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

MONITORING OF THE SOCIO-ECONOMIC IMPACT OF THE PROJECT ACTIONS (D2)

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LIFE OrgBalt compiled the first regional Baltic/Finnish GHG emission factors for managed nutrient-rich organic soils (current and former peatlands), which have been made available for the customary scientific review and further verification for national GHG inventories in the hemiboreal region in Finland and the Baltic countries. While the project analysed selected CCM measures for drained organic soils in agriculture and forestry and developed spatial models and tools, it also identified remaining knowledge gaps. To bridge the remaining limitations and fill the gaps, it is essential to continue GHG measurements and model development, as well as to broaden and complete the scope of the evaluated CCM measures in the after-LIFE-project period, notably by including rewetting and restoration of peatlands that are currently considered to be among the most recommended CCM measures on drained peatlands in the EU. In addition, the developed Simulation and PPC models still include limited macroeconomic considerations and lack an assessment of all environmental impacts. For all these reasons, these models should be used carefully in CCM strategy development for the identification of gaps in climate neutrality transition policy and funding frameworks and need further optimization for broader applicability as decision-making tools.

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Abbreviations

CAP	-	EU Common Agricultural Policy
CCM	-	Climate change mitigation
CO_2	-	carbon dioxide
ES	-	ecosystem services
LIFE OrgBalt	-	LIFE Programme Project “Demonstration of climate change mitigation potential of nutrients rich organic soils in Baltic States and Finland”
LULUCF	-	land use, land-use change and forestry
PPC	-	Public and private cooperation
RDP	-	Rural Development Programme

SUMMARY

The implementation of the project "Demonstration of climate change mitigation potential of nutrient rich organic soils in Baltic States and Finland" (LIFE OrgBalt, LIFE18 CCM/LV/001158) (Project) includes analysis of the achieved socio-economic development during the Project implementation.

The objectives of Action D2 ”Monitoring of the socioeconomic impact of the Project actions” aims to monitor and evaluate of the socio-economic impacts of the Project activities and also identifying risks in general for the project implementation. To achieve the monitoring goal two main socio-economic monitoring tasks are carried out: Evaluation of socio-economic effects of implemented CCM measures in demo sites and assessing socio-economic effects of the Project outcomes in policy planning. The Project will provide information on quantitative assessment of CCM effect, which is mandatory for implementation of the measures within the scope of CAP and LULUCF action plans.

Within the Assessment, the socio-economic effects of implemented CCM measures in demo sites are measured according to the criteria of investment, profitability and expected returns, employment, costs for territory establishment and maintenance, GHG reduction and ecosystem services. To assess socio-economic effects of the Project outcomes in policy planning, two categories of indicators are defined – (1) policy indicators: recommendations developed based on Project results, advisory and support for policy planning, contribution to achievement of EU and national CCM goals, and (2) stakeholder and society involvement: stakeholder engagement and participation, capacity building and increase of knowledge, collaboration and experience exchange, information and awareness rising.

Implementation of CCM measures was carried out in established demosites (14 in Latvia and 3 in Finland) with the aim to demonstrate the climate change mitigation potential of the specific mitigation practices to be implied in nutrient – rich organic soil management by considering cost-effectiveness. The assessment is based on data obtained within the development of the modelling tools for calculation and estimation of socio-economic benefits of the CCM measures demonstrated within the Project (Public and Private Cooperation (PPC) model and Simulation Model) –quantitative and qualitative information provided by site owners and project partners responsible for the activities in the demonstration sites, other input data based on previous researches and output data of the model estimations and calculations regarding the feasibility of the investments. Qualitative information will be the main source of assessment of the second group of criteria, the effect of the project on the policy planning.

During the implementation of the Project, the transition from the Rural Development Plan as the main document setting priorities, measures and funding for rural development before 2023 to Common Agricultural Policy Strategic Plan for 2023-2027 (CAP SP) took place. CAP SP is a medium-term policy planning document that incorporates all new rural development actions from 2023 onwards and determines support priorities and support instruments in the sectors of agriculture and rural development, as well as LULUCF. the implementation of LIFE OrgBalt project has delivered multiple results in support of policy planning and implementation in aforementioned sectors that may be used for further adaptation in land management practices and possibly integrated into the future Common Agricultural Policy Strategic plans – both as recommendations and proposals for improvement of policy documents and practical tools as support instruments for policy and decision makers.

During the Project a wide range of information and awareness rising activities were implemented to disseminate the research and collected results to provide our stakeholders, which range from researchers to experts, to consultants, to landowners, to local communities, as well as policymakers with practical tools and theoretical conclusions for a better understanding of CCM measures and a better knowledge of their impact.

Various educational, scientific and informative materials were developed – scientific publications (28), popular articles for general public (8), e-newsletters (8), short documentaries (4). Educational and informational events were organised – seminars, training sessions for practical use of developed tools, meetings with target groups, lectures at universities, as well as an international conference (more than 30). Project experts presented the results achieved at important international events, including the UN Climate Change Conference (COP28) in Dubai, sharing and gaining knowledge on the project-related topics.

1. INTRODUCTION

Climate change is one of the greatest environmental, social and economic challenges of our days and the warming of the climate system is unequivocal. Greenhouse gases (GHG) emissions caused by human activities are the most significant driver of the observed climate changes since the mid-20th century. Managed nutrient rich organic soils are one of the largest key sources of GHG emissions in Boreal and Temperate cool and moist (TCM) climate regions in Europe. In these regions managed organic soils usually are drained forests and fens or mires that when efficiently drained can increase GHG emissions. Total area of managed organic soils in EU is 34.5 mill. ha (7% of the EU area).

Organic soils can have high GHG emission as well as carbon storage potential depending on chosen management strategies. The general aim of the LIFE OrgBalt project is to explore the potential of CCM practices that could contribute to a decrease of GHG emissions from drained nutrient-rich organic soils managed for agriculture or forestry purposes and demonstrate how these territories can be managed in a way that is balanced economically, socially, and environmentally. Based on the research and results obtained within the framework of the LIFE OrgBalt project, Association Baltic Coasts have carried out monitoring and assessment of the socio-economic impacts of the Project Actions and the findings are summarised in this deliverable.

The scope of the Action D2 – Monitoring of the socio-economic impact of the Project Actions is to perform socio-economic monitoring assessment of Project-related direct socio-economic impacts of implemented measures (indicators, such as profit, return of investment, etc.) to evaluate effects on people and communities that are directly related with Project activities and indirect socioeconomic impacts, (such as GHG emission reduction, impacts of ecosystem services etc.) as overall effects on people and communities.

Within the Action tasks have been carried out with a focus:

- To evaluate socio-economic effects of implemented CCM measures in demo sites.
- To assess socio-economic effects of the Project outcomes in policy planning and communities.

Within this Action two deliverables are prepared:

1) Initial monitoring report on socio-economic impact of Project Actions (Report “Initial monitoring report on socio-economic impact of project actions” (Deliverable No. D2/1).
2) Final monitoring report on socio-economic impact of Project Actions.

2. SOCIO-ECONOMIC MONITORING APPROACH

2.1 Methodology

In the process of carrying out socio-economic monitoring of the Project Actions it has been determined that changes in the initial approach in monitoring methodology and data collection is required for more consistent analysis of the effects of implemented measures. Instead of initially planned data collection through separate questionnaires, the assessment is based on data obtained through modelling tools developed within the Project (Public and Private Cooperation (PPC) model and Simulation Model) – quantitative and qualitative information provided by site owners and project partners responsible for the activities in the demonstration sites, other input data based on previous researches and output data of the model estimations and calculations regarding the feasibility of the investments. The main reason behind the changes in the methodology and initially defined criteria for the Assessment is the ownership structure of the demonstration sites where the Project CCM measures are demonstrated – majority of scenarios are implemented in publicly owned sites and only three are implemented in the private lands, thus it was not possible to obtain coherent and comparable data on indicators such as income, profit, revenues from production, etc. based on actual values before and after the Project implementation. Therefore, the methodological approach for the Assessment is based on data incorporated in the developed models for estimation of the socio-economic gain of the implemented measures, providing for the analysis of equivalently valued criteria for all CCM scenarios.

The PPC model (https://www.orgbalt.eu/?page_id=2761) was developed within the LIFE OrgBalt project as a functional land management model – a tool for sustainable and climate friendly management of nutrient rich organic soils for calculation of socio-economic benefits and feasibility of the investments. The model is designed to allow the user to assess the performance of organic soils depending on the planned land use type (scenario), based on land use performance criteria: financial return, economic return, financial deficit and the optimal amount of public funding, reduction of GHG emissions and ecosystem services assessment. Based on the findings and using the developed model, it is possible to implement deliberative management decisions of managed nutrient rich organic soils, to evaluate potential management costs, plan the expected financial return, assess the benefits of climate mitigation and consider nature values.

Within the monitoring activities the data were collected and analysed in terms of sustainability of the measures implemented in the demonstration sites, potential benefits for their owners' and managers', and their dissemination potential towards other land owners.

The analysis of data in the PPC model is based on calculations for a land area of one hectare but the time periods differ based on the types of CCM measures and their crop rotation cycles: for agricultural CCM measures calculations are for a 5-year period; for afforestation measures the period is 100 years; but calculations for forestry measures are analysed for the period of 200 years. Data from demonstration sites in Latvia are included in the calculations.

The Simulation Model (https://bioekonomika.lbtu.lv/orgbalt/) was developed as a data-based tool for policy planning and decision making at regional and national level. It allows to evaluate the impact of climate change mitigation measures selected within LIFE OrgBalt project on socio-economic indicators and GHG emission reduction at national level for three Baltic States. The results of the model are not only an impact assessment of GHG emission reduction measures at the national and regional level, but also spatial location of the GHG emission reduction measures. The Simulation tool assesses the effects of various economic activities and policy decisions in agriculture and forestry on profit, employment, and GHG emissions. The Simulation Tool provides estimation data for 2030 and 2050 for all three Baltic States.

The models provide a good insight and evaluation of the measures included in them both at the farm and national level. Though these models should be only considered as complementary tools providing indicative guidance on the costs and benefits of organic soil management choices under the assumptions and input data used in the algorithms (see model descriptive section and report on the models). They are not designed to be the only decision-support tools used.

In the view of the aforementioned changes in the methodology and data collection approach, the list of indicators for the monitoring of the socio-economic impacts of the Project Actions was updated.

2.2 Indicators and criteria

Within this Assessment, selected data extracted from PPC model was used. For the analysis of the valued criteria within the Assessment values of separate components were extracted from the PPC model. The main model output data of financial and economic indicators and their components used in calculations for each potentially implemented CCM are listed below:

1. Financial indicators:

(1) Average investment costs (EUR): The average amount of money spent for the investment – the model calculates the average amount of money what needs to be invested to implement the chosen CCM measure on a x ha land. The amount varies and is influenced by the average costs of territory cleaning, the type of management chosen the status of the drainage system the type of planting culture, the presence or the absence of public funding.

(2) Average notional profitability on net profit: The profitability on net profit is calculated by dividing the cash flow by total revenue and divided by the number of years of the analysed time period (5, 10, 25, 100, 200 years).

(3) Average notional return on equity (ROE): a measure of financial performance calculated by dividing net income by shareholders' equity. The average notional ROE is calculated by dividing the cash flow by the investment costs and divided by the number of years of the analysed time period.

(4) (EUR) Financial Net Present Value (FNPV) (real discount rate: 4%): The net present financial value of the measure's investment. A negative net present value (NPV) forecasts loss, while a positive NPV forecasts profitability. The measure qualifies for attracting public funding if the FNPV is less than 0 EUR.

(5) Financial Internal Rate of Return (%) (FIRR): The financial profitability of measure investments. If the FIRR is higher than the discount rate used in the calculation (4%), then the measure has sufficient revenue to cover the investment and operating costs, and possibly EU co-financing is not needed or is needed in a smaller amount.

2. Economic indicators:

(1) Reduction of GHG emissions (tonnes / year): The total reduction of GHG emissions in tons obtained as a result of the CCM measure implementation.

(2) GHG emission reduction value (EUR): The economic value attributed to obtained GHG emissions reduction. The yearly economic benefits for the reduction of GHG emissions (EUR) is calculated by multiplying the predicted GHG emissions reduction value (t/ha), by the price attributed to that reduction (EUR/t CO_2 eq.) and by the size of the land area (ha).

(3) Value of ecosystem services (EUR): An estimation of the value of ecosystem services, based on previous researches.

(4) Economic Net Present Value (ENPV) total value (EUR) (real discount rate 5%): The net present economic value of the measure.

(5) Economic Internal Rate of Return total value (EIRR) (%): Economic profitability of measure investments. If the ERR is greater than the social discount rate, then the measure is socio-economically beneficial for society. (4) and (5) can be calculated both with or without ecosystem services value.

3. Funding gap:

(1) Eligible costs (EUR): Amount of costs that can be considered for a funding request.

(2) Financing deficit rate (%): The financial deficit is the part of the investment costs that is not covered by the measure's net income. The financing deficit is the amount of public financing for the measure to be profitable for its implementer (FNPV = 0 EUR). The financial deficit determines the maximum amount of public funding to be attracted for measure implementation.

(3) Decision amount (EUR) (Relative amount funding gap rate).

4. Cost effectiveness:

(1) Investment payback period (years).

(2) GHG reduction costs (EUR / tonne): The total reduction of GHG emission costs obtained as a result of the measures implementation in EUR. For the emission reduction price, the value 50 EUR/t CO_2 eq. is used.

For detailed information on the PPC model calculations and data sources please see the Project deliverable No. C 2/5 "Filling knowledge gaps in GHG emissions from nutrients rich drained organic soils" https://www.orgbalt.eu/wp-content/uploads/2024/08/2022_C2_5-Methodology-of-the-socio_economic-analysis.docx.pdf).

The Simulation Model assesses the effects of various economic activities and policy decisions in agriculture and forestry on *profit*, *employment*, *and GHG emissions*, and data of these estimates were used in the Assessment.

Updated list of indicators for the monitoring of the socio-economic impacts of the Project Actions is given in the Table 1.

Table 1. Indicators for assessment of socio-economic effects of the Project in demonstration sites

Criteria	Indicators
GHG reduction *(PPC model data)*	• Reduction of GHG emissions (tonnes/year) • GHG reduction costs (EUR/tonne)
GHG reduction *(Simulation Tool estimates)*	• GHG reduction (t CO_2 eq.)
Profitability *(PPC model data)*	• Return of investment (years) • Revenues from agriculture and forestry production (EUR) • Income from quota or other public funding (EUR)
Profitability *(Simulation Tool estimates)*	• Profit (EUR)
Investment costs *(PPC model data)*	• Territory establishment costs (EUR) • Planting material, planting costs (EUR) • Harvesting costs (EUR)
Maintenance costs *(PPC model data)*	• Maintenance of established culture • Repair and maintenance costs
Ecosystem services *(PPC model data)*	• Monetary values of ecosystem services (EUR/ha) • Ecosystem services yearly value coefficients

Employment *(Project data)*	• Engaged employees • Total days and hours worked per year • Personnel costs
Employment *(Simulation Tool estimates)*	• Employment (full time persons)

For the assessment of socio-economic effects of the project outcomes on communities and policy planning data from project progress reports is analysed. This part of the assessment focuses on the contribution of the LIFE OrgBalt project to the improvement of sectoral strategies and action plans to reduce GHG emissions from organic soils, as well as Project achievements for stakeholder and society involvement, including indicators on stakeholder engagement, capacity building, collaboration and awareness rising (Table 2).

Table 2. Indicators for assessment of socio-economic effects of the project outcomes on communities and policy planning

Criteria	Indicators
Policy planning *(Project data)*	• Recommendations developed based on Project results • Advisory and support for policy planning • Contribution to achievement of EU and national CCM goals
Stakeholder and society involvement *(Project data)*	• Stakeholder engagement and participation • Capacity building and increase of knowledge • Collaboration and experience exchange • Information and awareness rising

3. SCENARIOS AND DEMONSTRATION SITES

3.1 Scenarios

The assessment of socio-economic effects of CCM measures implemented in demonstration sites within the LIFE OrgBalt project is carried out as a comparative analysis of the indicator values for three categories of scenarios: agricultural sector measures, afforestation measures implemented on agricultural land, and forest sector measures. (See Table 3).

Table 3. Scenarios of CCM measures implemented in demonstration sites

Agricultural sector CCM measures	
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing
LVC304	Introduction of legumes in conventional farm crop rotation
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period
Measures involving complete or partial afforestation	
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)
LVC303	Paludiculture – afforestation of grassland with black alder and birch
LVC306	Agroforestry – fast growing trees and grass
LVC310	Fast growing species in riparian buffer zones
Forest sector CCM measures	
LVC307	Application of wood ash after commercial thinning in spruce stand
LVC308	Continuous forest cover as a forest regeneration method in spruce stand
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems
LVC311	Riparian buffer zone in forest land planted with black alder
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems
LVC313	Strip harvesting in pine stand

The analysis of data in the PPC model is based on calculations for a land area of one hectare for different time periods: 5-year period for agricultural CCM measures calculations, 100-year period for afforestation measures, and 200-year period for forestry measures. Calculations include data from demonstration sites in Latvia.

The Simulation Tool provides estimation data for 2030 and 2050 for all three Baltic States for the scenarios of CCM measures excluding agricultural sector scenarios LVC304 (Introduction of legumes in conventional farm crop rotation) and LVC305 (Controlled drainage of grassland).

3.2 Demonstration sites

In total, 17 demonstration sites are included in the LIFE OrgBalt project, however, the PPC model calculations are based on data from 14 Latvian demonstration sites.

The demonstration sites in Latvia are located in central, northeastern and southwestern parts of the country. The location of the demonstration sites is depicted in Figure 1.

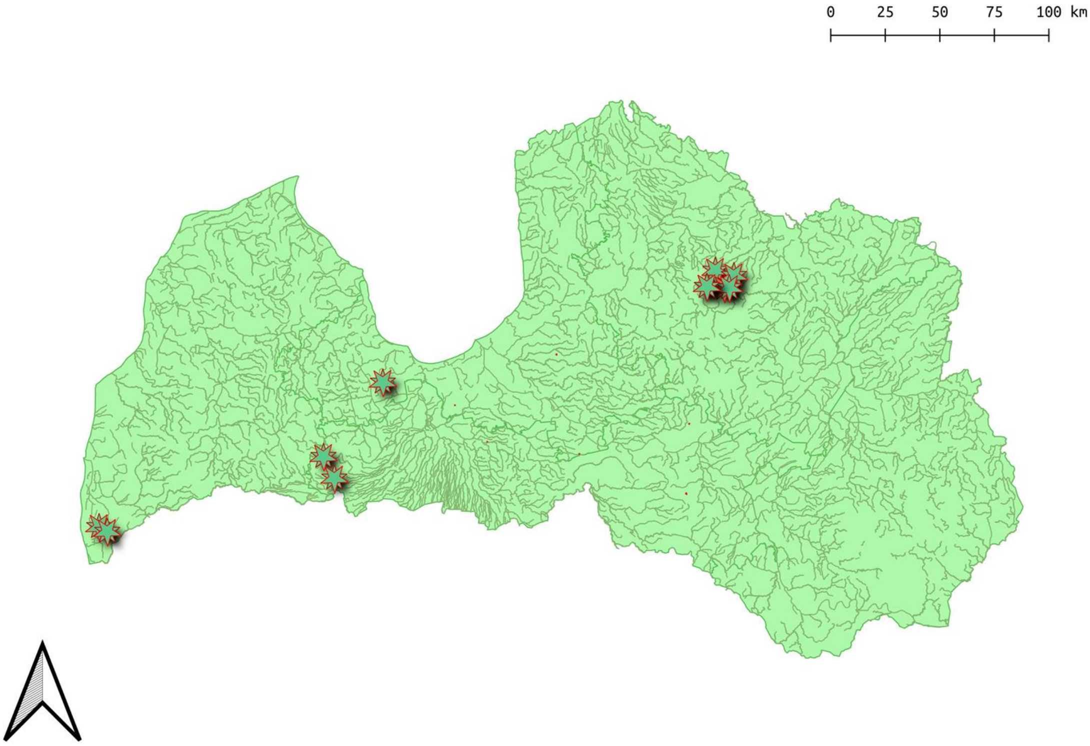

Figure 1. **Location of the demonstration sites in Latvia** (Source: LIFE OrgBalt project materials).

The forest management sites in Latvia are owned by the Public Agency "Forest Research Centre", which is co-owned by the Project partners Latvian State Forest Research Institute "Silava" and Latvian University of Life Sciences and Technologies. The agricultural land sites in Latvia are owned by Latvian University of Life Sciences and Technologies. Additionally, forest soil pilot projects are implemented in private farm "Andrupēni". Growing of legumes in the integrated cropping system is implemented in site owned by SIA "Latvijas grauds" and SIA "Jaunkaudzītes" The overview of the demonstration sites for implementation of CCM measures and their ownership is given in Table 4.

Table 4. Overview of the demonstration sites and implemented CCM measures

Scenario	CCM measure	CCM benefits	Owner / main stakeholder
LVC301	Conversion of cropland used for cereal production into grassland considering periodic ploughing	Benefits of cropland conversion to grassland: ✓ Reduced GHG emissions from soil ✓ Increased carbon stock in soil and below-ground biomass ✓ Reduced risks of nutrient leaching and soil erosion	Private, farm "Andrupēni"
LVC304	Growing of legumes in the integrated cropping system to increase carbon input and reduce N_2O	Benefits of legumes in conventional 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	LLC "Latvijas grauds" LLC "Jaunkaudzītes".

Scenario	CCM measure	CCM benefits	Owner / main stakeholder
	emissions	✓ Increased carbon input with plants ensuring increased soil carbon stock	
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	Benefits of controlled drainage: ✓ Reduced GHG emissions from organic soils due to reduced fluctuations of groundwater level ✓ Reduced leaching of nutrients to surface water bodies ✓ In summer drought additional water is available to meet crop demand ensuring higher carbon inputs into soil	Latvian University of Life Sciences and Technologies
LVC302	Conventional afforestation considering shorter rotation	Benefits of afforestation: ✓ Reduced GHG emissions from soil ✓ Accumulation of CO_2 in living and dead biomass, soil and litter and replacement effect of forest biofuel and harvested wood products ✓ Shorter rotation and more intensified management ensure higher yield and replacement effect, as well as reduces carbon losses due to root rot and other disturbances	Public agency “Forest Research Centre”
LVC303	Paludiculture – afforestation of grassland with black alder and birch	Benefits of establishment of forest paludiculture in rewetted grassland: ✓ Reduced GHG emissions from soil due to improvement of water regime by mounding and establishment of network of shallow furrows to drain exceeding surface water ✓ Reduction of risks associated with natural disturbances in forests with wet organic soils ✓ Accumulation of CO_2 in living and dead biomass, soil and litter and replacement effect of forest biofuel and harvested wood products	Public agency “Forest Research Centre”
LVC306	Agroforestry - fast growing trees and grass	Benefits of agroforestry: ✓ Increased CO_2 removals in living biomass and soil ✓ Reduced GHG emissions from soil and replacement effect of woody and herbaceous biofuel and harvested wood products	Private, farm “Andrupēni”
LVC310	Fast growing species in riparian buffer zones	Benefits of fast-growing species in riparian buffer zones: ✓ Increased CO_2 removals in living biomass and soil ✓ Replacement effect of woody and herbaceous biofuel and harvested wood products ✓ Avoided nutrients leakage from farmlands	Private, farm “Andrupēni”
LVC307	Application of wood ash after commercial thinning in spruce stands	Benefits of wood ash application in forest on organic soils: ✓ Increased CO_2 removals in living biomass, dead wood, soil, litter and harvested wood products due to improved growth conditions and additional increment in living biomass	Public agency “Forest Research Centre”
LVC308	Selective harvest as alternative to clear-felling in spruce forest	Benefits of selective felling: ✓ Reduced CH_4 and N_2O emissions from soil due to avoiding of increase of the groundwater level after harvesting	Public agency “Forest Research Centre”

Scenario	CCM measure	CCM benefits	Owner / main stakeholder
LVC309	Regeneration of forest stand with wet organic soil by mounding and planting of black alder – forest paludiculture	Benefits of forest stand regeneration without reconstruction of drainage systems (from naturally wet or rewetted organic soils): ✓ Reduced GHG emissions from soil due to improvement of water regime by mounding and establishment of network of shallow furrows to drain exceeding surface water ✓ Reduction of risks associated with natural disturbances in forests with wet organic soils ✓ Accumulation of CO_2 in living and dead biomass, soil and litter and replacement effect of forest biofuel and harvested wood products	Public agency “Forest Research Centre”
LVC311	Planting of black alder on mounds nearby buffer zones of natural streams – forest paludiculture	Benefits of improved planting of black alder in riparian buffer zone: ✓ Reduced GHG emissions from soil due to improvement of water regime by mounding and establishment of network of shallow furrows to drain exceeding surface water ✓ Reduction of risks associated with natural disturbances in forests with wet organic soils ✓ Accumulation of CO_2 in living and dead biomass, soil and litter and replacement effect of forest biofuel and harvested wood products	Public agency “Forest Research Centre”
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	Benefits of forest regeneration with coniferous trees without reconstruction of drainage systems: ✓ Reduced GHG emissions from soil due to improvement of water regime by mounding and establishment of network of shallow furrows to drain exceeding surface water ✓ Reduction of risks associated with natural disturbances in forests with wet organic soils ✓ Accumulation of CO_2 in living and dead biomass, soil and litter and replacement effect of forest biofuel and harvested wood products	Public agency “Forest Research Centre”
LVC313	Strip harvesting as alternative to clear-felling in pine forest	Benefits of strip harvesting: ✓ Reduced CH_4 and N_2O emissions from soil due to avoiding of increase of the groundwater level after harvesting in comparison to clear-felling	Public agency “Forest Research Centre”

4. SOCIO-ECONOMIC ASSESSMENT OF IMPLEMENTED CCM MEASURES IN DEMONSTRATION SITES

4.1 GHG reduction

The PPC model provides calculations for the reduction of GHG emissions as tonnes per year and GHG reduction costs per tonne.

The GHG emissions reductions initially included in the model are taken from researches from the Latvian State Forest Research Institute "Silava". In the process of the testing of the model it was updated with additional data on GHG emissions, obtained as a results of the LIFE OrgBalt project's research conducted on the project demonstration sites where impacts of the CCM measures were studied. The yearly reduction values are summarised in Table 5.

The yearly economic benefits for the reduction of GHG emissions (EUR) is calculated by multiplying the predicted GHG emissions reduction value (t/ha), by the price attributed to that reduction (EUR/t CO_2 eq.) and by the size of the land area (ha). For the emission reduction price, the value 50 EUR/t CO_2 eq. is used. The model provides calculations for the minimum and maximum values for each scenario, and the minimum values are analysed in the assessment (Table 6).

Table 5. Reduction of GHG emissions (tonnes/year)

Reduction of GHG emissions		(tonnes / year)
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	0,55
LVC304	Introduction of legumes in conventional farm crop rotation	-0,64
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	3,25
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)	22,94
LVC303	Paludiculture – afforestation of grassland with black alder and birch	21,06
LVC306	Agroforestry – fast growing trees and grass	31,26
LVC310	Fast growing species in riparian buffer zones	31,3
LVC307	Application of wood ash after commercial thinning in spruce stand	1,19
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	1,28
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems	-1,02
LVC311	Riparian buffer zone in forest land planted with black alder	0,73
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	1,05
LVC313	Strip harvesting in pine stand	0,12

Measure LVC305 shows the highest reduction in GHG emissions at 3.25 tonnes/year, while LVC301 reduces emissions by 0.55 tonnes/year. Interestingly, LVC304 has a negative reduction of -0.64 tonnes/year, indicating an increase in emissions.

All afforestation measures show a significant reduction in GHG emissions, ranging from 21.06

tonnes/year for LVC303 to 31.26 tonnes/year for LVC306 and LVC310.

LVC308, LVC309, LVC311, LVC312, and LVC313 show positive reductions in GHG emissions, indicating their effectiveness in mitigating climate change. However, LVC309 has a slight negative reduction (-1.02 tonnes/year).

Table 6 shows the GHG emission reduction costs per tonne obtained as a result of the measures implementation in EUR. Values are not indicated for scenarios where reduction of GHG emissions is not estimated.

Table 6. GHG reduction costs (EUR/tonne)

GHG reduction costs (minimal values)*		**(EUR / tonne)**
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	1205,22
LVC304	Introduction of legumes in conventional farm crop rotation	-
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	214,4
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)	2,29
LVC303	Paludiculture – afforestation of grassland with black alder and birch	1,37
LVC306	Agroforestry – fast growing trees and grass	5,51
LVC310	Fast growing species in riparian buffer zones	5,51
LVC307	Application of wood ash after commercial thinning in spruce stand	18,92
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	20,11
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems	-
LVC311	Riparian buffer zone in forest land planted with black alder	19,88
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	15,92
LVC313	Strip harvesting in pine stand	182,76

Within the assessment the estimates of the Simulation Model were used for selected indicators. The Simulation Tool is developed as a data-based tool for policy planning and decision making at regional and national level. It allows to evaluate the impact of climate change mitigation measures selected within LIFE OrgBalt project on socio-economic indicators and GHG emission reduction at national level for three Baltic States. The Simulation Model assesses the effects of various economic activities and policy decisions in agriculture and forestry on profit, employment, and GHG emissions (Table 7). Values are not indicated for scenarios and time periods with estimated increase of GHG emissions.

Table 7. GHG reduction (t CO_2 eq.)

GHG reduction (t CO_2 eq.)*		LATVIA		ESTONIA		LITHUANIA	
		2030	**2050**	**2030**	**2050**	**2030**	**2050**
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	-33 844	-66 881	-17 181	-34 973	-44 840	-89 390
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)	-1 507 504	-1 387 231	-445 985	-423 569	-2 157 960	-2 020 582
LVC303	Paludiculture – afforestation of grassland with black alder and birch	-925 661	-1 867 025	-273 851	-570 067	-1 325 063	-2 719 430
LVC306	Agroforestry – fast growing trees and grass	-377 373	-1 657 059	-139 843	-631 194	-495 859	-2 215 331
LVC310	Fast growing species in riparian buffer zones	-80 905	-356 169	-53 768	-244 593	-119 628	-534 863
LVC307	Application of wood ash after commercial thinning in spruce stand		-72 675		-142 953		-58 521
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	-250	-8 622	-211	-3 837	-255	-5 771
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems		-110 213		-15 550		-20 679
LVC311	Riparian buffer zone in forest land planted with black alder		-15 873		-10 104		-27 700
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	-7 114	-7 099	-5 953	-5 037	-6 529	-5 856
LVC313	Strip harvesting in pine stand	-2 143	-4 515	-1 241	-2 295	-157	-276

Results show that 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. By 2050, an additional increase in wood volume is expected, resulting in a significant reduction in GHG emissions due to the increase in biomass. 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 (Figure 2).

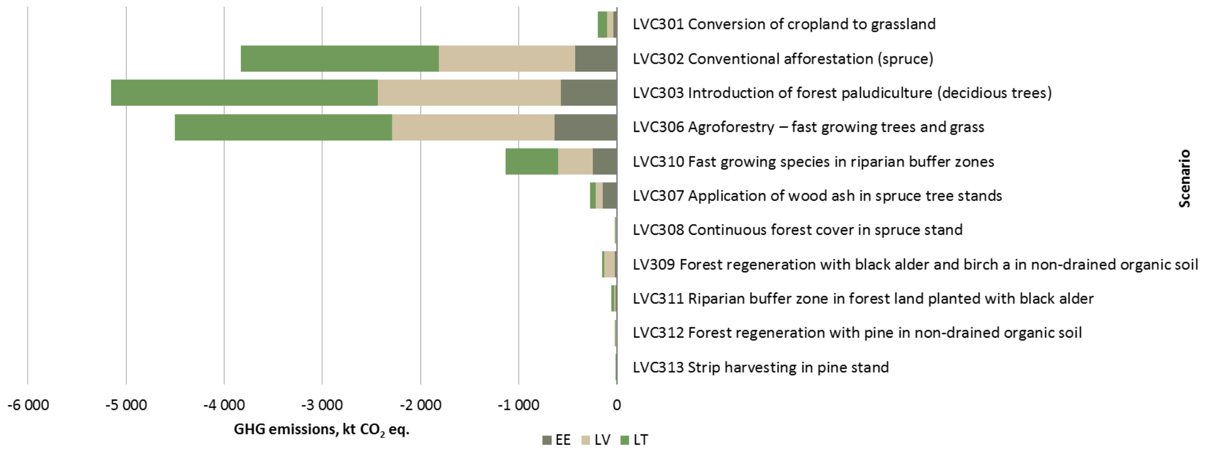

Figure 2. **Impact on GHG emissions in 2050.** (Source: LIFE OrgBalt Project materials)

4.2 Profitability

The PPC model calculates profitability as the average notional amount of revenue calculated after deducting all expenses. Total revenue include revenue from sales and support payments if any. For the analysis of the profitability criteria within the Assessment values of separate components were extracted from the PPC model.

4.2.1 ROI Return of investment

One of the indicators characterising profitability and cost efficiency is measured in ROI (return of investment) – see the table below.

Table 8. Return of investment (years)

Income – Return on investment (longest periods)		Years
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	2,48
LVC304	Introduction of legumes in conventional farm crop rotation	3,22
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	3
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)	60,22
LVC303	Paludiculture – afforestation of grassland with black alder and birch	70,39
LVC306	Agroforestry – fast growing trees and grass	26,14
LVC310	Fast growing species in riparian buffer zones	26,17
LVC307	Application of wood ash after commercial thinning in spruce stand	60,25
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	60,37
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems	70,53
LVC311	Riparian buffer zone in forest land planted with black alder	70,37
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	80,11
LVC313	Strip harvesting in pine stand	78,87

Agricultural CCM: From the data presented in the table, it can be inferred that measure LVC301 has the shortest return on investment period at 2.48 years, followed by LVC305 at 3 years and LVC304 at 4.73 years. A shorter return period signifies quicker recoupment of the initial investment.

Afforestation CCM: LVC302 have the longest payback periods, with a return on investment of 61.11 years which is related that measure provides afforestation with Spruce.

Forest CCM: LVC308, LVC312, and LVC313 also show relatively shorter payback periods compared to LVC311 and LVC309, which have no return on investment within the 200-year period analysed.

4.2.2 Agriculture and forestry production (EUR)

For scenarios implemented on agricultural land, values for revenue from sales are obtained as the product of culture's price, productivity's points and the land area. In this Assessment the minimal values calculated by the model are taken into account (Table 9). Real discount rate of 5% is applied for these calculations.

Table 9. Income from agriculture and forestry production

Income – Agriculture and forestry production (EUR/ha) (minimal values)		**5 yrs**	**100 yrs**	**200 yrs**
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	6494,22		
LVC304	Introduction of legumes in conventional farm crop rotation	7971,78		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	6494,22		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		2521,51	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		522	
LVC306	Agroforestry – fast growing trees and grass		15135,3	
LVC310	Fast growing species in riparian buffer zones		15135,3	
LVC307	Application of wood ash after commercial thinning in spruce stand			1984,06
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			2664,84
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			1273,32
LVC311	Riparian buffer zone in forest land planted with black alder			539,07
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			940,37
LVC313	Strip harvesting in pine stand			1998,84

The highest income as revenues from sales of production per one hectare among the agricultural sector scenarios in 5-yer period is expected for LVC304 (7 971 EUR/ha), the other two scenarios – LVC301 and LVC305 delivering slightly less income (6 494 EUR/ha).

From afforestation CCM measures most profitable are LVC306 and LV310 both for introducing fast growing trees – in 100-year period 15 153 EUR/ha. For LVC302 significantly less income from sales is estimated – 2 521 EUR/ha, and the least among all the scenarios is for LVC303 involving paludiculture in the estimated amount of 522 EUR/ha.

According to model data, the most profitable in 200 years among forestry sector scenarios is LVC308 with 2 664 EUR/ha, following by LVC307 and LVC313 (1 984 EUR/ha) and LVC309 (1 273 EUR/ha). Least income is expected from implementation of LVC312 with 940 EUR/ha and LVC311 with 539 EUR/ha.

4.2.3 Income from quota or other public funding

This indicator measures the amount of available support payments for growing the respective crops or support for forest planting, agrotechnical maintenance, or maintenance for young tree stands. The values do not include support for the creation or reconstruction of melioration systems (Table 10).

Table 10. Income from quota or other public funding (EUR)

Income – Income from quota or other public funding (EUR/ha)		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	765,6		
LVC304	Introduction of legumes in conventional farm crop rotation	840		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	1690		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		2610	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		2610	
LVC306	Agroforestry – fast growing trees and grass		5225	
LVC310	Fast growing species in riparian buffer zones		5220	
LVC307	Application of wood ash after commercial thinning in spruce stand			1262,4
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			420,8
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			1262,4
LVC311	Riparian buffer zone in forest land planted with black alder			1262,4
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			1262,4
LVC313	Strip harvesting in pine stand			1262,4

From analysed agricultural CCM measures the highest available public funding is for LVC305 (1 690 EUR/ha), which is approximately twice as much as for scenarios LVC304 (840 EUR/ha) and LVC301 (765 EUR/ha).

From afforestation CCM measures the highest rate of public funding is allocated for LVC306 and LV310 – 5 225 EUR/ha and two times smaller amount for LVC302 and LVC303 – 2 610 EUR/ha.

For the forestry CCM scenarios support payments are provided in the same amount of 1 262 EUR/ha, except LVC308 with only 420 EUR/ha.

Simulation Tool estimates of expected profit from implementation of the Project CCM measures are shown in the Table 11. Values are not indicated for scenarios and time periods with estimated loss of profit.

Table 11. Profit (EUR)

Profit (thous. EUR)		LATVIA		ESTONIA		LITHUANIA	
		2030	2050	2030	2050	2030	2050
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing						
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)						
LVC303	Paludiculture – afforestation of grassland with black alder and birch						
LVC306	Agroforestry – fast growing trees and grass		47 294		17 519		63 624
LVC310	Fast growing species in riparian buffer zones		10 185		6 777		15 370
LVC307	Application of wood ash after commercial thinning in spruce stand		3 160		8 229		1 895
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	630	1 366	204	454	453	661
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems						
LVC311	Riparian buffer zone in forest land planted with black alder						
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems						
LVC313	Strip harvesting in pine stand	5 439	6 700	1 872	3 314	242	337

By 2050, profits are expected to decline in all scenarios except for LVC306. In the LVC306 scenario, profits increase in 2050 because the fast-growing trees have reached cutting age (Figure 3). 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.

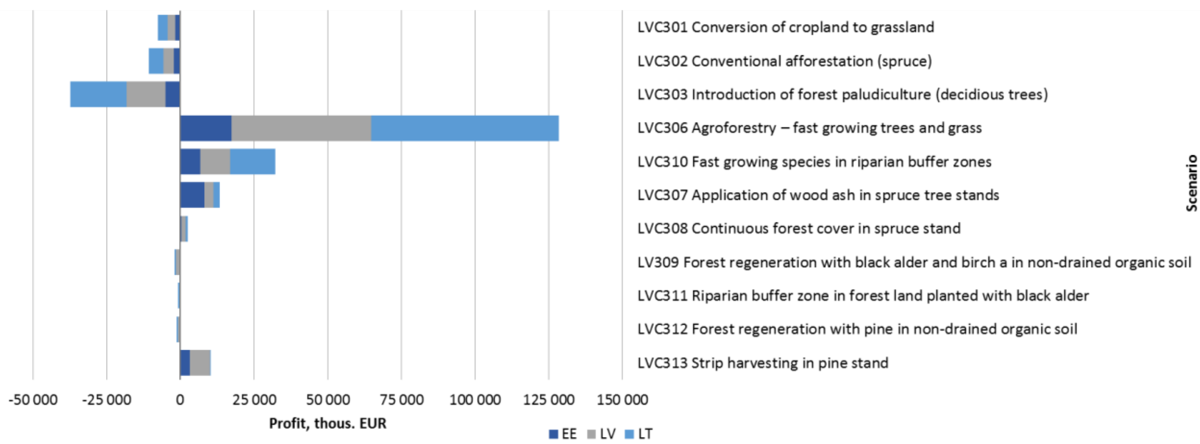

Figure 3. **Impact on profits in 2050.** (Source: LIFE OrgBalt Project materials)

4.3 Investment costs

4.3.1 Average investment costs

The PPC model calculates the average amount of money to be invested to implement the chosen CCM measure per ha land. The amount varies and is influenced by the average costs of territory cleaning, the type of management chosen (for agricultural land – integrated vs organic), the status of the drainage system (in good conditions, reconstruction needed, new ditch system required) the type of planting culture, the presence or the absence of public fundings (Table 12).

Table 12. Average investment costs

Average investment costs (EUR)		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	2022,00		
LVC304	Introduction of legumes in conventional farm crop rotation	5878,25		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	2502,81		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		3427,14	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		1677,14	
LVC306	Agroforestry – fast growing trees and grass		5112,27	
LVC310	Fast growing species in riparian buffer zones		4112,27	
LVC307	Application of wood ash after commercial thinning in spruce stand			2102,14
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			3604,60
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			1352,14
LVC311	Riparian buffer zone in forest land planted with black alder			2460,15
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			1875,15
LVC313	Strip harvesting in pine stand			2102,14

The highest average investment costs for implementation of agricultural CCM measures are determined for LVC304 in the amount of 5 878 EUR/ha, which is also the highest amount among all the analysed scenarios. Approximately twice less is required for LVC301 (2 022 EUR/ha) and LVC305 (2 502 EUR/ha).

Highest average investment costs for measures involving afforestation are expected for LVC306 – 5 112 EUR/ha, followed by LVC310 (4 112 EUR/ha), LVC302 (3 427 EUR/ha), and the lowest for LVC303 – 1 677 EUR/ha.

Forestry sector CCM have the highest average investment costs for LVC308 – 3 604 EUR/ha, less by one third for LVC311 – 2 460 EUR/ha. Calculated costs for LVC307 and LVC313 are 2 102 EUR/ha for both, slightly less for LVC312 – 1 875 EUR/ha and the least amount for LVC309 – 1 352 EUR/ha.

4.3.2 Territory establishment costs

Within the assessment, model data regarding costs for territory establishment and investment (planting, material and harvesting) are analysed separately. (Table 13)

Table 13. Territory establishment costs

Territory establishment costs (EUR/ha)		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	100,14		
LVC304	Introduction of legumes in conventional farm crop rotation	0		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	100,14		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		1125,38	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		625,38	
LVC306	Agroforestry – fast growing trees and grass		7750,76	
LVC310	Fast growing species in riparian buffer zones		7750,76	
LVC307	Application of wood ash after commercial thinning in spruce stand			6238,07
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			912,69
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			2738,07
LVC311	Riparian buffer zone in forest land planted with black alder			1238,07
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			1238,07
LVC313	Strip harvesting in pine stand			4738,07

For implementation of agriculture CCM there are no territory establishment costs necessary for LVC304. Establishment of measures within LVC301 and LVC305 is estimated at 100 EUR/ha, which is the lowest value among all the analysed scenarios.

Among the scenarios involving afforestation measures on agricultural land, the next lowest costs are for LVC303, and double amount required for LVC302 – 1 125 EUR/ha. Calculated costs for territory establishment in LVC306 and LVC310 are 7 750 EUR/ha, which is the highest value considering all the scenarios.

Next highest value for this indicator is estimated for the forestry sector CCM scenario LVC307 – 6 238 EUR/ha, followed by LVC313 with 4 738 EUR/ha. Territory establishment costs for LVC309, LVC311 and LVC312 are 1 238 EUR/ha, and the lowest costs in the forestry sector are expected for LVC308 – 912 EUR/ha.

4.3.3 Planting material, planting costs

Another component of investment costs analysed in the model is expenses required for planting material and planting activities (Table 14)

Table 14. Planting material, planting costs

Investment costs – planting material, planting costs (EUR/ha)		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	379,14		
LVC304	Introduction of legumes in conventional farm crop rotation	757,7		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	379,14		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		2654,28	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		1154,28	
LVC306	Agroforestry – fast growing trees and grass		6948	
LVC310	Fast growing species in riparian buffer zones		6180	
LVC307	Application of wood ash after commercial thinning in spruce stand			1731,42
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			577,14
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			1731,42
LVC311	Riparian buffer zone in forest land planted with black alder			1731,42
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			1731,42
LVC313	Strip harvesting in pine stand			1731,42

From agriculture measures the highest planting material and planting costs are for LVC304 – 757 EUR/ha, but LVC301 and LVC305 require 379 EUR/ha.

Afforestation measures LVC306 and LVC310 will require the highest amount of investment for planting among all the analysed scenarios – 6 949 and 6 180 EUR/ha.

Costs for forestry sector CCM measures are estimated at 1 731 EUR/ha, except for the scenario LVC308 involving wood ash application – a significantly less amount of 577 EUR/ha.

4.3.4 Harvesting costs

Model calculations for harvesting costs are summarised in Table 15.

Table 15. Harvesting costs

Investment costs – harvesting costs (EUR/ha) (minimal values)		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	1273,2		
LVC304	Introduction of legumes in conventional farm crop rotation	608,95		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	1273,2		

Investment costs – harvesting costs (EUR/ha) (minimal values)		5 yrs	100 yrs	200 yrs
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		11910,65	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		5799,19	
LVC306	Agroforestry – fast growing trees and grass		28383,77	
LVC310	Fast growing species in riparian buffer zones		28383,77	
LVC307	Application of wood ash after commercial thinning in spruce stand			33423,55
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			32737,72
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			25012,9
LVC311	Riparian buffer zone in forest land planted with black alder			11126,93
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			15971,82
LVC313	Strip harvesting in pine stand			24272,83

Harvesting costs for agriculture CCM measures are the lowest – for LVC301 and LVC305 – 1 273 EUR/ha, and for LVC304 – 757 EUR/ha.

Afforestation CCM measures LVC306 and LVC310 will require 28 383 EUR/ha for harvesting, for LVC302 the amount is 11 910 EUR/ha and the lowest expenses are calculated for LVC303 – 5 799 EUR/ha.

Among the forestry sector scenarios, the highest costs are estimated for LVC307 (33 423 EUR/ha) and LVC308 (32 737 EUR/ha). Similar harvesting costs are calculated for LVC313 (24 272 EUR/ha) and LVC309 (25 012 EUR/ha), and lower costs for LVCLVC312 (15 971 EUR/ha) and LVC311 (11 126 EUR/ha).

4.4 Maintenance costs

Another group of indicators related to necessary investment for the implementation of analysed CCM scenarios is maintenance costs, which are extracted from the PPC model separately as maintenance of established culture and repair and maintenance costs.

4.4.1 Maintenance of established culture

According to the model data, costs for maintenance of established culture in all scenarios do not have vast differences, if compared with values of other indicators. See Table 16.

Table 16.. Maintenance of established culture

Maintenance costs – Maintenance of established culture		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	1018,54		
LVC304	Introduction of legumes in conventional farm crop rotation	1225,6		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	1018,54		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		1012,83	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		1012,83	
LVC306	Agroforestry – fast growing trees and grass		2749,11	
LVC310	Fast growing species in riparian buffer zones		2749,11	
LVC307	Application of wood ash after commercial thinning in spruce stand			2170,35
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			434,07
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			1591,59
LVC311	Riparian buffer zone in forest land planted with black alder			1591,59
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			1591,59
LVC313	Strip harvesting in pine stand			1591,59

Maintenance costs of established culture in agriculture CCM scenarios are estimated at 1 225 EUR/ha for LVC304, and 1 018 EUR/ha for both LVC301 and LVC305.

The highest costs are for afforestation CCM measures LVC306 and LVC310 – 2 749 EUR/ha. For LVC302 and LVC303 estimated costs are similar to agriculture scenarios – 1 012 EUR/ha.

Forestry CCM measure LVC307 have the second highest amount of 2 170 EUR/ha and the lowest among all analysed scenarios for LVC308 – 434 EUR/ha. Other forestry measures will require 1 591 EUR/ha.

4.4.2 Repair and maintenance costs

Table 17. Repair and maintenance costs

Maintenance costs – Repair and maintenance costs		5 yrs	100 yrs	200 yrs
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	125		
LVC304	Introduction of legumes in conventional farm crop rotation	125		
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	125		
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		3822	
LVC303	Paludiculture – afforestation of grassland with black alder and birch		590	
LVC306	Agroforestry – fast growing trees and grass		5908	
LVC310	Fast growing species in riparian buffer zones		5908	
LVC307	Application of wood ash after commercial thinning in spruce stand			8498
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			2386
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			2426
LVC311	Riparian buffer zone in forest land planted with black alder			1055
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			1393
LVC313	Strip harvesting in pine stand			1977

CCM measures in agricultural sector will require the lowest repair and maintenance costs of 125 EUR/ha.

For CCM scenarios involving afforestation measures LVC306 and LVC310 expected costs are 5 908 EUR/ha, followed by LVC302 with 3 822 EUR/ha, but LVC303 have the second lowest result – 590 EUR/ha.

The highest value for this indicator is calculated for forestry CCM scenario LVC307 involving wood ash application – 8 498 EUR/ha. Repair and maintenance for the rest of forestry measures vary from 1 055 EUR/ha for LVC311 to 2 386 EUR/ha for LVC308.

4.5 Employment

For the direct impacts of the LIFE OrgBalt Project on employment the following indicators were analysed:

- Engaged employees
- Total days and hours worked
- Personnel costs

Assessment is carried out based on Project data (Table 18).

Table 18. Overview of employment indicator values of the OrgBalt project

Beneficiary	Engaged employees	Days	Productive hours in project	Personnel costs, EUR
SILAVA	15	2 950	23597	310 097,0
BaltCoasts	15	1 716	13728	275 258,5
LAMMC	10	1 231	9847	133 163,5
LULSaT	16	1 753	14022	248 814,2
Luke	65	1 920	15363	581 777,4
MA	5	1 519	12154	148 988,2
MSF	2	585	4681	153 156,6
UT	14	3 248	25987	457 399,3
Total	**142**	**14 922**	**119379**	**2 308 654,7**

Overall, the LIFE OrgBalt project has employed 142 persons over a 5-year period. Gender distribution is reasonably equal – 67 male and 75 female employees. In total, the engaged employees worked 14 922 days and the number of productive spent hours in the Project is 119 379. The work in the Project has generated personnel costs in the amount of EUR 2 308 654.

Project effects on employment are also analysed based on Simulation Tool estimates. The developed Simulation Tool for policy planning and decision making at regional and national level assesses the effects of various economic activities and policy decisions in agriculture and forestry, including employment. The Table 19 below shows the estimated impact on employment in Latvia, Estonia and Lithuania resulting from implementation of CCM scenarios. Data is not indicated for scenarios and time periods with estimated reduction in employment.

Table 19. Employment

Employment (full time persons)		LATVIA		ESTONIA		LITHUANIA	
		2030	2050	2030	2050	2030	2050
LVC30 1	Conversion of cropland used for cereal production to grassland considering periodic ploughing						
LVC30 2	Conventional afforestation considering shorter rotation conventional afforestation (spruce)						
LVC30 3	Paludiculture – afforestation of grassland with black alder and birch						
LVC30 6	Agroforestry – fast growing trees and grass		74		32		

LVC310	Fast growing species in riparian buffer zones				11		
LVC307	Application of wood ash after commercial thinning in spruce stand	1	12	2	32	1	7
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	3	3	1	2	2	2
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems	136	64	15	7	26	13
LVC311	Riparian buffer zone in forest land planted with black alder	14	7	11	8	28	16
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	40	22	25	11	33	17
LVC313	Strip harvesting in pine stand	20	20	8	17	1	2

The implementation of scenarios LVC301, LVC302, and LVC303 results in a reduction in employment by 2050 (Figure 4). This is because employment prior to the implementation of these scenarios on agricultural land depends on specific land use and management activities. Greater employment opportunities arise in 2050 when thinning or regeneration cuts are carried out in areas that have reached the specified age.

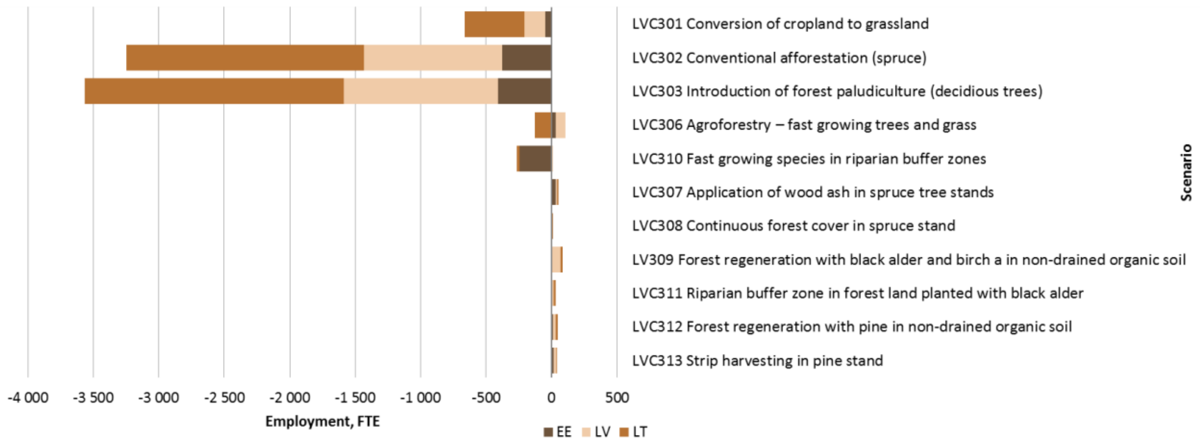

Figure 4. **Impact on employment in 2050.** (Source: LIFE OrgBalt Project materials)

4.6 Ecosystem services

Agroecosystems, are defined as communities of plants and animals interacting with their physical and chemical environments that have been modified by people to produce food, fibre, fuel and other products for human consumption and processing (Maes, 2018). To a very large degree these are managed ecosystems, the maintenance of which in good condition requires balance in the use of natural resources while maintaining biodiversity, in the supply of a set of ecosystems services, and in the necessity to fulfil the needs of current as well as of future generations.

Agriculture provides a diverse range of benefits to human well-being. The concept of ecosystem services (ES) is used to demonstrate the benefit of nature to human well-being. Besides primarily producing food, fodder, fibre, and fuel, agriculture plays a crucial role, for example, in carbon storage, maintaining nutrient and hydrological cycles, hydrological flow regulation, biodiversity conservation, including pest regulation, pollination, erosion, bio-remediation and diversity of genetic resources. Also, agricultural activity is also linked to a wide range of less tangible ES, as sustaining rural economies and cultural heritage, as well as scenic beauty and recreation. In this sense, agricultural systems can be considered multifunctional, as they fulfil several purposes simultaneously. However, agricultural management often generates trade-offs between functions, e.g., maximisation of biomass production versus conserving biodiversity, resulting in outcomes that are detrimental to long-term environment and socio-economic sustainability. To promote informed decisions and sustainable agricultural management, integrated and systems-based approaches are needed in science, policy and practice.

Activities within the LIFE OrgBalt project are not principally aimed at improvement of ecosystems and supply of services they provide; however, implementation of the CCM measures demonstrated in the Project are expected to have contributing effect to the quality of ecosystems and their functions. Thus, ecosystem services present an important group of indicators.

It is determined that all proposed measures will contribute to the reduction of the greenhouse gas emissions and thus the carbon omission from the atmosphere in longer or shorter run. Apart from this straightforward achievement, it is given that all scenarios contribute to improved landscape. In many cases, especially when it involves felling and consequent afforestation it will be a lengthy process, which will take decades.

Restoration of wetlands, grasslands and planting of new forest stands will contribute positively to formation of biodiversity and habitats. Additionally, forests are supposed to produce forest goods, however it cannot be expected in substantial amounts in the nearest years in the new forest sites.

Within the Project, estimation of the value of ecosystem services has been carried out based on previous researches. Values of such ecosystem services, as food or goods from the direct produce, are already included in the calculations of the Income criterion indicators within the PPC model, which assesses all potential income sources from the proposed management scenarios. For better overview and analysis in the socio-economic context the model data on monetary values of the ecosystem services and defined coefficients of use for the CCM scenarios and respective analysed periods are extracted from the model separately and summarised in the tables below.

The model takes into consideration monetary values of regulating and cultural ecosystem services, as well as provision services for agricultural CCM scenarios. Data are secondary since currently there are no definitive results for ecosystem services indicators from the LIFE OrgBalt project demonstration sites. This data is not statistic, but rather dynamic since it takes into consideration the development of culture and forest (Table 20).

Table 20 Monetary values of ecosystem services

Monetary value of ecosystem services EUR/ha		Provision services	Regulatory services	Cultural services	Total
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	817,00	1 509,00	4 119,00	**6 445,00**
LVC304	Introduction of legumes in conventional farm crop rotation	639,00	327,00	140,00	**1 106,00**
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	742,00	4 506,00	4 379,00	**9 627,00**
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)	0,00	6 706,00	2 143,00	**8 849,00**
LVC303	Paludiculture – afforestation of grassland with black alder and birch	0,00	6 706,00	2 143,00	**8 849,00**
LVC306	Agroforestry – fast growing trees and grass	0,00	6 706,00	2 143,00	**8 849,00**
LVC310	Fast growing species in riparian buffer zones	0,00	6 706,00	2 143,00	**8 849,00**
LVC307	Application of wood ash after commercial thinning in spruce stand	0,00	6 706,00	2 143,00	**8 849,00**
LVC308	Continuous forest cover as a forest regeneration method in spruce stand	0,00	6 706,00	2 143,00	**8 849,00**
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems	0,00	6 706,00	2 143,00	**8 849,00**
LVC311	Riparian buffer zone in forest land planted with black alder	0,00	6 706,00	2 143,00	**8 849,00**
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems	0,00	6 706,00	2 143,00	**8 849,00**
LVC313	Strip harvesting in pine stand	0,00	6 706,00	2 143,00	**8 849,00**

For the calculation of the values of ecosystem services for implemented CCM scenario for each of the analysed periods, the model applies ecosystem services yearly value coefficients depending on the crop rotation cycle. In cases where the use of ecosystem services does not depend on the crop/plantation production cycle, etc. factors, the full value "1" is attributed to the entire project life cycle, e.g. for scenario LVC304. Table 21 below shows the yearly value coefficients for the analysed scenarios for their respective time periods, as well as description when full values are reached within the crop production cycles for each scenario.

Table 21. Ecosystem services yearly value coefficient

Ecosystem services coefficient (years)		5 yrs	100 yrs	200 yrs	Full values in rotation cycle
LVC301	Conversion of cropland used for cereal production to grassland considering periodic ploughing	1,00			by yr 4
LVC304	Introduction of legumes in conventional farm crop rotation	1,00			for full cycle
LVC305	Controlled drainage of grassland considering even groundwater level during the whole vegetation period	1,00			by yr 4
LVC302	Conventional afforestation considering shorter rotation conventional afforestation (spruce)		0,70		every 60 yrs for 2 yrs

Ecosystem services coefficient (years)		5 yrs	100 yrs	200 yrs	Full values in rotation cycle
LVC303	Paludiculture – afforestation of grassland with black alder and birch		0,53		every 70 yrs for 3 yrs
LVC306	Agroforestry – fast growing trees and grass		0,73		every 20 yrs for 3 yrs
LVC310	Fast growing species in riparian buffer zones		0,73		every 20 yrs for 3 yrs
LVC307	Application of wood ash after commercial thinning in spruce stand			0,34	every 50 yrs for 10 yrs
LVC308	Continuous forest cover as a forest regeneration method in spruce stand			1,00	by yr 60 then every ca. 10 yrs, full value yrs 97-120, next cycle after 25 yrs
LVC309	Semi-natural regeneration of regeneration felling site with grey alder without reconstruction of drainage systems			1,00	every 40 yrs for 30 yrs
LVC311	Riparian buffer zone in forest land planted with black alder			0,77	every 70 yrs for 3 yrs
LVC312	Forest regeneration (coniferous trees) without reconstruction of drainage systems			0,63	every 75 yrs for 5 yrs
LVC313	Strip harvesting in pine stand			0,61	by yr 65 for 3 yrs after 10 yrs red for 10 yrs

Monetary values of ES in agricultural scenarios are highest for LVC305 Controlled drainage of grassland and lesser ES value by third is for LVC301 Conversion of cropland to grassland, both reaching the full yearly value coefficient by 4th year and maintaining for entire project period further. Smallest ES values are for LVC304 Introduction of legumes in conventional farm crop rotation with a full value of ES yearly value coefficient for entire project time.

ES values for all afforestation and forestry sector scenarios are the same, not taking into account provision services. For scenarios LVC306 Agroforestry – fast growing trees and grass and LVC310 Fast growing species in riparian buffer zones full values are reached by every 20 years for 3 years, and for analysed 100year period respective values are 0,73 for both scenarios. LVC302 Conventional afforestation considering shorter rotation conventional afforestation (spruce) reaches full value every 60 years for 2 years, and for the analysed period has a coefficient value of 0,70. LVC303 Paludiculture – afforestation of grassland with black alder and birch has full value by every 70 years of the rotation cycle, and has a coefficient value of 0,50 in the analysed time period.

Forest scenarios LVC308 Continuous forest cover as a forest regeneration method in spruce stand and LVC311 Semi-natural regeneration with grey alder without reconstruction of drainage systems have full value coefficients for the analysed period of 200 years, but their production cycles vary. LVC308 reaches full value by year 60 and then every ca. 10 years after slight reduction, then maintaining full value from year 97 till 120. Next full value is reached in 25 years and production cycle is the same. LVC309 has more steady rotation cycle – full value every 40 years and is maintained for 30 years.

Scenarios LVC311 Riparian buffer zone in forest land planted with black alder and LVC312 Forest regeneration (coniferous trees) without reconstruction of drainage systems have coefficients of 0,77 and 0,63 for the analysed time period, their rotation cycles being every 70 years for 3 years for LVC311 and every 75 years for 5 years for LVC312.

Scenario LVC313 has a coefficient of 0,61 in the time period and reaching full value by year 65 of rotation cycle for 3 years, followed by 10 years of slight reduction and maintaining full value for next 10 years, after which the cycle repeats.

The least Es value coefficient of forest CCM scenarios at the analysed 200-year time period is for LVC308 Application of wood ash after commercial thinning in spruce stand, which has a steady rotation cycle with full value for 10-year period after every 50 years.

4.7 Overall assessment of the scenarios

Achieving a balance between productivity and climate mitigation in organic soil management necessitates a comprehensive understanding of the trade-offs involved. Sustainable practices that enhance soil carbon sequestration, maintain soil fertility, and optimise agricultural productivity are essential for addressing the challenges posed by climate change while ensuring the long-term sustainability of agriculture and forestry sector. By quantifying these trade-offs, researchers and policymakers can develop sustainable land management practices that optimize both productivity and carbon storage while maintaining ecosystem health and resilience.

Almost each of the demonstrated CCM measures in organic soils have different nature, environmental and climate impacts (irrigation, drainage, afforestation, etc), therefore, further research of clear benefits and adverse effects is necessary. There are various studies investigated these relationships, shedding light on potential trade-offs and synergies, emphasising the importance of managing forests and agriculture land for multiple ecosystem services while considering trade-offs. For example, the trade-offs between two soil functions – primary productivity and C cycling and storage in response of intervention of drainage systems in agriculture lands. The results show that at the current CO_2 price, the agronomic benefits are larger than the monetised environmental costs.

Agriculture CCM measures financial return is larger and payback period is shorter than that of forestry measures, it must be considered that these sets of measures provide annual income but on the other hand, compared to forestry measures, risks related to weather conditions (droughts, frosts, snowless winters, flooding, hail, etc.) may be comparatively higher for the harvest. The PPC Model reveals that over a five-year period, in agricultural organic soils, the most financially and economically beneficial CCM measure in LVC305, which involves the Controlled drainage of grassland, followed by LVC301, the Conversion of cropland to grassland.

For afforestation measures over a 100-year period, the CCM measures with the best financial and economic returns are Agroforestry with fast-growing trees and grass (LVC306) and planting fast-growing species in riparian buffer zones (LVC310). Conversely, Conventional afforestation with Spruce (LVC302) is not as financially beneficial due to its long payback period. Model shows that all afforestation measures are related to significantly bigger cumulative reductions of GHG emissions than other sets of measures because of much more significant changes in land use. Investment costs and financial return differ significantly due to growth rate of selected species and lengths of rotation periods respectively. Measures related to planting fast growing tree plantations are the most profitable within the group of afforestation measures taken into consideration, while the least profitable is the set of measures related with planting of black alder and excluding the maintenance of drainage systems.

In forest lands, the most financially and economically beneficial measure is the Application of wood ash in coniferous tree stands (LVC307). Other measures, such as Strip harvesting in pine stands (LVC313), Forest regeneration with pine in non-drained organic soil (LVC312), Riparian buffer zone in forest land planted with black alder (LVC311), and Continuous Forest cover in spruce stands (LVC308), show relatively large economic value based on GHG emission reduction and ecosystem services but indicate a negative financial outcome for foresters. Therefore, public funding support should be considered for these measures.

The overview of the financial, economic and environmental benefits of the CCM measures is given in the Table 22.

Table 22. Overview of implemented CCM scenarios and their effectiveness

CCM measures		
Agricultural CCM measures		
LVC301 **Conversion of cropland to grassland**		The measure with limited efficiency, but also with the smallest investments and low level of risk to reach the mitigation effect. Can be improved by implementation of controlled drainage system.
LVC304 **Introduction of legumes in crop rotation**		Positive effect can be reached in agriculture sector, but no in LULUCF sector. Further studies are necessary on carbon uptake in plant residues and to productivity of following rotation of crops.
LVC305 **Controlled drainage of grassland**		The measure has theoretical positive effect; however, study results do not prove it. The studies should be continued to evaluate the long-term effect of the measure, particularly on the crop yield, and the possibilities of improving its effectiveness.
Afforestation CCM measures		
LVC302 **Conventional afforestation (spruce)**		The measure has the best ratio of the GHG emission reduction effect and the potential impact of natural disturbances (the level of risk to reach the mitigation effect}. Proper management should be applied during the whole rotation period. The effect can be increased by application of mineral fertilisers and wood ash.
LVC303 **Paludiculture – afforestation of grassland with black alder and birch**		The measure can significantly reduce GHG emissions, but it is associated with a high risk of natural disturbances that reduce or even result in negative effect. Proper management actions can be remedial drainage system, planting trees on larger mounds. The effect can be increased by application of mineral fertilisers and wood ash.
LVC306 **Agroforestry – fast growing trees and grass**		The measure provides the greatest effect of reducing GHG emissions, but additional plant protection measures must be implemented. The effect of different species and management techniques needs to be further evaluated. Amendments to the regulatory environment are necessary - permissible duration of rotation should increasing the 20-25 years or not regulated at all. The effect can be increased by application of mineral fertilisers and wood ash.
LVC310 **Fast growing species in riparian buffer zones**		The measure provides the second largest GHG emission reduction effect, but the potential for the measure's implementation is small if most of the organic soils are afforested. The measure can be recommended for implementation, but additional plant protection measures should be implemented. Selection of "animal tolerant" species will reduce the mitigation effect, but also - the risk.
Forestry CCM measures		
LC307 **Application of wood ash in spruce stand**		The measure with the quickest and at the same time long lasting GHG emission mitigation effect in areas with organic soils with minimal risk of natural disturbances. The measure has great potential for implementation, limited only by the availability of wood ash.
LVC308 **Continuous forest cover as a forest regeneration method in spruce stand**		The measure contributes to reduction of GHG emissions from the soil in short term, but it increases the logging area by at least 3-4 times, increases the risk of natural disturbances, particularly in spruce stands, and prevents the use of the breeding effect. The measure is more suited for boreal climate zone.
LVC309 **Semi-natural regeneration with black alder without reconstruction of drainage systems**		Research on the effectiveness of the measure should be continued, as the available information does not accurately reflect various aspects of the measure, especially the reduction of the risk of natural disturbances and the long-term impact on the GHG emissions from soil.
LVC311 **Riparian buffer zone in forest land planted with black alder**		Research on the effectiveness of the measure must be continued. The implementation potential and the effect are significantly limited by the management conditions in the protective zones of natural water streams.

LVC312 **Forest regeneration (coniferous trees) without reconstruction of drainage systems**		The effectiveness of the measure is influenced by different factors compared to deciduous tree stands. Additional issue is considerably higher risk of natural disturbances.
LVC313 **Strip harvesting in pine stand**		The effectiveness of the measure has not been proved, and the research should be continued, especially to assess the effect of size of the openings on the course of tree growth and soil GHG fluxes.

5. ASSESSMENT OF THE SOCIO-ECONOMIC EFFECTS OF THE PROJECT OUTCOMES ON COMMUNITIES AND POLICY PLANNING

5.1 Policy planning

The implementation of LIFE OrgBalt project has delivered multiple results in support of policy planning and implementation in aforementioned sectors that may be used for further adaptation in land management practices – recommendations and proposals for improvement of policy documents, improved national GHG inventory and practical tools as support instruments for policy and decision makers.

5.1.1 Proposals for sectoral strategies and action plans to reduce GHG emissions from organic soils

Proposals for improvement of sectoral strategies and action plans to reduce GHG emissions from organic soils are developed to provide comprehensive and transparent information on the situation in Latvia and the project partner countries, and in the European Union (EU) as a whole. Organic soil management and GHG accounting improvements are crucial for climate policy as it is now. There are many policy documents - legislative acts, strategies and action plans - not only in the partner countries but also on EU level, which can benefit from improved CCM measures, especially when incorporated in a model that can give the overall picture on both farm level and regionally. The most important documents where the CCM measures can be implemented are the Common Agriculture Policy and National Climate and Energy Plans.

Proposals for Common Agriculture Policy

During the implementation of the Project, the transition from the Rural Development Plan as the main document setting priorities, measures and funding for rural development before 2023 to Common Agricultural Policy Strategic Plan for 2023-2027 (CAP SP) took place. CAP SP is a medium-term policy planning document that incorporates all new rural development actions from 2023 onwards and determines support priorities and support instruments in the sectors of agriculture and rural development, as well as LULUCF.

In the Latvia`s CAP Strategic Plan 2023 – 2027 the main identified weakness is lack of up-to-date spatial information on the actual distribution of organic soils in Latvia, as well as deficiency of reliable information on soil carbon stocks that hamper to identify the level of carbon rich soils on agricultural land. Based on the results of the LIFE Restore project, priority is given to actions to promote afforestation of organic and non-productive soils, thus reducing GHG emissions and increasing CO_2 sequestration.

Developed proposals provide a framework to incentivise more climate-friendly land use, supporting development of climate-smart agriculture practices and promoting greater visibility for the climate benefits by creating incentive mechanisms to encourage individual actors to climate-smart agriculture practices for possible introduction into national CAP SPs as eco-schemes for organic soils.

Updating the National energy and climate plan

National energy and climate plan (NECP) is a long-term energy and climate policy planning document that sets out Latvia's national energy and climate policy framework, objectives and courses of action for the period up to 2030. The NECP includes measures to reach the goals of the non-ETS and LULUCF sectors. Most Member States submitted their draft NECP's at the end of 2023 and the EC have prepared recommendations. The measures in the draft NECP's for most

Member States have been pointed out not to be sufficient by the EC. In July 2024, Latvia submitted the updated NECP, including proposals of several LULUCF measures demonstrated in LIFE OrgBalt:

- Use of wood ash for soil enrichment/fertilization in drained organic soil forests
- Rewetting/paludiculture in cropland/grassland organic soils – afforestation with black alder together with rewetting
- Afforestation of organic soils where rewetting isn't possible
- Trees, hedges along ditches
- Group of trees in pastures (0.09 ha per 1 ha of pasture) – agroforestry

5.1.2 Advisory and support for policy planning

Improvement of national GHG inventory

Over a two-year period, LIFE OrgBalt project has carried out measurements of GHG fluxes and other environmental variables in agricultural and forest land with nutrient-rich drained organic soils of different land use types, different moisture and other factor conditions. Improving GHG inventory methods used in assessment and projections of GHG emissions and carbon sequestration in the management of nutrient-rich organic soils results in more transparent, accurate, complete, comparable and consistent data for the national GHG inventory thereby supporting efforts to mitigate and adapt to climate change.

The inventories help policymakers set targets and identify areas and sectors where actions should be taken in order to achieve a reduction in GHG emissions and adhere to international agreements.

Improvement of GHG inventory calculation methods (regionally specific GHG emission factors) and activity data sets is crucial for more precise GHG inventory calculations and GHG emission projections.

Filling knowledge gaps on activity data

Activity data {e.g. land use and management practices and conditions) is one of the most important elements of the GHG calculation and projections from organic soils, especially if change in climate conditions is considered in modelling. A set of maps as a practical tool for planning sustainable soil management activities, both in the forestry and agricultural sectors was developed.

Depth-to-water maps for the entire territory of the Baltic States – the single source of information that allows modelling of water accumulation sites by showing water table depth in meters.

Wet area maps for the territory of the Baltic States are generated in 5 m horizontal resolution and depict the surface of water objects, areas and possible accumulation areas of surface water.

Wet area maps can be used in a variety of forestry and agricultural areas. Wet area maps can be used to plan the movement of heavy forestry and agricultural machinery, thus reducing the risk of soil damage, to select the most suitable tree and crop species for specific forest and agricultural areas, as well as in other respects.

Simulation Model for policymakers

The simulation model is a policy planning / decision support tool for projections of GHG emissions and socio-economic consequences of selected management options and initial conditions. The Simulation model is designed to reflect activity data, emission factors and socio-economic estimates. It includes geospatial information layers with data on soil, water and land use related indicators in all target countries.

- Simulation model is developed as a data-based support tool for policy planning and decision-making at a regional and national level.
- It evaluates the impact of climate change mitigation measures on socio-economic benefits of various land-management approaches and GHG emission reduction at national level for the Baltic States.
- Results of Simulation model also demonstrate potential locations of the GHG emission reduction measures.

5.1.3 Contribution to achievement of EU CCM targets and national commitments

Implementation of the Project Actions have contributed to achievement of climate change mitigation targets set out in EU regulatory framework and respective national commitments.

Under **LULUCF regulation**, EU Member States have to ensure that accounted GHG emissions from land use, land use change or forestry are balanced by at least an equivalent accounted removal of CO_2 from the atmosphere through action in the sector. This is known as the "no debit" rule. The scope is extended from only forests to all land uses (including wetlands by 2026), contributing to reaching our long-term climate mitigation objectives.

The revised Regulation consists of two phases:

- Phase 1 from 2021 to 2025: For the period from 2021-2025, the goal of each member state, including Latvia, is to ensure that GHG emissions in its territory do not exceed the base level of removals.
- Phase 2 from 2026 to 2030: This phase enlarges the territorial scope to cover all managed land and introduces the EU-wide target of -310 Mt CO_2 equivalent of net removals by 2030.

EU Forest Strategy for 2030, Target 3 "Protecting, restoring and enlarging EU's forests to combat climate change, reverse biodiversity loss and ensure resilient and multifunctional forest ecosystems" In light of climate change and biodiversity loss there is an urgent need for adaptive forest restoration and ecosystem-based management approaches that strengthen the resilience of EU forests. This is a precondition for forests to be able to deliver on their socio-economic and environmental functions for future generations, to preserve, protect and multiply ecosystem services provided by forests that are providing habitats for the variety of living species they host. The Project contributes to improvement of forest resilience and adaptation by actions addressing protection and restoration of forest biodiversity and adoption of biodiversity-friendly forest management practices.

Nature Restoration Law is a key step in avoiding ecosystem collapse and preventing the worst impacts of climate change and biodiversity loss. Restoring EU wetlands, rivers, forests, grasslands, marine ecosystems, urban environments and the species they host is a crucial and cost-effective investment: into our food security, climate resilience, health, and well-being. In the context of the Nature Restoration Law, the LIFE OrgBalt project and its approaches can be used as a knowledge base for accelerating nature restoration on drained peatlands across Europe.

The upcoming Carbon Removal Certification Framework (CRCF) Regulation foresees that measures for organic soils would have to include raising the water to be within the scope of the certification. This means that it will not be possible to use financing from the sale of carbon credits for measures that do not include raising the water table – for example, afforestation on drained organic soils. Voluntary carbon certification schemes also follow a similar approach.

The sale of carbon credits (where applicable), ETS and ETS2 revenues, JTF, CAP, private and national public financing should be considered as possible financing for CCM measures for organic soils.

What should be considered in the policy implementation scope is that rewetting was not considered as a form of CCM measure within the LIFE OrgBalt project. This was mostly because at the time of preparing the project proposal this measure was not as researched and promoted as it is now. When implementing CCM measures in policy, we should consider rewetting as well, as it is one of the acknowledged CCM measures for organic soils, therefore, there should be a continuation of this type of project that continues exploring the potential of various CCM measures, this time, including rewetting of organic soils. Future research is needed:

1. Support for research to improve understanding of soil carbon dynamics and sustainable soil management practices to obtain robust data on EF’s for the national GHG inventories is needed. Continuous emission measurements at typical locations should be preferred.
2. Before the implementation of sustainable management practices on a large scale, support for research on evaluation of the impact of these practices on socio-economic indicators on a local and national scale is required.
3. Development of hydrological regime modelling tools should be supported to remotely assess areas suitable for growing forests with optimal moisture regimes and areas where rewetting can be performed without intentional tree planting.

5.2 Stakeholder and society involvement

5.2.1 Stakeholder engagement and participation

During the Project a wide range of information and awareness rising activities were implemented to disseminate the research and collected results to provide our stakeholders, which range from researchers to experts, to consultants, to landowners, to local communities, as well as policymakers with practical tools and theoretical conclusions for a better understanding of CCM measures and a better knowledge of their impact.

By 22/08/2024 more than 1312 e-mails were sent (and received) to interested stakeholders (e-mails sent directly to stakeholders in process of dissemination of the published 8 newsletters). Altogether 524 persons participated in the National and training workshops on climate change mitigation measures for nutrient rich organic soils in each partner country (Finland 78 participants, Germany 75 participants, Lithuania 100 participants, Estonia 77 participants, Latvia 194 participants).

On 19/05/2022 the Opening event of the demonstration sites of climate change mitigation measures with the visit to demonstration of controlled drainage and conversion of cropland to grassland in Vecauce (Latvia) parish. Total number of participants was 32 persons. In addition, by 22/08/2024 the project partners in different combinations participated in different levels networking and awareness raising events where they shared the information about the Project and its activities. The total number of participants in described events was 1501 persons.

Altogether by 22/08/2024 number of participants in LIFE OrgBalt project’s events, external networking events and e-mails sent to stakeholder’s, reached 3965 persons, that exceeds the planned value of the indicator in Project proposal.

5.2.2 Capacity building and increase of knowledge

Research

The project has positively impacted the broader scientific community by bringing together Baltic and Finnish research teams in the field, providing a platform for research collaboration and sharing of experiences, as well as building up skills to communicate the research results in a well-understandable way to a wide audience of stakeholders including policymakers.

The research and data analysis carried out within LIFE OrgBalt has provided valuable insights into the effectiveness of various mitigation strategies, providing policymakers with evidence-based guidance to inform their decision-making processes. At the moment, policy makers are faced with the complex task of implementing climate change mitigation measures in various policy areas. It is especially challenging in the land use sector as emissions fluxuate and are harder to predict.

The research performed by LIFE OrgBalt experts has resulted in the collection of a large amount of data, and a considerable number of scientific articles on drained, nutrient-rich organic soil characteristics and emissions (28). Moreover, the Project has delivered regionally harmonised field protocols and methodology for GHG monitoring, biomass related measurements, quantifying annual production, carbon inputs with dead biomass and carbon loss rates, characterisation of soil microbial communities, soil screening with infrared spectroscopy and soil and water analyses.

The project's research group included scientists with diverse experience, thus providing the best knowledge available in the region, as well as allowing the buildup of further research capacity.

Support tools

In addition to a valuable contribution to the research field, the project has developed important tools to provide landowners and institutions with a socio-economic analysis of the implemented measures. A collaborative approach has been chosen in developing the model bringing together a diverse array of stakeholders who helped providing input and useful feedback during the testing phase.

The developed public and private sector cooperation model (PPC model) is a functional land management model as a tool for climate change mitigation and sustainable soil management. The aim of the model is to suggest innovative land management practices and its main target audience is landowners. The model demonstrates how these important territories can be managed while ensuring that economic, social, and climate mitigation benefits are achieved.

The PPC model is created to examine the benefits and costs of proposed CCM practices, financing opportunities, institutional arrangements and enabling conditions that could motivate the implementation of CCM measures. The model provides landowners with helpful specific financial and socio-economic indicators for each CCM measure implemented in the project relating them to a specific land plot which is entered by users based on the current characteristics of their land. Achieving a balance between productivity and climate mitigation in organic soil management demands a comprehensive understanding of the trade-offs involved. Sustainable practices that enhance soil carbon sequestration, maintain soil fertility, and optimize agricultural productivity are essential for addressing the challenges posed by climate change while ensuring the long-term sustainability of agriculture and forestry sector. By quantifying these trade-offs, researchers and policymakers can develop sustainable land management practices that optimise both productivity and carbon storage while maintaining ecosystem health and resilience.

Capacity building

LIFE OrgBalt organised two workshops and training sessions in each Project participant countries – Latvia, Estonia, Lithuania, Finland, and Germany, engaging more than 500 participants. The activities were designed to disseminate the research findings, introduce significance and influence of policy initiatives on organic soil management and enable practical use of supportive tools developed for the sustainable management of nutrient rich organic soils. National workshops included external expert presentations who gave the participants an insight on organic soil management good practices in partner countries for knowledge exchange. National workshops and Training sessions were focused on main Project target groups – landowners and managers, farmers and foresters, NGOs, rural and forestry advisors, scientific organisations as well as policy planners.

5.2.3 Networking and experience exchange

In the course of the LIFE OrgBalt project, knowledge, experience exchange and networking activities took place with more than 15 other projects and partners operating in similar or related fields in Germany, Denmark, Great Britain, Iceland, Finland, Belgium, Lithuania, Estonia and Norway. In total Project partners participated in 43 external events, with at 1950 participants in person and least 1600 remotely.

5.2.4 Information and awareness rising

Website. In period of 01/08/2022 – 14/08/2024 the website had 3628 sessions or unique visits, and in total 16080 page views. Project website performance's cumulative statistics since the beginning of the project (01/08/2019 – 14/08/2024): 10031 individual visitors or users and 41098 pageviews that exceeds the planned value of the indicator in Project proposal.

Print media is to be measured by number of printed materials distributed to the Project` stakeholders` audience. Data gathering – information on printed and distributed materials. The first printed material, the leaflet, has been printed in all project languages altogether in 1500 printed copies. Digital version available in OrgBalt webpage. Due to the COVID-19 created obstacles all project events were held digitally, and the distribution rate of paper leaflets is growing, in total 136 pieces distributed (that is 6,8 % of total planned 2000 no of individuals planned project proposal). The leaflet was developed by BC in cooperation with WG Communication.

Altogether 700 printed copies of layman's report have been developed, 200 copies in English, and 500 copies in project partners languages (100 copies per each respectively).

Additionally, the booklet has been printed in 1200 copies in english and digital copies in project partner's languages have been developed and published. Both the booklet and layman's report have been distributed at project's events, such as the final conference and in-person national and training workshops.

Film/broadcasts. By 22/08/2024 4 short documentaries are published on LIFE OrgBalt youtube channel and website, each in Project 6 language versions with subtitles. The total number of views of the 1st short documentary in digital channels is 353 views, number of views of 2nd short documentary in the digital channels is 215 views and the number of 3rd short documentary in the digital channels is 216. The documentaries on the project's website have also been viewed 51 times. Altogether number of views of the documentaries and video materials in digital channels reached is 835 views.

In addition, two other video materials have been developed within the project: 1) short video about installation of the Project notice boards at the project demonstration sites (44 views in digital channels) and 2) short retrospective video about the Opening event of the demonstration sites of climate change mitigation measures with the visit to demonstration of controlled drainage and conversion of cropland to grassland in Vecauce (Latvia) parish on 19/05/2022 (13 views in digital channels).

In addition to digital channels documentaries and video materials has been demonstrated in several

Project events and events project partners participated with the project dissemination activities – 3 events with total participant number of 61 persons as well as on the first day of the project's final conference with 77 participants.

The popular national TV broadcast "Environmental facts" ("Vides fakti") produced and published in 11/06/2022 broadcast a story about the Project and the documentary and demonstrated partly 2nd documentary (source: https://ltv.lsm.lv/lv/raksts/11.06.2022-vides-fakti.id264066). The audience of each series of the broadcast is 50000 people.

Altogether by 22/08/2024 project videos, outside the ''Environmental facts'' (''Vides fakti'') broadcast have been viewed 976 times (that is 9.76 % of total planned number 10000 views of short documentary in Project proposal). Including the ''Environmental facts'' broadcast on 11/06/2022, the reach of the film is over 50'000 people which exceeds the the planned value of the indicator in Project proposal.

By 22/08/2024 altogether 26 articles, 8 newsletters, 4 press releases and a leaflet in all 6 Project languages is published in Projects main webpage www.orgbalt.eu.

By 14/08/2024 8 newsletters are published in Projects main webpage www.orgbalt.eu and in addition to the publishing all newsletters are sent to stakeholders and interested parties through e-mail. Newsletters have been sent to 1312 e-mail addresses.

The number of page views of published popular articles, technical articles, articles for general public, press release and leaflets on the Projects main webpage www.orgbalt.eu is 4388 pageviews (from the beginning of the project – 14/08/2024).

The value of the indicator – the number of digital reaches of published popular articles, technical articles, articles for general public, press release and leaflets on the Projects main webpage is 6457 downloads (01/08/2021 – 14/08/2024) and 9685 downloads from the beginning of the Project by 14/08/2024, that exceeds the planned value of the indicator in Project proposal.

Altogether the reach, evaluated by the number of downloads of articles and newsletters from the website, e-updates from the newsletters sent out from the start of the Project by 14/08/2024 is over 15385 (including pageviews) or 10997 (excluding pageviews), which exceeds the planned value of the indicator in Project proposal.

The total number of followers of all Projects partners accounts and LIFE OrgBalt official account on Twitter followers and Facebook platforms by 22.08.2024 is 124777 followers (83804 followers on Facebook platform and 40973 followers on Twitter platform). The total number of Facebook followers on LIFE OrgBalt and the Latvian partners (Silava, Ministry of Agriculture of Latvia, Association Baltic Coasts, LBTU) facebook accounts is 17531 and twitter accounts is 7970.

Number of manual copies distributed. During the in-person workshops, altogether over 137 copies of printed training materials have been distributed. As the rest of the training owrkshops took place online, 387 digital copies of training materials were distributed to the rest of the participants. Furthermore, the digital copies of the materials have been published on the www.orgbalt.eu website.

International conference. The conference, that spanned 2 days, was held in-person in Riga, Latvia with the option for attendees to participate through the online streaming on project's website and social media. 77 participants joined the first day of the conference in-person, and 116 joined on-line. On the second day of the conference, 39 participants joined the project's demonstration site visits. Altogether, the conference gathered 232 participants, which exceeds the planned value of the indicator in Project proposal.