Conference Volume	5th Symposium for Research in Protected Areas 10 to 12 June 2013, Mittersill	pages 309 - 312

Status of peat lands in Upper Austria
A survey study on vegetation, including management plans for renaturation

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Abstract

The impact on our environment caused by large-scale destruction of mires is still unrecognized and highly underestimated by the general public, not raising too much awareness in political discussions or academic circles. Mires seem to continue to be mystical biotopes not concerning many people. However the need for sustainable conservation and effective renaturation programs is becoming a global issue.

Why is that?
The value of mires and intact, living peat lands is not only limited to unique landscapes and habitats of highly specialized flora and fauna, but they provide very real functional values in their natural state. Because of their water retentivity, mires influence the hydrologic balance of their surrounding positively. Apart from that, peat lands play a valuable role in the atmospheric carbon flux. Active peat lands are a slow sink for atmospheric carbon, while drainage and oxidation lead to a considerable release of carbon dioxide and methane into the atmosphere. We need to raise awareness to the significance our world peat land resources have on the environment.

Keywords

peat land, bog, fen, vegetation analyses, restoration, renaturation, conservation, Upper Austria

Introduction

In Central Europe, wetland areas decreased considerably during the last century, mainly due to urban scrawls and agricultural cultivation. Nowadays intact peat lands are highly rare biotopes. In Austria and Switzerland the original extend of peat lands has decreased by 90% since the beginning of industrialization 200 years ago. Today the bogs in Upper Austria cover less than 0,1% of the total land area. 55% of the remaining mires are classified to be affected by anthropogenic changes, and while 11% are intact 80% are endangered. Even in protective areas man-made impact like groundwater recession, eutrophication and increasing emission levels are noticeable. To prevent the silent extinction of these sensible ecosystems, and to actively enhance the situation, projects are initiated to systematically survey the remaining peat lands for further development and conservation plans. To preserve the remains effectively a precise knowledge of the actual state and condition of the biotopes is necessary. Only on the basis of a detailed inventory is it possible to develop specific strategies to protect and restore mires with suitable methods. For that purpose the Upper Austrian Ombudsoffice for Environmental Protection (Umweltanwaltschaft Oberösterreich) established the project "MEK" (Moorentwicklungskonzept Oberösterreich) in Upper Austria to conserve, restore and regenerate peat lands (PÖSTINGER 2011). The goal is an environmental sustainable preservation of peat lands in Upper Austria. Besides conservation of intact bogs the restoration of unbalanced peat lands is a priority. Because of a high but complex level of hydrological self-regulation a lot of experience and sophisticated strategies are needed to induce self regeneration and stabilization through the right procedure. With the help of a specifically designed peat land database it is possible to target renaturation plans very effectively corresponding to the actual priority, feasibility and financial capabilities. Taking historical inventories into consideration, like the 'Franziszeischer Kataster' an Austrian cadastre since 1825, as well as including more recent publications, is a central aim of the project. Due to publications by KRISAI & SCHMIDT (1983) and STEINER (1992), there exists a profound description of a majority of the Austrian peat lands over the last three decades. Thanks to this data the development of bogs and fens in Upper Austria is reproducible.

Methods

In this study peat lands and bogs of the district "Kirchdorf an der Krems" in Upper Austria were examined from a botanical and landscape ecological point of view. By using the general methods of vegetation analysis following BRAUN-BLANQUET, the vegetation (including moss) was registered and plant communities were assigned with the program TWINSPAN and subsequently manually adjusted. All kinds of artificial structures and anthropogenic disturbances, as well as the vegetation analysis were drawn out in Arc GIS.

Results

Almost every investigated peat bog and fen showed influences by drainage, peat farming or damage due to grazing cattle, all of which are responsible for a progressive degradation of peat lands. In order to stop and avoid further

deterioration, a re-cultivation program has to be implemented to improve the situation. Therefore suitable management strategies for each field site were elaborated. This survey was initiated through the "Umweltanwaltschaft Oberösterreich" as part of the project MEK to enhance the general situation of mires in Upper Austria, and supported by the National Park Kalkalpen as a co-operation partner.

Discussion

There are specific phenomena leading to the deterioration of peat ecosystems:

- The sensitive hydrology of peat bogs and fens gets easily imbalanced through **drainage channels** and similar measures, whereby vegetation changes are irreversible.
- Peat lands are often affected by **grazing cattle,** even though it is well known that the nutritional value of these areas is minor. The cattle cause considerable damage on the vegetation and ground level. The problem intensifies in consequence of the modern profit optimization progress: today the average cow weighs around 200 kg more than 50 years ago (DIETL 2007). Of course high performance cattle with heavy duty exceed less intensive used cattle comparatively.
- Industrial **peat cutting** to use as fuel for peat power stations is still happening while Russia, Ireland, Finland and Sweden rely partly on this unsustainable generation of energy (combustion capacity of ~300-600 Megawatts). Products in garden centers are an ongoing issue as well; For example Austria imports 190.000 tons of peat each year, mainly from Eastern Europe, to use for hobby gardening and the like. A distinct reduction of this inconsiderate use of peat is essential. Even though most initiatives promoting anti-peat-guidelines are on local level with little public impact, they are still beneficial movements worth mentioning (f.e.: Anti-Peat-Movement in Great Britain: www.naturalengland.org.uk / 28.04.2013; Austrian waste management department (MA 48) "Guter Grund - Torffreie Erde aus der Wiener Biotonne"; WWF Project: „Torf gehört ins Moor und nicht in den Garten!"). Unfortunately due to a lack of awareness on behalf of the consumer, shopping habits remain unchanged.

But why protect peat lands in the first place?

Bogs are habitats with highly specialized flora and fauna, playing a key role in global biodiversity. Around 25% of endangered vascular plants are found on wet-lands, as well as a diversity of reptiles and amphibians. Apart from High Mountain regions, bogs and fens are last wilderness areas in our otherwise intensively cultivated landscape, densely populated and agriculturally used.

Peat lands are important archives: Through analysis of pollen stored within peat it is possible to gain an understanding of climate developments since the last ice age.

Intact bogs are indirectly regulating the landscape water regime. Their enormous water absorptive capacity, combined with a considerable water retentivity, balances the hydrology of their surrounding positively. Peat lands therefore serve as highly effective water retention bodies, releasing water slowly to the environment and atmosphere. But once the hydrologic balance is disturbed and the water level drops, oxidative degradation starts and the peat body shrinks. Changes in the hydraulic conditions are induced: the peat grows impermeable to water and loses its ability to retain it, which results in fluctuation of the water table.

Living peat lands play an important role as a natural water filter and water collection system in our landscape (SUCCOW & JESCHKE 1986). Modern 'root-zone-disposal-facilities' copy this sophisticated self-purification process for sewage treatment.

A currently very relevant topic in mire conservation is the enormous carbon reservoir bound globally in peat deposits, exceeding the carbon amount stored in tropical rainforests 3,5-times *(*LINDSAY 1992*)*. On a global level, one third of all soil bound carbon (= 1 395 x 10^9 t) is linked to peat (JOOSTEN & CLARKE 2002). This valuable role in the atmospheric carbon flux has not raised appropriate attention so far. Intact peat lands function as carbon accumulators and as active (but slow) sink for atmospheric carbon, while drained bogs transmute to massive carbon emission sources, due to mineralization and peat degradation (SUCCOW & JESCHKE 1986, SUCCOW & JOOSTEN 2001, MATZ 2008). In addition nitrous oxide, methane and nitrate are released because of the accelerated metabolic circle (TIMMERMANN et al. 2009). Currently 150 – 250 x 10^6 t CO_2/ha/year are globally bound in intact peat lands, while drained bogs each year emit around 3 x 10^9 t CO_2 (JOOSTEN & CLARKE 2002). At present the CO_2 emission of tropical mires amounts up to two billion tons, equivalent to 8 – 10 % of the global emission of fossil fuels, with obvious impact on the global climate. We are turning natural carbon reservoirs into carbon rises through our own ignorance.

Renaturation- how it works

Renaturation or revitalization of peat lands intends to re-establish specific characteristics, like the re-animation of peat growth and stabilizing of the water body. Even though the aim is to restore peat lands to its original state, some changes are irreversible. Once a bog, which grew over millenniums, is considerably out of balance a degree of harmonization might be the best one can achieve. An efficient vegetation analysis, including hydrology and genesis is the necessary preliminary to any restoration and management plane.

Crucial for a successful renaturation is the profound understanding and consideration of three components: Water, vegetation and peat. The hydrology determines which plants will grow and if peat is accumulated or decomposed. The plants on their part affect the structure of the growing peat and its hydraulic qualities. The peat

structure influences horizontal and vertical water movement and hence also the vegetation. Thus even the change of one component will inevitably influence the whole system; that is why this sensitive self-regulation mechanism is easily disturbed by anthropogenic intervention (TIMMERMANN et al. 2009).

Most effective is obviously the preventative environmental protection of healthy, intact peat lands. It is the responsibility of governments as well as great land owners to take measures accordingly, like the Austrian forestry office did recently with the ÖBf projects: "Aktiv für Moore" (2000-2005) and „Moor-Revitalisierung Inneres Salzkammergut“ (2010-2014).

Conclusion & Perspective

In Europe there are two opposing trends apparent: On one hand there are large-scale peat land restoration projects, with one of the biggest ongoing revitalization projects (over 40 000 ha) being conducted in White Russia. On the other hand there is still a lack of appropriate protective measures for the majority of wet habitats including bogs and fens. Today, it is foreseeable that mire conservation is becoming as much of an economic necessity as it is an ecological one, since the consequences of environmental damage (negative carbon footprint, water supplies a.s.f.) are rising and will do so excessively in the future.

It will be necessary to find a constructive approach to secure peat lands sustainably. Whereas information is a major key; only if people are made aware of the great value of these highly specialized (and extremely beautiful) biotopes is there the chance of a true interest for lasting preservation.

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