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## **Lichen indication in the Przemyśl District (S.E. Poland)**

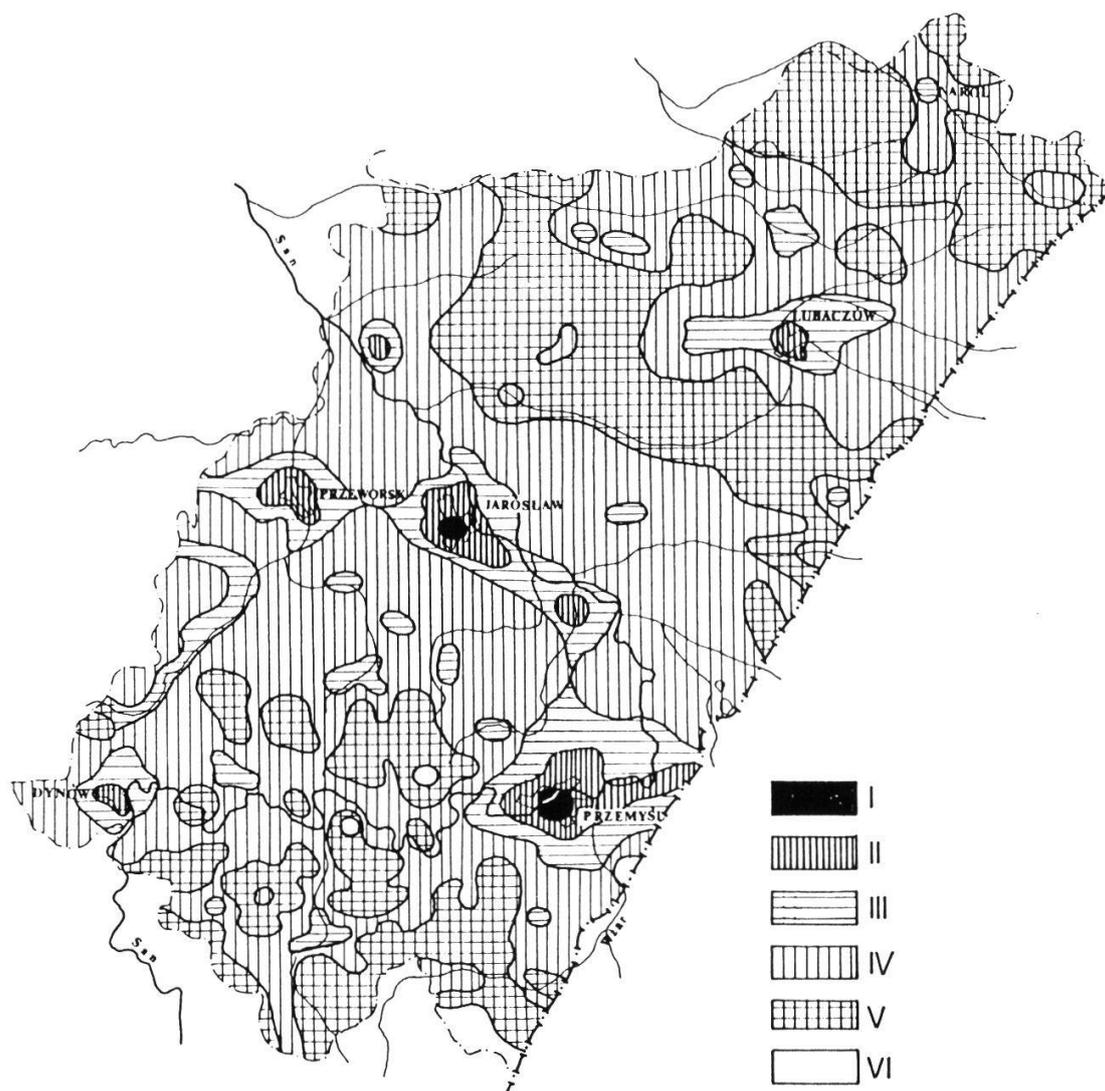
Jozef KISZKA

Studies on epiphytic lichens carried out in 1986 in the Przemyśl District aimed at elaborating a lichen indication map. A map of the Przemyśl District on the scale of 1:100'000 was divided into plots of 2 km<sup>2</sup> for wood, and 4 km<sup>2</sup> for woodless areas (arable fields, meadows, etc.). In each plot the number of epiphytic lichens in stands, the morphological appearance of their thalli (healthy, degenerating, decaying), and also their abundance on the trunks of various tree species was established. The data collected in each square were compiled in files. Information on epiphytic lichens was correlated with indicator species (Table 1) of the zone scale by HAWKSWORTH and ROSE (1970) adapted for the Polish flora (KISZKA 1977, 1990). Squares of identical scale degrees were connected by means of isolines and thus six lichen indicator zones were distinguished in the Przemyśl District (Fig. 1).

Mean SO<sub>2</sub> levels in the winter months corresponding to the zone scale degrees are given in Table 2. Differences in values of SO<sub>2</sub> in respective degrees of the scale are stimulated, inter alia, by climatic differences between England and Wales (Atlantic climate) and Southern Poland (a more continental climate). It should be noted that the data are only an estimate, since in the natural environment the air is likely to contain various phytotoxic compounds such as HF, H<sub>2</sub>S, NO, NO<sub>2</sub> and some others, which synergetically affect the lichen thalli.

In the Przemyśl District where zone I and II have a very high SO<sub>2</sub> level in the air, the epiphytic lichen flora no longer occurs or it is confined to a few, strongly resistant taxa of the zone scale 2 and 3 (Table 1). Even in zone VI,

where the epiphytic lichens are fairly abundant (zone scale 7), according to Table 2 winter  $\text{SO}_2$  level in the air should be  $40 \mu\text{g}/\text{m}^3$ . In the district under study,  $\text{SO}_2$  in the air is emitted from local sources, from other territories of Poland and adjacent countries.



**Fig. 1.** The six lichen indicator zones in the Przemysl District.

- I Very strong degradation of ecological conditions of the natural environment. Zone scale 0-1.
- II Strong degradation of ecological conditions of the natural environment. Zone scale 2-3.
- III Marked degradation of ecological conditions of the natural environment. Zone scale 4.
- IV Strong influence of zones degenerated by the inflow of polluted air. Zone scale 5.
- V Marked influence of polluted air on the natural environment. Zone scale 6.
- VI Perceptible influence of air pollution on the natural environment. Zone scale 7.

**Table 1.** Zone scale for the epiphytic lichens by HAWKSWORTH and ROSE (1970) adapted for the Polish flora (KISZKA 1990).

scale	acid or slightly acid bark	neutral and basic bark
0	epiphytes absent	epiphytes absent
1	<i>Desmococcus viridis</i> s.l. present	<i>Desmococcus viridis</i> s.l. extends but confined to the base up the trunk.
2	<i>Desmococcus viridis</i> s.l. extended up the trunk. <i>Lecanora conizaeoides</i> confined to the base. Thalli of <i>Lecanora conizaea</i> , <i>Bacidia chlorococca</i> , <i>B. albescens</i> and <i>Lepraria</i> occur rarely.	<i>Lecanora conizaeoides</i> abundant. <i>Lecanora expallens</i> , <i>Bacidia chlorococca</i> , <i>Buellia punctata</i> , <i>Lecanora sarcopsis</i> , and <i>Lepraria aeruginosa</i> occur occasionally.
3	<i>Lecanora conizaeoides</i> frequent even up the trunk. <i>Cladonia coniocraea</i> and less frequently, <i>Cladonia macilenta</i> or <i>C. bacillaris</i> , occur on the bases. <i>Lecanora conizaea</i> , <i>Bacidia chlorococca</i> , <i>B. albescens</i> , <i>Lecidea flexuosa</i> and <i>Lepraria aeruginosa</i> also occur.	<i>Lecanora conizaeoides</i> and <i>Buellia punctata</i> abundant. <i>Lecanora conizaea</i> , <i>L. sarcopsis</i> , <i>L. expallens</i> and <i>Bacidia chlorococca</i> less numerous. Degenerated thalli of <i>Physcia ascendens</i> appear on the bases in the fissures of the bark.
4	<i>Hypogymnia physodes</i> , <i>Parmelia saxatilis</i> , <i>P. sulcata</i> occur on the degenerated thalli at the bases. <i>Lecanora expallens</i> , <i>Lecidea scalaris</i> , <i>Chaenotheca melanophaea</i> appear. Species of the 3rd scale degree are dominant on the trunks.	<i>Physcia ascendens</i> , <i>Ph. tenella</i> , <i>Ph. orbicularis</i> , <i>Xantoria parietina</i> , <i>X. polycarpa</i> , occur on the bases. <i>Physcia grisea</i> , <i>Lecanora chlorotera</i> , <i>Hypogymnia physodes</i> and <i>Parmelia sulcata</i> with the degenerated thallus appear.
5	<i>Hypogymnia physodes</i> , <i>Parmelia saxatilis</i> , <i>P. sulcata</i> extend to 2.5 m or more up the trunk. <i>Parmeliopsis ambigua</i> , <i>P. aleurites</i> , <i>Lecanora pinastri</i> , <i>L. chlorotera</i> , <i>L. carpinea</i> become established. Innumerable degenerated thalli of <i>Evernia prunastri</i> , <i>Ramalina farinacea</i> , <i>R. pollinaria</i> and <i>Cetraria glauca</i> appear.	<i>Physcia enteroxantha</i> , <i>Ramalina farinacea</i> , <i>Evernia prunastri</i> , <i>Opegrapha varia</i> , <i>Lecanora chlorotera</i> , <i>L. carpinea</i> , <i>Physcia stellaris</i> occur with the species of the 4th scale. The degenerated thalli of <i>Parmelia acetabulum</i> , <i>P. exasperatula</i> and <i>Candelaria concolor</i> appear.
6	<i>Parmelia caperata</i> appears on the bases with degenerated thalli. Thalli such as: <i>Pseudevernia furfuracea</i> , <i>Evernia mesomorpha</i> , <i>Alectoria</i> sp. appear. <i>Usnea hirta</i> , <i>U. dasypoga</i> , <i>Graphis scripta</i> , and <i>Parmelia dubia</i> degenerated. <i>Lecanora</i> , <i>Lecidea</i> and <i>Pertusaria</i> abundant.	<i>Physcia pulverulenta</i> , <i>Ph. aipolia</i> , <i>Anaptychia ciliaris</i> , <i>Parmelia scortea</i> , <i>Acrocordia alba</i> and <i>A. biformis</i> appear. <i>Candelaria concolor</i> , <i>Physcia enteroxantha</i> , <i>Ph. stellaris</i> and some other abundant on the trunks.

**Table 1** (continued)

scale	acid or slightly acid bark	neutral and basic bark
7	<i>Parmelia caperata</i> , <i>P. dubia</i> , <i>Pseudevernia furfuracea</i> abundant. Thalli such as: <i>Parmelia cetrarioides</i> , <i>P. revoluta</i> , <i>Normandina pulchella</i> , <i>Usnea florida</i> and other species from the genus <i>Usnea</i> , <i>Ramalina</i> and <i>Alectoria</i> .	<i>Physcia pulverulenta</i> , <i>Ph. aipolia</i> , <i>Anaptychia ciliaris</i> , <i>Bacidia rubella</i> , <i>Ramalina fastigiata</i> , <i>Acrocordia alba</i> and a series of species with a foliose or crustose thallus.
8	Thalli of <i>Usnea ceratina</i> , <i>Menegazzia terebrata</i> , <i>Hypogymnia vittata</i> , <i>Parmelia arnoldii</i> appear, species of the 7th degree abundant.	<i>Ramalina fraxinea</i> , <i>Caloplaca cerina</i> , <i>C. herbidella</i> , <i>C. ochroleuca</i> , <i>Gyalecta truncigena</i> and <i>Parmelia laciniatula</i> appear, species of the 7th degree abundant.
9	Thalli of <i>Lobaria pulmonaria</i> , <i>Pachyphiale cornea</i> appear, species of the 7th and 8th degree dominant on the trunks and branches.	<i>Ramalina fraxinea</i> dominant, <i>Physcia leptalea</i> , <i>Caloplaca aurantiaca</i> and a series of the above mentioned species.
10	<i>Lobaria amplissima</i> , <i>L. scrobiculata</i> species of the genus <i>Sticta</i> , <i>Nephroma</i> and <i>Pannaria</i> , numerous taxa of the 8th and 9th degree.	Species of the 8th and 9th degree with no signs of degeneration.

**Table 2.** Mean winter SO<sub>2</sub> µg/m<sup>3</sup> concentration for England and Wales by HAWKSWORTH and ROSE (1970) and for Poland (KISZKA 1990).

zone scale	mean SO <sub>2</sub> µg/m <sup>3</sup> concentration	
	England and Wales	Southern Poland
0	over 170	about 200
1	about 170	170-200
2	about 150	about 170
3	about 125	about 150
4	about 70	about 100
5	about 60	about 70
6	about 50	about 50
7	about 40	about 40
8	about 35	about 35
9	below 30	below 30
10	"pure"	"pure"

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