SIMULATION TOOL FOR BALANCING SOCIO-ECONOMIC AND ENVIRONMENTAL BENEFITS FROM MANAGEMENT OF NUTRIENT-RICH ORGANIC SOILS

The LIFE OrgBalt project has developed a simulation tool designed to balance the reduction of greenhouse gas emissions and the promotion of bioeconomy in the Baltic States. It is a data-driven instrument for policy planning and decision-making at regional and national levels and is primarily intended for policymakers and regional planners in the Baltic States. The tool is to be considered a complementary instrument providing indicative guidance on the costs and benefits of organic soil management choices under the assumptions and input data used in the algorithms. The tool's main function is to evaluate the impact of various climate change mitigation measures applied on nutrient-rich organic soils within the dimensions of socio-economic indicators and greenhouse gas emissions. The indicators assessed by the model include profit, employment, and greenhouse gas emissions.

The simulation tool covers the dominant landscapes in the Baltic States, which are forest land and agricultural land. Each of the Baltic States has a different proportion of these land uses. For example, in Lithuania, agricultural land accounts for more than 47% of the total area, while in Latvia it is 32%, and in Estonia 23%. To assess the scope of the areas on which climate change mitigation (CCM) land management practices can be considered, maps of agricultural and forest land are overlapped with maps of organic soils and protected areas. As a result, an illustration of the potential target areas for scenarios with CCM measures is created, see Figure 1.

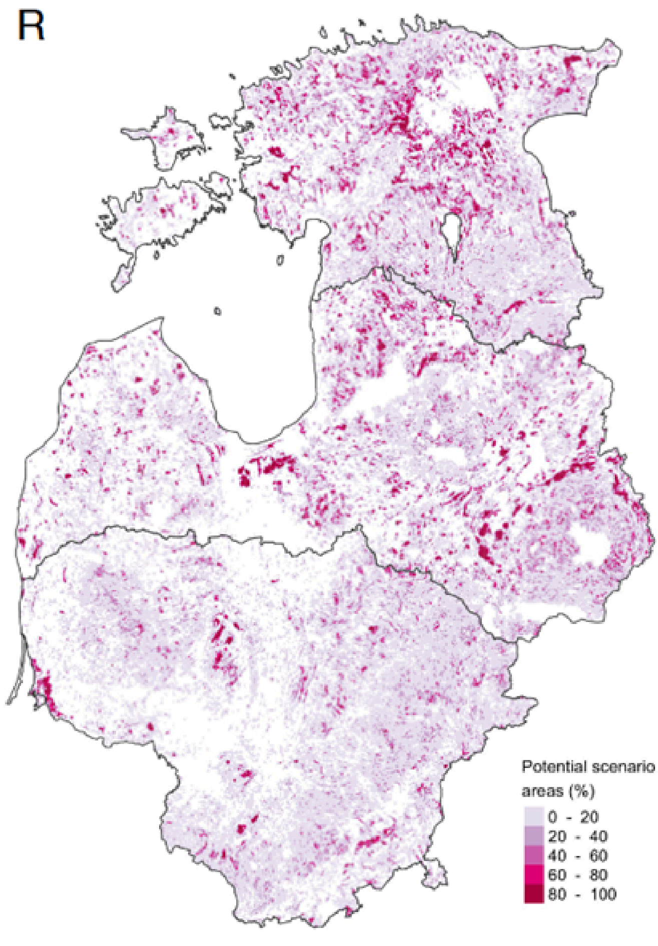

Figure 1. Potential scenario areas

An interactive application has been created to display the results of the Simulation tool, providing both summary and detailed spatial information for each scenario and country (Figure 2). The left panel visualizes all areas where a scenario's measures are applied. Users can switch scenarios using the "Select scenario" block. The spatial data for visualization purposes is aggregated into a grid of 100 hectares (1 km²). Figure 2 depicts the application interface.

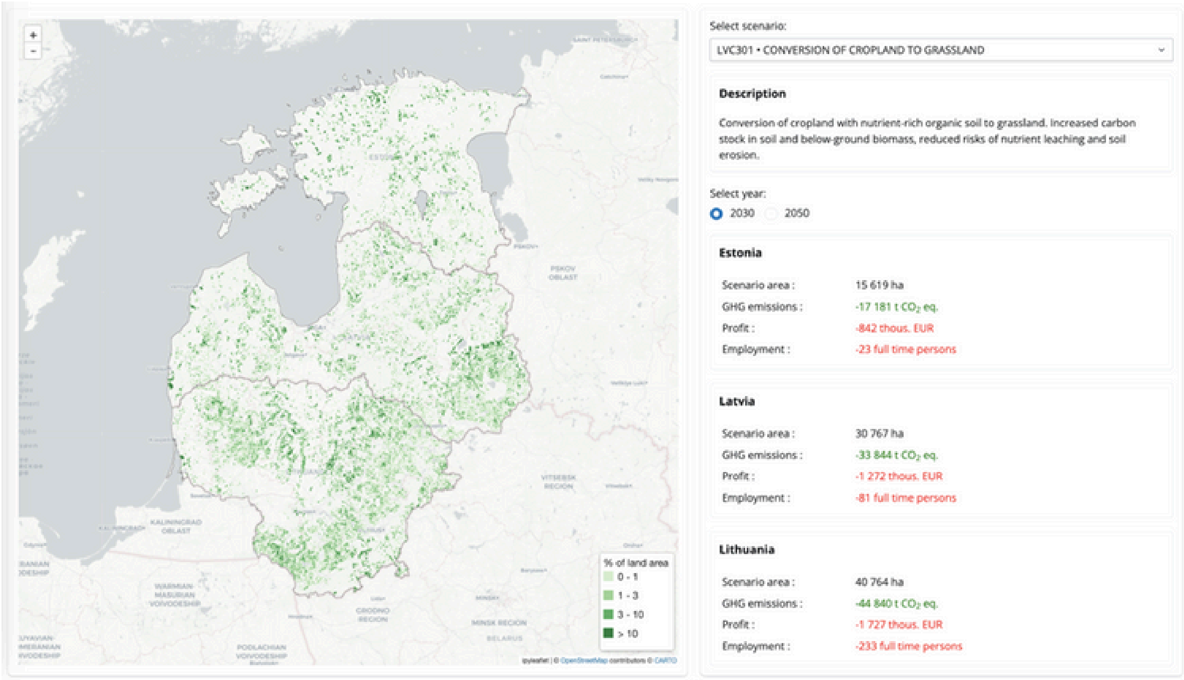

Figure 2. Application of Simulation tool.

Simulation results

The output of the model shows that by 2050, profits are expected to decline in all CCM scenarios analysed except for LVC306 - Agroforestry - fast growing trees and grass. In the LVC306 scenario, profits increase in 2050 because the fast-growing trees have reached cutting age. 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.

The implementation of scenarios LVC301- conversion from cropland to grassland, LVC302 - conventional afforestation, and LVC303 - introduction of forest paludiculture (decidious trees) results in a reduction in employment by 2050. 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.

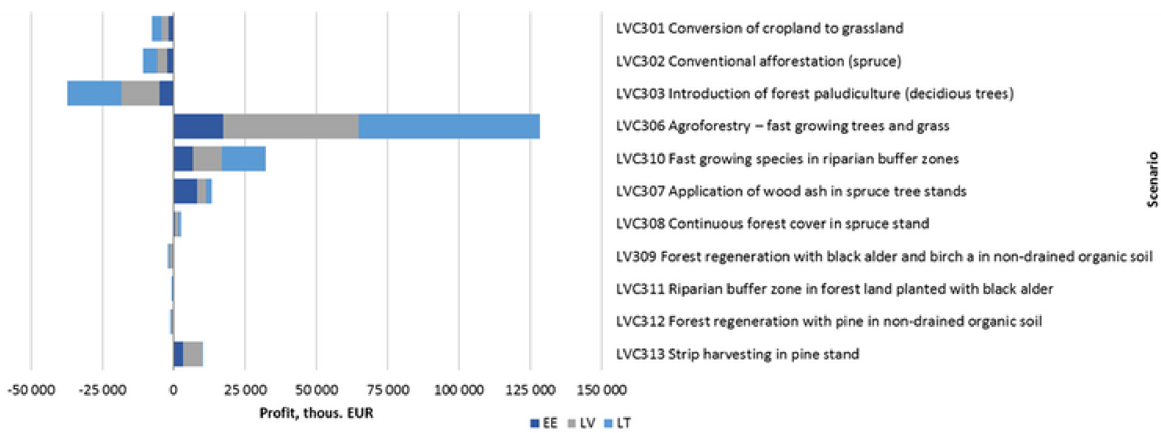

Figure 3. Impact on profit in 2050.

Results show that the reduction in GHG emissions resulting from implementation of CCM scenarios on agricultural land is attributed to the increase in biomass of the surface, subsurface, and ground cover resulting from 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 -forest cover in spruce stand and LVC313 - strip harvesting in pine stand, where selective logging is performed, a more moderate reduction is expected, while in scenario LVC312 - forest regeneration with pine in non-drained organic soil, a consistent reduction throughout the rotation cycle is expected.

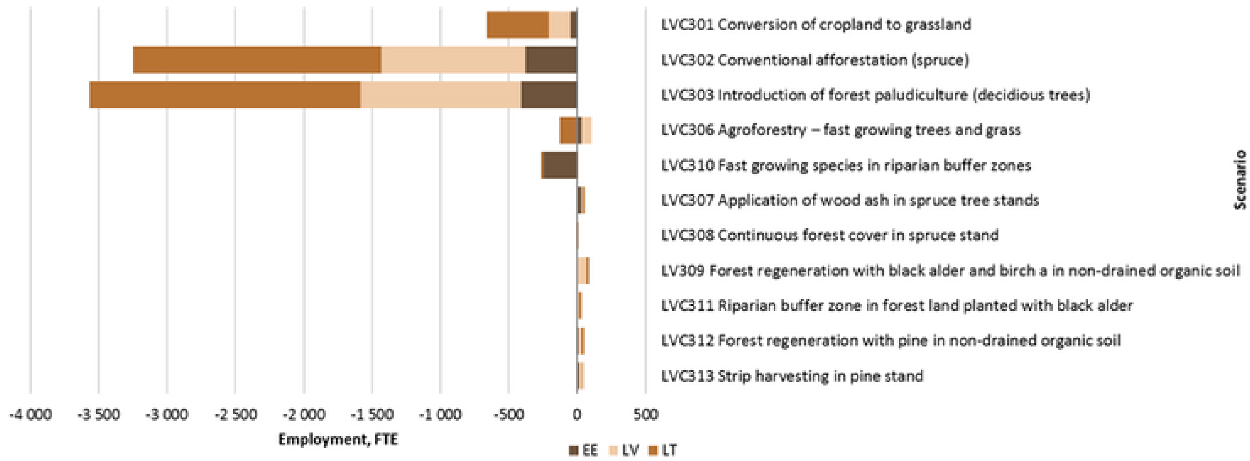

Figure 4. Impact on employment in 2050.

Overall, the CCM practices which show comparatively good results in 2 out of 3 indicators are LV302-Conventional afforestation (spruce), LVC303 - Introduction of forest paludiculture (decidious trees), LVC310-Fast growing species in riparian buffer zones, and LVC307-Application of wood ash in spruce tree stands. The measure LVC306 - Agroforestry-fast growing trees and grass stands out with good results in all 3 indicators, especially with its performance in the profit category.

The tool can be accessed here: https://bioekonomika.lbtu.lv/orgbalt /

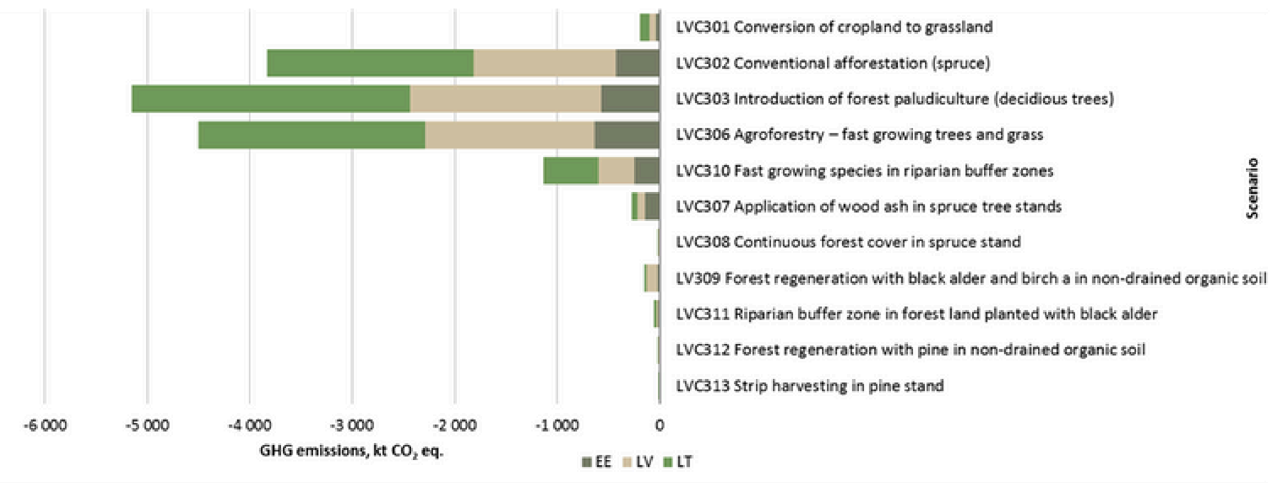

Figure 5. Impact on GHG emissions in 2050.

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