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Factors determining changes in the flora of xerothermic habitats in Skierbieszów Landscape Park (SE Poland)

Czynniki powodujące zmiany flory siedlisk kserotermicznych
Skierbieszowskiego Parku Krajobrazowego (Polska południowowschodnia)

SUMMARY

Skierbieszów Landscape Park was established in order to preserve the landscape of Działy Grabowieckie with beech, hornbeam woods, and xerothermic grasslands. The present study, compared with the results of the floristic studies conducted 30 years earlier, reveals that the xerothermic flora of described area is showing changes. The main goal of this paper was to investigate if changes in xerothermic flora of Skierbieszów Landscape Park (SE Poland) were caused by the cessation of use or by the influence of climatic changes. The flora of 15 slopes with dry grasslands was examined. The Ellenberg ecological indicator values were used to detect which habitat factor has changed the most. The greatest changes were noted in the value of substrate fertility N. But the changes of flora also demonstrated its statistically important dependences on temperature T and continentality K. The changes in xerothermic flora were mainly caused by succession. However, the increase in T and K indicators may have been caused by either their higher tolerance towards worsening light conditions or more favourable thermal conditions.

STRESZCZENIE

Skierbieszowski Park Krajobrazowy został utworzony w celu ochrony krajobrazu Działów Grabowieckich z typowymi dla tego obszaru lasami grądowymi i murawami kserotermicznymi. Prowadzone obecnie na tym terenie badania flory siedlisk kserotermicznych wskazują na znaczne

jej zmiany w porównaniu z danymi sprzed 30 lat. Celem opracowania jest próba odpowiedzi na pytanie czy zmiany te spowodowane są jedynie zaprzestaniem użytkowania, czy również, w tak krótkim czasie możliwe jest zaobserwowanie wpływu zmian klimatycznych. Badaniami objęto 15 zboczy, na których wykształciły się murawy kserotermiczne. W celu wskazania, który z czynników siedliskowych uległ największym zmianom wykorzystano ekologiczne liczby wskaźnikowe Ellenberga. Największe zmiany odnotowano w wartości wskaźnika żyzności siedliska N. Jednak stwierdzono także statystycznie istotną zależność między składem flory i zmianami wartości wskaźników temperatury T i kontynentalizmu K. Zmiany flory kserotermicznej powodowane są głównie przez sukcesję. Jednak wzrost wskaźników T i K, wynikający z większego udziału w zbiorowiskach gatunków o dużych wymaganiach termicznych może być powodowany albo większą tolerancją tych gatunków na pogorszenie warunków świetlnych, albo/i bardziej sprzyjającymi ich rozwojowi warunkami termicznymi.

Keywords: xerothermic grasslands, SE Poland, changes of flora

INTRODUCTION

Skierbieszów Landscape Park (SLP) is located on the area of Działy Grabowieckie in the Lublin Upland (SE Poland), on the migration route of steppe species from the Podolia mainstay to North East Europe. It was established in 1995 on an area of 35,488 ha with the aim of preserving the landscape with beech, hornbeam woods and xerothermic grasslands. Thermophilous species can be found on balks, roadbanks and marginal parts of fields, but typical xerothermic plant communities occur on steep slopes where limestone crops out. The first report of xerothermic flora of Działy Grabowieckie dates back to the 19th century (14). Extensive botanical research was carried out in the 1950s–1960s. Comparison of recent floristic data and surveys conducted 30 years earlier indicated negative changes of the xerothermic flora of SLP. The main goal of this study was to investigate if these changes were caused by the cessation of use or by the influence of climatic changes.

MATERIALS AND METHODS

In the area of the SLP 15 slopes with xerothermic grasslands were localized. Most of them were grazed until the early 70s. Only one slope is protected as a nature reserve (Broczówka) with a fuller historical description (list of occurring species and 16 surveys of xerothermic plant associations (11). Other sites were just reported as rare plant localities. The available published data (3–10, 12, 13) and herbaria collections (Herbarium of the Department of Botany and Mycology of the Maria Curie-Skłodowska University in Lublin, Herbarium of the Institute of Soil Science and Plant Cultivation in Puławy, Herbarium of the Physiographical Commission, Herbarium of Warsaw University) were used to compare the past and present occurrence of xerothermic species on the SLP area. Altogether nearly 1,000 floral data were gathered and verified in the present research. Moreover, changes in habitat conditions of the grasslands were assessed based on the relevés of Broczówka reserve. The relationship between the decrease in the number of

localities of particular xerothermic plant species and their habitat requirements described by Ellenberg's ecological indicator values (2) were analyzed using Spearman's rank correlation coefficient. The significance of differences between the weighed means of ecological indicator values (with cover in relevé transformed from the Braun-Blanquet (1) scale to van der Maarel (15) one as a weight) was examined using Wilcoxon's test. The dependence of floristic composition on habitat parameters was analyzed by Canonical Correspondence Analysis (CCA). The significance of the influence of respective factors was checked using restricted permutations Monte Carlo test.

RESULTS AND DISCUSSION

In the examined localities 41 xerothermic vascular plants were lost from the flora. The greatest decrease in the number of xerothermic species localities concerned species that have both great light and temperature demands, and low requirements of substrate fertility and soil moisture. The decrease of localities exhibited significant correlation with species habitat demands, as reflected by the Ellenberg ecological indicator values – positive correlation with indicators: light L (r = 0.202; p = 0.036), temperature T (r = 0.308; p = 0.001) and continentality K (r = 0.221; p = 0.024), and negative correlations with soil moisture F (r = - 0.231; p = 0.016) and substrate fertility N (r = - 0.225; p = 0.02).

Furthermore, 33 species from the *Festuco-Brometea* class were lost from the site of Broczówka reserve. The structure of the grassland associations present on the site also underwent changes, which was reflected in the ecological indicator values. The greatest changes were noted in the value of substrate fertility N (0.51; p = 0.016), the light indicator value shifted to a lesser extent: L (0.28; p = 0.059). The differences were larger in calcareous associations (*Inuletum ensifoliae*, com. with *Brachypodium pinnatum*) than in loess associations (*Thalictro-Salvietum pratensis*). The ordering of relevés (CCA) along the ordination axis (axis I, eigenvalue 0.43; axis II, eigenvalue 0.33) differentiated the historic and present data (Fig. 1). Both ordination axes accounted for merely 59.7% of diversity. In general the diversity of flora was to a large extent statistically dependent on the following factors: temperature T (p = 0.022), continentality K (p = 0.044) and substrate fertility N (p = 0.046). But there were some differences between plants communities on various type of background. An important factor which determined the diversity in calcareous communities was soil fertility N (p = 0.046), while in loess communities none of the factors was statistically relevant to the ordination of the relevés.

The low variability of the mean indicator values revealed a relatively constant floristic structure. Simultaneously, the reduction of the area of *Thalictro-Salvietum pratensis* patches as well as the extinction of the previously reported *Prunetum fruticosae* association testified to the greater sensitivity of loess communities to the changing habitat conditions. On the other hand, the calcareous communities,

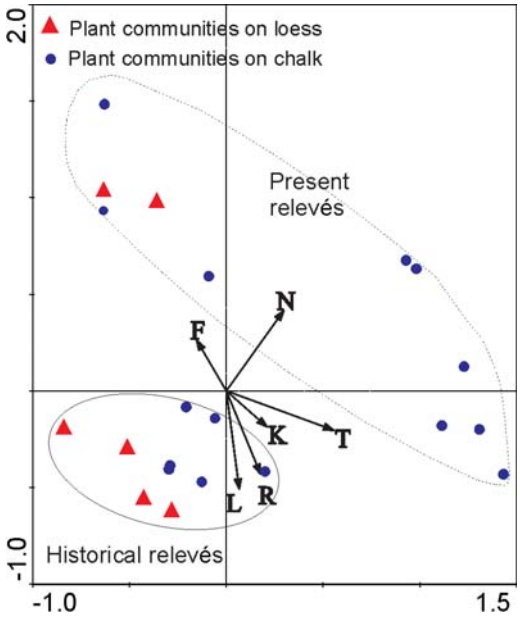

Fig. 1. Ordination of the historical and present relevés made in Broczówka steppe reserve along the first two CCA axes on the basis of species cover. Ecological indicators: L – light, T – temperature, K – continentality, F – soil moisture, R – acidity, N – substrate fertility

however impoverished, continued to exist in spite of the considerable shift in the ecological indicator values, which exhibits their higher tolerance towards fluctuating habitat conditions.

CONCLUSIONS

Comparison of recent floristic data and surveys conducted 30 years earlier indicated negative changes of the xerothermic flora of SLP. The greatest loss of localities concerned species that have both great light and thermal demands, and small soil moisture and substrate fertility demands. The major shift in indicators of light L and substrate fertility N pointed to fertilization of the habitat and deteriorating light conditions. Such changes take place during natural succession. So, the changes in xerothermic flora were mainly caused by cessation of grazing. However, the increase in value and importance of temperature T and continentality K indicators, arising from greater abundance in the communities of high thermal demand species may be caused by either their higher tolerance towards worsening light conditions or more favourable thermal conditions.

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