

Zeitschrift: Veröffentlichungen des Geobotanischen Institutes der Eidg. Tech. Hochschule, Stiftung Rübél, in Zürich

Herausgeber: Geobotanisches Institut, Stiftung Rübél (Zürich)

Band: 107 (1992)

Artikel: Resources of lichens at the Bialowieta Nazional Park (N.E. Poland) and their changes

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DOI: <https://doi.org/10.5169/seals-308971>

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Resources of lichens at the Bialowieza National Park (N.E. Poland) and their changes

Stanislaw CIEŚLIŃSKI, Krystyna CZYZEWSKA and Kazimierz GLANC

1. INTRODUCTION

The Bialowieza National Park (BNP, 580 km²) is located in the centre of the Bialowieza Forest (1250 km²). It is a strict reserve of 47,5 km² (Fig. 1) which has been under protection since 1921 and one of the most valuable natural objects in lowland Europe. As a biosphere reserve (since 1977) it was included in the List of World Human Heritage (since 1979). It owes its special status in the nature of Europe and a great importance for natural studies to its properties (FALINSKI 1968, 1986, MATUSZKIEWICZ 1968):

- Similarly to the Bialowieza Forest it represents a lowland type of forest, specific for the boreo-nemoral zone. Located between Central and East Europe, it is a transition area with biogeographical, climatical and hydrographical characters of both two regions.
- It is conspicuous for its great phytosociological and ecological diversity of forest associations, well represented by one of the forest units (Fig. 1). Most of the phytocenoses are represented by subboreal or subcontinental varieties with the proportion of boreal, boreal-montane and arctic species.
- Forest associations are well preserved. The vegetation has a rich floristic composition, typical spatial structure and phytoclimate. Forests particularly abound in very old monumental trees, lichen habitats (Fig. 2), and accumulation of decaying wood.

The BNP is the only protected area of Poland where lichen resources have full taxonomic and ecological differentiation, and where natural lowland forests are still present without any marked disturbances caused by man's activity. Species which are extinct in other regions of the country, partly even occur very abundantly and exhibit full vitality (Fig. 3).

2. LICHEN RESOURCES

So far, 210 lichen species have been recorded from the Park. CIESLINSKI and TOBOLEWSKI (1988) studied 182 species. Interdisciplinary studies on proportion and function of cryptogamic plants in the forest ecosystems of the BNP

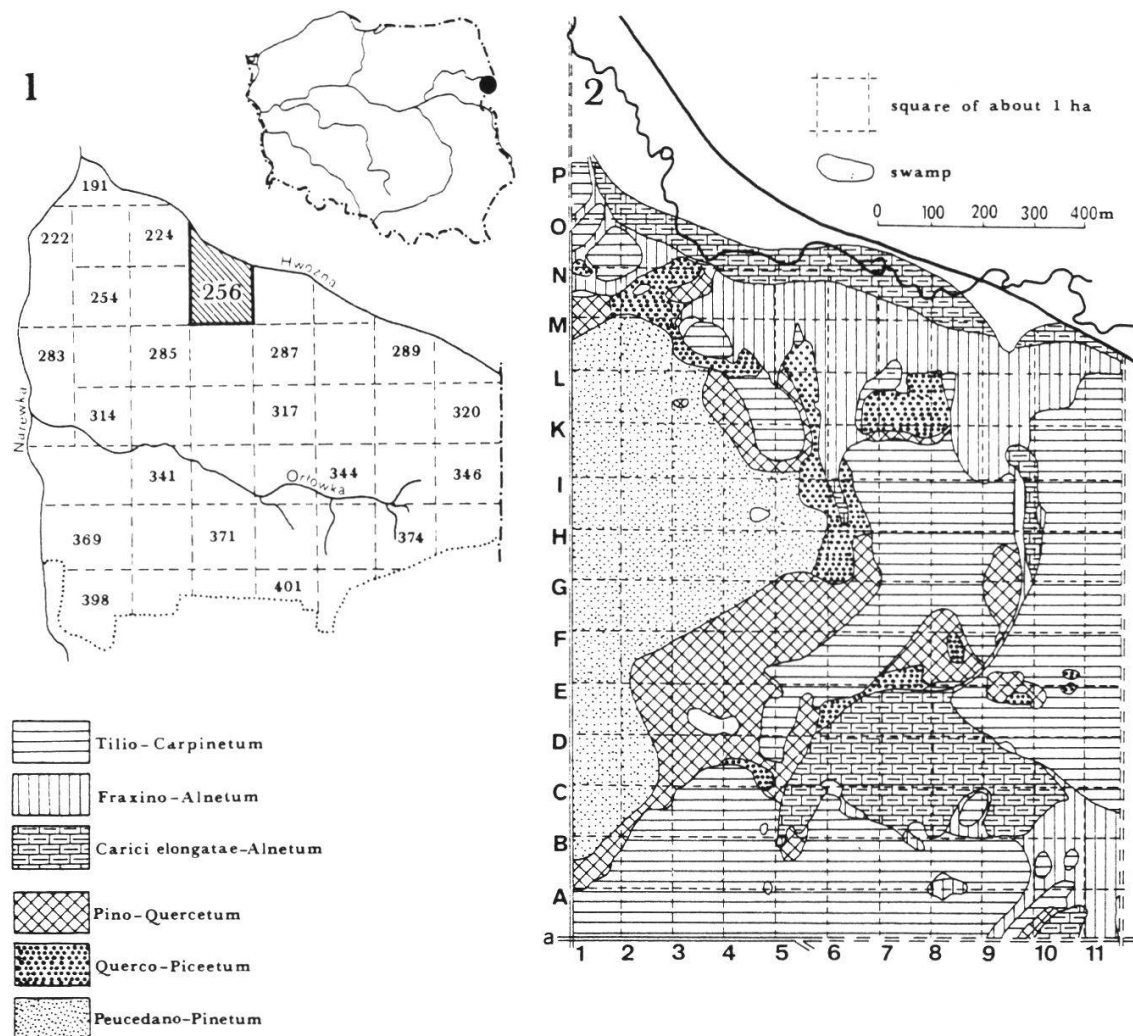


Fig. 1. The Białowieża National Park (1) and forest associations (for the division 256) (2 - RIJKEN 1976; Cartographic study - the Białowieża Geobotanical Station of the Warsaw University).

continued from 1988 to 1990 (unit 256, Fig. 1) lengthened the list of lichens for several further species.

The characteristic of BNP is its forest flora of epiphytic and rotten-wood lichens. Some common terrestrial species occur on rotten-wood in *Peucedano-Pinetum* and *Pino-Quercetum*. They may also be found in raised peat-bogs (*Sphagnetum medio-rubelli pinetosum*) and, exceptionally, directly on the ground.

Skiophytes with crustose and pulverulent thalli dominate in the great dynamics of *Carpinus betulus* and *Picea abies* which allow the interior of forest biocenoses to be characteristic of marked shade and good relative humidity of the air. Skiophytes occur abundantly or sometimes even in mass on the bark in deciduous forests (*Tilio-Carpinetum*, *Fraxino-Alnetum* and *Carici elongatae-Alnetum*): *Arthonia byssacea*, *A. spadicea*, *Arthothelium ruanum*, *Bacidia arnoldiana*, *Calicium adpersum*, *C. salicinum*, *Chaenotheca trichialis*, *Chrysothrix candelaris*, *Coniocybe furfuracea*, *Graphis scripta*, *Haematomma ochroleucum* var. *ochroleucum*, *Opegrapha niveoatra*, *O. rufescens*, *O. varia*, *O. viridis*, *O. vermicellifera*, *Pertusaria pertusa*, *P. multipuncta*, *Pyrenula nitida*, *P. nitidella*, *Thelotrema lepadinum*, and among the foliaceous forms: *Cetrelia olivetorum*, *Menegazzia terebrata*, *Peltigera praetextata* (Fig. 3). In forests (*Peucedano-Pinetum* and *Pino-Quercetum*) fairly frequent are: *Micarea melaena*, *M. elachista* and *Haematomma elatinum*, and among the

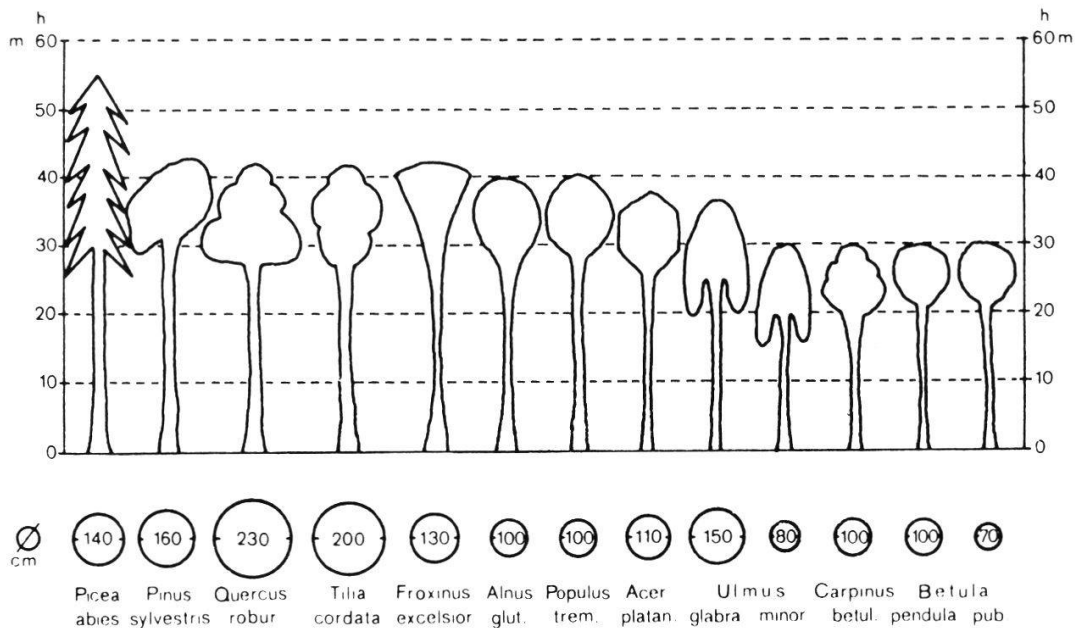


Fig. 2. Maximum size of the tree species occurring in the Bialowieza Forest (FALINSKI 1986).

foliaceous and fruticose forms *Cladonia parasitica* and *Platismatia glauca* (Fig. 3). All these species are very rare in other regions of Poland. They are only known from local stands in the Carpathians and Sudeten. Especially the upper mountain element represents a series of species, yet rare in the Park, e.g. *Evernia divaricata*, *Icmadophila ericetorum*, *Lecanactis abietina*, *Lecanora pallida*, *Lecidea turgidula*, *Schismatomma abietinum*, *Usnea florida*.

Species of the boreal-Central European type of range are characteristic of the Bialowieza Forest. Among them are the mountain species (apart from the above-mentioned): *Arthonia leucopellaea*, *Cetraria pinastri*, *Cladonia botrytes*, *Ochrolechia androgyna*, and the non-mountain lichens: *Bacidia subincompta*, *Calicium glaucellum*, *Chaenotheca brunneola*, *Ch. carthusiae*, *Ch. ferruginea*, *Ch. stemonea*, *Ch. xyloxena*, and others.

In the BNP a great concentration of subatlantic species is being observed. In Europe these are very rare and rare lichens, which occur only in forests little changed by man's activity. This is the most interesting species group. They occur on the bark of very old deciduous trees and on rotten-wood.

Apart from earlier mentioned species, deserving attention are also: *Arthonia tumidula*, *Arthothelium spectabile*, *Bacidia phacodes*, *B. polychroa*, *Bactrospora dryina*, *Catillaria graniformis*, *Coniocybe sulphurea*, *Lobaria pulmonaria*, *Ochrolechia pallescens*, *Parmelia revoluta*, *Pertusaria coronata*, *P. flavida*, *Phlyctis agelaea*, *Pyrenula laevigata*, *Schismatomma decolorans*, *Usnea ceratina*, and others. Only slight proportion in the flora of lichens is represented by subcontinental and continental species.

Likewise forest heliophilous epiphytes, especially of foliaceous and fruticose lichens, are in small proportion. They are to be met more frequently in the managed part of the Bialowieza Forest. These are, inter alia: *Bryoria crispa*, *B. implexa*, *Cetraria chlorophylla*, *Evernia prunastri*, *Pseudevernia furfuracea*, *Ramalina farinacea*, *Usnea hirta*, *U. filipendula*. In the canopy these lichens are more widespread.

The general view of the lichen flora of the BNP photophilous, coniophilous and nitrophilous forms have no greater importance, e.g. *Xanthoria parietina*, *Phyiscia aipolia*, *P. tenella*, *Caloplaca holocarpa* and others. Single localities of these species may be met in the canopy (mainly *Populus tremula*) or in loose stands.

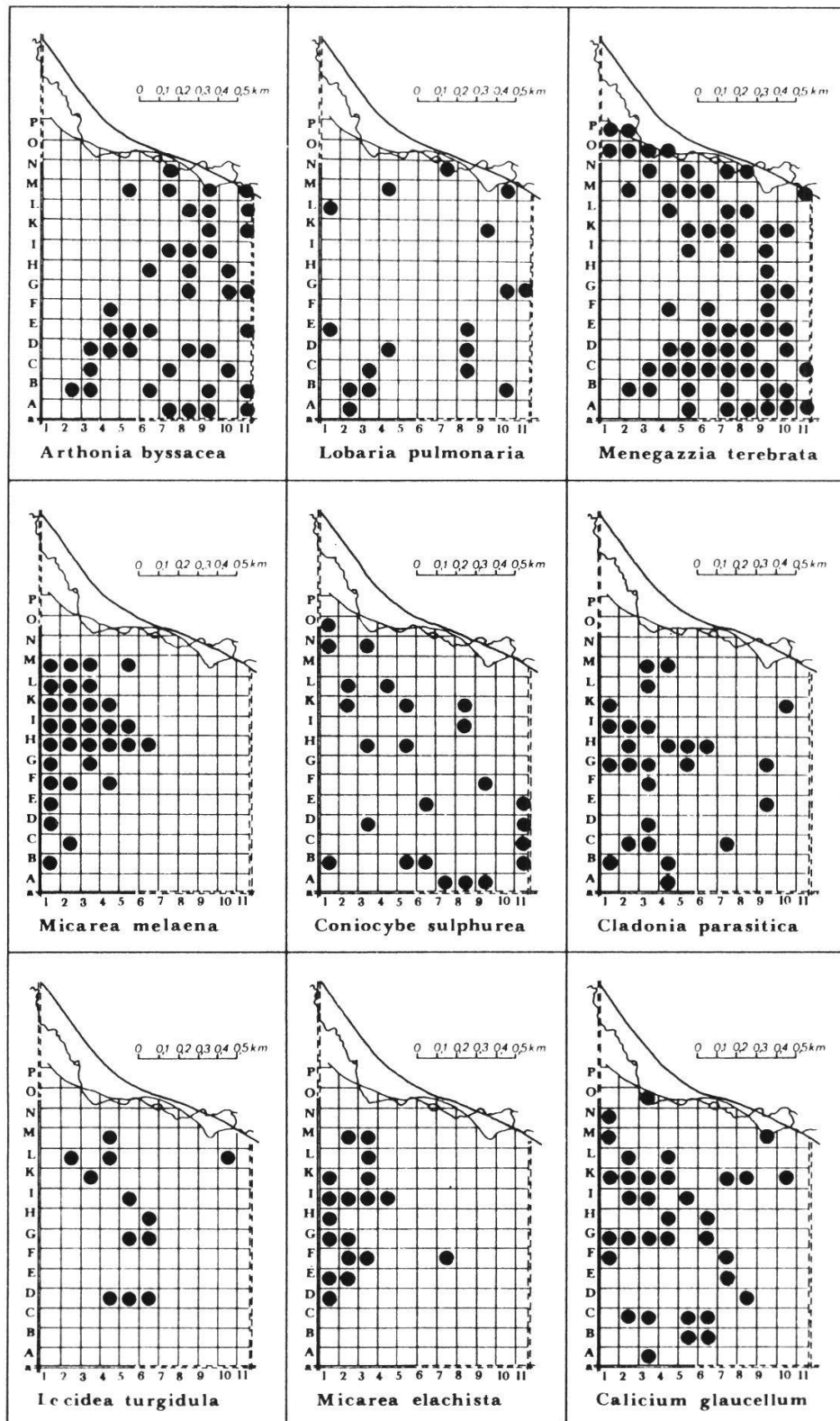


Fig. 3. Distribution of selected lichen species in the permanent study area in the Białowieża Geobotanical Station of the Warsaw University (division 256) recorded in 1988-1989.

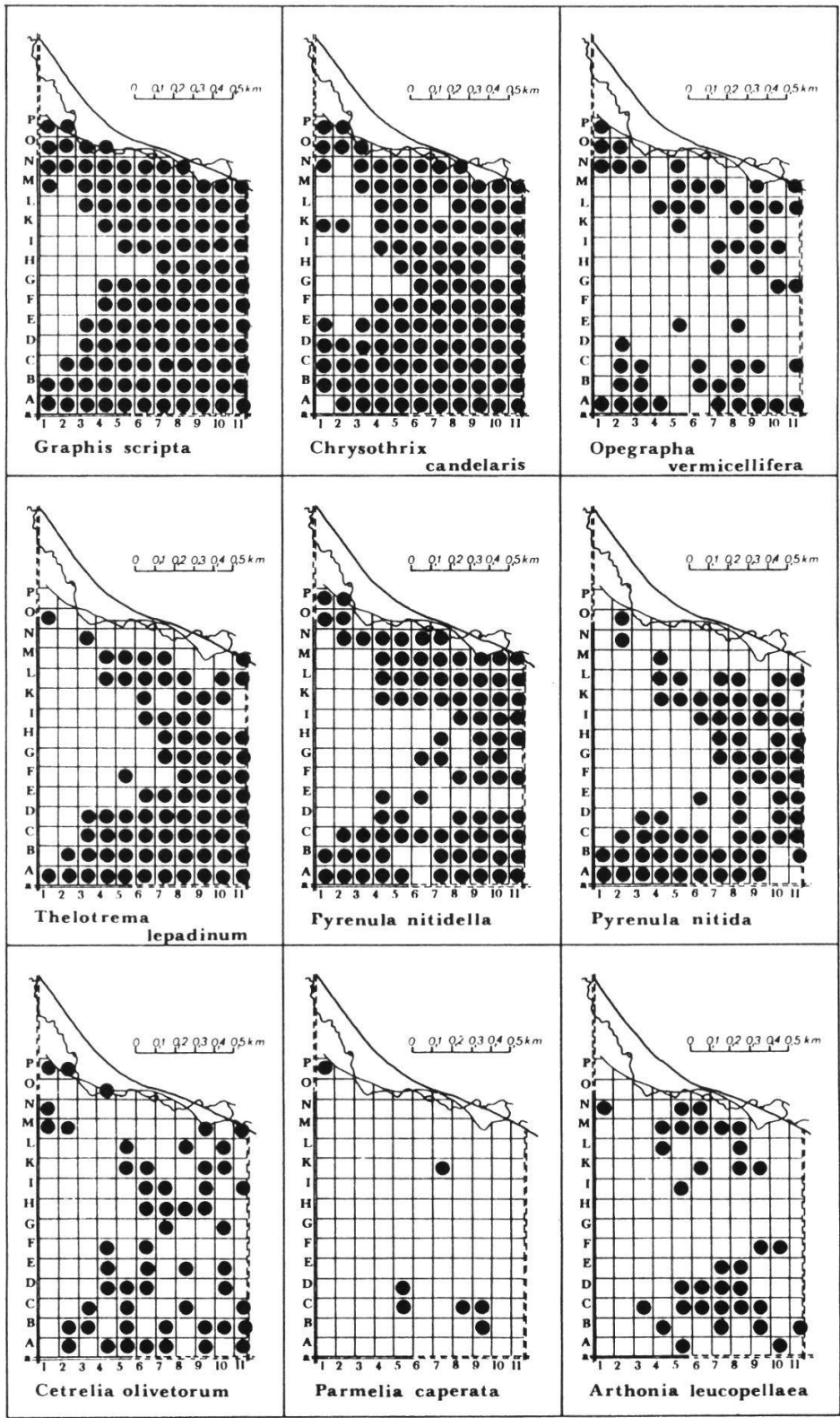


Fig. 3 (continued)

3. CHANGES IN THE LICHEN FLORA

In the past 30 years lichen resources diminished. Mainly foliaceous and fruticose epiphytes receded.

3.1. EXTINCT SPECIES

The greatest losses were suffered by the genera *Bryoria* (75% of species are extinct) and *Usnea* (60%). From 1982 to 1989 the following species have neither been recorded in the BNP nor from other parts of the Bialowieza Forest (nomenclature after BYSTREK [1986] and MOTYKA [1962]: *Bryoria cana*, *B. fuscescens*, *B. mirabilis*, *B. nidulifera*, *B. positiva*, *B. proluxa*, *B. sarmen-tosa*, *B. setacea*, *B. smithii*, *Usnea caucasica*, *U. cavernosa*, *U. distincta*, *U. esthonica*, *U. extensa*, *U. glauca*, *U. glabrata*, *U. glabrescens*, *U. graciosa*, *U. longissima*, *U. rugulosa*, *U. sorediifera*, and *U. sublaxa* (cf. Fig. 4). From this group, the boreal species *Bryoria nidulifera* and *Usnea extensa* were only known in Poland from the BNP. The disappearance of so many species of the genus *Bryoria* and *Usnea*, and also decrease in the number and occurrence frequency of the species which survived, very unfavourably effected the physiognomy of the BNP. The thalli of these lichens covering abundantly the stems and twigs were an important supplement to the biocenoses of a natural character. The lichens mentioned at the end of the 19th century by BLONSKI (1888, 1889: *Leptogium saturninum* and *Nephroma laevigatum*) are now absent from the Park and from other parts of the Bialowieza Forest. *Hypogymnia vittata* (KRAWIEC 1938), *Cladina stellaris* (FABISZEWSKI 1968), *Calicium quercinum*, and others (RYDZAK 1961) have disappeared, too.

3.2. DYING OUT AND THREATENED SPECIES

Many species are now rarer, scarcer and less vital, e.g. *Icmadophila ericetorum* abundantly covered rotten oaks (BLONSKI 1888). In 1988, only two localities have been found in the Bialowieza Forest.

Another frequent lichen was *Lobaria pulmonaria* which occurred on the bark of various trees (e.g. *Picea abies*). It grew markedly big thalli which produced numerous fructifications. At present, this lichen is still frequent (Fig. 4), but it shows characteristics of dying species: small thalli, parts of thalli squeezed in the cracks in the bark and usually in the upper parts of stems and twigs. No specimens with apothecia have been found. Similar properties were

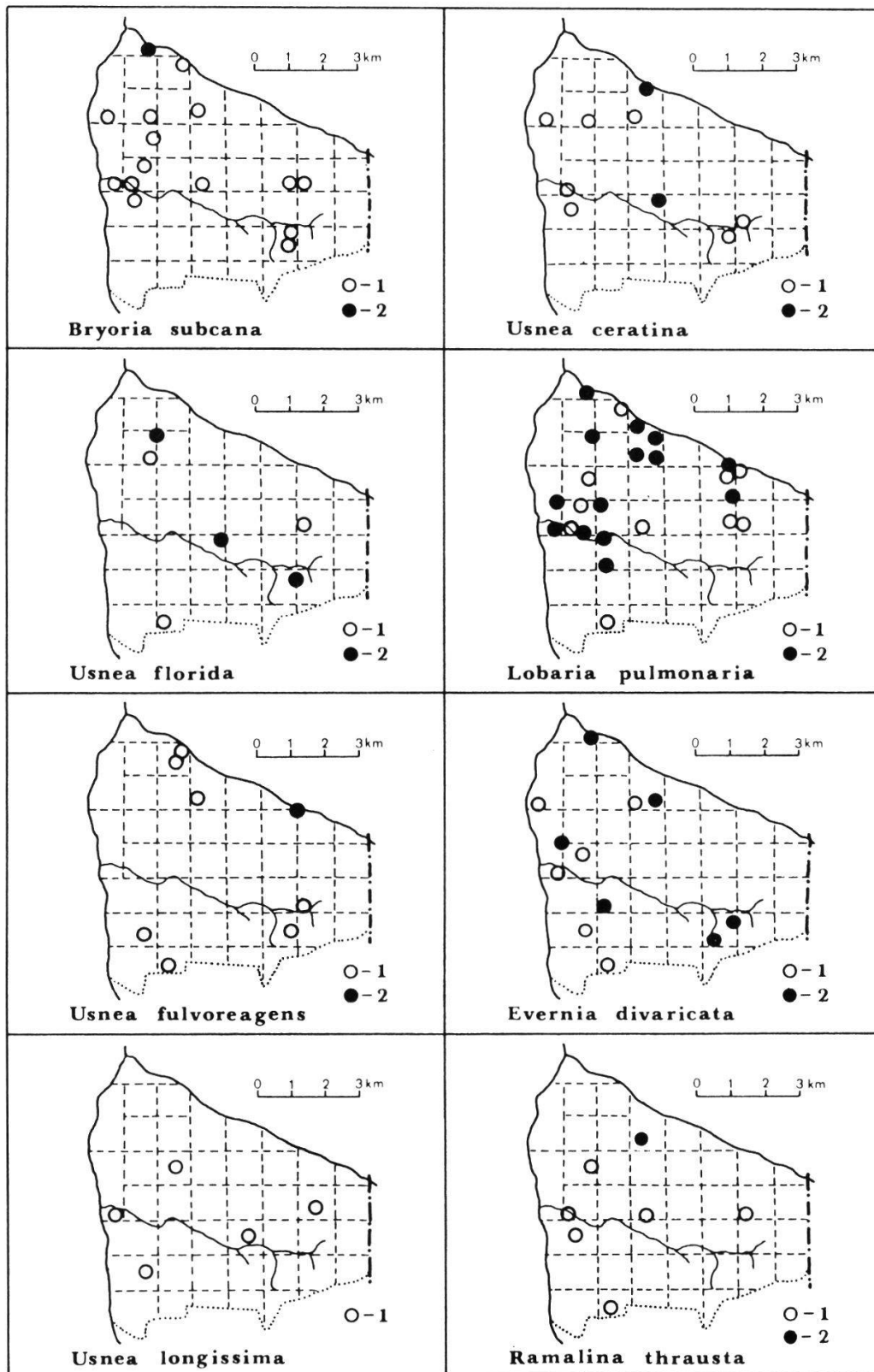


Fig. 4. Localities of selected lichen species from 1953 until 1955 (1) and from 1982 until 1989 (2) (LECEWICZ 1954, RYDZAK 1961, CIESLINSKI and TOBOLEWSKI 1988; and authors' own studies).

observed on *Evernia divaricata*, *Lobaria scrobiculata*, *Parmelia caperata*, *P. exasperata*, *P. revoluta*, *Usnea ceratina*, *U. florida*, *U. fulvorea*, *U. lari-cina*, and among the crustose forms *Arthonia tumidula*, *Buellia disciformis*, *Chaenotheca brunneola*, *C. carthusiae*, *C. stemonea*, *C. xyloxena*, *Lecanactis abietina*, and others. These lichens are very rare at present. Many of them are yet extinct in other parts of the country.

The vitality of some widespread species has also decreased and especially the ability to produce fructifications is declining. In the past, the thalli and the fructifications collected from *Hypogymnia physodes*, *Evernia prunastri*, *Parmelia sulcata*, *Ramalina farinacea* and *Usnea filipendula*. Currently, these specimens are absent in the Bialowieza Forest.

4. CONCLUSIONS

It is very difficult to protect the whole specific variety of lichens, even in areas under a long-term strict protection. The impoverishment of the lichen flora in the Bialowieza National Park has its particular significance: the lichens as good indicators of environmental conditions, demonstrated that the most natural forests which have been preserved in the lowlands of Europe are also exposed to degeneration processes.

The Bialowieza National Park is situated in the centre of a forest complex far away from urban agglomerations or industrial centres. The sources of the floristic impoverishment have to destructive, extralocal, anthropogenic factors, such as intensification of global and regional air pollution, changes in local climates, water and soil relations.

SUMMARY

In the lowland of Central Europe the Bialowieza National Park is remarkable for its rich and diversified flora of epiphytic and epixylous lichens. A great number of species, extinct in other regions of Poland, still exist here. In recent years, unfavourable changes have been observed in the flora of lichens in the Park. Some foliaceous species (e.g. *Leptogium saturninum*, *Nephroma laevigatum*, *Hypogymnia vittata*) and *Bryoria* and *Usnea* have disappeared.

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