

Prądnik. Prace Muz. Szafera	13	7–31	2002/2003
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**ZRÓŻNICOWANIE MIKROKLIMATYCZNE W ŚWIETLE BILANSU  
PROMIENIOWANIA SŁONECZNEGO NA PRZYKŁADZIE  
OJCOWSKIEGO PARKU NARODOWEGO**

**Microclimatic variation on the basis of the solar radiation balance  
of Ojców National Park**

**ABSTRACT.** This paper presents results of meteorological and radiation balance (net radiation flux density across all wavelengths) measurements conducted in Ojców National Park during the period 6–14.09.1999.

**KEYWORDS:** Net radiation, microclimate, Ojców National Park.

**SUMMARY**

Meteorological and radiation balance (net radiation flux density across all wavelengths) measurements were conducted in Ojców National Park during the period 6–14.09.1999. The measurements were carried out in characteristic locations (upland, valley bottom). Automatic Weather Stations were used to register the above mentioned factors. The upland was distinguished by a high mean temperature and the minimum temperature. Very good radiative and insulative conditions for non-sheltered areas were confirmed. The valley was characterised by high air temperature amplitudes (16 °C), frequent calms (73%), or light winds and a low sun duration. The low level of the sun duration resulted from valley overshadowing. The spatial diversification of the sun duration as well as an active surface structure determine the microclimatic processes of uplands and valleys. The valley bottom received 16% less radiant energy (K?) than the unsheltered upland area. The surfaces without vegetation (ploughed field) reflected the incoming short-wave radiation (albedo 20%) more strongly than the grassy surface of the valley bottom (albedo 12%). In spite of the albedo value for the valley, the daily total net short-wave radiation was measured to be 1.29 MJ/m<sup>2</sup> lower than the daily total net short-wave radiation of the upland. The energetic processes, which proceeded in the active surface, condition microclimate and can be described by the net radiation quantity across all wavelengths (Q\*). On sunny days the quantity (Q\*) was measured to be 8.2 MJ/m<sup>2</sup> for the upland and 9.9MJ/m<sup>2</sup> for the Prądnik Valley. However, on variable cloud cover days the values of Q\* were 5.9 MJ/m<sup>2</sup> and 6.8 MJ/m<sup>2</sup>, accordingly.

*Translated by Erica Goetze*

Prądnik. Prace Muz. Szafera	13	33–50	2002/2003
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**WSTĘPNE WYNIKI BADAŃ NAD WARUNKAMI TERMICZNO-  
WILGOTNOŚCIOWYMI WYBRANYCH JASKIŃ  
OJCOWSKIEGO PARKU NARODOWEGO**

**Preliminary results of studies on the thermal and humidity conditions  
in caves in Ojców Nationale Park**

**ABSTRACT:** The paper presents results of seasonal microclimatic researches in the five caves in Ojców National Park (Ciemna, Łokietka, Okopy Wielka Dolna, Zbójecka, Złodziejska) and in two caves situated not far from OPN (Mamutowa, Nietoperzowa). There were analysed horizontal and vertical stratification of air temperature and humidity, interseasonal changes these parameters in the caves. The dynamic thermic zone were identified in all the caves but only in two of them distinguished statical zone. Seasonal fluctuation of microclimatic conditions in the caves mainly depends on entrance's dimension. Taking into consideration the interseasonal fluctuations of thermic conditions three types of cave's microclimate may suggested.

**KEY WORDS:** temperature, humidity, microclimate, caves, Ojców Nationale Park.

**SUMMARY**

1. The main subject of the present study are results of microclimatic researches in the five caves in Ojców Nationale Park (Ciemna Cave, Łokietka Cave, Okopy Wielka Dolna Cave, Zbójecka Cave, Złodziejska Cave) and in two caves situated not far from OPN (Mamutowa Cave, Nietoperzowa Cave). The researches were done in 4 seasons: spring, summer, autumn, winter.

2. The temperature distribution in the caves depends on the season. Temperature in the caves increased from the main entrance to deeper parts in winter and spring. The opposite thermic conditions were observed in summer and autumn, when temperature decreased from the entrance to deeper parts.

3. The lowest value of relative humidity occurred in winter and spring. In summer and autumn relative humidity increased and reach 100% in the deepest parts.

4. The biggest values of interseasonal fluctuation of temperature and humidity were observed near the entrance. If the distance from the entrance is getting longest the values of fluctuation decreased but only in two caves (Ciemna and Zbójecka Caves) were noted oscillation below 1°C in the deepest parts. In these caves identified statical thermic zone, remaining caves distinguished dynamic zone due to considerable variability of temperature and humidity.

5. Taking into consideration the interseasonal fluctuation of thermic conditions three types of cave's microclimate may suggested:

I. Stable microclimate (Ciemna and Zbójecka Caves)

II. Relative stable microclimate (Łokietka and Nietoperzowa Caves)

III. Instable microclimate (Mamutowa, Okopy Wielka Dolna and Złodziejska Caves).

*Translated by the authors*

Prądnik. Prace Muz. Szafera	13	51–76	2002/2003
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**EKOLOGICZNE PODSTAWY OCHRONY AKTYWNEJ  
I KSZTAŁTOWANIA EKOSYSTEMÓW MURAW  
KSEROTERMICZNYCH W OJCOWSKIM PARKU NARODOWYM  
I OTULINIE  
I. WPROWADZENIE**

**Ecological principles of the active protection and management of xerothermic grasslands in the Ojców National Park and its protection zone. I. Introduction.**

**ABSTRACT:** This paper is an introduction to “monograph” dealing with active protection of xerothermic grasslands in Ojców National Park, southern Poland. A review of literature related to ecological principles of active protection of semi-natural, species-rich limestone grasslands from Poland and Western European countries is presented. Moreover, the study area is presented and historical changes in xerothermic vegetation on the plots studied is discussed.

**KEY WORDS:** limestone grasslands, secondary succession, methods of active protection management, biodiversity, Ojców National Park

SUMMARY

This paper is an introduction to “monograph” dealing with active protection of xerothermic grasslands in Ojców National Park, southern Poland. The preliminary studies were performed in the years of 1996-1998 in xerothermic vegetation patches in Prądnik Valley, Ojców National Park, Southern Poland. Analysis of vegetation under different active protection management were performed in the three localities, lying in the most valuable and representative xerothermic communities of the Prądnik Valley (Fig. 2). In these places, permanent study plots were established for monitoring the changes in species richness and dynamics of vegetation under different management.

Moreover, a detailed study of literature and archival materials: old maps, aerial photographs, postcards and pictures was performed to learn about changes of vegetation cover during last 100 years and about management practices used in the study area. It seems xerothermic grasslands in the middle and lower part of Prądnik stream valley are of 100 years old and those on Grodzisko about 300-350 years old. The latter ones are the richest in species and having typical species composition. During last 40 years most of xerothermic grasslands patches had been converted into shrubland as a result of cessation of traditional management: grazing and mowing. As is shown in many studies, only management frequently applied to xerothermic grasslands together with rich local species flora ensure of species richness preservation.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	77–94	2002/2003
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**EKOLOGICZNE PODSTAWY OCHRONY AKTYWNEJ  
I KSZTAŁTOWANIA EKOSYSTEMÓW MURAW KSEROTERMICZNYCH  
W OJCOWSKIM PARKU NARODOWYM I OTULINIE  
II. ZMIANY SKŁADU FLORYSTYCZNEGO BADANYCH POLETEK**

**Ecological principles of the active protection and management of xerothermic grasslands in the Ojców National Park and its protection zone. II. Changes in floristic composition of the plots**

**ABSTRACT:** The study has been performed in xerothermic grassland and xerothermic scrub communities in the Prądnik Valley, Ojców National Park, Poland. The main aim of the study was to compare the floristic composition of well-preserved, xerothermic grasslands, which were not managed and patches of xerothermic vegetation in different successional stages, mowed or cleared annually. The former were characterized by high biodiversity and the domination of species of *Festuco-Brometea* and *Trifolio-Geranietea* classes. Mowing the early successional stages of xerothermic vegetation resulted in declining of *Brachypodium pinnatum* and recreation of floristic composition typical to xerothermic grasslands. The clear-cut plots, on the contrary, strongly differed in floristic composition from xerothermic grasslands. The maintenance of species composition typical of floristically abundant grasslands required mowing and removal of shrubs.

**KEY WORDS:** limestone grasslands, floristic composition, secondary succession, active protection management, biodiversity, clearing, mowing

SUMMARY

The researches were performed in the years of 1997–2000 in xerothermic vegetation patches in Prądnik Valley, Ojców National Park, Southern Poland. Analysis of vegetation under different active protection management were performed in the three localities, lying in the most valuable and representative xerothermic communities of the Prądnik Valley. On all the plots, two or three 100 m<sup>2</sup> study plots were established. Plots, which represent species-rich xerothermic grasslands were left without management, in the remaining ones, active protection management were performed. Detailed description of management applied to particular plots are shown in table 1. The vegetation within plots are sampled in three transects, each of them consisted of 10 quadrats

(Fig. 2). In quadrats abundance of all species were recorded on yearly intervals.

The plots were chosen to represent the consecutive stages of secondary succession from well-preserved xerothermic grasslands to dense xerothermic shrub.

Additionally, to check the effectiveness of management have hitherto been applied to xerothermic grasslands in Ojców National Park, four transects, lying in the middle part of Prądnik Valley were sampled. They were established in 1992 in vegetation patches, cleared with different frequency (Tab. 1).

Results:

1. Xerothermic grasslands which still exist in Ojców National Park, are characterised by high species richness and spite of small area they occupy.

2. Patches of xerothermic vegetation underwent active protection management differed strongly in species composition as compared to unmanaged ones.

4. The effectiveness of active protection management depends strongly on successional stage plots are in at the start of experiment:

– in xerothermic grasslands mowed annually, there was a strong increase of species characteristic to xerothermic grasslands,

– in xerothermic vegetation on shallow soil, slightly overgrown by shrubs, the management practices resulted in increase of species of *Festuco-Brometea* i *Trifolio-Geranietea* classes,

– in xerothermic grasslands and xerothermic shrub on more thick soil, number and percentage cover of xerothermic species increased only slightly, and were quickly outcompeted by more expansive forest species. When mowing was applied too frequently, it caused quick expansion of grasses, sedges and finally – it resulted in declining of overall species diversity.

5. Patches of bare soil, formed after tree and shrub cutting, are colonized mainly by species such as *Coronilla varia*, *Hypericum perforatum* and *Euphorbia cyparissias* with grow, except xerothermic grasslands, also in habitats formed by man: roadverges and escarpments.

6. Highly light-demanding species: *Festuca rupicola*, *Carex pediformis*, *Phleum phleoides* i *Thymus* spp. (*marschallianus*, *austriacus*, *kosteleckyanus*, *glabrescens*) occurred only in well-preserved xerothermic grasslands and they were never found in the restored plots.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	95–114	2002/2003
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**EKOLOGICZNE PODSTAWY OCHRONY AKTYWNEJ  
I KSZTAŁTOWANIA EKOSYSTEMÓW MURAW KSEROTERMICZNYCH  
W OJCOWSKIM PARKU NARODOWYM I OTULINIE  
III. ZMIANY STRUKTURY ZBIOROWISK POD WPŁYWEM  
ZASTOSOWANYCH ZABIEGÓW**

**Ecological principles of the active protection and management of xerothermic  
grasslands in the Ojców National Park and its protection zone  
III. Changes in the structure of the plots after management was applied**

**ABSTRACT:** The study has been performed in xerothermic grassland and xerothermic scrub communities in the Prądnik Valley, Ojców National Park, Poland. The main aim of the study was to compare the species richness and dynamics of well-preserved, xerothermic grasslands, which were not managed and patches of xerothermic vegetation in different succesional stages, mowed or cleared annually. The former were characterized by great microsite differentiation, which resulted in high biodiversity and stability of these structure of the communities in spite of small areas they occupied. The latter showed much higher rate of species turnover and differed much from not managed grasslands in species composition. The maintenance of species composition typical of floristically abundant grasslands required removal of shrubs with subsequent periodical mowing of herbs.

**KEY WORDS:** limestone grasslands, community structure, secondary succession, active protection management, biodiversity, clearing, mowing

SUMMARY

The researches were performed in the years of 1997–2000 in xerothermic vegetation patches in Prądnik Valley, Ojców National Park, Southern Poland. Analysis of vegetation under different active protection management were performed in the three localities, lying in the most valuable and representative xerothermic communities of the Prądnik Valley (Fig. 1; Bąba 2002, Part I). On all the plots, two of three 100 m<sup>2</sup> study plots were established. Plots, which represent species-rich xerothermic grasslands were left without management, in the remaining ones,

active protection management were performed. Detailed description of management applied to particular plots are shown in table 1 (Bąba 2002, Part II). The vegetation within plots are sampled in three transects, each of them consisted of 10 quadrats (Fig. 2; Bąba 2002, Part II). The plots were chosen to represent the consecutive stages of secondary succession from well-preserved xerothermic grasslands to dense xerothermic shrub.

Additionally, to check the effectiveness of management have hitherto been applied to xerothermic grasslands in Ojców National Park, four transects, lying in the middle part of Prądnik Valley were sampled. They were established in 1992 in vegetation patches, cleared with different frequency.

In all plots, mean species number, number of species of the *Festuco-Brometea*, *Trifolio-Geranietea*, *Molinio-Arrhenatheretea* and *Rhamno-Prunetea* classes were calculated. Species diversity was calculated according to Shannon-Wiener ( $H'$ ) formula (Hill 1973) and dominance structure of vegetation – by means Simpson's index.

For all quadrats, percentage of species represent different Grime (1979, 2001) strategies were calculated). Types of primary (C, R, S) and secondary (S-R, C-R, C-S i C-S-R) strategies were determined based on Grime et al. 1986, 1995.

In order to determine the main habitat preferences of species, mean Ellenberg values (L, N, F; Lindacher i in. 1995) per 1m<sup>2</sup> were evaluated.

Differences between years were tested by means Friedman test and between consecutive pair of year – by means Wilcoxon match pair test (Sokal i Rohf 1981). To assess the species dynamics and species mobility in particular plot, mean cumulative species number (Rusch, van der Maarel 1992; van der Maarel, Sykes 1993, 1997; Sykes i in. 1994) was calculated.

## Results

1. Species richness of xerothermic grasslands in the Ojców National Park depends on:
  - microsite differentiation, which allow many species of different ecological amplitude to coexist for a long without competition,
  - attributes of species, which form these communities – they are mainly tufted perennials, with low growth rate,
  - unfavourable climatic conditions – high temperature in summer, lack of snow bed in winter, shallow and poor in nutrient soil,
  - low participation of strongly competitive species,

These factors resulted in low dynamics of the community as a whole, thus increase its stability.

2. Patches of xerothermic vegetation underwent active protection management, are characterized by higher turnover species rate, as compared to control plots, but they differed strongly in species composition.

3. The effectiveness of active protection management depends strongly on successional stage plots are in at the start of experiment:

- in xerothermic grasslands mowed annually, there was an strong increase of species characteristic to xerothermic grasslands (of S and SC strategy; Grime 1979).
- in xerothermic vegetation on shallow soil, slightly overgrown by shrubs, the management practices resulted in increase of species number of *Festuco-Brometea* i *Trifolio-Geranietea* classes,
- in xerothermic grasslands and xerothermic shrub on more thick soil, number and percentage cover of xerothermic species increased only slightly in spite of high overall species turnover.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	115–120	2002/2003
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**ZBIOROWISKA ROŚLINNE REZERWATU KRAJOBRAZOWEGO  
„DOLINA ELIASZÓWKI”**

**Plant communities of the Eliaszkówka Valley landscape reserve**

**ABSTRACT.** A detailed phytosociological studies has been performed in the „Dolina Eliaszkówki” reserve. In the reserve 7 forest associations have been found (*Quercus roboris-Pinetum*, *Alno-Ulmion* communities, *Tilio-Carpinetum*, *Dentario eneaphylli-Fagetum*, *Dentario glandulosae-Fagetum*, *Carici-Fagetum* and *Luzulo pilosae-Fagetum*) and 3 transitional communities.

**KEY WORDS:** forest communities, nature reserve, Cracow Upland

SUMMARY

A detailed phytosociological studies has been performed in the year 2001 in the „Dolina Eliaszkówki” reserve. 89 phytosociological releves have been made in 11 forest communities. Among them, 7 forest associations and 3 transitional communities have been found (*Quercus roboris-Pinetum*, *Alno-Ulmion* communities, *Tilio-Carpinetum*, *Dentario eneaphylli-Fagetum*, *Dentario glandulosae-Fagetum*, *Carici-Fagetum*, *Luzulo pilosae-Fagetum* and *Tilio-Carpinetum/Quercus roboris-Pinetum*, *Dentario glandulosae-Fagetum/Quercus roboris-Pinetum*, *Luzulo pilosae-Fagetum/Dentario glandulosae-Fagetum* respectively).

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	121–129	2002/2003
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**ZBIOROWISKA ROŚLINNE REZERWATU  
„WĄWÓZ BOLECHOWICKI” NA WYŻYNIIE KRAKOWSKIEJ**

**Plant communities of the “Wąwóz Bolechowicki” landscape reserve  
on Kraków Uppland**

**ABSTRACT.** The aim of this study is to present the plant communities of the “Wąwóz Bolechowicki” reserve. In this reserve, five non-forest communities (*Mentho longifoliae-Juncetum inflexii*, *Lolio-Cynosuretum*, *Festucetum pallentis*, *Koelerio-Festucetum rupicola*, *Origano-Brachypodirtum pinnati*), two shrub communities (*Pruno-Ligustretum*, *Peucedano cervariae-Coryletum*) and two forest communities (*Alno-Ulmion*, *Tilio-Carpinetum*) has been found. This paper presents the phytosociological characteristics of these communities.

**KEYWORDS:** characteristics of plant communities, nature reserve, Kraków Uppland

**SUMMARY**

The aim of this study is to present the plant communities of the „Wąwóz Bolechowicki” reserve. In this reserve, five non-forest communities (*Mentho longifoliae-Juncetum inflexii*, *Lolio-Cynosuretum*, *Festucetum pallentis*, *Koelerio-Festucetum rupicola*, *Origano-Brachypodirtum pinnati*), two shrub communities (*Pruno-Ligustretum*, *Peucedano cervariae-Coryletum*) and two forest communities (*Alno-Ulmion*, *Tilio-Carpinetum*) has been found. This paper presents the phytosociological characteristics of these communities.

A numerical classification revealed later differentiation of non-forest communities (community with *Melica transsylvanica*, *Origano-Brachypodietum*: *O-B vincetoxicetosum*, *O-B agrimonietosum*, *O-B* with *Inula ensifolia*).

*Translated by the authors*

Prądnik. Prace Muz. Szafera	13	131–139	2002/2003
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## ROŚLINY NACZYNIOWE REZERWATU „WĄWÓZ BOLECHOWICKI”

### Vascular plants of the “Wąwóz Bolechowicki” nature reserve

**ABSTRACT:** A full list of vascular plant (485 species) of the “Wąwóz Bolechowicki” reserve is presented. A characteristic feature of this flora is a high contribution of the xerothermic (89) and low the montane species (16). 21 species were under strict protection and 3 another ones in Polish Red Book.

**KEY WORDS:** vascular plants, xerothermic and montane species, Polish Red Book, southern Poland

### SUMMARY

A full list of vascular plant (485 species) of the Wąwóz Bolechowicki reserve is presented. A characteristic feature of this flora is a high contribution of the xerothermic and thermophilous species (89), which occupy the south and south west slopes in the lower part of the valley, and low contribution the montane species (16). 21 species were under strict protection and 3 another ones in Polish Red Book. Among them are *Orobanche picridis*, *Cypripedium calceolus* and *Cephalanthera rubra*.

*Translated by the authors*

Prądnik. Prace Muz. Szafera	13	141–150	2002/2003
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## ROŚLINY NACZYNIOWE REZERWATU „DOLINA MNIKOWSKA”

### Vascular plants of the natural reserve “Dolina Mnikowska”

**ABSTRACT:** Rich flora of vascular plants, approximately 400 species, has been preserved in the landscape natural reserve “Dolina Mnikowska” located in a rocky limestone valley (the area of 20.43 ha.). Large ecological and geographical variation is a characteristic feature of the flora. Approximately 80 xerophilous species, representing mainly SE geographical elements and 17 mountain species have been found there. A substantial part of the species belongs to legally protected plants in Poland.

**KEY WORDS:** xerophilous and mountain plants, legally protected plants, natural reserve, Kraków Upland.

### SUMMARY

The landscape natural reserve “Dolina Mnikowska” covers the area of 20.43 ha. It is located in a rocky limestone valley, which is a typical one for the southern part of the Kraków Upland. Rich and varied flora of vascular plants consisting of approximately 400 species has been preserved there. It includes a significant amount of xerophilous plants, approximately 80 species, and numerous mesophilous forest and meadow species. There is also an interesting, but relatively small, group (17 species) of oligothermic mountain plants there. A large share of rare and endangered, legally protected in Poland, plants in the flora of the reserve should be emphasized. 22 such species have been found including 13 species strictly protected and 9 partly protected ones.

*Translated by Marek Niemiec*

Prądnik. Prace Muz. Szafera	13	151–158	2002/2003
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## ZBIOROWISKA ROŚLINNE REZERWATU KRAJOBRAZOWEGO „DOLINA MNIKOWSKA”

### Plant communities of the landscape natural reserve “Dolina Mnikowska”

**ABSTRACT:** 12 plant communities have been determined in the landscape natural reserve „Dolina Mnikowska” which is located in a rocky limestone ravine. In forests, which cover approximately 85% of the reserve, the largest communities are; *Tilio-Carpinetum* and *Quercus roboris-Pinetum*. Non-forest plant communities are represented mainly by xerophilous shrubs, saxicoline grasslands and herbages.

**KEY WORDS:** plant communities, landscape natural reserve, Kraków Upland.

### SUMMARY

The landscape natural reserve „Dolina Mnikowska” covering the area of 20.43 ha., is located in a rocky limestone ravine. 12 plant communities have been determined there (fig. 1). Forests, which cover 85% of the area are represented by three communities (*Circaeo-Alnetum*, *Tilio-Carpinetum*, *Quercus roboris-Pinetum*) and artificially planted trees. Non-forest plants are largely varied and occur as small scattered patches. Sunlight exposed rock massifs are covered with xerophilous shrubs (*Peucedano cervariae-Coryletum*) and grass lands (*Festucetum pallentis*, *Origano-Brachypodietum*). Shaded mid-forest rocks are covered with liverwort communities. Herbages including *Urtica dioica* and *Cirsium oleraceum* are dominating on the bottom of the valley. The other communities (*Cirsietum rivularis*, *Scirpetum sylvatici* and *Lolio-Cynosuretum*) occupy relatively small areas.

*Translated by the authors*

Prądnik. Prace Muz. Szafera	13	159–164	2002/2003
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## ROŚLINY NACZYNIOWE REZERWATU „PANIĘSKIE SKAŁY” W KRAKOWIE

### Vascular plants of the “Panięskie Skały” nature reserve in Cracow

**ABSTRACT:** In this reserve, whose area of 6.41 ha is covered by old deciduous wood stands, 145 vascular plant species were found, of which 12 are rare ones legally protected in Poland.

**KEY WORDS:** vascular plants, legally protected species, nature reserve, the Cracow Upland.

### SUMMARY

This reserve, 6.41 ha in area and located on the Cracow Upland within the borders of the City of Cracow, has been established to protect a valley with numerous limestone outcrops. It is covered by old deciduous wood stands of the *Tilio-Carpinetum* and *Luzulo luzuloidis-Fagetum* communities. Vascular plant species found in this reserve number 145. They are mainly forest species typical for rich biotopes, while acidophilous plants are infrequent. The flora of the reserve is natural in character. The only synanthropic species that has spread here is *Impatiens parviflora*. What is notable is the high share of rare plants, under legal protection in Poland. They are represented by 12 species, e.g.: *Aruncus sylvestris*, *Cephalanthera damasonium*, *Daphne mezereum*, *Lilium martagon*.

*Translated by the authors*

Prądnik. Prace Muz. Szafera	13	165–172	2002/2003
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## ZBIOROWISKA ROŚLINNE REZERWATU „PANIĘSKIE SKAŁY” W KRAKOWIE

### Plant communities of the “Panięskie Skały” nature reserve in Cracow

**ABSTRACT:** This study presents the characteristics of natural forest plant communities (*Tilio-Carpinetum*, *Luzulo luzuloidis-Fagetum*) and a map of their distribution in a nature reserve created in 1953.

**KEY WORDS:** Natural forest plant communities, phytosociological map, nature reserve, the Cracow Upland.

### SUMMARY

The „Panięskie Skały” landscape reserve, created in 1953 on the area of 6.41 ha, protects a valley with numerous upper Jurassic limestone outcrops. Here, natural deciduous and mixed old wood stands between 120 and 170 years of age have been preserved. They belong to the *Tilio-Carpinetum* (Tab. 1) and *Luzulo luzuloidis-Fagetum* (Tab. 2) communities. *Tilio-Carpinetum* dominates the reserve and is characterised with great differentiation into sub-associations and variants (Fig. 1). *Luzulo luzuloidis-Fagetum* is only found in the form of small patches on local hills with barren and aciduous soil.

*Translated by the authors*

Prądnik. Prace Muz. Szafera	13	173–180	2002/2003
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**WSTĘPNE WYNIKI BADAŃ NAD EKSPANSJĄ NIECIERPKA  
GRUCZOŁOWATEGO *IMPATIENS GLANDULIFERA* ROYLE  
W OJCOWSKIM PARKU NARODOWYM**

**Initial remarks about the invasion of *Impatiens glandulifera* Royle  
in the Ojców National Park**

**ABSTRACT.** The paper presents the results of the initial findings of the rate of invasion of an alien species – *Impatiens glandulifera* Royle in the Ojców National Park. Local conditions of habitat of the species are characterized using ecological indicator values.

**KEY WORDS:** *Impatiens glandulifera* Royle, Ojców National Park, synantropization.

SUMMARY

The paper presents the results of the investigation on the *Impatiens glandulifera* Royle in the Ojców National Park (OPN). Till now this takson has been described from one stand. Recently the six new stands have been found. Their localities shown in fig 2. Local conditions of habitats of the species are characterized using ecological indicator values (fig.3.) The typical habitats of this species are semi natural and natural communities. *Impatiens glandulifera* Royle grows in half shadow or half light place, in fresh and moist soils, weakly acid, rich in mineral nitrogen.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	181–187	2002/2003
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**ZAWARTOŚĆ PIERWIASTKÓW METALICZNYCH W IGLACH SOSNY  
W REJONIE ODDZIAŁYWANIA PRZEMYSŁU WAPIENNICZEGO  
W WOJEWÓDZTWIE ŚWIĘTOKRZYSKIM**

**Concentration of metallic elements in pine needles  
in the Kielce calcareous industry area**

**ABSTRAKT.** The elemental composition of pine needles has been investigated and the samples for analyses have been taken from woodland sites located near three huge cement factories of Kielce province. For comparative needs the samples from sites free of alkali emission have been studied. The increase in pH as well as the higher concentration of Ca, K, and Mn have been stated, while the contents of Al, Fe, and Zn have been even 3-6 times lower. Proportions in the qualitative and quantitative characteristics have also been altered.

**KEY WORDS:** pine needles, elements, alkalic emission

**SUMMARY**

The article contains the results of investigations concerning the contents of metallic elements in the *Pinus silvestris* needles in the area of alkali emission. The general objective of the study was the qualitative and quantitative comparison of metals concentration in pine needles that were gathered in both places of alkali stress and areas free of industrial pollution. Additional task was to formulate the relation between elemental composition of needles and the alkali emission volume. The samples for analyses were gathered in three woodland areas located in vicinity of cement factories in the years of 2001 and 2002. As the comparative material there have been also utilized samples taken from the *Leucobryo-Pinetum* forest of Wymysłów and from the pine forest of Psary Hill – both located out of the reach of industrial influences. In spite of the relatively low levels of direct alkali emission, the pH reagent showed to be essentially changed in the samples taken from the first three sites. The concentrations of such elements like Ca, K, Mg showed to be 2-4 times higher and simultaneously, the contents of Al, Fe, Zn, Mn were essentially reduced (3–6 times) in comparison to the samples taken from the last two sites. Essential reduction of barium, lead, zinc, and, last but not least, the manganese (even 15 times) were observed and the concentration of strontium and copper showed to be 2–5 times greater in comparison to the natural contents of those elements in pine needles. Those changes and the increase in pH reagent in woodland habitats are the result of industrial activity and they influence the sanitary conditions of pine trees in the areas of calcareous industry.

*Translated by W. Wilczyński*

Prądnik. Prace Muz. Szafera	13	189–215	2002/2003
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**WSPÓŁCZESNA I SUBFOSYLNA MALAKOFAUNA  
W BIELAŃSKO-TYŃIECKIM PARKU KRAJOBRAZOWYM**

**Recent and subfossil mollusc fauna in the Bielany-Tyniec Landscape Park**

**ABSTRACT.** Rich and differentiated assemblages of living and subfossil land snails have been found in the Bielany-Tyniec Landscape Park (southern part of the Cracow Upland). Two different types of communities occur in woodlands – the fauna with a considerable content of shadow-loving snails, and in grasslands – the fauna dominated by open-country and xerophile species. Intermediate types of snail communities occur in few localities, too. Woodland snails are most important component of subfossil assemblages found in Holocene deposits while in Pleistocene sediments only cold-tolerant snails were found. Populations of species connected with open habitats represented by numerous specimens can be reported from a few localities. Afforestation of the Cracow Upland followed the warming of the climate since the Late Vistulian till the Middle Holocene while the human activity was responsible for the deforestation and spreading of open habitats during the Late Holocene. The recession of pasturing and mowing leads recently to secondary succession of shrubs, bushes and trees. In consequence xerothermic grasslands overgrow and gradually become more and more reduced. Active protection should be introduced in many places to protect both malacocoenoses inhabiting open-country habitats and the diversity of mollusc fauna in the Landscape Park.

**KEY WORDS:** mollusc fauna, Bielany-Tyniec Landscape Park.

## SUMMARY

The Bielany-Tynieć Landscape Park is situated in the southern part of the Cracow Upland close to the Cracow urban agglomeration, partly even inside them. It is crossed by the Vistula River forming a gap between hills raising up to 150 m above the valley bottom. The present study has been carried out since 1992 enclosing 4 nature reserves, 2 geological documentary sites, 2 nature monuments and several other localities (Fig. 1). Additionally two public parks are inside this area. The living fauna encloses 58 species, and subfossil assemblages – 55 species of land snails (Tab. 1). Snail communities containing a considerable content of shadow-loving species and another ones dominated by open-country and xerophile species have been distinguished (Fig. 2, 4, 5). They are characterised by a few indices, mainly by the species diversity index TDA (Fig. 3). Populations of selected species, mainly xerophile ones, have been studied using biometrical methods (Fig. 6).

Changes of the fauna during the last twenty thousand years can be reconstructed (Fig. 7). The succession began with assemblages of cold-tolerant species found in loess-like deposits filling karst forms developed within Upper Jurassic limestones (UV). Their next step was connected with the warming of the climate and the afforestation of the upland during the Lower and Middle Holocene (EH-MH). Such type of the fauna with numerous shadow-loving and mesophile snails survived up till now and occurs recently in woodlands (Rc-L). The forest clearance initiated by Neolithic man and accelerated since Middle Ages led to the spreading of open, stepe-like environments inhabiting by xerophile snails (Rc-X). Another type of the fauna is connected with abandoned quarries and other environments strongly transformed by the human impact (Rc-S). The recession of pasturing and moving as well as opencast mining of limestones promote the spontaneous secondary succession of bushes and trees leading to the afforestation and the development corresponding snail communities.

Twelve species of snails living in the Bielany-Tynieć Landscape Park are listed on the red list of threatened animals in Poland. The reduction of open habitats can eliminate some of them – mainly xerophile ones. Therefore the active protection should be introduced to restrain the secondary plant succession and to preserve xerothermic grasslands in some nature reserves. A few sites inhabited by rich malacocoenoses or rich populations of selected species should be additionally protected as nature monuments, ecological sites or nature landscape complexes. The same refers to limestone tors with rock-shelters and enlarged fissures filled with Vistulian or Holocene mollusc-bearing deposits. The picturesque rock crowned by the Tynieć Abbey situated on the right bank of the Vistula gape (Tynieć Gape) is the best example of such an object.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	217–228	2002
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## ZIMOWE SPISY NIETOPERZY NA WYŻYNIE KRAKOWSKIEJ W LATACH 2000–2002 NA TLE 15 LAT BADAŃ

### Winter bat censuses in the Kraków Upland in years 2000–2002 against a background of 15 years of research

**ABSTRACT:** During 164 controls there were found 1014 bats and 988 of them were recognised. 73 caves were controlled minimum once time and in 32 of them were found bats. Presence of minimum 14 species was confirmed: *Rhinolophus hipposideros*, *R. ferrumequinum*, *Myotis myotis*, *M. nattereri*, *M. emarginatus*, *M. mystacinus/brandtii*, *M. dasycneme*, *M. daubentonii*, *Eptesicus nilssonii*, *E. serotinus*, *Nyctalus noctula*, *Plecotus auritus*, *P. austriacus* and *Barbastella barbastellus*. The most numerous were *R. hipposideros* (49%), *M. Myotis* (32,5%) and *M. daubentonii* (8,8%). It is the first time after the 50s. that *R. hipposideros* is the most numerous. During last 15 years a distinct increase of bats' number is observed. The most significant increase concerns *R. hipposideros*, *M. myotis*, *M. daubentonii*, *M. emarginatus* and *P. auritus*. There were found new localities of rare bat species *R. ferrumequinum*, *M. nattereri*, *M. dasycneme*, *E. nilssonii*, *N. noctula* and *P. austriacus*. The most important localities are: Nietoperzowa Cave, Ciemna Cave, Wierzchowska Górna Cave, Łokietka Cave and Raclawicka Cave.

**KEY WORDS:** *Chiroptera*, hibernation, caves, karst.

## SUMMARY

The Kraków Upland is situated at north-west from Cracow City, and it is a part of the Kraków – Wieluń Upland – the biggest karstic region of Poland. The bat research has been carried out in this territory for almost 150 years.

During 164 controls there were found 1014 bats and 988 of them were recognised (Table 1). 73 caves were controlled minimum once time and in 32 of them were found bats (Table 4). It is the biggest research activity during last 15 years (Fig. 2). Presence of minimum 14 species was confirmed: *Rhinolophus hipposideros*, *R. ferrumequinum*, *Myotis myotis*, *M. nattereri*, *M. emarginatus*, *M. mystacinus*, *M. brandtii*, *M. dasycneme*, *M. daubentonii*, *Eptesicus nilssonii*, *E. serotinus*, *Nyctalus noctula*, *Plecotus auritus*, *P. austriacus* and *Barbastella barbastellus*. The most numerous were *R. hipposideros* (49%), *M. Myotis* (32,5%) and *M. daubentonii* (8,8%). It is the first time after 50s. that *R. hipposideros* is the most numerous. During last 15 years a distinct increase of bats' number is observed (Table 3). The most significant increase concerns *R. hipposideros*, *M. myotis*, *M. daubentonii*, *M. emarginatus* and *P. auritus* (Fig. 3 and 4). There were found new localities of rare bat species *R. ferrumequinum*, *M. nattereri*, *M. dasycneme*, *E. nilssonii*, *N. noctula* and *P. austriacus*. The most important localities for bats are: Nietoperzowa Cave, Ciemna Cave, Wierzchowska Górna Cave, Łokietka Cave and Raclawicka Cave (Table 2).

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	229–234	2002/2003
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**WSTĘPNE BADANIA LICZEBNOŚCI PRYSZCZARKA  
MAYETIOLA POAE (BOSC, 1817) (DIPTERA, CECIDOMYIIDAE)  
W OJCOWSKIM PARKU NARODOWYM**

**Preliminary studies on gall-midge *Mayetiola poae* (Bosc, 1817)  
(*Diptera*, *Cecidomyiidae*) in the Ojców National Park**

**ABSTRACT:** The numbers of gall midge species *Mayetiola poae* (Bosc, 1817) (*Diptera*, *Cecidomyiidae*) was calculated by analysis of the zoocoecidia caused on the stems of *Poa nemoralis* L. (*Gramineae*). Investigations were carried out in Ojców National Park during 1996–1998.

**KEYWORDS:** *Mayetiola poae*, Ojców National Park.

SUMMARY

Investigations relating to the abundance of *Mayetiola poae* (Bosc, 1817) (*Diptera*, *Cecidomyiidae*) caused plant-galls on *Poa nemoralis* L. stem were carried out in the Ojców National Park in 1996–1998. During three consecutive years a total of 1095 blades of the mentioned grass, growing in the same area of ca. 1 m<sup>2</sup>, were analysed. It appeared that 491 blades were infested by *M. poae* (44.8%) which caused 506 plant-galls. Abundance of *M. poae* ranged from 6.7% in 1998 to 64.1% in 1996.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	235–244	2003/2003
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**TRZMIELE (*BOMBUS LATR.*) I TRZMIELCE (*PSITHYRUS LEP.*)  
(*HYMENOPTERA, APIDAE*) W WYBRANYCH FITOCENOZACH  
SUCHEJNIOWSKO-OBŁĘGORSKIEGO PARKU  
KRAJOBRAZOWEGO W GÓRACH ŚWIĘTOKRZYSKICH**

**Bumble-bees (*Bombus Latr.*) and *Psithyrus Lep.* (*Hymenoptera, Apidae*) in  
chosen phytocenoses of the Suchedniowsko-Obłęgorski Landscape Park in the  
Świętokrzyskie Mountains.**

**ABSTRACT:** In the years 1999–2000 the research on a species composition, domination structure and constancy of occurrence of (*Bombus Latr.*) and (*Psithyrus Lep.*) were carried out in the area of the Suchedniowsko-Obłęgorski Landscape Park in the Świętokrzyskie Mountains. The research was conducted in 3 chosen phytocenoses: mixed forest, xerothermic grass and ruderal community. There were found 11 species of bumble-bees and 3 species of *Psithyrus Lep.*

**KEY WORDS:** bumble-bees species, stability of occurrence, domination, phytocenosis, biodiversity, Suchedniowsko-Obłęgorski Landscape Park.

SUMMARY

In the years 1999 and 2000 the research on the species composition, phenology and host plants of bumble-bees and *Psithyrus Lep.* was carried out in chosen phytocenoses of the Suchedniowsko-Obłęgorski Landscape Park in the Świętokrzyskie Mountains Region (Fig. 1). Three groups of phytocenoses were distinguished: a) natural communities – mixed coniferous forest, b) semi-natural communities – xerothermic grass, c) anthropogenic communities – ruderal communities. The research was conducted also in the ecotone between a meadow and forest.

Observations and catches of bumble-bees (only to check the marks) were carried out in two localities in each of the communities weekly. Density of the bumble-bees was evaluated by using the belt method. A sample was the number of observed or caught individuals during a 20-minute walk across a researched phytocenosis. A research belt was 200 m long and 1 m wide.

There were evaluated the following indices for the counted species – a constancy coefficient C (Szujewski 1983), domination coefficient D (Balogh 1958) and coefficient of the species diversity  $H'$  (Shannon-Weaver, 1963) (table 1, 2, 4).

In the chosen localities 11 species of bumble-bees and 3 species of *Psithyrus* Lep. were found. From among the bumbles the most numerous species were *Bombus terrestris* L. – a constant species and *B. lapidarius*, *B. pascuorum* Scop., *B. lucorum* L. – accessoric species. This species were dominant in the whole research area.

*Bombus subterraneus* L. and *B. muscorum* were the species of rarest occurrence there. The number of caught *Psithyrus* individuals was between 1 and 10. In summer the density of this insects was 50–500/ha in natural communities, 50–1050/ha in xerothermic grass and 100–800/ha in ruderal community (table 3).

The list of host plants from the area of the Suchedniowsko-Oblegorski Landscape Park covers 36 species from 14 families (table 5).

The research in the described area will be continued.

*Translated by the author*

Prądnik. Prace Muz. Szafera	13	245–250	2002/2003
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**ZAGROŻENIE POPULACJI MOTYLI (*LEPIDOPTERA*)  
PODCZAS USUWANIA KRZEWÓW I DRZEW ZARASTAJĄCYCH  
KSEROTERMICZNE BIOTOPY  
W PARKACH NARODOWYCH I REZERWATACH PRZYRODY**

**The threat to populations of *Lepidoptera* during removal of shrubs and trees  
overgrowing the xerothermic biotopes in national parks and nature reserves**

**ABSTRACT.** The author, on the basis of his long term field studies, discusses the threat to lepidopteran populations which survived in the xerothermic grass biotopes in “steppe reserves” of Kraków vicinity and Miechów Upland.

**KEY WORDS:** Ojców and Pieniny National Parks, nature reserves of Kraków vicinity and Miechów Upland, dry xerothermic biotopes, „steppe” localities, ecological active protection, time limit to execute active protection.

SUMMARY

The author, on the basis of his long term field studies, discusses the threat to lepidopteran populations which survived in the xerothermic grass biotopes in „steppe reserves”. He points to the necessity of the removal of shrubs and trees overgrowing these grasslands in order to carry on an active protection of lepidopterans. However at the same time he stresses the necessity of rigorous observing of proper timing of these treatments, which should be carried out exclusively from mid-September to the end of October. Otherwise the insect populations living there, already threatened by the reduction of their habitats by forest invasion, may be destroyed.

*Translated by dr M. Witrylak*