasākumos ieviests kopš 2018. gada. Atbalsta maksājums 134 EUR/ha ietver kompensāciju par ienākumu zudumu kultūraugu ražošanas samazinājuma dēļ pēc videi labvēlīgu prakšu ieviešanas, papildu izmaksas par ierīkošanu, sēšanu, sēklām un rugāju kultivēšanu. Savukārt Polijā un

Somijā atbalsts uztvērējaugu audzēšanai ir pieejams gan kā tiešs mērķa pasākums, gan netiešā veidā, iekļaujot to kā vienu no agrovides aktivitāšu izvēlēm.

Pretēji ENP, agrovides un klimata pasākumu ietvaros audzētie uztvērējaugi pārsvarā apkopojumā ietvertajās valstīs ir jāsaglabā līdz pavasarim, izņēmumi ir Somija un Zviedrija. Vispārpieņemta prakse ir, ka uztvērējaugiem, piesakot tos LAP agrovides atbalsta platībām, ir aizliegts izmantot augu aizsardzības līdzekļus un arī mēslošanas līdzekļus. Savukārt atšķirīgas ir pieejas, ko politikas veidotāji nacionālā līmenī piemērojuši, nosakot LAP agrovides pasākumos atbalstāmo kultūraugu sarakstu. Dažās valstīs (piem., Lietuvā, Zviedrijā un Polijā) šis saraksts ir drīzāk limitēts, savukārt Somijā vietējiem apstākļiem vispiemērotāko kultūraugu izvēle ir atstāta pašu lauksaimnieku ziņā. Tas var būt atkarīgs no katrā valstī noteiktajiem konkrētā agrovides pasākuma mērķiem. Jo vairāk atbalsts ir paredzēts tieši uztvērējaugiem, jo precīzāks ir atbalstīto kultūraugu saraksts un tiek piemērota arī lielāka atbalsta likme.