Extended abstract No. 395

ASSESSING EFFECTS OF PEAT MINING, PEATLAND FORESTRY AND NATURAL PEATLAND TO WATER QUALITY USING CONTINUOUS MONITORING STATIONS

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SUMMARY

Impact of peat mining to water quality may be locally significant. Especially, the loads of nutrients, suspended solids and humic substances to the water system may be remarkable. In a 3-year project TASO we investigate the load to the water system caused by peat harvesting and peatland forestry and the effects of several water protection activities. To this end we apply continuously monitoring stations collecting data of water flow, COD, DOC and suspended solid via turbidity measurements. In addition, we take manual water samples to measure the nutrient loads. Water quality changes caused by peat mining and peatland forestry are compared to the water quality at a control site located in a natural peatland. The monitoring started in November 2011 and it continues to the end of 2013. The first preliminary results are shown in our presentation.

KEY WORDS: Peatland, peat mining, peatland forestry, water quality, DOC

INTRODUCTION

The Finnish Government approved in November 2006 a new set of national Water Protection Policy Outlines to 2015 in a decision in principle that also defines measures needed to improve water quality. Its objective is to achieve a good ecological level of the aquatic ecosystems by 2015 in accordance with the Water Framework Directive of the European Union (2000/60/EY).

The peat mining for energy production in Finland causes leaching of suspended solids, nutrients, organic matter and iron from the peat production areas into the water systems (Heikkinen, 1990; Sallantaus, 1984). The phosphorus and nitrogen loads caused by peat mining may locally have a significant effect on water quality and cause eutrophication (Heikkinen, 1990; Kloeve, 2001). Usually the effects are most severe in the vulnerable headwaters.

Constructed wetlands have been successfully used to remove suspended solids and nutrients such as nitrogen, phosphorus and iron from diffuse source discharge due to peat mining (Heikkinen *et al.*, 1995). Also in forestry, peatland buffer areas are considered as the best water protection means with respect to the discharge from peatlands drained for forestry (Nieminen *et al.*, 2005a, 2005b). However, the results of the studies assessing the ability of peatland buffer areas to retain nutrients, suspended solids and dissolved organic carbon (DOC) are highly divergent (Liljaniemi *et al.*, 2003; Silvan *et al.*, 2004; Nieminen *et al.*, 2005b; Väänänen *et al.*, 2008).

In the project TASO, which is situated in and governed by Centre for Economic Development, Transport and the Environment for Central Finland, we monitor the loads of suspended solids, DOC and nutrients caused by peat mining and peatland forestry and the effects of several water protection activities. We develop the measuring of the loads, e.g., by using continuous monitoring stations of water quality. To our knowledge, continuous monitoring stations have not been used in assessing the loads of peat mining. The load from peatlands to the water system is highly variable in time depending on the season, weather conditions and the local activities related to peat mining or forestry. Hence, a temporally systematic or randomized sampling of water quality may easily fail to catch the overall load and its temporal variation.

The results of the project may be applicable as a guideline to achieve more reliable load estimates. Based on our measurements, the aim is also to evaluate the efficiency of the present water protection activities in peat mining and peatland forestry.

MATERIALS AND METHODS

Study area

Our study sites are located in the Saarijärvi water course in Central Finland. The surface area of the drainage basin is 3120 km^2, of which 9.4% are lakes. The water originates mainly from peatlands, and thus the water is naturally very humic. Peatlands make up about one fourth of the land area. And there are 50 peat mining sites, with total area of 3600 ha. The rest of the area is forests (2/3 of the land area) and agricultural fields (7%). In the general usability classification of Finnish water bodies about 60% of the lakes and 50% of the rivers belonging to the Saarijärvi water course have been defined satisfactory or poorer. The Saarijärvi water course was selected as a pilot area for the study, but the results are to be exploited on a national level.

Three of the eight continuous monitoring stations are situated at peat production areas, and four at peatland forestry sites. The monitoring stations at the peat production areas monitor the functioning of buffer areas (one pristine buffer area and one constructed water protection wetland with *Sphagna* sowing). Stations in peatland forestry areas monitor the load from a harvested site with soil preparation (catchment 115 ha), a ditch network site with constructed wetland (catchment 77 ha), and an old ditched forestry site (catchment 70 ha). One station is located at a pristine peatland (catchment 317 ha) serving as a reference area.

Continuously monitoring stations and water samples

Eight continuously monitoring stations were set up in November 2011. We used monitoring stations provided by EHP-tekniikka Ltd. Automatic monitoring of water flow, water level and quality (COD, DOC and suspended solid via turbidity measurements) is possible year round, also in sub-zero temperatures. Collected data are transmitted on-line via a GSM/GPRS modem to the Internet server. In addition to the automatic water quality monitoring we take manual water samples ca. 20 times a year to measure the pH, turbidity, water colour, conductivity, total P, PO_4-P, total N, NH_4-N, NO_2+NO_3-N, COD, DOC, suspended solids and Fe.

RESULTS AND CONCLUSIONS

The water quality monitoring stations were set up in November 2011 and they will continue to collect data until the end of 2013. The stations have been working well during the first winter in varying conditions (exceptionally warm and wet December, temperatures down to -30°C in January, and heavy snowfall in February). The results of the first six month monitoring period are presented in our poster presentation.

Continuous, all-year water quality monitoring has not been used in peatlands before. This monitoring program will bring new data and knowledge from the discharge of peat mining areas. Results can be utilized when assessing the efficiency of the different peat mining water purification systems and verifying the load assessments. This monitoring program will also complement the continuous monitoring network of forested peatlands in Finland.

ACKNOWLEDGEMENTS

Main financiers of the project TASO are the Finnish Ministry of the Environment, Ministry of Agriculture and Forestry and Ministry of Employment and the Economy.

Project TASO is joint venture with several collaborators: City of Saarijärvi, EHP-tekniikka Ltd., Finnish Environment Institute (SYKE), Finnish Forest Research Institute (Metla), Forestry Development Centre Tapio, JAMK University of Applied Sciences Jyväskylä, Metsähallitus, Metsänomistajien Liitto Järvi-Suomi, Municipality of Karstula, Municipality of Kyyjärvi, Municipality of Uurainen, Regional Council of Central Finland, The Association of Finnish Peat Industries, The Finnish Forestry Centre, University of Jyväskylä Institute for Environmental Research, VAPO Oy, VTT Technical Research Centre of Finland.

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