

SUMMARY

FLORISTIC, UTILITY AND LANDSCAPE VALORIZATION OF MEADOW, SEGETAL AND ROADSIDE COMMUNITIES IN THE COMMUNE OF MARKOWA

447 phytosociological relevés in meadow communities (agriculturally used and unused), arable lands and roadsides were taken in the years 2011-2013 in three municipalities belonging to the commune of Markowa (Markowa, Husów, Tarnawka). 53 soil samples were collected and investigated under laboratory conditions. Habitat conditions in the area were determined according to the soil-agricultural maps in a scale of 1: 5000. In addition, in 2013 a survey concerning production intensity applied on arable land and grasslands was conducted among randomly selected agricultural producers in all the above mentioned municipalities.

The aims of the study were: comparing flora as well as meadow, segetal and roadside communities in individual municipalities of the commune of Markowa, depending on some ecological factors and the degree of anthropopressure, assessing their utility value, biodiversity and the degree of synanthropisation, conducting general environmental valorization of meadow and roadside communities, as well as as drawing attention to nature-landscape value of the area under study.

The research has indicated that the largest presence of arable lands in the structure of agricultural lands can be observed in Markowa, while grasslands in Tarnawka. Agriculturally unused meadows constitute for about 70% of the grassland surface of the commune.

Most frequently occurring arable soils in the commune are brown soils and pseudo-podzolic soils made from silt of various origins and grain size. In Markowa, the largest area is covered with loess soils of good wheat complex, while in Husów and Tarnawka leached brown soils of mountain wheat and cereal complexes.

The intensity of production on agricultural lands was varied, the largest in Markowa where high amounts of mineral fertilizers and pesticides, including herbicides were used. Mechanical cultivation practices on arable lands in all localities were conducted cautiously. Farmers in all localities of the commune of Markowa cultivated basic cereals on the largest area, in addition in Markowa corn, root crops and rape were cultivated, and in Husów corn and root crops.

The floristic composition of plant communities associated with various cultivated plants were similar in terms of participation of species characteristic of the orders: *Centauretalia* and *Polygono-Chenopodietalia* (excluding rape) and meadow species of the class *Molinio-Arrhenatheretea*. The segetal flora of rape could be distinguished by a large participation of ruderal species. The differences between the crops concerned mainly quantitative relations between individual species. Generally, weed communities were poorly developed and it was uneasy to qualify them as belonging to any association established in the subject literature. It can be assumed on the basis of the occasional presence in cereals species characteristic of the association *Vicetum tetraspermae* that in the past this

association was present in the fields of the commune of Markowa. In turn, *Echinochloa crus-galli*, *Galinsoga sp.*, *Setaria pumila* that were present in root crops and corn suggest the presence of an impoverished association of *Echinochloa-Setarietum*.

Generally, crops in the municipalities of Markowa had low participation of weed. Extremely little level of weed content could be observed for cereals, root crops and rape in Markowa. Many arable lands in this municipality was completely free of weeds. They were totally destroyed with herbicides, thus frequently it was impossible to take any phytosociological relevé there. Thus, the least weed species were present in Markowa and most in Husów where their occurrence was nonetheless sporadic. Winter cereals were most threatened by *Apera spica-venti* in Husów and in Tarnawka, while spring cereals by *Avena fatua* and *Equisetum arvense* in Husów and *Vicia hirsuta* in Tarnawka. Both spring and winter cereals in Husów, and only winter cereals in Markowa had large weed participation of *Convolvulus arvensis*. Root species and corn was most threatened by the nitrophilous species of *Echinochloa crus-galli*, *Chenopodium album* and *Galinsoga sp.*

The segetal flora was characterized by the highest participation of anthropophytes. Frequent was also the occurrence of native flora that is transferred to the fields from the adjacent meadows, grasslands and roadsides.

Most meadow soils belong to brown leached and acid soils made from dust, and sometimes clay. Markowa and Husów are dominated by grasslands of average quality complex 2z and in Tarnawka poor and very poor complex 3z. Small areas of the best grassland complex 1z can be found in Markowa. Many patches of the analyzed grasslands developed on complexes of arable land what can be read from soil-agricultural maps in a scale of 1: 5000.

The issue concerns Markowa to the greatest extent. It can be assumed that due to the fact that in the 70-ties and 80-ties of the twentieth century, when the cattle population was large, the amount of animal feed from permanent grasslands was insufficient and therefore arable lands became grasslands. On the other hand, contemporary grasslands in the commune of Markowa could have developed as a result of self-sodding of the fields, after they had been excluded from agricultural production.

Most farmers in Markowa applied regular fertilization and mowing the meadows up to three times during the growing season. Some of them also introduced sod-seeding with cultivated species of grasses and legumes. Agriculturally unused meadows dominated the area of Husów and Tarnawka. Only a small area occupied one- or two-cut land that were poorly or not at all fertilized.

Based on 250 phytosociological relevés taken in the meadows of the commune of Markowa – 8 associations and 8 meadow communities were distinguished, the majority - 14 were identified in Tarnawka and the least in Markowa - 4. The most widespread was the association *Arrhenatheretum elatioris* in a typical subassociation, differentiated into variants, including the typical variant with *Dactylis glomerata* and *Festuca pratensis* which were present in all the municipalities. Additionally, in Husów a variant with *Trisetum flavescens* was distinguished and in Markowa a variant with *Alopecurus pratensis*. A large area of meadows included communities of *Holcus lanatus*. The

communities of the *Arrhenatheretalia* order included frequently and in large numbers, even on unused meadows and pastures agriculturally valuable species of grasses and legumes.

The spread of ruderal meadows on agriculturally unused land, in forests and shrubs in the result of secondary succession promotes the development of communities of low agricultural and nature value. The presence of segetal flora in some patches of agriculturally unused meadows indicates their post-agricultural origin.

As compared to Markowa, meadow communities in Tarnawka and Husów were floristically richer in thermophilic taxa from the classes: *Trifolio-Geranietea* and *Festuco-Brometea* and many others that occur on warm slopes with southern exposure and varying angle.

The meadow flora of Husów and Tarnawka included species under partial protection: *Colchicum autumnale*, *Centaureum erythraea* and *Platanthera bifolia*.

Taking into account nutritional requirements of ruminants, the highest utility value of sward could be recorded for the *Arrhenatheretum* associations in all the municipalities, *Lolio-Cynosuretum* in Tarnawka and Husów. The sward of other communities was of poor or no value.

Generally, meadow communities in Tarnawka and Husów could be characterized as possessing greater species richness and higher values of the Shannon-Wiener diversity index, in comparison to Markowa. The reason for this result of the research can be justified by habitat conditions (different soils, moist, localization of meadows on slopes of varying exposure and angle) as well as anthropogenic conditions (extensive fertilization, agricultural use or lack thereof). Not always the higher value of the biodiversity index counted for the higher value of species evenness.

The indexes of synanthrophisation, apophytisation and antropophytisation that were calculated for the meadow communities varied and depended on anthropogenic activities, or lack thereof. Floristic composition of the lowest degree of transformation as the result of human activity could be observed in the following associations: *Mentha longifoliae-Juncetum inflexi*, *Angelico-Cirsietum oleracei* and the community *Deschampsia caespitosa* in Husów, *Scirpetum sylvatici* in Husów and in Tarnawka.

Four associations and six plant communities were distinguished in the roadsides of the comune of Markowa. Most frequently occurring in Markowa were the communities: *Bromus inermis*, *Papaver rhoeas*, while in Tarnawka - the communities: *Impatiens glandulifera* and *Equisetum telmateia* and the *Urtico Aegopodietum podagrariae* association. Their floristic composition was conditioned by habitat conditions and the time since the roadside had been modernization.

The chemical properties of soils – both of the arable lands and grasslands varied within the area of individual municipalities, and to a lesser extent between the municipalities themselves. The usefulness of the phytoindication method in evaluation of certain ecological factors of the distinguished communities has been confirmed. A statistically positive correlation has been proven between the pH index and the soil pH.

It has been found that the communities of arable lands, meadows and roadsides included a total of 330 species of vascular plants. The segetal communities of the municipalities under study comprised

of 105 species, including meadow species - 280 and roadside species - 166 which appeared to be an important reservoir of floristic diversity of the commune of Markowa.

The meadows and roadsides of the commune of Markowa were dominated by communities of low nature values and occurred in fresh and drier habitats which according to Oświat's method are rated the lowest.

Out of the three municipalities of the commune of Markowa the highest rated in terms of nature and landscape values were Tarnawka due to its rich lanform, a large participation of forest-covered area and the presence of water reservoirs.

The landscape of the commune of Markowa has lost its attractiveness to a great extent. The situation has been caused by the lack of agricultural use of meadows and pastures and livestock. In addition, dry patches of vegetation in the second half of the year on unused meadows reduce their aesthetic qualities. The open landscape of the commune is affected by floristically poor segetal communities, and positively influenced by phytocoenoses that develop along the roadsides.

Undoubtedly, intensification of agriculture will cause a decrease in species richness and floristic diversity of segetal and meadow communities, until the disappearance of many taxa and communities that they create. Only the restoration of agricultural use of meadows and pastures in Husów and Tarnawka and reduction of intensification of production on arable lands and grasslands in Markowa can reduce the adverse effects that currently occur in these ecosystems. It can be achieved in the future provided that new agri-environmental programs are developed and their purpose is broadly understood protection of biodiversity, including segetal vegetation.