Water resource management and soil examinations to protect the peaty meadows from drying in Galgaheviz, Hungary

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Abstract:
In the Carpathian Basin, peaty areas cover the creeks' lower section. In 1950–1970 these areas were dried to use as agricultural lands, thus the valuable species of the peaty meadows became endangered. Until today, the peaty areas suffered serious loss. The remaining peaty meadows represent extreme importance as natural values in Hungary. From 1950 to 2001 aerial photographs show major expansion of *Phragmites australis*, thus the area of mosaic, species rich meadow vegetation is shrinking and getting drier in Galgaheviz, Hungary. Aridification is proved by soil examination, too. During the construction of the soil map (based on 250 core sample sites) we found paleo-peaty layer at the depth of 70-90 cm, but recent peat formation is restricted to smaller patches. It is important to reduce the area of reed and to supply extra water for the meadows to protect its natural values.

Introduction:

Our target area is situated on a peaty meadow of Galgahévíz. The peaty areas of Hungary (Central-Europe) and along the Galga river are shrinking, so the one in Galgahévíz bears high value. In the 1950's, 1960's and 1970's the Galga river was regulated (VIZITERV 1972), straightened and its lower section was forced between embankment. These regulations were reasonable because it protected human properties, forcing water to run off quickly from the areas close to the river, established the possibility of arable farming and protected the land from undesirable water. However, peaty areas are having valuable plant associations but the areas of these associations are shrinking seriously.

Thanks for the regulations, the number and area of wetlands and water effected habitats reduced significantly. Along the Galga River the large and continuous peaty meadows are partitioned, in many cases disappeared. Most of them are ditched, thus its aridification is forced (FVM 2002).

The aim of my research is the description and monitoring of the degradation processes, causing aridification and loss of habitat based an aerial photographs from the following years: 1952, 1975, 1982, 1990 and 2000. Our purpose was to fully reveal the botanical, pedological and landscape potential data of the area and to monitor the changes caused by handling in the last five years. Based on the results our purpose is to outline a plan for handling that secure the future viability of the peaty meadow.

Meanwhile, caused by arable farming, intensive erosion, nutrient loss and sedimentation can be measured and modeled (Centeri 2003) on the hill slopes of the Galga watershed (Centeri and Császár 2005). Regulated riverbeds, ditches along the river and its side waters, increased nutrient load from agricultural areas, even appearing in the sediment and in the soil water fastened drying and intensive area growth of reed. The reed is taking areas from high nature protection value vegetation. During the examination of the change in the surface cover (Vona 2005), the growth of the reed area and the diffuse agricultural pollution (Centeri and

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Pataki 2003) and the lack of mowing (Malatinszky et. al 2004, Malatinszky 2004) could be proved.

Materials and methods:

The settlement Galgahévíz lies in Hungary, Pest county, 46km eastwards from Budapest in the Gödöllő Hillside.

Soil examinations were done by the Pürckhauer type soil core sampler (Finnern 1994) and by full soil profile descriptions (Stefanovits 1992). The core sampling gave possibility to take several samples and examine the depth of layers, pH, color, soil physical type, carbonate content, soil type. It gives possibility to draw coarse borders of soil types and prepare a genetic soil map, too. During the sampling we examined 250 sampling points.

We burned the area in the winter under control (Hawke et al. 2002) and mowed the grass 4 times in the summer and autumn.

Aerial photo analyses were done by GIS–ArcView.

Results:

Pedological examination

The soils of the peaty meadow are extremely mosaic with varying soil types and textures even in the parent material. The typical soil type of the area is the peaty meadow and the fluvic meadow soils.

We found buried peaty layers at the depth of 60 and 90cm. These two layers could be clearly separated based on the 250 core samples. The textures were greatly varying beginning from coarse sand as far as clay and even clay and sand were mixed up in several samples. The clayey loam, loam, sandy loam and sand textures prove that the area was greatly effected by watercourses. This is caused by the older Galga river and the Sósi creek volt. There are several old riverbeds that can be seen on aerial photographs as well. Both water courses were meandering and leaving varying sediments in smaller spots. The heterogeneity of the relief of the peaty meadow area can be explained from the varying riverbeds. There are higher sandy areas and lower clayey spots (Centeri el. al 2005).

Differences in the depth of the buried peaty layers at 60 and 90cm prove the theory of big sediment movement. The original peaty surface was covered by sediment and soil formation started again. This is what we see today on the peaty meadow.

In the soil samples there are only a few examples that prove present day peat formation. The present day peat is raw and very shallow, 1-5cm deep. We found the soil types described in Table 1. We prepared the 1:5000 scale genetic soil map of the area, too. On the soil map we find the following soil types: peaty meadow soil, histosol, fluvisol, vertisol.

No.	Genetic soil layer	Depth (cm)	Soil physical type	$CaCO_3$	Soil type
1.	A	0-31	loam	+++	Peaty meadow soil
	B	31-78	clayey loam (with sand)	+++	
	C	78-90	sand (with clay)	+++	
	D	90-100	loam	+++	
2.	A	0-50	loam	+++	Peaty meadow soil
	AC	50-65	clayey- loam	+++	

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	D_1	65-95	loam	0	
	D_2	95-100	clayey- loam	++	
3.	A	0-37	clayey loam (with sand)	0+	Histosol
	C	37-76	clay	0+	
	Da	76-80	loamy-sand (clay)	+	
	Dc	80-100	clay	0+	
4.	A	0-40	loam	++	Peaty meadow soil
	B	40-93	clayey-loam	+	
	C	93-100	clayey-loamy (with sand)	0+	
5.	Ao	0-45	loam	+++	Fluvisol
	C	45-75	loam	++	
	C_2	75-90	clayey-loam	++	
	C_3	90-100	sand	+	
6.	A_{tilled}	0-20	clayey loam	+++	Vertisol
	AB	20-64	clay	+++	
	BC	64-94	clay	+++	
	C	94-100	loamy sand	+++	

Table 1: Some soil parameters of typical soil types on the peaty meadow

Results from analyses of aerial photographs

Analyses of aerial photographs and field studies proved that there have been extreme changes on the meadow area in the last 53 years (1952-2005). The area of the reed expanded, suppressed the associations of the meadow vegetation with high nature protection value (Vona and Falusi 2005).

Based on the aerial photographs, the most intensive human effects on the meadow was between 1975 and 1990. The effects of human activity was the homogenization of the meadow vegetation, it was not possible to separate vegetation patches.

We also calculated the territory per periphery rate for the visible surface covers. It is an important value which gives us figures to describe a biotope on a natural area. Higher values mean higher chance for the survival of the biotope. In 1990 the territory per periphery rate of the meadow was 28.47, while in 2000 it was only 14.59!

Discussion and conclusions:

Pedological investigations revealed buried peat layers and assigns of drying processes on the meadow. This drying is greatly helps the expansion of the reed, degradation of the valuable plant vegetation.

Shrubs started to grow on larger extent. The area was left, local people did not cut the grass and did not use as pasture. Trees were cut.

The area underwent degradation, from the nature protection point of view. However it is a natural process that ends with forest, the valuable vegetation should be saved, because only 3 percent of all meadows left alive in Hungary.

Thanks to the handlings, the reed is in regression but surface water cover must be enlarged for the future survival of the meadow. The Sósi Creek, flowing at the border of the meadow, might provide the necessary extra water.

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