

## NATURAL AND LANDSCAPE VALUES OF DISTINGUISHED MEADOW-PASTURE COMMUNITIES IN KŁODZKO COUNTY

### Summary

Grasslands were seen in the past primarily as a source of feed. The important function of grassland, beside the role of feed, consists in their natural value and role in the landscape. The aim of this study was to assess natural and landscape values of the distinguished meadow-pasture communities in Kłodzko. It is located in the south-western part of Poland, within the Sudety chain and is surrounded by mountains that form its natural boundary. The whole area of the county is very diverse in terms of physiogeography and climate what affects its natural and landscape values. The natural value of the seven distinguished plant units: 4 associations - *Angelico-Cirsietum oleracei*, *Arrhenatheretum elatioris*, *Lolio-Cynosuretum*, *Festuco-Cynosuretum*, 3 communities with dominant species - *Poa pratensis-Festuca rubra*, community with *Agrostis capillaris-Festuca rubra*, community with *Trisetum flavescens*, on subject area was determined on the basis of the species richness represented by the total number of species, the Shannon-Wiener species diversity index  $H'$  and the presence of endangered and rare species. These phytocenoses are characterized by a large species richness from 34 to 150 species. The values of the  $H'$  index are at an average level and ranged from 2.32 to 2.64. Community with *Trisetum flavescens* is characterized by the highest diversity index value. The biggest species richness is in the *Lolio-Cynosuretum*. Among species legally protected are noted in Poland: *Carlina acaulis* and *Colchicum autumnale* and near threatened (NT) *Geranium sylvaticum*. Plant species richness, the high proportion of the color of flowering herbs and weeds and *Fabaceae* plants flowering in different time of the growing season, affect the aesthetic qualities and the landscape values of the meadow-pasture communities analyzed. Their location in the landscape varied with hills and terrain, enhancing the landscapes of the studied Kłodzko county.

**Key words:** Kłodzko county, meadow-pasture communities, species richness, index  $H'$ , landscape values, the Sudety

## PRZYRODNICZE I KRAJOBRAZOWE WALORY WYRÓŻNIONYCH ZBIOROWISK ŁAKOWO-PASTWISKOWYCH W POWIECIE KŁODZKIM

### Streszczenie

Użytki zielone postrzegane były w przeszłości przede wszystkim jako źródło paszy. Obecnie, zwłaszcza w sytuacji zaniechania lub ograniczania chowu zwierząt, ważną funkcją użytków zielonych, obok roli paszowej, jest ich wartość przyrodnicza i rola w krajobrazie. Celem pracy było określenie wartości przyrodniczej oraz krajobrazowej wyróżnionych zbiorowisk łakowo-pastwiskowych w powiecie kłodzkim, który znajduje się w południowo-zachodniej części Polski, w obrębie łańcucha Sudetów. Otoczony jest górami stanowiącymi jego naturalną granicę. Cały obszar powiatu jest silnie zróżnicowany pod względem fizjogeograficznym i klimatycznym, co wpływa na jego walory przyrodnicze i krajobrazowe. Walory przyrodnicze wyróżnionych na badanym terenie siedmiu zbiorowisk roślinnych (4 zespołów - *Angelico-Cirsietum oleracei*, *Arrhenatheretum elatioris*, *Lolio-Cynosuretum*, *Festuco-Cynosuretum* oraz 3 zbiorowisk z gatunkiem dominującym: *Poa pratensis-Festuca rubra*, zbiorowisko z *Agrostis capillaris-Festuca rubra*, zbiorowisko z *Trisetum flavescens*) określono na podstawie bogactwa gatunkowego wyrażonego liczbą gatunków ogółem, współczynnika różnorodności gatunkowej Shannona-Wienera, wyrażonego wskaźnikiem  $H'$  oraz obecności gatunków chronionych i rzadkich. Fitocenozy te charakteryzują się dużym bogactwem gatunkowym od 34 do 150 gatunków. Wartości wskaźnika  $H'$  kształtują się na średnim poziomie i wynoszą od 2,32 do 2,64. Najwyższą wartość współczynnika różnorodności charakteryzuje się zbiorowisko z *Trisetum flavescens*, a największym bogactwem gatunkowym *Lolio-Cynosuretum*. Spośród gatunków prawnie chronionych w Polsce odnotowano obecność: *Carlina acaulis* i *Colchicum autumnale*, a bliskich zagrożenia (NT) - gatunek *Geranium sylvaticum*. Bogactwo gatunkowe roślin, wysoki udział barwnie kwitnących w różnych porach sezonu wegetacyjnego ziół i chwastów oraz roślin z rodziny bobowatych wpływają na walory estetyczne i krajobrazowe analizowanych zbiorowisk łakowo-pastwiskowych. Ich lokalizacja w krajobrazie urozmaiconym wzniesieniami, zagłębieniami terenu, podnoszą atrakcyjność badanych rejonów powiatu kłodzkiego.

**Słowa kluczowe:** bogactwo gatunkowe, powiat kłodzki, walory krajobrazowe, wskaźnik  $H'$ , Sudety, zbiorowiska łakowo-pastwiskowe

### 1. Introduction

In the past permanent grasslands were seen primarily as a source of feed. The important function of grassland, beside the role of feeds production, is their natural value and

role in the landscape. This is important for counties and communities situated in tourist areas, especially at mountain areas whose development strategies are often based on the development of hiking and cycling. Grasslands in the mountain landscape are a picturesque part of it. Thanks to

the large richness of species, larger than in the lowlands, they create colorful aspects changing over time [28]. Seasonal rhythm of phenological changes is evident in the flowering more and more plant species. That at the end result determines the extremely decorative qualities of such landscape [32]. Grasslands are also a reservoir of many endangered and rare species what raises their natural and landscape value [16, 32]. The richness of the positive experiences of landscaping enriches the human psyche. Landscape affects the well-being, reduces stress, facilitates physical and spiritual regeneration. In the Nature Conservation Act of 16 April 2004 article 5 p. 23 landscape values are defined as "the ecological, aesthetic or cultural value of the area and the associated terrain, creatures and components of nature, formed by the forces of nature or human activity" [30]. The relationship between landscape and health and quality of life has recently been more and more emphasized and aesthetic values of the landscape are very important ingredient of the quality of life that is perceptible at any moment. The natural and landscape values of meadow-pasture communities are not measurable and there is no doubt that one should strive for the harmonious use of meadows and pastures so that they can fulfill their roles without harm to any of their functions.

The aim of this study was to assess natural value of the distinguished meadow-pasture communities in one of the Sudety counties and their aesthetic qualities in the landscape.

## 2. Study area

Kłodzko county is located in the south-western part of Poland, within the chain of the Sudety. It is surrounded by mountains that form its natural boundary. The whole area of the county is very diverse in terms of physiogeography and climate what affects its natural and landscape values. Because of the attractiveness of the area, the big part of the county has been protected by law. Detailed description of the surveyed area as presented in Paszkiewicz-Jasińska and Helis [17].

Geographical and landscape conditions of Kłodzko, already in the 18th century, influenced the interest of tourists. Recent county development plans focus on the use of the natural resources of the area and influenced the development strategy of Kłodzko county. The development of tourism (including farm tourism) and recreation is one of the objectives of the strategy developed for years 2016-2020 [26]. At the beginning of the tourist traffic development in the region the accommodation base in a rural environment was rather at starting point for visiting the tourist attractions of Kłodzko [31]. In time, with the intensified growth of urbanization processes, tourist offer in rural areas has gained another significance. More and more often, a stay in a rural environment, characterized by a harmonious agricultural landscape with a low degree of urbanization, was an attraction. It was all the greater, the greater changes took place in an urban environment increasingly isolating man from nature. A country side has become a peculiar antidote to the urban stress of urban residents, the stress of functioning in urbanized areas.

Grasslands are an important element of the agricultural landscape in Kłodzko county. Their share in the area of agricultural land, according to Drzewiecki [3], is one of the criteria taken into account when assessing the farm tourism

potential of a given area. In the Kłodzko county meadows and pastures account more than 40% of the area of agricultural land. According to the latest Agricultural Census [25] meadows occupy more than 15 thousand ha and pasture 5 thousand ha.

## 3. Materials and methods

Grasslands, where field trials were carried out in the years 2009-2013, mostly belong to farmers of the Kłodzko district, specialised in extensive beef cattle or dairy cattle production. Farmers until 2015 formed a producer group "Sudety Beef" and they are now affiliated in the cluster. The field research (vegetation of meadows and pastures) was conducted using Braun-Blanquet method [20]. Classification of communities, their characteristics and natural conditions were presented in Paszkiewicz-Jasińska and Helis research [17]. There are seven plant communities belonging to the class *Molinio-Arrhenatheretea*, in two orders - *Molinietalia* and *Arrhenatheretealia*. Within the *Molinietalia* order the community of *Angelico-Cirsietum oleracei* was distinguished. In the order *Arrhenatheretalia* three communities were classified: *Arrhenatheretum elatioris*, *Lolio-Cynosuretum*, *Festuco-Cynosuretum* and three communities with dominant species: *Poa pratensis-Festuca rubra*, community with *Agrostis capillaris-Festuca rubra*, community with *Trisetum flavescens*. In this paper, the value of natural values of plant communities and groups, as well as their aesthetic and landscape values, were evaluated. The Latin names of vascular plants were adopted by Mirek et al. [13].

The natural value was based on:

- species richness - the total number of species found in the plant community,
- calculation of the Shannon-Wiener diversity index  $H'$  [12]:

$$H' = -\sum_{i=1}^S (p_i)(\log_2 p_i)$$

where:

S - number of species

$p_i$  - number of localities of species in relevés,

- presence in the sward species of protected vascular plants,
- endangered and rare; the rating was based on:
  - List of plants covered by strict protection, specifying the species
    - Requiring active protection (Attachment no 1) and List of plant species protected by partial protection (Attachment no 2), Ordinance of the Minister of the Environment of 9 October 2014 on protection
      - Species of plants [23]
      - Polish Red Data Book of Plants [6]
      - Red List of Vascular Plants in Poland [33]
      - Polish red list of pteridophytes and flowering plants [5]
      - Red list of vascular plants dying and threatened Lower Silesia [7].

This list was elaborated on the basis of the guidelines of the International Union for the Conservation of Nature (IUCN), supplemented by regional criteria and categories.

In addition, the share of particular utility (functional) groups in the ranks of the selected communities was determined.

Aesthetic and landscape values were assessed on the basis of observations of the studied meadows and pastures. The dates of occurrence of flora aspects of many plant species have also been recorded. Photographic documentation was done to visualize the visual qualities of the area under investigation.

#### 4. Results and discussion

*Angelico-Cirsietum oleracei* was distinguished only at one subject area at 480 m (ASL), with a slight slope. Many authors in recent years has noticed diminishing role of this community in Poland and decreasing of its area [2, 8]. The *Angelico-Cirsietum oleracei* is characterized by the smallest number of total species - 34 at subject area (tab.1). In the studies conducted by other authors, less than 10 species were recorded in the poorest patch of this group [1] and in the richest - over 40 [22]. The most abundant group in the sward are herbs and weeds, their share is about 59%. There was also a significant share of *Fabaceae* plants in the community - about 9% (fig. 1). These species of varying color and floral structure and flowering time increase the landscape value of the examined community. The value of the diversity index  $H'$  is 2.42 and is one of the higher values obtained for the selected communities in the surveyed area (tab. 1).

This association, according to authors, has unusual landscape values throughout the vegetation period, what was noticed by Kozłowski et al. [10], Trzaskoś et al. [29] too. In a spring time, during flowering, *Lychnis flos-cuculas* with pink color of flower is given colors, *Geum rivale* with bell-shaped flowers, red-brown and yellow-cream colors inside, *Myosotis palustris* - with light blue flowers. In the early summer dark red color is given *Sanguisorba officinalis*, the yellow color is added by *Lotus uliginosus* and in late summer - *Cirsium oleraceum*.

*Arrhenatheretum elatioris* was distinguished on slopes with an average slope ( $6.4^\circ$ ) at an altitude of 430-480 m (ASL). It is characterized by the average species total number (83) and the average diversity index value  $H'$  (2.24) with respect to the values reported in the literature for the Sudety region (tab.1). The obtained results are lower than those reported by Paszkiewicz-Jasińska and Steinhoff-Wrzeźniewska [19] for this community in the Wałbrzych county, however higher than those given by Żyszkowska and Paszkiewicz-Jasińska [35] for the Złotoryjski Foothills. In addition, the diversity index  $H'$  given by Kryszak et al. [11] in the research conducted in Kłodzko county is lower (1.76) than that obtained by the authors. The share of grasses in the discussed association is approximately 19% (fig. 1) and is higher than the recorded for this community by Paszkiewicz-Jasińska and Steinhoff-Wrzeźniewska [19]. A large proportion of *Fabaceae* (14.5%) among dicotyledonous was recorded. Out of all the distinguished plant communities, *Arrhenatheretum elatioris* has the largest share in this group (fig. 1).

The appearance of distinguished association on the studied area is formed by grasses, among them high - *Arrhenatherum elatius*, *Dactylis glomerata*, *Phelum pratensae* and slightly lower: *Agrostis capillaris* and *Holcus lanatus*, forming a backdrop for the colorful flowering dicotyledonous species. These meadows, especially after *Arrhenatherum elatius* earing, create a unique element of the beauty of the landscape, as noticed by Kozłowski et al. [9].

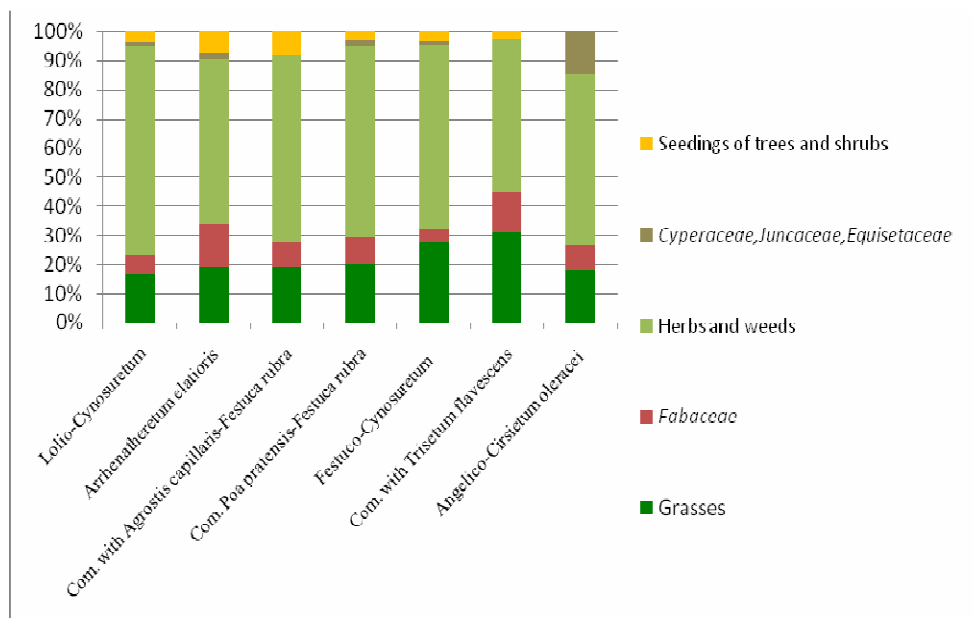
Eared but clustered panicles with silvery-gloss, contrast with the green of the sward. On the other hand, the flowering, fully spread panicle gives a golden aspect to the waving grasses. On the background of the shimmering *Arrhenatherum elatius* there is a game of colors: in the spring the yellow color is given by *Taraxacum officinale*, and in summer - *Crepis biennis*, *Tragopogon pratensis*, *Lathyrus pratensis*, blue - *Campanula patula*, purple - *Geranium pratense*, red - *Trifolium pratense*, white - *Galium mollugo*, *Achillea millefolium* and *Trifolium repens*.

**Community *Poa pratensis-Festuca rubra*** was distinguished on the slopes with a slightly higher incline ( $8.4^\circ$ ) from the discussed *Arrhenatheretum elatioris* team, located at 430-480 m (ASL) and 800-840 m (ASL). Community *Poa pratensis-Festuca rubra* is characterized by a large species richness. The total number of species is 99 (tab.1). In the species composition, the group of herbs and weeds accounts for almost 66% (fig. 1). Only in one of the distinguished communities the share of this group in the sward is greater. The results obtained for the total number of species were higher than those obtained by other authors conducting research in the Sudety region [4, 19, 35]. The second indicator of the value of nature - the diversity index  $H'=2.32$  (tab. 1) was lower than reported by Paszkiewicz-Jasińska and Steinhoff-Wrzeźniewska [19], Żyszkowska and Paszkiewicz-Jasińska [35], but higher than reported by Kryszak et al. [11].

The landscape values of this community result from presence of grasses with different inflorescences and the time of their flowering and earing, among others: *Alopecurus pratensis* - the earliest species of flora grasslands in Poland, *Festuca rubra*, *Poa pratensis*, *Agrostis capillaris* and species with the late beginning of vegetation - *Holcus lanatus*, where deposited abundant shiny dew drops. Meteorological phenomena according to some authors provide extraordinary aesthetic impressions [32]. These grasses create a green background for dicotyled blooming species such as: *Trifolium repens*, *Galium mollugo*, *Taraxacum officinale*, *Lathyrus pratensis*, *Trifolium dubium*, *Lotus corniculatus*, *Leontodon autumnalis*.

**Community with *Agrostis capillaris-Festuca rubra*** - recorded on test surfaces located at the height of 450-540 m (ASL), 710 - 720 m (ASL), and 800-810 m (ASL), with an average pitch of  $7.4^\circ$ . This community is characterized by high species richness, it has 120 species in total and the average value of index  $H'=2.40$  (tab.1). The obtained values are lower than the results obtained for this community by Paszkiewicz-Jasińska and Steinhoff-Wrzeźniewska [19]. The group of grasses accounts for about 19% of the sward composition (fig. 1). *Agrostis capillaris* and *Festuca rubra* dominated among them.

Tussocks of mentioned grasses, with live green leaves and red inflorescences give the community a specific coloration, constituting an element of often imperceptible beauty, what is also confirmed by Kozłowski et al. [9] and Paszkiewicz-Jasińska [16]. The distinctive color gives the flowering dicotyledonous raising the aesthetic qualities of the community. These include, among others yellow blossoming: *Alchemilla monticola* with lightly pubescence leaves on which morning dew, *Tragopogon pratensis*, *Crepis biennis*, *Trifolium dubium*, *Lotus corniculatus*, *Taraxacum officinale*, blue blossoming *Campanula patula* or blue-purple - *Knautia arvensis*.



Source: own work / Źródło: opracowanie własne

Fig. 1. The share of utility (functional) groups in distinguished communities of plants

Rys. 1. Udział grup użytkowych (funkcjonalnych) w wyróżnionych zbiorowiskach roślinnych

Table 1. Natural values of distinguished plant communities

Tab. 1. Wartość przyrodnicza wyróżnionych zbiorowisk roślinnych

Plant community	Overall number of species	$H'$ index	Species of vascular plants protected, endangered and rare
<i>Angelico-Cirsietum oleracei</i>	34	2.42	–
<i>Arrhenatheretum elatioris</i>	83	2.24	–
Community <i>Poa pratensis-Festuca rubra</i>	99	2.32	<i>Carlina acaulis</i>
Community with <i>Agrostis capillaris-Festuca rubra</i>	120	2.40	<i>Carlina acaulis</i>
Community with <i>Trisetum flavescens</i>	45	2.64	<i>Geranium sylvaticum</i>
<i>Lolio-Cynosuretum</i>	150	2.14	<i>Colchicum autumnale</i>
<i>Festuco-Cynosuretum</i>	81	2.49	<i>Carlina acaulis</i>

Source: own work / Źródło: opracowanie własne

**Community with *Trisetum flavescens*** was mapped out on one research surface on a slope of 9.9°, at an altitude of 580-590 (ASL). This group is characterized by a lower species total number (45 species) and lower value of the diversity index  $H'=2.64$  (tab. 1) than that reported for this community in Wałbrzych county [19]. Grasses are an important part of the community and their share in the sward is about 31% (fig. 1).

Valuable for landscape reason fine, shiny golden *Trisetum flavescens* panicles, which stand out against the greenery of the other grasses. Colors of dicotyledonous plants are also present in the sward. Among them also from the group of *Fabaceae* - about 13% of varied structure of inflorescences, leaves or shoots (fig. 1). It determines the extremely decorative qualities of such a landscape. Among them attract attention: *Geranium sylvaticum* with purple-violet flowers and leafy leaves, *Alchemilla monticola* with small, yellow flowers and oval-shaped, blue-green leaves, *Chaerophyllum hirsutum* with pink, small umbel and feathery leaves, *Angelica sylvestris* with white-green large umbels, *Trifolium repens* with white spherical flowers or *Rumex acetosa* with flowers gathered in red pitchers. The community with *Trisetum flavescens* is an irreplaceable element of the landscape, as other authors emphasize [9].

***Lolio-Cynosuretum*** is a pasture community. This association was recorded on the slopes at altitudes 400-500 m (ASL) and with an average slope of 6.6°. This association

was characterized by the largest number of species in the community among the respondents (the total species is 150) and the lowest value of the diversity index  $H'$  (2.14) (tab. 1). The results obtained by the authors differ from the results obtained by other authors conducting research in the Sudety. A smaller species richness of this team was identified by Grynia and Kryszak [4]. Also, Nadolna [14] have found the less richness of species in this association. The diversity index  $H'$  is higher than recorded by Kryszak et al. [11] but lower than observed by Nadolna [14]. In the species composition of the examined association the grass share is approximately 17% (fig. 1).

Landscapes value of *Lolio-Cynosuretum*, at study area, is strongly connected with grass species of. Among the grasses, the character of the group is given by the green but spectacular inflorescence of *Cynosurus cristatus* (often called "dog's tail") and ear of *Lolium perenne*. These grasses collected in the appropriate development phase are used in bouquets [32]. The beauty of *Cynosurus cristatus* causes that it may be grown as an ornamental plant. Beside grasses, a large proportion of multicolored dicotyledonous has been observed, increasing the aesthetic qualities of the team. The group of herbs and weeds accounts for about 71% and nearly 7% of *Fabaceae* plants (fig. 1). The large proportion of dicotyledonous species makes the bulk of the community rich. Among them are flowering in yellow: *Leontodon autumnalis*, *Leontodon hispidus*, *Lotus cornicula-*

tus, *Ranunculus acris*, in white: *Bellis perennis*: *Bellis perennis*, *Leucanthemum vulgare*, *Trifolium repens*, violet-blue - *Prunella vulgaris*, *Vicia cracca*, and red flowering - *Rumex acetosa*.

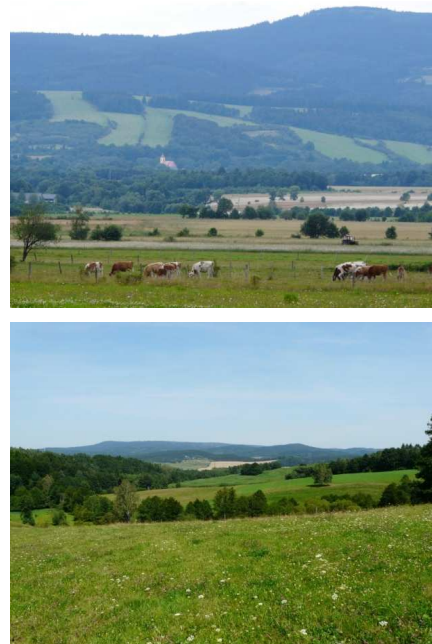
**Festuco-Cynosuretum** is the second of the pasture communities in the area. This communities was distinguished on the slopes at 720 m (ALS), with an average slope of 6.1°. The association recorded less total number of species than the *Lolio-Cynosuretum*, namely 81 species, whereas the higher value of the diversity index  $H'=2.49$  (tab. 1). Pasture communities distinguished by authors significantly differ of species richness. Nadolna [14] noted different results and found similar number of species in these communities. An important component of the community are grasses. Grasses are an important component of the community and their share 27% and group of herbs and weeds - 63% (fig. 1).

The dominant species in this association is *Festuca rubra* with dark green leaves and reddish purple panicle and *Cynosurus cristatus* with green combs, forming the background for a large group of herbs and weeds. The species of this group of varied colors and the construction of flowers, as well as the way they give the pasture aesthetic qualities. The species of this group of varied colors and the construction of flowers, as well as the habitus give the pasture an aesthetic qualities. Among them: *Alchemilla monticola*, *Leontodon autumnalis*, *Leontodon hispidus*, *Lathyrus pratensis* and *Potentilla erecta* - with yellow flowers, *Trifolium repens* - with white flowers, *Euphrasia rostkoviana* - with white flowers and yellow spots, *Carum carvi* - the most commonly white, sometimes pink, *Campanula patula* - with blue flowers, *Prunella vulgaris* - blue violet, *Centaurea jacea* - purple-violet flowers. Also worth mentioning is the presence of small grass-shaped *Briza media*, which enhances the aesthetic qualities of this team.

The landscape values of pasture communities are growing due to the fattening animals, which is also referred by other authors conducting research in the foothills [32]. At the area under study conducted by the authors, the presence of cattle and sheep were noted not only on pastures but also on most meadows (Fig. 2). These meadows were used as pasture meadows. The use of the discussed plant communities is detailed in the work of Paszkiewicz-Jasińska and Helis [17]. Wolański et al. [32] pay attention to the aesthetic qualities of the haystacks set in the meadows. Unfortunately, this is an increasingly rare sight on the studied area.

In the identified communities, the presence of protected species endangered and rare was noted. According to many authors grasslands are often a refuge for these species and increases their natural value [15, 27, 32]. There were three protected and rare species on the study area: *Carlina acaulis*, *Colchicum autumnale* and *Geranium sylvaticum*. *Carlina acaulis* is a species often found in southern Poland, also in the Sudety. Its presence was recorded by Żyszkowska [34], Paszkiewicz-Jasińska and Nadolna [18], Kryszak et al. [11] conducting research on grasslands in the Sudety, both in meadow and pasture communities. In own research this species is listed in three plant communities: *Poa pratensis*-*Festuca rubra* community, in the community with *Agrostis capillaris*-*Festuca rubra* and in *Festuco-Cynosuretum*, which are used as extensive hay meadows or pastures. Extensive grasslands management creates favorable conditions for the occurrence of rare and protected

species, as confirmed by other authors [14, 32]. *Carlina acaulis* in Poland is a species that has been found since 2014 [23] on the list of partially protected plants, until 2014 it was fully protected. This species forms a large silvery-white flower head opening only in the sun, raising the aesthetic qualities of the communities in which it occurs. Due to its decorative qualities, formerly was collected in mass for dry bouquets and currently applies to the arrangement of rock gardens. *Colchicum autumnale* is the second species listed. In the Sudety it has been listed in plant communities by many authors, among others by Kryszak et al. [11], Żyszkowska [34], Smoczyk [24]. On the study area *Colchicum autumnale* was noticed in *Lolio-Cynosuretum*. In Poland this species is covered by partial protection [23]. According to the International Union for the Conservation of Nature (IUCN), it is a species endangered by extinction - VU hazard category [21]. In addition, it is a species placed on the red leaf of vascular plants dying and threatened on Lower Silesia as a species with a lower risk of extinction (rare) - poorly endangered (LC) [7]. Its pink flowers at the end of summer give the color of the plant community attracting the eyes of tourists. *Geranium sylvaticum* is the next species. This species was found in the community with *Trisetum flavescens* and in the association *Festuco-Cynosuretum*. It was also listed in the Sudety by Paszkiewicz-Jasińska and Nadolna [18]. This species is placed on the Polish red list in the near threatened category (NT) [5]. *Geranium sylvaticum* of purple-violet flowers is distinguished among other species, raising the aesthetic qualities of the aforementioned communities.



Source: own work / Źródło: opracowanie własne

Fig. 2. Meadow-pastureland communities in the landscape of the area under study

Rys. 2. Zbiorowiska łąkowo-pastwiskowe w krajobrazie badanego terenu

## 5. Conclusions

1. Distinguished meadow-pasture communities of the studied area are characterized by quite large species richness, expressed in the total number of species ranging from 34 to 150 species. Most species were found in *Lolio-Cynosuretum*.

2. Floristic diversity expressed by the index  $H'$  shows average values from 2.14 to 2.49. The highest value of  $H'$  is characterized by community with *Trisetum flavescens*.

3. In five of the communities distinguished in the surveyed areas, species of vascular plants protected, threatened with extinction and rare were noticed, among them: *Carlina acaulis*, *Colchicum autumnale* and *Geranium sylvaticum*. The presence of these species improve natural value of pasture-meadow communities and their aesthetic values.

4. The sward analyzed communities of Kłodzko county reported significant proportion of species from the group of herbs and weeds (from 53 to 71%). The diversity of colors, the construction of flowers, leaves or shoots significantly increases the aesthetic qualities of particular communities that are an important element of the agricultural landscape of this county. Their location in the landscape varied with hills and terrain, enhancing the landscapes of the studied Kłodzko county. The location of the analyzed communities in the area of diverse shape (hills, hollows) has a positive influence on the landscape attractiveness of the area being studied and may improve the well-being of tourists visiting this region.

## 5. References

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