

## Lichen Mapping in Austria

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With 6 figures

ARNOLD'S "Lichenologische Ausflüge in Tirol (1868–1897)" represent the first attempt to investigate the lichen flora and the phytogeographical differences in the distribution of lichens in the Alps. The results of his intensive floristic and taxonomic research were compiled by DALLA TORRE & SARNTHEIN (1902) in "Die Flechten (Lichenes) von Tirol, Voralberg und Liechtenstein" and they are still an important basis for the study of lichen distribution and the changes of lichen flora caused by anthropogenic influences. In the 19th century POETSCH & SCHIEDERMAYR (1872) and SCHIEDERMAYR (1894) published a review on the lichen flora of the Austrian province Upper Austria and SAUTER (1872) of the Salzburg province.

Although many lichenological collections have been made in the Austrian Alps during the last three decades, only a few surveys on the distribution of selected lichen species occurring in Austria or certain provinces have been published (e. g. SCHAUER 1965, KALB 1970, BUSCHARDT 1979). Since 1975 comprehensive mapping studies on lichens were started in Austria, following the appeal by PHILIPPI & WIRTH (1973). The grid system used for the floristic lichen mapping is described by NIKLFELD (1971).

Until now the results have been published for two provinces: Upper Austria (TÜRK & WITTMANN 1984) and Salzburg (TÜRK & WITTMANN 1987). In Upper Austria especially macrolichens were studied with regard to air pollution and other human impacts (agriculture and forestry). A grant of the "Fonds zur Förderung der wissenschaftlichen Forschung (Project Nr. 5764)" enabled us to intensify our efforts in lichen mapping especially in the province of Salzburg, where we have so far registered more than 1300 species of lichens and lichenicolous fungi. Such a work cannot be carried out without support and assistance by lichenologists from other universities in Austria (Graz, Innsbruck) and other institutions (Vienna).

Substantial progress in lichen mapping in Austria has been made by the field meetings of the "Bryologisch-Lichenologische Arbeitsgemeinschaft für Mitteleuropa" in different provinces of Austria. All participants of these meetings placed the lists of lichens collected at the different localities at our disposal. The results of the excursions with a remarkable number of registered species were published by HEISELMAYER & TÜRK (1979; Salzburg, Flachgau), POELT & TÜRK (1984; Salzburg, Lungau) and MAYRHOFER et al. (1989; Vorarlberg). The publication of the last field meeting in Eastern Tyrol is in preparation (HOFFMANN & GÄRTNER). Further details on floristic work in Austria are given by HAWKSWORTH & AHTI (1990). At present about 65.000 records for 1.800 taxa of lichens and lichenicolous fungi have been registered. We expect that the number of lichen species will rise to 2.000 or more after our investigations on the lichen flora of the climatically more favourable regions of Austria, especially of the lowlands of Lower Austria and Burgenland.

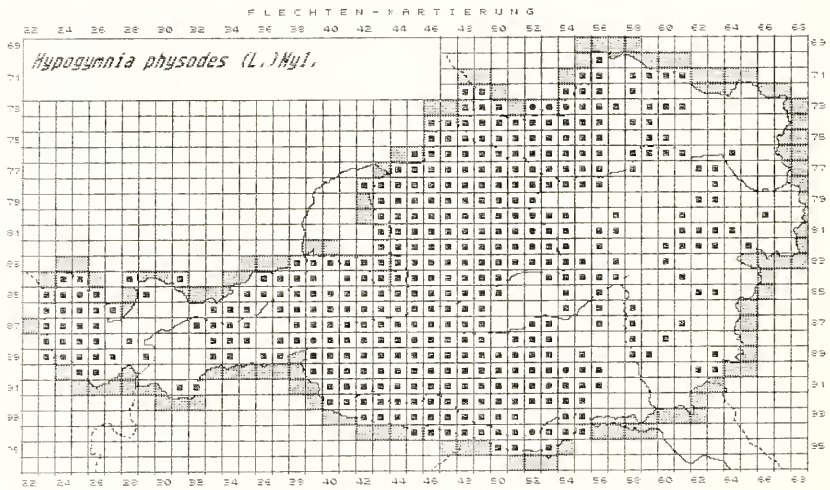
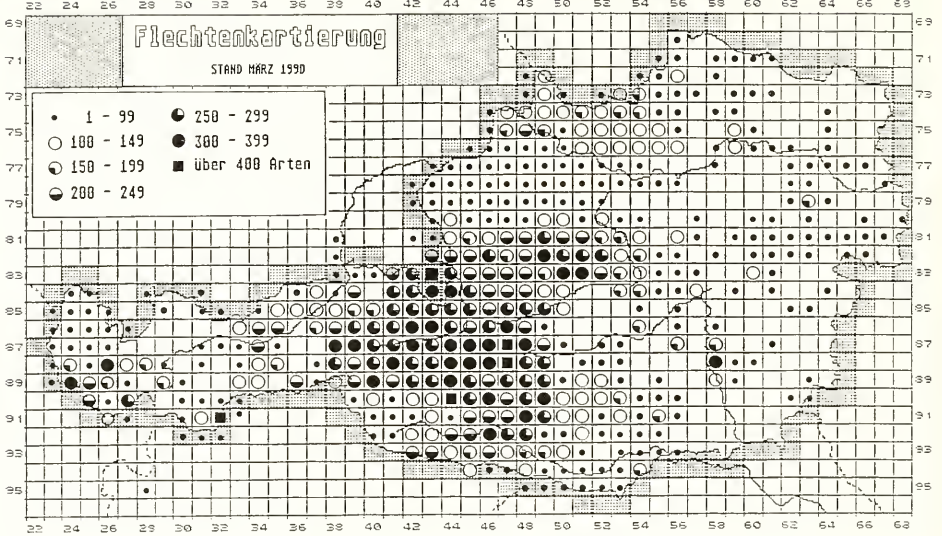
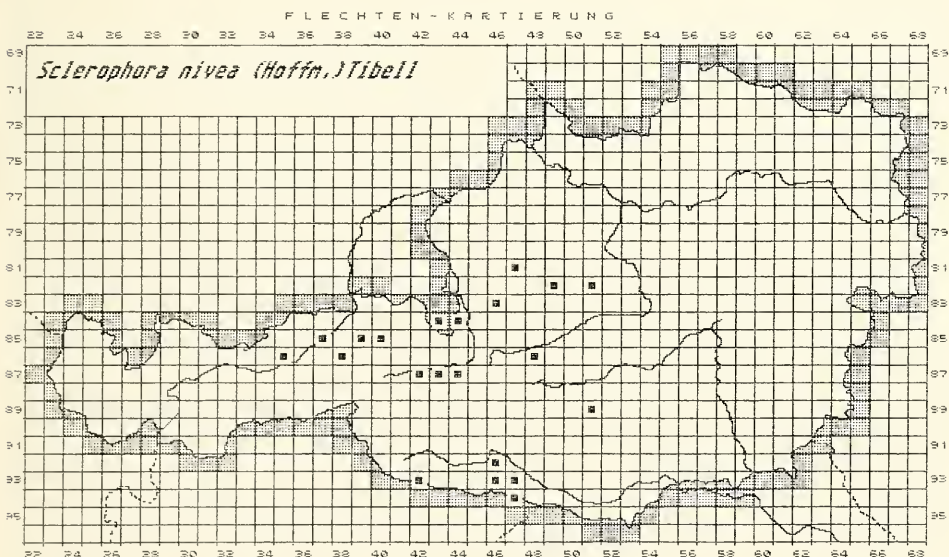
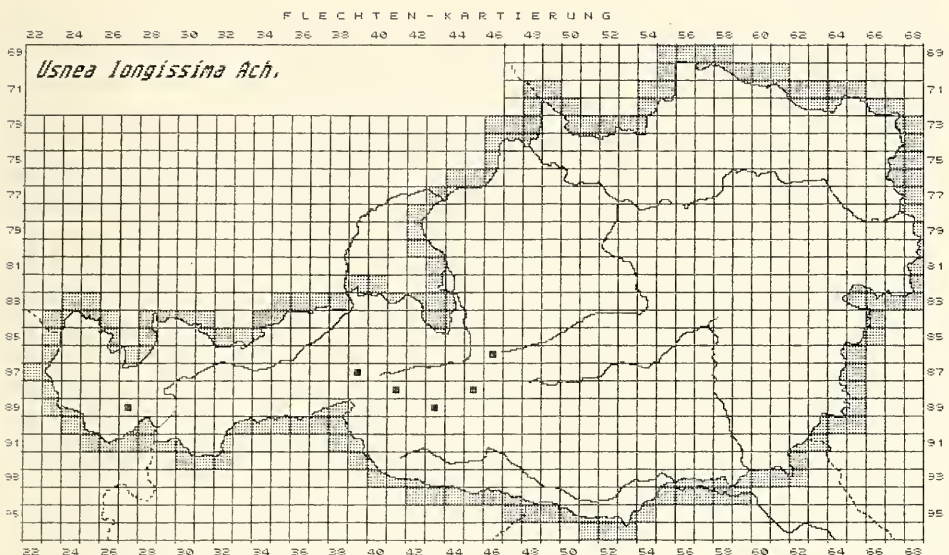


Fig. 1. (above) Grid-map of Austria with the numbers of recorded lichen species per mapping unit.

Fig. 2. *Hypogymnia physodes* (L.) Nyl.; actual distribution.



Figs. 3-4. Actual distribution of 2 lichen species. - 3. *Usnea longissima* Ach.; - 4. *Sclerophora nivea* (Hoffm.) Tibell.



Since 1989 data are stored on computer files. A special programme (HARTL & RADIC 1989; „BIODAT“) enables us to store the large database and to print the distribution maps of any registered species occurring in Austria as well as in the separate provinces. The distribution maps show the distribution of lichens recorded since 1975. The integration of pre-1975 data from lichen herbaria and literature is planned for the next three years. In addition to a bibliographical survey, our goal is to demonstrate the change of the lichen flora in Austria during the last hundred years.

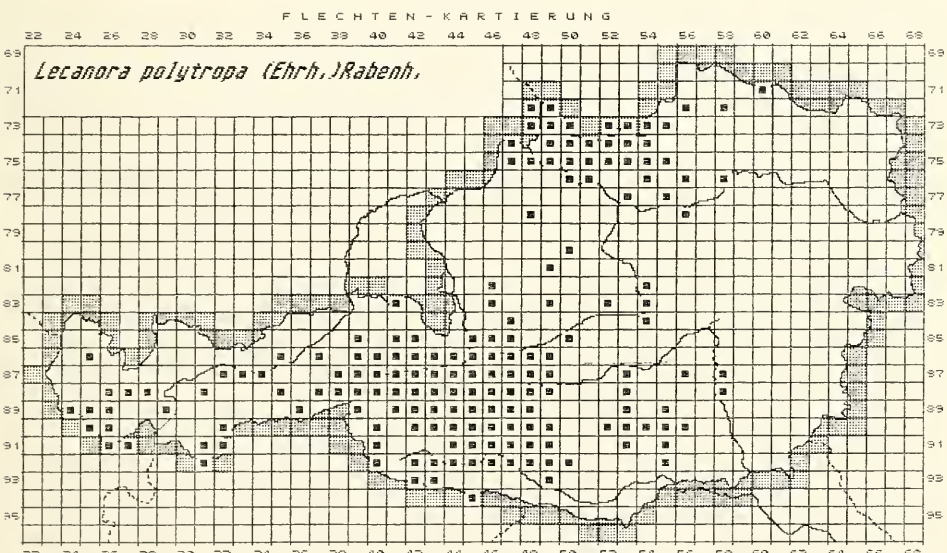
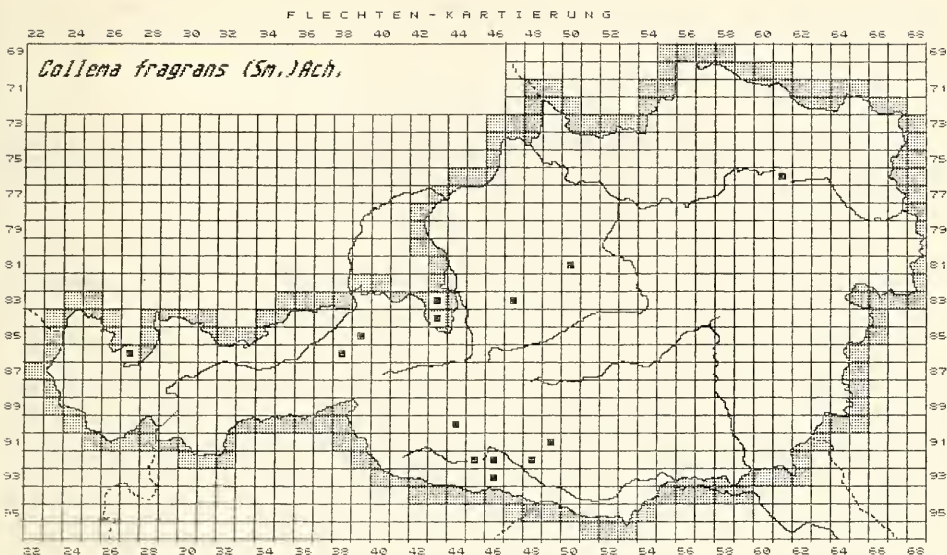
The total area of Austria is 83.849 km<sup>2</sup> and it covers 702 recording units of the mapping grids of Central Europe (10' longitude, 6' latitude). 65% of the total area is mountainous with altitudes of more than 1.000 meters. The varied topography at the edges of the Alps and within the Alps implies a high climatic and geological diversity. Precipitation rates vary from 500 to 2.800 mm per year. Due to the geological and climatical diversity lichens with extreme ecological demands can occur. The lichen flora includes oceanic and continental species as well as acidophilous and basiphilous species.

The total number of lichen species of the different grid squares is shown in Fig. 1. Whereas the number of lichen species recorded per grid square is relatively low in the Prealps (between 50 to 100 species), it rises significantly in the northern margins of the Alps and increases to more than 500 species in the Central Alps. The distribution map of the widely distributed lichen *Hypogymnia physodes* (Fig. 2) shows where mapping studies have been carried out and where information is lacking. The species number per grid square not only shows the degree of human impact on the terrestrial ecosystems but also serves as a criterion for the evaluation of landscape quality. The more microhabitats suitable for lichen colonization are preserved in a region the higher is the species diversity in the investigated area. Thus Fig. 1 illustrates the intensity of the land use and vice-versa the natural environmental quality of a region.

At the northern border of the Alps many sensitive lichen species show visible damage caused by far range immissions of SO<sub>2</sub> up to an elevation of 1.400 to 1.700 m. This SO<sub>2</sub>-pollution took place mainly in the winter 1984/85 and 1985/86 and injured primarily the large lobed lichens *Lobaria pulmonaria*, *Cetrelia cetrarioides*, *Parmelia* spp., *Peltigera* spp., and fruticose species. In some regions the entire macrolichen flora was damaged so severely, that in some cases the extinction must be assumed (WITTMANN & TÜRK 1988). During the last three winter periods this type of far range pollution did not appear and those lichens which were not lethally damaged showed a significant degree of recovery. After a period of one to one and a half years lobulae grew out from damaged lobes and showed a healthy development.

The preliminary results of the mapping studies are presented in the following distribution maps for some selected species in Austria. A very rare lichen is *Usnea longissima* (Fig. 3) which was formerly much more frequent than now. This species is highly affected by modern forest practices and air pollution by gaseous pollutants and acid rain.

*Sclerophora nivea* (Fig. 4), a tiny crustose lichen with stalked, white apothecia grows on the bark of old trees (mainly *Acer pseudoplatanus*, *Fraxinus excelsior* and *Ulmus* spec.) in stem flow furrows. The bark must have a high water retention capacity. Thus *Sclerophora nivea* settles on old trees with softened bark and in regions with high relative humidity. The combination of all these factors is relatively rare as shown in Fig. 4. This lichen is widely distributed in the Austrian Alps.



Figs. 5–6. Actual distribution of 2 lichen species. — 5. *Collema fragrans* (Sm.) Ach.; — 6. *Lecanora polytropa* (Ehrh.) Rabenh.

A further example for a rare resp. easily overlooked lichen, is *Collema fragrans* (Fig. 5) with similar ecological demands as *Sclerophora nivea*. This lichen is mainly distributed in the montane zone of the Alps. Outside the Alps *Collema fragrans* occurs in the Danube valley on old ash trees in floodplain forests.

*Lecanora polytropa* is a common saxicolous lichen on acidic to slightly acidic rocks from the lowlands up to the alpine zone. Its natural distribution is on granitic rocks of the Bohemian Mass (northern region) and on shale, Gneis and sandstones in the

Alps (Fig. 6). In the Prealps *Lecanora polytropha* can occasionally be found on granitic tombstones and on old tiles.

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