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Responses of different mire types on temporal climatic shifts and land-use parameters

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INTRODUCTION

Wetlands are depending on water. Number and type (hydro-genetic type according to Succow 1988) of mires are strongly connected with the landscape, e.g. number of depressions and groundwater level as well as climate. Fens as well as kettle hole-mires are representative for the young glacial area and are characterized by spatially compact changes of the hydro-genetic mire type. Often they combine aggradation, paludification, percolation and spring type. The major part of the mires is degraded due to human influence and suffered from a loss of biodiversity. While in the last century man has changed the water levels of the sites itself by ditch drainage now the land-use of catchments are in focus to be affecting the water levels in mires. Increasingly climatic changes and temporal shifts of precipitation and temperature are considered to be stress factors.
The paper summarises the key hydrological, geological and land-use parameters for different mire types and reasons for the considerable drop of water level over the last years. Furthermore, it introduces the functional chain of water level fluctuations at site scale in terms of a conceptual model derived from geo-statistical and statistical analysis.

METHODS

The effects of geology in addition with land-use patterns such as forest species composition or forestation are examined particularly with regard to the resulting groundwater recharge and the annual stability of mire water levels for the period of the last 20 years. We used information of the ecological, paleoecological and soil development of more then 50 sites in order to identify the hydro-genetic mire type and intersect this with the map of glacial geological landscape forms (ground moraine, end moraine, outwash-plain, glacial valley) in order to classify their occurrence in the landscape units. In the next step we associated the catchment area (surface and geology) and intersect this with land-use information (land-use: forest, grassland, agriculture; forest species composition). Statistical and geo-statistical analyses are used to establish relationships between the different types of data and the hydrograph of water levels in mires and catchments. The geo-statistical analysis enables to estimate the main driver of water level fluctuation.

RESULTS and DISCUSSION

Mires in so called ground moraine areas show a stronger degradation in the same time scale than mires in end moraine areas. In addition with annual changes of precipitation (both, in total and annual distribution) paludification mires are more effected by sinking water levels then other types. Reasons to be mentioned are: ground moraine catchments are often very large and strongly used by coniferous forests. Unlike end moraine catchments, these are often small and used by deciduous forests.

CONCLUSIONS

The conservation and restoration of mires, especially in ground moraine areas need changes in land-use, such as changes in forest species composition to increase water levels, to initiate a new formation of peat and at least to stabilise and increase the biodiversity.