CHANGES OF PEAT PROPERTIES IN VARIOUSLY INFLUENCED PARTS OF THE LAUGA MIRE

Jānis DREIMANIS[1], Laimdota KALNIŅA[1, 3], Ingrīda KRĪGERE[2, 3], Līga PAPARDE[1]

[1] LU Ģeogrāfijas un Zemes zinātņu fakultāte, e-pasts: janis.dreimanis85@inbox.lv; Laimdota.Kalnina@lu.lv;
[2] LKRA, e-pasts: Ingrida@peat.lv; [3] LIFE REstore projekts.

INTRODUCTION

In the 21st century the focus is on identifying and researching affected or degraded peatland areas, mainly by observing the nature of mire vegetation cover. However, it is recognised that for the most effective recultivation method, it is important to know the properties of the remaining peat layers. **The aim of this work** is to research, characterise and compare peat deposit properties and their differences in three boreholes in three different locations of variously affected Bog Lauga areas.

RESEARCH LOCATION

Bog Lauga (Fig. 1) was chosen for study as it provides an excellent platform for a research of peat properties from differently influenced peatland areas, located on the border between the Piejūra Lowland and the Idumeja Upland, in the southern part of the Metsepole Plain, to the east to the Bīriņu Ridge.

Fig.1. Location of the bog Lauga.

Fig. 2. Location of the bog Lauga and boreholes „Lauga-1", „Lauga-2" un „Lauga-3".

MATERIALS AND METHODS

Field studies were carried out to research peat properties and their changes including geological coring (Fig. 2) and obtaining a deposit core sample (Fig. 3) for further laboratory analysis.

Fig. 4. Location of the borehole „Lauga-1".

Fig. 5. Location of the borehole „Lauga-2".

Fig. 6. Location of the borehole „Lauga-3".

Fig. 3. Packed and labeled peat samples prepared for transportation.

The location of borehole «Lauga-1» is set in the part of Bog Lauga where the top layer of the ground has been removed and ditches are being installed (Fig. 4). The borehole «Lauga-2» is located in an impacted bog area, at the foot of the dome (Fig. 5). The borehole «Lauga-3» is located in partly affected part of the bog where vegetation is not removed, but there is a contour ditch within 5 m distance (Fig. 6).

Laboratory analysis included: the analysis of loss ignition, spore-pollen analysis and determination of the peat density, pH, conductivity and magnetic susceptibility measurement, peat decomposition degree and botanical composition. Several computer programmes were used (e.g. Excel, TILIA, ect.), to carry out data processing and visualisation as well as the interpretation of the results. In total, 2168 samples were used to characterise peat sediments (Table 1).

Table 1
Number of samples used for peat study methods.

Methods	Number of samples
Peat density	768
The analysis of loss ignition	768
pH	171
Conductivity measurement	171
Magnetic susceptibility measurement	148
Peat decomposition degree	64
Botanical composition	64
Spore-pollen analysis	14
Total:	**2168**

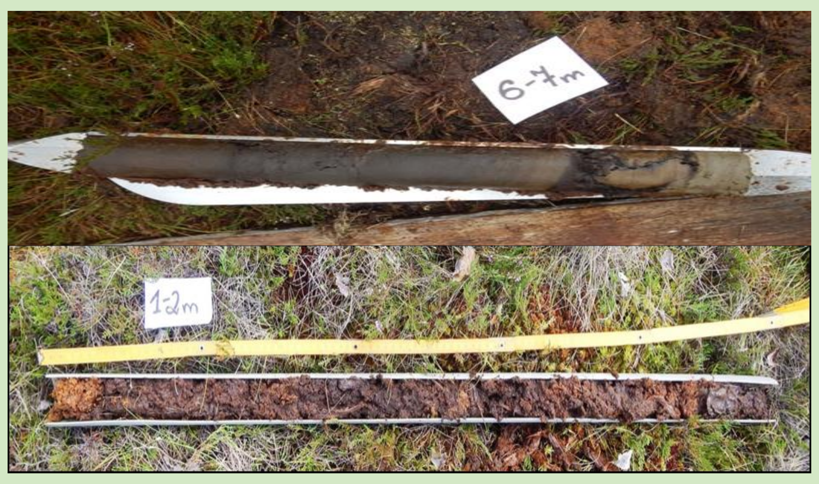

Fig. 7. Peat sample monolith.

RESULTS (

The following peat monoliths were obtained in field works (Fig. 7): in the borehole "Lauga-1": 4.7 m is peat, 1.3 m – clay blue-algae sapropel with aleyrite admixture, depth of borehole – 6 m; in the borehole «Lauga-2»: 6.9 m is peat, 0,1 m – clay blue-algae sapropel with aleyrite admixture, depth of borehole – 7 m; in the borehole «Lauga-3»: 6,7 m is peat, 0,3 m – clay blue-algae sapropel with aleyrite admixture, depth of borehole – 7 m.

The boreholes „Lauga-1" and „Lauga-3" located in the affected part of the mire have the highest values of natural density (Fig. 8) found in sediments due to the effect of drainage of the bog.

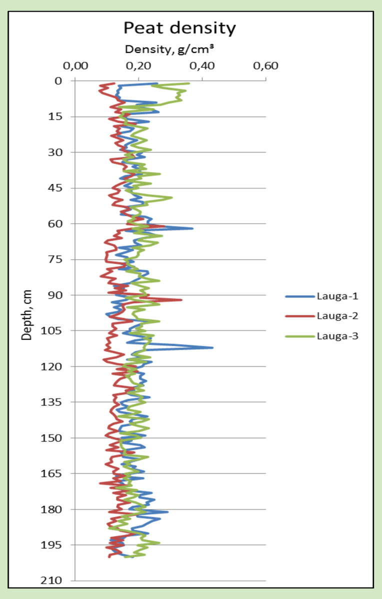

Fig. 8. Diagram of peat density.

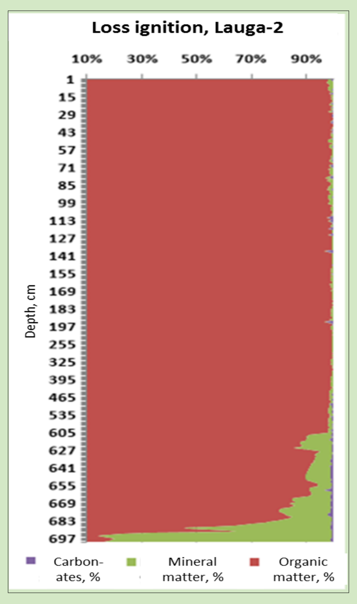

Fig. 9. Diagram showing loss ignition analysis results for deposits in borehole «Lauga-2».

In the borehole "Lauga-2" (Fig. 9) within the range of 0,0-6,15 m, no significant changes were observed in the content of both organic and mineral matters, and carbonates. However, in the range 6,15-7,00 m, a significant decrease in the amount of organic matter and a striking increase of the mineral matter was observed, while the changes of carbonate content were on a smaller scale. This is due to the accumulation of sapropel under the peat.

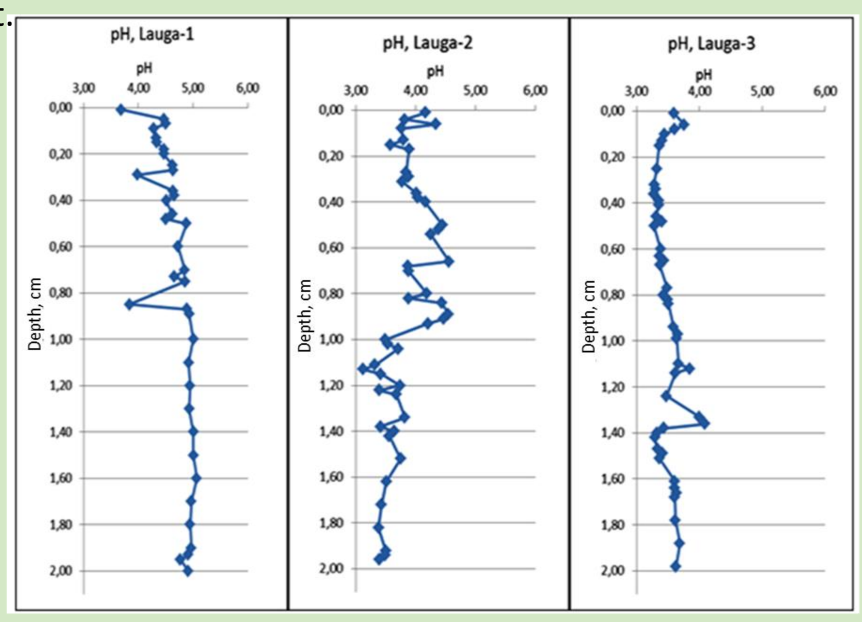

Fig. 10. Diagram of pH for deposits in boreholes «Lauga-1», «Lauga-2» and «Lauga-3».

Changes in the smallest amount of organic matter were detected in peat deposits in the borehole «Lauga-2», indicating that sediments accumulated under more calm conditions.

The greatest impact of groundwater flows is in the borehole «Lauga-1» (Fig. 10), which is indicated by pH = 4.7. The pH of other boreholes is mainly influenced by precipitation waters, as evidenced by the sour environment (pH <4).

Negative values for low and high frequency magnetic susceptibility of all boreholes (Fig. 11), mean values and their minimum differences indicate that no magnetically susceptible minerals have been detected in the boreholes.

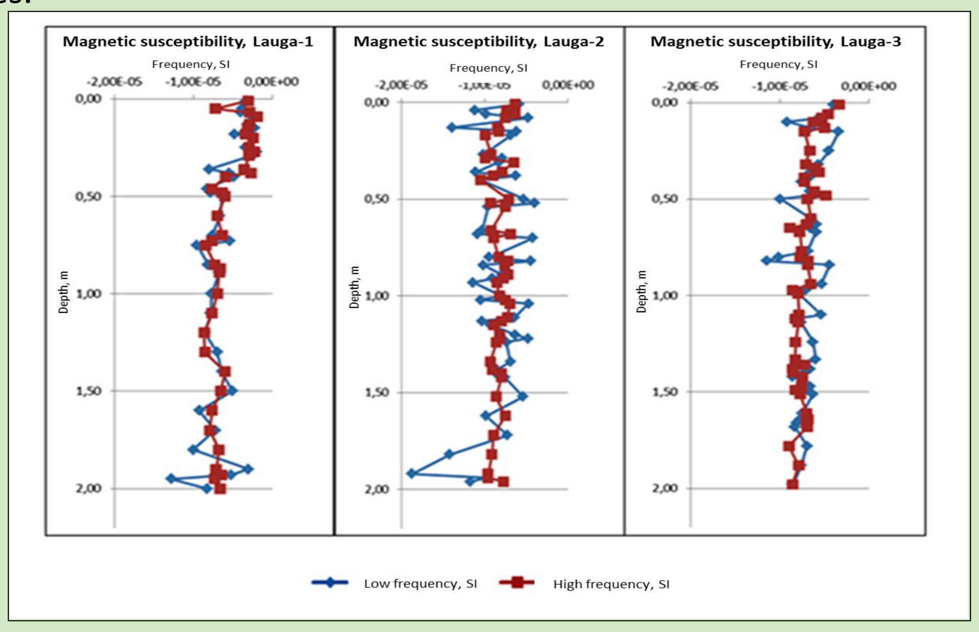

Fig. 11. Diagrams of magnetic susceptibility analysid for deposits in boreholes «Lauga-1», «Lauga-2» and «Lauga-3».

In the borehole «Lauga-1» (Fig. 12), the main form of peat is the brown sphagnum (*Sphagnum fuscum*), which dominates in all studied samples, reaching 65-80%. The exception is an interval of 1.0-1.2 m, where the amount of brown sphagnum decreases to 35%, but dominated by the *Sphagnum angustifolium*.

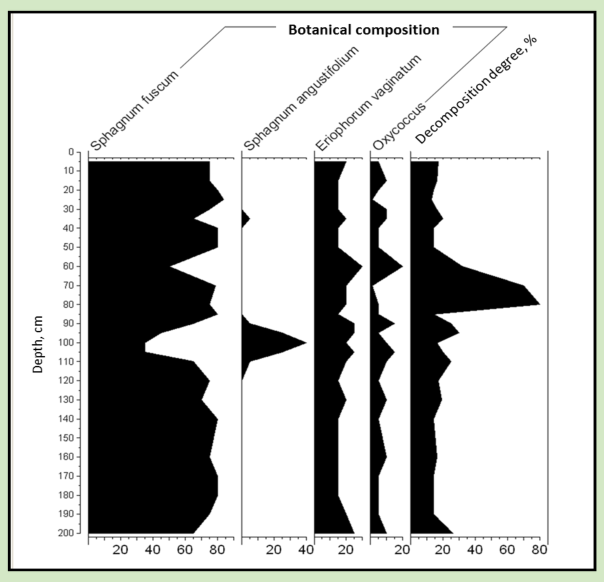

Fig. 12. dDiagram of peat botanical composition and decomposition degree in borehole «Lauga-1».

The peat in general is weakly decomposed (13-17%), except at a depth of 0.55-0.98 m (Fig. 12), in which the peat is well decmostlyomposted and the decomposition degree reaches 32%. This indicates a temporary, distinctly dryer conditions and a lower groundwater level in the bog when the environment was suitable for plant decomposition processes.

Like in the borehole «Lauga-1» the brown sphagnum (*Sphagnum fuscum*) also dominates in the borehole «Lauga-2» (Fig. 13), but at a depth of 1.50 m it decreases and the amount of *Sphagnum angustifolium* increases significantly. Compared to the borehole «Lauga-1», the decomposition degree has not changed in the borehole «Lauga-2».

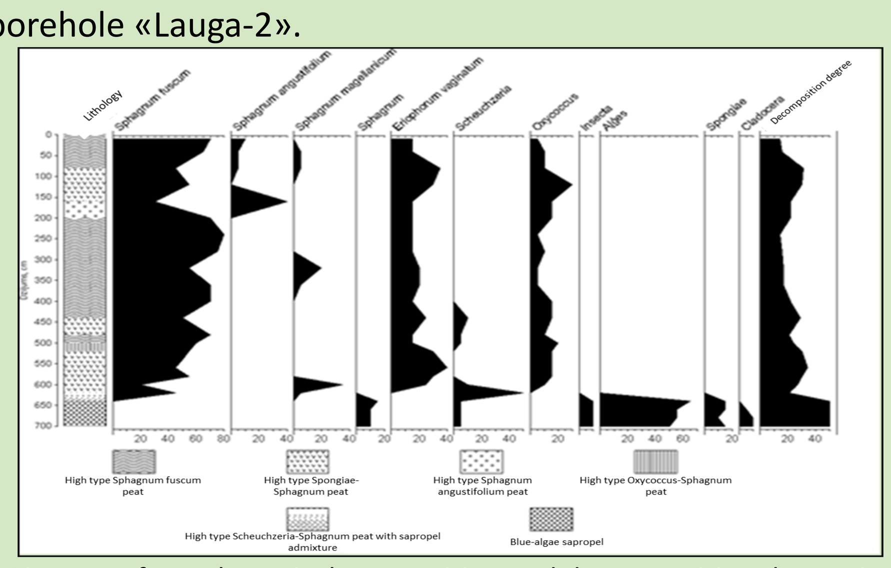

Fig. 13. Diagram of peat botanical composition and decomposition degree in borehole «Lauga-2».

Since the absolute age of sediment was not determined by the ^{14}C dating method, the relative age of sediment was identified by spore-pollen analysis. While interpreting the results of the spore-pollen analysis (Fig. 14), it was found that the Bog Lauga formed shortly before climatic optimum.

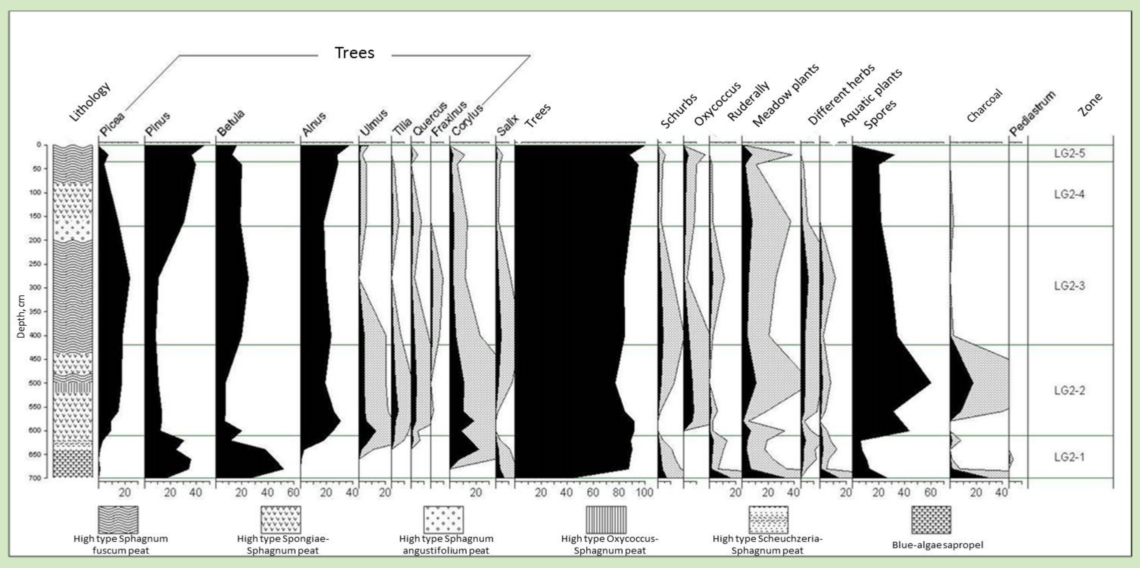

Fig. 14. Percentage diagram of spore-pollen analysis for deposits in borehole «Lauga-2».

CONCLUSIONS

Due to the drainage of the bog and the sanding of the upper peat layer in the affected part of the bog (in the boreholes "Lauga-1" and "Lauga-3"), the natural density of peat is higher than in the natural part of the Bog Lauga (borehole "Lauga-2").

In the affected part of the bog, in the borehole "Lauga-1" there are two intervals with a significant decrease in the amount of organic matter, while the natural part of the bog in the peat (in the borehole "Lauga-2") has a regular amount of organic matter.

More pronounced pH changes occur in the natural part of the mire, with the depth of the pH values tending to decrease. The highest pH values were detected in the borehole "Lauga-1".

In various affected parts of the bog in the range of 0.0-2.0 m, there are negative magnetic susceptibility values indicating that there is no magnetically susceptible minerals in the peat.

The data of the botanical composition and the decomposition degree of the peat from the explored boreholes of the Bog Lauga indicate that the trend of accumulation of sediments in the upper 0.0-2.0 m interval has been similar.

Pollen spectra and their changes in the percentage of sediment in the Bog Lauga reflect the changes in vegetation throughout the development of the bog, since the early end of the Holocene shortly before climatic optimality up until nowadays.