

# Evaluation of elements content in grasses and red clover grown on soils adjacent to a petroleum waste landfill

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## Summary

The development of natural gas and oil prospecting and processing in the Podkarpackie region has a strong environmental impact. Various chemical waste deposited in landfills undergo various processes, mostly physicochemical ones, which may result in contaminating arable soils with oil products, and heavy metals. Storage contaminations disturb the ecosystem equilibrium, reducing its productivity, and deteriorating the quality of crops. The latter eliminates them as feed for farm animals. Therefore, the analyses were aimed at an evaluation of Cu, Zn, Cd, Pb, Ni, Fe, Cr, Co and Mg content in soil, grasses and red clover grown near the refinery landfill in Jasło-Nieglówice.

To assess the content of the above mentioned elements, 16 soil and vegetation samples were collected: 10 grass samples and 6 red clover (*Trifolium pratense*) samples. The above elements content in grasses varied, ranging between 6.02 and 35.55 mg Cu; 33.57 to 138.60 mg Zn; 0.75 to 1.48 mg Cd; 6.26 to 16.56 mg Pb; 3.24 to 33.44 mg Ni; 0.04 to 1.04 mg Cr; 1.36 to 2.62 mg Co; 110.6 to 1367 mg Fe; 994.1 to 4999.0 mg Mg kg<sup>-1</sup> dry matter. In red clover, the elements contents were the following: 5.74 to 15.74 mg Cu; 24.27 to 49.35 mg Zn; 0.86 to 1.22 mg Cd; 6.03 to 18.21 mg Pb; 3.52 to 33.55 mg Ni; 0.61 to 1.29 mg Cr; 0.96 to 2.14 mg Co; 204.9 to 1346.4 mg Fe; 550.9 to 5210.2 mg Mg kg<sup>-1</sup> dry matter. The analysis of the above mentioned elements content shows that grasses had a higher Cu, Zn, Cd, Pb and Co content, whereas red clover had a higher Cr and Mg content. The Ni and Fe content in grass and red clover was on the same level. The admissible cadmium and lead contents were exceeded in the analysed vegetation material. Moreover, a great influence of organic matter and heavy metals content in soil were observed. No significant influence of metal content in soil on their content in vegetation was noted.

# Influence of irrigation using purified municipal sewage on species composition of meadow mixtures

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## Summary

Studies aimed to evaluate the influence of irrigation using post-sewage water (purified sewage) on the sward species composition of two grass mixtures, were performed in 1996-2000. Experiments were carried out on the experimental plot (about 8 ha area), where the effect of irrigation on various plant species was evaluated, including grass communities shaped by sowing the grass mixtures (I – onto wetter habitats with dominating *Alopecurus pratensis* and *Phalaris arundinacea*, II – onto optimum wet habitats with dominating *Alopecurus pratensis* and *Dactylis glomerata*). Irrigation was applied once a year (A – with no irrigation – control, B – 600 mm, C – 1200 mm) in 10 doses by means of flooding system. The sward was cut three times, and species composition was estimated by means of botanical and gravimetric method. Applied irrigation was the factor that stimulated the share increase of wet-habitat species in sward (*Alopecurus pratensis* and *Phalaris arundinacea*). The share of *Phalaris arundinacea* gradually increased in mixture I at second re-growths in following years – opposite to *Alopecurus pratensis*. Above species had reduced share on not irrigated plots with advantage of *Festuca pratensis*, *Festuca arundinacea* and *Poa pratensis*. Achieved results indicate the great usefulness of *Alopecurus pratensis* and *Phalaris arundinacea* for grass mixtures applied for sowing on irrigated areas taking into account other species such as: *Poa pratensis*, *Festuca pratensis* or *Festuca arundinacea*.

# The response of *Dactylis glomerata* used in meadow mixture on the course of weather conditions in the long term

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## Summary

The studies were carried out in 1990-2001 on experimental field in central Poland on a natural moderately wet meadow site on mineral soil. The long term research dealt with *Dactylis glomerata* cultivar 'Nera' in meadow mixture. The aim of the study was to evaluate the response of *Dactylis glomerata* to weather conditions. There were noticeable changes in percentage contribution of *Dactylis glomerata* and other components in the sward of the first cut of meadow mixture since the first year of utilisation. It was determined by competition between components and the weather conditions. It was found that low temperatures in winter ( $-12\text{ }^{\circ}\text{C}$  to  $-17\text{ }^{\circ}\text{C}$ ) and in early spring without snow as well as periods of drought in summer affected the less share of *Dactylis glomerata* in sward of mixture. *Dactylis glomerata* cultivar 'Nera' occurred aggressive and persistent component of meadow mixture. *Poa pratensis* cultivar 'Beata' and *Festuca rubra* cultivar 'Brdzyńska' were the components with great contribution in meadow sward and also influenced on *Dactylis glomerata*. These components were persistent and resistant for unfavourable weather conditions, especially drought.

# Grass communities in extremely dry habitats

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## Summary

This paper presents a synthesis of some studies from 2000-2004, concerning sandy turf, xerothermic turf and anthropogenic areas. On the studied objects the following plant communities were identified:

- on sandy turf – *Deschampsia flexuosa* with *Agrostis capillaris*, *Avenula pubescens*, *Festuca ovina*, *Agrostis capillaris*, *Holcus mollis*;
- on xerothermic turf – *Phleum phleoides* with *Anthericum liliago* and *Koeleria glauca*; *Brachypodium pinnatum* with *Stipa joannis* and *Festuca rubra*; *Brachypodium pinnatum* with *Stipa capillata*; *Stipa joannis* and also *Stipa joannis* with *Festuca rubra*;
- on anthropogenic areas – *Calamagrostis epigejos* and *Festuca ovina* with *Holcus lanatus* and also *Festuca ovina* with *Arrhenatherum elatius*.

The described communities which grow in dry habitats have various functions, both productive and other. Management of these areas should consider their biodiversity and peculiarity. Ecosystems of the studied habitats demand an active protection, not only of particular species but the whole plant communities.

# Comparison of two methods of evaluation of meadow species composition – estimation by eye and botanical separation

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## Summary

The studies were carried out in central Poland on a natural moderately wet meadow. In the meadow sward were grasses, leguminous and herbs. Dominant species of grasses were *Dactylis glomerata* and *Poa pratensis*. The aim of the study was comparison of two methods of evaluation of meadow species composition. The obtained data showed the differences between two methods. On the bases of the eye estimation the grasses were 78.3% and dicotyledonous 21.7%. According to botanical separation the grasses were 87.2% and dicotyledonous 12.8%. It was found that botanical separation overstates the percentage of height grasses. Whereas the eye estimation overstates the percentage of low grasses and dicotyledonous. The methods were not differ about the percentage of total grasses.

# Grasses communities of roadside plantings near Gryfino

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## Summary

The results of studies of grass communities appearance within of roadside plantings along sides of the roads with asphalt surface or midfield roads are presented in this paper. The roadside plantings located between Gryfino and Gardno within the area of Szczecin Lowland (mesoregion of Wełtyńska Plain) Western Pomeranian voivodeship were analyzed. The studies were conducted along both types of roads on 14 stable sites of size 4 × 10 m on every type of road. During the 2002-2004 years 28 phytosociological records were done using Braun-Blanquet method as well as 30 floristic lists were prepared. Basing on these records and lists the nine plant communities were distinguished. Among them grass communities with *Poa annua*, *Bromus hordeaceus* and *Dactylis glomerata* as well as nitrophilous communities with *Aegopodium podagraria* and *Urtica dioica* were dominated. Beside of common species, seven species under legal protection and two rare species of field weeds were found. The total number of species found within the area of roadside plantings were: 130 species (with 23 of species which belong to *Poaceae* family), 16 tree species and 15 bush species. The appearance of individual species was substantially effected by location of roadside plantings, for example if road was located between fields, fallowed areas, among meadows or beside of forest.

## Grasses on the selected roadsides of Lublin region

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### Summary

The aim of the investigation we have carried out was to evaluate the participation of the grass species in the sward of the roadsides, in view of their possible usefulness to sow with them those roadsides, which are being built or modernised.

The investigation was carried out in 75 study positions on the roadsides of the voivodship roads, as well as on the national, district and communal roads of Lublin region. Within the areas of 50–100 m<sup>2</sup> characterised by a similar species composition and of similar seat conditions the flora lists were prepared and the percent participation of the given grass species was determined.

In the sward of the roadsides, 215 species of vascular plants, including 33 species of grass were found. Most often there occurred *Agropyron repens* (in 68 points in about up to 95%), *Poa pratensis* (60 points, up to 60%), *Dactylis glomerata* (58 points, up to 25%), *Festuca rubra* (56 points, up to 60%) and *Arrhenatherum elatius* (43 points, up to 80%). On freshly repaired roadsides, in the seats, which were already strongly transformed, in the direct vicinity of the roadway or even in the asphalt fissures the presence of *Agrostis vulgaris*, *Poa pratensis* and *Agropyron repens* was confirmed. These data show a considerable tolerance of these species on the stressing environmental factors, which come into action on the roadsides. The investigation proves the flora composition of the roadsides depends both on the place the given road is situated in the landscape (cultivated fields, woods or grassland), on the degree of the change of soil profile, as well as on the intensity of the traffic there.

# **The influence of permanent meadow manuring with post-mushroom's compost on the content of some microelements in meadow sward**

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## **Summary**

The plot experiment in randomized block design and four replications was carried out within 1999 – 2001 on the permanent meadow to determine the effect of post – mushrooms' compost manuring on the content of microelements (Mn, Cu, Zn) in harvested green crop. Five fertilization combinations were applied (NPK, farmyard manure, post – mushrooms' compost, with and without NPK). Organic manure was applied once in spring 1999 at the rate of 10 t organic matter per ha, while the mineral fertilization was used every year.

Obtained results showed that the use of organic manures increased Mn and CU contents in harvested plant material as compared to the control. Moreover, the effectiveness of these microelements' cumulation was higher at combinations with joint organic – mineral fertilization than at separate organic only. Plant material harvested from the plots manured with post – mushrooms' compost contained more copper and manganese than that after farmyard manure application. However, the content of zinc was higher in green crop fertilized with farmyard manure in comparison to post – mushroom compost applied.

# Biological and chemical properties of *Elymus arenarius* as an anti-erosive grass

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## Summary

The objective of the study was to get acquainted with the biological and chemical properties of *Elymus arenarius* which are important for the utilisation of this grass taxon as an anti-erosive grass. Experiments were carried out in years 2000 – 2004. They were conducted on experimental fields characterised by difficult soil conditions and differing from one another with regard to the degree of insolation on which seedlings of this grass, developed from kernels collected from seaside dunes, were planted out. Results of our investigations revealed that *Elymus arenarius* distinguishes itself by its considerable capability of developing shoots and the rate of covering the soil surface as well as by the rate of establishment and spreading in the site and taking over new areas by means of vegetative processes. Therefore, it can be recognised as a valuable anti-erosive grass of difficult sites in various places in Poland situated outside seaside areas. One of the characteristic features of *Elymus arenarius* is its high vitality in difficult site conditions. The observed low level of chlorophyll dyes does not restrict the vitality of this species. In difficult soil conditions regarding soil fertility and moisture content, the plants do not dry and die out even at high air temperatures, provided full, unrestricted sunlight can be insured. Sea lyme grass owes its capability to sustain in difficult sites and maintain the shape of its shoots to a considerable proportion of cellulose, hemicelluloses and lignins. One of the factors limiting its generative proliferation is its low seed potential of this species.

# Grass communities of excessively wet sites in river valleys

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## Summary

In the examined site conditions, grass communities, their development, phytosociological variability, floristic diversity, the performed function are all affected by moisture conditions as well as water mobility and aeration. Additionally, the current condition of communities growing in sites, which are periodically excessively wet, is strongly influenced by their utilisation, i.e. date and frequency of cutting as well as the possibility of light grazing and applied harvesting technologies. Frequently, the sward of such areas is invaded by communities of other plant species characteristic for other phytosociological units, which leads to the development of phytosociological units lower than the association. Syntaxons such as, for example, variants of associations, as a rule, show a higher floristic wealth than typical forms. Despite the fact that areas flooded systematically exhibit greater resistance to invasions by foreign species associated with human activities, the author observed penetration of synanthropic species which were not typical for these sites. In view of the need to maintain the biodiversity of plant communities, it would be advisable to protect them and maintain their natural value by encouraging extensive, traditional utilisation. Therefore, there is an urgent need to monitor changes taking place in these communities, including grass communities growing in excessively wet sites.

# Grasses in plant communities of the Warta old river-beds

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## Summary

The analysis of long-term results of geobotanical investigations revealed that, among the floral communities occurring in the old river-beds of the Warta, 14 grass species were found of which *Glyceria maxima* (max. V<sup>6337</sup>), *Phalaris arundinacea* (max. V<sup>1563</sup>), *Phragmites australis* (max. V<sup>8523</sup>) and *Poa palustris* (max. V<sup>550</sup>) were the most frequent and characterised by the highest coverage index.

The species wealth and floristic diversity of plant communities of the old river-beds depended on the degree of water content and the site trophic value. The associations occurring in the central part of the old river-beds of higher humidity (F over 10) showed a smaller number of plant species (mean number of species in one survey – from 4.4 to 9.3), including grasses (from 1 to 3). Site changes associated with the smaller water content caused changes in the floristic composition of communities not only on flooded areas adjacent to old river-beds but also in the old river-beds themselves, which led to the infiltration of species belonging to the communities of the *Molinio-Arrhenatheretea* class and frequent development of transitory forms of associations.

# The effect of root grass phyto-toxins on preliminary growth and development of *Lolium perenne*

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## Summary

Allelopathic activity of decomposing roots of selected grass species previously grown at optimum and excessively dried medium was evaluated under conditions of pot culture. On a base of phenolic compound content in medium where previously grasses were grown that was higher than for control as well as lower content of these compounds in soil taken in spring than when the experiment was completed, it can be supposed that gradually decomposing root system of tested grasses was the phenolic compound source. The worse emergence and tested species growth inhibition are the proof of allelopathic stress towards plants and it may prove the role of allelochemicals in forming growth conditions. Negative influence of phytotoxins varied in presented studies depending on the species and root matter decomposition time. The strongest inhibition was due to decomposing roots of *Phleum pratense* and *Poa pratensis*. The highest allelopathic activity of mediums was observed since the 7<sup>th</sup> week of study when *Lolium perenne* seedlings were even twice as short as in control objects.

# Assessment of moisture of grassland sites by the phytoindication method in the region of depression crater of KWB Bełchatów

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## Summary

Within the range of the depression cone water regime of grassland sites underwent a radical change. Grasslands of these sites were entirely deprived of water supply from outside the site. Lack of water supply from outside the sites caused a change of ground-water regime to precipitation-retention one. Long-lasting deprivation of ground water supply of grassland sites caused a decrease in share of species with high water requirements, with a humidity figure from 6 to 9, and increase in share of species with low water requirements, with a humidity figure from 3 to 5. In the latter group of species changes under the influence of long-lasting drainage were not, however, so distinct as in the group of species with high water requirements. Assessment of water conditions of grassland sites in the region of the Bełchatów brown coal mine depression cone by the phytoindication method according to Oświt did not fully reflect a real differentiation of these conditions, mainly because of a too high humidity figure of the long-drained sites occurring in the depression cone area. Taking into account the *Festuca rubra* share in calculating a mean humidity figure of the sites by the phytoindication method caused a decrease in assessment accuracy of this method. In this connection when estimating moisture conditions of the sites in the region of the ground water depression cone of the Bełchatów brown coal mine this species should be taken into account as an indicator species with a humidity figure equal to 4.

# Grasses in the plant communities of extremely wet habitats in San valley

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## Summary

In the course of the study 146 phytosociological relevés recorded in the San valley in the vegetation on extremely wet habitats turned out that twenty-four plant communities were identified, in which 28 species of grasses were found. Only *Glyceria maxima* was abundant across the whole moisture spectrum (F = 8.0-11.5) and the other four species (*Agrostis stolonifera*, *Alopecurus geniculatus*, *Phragmites australis* and *Poa palustris*) also occurred along a wide moisture gradient but their abundance declined with increasing moisture of the soil.

Other seven species (*Agrostis gigantea*, *Alopecurus pratensis*, *Glyceria fluitans*, *Glyceria plicata*, *Phalaris arundinacea*, *Poa palustris*, *Poa trivialis*) were found on the drier side of the gradient (F = 8.0-10.0); and only *Glyceria plicata* and *Phalaris arundinacea* grew in habitats which slightly exceeded these moisture levels. Other grass species listed in the paper occurred only sporadically, and only on the drier side of the gradient.

**Effects of magnesium deficiency on gas exchange parameters, leaf greenness index (SPAD) and yields of *Lolium perenne* and *Dactylis glomerata***

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**Summary**

The rate of photosynthesis, transpiration and leaf greenness index (Soil Plant Analysis Development) of perennial ryegrass and orchard grass, grown under conditions of magnesium deficiency in the soil, were studied in a greenhouse experiment. The rates of photosynthesis and transpiration were measured with a LI-COR 6400 portable gas analyzer, and leaf greenness – with a SPAD 502 optical chlorophyll meter (Minolta). Dry matter yield was determined by drying the biomass collected at 105°C, to constant weight.

Magnesium deficiency significantly reduced plant yield. The highest yield decrease was noted in perennial ryegrass cv. 'Argona'. The results obtained show that the rates of photosynthesis and transpiration in both species depend on magnesium supply to plants. Magnesium deficiency in the soil significantly limited the processes of photosynthesis and transpiration in the leaves of perennial ryegrass and orchard grass. The highest rates of photosynthesis and transpiration were recorded in 'Argona', and the lowest – in 'Areda'. Magnesium deficiency significantly reduced chlorophyll content in leaves. Perennial ryegrass cultivars showed a higher concentration of chlorophyll in leaves than orchard grass cultivars.

**Summary**

The paper presents a concept of spatial identification of extreme grassland habitats. The extreme habitats are defined within agriculturally managed meadows and pastures, distinguishing their three major types in Poland: hydrotrophic, xerotrophic and litotrophic in relation to main factors limiting habitat trophic status.

It was attempted to undertake this identification based on a computing technique using the database of marginal soils and a geographical information system on the characteristics and values of wetlands and grasslands in Poland, both established at IMUZ. The model for identification of marginal habitats was built using diagnostic features selected from both databases. The database of marginal soils was supplemented by software application that allowed for generating an example map of extreme grassland habitats for the Łomża region.

# The occurrence of endophytic fungi on turf grasses and its susceptibility to drought stress

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## Summary

Twenty-eight turf grass varieties, ecotypes and breeding lines were evaluated in field experiment for natural drought susceptibility. Conditions of close and frequent mowing, together with low fertilisation and no additional watering were used to enhance natural drought stress. Using 1-9 scale sward density, general aspect and condition of turf plots were evaluated during periods of drought and subsequent regeneration. Further, seed and plant infestation with endophytic fungi was also performed. Only three varieties from all tested exposed infection in seeds and only for two of them (tall fescue 'Barrocco' and one ecotype of *Koeleria*) plant infection was detected. Endophyte infected plants were more susceptible to red thread disease but also exposed better general aspect and sward density at the end of evaluation period.

# Appearance of grass communities on the recultivated power plant ash dumping

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## Summary

10 plant communities on ash dump were distinguished on the area of the Siekierki Power Plant ash dumping (8 on the main dump and 2 on the temporary dump). On the top of the dump and on the northern slope most of the surface was occupied by hay-growing meadows *Arrhenatheretum elatioris medioeuropaeum*. On the western slope the predominant community was *Arrhenatheretum elatioris medioeuropaeum* and its ruderal form, on the southern slope - plant communities with the significant share of legumes, and on the eastern slope - initial communities. 34 species of grasses were distinguished, with *Elymus repens*, *Poa pratensis*, *Festuca rubra* and *Agrostis tenuis* (57 - 44% plots) appearing most often. Relatively common were also *Dactylis glomerata*, *Phleum pratense*, *Agrostis gigantea* and *Calamagrostis epigeios* (36 – 21% plots). On the top of the dump the predominant species were *Elymus repens* and *Festuca rubra*, on the western slope - *Festuca rubra* and *Poa pratensis*, and on the southern slope it was *Poa pratensis*.

# **Plant responses to the abiotic environmental stresses – acclimatization and adaptation**

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## **Summary**

Plants encounter a wide range of environmental insult during their life cycle and have evolved mechanisms by which to increase their tolerance at different level of plant organisation. In this paper it is discussed plant mechanisms of response to survive natural adverse environmental conditions as circadian (day and night) and seasonal changes of many physical factors. Very few of plants are adapted in evolution to relatively constant environments; plants have ability to cope with natural fluctuations of conditions, without irreversible destruction. Severe stresses may cause elastic or plastic deformations. Fluctuations of plant responses, expressed as changes in the rate of physiological processes are also presented. They depend mainly on severity and duration of stresses. Our knowledge about the plant coping with environmental stresses tremendously increased over recent years. During stress acclimation, changes in gene expression occur. A large number of stress genes encode proteins with known enzymes, hormones or other regulators activity that potentially contribute to stress tolerance. Speculatively the differences between tolerant and sensitive plants may be attributed to differences in precise regulation of stress related gene expression.

# The presence of grasses in plant communities developing on abandoned fields and meadows in the Kolbuszowa Plateau

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## Summary

On the basis of 59 phytosociological releves (Braun-Blanquet approach) four plant communities were identified. The study area features very light, sandy soils. Habitat conditions were evaluated on the basis of the chemical analyses of soil samples and with the Ellenberg phytointication method (Ellenberg indicator values). The achieved results showed high acidity and low, although varied, nutrient levels. The poorest soils were occupied by *Festuca ovina* grasslands, and the richest ones by *Agrostis capillaris* grasslands. The driest and warmest sites were occupied by *Spergulo-Corynephorum*, and the moistest and coldest by - *Polygalo-Nardetum*. The largest number of grasses – 19, was found in the *Agrostis capillaris* community, the lowest –12, in the *Festuca ovina* community. The feature common to all the studied phytocoenoses was the presence of the following grass species *Agrostis capillaris*, *Festuca ovina*, *Poa pratensis*, *Calamagrostis epigejos*, *Anthoxanthum odoratum* and *Festuca rubra*. *Corynephorus canescens* was most abundant in the pioneer *Spergulo-Corynephorum* grasslands and it was not recorded in abandoned meadows belonging to *Polygalo-Nardetum*. *Holcus mollis*, *Anthoxanthum aristatum* and *Elymus repens* grew only in *Spergulo-Corynephorum* and *Agrostis capillaris* community loose grasslands. The *Polygalo-Nardetum* association was differentiated by the presence of *Nardus stricta* and *Festuca rubra*, and a frequent but not abundant occurrence of *Danthonia decumbens*.

# Environmental value of plant communities of moist and wet habitats of the Kostrzyn Broad

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## Summary

The study was done on the Kostrzyn Broad, in the Odra river valley between Siekierki and Kostrzynek. The studied sites (1-6) were along a transect influenced by the backwater. The base is proper river alluvial soil and river alluvial humus soil. The following species grew in this area: *Glyceria maxima*, *Phalaris arundinacea* and *Carex gracilis* creating communities of rush type. The other species present *Agrostis stolonifera*, *Acorus calamus*, *Bulboschoenus maritimus*, *Polygonum hydropiper* should be mentioned. The floristic composition and natural value of the studied communities depended on the kind of habitat. There were 71 vascular plant species. Communities which built the plant cover of Kostrzyn Broad from very moist and wet sites (D) were classified as those representing medium high value, and communities of very high value were those from swamp areas (E). The most interesting community was that *Bulboschoenus maritimus* which had unique and exceptional natural value. Species which improved the natural value of Kostrzyn Broad were *Achillea ptarmica*, *Butomus umbellatus*, *Galium uliginosum*, *Iris pseudoacorus*, *Xanthium albinum*, *Mentha pulegium*, *Inula britannica*, *Thalictrum flavum*, *Schoenoplectus lacustris* and other.

# The effect of thermal stresses on the presence of *Lolium perenne* in the pasture sward on organic soil

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## Summary

The grazing studies were conducted in the experiment established in 1996 and located on peat-muck soil. A randomized block design with four replications was used. One of the aims of these studies conducted in the years 2000-2003 was to evaluate the effect of winter conditions on the presence of *Lolium perenne* in the pasture sward on peat-muck soil. The main grass component of the mixtures with *Trifolium repens* was *Lolium perenne*. Apart from this species, grass-clover mixtures contained *Phleum pratense* and *Dactylis glomerata*. Mixed sward was fertilised with 40 kg ha<sup>-1</sup> N. A grass sward was composed only of these grasses and fertilised with 40, 80 and 120 kg ha<sup>-1</sup> N. The swards were grazed rotationally with Limousine cattle four times during the grazing season. Samples of herbage were botanically analysed by manual separation and expressed on a weight basis. Presence of *Lolium perenne* in the pasture sward on peat-muck soil was differentiated dependently on sward type and time of observations. The most important reason of perennial ryegrass content fluctuations in the sward between autumn and spring regrowth was insufficient its resistance to frost. Lower variations of *Lolium perenne* content were confirmed in the grass-clover than in grass sward.

# Valuation of rushes and grassland phytocenoses of the over-moist sites of the Wieprz valley in the Roztoczański National Park

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## Summary

The investigations covered the grassland of the Wieprz valley stretch (near Gucioł locality) included into the Roztoczański National Park area. Regarding the natural aspect of eastern Poland, the Roztocze is considered one of the most attractive areas in our country. Within the Wieprz valley the ground water level occurs at only some depth and periodically, the water appears at the flood-terrace. Under such conditions there was formed a mosaic of hydrogenic soils from different typological units. At small area typical mud and peat-mud soils are recorded. The meadow plant communities were also developed on the post-bog soils. The class of these soils is represented by the degraded meadow black earth and mucky soils.

The phytosociological investigations conducted on the grassland in the part of the Wieprz valley with Braun-Blanquet's method on the turn of May and June 2003 showed that they are characterised with various associations of the *Phragmitetea* class. The greatest area was occupied by the *Cariceteum rostratae* and *Cariceteum gracilis* communities. They dominated exclusively at some sites over very large area. The smallest area, however, was taken by *Sparganio-Glycerietum fluitantis*. Among the analysed communities, the richest floristically proved to be *Cariceteum gracilis* and *Phalaridetum arundinaceae*, whereas *Sparganio-Glycerietum fluitantis* - the poorest among the studied associations.

The investigations aimed at the determination of the floristic diversity of marshy associations from the *Phragmitetea* class situated in the part of the Wieprz valley at the Roztoczański National Park.

## Grasses in urban aeras

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### Summary

The aim of the article was to show the problem of grass species function in urban condition. This work attempts to be sort of an overview of the whole research done in this field so far. It refers to numerous achievements of authors. The first part of article was presents specific elements of urban environment such as higher temperature, lower level of ground water, air-pollution, ground pollution, water pollution and compares these components to suburban conditions. It describes the function of grasses in sward of lawns and the share of synantropic species which appear during succession process on extensive exploitation areas. It was proved that specific habitat conditions have got impact on floral composition the area of deliberately established lawns and on those species' share in this sward as a whole. The productivity of lawns in urban areas is much lower than that of the similar floral compositions located out of the town. In non-cultivated areas stenothermal species, *Hordeum murinum*, *Bromus sterilis*, *Eragrostis minor* and subhalophyt *Puccinellia distans*, which is salt-tolerant, tend to accur during succession process more frequently.

## Summary

The experimental plant material was collected from selected permanent meadows situated in the region of Wielkopolska as well as from one experimental plot located near Poznań. The permanent meadows were characterised by peat-mucky soils of varying degree of organic matter mineralisation. The soil of the experimental field is classified as brown soil of grey-brown podzolic type and sub-type – typical. The analysis of its mechanical composition indicated that it developed from loamy sand. The performed investigations on *Holcus lanatus* winter hardiness were carried out in several different directions and each one was of different nature and time of realisation. However, they all formed a complementary whole. The assessment of winter hardiness of *Holcus lanatus* in the swards of meadows was conducted in years 1995–2000. The meadows were situated in the valleys of the following rivers: the Sama, the Samica and the Warta. These studies were carried out always in the same places, which were selected and marked out earlier and which were deemed characteristic for a given meadow. In 1997, simultaneously with the establishment of the collection of *Holcus lanatus*, a fertilizer experiment with cloned *Holcus lanatus* plants was established. The nitrogen fertilizer was administered at two levels – 50 and 100 kg ha<sup>-1</sup> N and control – „0” –without nitrogen fertilization. The proportion of *Holcus lanatus* in the meadow sward in the spring 1995 varied and ranged from 10.5% to 19.4% - on average 14.9%. In 1996, following the severe and snowless winter of 1995/1996, the proportion of velvet grass in the sward dropped to the level of 3.3%. However, later on the species showed a growing trend with regard to its share in the meadow sward. Winter conditions in 1995/1996 were extraordinarily unfavourable for plant overwintering. Two winter months turned out to be particularly critical – December 1996 with the precipitation of 6 mm m<sup>-2</sup> and minimal night temperatures from December 26-31 ranging from –11.9 to –15.9 °C (mean monthly temperature –3.5 °C) and January 1997 with the precipitation of 1 mm · m<sup>-2</sup> and minimal temperatures from January 1-5 ranging from –8.9 to –18.4 °C (mean monthly temperature –3 °C). These exceptionally severe and unfavourable conditions in the two months (low temperatures and absence of snow cover) caused very strong damages of *Holcus lanatus* and a decline of the proportions of this grass species in the sward. The analysis of the collected data clearly shows that velvet grass is characterised by considerable sensitivity to frosts and its recovery in the sward is a long process. Results of investigations on *Holcus lanatus* winter hardiness indicated an important, with regard to this property, role of nitrogen fertilization. It is easy to see that this impact was negative and visible during the entire period of the experiment. The applied higher dose of nitrogen did not have a positive influence on winter hardiness of velvet grass. The impact of the applied fertilization was not so obvious in the successive years, when the weather conditions were much milder. *Holcus lanatus* is characterised by a limited winter hardiness of its plants. Plant damages caused by winter conditions are important for the persistence of velvet grass in the sward. Abundant nitrogen fertilisation

and, in particular reduce winter hardiness of *Holcus lanatus*. Therefore, it can be said that sustained management of velvet grass meadows should include rational fertilisation and utilisation.

# Characteristics of the plant communities with a share of *Stipa joannis* and *Stipa capillata* on xerothermic greens in Owczary (research note)

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## Summary

The study was done on xerothermic greens in Owczary, Górzycza commune. Areas covered by plants including *Stipa joannis* and *Stipa capillata* were examined. Nine patches were taken into consideration as far as their phytosociology was concerned.

The studied greens belong to the class *Festuco-Brometea*, *Festucetalia valesiaceae* line, *Festuco-Stipion* association, *Potentillo-Stipetum capillatae* set. Species characteristic for communities of the *Molinio-Arrhenatheretea* and *Koelerio-Corynephoretea* classes were also presented. The presence of species from other classes indicates that the communities are of a changing character and were influenced by antropoppression. Along with increasing share of *Stipa joannis* increased also that of *Dactylis glomerata*, *Poa pratensis* subsp. *angustifolia*, *Centaurea scabiosa*, *Coronilla varia*, *Thymus pulegioides*, and decreased the share of other grasses: *Briza media*, *Brachypodium pinnatum*, *Festuca rubra*, *Festuca trahyphylla*, *Stipa capillata*, *Arrhenatherum elatius*, *Koeleria glauca*, *Phleum phleoides*. *Stipa capillata* was present in all samples, and in similar amounts. No distinct connection with the presence on other plant species was found.

## The changes in botanical composition of fallowed meadow sward under the influence of treated mineral and organical fertilizers (research note)

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### Summary

This experiment was carried out in 1999-2001 on the meadow fallowed over 20 years. It was put by the method of randomized blocks in four replicates. It was used the following fertilizer combination: with out fertilization as control, NPK, farmyard manure, farmyard manure + NPK, vermicompost, vermicopmost + NPK, post-mushroom compost, post-mushroom compost. The organic manure were used early spring 1999 in quantity 10 ton of organic matter per ha. Mineral fertilization was used in following dose: N – 180 kg ha<sup>-1</sup>, potassium – 150 kg ha<sup>-1</sup> K<sub>2</sub>O, phosphorus – 110 kg ha<sup>-1</sup> P<sub>2</sub>O<sub>5</sub>. The annual dose of nitrogen and potassium was divided on 3 eagle parts and was treated under each regrowth. The phosphorus as delivered was one part in the spring. Every year the botanical composition was estimated from the meadow sward in first moving. The quality of this sward was estimated on the base of percentage proportion and number of fodder value (UVN) for the grasses. The obtained results showed, that the percentage proportion of grasses in second and third year on the all experimental object were higher than on the plots without fertilization. Significant difference in the grass number was between combination with farmyard manure and post-mushroom compost. In compare to control fertilization applied in experiment, decreased the legumes proportion in the sward. But the number of herbs was reduced on the plants with mineral fertilization in successive years. On the plot fertilized with post-mushroom compost + NPK this plants has increased. The highest decreased of weeds proportion was observed on the objects with farmyard manure. Generally, on the objects with post-mushroom compost the infestation was significantly higher than on the plots fertilized with NPK or with farmyard manure. The quality of the meadow sward has amended under the influence of used fertilization. The applied composts effected slowly than mineral fertilizers or farmyard manure. So, they improved the sward quality only in third year. This investigation showed that vermicompost and post-mushroom compost effected similarly the botanical composition and the sward quality as mineral fertilization (NPK) and farmyard manure. So, they can be applying as organic manuring for fallowed meadow renovation.

### **Summary**

The well preserved phytocoenoses of the humid meadows, belonging to the association *Angelico-Cirsietum oleracei*, were documented in the site, localized on the northern boundary of Poznań city area, in the Nowa Wieś Dolna. The patches cover approximately 2 ha of land. The phytosociological records are shown in the Table 1. The community has fully developed the characteristic species combination and shows no signs of the anthropogenic degeneration of the association. In the described phytocoenoses occur 3 interesting, rarely seen species of vascular plants: *Tetragonolobus maritimus*, *Briza media* and *Carex panicea*. Additionally – the large populations of protected species of orchids - *Dactylorhiza majalis* and *Dactylorhiza incarnata* were also noted. The described area is being under influence of strong anthropopressure, and should be protected.

# Grasses of anthropogenic habitats in municipal and industry agglomeration (research note)

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## Summary

This paper focus on the grass species commonly met at anthropogenic habitats in degraded municipal and industry areas. Most of plants living in such extremely difficult environment are so called ruderal species, known for their broad ecological spectrum. Ruderal plants involve some grass species, such as *Agrostis stolonifera*, *Calamagrostis epigjos*, *Eragrostis minor*, *Poa annua*, *Poa angustifolia*, *Poa compressa*, *Bromus tectorum*, *Bromus sterilis*, *Festuca rubra*, *Agropyron repens*, *Hordeum murinum*, *Digitaria sanguinalis*, *Setaria viridis*, and partially *Dactylis glomerata*. The above grasses are an important component of ruderal vegetation in degraded municipal and industry areas owing to their biological specifics. Their function for such degraded habitats is vital, because they mask ugly sites, protect the soil against erosion and make good life-conditions for small animals. On the other hand they are a good source of oxygen to the atmosphere, increase humidity of the air and reduce its pollution in municipal and industry areas. The paper discuss these ruderal grass species and their value for management of devastated sites, where most of plants cannot survive. Therefore, the grasses ought to be extensively utilized in large agglomerations to restore degraded habitats. Unfortunately, the lack of seed production for sale precludes this in practice. Nevertheless, we should be aware that occurrence of ruderal grasses at anthropogenically devastated habitats is indispensable and useful from an environmental point of view.

## Grasses occupying postindustrial and postexploitation waste land on selected objects of Western Pomerania (research note)

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### Summary

According to Central Statistical Office in Warsaw, as many as 78.2 thousand hectares of waste land have been found in Western Pomeranian Province until 12 December 2003. Some of them are industrial and post-exploitation waste land, where vegetation succession takes place spontaneously. Grass species are predominant among pioneer plants occupying such areas. The study was aimed at determining the role of grass species in spontaneous seizure of industrial and post-exploitation waste land on selected objects of Western Pomerania, i.e. "Dolna Odra" Power Plant cinder and slag waste sites, "Police" Chemical Plant phosphogypsum dumps and post-exploitation gravel-pit workings. It was based on the analysis of grass species occurrence and number as well as on ecological characteristics according to generally accepted principles (ELLENBERG et al., 1992; ROSTAŃSKI, 2000; SUDNIK-WÓJCIKOWSKA & KOŻNIEWSKA 1988; ZARZYCKI, 1984). Within the areas under investigation 43 grass species were found. The scantiest grass flora, i.e. 24 species, occurred on cinder waste sites whereas it was represented most abundantly on gravel heaps – by 38 taxa. Native species composed 74% of total grass number, archeophytes 21% and cenophytes 7%. Differences were found in particular biotopes in the percentage participation of geographic-historic groups, for instance the participation of native species on cinder waste sites exceeded 80%, while reaching about 70% on gravel heaps. Among grass species occurring there, perennial plants (47%), strongly expansive and expansive (40%), mezophilous as well as luciphilous and heliophilous ones were predominant. The composition of grass flora occupying industrial and post-exploitation waste land confirms the initial nature of these biotopes and early succession stages.

# The evaluation of decoration and recreation lawns in the selected agritourism farms in north-eastern Poland (research note)

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## Summary

In 1998-2004 comparative-cataloguing researches were doing in the agritourism farm in north-eastern Poland. The goal of researches was evaluation of green areas including esthetic and practical aspects. Also compare the development gradation, the practical-spatial solutions, the plant, trees and shrubs species selection and especially location, types and condition of keeping of the lawns. In the all farm which run a agritourism business by the several years make an adaptation of farm plots taking tourists needs into the consideration. Progress in green area management in the selected farms considered conducting agrotourism activities according to the certain specifications. In the each of farms divide recreation areas, which are based on lawn. The typical decoration lawns in the representative areas were only in the few structures. Those decoration lawns have two functions: as the background for the other plants and as the places for walks and for the calm rest and in the other farms as the background for the compositions appearance and they were excluded from using. Those structures had good looks. The low grasses included *Lolium perenne*, *Poa pratensis* and *Festuca rubra* were dominated in the lawn and very seldom the other species dicotyledones plants. There were good conditions of this lawns because of the good nurturing and they were found 3-4 years before. Recreation lawns were multispecied with the high share of the dicotyledones plants, *Trifolium repens*, *Taraxacum officinale*, *Bellis perennis*, *Polygonum aviculare*. The condition of recreation lawns was dissatisfied and in this case it is essential to renovate lawns and rebuild area. Tourist could use also meadow lawns which were located near farms.

## Grasses in plant communities of cemeteries in Lublin (research note)

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### Summary

Sixty three phytosociological releves were taken on five cemeteries in Lublin by means of Braun-Blanquet's method, under various insolation conditions. In total, 189 plant species that spontaneously grown on cemeteries, including 32 grasses, 20 papilionaceous and 137 herbs and weeds, were recorded. Low grasses were characterized with the highest cover coefficient: *Lolium perenne*, *Festuca rubra* and *Poa pratensis*; high ones: *Arrhenatherum elatius* and *Agropyron repens*. Twenty-six grass species were found in similar soil and weather conditions, but at high insolation level (cemetery "Majdanek"), at medium – 20 (cemetery "Unicka") and at low – 16 (cemetery "Lipowa"). Following species occurred in dug habitats: *Agropyron repens*, *Arrhenatherum elatius*, on gravel paths: *Poa annua*, *Poa pratensis*, *Dactylis glomerata* and sporadically *Agrostis gigantea*, and on asphalt paths: *Agropyron repens* and *Bromus hordeaceus*. Meadow-pasture species from *Molinio-Arrhenatheretea* class dominated among grasses on four cemeteries (Majdanek, Unicka, Lipowa and New Jewish Cemetery), and steppe species with *Brachypodium pinnatum* were majority on Old Jewish Cemetery.

# Changes of sward botanical composition in the mountain meadow after ceasing of the utilization (research note)

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## Summary

After ceasing of the meadow and pasture utilization disadvantageous changes of the floral composition takes place. There occur less valuable species, which displace more demanding plants. In a consequence there appears a competition for nutrients, water and light. Thus the aim of the study is to present the changes occurring in the floral composition of the mountain meadow after rejection of the utilization in comparison with cutted and grazed grasslands.

The investigations were carried out in Czarny Potok near Krynica (altitude of 650 m), in 1999-2002. Four objects in four replicants were taken into account i.e.: twice-cutted sward, once-cutted and twice-grazed sward, four times grazed sward and the natural sward.

As a result of cutting and grazing the share of the grasses of low value i.e.: red fescue, creeping fog-grass, soft meadow-grass and tufted hair-grass decreased but the share of the meadow fescue, cocksfoot and kentucky-bluegrass increased. An increase of the tufted hair-grass share (*Deschampsia caespitosa*) in the investigated meadow was observed after cutting ceasing. The share of this species after the four years increased from 5 to 83%. UVN number as regards to the utilization value of the sward decreased from 6.2 to 3.5. Midlerock outflow of spring water in the third year of the study, occurring usually during heavy rainfalls was an additional factor influencing massive appearing of the *Deschampsia caespitosa*. The analysed meadow of the control object can be qualified for the re-utilization.