“Baseline scenario” development
for the WFD river basin management planning
(with focus on agriculture and forestry)

LATVIAN STUDY REPORT

Project „Towards joint management of the transboundary Gauja/Koiva river basin district”
(Nr. EU 38839)

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List of abbreviations

BS	“Baseline scenario” according to the WFD
CAP	EU Common Agricultural Policy
CLC	Corine Land Cover
CSB	Central Statistical Bureau
GES	Good ecological status
GGE	Grennhouse Gas Emmisions
IMPRESS	Impact and pressure analysis
LEGMA	Latvian Environment, Geology and Meteorology Agency
MBM	Mass Balance Model (Swedish Water Management Model – An Excel based model adapted and used in Latvia for estimating nutrient pollution loads to WBs)
N	Nitrogen
NVZ	Nitrate Vulnerable Zone (according to reqirements of the Nitrate directive (91/676/EEC))
P	Phosporus
RB	River basin
RBD	River basin district
RBMP	River Basin Management Plan
RDP 2013	Latvian Rural Development Programme (for 2007-2013 and 2014-2020)
SFS	State Forest Service
WB	Water body
WFD	Water Framework Directive (2000/60/EC)

Introduction

The study was conducted as part of project "Towards joint management of the transboundary Gauja/Koiva river basin district". The project included work on the economic analysis elements of the RBMPs with a general aim to coordinate national approaches in Latvia and Estonia for joint RBMP for 2016-2021.

The "baseline scenario" (BS) development was among the economic analysis issues concerned by the project. The following tasks were set for this study:

1. To review and compare the national approaches for the BS development in Latvia and Estonia;
2. To develop recommendations concerning the approaches in light of their coordination;
3. To develop proposal for methodology to be tested in Latvia to improve coordination of the approaches and the BS assessments for the RBMP of 2016-2021;
4. To conduct testing of the proposed methodology in Latvia in the Gauja river basin;
5. To develop recommendations for Latvia in light of the RBMP of 2016-2021.

The given report summarises results of the work on the tasks above. At first it reviews the national approaches for the BS development in Latvia and Estonia and provides general recommendations for improving the approaches in light of their coordination (the Section 1). The methodology prosed for testing in the Gauja RB is discussed in the Section 2. Results from testing the approach are summarised in the Section 3. It ends with recommendations for the BS development approach in Latvia the chapter 3.4.

Authors of the report are very grateful to the project's expert Loreta Urtane ("L.U. Consulting") for hers valuable contribution in relation to environmental issues of the analysis.

1 Methodologies for the "baseline scenario" (BS) development in Latvia and Estonia

This section summarises results from reviewing and comparing the national approaches for the "baseline scenario" BS development in Latvia and Estonia. The national approaches for the 1st RBMPs in both countries were reviewed and discussed in details. Also information for planned approaches for the next WFD cycle was exchanged. These issues were also discussed as part of project's expert meetings on the economic analysis elements in the RBMPs.[2] The meetings aimed also to discuss relevant issues for coordination of the national approaches of the BS development.

1.1 In Latvia (Gauja RBD)

The same overall methodology is followed in all Latvian RBMPs, including the Gauja RBD. The approach used for the 1st RBMPs is briefly explained below. The specific results (e.g. the described main outcomes) concern Gauja RBD although they are similar for all Latvian RBD.

Aim of the analysis

To assess future changes in economic and policy drivers and factors determining size (thus changes) of pressures. These assessments were used then for assessing expected changes of pressures. The BS was relevant part of the "risk assessment" (risk of failing GES), since the "risk assessment" must consider expected state of water bodies for 2015 (the timescale of achieving the WFD objectives for the 1st RBMPs).

The main steps and elements of the analysis

The analysis for the BS development was conducted in the frame of "risk assessment" procedure, which included the following steps: 1) identification of relevant sectors/ activities causing significant pressures on water status; 2) identification, analysis and assessment of likely future development of drivers and factors influencing pressures from these sectors/ activities (the "baseline scenario"); 3) integration of the future estimates for the factors into likely changes of pressure (and assessment of expected changes in the state for 2015). See also the figure below.

The BS analysis was done separately for each sector with considerable contribution into significant pressures in the RBD. Changes in the factors determining size of pressures from each sector were assessed by analysing future development of their driving forces. These drivers cover to the main elements of the BS:

- future development of economic sectors (causing the pressures),
- planned policy measures/projects for reducing the pressures and protection of water ecosystems (so called "basic measures" of the WFD).

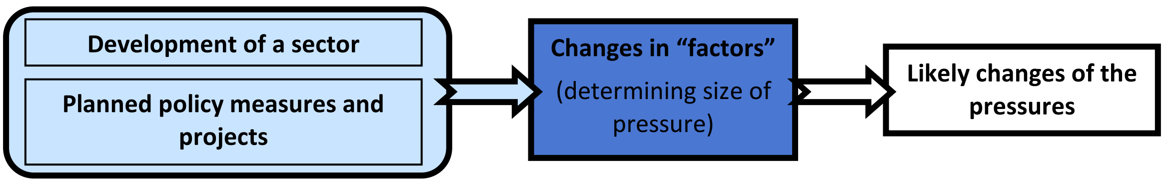

Figure 1.1. Main elements of the BS.

The analysed drivers for each sector can be grouped in the following groups: (1) socioeconomic drivers, (2) sectoral policy drivers, (3) environmental policy drivers. The first two groups relate to the BS element "development of a sector", the last one addresses the BS element on "planned policy

[2] Two joint expert meetings were organised as part of the project – in December of 2012 and May of 2013.

measures and projects"). For each sector relevant drivers from each group are analysed to assess changes in the "factors" determining directly size of the sectors's created pressure.

Specific methodological issues

The BS was developed only in relation to significant pressures in the RBD and for sectors giving relevant contribution into these pressures. The expected changes were assessed up to 2015.

The assessment of likely changes in the drivers and factors determining size of pressures was elaborated for each sector. These assessments were developed by analysing available future projections and scenario modelling results, information from policy planning documents and data on past trends.

The analysis for elaborating the assessments for BS development overall was conducted at two stages:

1. national scale analysis;
2. "regionalisation" of the national scale assessments to the required lower scales (RBD/WB …), as far possible and as needed for various sectors and pressures.

The second stage is conducted only concerning the factors determining directly size of pressures (to provide input for assessing changes in the pressures).

For the 1st RBMPs the second stage was conducted in the most details concerning pressure of nutrients' pollution to WBs (among the priority pressures to WBs in Latvia). Since a model[3] is used for estimating nutrients' pollution for each WB, there is a need for input data in the model on WBs scale to assess changes in the pressure for 2015. Illustration on the input data of the model is provided in the information box bellow. For assessments of changes of the factors concerning the nutrients' pollution caused by agriculture and forestry the assessments were prepared on the administrative district's scale and then adjusted to the water body scale. Concerning the centralised sewage sector the factors (e.g. proportion of population served with centralized sewage services, wastewater treatment level) were assessed on agglomeration/settlement scale while changes in total number of inhabitants were assessed on district scale.

Box 1.1. Input data sheet for the mass balance model used for estimating nutrients' pollution (N and P loads) to WBs – illustration on input data in relation to agriculture and forestry activities. *Source: MBM for the 1st RBMPs.*

DATA INPUT		Present situation	"Baseline scenario"
Land use			
Forest land area (km2)	km2		
Forest, soils fertile class I (%)	%		
Forest, soils fertile class II (%)	%		
Final cut area /yr (%)	%		
Drained area/yr (% of forested area)	%		
Fertilized area/y (% of forested area)	%		
Arable land (km2)	km2		
Arable land – reduction of P from all measures - % P			
Arable land – reduction of N from all measures - % N			
Winter grown land (% of arable and pasture land)	%		
Reduced N-leakage due to "green cover"	%		

[3] An Excel based model called „Mass Balance model" (MBM) allowing to calculate N and P loads to WBs taking into account loads from all main point and diffuse sources (both natural and anthropogenic). Besides it allows model these loads in various scenarios (e.g. the current situation, the "baseline scenario").

Pastures (km2)	km2		
Pastures – reduction of P from all measures - % P			
Pastures – reduction of N from all measures - % N			
Arable land, supplement (km2)	**km2**		
…			
Animals			
Total number of animal units (number a.u)	number		
of which dairy cows (number)	number		
Dairies using of phosphorus free detergents (%)	%		
Dairies using sedimentation tank-separation only (%)	%		
Dairies using sedimentation tank + infiltration (%)	%		
Dairies draining to manure-reservoir (%)	%		
Dairies draining without separation (%)	%		
Percent of leaking manure-pits (%)	%		

Development trends for other economic sectors and pressures (hydro-morphological pressures caused by agriculture, forestry, HPP and harbour activities) were analysed mostly on the national scale. It was done by reviewing the overall development trends of the sectors and their operation and analysing information about specific planned activities where available.

The main data sources

Available future projections/forecasts (demographic forecasts at administrative district scale, national macroeconomic forecasts); sectoral strategies, programs and development plans (e.g. for agriculture, energy production, industry, etc.); statistical data for analysis of past trends (data sources from assessing the socioeconomic significance of water use); policy planning documents in relation to the environmental protection (implementation plans of the EU directives e.g. UWWTD, Nitrates and IPPC directives in Latvia and related Latvian laws and regulations).

The main outcomes

For each sector: future development of the main socioeconomic and sectoral policy drivers influencing its development (e.g. number of inhabitants, economic development of agriculture and changes in its production, demand for electricity); review of the current environmental policies (requirements, measures) aiming to reduce the pressure. Output results include assessment of likely changes in the factors determining size of the pressure (specific for each sector) up to 2015.

The likely future development was assessed for the following sectors (in relation to specific pressure) and the factors influencing size of their pressures:

- Households/ centralised sewage services' sector (nutrients' pollution): number of inhabitants served and not served with centralized sewage services, treatment level of wastewaters (WW). The environmental policy drivers related to the policy requirements for the WW treatment level, investment plans and projects for development of the sewage infrastructure as well as funding for implementing them.
- Agriculture (nutrients' pollution): arable land and perennial plant land area, pasture and meadow area, "winter green" land area, use of fertilizers, animal units, dairy cow units, manure management (animal unit % ensured with required manure storage). The environmental policy drivers related to implementing requirements and measures of the Nitrate directive.
- Agriculture (hydro-morphological pressure): melioration of agricultural land (overall future trend).

- Forestry (nutrients' pollution): forest area, clear-cut area (future trends on district level based on past trends on district level and on overall future trend).
- Forestry (hydro-morphological pressure): melioration of forest lands (overall future trend).
- Industry (pollution from wastewater): economic development (overall future trend). The environmental policy drivers related to implementing requirements of the IPPC directive.
- Hydropower production (hydro-morphological pressure): trend in energy production. The environmental policy drivers relate to restrictions for building small HPP on specified rivers.
- Harbours (hydro-morphological pressure): development of harbours' infrastructure – development plans/ projects in each harbour.

It should be noted that the overall approach described above has been used in Latvia for the BS development from the very beginning of the WFD implementation in Latvia. It has be seen as technically feasible and applicable taking into account available resources and institutional capacity for implementation of the WFD in such small country like Latvia. The main advantages of the approach:

- it provides uniform methodological framework for developing the BS for any pressure and sector;
- it is flexible enough to allow using and combining various input data/ information sources and methods for developing the assessments – depending on specifics and relevance of pressure/sector;
- it allows presenting results of analysis in a transparent way that they can be reviewed and evaluated by policy-makers and stakeholders.

The main disadvantage of the given approach is that the quantitative assessment of changes in factors determining size of pressure on WB scale (for each WB) is very resource consuming exercise.[4] Besides it is not straightforward to judge on certainty of such assessments taking into account the large amount of various data/estimates/tools & methods used as input during the analysis process.

It is planned to use similar approach overall in Latvia **for the next cycle** also. The national scale assessments could be revised/updated to cover the time frame till 2021. They also should be complemented to cover the pressures/sectors not analysed in sufficient details in the previous cycle (e.g. land reclamation in agriculture and forestry). It is unclear yet how far the estimates on WB scale could be developed/revised (also taking into account limitations of available resources for such work).

1.2 In Estonia (Koiva RBD)

Like in Latvia, the same methodological approach overall is applied in all Estonian RBDs. The approach used for the 1st RBMPs is briefly presented below.

Aim of the analysis

The aim of the analysis was to assess expected trends in water use by the main sectors and estimate changes in the main pressures caused by them.

[4] For instance, for the nutrients' pollution pressure, where the MBM is used to estimate N and P loads to each WB, the BS work involves developing estimates of the changes in the BS for all input factors in the model for each WB. These estimates have been developed by adjusting national BS estimates. In addition, to obtain reliable estimates on the WB scale, a "bottom-up" approach with involvement of stakeholders should be used to validate the "adjusted" results for local areas (this was not done for the 1st RBMP).

It should be noted that the results of the BS were not used in the “risk assessment” (the risk of failing GES in 2015). The “risk assessment” for WBs was conducted based on the current pressures not the size of pressures in the BS.

The main steps and elements of the analysis

Analysis for the BS development included:

1. assessing likely changes for key economic and policy drivers (up to 2015), taking into account, for instance, changes in population, EU environmental policy requirements implemented via nationals laws and regulations, investment plans in relation them;
2. estimation of the impacts of these changes on the key pressures (up to 2015).

The BS scenario development concerned the main sectors causing pressures on waters: households, industry, agriculture, impoundment of water (for energy production).

Specific methodological issues

The most detailed BS was developed for households, industry and agriculture, for the first two sectors in relation to both individual and centralised sewage systems, for agriculture – for its individual water use (water abstraction and wastewater amounts). The given sectors were included in the analysis as causing the major pressures on waters. The analysis was less detailed/excluded other sectors causing pressures on the water ecosystems due to insufficient data for assessing them (e.g. forestry).

Data used in the analysis were collected on the administrative scale (e.g. parishes, towns). All pressures were linked to settlements and this way included into specific river basin. Pressures were not connected to WB since such scale analysis was not conducted for the 1st RBMPs.

The analysis of households’ water use was conducted on settlements’ scale and separately for households using centralised and individual water supply and sewage systems. The analysis included all settlements with more than 500 inhabitants in Estonia. For each settlement inhabitants using both systems were analysed and based on that overall trends of water consumption and wastewater discharge was estimated. In settlements with less than 100 inhabitants it was assumed that individual systems are used. For each settlement separate population estimates were prepared and specific wastewater loads calculated. Based on this analysis consolidated water use and pollution loads for RBD were estimated.

Also the analysis of industrial water use covered both individual and centralised systems. Water use by individual systems was estimated based on water permits therefore only relatively large industrial entities were included. The analysis included water abstraction and discharged wastewater amounts.

The BS analysis for agriculture included individual water abstraction and discharge only, e.g. agricultural entities with water permits are only included. Majority of water abstraction and wastewater discharge is made by the users having permits.

The main data sources

Available forecasts (demographic forecasts at administrative district scale, national macroeconomic forecasts); sectoral strategies, programs and development plans (e.g. for agriculture, industry); statistical data for analysis of past trends; policy planning documents in relation to the environmental protection (implementation plans of the EU directives e.g. UWWTD, Nitrates and IPPC directives).

The main outcomes

(1) For each sector analysed in details, results of analysis on future development of the main socioeconomic drivers influencing its development (e.g. number of inhabitants, economic development of agriculture and changes in its production), including, review of environmental policies (requirements, measures) aiming to reduce the pressure. Output results include assessment of likely changes in the drivers (specific for each sector) up to 2015. The assessment on likely future

development was provided for the following sectors (in relation to specific pressure) and the drivers of their development:

- Households/centralised sewage services' sector (nutrients' pollution): number of inhabitants served and not served with centralized sewage services, treatment level of wastewaters (WW). The environmental policy drivers related to the policy requirements for the WW treatment level, investment plans and projects for development of the sewage infrastructure as well as funding for implementing them;
- Industry (pollution from wastewater): economic development (overall future trend). The environmental policy drivers related to implementing requirements of the IPPC directive;
- Agriculture (pollution from individual wastewaters): specific drivers were not analysed, only trends in water consumption and wastewater discharge are discussed generally.

(2) For each analysed sector, the past trends of water use and likely development trends for the future. For instance, trends for average water consumption in households (l/day/inh., mln m^3/y), annual water consumption by industries (mln m^3/y), water consumption in agriculture (mln m^3/y).

The results on future development are mainly qualitative characterisation of expected changes. The expected changes in pressures were assessed based on expert knowledge.

Quantitative estimates for changes of pressures in the BS on WBs scale were seen as too unreliable (due to considerable uncertainties in such estimates). Besides limited value was seen for developing such estimates in Estonia since only small proportion of WBs fails GES at present, thus there was limited demand for developing the BS[5]. These are the main reasons why the quantitative estimates for changes in pressures, besides on the WB scale, were not developed for the 1st cycle.

For the next planning cycle the approach and results are improved in terms of:

- More structured and systematic analysis of the drivers behind the development of sectors causing pressures. The drivers are analysed within the following groups:
  - Political factors (e.g. tax, labour, environmental legislation/policies),
  - Economic factors (e.g. GDP, income level, employment, inflation, sectoral developments),
  - Social factors (e.g. demographic processes, lifestyle),
  - Technical factors (e.g. implementation of new technologies, development of new products, changes in productivity, spendings on research and development).

  The drivers are analysed qualitatively on national scale. For each group of drivers specific measurable indicators are used. Their likely changes are estimated based on publicly available data from Statistics Estonia database.
- Linking general trends for drivers (described with the indicators) to changes in the pressures they influence. The most likely trend for each pressure is estimated based on trends in the indicators, incl., by testing likelihood of various pressures' scenarios e.g. the pressure remains stable, increases, declines. The changes in pressures are estimated to 2021 on national scale.
- Coverage of pressures – likely changes in all relevant pressures to waters are analysed, incl., point source pollution (↓), diffuse pollution (→), water abstraction (↑), hydro-morphological pressures or changes in water flow due to HPP (↑), pressures from using the watercourses (unclear what is analysed by this) (→), pressures on coastal waters (e.g. from shipping) (↑).

[5] The main (although not the only) purpose of the BS development is to input in assessing gap between expected state in 2015/2021 and GES (which needs to be closed by additional measures) for the WBs failing GES.

The analysis so far overall is still largely based on analysing past trends and expert knowledge. It is unclear yet how far it would be possible to estimate the changes in pressures quantitatively and to go for the BS on WB scale. If the "risk assessment" wants to be conducted based on the BS (not the current size of pressures), it requires more quantitative analysis of pressures, besides on the WB scale.

It is planned to conduct detailed "risk assessment" for all WBs for the updated Art.5 report. The work on the BS development is on-going now. At first the BS is developed on the national scale. These estimates then would be transferred to the WB scale. It is unclear yet how far this could be done (also information about the used approach was not received) and if the results would be used for the "risk assessment" of WBs.

1.3 Conclusions and recommendations in light of coordination of the approaches

Conclusions and recommendations for coordination of the approaches that were developed based on the analysis of approaches and discussions during the project's meetings are presented below.

<u>Qualitative/quantitative BS assessments and their use for the "risk assessment" (risk of failing GES) on WBs scale</u>

An important aim of the BS development is that the changes in pressures are used for assessing changes in state and "risk" of failing GES (in 2015/2021/2027), which is conducted on WBs scale. If the "risk assessment" is done this way it indicates "gap" for each WB that needs to be closed by additional (so-called "supplementary") measures to reach GES.

Estonia could move towards more quantitative BS development, incl., on the WBs scale that these results could be used to assess expected changes in state and (at least where reasonable) in the "risk assessment" of WBs. Latvia could revise the approach for the BS development on the WBs scale (e.g. the detailed analysis concerning the nutrients' pollution pressure) to make it more pragmatic taking into account large uncertainties around the quantitative estimates of pressures on the WBs scale. In this way, the general aim and results of the BS would become more consistent between the countries.

<u>Scales of the BS assessments</u>

Both countries are using similar general approaches when the BS work is conducted at two stages – developing assessments on the national scale and then adjusting them to lower scales (e.g. WB). This two-stage approach could be maintained in both countries in the future.

Since it is unclear at this stage – what approaches could be used in each country in the future concerning the assessments on WB scale, it is not possible to make any conclusions nor suggestions in light of their coordination.

<u>Approaches for the national-scale BS assessments – relevant drivers</u>

It is important to account in a systematic manner all relevant drivers influencing changes in pressures from relevant sectors. Although the groups of drivers look different in both countries, the same types of drivers are accounted in principle e.g. general socioeconomic drivers, sectoral policy drivers, environmental policy drivers. The main difference is that technological drivers are accounted in Estonia, while they are not analysed systematically in Latvia. They are not ignored in principle but didn't appear as relevant in the BS analysis to be taken into account. It is due to the rather short time frame of the BS (assumed overall to be too short for significant changes in technologies to change considerably pressures from the analysed sectors).

In light of coordination of the approaches it can be proposed that the following principle is maintained in both countries: that all <u>relevant drivers having impact on development of sectors and</u>

changes in their caused pressures are accounted systematically (but the drivers as such may be country specific).

In particular, drivers related to the existing environmental policies (with an impact on water environment) have to be analysed in details. According to the commonly agreed (internationally) principle, implementation of the existing EU policies besides the WFD has to be accounted in the BS.

Sectors and pressures included in the BS development

The list of pressures and sectors may be country specific (although it is quite similar in both countries overall). It can be proposed that the following principle is considered in both countries – that those sectors are included that cause significant pressures (today or in the future) in a RBD. The significant pressures are determined based on the pressures & impacts' analysis.

2 Approach for the BS development proposed for the study

This section describes approach of the BS development that was applied in Latvia as part of this study.

The analysis and discussions during implementation of the Task showed that the practical analysis in Latvia **should aim to support improving the national approach in terms of**:

- exploring possibilities of applying more pragmatic approach for the BS development on WB scale;
- covering pressures/activities that have not been analysed in sufficient details in the previous cycle (e.g. land reclamation).

Due to the first point above the analysis focused on the **pressure of nutrients pollution**, which will remain the most **quantitatively analysed** pressure, besides **on the WB scale**, in terms of the BS development. It is planned to continue using a model for calculating nutrient loads to WBs, thus quantitative estimates for changes of the model's input factors in the BS are needed for each WB. At the same time, **more pragmatic approach should be found for this analysis taking into account uncertainties in such estimates on the WBs scale** (and also limitations of resources for repeating such work fully for the next cycle).

In light of the general aim the work involved:

1. revising/developing the national-scale BS assessments in relation to agriculture and forestry (as relevant sectors causing nutrients' pollution and hydro-morphological pressures);
2. exploring possibility of simplifying approach to estimate changes in nutrient loads in the BS on the WB scale when applying the MBM.

2.1 General approach

The same general two-stage approach as used in 1st Latvia RBMPs (described in the chapter 1.1) was applied in this study. The approach involves for each analysed sector:

1. developing national-scale BS assessments for future development of sector specific drivers and factors determining size of analysed pressure;
2. developing local scale (WB-scale in the case of nutrients' pollution) assessments by adjusting the national-scale assessments. This stage is conducted concerning the factors determining size of pressures (in the case of nutrients' pollution – to provide input data for assessing changes in nutrient loads by the MBM).

Eutrophication or unnatural enrichment of waters with nutrients (phosphorus and nitrogen) is among the priority environmental problems of inland and coastal waters in Latvia. It is characteristically to Latvia overall that considerable proportion of anthropogenic nutrients' pollution load comes from **agricultural and forestry activities** (besides load from centralized sewage services' sector) [1]. Thus the named two sectors were included in the analysis.

The work involved developing/updating the national-scale BS assessments for these sectors and analysis of the factors determining size of nutrient loads from specific activities of these sectors (e.g. drainage of forest lands). Since the MBM is used for estimating nutrient pollution load to each WB, the **input data required for the model determine which factors needs to be taken in the BS analysis**. Due to limitations of the study not all factors determining nutrient load from agriculture and forestry (according to the MBM) could be covered.[6]

A list of significant pressures from agriculture and forestry in the Gauja RBD (according to the 1st RBMP) is provided in the next table. The table also highlights which of these pressures were concerned by the analysis and which factors where covered by the analysis. Drivers and factors that were analysed for each sector are described in more details in the next chapters.

It should be noted that, although the focus of the analysis was on the pressure of nutrients' pollution, results concerning the forestry drainage systems can be used also for the BS in relation to the hydro-morphological pressures from this activity.

Table 2.1. Significant pressures from agriculture (AGR) and forestry (FOR) in the Gauja RBD (according to the 1st RBMP) concerned by the analysis.

* According to the MBM.

Significant pressures from agriculture and forestry in the Gauja RBD	Pressures concerned by the study	Factors determining size of the pressure* covered by the study
Pressures related to nutrients pollution from AGR and FOR		
from point sources (from animal husbandry buildings, manure storage sites, dairies)		
from diffuse sources (run-off from (various types of) agricultural land and forestry)	**X** (due specific AGR and FOR activities e.g. crop-production, land reclamation and felling in FOR)	For agriculture: total agricultural land area, arable land area, winter grown land area. For forestry: forest area, total felling area, drained forest area.
Hydro-morphological pressures from AGR and FOR		
from land reclamation (drainage)	**X** (due to land reclamation in FOR)	Drained forest area.
from polders, straightening of (natural) rivers		

[6] A full list of the input data/factors of the MBM concerning agriculture and forestry was provided in the information box 1.1 of the chapter 1.1.

2.2 Developing national-scale BS assessments

Two issues are relevant and are discussed here in relation to the approach overall:

- drivers that should be analysed – those influencing development of the factors determining size of the pressures (according to the MBM);
- approach for assessing the likely development of factors and their drivers.

The analysed factors and their drivers for each sector are summarised in the figures below.

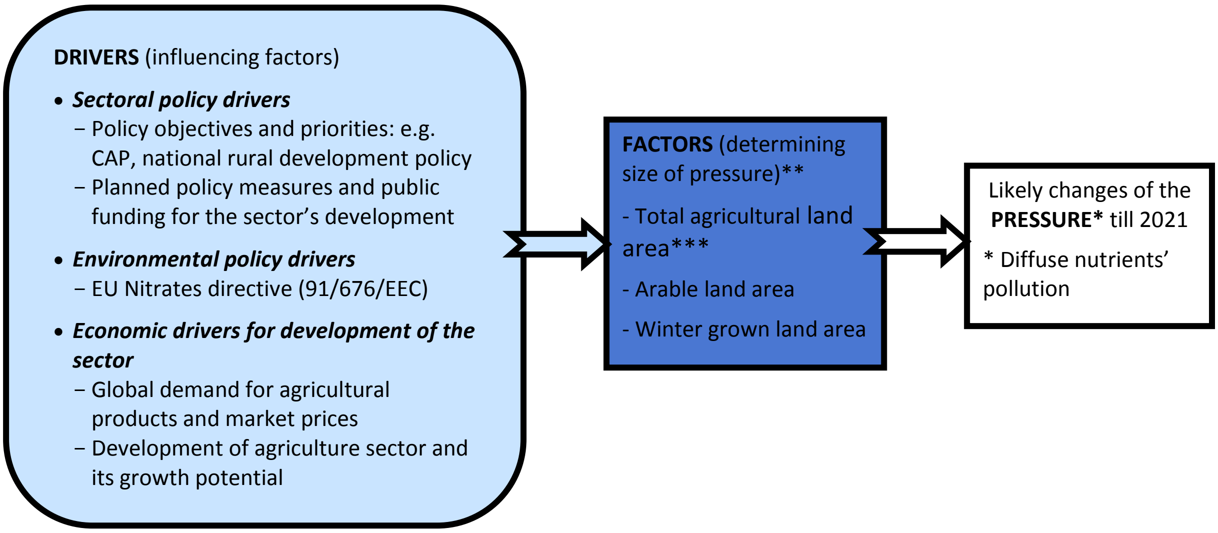

Figure 2.1. Elements (drivers and factors) of the BS analysed in the study in relation to nutrients' pollution pressure from <u>agriculture</u>.

** According to the MBM input data and calculations. *** The total agricultural land area was included since it determines area in which specific agricultural land use changes can occur.

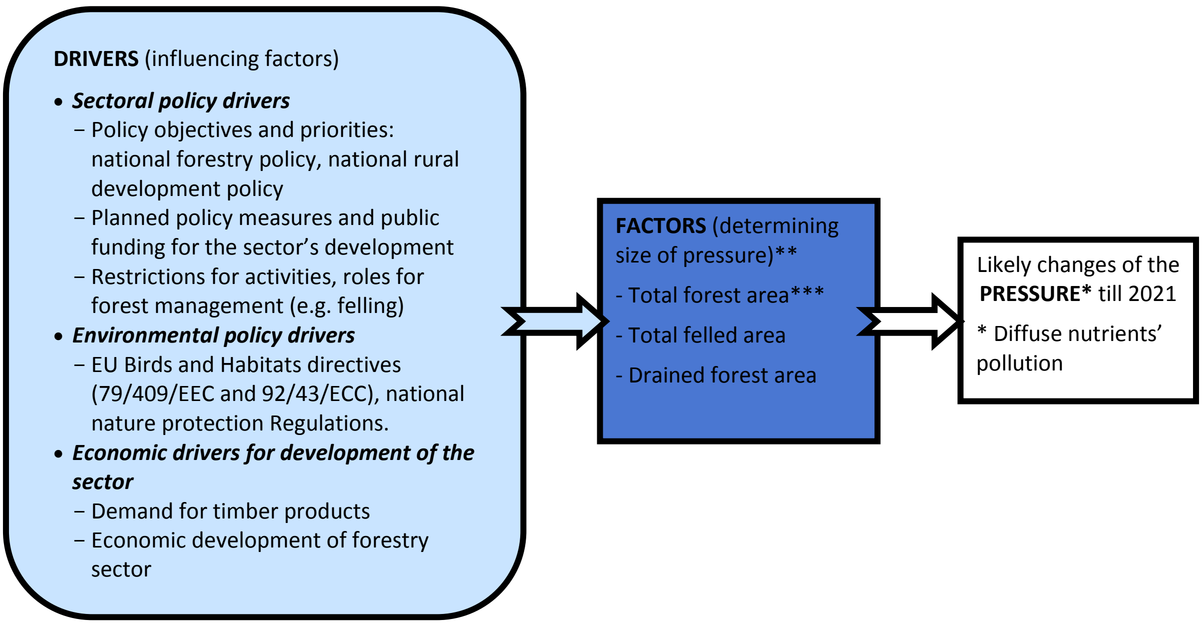

Figure 2.2. Elements (drivers and factors) of the BS analysed in the study in relation to nutrients' pollution pressure from <u>forestry</u>.

** According to the MBM input data and calculations. *** The total forest area was included as it determines area in which drainage and felling can occur. Although it should be noted that the run-off from forest land areas is considered as a natural not anthropogenic load. Only the calculated load due to felling and drainage are treated as anthropogenic load.

Concerning the factors included in the analysis:

- Nutrients' pollution from agriculture is generated as run-off from various agricultural land types and manure management practices. In this study the arable land and winter grown land were analysed, as well as the total agricultural land area as it determines area in which specific agricultural land use changes can occur.
- Nutrients' pollution (anthropogenic) from forestry is generated as increased run-off from forest areas (treated as natural not anthropogenic load) due to such forestry activities as clear-cutting, land reclamation (drainage), fertilisation of forest lands. In Latvia the fertilisation is not applied in forest lands, thus only the clear-cutting and drainage of forest areas were analysed in the study.

The analysed drivers overall belong to three groups – socioeconomic, sectoral policy and environmental policy drivers. All relevant drivers influencing development of the factors above were analysed.

Relevant element of the BS is implementation of measures/projects in relation to existing EU environmental policies (with an impact on waters), except the WFD. These are covered by the drivers' group "environmental policy drivers". For agriculture it is the Nitrate directive (91/676/EEC), which is commonly included in the BS. In Latvia the requirements of this directive are defined in Regulations of the Cabinet of Ministers N^{o} 628 (27.07.2004.) "*Special Environmental Requirements for Performance of Polluting Activities in Animal Housing*" and N^{o} 33 (11.01.2011.) "*Regulation Regarding Protection of Water and Soil from Pollution with Nitrates Caused by Agricultural Activity*" [12]. The Regulations prescribe special environmental requirements for storage and use of fertilizers on the whole territory of Latvia. In addition, additional requirements are prescribed for specially defined highly vulnerable zone – so-called Nitrate Vulnerable Zone (NVZ), where more stringent requirements apply for the protection of water and soil from pollution with nitrates caused by agricultural activities. The requirements include, for instance, maintaining grass (green) cover during autumn and winter period on at least 50 % of agricultural land of a farm. Small part of the Gauja RB belongs to the NVZ. In relation to the analysed factors for agriculture, the factor "winter grown area" is concerned by the above mentioned requirement. However, the directive had to be implemented fully till 2008. Thus it can be assumed that the effect of its implementation is accounted in the present situation and it doesn't create driver for further changes (e.g. for the size of winter grown areas). The data in relation to various types of "winter grown lands" in Latvia confirms it. Thus this was not analysed further for the BS.

In relation to the forestry activities, two EU directives concern forest lands directly and are commonly seen as part of the BS – the Birds and Habitats directives (79/409/EK and 92/43/EK). There are also national regulations of the nature protection (in particular, the Regulation of Cabinet of Ministers N^{o} 189 (05.05.2001.) *"Nature protection requirements for forest management" ("Dabas aizsardzības noteikumi meža apsaimniekošanā")*) that define restrictions, for instance, for clear-catting (e.g. in the Protection Zones along water courses and water bodies). However, in light of the analysed forestry factors, it may be assumed that the effect of implementation of these policies is fully accounted in the present situation and they don't create driver for further changes (e.g. for the size of total clear-cutting or drained areas). Thus they were not analysed further for the BS.

National-scale BS assessments for drivers and factors overall were developed by analysing their past development trends, available projections and other information from various studies and policy planning documents. The main results from the analysis of **drivers** are included in the Annex 2 and 3. The likely development of the **factors** was assessed based on analysis of their past development trends, available projections (where available) and expected future development of their driving forces. The results of this analysis were used to produce estimates that were tested on the WB scale (in the MBM) in the calculations for changes in nutrients' pollution load.

An important element of the approach was **consultations with sectoral institutions.** The consultations allowed obtaining recent information concerning available data, projections and policy planning documents, and also clarifying availability of specific data and interpretation of sector specific terms relevant for the MBM.[7] Overview on the conducted consultations is provided in the Annex 1.

2.3 Developing WB-scale BS assessments

An Excel-based tool "Mass balance model" (MBM) is used in Latvia for estimating N and P loads to WBs. Such model allows estimating N and P loads for each single WB taking into account loads from all the main point and diffuse sources. Input data of the model concern the main "factors" determining size of pollution from each source (e.g. size of arable land, number of animal units, PE served with different wastewater collection and treatment facilities).

MBM allows modelling pollution load scenarios depending on input data entered in the model (e.g. input data for present loads, input data for the BS). Estimates for changes in the main input "factors" in the BS are developed as part of the BS development work to calculate pollution load in the BS.

As part of the study the **MBM for selected WBs of the Gauja RB – G205, G209, G220 and G229** were used. These WBs were selected as they have nutrients' pollution problem due to agricultural and forestry activities (according to the 1st Gauja RBMP).

The model versions completed for the 1st RBMP was used as basis (based on the MBM version 7.1). These model versions include present data (for 2006) and estimates in the BS (to 2015) according to the RBMP.

As noted earlier, the calculated loads on WBs scale are rather uncertain. This is caused by limitations of input data and estimates (as it is always with models).[8] Moreover, the results from the 1st RBMPs show that the estimated changes of input factors in the BS often are marginal (or don't differ from the present situation at all). This suggested that the efforts needed for developing the BS estimates (for each input factor, for each WB) should be viewed against the effect these estimates have on the total nutrient load on a WB. If these input estimates don't change the calculated load significantly at the end, a simplified approach for developing them would be "proportionate" to their significance.

The main idea was to perform the 'sensitivity analysis' **to test how much changes in the output – calculated N and P load on a WB, depend on changes in the input factors**. The larger the impact the more important the accuracy of input estimates.

The main task was to test the **impact of BS estimates** on the calculated load. At the same time **needs for improvements and corrections in relation to** other modelling "factors" were found during the study. They relate overall to **interpretation of input factors and data as well as pollution load coefficients used in the model**. Thus impact from improving accuracy in relation to them was also tested.

Impact of the following issues on the total calculated nutrient load on a WB was examined for each factor:

[7] An initial plan was to use the consultations for adjusting national-scale BS assessments to local scales. However, work during implementation of the Task showed that a simplified approach for the WB-scale analysis should be investigated for Latvia (see the chapter 1.3 for conclusions concerning this issue). Thus the consultations were used for developing the national-scale BS assessments.

[8] For instance, when the pollution run-off coefficients are not sufficiently accurate that the specific of each WB is taken into account.

1) **Accurate interpretation of input factors and data** (mistakes in relation to these issues were found in the RBMP model versions during the analysis). It was investigated based on consultations with the project's environmental expert (L. Urtane from "L.U. Consulting" Ltd.). Interpretations according to the original MBM description were compared with those in later modifications of the model (incl. those introduced during development of the RBMPs). As a result, corrections in some formulations of the input factors and data are proposed in the RBMPs model version to avert mistakes and possible misinterpretations.

2) **Necessary improvements/corrections in pollution load coefficients**[9] of the model according to recommendations from the project's task in relation to pressures' analysis – the work conducted by "L.U. Consulting" Ltd.[10]

3) **Changes in the input factors in the BS.** They were estimated on the WB scale based on a simplified approach, which involved feeding into the model interval values with an aim to test effect of these estimates on the calculated total N and P load on a WB. The interval values were derived from the national-scale analysis but taking into account also possible variations in WBs.

As noted earlier, the analysis was conducted for selected input factors in relation to the nutrients' pollution from agriculture and forestry (other input factors and data in the model were not concerned by the analysis).

The WB-models were run by introducing the changes concerning each issue above for each factor one by one and the relative effect of each investigated issue on the total calculated N and P load on a WB was recorded. The results indicate which input data/coefficients/introduced changes are important – the larger impact one has on the total N and P load, the more attention should be paid to the accuracy of estimates that are fed into the model. Results of this analysis are presented in the chapter 3.3.

[9] Coefficients used in the model to calculate N and P loads from various land types and sources.

[10] The recommendations are included in the projects' report L.U. Consulting (2013) *Gala atskaite Līgumam "Izkliedētā piesārņojuma slodžu un to radītās ietekmes analīze"*. VARAM.

3 Results from testing the proposed approach in Latvia

This section presents results of the analysis for the BS development conducted as part of this study, when the approach described in the previous section was applied in practice.

The first two chapters include results on development of the national-scale BS assessments for agriculture and forestry for the analysed factors determining size of the nutrients' pollution (the main results from analysis of drivers influencing these factors are provided in the Annexes 2 and 3).

It should be noted that the BS assessments from the 1st RBMP cannot be used for the next cycle. They are considerably outdated, but also because they are developed considering timeframe of the BS till 2015.

New BS for agriculture (incl. with the required timeframe) had been developed in Latvia after the 1st RBMPs as part of implementing the "Marine Strategy Framework Directive" (MSFD, 2008/56/EK) (for its first implementation report called "Initial Assessment" in 2011). However due to new information in recent years, including, in relation to the new CAP period, these assessments had to be updated. The BS work for the MSFD didn't cover forestry sector, thus new assessments for this sector were developed as part of this study.

It should be noted concerning the timeframe that assessments to 2021 are required for the next RBMPs. However the information provision for the BS analysis allowed developing assessments to 2020 only. It is common timeframe for planning of policies and scenario studies (e.g. projections to 2020, 2030). Thus the year 2020 is used instead of 2021 as the end year of the BS assessments.

The chapters 3.1 and 3.2 present the results of the national-scale analysis for agriculture and forestry respectively, the chapter 3.3 – the results of the WB-scale analysis. The WB-scale BS assessments were derived from the national-scale assessments taking into account also possible variations among WBs. They were used in the MBM calculations (for selected WBs of the Gauja RB) with the aim as described in the chapter 2.3.

3.1 National-scale BS assessments for agriculture

This chapter presents the results concerning likely development of the analysed factors determining size of the nutrients' pollution from agriculture (according to the MBM). The main results on development of drivers are provided in the Annex 2. Here the past development trends and available assessments on the future development of the analysed factors are discussed. The chapter ends with a summary on likely development of the factors.

3.1.1 Factor: Total agricultural land area

Past development trend

Considerable increase in use of agricultural land was observed from 2003 till 2006 (see the next figure) due to increase of arable land area. Since that time the utilised agricultural land area has remained relatively stable with the yearly growth rates in range of -1.5 till +1.4 %.

According to the CSB data from the "Farms' Structure Survey" non-utilized agricultural area has decreased during the period 2003-2006 from 18.5 % to 11.4 % and 8.0 % of the total agricultural land area in 2003, 2005 and 2007 respectively. Taking into account that the CSB "Farms' Structure Survey" doesn't contain data about small farms[11] the real area of un-utilized land is rather higher. According

[11] CSB do not provide reliable yearly data on un-utilized agricultural areas. Such data is available only from the data of "Farms' Structure Survey" (in 2003, 2005 and 2007) and the "Agricultural Census" (in 2001 and 2010). An aim of the "Farms' Structure Survey" is to characterise structure of farms. These data are aggregated for

to a survey on agricultural areas conducted by the Ministry of Agriculture in cooperation with specialists from the Latvian Rural Consulting Centre in 2005, around 14.6 % of the total agricultural land area in Latvia (2.4 million ha) were not utilized [20].

There are no reliable yearly CSB data on the total agricultural land area in Latvia (according to the information gained from CSB during consultation process (see the Annex 1 for more information).[12] Comparison of the CSB data on utilised agricultural area (1.8 milj ha in 2010) and the State Land Service's data on total agricultural land area (2.4 milj ha) shows that the non-utilised agricultural land area in 2010 could be around 25 %. It seems to be rather high amount and it highlights the problem of data for characterising the total agricultural land area as well as differences in the data of various information sources.

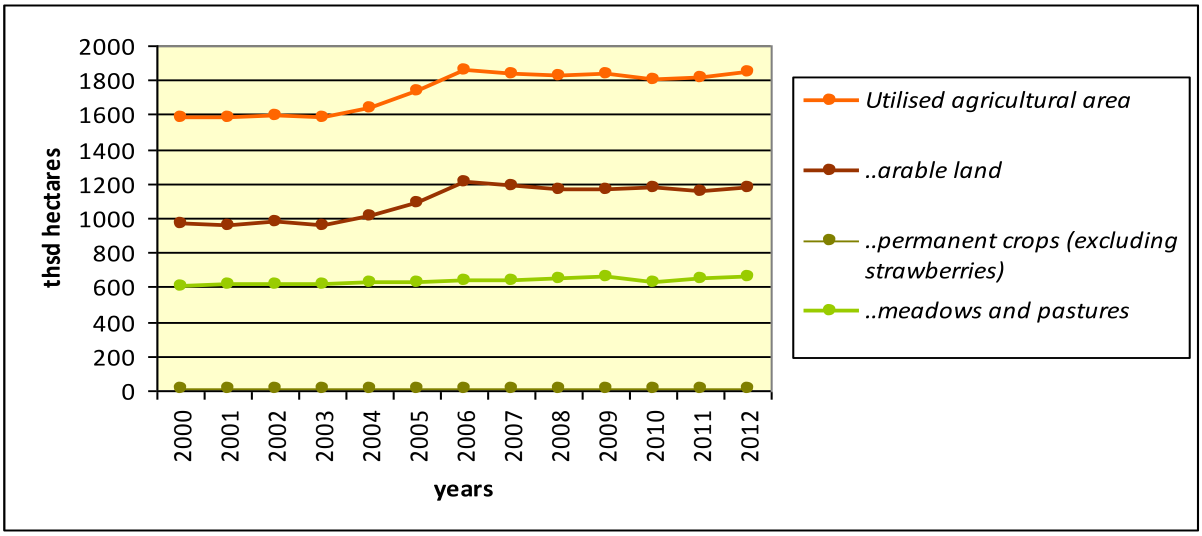

Figure 3.1 Utilised agricultural land area in Latvia. *(Source: CSB statistics.)*

Expected development in the future

Several studies have been conducted in Latvia that include also future scenarios/projections for specific agricultural indicators, including total agricultural land area.

Land Policy Strategy 2008–2014 includes short and long-term development scenarios of land use in Latvia. These projections were elaborated taking into account land policy and economic development tendencies (including from the global point of view), as well as studies on possible tendencies of land use in Europe. According to the long-term projections for 2030 included in the Strategy growing demand for the agricultural land in Latvia is predicted due to changes in climate conditions of other regions and growing demand for food products. Therefore decline of non-utilised agricultural land areas is foreseen. Non-use of specific areas might have temporary character. In part of agricultural land areas energy crops would be cultivated, while less fertile areas would be preserved (from overgrown) for nature landscape values. Thus only slight decrease of total agricultural land areas is foreseen comparing to the situation in 2007 but the non-utilised agricultural land area would significantly decrease (see the next table). Converting the provided projections to absolute figures **the decrease of total agricultural land from 2010 till 2020 can be assumed in range of 2 %**.

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concrete date (1st June or 1st July depending on the year) without adding data about small farms. Regarding total agricultural areas these data often is only provisional and do not suit fully for trend analysis.

[12] That's why the (yearly) CSB data on utilised agricultural land area were used for characterising the trend. The only data on total agricultural land area comes from the "Farms' Structure Survey" conducted every 2 years. However, as noted, these data are often only provisional and do not suit fully for the trend analysis.

Table 3.1. Agricultural land use projections for Latvia. *(Source: Ministry of Regional Development and Local Government of Latvia (2008) Land Policy Strategy 2008-2014.)*

	Total agricultural area, % from total territory of Latvia*	**Non-utilised agricultural area, % from total agricultural area**
2008	37.9	14.6**
2009	37.5	14
2010	37	8
2014	37	5
2030	35	1
Development till 2020	**slight decline ⇓**	**significant decline ⇓**

* Based on the State Land Service's data from the State Cadastre of real estate. ** According to a survey on agricultural areas conducted by the Ministry of Agriculture in cooperation with the Latvian Rural Consulting Centre in 2005, around 14.6 % (2.4 milj) of the total agricultural land area in Latvia was not utilized. [20]

A research study on GGE assessment till 2020 by the Institute of Physical Energetic in 2011 (literature source [11]) includes projections for agricultural indicators to 2015 and 2020. In this study a combined forecasting method was used – statistical trend analysis and experts' assessments. During the first stage of the analysis the most appropriate trend model was selected for each indicator's time series data row and confidence interval of the obtained estimates was calculated. After that a group of experts evaluated the intervals for the indicators predicted by the trend models. After experts' discussions projections for 2015 and 2020 were defined. The analysis takes into account also long-term forecasts (till 2025) of macroeconomic indicators prepared by the Latvian Ministry of Economics, which takes into account national demand for agricultural products, as well as export possibilities and tendencies when developing forecasts for agricultural indicators**.**

According to the study increase for agricultural indicators is predicted, including, increase in livestock number and more considerable increase in crop production, especially for sown areas under the cereals and rape. Increase of agricultural land utilization is foreseen for all main agricultural land use types with total **increase of utilised agricultural land by 22.4 %[13] from 2010 to 2020. At the same time constant size of total agricultural land area is assumed like it was assumed for the past**.

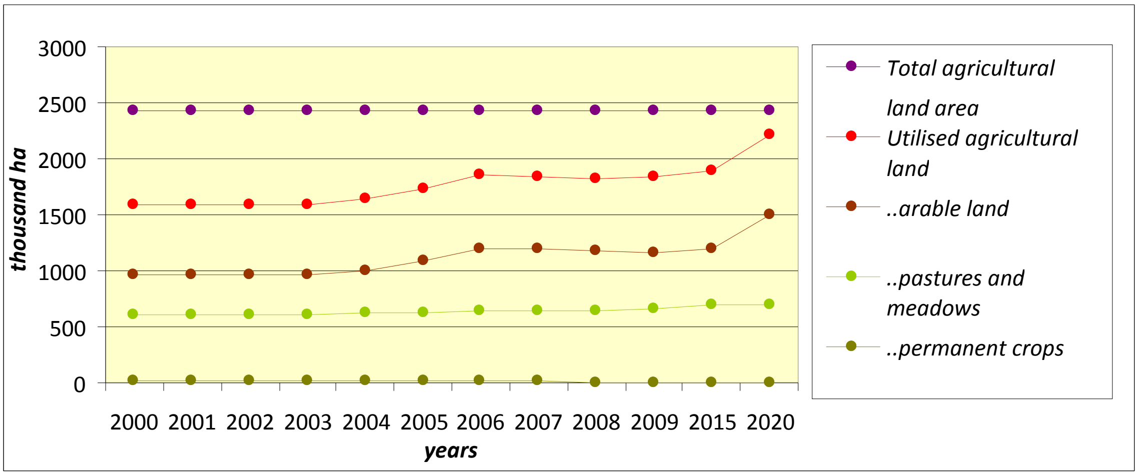


Figure 3.2. Forecast of total agricultural land area and its structure. *(Source: Institute of Physical Energetics (Decemebr, 2011) Reaserch report „Latvijas siltumnīcefekta gāzu emisiju un piesaistes prognožu līdz 2020.gadam sagatavošana saskaņā ar Eiropas parlamenta un padomes lēmumu Nr.280/2004/EK".)*

[13] This is calculated by using the CSP actual data for 2010 and the projected area in 2020 by the study (using the final projection – after validation by experts).

This study includes total land balance projections (including all main land use types) for various scenarios. Changes in areas of both the utilised agricultural land and forest land need to be viewed together against the total available land area. Increase for each type can be assumed when using non-utilised agricultural land (the study uses the "Land Policy Strategy" as basis assuming 14.6 % of such land in 2008). Basic scenario projects slight decrease of the forest land area (-1.6 %) and considerable increase of the utilised agricultural land area (+38 %) for 2020 (comparing to 2009) with the total agricultural land area remaining almost constant (-0.5 %). Alterntative scenario projects 8 % increase of the forest land area and the same considerable increase of the utilised agriculrual land area by decreasing non-utilised agricultural land area (up to 0 ha). The total agricultural land area decreases by 13.8 % as a result. What can be concluded is that **the increase of areas of both the utilised agricultural land (presented earlier in this chapter) and the forest land (will be used in the BS for forestry) may be accounted and would fit with the total land balance.**

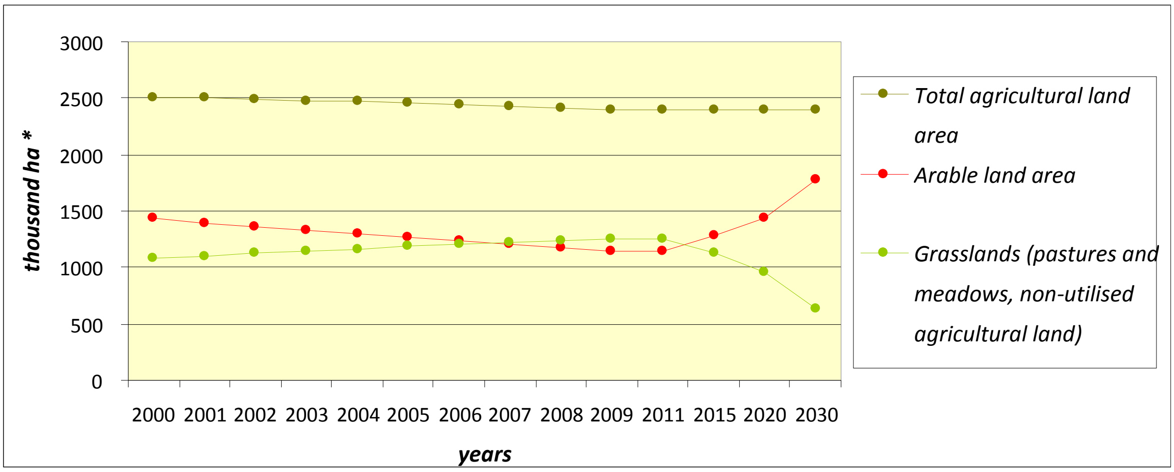
A research study on likely development of various agricultural indicators till 2015, 2020 and 2030 conducted by the Ministry of Agriculture and Latvian University of Agriculture in 2013 (literature source [8]) also includes assessments of likely development for various agricultural indicators. Projections in this study were prepared in the context of GGE assessments in a similar way like in the previous study on GGE assessments till 2020. However different approach for the projections till 2030 was used at first stage of the analysis – correlation between GDP and relevant agricultural indicators was used instead of statistical trend modelling. This was explained by the fact that it is not appropriate to use trend analysis method for long-term projections of indicators with short time-series data row. It was recognized in the study that agriculture is developing in very changeable conditions, which are influenced by climate change, market conjuncture and development of technologies. Thus combination of forecasting methods (statistical trend analysis, correlation analysis and experts' opinion) was chosen as the most appropriate approach, as well as only the most reliable data sources were used (CSB, Ministry of Agriculture and Agricultural Data Centre). CAP and existing national support measures (incl., direct payments, rural development and state financial support) and global market tendencies (demand and prices) were taken into account, as well as suitability of Latvia's agro-climatic and environmental conditions for specific agricultural sub-sectors.

According to this study concentration in dairy farming, pig farming, poultry farming, grain production and vegetable production would continue in Latvia, which would result in increase of production efficiency and yield. **Structural changes in agricultural areas and increase in its utilisation are foreseen, while size of the total agricultural land area is assumed constant for the future** (see the next figure).

Conclusions on the likely development of the factor to 2020

Taking into account increasing global demand for the agricultural products, supportive policy for development of the agricultural sector[14] and projections for its positive growth, it is expected that utilized agricultural land area will increase by reducing non-utilised agricultural land. Considering that part of the non-utilised agricultural land will continue overgrow and is foreseen also for targeted afforestation (as it is stipulated in the Latvia's Forest Policy and Land Use Policy, and foreseen by the next period "Rural Development Programme"), it may be assumed that the total agricultural land area could remain with no changes or decline. Magnitude of the decline would depend on how mach of the non-utilised agricultural land is converted to forest land. Scenario projections show that decline up to -13 % is possible in principle.

[14] More information about development of the drivers is provided in the Annex 2.



* Different size of arable land area till 2006 comparing to the CSB data can be explained by the fact that figures here are based on the national monitoring forest data of the Latvian State Forest Research Institute "Silava", which are used for preparation of the national report on inventory of GHG emissions.

Figure 3.3. Forecast of total agricultural land area and its structure. *(Source: Ministry of Agriculture and Latvia University of Agriculture (2013) Research report „Lauksaimniecības rādītāju prognoze 2015., 2020. un 2030. gadam.")*

3.1.2 Factor: Arable land area

According to the MBM, arable land area and area occupied by permanent crops are viewed together as "arable land area" (see the chapter 3.3 for more information).

Past development trend

According to the CSB data size of arable land area has remained with no changes overall from 2006 – yearly growth rates are in range of -1.5% to +1.7%. The largest share of it is occupied by cereals followed by forage crops. The permanent crops occupy very small area (see the figure below).

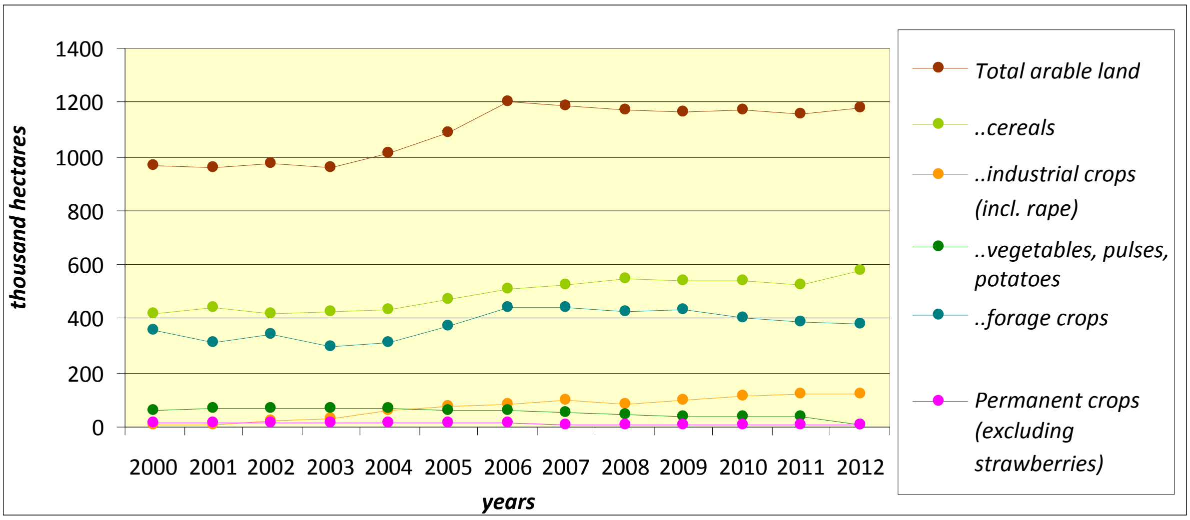


***Figure 3.4. Arable land area (incl., by the main crops) and area occupied by permanent crops**. (Source: CSB statistics.)*

Expected development in the future

Research on GGE assessment till 2020 conducted by the Institute of Physical Energetic in 2011 (literature source [11]) foresees **increase of arable land area by 27.8 % from 2010 to 2020** by increasing use of non-utilised agricultural land. **Area of permanent crops would increase slightly – by 2.9 % from 2010 to 2020**[15] (see the next figure).

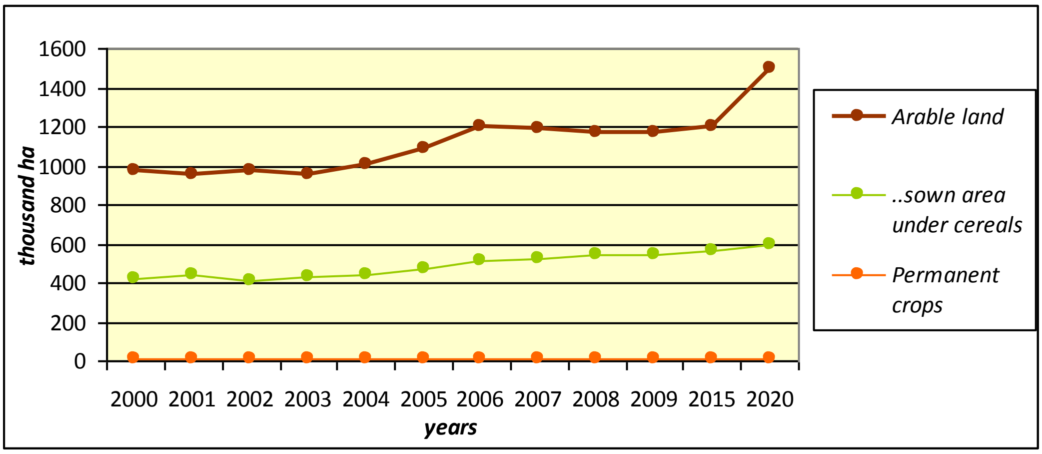
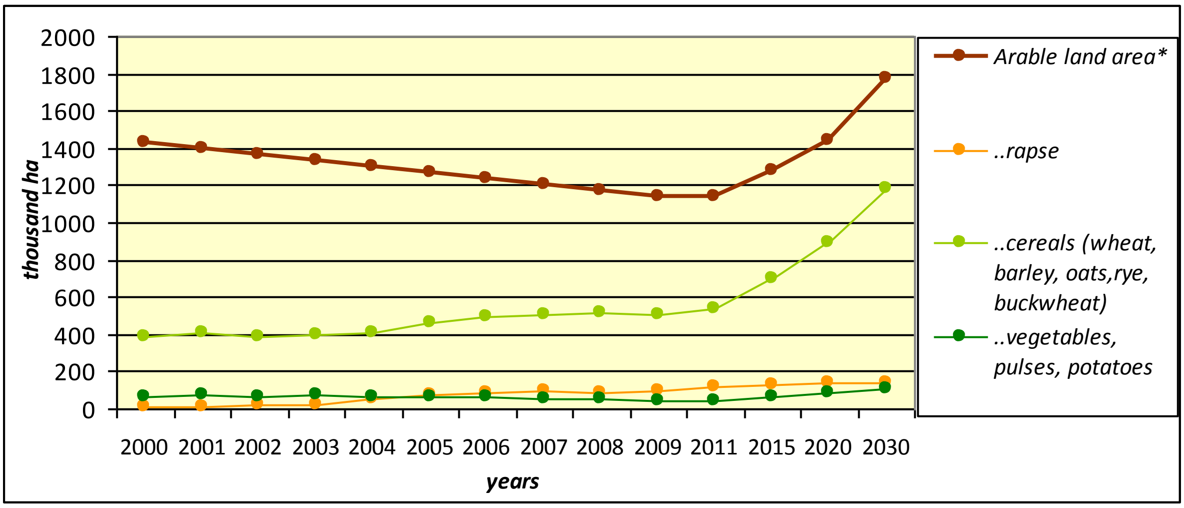


Figure 3.5. Forecasted changes in arable land area, sown area under the cereal crops and permanent crops to 2020. *(Source: Institute of Physical Energetics (2011) Reaserch report „Latvijas siltumnīcefekta gāzu emisiju un piesaistes prognožu līdz 2020.gadam sagatavošana saskaņā ar Eiropas parlamenta un padomes lēmumu Nr.280/2004/EK".)*

Also the **research study on likely development of agricultural indicators till 2030 by the Ministry of Agriculture and Latvian University of Agriculture** (literature source [8]) shows **increase of arable land area – by 26.3 % from 2010 to 2020, especially due to increase of cereal sown areas** (see the figure below).



* Different size of arable land area till 2006 comparing to the CSB data can be explained by the fact that figures here are based on the national monitoring forest data of the Latvian State Forest Research Institute "Silava", which are used for preparation of the national report on inventory of GHG emissions.

Figure 3.6. Forecasted changes in arable land area, incl. by the main crops. *(Source: Ministry of Agriculture and Latvia University of Agriculture (2013) Research report „Lauksaimniecības rādītāju prognoze 2015., 2020. un 2030. gadam.")*

[15] Both figures are calculated by using the CSP actual data for 2010 and the projected areas in 2020 by the study (using the final projections – after validation by experts). Concerning the permanent crops' area, it was 5.9 thous. ha in 2009 (actual data of the study) and would be 7 thous. ha in 2020 according to the projection, which compose +18.5 % increase comparing 2020 and 2009. At the same time, the actual CSB data show 6.8 thous. ha of such area in 2010 already leaving only 2.9 % increase up to the prjected 7 thous. ha in 2020.

Conclusions on the likely development of the factor to 2020

Taking into account increasing global demand for agricultural products, supportive policy for development of the agricultural sector[16] and projections for its positive growth, it is expected that size of arable land area could increase significantly. According to the studies by the Institute of Physical Energetic (in 2011, literature source [11]) and by the Ministry of Agriculture and Latvian University of Agriculture (in 2013, literature source [8]) an increase of the total arable land area is projected by +27.8 % and +26.3 % respectively, while non-utilised agricultural areas would decline. Area under the permanent crops could increase a little – by 2.9 % from 2010 to 2020 (according to the study by the Institute of Physical Energetic in 2011).[17]

At the same time the study by LSIAE[18] (in 2008) includes different projections for the agricultural areas and production (see the Annex 2 for more information about this study). According to this study more moderate or no growth could be expected overall for the agricultural land areas and production (depending on crops). In addition, specifics of the used forecasting methods in both studies discussed here should be taken into account, which induces uncertainties in the obtained results.[19] Comparing to the LSIAE study results the projections presented here for increase of arable land area by 26-28 % might involve overestimation.

3.1.3 Factor: Winter grown land area

According to the MBM, the winter grown land areas consists of sown areas under the forage crops for green fodder or silage and hay, as well as of fields left as fallow land (see the chapter 3.3 for more information).

Past development trend

According to the CSB data perennial grass occupies the largest share of sown areas under the forage crops (it composed 93 % in 2010) (see the figure below). Total sown areas under the forage crops have declined during the last 5 years.

Area of arable land left as fallow land ("papuves" in Latvian) has been declining overall since 2003 (see the next table). The CSB "Farms' Structure Survey" in 2003, 2005, 2007 and the "Agricultural Census 2010" are the only source for such data.

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[16] More information about development of the drivers is provided in the Annex 2.

[17] All figures are calculated by using the CSP actual data for 2010 and by the studies projected areas in 2020 (using the final projections – after validation by experts).

[18] The study was conducted by the Latvian State Institute of Agrarian Economics (LSIAE) in 2008 to analyse future development of the agriculture in Latvia with various economic development and CAP scenarios. For assessing impacts of economic and policy changes a model called AGMEMOD was used (econometric partial equilibrium model of agricultural products).

[19] For instance, the study by the Institute of Physical Energetic (in 2011) includes increase for arable land area in range of 28.5 % comparing 2009 (actual data in the study) and 2020. Almost half of the arable land area is occupied by cereals for which only 11 % increase is forecasted in the given period. Projections for the rest of arable land (the most of which is occupied by perennial grass) are not provided in neither of the studies. In the given case this other part should increase by more than 40 % to achieve the increase of total arable land by 28.5 %. A question may arise due to what type of crop areas such increase could be accounted.

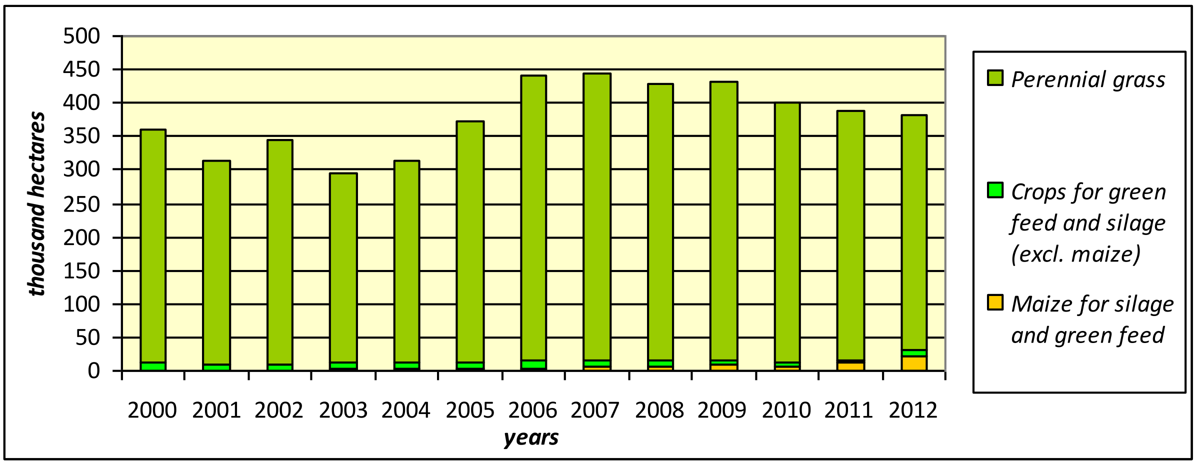

Figure 3.7 Sown areas under the main forage crops. *(Source: CSB statistics.)*

Table 3.2. Fallow area in Latvia. *(Source: CSB statistics.)*

Data source and year	Arable land, thsd. ha	of which fallow, thsd. ha	of which fallow, %
Farms' Structure Survey, 2003	944.7	104.7	11.1 %
Farms' Structure Survey, 2005	1077.7	97.0	9.0 %
Farms' Structure Survey, 2007	1113.1	64.6	5.8 %
Agricultural Census 2010	1120.2	74.5	6.6 %

Expected development in the future

According to the **research study on likely development of agricultural indicators till 2030 by the Ministry of Agriculture and Latvian University of Agriculture** (literature source [8]) large increase of sown areas under the forage crops for green feed and silage is projected from 2010 to 2020: **by +745.1 % for sown areas under maize and by +217.5 % for sown areas under other forage crops** (see the next figure). Such relative increase can be explained by relatively low size of such land areas in absolute figures, and by development of the economic processes driving such changes (discussed in the Annex 2).

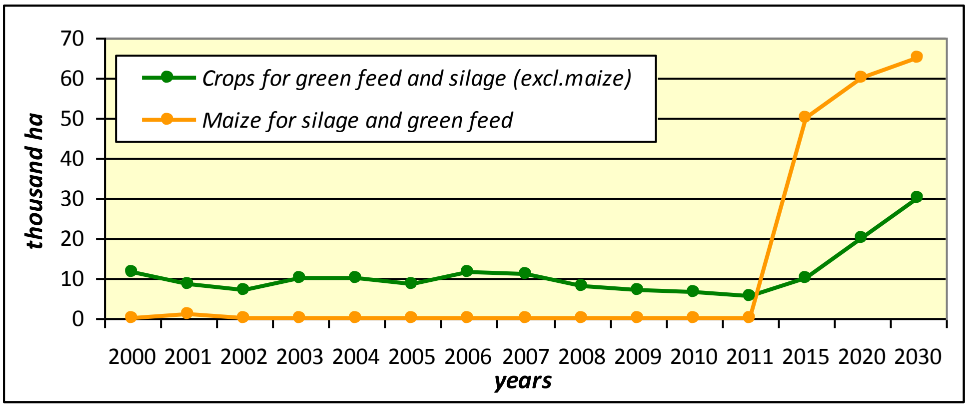

Figure 3.8. Forecasted changes in sown area under the forage crops for green feed and silage. *(Source: Ministry of Agriculture and Latvian University of Agriculture (2013) Research report „Lauksaimniecības rādītāju prognoze 2015., 2020. un 2030. gadam.")*

No projections were found for sown areas under the perennial grass (composing more than 90 % of the sown areas under the forage crops). Taking into account the predicted increase of global demand for the agricultural products, especially milk and meat (FAPRI, 2009), and the forecasted increase in livestock number for Latvia (literature sources [11] and [8]), it can be expected that sown area under the perennial grass would also increase. **The increase could be assumed similar to what is forecasted for meadows and pastures (+ 6 % from 2009 to 2020 in the study [11] or by 12 % if comparing actual data for 2010 and the forecasted figure for 2020 of this study).** The forecasted changes of the same study for number of animals (demanding hay) show similar increase (+3.7 % for milk cows, +11.6 % for cattle, 16.9 % for sheep, 15.4 % for goats).

No projections were found for the fallow land area as well. **Assuming constant share of the fallows in total arable land area (could be assumed 6-7 % for Latvia overall), changes in the fallow land area would be in line with the expected increase in the arable land area (up to +25 % for 2020)**.

Conclusions on the likely development of the factor to 2020

Taking into account increasing global demand for agricultural products (incl. for livestock products), supportive policy for development of the agricultural sector and projections for its positive growth, it is likely that the winter grown areas will increase.

According to the study on projecting changes in various agricultural indicators by the Ministry of Agriculture and Latvian University of Agriculture in 2013 (literature source [8]) an increase of sown areas under the forage crops for green feed and silage are foreseen – by +745.1 % for sown areas under maize and by +217.5 % for sown areas under the other forage crops from 2010 to 2020.

Increase of sown areas under the perennial grass may be assumed similar to what is projected for meadows and pastures as well as number of animal units (demanding hay) [11] – it could be assumed to be in range of 6-12 %.

Concerning the fallow land, a constant share of it in the arable land is assumed, which is in range of 5-6 % for Latvia overall (according to the CSB data for 2007 and 2010). Thus it could change in line with the expected increase in the arable land area (up to +25 % for 2020).

3.1.4 Summary on the likely development of the factors for pressure's analysis

Summary on likely development of the analysed factors causing nutrients' pollution from agriculture is provided in the table below. These results were taken further for the WB-scale analysis (see the chapter 3.3 for the results).

Table 3.3. Summary on likely development to 2020 of the analysed factors determining nutrients' pollution from agriculture.

* The list of information sources is provided after the table.

Analysed factors	Present situation (data for 2010)	Likely changes to 2020	Information sources* for likely changes
"Total agricultural land area"	According to the State Land Service data (State Cadastre of real estate) **– 2.4 million ha**, part of which was not utilised (various rates depending on data source).	**No changes or slight decline** caused by natural and targeted afforestation of non-utilised agricultural land: **-2 % - 0 %**. Larger decrease (up to 13 %) may be assumed if the forest area is increased more considerably (e.g. by +8 %). Although it still doesn't preclude increase of utilised agricultural land (incl. arable land as indicated below) also since the non-utilised agricultural land is converted for use.	(1), (2), (3), (4).

Analysed factors	Present situation (data for 2010)	Likely changes to 2020	Information sources* for likely changes
"Arable land area" (arable land and permanent crop area)	According to the CSB data size of arable land area has been stable from 2006 – yearly growth has been in range of -1.5% to +1.7 %. The permanent crop area has declined. In 2010: • arable land area 1173.4 thsd. ha; • permanent crop area 6.8 thsd. ha.	**Arable land: Significant increase +26.3 % / +27.8%** (depending on the source) by increasing further use of non-utilised agricultural land. The increase is related to economic development of the sector and increasing global demand for agricultural products. The increase may be overestimated. **Permanent crop area: + 2.9 %.**	(1), (4).
"Winter grown land area" (fallow land area and sown area under forage crops for green feed or silage and hay)	According to the CSB data in 2010: • sown are under the forage crops for green feed or silage, excl. maize 6.3 thsd. ha; • sown area under maize for silage and green feed 7.1 thsd. ha; • sown area under the perennial grass 387.3 thsd. ha; • fallow land area - around 5-6 % from arable land area (the share is calculated based on the CSB data from "Farms' Structure Survey" in 2007 and the "Agricultural Census 2010").	**Area under forage crops: Significant increase** related to economic development of the sector and increasing global demand for agricultural products (incl. for livestock products): • sown are under the **forage crops for green feed or silage, excl. maize +217.5 %**; • sown area under **maize for silage and green feed +745.1%**; • sown area under the **perennial grass +6/12 %** (depending on reference year). **Fallow land area: no changes in terms of the share in arable land – 5-6 %.**	(1). For perennial grass – own assumption based on projections for meadows & pastures, number of animals (4). For fallow land – CSP actual data and own assumption.

Information sources for the assessements on likely changes to 2020:

(1) Ministry of Agriculture and Latvian University of Agriculture (2013) Research report *„Lauksaimniecības rādītāju prognoze 2015., 2020. un 2030. gadam*."

(2) Ministry of Regional Development and Local Government, Land Policy Strategy 2008–2014 "*Zemes politikas pamatnostādnes 2008-2014*", approved by the Latvian Cabinet of Ministers Order No. 613, 13.10.2008.

(3) Ministry of Agriculture (2013) Draft document of the *"Latvian Rural Development Programme 2014-2020"* "*Latvijas lauku attīstības programma 2014-2020 (projekts)*".

(4) Institute of Physical Energetics (2011) Reaserch report *„Latvijas siltumnīcefekta gāzu emisiju un piesaistes prognožu līdz 2020.gadam sagatavošana saskaņā ar Eiropas parlamenta un padomes lēmumu Nr.280/2004/EK*".

3.2 National-scale BS assessments for forestry

This chapter presents the results concerning likely development of the analysed factors determining size of the nutrients' pollution from forestry (according to the MBM). The main results on development of drivers are provided in the Annex 3. Here the past development trends and available assessments on the future development of the analysed factors are discussed. The chapter ends with a summary on likely development of the factors.

3.2.1 Factor: Total forest area

According to the MBM, the forest land area includes also shrubs land areas (see the chapter 3.3 for more information). Taking into account that shrubs occupy less than 2 % of the total territory of Latvia (according to the State Land Service data) they were not examined in the BS analysis.

Past development trend

Total **forest area** has gradually increased in recent years (see the figure below) due to both natural overgrowth of non-utilized agricultural land and targeted afforestation of such land. Also reverse process – deforestation, transformation of forest and afforested areas for construction and agriculture can be observed, however it introduces relatively small changes due to strict restrictions for forest land transformation and obligation for its restoration after clear-cutting or damage due to natural reasons.

It should be noted that there are **two data sources providing slightly different data on relevant forest and forestry statictiscs** – the "State Forest Register" (maintained by the State Forest services (SFS)) and the "National Forest Inventory".[20] The data presented in the figure below come from the former. For comparison, according to the inventory data forest ocuppied 3.221 milj ha in 2008.[21] It is lager area than 2.96 milj ha according to the register (for the same year).

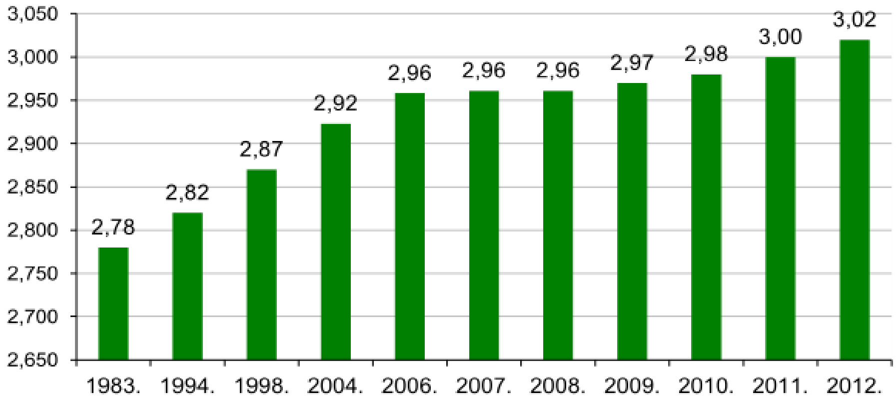

Figure 3.9. Dynamics of forest area in Latvia (million ha)*. (Source: Data of the State Forest Service from the "State Forest register", https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/00/30/09/Meap.pdf)*

According to the inventory data the size of **forest land area**[22] was 3.354 milj ha in 2010 [35] and it has slightly decreased since 2006 (see also the next table).

Table 3.4. Forest land area in Latvia (milj ha). *(Source: based on data of the „National Forest Inventory")*

Data year	Forest land area	Source
2006	3.603	CSB (table MSG01)
2007	3.536	CSB (table MSG01)
2008	3.497	CSB (table MSG01)
2009	3.349	[11]
2010	3.354	[35]

[20] In Latvian *"Meža statistiskā inventarizācija"*. Responsibility of the Ministry of Agricultre, conducted by Latvian State Forest Research Institute "Silava". Since 2006 assessment of forest resources in Latvia is based on data from the inventory. Before that data from the "State Forest register" were used. Both data differ due to differences in the methodologies for forest resources assessment. The inventory provides more precise data. (http://www.silava.lv/23/section.aspx/View/119, https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/00/02/46/platiba.pdf)

[21] Source: https://www.zm.gov.lv/public/files/CMS_Static_Page_Doc/00/00/00/02/46/platiba.pdf.

[22] Forest land area is larger than forest area (in Latvian *"mežu platība"* un *"meža zemju platība"*). The forest land area is invetorised area where economic activity is taking place, which is regulated by the Forest Law. The forest land area incudes, besides the forest area (which compose 91.4 % of the forest land area), also areas with bogs, glade, inundated land and infrastructure objects. (Source: http://www.vmd.gov.lv/valsts-meza-dienests/statiskas-lapas/-meza-apsaimniekosana-?nid=870#jump)

According to the data of the State Forest Service (SFS) on forest restoration (after felling and damage caused by specified reasons), targeted forest sowing and planting compose around 1/3 of totally restored forest area and it has increased slightly in terms of yearly restored area during the last 5 years (see the next figure). The other 2/3 are composed by natural overgrowing.

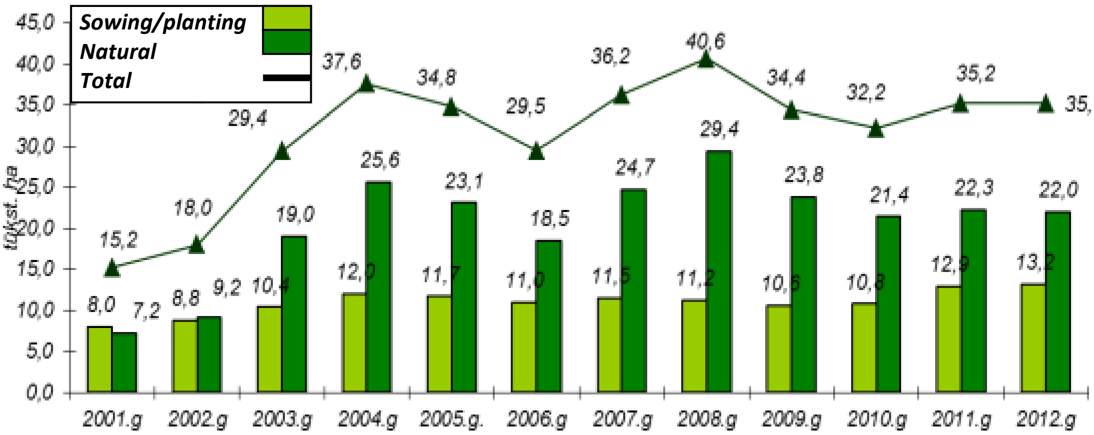

Figure 3.10. Dynamics of forest restoration by sowing/planting and natural overgrowing in Latvia, thsd.ha. *(Source: SFS Public report 2012 [22].)*

Afforestation is forest sowing and planting in areas not covered by forest before. Since the year 2004 the state's and EU financial support is available for this activity. [22] Dynamics on targeted afforestation of non-forest areas shows that afforestation has increased in 2010 and decreased since that coming back to the level of 2009 (see the next figure).

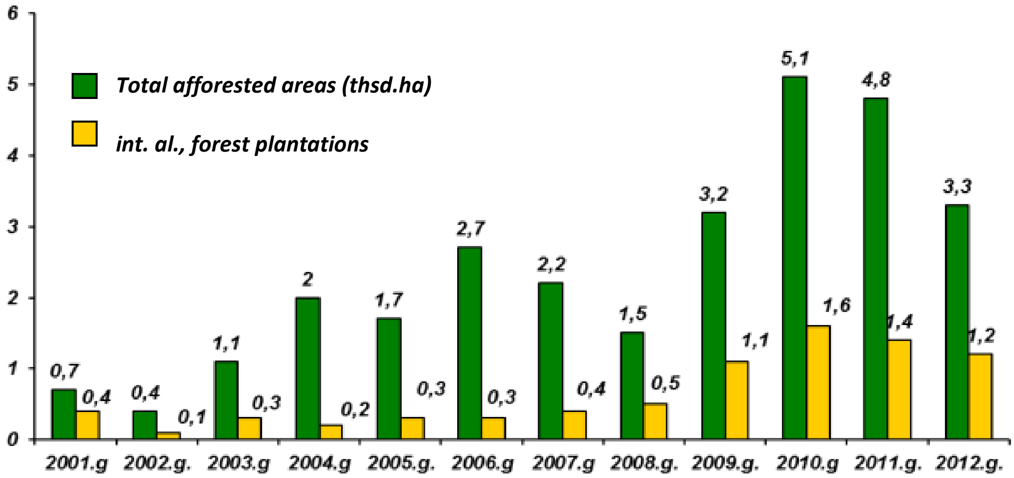

Figure 3.11 Dynamic of afforestation – forest sowing and planting in Latvia, thsd.ha. *(Source: SFS Public report 2012 [22].)*

Due to strong policy commitments and the available public funding stable continuation of the given processes can be expected also in the future. Research studies on future development are dicussed latter in this chapter.

Deforestation or forest transformation into other land use types occurs in rather small areas in Latvia overall. For instance, in 2012 SFS issued 356 deforestation permits (of which almost 70 % were issued in the Riga regional forestry) for only 309.5 ha forest area in total. Forest transformations were done for the needs of electricity and communication lines and pipeline construction, establishment of water reservoirs and quarries, road construction, agriculture and other construction purposes. [22]

Expected development in the future

Two studies have been identified that include also assessments on future changes of the forestry related indicators, including **forest land**[23] area.

Land Policy Strategy 2008–2014 includes short and long-term development scenarios of land use in Latvia. The projections were elaborated taking into account land policy and economic development tendencies (including from the global point of view), as well as studies on possible tendencies of land use in Europe. According to the long-term projections included in the Strategy slight increase of forest land area is foreseen. Forest management is seen balanced with care about sustainable use of resources and considering environmental protection requirements.

Table 3.5. Forest land projections for Latvia. *(Source: Ministry of Regional Development and Local Government of Latvia (2008) "Land Policy Strategy 2008-2014".)* *Based on the State Land Service's data from the State Cadastre of real estate.

	Total forest land area, % from total territory of Latvia *
2008	45,5
2009	46
2010	47
2014	48
2030	56
Development till 2020	**increase ⥣**

The research study on GGE assessment for 2020 conducted by the Institute of Physical Energetics in 2011 (literature source [11]) includes projections of forestry indicators for 2015 and 2020. In this study a combined forecasting method was used **–** statistical trend analysis and experts' assessments (see the chapter 3.1.1 for more information about the approach). The study builds on the Land Policy Strategy and develops two scenarios for the forest land area by applying specific assumptions concerning changes in non-utilised agricultural land. Basic scenario assumes decrease in the non-utilised agricultural land due to involving it in agricultural production, while the forest land area would decrease slightly due to increase of urban areas. The second scenario assumes partial afforestation of the non-utilised agricultural land. The projected changes in all land use types including the forest land area are summarised in the table below.

Table 3.6. Projected changes in the forest land area for Latvia according to the research study on GGE assessment for 2020 by the Institute of Physical Energetics in 2011. *(Source: [11])*

Land Use Types (thsd. ha)	**2005**	**2009**	**2015**	**2020**
Basic scenario 1				
Utilised agricultural area	1512	**1498**	**2067**	**2067**
Un-utilised agricultural area	943	**904**	**323**	**323**
Forest land area	3300	3349	**3294**	**3294**
Shrubs, bogs, land under water and other territories	452	452	452	452
Cities and construction areas	249	252	323	323
Total area	**6456**	**6455**	**6459**	**6459**

[23] These studies analyse changes in "forest land area" not "forest area" (see the comments on difference earlier in this chapter). Although the "forest area" is used as input data in MBM, these were only suitable studies that provide projections.

Land Use Types (thsd. ha)	2005	2009	2015	2020
Alternative scenario 2				
Utilised agricultural area	1512	**1498**	**2067**	**2067**
Un-utilised agricultural area	943	**904**	**162**	**0**
Forest land area	3300	3349	**3455**	**3617**
Shrubs, bogs, land under water and other territories	452	452	452	452
Cities and construction areas	249	252	323	323
Total area	**6456**	**6455**	**6459**	**6459**

The first scenario foresees small decrease (by -1.6 %) of the forest land area in 2020 comparing to the year 2009 (the reference year of the study). Such area would compose 51 % of the total teritory of Latvian. The second scenario foresees increase of the forest land area by +8 % to 2020 increasing the share of the forest land in the total territory of Latvia till 56 %.

Conclusions on the likely development of the factor to 2020

Taking into account the sectoral policy aimed at sustainable forest and forestry management (see the Annex 3 for more information) and the available projections for changes in land use, changes in the **forest land** area may be assumed to be in range of -1.5 to +8 % (as a maximum). This would be related to continuing of natural overgrowing of non-utilised agricultural areas and their targeted afforestation. Share of the forest land area in the total territory of Latvia can be assumed in range of 51-56 % in 2020. **Similar changes are assumed for the forest area also**.

3.2.2 Factor: Total felled area

Taking into account that increased nutrients' leakage is observed several years after clear-cutting (see the chapter 3.3 for more information), **total (cumulative) felled area** (in Latvian – *"izcirtumi"*) **should be accounted**. According to the existing regulations[24] forest restoration should be done within five years after clear-cutting (ten years regarding very humid forests, which might not compose considerable part of the total area). After restoration the felled area is considered as forest stand (in Latvian – *"mežaudze"*) again. Thus for the baseline scenario projections 5 years were assumed as an average period in which forest stand is restored after the felling.

Past development trend

Amount of yearly harvested wood has been slightly varying since 2000 however it has been in range of 10-12 million m^3 on average per year. Only the amount in 2008 has been slightly below this level, while the amount in 2010 and 2011 was slightly above (see figure below). Equable wood harvest is guaranteed by stable and planned forest felling policy. For instance, at the end of 2008 permitted forest felling (and thus felled timber volume) in the state forests was increased urgently for 2009-2010 in order to compensate predicted decrease of wood supply for timber industries from private forests and termination of round timber import from Russia from 2010 [1].

[24] Cabinet of Ministers Regulations N° 308 (02.05.2012.) "Meža atjaunošanas, meža ieaudzēšanas un plantāciju meža noteikumi".

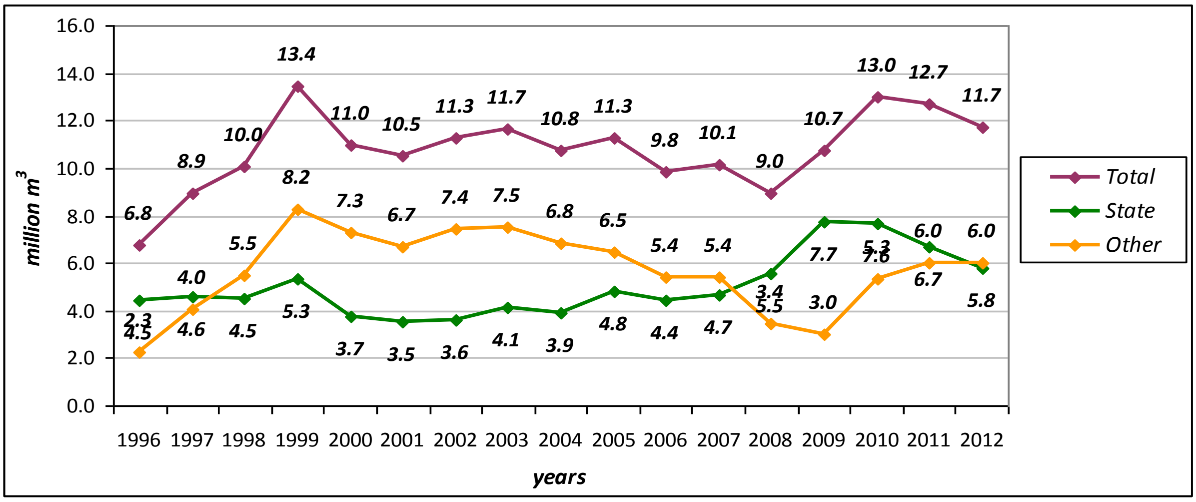

Figure 3.12. Dynamics of yearly wood harvest in Latvia 1996-2012 (million m^3/year) (incl. from the state and other forests). Source: State Forest Service [21, 24].

According to the SFS statistics around 80 % of wood is harvested in the main felling[25], around 90 % of which are harvested in clear-cut manner. Thus the area of felling in clear-cuts (see the next figure) changes similarly to the dynamics of harvested wood (presented in the fugure above). The yearly area of felling in clear-cuts has been varying in range of 25.5 to 42.3 thsd ha during the period 2005-2012 (35.2 thous. ha on average in this period).

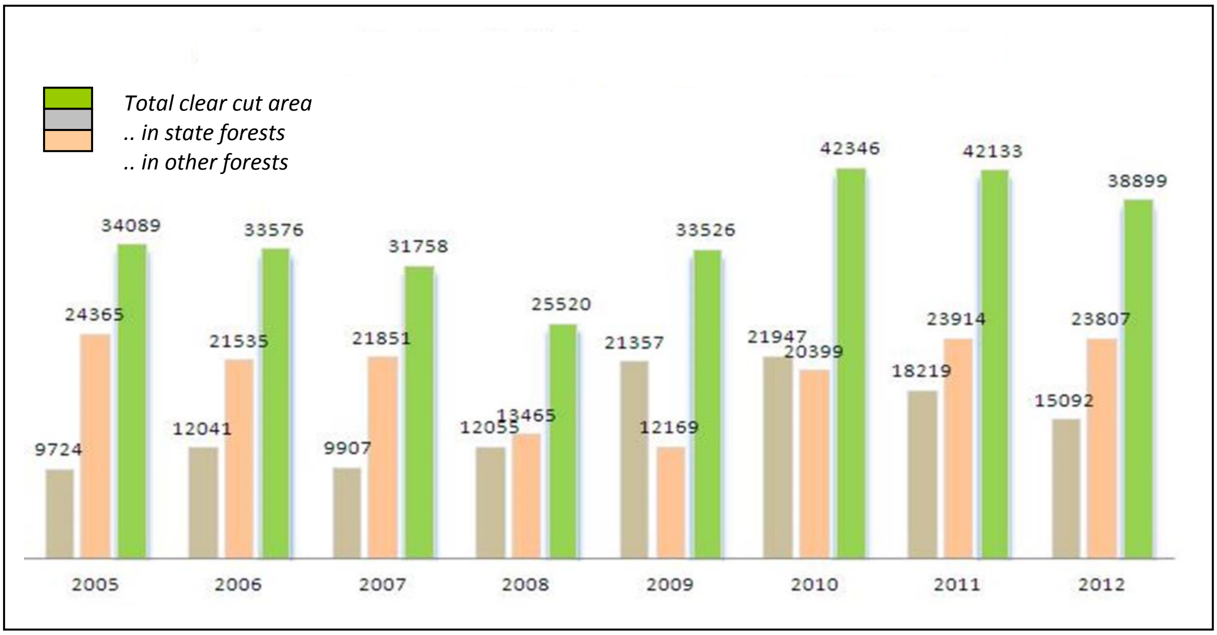

Figure 3.13. Dynamics of yearly felled area in clear-cutting (ha/year) in Latvia in 2005-2012. *(Source: State Forest Service, http://www.vmd.gov.lv/valsts-meza-dienests/statiskas-lapas/-meza-apsaimniekosana-/valsts-meza-dienests/statiskas-lapas/valsts-meza-dienests/statiskas-lapas/cirsanas-apjomi-skaitlos-un-faktos?id=2638#jump).*

[25] In terms of harvested wood amount (m^3), not the area from where it is harvested. The later is different. In 2011 35% of the area in which timber was harvested involved final felling areas, while in other cases this related to thinning, reconstructive or sanitary felling on a selecting basis. [35]

As noted the total existing (cumulative) felled area (in Latvian – *"izcirtums"*) should be accounted in light of the nutrient's load calculations. It formed around 5 % on average of the country's total forest area in the period 2005-2012 (see also the table below).

Table 3.7. Wood harvest and felling statistics for Latvia for 2005-2012. *(Source: State Forest Service, data from the "State Forest Register").*

	2005	2006	2007	2008	2009	2010	2011	2012	Average (2005-2012)
[A] Total forest area, km^2	29 503	29 584	29 503	29 562	29 663	29 842	30 073	30 206	29 742
[B] Yearly wood harvest, milj m^3	11.3	9.8	10.1	9.0	10.7	13.0	12.7	11.7	11.0
[C1] Yearly clear-cutting area in, km^2	341	336	318	255	335	423	421	389	352
[C2] Yearly clear-cutting area, % of forest area [C1/A]	*1.2 %*	*1.1 %*	*1.1 %*	*0.9 %*	*1.1 %*	*1.4 %*	*1.4 %*	*1.3 %*	*1.2 %*
[D] Total felled area, ("*izcirtumi*"), km^2	1 499	1 607	1 526	1 368	1 333	1 476	1 524	1 553	1 486
[D/A] Total felled area, % of forest area	***5.1 %***	***5.4 %***	***5.2 %***	***4.6 %***	***4.5 %***	***5 %***	***5.1 %***	***5.1 %***	***5 %***

Expected development in the future

According to the EU Joint Research Centre research used by Hamburg university in 2011 for the study "Projection of Net-Emissions from Harvested Wood Products in European Countries" (literature source [27]) slight increase of wood harvest in Latvia is projected – up to the 12 341 thsd.m^3 of harvested wood in 2020.[26] However, it is noted that considerable forest area in Latvia will reach the final felling age in the future and therefore the amount of harvested wood could increase even more that the projection shows. The trend in timber demand will mainly be determined by economic drivers and regulations on forest use. [28]

Simple comparison of the data on the harvested wood amount and the total felling area (in the previous table) shows that around 11 milj m^3 of wood have been harvested from around 5 % of the total forest area on average in the period 2005-2012. Thus, the same or slightly increasing total felled area can be expected with the projected increase of wood harvest.

Conclusions on the likely development of the factor to 2020

Taking into account that:

- the national policy for the forest sector aims to ensure sustainable wood availability and predictable field for development of the forestry products processing,
- the national mid-term macroeconomic forecasts indicate slight positive growth of the forestry sector,

[26] See the Annex 3 for more information (the chapter 2).

- the available projections show slight increase of wood harvest in Latvia for 2020, which might be even higher than projected due to considerable forest area reaching the final felling age in the future[27] and
- simple comparison of past data about wood harvest amounts and total felling area in Latvia,

the total felling area could be assumed without considerable changes to 2020 – in range of 5-6 % from the total forest area.

3.2.3 Factor: Drained forest area

According to the methodology for nutrient load calculations the drained forest area means existing drained area where drainage systems are functioning properly (see the chapter 3.3 for more information).

Past development trend

There are around 1.5 million ha of over-hummed and bogged forests in Latvia, around almost 700 thsd ha[28] of which have been drained (they compose around 25 % of all forests in Latvia). [15] Building of new drainage systems has not taken place since 1993. [14]

There is no data on the area with properly functioning forest drainage systems. According to the new rules for the forest inventory (Regulations of the Cabinet of Ministers N^o 88 (12.02.2013.) "*Meža inventarizācijas un Meža valsts reģistra informācijas aprites noteikumi*") two data codes will be introduced for characterization of drainage systems – code "532" for ditches/channels registered in the "Melioration Cadastre" (these ditches/channels can be assumed as functioning melioration systems) and code "531" for other ditches (maintenance of which can be characterized as occasional).[29] The new rules came into force in 2013 thus such data will become available gradually from the next forest inventories. This information should be available also in geo-spatial form. In addition development of the digital "Melioration Cadastre" is ongoing that would cover all melioration ditches of the State's improtance. 45 % of the territory of Latvia is already digitalized and available for public on website – http://melioracija.lv/. Development of the digital Cadastre is linked to the elaboration of hydrographical network under EU INSPIRE directive (2007/2/EC).

According to assessments developed for the Latvian "Rural Development Program 2007-2013" a large part of melioration infrastructure is deteriorated – repair of ditches is necessary for around 20 000 km, reconstruction of infrastructure for area around 12 000 ha, but full renovation of drainage systems for area around 50 000 ha. [14] In order to restore efficiency of historically built drainage systems their renovation and reconstruction is necessary.

Investments in forest drainage infrastructure occur only in large forest holdings, mainly by the company "Latvian State Forests". This company manages the major part of the state's owned forests (composing around half of all forests in Latvia). [14] For instance, in the period from 2005 till 2009 the company "Latvian State Forests" renovated forest drainage systems in area of 64 748 ha. According to the company's mid-term strategy "*Vidēja termiņa stratēģija (paskaidrojošais raksts)*" (2010) around 26 % of the company's managed forests stand on drained mineral or drained peaty soils (around 350 thsd ha area). [24]

Forest owners or legal prossesors have to submit information to the SFS about constructed forest infrastructure objects (roads and drainage systems) every year. SFS process the data and publish

[27] More detailed information about these drivers and available projections is provided in the Annex 3 (the chapter 2).

[28] 652 720 ha in 2010 according to SFS data.

[29] Information from consultations as part of the study (see the Annex 3).

them yearly. The last data are available for the year 2010[30]. The data concerning drainage systems include length of reconstructed drainage systems in km (see the table below). The data show varying reconstructed length from year to year, but regular investments for reconstruction of the systems overall.

Table 3.8 Length of reconstructed forest drainage systems in Latvia in the period 2005-2010. *(Source: data from the State Forest Service)*

	2005	2006	2007	2008	2009	2010
Reconstructed forest drainage systems, total length, km	171.5	413.5	267.5	1004.3	154.5	134.9

Expected development in the future

Renovation and reconstruction of old drainage systems has been set among the priorities of the Latvian Rural Development Program (RDP) (both till 2013 and till 2020). Building of new drainage systems is not promoted and expected. Public financial support for renovation and reconstruction of forest drainage systems has been and will be available through RDP measures (see the Annex 3 for more information).

The funding is available for those drainage systems that are registered in the "Melioration Cadastre". According to the information provided by the Ministry of Agriculture[31] the company "Latvian State Forests" has registered in the Cadastre (in 2008-2011) forest melioration systems for total area of 450 000 ha. This is area where continuous maintenance of drainage systems can be assumed. There are no other forest melioration systems registered in the Cadastre so far.

To promote investments in private melioration systems priority for the financial support was given to private forest owners in the previous RDP period.[32] However since there are no meliorations systems registered in the Cadastre besides those managed by the company "Latvian State Forests", it can be concluded that the private forest meliorations systems were renovated on very limited extent – only within the framework of projects of joint (state and private) use melioration systems.

Curently there is no information allowing assessment of the situation and possible future development of the private (and municipal) drainage systems. Concerning the state owned forests, the company "Latvian State Forests" is planning maintenance of forest drainage systems by taking into account the current conditions of each system and need for its renovation. Economic effectiveness calculation is performed for each system (including, calculation of NPV, IRR[33] of investments). Plans for the drainage systems' renovation are developed based on these assessments for each of the 8 regional forestries. Objects of the meliorations systems planned for renovations are specified in the "Forest management plans" of the regional forestries. (See [25], [26] for example.) The current plans concern period from 2012 till 2017 and each includes a list of forest drainage systems' objects planned for renovation in this period (e.g. name, forest site/district and area (ha) of the object, planned year of the renovation).

[30] https://www.zm.gov.lv/valsts-meza-dienests/statiskas-lapas/-meza-apsaimniekosana-/celi-un-melioracijas-sistemas?nid=877#jump

[31] As part of consultations for this study, see the Annex 1 for more information.

[32] The company "Latvian State Forests" could receive financial support only if a project was realised together with private forest owners or municipality (contribution in the private forest melioration systems should not be less than 30 % of the total eligible costs of a project).

[33] Net Present Value, Internal Rate of Return.

Conclusions on the likely development of the factor till 2020

Building of new drainage systems is not expected in the future. Thus the total area of drained forests – forests on drained mineral soils and drained peaty soils (around 650 thsd ha in Latvia overall[34]) will not increase or could even decline due to economic and nature protection considerations.

There is not data available for the time being concerning state of the current systems, e.g. how much of them function properly. Assessment conducted for the "RDP 2007-2013" shows that considerabe part of the systems in Latvia need repair, reconstruction and renovation.

Concerning private and municipal forest drainage systems, as long as these systems are not registered in the "Melioration Cadastre" (the precondition for receiving the RDP funding) increase in the areas with functioning drainage systems should not be assumed (since increasing such areas would require renovation/reconstruction and it would be logically to assume that owners would want to use public financial support for it). At the same time assuming all historically drained systems as functioning properly seems leading to overestimation of the nutrients' load to water bodies.

Concerning state owned forest drainage systems, renovation and reconstruction of historically built drainage systems will continue. Intenstity of these works might even increase due to the strong policy commitment and public financial support for it. Area in which continuous maintenance of the drainage systems will likely be ensured compose at least **450 000 ha** – the area registered in the "Melioration Cadastre" by the company "Latvian State Forests".[35] It compose around 28.5 % of all state owned forest area (1.583 milj ha in 2011). [35] The list of objects of drainage systems planned for renovation is specified (incl., published in the company's (8) regional forestries "Forest management plans") for the period 2013-2017.

3.2.4 Summary on the likely development of the factors for pressure's analysis

Summary on likely development of the analysed factors causing nutrients' pollution from forestry is provided in the table below. Thes results were taken further for the WB-scale snalysis (see the chapter 3.3 for the results).

Table 3.9. Summary on likely development to 2020 of the analysed factors determining nutrients' pollution from forestry.

* The list of information sources is provided after the table.

Analysed factors	Present situation	Likely changes to 2020	Information sources for likely changes*
"Total forest area"	According to data (for 2010) from the "National Forest Inventory" – 3.354 milj ha in Latvia, what composes 52 % of the total forest area.	Changes in forest land area can be assumed **in range from -1.5 % to +8 % (as a maximum)** comparing to the 2010 area. Similar changes are assumed for the forest area. Share of the forest land area in the total territory of Latvia would be in range of 51-56 % respectively.	(1), (2).

[34] 652 720 ha in 2010 according to SFS data.

[35] According to information from the company "Latvian State Forests" (LSF) [24] 350 thsd ha of their managed forests stand on drained minera and drained peaty soil – the forest types that usually are assumed as the total drained area. The larger area registered in the Cadastre (450 thsd) could be explained, for instance, due to some part of joint use systems (being partly in private/municipal forests) being registered in the Cadastre by the company LSF. Thus this area could account to some extent also systems in private/municipal forests.

Analysed factors	Present situation	Likely changes to 2020	Information sources for likely changes*
"Total felled area"	According to SFS data ("Forest CD") – 1 476 km^2 in 2010 composing 5 % of the total forest area. (1 553 km^2 in 2012, 5.1 % of total forest area.)	The total felled area could be assumed **without considerable changes – in range of 5-6 % from the total forest area.**	(3), own assumption based on the conducted analysis.
Drained forest area	According to SFS data (for 2010), **area of (historically) drained forests** – forests on drained mineral soils and drained peaty soils – **652 720 ha** (or 22 % from all forests in Latvia). **No data on area with properly functioning drainage systems.** According to the assessments prepared for the RDP 2007-2013 **considerable part of the drainage infrastructure is deteriorated**. **Public funding from the RDP** (till 2013) has been available, however has been used on very limited extent for private/municipal systems. SFS data on reconstructed systems (length in km) show **varying reconstructed length from year to year, although regular investments**.	Building of new drainage systems is not expected. **Total area of (historically) drained forests will not increase or could even decline.** **Area with properly functioning forest drainage systems:** - Concerning private and municipal drainage systems – **increase could not be assumed comparing to the current situation (not known)** (as long as no such systems are registered in the "Melioration Cadastre" – precondition for receiving RDP funding). - Concerning the state owned forests (managed by the company "Latvian State Forests") – **450 000 ha area where continuous maintenance of drainage systems can be assumed.** (The figure could include to some extent also joint use systems being partly in private/municipal forests.) Objects of drainage systems for renovation are specified for the period till 2017 (incl. in terms of their location and size of area).	(4), (5), (6).

* Information sources:

(1) Ministry of Regional Development and Local Government, Land Policy Strategy 2008–2014 "*Zemes politikas pamatnostādnes 2008-2014",* approved by the Latvian Cabinet of Ministers Order No. 613, 13.10.2008.

(2) Institute of Physical Energetics (December, 2011) Research report „*Latvijas siltumnīcefekta gāzu emisiju un piesaistes prognožu līdz 2020.gadam sagatavošana saskaņā ar Eiropas parlamenta un padomes lēmumu Nr.280/2004/EK*".

(3) Rüter S. (2011) *"Projection of Net-Emissions from Harvested Wood Products in European Countries (for the period 2013-2020)".* Johann Heinrich von Thünen-Institute (vTI).

(4) Information provided by Ministry of Agriculture about registered melioration systems in Melioration Cadastre and granted under RDP 2013 melioration projects.

(5) Ministry of Agriculture (2013) Draft document of the Latvian Rural Development Programme 2014-2020 "*Latvijas lauku attīstības programma 2014-2020 (projekts)*".

(6) "Latvian State Forests" (2013) regional forestries' management plans.

3.3 WB-scale analysis (with applying MBM)

General aim of this analysis was **to explore possibility of simplifying approach for development of the BS assessments on the WB scale.** Taking into account relatively large uncertainties in the nutrient load calculation on WB scale overall, developing very precise BS estimates for all factors in the MBM input data for each WB might be seen as disproportionally resource consuming work.

Moreover the results of the 1st RBMPs show that the estimated changes in the BS often were marginal or didn't differ from the present situation at all.

The main idea was to perform **'sensitivity analysis' to test how much changes in the output – calculated N and P load on a WB, depend on changes in the input factors**. The larger the impact the more important the accuracy of input estimates. Due to limitations of this study this was tested concerning the analysed input factors of MBM only (as discussed in the section 2).

With this aim the national-scale assessments (described in the previous chapters 3.1 and 3.2) were expressed as interval estimates and their upper and lower bounds were entered into MBM (for 4 selected WBs of the Gauja RB). **The interval estimates aimed to incorporate possible variations (range) of the BS estimates among WBs**.[36] The national-scale assessments from the previous stage and the respective interval estimates used for the WB-scale analysis are summarised in the table 3.10 of the next chapter. The performed calculations show **difference in the calculated N and P load with the upper and lower bound of the BS interval. If the difference is small there is limited value from developing very accurate BS estimates for each WB**.

The analysis showed **need for some corrections in interpretation of the input factors (data) and "load coefficients" for calculating N and P loads in relation to the analysed factors**. The required corrections were also considered in the 'sensitivity analysis'. Performed testing shows differences in the calculated N ad P load when using corrected input data and load coefficients instead of those used for the 1st RBMPs. Like with the testing impact of the BS estimates, the larger the impact the more important the accuracy of the used input estimates, thus more efforts should be put on improving information and knowledge base for setting them. The tested changes are described in the next chapter. Due to the specific purpose of the analysis, the WB-models filled for the 1st RBMP were used as "reference situation" for these calculations.

3.3.1 Tested changes in the input factors, load coefficients and BS estimates

As noted, impact on the calculated N and P loads from the following issues was tested overall:

- correcting interpretation of the input factor (data),
- correcting used "load coefficients",
- changes in the BS.

Not all issues were relevant or possible to be tested for each analysed factor. The changes in the BS were tested for all analysed factors except the "drained forest area" (due to lack of data on the current area with properly functioning drainage systems). The next table presents the interval values used for the 'sensitivity analysis'.

Corrected interpretation of the input factors (data) was tested only for those factors where necessary. Corrected load coefficients were tested where possible, since some corrections require modification of the MBM structure that were not possible due to limitations of this study. All identified needs for corrections and the tested changes are summarised in the table 3.11 for each analysed factor.

[36] The intervals were developed based on own expert knowledge. Specific data collection or analysis was not conducted. But review of the data from MBM models for the 1st RBMP was done. Respective data (for the analysed factors) from WB-models were reviewed and compared for all WBs. Since the BS analysis was done for the 1st RBMP for each WB, these data show variations of the current land use in WBs and possible variations (range) of the BS estimates for WBs.

Table 3.10. The BS estimates used in the WB-scale analysis (with MBM) to investigate their impact on calculated nutrient load.

** More information is provided in the chapters 3.1 and 3.2. ** To incorporate possible variations of the BS estimates among WBs. *** Also the total agricultural land area was analysed on the national scale. But it is not the input factor in the MBM thus was not taken further for the WB-scale analysis.*

Analysed factors	National scale BS assessments*	Interval estimates** used in the WB-scale analysis with MBM
Arable land area ***	Arable land area: increase of the area by +26.3/+27.8 % depending on the literature source. Permanent crop area: increase of the area by +2.9 %.	Arable land area: changes in the area from 0 % (min) till +25 % (max). Permanent crop area: changes in the area from 0 % (min) till + 3 % (max).
Winter grown land area	Area under forage crops: increase of the area under – forage crops for green feed or silage (excl. maize) by +217.5 %. – maize for silage and green feed by +745.1 %. – perennial grass by +6/+12 %. Fallow land area: no changes in terms of share into the arable land, which is 5-6 % of the arable land area.	Area under forage crops: changes in the area under – forage crops for green feed or silage (excl. maize) from 0 % (min) till +200 % (max). – maize for silage and green feed from 0 % (min) till +700 % (max). – perennial grass from +6 % (min) till +12 % (max). Fallow land area: share into the arable land area from 5 % (min) till 6 (max) %.
Total forest area	Changes in the area in range from -1.5 % to +8 % (as a maximum).	Changes in the area from -1.5 % (min) till +8 % (max).
Total felled area	No considerable changes – remaining in range of 5-6 % from the total forest area.	Share into the forest area from 5 % (min) till 6 % (max).
Drained area	*Since the current area with properly functioning drainage systems is not known, expected changes in the BS could not be assessed.*	*Could not be analysed in the study due to lack of information.*

The interval estimates were fed into the WB-models of four WBs of the Gauja RB. Several WBs were included in the analysis to ensure incorporation of land use variations among WBs. Hence possible differences in the significance of various pollution sources and calculated loads from them are accounted. The following WBs were selected – **G205 Gauja, G209 Gauja, G220 Abuls and G229 Vija**. These WBs have nutrient pollution problem due to agricultural and/or forestry activities according to the 1st RBMP of the Gauja RBD (thus the agricultural and forestry activities are there). The results are presented in the next chapter.

The next table highlights the identified needs for corrections and the tested changes concerning the input factors (data) and "load coefficients"[37] for all analysed factors. The suggested corrections should be considered in the MBM files used in the future.

[37] Suggested corrections are taken from the work as part of the project's task in relation to pressures' analysis (conducted by "L.U. Consulting" Ltd.). For more information see the project's report *L.U. Consulting (2013) Gala atskaite Līgumam "Izkliedētā piesārņojuma slodžu un to radītās ietekmes analīze". VARAM.*

Table 3.11. Interpretation of input factors, input data and load coefficients of MBM for the analysed factors.

NOTE: Suggested corrections are highlighted with red text.

	MBM of the 1st RBMP (version 7.1)	Approach, data and estimates used in this study	Proposals for changes
Name of input factor	**Arable land, km²**	**Arable land, km²**	**Arable land, km²**
Input data	GIS data from **CORINE Land Cover (CLC)**, classes: 2.1. Arable land: – 211 (Non-irrigated arable land); 2.2. Permanent crops: – *221 (Vineyards) – not relevant for Latvia*, 222 (Fruit trees and berry plantations). For the BS analysis other data sources than CLC are used. Mainly CSB statistical data, also from the State Land Service.	The same interpretation and data sources as for the 1st RBMPs. **According to data from CSB**: Arable land: areas regularly farmed, usually in accordance with the crop rotation scheme of the holding; it includes sown areas of agricultural crops, fallows, *areas of strawberries*, flowers, open areas of ornamental plants, utilised areas of greenhouses; Permanent crops: plantations of fruit trees and berry bushes, including new plantations. *The area including and excluding strawberries are available.*	No need for changes was identified.
Load coefficients	The same **N leakage** coefficient for all WBs was used: **10 kg/ha/year** both for CLC 211 and 222. The same **P leakage** coefficient for all WBs was used: **0.18 kg/ha/year**.	**N leakage** from cultivated agricultural lands (arable lands) in Latvia is **6-20 kg/ha/year** according to the actual agricultural runoff monitoring in Latvia (from 6 kg/ha/year from territories with small share of arable lands up to 20 kg/ha/year from territories with high share of arable lands). Thus appropriate coefficients were tested for the analysed WBs (6.67, 8 or 9.33 depending on the WB). **P leakage** coefficients were corrected accordingly.	Using appropriate WB-specific coefficients according to the share of arable land in the catchment area of WB. (See the respective project's report from the pressures' analysis work for more information.)
Name of input factor	**Winter grown land, % of arable and pasture land**	**Winter grown land, % of arable land**	**Winter grown land, % of arable ~~and pasture~~ land**
Input data	According to methodology used for the 1st RBMP „winter grown land" is defined as: **meadows, pastures and winter crops**; furthermore all types of meadows or temporary pastures are classified as „winter grown land".	According to the definition given in the MBM (version 7.4) manual for „winter grown land", areas that are green during the winter consist of the following areas: **land used to grow green fodder or silage and hay, and unused fields**. **Relevant data from CSB**: Green fodder or silage: Sown area under the forage crops: maize for silage and green feed; crops for green feed and silage (excl. maize); Hay:	Introducing corrections in the input data according to the MBM definition (the approach used in this study). According to the MBM methodology effect from "green cover" defined as "winter green area" in the 1st RBMP should be considered in MBM Input data rows "Arable land - reduction of phosphorous from all measures - % P"

		Sown area under the forage crop: perennial grass; Unused fields: Fallow land area (Latvian - "*papuves*").	and "Arable land - reduction of nitrogen from all measures - % N".
Load coefficients	50 % reduction from the runoff coefficient for arable land was used for "winter grown land". The reduction is based on Swedish monitoring and statistical data. Thus **N leakage** coefficient from arable land area which is "winter grown land" is **5.00 kg/ha/year** (instead of 10.00 kg/ha/year used for non-"winter grown" arable land).	Corrected coefficient was tested in the study according to the actual agricultural monitoring in Latvia: **N leakage** of **5.35 kg/ha/year** from winter grown land.	Decoupling the coefficient for winter grown land from the coefficient for arabale land. Using coefficient according to the actual agricultural monitoring in Latvia: **N leakage** of **5.35 kg/ha/year**.
Name of input factor	**Forest land area, km^2**	**Forest area** ("Meža platība")	**Forest ~~land~~ area** ("Meža platība")
Input data	GIS data from **CORINE Land Cover**, classes: 3.1. Forests: – 311 (Broad-leaved forest), – 312 (Coniferous forest), – 313 (Mixed forest), 3.2. Scrub and/ or herbaceous vegetation associations: – 321 (Natural grasslands), – 322 *(Moors and heathland) – not relevant for Latvia*, 324 (Transitional woodland-shrub). For the BS development other data sources than CLC are used (e.g. yearly data from SFS).	The same as for the 1st RBMPs. **For the BS development other data sources than CLC are used.** Yearly data are available from SFS for two types of areas: 1. Forest area ("meža platība"), 2. Forest land area ("meža zemju platība"). The 2nd type includes: forests, bogs, glade, inundated land, forest infrastructure objects.[38] For comparison – data for the year 2000 for Latvia (milj ha): - CORINE – 2.232, - SFS, forest area – 2.888, - SFS, forest land area – 3.208. The "forest area" is suggested as more corresponding to the CLC interpretation of forest areas.	No need for changes was identified. Possible use of data from the "National Statistical Forest Inventory" for the BS development (more precise data than the yearly SFS data) should be discussed for the future.
Load coefficients	na	na	Correction are suggested (see the respective project's report from pressures' analysis for more information)

[38] http://www.vmd.gov.lv/valsts-meza-dienests/statiskas-lapas/-meza-apsaimniekosana-?nid=870#jump

	MBM of the 1st RBMP (version 7.1)	Approach, data and estimates used in this study	Proposals for changes
Name of input factor	**Final cut area/ year, % of forested area**	**Total felled area, % of forest area** ("Kopējā izcirtumu platība")	**Total felled area, % of forest~~ed~~ area** ("Kopējā izcirtumu platība")
Input data	Total felled area (in Latvian "izcirtumi") was calculated per each WB based on SFS yearly forest statistics (ha/year for each municipality as from 2001). Thus the "cumulative" clear-cutting area was used.	The same as for the 1st RBMP. Total (cumulative) felled area (in Latvian – *"izcirtumi"*) for a given year based on data from SFS ("Forest CD").	No need for changes was identified.
Load coefficients	According to original MBM (Sweden) methodology clear-cutting **increases** natural **N leakage from forests by 400 % during 8 years** following the felling **and P leakage by 200 % during following 3 years**. The run-off coefficients for forest area are used as the basis. The increased runoff coefficients are based on Swedish monitoring and statistical data. Two approaches can be used for the load caclutaion depending on the input data: 1) using in the input data on one year clear-cutting area and multiplying the increased load coefficient by the number of years with increased leakage (8 for N, 3 for P), or 2) using in the input data on "cumulative" felled area for a given year (without multiplying the coefficient by the number of years). The 2nd approach was used in the 1st RBMPs. But mistake in the used MBM files was found – P leakage coefficient was still multiplied by 3 (years) in spite of using the data on "cumulative" clear-cutting area.	The same as for the 1st RBMPs.	No need for changes in the approach was identified. The mistake in MBM files used for the 1st RBMP needs to be corected – removing multiplication of P leakage coefficient by 3 (years, in which increased leaching occurs if one year clear-cutting area was used used in the input data). Load from felling area is calculated as increased natural run-off from forests. Thus the calculated load from such area depends on coefficients used for the forest run-off.
Name of input factor	**Drained area/yr, % of forested area**	**Drained area, % of forest area**	**Drained area~~/yr~~, % of forest~~ed~~ area**
Input data	Drained forest area was assumed as area of two anthropogenic forest types[39] – forests on drained mineral soils (Latvian "*āreņi*") and drained peaty soils (Latvian "*kūdreņi*"). Area was calculated based on SFS yearly forest statistics (available as ha/year for each municipality as from 2001). The way factor is named in the used MBM files is confusing (might lead to using wrong input data, e.g. on area drained in the given year).	Part of drainage systems are deteriorated and don't function properly (thus the increased leakage should not be calculated there). However no data are available for the time being on the area with functioning drainage systems.	No changes could be suggested due to lack of data. Impact of using appropriate input data was tested as pat of the WB-scale analysis (see the next chapter for more information).
Load coefficients	According to the original MBM methodology forest drainage **increases** natural **N and P leakage from forests by two times**.	The same approach as for the 1st RBMPs.	No need for changes was identified.

[39] http://latvijas.daba.lv/biotopi/

3.3.2 Calculated changes in the nutrient load to WBs of the Gauja RB

The next tables summarise the results in terms of calculated changes in N and P loads from testing each issue concerning each analysed factor.

Concerning the corrections in input factors (data) and "load coefficients", the calculated changes in N and P loads are compared with the load from the 1st RBMP (the "reference situation"). The tested corrections were explained in the table 3.11 of the previous chapter. The results are presented in the table 3.12.

Concerning the changes in the BS the calculated loads are compared for the upper and lower bound of the BS estimate. The tested values were presented in the table 3.10 of the previous chapter. The results are presented in the table 3.13.

Table 3.12. Calculated (by MBM) differences in the pollution load when using <u>right interpretation of input factor (data) and appropriate load coefficients</u> for the analysed factors.

[1] The reference load – calculated load for the 1st RBMP.

[2] There is no reduced leakage of P from winter grown land.

[3] When testing max load coefficient – 20 N kg/ha/year from the recommended interval 6-20 kg.

[4] When using area with properly functioning drainage systems instead of all drained area. Based on consultations as part of the study it was assumed that the area with the drainage systems registered in the "Melioration Cadastre" can be assumed as continuously maintained (see the chapter 3.2.3 for more information). The reference level is the total drained area (like it was used in the 1st RBMPs).

[5] Identical changes are calculated for all WBs and for N and P since the same interval of the BS estimate is applied to all WBs and it concerns similarly both N and P.

N° of WB	Changes comparing to the reference load [1], %			
	for the Factor		for the total load on WB	
	N	P	N	P
1. When using right interpretation of input factor (data) for winter grown land area				
G205	-8 %	(not relevant [2])	-1.3 %	(not relevant [2])
G209	-12.2 %		- 1.2 %	
G220	-12.1 %		-3.5 %	
G229	-12.7 %		-2 %	
2. When using appropriate load coefficients for arable land area and winter grown land area				
G205	-4.5 %	-7.7 %	-0.7 %	-0.2 %
G209	-17 %	-20 %	-1.7 %	-0.8 %
G220	-5.2 %	-7.7 %	-1.5 %	-0.9 %
G229	-29 %	-32 %	-5 %	-4 %
G205 assumed [3]	+84.6 %	na	+13.8 %	na
3. When using right interpretation of input factor (data) for drained forest area [4]				
G205	-45 % [5]	-45 % [5]	-1.1 %	-0.6 %
G209			-0.6 %	-0.4 %
G220			-0.9 %	-0.6 %
G229			-2 %	-2.5 %

Concerning the correct interpretation of the factor "winter grown land area" (the 1st test in the table above):

- Lower pollution "load coefficient" is applied to winter grown land comparing to the arable land. Since these areas become larger with the corrected interpretation of this factor, the total calculated N load to the WBs declines. Thus due to wrong interpretation of this factor the load has been overestimated in the 1st RBMP.
- Although changes in the calculated N load due to this input factor are noticeable (-8 till -13 % depending on the WB), the total calculated load to WBs decreases rather marginally (by -1.2 till -3.5 % depending on the WB).

Concerning use of appropriate "load coefficients" for arable land and winter grown land areas (the 2nd test):

- For all analysed WBs the recommended load coefficients for arable land are lower than those applied in the 1st RBMP (the same N 10 kg/ha/year and P 0.18 kg/ha/year for all WBs in Latvia). Thus the calculated load is lower. Even in spite of slight increase of N load calculated from the winter grown lands (due to the load coefficient 5.34 N kg/ha/year instead of 5 kg[40]).
- It can be expected that there are no such WBs in the Gauja RB where intensity of agriculture would be such requiring application of the maximum N load coefficient 20 kg/ha/year.[41] To demonstrate possible changes in the N load if such coefficient is applied, it was fed in the model for WB G205. It can be seen that the total N load to the WB increases by almost 14 %, which is noticeable amount. The load would be even larger if input data were corrected as required.[42] This calculation demonstrates overall that load from arable land in WBs with less intense agriculture, like it is in the Gauja RB, are rather overestimated in the 1st RBMPs. At the same time, there are WBs in other RBs (e.g. in the Lielupe RBD) where this load might be considerably underestimated.

Concerning the correct interpretation of the factor "drained forest area" (the 3rd test):

- Since drained area becomes smaller with the corrected interpretation of the input factor (data), the calculated nutrient load decreases.
- Although changes in the calculated load due to this input factor are large (-45 %), decrease in the total load to WBs is rather negligible (from around -0.5 % till -2.5 % depending on the WB).

[40] Approach in the MBM for the 1st RBMPs – 50 % of the load from arable land (10 kg/ha/y).

[41] The coefficients were 6.67, 8 or 9.33 kg/ha/y (depending on the WB) for the analysed WBs.

[42] The input data on arable land area were not changed. The area would be larger if a WB is such requiring application of the coefficient 20 kg/ha/y (since the coefficient is determined for a WB based on the proportion of the arable land in the catchment – the larger proportion the larger coefficient).

Table 3.13. Calculated (by MBM) impact of the BS estimates on pollution load from the analysed factors.

[1] Identical changes are calculated for all WBs since the same interval of the BS estimate is applied to all WBs.

[2] Identical changes are calculated for all WBs and for N and P since the same interval of the BS estimate is applied to all WBs and it concerns similarly both N and P.

N° of WB	Changes comparing loads from upper and lower interval value of the BS estimate, %			
	for the Factor		for the total load on WB	
	N	P	N	P
From arable land area and winter grown land area				
G205	+25.2 % [1]	+24.9 % [1]	+5.4 %	+1.6 %
G209			+2.1 %	+0.8 %
G220			+5.4 %	+2.1 %
G229			+3.3 %	+2.2 %
From total forest area				
G205	+9.6 % [2]	+9.6 % [2]	+3 %	+0.3 %
G209			+ 3.3 %	+0.4 %
G220			+ 2.1 %	+0.3 %
G229			+3.6 %	+1.2 %
From total felled area				
G205	+20 % [2]	+20 % [2]	+0.5 %	+0.4 %
G209			+0.6 %	+0.7 %
G220			+0.4 %	+0.4 %
G229			+0.6 %	+1 %

Concerning the impact of the BS estimates in relation to the arable land area and winter grown land area:

- The calculated load from the input factor increases significantly (by around 25 %) if the upper bound of the BS estimates is used instead of the lower bound (e.g. +25 % of arable land area instead of no changes in such area).
- The calculated changes in terms of the total load to the WBs are rather marginal (from +1 % till + 5.5 % depending on the WB), and the increase is slightly higher for N than for P.

Concerning the impact of the BS estimates in relation to the total forest area:

- The calculated load from the forest area increases by around 9.5 % if the upper bound of the BS estimate is used (+8 % of the area) instead of the lower bound (-1.5 % of the area).
- The total calculated load to the WBs doesn't change considerably (increases by 0.3 % till 3.5 % depending on the WB), and the increase is slightly higher for N than for P.

Concerning the impact of the BS estimates in relation to the total felled area:

- The calculated load from the felled area increases by around 20 % if the upper bound of the BS estimate is used (total felled area is 6 % of the forest area) instead of the lower bound (total felled area is 5 % of the forest area).
- The total calculated load to the WBs doesn't change considerably (increases by 0.4 % till 1 % depending on the WB).

It can be concluded overall that:

- The impact of the BS estimates is rather small in terms of changes in the total load to WBs. Thus there would be limited value from developing precise estimates for each WB. It should be noted however that only part of the MBM input factors have been analysed, in particular concerning the agriculture (see the box 1.1 in the chapter 1.1 for full list of the input factors concerning agriculture and forestry). Thus similar analysis should be conducted concerning other factors also for generalising this conclusion.
- At the same time, the calculated load coming from each factor changes considerably. In particular, if considerable changes are projected for the factor in the BS (like it is concerning the arable land area with possible increase up to 25 %). Nutrient load reduction targets are set for WBs being "at risk" of achieving GES. If the targets are set for each sector/activity separately – according to the contribution in the total load, the changes in the BS might have significant impact on concerned sectors/activities in terms of additional measures (thus costs) needed to achieve the targets. In such cases accurate WB-scale assessments would allow determining more correctly extent of additional measures required for concerned sectors/activities.

3.4 Conclusions and recommendations for the BS development approach in Latvia

The 'sensitivity analysis' conducted as part of the study allows demonstrating for various input factors **importance of accuracy in**

- interpretation of input factors (data),
- using appropriate "load coefficients" and
- assessments of changes in the BS.

The importance was tested in terms of relative changes in the calculated N and P loads to WBs.

The **wrong interpretation of input factors (data) in the MBM versions completed for the 1st RBMP** was identified concerning the input factors "area of winter grown land" and "drained forest area".

Concerning the drained forest area, the impact of correcting input data appropriately seems to be rather marginal. It is due to relatively low run-off from the forest areas overall from which the elevated load due to drainage is calculated. There would be limited benefits from a special data collection or investigation to assess more accurately drained areas with actually functioning drainage systems (instead of assuming all drained areas with functioning systems). It could be recommended to wait when such data become available due to the new roles for forest inventory (see the chapter 3.2.3 for more information). Meanwhile the same approach as for the 1st RBMP could be used (data from SFS yearly forest statistics on forests on drained mineral and peaty soils).

Concerning the winter grown land areas the impact of correcting the input data also seems to be limited. Besides correcting respective input data in each WB-model might take some resources since input data need to be recalculated for each WB from CSB statistics according to administrative division. Thus pragmatic approach could be investigated e.g. when such corrections are introduced only in the models of WBs where nutrient loads are around the thresholds of failing targets (where even small changes in the calculated load to WBs might change their classification meeting/failing GES).

Concerning the **use of appropriate load coefficients, the impact of recommended changes concerning arable land could be very WB-specific**. In the analysed WBs of the Gauja RB (where the recommended coefficients are close to one used for the 1st RBMPs), the impact of changing coefficients is not significant. However, in the WBs with intensive agricultural production (large proportion of arable land in the catchment) the calculated N and P loads on WBs might become considerably larger. Thus **correcting the coefficients would be recommended for all WB-models**.

In relation to using **accurate WB-specific BS estimates it can be recommended that:**

1) Different approaches for developing WB-scale BS assessments could be applied to various WBs depending on the factor and the status of a WB. WB-specific assessments could be useful for WBs with the total calculated load around the threshold that is set to be a WB classified as having GES, since considerable changes in the BS may cause such WBs pass the threshold and change the status (from being at GES to non-GES, or other way round).

The next table provides a possible "matrix" for choosing the approach for WB-scale BS analysis**.** It is recommended that accurate national-scale BS estimates are developed for all input factors. For the factors analysed in this study the developed assessments can be of use already (see the chapter 3.1 and 3.2). But approach for the WB-scale analysis could differ depending on two criteria: (1) the impact of a factor on calculated load (should be tested for all input factors) and (2) the magnitude of expected changes in the BS (indicated by the national-scale analysis). The matrix shows 6 possible situations (squares) from combining both criteria. As indicated in the table, the factors analysed in this study belong to the squares 2, 3 and 5.

2) Similar 'sensitivity analysis' as in this study is conducted for other factors also. It could be done in selected WBs from each RBD representing variety of situations in light of analysed factors. Based on such results, all factors could be grouped according to their impact on calculated load (the 1st criterion) to guide further work for the BS development on WB-scale.

Table 3.14. Matrix for choosing approach for the BS development on WB-scale depending on the impact of a factor on calculated pollution load and the magnitude of expected changes in the BS (indicated by the national-scale BS analysis).

Impact on calculated load / **Changes in the BS**	**Significant impact on the total load to WB**	**Only significant impact on the load from a "factor"**	**Impact is not significant**
Considerable	**[1]** WB-specific estimate **for each WB**.	**[2]** WB-specific estimate **for WBs around threshold for GES.** [1] The same BS estimate for all other WBs.[2] *Arable land area*	**[3]** The same estimate for all WBs[2]. *Winter grown land area* *Total forest area*
Small	**[4]** WB-specific estimate **for WBs around threshold for GES.** [1] The same BS estimate for all other WBs.[2]	**[5]** WB-specific estimate **for WBs around threshold for GES.** [1] The same BS estimate for all other WBs.[2] *Total felled area*	**[6]** Simplified national-scale analysis. No need for WB-specific estimate (using the same estimate as for the "current situation").

[1] WBs with the total calculated load around the threshold that is set to be a WB classified as having GES.

[2] Derived from the national-scale estimate, which should be developed as an interval estimate (min-max expected changes). The value with more negative impact on pollution load could be tested in the WB-models (to account the most negative load scenario).

Information sources used in the study

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[15] Ministry of Agriculture of Latvia (2013) Draft document of the Latvian Rural Development Programme 2014-2020 *"Latvijas lauku attīstības programma 2014-2020 (projekts)"*.

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Annex 1: Consultations conducted as part of the study

Institution, contact person	Issues/questions for the consultations
In relation to the BS development for agriculture	
Latvian State Institute of Agrarian Economics (LSIAE), Department of Agricultural Development and Economic Relations, Agnese Krieviņa	Information on recent research conducted by the institute that would be relevant for the BS development. Important results: There is no more recent research studies by LSIAE than the one on possible impacts of CAP scenarios on agriculture: LSIAE (2008) Research report *„Eiropas Savienības lauksaimniecības un lauku attīstības politikas sagaidāmās pārmaiņas – perspektīvais novērtēj.ums Latvijai un Baltijas valstīm”*.
Ministry of Agriculture of Latvia, Agricultural Department, Division of Agricultural Resources, Ļubova Tralmaka	Information on research and policy documents that would be relevant for the BS development. Important results: • joint research of Ministry of Agriculture and Latvia University of Agriculture about projections for various agricultural indicators till 2015, 2020 and 2030: Ministry of Agriculture and Latvian University of Agriculture (2013) Research report *„Lauksaimniecības rādītāju prognoze 2015., 2020. un 2030. gadam.”*; • there are no other policy documents in addition to those that are placed on the Ministry's website, int. al., draft document of the "Latvian Rural Development Programme 2014-2020".
Central Statistical Bureau of Latvia (CSB), Information centre, Agricultural and Environmental Statistics Department, Anita Raubena	Clarifications regarding available statistical data on agricultural areas, including their availability for various geographical scales. Important results: • source of yearly statistics on agriculture is sampling-type surveys, thus CSB can ensure reliable data only on region level (as the lowest level). It should be noted that the aim of CSB "Farm Structure Surveys" (data are available in CSB data bases) is to characterise structure of farms. These data are aggregated for concrete date (1st June or 1st July depending on the year) without adding data about small farms. Regarding agricultural areas these data often is only provisional and do not suit for trend analysis. While yearly statistics on whole country contains also data about small farms and are reliable for analysis of trends; • there is no yearly statistics on un-utilized agricultural land area.
In relation to the BS development for forestry	
Ministry of Agriculture, Forest Department, Division of Forestry Strategy and Support, Ilze Silamiķele	Information on existing relevant to the BS development researches and policy documents; clarifications about differences between terms "renovation" and "reconstruction" of forest melioration systems used in Latvian Rural Development Programme. Important results: • there are no studies on the forestry development done by the Ministry; • there are no other policy documents available in addition to those that are placed on Ministry's website, int. al., "*Meža un saistīto nozaru attīstības pamatnostādnes* " approved by the Cabinet of Ministers in 2006; • both terms "renovation" and "reconstruction" exclude construction of new melioration systems; these terms differ by scope of activities that refer to maintenance of existing melioration systems.

Institution, contact person	Issues/questions for the consultations
Latvian State Forest Research Institute "Silava", Forest ecology and silviculture, Researcher, Zane Lībiete-Zālīte	Information on existing relevant to the BS development researches; clarifications on what can be considered as drained forest area and data sources for it. <u>Important results</u>: • there are projections developed as part of the GGE assessments (for Ministry of Environmental Protection and Regional Development); • drained forest areas can be defined as sum of forests on drained mineral soils and drained peaty soils. SFS yearly statistics is the most precise source for area calculation of these forests. Drained forest area the most likely will remain at existing level as renovation of old drainage systems is taking place, but not building of new systems; • regarding actually functioning melioration systems, the Forest department of Ministry of Agriculture, and the state company "Latvia's state forest" should be consulted.
Ministry of Environmental Protection and Regional Development, Climate and Environmental Policy Integration Department, Climate Change and Adaptation Policy Division, Agita Gancone	Information on existing relevant to the BS development researches. <u>Important results</u>: research on GGE assessment till 2020, including projections of agricultural and forestry indicators – Institute of Physical Energetics (December, 2011) Research report „*Latvijas siltumnīcefekta gāzu emisiju un piesaistes prognožu līdz 2020.gadam sagatavošana saskaņā ar Eiropas parlamenta un padomes lēmumu Nr.280/2004/EK*".
State Forest Service (SFS), Central Office, Forest resource management department, Forestry Unit, Normunds Knēts	Clarifications regarding drained forest areas and operating forest drainage systems. <u>Important results</u>: • drained forests are forests on drained mineral soils and drained peaty soils; • according to the new rules for forest inventory (Cabinet of Ministers Regulations N^{o} 88 (12.02.2013.) "*Meža inventarizācijas un Meža valsts reģistra informācijas aprites noteikumi*") two codes will be introduced for characterization of drainage systems: code "532" for ditches/channels registered in the melioration Register (these ditches/channels can be classified as functioning melioration systems) and code "531" for other ditches (maintenance of which can be characterized as spontaneous). New rules come into force as from 2013, thus additional data will become available gradually from next forest inventories (*according to the 29th article of the Law on Forests, it is duty of forest owner or lawful possessor to perform forest inventory at least once in 20 years and to submit these information to the State Forest Service (SFS), as well as to notify SFS about forestry activities each year*).
State company "Agriculture Ministry Real Estate", Head of Drainage Department, Edgars Griķītis	Clarifications regarding drained forest areas and operating forest drainage systems. <u>Important results</u>: • drained forests are forests on drained mineral soils and drained peaty soils; • digital melioration Register with melioration ditches of the State importance is under development. 45% of Latvia's territory is already digitalized and available for public on website - http://melioracija.lv/. Development of the Register is related to elaboration of hydrographical network under EU INSPIRE directive.

Institution, contact person	Issues/questions for the consultations
Ministry of Agriculture, Forest Department, Division of Land Management and Reclamation, Valdis Pētersons, Division of Forest Resources and Hunting, Valentīns Kukšinovs	Clarifications regarding drained forest areas, operating forest drainage systems and projects of forest melioration systems funded by the RDP till 2013. Important results: • in 2008-2011 JSC "Latvian State Forests" has registered in the melioration Register forest melioration systems with total area of 450 000 ha – this is area in which maintaining of drainage systems will the most likely be ensured. There are no other forest melioration systems (of other owners) registered in the Cadastre; • when performing forest inventory, SFS adds to the State Forests Register (database of all state forests) information on forest melioration systems that are registered in the melioration Cadastre. This information should be available also in geo-spatial format; • RDP financial support was and will be available only for those drainage systems that are registered in the melioration Cadastre; • limited number of projects on renovation of forest drainage systems were supported from RDP in period 2007-2013 – only within the frame of projects on jointly used drainage systems.
LU Consulting, Ģirts Karss	Consultations concerning input data in the MBM. Important results: • forest area - according to researches of the Latvian State Forest Research Institute "Silava" average nutrient run-off from forests in Latvia is: N_{tot} 2.92 kg/ha per 1 year, P_{tot} 0.099 kg/ha per 1 year; • "drained forest area" should be treated as existing drained areas where drainage systems are functioning properly. Drained forest area can be approximately assumed as sum of the two forest types: drained mineral soil (Latvian - "*āreņi*") and drained peat soil (Latvian - "*kūdreņi*"), however part of drainage systems is not functioning properly (incl. due to beavers' actions); • "final cut area" should be treated as existing (cumulative) felling area; • nutrient run-off effect from sanitary clear felling is the same as from clear-cutting, thus both types should be considered; • it can be assumed that clear-cutting increases natural leakage of N by 400 % during 8 years following the felling and the leakage of P by 200 % during 3 years; • according to the national legislation forest restoration after clear-cutting should be done within five years period after performance of clear-cutting in the main felling (ten years for very humid forests, which might make small share of total forests); • fertilization of forests in Latvia may occur only on relatively small areas, for instance, in plantations - energy willow stands; fertilization may occur in negligible quantities.

Annex 2: Development of Drivers influencing the "pressure's factors" for agriculture

1 Sectoral policy drivers

Latvia as EU Member State is influenced by the **EU Common Agricultural Policy (CAP)**. On national level agriculture is influenced also by national initiatives through related policies and plans, in particular, the Latvian National Development Plan, the Latvian Rural Development Programme, the Latvian land use policy.

CAP 2007-2013

The main objectives of CAP are to ensure a decent standard of living for farmers and to provide a stable and safe food supply at affordable prices for consumers. For implementation of the CAP objectives three main directions can be highlighted: promotion of market-guided agricultural entrepreneurship development, stimulation of sustainable and environmental friendly agriculture development and promotion of further rural development. CAP consists of two pillars:

- 1st pillar includes direct payments, overall market organization mechanisms and market promotion measures (market intervention, price support and export subsidies);
- 2nd pillar concerns rural development measures.

Conditions for receiving direct payments are defined by the Council Regulation (EC) No 73/2009 (19.01.2009.) establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers, amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003 and by the Latvian Cabinet of Ministers Regulations No 139 (12.03.2013.) "*Kārtība, kādā tiek piešķirts valsts un Eiropas Savienības atbalsts lauksaimniecībai tiešā atbalsta shēmu ietvaros*". In a similar way market promotion measures are defined by the Cabinet of Ministers (for more information, see for instance, http://www.zm.gov.lv/?sadala=1818). Total available financing (EU and national) under the 1st CAP pillar in 2007-2013 planning period is 0.59 billions LVL. [21]

In accordance to the EC Regulation No.1698/2005 (20.09.2005) on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) a middle term policy planning document the **Rural Development National Strategic Plan of Latvia for 2007-2013** was elaborated. It stipulates the main needs and priorities that should be co-financed from the EAFRD. The priorities included in this Plan are in line with the Community Strategic Guidelines for rural development 2007-2013 and have been implemented by the Ministry of Agriculture through the **Latvian Rural Development Programme 2007-2013**. Total available funding (EU and national) under the 2nd CAP pillar in 2007-2013 planning period was 1.37 billions LVL according to the Latvian Rural Development Programme's 11th version [14], which after funding reallocation was reduced till 0.92 billion LVL (the 12th RDP 2013 version) [16].

CAP after 2013

The last CAP reform focused on three priorities**:** viable food production, sustainable management of natural resources and balanced development of rural areas throughout the EU. This reform was adopted in 2013 and will become effective as of 1 January 2014, except the new direct payments structure ('green' payments, additional support for young people, etc.) which will apply as from 2015. The main changes in the new CAP[43]:

[43] http://ec.europa.eu/agriculture

- **Direct payments** will be distributed in a fairer way between Member States. The national envelopes for direct payments for each Member State will be progressively adjusted such that those Member States where the average payment (in € per hectare) is currently below 90% of the EU average will see a gradual increase in their envelope by 2019. The amounts available for other Member States who receive above average amounts will be adjusted accordingly. Direct payments also will provide more support to regions where conditions are more difficult (almost whole territory of Latvia is defined as the area less favourable for agriculture) and will help for young people to take up farming.

Taking into account the transition period for implementing of new direct payments system it might be presumed that some positive impact of these changes might be seen in Latvia after 2015 (date of official application of new direct payments structure) and at larger extent at the end of BS assessment period - 2021 (as gradual increase of direct payments is guaranteed by the 2019). According to the Latvia's statements about CAP reform, it means that Latvia starting as from 2017 will receive only around a half of the EU average level of direct payments or ~141 EUR/ha. [18]

- Further **improving the market orientation of** European **agriculture** will be supported by allocating new resources to farmers, enabling them to be reliable participants in the food production chain. Professional and inter-professional organisations will be promoted, and, for certain sectors, there will be specific regulations on competition law (milk, beef, olive oil, cereals). Such organisations will be able to increase efficiency by negotiating sales agreements on behalf of their members. Sugar quotas will be abolished by 2017, and the organisation of the sugar sector will be strengthened on the basis of contracts and mandatory inter-professional agreements. Additional new crisis management tools will be put into place, for instance, under rural development programmes, Member States will be able to encourage farmers to take part in risk prevention mechanisms (income support schemes or mutual funds) and to devise sub-programmes deployed for sectors facing specific problems.
- Rural development policy will focus on increasing competitiveness and promoting innovation.

Taking into account that competitiveness is essential precondition for the development of Latvian economy and int. al. agriculture sector [17] all these last CAP reforms concerning improvement of the market orientation of agriculture and competitiveness promotion along with more faire direct payment approach might impact positively further development of agriculture in Latvia.

- **A greener CAP** policy will be promoted. 'Greening' of 30% of direct payments will be linked to three environmentally-friendly farming practices: crop diversification, maintaining permanent grassland and conserving 5 %, and later 7 %, of areas of ecological interest as from 2018 or measures considered to have at least equivalent environmental benefits. At least 30% of the rural development programmes' budget will have to be allocated to agro-environmental measures, support for organic farming or projects associated with environmentally friendly investment or innovation measures. Agro-environmental measures will be stepped up to complement greening practices. These programmes will have to set and meet higher environmental protection targets.

Higher environmental protection targets of CAP might create an additional burden for farmers from one side and facilitate sustainable development of rural areas and satisfaction of demand for the healthier food from the other side.

More detailed information about main political agreements on the new CAP is available, for instance, on the Europe Commission web-site http://ec.europa.eu/agriculture.

In Latvia elaboration of planning documents regarding EU and other foreign financing instruments for the period of 2014-2020 must be based on the priorities and targets defined by the highest state mid-term policy document **Latvian National Development Plan 2014-2020** ("*Latvijas Nacionālais attīstības plāns*") approved by the Saeima in 20.12.2012. The Latvian National Development Plan prescribes division of development budget (but not the basic budget), and instruments for its implementation are state and municipalities' budgets, EU and other foreign funds and financing instruments, as well as private financing.

For the moment **draft document of the Latvian Rural Development Programme 2014-2020** is available. The main provisions for development of the Latvian rural sector till 2020 are pursuant to targets of the Latvian National Development Plan 2014-2020 and their achievement is planed using different available instruments (int. al., EAFRD) and according to the following priorities:

1. to promote knowledge transfer and innovation in agriculture, forestry and rural areas;
2. to enhance competitiveness of all types of agriculture and to strengthen viability of farms;
3. to promote food chain organization and risks management in agriculture;
4. restoration, preservation and enhancing of ecosystems tied with agriculture and forestry;
5. to promote effective use of resources and to support stable to climate changes economy with low level of carbon dioxide emissions in agricultural, food and forestry sectors;
6. to promote social inclusion, poverty reduction and economic development in rural areas.

For each priority relevant thematic objectives are defined and a list of chosen measures (similar to planned for period 2007-2013 measures), as well as they descriptions, int. al., available public support and rules for obtaining it, are provided.

The total indicative financial support for rural development in 2014-2020 planning period is 1.5 billion EUR (similar to planned for period 2007-2013 financing amount), of which:

- 1.22 % are granted for the <u>knowledge transfer and innovations</u> in order to promote environment friendly agriculture and sustainable use of resources (int. al., concerning private forests), as well as to develop competitive and sustainable agriculture and forestry sector;
- 33.77 % are granted for <u>investments in tangible assets of agriculture and forestry</u> in order to develop competitive and sustainable agriculture, as well as to develop infrastructure for development and adaptation of agriculture and forestry;
- 9.35 % are granted for development of rural farming and entrepreneurship: promotion of <u>young people involvement in agricultural activities</u>, promotion of commercial and competitive farming development by <u>restructurings of small farms</u>, as well as <u>promotion of non-agriculture entrepreneurship</u> for developing of alternative profit sources of rural population;
- 17.59 % are planned as payments for farms having natural constraints in order to promote sustainable <u>agricultural activities in less for agriculture favourable regions</u>;
- 19.74 % are planned for <u>environmental measures</u> like agro-environmental measures, biological farming, Natura 2000 payments, enhancing of forest ecosystems.
- remaining financing is granted for various other supporting measures: support for cooperation companies of agricultural and forestry (establishment of new companies and their production adjustment to market requirements); building of roads in rural areas; "LEADER" type measures for implementation of the local development strategies; technical support and other.

<u>Land use policy</u>

The **Land Policy Strategy 2008–2014** (approved by the Latvian Cabinet of Ministers' Order No. 613, 13.10.2008.) elaborated by the Ministry of Regional Development and Local Government prescribes sustainable use of land. Land Policy Strategy's <u>targets regarding agricultural areas</u> are:

- to preserve agricultural land areas in such extent that will ensure manufacturing of food products for internal supply and export, as well as for the growing needs of the technical crop production;

- to procure usage of un-used agricultural areas that are suitable for the agricultural production.

Examples on specific measures of the national development programs/plans in relation to agriculture driving the analysed BS "factor" *"(size of) total agricultural land area"*.

According to the Latvian "Rural Development Programme" almost whole territory of Latvia is defined as area less-favourable for agriculture activities (around 75 % or 1.81 million ha under the RDP till 2013 and 90 % under the draft RDP 2014-2020). A supporting measure „Payments for farms with nature constraints" ("*Maksājumi saimniecībām ar dabas ierobežojumiem*") is available for such areas. The area to which the measure was applied (and the total granted funding) was 1 055 000 ha (269 270 528 EUR) under the RDP till 2013 and 800 000 ha (267 499 900 EUR) expected in the next period 2014-2020. The aim of this measure is to promote agricultural activities in less for agriculture favourable areas and to prevent land marginalization and abandonment. All the available funding of the period 2007-2013 was used [16], what indicates acceptance of this measure by farmers and its potentially effective implementations in the next period also.

According to the "Latvian National Development Plan 2014-2020" it is planned to ensure biologicaly safe food supply till 2030 by increasing biological farming area up to 15 % of the total agricultural land. Taking into account that biological farming uses extensive farming methods, to reach the given share plowing of additional agricultural land areas (currently not cultivated and overgrown) will be needed. There were only 39 biological farms with total area of 1426 ha in Latvia in 1998, while in 2012 number of biological farms reached 3484 with increase of the area from 0.2 % to 10 % of the total agricultural land area. [15. Under the RDP 2014-2020 promotion of further development of biological farming is foreseen by the measure "Biological farming" with total public support of 149 401 540 EUR for 200 000 ha area. It should result in 12 % of the total agricultural land area cultivated by the bilogical farming methods.

2 Economic drivers

Global demand for agricultural goods

Significant part of the Latvian agricultural products is exported. For instance, in 2009 more than 70 % of grains and its products volume produced in Latvia and more than 85 % of produced rape volume were exported, as well as 30 % of milk and its products. Thus production output of agricultural sector in Latvia is largely influenced by the global demand for agricultural products and market development tendencies.

Studies done by the Food and Agricultural Policy Research Institute (FAPRI, 2009) predict further growing of population and increasing demand for agricultural products, especially milk and meat, both in the EU and elsewhere in the other world. For instance, meat consumption is expected to increase by 57.8 kg per capita till 2018, of which pork consumption would increase mainly (by 1.1 % annually). Poultry is and would remain as the second most popular meat, and then beef follows. Milk consumption is expected to increase by 18.8 % within the given period, which would be achieved mainly by increase of dairies productivity [8].

National economic growth

According to assessments of the Ministry of Economics the overall economy of Latvia is recovering after the global financial crisis, which affected severely the economy of Latvia as from 2007. Gradual economic growth has been observed since 2010. The same tendency is observed in the agricultural sector. Agricultural production started to decline in 2007, but it growth can be seen from 2010 (see the next figure).

Transition to a sustainable economic model is taking place in the economy of Latvia, in which export is the key driver of growth. Thus the medium-term growth of the economy and also agriculture will mainly depend on the economic situation in Europe and the structural policy implemented by the Latvian government for improvement of competitiveness. [17]

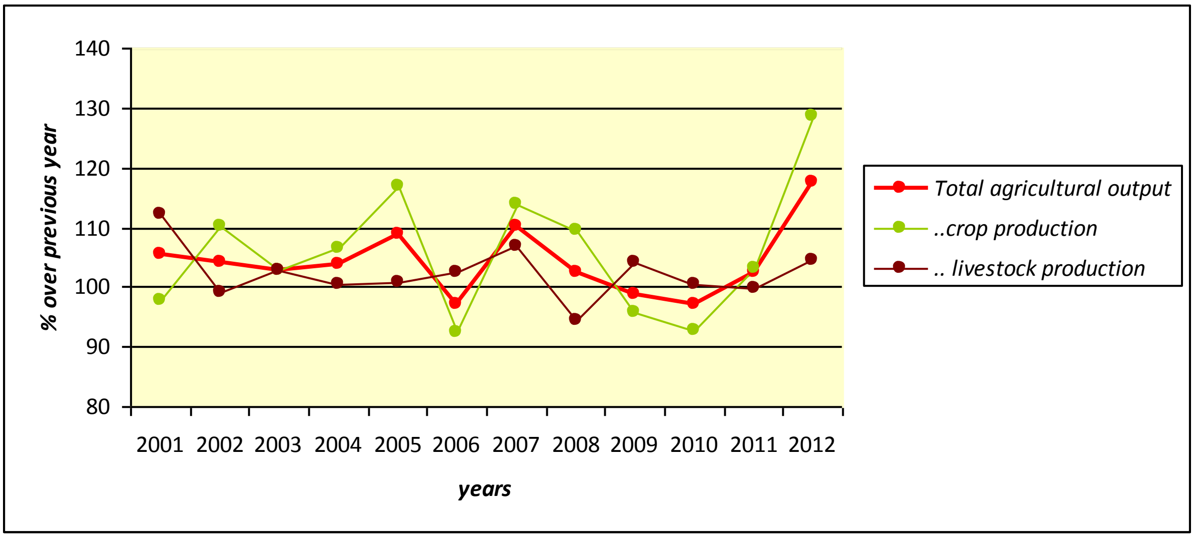

Figure A2.1. Agricultural output indices (% comparing to previous year, at constant prices). *(Source: CSB data.)*

The medium-term forecasts (till 2020) of economic development of Latvia (prepared by the Ministry of Economics) predict positive GDP growth for all branches of the economy. However growth of the agricultural sector (and forestry) will be lower than the average growth of economy (see table below). Assumptions behind the forecasts for scenarios of more rapid or slower development are based on various global economic recovery scenarios in a medium-term and on the ability of Latvian producers to maintain further their competitive capacity.

Table A2.1. Forecasts of GDP growth (real growth, % in comparison with previous year) for whole economy and agriculture in Latvia. *(Source: Ministry of Economics (June, 2013) Report „Economic development of Latvia".)*

	2012 (actual data)	2013	2014	2015-2020 (on average annually)
Gross domestic product	5.6	4.5	4.5	3.0-4.6
Agriculture and forestry	6.9	1.0	3.9	1.7-2.4

<u>Public funding</u>

High dependence of agricultural producers on the public funding (either in the form of direct payments or in the form of other subsidies, such as rural development measures, national subsidies) is spread over the Europe. When all subsidies are taken into account, the share of total public support in agricultural income reached 45 % on average in the EU (direct payments composed around 30 % in 2009-2011). Share of the direct payments ranged between EU members from less than 12 % to more than 50 %, while in Latvia it reached around 25%. [19]

The future public financial support for agriculture is briefly characterized in the previous chapter.

In summary, growth potential of Latvian agriculture can be seen as related to [7]:

- <u>facilitation of agricultural sector's competitiveness</u> by modernizing obsolete equipment and buildings (by paying special attention to the long-term investments), promoting of younger people involvement in agricultural business, promoting professional qualification of employed in agriculture, promoting manufacturers' cooperation, facilitating introduction of modern technologies in processing of agricultural products, logistic and selling chains;

- development of market oriented production units. Development of effective market oriented production units will facilitate increase of agricultural production and food produced from it, that together with the total efficiency increase in agricultural sector can contribute to the growth of agricultural sector added value;
- involvement of un-utilized agricultural areas in production of agricultural products and improvement of rural landscape and conservation of nature values;
- relatively uncontaminated environment as resource for the production of agricultural products, that allows to use sustainable environmentally-friendly agricultural methods, to add value to the agricultural products and satisfy consumers' demand for the healthier food, that is grown by environmentally-friendly methods.

3 Projections on future development of the sector

Several research studies are available that concern future development of the agriculture sector. Those focusing on projecting of agricultural input factors (e.g. changes in land use) were used in the analysis for assessing likely development of the analysed factors (they are discussed in the chapter 3.1). However one more study should be noted – in light of estimating future economic development of the sector. It is discussed further in this chapter. Althoug its main focus is on the economics of the sector (production outputs) it concerns to some extent also input land areas. Although it is former than the ones included in the analysis of factors, besides with own limitations (e.g. conducted in 2008 before the economic crisis in Latvia and when future CAP was unclear) it shouldn't be ignored due to its respectable methodological ground (e.g. economic modelling) and scope of the analysis.

A study on modelling scenarios for development of agriculture in light of future CAP (2008)

The study was conducted by the Latvian State Institute of Agrarian Economics (LSIAE) in 2008 to analyse future development of the agriculture in Latvia with various economic development and CAP scenarios.[44] For assessing impacts of economic and policy changes a model called AGMEMOD was used[45], which has been developed as part of the EU 6th framework research project "AGMEMOD2020" (2006-2008). The model was feed with forecasts for macroeconomic changes (for population, GDP per capita ect.) developed based on FAPRI forecasts and expert assessment, changes in market prices and various scenarios of the CAP measures/insturments for the next period (2014-2020). The coming financial crisis was taken into accunt by developing a "pessimistic" baseline scenario of the macroeconomic development.

The study developed 6 scenarios – two baseline scenarios (incl. the "pessimistic" one) assuming no changes in the CAP comparing to the current period and 4 policy scenarios with various changes in the main CAP measures/instruments (based on the international discussions on the future CAP for that time). Results for changes in the modelled scenarios for various indicators of agricultural production are summarised in the next tablee.

The results show the following trends to 2020 (comparing to 2006):

- Production output of cereals will increase significantly (by 65-80 % depending on the policy scenario), what would be achieved by increasing productivity not the sown area. It is

[44] Methods used in the study: expert methods fo collecting and processing information, qualitative analysis methods for assessing strategic policy documents, quantitative analysis methods, incl. econometric and statistical modelling, for assessing economic and market development trends and impact of the CAP policy measures.

[45] AGMEMOD is an econometric partial equilibrium model of agricultural products. Agricultural products included in the model for Latvia: grain (various crops separately), rape seeds and oil, potatos, cattle, pigs, sheep and poultry, milk, butter, cheese, cream and other milk products.

explained by increased export and prices for these proudcts in global markets. Decline is estimated only for rye production. Concerning rape both increase of production and sown area is estimated.

- For live-stock farming all scenarios foresees decline in terms of both output and number of animals except for pultry meet production and number of pigs (although the output would decline).

Table A2.2. Changes in the Latvian agricultural production in various economic and future CAP scenarios, changes as % comparing 2020 and 2006 (reference year). *(Source: LVAEI, AGMEMOD model results.)*

Notes: BS – „baseline scenario"; BS-P – „baseline scenario – pessimistic" in the case of pessimistic development of the macroeconomic situation.

Changes % (2020/2006)	BS	*BS-P*	In the (CAP) Policy scenarios, changes comparing to the BS	Overall development trend to 2020
CROP FARMING				
Grain, area	0	***-16***		⇒ / ⇓ **(Uncertainty in relation to global economic development)**
Grain, output	69	***39***	Increase by 65-80 %	⇑
Wheat, area	7	***-13***		⇑ / ⇓
Wheat, output	88	***52***	Increase by 85-100 %	⇑
Barley, area	-8	***-23***		⇓
Barley, output	73	***41***	Increase by 70-80 %	⇑
Rye, area	-6	***-23***		⇓
Rye, output	-8	***-24***	Decline byr 3-9 %	⇓
Rape, area	80	***61***		⇑
Rape, output	220	***187***	Increase by 210-250 %	⇑⇑
LIVE-STOCK FARMING				
Cattle, number	-24	***-24***		⇓
Milk cows, number	-19	***-20***		⇓
Output of milk products	-2	***-2***	Decline by 4-6 %	⇓
Output of cattle meat products	-14	***-16***	Decline by 12-26 %	⇓
Output of pigs' meat products	-12	***-11***	Decline by 12-13 %	⇓
Output of sheep's meat products	-25	***-25***	Decline by 20-30 %	⇓
Output of poultry meat products	43	***43***	Increase by 43 %	⇑

It should be noted that changes in land areas have been estimated in the baseline scenarios only (the CAP remains with no changes). For total arable land these estimates show changes from -4 % till +4 % (comparing 2020/2006) depending on the baseline scenario (the decrease in the "pessimistic" scenario). If comparing the forecasted figures for 2020 with actual data for 2010, the changes are in range of -1.4 % or + 7 % depending on the scenario. For cereals the sown areas declines in both baseline scenarios (by 6 or 20%), except for rape. **Taking into account the current CAP proposal, incl., the expected provisions for Latvia, more positive tendencies in the development of the sector could be expected than projected by this study.**

Annex 3: Development of Drivers influencing the "pressure's factors" for forestry

1 Sectoral policy drivers

The forestry sector is directly influenced by specific national forest policy, however also by other national policies – the Rural Development Policy in relation to the EU CAP and the Latvian land use policy.

National forest policy

The **Forest Policy of Latvia**[46] (approved by the Cabinet of Ministers' protocol decision N^{o} 22, 28.04.1998) defines long-term strategic and operational targets and principles aimed at sustainable (non-depleting) forest and forestry land management. The main Latvia's Forest Policy targets are:

- to prevent reduction of forest cover, defining restrictions for forest area transformation;
- to ensure preservation and improvement of productivity and values of forest areas;
- to promote afforestation of marginal agricultural and other land types, using existing state policy mechanisms.

The **Forest and related sectors development strategy** ("*Meža un saistīto nozaru attīstības pamatnostādnes*") approved by the Latvian Cabinet of Ministers' Order N^{o} 273 (18.04.2006.) is a long-term policy document prescribing long-term strategic development targets, problems that delay achievement of these targets, policy principles and results, directions of actions for achieving the targets. The main policy principles for the development of forest and related sectors are prescribed as follows:

1. Forests are national treasure of Latvia, which should be managed, preserved and enhanced to balance ecological, economic and social needs of the society and to ensure development possibilities, while the state forest property is a state capital and guarantee for realization of Latvian inhabitants' social and ecological interests;
2. Principles of forest use should be state regulated for stabilization of sustainable wood availability and predictable economic environment for development of processing of the forestry products;
3. Defining additional restrictions for economic activities in interests of the state, forest owner has right for compensation of foregone incomes;
4. Development of market economy and free competition should be facilitated in the forest sector, forming appropriate system of legislation and reducing the state intervention in economic activities;
5. The state and private partnership should be promoted in the forest sector;
6. Planning of the forests sector's development in the context of the Latvian national economy should take into account interests and opportunities for the sectors related to forest and forestry products, as well as promotion of balanced regional development;
7. When planning development of other sectors, the development targets and interests of the forest sector should be taken into account.

[46] http://www.zm.gov.lv/?sadala=75

Land use policy

The **Land Policy Strategy 2008–2014** (approved by the Latvian Cabinet of Ministers' Order N° 613, 13.10.2008.) elaborated by the Ministry of Regional Development and Local Government aims to ensure sustainable use of land. In relation to forest land areas it stipulates afforestation of those non-utilised agricultural areas fertility of which is not suitable for agricultural production.

Rural development policy in relation to the EU CAP

CAP does not concern commercial forestry, however it recognises the beneficial impact of well-managed woodland on natural landscape and biodiversity and therefore supports forestry sector through the related **rural development measures** aimed on enhancing of forest ecosystems and promoting forest management in environment friendly manner. The financial support available under the **Latvian Rural Development Programmes** (both till 2013 and the next period till 2020) include measures related to land afforestation and forest restoration after damages caused by fire, nature disasters and other accidents, as well as damage prevention measures (see the next table).

Table A3.1. Financial support in relation to forest management under the Latvian Rural Development Programme. *(Source: [14], [15].)*

RDP measures	Amounf of public funding (EUR)	Planned area (ha)
For afforestation of non-forest land areas:		
In 2007-2013	17 221 665*	14 896 ha
In 2014-2020	9 960 103	6 000 ha
For forest restoration after damages and prevention measures:		
In 2007-2013	8 521 810	3 000 ha
In 2014-2020	5 691 487	1 250 ha

* Almost all financing was used for afforestation projects according to the data to 01.08.2013. [16]

National regulations

The Forest Law (*"Meža likums"*, valid since 17.03.2000.) along with other laws and **regulations** defines specific rules for implementation of sustainable forest and forestry management policy. For instance, according to the article 21 of the Law of Forest it is an obligation of forest owner or lawful possessor to restore forest stand after performance of felling or impact of other factors if the base area of the forest stand has become, due to such impacts, smaller than the critical base area (where "critical base area" is a limit value below which development of forest stand is impossible, and the forest stand has to be restored). This forest restoration should be done within 5 years (10 years for very humid forests) after performance of the felling or impact of other factors.[47]

2 Policy and economic drivers for forest felling

National regulations

Roles for forest felling are prescribed by **the Forest Law**. Felling, incl. clear-cutting, may occur if a special permit is received from the "State Forest Service" (SFS).

SFS (state institution subordinated under the Ministry of Agriculture) is responsible for realization of the forest policy in the territory of Latvia, supervises compliance with legal requirements and

[47] Regulations of the Cabinet of Ministers N° 308 (02.05.2012.) "Meža atjaunošanas, meža ieaudzēšanas un plantāciju meža noteikumi".

implements supporting programmes for insurance of sustainable forestry management. SFS maintain the "State Forest Register" – information system about the forest and commercial activities there. According to the article 29 of the Forest Law, it is duty of forest owner or lawful possessor to perform forest inventory at least once in 20 years and to submit this information to the SFS, as well as to notify SFS about forestry activities each year. Felling is forbidden if inventory of forest land unit is not performed (the article 12 of Forest Law).

In light of nature protection interests, restrictions for forestry activities (e.g. for the main felling, thinning felling and clear-cutting) are set in part of the NATURA 2000 territories.[48] Restrictions for forestry activities are set for 318 804 ha forest area. [14] SFS provides yearly statistics about forest areas by all types of restrictions.

Total allowed felling amount (in terms of felling area, not harvested amount) for the state forests[49] are evaluated by SFS and approved with the Cabinet of Ministers' Order for 5 year period (according to the article 5 of the Forest Law). The valid order[50] concerns period 2011-2015. According to this order the maximum allowable felling amount in the state forests is 23.19 million.m^3 timber in 92 063.4 ha area for the whole period. More than 90 % of this amount (or 22.13 million.m^3 of timber in 84 962 ha area) are permitted for the company "Latvian State Forests". In addition, the maximal allowable amount was not felled fully in the previous period (2006-2010), which will be carried forward to the period 2011-2015.

Comparison of the allowed and "sustainable" felling amount (evaluated by SFS) for the company "Latvian State Forests" in 2011-2015 shows that the former is slightly below the last. [33] The evaluated "sustainable" felling amount is based on forest growing cycle in 120 years, which ensures stable wood harvest amount according to the targets of the "Forest Policy of Latvia" and **the forest management strategy of the company "Latvian State Forests".**[51]

Taking into account the evaluated "sustainable" felling amounts for the company's "Latvian State Forests" managed forests (around half of the total forest in Latvia), the maximal sustainable yearly amount of wood harvest for whole Latvia may be in range of 30-40 thsd ha or 10-12 milj m^3.

Resources' availability

Implementation of the Forest Policy of Latvia has resulted in stable available growing forest stock (see the next figure).

[48] Significant part of NATURA 2000 territories is situated in forest land areas – 426 989 ha or around 55 % of all NATURA 2000 territories in Latvia. They compose around 14.5 % of all forest areas in Latvia. (Source: [14])

[49] Compose around half of the total felling area/amount in Latvia.

[50] Cabinet of Ministers Order N^o 364 (30.06.2010.) „Par koku ciršanas maksimāli pieļaujamo apjomu 2011.-2015.gadam".

[51] Approach for strategic planning of forest growing is described in documents of the company „Latvian State Forests" "Meža audzēšanas stratēģiskās plānošanas pieejas datu avoti, veidošanas principi un vērtības" and "Meža audzēšanas stratēģiskās plānošanas metodika" (approved in 30.06.2010.).

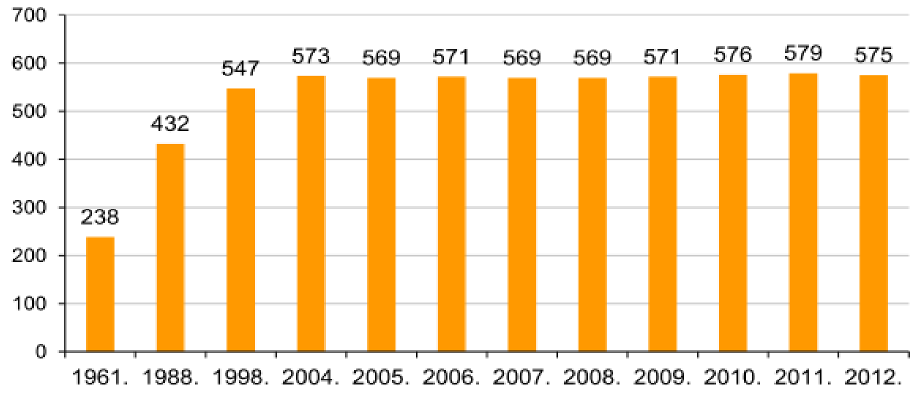

Figure A3.1 Dynamic of total growing forest stock in Latvia, million m³. *(Source: SFS data.)*

Increase of growing stock has been influenced by increase of forest area and efficient forest management. Forest productivity (average stock m^3/ha) has almost doubled since the last century. [11]

Economic development

From an economic perspective the main product of forest is timber. According to more narrow (economic) definition the forest sector is seen as including forestry (including timber preparation, distribution and sale) and wood processing industry.

Drivers and factors determining development of the forest sector lie beyond the sector. Socioeconomic development trends (e.g. in the income of inhabitants, changes in technologies, choices of individuals and society) determine demand within the sector. Environmental factors – forest stocks, climate change and nature disturbances (disasters) determine available resources and supply of wood products. The main economic driver is the demand for timber products by wood processing industry in the national and international markets.

The wood processing industry (manufacture of wood products and furniture) is among the largest branches of manufacturing in Latvia. It was one of the first sectors experiencing growth after the significant decrease in manufacturing till 2009. About 3/4 of the total production in the sector is being exported, thus growth of wood processing is related closely to processes in foreign markets.

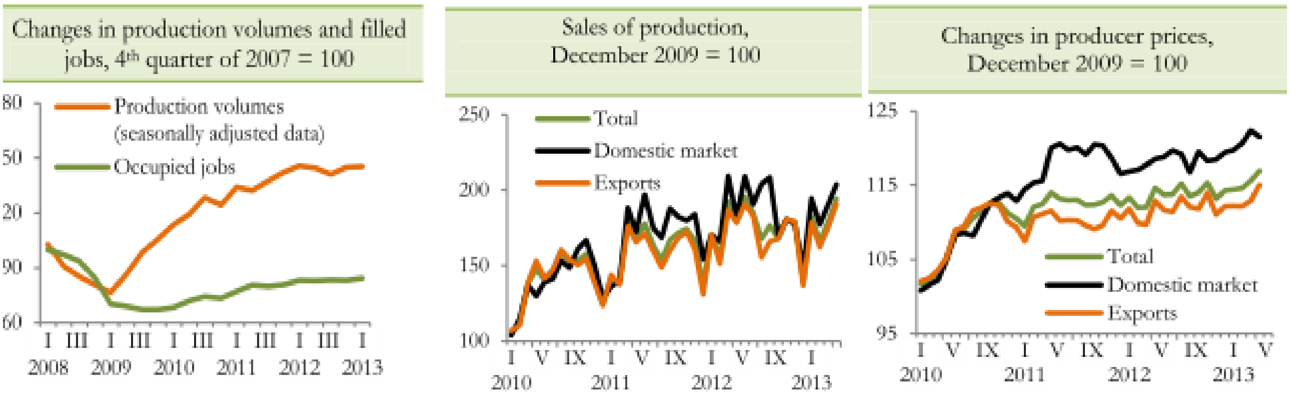

Figure A3.2. Economic characteristics of wood processing industry in Latvia (in the period 2010-2013, relative changes). *(Source: Ministry of Economics of Latvia (2013) "Economic development of Latvia". Report)*

The medium-term forecasts (till 2020) of economic development for Latvia (prepared by the Ministry of Economics) predict positive GDP growth for all branches of the economy. However growth of the forestry sector (like for agriculture) will be lower than the average growth of economy (see the table below). Assumptions behind the forecasts for scenarios of more rapid or slower development are based on various global economic recovery scenarios in a medium-term and on the ability of Latvian producers to maintain further their competitive capacity.

Table A3.2. Forecasts of GDP growth (real growth, % in comparison with previous year) for whole economy and forestry in Latvia. *(Source: Ministry of Economics of Latvia (2013) „Economic development of Latvia".Report)*

	2012 (actual data)	2013	2014	2015-2020 (on average annually)
Gross domestic product	5.6	4.5	4.5	3.0-4.6
Agriculture and forestry	6.9	1.0	3.9	1.7-2.4

<u>Projection on future development of the sector</u>

According to the EU Joint Research Centre (JRC) research used by Hamburg university in 2011 within research study "Projection of Net-Emissions from Harvested Wood Products in European Countries" (literature source [27]) slight increase of wood harvest in Latvia is projected – up to the 12 341 thsd.m^3 of harvested wood in 2020 (see the figure below). The future harvest demand under a 'business as usual' scenario was derived from macroeconomic drivers (e.g. gross domestic product, population) and policies enacted in Latvia up to 2009. This information was used as data input to the model GLOBIOM (Global Biomass Optimization Model), which projects demand for timber. However, the quality of timber demand projections depends on how well macroeconomic variables can predict timber demand for a country. Moreover, in the future a considerable forest area in Latvia will reach the final felling age and therefore the amount of harvested wood could increase even more than the projections show. The trend in timber demand will mainly be determined by economic drivers and regulations on forest use, which prohibit certain types of felling practices. [28]

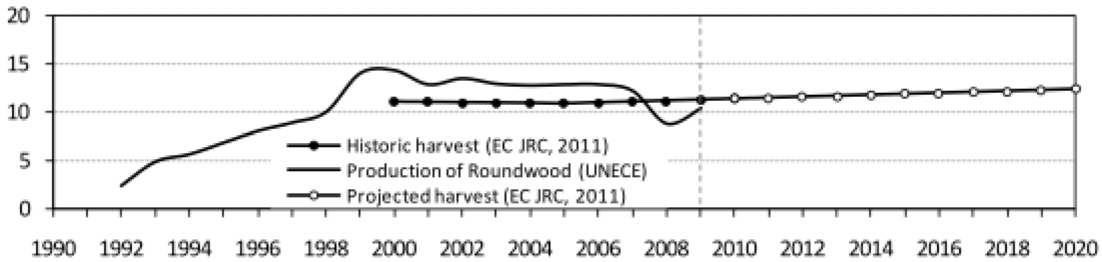

Figure A3.3. Historical and projected wood harvest and roundwood production in Latvia (milj m³). *(Source: [27])*

3 Policy and economic drivers for forest drainage

Around half of all forests in Latvia suffer from excessive moisture (around 1.5 million ha of over-hummed and bogged forests). Land moisture regulation and its prevention from inundation are necessary to improved wood growth there. Almost 700 thousand ha of humid forests have been drained till 1993. Since that building of new drainage systems has not taken place. According to assessments developed for the Latvian "Rural Development Program 2007-2013" [14] a large part of melioration infrastructure is deteriorated – repair of ditches is necessary for around 20 000 km, reconstruction of infrastructure for area around 12 000 ha, but full renovation of drainage systems for area around 50 000 ha.

National policy and regulations

Renovation of old drainage systems has been set among the priorities of the Latvian Rural Development Program (RDP) (both till 2013 and till 2020). Building of new drainage systems is not promoted and expected. Public financial support for renovation and restoration of forest drainage systems has been and will be available through RDP measures.

The funding is available for those drainage systems that are registered in the "Melioration Cadastre". This cadastre is developed and maintained according to the Regulations of the Cabinet of Ministers N^{o} 623 (13.07.2010.) „Provisions for Melioration Cadastre" (*„Meliorācijas kadastra noteikumi"*), according to the Melioration Law (*„Meliorācijas likums"*, valid from 25.01.2010.)

In order to mitigate possible negative effects on the environment, renovation and reconstruction of drainage systems are not supported by the RDP in NATURA 2000 areas and special areas of conservation. Moreover for nature protection interests restrictions for performance of melioration works in nature protection areas are set by national regulations. Initial environmental impact assessment is also required if reconstruction of forest drainage systems is planned for area larger than 50 ha. [14]

Around half of forests in Latvia are state owned. Major part of them is managed by the company "Latvian State Forest". The main planning documents of the company "Latvian State Forests" are its mid-term strategy "*Vidēja termiņa stratēģija*" (2010) and "Regional forest management plans for 2013-2017" (2013). The forest management plans set among the priorities to ensure functioning of the existing drainage systems and to prevent their degradation (but not building of new systems), as well as operative elimination of problems caused by beavers' actions (see for instance [25], [26]). Moreover the strategy specifies among its measures minimization of forest management negative impacts on the environment, which considers also not renewing part of historical drainage systems to enabling restoration of natural structure in these systems [24].

Public funding

Financial support for renovation and restoration of forest drainage systems was available in the previous RDP period under the measure "Infrastructure related to the development and adaptation of agriculture and forestry" with the total public funding for investments of 86 245 808 EUR (according to the 11th version (09.11.2012.) of RDP 2013). [14] After following funding reallocation the amount was reduced by a half (96 % of it was reserved by projects till 01.08.2013). [16] According to information provided by the Ministry of Agriculture all financing granted for the renovation of melioration systems was consumed (around 22 million EUR) and even additional financing was granted after the funding reallocation. It was mainly used for projects in relation to agriculture melioration systems.

In the next RDP period till 2020 the funding is available under the measure "Investments in tangible assets" with total public funding for investments of 478 084 928 EUR. It is planned for development of competitive and sustainable agriculture by investing in farms and processing enterprises, as well as developing infrastructure related to the development and adaptation of agriculture and forestry.

In order to promote renovation of melioration systems in private forests priority for financial support is given to private forest owners. In the previous planning period (2007-2013) the public financial support rate was 75 % of total project's eligible costs. The company "Latvian State Forests" could receive financial support only if a project was realised together with private forest owners or municipality. Contribution in the private forest melioration systems should not be less than 30 % of the total eligible costs of a project. Maximal available financing for one receiver was 100 000 EUR (this is rule doesn't apply to the forest melioration systems of the state importance), while it was up to 200 000 EUR for projects realised in cooperation with the company "Latvian State Forests".

In the next planning period (2014-2020) the public financial support rate for renovation of melioration systems will be 100 % for the systems of the state importance and 75 % for other systems. Maximal available financing for one receiver remains the same – up to 100 000 EUR, while it is increased for municipalities up to 200 000 EUR and up to 400 000 EUR for projects realised in cooperation with the company "Latvian State Forests".

As noted, the financial support was and will be available only for those drainage systems that are registered in the Melioration Cadastre (in order to promote its further elaboration). Concerning the forest melioration systems, up today only systems of the company "Latvian State Forests" have been registered in the Cadastre (according to the information provided by the Ministry of Agriculture). It means that in the previous RDP period the private forest meliorations systems were renovated on very limited extent – only within the framework of projects of joint use melioration systems.