Projekt Hof Ritzerau

Ecohydrological management strategies in a minerotrophic fen

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Introduction

The effects of landuse changes and rewetting on a formerly drained and species poor minerotrophic fen (Ritzerau, Northern Germany) and attaching surface waters are monitored since 2001.
The investigations aim at the detection of nutrient retention under different hydrological boundary conditions and on different temporal and spatial scales.

Study area

• location: Ritzerau, Schleswig-Holstein, 10° 35` east, 53° 39` 50`` north

• hydrology: fen meliorated during the past two centuries, the small river Duvenseebach with high nutrient inputs from the upper catchment runs through the fen

• landscape history: silted lake and eventual peatland in a former subglacial tunnel valley of the Weichselian glaciation, the upper horizons of the peat are strongly mineralized (fig. 1)

• vegetation and landuse: species-poor Lolio-Potentillion, few remaining Calthion stands, grazing with cattle, no fertilization

0-1,00 m	sedge-fern-peat, strongly degraded,H9
1,00-2,50 m	alder-peat, H7
2,50- 4,00 m	calcareous organic silt
4,00- 4,50 m	organic peat clay
4,50 m and below	sand

Fig. 1: Peat profile of the fen

Hydrological management

Since 2003 a rewetting project in the fen area targets at:

• reducing the mineralization processes,
• creating a retention area for nutrients of the upper catchment of the river Duvenseebach and
• increasing habitat quality for typical fen species and communities.

It includes two phases:

• **Phase I** (accomplished in 2003): removal of drainage (fig. 2) mainly in the southern part of the fen, river unaffected (no contact peat-river)

There is a stronger and faster response to the measures in the south of the fen (fig. 3).

• **Phase II** (planned): raising the river bed of the Duvenseebach to promote flooding of the fen with river water→ will affect the whole fen and cause contact between river and fen

Fig. 2: Phase I of the rewetting; a. removal of drainage pipes; b. impounding ditches; c. leveling banks of ditches and small depressions

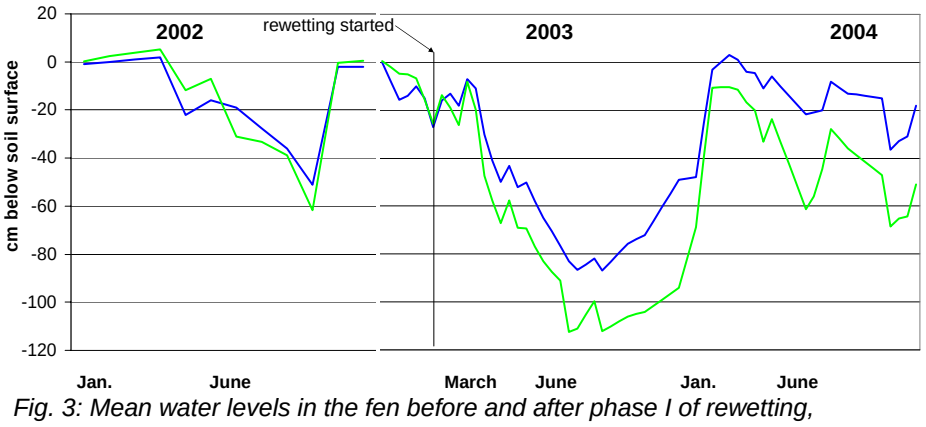

Fig. 3: Mean water levels in the fen before and after phase I of rewetting, measured in 13 installed groundwater wells; south affected by rewetting (blue), north not yet affected by rewetting (green)

Monitoring of stream water quality

Since 2003 the stream water quality entering (input) and exiting (output) the fen are recorded by two automatic measuring- and sampling-stations (daily water samples - mixed over the day and hourly logged physical parameters) (fig. 4). The stations are about 1,5 km apart.
During a typical week in the summer of 2003 (07/09-07/16) no lateral water inputs to the stream existed between the two stations. Similar discharges at baseflow conditions were measured at both stations. Under these conditions the difference of nutrients can serve as a measure for instream retention. In this period the retention averages about 2,06 mg for NO_3-N (39%) and 0,05 mg for SRP (21%) (fig. 5).

Fig. 4: Instruments of the automatic sampling stations; a. sensors in the stream; b. sensor amplifiers and data logger; c. water sampling and cooling (design: Dr. W. Schäfer, Ambio-Tec, Palzing)

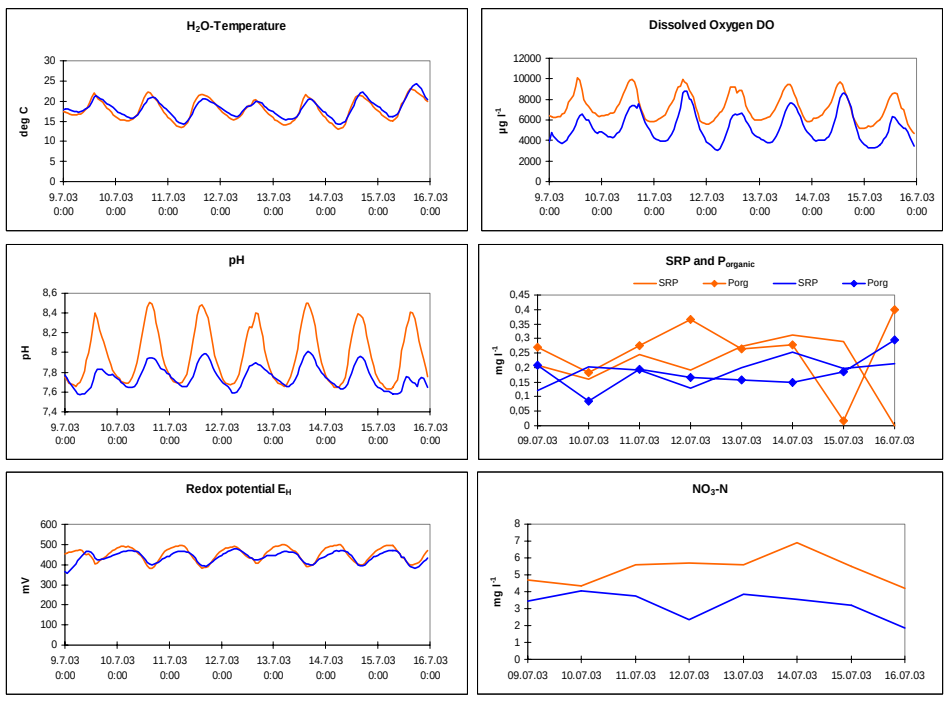

Fig. 5: Diurnal variation of the instream parameters temperature, pH, E_H and DO as well as daily sampled concentrations of Nitrate-N, SRP and Organic P (DOP+POP); input station (red) and output station (blue)

The diurnal curves of temperature and redox potential show similar variations. The pH-curve has a higher amplitude and the oxygen curve higher concentrations at the input station. A possible reason for the lowered oxygen concentrations at the output as well as the decrease of NO_3-N between the two stations is instream microbial reduction.

Perspectives

The boundary conditions for nutrient retention will change once phase II of the rewetting project will allow flooding of the fen with river water.

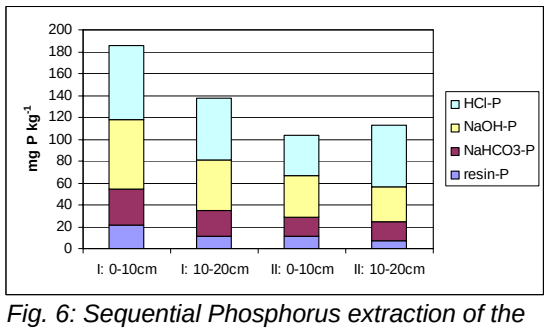

Fig. 6: Sequential Phosphorus extraction of the peat at two different depths and locations, south (I) and north (II) - before rewetting started

A potential risk of flooding a degraded fen is an increased SRP-output due to the lowered redox potential in the flooded soil. A sequential phosphorus extraction before rewetting shows relatively low available pools of resin- and $NaHCO_3$-extractable phosphorus (fig. 6), which will probably not pass the redox-barrier to the oxygen-rich flooding water.

High-resolution measurements of stream- and groundwater quality will be carried out in Ritzerau during the next 15 years. This allows the quantification of changes in nutrients of stream water and fen area over several temporal scales beginning at diurnal variations up to seasonal or successional changes and long-term effects of different management options.

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