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USING LAKE SEDIMENTS IN ESTIMATING POSSIBLE ENVIRONMENTAL IMPACTS OF PEAT PRODUCTION: CASE STUDIES FROM FINLAND

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SUMMARY

Since the early 2010's, the impact of environmental loading of peat production in lakes and waterways has been widely discussed in Finland. The scarcity of scientific evidence related to influx of allochthonous carbon and the rate of sedimentation in lakes and rivers affected by peat production activities has been a problem and partially prevented a detailed scientific discussion on the topic. In order to provide unbiased data, the Geological Survey of Finland (GTK) launched a sedimentological research project on this topic in 2013. The goal is to compare data from several pairs of lakes on the same catchment, the other lake affected by water coming from peat production area, and the other without any connection to peat production areas. The lakes that are possibly affected by peat production have been chosen using different spatial methods, with a wide geographical coverage over Finland in mind. So far, totally 21 pairs of lakes have been investigated. Four of these lakes were selected for long core sampling. For ensuring a good geographical coverage, another set of 10 lake pairs will be studied during summer 2016. The total amount and areal distribution of sediment was evaluated with echo soundings. Sediment quality, chemical and physical properties, as well as testacean communities were studied from short cores, and the recent sedimentation rate was estimated using a proper dating method (e.g. ¹³⁷Cs). The description of the long-term sedimentation and natural changes in the study lakes history will be carried out from a long core samples using biostratigraphy and proper dating methods (e.g. ¹⁴C, palaeomagnetic dating). Altogether, these results will increase our understanding on if and how peat production activities affect sedimentation rates in lakes and rivers throughout Finland.

Keywords: lake sediments, peat production, environmental impact, Finland

INTRODUCTION

Since the early 2010's, the impact of environmental loading of peat production in lakes and waterways has been widely discussed in Finland. Recent legislative actions have emphasized the need for the protection and monitoring of aquatic systems under the influence of peatland use. The scarcity of scientific evidence related to influx of allochthonous carbon and the rate of sedimentation in lakes and rivers affected by peat production activities has been a problem and partially prevented a detailed scientific discussion on the topic. In order to provide unbiased data, the Geological Survey of Finland (GTK) launched a sedimentological research project on this topic in 2013. The goal is to compare data from several pairs of lakes on the same catchment, the other lake affected by water coming from peat production area, and the other without any connection to peat production areas.

MATERIALS AND METHODS

The lakes have been chosen using different spatial methods with several different data in use. The lakes that are possibly affected by peat production are confirmed to be located in the catchment of a peat production area as documented by the environmental permits of peat production. During selection, a perspective on a wide geographical coverage over Finland was used. So far 21 pairs of lakes were investigated of which four lakes were selected for long core sampling. For ensuring a good geographical coverage, another set of 10 lake pairs will be studied during summer 2016 (Fig. 1).

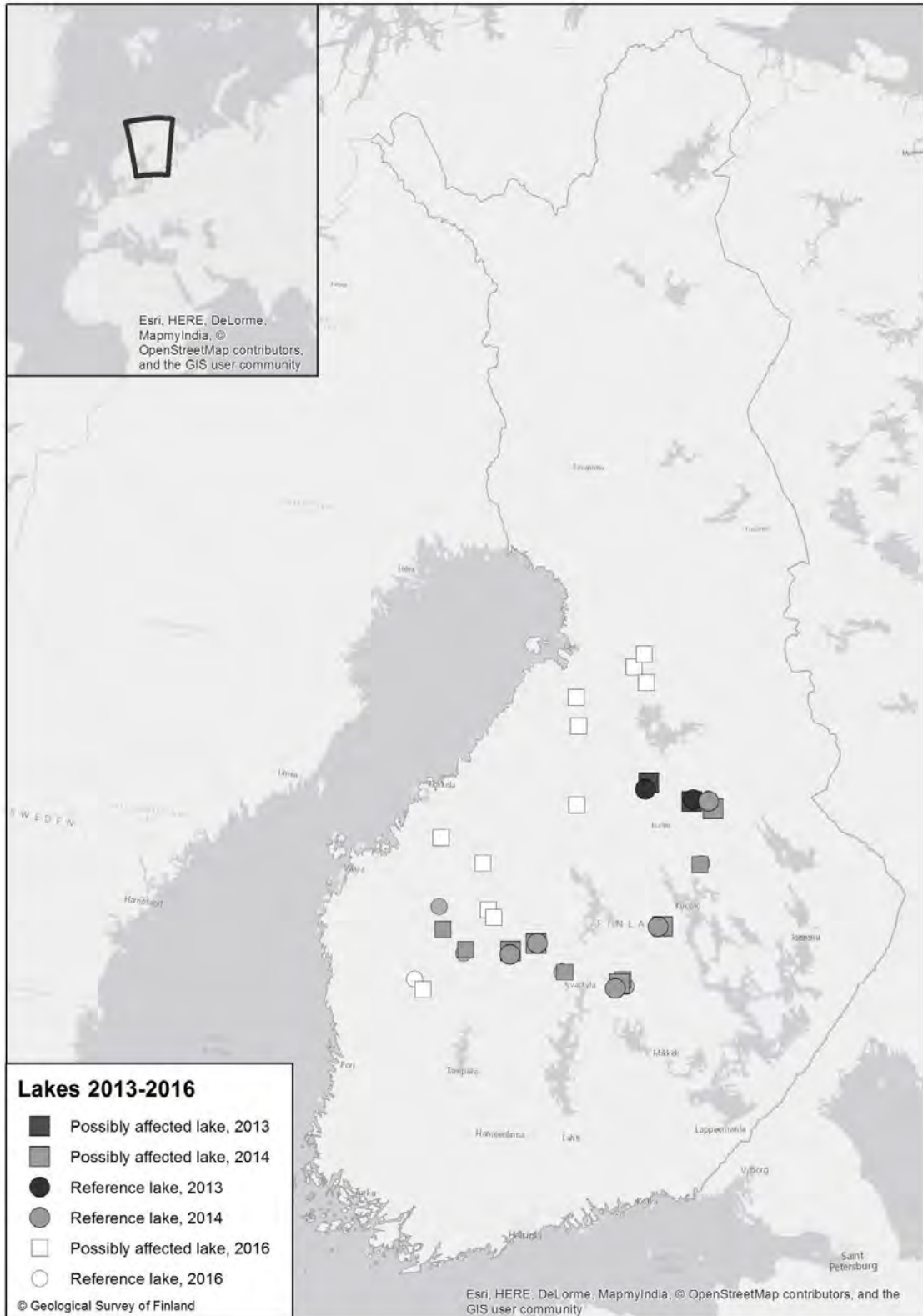


Figure 1: Index map of lakes studied during the years 2013-2016.

A wide variety of physical and chemical analyses have been undertaken to verify the changes in the quality of the sediments and sedimentation history of study lakes. The general characteristics of the lakes and their watersheds have been collected from both reference and possible peat production impacted lakes. Lakes (whenever possible) were surveyed with a sediment penetrating (24 kHz) echo sounder (with MeriData MD 500 Echo sounder and MDSC data collection software) to produce 3D information on the spatial distribution and amounts of soft post-glacial sediments in the basins. The processing and interpretation of sediment units and their boundaries was done

with the MDPS Software. Sediment coring from the deepest parts of the lakes or other suitable locations with thick gyttja sections was done with heavy piston gravity corer (PP-corer) and Limnos gravity corer for long and short sediment sections, respectively. The coring method was selected based on objectives of proxy analyses from the sediments. Dating of the cores was done with the ¹³⁷Cs. Chemical and physical analyses were performed, of which sediment chemical composition was used to obtain information on past land use changes and other stressors that may have affected the lakes (Kauppila *et al.*, in prep.). Physical analyses included e.g. sediment water and dry matter contents and the results from these studies was used together with carbon concentrations and dating results to estimate (apparent) carbon and dry matter accumulation rates for certain periods (Kauppila *et al.*, in prep.). Where possible, testacean communities were also studied.

PRELIMINARY RESULTS

The results from the 2013 and 2014 lake pair cores are under compilation. The results from the echo sounding studies and gyttja coring from the remaining lakes can be expected during the summer 2016 (see Fig. 2). Some complimentary sedimentological results are also expected during the summer 2016. A study compiled by Kauppila *et al.*, (in prep) from one lake pair where results have been obtained earlier will be published later this year. According to the manuscript of Kauppila *et al.*, it seems that the peat production has not affected the distribution and the thickness of lacustrine sediments in Lake Martinjärvi (possibly affected lake) when compared to the reference lake. When the relative increase in coring site-specific carbon and dry matter accumulation was compared, the relative increase was higher in the reference lake, meaning that it eliminates the influence of any differences in sedimentation efficiency between the lakes (Kauppila *et al.*, in prep). As conclusions the manuscript states that peat production has not resulted in excessively thick lake sediment deposits in the impacted lake and when the recent increases in apparent carbon accumulation were compared between the peat mining impacted and the reference lakes, no significant differences were found.

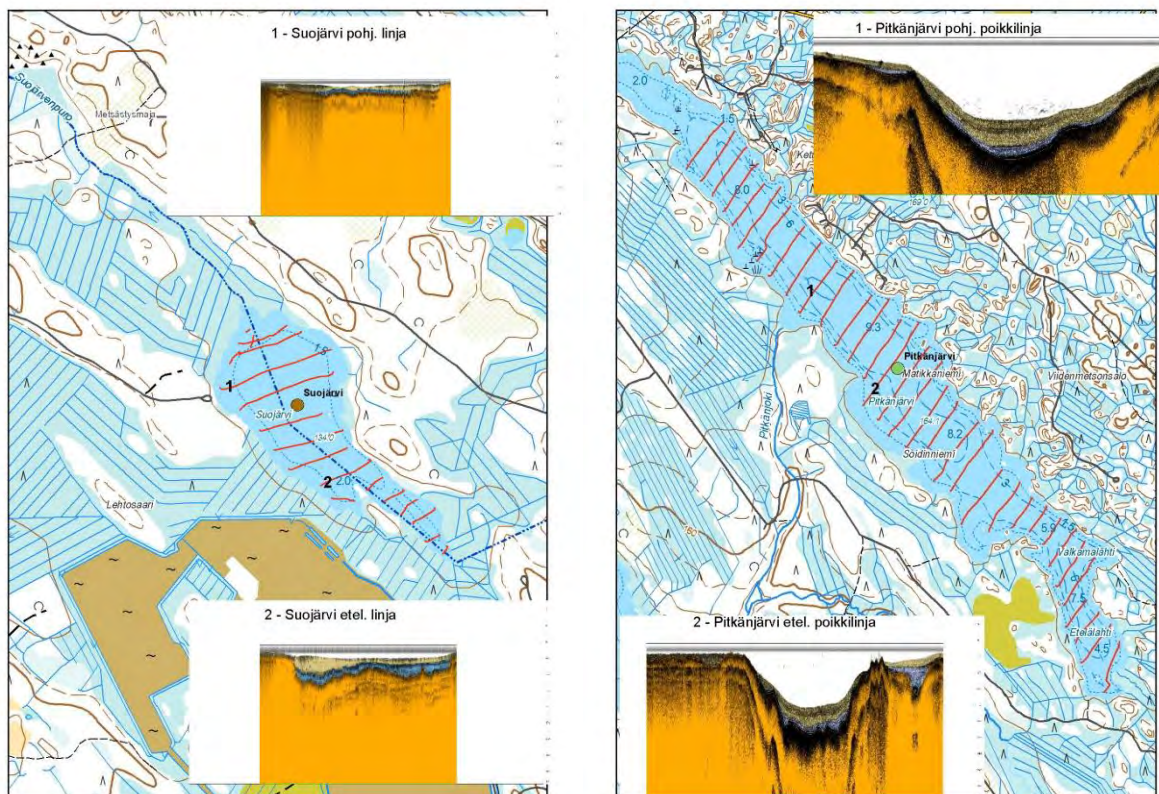


Figure 2: Examples of Echo soundings and profiles from lake Suojärvi (possibly affected lake) and Pitkänjärvi (reference lake), which were surveyed year 2014.

REFERENCES

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