



RESTORATION OF HYDROLOGY REGIME OF BOG WOODLAND (91D0*) HABITAT IN THE GULBJUSALA NATURE RESERVE



Forest Habitat Restoration within the Gauja National Park
LIFE10 NAT/LV/000159 FOR-REST
Overview of hydrological regime restoration programme

Institute for Environmental Solutions

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Forest Habitat Restoration within the Gauja National Park (FOR-REST)

The goal for FOR-REST is to develop long-term solutions for forest habitat restoration and management by selecting priority species and habits upon which innovative habitat evaluation techniques will be tested, demonstrated and put into practice. Drainage has been responsible for the reduction in spatial coverage and habitat quality in *Bog woodlands (91D0*)*. One of FOR-REST's aims is restoring the natural habitat of bog woodlands and reversing the damage of the drainage

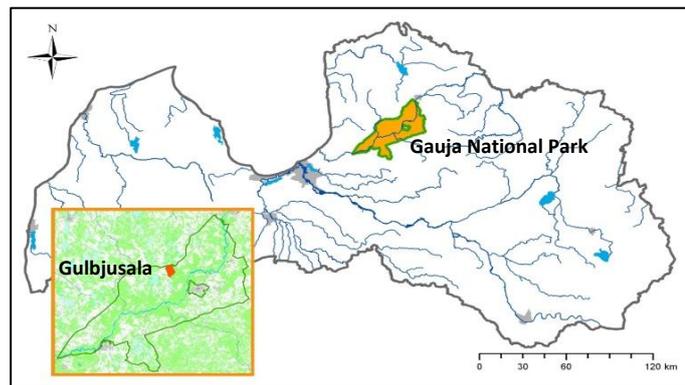


Figure 1 Location of Gulbjusala Raised Bog within Gauja National Park

regime upon the Natura 2000 site in Gauja National Park. Gulbjusala was chosen as the location to implement the hydrological restoration activities, as it has the densest area of drained and wetland forests within the national park (Figure 1). The lessons learnt in Gulbjusala will be applied in further restoration works throughout Gauja National Park. The remaining goals of FOR-REST are the restoration, status improvement and long-term preservation of *Western taiga (9010*)* and *Tilio-Acerion forests of slopes, screes and ravines (9180*)*. The latter habitat is home to the hermit beetle (*Osmoderma eremita*) and particular attention will be devoted to ensure a suitable habitat for the especially endangered species.

Project duration: September, 2011 – August, 2015

Project carried out by: Nature Conservation Agency

Project partners: Institute for Environmental Solutions, Latvian Fund for Nature and “ELM MEDIA”

Project financed by: European Commission LIFE+ programme

Co-funding: Administration of Latvian Environmental Protection Fund

The aim and tasks

To achieve hydrological restoration and ecosystem functionality improvements, especially, for *Bog woodland (91D0*)* in Gulbjusala, the following tasks are addressed:

1. Supplement existing information with newly acquired airborne remote sensing data about Gulbjusala and compare historic and contemporary maps to determine the change in the hydrological regime, land use and nature values.
2. Creation of a favourable hydrological regime restoration scenario in bog woodlands.
3. Evaluation of the proposed scenario's impact on hydrological restoration within Gulbjusala and on properties adjacent to the project area.
4. Design and selection of appropriate restoration actions and monitoring description based on the chosen scenario.

Necessity of restoration

The latest report on the status of habitats of EU importance in Latvia has highlighted the need for urgent restoration activities. It concluded that most of the habitats are in poor functional and protective status and called for the restoration of at least 15% of degraded ecosystems. Bog ecosystems perform a number of vital functions that are lost as a result of drainage and peat gathering. It is estimated that drainage has reduced 90% of the areas covered by bogs in the EU. The

typical hydrological regime is a precondition for the effective functioning of the bog ecosystem. Wetlands, peat accumulation and limited presence of nutrients is necessary for bog formation. Once bogs lose their ability to form peat effectively, they also lose the capacity to absorb carbon dioxide. The drained conditions favour the growth of trees, which further reduces the required wetness and the ability to absorb carbon dioxide. Reversing the negative impacts of drainage upon bog ecosystems will not only help to slow down global climate change, but restore the bog's ability to act as a sponge and absorb excess water during the flooding season.

Approximately 3% of Latvia's territory is covered by bog woodlands, however drainage actions have distorted their natural hydrological regime and endangered the existence of this protected habitat. Historic materials show that the first drainage actions in Gulbjusala bog began in 1937, while the existing regime has been in place since the early 1960's. There is a lack of information regarding any possible improvements or maintenance actions performed since then, however inspection of the territory reveals a number of no longer functional ditches and the influence of beaver dams upon the water levels of *Dystrophic (3160) Auciema and Melnezers lakes*. The previous drainage actions have lowered the water levels in both of these lakes and to preserve their intended functioning, it is necessary to ensure that their natural hydrological regime is maintained. Dystrophic lakes are protected by domestic and EU legislation and are characterised by little vegetation and proximity to *Active raised bogs (7110*)*. The overgrowth of pine trees in Gulbjusala, indicates a hydrological regime incompatible with the hydrological requirements necessary to preserve the active raised bog.

The project will have restored Gulbjusala's hydrological regime, thereby improving the status of *Bog woodlands (91D0*)* which cover 242 hectares. Actions will be concentrated on 138 hectares of the habitat that will provide an opportunity for future restoration, status improvement and appropriate habitat distribution near Gulbjusala's and Melnezers' raised bogs. Regardless of what habitats will be restored in the future, it is necessary to stop the functioning of the drainage system to ensure suitable circumstances for the natural conditions and distribution of habitats in Gulbjusala.

Although Driškina Lake is outside FOR-REST territory, its hydrology, status and changes will be evaluated as part of the project due to the lake's influence on Gulbjusala. Furthermore, a number of woodland bogs in the project area have occupied areas that were previously active raised bogs. As both of these habitats are protected on an EU level, it is necessary to ensure an appropriate hydrological regime for each of them.

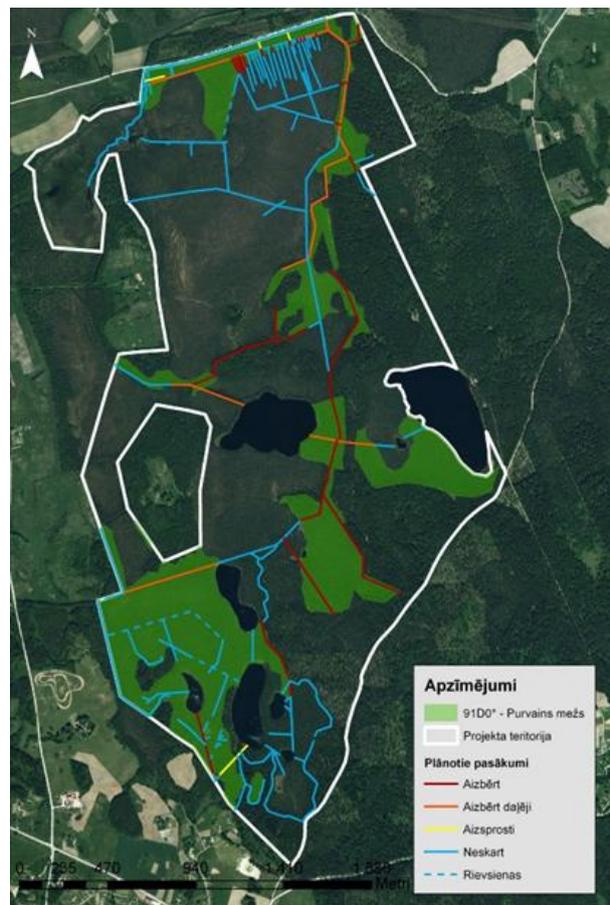


Figure 2 Illustration of hydrological restoration activities in Gulbjusala. (Green - Bog woodlands (91D0*); white line - project territory; red line - ditches to be filled fully; orange line - ditches to be filled partially; yellow line – ditches with dams; blue line - unaffected; blue striped line - sheet piling).

Restoration actions

The following actions took place prior to the restoration activities:

1. Evaluation of the current hydrological regime status and the distribution of drainage system;
2. Habitat status evaluation and mapping;
3. Airborne remote sensing using a laser scanner to determine precise terrain and digital surface model.

The gathered information allowed to concentrate the hydrological regime restoration scenario on the target habitats in Gulbjusala bog. To ensure the desired distribution of bog woodlands, it is necessary to fill the ditches shown responsible for the distortion of the hydrological regime in Gulbjusala and Melnezers bogs and their related habitat ecosystems, shown in Figure 2. The chosen action areas were selected to allow future restoration of Gulbjusala and Melnezers ecosystem functioning and ensuring diverse habitat distribution.

Impact of restoration

On adjacent private properties

Project actions will impact only the project area and its hydrological regime. Properties outside the project area will be unaffected and changes in the water levels in the closest lakes are not expected. The activities will preserve the Driškina Lake tourism and recreational functionality, while also ensuring that lake fish resources or opportunities for fishing are not reduced.

Nature value status improvement

It is expected that in the short-term vegetation near ditches will be harmed by the necessary use of machinery. However, in the long-term Gulbjusala bog ecosystem will improve, particularly because of bog woodland quality and the overall habitat appropriateness improvements.

Bog woodlands and active raised bog

Areas that prior to drainage, were most likely covered with *Bog woodland (91D0*)*, are expected to provide the necessary hydrological regime for the habitat's restoration once the groundwater level is raised (Figure 3). The restored hydrological regime will support the characteristic process of the habitat – slow tree growth and peat formation. Hydrological restoration should foster the gradual return of active raised bog in locations that are now occupied by tree overgrown bog areas.

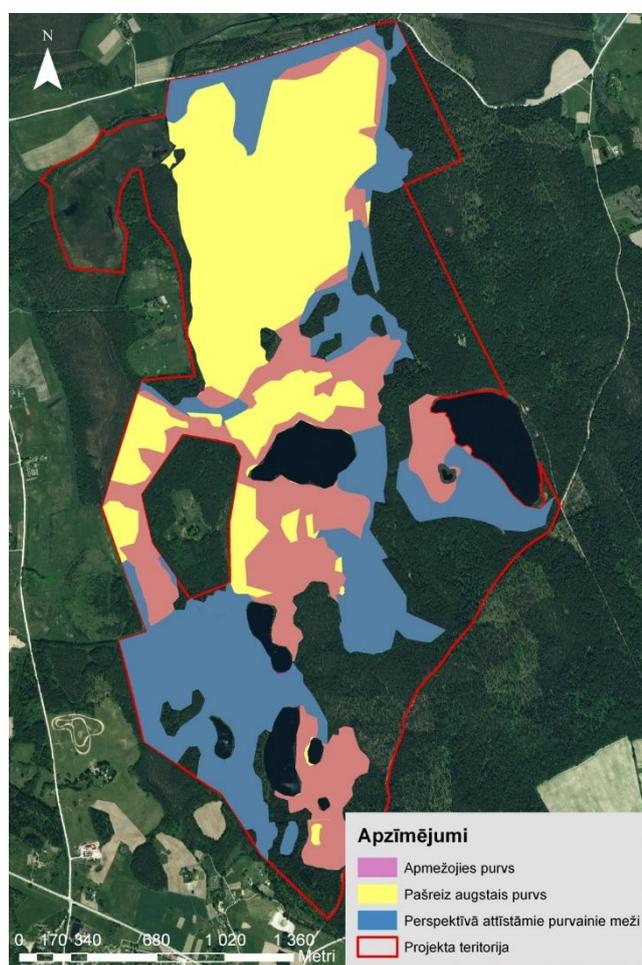


Figure 3 Bog woodland and active raised bog habitats showing the expected changes after hydrological restoration. (Pink – raised bog overgrown with forest; yellow - active raised bog; blue – bog woodland that has to be restored; red line - project territory).

Areas densely covered with similarly aged trees with a peaked canopy suggest that they have formed after the creation of drainage ditches. Therefore, these trees could be cut to accelerate the long process of bog transformation. Additionally, forest rarefaction is expected as some trees will struggle to adjust to the new habitat, thereby signalling the effective functioning of the restored hydrological regime.

The fastest and most observable changes after hydrological restoration will be seen in ground-floor vegetation as dwarf shrub projective cover is reduced and sphagnum hummock structures return, thereby indicating a more suitable vegetation for bog woodlands and raised bogs. Club-moss, which is atypical to bog woodlands and has most likely formed in the project territory due to drainage, will be reduced or eradicated altogether in the project territory. Areas where the active raised bog has been preserved will see minimal changes, as the project is aimed at *Bog woodland (91D0*)* restoration.

Lakes

Hydrological regime restoration will preserve the existing water levels and favourable circumstances for the habitats, both within the project territory's lakes and in Driškina Lake. Ditches near Auciema Lake will be filled to preserve the current water level, which has been reliant on beaver dams. Creation of dams in the appropriate ditches reduces risk in dystrophic lake quality loss by preventing eutrophication through slowing the inflow of nutrients.

Impact assessment

Regular groundwater monitoring is performed in 7 different locations, where bog forests are most prevalent to ensure that the expected results are achieved in hydrological regime restoration. The first measures were taken before restoration actions began to provide a base line and improve the restoration plan. Groundwater monitoring will be continued for five years after the project's completion to ensure that territories outside the project area remain unaffected.

Vegetation monitoring, which began in 2014 and will continue until 2016, observes the impact of the changing hydrological regime upon bog woodland areas. It is advised that the area is monitored for 10 years, however the adherence to this advice is dependent on the Nature Conservation Agency.