

Prądnik. Prace Muz. Szafera	2	9–16	1990
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**ROLA NIEKLIMAKSOWYCH BIOCENOZ W PARKACH
NARODOWYCH I REZERWATACH**

The role of non-climax biocenoses in national parks and nature reserve

ABSTRACT. The work presents the advantage of semi-natural biocenoses, which are usually of a very high species diversity. Many of them are endemic for small areas. It is recommended to preserve, in national parks and nature reserves, in some cases, small areas of semi-natural biocenoses as well as the natural ones. This would permit a considerable increase in the diversity of nature and landscape there.

KEY WORDS: National parks; nature reserves; semi-natural biocenoses; biocenotic and species diversity; secondary succession; diversity protection.

SUMMARY

The role of non-climax semi-natural biocenoses (xerothermic grasslands and scrubs, meadows and pastures, low peatbogs, etc.) is gradually being recognized in nature preservation, especially in reserve protection. Such biocenoses form unique species combinations of a high level of organization; they are often endemic for small areas. They exhibit a very high, often exceptional, species diversity, frequently being the unique habitat for rare, endangered species. In Ojców National Park, for instance, semi-natural associations, which only account for dozen or 15% of total area, contain above 50% of vascular flora. In our national parks and reserves, the natural succession series usually end in forest associations. A preservation of semi-natural non-forest biocenoses on a part of the area always results in an increase of biocenotic and species diversity there. Such actions agree with the world-wide strategy for diversity protection.

Prądnik. Prace Muz. Szafera	2	17–21	1990
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**PROBLEMY OCHRONY ROŚLINNOŚCI KSEROTERMICZNEJ
W REZERWATACH GÓRA GIPSOWA I LIGOTA DOLNA
NA OPOLSZCZYŹNIE**

**Problems of xerothermic vegetation protection in the reserves
Góra Gipsowa and Ligota Dolna in the Opole region**

ABSTRACT. The problem of preserving semi-natural biocenoses has been presented in the instance of 2 reserves of xerothermic vegetation in Opole district. The major threats result here from natural succession and the various forms of human activity, which should be countered with active protection.

KEY WORDS: Góra Gipsowa reserve; Ligota Dolna reserve; xerothermic vegetation; natural succession; anthropogenic threats, active protection.

SUMMARY

The problem of preservation xerothermic vegetation is considered on the groups of two strict nature reserves in the Opole district: Góra Gipsowa (1.02 ha) and Ligota Dolna (4.90 ha). Their situation at the mouth of the Moravian Gate causes their great scientific importance. Unhappily, their vegetation is threatened by the natural succession and anthropogenous factors. The succession tends there to shrubbery and forest; the phenomenon becomes particularly marked in Ligota Dolna reserve and in the western part of Góra Gipsowa reserve. The most stable are the grassland of the association *Koelerio-Festucetum* and *Thalictro-Salvietum*. Both objects are of small size and this is why they are seriously endangered by human activity in the environment, such as foresting refuse dropping, quarries, postindustrial wastes and cattle grazing. In order to prevent the unfavourable changes, it is needed to conduct periodical cutting out of shrubbery and restore order in the reserves' protective zone.

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**ZMIANY ROŚLINNOŚCI KSEROTERMICZNEJ W
PROJEKTOWANYM REZERWACIE „ZAPUSTY” W WARUNKACH
OGRANICZONEJ INGERENCJI CZŁOWIEKA**

**Changes in xerothermic vegetation in the projected „Zapusty”
reserve in conditions of limited human interference**

ABSTRACT. The projected „Zapusty” reserve is situated in the protection zone of Świętokrzyski National Park on private land owned by the inhabitants of the village of Cząstków. The steep slope of the Zapusty hill, facing SW, with naturally-exposed dolomites contains a number of xerothermic plants species forming lichenaceous, grassland and scrub associations. The abandonment of old styles of management of this area enhances the slope’s overgrowing with scrubs and the retreat of some xerothermic plants, e.g. *Carex pediformis*, *Anemone silvestris*, *Aster amellus*.

KEY WORDS: Święty Krzyż National Park, „Zapusty” reserve, xerothermic associations, natural diversity, secondary succession, species extinctions, old forms of management.

SUMMARY

The proposed reserve is situated at some 0.5 km N of Chełmowa Góra in Świętokrzyski National Park and includes the steep slope of the Zapusty hill covered – depending in the type of soil and exposure – with lichenaceous, grassland, scrub or forest vegetation.

A reserve was already proposed here in 1947 (Kobendza 1947). At the end of the 70’s the author renewed attempts at the creation of the reserve which would include fragments of associations of both xerothermic – with *Anemone silvestris*, *Anthemis tinctoria*, *Asperula cynanchica*, *Aster amellus*, *Brychopodium pinnatum*, *Campanula sibirica*, *Carex pediformis*, *Cotoneaster melanocarpa*, *Echinops sphaerocephalus*, *Inula hirta*, *Libanotis montana* and others – and forest – with *Galanthus nivalis*, *Aconitum variegatum*, *Daphne mezereum*, *Lilium martagon*, *Galium Schultesii*, *Asarum europaeum*, *Aruncus silvestris* and others – vegetation.

A total of some 300 species of vascular plants have been recorded from the area (3.85 ha), including 61 xerothermic species. Of the earlier mentioned species (Kobendza 1947, Zaręba 1960), *Asparagus officinalis* and *Galium cruciata*, could not be identified.

The abandonment of old styles of management of this area is one of the main causes of the retreat of a number of xerothermic species.

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**PROBLEM ZACHOWANIA ZBIOROWISK STEPOWYCH
NA PODSTAWIE BADAŃ PROWADZONYCH NA LUBELSZCZYŹNIE**

The problem of preservation of steppe associations as studies in the Lublin region

ABSTRACT. The Lublin region is one of the few parts of Poland rich in xerothermic plant associations which are being preserved as the so-called steppe reserves. These extrazonal plant associations undergo changes resulting both from anthropopressure and natural plant succession. The major threat consists in the invasion of scrubs and forest vegetation. This phenomenon has been observed in practically all steppe reserves. Experimental attempts at protecting the endangered associations (the reserves Stawska Góra, Wolwinów) have been initiated with considerable thinning of the scrubs. Positive results can already be observed.

KEY WORDS: Lublin Upland, "Stawska Góra" reserve, "Wolwinów" reserve, steppe vegetation, human interferences, habitat destruction, natural succession, vegetation degradation, scrubs clearing, active protection.

SUMMARY

The favourable conditions in the region of the Lublin Upland i.e. the differentiated structure and the warm soils on a background rich in calcium carbonate have enhanced the preservation of fairly numerous stretches of steppe vegetation. The greatest area is covered by the association *Thalictro-Salvietum pratensis*, while *Stipetum capillatae* and *Inuletum ensifoliae* are the most interesting from a floristic point of view. Numerous species of steppe plants of the Pontian element are present there: e.g. *Linum flavum*, *Cirsium pannonicum*, *Iris aphylla*, *Inula hirta*, *Cerasus fruticosa*, *Carlina onopordifolia*, *Echium rubrum* and *Cytisus albus*. The latter two species are there in their sole Polish locality.

Steppe associations are little stable in our conditions and undergo changes caused by human activity as well as natural succession. In the post-war period, the greatest harm was done by the tendency to plough pasturelands and long-term wastes. In regions with differentiated structure, this also caused an intensification of erosion leading to the destruction of some habitats. Similar effects were caused by a stubborn foresting of slopes, in spite of the doubtful economic profits. Negative was also an overzealous protection of certain objects, i.e. the creation of strict nature reserves, the prohibition of pasture or of hay-mowing, etc. This caused a rapid overgrowing of steppe grassland, first with scrubs then also with forest, resulting in the disappearance of steppe vegetation. Such unfavourable changes are described on the basis of two reserves, Stawska Góra and Wolwinów. In order to arrest the harmful vegetation succession in those reserves, actions have been undertaken lately consisting in the cutting out of scrubs, especially of juniper and blackthorn. The first effects of that are already visible, e.g. in the increase of the number of *Carlina onopordifolia* and the appearance of new stretches with *Cerasus fruticosa*.

Prądnik. Prace Muz. Szafera	2	35–42	1990
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**ZMIANY POWIERZCHNI ZBIOROWISK ROŚLINNYCH
KOMPLEKSU SKALNEGO „CZYŻÓWKI” W OJCOWSKIM PARKU
NARODOWYM W LATACH 1966-1986**

**Changes in plant association areas of the Czyżówki rocky ridge
in Ojców National Park, between 1966-86**

ABSTRACT. Very considerable changes in vegetation have been observed on a permanent study plot situated on a rocky valley slope typical for Ojców National Park. During the 20 years a rapid growth was observed in shade-loving and oligothermic associations. Xerothermic vegetation dwindled by about 70%. Some associations of xerothermic grasslands and bushes might disappear totally by 2000-2010. The preservation of the present diversity of plants requires active protection.

KEY WORDS: Ojców National Park, phytosociological cartography, spatial pattern of vegetation, vegetation changes, ecological diversity protection, active protection.

SUMMARY

The changes in plant association areas were determined by comparing detailed 1:500 phytosociological maps of 1966 and 1986 (Figs 1, 2, 3). Shade-loving and oligothermic associations have visibly increased their participation in the studied period (Tab.1, 2). A particularly strong expansion was exhibited by the montane sycamore forest *Phyllitido-Aceretum*. Mesophilous associations had various tendencies Slightly thermophilous associations usually extended their area. The most uniform reaction was exhibited by strongly thermophilous and xerothermic associations (Tab.1), which have diminished their area by about 75%. At the present rate of disappearance of xerothermic vegetation, three associations (*Origano-Brachypodietum*, *Festucetum pallentis semperviventosum* and *Peucedano cervariae-Coryletum*) might disappear totally by 2000-2010.

The observed changes result in the decrease of ecological diversity in the vegetation. Natural succession tendencies lead to the emergence of a climactic spatial pattern of vegetation, more uniform and monotonous in comparison to the present one. The preservation of the diversity of the Park's plant associations, formed, to a large extent, by old human activity, requires active protection methods.

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**PRZEMIANY ROŚLINNOŚCI KSEROTERMICZNEJ
W CZASIE 20-LETNIEJ SUKCESJI WTÓRNEJ
NA POWIERZCHNI BADAWCZEJ „GRODZISKO”
W OJCOWSKIM PARKU NARODOWYM**

**Changes in xerothermic vegetation during the 20 years' secondary succession
on the study area of Grodzisko in Ojców National Park**

ABSTRACT. The study presents cartographically and quantitatively the changes in area participation of plant association on a permanent study plot in Ojców National Park. A rapid disappearance of semi-natural associations: grasslands and scrubs by secondary succession has been observed. A forecast shows that 2 xerothermic associations will disappear by 2000 and further 2 will become limited to small, isolated areas.

KEY WORDS: Ojców National Park, xerothermic vegetation, secondary succession, permanent study plot, changes forecasting, active protection.

SUMMARY

Changes in area participation of various xerothermic plant associations over 23 years were analysed on a permanent study plot situated on a south-facing valley slope in Ojców National Park. The extent of changes was evaluated by comparing detailed 1:1000 plant association maps of 1963 and 1986.

The valley slope of the plot has been deforested (Figs. 1, 2) and heavily pastured upon since the 19th century. It has been dominated by semi-natural xerothermic grassland and, to a lesser extent, by sparse xerothermic scrubs. The National Park was created over this area in 1956. This resulted in the decrease of pasturing, which was finally terminated in 1960-75 together with all other forms of management. This, in turn, led to the appearance of natural plant succession processes. Very considerable changes in the participation of plant associations (Tab. 1, Figs 3, 4), strongly dependent on their ecological character, have been observed in the 23 years of study. Typical xerothermic and photophilous grasslands (*Koelerio-Festucetum sultacae*, *Origano-Brachypodietum*, *Festucetum pallentis semperviventosum*) accounted for 50% of total plot area in 1963. This has diminished to 17% by 1986, as a consequence of forest and scrub succession. The strongest disappearance trend has been observed in *Koelerio-Festucetum sultacae*. Xerothermic, light-loving scrubs, *Peucedano cervariae-Coryletum* have decreased their area by 45%. A significant growth was stated in the studied period in weakly thermophilous and mesophilous forest associations (*Tilio-Carpinetum*) and shrubland biotopes (*Ligustro-Prunetum* and impoverished stretches of *Peucedano cervariae-Coryletum*). Their

participation increased from 22% in 1963 to 64% in 1986.

Those results permit a forecast of future changes (Fig. 5). Two associations of xerothermic grassland, *Koelerio-Festucetum sultacae* and *Origano-Brachypodietum*, will most probably vanish by 2000. The remaining xerothermic grassland might be preserved as small, isolated stretches on hilltops and walls of high rocky massifs. The mesophilous and slightly thermophilous forest and bush associations will dominate almost the whole study area.

Prądnik. Prace Muz. Szafera	2	53–57	1990
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**ZABIEGI OCHRONY CZYNNEJ BIOCENOZ NIELEŚNYCH
STOSOWANE W OJCOWSKIM PARKU NARODOWYM**

**Practices in active protection of non-forest biocenoses
employed in Ojców National Park**

ABSTRACT. Anthropoclimactic in character, semi-natural non-forest biocenoses have a considerable participation in Ojców National Park vegetation. Their presence causes the increase in natural diversity and abundance. The national park administration has thus undertaken actions to counter degradation of the particularly rich fragments of those biocenoses.

KEY WORDS: Ojców National Park, natural diversity, deterioration, semi-natural biocenoses, secondary succession, active protection practices, traditional land-use, management plan changes.

SUMMARY

Ojców National Park is of considerable natural richness and diversity. An introduction of semi-natural, non-forest anthropoclimactic biocenoses to the original vegetation is one of the reasons of that feature. Of greatest importance here are xerothermic grassland and hay meadows. Following the considerable endangering of those biocenoses by degradation processes in the form of secondary succession the national park administration had to undertake counteractions against the changes. These include removing of scrubs and self-sowing trees within xerothermic grassland and the introduction of a constant mowing regime similar to extensive economical land-use. Attempts have also been undertaken to systematize employed procedures and for the introduction of that type of protection into the management plans of the Park.

Prądnik. Prace Muz. Szafera	2	59–65	1990
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**SUKCESJA WTÓRNA PÓLNATURALNEJ MURAWY
KSEROTERMICZNEJ *ORIGANO-BRACHYPODIETUM* W LATACH
1960-1984 WSKUTEK ZAPRZESTANIA WYPASU W REZERWACIE
KAJASÓWKA**

**Secondary succession in semi-natural xerothermic grasslands
Origano-Brachypodium in 1960-84 due to the termination
of pasture in the reserve Kajasówka**

ABSTRACT. The termination, in 1962, of pasturage in the xerothermic grasslands did not cause any visible effect on floristic composition in the initial 5 years. After that time, a phase of degeneration of the grasslands occurred, consisting of the disappearance of xerothermic species of herbaceous plants and the development of scrubs. A new scrub community, *Ligustro-Prunetum* appeared in place of the grasslands in 1973.

KEY WORDS: Kajasówka reserve, xerothermic vegetation, secondary succession, grassland degradation, diversity protection, active protection.

SUMMARY

The reserve was created in Cracow Upland in 1962 for a protection of a limestone hill with a rich xerothermic vegetation. The previously intensive cattle grazing there was abandoned. This resulted in the process of secondary succession in the xerothermic grassland of the association *Origano-Brachypodium*. The process was recorded on a permanent study plot, where the state of vegetation was evaluated every second year. A small rise in the number of species was observed in the initial 5 years (Fig.1). The grassland was very rich in flowering plants. The next 7 years saw a rapid disappearance of herbaceous plants and a development of scrubs (Tab. 1). The number of species over the 200m² area dwindled from 84 in 1964 to 48 in 1970. This was the degeneration phase of the xerothermic grasslands association and the formation of a scrub association. A typical scrub association, *Ligustro-Prunetum fruticosae* was already in place of the grasslands by 1974; no further changes in floristic composition have been observed until the end of the study.

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**STAN ZAGROŻENIA LEPIDOPTEROFAUNY
W PARKACH NARODOWYCH I REZERWATACH PRZYRODY.
CZĘŚĆ V. OJCOWSKI PARK NARODOWY**

**The state of danger to lepidopterofauna in national parks and nature reserves.
Part V. Ojców National Park**

ABSTRACT. The author describes the negative changes in the fauna of *Macrolepidoptera*. It has been established that, between 1953 and 1987, 12 species became extinct (Ex), 16 are in the course of extinction (E), 36 are endangered (V) and 1 disappeared (I). He also discussed one example of successful reintroduction: *Zygaena carniolica* (Scop). A presentation of the negative natural and anthropogenic factors and their influence on the lepidopterofauna of the Park is followed by a proposal of active protection, especially, concerning unstabilized habitats, which gather the highest number of Butterflies and Moths, including the endangered species.

KEY WORDS: Ojców National Park, lepidopterofauna degradation, habitat changes, anthropogenous factors, secondary succession, endangered species, reintroduction, active protection.

SUMMARY

The author discussed the changes in the lepidopterofauna of *Macrolepidoptera* observed in 1953-1987. Museum and private collections as well as own field work have submitted material for the study.

Important natural factors shaping the lepidopterofauna of Ojców National Park are especially the succession of the forest over grassland associations and factors limiting and slowing this successions. The group of anthropogenous factors is dealt with separately. This pressure includes negative factors created by forest management: tree stand exploitation, artificial foresting, elimination of some tree and shrub species. Next, agricultural factors are presented, including pasture, melioration and meadows ploughing as well as effects of artificial fertilization. Other factors of urbanization and the influences of local industry, mass tourism, transport routes, light traps, apiculture and butterfly captures. The degradation of the Park's lepidopterofauna is shown, in the instance of selected butterfly, by the list composed according to the example of the red lists of endangered and disappearing plant and animal species of IUCN. The example of the successful reintroduction of *Zygaena carniolica* (Scop.) suggests some possibilities for saving at least some of the species extinct in the Park. While some floral species are able to survive relatively long periods on small areas, the representatives of fauna disappear at a faster rate. The populations of the majority of lepidoptera species are endangered with extinction after the decrease of the number of individuals below a threshold critical value characteristic for each species. This decrease in the life space of butterfly

populations in the Park already caused in the discussed period the extinction (Ex) of 12 species, the direct threat of extinction (E) to further 36 species are vulnerable (V) and 1 has disappeared (I). Although the present work is not a faunistic contribution, it is striking that the area of the Park, considered as one of the best – studied in Poland, still contains unrecorded species of lepidopteras. What's more, these are characteristic and visible: *Zygaena viciae* (Den. & Schiff.), *Hepialus humuli* (L.), *Hipocrita jacobaeae* (L.) or *Lycaena helle* (Schiff.). This not only shows that the lepidopterofauna of the Park is still but superficially studied, but also that the lack of earlier comprehensive faunistic studies already precludes the possibility of the recording of a number of species which were once known in the Kraków vicinity and whose occurrence on the area studies was possible.

Presented are the proposals for an active protection of unstabilized habitats, where a great number of the endangered butterflies concentrates. The realization of the active ecological protection should take into consideration the rules proposed by Michalik (1985) and the program of preparing the "Kajasówka" reserve (Gradziński & Baryła, 1985) with the participation of geologists, botanicians and zoologists. The detailed section presents activities with operations which would not collide with the proposals of specialists of other branches of natural sciences.

Prądnik. Prace Muz. Szafera	2	97–106	1990
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**PRZEMIANY ZBIOROWISK ŁĄKOWYCH W OJCOWSKIM
PARKU NARODOWYM W OSTATNIM TRZYDZIESTOLECIU**

**Changes in the vegetation of hay-meadows in the Ojców National Park
in the last 30 years**

ABSTRACT. In 1958-9, the valley bottoms in the Ojców National Park, potential oak-hornbeam forest (*Tilio-Carpinetum*) habitats were dominated by fertile, mowed twice a year meadows, with a rich and uniform floristic content, *Arrhenatheretum medioeuropaeum alchemilletosum*. The changes in utilizations in the last 3 decades have led to far-reaching modifications of this plant association. Its parts still mowed for hay and intensively fertilized with mineral substances have preserved impoverished stands of *Arrhenatheretum*. Those parts where vegetation was mowed without hay-making developed a strongly impoverished “truncated” community of order *Arrhenatheretalia*. Those parts where mowing was totally abandoned, stands of nitrophilous and hygrophilous community with large perennials, dominated by *Urtica dioica* and *Cirsium oleraceum*, have appeared. The preservation of meadow associations in Ojców National Park, a condition for the preservation of its floristic and faunistic diversity, requires active protection i.e. reintroducing the former extensive management or introducing other, ecologically equivalent actions inhibiting the natural succession.

KEY WORDS: Ojców National Park, hay-meadows, secondary succession, management system, diversity protection, traditional land-use methods.

SUMMARY

Secondary hay-meadows (*Arrhenatheretum medioeuropaeum alchemilletosum*) dominated thirty years ago on valley bottoms in the Ojców National Park (Tab. 1), on sites of the potential natural vegetation of oak-hornbeam forests (*Tilio-Carpinetum*). These meadows, floristically very rich and homogeneous, were mown twice a year, extensively grazed after the hay harvest, and regularly manured with cow dung. Changes in the management practices which occurred since then, resulted in far-going modifications of the former *Arrhenatheretum* (Tab. 2). In places where hay is still being harvested and the meadows are being intensively fertilized (mostly with mineral compounds), impoverished stands of *Arrhenatheretum* still persist. In places where the meadows are being mown to prevent the succession of shrubs and trees, and hay is being left on the spot, highly impoverished (truncated) communities of the *Arrhenatheretalia* order developed. In meadows completely abandoned and not mown for several years, nitrophilous and hygrophilous tall forb communities, dominated by *Urtica dioica* and *Cirsium oleraceum*, were formed. These changes in vegetation are linked with changes in habitat conditions, as indicated by the indicator values of F, R and N according to Ellenberg (Tab. 3). Maintenance of meadows in the Ojców National Park – highly desirable because of their floristic and faunistic diversity – requires active conservation, either through traditional management practices or through ecologically equivalent new treatments (e.g. mowing with partial removal of dead plant material); these practices are to be carefully checked and constantly monitored for eventual corrections.

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**BADANIA NAD ZMIANAMI FAUNY PSZCZÓŁ (*APOIDEA*)
W OJCOWSKIM PARKU NARODOWYM PO ROKU 1976**

Studies on the changes in the apid fauna in Ojców National Park after 1976

ABSTRACT. 100 of the 134 *Apoidea* species in the Park in 1963-75 are endangered. This is caused by succession taking place in most semi-natural grassland and meadow associations.

KEY WORDS: Ojców National Park, apid fauna, species extinction, secondary succession.

SUMMARY

The majority of xerothermic species became extinct in Ojców National Park (there had been 24 species in 1958-75) as a result of overgrowth of xerothermic grasslands. E.g. *Osmia cerinthidis* and *Andrena paucisquama* can no longer exist there as their host plants (*Cerithe* and *Campanula sibirica*) no longer grow in the area. The fauna of warm meadows and pasturelands has become extinct in its former localities; it is preserved in previous xerotherms if they are now overgrown with a warm meadow. Several early – spring apid species, e.g. *Andrena ventralis*, are missing in certain localities.

The number of *Bombinae* in the Sąspówka valley has increased almost three-fold as a consequence of the decrease in field chemization after the martial law in Poland and of the abandonment of systematic field mowing. The overgrowth and increased humidity of those meadows led to the extinction of species characteristic for warm meadows.

Endangered are also early-spring bees, whose main food basis, i.e. the edges of marsh plant associations, specially, willow trees, is being destroyed by the beaver.

The changes in plant succession and the introduction of the beaver in the Park constitute a threat to the existence of about 100 bee species (of the 134 reported in 1958-1975), which have already become, or will shortly become extinct. As the fields surrounding the Park have already become empty of insects with the exception of noxious ones, it is imperative that the further extinction of bees be stopped in Ojców National Park.

PRĄDNIK
PRACE I MATERIAŁY MUZEUM IM. PROF. WŁADYSŁAWA SZAFERA

Prądnik. Prace Muz. Szafera	2	111–113	1990
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MAREK FERCHMIN

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**PROJEKT OCHRONY CZYNNEJ EKOSYSTEMÓW PÓLNATURALNYCH
(NP. ŁĄK) W KAMPINOSKIM PARKU NARODOWYM**

**Project of active protection of semi-natural ecosystems
(e.g. meadows) in Kampinos National Park**

ABSTRAKT. The report concerns a management policy of some semi-natural lowland meadows incorporated to Kampinos National Park with a protection of flora and fauna as a rationale. A natural succession of forest communities or an afforestation would cause a degradation of meadow communities and an extinction of many species.

KEY WORDS: Kampinos National Park, semi-natural ecosystems, lowland meadows, diversity protection, active management.

SUMMARY

The head protection idea is that Kampinos National Park as the largest park (35.000 ha) in Poland should protect the most diversified nature.

The forms of protection:

- in strict reserves (4.000 ha) without human ingerention
- in partial reserves – intensive help to the change process of nature communities (mostly forests)
- active protection in Kampinos National Park this are keeping in woodless situation of semi-natural communities on dunes – heathes, psammophile and xerothermic swards, on marsh territory – sedge marshes, willow scrubs and large areas of semi-natural meadows.

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**ZNACZENIE ŚRODOWISK OTWARTYCH DLA ZACHOWANIA
BOGACTWA GATUNKOWEGO BEZKRĘGOWCÓW
W PIENIŃSKIM PARKU NARODOWYM**

**The importance of open environments for the preservation of invertebrate
species diversity in Pieniny National Park**

ABSTRACT. The Pieniny range contains a very rich invertebrate fauna, mostly terrestrial groups, evaluated at about 50% of all species known from Poland. This fauna includes endemites and numerous relicts and unique species in our country. Of the Pieniny biocenoses, that with the greatest species richness is the Pieniny meadow, abundant fauna being also preserved in the ecosystems of xerothermic grasslands and the Carpathian beechwood. Particularly rich in species are Wąwóz Sobczański gully and the region of Trzy Korony Mt. The grasslands of the Pieniny range require careful protection. Its two major threats consist in the abandoning of utilization and the intensification of management. Both lead to a rapid elimination of the previously occurring species.

KEY WORDS: Pieniny National Park, invertebrate fauna, grasslands, habitat evaluation, traditional land-use, semi-natural grasslands deterioration, species extinction, active resources management.

SUMMARY

The Pieniny range are inhabited by 13-15 thousand animal species, most of them terrestrial invertebrates. The abundance of this group is striking; the area less than 0,1% total country surface contains, in the majority of the studied groups, about 50%, on the average, of species known from Poland. The Pieniny range also contained some endemic forms: the springtail *Onychiurus carpenterii* Stach, the orthopteran *Isophya piennesis* Maran and the Pieniny subspecies of parnassian, *P. apollo frankenbergi* Slaby.

The invertebrate fauna of the range is particularly well represented in grasslands, especially in the Pieniny meadow and xerothermic grasslands. A spatial evaluation of the range has shown that the part of greatest faunistic interest includes Wąwóz Sobczański gully, the region of Trzy Korony Mt., that of Białe Skąły Mt., the valley of Ociemny Potok stream, and the mountain glades of Polana Stolarzowa and Kras. Of greatest faunistic interest outside the Central Pieniny range is Wąwóz Homole canyon.

The non-forest association of the Pieniny are usually unstable. Their abandonment will cause and impoverishment of the fauna there by 30-50%. Another threat is connected with the intensification of the agriculture and the excessive fertilization of meadows and pasturelands. Pieniny National Park becomes an increasingly isolated enclave of species diversity in view of the rapid changes in agriculture in its vicinity. This isolation accelerates the rate of rare forms' extinction.

Prądnik. Prace Muz. Szafera	2	127–136	1990
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**WPLYW OGRANICZONEGO WYPASU OWIEC NA BIOTOP I BIOCENOZY
POLAN REGLOWYCH W TATRACH**

**The effect of limited sheep grazing on the biotope and biocenoses
of glades in the lower parts of the Tatra Mts.**

ABSTRACT. The limited sheep grazing in glades situated in the Tatra mountain forest zones did not cause durable changes in the chemistry and humidity of soils. At a small number of sheep a danger of soil erosion occurred only locally. The fertilization caused positive floristic changes in meadow communities and increased their productivity. Sheep grazing did not affect predatory and omnivorous invertebrates (*Formicidae*, *Stenus* sp.) but it had a negative influence on herbivores (bumble-bees, weevils, snails).

KEY WORDS: Tatra National Park, mountain meadows, sheep pasture, sheep folding, management changes, active management.

SUMMARY

The biocenoses of glades situated in the mountain forest zones of the Tatras were shaped under the influence of pasturage. For some hundred years the herds of sheep, cows and horses were grazed in the Tatras. In the period of intense pasturage the number of sheep reached 30 000. As the meadows in glades were mown for hay they were used as pastures only after hay-making. However, during the whole period of grazing sheep were gathered together in glades for milking and for the night which they spent close in folds. This resulted in the intense fertilization of glades. Under these conditions there developed the endemic meadow association of *Gladiolo-Agrostietum alpinetosum*. After the sheep grazing was stopped the Tatra glades underwent successional changes which led to their overgrowing with forest.

In the years 1981–1982 a number of sheep was limited to be grazed anew in certain glades and at the same time there were initiated investigations on the effect of grazing on the biocenoses of these glades. Only transitory changes in the chemical and water properties of soils were found and only steep limestone slopes with a shallow soil cover appeared to be endangered by erosion. Dusty and sandy soils were the most vulnerable to this process. The cessation of grazing conducted to the considerable degradation of the meadow associations of the Tatra glades, which was indicated by their great floristic impoverishment. The fertilization of glades by the folded sheep herds has raised the productivity of meadows causing favourable changes in their specific composition, e.g. the participation of fresh meadow species in the patches of *Hieracio-Nardetum strictae* has increased.

The Tatra glades witch occupy ca. 2% of the total area of these mountains have a very rich invertebrate fauna. In the particular groups of invertebrates 40-70% of all the species known

from the Tatras were recorded from glades (Fig. 1). There were also found some species new to the Tatra Mts. (Fig. 2). In the grazed glades the number and abundance of omnivorous and predatory invertebrates (*Formicidae*, *Stenus sp.*) was higher than in the non-grazed ones. On the other hand, the fauna of herbivorous invertebrates was more or less affected by grazing.

The above observations seem to indicate that glades should be maintained in the Tatras. However, the ways of their preservation may be different. Some glades may be grazed, a number of sheep being not greater than 6 ind. per 1 ha, others may be mown but in this case there arises the problem of their fertilization.

Prądnik. Prace Muz. Szafera	2	137–148	1990
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**SUKCESJA ROŚLINNOŚCI NA POLANIE REGLOWEJ
W GORCZAŃSKIM PARKU NARODOWYM W OKRESIE 20 LAT
W WYNIKU ZAPRZESTANIA WYPASU**

**Vegetation succession in a mountain glade in Gorce National Park
during 20 years, as a result of pasturage abandonment**

ABSTRACT. The course and rate of succession typical for majority of semi-natural montane meadows situated in forest zones in Gorce National Park has been described. 20 years after abandoning all management, 2 meadow associations disappeared: *Gladiolo-Agrostetium* and *Poo-Veratretum*. *Hieracio-Nardetum* was overgrown by *Vaccinium myrtillus* and young spruce forests. The area of the montane forest *Piceetum tatricum* increased from 7.3% to 28.3%. A very considerable fall in species diversity was observed in the glade as a result of the disappearance of many light-loving high-mountain species.

KEY WORDS: Gorce National Park, mountain meadows, secondary succession, species diversity, vegetation structure.

SUMMARY

The study has been carried out in a semi-natural mountain meadow situated on the “Czoło” glade about 1200 m a.s.l. in Gorce Mts. (Western Carpathians) since 1963. The abandoning, in 1963-1965, of pasturing and mowing of the meadow resulted in a rapid process of spontaneous plant succession leading from meadow to forest associations.

In order to determine the changes, detailed maps of plant association in the glade were made every 5th year. Detailed quantitative methods were also used to study the floristic composition and the structure of vegetation on 6 plots corresponding to the consequent phases of succession.

The 20 years saw a total disappearance of two associations, *Gladiolo-Agrostetium* and *Poo-Veratretum* (Fig. 2). *Hieracio-Nardetum* became overgrown in 2/3 with *Vaccinietum myrtilli* and young spruce forests. The area of the spruce forest *Piceetum tatricum* increased from 7.3% to 28.3%. The floristic composition underwent rapid changes (Fig. 3). Similarity index of 1 (*Gladiolo-Agrostetium*) to plot 2 (*Hieracio-Nardetum*) was 10.6% and to other 1.3-0.2%. A marked decrease was observed in the number of species and the value of diversity and relative abundance coefficients.

It has been established on the basis of the results obtained that the time from abandoning utilization to total overgrowing of the glade with forest and young spruce will be about 30-35 years. Similar succession is observed in most glades in the forest zone of the Park. This results in the disappearance of the floristically rich meadow association, very unfavourable for the preservation of biocenotic diversity and genetic resources of the Park. About 130 species of vascular plants, most of them rare high-mountain plants, occur solely in glades. Some 150-200 further species grow mainly in glades and only occasionally in other habitats. It has been evaluated that a total overgrowing of the glades will result in a least a 30-35% loss of species and 30% disappearance of plant associations in Gorce National Park.

Prądnik. Prace Muz. Szafera	2	149–159	1990
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**PRZEMIANY ROŚLINNOŚCI ŁĄKOWEJ W TOKU SUKCESJI WTÓRNEJ
NA STAŁEJ POWIERZCHNI BADAWCZEJ W OJCOWSKIM
PARKU NARODOWYM**

**Changes in meadow vegetation due to secondary succession on a permanent
study plot in Ojców National Park**

ABSTRACT. The process of secondary succession, taking place as a result of abandoning all utilization, has been studied in a meadow of the association *Arrhenatheretum medioeuropaeum* for 23 years. The results yielded a decrease in the number of species from 72 to 22, a considerable fall in diversity indices, H' from 4.7 to 0.7, and in relative abundance J' , from 0.85 to 0.20. Plant biomass production increased by some 60%. The very rich meadow association has degenerated, after 23 years, into a poor association with 90% biomass accounted for by *Urtica dioica*. Tree and shrub invasion has become marked.

KEY WORDS: National Park, secondary succession, species diversity, relative abundance, meadow association.

SUMMARY

The studies on secondary succession in a meadow of the association *Arrhenatheretum medioeuropaeum* (B.r-BI. 1919) Oberd 1952 have already been conducted in Ojców National Park for 23 years. In 1964, a 2500m² surface of the meadow was fenced in and all utilization abandoned.

The floristic composition of the meadow in the consecutive years was evaluated with two methods: 1) a phytosociological record was taken over the same area each year; 2) 25 circular samples (covering 625 cm² each) were taken, the vegetation was separated into species and its dry mass was weighed. The samples were taken yearly in 1964-67, then in 1972 and 1974, and every second year starting 1977. The indices of diversity H' (after Shannon 1948), relative abundance J' (after Cody 1970) and similarity (after Jaccard's formula) were calculated to present the general trends in the succession.

Succession caused a gradual elimination of species typical for *Arrhenatheretum medioeuropaeum* meadows (Fig. 1). The total species number dropped considerably. Particular species exhibited very different trends (Fig. 2). The monocotyledones, mainly represented by grasses, increased their participation in the biomass from 52 to 75% in the first decade and then withdrew to 10%, mainly because of the massive expansion of *Urtica dioica*. The values of the indices: of similarity (Fig. 3), diversity (Fig. 4) and relative abundance (Fig. 4) systematically decreased with the course of succession. Vegetation biomass decreased in the first 4 years, later exhibiting a constant rising tendency (Fig. 5). Tree and bush seedlings

already appeared in the first years after abandoning mowing and attained the height of 70-120 cm about 1969. No young specimens of trees or bushes were observed later, for the whole meadow was covered with a thick layer of dead plant material, the expansion of the forest took place solely by the growth of the already-existing trees and bushes.

Four separate phases were observed in the analysed process of succession:

A. Degeneration phase of the associations *Arrhenatheretum medioeuropaeum*, taking place in the first 5 years. It is marked with the strong reduction on the number of species, and abrupt fall in diversity and similarity indices and in plant biomass production.

B. The phase of the formation and stabilization of the transitional community, 1968-77. It saw a slight increase in the number of species, then followed by another decrease. The indices of similarity, diversity and relative abundance gradually decrease, with periods of stability and even slight rise. A constant, visible growth is exhibited by plant biomass.

C. The degeneration phase in the transitional community and the emergence of the association with *Urtica dioica* is fairly short (1978-1982) and is accompanied by a visible decrease in the number of species. An abrupt fall is observed in the index of similarity (34 to 7%). The other two indices also exhibit a constant decrease. An abrupt rise in plant biomass is observed.

D. The phase of stabilization in the association with *Urtica dioica* starts 1983 and will most probably survive for many years. A stabilization of all processes described occurs. The number of species, diversity and relative abundance indices are very low. Similarity of floristic composition is only 1-3% in comparison with 1964.

Prądnik. Prace Muz. Szafera	2	161–173	1990
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**KONCEPCJA CZYNNEJ OCHRONY ZAGROŻONYCH
I ZMIENIONYCH ZBIOROWISK ŁĄKOWYCH NA PRZYKŁADZIE
REZERWATU PIAŚNICKIE ŁĄKI**

**Conception for an active protection of endangered and changed meadow
communities on the example on the reserve Piaśnickie Łąki**

ABSTRACT. The reserve Piaśnickie Łąki is a major association of the wet meadows included into *Molinietum medioeuropaeum* and of short sedge communities with *Carex buxbaumi*. These associations undergo a rapid degeneration and require an urgent undertaking of protective management. In order to create bases for such a practical program of protecting the plants of the reserve, the present vegetation pattern and the water relationship have been studied, and a series of archival aerial photographs have been analysed to determine the former state of vegetation. A numerical modeling of water relationships has been done. This permitted to determine the type, direction and cause of the changes, and a concrete management have been devised. They include the reintroduction of extensive mowing and a correction of the distorted water relationships in the reserve.

KEY WORDS: Piaśnickie Łąki reserve, meadow communities, degeneration of plant communities, evaluations of changes, numerical modelling, phytosociological maps, ground water table disturbance, mowing abandonment, active protection procedures, traditional meadow management, regulation of hydrological conditions.

SUMMARY

Extensive meadows of *Molinietum medioeuropaeum* are one of lowland meadow communities most endangered with extinction in Poland. This is caused by intensification of meadow management and the changes of habitats; active reserve protection is thus their only chance of survival. The basic difficulty here consists in the insufficient documentation of the state of vegetation at the creation of the reserves (especially those founded some time ago). In the conditions of presently observed degeneration of the vegetation, there appear problems in an accurate evaluation of the type of changes, their direction, rate, causes. Such information are crucial for drafting the adequate program of future protection, especially of the restitution of changed meadow communities.

Exemplary here is the reserve Piaśnickie Łąki, founded in 1959, situated on a peaty lowland near the outflow of the small river Piaśnica into the Baltic. The presently identified 18 communities there, the most important non-forest ones include *Molinietum medioeuropaeum* and community of *Carex buxbaumi* (Fig. 1)

The present study contains a discussion of methodological grounds for a program of practical vegetation protection in the reserve and constitutes an instance of the possibilities in solving the problems mentioned in the introduction with the sole use of recently gathered material.

The material included recent phytosociological data, series of archival standard panchromatic aerial photos taken in several years' intervals and hydrological maps obtained by field research and numerical modeling.

Phytosociological research yielded significant degeneration of the meadow vegetation in the reserve. An analysis of the aerial photos showed that one of the causes is the abandonment of meadow mowing. A comparison of the present hydrological situation (Fig. 2) with a reconstructed modelled one also permitted to state with certainty that the basic cause of the recent degeneration of those meadows lies in the influence of a deep drainage ditch dewatered by a pump station. The same method was used for determining the water table draw-down (Fig. 3).

Maps of causes and changes were made for a detailed determination of the direction in the vegetation changes, basing on the whole phytosociological material, aerial photos and hydrological maps. Then a map of historical real vegetation was drawn to present its state before the last period of change, i.e. when the meadows were still utilized and not dewatered. This provided a basis for a detailed determination of the changes in the communities in the particular parts of the reserve (Fig. 3). It has been determined, among others, that, because of water table draw-down, *Molinietum typicum* developed in the place of *Molinietum caricetosum buxbaumi*.

The results of the analysis of the present state of meadow vegetation and the documented causes of its degeneration gave grounds for planning concrete protection procedures. They consist in simultaneous actions in two directions: towards the renewal of the traditional meadows utilization, i.e. hay-making, and towards a change in hydrological conditions. The planned target hydrological condition of the reserve stems from the required differentiation and distribution of plant communities. This differentiation does not agree totally with the reconstructed historical real vegetation because of the partly irreversible changes in the habitats, including, however, the most valuable non-forest communities.

The modeling carried out allows to state that it is possible to create new, previously non-existent hydrobiological conditions (Fig. 6A), which would be, at the same time, optimum in terms of the strategies in the protection of the most valuable plant communities of the reserve.

Prądnik. Prace Muz. Szafera	2	175–198	1990
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**SUKCESJA WTÓRNA I PROBLEMY AKTYWNEJ OCHRONY
BIOCENOZ PÓLNATURALNYCH W PARKACH NARODOWYCH
I REZERWATACH PRZYRODY**

**Secondary succession and problems in the preservation of semi-natural
biocenoses in national parks and nature reserves**

ABSTRACT. About 1/5 of the area of Polish national parks and nature reserves is covered with semi-natural biocenoses of meadows, pastures and xerothermic grasslands. These biocenoses play a major role in the protection of diversity and gene resources of flora and fauna. The preservation of the semi-natural biocenoses, vulnerable to rapid processes of secondary succession, requires active protection. It would consist of: ensuring stable habitat conditions, systematic actions (e.g. controlled pasturing, mowing, limited fertilization, burning, cutting out scrubs), a prohibition of intensifying utilization (ploughing meadows and grasslands sowing mixed fodder plants, intensive nitrogen fertilizing, etc.).

KEY WORDS: national parks; nature reserves; semi-natural biocenoses – meadows, pastures, xerothermic grasslands; secondary succession; decrease of biocenotic diversity; species extinction; gene resources preservation; traditional land-use practices; active protection methods.

SUMMARY

Introduction

The biocenoses of semi-natural pastures, meadows, low peatbogs and xerothermic grasslands are very rich in plant and animal species. In the utilized areas, those biocenoses are rapidly disappearing now because of the intensification of agriculture and other forms of management. They will survive only in protected areas, such as national parks and nature reserves.

Presently, semi-natural biocenoses cover less than 25% of the total area of Polish national parks and reserves. This area is rapidly dwindling because of secondary succession.

The preservation of such biocenoses essential for the protection of diversity and gene resources of the country's flora and fauna in national parks and reserves. This requires the use of active methods of protection, which must be undertaken immediately. The presently observed rate of secondary succession in the associations of semi-natural grasslands, meadows and pastures shows that they will become totally overgrown with scrub and forest in the next 15-20 years.

Causes, rate and consequences of secondary succession in semi-natural biocenoses and general principles of their active protection

1. Biocenoses of glades in the national parks in the Polish Carpathians.

A recession of pasturing and mowing has occurred in meadows situated on glades in the last decades. This is why many meadow associations, often endemic for the Western Carpathians and very rich in species (e.g. *Gladiolo-Agrostietum*, *Poo-Veratretum*, *Anthylli-Trifolietum montani*) undergo a rapid secondary succession. Those associations, if not utilized and unfertilized for 10-15 years, change into a poor association with *Nardus stricta*, then with *Vaccinium myrtillus* and become overgrown with young spruce forest. The amount of time needed for a total of the meadow, depending on its area and habitat conditions, is 20-30 years. The overgrowing of the meadows with the forest leads to the decrease of biocenotic diversity in mountain national parks and threatens with extinction some 10-20% of plant and animal species present there now.

Meadow biocenoses, which developed as a result of many centuries' pasturing and mowing cannot remain there without human interference. Old methods of management should then be immediately reintroduced. Intervals in such management (pasturing, mowing, fertilizing) should not exceed 5-8 years, after which time it is difficult to recover the rich species composition. Studies and observations show that the richest species composition of flora and fauna is obtained by interchanging pasturing and mowing. Where, for technical reasons, there is no possibility of sheep and cattle grazing, the meadows should be mowed and may be removed yearly; small doses of phosphate fertilizer should be used there each 2 or 3 years.

2. Fresh and damp meadows and low peatbogs.

Most of the associations belonging here (e.g. *Arrhenatheretum medioeuropaeum*, *Cirsio-Polygonetum*, *Molinietum medioeuropaeum*, *Caricetum davallianae*) are characteristic because of their richness in species and constitute a habitat for many rare and endangered plant and animal species. In the last decades, meadow and peat biocenoses have been disappearing not only in utilized areas, but also in national parks and reserves. This is caused by the drainage of terrain, the abandoning of pasturing and mowing, and the use of intensive agriculture consisting of ploughing semi-natural meadows and sowing mixed fodder plants or very intensive nitrogen fertilizing.

Research on the present secondary succession of meadows and low peatbogs show that these biocenoses might disappear from national parks and reserves in the next 15-25 years. Their preservation requires the abandonment of terrain drainage in the vicinity of the protected areas and the reintroduction of traditional methods of mowing and pasture into meadow and peat associations.

3. Xerothermic grasslands

Semi-natural xerothermic grasslands, developed in the many centuries of pasturing and other forms of agriculture, are among the richest biocenoses in Poland. They are the only sanctuary of many very rare species representing Southern and South-Eastern geographical elements. The preservation of those associations in national parks and reserves is a major basis for the protection of the diversity and gene resources of flora and fauna. The very intensive pasturing in the past ensured the existence of such grasslands causing, at the same time, an impoverishment in species and limited flowering. Research has shown that an optimum species composition in xerothermic grasslands is maintained by pasturing them every 2nd and 3rd year. Pasturing a part of the area each year always preserves large stretches of the grasslands rich in flowers, i.e. adequate conditions for a rich insect fauna. Such a limited periodical pasturing does not totally inhibit the growth of shrubs which should be cut out from time to time.