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MONITORING THE FLOODPLAINS OF THE NORTHERN RIVER ODER: SPATIAL ALLOCATION OF DEPOSITS AND SOILS, RECENT ECOLOGICAL STATE AND BIODIVERSITY

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SUMMARY

Floodplains show typically a mosaic of different riparian biotopes depending on hydrology, surface relief, substrates and soils. The Oder's riparian zone is marked by the stream itself, by its bayous, reed beds, periodically flooded wet meadows and by its natural riparian forests. In order to increase and to protect the dynamics of the Oder river system and to improve the variability of habitats with a high degree of "wilderness" northern parts of the Oder floodplain are declared as a transnational protection area. A long term ecological monitoring programme is installed since 2011. Concepts, methods and first result are presented here.

KEYWORDS: floodplain, inundation fen, Oder, biodiversity

INTRODUCTION

Floodplains show typically a mosaic of different riparian biotopes depending on hydrology, surface relief, substrates and soils. The majority of middle European floodplains had been drained and used for agriculture since centuries. Mineral soils mostly had been used as arable land while the peat soils (type: inundation fens) often were used as meadows and pasture. Effects of the intense utilisation of floodplains are: loss of inundation dynamics, higher depth of water table, loss of habitat diversity and at least a loss of biodiversity at different scales. Only a few of rivers and then mostly only parts of them are in a state that allows natural stream dynamics. One of them is the northern part of the Oder valley, between the villages of Stolzenhagen and Schwedt. This part also has been used since centuries but even so remained in near-natural state (see Fig. 1). The Oder's riparian zone here is marked by the stream itself, by its bayous, reed beds, periodically flooded wet meadows and by its natural riparian forest. In order to increase and to protect the dynamics of the Oder river system and to improve the variability of habitats with a high degree of "wilderness" northern parts of the Oder floodplain are declared as a transnational protection area (since 1993 the Polish part as Landscape Park (6,000 hectares) and in 1995 the German part as National Park "Lower Oder Valley" (10,500 hectares)). In the category "National Park" (IUCN Category II) protected areas "are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities." (Lausche, 2011). Large areas of the Lower Oder

Valley are protected in category 1a or b that means that no utilisations take place anymore. Prospective changes in land use (that includes also no utilisation), flood control measures, but also in climate let expect changes in ecosystem dynamics.

Fig. 1. Digital Orthophoto of the Oder Valley near Schwedt.

MATERIALS AND METHODS

Monitoring Framework

A monitoring programme is required by German law for all protected areas of the category National Park as well as Biosphere Reserve. Investigations combine common technologies conducted on transects and additional sites covering a gradient of water levels and soil types in order to identify the biodiversity of habitats and species (e.g. soil profiles, plant and animal species, water levels) with modern air-born technologies to facilitate the evaluation of the whole National Park area. We use satellite image analysis to identify vegetation communities

and a digital terrain model (conducted from laser scanning data) to model surface water levels related to stream water levels.
In order to address questions of
- inventory (present condition, ecosystem health, species which are present now),
- assessment (relationship between ecosystem components and ecosystem processes, parameter to be used to measure the effects of altered environmental conditions, threatening processes, responses of the ecosystem),
- monitoring of trends (changes in species composition, changes of the state of naturalness in direction to wilderness) as well as
- adaptive management (management measures that are required to enhance development)

We developed a temporal and spatial monitoring framework. A cost effective strategy is to routinely measure a suite of easy variables and supplement these data with less frequent. Ideally, a wide range of both physico-chemical and biotic indicators should be monitored (Reid and Brooks, 1998). Furthermore is the combination of routinely collected data (e.g. reporting commitment to Water Framework Directive) and within the monitoring by itself collected data cost-efficient. In order to document changes of ecosystem due to the different impacts mentioned above a long-term monitoring was installed by the University of Applied Science Eberswalde since 2011 (Luthardt & Gruebler, 2011). The collection of data (baseline) started in 2011.

Spatial framework

The framework has three spatial levels covering various monitoring objectives, parameters and methods: i) the entire area, ii) transects and iii) additional sites. While at scale i) shifts of vegetation via satellite imagery will be analysed. We used field methods for scale ii) and iii). In scale ii) three transects were selected which are crossing the lateral arranged zones (following a gradient of slope, groundwater level and inundation frequency) with forests at the loamy upland plains, hardwood at the slopes and the riparian zone which is marked by bayous, reed beds, periodically flooded wet meadows and natural riparian forests. Transects are divided into regular section of 50 m. In scale iii) additionally seven sites were selected with special vegetation types that are not included in the transects (e.g. dry grasslands, very wet meadows, standing water bodies).
Exemplary parameters for the different scales are:

i) climate and air quality, stream water and groundwater levels, biotopes, fauna: not sedentary animals, mammals, birds;
ii) vegetation (species, covering, browsing damage), fauna: breeding birds, soil, rates of (annually) sedimentation;
iii) terrestrial and semi-terrestrial: vegetation (species, covering, browsing damage), soil, fauna: grasshoppers, butterflies;
aquatic: lake depth and extent of water surface, vegetation, water quality parameters, fauna: amphibians, dragonflies, fishes.

Temporal framework

According to a formerly developed monitoring framework (ecological environmental monitoring) we adopted a temporal harmonised framework, with intervals of 1, 3 and 6 years. The majority of parameters will be collected every three year, only a few parameters with a low degree of alteration will be measured every six year. Results will be reported every six year. Baseline data have been collected in year 2011.
However, possibly there are effects of annually climatic changes within the natural variation that overly the effects of middle and long-term changes in land use or inundation intensity. Tentatively a shorter frequency then 3 years might be wise.

FIRST RESULTS

The water levels of the river Oder and the spatial allocation of sediments are influenced by the slope, the surface relief of the floodplain as well as the distance to the Baltic see as a base level of erosion. Downstream the amplitude of water levels is quite higher than upstream. Intensity and frequency of floods decrease northwards (see Fig. 2). While in the upstream parts the riverine zone is dominated by sandy material, downstream parts are mostly dominated by clay material (Geological map, 1890). The very low flow velocity, while inundation events lead to the sedimentation of fine material like clay or silt in the northern parts of the lower Oder valley.
The content of organic carbon in the topsoils ranges between 3 and 8%. The higher of content of organic carbon the higher concentrations of heavy metals (Cd, Cr, Cu, Ni, Pb, Zn). The exceedance of maximum accepted concentration and the concentrations above the geological background levels are currently proven.

The majority of plots show grassland vegetation cover with wetland species typical for eutrophic periodically flooded or wet soils. The following more or less uniform vegetation coverage occur (exemplary): open water; *Phalaris arundinaceae* reed; *Bidens spec.; Phragmites australis* reed, Sedge reed; *Glyceria fluitans* reed, *Salix spec.* coppices.

CONCLUSION

Monitoring can be an important and useful approach in order to identify trends of landscape and ecosystem development effected by land use change, climate change and changes due to measures. It is essential to develop a realistic temporal and spatial framework. Nevertheless adaptions have to be proven and implemented in the first years of a monitoring programme.

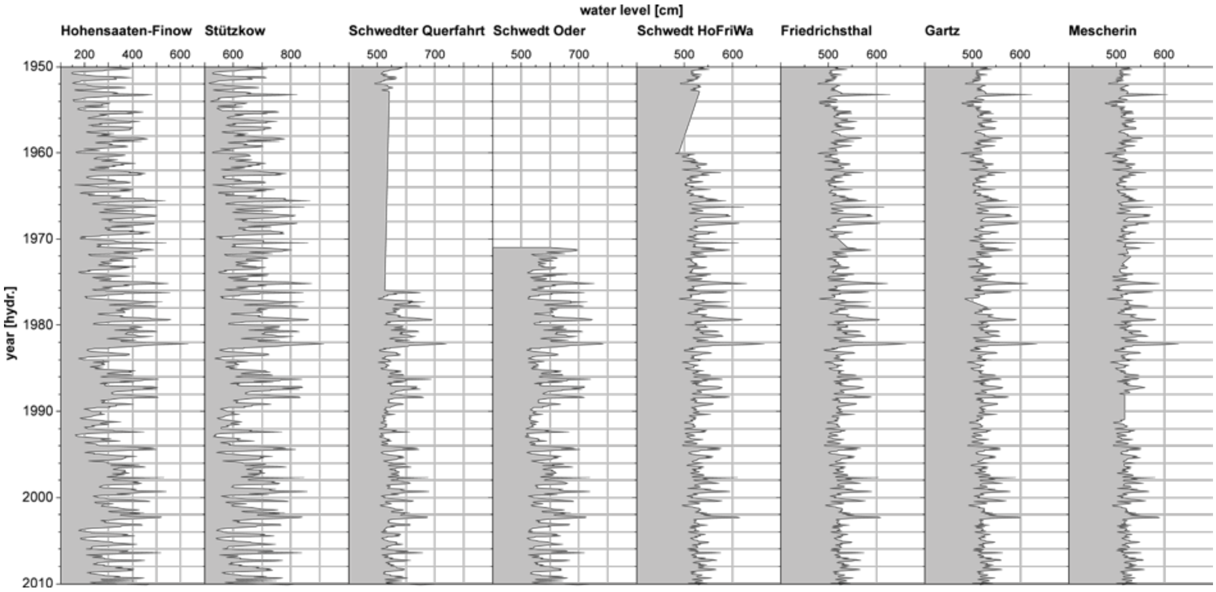

Fig. 2. Hydrographs at different recording points (from left to right downstream).

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