

# Key findings from monitoring of environmental impacts



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# KEY FINDINGS FROM MONITORING OF ENVIRONMENTAL IMPACTS



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# 1. Introduction

The LIFE Viva Grass project, implemented from June 2014 until April 2019, aims to support the maintenance of biodiversity and ecosystem services provided by grasslands, through encouraging ecosystem-based planning and economically viable grassland management in Estonia, Latvia and Lithuania. Furthermore, the project demonstrates opportunities for the multifunctional use of grasslands as a basis for sustainability of rural areas and a stimulus for local economies. The LIFE Viva Grass was developed as a “policy governance” project, thus having a strategic and demonstrative character.

A major task of the project was the development of an integrated planning tool, which could operationalise the ecosystem services concept into decision-making on grassland management in various planning contexts. Application of the tool ranges from a farmer’s choice of the grassland related land use, development planning by municipalities, management planning of protected areas, through to national policy-making tailored to the rural support conditions.

During the implementation of the LIFE Viva Grass project, several activities were targeted to improve the environmental conditions of abandoned grasslands in the Baltic States by carrying out restoration works at selected areas. Therefore, one of the project tasks was to monitor and assess systematically the direct and indirect environmental impacts caused by the project activities on grasslands.

In 2015, the Initial Environment Report was prepared to benchmark the situation immediately before implementation of the project demo activities. The Initial Environment Report described the project areas with regard to the natural characteristics, land cover and land uses as well as presenting the results from the field work on soil and vegetation assessments. Towards the end of the activities, assessment was carried out to evaluate the change and progress in restoring abandoned grasslands. This brochure presents the key findings from the environmental impact assessment of the project activities.



## 2. Overview on nine project case study areas

### REGIONAL LEVEL:

- **Lääne county, Estonia** was selected to develop and demonstrate application of the integrated planning tool for relevant planning cases at regional level. The use of biomass from grassland for bio-energy production was explored to demonstrate the functionalities of the tool to support regional development planning on the use of grasslands as an alternative energy source. During the project duration Estonia implemented an administrative reform that eliminated county administrations; nevertheless, the issue addressed by the project is still valid for planning at regional level.

### MUNICIPAL LEVEL:

- **Saaremaa municipality, Estonia** – the tool will contribute to management of semi-natural grasslands by developing a green network scheme at municipal level. During the project duration, Estonia implemented an administrative reform leading to a merger of smaller municipalities. The initial partner Lümada municipality became a part of Lääne-Saare, but since 2018 has been a part of Saaremaa municipality.
- **Cēsis municipality, Latvia** – the tool will provide decision-making support in the planning of landscape maintenance and restoration by prioritisation of areas based on the relevant ecosystem service supply, as well as risk factors related to landscape quality. Outputs of the tool are to be integrated in the new Cēsis municipal development plan aimed at supporting long-term grassland management as an important structural and functional component of rural landscapes.
- **Madliena parish in Ogre municipality, Latvia** – local stakeholders developed proposals to improve grassland management at local level. Mapping and assessment of ecosystem services, their contribution to well-being were delivered by applying a participatory approach and communicating on ecological as well as social values of grassland ecosystems.
- **Šilutė municipality, Lithuania** – proposals elaborated on nature tourism development, where grassland management shall be an essential precondition for developing the areas as an attractive tourism destination.

### FARM LEVEL:

- **Kurese, Estonia** – grazing by cattle ensures maintenance of the alvar habitats and traditional landscape in ~180 ha. Continuation of the grazing was at risk due to limited access of cattle to drinking water. The project supported the farm with the instalment of a proper water supply as well demonstrating the values of ecosystem services and provided recommendations for the future.
- **Šovītes, Latvia** – a farm where ~ 85 ha of grassland was restored by removing shrubs and their root systems, cattle grazing, microrelief improvement (milling, levelling) to enable its management with grass cutting machinery, and introduction of the species rich in seed material for increasing the biological value of grasslands and the ecosystem service supply.

### PROTECTED AREA LEVEL:

- **Pavilniai regional park, Lithuania** is located within the administrative boundaries of Vilnius, thus the socio-economic impacts are related to the capital city. During the project the grasslands were restored (~11 ha) to provide visitors and business developers with new access to the areas suitable for recreational activities.
- **State Pašešuvis landscape reserve and Dubysa regional park** are located in the Raseiniai district municipality. Both nature conservation areas are administered by the Dubysa regional park directorate. The restoration activities (ca~31 ha) provided preconditions for regular grazing and grass cutting.





Activities in „LIFE Viva Grass”  
case study areas



Notice board



Testing of the Tool



Bird guide



A watering facility for grazing animals



Report on assessment of grassland manage-  
ment in Lūmānda during the last 20 years



Mapping and assessment of ecosys-  
tem services by local stakeholders



Recommendations for further  
grassland maintenance



Restoration of grasslands



Round tables and  
stakeholder meetings



Visitor days

**Figure 2.1.** LIFE Viva Grass project case study areas



# 3. Monitoring and assessment approach

## 3.1. Ecosystem-based management and ecosystem services

Management of grasslands delivers direct and indirect economic and social benefits, at the same time being an important activity for safeguarding biodiversity. Land use and management practices impact upon the structure and conditions of grassland ecosystems, which in turn determine the kind of ecosystem services and benefits that can be delivered for society (Figure 3.1.).

From a business perspective, grasslands are managed for cattle feeding, including the collection of biomass (e.g., hay, forage, silage) and/or as pastures where cattle graze seasonally or throughout the year. In order to distinguish the differences in ecosystem service supply, for the purpose of the project, the grasslands were classified according to the intensity of land use: cultivated or sown grasslands, permanent grassland (not cultivated/ploughed for more than 5 years); semi-natural grasslands (habitats of Community importance or high value grasslands). The latter have the highest ecological value, thus, the aim is to achieve a favourable status of these grassland habitats, as well as to increase the ecosystem service supply of grasslands in general. When people stop managing grasslands, the abandoned areas become overgrown with shrubs and bushes and the grasslands deteriorate. In the Baltics, the natural succession from grassland towards forest ecosystems takes place in the majority of such cases. Grassland can also be turned into arable land, mainly for crop production. The above described land use practices were assessed in the terms of delivery of ecosystem services and developing the Viva Grass Integrated Planning Tool.

An ecosystem structure and condition (status) can be characterised by the physical, chemical and biological condition or quality of an ecosystem over a monitored period of time. Ecosystems should be in good condition to provide multiple ecosystem services. The LIFE Viva Grass project restored abandoned grasslands to improve the ecosystem condition. Moreover, the project developed the Viva Grass Integrated Planning Tool that will enhance the ecosystem-based planning of agricultural lands in future.

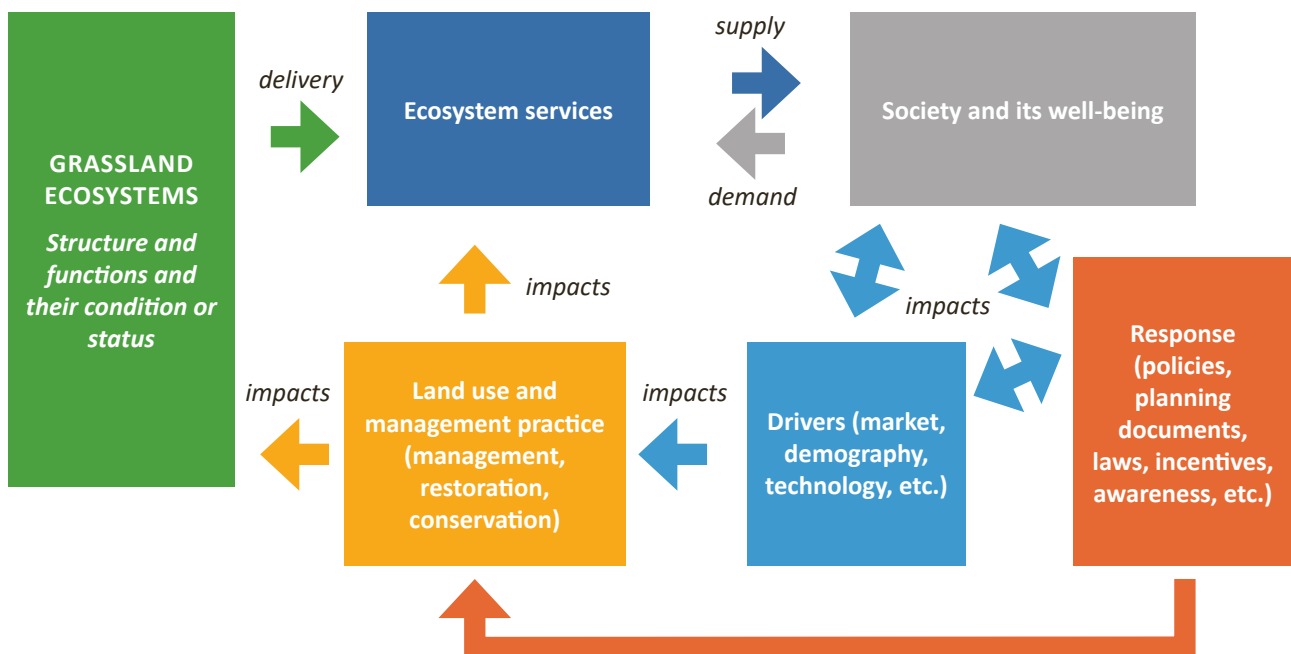


Figure 3.1 Viva Grass assessment framework



## 3.2. Indicator approach

One of the project tasks was to systematically monitor and assess the environmental impacts of the project activities on grasslands. In order to ensure a coherent approach towards monitoring and assessing the impact across the project sites in the three countries, the project team developed a common methodology, in 2014. The methodology was based on the use of indicators as a tool for the assessment of different environmental aspects. The aim was to select a few key indicators which can show short and long-term, as well as direct and indirect impacts caused by the LIFE Viva Grass project.

### 3.2.1. Short-term impact indicators

The key indicators applied for monitoring short-term direct impacts in the project areas, where grassland restoration activities were implemented, are presented in the scheme below. Depending on the location of the restoration site (e.g. the vicinity of water) or other factors, the exact monitoring programmes were developed by the relevant project partners.

According to the developed site-specific monitoring programmes, samples were collected in 2014-2015 before restoration of the grasslands. Another round of extensive fieldwork took place in summer 2018. The samples were collected and analysed in laboratories of partner organisations. In the meantime, the project experts visited the sites to supervise and advise throughout the restoration process.

<b>GRASSLAND HABITATS</b>	<ul style="list-style-type: none"><li>• Area covered</li><li>• Status</li></ul>
<b>GRASSLAND COMMUNITIES</b>	<ul style="list-style-type: none"><li>• Species diversity</li><li>• Abundance</li><li>• Coverage</li></ul>
<b>SOIL PROPERTIES</b>	<ul style="list-style-type: none"><li>• Texture</li><li>• Moisture</li><li>• Bulk density, litter</li><li>• Soil nutrients, carbon, other chemicals</li></ul>
<b>WATER QUALITY</b>	<ul style="list-style-type: none"><li>• Oxygen,</li><li>• Nutrient concentration</li><li>• Macro-elements</li></ul>
<b>LANDSCAPE</b>	<ul style="list-style-type: none"><li>• Fragmentation</li><li>• Connectivity</li><li>• Relief (topography)</li><li>• History of the land use</li></ul>

**Figure 3.2.** Key environmental issues and indicators for monitoring the short-term impacts of the project activities



### 3.2.2. Long-term impact indicators

As the Viva Grass Integrated Planning Tool and related planning initiatives may only cause long-term environmental impacts, the relevant long-term indicator was selected for monitoring the status of the ecosystem in the total land cover. The share of grasslands in the total land cover and change in the area covered by grasslands were identified as the most suitable for monitoring the impact of the project activities.

The European Environment Agency (EEA) coordinates the Copernicus programme which is a European system for monitoring the Earth. Amongst other things, it produces land cover/land use (LC/LU) information in the CORINE Land Cover data system. The CORINE Land Cover data is provided for 1990, 2000, 2006, 2012 and 2018. The vector-based datasets include 44 land cover and land use classes. The time-series also includes a land-change layer, highlighting changes in land cover and land use from one period to another. Out of 44 land cover classes, grasslands as habitats belong to 2 classes and 3 types – i) agricultural areas (231 – Pastures; 243 – Land principally occupied by agriculture, with significant areas of natural vegetation) and ii) forests and semi-natural areas (322 – Moors and heathland; 324 – Transitional woodland-scrub). As all Baltic States participate in the Copernicus programme, the relevant CORINE Land Cover data are available to benchmark the situation, as well as monitor changes at municipal, county and national level.

The national authorities in charge of supervising the implementation of CAP in countries have annual data on those agricultural fields for which farmers and landowners have applied to receive subsidies (payments). The information is stored in the integrated administration and control system (IACS) and these agricultural land use data were also used for the Viva Grass Integrated Planning Tool, as well as for preparing the environmental impact assessment report.

### 3.3. Remote sensing techniques

Assessment of grasslands using remote sensing techniques was performed during two airborne observation campaigns (09-07-2014 and 02-06-2018) in Cēsis municipality. Acquired airborne hyperspectral and LiDAR data were used for the mapping of grassland and tree/shrub cover, the presence of Sosnowsky's Hogweed (*Heracleum sosnowskyi*) as well as an assessment of grass biomass in Cēsis municipality. Repeated data acquisition allows monitoring of the changes. The work was performed by the Institute of Environmental Solutions, Latvia.





# 4. Short-term impacts

## 4.1. Kurese farm, Estonia

### WHICH ACTIVITIES WERE IMPLEMENTED BY THE PROJECT?

Kurese farmland is located in West-Estonia, Pärnu County, Lääneranna municipality. The territory of the Kurese farm is part of the Kurese landscape protection area and the Natura 2000 site Kurese SAC. At the beginning of the project, 170 ha of semi-natural grasslands were managed. In 2015, 10 more ha of alvars were restored (i.e. trees and bushes removed but the site still needs continued restoration by grazing) in the territory of Kurese farm, so the total territory of managed semi-natural grasslands is 180 ha (Figure 4.1.).

The semi-natural grasslands are managed by cattle grazing. Up to 2015, the cattle (approx. 200 heifers) for the management of semi-natural habitats (alvars, dry and wet grasslands, wooded pastures) were brought (lent) for the grazing season from other farms. Before the project, a lack of drinking water for animals in the farm did not accommodate permanent livestock nor did an increase in the number of animal units. During the LIFE Viva Grass project (in 2015) a water supply was installed in the form of a drilled well and water reservoirs. The average grazing pressure is 1.1 AU/ha.

### WHAT ARE THE MONITORED IMPACTS ON HABITATS AND SPECIES?

The benchmarking of the environmental conditions in the farm was carried out in summer 2014 and 2015. The fieldwork to monitor the impacts from the project activities took place in summer 2018. The monitoring covered vegetation and soil analysis.

- **Grassland habitats in the area and their quality**

Four habitat types of Community importance are present in the farm: *Juniperus communis* formations on heaths or calcareous grasslands (5130); Nordic alvar and precambrian calcareous flat rocks (6280\*); Lowland hay meadows (6510); Fennoscandian wooded pastures (9070). The assessment of the sites indicates that the present quality of the habitat is improving and is close to favourable, or is favourable.

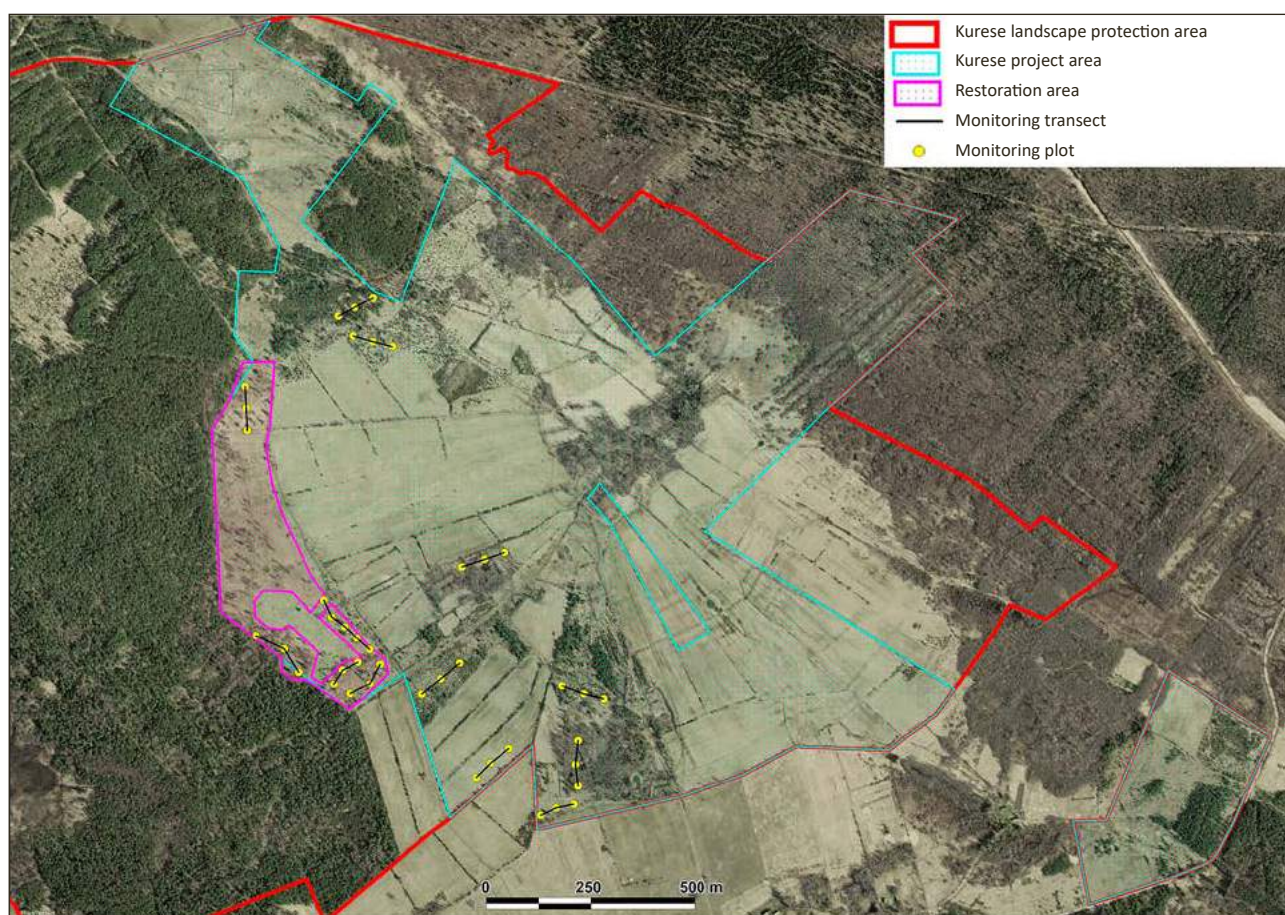
- **Plant species composition and abundance**

During the project duration, the total number of all plant species on test sites/plots has increased from 146 to 174 plants. Approximately 50% of recorded plots had typical alvar species in 2014, whereas 60% of typical alvar species were recorded in 2018, although the total number of plant species within the study area in 2018 was relatively similar to 2014. Several typical species for alvar communities were added, such



*Kurese restoration area before and after the restoration*





**Figure 4.1.** Kurese farmland and monitoring sites in 2017

as *Senecio integrifolius*, *Polygala comosa*, *Origanum vulgare*, *Orchis militaris*, *Hypericum hirsutum*, *Carex ornithopoda*, *Carex caryophylllea*, *Anthyllis macrocephala*, *Antennaria dioica*.

#### • Soil properties

Soil conditions are heterogeneous in alvars. Some sites have very shallow soil and unvegetated patches are common. Other alvars have underlying limestone gravel, with a fine upper soil layer of up to a few decimetres. During summer, the shallow soil layer often dries out completely through the action of wind and direct solar irradiation. Analysis of soil characteristics (e.g., bulk density, organic matter thickness) does not note any significant changes between 2014-2018.



*Military orchid (Orchis militaris)*

## CONCLUSIONS

- The restoration activities, including grazing by cattle, have led to achieving a favourable status of the four habitat types of Community importance, particularly Nordic alvars that are a priority habitat for protection and management.
- Due to adequate grassland management practices plant species diversity increased between 2014-2018, and more typical alvar species are present.
- Basic soil properties have not been impacted upon significantly in such a short period.



## 4.2. Šovītes” farm, Latvia

### WHICH ACTIVITIES WERE IMPLEMENTED BY THE PROJECT?

“Šovītes” farm is located in the central part of Latvia, Vidzeme uplands, Vecpiebalga municipality. The territory of the farm is approx. 120 ha, of which about 80 ha are grasslands. In the framework of the LIFE Viva Grass project, grassland restoration activities were implemented gradually over 5 different grassland fields (approx. 85 ha) due to the need of fodder for cattle herds of about 60 animals. The aim was to enhance 3 fields as pastures – grazing grasslands for cattle; and 2 hay fields (meadows) to produce fodder.

At the start of the project, most of the grasslands were invaded by shrubs, since they had not been managed for approx. 20 years and needed to be restored in order to start the farming activities. The decision was not only to remove shrubs and to level the microrelief of fields, but also to increase the natural diversity of the grassland and to improve the quality of grass fodder. During project implementation, 37 ha of grassland were restored including through ploughing, re-sowing with a perennial grass mixture to ensure sufficient grass biomass for beef cattle grazing and forage production. Other grassland areas (approx. 48 ha) were restored by intensive grazing practices to reduce expansionary plant species. (Figure 4.2.)

### WHAT ARE THE MONITORED IMPACTS ON THE ENVIRONMENT?

The initial environmental monitoring took place in summer 2014 to benchmark the status of grasslands. The second round of sampling took place in 2018. The monitoring programme included 48 monitoring plots where soil and vegetation samples were collected and 4 sites for water quality monitoring. The samples were analysed in the laboratory of the University of Latvia. The differences between the ploughed fields and those which were intensively grazed were assessed.

- **Grassland habitats in the area and their quality**

At the start of the project, no habitats of Community importance were present in any of the farm fields. Although the quality of the grasslands in 2018 do not qualify as habitats of Community importance, the changes between ploughed and grazed areas are recognised in terms of species composition and abundance. In future, with extensive grazing and grass cutting, the habitats could evolve towards 6270 Fennoscandian lowland species-rich dry to mesic grasslands with its variants. The field of organogenic peat deposits has the potential to become a wetland type habitat if the drainage system is not restored.

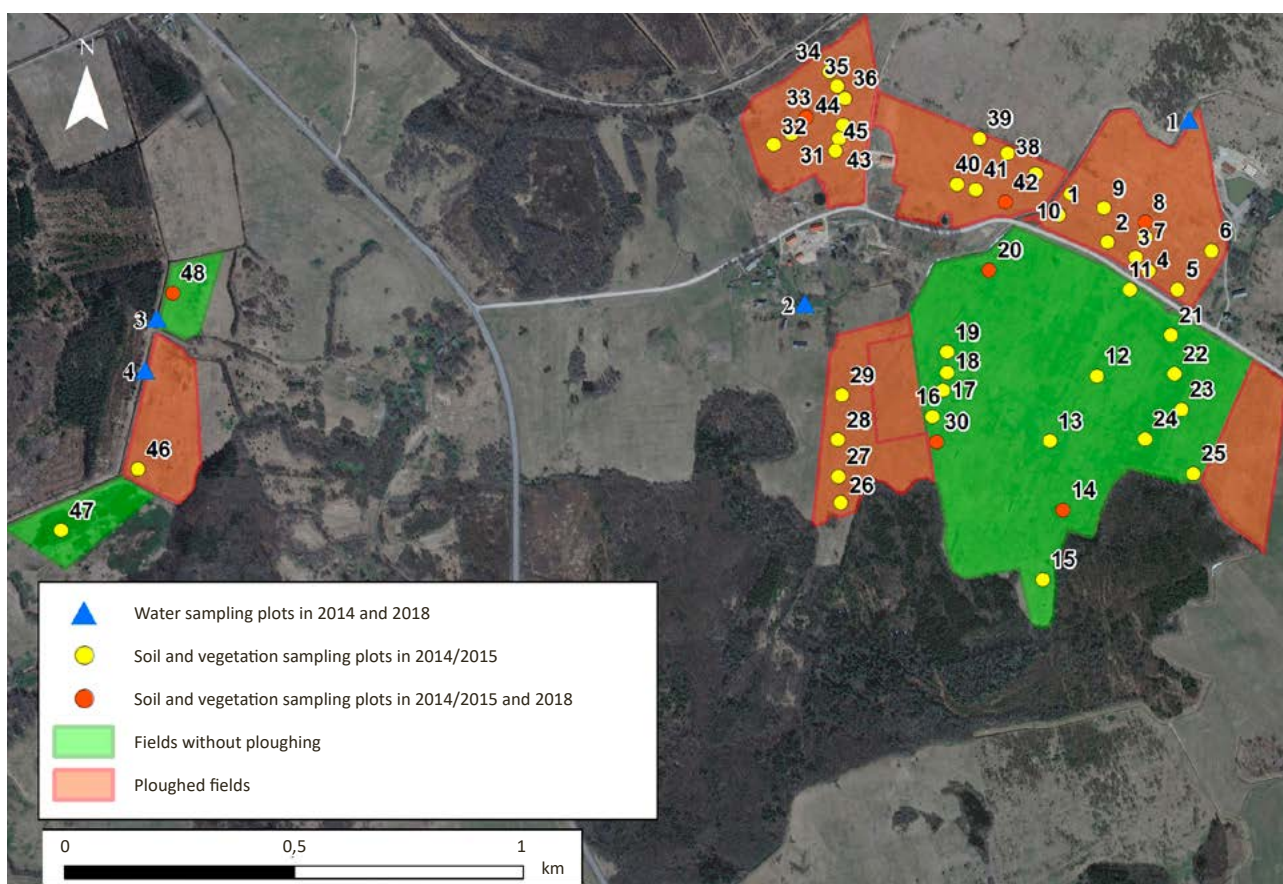
- **Species composition and abundance**

There has been a shift in the predominant species composition since the start of the project. However, the new species are mainly those which represent cultivated grasslands. Among the newly occurring species, botanists identified lady’s-mantle (*Alchemilla vulgaris*) in both field types which is a sign of rewilding processes in grasslands.



Grassland restoration in Šovītes farm





**Figure 4.2.** Šovītes farm – restored grassland areas and monitoring plots

### • Soil properties

Due to the location of the farm on glaciogenic till deposits, soil diversity is high. Grassland restoration practices, e.g. ploughing, could influence changes in soil properties. The monitored chemical parameters have fluctuated slightly over the time period and sampling plots; nevertheless, it is relatively certain that the grassland management practices have not made a significant impact on the soil. None of the samples indicate issues of acidification as the pH is normal. The chemical parameters indicate that the values of nutrients and macro elements are comparatively low and, in many cases, this supports the re-naturalisation process.



## CONCLUSIONS

- Removal of stones, bushes and stumps, re-sowing of the grass has improved conditions for grassland management and thus the potential for an increase in biodiversity in the long-term.
- The progress of enriching the diversity of species is not as fast if the significant grassland restoration activities are carried out in parallel to cattle farming.
- The high soil diversity and the decrease in the content of the key chemical elements could facilitate the rewilding processes in grasslands in future.
- However, there are still many years ahead of extensive agriculture to ensure the transformation of permanent grasslands into habitats of Community importance.



## 4.3. Cēsis municipality, Latvia

### WHICH ACTIVITIES WERE IMPLEMENTED BY THE PROJECT?

Cēsis municipality is located in the central part of Latvia, consisting of the town Cēsis and Vaive parish. The restoration activities took place in seven fields (in total ~30 ha) of municipal land in Vaive parish in 2015-2016 (Figure 4.3.). The areas were abandoned for a long time, thus overgrown by bushes, shrubs and invaded by Sosnowsky's Hogweed. In two of the restoration areas, the species covered nearly 100% of the area. Therefore, the restoration works were very challenging.

A grassland restoration scheme and plan of activities were developed in detail to guide the subcontracted company to carry out the grassland restoration works. In addition to removal of bushes and stones, the restoration also included soil processing, including ploughing and reseeded with species rich seed mixture. Also, sowing oats as an intercrop was used in many plots to remove excess nutrients from the former arable lands and outdo more expansive species. The restoration work was also hampered by unfavourable weather conditions (a very rainy summer, autumn and even winter). The restored fields were handed over to the local farmers to ensure maintenance of grasslands at least 5 years after the end of the project. So far, the grasslands are maintained by annual grass cutting.

### WHAT ARE THE MONITORED IMPACTS ON HABITATS AND SPECIES?

The initial environmental monitoring took place in summer 2015, when the sites for restoration were pre-selected. 30 sampling plots were installed in 5 sites, where vegetation and soil samples were collected. In 2018, the sites were monitored once more.

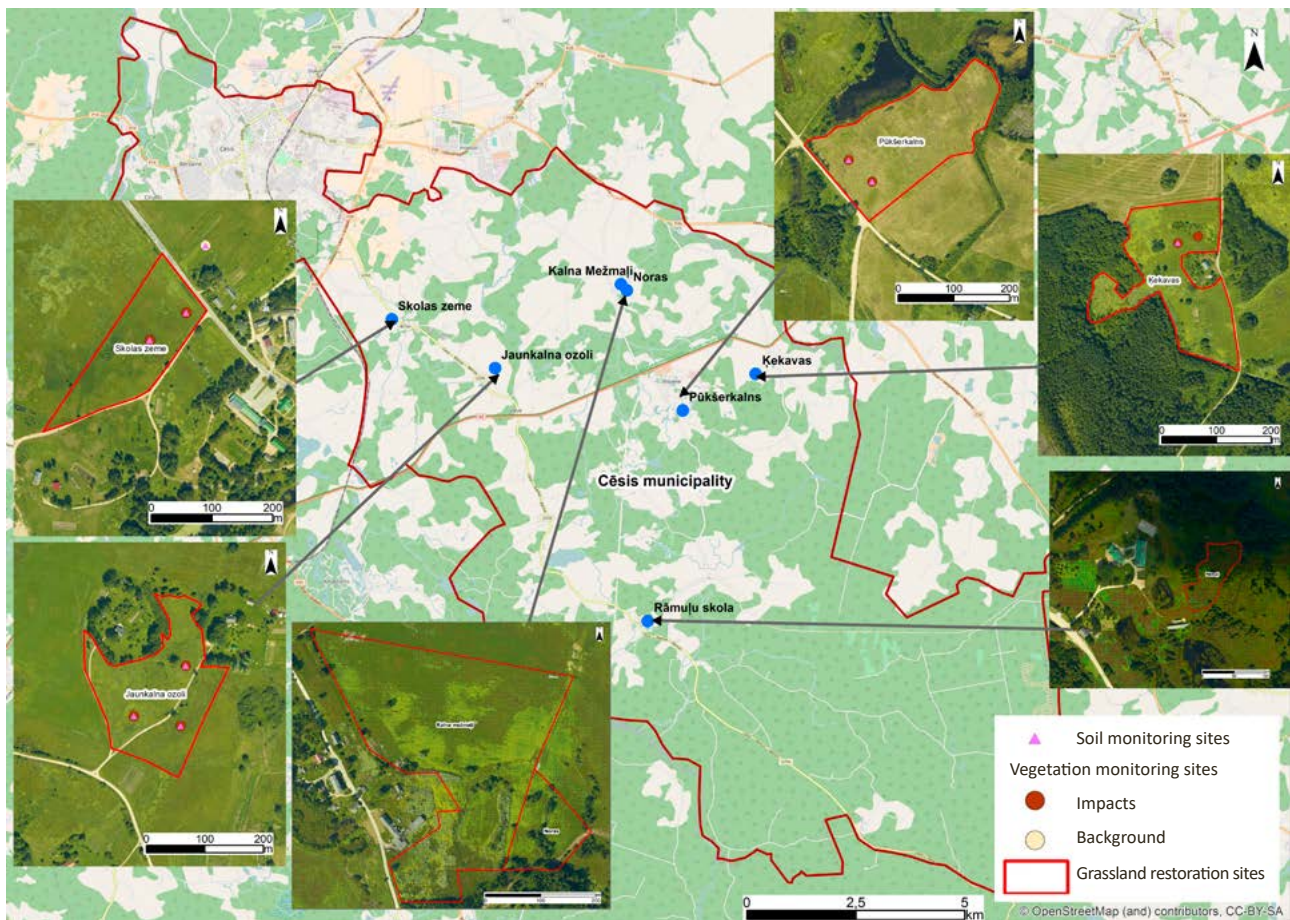
#### • Grassland habitats in the area and their quality

At the start of the project, no habitats of European importance were present in any of the seven selected fields. They were overgrown by bushes and covered by invasive and expansive plant species. As the restoration works involved ploughing and seeding, the current status of the area corresponds to cultivated grasslands with good conditions for further re-naturalisation processes.



*Grasslands in Cesis municipality: invaded by Sosnowsky's Hogweed (above) and managed (below)*





**Figure 4.3.** Cēsis restored areas and monitoring plots

- **Species composition and abundance**

The monitoring results reveal that species diversity has been increased in some plots. Perennial meadow grass species have become dominant instead of Sosnowsky's Hogweed. Some new herbaceous perennial species of flowering plants have now been recorded.

- **Soil properties**

Grassland restoration practices, including ploughing, could have slightly influenced changes in soil chemical properties. In some plots, reduced amounts of nitrogen and mobile phosphorus, carbon have been detected. However, it is too early to conclude about the significant impact of the restoration measures on soil properties.



*Lady's mantle (Alchemilla spp.)*

## CONCLUSIONS

- The largest environmental benefit was to turn degraded and abandoned land back into functional grasslands, while still in the early stages but with the potential to continue.
- The largest challenge was to eradicate Sosnowsky's Hogweed. The subsequent years after the restoration works show that common grassland species can overcome the invasive species.



## 4.4. Pavilniai regional park, Lithuania

### WHICH ACTIVITIES WERE IMPLEMENTED BY THE PROJECT?

Pavilniai regional park (2176 ha) is located within the boundaries of Vilnius city municipality (Figure 4.4.). 8% of the territory is covered by semi-natural grasslands, which are spread throughout the territory of the park by very small plots on average 4-6 ha. The grasslands are rich in flowering plants, which are important for various insects and provide ecosystem services such as medicinal herbs, cultural and recreational ecosystem services. These plots have the good potential for recreation and education activities as they are located in hilly landscapes, with wonderful panoramic views to Vilnius old town. However, many areas were overgrown by shrubs and could not be physically accessed by visitors.

Several grassland plots - 11 ha in total - were selected for restoration works that took place in January – March 2015. The abandoned grassland plots were cleared from shrubs.

### WHAT ARE THE MONITORED IMPACTS ON HABITATS AND SPECIES?

The initial environmental monitoring took place between 30 June – 1 August 2015 to assess the background conditions of the grassland habitat - (6210) Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*). Only one plot was investigated as other areas were degraded and overgrown by bushes. In 2017, two new areas were investigated. In 2018, the monitoring was repeated.

#### ● Grassland habitats in the area and their quality

As a result of the restoration activities, the following habitat type of European importance was present in the monitoring area in 2018:

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) and 3 variants:

- \* the thermophilic open grasslands overgrown by *Crataegus* sp., *Prunus* sp.;
- \* the thermophilic open grasslands overgrown by *Pinus Sylvestris*;
- \* the typical thermophilic open grasslands.

The habitat quality was assessed as unfavourable in 2015. In 2018, habitats of the semi-natural dry grasslands were assessed as suitable, of good quality and were included in the Natura 2000 network as “Kaukysos upės slėnis”, code LTVIN0035. All characteristic species of plants and insects have been recorded there.

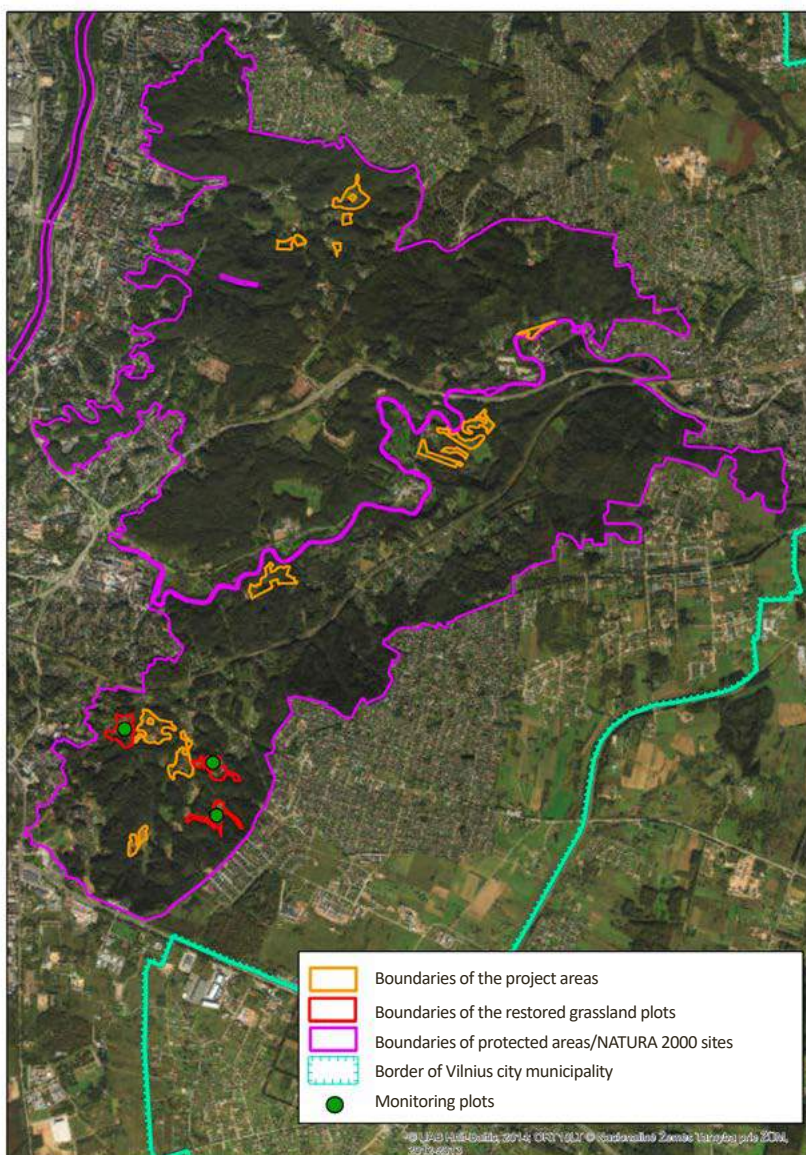
#### ● Species composition and abundance

In 2015, 43 plant species were counted in two layered communities of low grasses and mosses. The herb layer was rich in species and abundant (projection coverage 100%). The moss cover was not abundant.



Restoration area in Pavilniai regional park before (left) and after (right) restoration





*Alcon blue butterfly (Maculinea alcon)*

**Figure 4.4.** Pavilniai regional park – restored areas and monitoring plots

In 2018, the number of species has remained unchanged. However, a new butterfly species – *Maculinea alcon* was discovered, which is specific and characteristic for semi-natural dry grassland habitats and indicates the good status of the habitat.

## CONCLUSIONS

- Cutting shrubs and regular mowing (once or twice per year) are the main restoration works for the recovery of 80% overgrown semi-natural dry grassland habitats – the habitat of Community importance.
- During three years, periodically cutting shrubs and mowing lead to conditions of semi-natural dry grassland habitats being restored to their typical and characteristic status.
- The diversity of species has increased: from some monodominant shrub species (*Salix spp.*, *Crataegus spp.*, *Rosa spp.*) to herbal plant species. Newly discovered butterfly species – *Maculinea alcon*, which is specific and characteristic for semi-natural dry grassland habitats has been observed.



## 4.5. State Pašešuvis landscape reserve, Lithuania

### WHICH ACTIVITIES WERE IMPLEMENTED BY THE PROJECT?

State Pašešuvis landscape reserve (308 ha) is located in an intensively agrarian west-central part of Lithuania and attributed to the jurisdiction of Dubysa regional park directorate's management. The area is a designated Natura 2000 site - Šešuvies upės slėnis žemiau Molavėnų (site code – LTRAS0005).

The protected area covers the valley of the river Šešuvis and its tributaries (Figure 4.5.). According to the information of the Lithuanian Environmental Protection Agency, the river water quality in the project area is assessed as good.

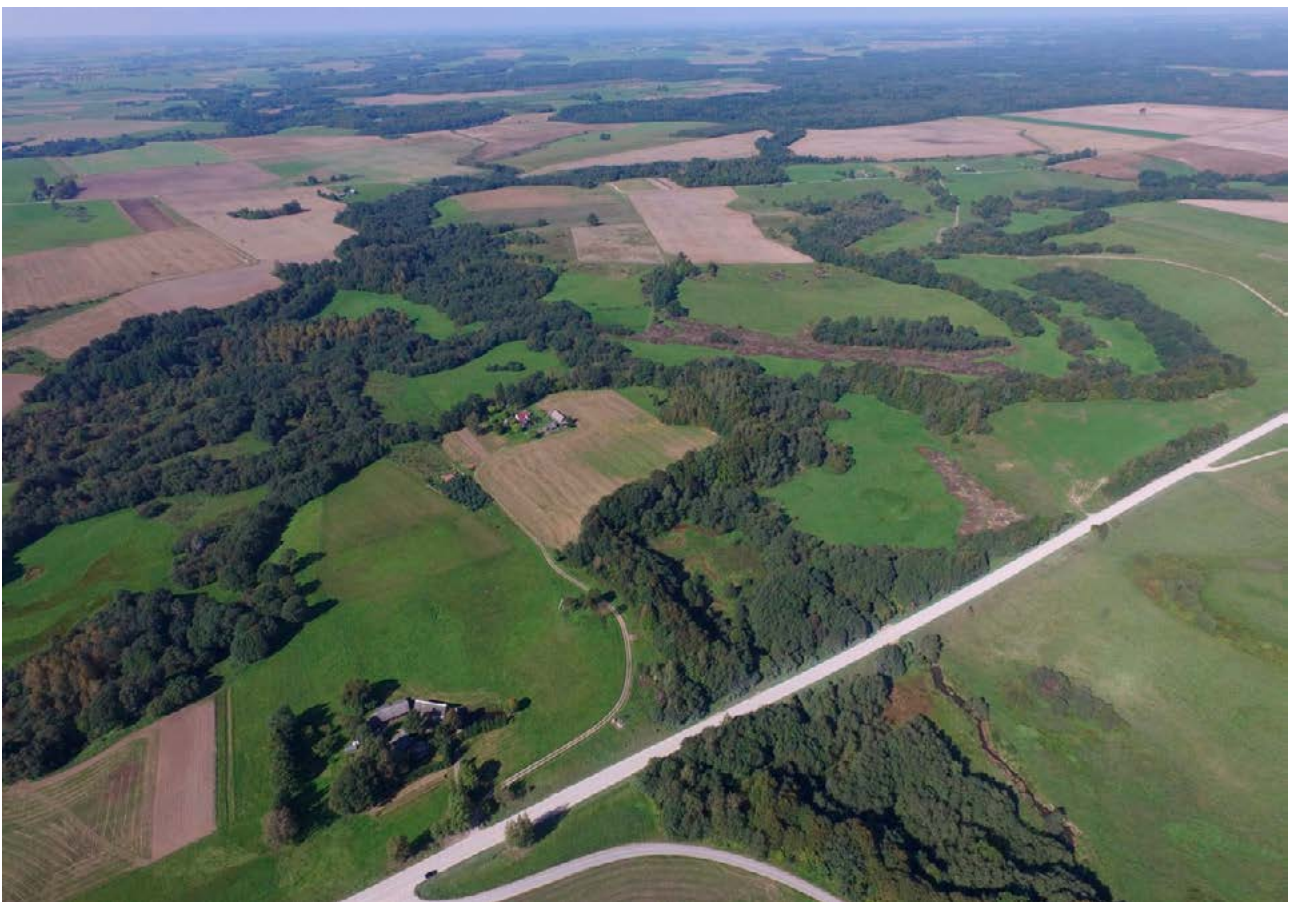
The restoration activities (removal of bushes and shrubs) were carried out over 7,66 ha in autumn 2017. The monitoring of impacts on species and habitats was implemented in these restored areas (Figure 4.5.).

### WHAT ARE THE MONITORED IMPACTS ON HABITATS AND SPECIES?

The initial assessment was based on an inventory implemented in the selected project area in July- August 2008, before the project. In summer 2018, the monitoring activities (4 transects with 3 points at each transect) in the restored areas were carried out to assess the short-term impacts from the restoration actions.

- **Grassland habitats in the area and their quality**

Although the area is relatively small, it has a high variety of species and spectacular landscapes. After the restoration, the valley is mostly covered by habitats 6270\* Fennoscandian lowland species-rich dry to mesic grasslands, 6450 Northern boreal alluvial meadows and 6510 Lowland hay meadows.



*Restoration area in Pašešuvis landscape reserve*





**Figure 4.5.** Pašešuvis landscape reserve – restored areas and monitoring

Early-purple orchid (*Orchis mascula*)

### • Species composition and abundance

The number of species and status of the species in habitats 6270\* and 6450 has not changed much: respectively from 29 to 26 species in the habitat 6270\* and from 31 to 30 in the habitat 6450. The status of the species varies from moderately rich to very rich. Several medicinal plants have been recorded in both habitats. In 2018, the habitat of Lowland hay meadows was investigated within two transects. The number of species is lower, 14-16 per transect.

### CONCLUSIONS

- The restored grasslands form an important part in the total area covered by grassland habitats of Community importance in State Pašešuvis landscape reserve – more than 20%.
- The restored grassland habitats represent river valley meadows that are rich in species, including rare ones. During monitoring, experts also recorded rare and protected species such as: Jacob's-ladder (*Polemonium caeruleum*) and early-purple orchid (*Orchis mascula*).



## 4.6. Dubysa regional park, Lithuania

### WHICH ACTIVITIES WERE IMPLEMENTED BY THE PROJECT?

Dubysa regional park (11 546.58 ha) is situated in the west-central part of Lithuania, on both sides of the river Dubysa. The territory of the park covers the bigger part of the erosive, steep sloped river valley. This valley is one of the few territories in Lithuania that kept its traditional landscape with open grassland plots. However, agricultural practice is not in favour of the maintenance of these open spaces. One-third of the grasslands in the park are not mowed and most of the plots are not grazed. This situation is occurring due to the ageing of the farmers and their keeping fewer animals. This leads to an abandonment of valuable grasslands, which start to overgrow with woody vegetation.

Three grassland restoration plots were chosen in Dubysa regional park (Figure 4.6.). 18.82 ha of bushes were removed, and 14,02 ha of old biomass removal was implemented during the restoration works. The works were implemented in 2017.

### WHAT ARE THE MONITORED IMPACTS ON HABITATS AND SPECIES?

As the restored plots were heavily covered with bushes, no vegetation data was collected before the restoration activities. In summer 2018, the monitoring activities (4 transects with 3 points at each transect) in the restored areas were carried out to assess the short-term impacts from the restoration activities.



*Restoration area in Dubysa regional park before (above) and after (below) restoration*





**Figure 4.6.** Dubysa regional park and restored areas



*Agrimony (Agrimonia eupatoria)*

- **Grassland habitats in the area and their quality**

The restored areas represent the habitat 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates, which is important for orchids.

- **Species composition and abundance**

The number of species varies between 17-20 in the monitored transects. The status of the species varies from moderately rich to very rich. Medicinal plants have been recorded, for example, Cowslip (*Primula veris*), Agrimony (*Agrimonia eupatoria*).

## CONCLUSIONS

- The restored areas of Dubysa regional park represent a habitat of Community importance and are particularly relevant for orchid species.
- In the short period since restoration, several herbal plants have been monitored in species composition.
- The preconditions for management by mowing and grazing have been established to maintain this grassland habitat in future.



## 5. Long-term impacts

### 5.1. Trends in share of grasslands in total land cover

The CORINE Land Cover data includes grassland ecosystems in classes of pasture, transitional woodland-scrub and moors and heathland. The grasslands in the project areas cover more than 10% of their territory. The trend between 2012 and 2018 varies between the project areas – in some the share of grasslands has increased, for some it has decreased (Table 5.1). In 2018, grasslands in Lääne county and Saaremaa municipality cover almost twice as much as the average in Estonia – 7.3%. The situation was also similar in Šilutė municipality: 16.2% versus 7% on average in Lithuania. In Latvia, Cēsis municipality had almost the same grassland coverage as the average in Latvia – 10.0% whereas Madliena parish had the highest share of grasslands – 14.5% of its territory.

**Table 5.1.** Share of grasslands (% of the project area) (source: CORINE Land Cover)

Area	1990	2000	2006	2012	2018
Lääne county, Estonia	8.3	8.2	13.3	13.5	14.4
Saaremaa municipality, Estonia	10.3	9.9	13.0	12.7	12.8
Madliena parish, Latvia	12.3	16.7	17.6	15.6	14.5
Cēsis municipality, Latvia	8.1	8.1	11.9	11.8	10.3
Šilutė municipality, Lithuania	14.8	13.4	11.6	11.6	16.2

In general, the indicator value on the „share of grasslands“ is largely influenced by the spatial limitations of the CORINE Land Cover data sets. The CORINE Land Cover programme was implemented for Europe-wide land monitoring, thus a minimum mapping unit is 25 ha. Due to this threshold, the semi-natural grasslands have not been recorded in both Latvian project areas. An area smaller than 25 ha is attributed to the spatially adjacent land cover category.

During the project period, the agricultural sector experienced a transition between two Common Agricultural Policies. According to the IACS database, the impact of new policies that set new conditions regarding grasslands is recognisable from 2015 and onwards. This has resulted in a positive outcome towards the grasslands managed and supported by subsidies in the project areas. In Saaremaa municipality and Lääne county the managed grassland areas have increased by 4%, in Šilutė municipality by 8%, and in Cēsis municipality and Madliena parish by 12.3%. This might outdo the negative trend observed by CORINE Land Cover monitoring data.

## 5.2. Change in area covered by grasslands

The main reasons for a change in the area covered by grasslands, between 2012 and 2018, are due to agricultural practices (a shift from pastures to non-irrigated arable land and vice-versa) and land abandonment i.e., resulting in land covered by transitional woodland-scrub (Figure 5.1.).



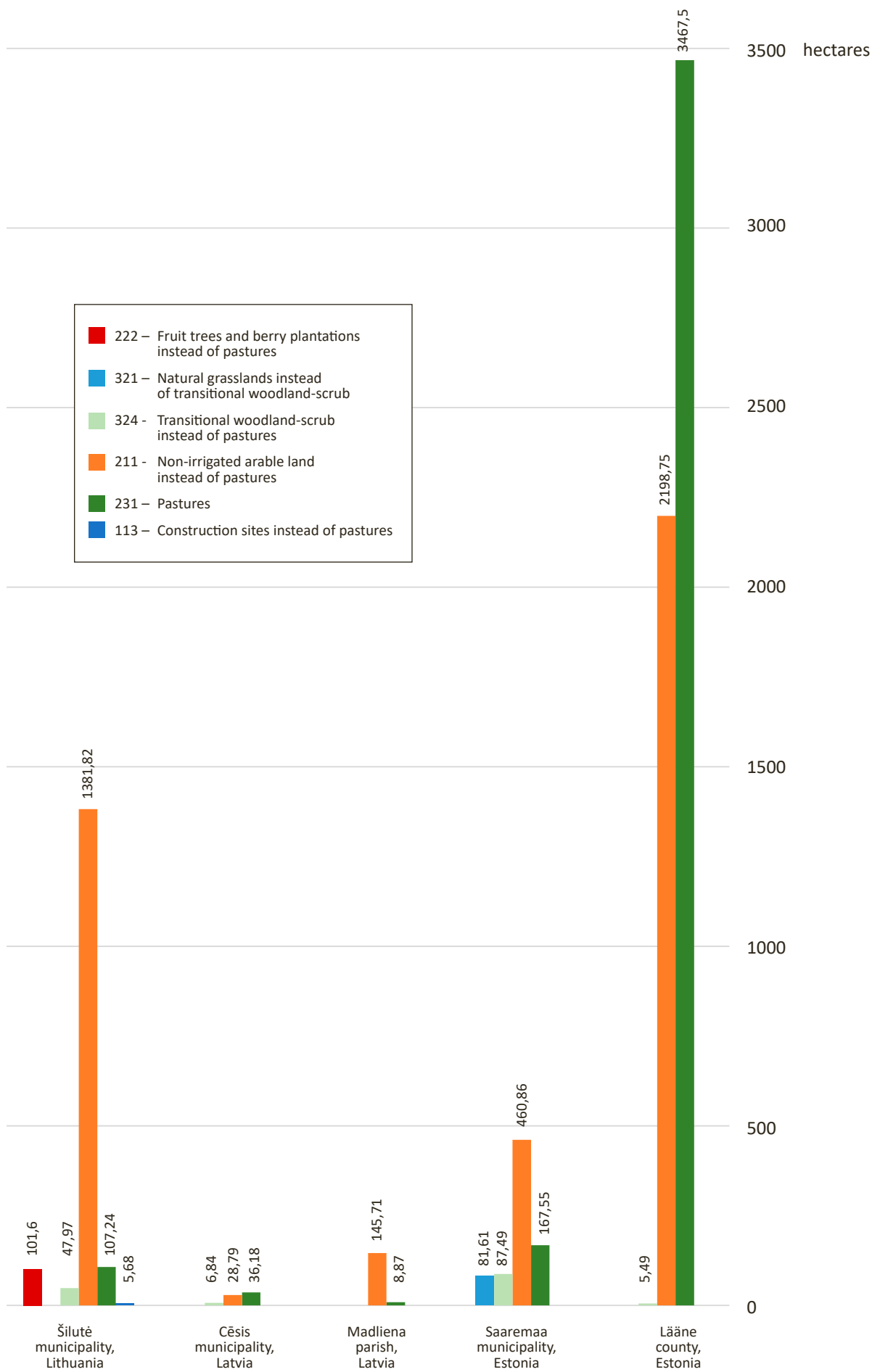


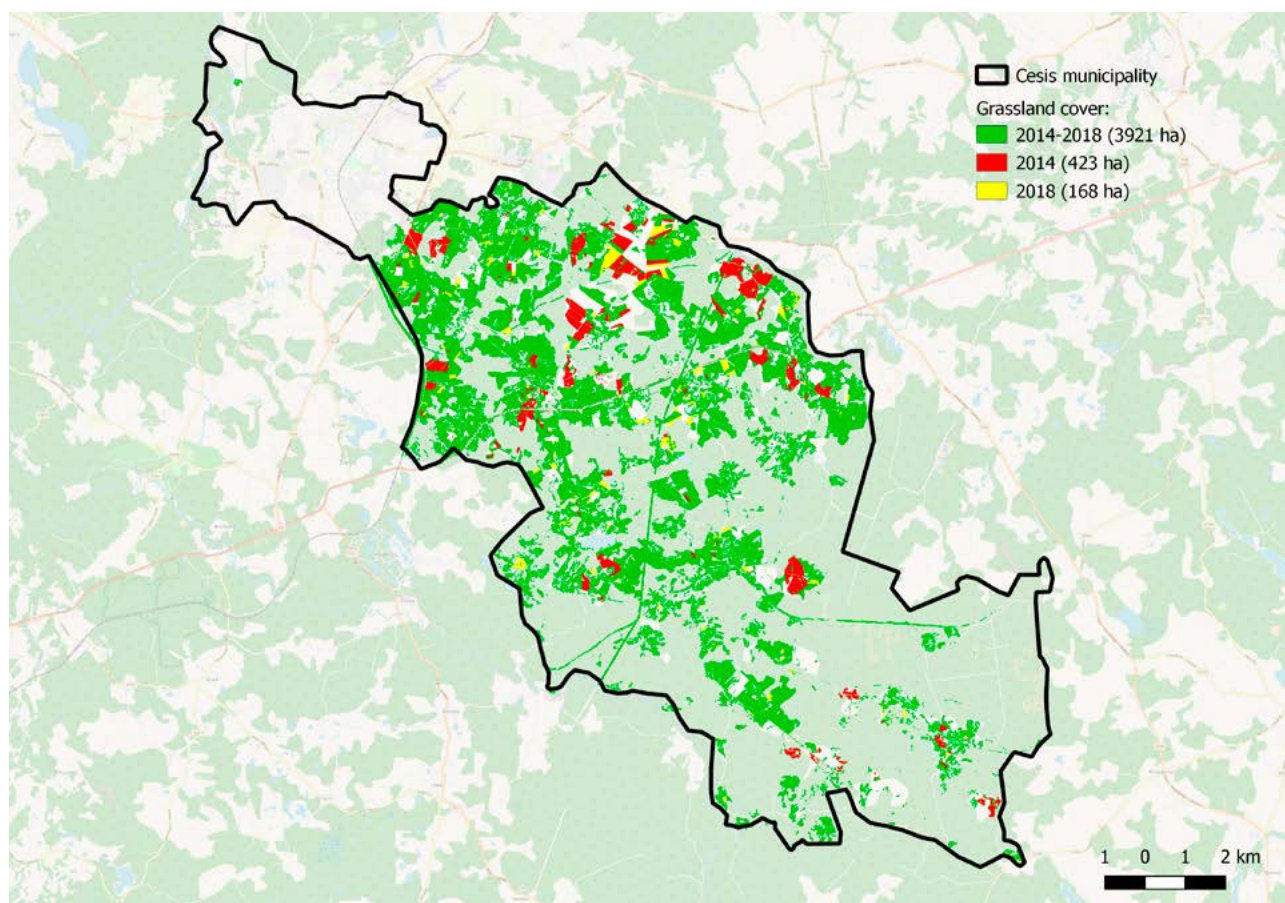
Figure 5.1. Change in grassland cover (ha) between 2012 and 2018 (source: CORINE Land Cover)



## 5.3. Assessment of grasslands using remote sensing techniques

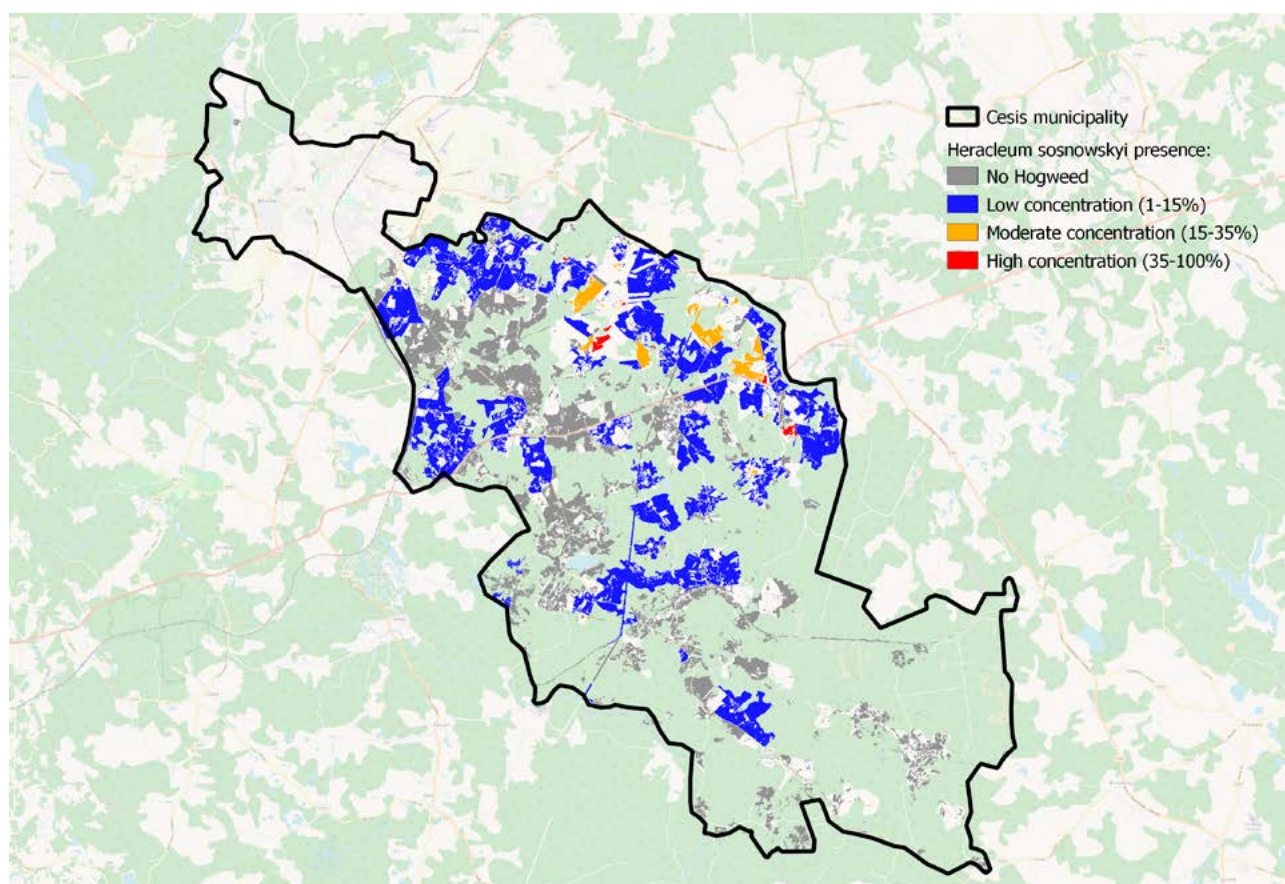
Monitoring of grassland cover change 2014 – 2018 in Cēsis municipality shows that the total grassland cover has slightly decreased by 6%. The grasslands have been mainly transformed into arable land. The trend using airborne hyperspectral and LiDAR data also mirrors the observations from satellite data presented by the Corine Land Cover (Figure 5.2.). Therefore, it is essential to continue to support the grassland management by subsidies, as well as integrated payments for ecosystem services in new policies and land-use planning documents.

Monitoring data of aerial images shows that the cover of Sosnowsky's Hogweed in open areas has significantly decreased by 56 % - from 215.4 ha in 2014 to 94.8 ha in 2018 (Figure 5.3.). Nevertheless, there are also still cases where new areas are occupied, mainly in the vicinity of areas where Sosnowsky's Hogweed was detected in 2014.



**Figure 5.2.** Change in grassland cover in Cēsis Municipality





**Figure 5.3.** Distribution and cover of Sosnowsky's Hogweed in Cēsis municipality

## 6. Impact on ecosystem services supply

Each land use and grassland management practice impacts on conditions (status) of the ecosystems and, in turn, this also impacts on the ecosystem services supply. During the LIFE Viva Grass project, the interactions between the main grassland management categories (cultivated, permanent and semi-natural) and arable land were studied to explore the trade-offs and synergies in ecosystem services. The main outcomes are presented in the Viva Grass Integrated Planning Tool and its data products.

For strategic planning and decision-making on sustainable land use, an overall look at ecosystem services and their interdependencies shall be analysed, as there may be constraints in the simultaneous delivery of requested ecosystem services. In many cases, a choice between two or more benefits that cannot be acquired simultaneously shall be taken. The term “trade-off” was used in the project to illustrate a situation in which the use of one service decreases the benefits supplied by another service.

Interactions or trade-offs between ecosystem services occur not just among single ecosystem services but within and among groups of services, thus allowing to group or bundle the ecosystem services together that respond to changes in similar ways. The Viva Grass Integrated Planning Tool contains data layers that illustrate the bundles, as well as trade-offs, of the current land use practices in the three countries.

### 6.1. Bundles of ecosystem services

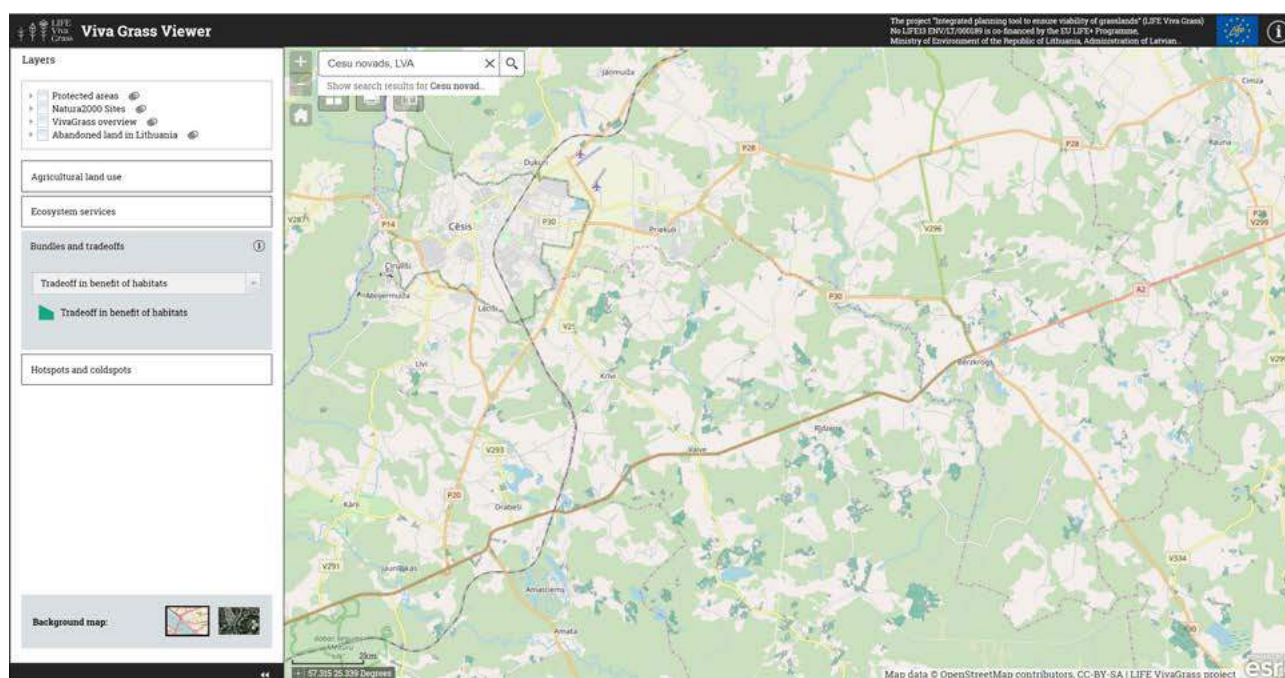
Bundles of ecosystem services are defined as a set of associated ecosystem services that are linked to a given ecosystem and usually appear together repeatedly in time and/or space. The increase of one service in the bundle usually also means an increase of other services belonging to the bundle. LIFE Viva Grass project analysed the interactions between ecosystem services and revealed 3 bundles of ecosystem



services for grasslands: “Production”; “Habitats”; “Soil”. For example, the “Habitats” bundle represents fields where such services as “herbs for medicine”, “maintaining habitats”, “global climate control” and “pollination and seed dispersal” have supply potential values above average (values from 3 to 5).

## 6.2. Trade-off in benefit of habitats

“Trade-off in benefit of habitats” represents the fields where high values in the “Habitats” bundle occur simultaneously with low values in the “Production” bundle (Figure 6.1.). In the context of grasslands, the trade-off between biomass production and biodiversity and habitats: increasing productivity of grassland usually requires a certain degree of intensification through fertilisation, ploughing and reseeded with a mix of selected species. These intensification practices in turn simplify grasslands’ structure and decrease the number of grassland species, leading to a loss of habitats for birds and arthropods.



**Figure 6.1.** Trade-off in benefit of habitats in Cēsis municipality

## 6.3. Hot-cold spot analysis

The Viva Grass Integrated Planning Tool also presents data layers to highlight inappropriate management of agricultural land. “Cold-spots” are fields (coloured in blue) with low or very low (below 3) values in the majority of ecosystem services provided. The field assessed as a cold-spot signals to landowners or planners the need for change in land use practices to achieve the potential of higher benefits. “Hot-spots” are fields with a great variety of ecosystem services provided at values above average (from 3 to 5), which indicate areas where the present management practice should be maintained. (Figure 6.2.)



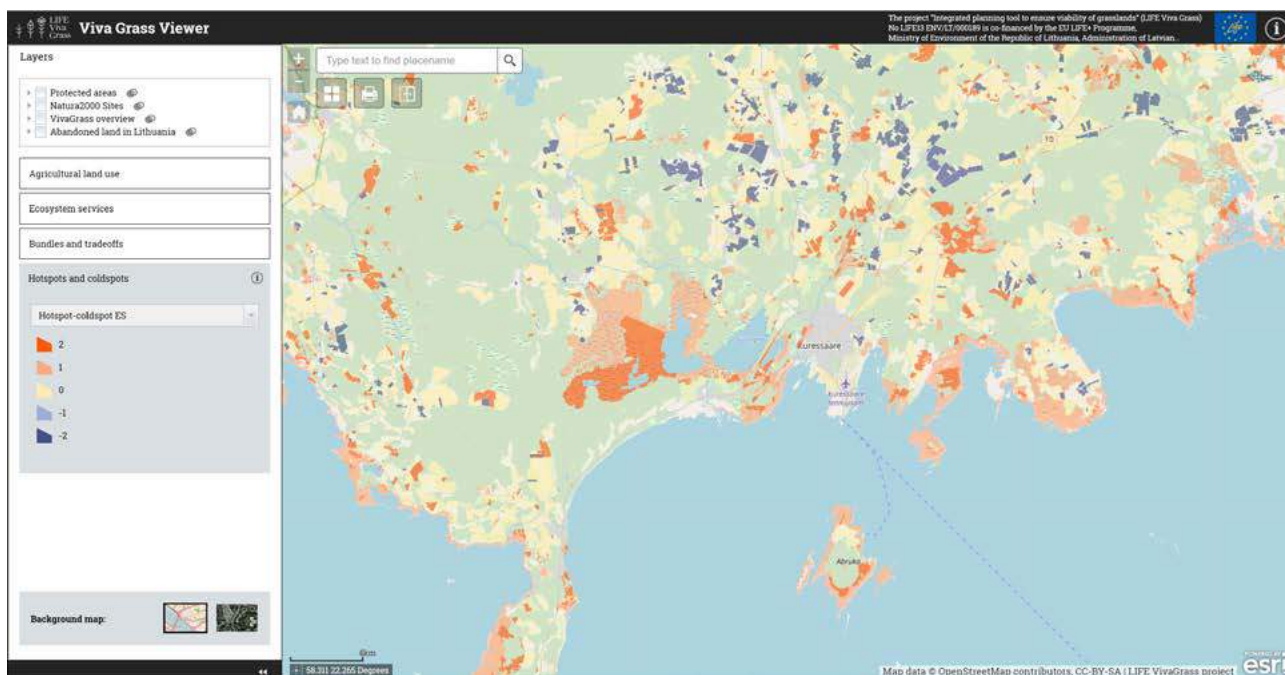


Figure 6.2. Cold-hot spot analysis in part of Saaremaa municipality

## 6.4. Impact of land use change on values of ecosystem services

The Viva Grass Integrated Planning Tool not only contains information regarding ecosystem service supply, but also allows any user to explore scenarios that show the impact of land use changes between different agro-ecosystem categories on the supply of provisioning and regulating ecosystem services (Figure 6.3.). The indicated trend in the change of ES supply (arrows on the right side of the pop-up bar) due to a change of agricultural land use stimulates awareness raising about the interconnections between different ecosystem services and the subsequent trade-offs in order to gain the optimum amount of desired benefits.

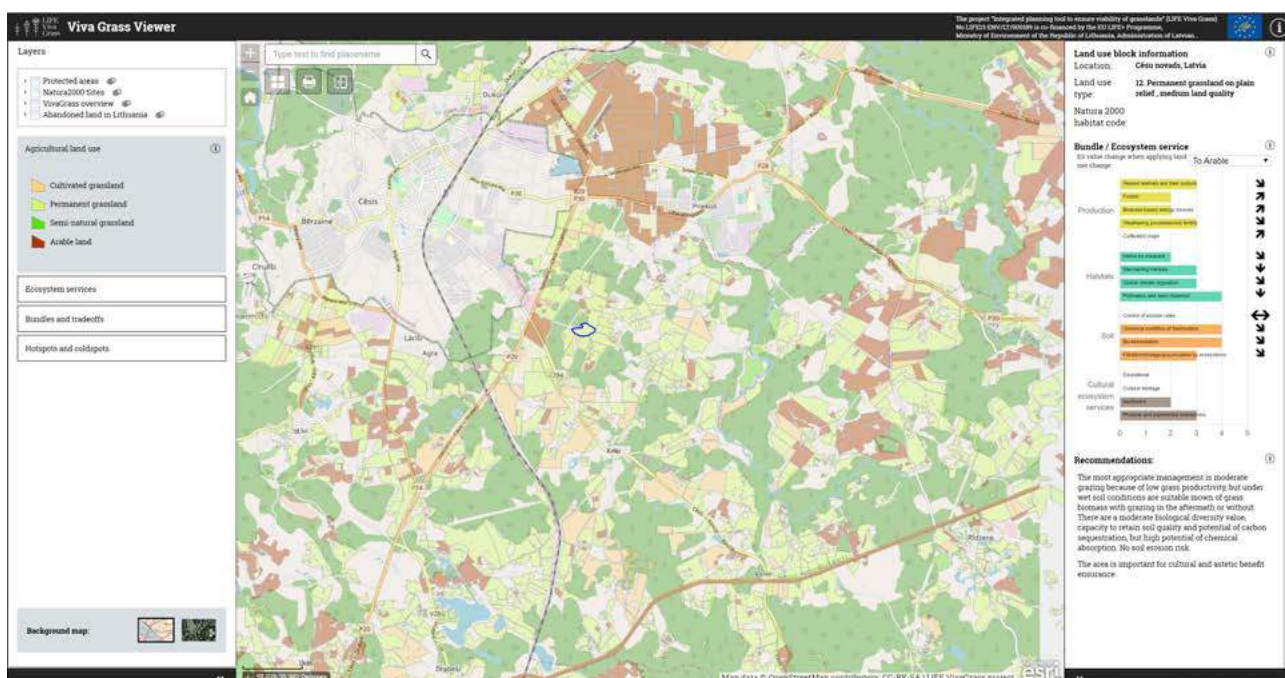


Figure 6.3. Example of pop-up bar with assessment of ecosystem services and potential impact of the land use change from permanent grassland to arable land



## 7. Conclusions

The LIFE Viva Grass project implemented a range of activities that have short-term, but most importantly, the potential for long-term, environmental impacts. The short-term impacts were closely monitored at the grassland restoration sites throughout project implementation. The initial status of the grasslands varied greatly – from habitats with a tendency to be overgrown with shrubs, partly or fully overgrown areas with bushes, or even degraded areas with invasive species, mainly Sosnowsky's Hogweed. Therefore, different grassland restoration and management measures were implemented to recover grassland ecosystems and to provide preconditions for sustainable management in future.

Monitoring results reveal that habitats of Community importance have been restored and the quality improved in restored sites that were located in nature protected areas – Pavilniai regional park, state Pašešuvīs landscape reserve, Dubysa regional park, as well as the Kurese farm that is located in Kurese landscape protection area. In Cēsis municipality, the achieved progress in grassland recovery is slower due to invasive species which meant that restoration works most involved heavy ploughing and resowing. Such agriculture areas will become permanent grasslands initially, but habitats of Community importance only over a longer time period. Šovītes farm implemented a range of activities to facilitate enrichment of the grasslands with species in parallel with livestock farming activities. This approach was challenging for farmers in terms of balancing business needs and restoration ambitions. Fields that were used for grazing presented a higher plant diversity by the end of the project.

Results of analysis of soil quality and basic properties showed large heterogeneity and thus also the potential for evolution of different habitats. Despite restoration activities, basic soil properties were not impacted upon significantly during the project period. Efforts to decrease the content of the key chemical elements – nutrients – in soil could facilitate the rewilding processes in grasslands in future.

Long-term trends in grassland cover were monitored using CORINE Land Cover data that were supplemented with remote sensing techniques in Cēsis municipality. 2012–2018 data reveals that the proportion of grassland cover has increased in Lääne county, Saaremaa and Šilute municipalities, whereas it has decreased in Cēsis municipality and Madliena parish. This monitoring period also reflects a shift between two periods of the EU Common Agricultural Policies. The impact of ongoing national agricultural and rural development policy shows a positive impact towards the grasslands areas supported. Consequently, the area receiving subsidies for grassland management has increased in the project areas. This may overcome the negative trend observed by CORINE Land Cover monitoring data.

The Viva Grass Integrated Planning Tool embeds the results of mapping and assessment of grassland ecosystem services. The tool not only presents the values of the ecosystem service supply at field level, but it also allows the discovery of the potential impact of land use changes on the supply of provisioning and regulating ecosystem services. The project has delivered a tool that, when applied in strategic planning and decision-making on sustainable agricultural land use, could result in a positive long-term effect on grassland ecosystems and the ecosystem services they provide.







The aim of the LIFE Viva Grass project is to support the maintenance of biodiversity and ecosystem services provided by grasslands, through encouraging ecosystem-based planning and economically viable grassland management.

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