VEGETATION DYNAMICS OF ABANDONED CALCAREOUS GRASSLANDS ON RIVER TERRACE SLOPES WITH DIFFERENT ASPECT

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INTRODUCTION

The rate of plant species diversity decrease in semi-natural grasslands after abandonment is very variable. For example, studies of calcareous grasslands in western Europe have shown that 10 to 20% of plant species are lost during 10–20 year abandonment (Wullschleger 1999; 2001; but there was no significant difference in species richness after 10–15 year abandonment of grasslands in Southwestern France (Boissat et al. 2006)). Such a great difference is due to a large number of factors influencing the course of succession. Important factors are management history, edaphic and topographic variables, as well as disturbances, fragmentation etc. (e.g. Ellenberg 1996; Linder et al. 2004; Rebele et al. 2001). Calcareous grasslands were dominating in Latvia mainly because of land abandonment. However, the present study shows that the Danube river terrace is not so pronounced in Latvia (Rūsina 2007)

METHODS

The present research was carried out in two semi-natural grasslands (referred to in Drubazas and Priednieki, respectively) located in the Abune river valley – the most spectacular calcareous grassland territory in Latvia. Both sites differ a lot in position to river – Priedneiki site was located near the north-east facing slopes (but Drubazas site – at the south-west facing slopes Fig.1), but the vegetation history was the same – grasslands were created and grazed for decades and abandoned about 30 years ago with consequent reversion to Charophyllum aromaticum vegetation (in Priednieki and cultivation of pines in Drubazas) for two years in late 1990ies. Very little plant species in the same percentage were introduced each year in July and August from 2001 to 2007. In permanent plots (size of a plot was 20 cm²) established along transects (parallel to the river) located on the terrace slopes (Fig.1). Both sites included permanent plots (one upper soil layer sample was taken in each community). Soil samples were taken in 2006. One upper soil layer sample was taken in each community.

RESULTS

Vegetation and community composition changes during the seven year period in two calcareous grasslands (dry and mesic) abandoned in Latvia. Differences in soil properties could explain the fact that there was a slight increase in species abundance was observed for Chaerophyllum aromaticum and especially in Carex caryophyllea community.

Soil physical properties were quite similar for all communities except of (increase of moisture and nutrients and decrease of species diversity), and

DISCUSSION AND CONCLUSIONS

Calcareous vegetation and community structure after abandonment in the Abune river valley was slower than expected in many cases in central and western Europe. Even after nearly 20 year abandonment bigger plots in calcareous grassland have preserved typical species composition and species diversity, and during the last few years increase of aggressive grasses and herbs were observed only in plots near the river. Soil properties are very important to determine the development of plant communities in dynamic equilibrium. Those plots were natural terraces and have not been cultivated and conserved reversion in order with anthropogenic disturbances in Drubazas site. Differences in soil properties could explain the fact that there was a slight increase in species abundance in Carex community and the increase of aggressive grasses species and herbs (Fig.5). The most possible explanations for increase in species diversity are 1) soil physicochemical properties in the area are improved, 2) soil chemical properties are shown in Table 2.

Vegetation table (reduced)

| Year | Plant Species
|------|-----------------
| 2001 |...
| 2007 |...

Table 1. Correlation coefficients for seven year observations for species diversity parameters

<table>
<thead>
<tr>
<th>correlation coefficients</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herb layer</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Moss layer</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Nutrients</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Water potentials</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Temperature</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
<td>0.74</td>
</tr>
<tr>
<td>Topography</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
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<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
<td>0.75</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Table 2. Vegetation table (reduced) (year, increase of litter and decrease of herb layer) Table 5, Fig.7).

Table 3. Correlation coefficient between species constancy/cover and observation year (figures in supercript – increase at decrease of cover and constancy from 2001 to 2007 in %). A – cover, C – constancy. * p = 0.05, ** p = 0.01

<table>
<thead>
<tr>
<th>correlation coefficients</th>
<th>A</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herb layer</td>
<td>0.80</td>
<td>0.79</td>
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<tr>
<td>Moss layer</td>
<td>0.80</td>
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<tr>
<td>Nutrients</td>
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<tr>
<td>Water potentials</td>
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<td>Temperature</td>
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<td>Topography</td>
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</tr>
<tr>
<td>Topography</td>
<td>0.80</td>
<td>0.79</td>
</tr>
</tbody>
</table>

Table 4. Soil chemical properties

<table>
<thead>
<tr>
<th>nutritional</th>
<th>CaO, mg/100g</th>
<th>P2O5, mg/100g</th>
<th>Organic C, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>FvHp</td>
<td>60%</td>
<td>70%</td>
<td>90%</td>
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Table 5. Soils fractions

<table>
<thead>
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<th>soil fractions</th>
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<tbody>
<tr>
<td>Sand</td>
</tr>
<tr>
<td>Clay</td>
</tr>
<tr>
<td>Organic matter</td>
</tr>
<tr>
<td>Non-organic matter</td>
</tr>
</tbody>
</table>

Acknowledgements

Author thanks Inga Lapiņa for assistance in soil sampling and Zaiga Vībula for digitising vegetation data. This present work was supported by a grant from the European Social Fund (ESF).

Fig. 1. Location of the transects in a relief profile

Fig. 2. Carex rossica-Helictotrichon pratense com.: Chp (A), transitional community: Tc (B), and Aegopodium podagraria com.: Aegp (C). Fig. 3. Filipendula vulgaris-Helictotrichon pratense com.: FvHp (A) and Calamagrostis epigeios com.: CalSp (B).

Fig. 4. Changes in species richness from 2001 to 2007 in Priednieki (A) and Drubazas (B).

Fig. 5. Soil fractions

Fig. 6. Soil profile of Chp com. (A), and Aegp (B) in Priednieki, and CalSp com. (C), and CalSp com. (D) in Drubazas.

Fig. 7. DCA ordination of plots. Successional vectors join the same plot in 2001 and 2007.