EVALUATING SOIL CHARACTERISTICS AND VEGETATION COMPOSITION IN DIFFERENT LAND USE CATEGORIES IN THE MÁTRA WINE REGION IN HUNGARY

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INTRODUCTION

Mátra wine region is the second largest wine region in Hungary. The area is characterized by the so-called household plot system [háztájizás] organized by local cooperatives and state farms. These parcels (cc. 0.3 hectares) are currently the basis of many small-holding family wineries, and the structure of the landscape is also determined by them (Király, 2014). We aimed to investigate the difference between soil characteristics and vegetation composition of land uses (vineyard, fallow, fallow with perlite, orchard, shurb, forest). We hypothesized that sites under cultivation have higher soil nutrient and those without treatment would have lower soil nutrient and higher soil organic matter and water content.

METHODS AND DATA

The study area is located on the southern part of the Mátra Mountains, in the Mátra wine region, near the city of Gyöngyöspata in Heves County, Hungary (Fig. 1). We examined six different areas: vineyard (V), fallow (W), fallow with perlite (P), orchard (O), shurb (S), forest (F) (Fig. 2). The examined sites are typically small parcels. They are located very close to each other, but they are very diverse (Fig 3).

Fig. 1. A typical landscape of the Mátra wine region with fragmented plots (Photo: Katalin Rusvai, 2025)

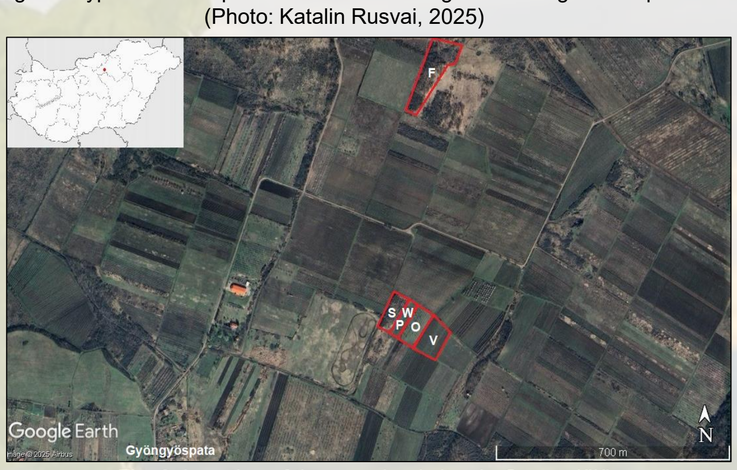

Fig. 2. Location of the examined sites in Gereg-dűlő, near Gyöngyöspata, Hungary.

Vineyard (V)

Fallow (W)

Fallow with perlite (P)

Orchard (O)

Shurb (S)

Forest (F)

Fig.3. Photos and descriptions from the examined sites (Photos: Csaba Centeri and Katalin Rusvai, 2025)

Soil samples were collected from the 0–20cm. Soil properties were measured by a near-infrared device (Agrocares Ltd.) and compared. Vegetation was examined using 1×1 m quadrats, coverage of each plant species was recorded. To estimate the naturalness of communities, Borhidi's social behavior type (SBT) classification was used (Borhidi, 1995).

RESULTS AND DISCUSSION

Soil characteristics

Soils proved to be quite degraded, only some of the examined parameters were in the appropriate range. The clay content was generally high, while soil pH and soil moisture were acceptable at all of the examined sites. The main nutrients (P, N, K) were higher in the natural habitat types (scrub, forest), and were lowest in the case of orchard, fallow and even vineyard (Fig. 4). However, in the case of micronutrients (Mg, Al, Fe), the values were the highest in the vineyard and the lowest in perlite site (Fig. 5). This is presumably due to a recent supply of nutrients. Phosphorus content proved to be the highest at sites sprinkled with perlite. Compared to the fallow (without this nutrient supply), the pH, total nitrogen and freely available nitrogen were higher in these sites (Table 1). However, Ca, Mg, Al, Fe were higher at fallow sites without perlite treatment.

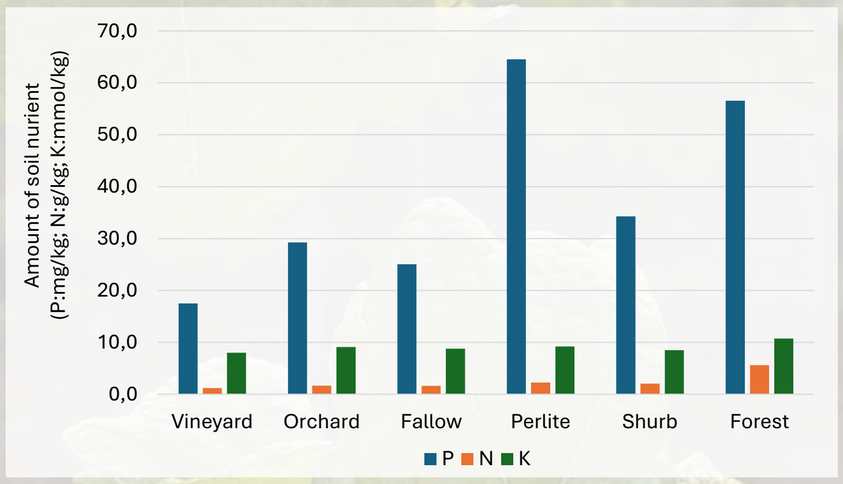

Fig.4. The amount of main soil nutrients (N, P, K) in the examined sites

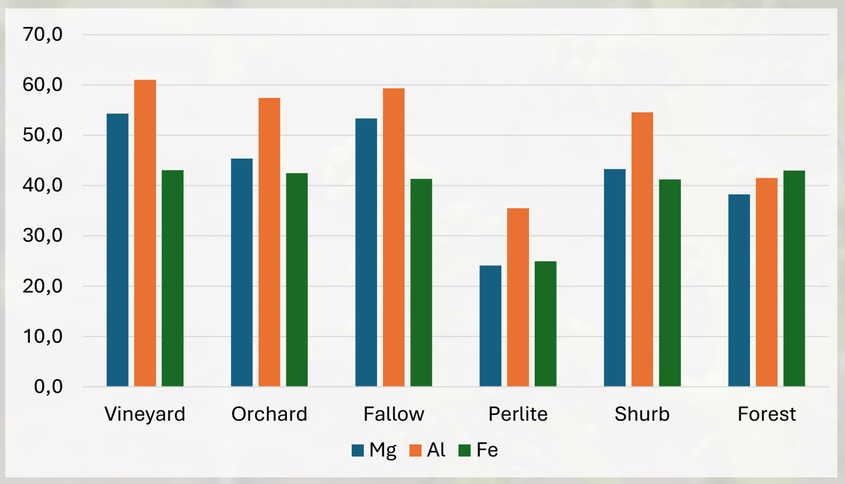

Fig.5. The amount of micronutrients (Mg, Al, Fe) in the examined sites

Table 1. Average data of the fallow and perlite plots

	Fallow	Perlite
pH (H_2O)	7,3	7,4*
SOM (%)	3,2	4,0
P (mg/kg)	25,0	64,5**
N (g/kg)	1,6	2,2*
K (mmol/kg)	8,8	9,2
Ca (mmol/kg)	379,5***	262,1
Mg (mmol/kg)	53,3***	24,1
Organic C (g/kg)	18,6	23,5
A_N_PMN	58,9	86,4*
CEC (mmol/kg)	370,6***	248,8
Al (g/kg)	59,3***	35,5
Fe (g/kg)	41,3***	24,9
Clay (%)	40,4***	24,4
Soil moisture (%)	25,4	27,3

A_N_PMN: potentially mineralizable nitrogen, CEC: cation exchange capacity
*= significant difference based on based on a two-sample t-test. Bold letters: larger values.

Considering soil moisture, even though the inter-rows were characterized by bare soil surface, we could not detect reduced soil moisture in the vineyard. Maybe is due to the special microclimate (vineyards are protected from the cool northerly winds by Mátra mountains) and soils with a high clay content (Király 2014). The soil moisture was the highest in the scrub, which was due to high, multi-storey vegetation cover.

Vegetation composition

In the vegetation a total of 95 species were found. Of these, 39 were weed species (41.1%), most of which were natural weed species (24 species). Of the invasive species, only 4 species (*Ambrosia artemisiifolia, Xanthium italicum, Erigeron annuus, Amaranthus retroflexus*) were found.
The naturalness of the vegetation in the study areas was as expected. The smallest number of species (18) and the highest proportion of weed species (83.3%) were detected in the vineyard (Fig. 6). The proportion of weed species was the lowest in the forest, but the value was similar to the orchard. This is probably due to the fact that the place of the forest could also have been a cultivated area in the past. The largest number of species and most natural species were clearly detected in the orchard. Most weed species were present in fallow site.
The effect of previous intensive use and farming is clearly indicated by the fact that even in habitats that can be called natural (lacustrine bushes, forest) the disturbance-tolerant species typically dominant.

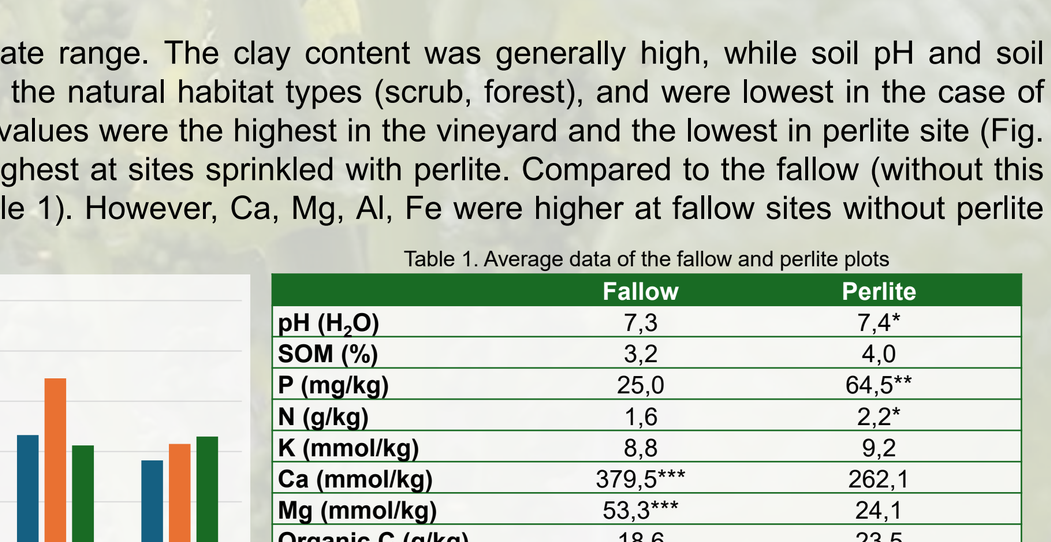

Fig.6. The number and the proportion of weed species in the vegetation of the examined sites

CONCLUSIONS

This study suggests that soils under regular cultivation (vineyard, orchard) are exhausted, and the soil of natural habitats (forest, scrub) is richer in nutrients. However, our results showed that the application of some winemaking by-products (e.g. perlite) can help improve the nutrient content of the soils.
Based on the vegetation, it is clearly visible that the entire area has been used for viticulture before. However, the relatively high proportion of natural species and the small presence of invasive species indicate that this land structure can be a sustainable way both from a farming and ecological point of view. A site-specific assessment that considers the characteristics of the terroir and also socioeconomic factors can improve the development of the region.

REFERENCES

Borhidi, A. (1995): Social behaviour types, the naturalness and relative ecological indicator values of the higher plants in the Hungarian Flora. Acta Bot. Hung. 39, 97–181.
Király, G. (2014): 'A Mátrai borvidékre jellemző szőlész és borász üzemtípusok [Typology of viticulturists and viniculturists in Matra wine region]', Gradus, 1(2), pp. 171–178.