Floristic diversity of extensively used fresh meadows (6510) in the Wielki Łęg Obrzański complex

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Abstract

One of the habitat types protected within the framework of the NATURA 2000 network due to the presence of species of European importance are fresh meadows from the Arrhenatherion alliance. The maintenance of their characteristic floristic composition depends on habitat conditions and extensive use, while any changes in this respect trigger succession transformations potentially threatening their nature value.

The aim of the study was to conduct nature and habitat valuation of one of the largest meadow complexes in the Wielkopolska region, i.e. Wielki Łęg Obrzański, which will make it possible to describe the preservation status of fresh meadows and their habitats.

Based on multifaceted analyses of 535 relevés made using the Braun-Blanquet method in the years 2006–2012 and representing the Arrhenatherion alliance, the phytosociological and botanical structure as well as constancy of species in individual variants (floristic types) were determined. Moreover, their habitat conditions were defined, i.e. soil moisture and nitrogen content using the index method according to Ellenberg, while laboratory methods were used to determine the content of organic matter, soil moisture as well as the contents of potassium, magnesium and phosphorus in soil.

Floristic composition of fresh meadows from the Arrhenatherion alliance differs due to high heterogeneity of habitat. The presence of fresh meadow phytocenoses both on dried organic soils (the driest forms of flood meadows) and on mineral soils (oak-hornbeam forests) contributes to differences in the floristic composition both in ryegrass meadows and grass–fescue meadows, mainly due to soil moisture and fertility as well as sward use type. This constituted the basis for the identification of lower syntaxonomic units in the internal structure of the plant associations. Five variants were distinguished in Arrhenatheretum elatioris, while the community of Poa pratensis–Festuca rubra was developed in as many as 8 variants.

Keywords: Arrhenatherion; fresh meadows; species diversity; habitat conditions; succession
not occurred for many years are rapidly manifested in the condition of vegetation. This results in the transformation of numerous, previously not observed subassOCIations or floristic types of plant communities [17].

The aim of this study was to conduct a nature and habitat evaluation of one of the largest meadow complexes in the Wielkopolska region, i.e. Wielki Łęg Obrzański (Fig. 1), which will make it possible to specify the preservation status of fresh meadows and their habitats.

Wielki Łęg Obrzański (PLB300004) is an extensive meadow area located in the western part of the Wielkopolska region, protected as a NATURA 2000 area. It covers the widest section of the Obra Valley, crisscrossed by a dense network of canals and drainage ditches. The Central Obra Canal crosses it in the middle, while on the north the area is bordered by the Northern Obra Canal and in the south – by the Southern Obra Canal. In this area, in the last 15 years we have been observing a trend towards reduction in land use intensity, particularly in the area of the Southern Obra Canal where the proportion of small farms is greater. Typically 1–2 cuts are done during the growing season and frequently no fertilization is applied. Meadow plant communities from the Arrhenatherion alliance are used slightly more intensively on the Northern Obra Canal, where several larger dairy cattle farms are located.

Material and methods

The vegetation cover was analyzed and evaluated based on 535 relevéS of plant communities from the Arrhenatherion alliance (Arrhenatheretum elatioris and the community Poa pratensis–Festuca rubra), using the Braun-Blanquet method, in the meadow complex Wielki Łęg Obrzański (WŁO) in the years 2006–2012.

RelevéS were entered in the TURBOVEG data base. Using the JUICE software [18], a preliminary hierarchical classification analysis TWINSPLAN [19] was performed. Further analysis was carried out using the NCLAS program of the SYNTAX 5.0 software package [20]. The relevéS were classified twice, once on the basis of whether particular species were present, and once on the basis of their quantitative abundance. The similarity of the flora between the relevéS was calculated using Jaccard's formula: \[ P = 2c/a + b \times 100\% , \]

where: \( P \) – similarity index; \( c \) – the number of common species for both relevéS; \( a \) – the number of species in the first relevé; \( b \) – the number of species in relevé 2, 3, 4, … , \( n \).

On this basis, individual variants (floristic types) of plant communities were distinguished. The multifaceted nature valuation included the phytosociological structure of phytocenoses, constancy of species, the degree of cover in the phytocenosis surface area, biodiversity expressed in the number of species, and the Shannon–Wiener index – \( H, H = -\sum (p_i \times \ln p_i) \), where: \( H \) – diversity index; \( p_i \) – the ratio of the number of occurrence of a given species to the number of all occurrences of species \( n/N; n_i \) – the number of occurrences of \( i \)-th species in the phytosociological table; \( N \) – the number of occurrences of all species.

Syntaxa and the species characteristic for them were identified on the basis of Matuszkiewicz [21]. Vascular plants were identified in accordance with the nomenclature presented in Mirek et al. [22].

Habitat conditions of meadow communities were determined using the phytoindication method [23], assessing for each relevé: light conditions (L), moisture content (F), nitrogen content (N), and soil reaction (R). Moreover, the following laboratory methods were used to determine: (i) soil moisture content – by gravimetry; (ii) content of organic matter in soil – by the weighing method consisting in sample roasting at a temperature of 600°C and calculation of weight losses; (iii) pH of soil in 1 mol KCl dm−3 – by potentiometry; (iv) contents of potassium (by flame photometry) and phosphorus (by colorimetry): in mineral soils – using the Egner–Riehm method, in organic soils in 0.5 mol HCl dm−3; (v) content of available magnesium: in mineral soils – by the Schachtschabel method, in organic soils in 0.5 mol HCl dm−3.

The floristic and habitat analyses constituted the basis for the identification of succession directions for the characterized plant communities from the Arrhenatherion alliance in the Wielki Łęg Obrzański complex.

Results

The actually observed variation in the internal structure of phytocenoses from the Arrhenatherion association is the basis for distinguishing five variants (floristic types) within the Arrhenatheretum elatioris association and eight in the plant community Poa pratensis–Festuca rubra.
Class: Molino-Arrhenatheretea
Order: Arrhenatheretalia
Alliance: Arrhenatherion
Association: Arrhenatheretum elatioris

- typical variant (= Arrhenatheretum elatioris typicum)
- variant with Alopecurus pratensis (= A.e. alopecurotosum pratensis)
- variant with Deschampsia caespitosa (= A.e. deschamp-sietosum caespitosae)
- variant with Dactylis glomerata (= A.e. dactyletosum glomerate)
- variant with Armeria maritima (= A.e. armerietosum maritimae)

community Poa pratensis–Festuca rubra
- typical variant with admixture of Poa pratensis
- typical variant with admixture of Festuca rubra
- variant with Phalaris arundinacea
- variant with Deschampsia caespitosa
- variant with Alopecurus pratensis
- variant with Arrhenatheretum elatioris
- variant with Dactylis glomerata
- variant with Armeria maritima

In the areas covered by the characterized phytocenoses, typical plots predominate (Tab. 1). Among the relevés of the Arrhenatheretum elatioris association, they are distinguished by greater species richness (98 phytocenoses). On average 23.8 species were recorded per relevé. They include here hornbeam habitats, moderately moist, and the meadows are typically mowed twice during the vegetation season. The phytocenoses in question usually develop on mucky peats, frequently at a depth of approx. 0.5 m, with underlying sand, with a groundwater level in July at a depth of 1.0–1.2 m below ground. Abundance of available forms of Mg, K and P in soil is limited here (Tab. 2). They are phytocenoses with a relatively loose sward, with the mean cover index of 77.3%. Apart from Arrhenatherum elatius, which covers here almost 48% of the phytocenosis area (Tab. 1), the highest constancy is observed for Achillea millefolium, Galium mollugo and Holcus lanatus (Tab. 3). Places with a higher moisture content, more abundant in nutrients, coming mainly from the mineralization process, and cut once start to be colonized by large quantities of Deschampsia caespitosa (L.) P.B. which eliminates other less expansive species, the trend which is in turn manifested in the mean number of species recorded in the relevés (19.8). The share of tall oat

<table>
<thead>
<tr>
<th>Variant of community:</th>
<th>Arrhenatheretum elatioris</th>
<th>com. Poa pratensis–Festuca rubra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>typicum</td>
<td>with Deschampsia caespitosa</td>
</tr>
<tr>
<td></td>
<td>with Alopecurus pratensis</td>
<td>with Dactylis glomerata</td>
</tr>
<tr>
<td></td>
<td>with Armeria maritima</td>
<td>with Poa pratensis</td>
</tr>
<tr>
<td>Relevé number</td>
<td>98</td>
<td>18</td>
</tr>
<tr>
<td>Share of relevé (%)</td>
<td>18.1</td>
<td>3.3</td>
</tr>
<tr>
<td>Number of species</td>
<td>151</td>
<td>82</td>
</tr>
<tr>
<td>Average number of species in relevé</td>
<td>23.8</td>
<td>19.8</td>
</tr>
<tr>
<td>Average coverage sward/sodding (%)</td>
<td>77.3</td>
<td>76.1</td>
</tr>
<tr>
<td>Shannon–Wiener index</td>
<td>1.85</td>
<td>1.70</td>
</tr>
</tbody>
</table>

Share (%) of differential and characteristic species for:

- Association/community
- O: Arrhenatheretalia
- O: Molinietalia
- O: Trifolium fragiferum – Agrostietalia stoloniferae + Plantaginetalia
- Cl. Molino-Arrhenatheretalia
- Cl. Phragmites
- Cl. Koeleria glauca–Corynephoretea canescents
- companions

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| 117 |
**Tab. 2** Characteristics of soils covered by distinguished variants of plant communities from the *Arrhenatherion* alliance.

<table>
<thead>
<tr>
<th>Variant of community</th>
<th>Moisture (% weight)</th>
<th>Soil pH (1 mol KCl)</th>
<th>Organic matter content (%)</th>
<th>Mg (mg kg⁻¹)</th>
<th>K₂O (mg kg⁻¹)</th>
<th>P₂O₅ (mg kg⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arrhenatheretum elatioris</em> typicum</td>
<td>37.6</td>
<td>5.6</td>
<td>18.3</td>
<td>16.5</td>
<td>54.9</td>
<td>68.5</td>
</tr>
<tr>
<td>with Deschampsia caespitosa</td>
<td>40.3</td>
<td>6.7</td>
<td>26.1</td>
<td>97.9</td>
<td>78.7</td>
<td>783.4</td>
</tr>
<tr>
<td>with Alopecurus pratensis</td>
<td>71.3</td>
<td>5.6</td>
<td>31.9</td>
<td>40.1</td>
<td>85.8</td>
<td>114.5</td>
</tr>
<tr>
<td>with Dactylis glomerata</td>
<td>58.8</td>
<td>6.1</td>
<td>27.9</td>
<td>134.1</td>
<td>399.3</td>
<td>2005.5</td>
</tr>
<tr>
<td>with <em>Armeria maritima</em></td>
<td>15.1</td>
<td>4.8</td>
<td>4.2</td>
<td>9.2</td>
<td>22.8</td>
<td>26.5</td>
</tr>
<tr>
<td><em>com. Poa pratensis – Festuca rubra</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with dom. Festuca rubra</td>
<td>16.0</td>
<td>6.0</td>
<td>4.6</td>
<td>41.1</td>
<td>89.1</td>
<td>156.9</td>
</tr>
<tr>
<td>with dom. Poa pratensis</td>
<td>53.2</td>
<td>7.1</td>
<td>26.7</td>
<td>165.4</td>
<td>69.9</td>
<td>176.3</td>
</tr>
<tr>
<td>with Phalaris arundinacea</td>
<td>63.9</td>
<td>5.6</td>
<td>54.4</td>
<td>146.7</td>
<td>71.4</td>
<td>1268.3</td>
</tr>
<tr>
<td>with Deschampsia caespitosa</td>
<td>65.0</td>
<td>6.2</td>
<td>36.6</td>
<td>88.0</td>
<td>58.6</td>
<td>615</td>
</tr>
<tr>
<td>with Alopecurus pratensis</td>
<td>71.0</td>
<td>5.9</td>
<td>32.2</td>
<td>311.2</td>
<td>135.3</td>
<td>1502.8</td>
</tr>
<tr>
<td>with <em>Arrhenatherum elatius</em></td>
<td>26.4</td>
<td>5.9</td>
<td>10.2</td>
<td>16.8</td>
<td>24.2</td>
<td>114.7</td>
</tr>
<tr>
<td>with Dactylis glomerata</td>
<td>53.2</td>
<td>7.3</td>
<td>20.9</td>
<td>217.3</td>
<td>156.5</td>
<td>805.2</td>
</tr>
<tr>
<td>with <em>Armeria maritima</em></td>
<td>36.8</td>
<td>5.1</td>
<td>16.8</td>
<td>137.0</td>
<td>33.3</td>
<td>25.4</td>
</tr>
</tbody>
</table>

**Tab. 3** Stability of species within distinguished variants of plant communities from the *Arrhenatherion* alliance.

<table>
<thead>
<tr>
<th>Variant of community</th>
<th>Stability of species (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
</tr>
<tr>
<td><em>Arrhenatheretum elatioris</em> typicum</td>
<td>2.6</td>
</tr>
<tr>
<td>with Deschampsia caespitosa</td>
<td>6.1</td>
</tr>
<tr>
<td>with Alopecurus pratensis</td>
<td>6.5</td>
</tr>
<tr>
<td>with Dactylis glomerata</td>
<td>4.4</td>
</tr>
<tr>
<td>with <em>Armeria maritima</em></td>
<td>4.5</td>
</tr>
<tr>
<td><em>com. Poa pratensis – Festuca rubra</em></td>
<td></td>
</tr>
<tr>
<td>with dom. Festuca rubra</td>
<td>2.3</td>
</tr>
<tr>
<td>with dom. Poa pratensis</td>
<td>1.8</td>
</tr>
<tr>
<td>with Phalaris arundinacea</td>
<td>6.0</td>
</tr>
<tr>
<td>with Deschampsia caespitosa</td>
<td>1.7</td>
</tr>
<tr>
<td>with Alopecurus pratensis</td>
<td>15.2</td>
</tr>
<tr>
<td>with <em>Arrhenatherum elatius</em></td>
<td>4.8</td>
</tr>
<tr>
<td>with Dactylis glomerata</td>
<td>8.3</td>
</tr>
<tr>
<td>with <em>Armeria maritima</em></td>
<td>6.7</td>
</tr>
</tbody>
</table>
grass in the sward decreases, as it is replaced by species from the order of Molinietalia. In these phytocenoses, high constancy is reached by Deschampsia caespitosa, Festuca arundinacea Schreb., or Holcus lanatus.

In places where a high soil moisture is maintained over a longer part of the vegetation season (Tab. 2), the developing phytocenoses are associated with foxtail grass meadows – the variant with Alopecurus pratensis. In their structure, an increased share was recorded both for species from the order Molinietalia and the class Phragmitetalia (Tab. 1), while the highest constancy was observed here, apart from Arrhenatheretum elatus, for Alopecurus pratensis L., Galium mollugo, Holcus lanatus, Plantago lanceolata L., and Rumex acetosa L. In localities typically slightly elevated and dried, on mineral soils, with a lower pH and a very low trophic level (Tab. 2), phytocenoses with a high share of Armeria maritima ssp. elongata Mill. Willd were observed (Tab. 1). They were characterized by a lower density of their swards, which was manifested in the mean vegetation ground cover of 73.2%. Apart from species characteristic of the order Arrhenatheretalia and the class Molinio-Arrhenatheretalia, their structure contained an increased share of species from the class Koelerio glaueae-Corynephoretea canescensis (Tab. 1).

In turn, the variant of A.e. with Dactylis glomerata developed on strongly decomposed peats and mucks with moderate soil moisture and much higher trophic levels in the habitats (Tab. 2), caused by regular fertilization.

The plant community Poa pratensis–Festuca rubra is typically characterized by a poorer species composition than ryegrass meadows (Tab. 1). Typical phytocenoses of this plant community developed here in two variants with the predominance of Poa pratensis (170 phytocenoses) or Festuca rubra (43 phytocenoses). The areas of the plant community with the predominant Poa pratensis cover slightly more moist and fertile habitats and are characterized by better covering levels in relation to those with the predominance of Festuca rubra. Apart from Poa pratensis, Achillea millefolium and Taraxacum officinale E.H. Wigg. are found with high constancy, while in phytocenoses with red fescue Holcus lanatus and Galium mollugo were recorded much more often (Tab. 3). The transition stage between ryegrass meadows and grass–fescue meadows is connected with the plant community Poa pratensis–Festuca rubra with Arrhenatheretum elatus. It is a degradation form of the Arrhenatheretum elatioris association, which is classified to this plant community due to the small share of tall oatgrass in the sward, at a considerable proportion of species distinguishing the community Poa pratensis–Festuca rubra.

In the phytocenoses of meadow grass–fescue meadows formed at the most moist localities, occasionally fertilized and usually cut twice, greater numbers of Phalaris arundinacea specimens are recorded (17 phytocenoses), accompanied by the species found with high constancy, e.g. Ranunculus repens L. or Potentilla anserina L., or Alopecurus pratensis (6 phytocenoses). This was the basis to distinguish variants with Phalaris arundinacea and with Alopecurus pratensis, whose species composition comprised an increased share of species characteristic of the orders Molinietalia, Trifolio fragfere-Agrostietalia stoloniferae and the class Phragmitetalia. In similar habitats, but with their very limited use, on strongly loosened soils, Deschampsia caespitosa is found in huge numbers. As many as 66 areas of the plant community of P.p.–Fr. in the variant with Deschampsia caespitosa were recorded, which indicates the unfavorable direction of changes, leading to a depletion of the floristic composition of the plant community. Similarly as in the case of ryegrass meadows, this is manifested in the recorded lower mean number of species in phytocenoses (20.3) in comparison to the other variants (Tab. 1). In turn, fragments of grass–fescue meadows used as pastures show a tendency towards transformation into Lolio-Cynosuretum, which is reflected in the considerable share of highly productive grasses such as Dactylis glomerata and Lolium perenne. In contrast, in strongly dried and poor habitats Armeria maritima ssp. elongata and Anthoxanthum odoratum occur in very high numbers (Tab. 3), accompanied by less numerously represented grassland species from the class Koelerio glaucae-Corynephoretea canescensis such as Festuca ovina L., Dianthus deltoides L., Trifolium arvense L., or Sedum acre L.

The principal component analysis (PCA) for the distribution of the main ecological and edaphic factors (Fig. 2, Fig. 3) shows the general habitat preferences of the distinguished subassociations, while the ranges for the moisture content index (F) and soil nitrogen resources (N), presented in Fig. 4, illustrate the ecological amplitude for the occurrence of phytocenoses of individual variants. The basic edaphic factor influencing heterogeneity of fresh meadows was associated with moisture content, which more markedly differentiates the association Arrhenatheretum elatioris (Fig. 2) than the plant community Poa pratensis–Festuca rubra (Fig. 3). In the case of ryegrass meadows, the moisture content factor makes it possible to distinguish the variant with Armeria maritima, while the variants with Deschampsia caespitosa and with Alopecurus pratensis are slightly less distinguishable. In grass–fescue meadows, their habitat moisture content plays the greatest role in the development of variants with Phalaris arundinacea, with Alopecurus pratensis as well as Armeria maritima.

In turn, the greatest effect on the development of variants with Dactylis glomerata is observed for the availability of nutrients and soil reaction. In lowland areas the light factor has no marked impact. A study by Zarzycki et al. [24] indicated a different situation in mountainous areas where light is a major ecological factor modifying the structure of fresh meadows. A considerable role is also played by soil reaction and fertility, while the effect of moisture content is slightly lesser.

This is confirmed by the main directions of transformations in plant communities of the Arrhenatherion alliance in the WLO complex, established on the basis of the analysis of the phytosociological structure of the distinguished floristic variants and the results of habitat studies (Fig. 5).

**Discussion**

Meadow plant communities from the Arrhenatherion alliance (Br.-Bl. 1925) Koch 1926 are a threatened type of natural habitats in Poland, as has already been pointed out much earlier by Wojterska and Brzeg [25] as well as...
as the first stage in succession towards forest. The other opposite trend is associated with the replacement of small farms with conventional farming systems with large farms, which in turn is related to the substitution of extensively used meadows and pastures by species-poor plant communities of crops [28]. In such a case, grass–fescue meadows are typically transformed into ryegrass meadows, which is followed by the depletion of their species composition and highly productive grasses such as Dactylis glomerata, or Festuca pratensis start to predominate in the sward, which gave rise to the distinction of the variant with Dactylis glomerata [17,25]. The considerable floristic and habitat diversity is manifested in the numerous variants and subvariants distinguished by many authors. Within the association Arrhenatheretum elatioris, Nowiński [29] distinguished 14 subassociations, Grynia [9] 5 subassociations and 2 variants, Kucharski and Michalska-Hajduk [1] 16 subassociations, while Trąba [30] distinguished 8 natural and 7 anthropogenic variants. A slightly lesser variation, resulting mainly from the habitat moisture content, is observed in the plant community Poa pratensis–Festuca rubra [31]; as far as Wielki Łęg Obrzański is concerned, however, the composition and proportions of species allowed us to distinguish only 8 variants in this community.

The average numbers of species in the relevés of the communities Arrhenatheretum elatioris and Poa pratensis–Festuca rubra indicate that, compared to other areas of Poland, these values are lower especially in relation to ryegrass meadows [17,32,33].

The high variability of meadow plant communities from the Arrhenatherion alliance frequently results in symptoms of degradation and in Wielki Łęg Obrzański they take fragmentary forms. The nature value, characteristic of the typical form, may be restored in some degraded areas. At present in Europe effective methods are searched for to restore the nature value of species-rich meadow communities, e.g. from the Arrhenatherion alliance [13,34–36]. One of the proposed solutions is to collect seeds or hay from donor localities, such as phytocenoses developed in the typical form with a considerable richness of species characteristic of the typical phytocenoses. An example in this respect may be provided by meadows from the Wielki Łęg Obrzański complex, where the use and first of all the rapidly progressing habitat changes connected mainly with the incorrectly operating system of canals and drainage ditches are the factors hindering the maintenance of stability in the species composition of the phytocenoses, constantly modifying them.

**Conclusions**

1. The high heterogeneity of habitats in the Wielki Łęg Obrzański complex, particularly in terms of soil moisture and soil nutrient availability, influences the variability in the internal structure of phytocenoses from

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**Fig. 2** Principal component analysis (PCA) – habitat variation in the association Arrhenatheretum elatioris (Br.-Bl. 1925) Koch.

**Fig. 3** Principal component analysis (PCA) – habitat variation in variants of the plant community Poa pratensis–Festuca rubra.
the Arrhenatherion alliance, which is manifested in the development of floristic types of fresh meadows:

1. The variant with Armeria maritima ssp. elongata with the presence of species characteristic of xerothermic meadows in loosened stands, mainly from the class Koelerio glaucae-Corynephoretea canescensis – at drying, with changes in soil structure, and nutrient deficits;
2. Variants with characteristic species from the order Molinietalia and the class Phragmitetalia – in small depressions with short-term spring floodings. This trend is manifested particularly in grass–fescue meadows.

The floristic composition of plant communities in the Arrhenatherion alliance in the Wielki Łęg Obrański complex undergoes constant transformations, frequently deteriorating their nature value, and their restoration is limited by the existing use, primarily rapidly progressing changes in the habitat.
Acknowledgments

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Authors’ contributions

The following declarations about authors’ contributions to the research have been made: research designing: AKl, AKr; conducting experiments: AK; writing the manuscript: AKI, AKr.

Competing interests

No competing interests have been declared.

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Klarzyńska and Kryszak / Preservation status of extensively used fresh meadows
Różnorodność florystyczna ląk świeżych użytkowanych ekstensywnie (6510) na Wielkim Łęgu Obrzańskim

Streszczenie
Jednym z typów siedlisk przyrodniczych objętych ochroną w sieci NATURA 2000 ze względu na występowanie gatunków o znaczeniu europejskim są ląki świeże ze związku Arrhenatherion. Utrzymanie ich charakterystycznego składu florystycznego jest zależne od warunków siedliskowych i ekstensywnego użytkowania, a wszelkie zmiany tych czynników zapoczątkowują przekształcenia sukcesyjne mogące zagrozić ich walorom przyrodniczym.


Wykazano zróżnicowanie siedliskowe i florystyczne ocenianych fitocenoz. Występowanie płatów ląk świeżych zarówno na przesuszonych glebach organicznych (najsuchsze postaci łągów) jak i na glebach mineralnych (grądy właściwe) przyczynia się do różnic w składzie florystycznym zarówno ląk rajgrasowych jak i wiechlinowo-kostrzewowych, głównie ze względu na warunki wilgotnościowe i żyzność gleb, ale także na użytkowanie runi. Dało to podstawy do wyodrębnienia w wewnętrznej strukturze zespołów niższych jednostek syntaksonomicznych. W Arrhenatheretum elatioris wyodrębniono 5 wariantów, natomiast w zbiorowisku Poa pratensis–Festuca rubra wyróżniono aż 8 wariantów.