GHG emissions from peatlands under different land use

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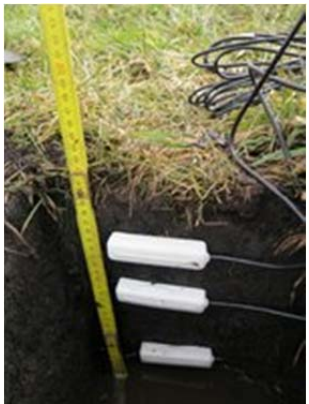
Peatlands serve as important carbon sinks. Globally, more than 30% of the soil organic carbon is stored in organic soils, although they cover only 3% of the land surface. The agricultural use of organic soils usually requires drainage thereby transforming these soils from a net carbon sink into a net source. Currently, about 2 to 3 Gt CO_2 are emitted world-wide from degrading organic soils which is ca. 5% of the total anthropogenic emissions. Restoration of degraded peatlands can reduce net greenhouse gas emissions. However, the quantification of the greenhouse gas balance after rewetting is challenging.

The restoration of cultivated peatlands is the major carbon sequestration potential for agricultural soils in Switzerland. Little attention was drawn to the restoration of these former fens – equally degraded bogs – in the context of climate protection. Moreover, measured emission data from peatlands are rare for Switzerland.

The goals of this project are:

- to improve the emissions factors of organic soils under different land use for climate reporting under UNFCCC;
- to evaluate the potential of Wetland Drainage and Rewetting in Switzerland;
- to develop climate smart management option for agriculture use of organic soils. Therefore, we measure the carbon balance of a degraded and of a drained fen. In 2017 this fen will be rewetted and we want to track the emission of greenhouse gases induced by the change in land use.

Under intact conditions, peatlands are carbon sinks over thousands of years, however at the same time emitting the potent greenhouse gas methane. On long term, the benefit of carbon sequestration is more effective as the release of methane, i.e. peatlands have a cooling effect on climate. **For the cultivation of peatlands, drainage is turning these former carbon sinks in strong carbon sources.** Organic carbon, which has accumulated over hundreds of years is rapidly oxidised and emitted as CO_2 (Paul & Schellenberger, 2015). This high emission rate is connected to a relatively small source area (for Switzerland less than 2% of agricultural soil is based on organic soil) makes them a hot spot of greenhouse gas emissions. The outcome of this is the possibility through land use change, especially through raising the groundwater level, to regenerate the degraded peatlands and to turn them back into carbon sinks (Drösler et al. 2013). **The restoration of cultivated peatlands is the major carbon sequestration potential for agricultural soils in Switzerland** (Leifeld et al. 2003). In Switzerland degraded peatlands emitted around 600 Gg CO_2-eq, which is a significant portion of the whole LULUCF-sectors of 3000 Gg CO_2 (Paul & Alewell, 2013).



In Switzerland, the Seeland region is characterised by fens which are intensively used for agriculture since 1900. The organic layer is continuously degrading and subsequently getting shallower. **The questions arises a) how high are the greenhouse gas emissions from these degraded fens; b) can the emissions be reduced though rewetting of these sites?**

This project measures the carbon balance of a fen in the Seeland near Cressier, Neuchâtel. The project is coordinated by the BAFU and operated by the University of Basel and Agroscope.

The study site was under crop rotation until 2009 when it was converted to extensively used grassland with the water regime still being regulated. In 2017 this site will be rewetted. The soil is characterised by a degraded organic horizon of 40 to 70 cm. **The greenhouse gases (CO_2, CH_4) are currently measured by a micrometeorological approach, the so-called Eddy-Covariance method.** It is based on the simultaneous measurement of gas concentration and three dimensional wind direction and speed. From these data the gas exchange between the fen (soil and vegetation) and atmosphere can be determined. Additionally, key meteorological and ecological factors like radiation, soil humidity and water level are recorded.

For 2015, the carbon balance indicates that the degraded fen is a strong carbon source, with approximately 600 g C m^{-1} a^{-1}. The carbon balance is dominated by CO_2 emissions and harvest. Methane emissions are negligible. With the gained emission factors, future scenarios can be evaluated for the current cultivation practice of organic soils in Switzerland. **It will be exciting to follow the development of fluxes after the site will be rewetted in 2017.**