Rewetting the polders: an ecological experiment

Promotor:
Prof. dr. Patrick Meire, ECOBE

Copromotor: Dr. Goedele Verreydt

Contactpersoon:
Patrick.meire@uantwerpen.be

Content:

The coastal polders of Flanders are a man made habitat. About 1000 years ago men started with the embankment of tidal marshes and converted them into agricultural land. For many centuries the polders consisted mainly of very wet grassland as draining these land became more and more difficult especially as the sea-level was rising. These wet grasslands were ecologically very interesting, harboring an enormous biodiversity. It were important breeding and wintering areas for many species of meadow birds as well as for many species of ducks and geese apart from holding a high botanical value. Since half the 20th century however the installation of pumps allowed an intensive drainage and water levels became regulated in such a way that in winter the water level is kept very low, contrary to the natural situation. In summer water levels are higher as water coming from canals are irrigating the polders, resulting in an unnatural situation of low winter and high summer water levels. This change in water management of course resulted in an intensification of the agriculture and many grassland were converted to arable land. The remaining grasslands became also much drier and lost a lot of their biodiversity.

Now several initiatives try to protect and restore these wet polder grasslands. Nature conservation bodies buy up land and prevent further reconversion of grassland to arable land but they do not succeed in restoring the original biodiversity because of the changed water management. Restoring the more natural water levels is far from easy and poses a lot of ecological and socioeconomic challenges. How can we restore more natural water levels, what are these water levels, what type of agriculture is still possible in these wet meadows are just some of the questions to be answered. The aim of this thesis is to unravel the complex ecohydrological relations in a polder complex near Damme, which is a nature reserve managed by Natuurpunt and to formulate an optimal water management for restoring the biodiversity. This study is part of a major project supported by the Flemish Government to look for possibilities to make our water management more climate proof.

The first crucial point is to understand the hydrology of the area. Therefore piezometers were installed to follow groundwater levels. But in addition sensors are installed that measure both the horizontal and vertical water flux. These are unique sensors, developed by the spin-off company iFlux (https://ifluxsampling.com/) and in fact it is the first time that it is possible to measure the flux in situ. The first step in this thesis is to extend the present sensor network and to analyse these data to understand the whole groundwater system as this is essential in order to work out a rewetting program. How are the groundwater flows? Are groundwater levels in the meadows more dependent on groundwater seepage than on surface water levels in the ditches are vice versa? Where is the groundwater coming from? This are just a few of the questions to be answered

Next to groundwater levels and flows of course also groundwater quality is important. Conductivity is measured by several sensors as salinization of the polder is an important issue, but also samples of groundwater must be taken for chemical analysis. This also helps understanding the groundwater system but is also essential to understand the trophic status as it can be expected that concentrations of some nutrients might be very high, which has of course an impact on the vegetation.

We also measure greenhouse gas fluxes in cooperation with ILVO to see what is the impact of rewetting on gas fluxes as we expect that rewetting creates a net sink for carbon. These measurements are done next to the piezometers so we can link the groundwater dynamics to the GHG fluxes as we expect that in wetter conditions the meadows will act rather as a sink than a source for GHG.

Finally vegetation relevees are made to describe the present biological values. Data on wintering and breeding birds are available.

The main challenge of this thesis is to collect and analyze these data and compile into a more holistic view on the functioning of the area and translate this into concrete management options. This is a priori oriented towards water management (optimal water levels) but equally important is of course also the necessary vegetation management (grazing, mowing,…). Also the translation of the management into ecosystem services will be an important part of the study.

Depending on the skills and background of the student the emphasis of the thesis can be put on a subset of the issues discussed above. Measurements already started so a lot of data will be available to the student but extra fieldwork will form an important part of the thesis as well.

Used methods:
fieldwork: water quality sampling, vegetation relevees, ecohydrological measurements

Data-analysis: GIS work, statistical analysis of data

Some pictures showing the study area

Wet polder grass lands

Installing piezometers in the field