THE IMPORTANCE OF GEOLOGICAL STUDIES FOR THE ASSESSMENT OF DEGRADED PEATLANDS

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The areas where peat has accumulated or is still accumulating cover more than 10% of Latvia's territory. Although part of peatlands is overgrown with forests, or they are drained for agricultural purposes or used for peat extraction and these areas became degraded.

Degraded peatlands are areas that have lost ecosystems functions and peat formation possibility as a result of adverse effects.

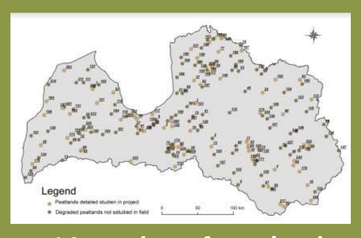

Figure 1 **Location of peatlands affected by peat extraction surveyed in the frame pf LIFE Restore project**

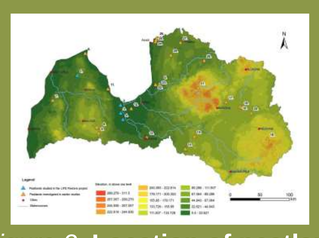

Figure 2 **Location of peatlands affected by peat extraction studied in details**

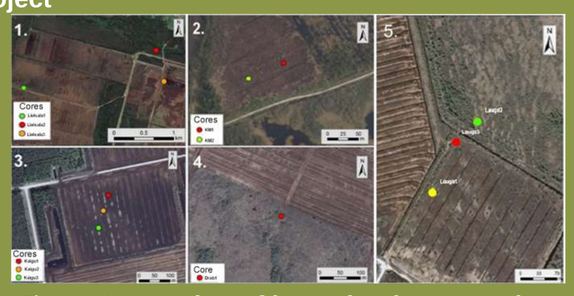

Figure 3 **Location of investigation cores in the peatlands studied in details**

Figure 4 **Field works in degraded Lauga peatland area**

Over the last hundred years, the development of many mires has been halted by mire drainage (15% for agricultural use and 3.9% for peat extraction), and by their overgrowth with forest, both naturally and in result of human activity. Peatland areas degraded by drainage were the research objects of project "Sustainable and responsible management and re-use of degraded peatlands in Latvia" (LIFE REstore, LIFE14 CCM/LV/001103). In these peatlands it was necessary to determine their geological structure, peat parameters, properties, which is very important to choose the most appropriate complex of management measures for the reasonable use of land resources and for climate change mitigation.

Figure 5 **Field works in degraded Kemeri peatland area**

Figure 6 **Peat monoliths prepared for transportation to the laboratory**

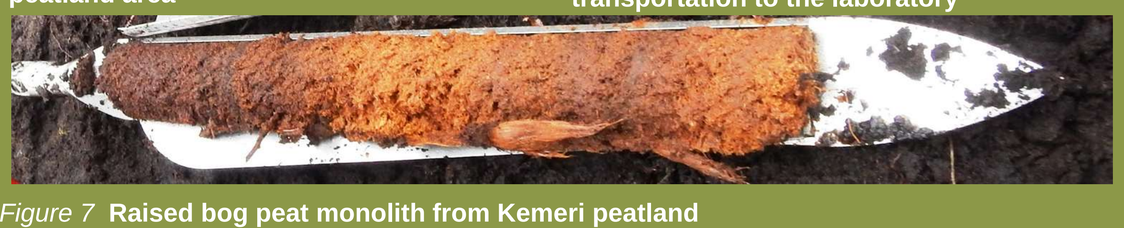

Figure 7 **Raised bog peat monolith from Kemeri peatland**

Degraded peatlands have been studied both by field and laboratory methods. Defined 78 peatlands were studied within LIFE Project include both chamber and field research methods, including geological coring and sampling. Pre- and post-field work information is compiled and obtained results are collected and analysed. Peat monoliths obtained in boreholes were studied in field, but 5 peatlands: Lauga Mire, Lielsala Mire, Kaigu Mire, Drabiņu Mire and Ķemeri Mire were additionally investigated in research laboratories of University of Latvia. Analysis included: loss-on-ignition analysis to determine the content of organic matter and ash; analysis of peat decomposition degree and botanical composition; peat pH values; peat density.

As a result of the peatland inventory in the project, it was found that among all the degraded peatlands surveyed in the upper layer is dominated by raised bog peat - 37 peatlands, slightly less degraded areas with fen type peat in the top layer - 29 peatlands, and only one case with peat bog peat transition, but in 7 of the sites surveyed, peat has been removed to mineral deposits (LIFE Restore, 2018).

The study results show that peat properties in residual peat layers are changed. Mainly it is related to pH value, increase of peat density, changes in peat composition, including fluctuations in amount of mineral substances which can be explained by peat mineralization due to mire hydrological regime changes. In some cases, an increase of peat density was observed in upper part of the sediment section where peat was more dry and compacted.

Often, pH values in upper peat layer of degraded peatlands do not correspond to pH values of the particular peat type, which indicates a change in environmental conditions due to various influences. Changes in mineral content and carbonate content indicate on changes in sediment accumulation environment – on influence of groundwater which likely introduced carbonates and mineral substances into peat layers.

Figure 8 **Boundary between clayey sapropel and fen peat from Lauga Bog core**

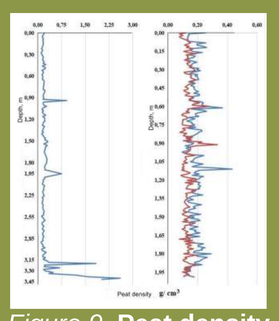

Figure 9 **Peat density dagram from Ķemeri Bog (lef) and Lauga Bog (right side)**

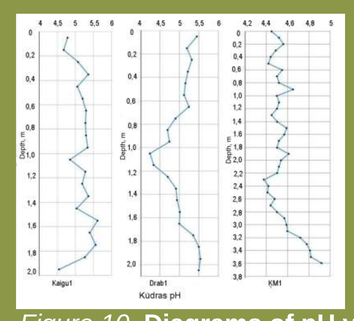

Figure 10 **Diagrams of pH values from Kaigu Bog (Kaigu1), Drabinu Bog (Drab1) and Kemeri Bog (ĶM1)**

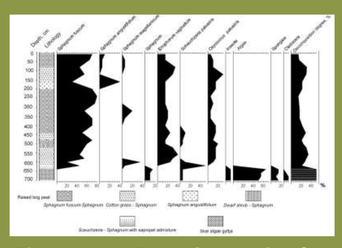

Figure 11 **Peat botanical composition from core of Lauga Bog (western part)**

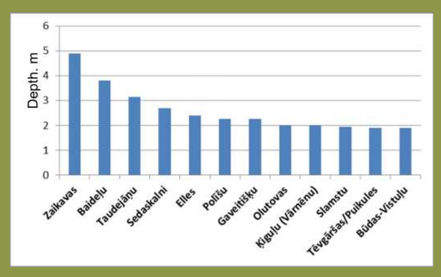

Figure 12 **Fens with the largest peat depth**

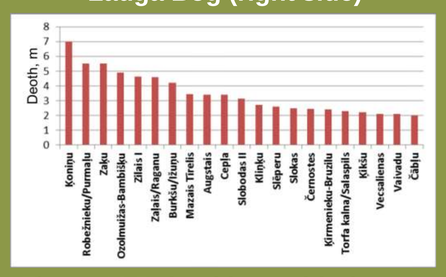

Figure 13 **Raised bog with the largest peat depth**

Figure 14 **Peatland researcher team**

In areas degraded by peat extraction, where residual peat layer is several meters thick, changes in peat composition can be explained mainly by natural processes. Higher proportion of mineral substances in lower parts of mire sections is determined by the fact that peat has accumulated directly on mineral ground in peatland bottom, and it is influenced by minerogenic sediments and by groundwater flow.

Peat decomposition degree in degraded peatlands in general are similar, and usually vary between 15% and 35%, however, the peat formed directly on the mineral deposits can has higher decomposition reaching 40 to 45%. The upper pest layer can be composed by low or medium decomposed peat. In some cases, changes of this indicator are associated with erosion processes, especially on the top of peat section, where peat is mineralised and dry.

The thickness of the layer thickness in different degraded peatlands changes from zero to those areas where peat was not found at all, up to 4.9 m in Ozolmuižas-Bambišķi Bog in the Latgale Highlands and 5.5 m in Robežnieku-Purmaļi Mire and Zaķu Bog in North Vidzeme According to the research carried out within the LIFE Restore project, information the average thickness of the peat layer, depending on the peat type, is as follows: for raised bog type peatlands the average peat layer thickness is 2.5 m and for fen type peatlands - 1.4 m. The thickness of the peat layer found in the only transitional peatland is 3.23 m. In peatlands of different peat types, the average peat layer thickness is 1.9 m. In order to ensure the rational use of peat resources, peat extraction is the best way to further utilize degraded peatlands containing peat for industrial production.

At the base of the studied 78 peatlands, the results show that sapropel has been found only on 7 sites under peat bed, which can be explained by the fact that peat extraction most often started sequentially from the edge of the peatland and thus, if the whole field is not extracted and the degraded peat fields are located in the periphery of the bog where peat formation was due to paludification processes on mineral deposit. Silt or clay has been found most frequently below the peat layers in the bog suggesting that these sediments have formed in the aquatic environment, as it has been for some time before the formation of the peatland, which has been subject to change due to climatic and geological conditions. At the bottom of the fen type peatlands, sand has been found only in 4 cases, but clay sediments - clay, till and clayey till have been found only in 7 peatland areas, mainly in highlands.

All geological information about the degraded peatland, properties of the remaining peat layer is important to assess what type of recultivation is most appropriate for the area. However the studied degraded peatlands in detail in the frame of the project obtaining information about their condition, peat thickness, peat type, pH and other properties are informative.

During the inventory of degraded peatlands they were not investigated according to the procedure established by the Cabinet of Ministers Regulation No.570 "Mining Procedures". This means that in the future, prior to the selection and implementation of the degraded peatland recultivation measures the necessary additional information should be obtained through detailed site research.

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