EU LIFE Programme project
"Demonstration of climate change mitigation potential of nutrients rich organic soils in Baltic States and Finland"

REPORT

ON IMPLEMENTATION OF THE PROJECT

DEMONSTRATION OF CLIMATE CHANGE MITIGATION MEASURES IN NUTRIENTS RICH DRAINED ORGANIC SOILS IN BALTIC STATES AND FINLAND

WORK PACKAGE

REPLICABILITY TOOLS (C.5)

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SUMMARY

The main scope of C5 activity is to ensure the replicability and transferability of the project results. The Simulation tool is a policy planning and decision support tool for application at a regional or national level for projections of GHG emissions and socio-economic effect of the selected management options within the LIFE OrgBalt project. The Simulation tool is designed by pulling together activity data, emission factors and socio-economic estimates. It integrates spatial information, projections of GHG emissions and socio-economic analysis for 15 scenarios developed within LIFE OrgBalt project.

This report (Deliverable C5/2) is continuation of the previous report (Deliverable C5/1) and do not duplicate methodological information provided there.

The first chapter of this C5/2 report summarises the importance of the management of organic soils and the results from the literature about the effect of different management strategies on organic soils.

The second chapter of the report describes the structure of the Simulation tool. The Simulation tool is developed in the R programming environment, it is a static tool that can be used to model the effects of different scenarios on land resources spatially. The data of land use, soil type, socio-economic parameters are fed into the Simulation tool. Agricultural land polygons include information on the following: area, type of support, mark if it is organic farming, farm size, crop, group of crops, mark if there is land reclamation, land quality. Forest land polygons include information on the following: area, dominant specie, forest type, site index, stand volume, stand basal area, height of tree species, and number of trees, stand density, restrictions, and last management activity. It is also necessary to have information about protected areas and restrictions on economic activity in these areas. Firstly, the agricultural and forestry land polygons, where the organic soil is located, are identified. Then the land area where each scenario may be implemented, is selected. Once the area has been selected, the calculation of profit, employment and GHG emissions according to the methodology described in Deliverable No C5/2 "Interim draft report on development of Simulation tool" is performed for each land polygon. Scenario analysis is carried out for the Baltic States. Subchapter 2.2 describes the developed scenarios within LIFE OrgBalt project, it also contains information on area selection criteria for implementation of scenarios. The type of land use after the implementation of the scenario has also been identified. Next subchapter explains the methodology for the impact assessment on profit, employment, and GHG emissions resulting from scenario implementation.

The third chapter presents a comprehensive examination of the impacts of 15 management strategies on organic soils in Baltic States in relation to GHG emission reduction. In this chapter we analyzed the resulting changes in land area, generated profit, provided employment, and GHG emissions after the implementation of each scenario. In this chapter, two land functions are calculated – socio-economic function and climate function. Climate function represents GHG emissions or carbon stocks which are expressed in CO2 eq. per hectare per year. The socio-economic function is divided into two parts: economic with indicator of profit (euro per hectare) and social with indicator of employment (full-time equivalent). Profit depends on soil quality, land use, crop, yield, price, support payments and expenses. For example, a higher yield in tons per hectare can be obtained from vegetables and fruits compared to cereals. Employment depends on size of the farm, amount of work required, land use and crop. For example, growing vegetables requires a much larger amount of labor than growing grains. However, in scenarios where afforestation occurs, employment is needed in the first year for

soil preparation, followed by subsequent years for tending and pre-commercial thinning. In this chapter also the results from activities C2 and C3 are integrated.

The Supplementary Material includes an overview of protected areas in the Baltic States and an overview of expenses and incomes for each analysed scenario from activity C2.

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1. INTRODUCTION

Organic soils have a high carbon content of more than 20% in dry weight and cover 8% of the EU territory [1]. Northern organic soils are estimated to contain 547 GtC of carbon stocks in total [2]. These soils are valuable resources with unique characteristics and functions that are essential for the global climate [3], provide a unique habitat for biodiversity [4], and play a crucial role in water regulation and flood mitigation [5]. Organic soils have formed in permanently waterlogged conditions, which inhibits the full decomposition of dead biomass and leading to the accumulation of carbon rich soil organic matter. This organic matter decomposed quickly when the soil is no longer saturated with water [6]. The drainage of organic soils across various land categories in the EU alone contributes approximately 5% of the total GHG emissions in the EU [1]. For instance, in Sweden, the management of organic soils accounts for 44% of all emissions in the agricultural sector, while in Latvia, it accounts for 38%, in Lithuania 21%, in Estonia 23%, and in Finland 20% [23]. Unless measures are implemented, drained organic soils will remain significant contributors to global GHG emissions. Restoration of drained organic soil and change in management practices to more regenerative practices may reduce GHG emissions from these areas and may have other co-benefits for nature, biodiversity and water protection. Overcoming the challenges of reducing GHG emissions from drained organic soils will require a combination of financial incentives, guidance, and innovation to ensure more regenerative practices, long-term productivity, biodiversity conservation and to achieve the objectives outlined in the Paris Agreement to combat the climate change [21].

Therefore, the EU has established restoration measures on 30% of organic soils used for agricultural production by 2030, with at least a quarter of this area requiring restoration of the hydrological regime. By 2050, restoration measures should be implemented on at least 70% of the organic soils used for agriculture, with restoration of the hydrological regime targeted for at least half of it [7]. Restoring the water table to pre-drainage levels is considered one of the key measures in emissions returning to levels comparable to undisturbed conditions [8,9,10,11]. However, during the early years after the rewetting begins, CH_4 emissions from nutrient rich sites may temporarily exceed those from undisturbed sites [12,13,14]. In addition, Ariva et al. (2023) concluded that rewetting drained organic soils is not a suitable mitigation measure in Estonia due to increased GHG emissions [22]. Rewetting of cultivated organic soil often extend beyond the scale of individual farms, necessitating implementation at the watershed and landscape levels [25]. In turn, implementing continuous-cover forestry on drained organic soils may effectively manage groundwater levels, reduce soil disturbance, and offer potential benefits for the environment, making it a promising compromise between industrialized forestry and peatland restoration [20]. However, it should be noted that mitigating GHG emissions from a forested organic soil requires an appropriate combination of hydrological controls to protect soil carbon and control stand density and evaporation [26].

The rewetting and afforestation of organic soils used for agricultural production is associated with loss of productive land and a reduction in rural employment opportunities [15]. Possibly, no single mitigation measure alone may effectively reduce GHG emissions from cultivated organic soils, and it may require individual mitigation strategies or exploring more radical land use change and management practices [24]. Despite the measures identified in various studies to reduce GHG emissions from drained organic soils, restore wetland ecosystems, and protect biodiversity, the impact of their implementation on the national economy has been limitedly studied.

The Simulation tool integrates various land use change and management scenarios for drained organic soils in the Baltic States, assessing their potential impact on socio-economic indicators and GHG emissions reduction. By simulating different management strategies, such as restoration, conservation, afforestation or sustainable agricultural practices, the tool provides insights into how these changes may influence key socio-economic factors, including agricultural and forestry productivity, and employment. Additionally, the tool evaluates the effectiveness of these strategies in achieving GHG emissions reduction targets set forth in the Paris Agreement. Through comprehensive analysis and scenario modeling, this research aims to inform policy decisions and land management practices that promote both environmental sustainability and socio-economic development in the Baltic States.

2. MATERIALS AND METHODS

Considering the complexity of spatial data analysis, the Simulation tool was developed to assess the effects of various economic activities and policy decisions in agriculture and forestry on profit, employment, and GHG emissions. The concept of the Simulation tool is shown in Figure 1. Initially, agricultural and forestry data collection was conducted to create a detailed data layer for each polygon (Step 1). Subsequently, data collection for organic soil was done (Step 2). Following the creation of agricultural, forestry, and organic soil data layers, this data was used to generate working files for Estonia, Latvia, and Lithuania including only those agricultural and forestry areas located on organic soil (Step 3). Then, an area is cut from the working files for each potentially applicable scenario based on predefined area selection criteria (Step 4). Finally, the impact assessment on profit, employment, and GHG emissions resulting from scenario implementation was conducted (Step 5).

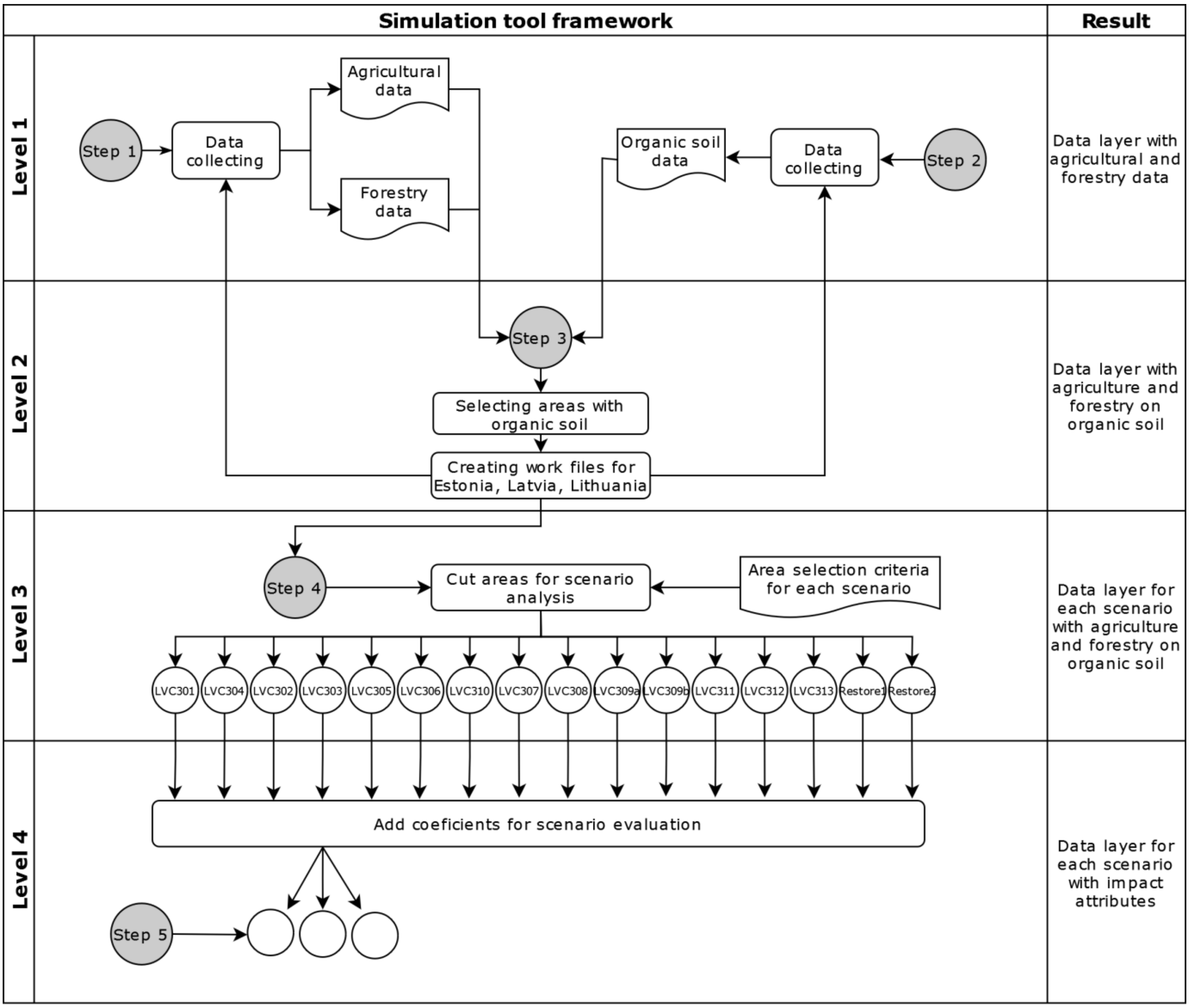

Figure 1. The flowchart of Simulation tool.

2.1. Data sources

For each country, there are two datasets: one for agricultural land fields and another for forest land parcels. The spatial information in both datasets is of the highest possible resolution. The spatial information in these datasets (layers) does not overlap.

Agriculture

The detailed spatial data on agricultural areas is provided by the institutions that implement and monitor the implementation of agricultural and rural support policies: Rural Support Service in Latvia; National Paying Agency in Lithuania; Agricultural Registers and Information Board in Estonia. The provided agricultural data contains information on the field area, the crop grown in 2023, the farmer`s anonymous identification number, and the type of support payment received. Using this information, the attribute table was supplemented with a crop group, grouping all crops into nine groups, and with a mark indicating if the given field receives organic farming support and/or support for protecting and maintaining biodiversity, derived from the support payment received. The agricultural databases for Estonia, Latvia, and Lithuania consist of the following parameters:

- Nr – identification number;
- Area – size if the field in hectares;
- Farmer_ID – fake ID number for farmer to identify the sizes of farms;
- CropName – crop name according to support payment agency classification;
- CropCode – crop code according to support payment agency classification;
- CropGroup – all of the crops are divided into 9 groups ("GrassesPerennial", "CerOilLeg", "Other", "GrassesArable", "Vegetables", "Potatos", "Fallow", "PlantingsPerennial", "EnergyPlants");
- Support – type of support payments received for this area;
- BioFarmSupport – support payment for organic farming (derived from Support);
- BioDiversitySupport - support payment for habitat (derived from Support);
- Geom – geometry of field.

Additionally, using these parameters the following calculations are made and included in the attribute table of the agricultural database for each country:

- CerOilLeg_TOTAL – total area of cereals, oilseed and legumes of the farm (derived using Farmer_ID);
- Other_TOTAL – total area of other crops of the farm (derived using Farmer_ID);
- GrassesArable_TOTAL – total area of grasslands in arable land of the farm (derived using Farmer_ID);
- Vegetables_TOTAL – total area of vegetables of the farm (derived using Farmer_ID);
- Potatos_TOTAL – total area of potatoes of the farm (derived using Farmer_ID);
- Fallow_TOTAL – total area of fallow land of the farm (derived using Farmer_ID);
- PlantingsPerennial_TOTAL – total area of perennial plantations of the farm (derived using Farmer_ID);
- EnergyPlants_TOTAL – total area of energy crops of the farm (derived using Farmer_ID).

Forestry

The spatial information on forest areas is provided by the state administrative institution, which maintains the state forest register and collects information on the economic activities taking place in the forests: State Forest Service in Latvia; Estonian Environment Agency in Estonia; State Forest Service in Lithuania. In order for the data to be comparable with each other, the classification of forest growing types has been carried out for all countries, according to the edaphic groups of Latvian forests. The data of the Lithuanian forest register does not include information on the stand volume and the number of trees, so it is additionally calculated and included in the database.

The Forest datasets for Latvia and Lithuania consist of the following parameters:

- Field_ID – forest field polygon ID;
- Spiecie – dominant specie (pine, birch, grey alder etc.);
- Forest_type – forest growing type (Vacciniose, Myrtyllosa, etc.)
- Forest_type_group – forest type group (edaphyc group) (5 groups: on dry mineral soils, on wet mineral soils, on wet mineral soils with organic layer >30 cm, on drained mineral soils, on drained organic soils);
- Area_ha – field area in ha;
- Site_index – site index (a unit for characterizing the productivity of a forest stand, which is determined by the height of trees at a certain age);
- Stand_m3_ha – standing volume, m^3/ha;
- Specie_yr – dominant specie age, years;
- Age_group – age group (young stand, seasoning stand etc.);
- Stand_basal_m2_ha – stand basal area, m^2/ha;
- Diameter_cm – dominant specie tree diameter in cm;
- Height_m – height of the dominant trees specie;
- Number_trees_ha – number of trees per ha;
- Stand_density – the ratio of the current number of trees to the normative number or the degree of closure of tree crowns;
- Restrictions – restrictions (all forestry activities, main felling and maintenance, main felling, clearcutting, seasonally prohibited, no restrictions);
- Last_activity_yr – year, when last action is done in forest stand (harvesting, thinning, reforestarion, planting)
- Last_activity – the type of last activity (clearcut, thinning, deforestation, planting).

The data of the Estonian forest register includes information on the dominant species, forest type, and whether the area has been drained. For the scenarios analysis, it is also necessary to have information on stand height and age. Therefore, the latest vegetation height models (CHM) from 2022 and 2023, with a horizontal resolution of 4 meters, were used to obtain information on the average height of the forest stand. These data were processed in the QGIS program using the Zonat statistics tool, assigning the median value of the height of the vegetation model to the sections of the forest register. Furthermore, the calculation of various statistical parameters was performed to characterize the height of the forest areas by forest type and dominant species. Using these indicators, the forest areas were classified by age group, which is necessary for selecting suitable areas for the implementation of the scenarios.

The Forest dataset for Estonia consist of the following parameters:

- Spiecie – dominant specie (pine, birch, grey alder etc.);
- Forest_type – forest growing type (Vacciniose, Myrtyllosa, etc.)
- Height_m – height of the dominant trees specie;
- Specie_yr – dominant specie age, years;
- Site_index – site index (a unit for characterizing the productivity of a forest stand, which is determined by the height of trees at a certain age);

Organic soils

Organic soils are nutrient-rich soils with a peat thickness of at least 30 cm and a groundwater level of at least 30 cm during the growing season. The organic soil data layer for the Baltic states is used from the project "Paludiculture in the Baltic states" financed by the European Climate Initiative (EUKI) [16]. The project involved data compilation and GIS-based assessment of peatlands using the data of soil, peatlands, drainage systems, nature conservation areas, and land cover. Within the project areas of organic soils are divided into four categories using the traffic light principle, which indicates the opportunities/constraints for the introduction of palludiculture: red, orange, yellow, and green (Figure 1 and Table 1).

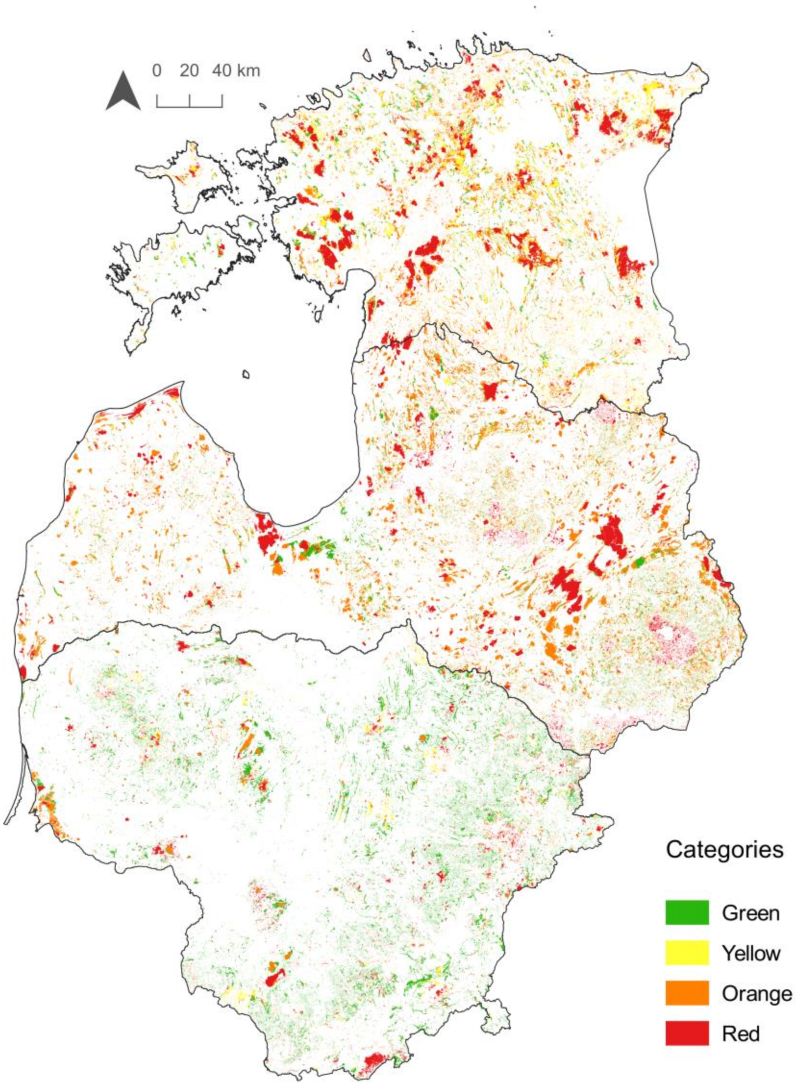

Figure 2. Distribution of organic soils in Estonia, Latvia and Lithuania

Table 1. Overview of areas in hectares of organic soils from the project "Paludiculture in the Baltic states"

Category	Description	Estonia	Latvia	Lithuania
Red	Areas not suitable for paludiculture (nature	251 142	226 023	116 510

	conservation)			
Orange	Conditionally suitable areas, mainly forests on drained wetlands	287 624	499 698	60 625
Yellow	Fully suitable areas after careful consideration, peatlands with less restrictions, abandoned peatlands	213 740	44 851	50 656
Green	Suitable areas, paying Agency fields	78 434	163 093	354 785

Protected sites

Information about protected sites in Estonia, Latvia, and Lithuania is used to spatially determine the areas where restrictions on economic activity occur. Spatial information about protected sites in Estonia is obtained from the Estonian Nature Information System [17], in Lithuania from the State Cadaster of Protected Areas [18], and in Latvia from the Nature Data Management System OZOLS [19].

Depending on the creation and protection purposes of protected areas, these territories are divided into categories, which may differ between countries. Therefore, the legislation and general regulations governing various restrictions in protected areas of Estonia, Latvia, and Lithuania were examined. All protected territories have been assigned a code from 1 to 3, where code 1 means that any economic activity is prohibited, code 2 indicates various mild restrictions, and code 3 means no specific restrictions. In Supplementary Materials S1, S2, and S3, the summary of protected areas and restriction codes in Estonia, Latvia, and Lithuania is provided.

2.2. Scenario description

Scenarios are identified in Activity C3 of the project, covering agricultural land, forest land, and wetland with nutrient-rich organic soil, peat thickness at least 30 cm, and a groundwater level of at least 30 cm during the growing season. For each scenario, the criteria for selecting land areas and the subsequent land use after implementation are determined. The overview of the scenarios are given in Table 2, Table 3, and Table 4.

Table 2. Overview of scenarios in agricultural land

Scenario	Name of scenario	Description	Area selection criteria	Land use after implementation
LVC301	Conversion of cropland to grassland	Cropland with nutrient-rich organic soil conversion to grassland. Increased carbon stock in soil and below-ground biomass, reduced risks of nutrient leaching and soil erosion.	Organic soil, arable land without perennial plantations	Grassland
LVC304*	Introduction of legumes in crop rotation	Reduced N_2O emissions from soil reported in agriculture sector because of avoided mineral fertilizer application and gradual nitrogen input by symbiotic organisms. Increased carbon input with plants ensuring increased soil carbon stock.	Organic soil, arable land with grains and rapeseed	Arable land with crop rotation
LVC302	Conventional afforestation (spruce)	Demonstration of the reduction of GHG emissions from area previously used as pasture or perennial grassland for fodder production by afforestation with spruce. Reduced GHG emissions from soil. Accumulation of CO_2 in living and dead biomass, soil and	Organic soil, grassland, perennial grassland, arable land without perennial	Forest stand with spruce

Scenario	Name of scenario	Description	Area selection criteria	Land use after implementation
		litter and replacement effect of forest biofuel and harvested wood products. Shorter rotation and more intensified management ensures higher yield and replacement effect, as well as reduces carbon losses due to root rot and other disturbances.	plantations	
LVC303	Introduction of forest paludiculture (decidious trees)	Reduction of GHG emissions by establishing forest paludiculture (dominant species - black alder and birch) in grassland with nutrient-rich organic soil and increased groundwater level.	Organic soil, grassland, perennial grassland, arable land without perennial plantations	Forest stand with black alder and birch
LVC305*	Controlled drainage of grassland	Reduction in GHG emissions from organic soils due to limited fluctuations of groundwater level during and outside the growing season, reduced leaching of nutrients to surface water bodies as drainage water will be stored in the field. It is expected that during the summer season additional water will be available to meet crop demand thus ensuring higher carbon inputs into soil.	Organic soil, grassland	Grassland with controlled drainage
LVC306	Agroforestry – fast growing trees and grass	GHG emissions reduction through transformation of cropland to tree plantation. Projected reduction of GHG emissions is related to the decrease of N_2O and CO_2 emissions from soil as well as to the increase of CO_2 removals in living biomass and other carbon pools.	Organic soil, arable land without perennial grassland and perennial plantations	Forest stand with poplar
LVC310	Fast growing species in riparian buffer zones	GHG emissions reduction through transformation of strip areas along drainage diches in cropland to tree plantation areas that avoid nutrient leaching and increase carbon removals in living biomass and other carbon pools. Projected reduction of GHG emissions is related to the decrease of N_2O and CO_2 emissions from soil as well as to the increase of CO_2 removals in living biomass and other carbon pools.	Organic soil, agricultural land, buffer zone at least 9.5 m wide from the edge of the ditch	Forest plantation with poplar and willow

* Scenario LVC304 and LVC305 are excluded from the further analysis because the effect of the implementation of these scenarios on the reduction of GHG emissions was not proven in activity C2.

Table 3. Overview of scenarios in forest land

Scenario	Name of scenario	Description	Area selection criteria	Land use after implementation
LVC307	Application of wood ash in	GHG emissions reduction in spruce stands on organic soils and lowered ground water table by	Organic soil, forest stand	Forest stand with spruce

Scenario	Name of scenario	Description	Area selection criteria	Land use after implementation
	spruce tree stands	implementation of wood ash after thinning thus enhancing stand growing conditions. Projected reduction of GHG emissions is related to groundwater level reduction, related to increase in growing stock increment and increased water amount used for transpiration processes – thus decreasing CH_4 emissions and increasing CO_2 removals in living biomass.	classification Kv, Km, Ks, Kp, II-IV site index, spruce at least 50%, age at least 20 years	
LVC308	Continuous forest in spruce stand	GHG emissions reduction in spruce stand by replacing clear felling with selective felling. Projected reduction of GHG emissions is related to the increase of groundwater level in an alternative – clear felling scenario. Increase of groundwater level is associated with significant increase of CH_4. In the case of selective felling increase of groundwater levels should be smaller thus also increase of GHG emissions is smaller.	Organic soil, forest stand classification Pv, Nd, Db, Lk, Kv, Km, Ks, Kp, main specie spruce, age 81 years	Forest stand with spruce
LVC309	Forest regeneration with black alder and birch in non-drained organic soil	GHG emissions reduction in black alder and birch stand by using genetically selected planting material and improving hydrological regime. Projected reduction of GHG emissions is related to groundwater level stabilizing during forest regeneration phase and better growth conditions and increased CO_2 removals in forest biomass and other carbon stocks.	Organic soil, forest stand classification Pv, Nd, Db, Lk, main specie black alder, birch, age 71 years, I-III site index	Forest stand with black alder and birch
LVC311	Riparian buffer zone in forest land planted with black alder	GHG emissions reduction in deciduous tree stands on organic soils with increased ground water table by enhancing tree growing conditions, using high quality planting material and preparing soil with mounding method including establishing of deep furrows for excess surface water drainage in spring time and after rainfalls. Projected reduction of GHG emissions is related to groundwater level reduction, related to establishment of deep furrows - as a result decreasing CH_4 emissions and increasing CO_2 removals in living biomass.	Organic soil, forest stand classification Ks, Kp, buffer zones of reclamation systems in forest lands	Forest stand with black alder
LVC312	Forest regeneration with pine in non-drained organic soil	GHG emissions reduction in coniferous stands on organic soils and increased ground water table by application of forest regeneration with high quality coniferous planting material and by using mounding method for soil preparation. Projected reduction of GHG emissions is related to groundwater level reduction, related to establishment of deep furrows - as a result decreasing CH_4 emissions and increasing CO_2 removals in living biomass because of enhanced	Organic soil, forest stand classification Pv, Nd, Db, main species birch (age 71, II-V site index), aspen (age 41, site index II-V), black alder (age 71, II-V site index),	Forest stand with pine

Scenario	Name of scenario	Description	Area selection criteria	Land use after implementation
		forest growing conditions.		
LVC313	Strip harvesting in pine stand	GHG emissions reduction in pine stand by replacing clear felling with strip harvesting. Projected reduction of GHG emissions is related to the increase of groundwater level in an alternative – clear felling scenario. Increase of groundwater level is associated with significant increase of CH_4. In the case of strip harvesting increase of groundwater levels should be smaller thus also increase of GHG emissions is smaller.	Organic soil, forest stand classification Kv, Km, Ks, Kp, main specie pine, age 101 years, I-III site index	Forest stand with pine

Table 4. Overview of scenarios in wetlands

Scenario	Name of scenario	Description	Area selection criteria	Land use after implementation
Restore1	Growing blueberries in wetlands	Conversion of former peat extraction sites to agricultural land where tall highbush blueberry *Vaccinium corymbosum*, or lowbush blueberry *Vaccinium angustifolium* are grown.	Former peat extraction field	Perennial plantation
Restore2	Growing cranberries in wetlands	Conversion of former peat extraction sites to agricultural land where large cranberry *Vaccinium macrocarpon* is grown.	Former peat extraction field	Perennial plantation

2.3. Impact assessment

The impact of different scenarios is assessed by calculating the difference in our target indicators (GHG emissions, profit, and employment) before and after implementing the measure. For example, in the LVC302 scenario GHG emissions, profit, and employment generated by agricultural land is calculated before and after afforestation. The disparity in these indicators before and after afforestation represents the impact.

Impact is evaluated at two time points – year 2030 and year 2050 – which coincide with the most crucial milestones in climate policy documents.

It is assumed that in all the scenarios activities are started from the year 2026. Each year the activity is implemented at 10% of the applicable area, which means that every activity is fully implemented over the period of 10 years. That also means that in all the scenarios at the end of 2030 activity is implemented on the half of applicable area, and all the measures are fully implemented till the end of 2035.

As the spatial information for the model consists of field level data and it is impossible to predict on which specific field and when the measures could be implemented, field selection for the implementation of each scenario is conducted randomly for the whole Baltic region.

To calculate the expected impact of each scenario on GHG emissions, data were used from the results obtained in Activity C2 of this project, where the empirical data acquired in the project were integrated into GHG, biomass, and forest growth models. The impact on GHG emissions is calculated based on the development and additional growth of living biomass and groundcover biomass, which is depicted dynamically in the results depending on the forest stand age in that specific year.

The calculation of profits and employment in forestry is based on similar principles, taking into account the forestry activities carried out in that specific year. For example, when initiating the implementation of a particular scenario, the first few years involve soil preparation, planting, and agronomical thinning, which reflects in the costs and employment in 2030. For example in 2030, in 10% of the available area soil preparation, planting and agronomical thinning will be done, but in the shares where same process was done in two previous years, secondary or third agronomical thinning will be done, which reflects in the spending and employment.

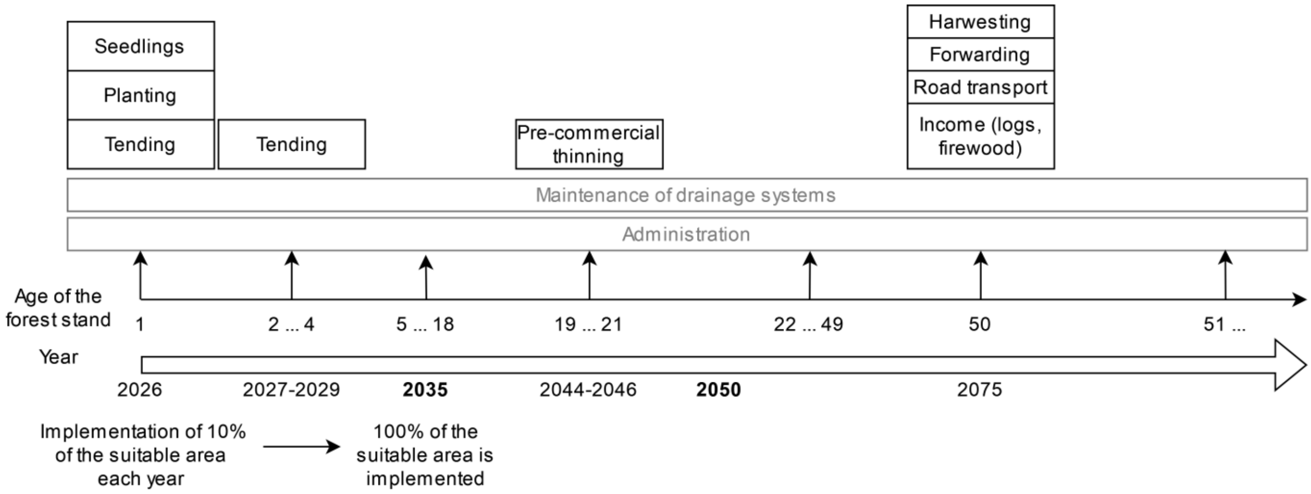

Figure 3. Example of actions taken in the scenario LVC309

However, by 2050, in certain cases depending on the stage of forest stand development, timber harvesting and profits from individual timber assortments are expected. The expected volumes of timber obtained, as well as the type and timing of the activities performed, are also derived from the forest growth model. The actions taken in scenario LVC309 over time are shown in Figure 3.

Some of the scenarios involve afforestation of agricultural land. In this case for profit and employment there is a separate evaluation how much profit is generated, and employment opportunities are created currently, calculation it per each separate field of agricultural land. Calculations are made according to the methodology described in the previous Activity C5 report.

All financial projections are conducted using fixed prices.

3. RESULTS

3.1. Area changes

Figure 4 presents an area available for implementation of 13 scenarios in Estonia, Latvia, and Lithuania (as it is mentioned before, 2 scenarios are excluded from the further analysis as the effect of the implementation of these scenarios on the reduction of GHG emissions was not proven in Activity C2 of the project). The land available for the implementation of the scenarios has been influenced by climatic conditions and previously implemented land policies, which have determined the dynamics of land use in the region. For instance, afforestation initiatives, deforestation, conservation efforts, urban development and application of different agricultural practices have influenced the area available for implementation of scenarios.

Scenarios LVC301, LVC304, LVC302, LVC303, LVC305, LVC306, and LVC310 are implemented on land used for agricultural production. The largest area available for the implementation of scenarios LVC301, LVC302, LVC303 and LVC306 is located in Lithuania, which is related to the fact, that Lithuania also has larger agricultural land areas. Arable land without perennial plantations is suitable for the implementation of scenario LVC301, with the largest available land located in Lithuania at 81 264 hectares, and the lowest in Estonia at 31 794 hectares. Scenarios LVC302 and LVC303 implemented on agricultural lands where grasslands are grown, the largest area of grasslands also is located in Lithuania. A similar area is available in Lithuania and Latvia for the implementation of scenario LVC306, which aims to grow fast-growing trees and grass on arable land previously used for growing cereal, oilseed, pulses, vegetables, potatoes, or fallow.

For scenario LVC307, the total applicable area in the Baltic States together is 40 145 hectares, with more than half located in Estonia, attributed to the larger area of drained organic soils in this country overall. The total applicable area for LVC308 is 14 342 hectares, with the majority situated in Latvia, indicating that Latvia has the most spruce stands of felling age on organic soils. For scenario LVC309, the largest area available for implementation is located in Latvia – 29 311 hectares, but in all three Baltic States together – 38 953 hectares, which is associated with Latvia having the most naturally wet organic soils. For the implementation of scenario LVC311, there are a total of 14 279 hectares of suitable forest stands in the Baltic States. In this case, the largest area suitable for the scenario is in Lithuania, but the area suitable for the implementation of the scenario may change depending on the condition of the drainage systems. The largest area available for the implementation of scenario LVC312 is found in Latvia – 9 431 hectares out of a total area of 23 068 hectares in the Baltic States. In this scenario, all three countries have a similar amount of available land for the implementation. For the scenario LVC313, the total available area is 35 428 hectares, of which the majority is in Latvia. In the Restore 1 and 2 scenarios, the total available area is the same – 60 767 hectares because in both scenarios, the suitable areas are former peat extraction fields.

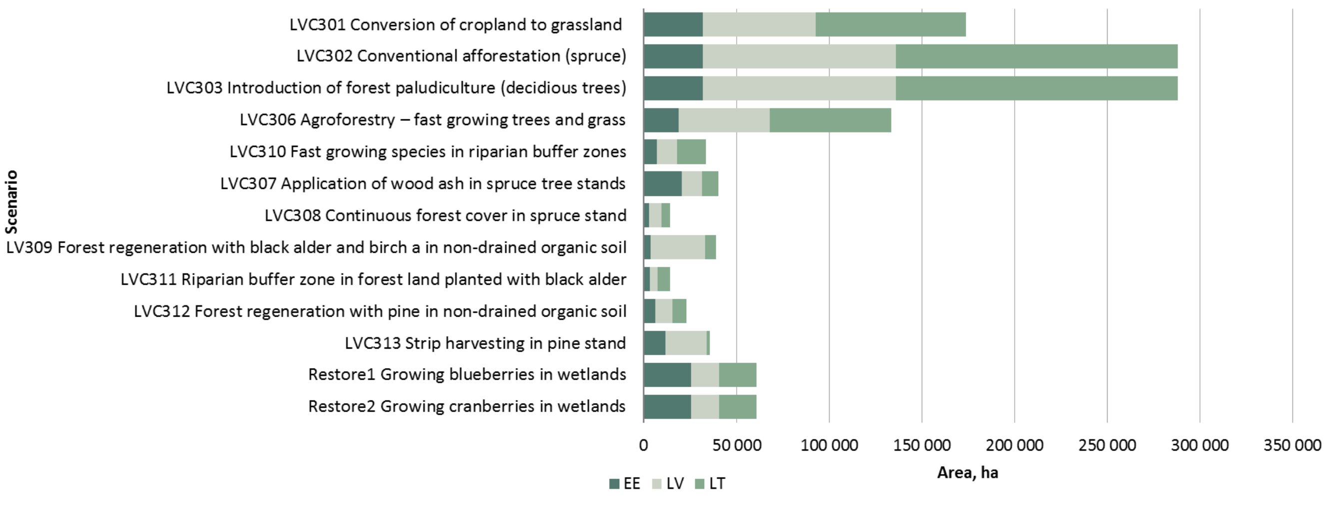

Figure 4. Areas available for the implementation of scenarios for the year 2050 in Estonia, Latvia, and Lithuania

In all scenarios, it is assumed that by 2030, the scenario will be implemented on 50% of the total available area – 10% each year, starting from 2026.

Table 5. Areas available for the implementation of scenarios country and target year

Area, ha	2030			2050		
	EE	LT	LV	EE	LT	LV
LVC301	15 619	40 764	30 767	31 794	81 264	60 801
LVC302	15 649	75 718	52 895	31 847	151 923	104 303
LVC303	15 649	75 718	52 895	31 847	151 923	104 303
LVC306	9 261	32 838	24 992	18 730	65 737	49 171
LVC310	3 561	7 922	5 358	7 258	15 871	10 569
LVC307	10 756	4 100	5 212	20 521	8 739	10 887
LVC308	1 496	2 452	3 219	2 747	4 799	6 797
LV309	2 158	2 635	14 679	3 794	5 847	29 311
LVC311	1 093	3 939	2 105	3 384	6 614	4 281
LVC312	3 620	3 831	4 075	6 145	7 492	9 431
LVC313	6 207	784	10 714	11 473	1 378	22 577
Restore1	17 306	1 760	11 178	25 750	19 908	15 109
Restore2	17 306	1 760	11 178	25 750	19 908	15 109

3.2. Impact on GHG emissions

The reduction in GHG emissions resulting from implementation of scenarios on agricultural land is attributed to increase in biomass of the surface, subsurface, and ground cover resulting from the afforestation. In scenario LVC302, a small increase in GHG emissions is observed because the spruce stand reached the need for maintenance cut.

The reduction or increase in GHG emissions resulting from the implementation of scenarios on forest land is attributed to changes in the biomass of the surface, subsurface, and ground cover. For instance, in 2030, implementing the scenario LVC307 initially results in emissions because this measure is implemented immediately after a stand maintenance cut, leading to a reduction in the initial carbon stock. However, over time, such as by 2050, an additional increase in wood volume is expected, resulting in a significant reduction in GHG emissions due to biomass increase.

A similar expected outcome is also seen for scenarios LVC309 and LVC311, where initially emissions are generated from the soil because the scenario is implemented immediately after a regeneration cut. By 2050, significant carbon sequestration and a reduction in GHG emissions are expected compared to the baseline scenario. In scenarios LVC308 and LVC313, where selective logging is performed, a more moderate reduction is expected, while in scenario LVC312, a consistent reduction throughout the rotation cycle is expected compared to the baseline scenario.

Table 6. Overview of the scenarios' impact on GHG emissions

GHG, t CO_2 eq.	2030			2050		
	EE	LT	LV	EE	LT	LV
LVC301	-17 181	-44 840	-33 844	-34 974	-89 390	-66 881
LVC302	-445 985	-2 157 960	-1 507 504	-423 569	-2 020 582	-1 387 231
LVC303	-273 851	-1 325 063	-925 661	-570 067	-2 719 430	-1 867 025
LVC306	-139 843	-495 859	-377 373	-631 194	-2 215 331	-1 657 059
LVC310	-53 768	-119 628	-80 905	-244 593	-534 863	-356 169
LVC307	29 268	12 030	14 894	-142 953	-58 521	-72 675
LVC308	-211	-255	-250	-3 837	-5 771	-8 622
LV309	5 245	6 438	35 831	-15 550	-20 679	-110 213
LVC311	2 624	9 454	5 051	-10 104	-27 700	-15 873
LVC312	-5 953	-6 529	-7 114	-5 037	-5 856	-7 099
LVC313	-1 241	-157	-2 143	-2 295	-276	-4 515

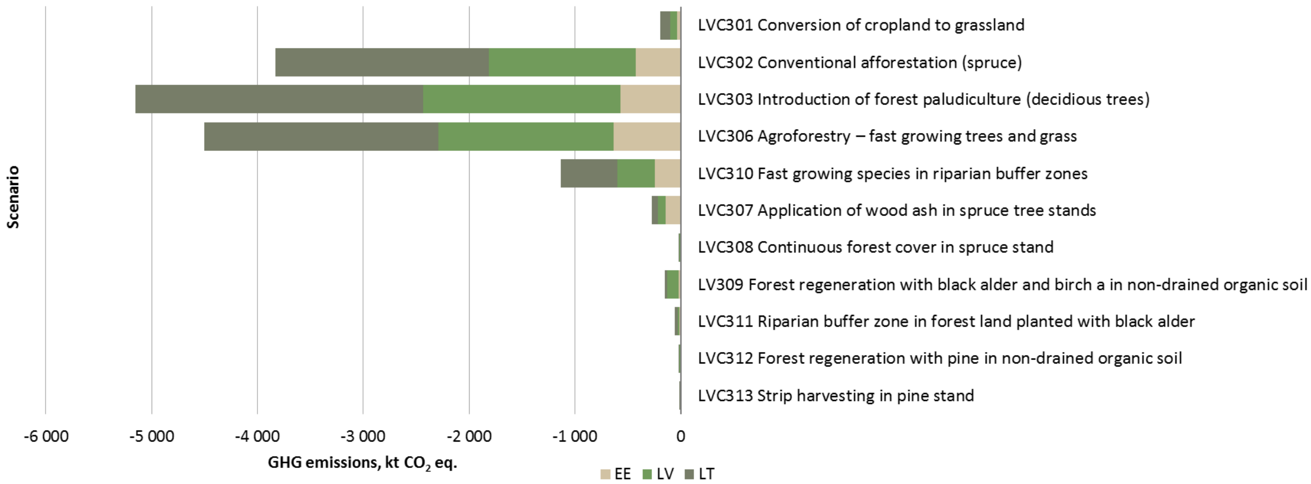

Figure 5. GHG emission changes in 2050 after the implementation of scenarios in Estonia, Latvia, and Lithuania

In the Restore 1 and Restore 2 scenarios, the most significant reduction in GHG emissions is expected in 2030 when significant carbon sequestration in plant biomass occurs. However, by 2050, cranberry plantations (Restore 2) begin to generate a small increase in GHG emissions (0.1 t CO_2 eq. ha^{-1}).

Table 7. Overview of the Restore scenarios' impact on GHG emissions

GHG, t CO_2 eq.	2030			2050		
	EE	LT	LV	EE	LT	LV
Restore1	-141 910	-14 434	-91 656	-69 525	-53 752	-40 795
Restore2	-29 506	-4 871	-17 092	2 575	1 991	1 511

3.3. Impact on profits

The scenarios implemented on areas previously used for the cultivation of agricultural crops such as grains, oilseeds, legumes, vegetables, and potatoes show a relatively large decrease in profits for 2030. The reduction in profits resulting from implementation of LVC301 and LVC302 scenarios on agricultural land is attributed to decrease in yields previously obtained from growing cereals, oilseeds, pulses, vegetables and potatoes. While this decrease is offset by an increase in biomass by 2050, there is still a decline in profits by 2050, except for the LVC306 scenario. In this scenario, there is a profit in 2050 because the fast-growing trees have reached cutting age.

Table 8. Overview of the scenarios' impact on profits per country and target year

Profit, EUR	2030			2050		
	EE	LT	LV	EE	LT	LV
LVC301	-842 601	-1 727 904	-1 272 646	-1 743 119	-3 394 151	-2 509 145
LVC302	-7 321 052	-33 009 134	-23 118 218	-2 093 312	-4 932 917	-3 553 927
LVC303	-6 898 540	-30 964 751	-21 690 056	-5 055 114	-19 061 799	-13 254 112
LVC306	-6 291 576	-21 339 266	-16 376 792	17 519 209	63 624 408	47 294 835
LVC310	-2 431 003	-5 135 865	-3 498 828	6 777 181	15 370 219	10 185 149
LVC307	-235 136	-113 616	-132 942	8 229 533	1 895 989	3 160 214
LVC308	204 791	453 218	630 015	454 405	661 983	1 366 074
LV309	-531 289	-896 274	-4 686 776	-153 076	-275 940	-1 405 386
LVC311	-483 199	-1 191 330	-592 412	-171 773	-405 984	-201 739
LVC312	-935 973	-1 284 652	-1 612 604	-254 426	-376 029	-490 346
LVC313	1 872 390	242 956	5 439 968	3 314 360	337 023	6 700 040

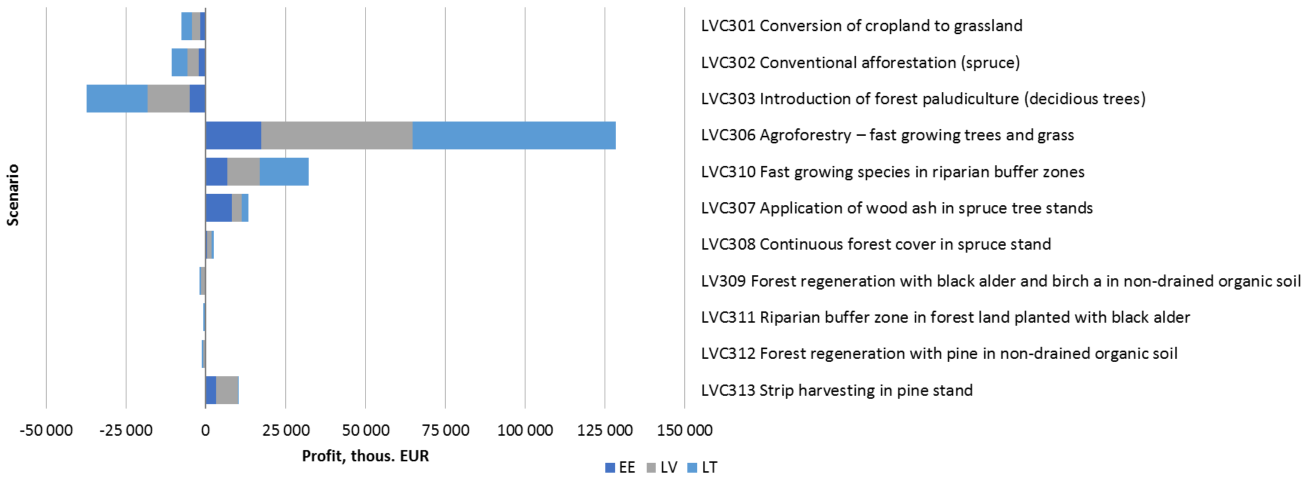

Figure 6. Profit changes in 2050 after the implementation of scenarios in Estonia, Latvia, and Lithuania

Profit in 2030 is only generated in scenarios where significant initial investments are not required for forest regeneration, planting, fertilization, or the creation of drainage systems. Instead, profit is derived through selective logging to obtain timber. Two such scenarios are LVC308 and LVC313, in which timber is obtained through selective cuts initiated during scenario implementation. In both cases, profit is also generated by continuing these activities until 2050.

In contrast, other scenarios in 2030 necessitate investments in forest regeneration and maintenance activities. However, by 2050, some of these scenarios – LVC307, Restore 1, and Restore 2 – already generate profit. In scenarios where losses occur in 2050, thinning of young stands is performed, and profit is anticipated in later stages of the rotation cycle. This expectation is based on the forest age in these areas, which is projected to be between 15 and 25 years by 2050.

Table 9. Overview of the Restore scenarios' impact on profits per country and target year

Profit, EUR	2030			2050		
	EE	LT	LV	EE	LT	LV
Restore1	-206 343 350	-55 932 319	-75 541 157	150 919 849	116 682 427	88 554 477
Restore2	-128 769 757	-35 159 629	-46 119 684	384 213 456	297 051 440	225 442 989

3.4. Impact on employment

The employment before the implementation of scenarios on agricultural land depends on the specific land use and management activities. Agricultural activities, particularly those associated with growing vegetables, are labour intensive. Therefore, the implementation of scenarios LVC301, LVC302, and LVC303 results in a reduction in employment both in 2030 and 2050. The exception is scenario LVC 306, where fast-growing trees reach harvestable conditions by 2050.

Employment resulting from the implementation of scenarios on forest land is directly dependent on the initial investments required for forest regeneration and maintenance. For instance, the lowest employment in 2030 will be generated by implementing the scenario LVC307, which only involves the mechanized scattering of ashes in the forest. Greater employment opportunities will arise in 2050 when thinning or regeneration cuts are carried out in areas that have reached the specified age.

A relatively modest increase in employment is also expected from implementing scenarios LVC308 and LVC313, as these scenarios involve periodic selective logging in small volumes.

An increase in employment in 2030 is anticipated with the implementation of scenarios LVC309, LVC311, and LVC312, as these scenarios require significant labour and financial investments in forest cultivation and maintenance. The rise in employment also persists into 2050, as thinning of young stands will be necessary based on the age of these stands in that year.

Table 10. Overview of the scenarios' impact on employment per country and target year

Employment, FTE	2030			2050		
	EE	LT	LV	EE	LT	LV
LVC301	-23	-233	-81	-48	-457	-157
LVC302	-105	-531	-273	-375	-1813	-1059
LVC303	-114	-573	-302	-410	-1981	-1175

Employment, FTE	2030			2050		
	EE	LT	LV	EE	LT	LV
LVC306	-24	-215	-75	32	-129	74
LVC310	-135	-46	-18	-242	-21	11
LVC307	2	1	1	32	7	12
LVC308	1	2	3	2	2	3
LV309	15	26	136	7	13	64
LVC311	11	28	14	7	16	8
LVC312	25	33	40	11	17	22
LVC313	8	1	20	17	2	20

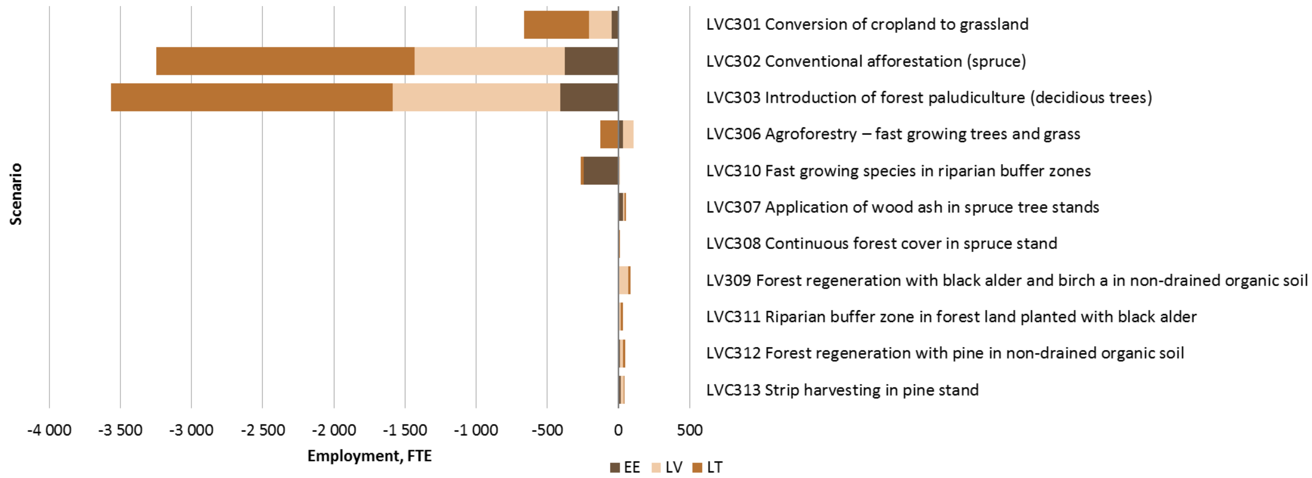

Figure 7. Employment changes in 2050 after the implementation of scenarios in Estonia, Latvia, and Lithuania

The most substantial increase in employment will result from implementing the Restore 1 and Restore 2 scenarios, which entail substantial labour investment in the preparation of cranberry and blueberry plantations, as well as their annual maintenance and harvest collection.

Table 11. Overview of the Restore scenarios' impact on employment per country and target year

Employment, FTE	2030			2050		
	EE	LT	LV	EE	LT	LV
Restore1	6 333	794	3 831	11 344	8 771	6 656
Restore2	6 333	794	3 831	11 344	8 771	6 656

3.5. Application (UI of the Simulation tool)

For the purpose of interactive it is created interactive application to display model results. It shows summary and detailed spatial information for each scenario and for each country.

On the left panel there is a visualisation of all areas on which scenario's measure is applied. It can be switched by changing scenario in the "Select scenario" block. Spatial data for visualisation purposes is agregated in 100 ha (which is 1 km^2) grid.

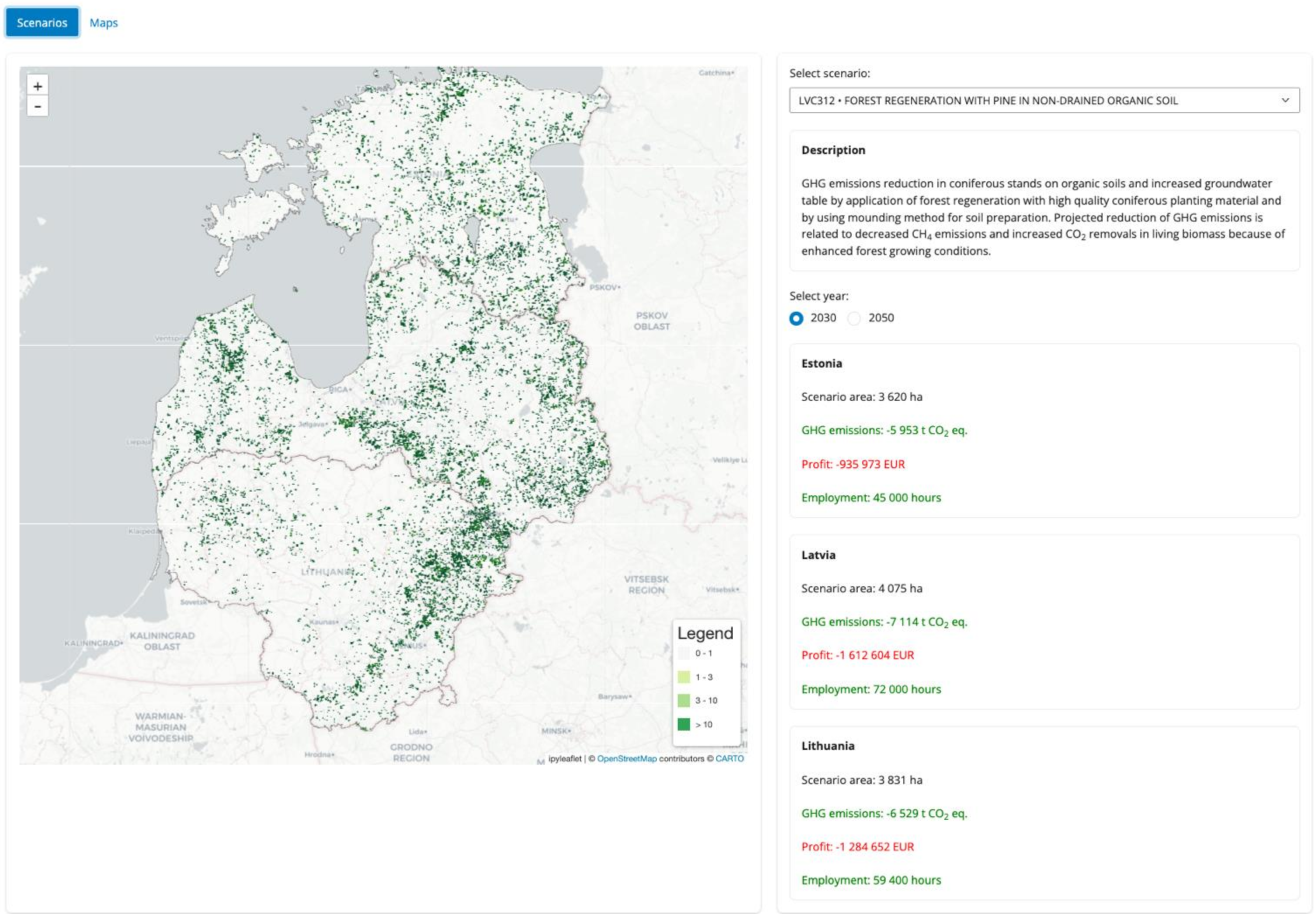

Figure 8. User interface of the Simulation tool

In the application positive impact is highlighted in as green text, while negative as a red text in the right panel.

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SUPPLEMENTARY MATERIAL

Supplementary Material S1

Restrictions on the use of land resources in protected natural areas of Estonia

In Estonia, there are diverse protected areas such as nature reserve, strict nature reserve, national parks, landscape protection areas and other. Protected areas are divided into zones to set the requirements for the conservation of values to be protected[1]. Based on the restrictions in protected sites mentioned in Nature Conservation Act[2], for all type of protected sites the code 1, 2 or 3 were assigned based on the intensity of restrictions (Table S2 and Table S3). Code 1 means that all economic activities are forbidden. Code 2 means that these areas have mild conservation priority. Code 3 means that there are no specific restrictions. The overview of protected areas, prohibited activities and assigned codes are given in Table S3. Further the codes were assigned to the shapefiles of protected areas in Estonia to select the areas where economic activities are forbidden[3].

Table S2. Coding of restrictions on the use of land resources in protected natural areas in Estonia

Code	Intensity of restrictions
1	Strict
2	Mild
3	No specific restrictions

Table S3. Overview of protected areas in Estonia

Protected area in Estonian	Protected area in English	Prohibited activities	Code
Kaitseala	Conservation area	Any economic activity is prohibited	1
Hoiuala	Limited-conservation areas	Destruction or harming of the habitats is prohibited, logging is prohibited if it harms the protected habitat, change of land use category is prohibited	2
Kaitstav looduse uksikobjekt	Individual protected natural objects	Change of land use category is prohibited	Included in other categories
KOV kaitstav loodusobjekt	Natural objects protected at the local government level	Protected zone of 50 m from individual object. Restrictions on changing the water level, extraction of mineral resources is prohibited, design of pure stands and planting of energy forests, use of mineral fertilizers and	2

[1] https://kaitsealad.ee/en/nature-conservation-abc/types-protected-areas

[2] Nature Conservation Act, In force from 01.01.2024. https://www.riigiteataja.ee/en/eli/ee/516012024002/consolide/current

[3] https://xgis.maaamet.ee/xgis2/page/app/looduskaitse

Protected area in Estonian	Protected area in English	Prohibited activities	Code
		herbicides is prohibited, hunting and fishing.	
Loodusreservaat	Nature reserve	The zones possible in a nature reserve are the strict nature reserve (any economic activity is prohibited), conservation zone (any economic activity is prohibited) and limited management zone.	Depending on zone
Hooldatav sihtkaitsevoond	Strict nature reserve	Any economic activity is prohibited.	1
Looduslik sihtkaitsevoond	Conservation zone	Any economic activity is prohibited.	1
Piiranguvoond	Limited management zone	Restrictions on changing the water level, extraction of mineral resources is prohibited, design of pure stands and planting of energy forests, use of mineral fertilizers and herbicides is prohibited, hunting and fishing.	2
Uksikobjekti piiranguvoond	Protected zone of natural objects	Restrictions on changing the water level, extraction of mineral resources is prohibited, design of pure stands and planting of energy forests, use of mineral fertilizers and herbicides is prohibited, hunting and fishing.	Included in other categories
Natura 2000 linuala	Natura 2000 bird area	Prevent activities that could significantly disturb species or damage habitats, but there is no restrictions in economic activities. If the area is located in an existing protected site, then its restrictions apply.	3
Natura 2000 loodusala	Natura 2000 natural area	Prevent activities that could significantly disturb species or damage habitats, but there is no restrictions in economic activities. If the area is located in an existing protected site, then its restrictions apply.	3

Supplementary Material S2

Restrictions on the use of land resources in protected natural areas of Latvia

Protected natural areas in Latvia are geographically defined areas that are under state protection to preserve and safeguard biodiversity - rare and typical natural ecosystems, habitats of protected species, Latvian landscapes, geological and geomorphological formations, dendrological plantations, and ancient trees, as well as areas significant for recreation, education, and cultural enrichment of the society. In Latvia, there are the following categories of protected areas: nature reserves, national parks, biosphere reserve, nature parks, natural monuments, protected marine areas and landscapes. Individual rules of protection and land use can be developed for a protected natural areas, taking into account the needs of the specific protected area, as well as the goals and needs of its creation and protection. The individual rules of protection and land use of the protected area regulate the types of permitted and prohibited activities in this area, as well as, if necessary, its division into functional zones[4].

In order to spatially determine the areas where there are restrictions on economic activity on agricultural land, the Natural data management system OZOLS and the individual protection and land use regulations of protected natural areas have been used. If no individual regulations have been developed, then general rules have been used[5]. The summary on restrictions in protected natural areas was prepared by the nature protection expert of the Nature Conservation Agency. To create a unified system for restrictions on agricultural and forestry lands, a code system from 1 to 6 was developed, similar to the compilation of forest statistics prepared by the State Forestry Service. In the developed system, code 1 means that any economic activity is prohibited, while code 6 means that there are no specific restrictions on economic activity (Table S4). Then, each specially protected natural area was assigned a code, taking into account the prohibited activities mentioned in the individual and/or general regulations. The cartographers of the Nature Conservation Agency prepared a shapefile, where each specially protected nature area is assigned a corresponding code. Areas where the assigned codes overlap have adopted the strictest conditions for prohibited activities, for example the meadows of Lake Burtnieku are divided between codes 3 and 4, but it is not possible to spatially separate which area is under code 3 and which area is under code 4, therefore the area is assigned code 3, which has the strictest requirements.

Table S4. Overview of land use restrictions in protected areas in Latvia

Code	Prohibited activity	Number of protected natural areas
1	Any economic activity is prohibited	39
2	Land use change, plowing of floodplain meadows, use of mineral fertilizers and plant protection products	28
3	Land use change, plowing of floodplain meadows and biologically valuable meadows, there are restrictions on changing the water level, mowing, land division, activities that contribute to soil erosion must not be carried out	69

[4] Law on specially protected nature territories, Latvijas Vēstnesis, 5, 25.03.1993. https://likumi.lv/ta/id/59994

[5] Cabinet Regulation No. 264 "General Regulations on Protection and Use of Specially Protected Nature Territories" https://likumi.lv/ta/id/207283-ipasi-aizsargajamo-dabas-teritoriju-visparejie-aizsardzibas-un-izmantosanas-noteikumi

4	Land use change, there are restrictions on changing the water level, mowing, dividing the land, activities that contribute to soil erosion must not be carried out	283
5	There are restrictions on changing the water level, mowing, dividing land, activities that contribute to soil erosion must not be carried out	37
6	There are no specific restrictions	22

Supplementary Material S3

Restrictions on the use of land resources in protected natural areas of Lithuania

In Lithuania, there are diverse protected areas such as nature reserves, national parks, and other designated zones that safeguard its natural and cultural heritage[6]. These protected areas serve not only as niches for biodiversity but also as recreational and educational spaces, attracting visitors. Strict regulations govern land use to preserve the ecological integrity and cultural significance. These restrictions may prohibit logging, hunting, and construction, and may also limit certain agricultural practices to prevent soil degradation and maintain biodiversity. Additionally, zoning laws may designate specific areas for particular uses[7]. Overview of protected areas in Lithuania and their restrictions:

- Rezervatai – strict conservation priority. Any economic activity is prohibited, except of restoration of protected site, scientific research, etc.
- Draustiniai – conservational priority, but less strict prohibitions as compared to rezervatai, economical activities are allowed. Some activities are prohibited, such as any activity which may have a negative impact on the area or objects protected. Prohibited activities may include: peat exploitation, destruction of landscape, any new mining installation, any industry or energy plant installation, large stone chipping, dam installation or any other regulation of rivers, change of lakes water level, restoration of damaged dams, excavation /creation of any artificial water body, drainage and land use change of peatlands, building any structures which are not related to the purpose of this protected area.
- Gpo (geologiniai, zoologiniai, hidrografiniai, hidrogeologiniai, geomorfologiniai, botaniniai) – nature heritage sites. Some activities are prohibited, such as land-use change, excavation of soil, moving of large boulders (stones), any building not related with restoration or protection of these nature heritage sites, reconstruction of buildings, infrastructure development, building dams, camping and campfire (allowed in designated areas only).
- Buferines apsaugos zonos – buffer zones around nature heritage sites (gpo's). Same restrictions as for gpo's. Buferines apsaugos zonos may surround other protected areas as well.
- Parkai – national parks. Restriction level may vary, according to the functional priority zone of the park, e.g. in the areas of rezervatai or draustiniai, restrictions for that areas are applied. In the other areas destroying or damaging landscape, hydrographic network elements is prohibited, as well as new mining installation, drainage of peatlands, any wetland conversion to other land uses, plowing of grassland, regulate water level via building dams, changing rivers and lakes, certain restriction for buildings, etc. Restrictions for non-conservation areas are milder than for draustiniai.
- Biosferos rezervatai - Restriction level may vary, e.g. in the areas of conservation priority (rezervatai or draustiniai), restrictions for that areas are applied. In the other areas destroying or damaging landscape, hydrographic network elements is prohibited, as well as new mining installation, drainage of peatlands, any wetland conversion to other land uses, plowing of grassland, regulate water level via building dams,

[6] Law on protected areas, 1993. Lietuvos Respublikos saugomų teritorijų įstatymas, 1993 m. lapkričio 9 d. Nr. I-301, Vilnius. *Žin. 1993, Nr. 63-1188, i. k. 0931010ISTA000I-301.* Aktuali redakcija: 2024 01 01, available at: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.5627/wIWoCqKETf

[7] Law on special land use conditions, 2019. Lietuvos Respublikos specialiųjų žemės naudojimo sąlygų įstatymas, 2019 m. birželio 6 d. Nr. XIII-2166, Vilnius. TAR, 2019-06-19, Nr. 9862. Aktuali redakcija: 2024 01 01, available at: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/46c841f290cf11e98a8298567570d639

changing rivers and lakes, certain restriction for buildings, etc.

- Biosferos poligonai - Restriction level may vary, e.g. in the areas of conservation priority (rezervatai or draustiniai), restrictions for that areas are applied. In the other areas destroying or damaging landscape, hydrographic network elements is prohibited, as well as new mining installation, drainage of peatlands, any wetland conversion to other land uses, plowing of grassland, regulate water level via building dams, changing rivers and lakes, certain restriction for buildings, etc.
- PAST – areas important for bird protection. Nature 2000 areas. Most of them are within other protected areas (rezervatai, draustiniai, gpo, parkai, biosferos rezervatai, biosferos poligonai).
- BAST – areas important for site protection. Nature 2000 areas. Most of them are within other protected areas (rezervatai, draustiniai, gpo, parkai, biosferos rezervatai, biosferos poligonai).
- Sklypai – restoration and environment protection (including genetic material protection) areas. Some activities are limited: natural resources reduction, exploitation of (mineral) resources, some limitations for land, forest or water use may be applied. Mildest restrictions compared to all other categories.

Based on the restrictions in protected sites mentioned in Law on protected areas and Law on special land use conditions, for all type of protected sites the code 1, 2 or 3 were assigned based on the intensity of restrictions (Table S1). Code 1 means that all economic activities are forbidden. Code 2 means that these areas have milder conservation priority. Code 3 means that there are no specific restrictions. Further the codes were assigned to the shapefiles of protected areas in Lithuania to select the areas where economic activities are forbidden.

Table S1. Restriction level in different protected areas in Lithuania

Code	Protected areas
1	Rezervatai, biosferos rezervatai, niosferos poligonai (conservation priority)
2	Draustiniai, GPO, biosferos rezervatai, biosferos poligonai, buferines apsaugos zonos (conservation priority)
2	Parkai, bufernies apsaugos zonos (ecological protection)
3	Sklypai (restoration priority)
3	Areas where no specific restrictions are applied

Supplementary Material S4

Activities for the implementation of afforestation scenarios (all except LVC301)

LVC302 Conventional afforestation (spruce)

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	162	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	164	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Administration	€ ha⁻¹	80	12	12	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	13	13	13	2	44	2	2
Total expanses	€ ha⁻¹	1227	182	182	182	27	27	27	27	27	27	27	27	27	27	27	27	27	27	195	195	195	27	671	27	27
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1849	0	0

LVC303 Conventional afforestation (spruce)

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Administration	€ ha⁻¹	79	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	0	0
Total expanses	€ ha⁻¹	1201	155	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	168	168	0	0	0	0
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LVC306 Agroforestry – fast growing trees and grass

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha^{-1}	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400	0	0	0
Seedlings	€ ha^{-1}	1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1200	0	0	0
Planting	€ ha^{-1}	345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	345	0	0	0
Tending	€ ha^{-1}	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145	145	145	145
Pre-commercial thinning	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harvesting	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2733	0	0	0
Forwarding	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1879	0	0	0
Production of harvesting residues	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2484	0	0	0
Application of mineral fertilizers	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1500	0	0	0
Maintenance of drainage systems	€ ha^{-1}	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Administration	€ ha^{-1}	148	12	12	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	750	12	12	12
Total expanses	€ ha^{-1}	2263	182	182	182	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	11461	182	182	182
Total income	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22664	0	0	0

LVC310 Fast growing species in riparian buffer zones

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400	0	0	0
Seedlings	€ ha⁻¹	1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1200	0	0	0
Planting	€ ha⁻¹	345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	345	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145	145	145	145
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2733	0	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1879	0	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2484	0	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1500	0	0	0
Maintenance of drainage systems	€ ha⁻¹	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Administration	€ ha⁻¹	148	12	12	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	750	12	12	12
Total expanses	€ ha⁻¹	2263	182	182	182	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	11461	182	182	182
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22664	0	0	0

LVC307 Application of wood ash in spruce tree stands

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha^{-1}	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha^{-1}	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha^{-1}	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha^{-1}	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	345
Forwarding	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225
Production of harvesting residues	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
Road transport	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	227
Application of mineral fertilizers	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120
Establishment of drainage systems	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha^{-1}	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Administration	€ ha^{-1}	80	12	12	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	13	13	13	2	2	2	68
Total expanses	€ ha^{-1}	1227	182	182	182	27	27	27	27	27	27	27	27	27	27	27	27	27	27	195	195	195	27	27	27	1045
Total income	€ ha^{-1}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2557

LVC308 Continuous forest in spruce stand

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	162	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	164	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Administration	€ ha⁻¹	79	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	40	0	0
Total expanses	€ ha⁻¹	1201	155	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	168	168	0	615	0	0
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1849	0	0

LVC309 Forest regeneration with black alder and birch in non-drained organic soil

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Administration	€ ha⁻¹	80	12	12	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	13	13	13	2	2	2	2
Total expanses	€ ha⁻¹	1227	182	182	182	27	27	27	27	27	27	27	27	27	27	27	27	27	27	195	195	195	27	27	27	27
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LVC311 Forest regeneration with black alder and birch in non-drained organic soil

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Administration	€ ha⁻¹	79	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	0	0
Total expanses	€ ha⁻¹	1201	155	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	168	168	0	0	0	0
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LVC312 Forest regeneration with pine in non-drained organic soil

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Administration	€ ha⁻¹	79	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	0	0
Total expanses	€ ha⁻¹	1201	155	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	168	168	0	0	0	0
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

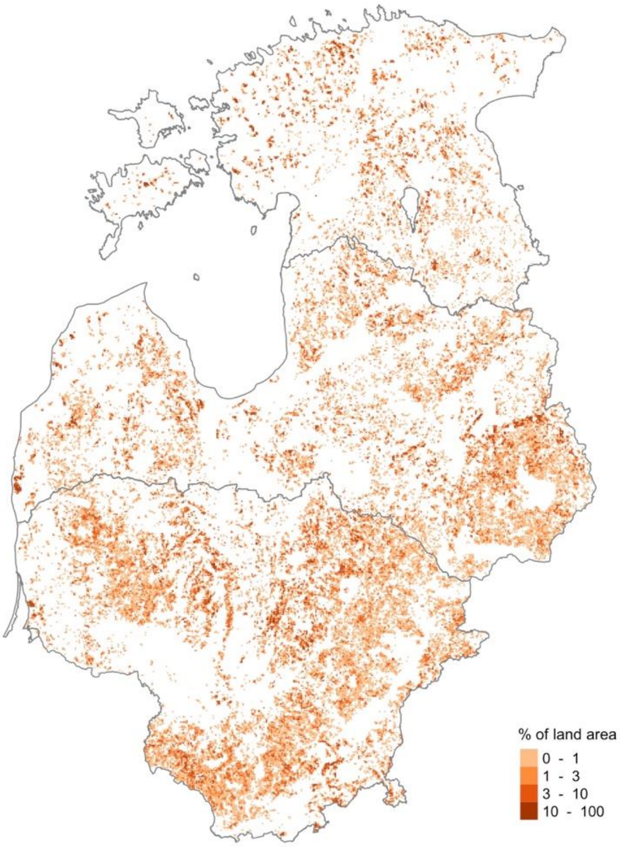
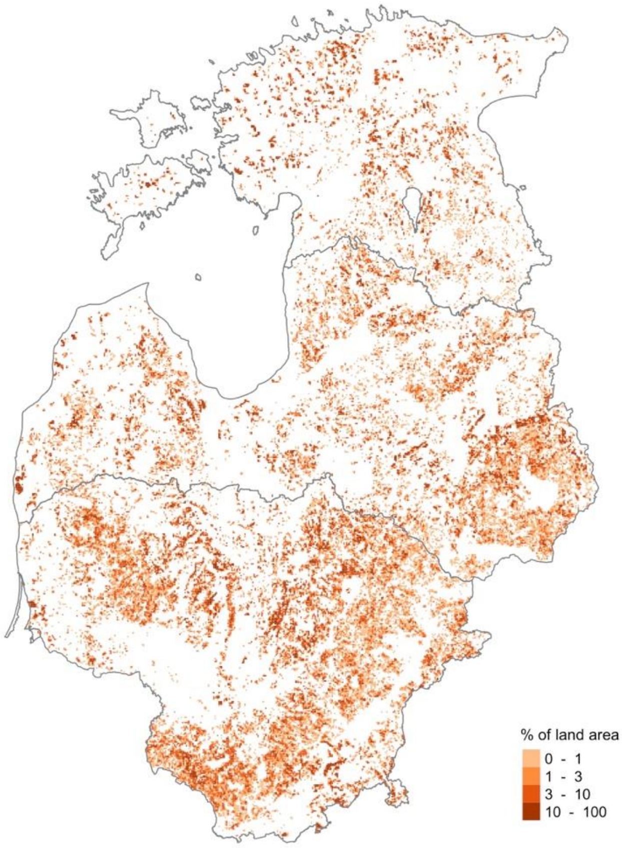
LVC313 Strip harvesting in pine stand

Type of cost	Unit	Year																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Soil scarification	€ ha⁻¹	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seedlings	€ ha⁻¹	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planting	€ ha⁻¹	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tending	€ ha⁻¹	145	145	145	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-commercial thinning	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	157	157	0	0	0	0
Harvesting	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forwarding	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production of harvesting residues	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road transport	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of mineral fertilizers	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Application of wood ash	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Establishment of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance of drainage systems	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Administration	€ ha⁻¹	79	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	0	0
Total expanses	€ ha⁻¹	1201	155	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	168	168	0	0	0	0
Total income	€ ha⁻¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

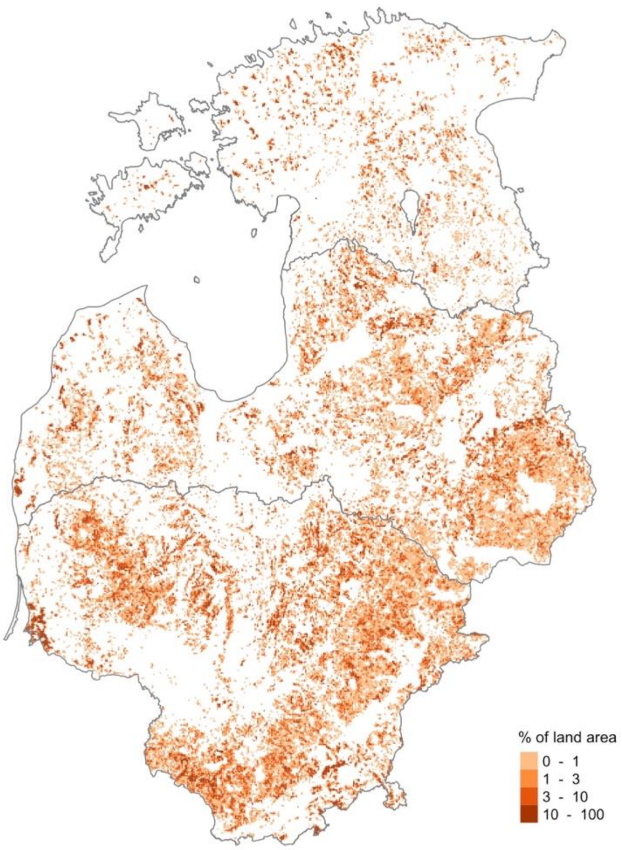
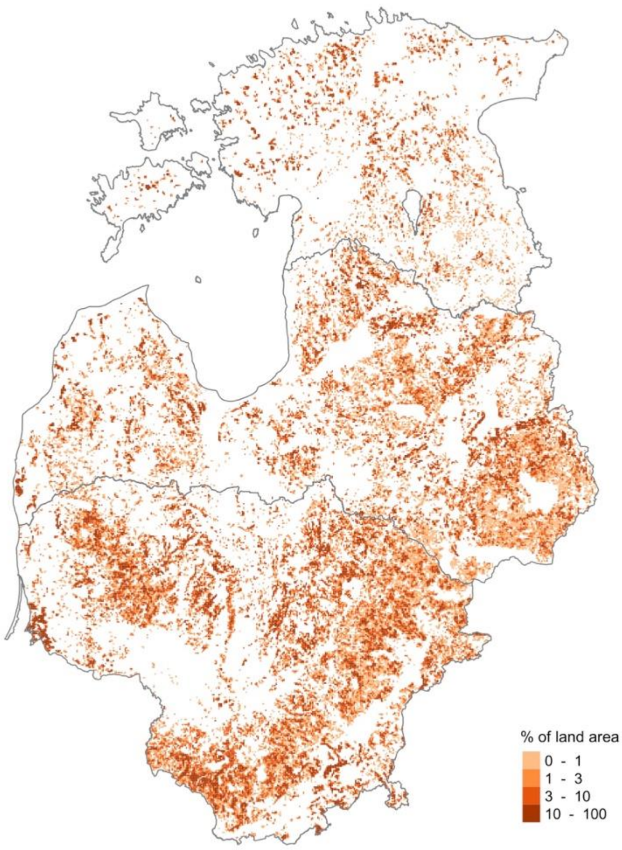
Supplementary Material S5

Area for the implementation of scenarios

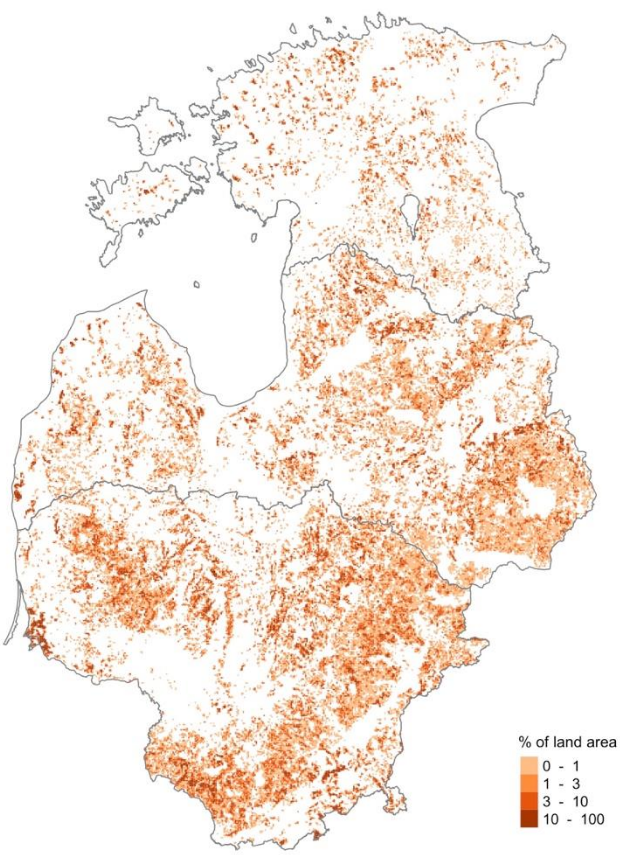
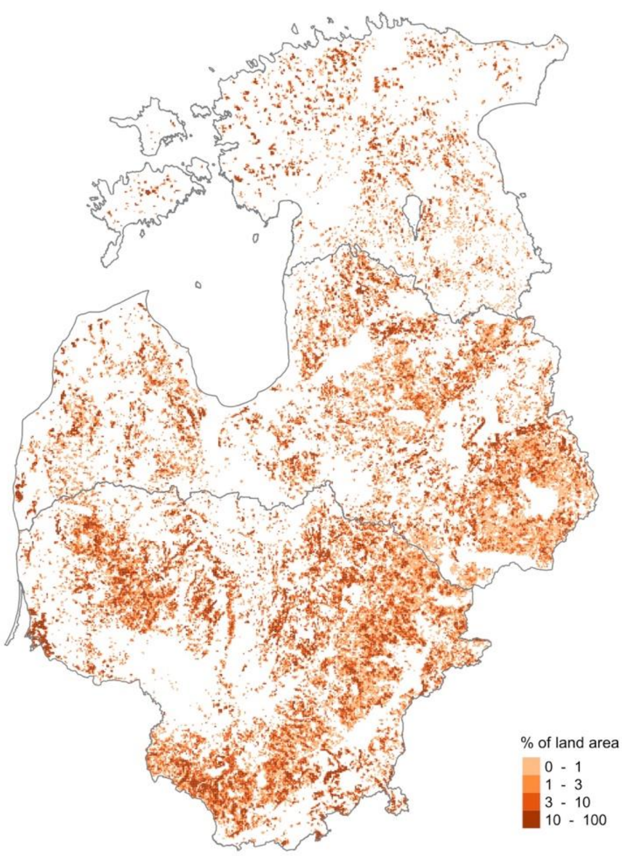
Scenario LVC301

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

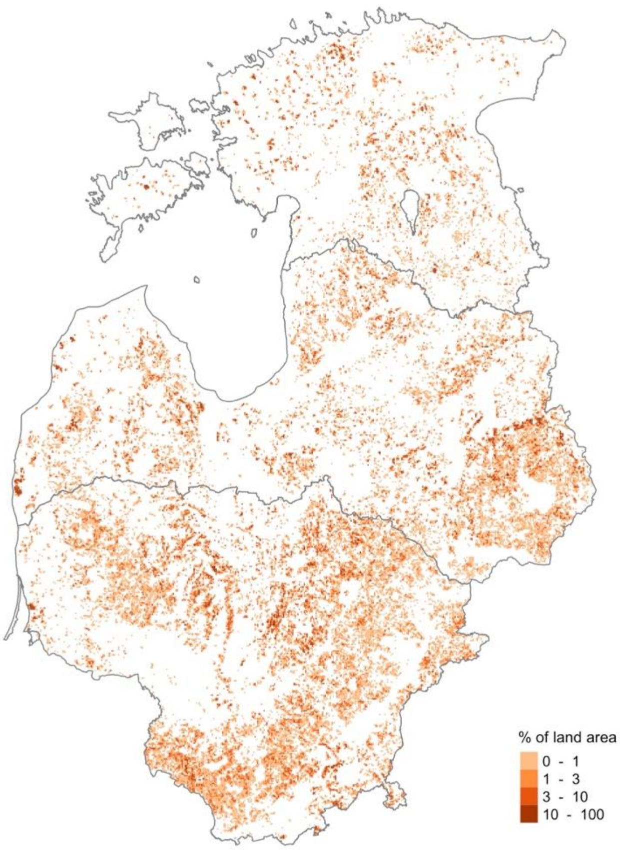
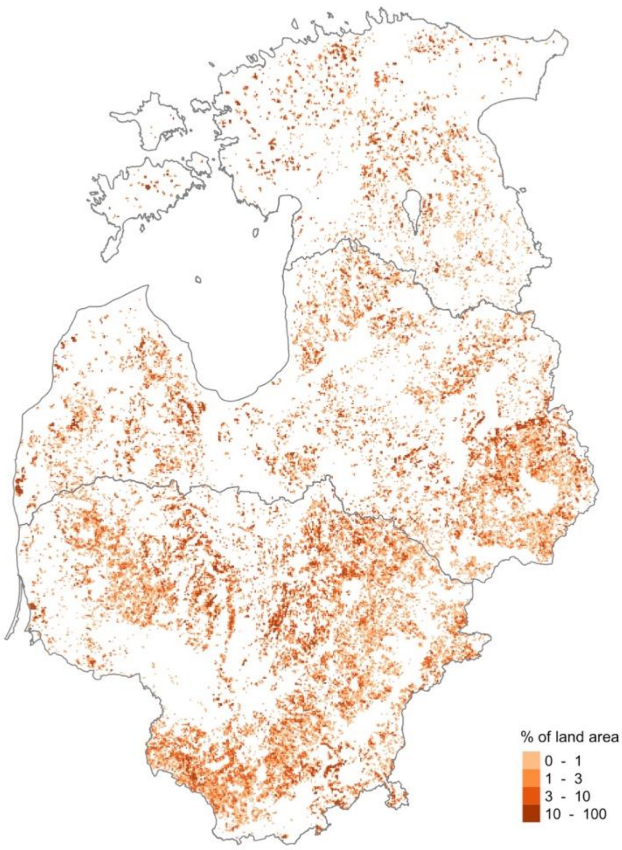
Scenario LVC302

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

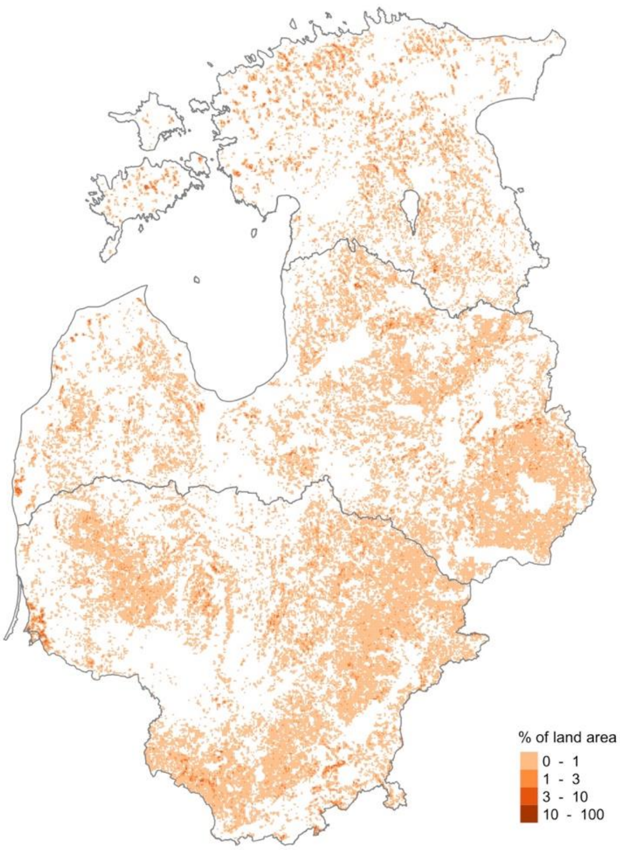
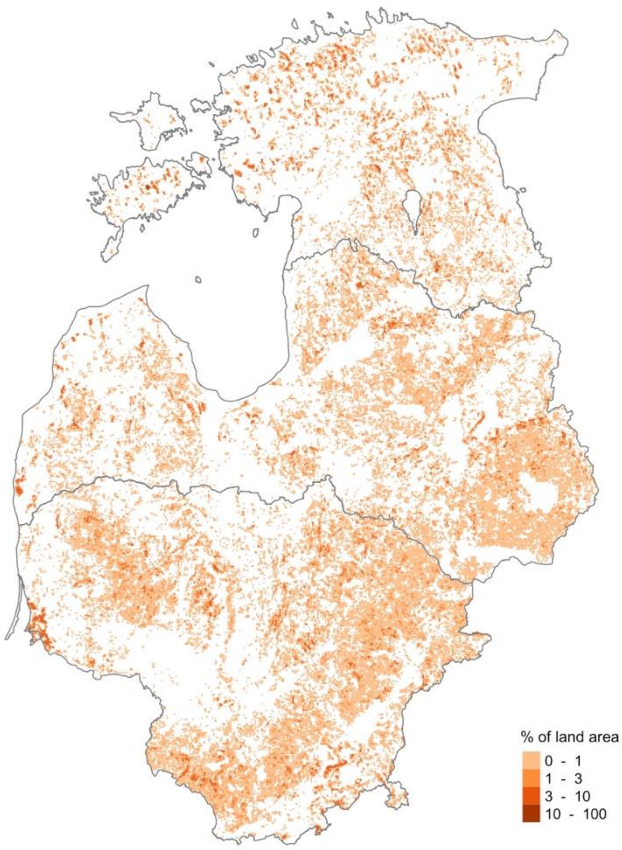
Scenario LVC303

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

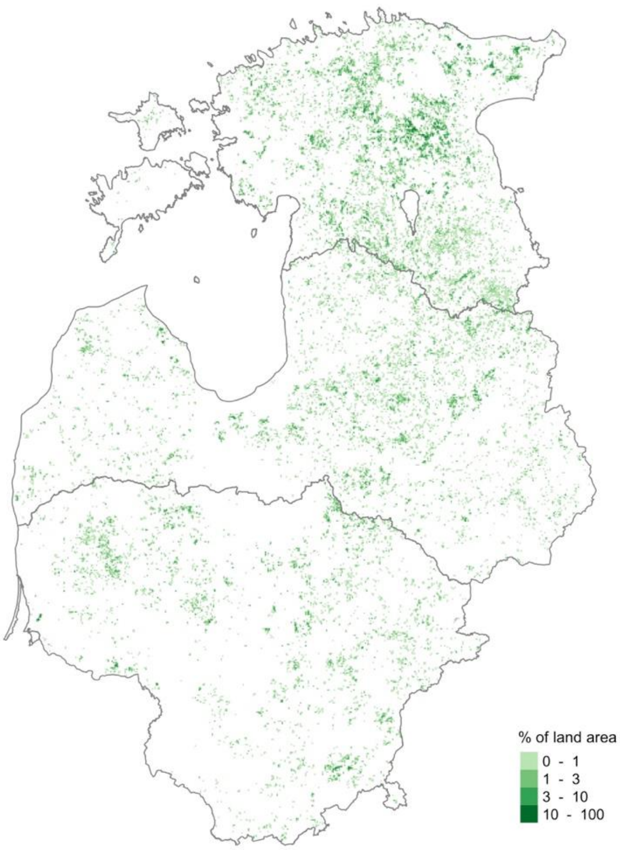
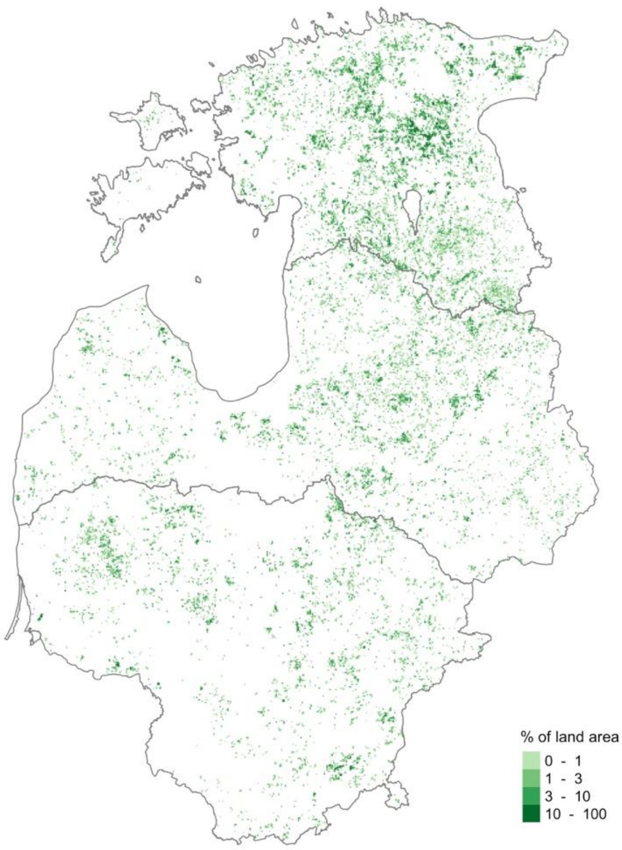
Scenario LVC306

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

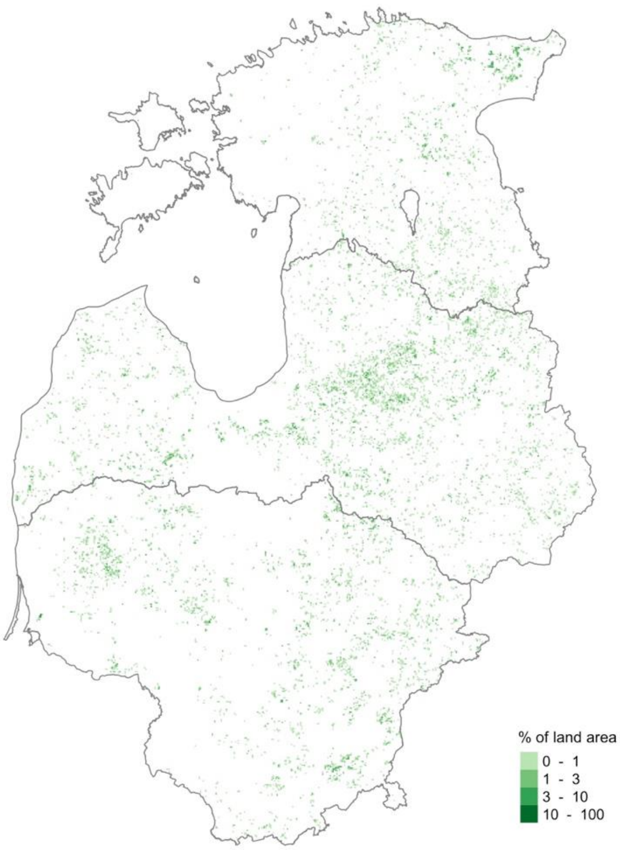
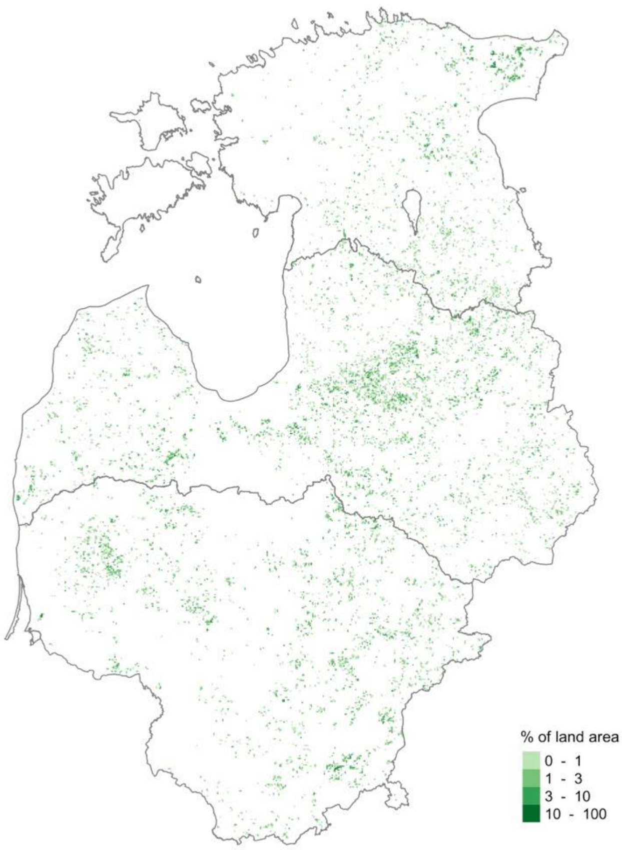
Scenario LVC310

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

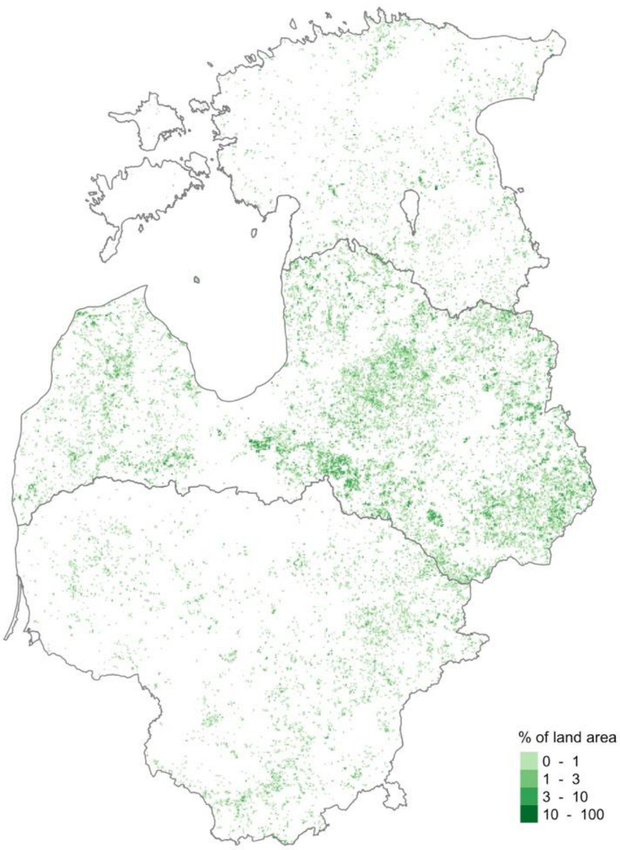
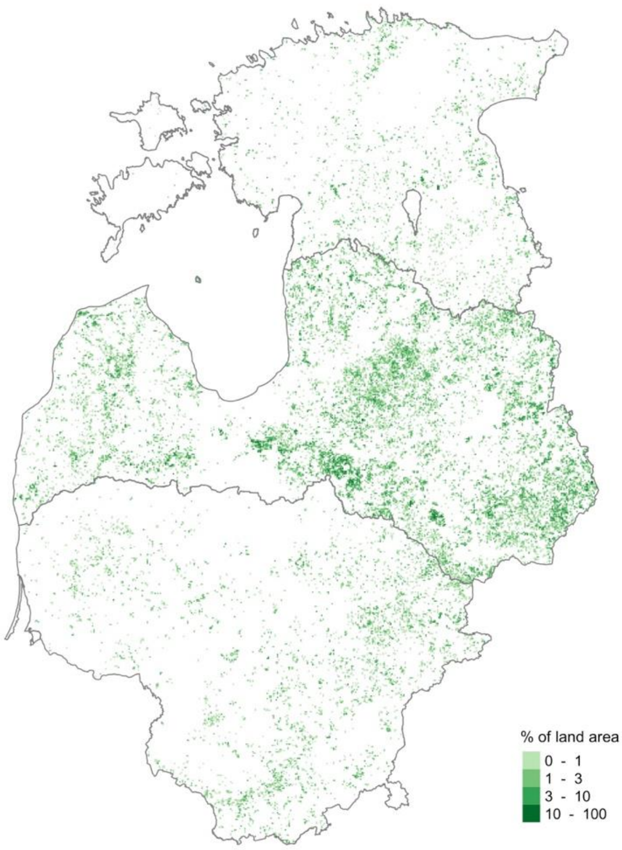
Scenario LVC307

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

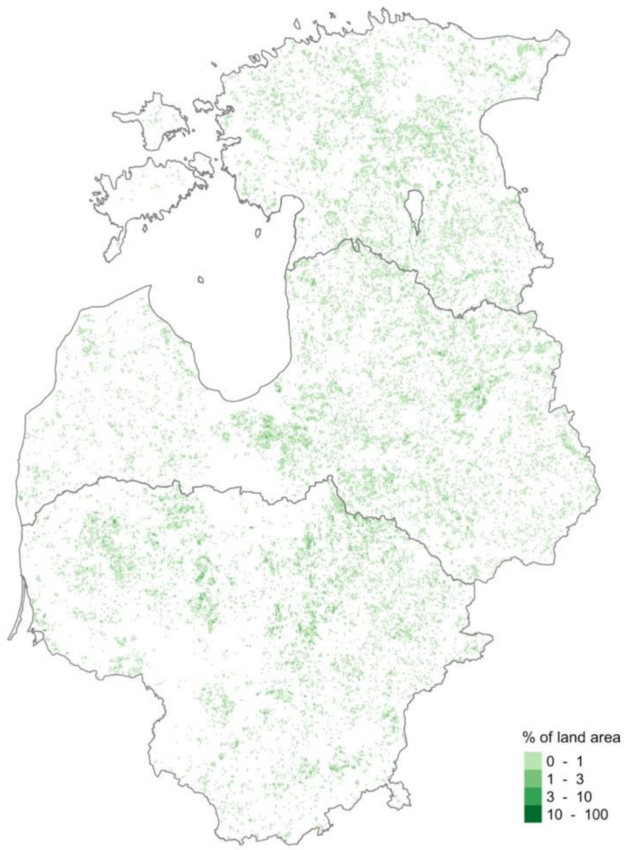
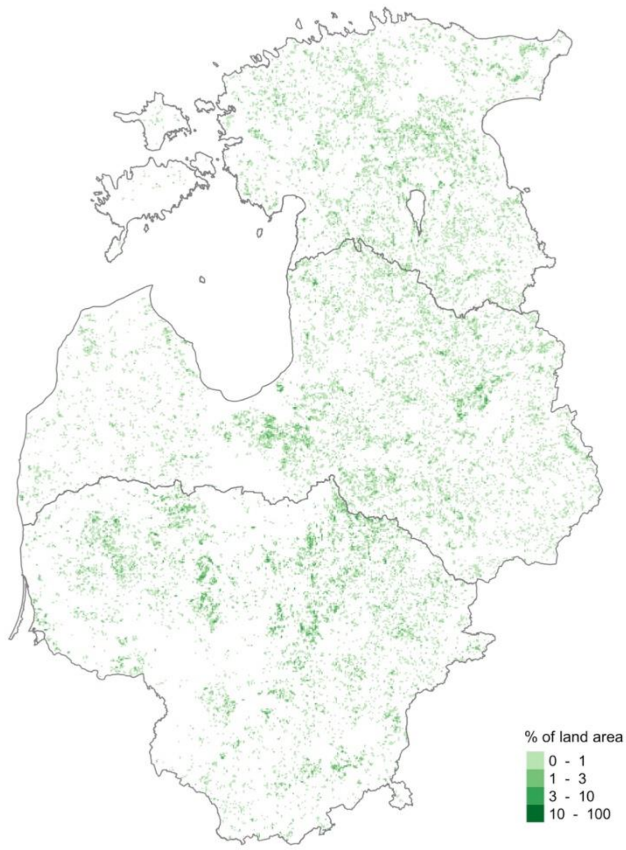
Scenario LVC308

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

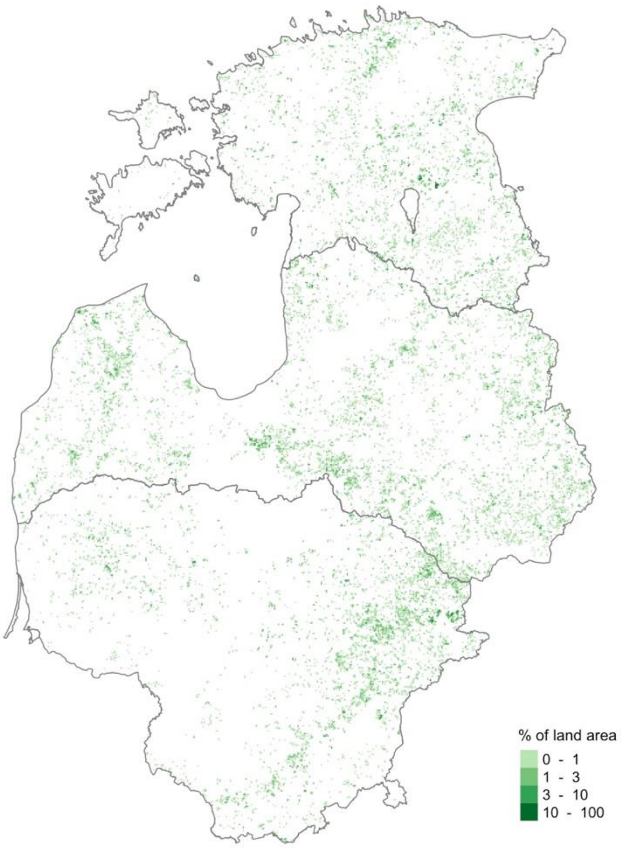
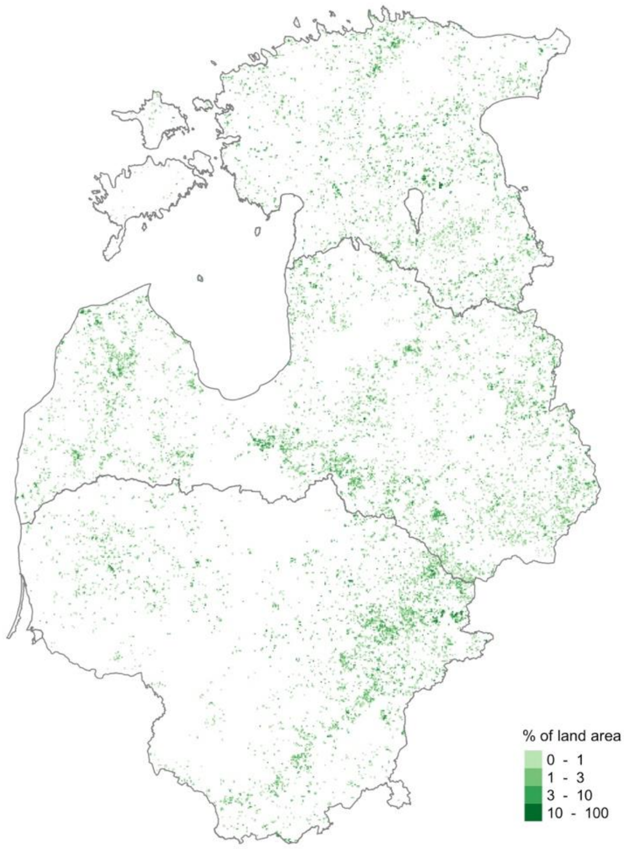
Scenario LVC309

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

Scenario LVC311

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

Scenario LVC312

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)
	

Scenario LVC313

Scenario implementation area (year 2030)	Scenario implementation area (year 2050)