

## Utilization History of Alkaline Fens in the Natura 2000 Area Ödensee Salzkammergut New Strategies for Future Management

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### Abstract

Alkaline fens (7230) are species-rich ecosystems. They are the habitats for many rare and endangered species. For example, the distribution of *Euphydrias aurinia* is mainly restricted to fens in the protected area Ödensee, Salzkammergut. Fens of this area were originally disturbed by peat cutting which was ceased in 1926. Today, the fens are in different stages of succession according to their past management. To define future management, it is important to understand and learn from the cultural history of these sites.

Fens of this area are characterized by a wide range of different management practices like low-intensity cattle grazing, mowing or clearing of scrubs as well as long periods of abandonment. The diversity of past management results in today`s biodiversity. Interpretation of aerial photographs over the past 60 years and a survey of the cultural history enable a better understanding of future needs.

Today`s management is mainly based on agricultural subsidies. With the ongoing structural change in agriculture new strategies and innovative solutions are needed for future management. Approaches for common strategies and instruments are developed by the INTERREG SEE project BE-NATUR.

The objective is a transnational management of habitats and species. The implementation contains the compilation of a GAP Analyses, the development of Action Plans for selected species and habitats on wetland areas as well as direct and indirect interventions at site level.

- Research on the use of marsh hay for horses or bedding
- Restoration of fens by water management
- Using horsepower to cut and harvest fens
- Long-term monitoring

Given the scientific expertise, management measures are now being implemented in selected areas for direct intervention. Monitoring the project is the basis for the targeted development of the areas, in accordance with the Natura 2000 management plan requirements.

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### Keywords

management strategies, succession of alkaline fens, conservation practices, traditional land use of wetlands

### Introduction

Alkaline fens are peat forming wetlands that receive nutrients from sources other than precipitation and are characterised as wetlands which are mostly occupied by peat- or tufa-producing small sedge and brown moss communities. Usually, they develop on permanently waterlogged soils with a nutrient-poor, base-rich, calcareous water supply which results in rather neutral to alkaline milieu (OPW 2009). Above the timber line there are biotopes that remain stable on the long term. Below they have to be cultivated in some way to prevent reforestation (ELLMAUER 2005).

Today 14 ha of raised bogs and seven ha alkaline fens remain at the Natura 2000 site Ödensee from an originally far bigger complex of bogs in the area (POCK et al. 2011). Therefore, conservations aims have to ensure future management of these alkaline fens. The presented research work aims at comprehending the utilization history of some alkaline fens of the Natura 2000 site Ödensee over a period of 150 years. The results should support decisions for future management of the site.

### Research Questions

What ist to be learnt from the utilization history of alkine fens in the area? Can managment strategies be improved to appoint expertises and knowhow of traditional landuse systems? What kind of management methods are used for the continuing protection?

### Map Section of the Study Area, Natura 2000 Site Ödensee

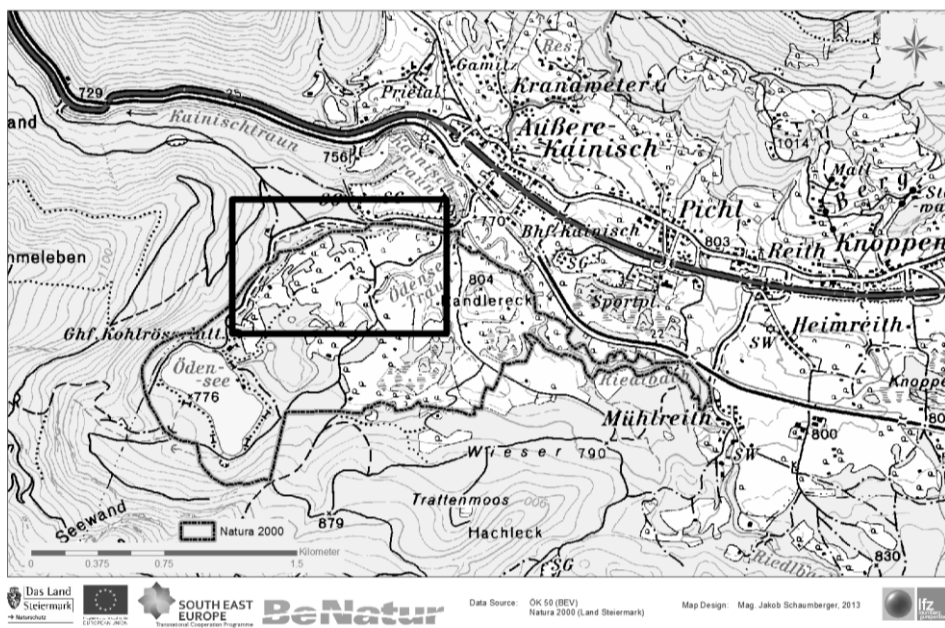


Figure 1: Study Area

### Methods

Interpretation of historic maps as well as aerial photographs over the past 100 years and a survey of the history of land use by a survey of farmers in the area. A SWOT analysis of land use management methods including employment of special tools and machines for wetland areas. Comparison of the change of biodiversity in relation to management methods.

### Analysis of the Utilization History of Alkaline Fens from 1875 to 1926

From a historic map (1875) and photographs taken in 1923 we can tell that the development of most of the alkaline fens of the area is of secondary origin. Large-scale peat cutting and draining resulted in massive destructions of bogs and the development of extensive alkaline fens. Peat cutting was necessary for the production of salt. Dried peat was transported to Bad Aussee by horse and ox. There peat was burnt to heat up the salt solution where valuable salt remained after the water had evaporated.

### Map Section of the Natura 2000 Site Ödensee, Historic Map 1875

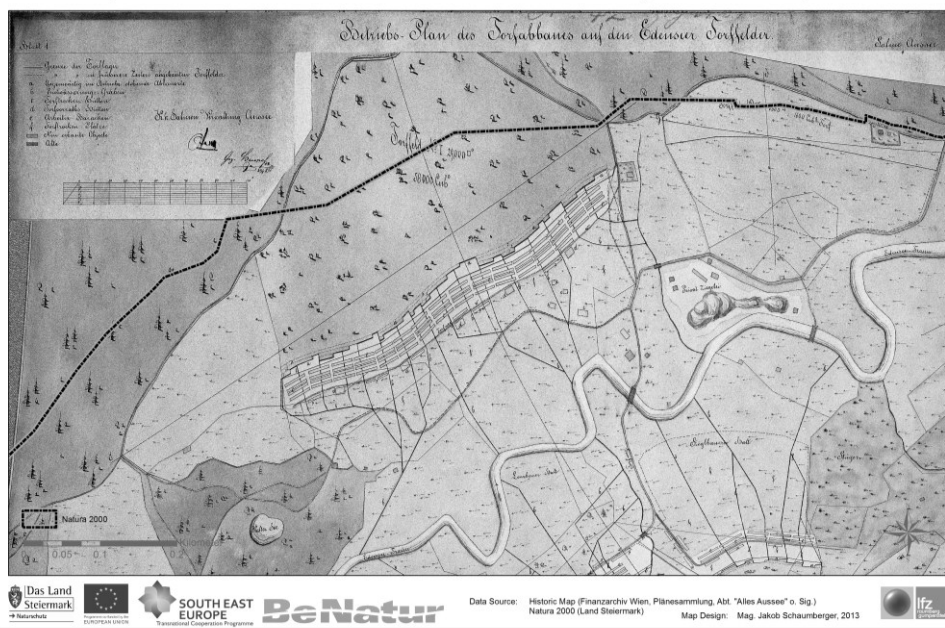


Figure 2: Historic Map 1875 Source: Finanzarchiv Wien, Plänesammlung, Abt. "Alles Aussee" o. Sig.

Alltogether three peat areas with a total amount of 104.800m<sup>3</sup> are presented on the map. The boundary of the potential peat and bog area is marked with a red line. In the section of our detailed investigation, with number I,

the amount of peat is estimated with 58.000 m<sup>3</sup>. Probably half of the amount was actually cut until 1926, leaving only about one third of the raised bog undisturbed. The broken red line shows former peat cutting areas. It seems that the older peat cutting areas, shown in green on the map are already covered with vegetation. Today different biotope types can be found in these areas as indicated in figure 7, where the FFH biotope types are seen on the historic map. Biotope types in the former peat growing areas are as follows: 7120, 7230, 6410,91Do (POCK et al. 2011).

Simultaneously to the process of peat cutting drainage ditch were build. On the map they are marked with *b*, and lead directly to the next small river. Today some of these ditches still exist. Marked with *a* are the cutting areas which can be seen in the photograph of the next figure. Peat up to three meters in height was cut.

### Land Use 1926-2012

In 1926, peat cutting ceased and the area was abandoned. Natural succession took place and vegetation could establish in disturbed bogs. Due to the high groundwater level of the site alkaline fens developed. The first aerial photographs made in 1953 show intensive agricultural utilization. Narrow plots were distributed among farmers of the next village for cutting of hay and bedding material. Narrow drainage ditches were built between the plots. The ownership of this area was never private, but state-owned.

After the second world war, the first motor mowers were introduced in the area, thus enabling regular mowing. The harvested hay was either used as bedding material for cows or as hay for horses. For the use of bedding material the hay was cut in a length of 6-10cm. It had very good quality as litter in terms of drawing capacity as well as producing very good manure. On the other hand, the harvested hay could be used to feed workhorses. In comparison to cows, horses need a higher content of row fibre with lower protein content. Therefore they can utilize hay of alkaline fens, which is traditionally harvested in autumn. **Traditional land use after the second world war could make valuable use of alkaline fens.** A farmers survey revealed that traditional land use consisted of regular mowing with motor mowers in autumn without any input of fertilizers and further on the area was not used for grazing. **Biodiversity of the sites could benefit of traditional agriculture.**

A paper from 1977 describes the site as follows: After peatcutting the area is covered with vegetation of alkaline fens. Spruce, birch and poplar have established. Partly the sites have been drained for agricultural utilization (DAXLER 1977).

Map Section of the Natura 2000 Site Ödensee 1953

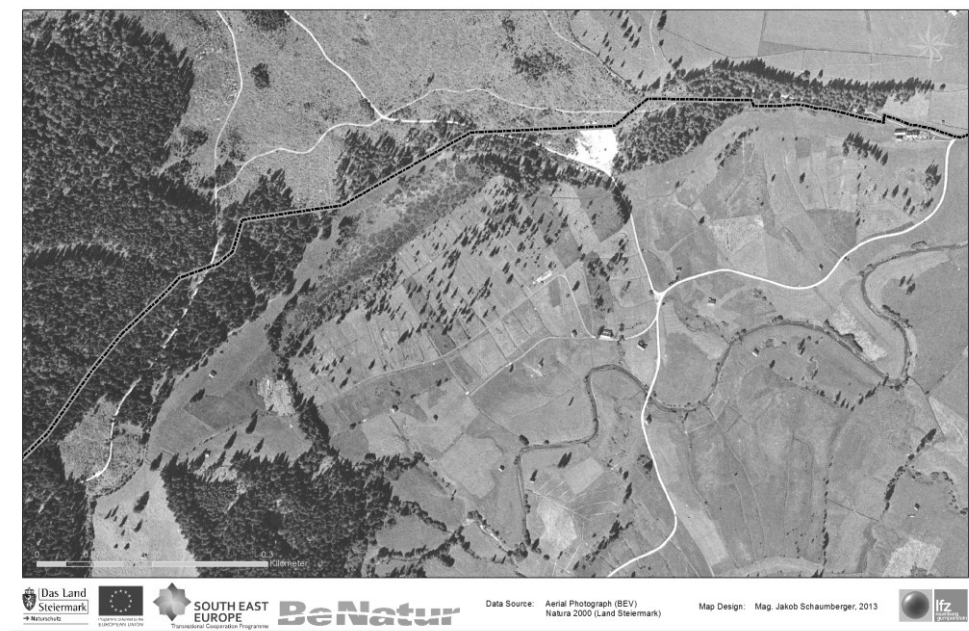


Figure 3: The aerial photograph shows the agricultural cultivation of the former peat cutting area.

1980- 1995 with ongoing structural changes in agriculture the sites were abandoned. Workhorses and manual labour were abolished, straw was bought and transported from other regions. As a result trees and shrubs, especially spruce trees colonised the site. From 1980 up to 1995, aerial photographs show no significant changes, except spruce trees becoming more dominant.

In 2002 with raising consciousness about bogs, a renaturing project started. The site was partly cleared of spruce trees, the ditches were dammed to raise ground water level. The aim of the project was the conservation of the site by preventing the growth of trees and scrubs by raising the ground water level. This was achieved through partly clearing Spruce trees, as well as damming the ditches to raise ground water level.

From 2002 to 2012, after the removal of spruce trees, more Alder Buckthorn started to colonise the site. From 2005 to 2012, different efforts were made to remove shrubs and little spruce trees by manual work.

### Map Section of the Natura 2000 Site Ödensee 1980

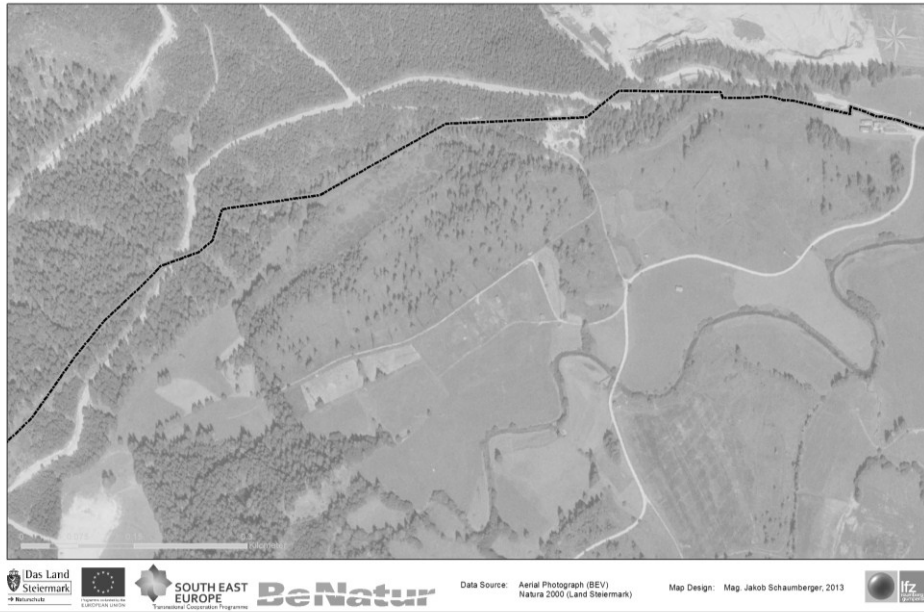


Figure 4: The aerial photographs shows that the site was abandoned and that spruce trees have become more dominant.

In 2010, the site was evaluated and a management plan defined the conservation aims. Protected and endangered species of the site species were defined (table1). The successional state in transition to woodland is the main challenge for future management. Without regular utilization the site will be quickly reforested. Management and restoration of fens for conservation often aims to maintain the species composition of a fen community at a specified stage along the natural transitional process, which can only be achieved by intervention, in the form of management.

Table 1: Protected and endangered species of the site

Protected and endangered species of the site	
bog rosmary	<i>(Andromeda polifolia)</i>
round-leaved sundew	<i>(Drosera rotundifolia),</i>
marsh orchid	<i>(Epipactis palustris),</i>
fragrant orchid	<i>(Gymnadenia conopsea)</i>
Heath spotted orchid	<i>(Dactylorhiza majalis)</i>
Common marsh orchid	<i>(Dactylorhiza maculata),</i>
globeflower	<i>(Trollius europaeus),</i>
bog-bean	<i>(Menyanthes trifoliata),</i>
musk orchid	<i>(Herminium monorchis)</i>

### Map Section of the Natura 2000 Site Ödensee 2008



Figure 5: The site was partly renaturated by damming the ditches and removing big spruce trees.

## Discussion

Based on the Utilization History of the Site, different Periods of Land Use can be defined:

1. Massive destruction of bogs with the complete loss of biodiversity
2. Recolonisation and natural succession of the former peat cutting areas with increasing biodiversity
3. Traditional land use after the second world war with low impact and high biodiversity
4. Abandonment and intensification with loss of biodiversity
5. Management and conservation to maintain biodiversity

Overlapping the historic map with the map of FFH biotope types (fig 7) various conclusions and research topics for future management can be drawn.

- The difference between secondary and primary alkaline fens in the area can be defined (see fig. 7, 7230)
- Secondary habitats of alkaline fens after peat cutting are quickly colonised by scrubs and trees, a process that is accelerated by nutrient enrichment and drainage around or within the site (91D0). The woodland that develops has wildlife interest but cannot support many of the species of open fen. The decision has to be made whether succession to a forest like state is preferable or whether the open character should be preserved. The latter will ask for different management measures.
- Alkaline fens of secondary origin have not been managed by extensive grazing. According to farmers marsh soil is too squasy.
- Primary alkaline fens in the area tend to be more stable. That could be due to different soil conditions with the absence of a layer of peat. Today, primary alkaline fens are still under cultivation and mowing can be accomplished with tractors (see fig 7, FFH 7230).
- The area where no FFH biotopes are marked is mostly covered by coniferous woodland, detailed investigation on the potential of these areas by removing spruce trees should be planned.
- In the former area of peat cutting a woodland biotope (91D0) established after the decline of traditional landuse like mowing for horse hay. Today's decision has to be whether a forest like state or an open vegetation is preferable.

### Map Section of the Natura 2000 Site Ödensee, FFH Habitat Types

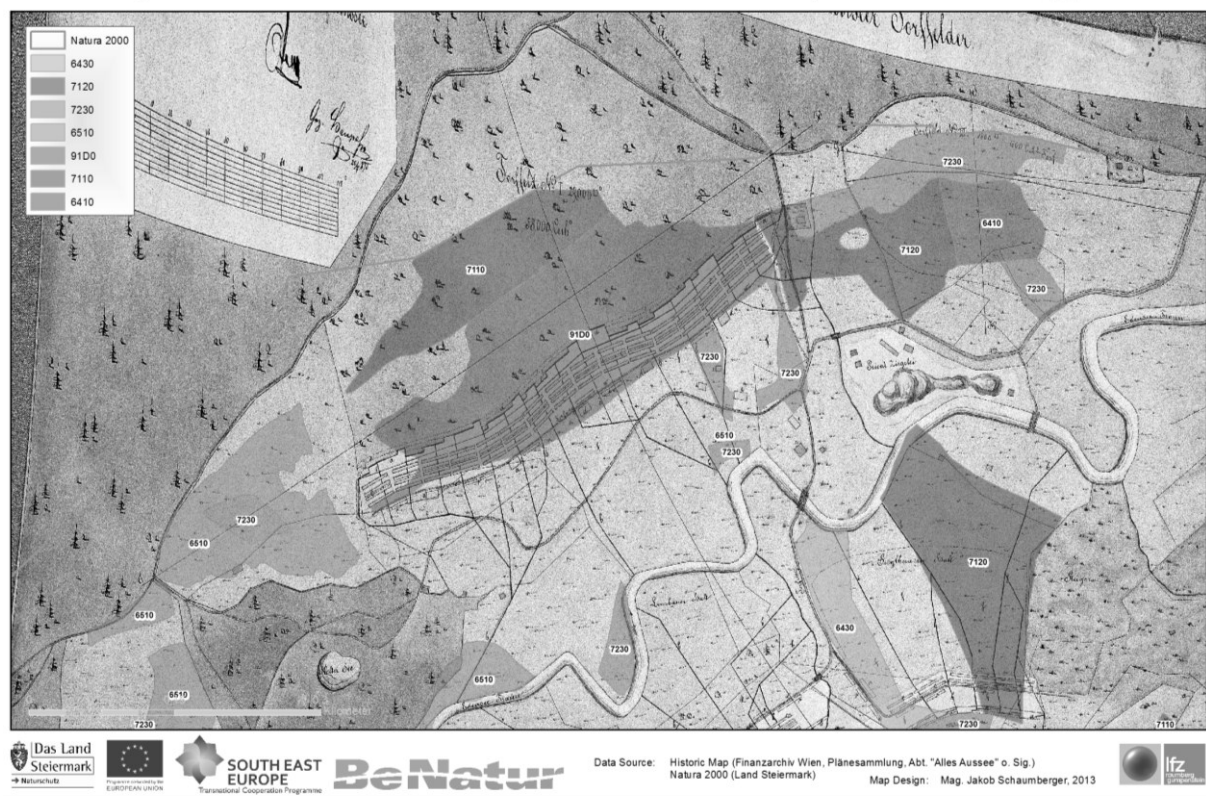


Figure 6: FFH Biotope types overlapping the historic map.

### Actual Situation, Basic Approach for further Management

Today`s problems of management are based on massive destruction 200 years ago.

In summary, we can observe that from a former area of raised bogs estimated at 20 ha, two hectares remained undisturbed. About 18 ha of former peat cutting areas are occupied by different vegetation types today, some of which belong to the FFH biotope types of the protected area.

Today`s management is mainly based on agricultural subsidies. With the ongoing structural change in agriculture new strategies and innovative solutions are needed for future management. Approaches for common strategies and instruments are developed by the INTERREG SEE project BE-NATUR.

The objective is a transnational management of habitats and species. The implementation contains the compilation of a GAP Analyses, the development of Action Plans for selected species and habitats on wetland areas as well as direct and indirect interventions at site level. The Action Plan for alkaline fens brought the following results:

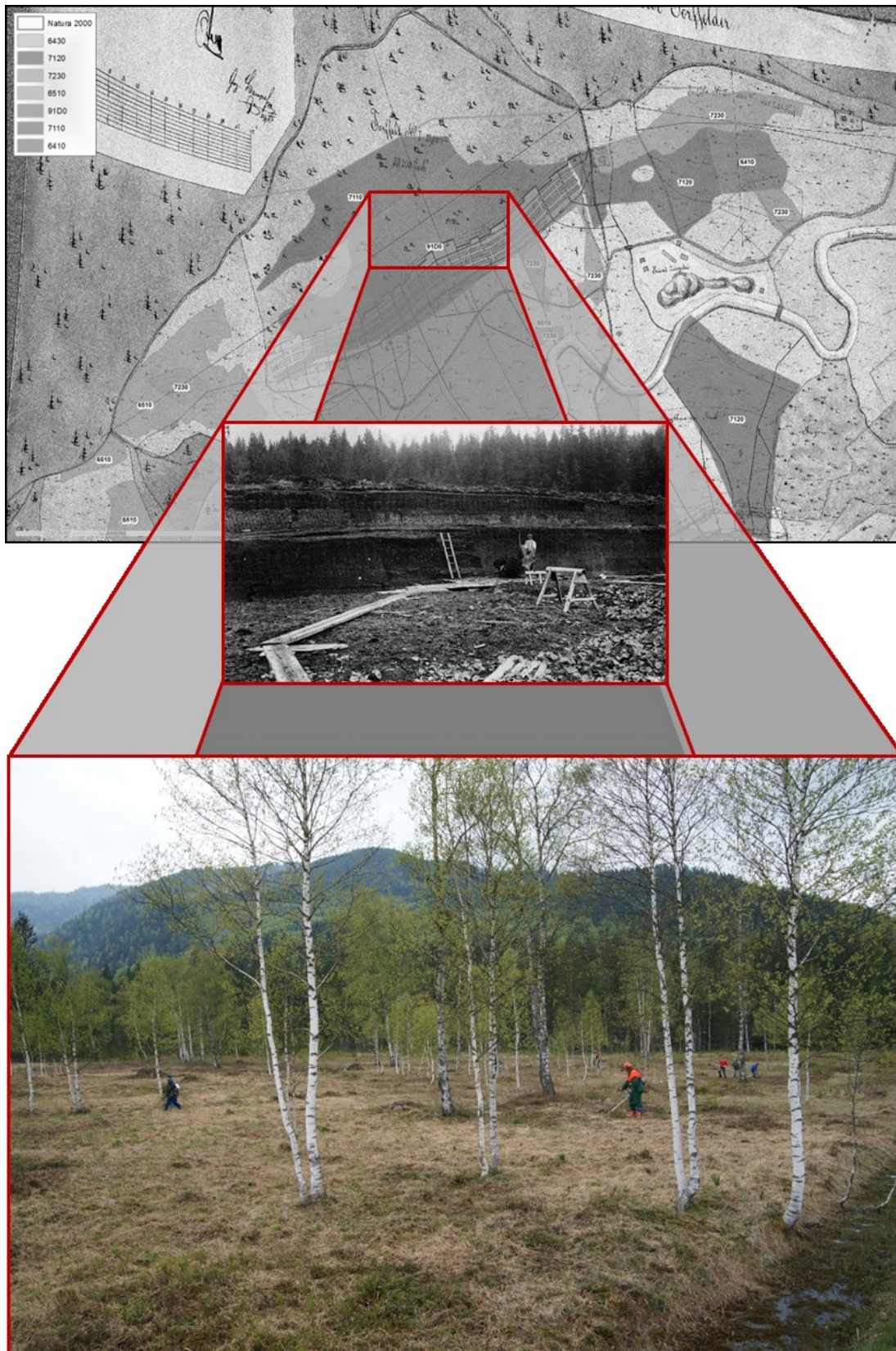


Figure 7: Peat cutting resulted in the development of extensive alkaline fens. Historic map from 1875 with FFH biotope types above, photograph of the area from 1923 and 2010 (below).

### Change of Management Patterns

Fens are highly sensitive ecosystems and are responding to a change in disturbance patterns with a change in species composition. Extensification as well as intensification of agricultural practices such as grazing, mowing and fertilizing but also changes towards tilling practices can strongly damage these habitats. This pressure becomes increasingly exigent due to changing agricultural systems, especially in south-eastern Europe. At the moment there is a small scaled mosaic-like structure of farmers who manage their patches of land in an extensive way, mainly for self-supply. Trends indicate that favourable site will be increasingly intensified whereas decentralised famers will stop their practices. This development will result in abandonment of large, formerly mown grasslands which will be prone to succession processes.

Table 2: Pressures and priorities for alkaline fens FFH 7230

Pressure	Priority	
	Austria	Hungary
Change of management patterns	Critical/High	Critical
Nutrient accumulation	Critical	Critical
Change of hydrology	High/medium	Critical
Mechanical damage	High	High
Invasive native and non-native species	High	High
Biocoenotic development, succession	Unknown	Unknown

### Objectives for Conservation sorted by priority – Management Concepts

Depending on the environmental requirements of each habitat type, *management concepts* have to be evaluated. These management concepts will be based on a clearly defined objective. Every stand is different by natural means and may need slightly different approaches to reach the goal.

- The main objective is to keep the hydrologic environment at a favourable level. Water body should be stable and a stable, low trophic level has to be kept.
- *Alkaline fens* have to be managed in a proper and ecologically sound way (extensive land use in form of grazing, mowing, manual removal of trees and shrubs...)
- Keeping the habitats open an close to their natural species composition and dominance
- Fens have to be protected against directly adjacent agricultural land to puffer the influence of fertilizers, pesticides and herbicides.

Table 3: Actions necessary to reach the objectives

Objective	Possible actions	Time	Priority	
			AT	HU
Keeping the water body stable	-Closing of all existing drainage ditches, reinforcing any feeding water bodies	Mid term	Essential	Essential
Keeping trophic level of the stands stable and low	-Rehabilitation and preservation of the natural catchment areas -Creating buffer zones such as shaws or hedge rows	Long term	Medium	Medium
Keeping secondary habitats free of trees and shrubs	-Manual removal of emerging shrubs and trees -Alien species control (active and preventive)	Short term	High	High
Insulation against directly adjacent agricultural land	-Creating buffer zones such as hedge rows or fallow strips	Short term	Medium	Medium

### **Conclusion: Future management of Alkaline Fens at the Natura 2000 Site Ödensee based on the Knowledge of the Utilization History**

As a result of the presented survey it can be assumed that alkaline fens of secondary origin are more difficult to manage. They tend to be colonised by shrubs and trees very quickly. Extensive grazing cannot be taken into consideration as the utilization history and the farmers survey revealed. To implement future management a preferable period along the different successional states of the site must be defined. Today's challenge is therefore based on the search for management practices similar to the land use after the Second World War, a period of high biodiversity. What is needed are modern and innovative methods of cultivation which have the same impact as manual work. As a result of this research a new approach will be implemented with the use of work horses.

The following aims based on traditional land use have been defined for further development:

- Research on the use of marsh hay for horses or bedding  
Traditional the harvested hay which is low in protein content and rich in raw fibre was fed to horses. As the number of privately kept horses in the area increases, marsh hay could be sold in the area which would offer an incentive for regular mowing.

- Using horsepower to cut and harvest fens  
Heavy tractors cannot be used to cultivate fens. Research on the use of workhorses will bring results about their capacity to be used for fen management.
- Restoration of fens by water management  
Further research is necessary to understand how the fen works hydrologically (how water enters, moves through and leaves a fen and its chemistry and quality), how it has changed in the past, or might change in future. Man-made structures such as ditches also affect the water management of the fen. Recent damming of ditches should be evaluated.
- Long-term monitoring  
In order to evaluate any management measures long term monitoring of key species is important and necessary.

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