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nate. The causes for the absence of the herbaceous undergrowth are — not to speak of the leaf carpet — sundry: a) poor soil with but a little humus, b) great dryness of the slope, c) a rather deep shade, and d) game destroying the undergrowth. Fungi are abundant, often present are *Strobilomyces*, *Craterellus*, *Hydnum repandum* and many others; on dead trunks *Polyporus fomentarius* grows in great abundance. The herbaceous undergrowth mostly is entirely lacking; I came across some green vegetation only in one lighter place, close to some uprooted trunks, full of *Polipori*. *Sambucus nigra* grows here as well as *Stachys alpina*, *S. silvatica*, *Impatiens noli tangere*, *Senecio Fuchsii*, *Paris quadrifolia*, *Monotropa hypopitys* var. *hypophegea*, rarely *Asperula odorata*, scattered *Dentaria bulbifera*, but further in the dense beech forest we see again only a bare leaf carpet, only in the highest beech forest zone the ground vegetation increases but consists mainly only of *Mercurialis perennis* which occurs here very gregariously, and scattered are *Calamagrostis arundinacea* and *Glechoma hirsuta*.

We recognise this bare-floor beech forest, therefore, as a very impoverished stage of the woodruff sociation.

8. Also on the eruptive, comparatively dry soils of middle Slovakia, bare-floor or half-bare-floor beech forests are very frequent. R. M i k y š k a <sup>(1)</sup> describes them from the Štiavnické Středohoří Mts. and states that, on an average, more than 90% of the floor is devoid of any ground vegetation. Many species grow here with a diminished prosperity and occur usually isolated, only exceptionally in small clans (*Asperula odorata*, *Asarum europaeum*, *Mercurialis perennis*, *Oxalis acetosella*). The individuals of these bare-floor beech forests usually occupy large areas in this territory; they occur mostly on sloping grounds covered by a thicker continuous leaf carpet, and on drier soils; but exceptions are not very rare. Even though the floristic composition seems to be more or less casual, it is evident that they are only impoverished types of beech forests common in the Štiavnické Středohoří Mts.

### XIII. Degraded and spurious beech forests.

A detailed study of the beech forests in various parts of our state shows that normal beech forests under favourable conditions, even

though they do show far-reaching differences in their undergrowth, agree in that they exclude Hercynian spruce forest elements, especially those of the heath character. Whenever these elements are present, it is usually due to the influence of forest culture, to other antropical agents, to the penetration onto roads and paths, openings and clearings, or sometimes to the quite special habitat conditions, that is to the degradation of the soil, its podzolation and increase in acidity. This degradation, it is true mostly secondary and antropical, may, however, also be natural. Especially near the upper forest limit this phenomenon is sometimes evident, but even here it is often brought about not only by the humid climate but also by the penetration of the spruce; in such a manner a mosaic of two entirely different consociations may arise which is not rarely incorrectly combined into one sociation. *Vaccinium* species always avoid the true beech forests and in the beech forest areas are usually entirely lacking. Their occasional presence may be due to a siliceous substratum forming an acid soil. Thus I noticed, in the Pieštany hills, a mossy *Myrtillium* only in one place on Permian quartzites, whereas in the neighbouring dolomitic Tematin hills, *Vaccinium myrtillus* (of course also *V. vitis idaea*) is entirely missing; in the dolomitic Rokoš group, I discovered *V. myrtillus* only quite locally in the Striebornica valley near Uhrovec on a loamy, non-limy layer, etc. By soil degradation, caused by forest culture, a succession is often produced, leading to these Hercynian types. Since all these types are foreign to true beech forests, I designate the respective beech forests as spurious (*Fagetum spurium*), as a distinct group of sociations, or as degraded (*Fag. degradatum*), inasmuch as there is an evident correlation to the deterioration of soil, eventually also, the bioclimatic conditions.

Already the three first types described by Hilitzer (<sup>1</sup>, p. 5—7) from the Český Les Mts. in the neighbourhood of Kdyně, belong to impoverished atypical beech forests, brought about by dryness and likely also by antropical influences. They are of the *Majanthemum* type, which in the first case is developed as a *Fagetum nudum* only with very solitarily scattered *Majanthemum bifolium*, *Hieracium murorum*, *H. vulgatum*, *Veronica officinalis*, *Poa nemoralis*. The second case pertains to a thinned beech forest in which solitarily occur also *Calamagrostis epigeios*, *Polygonatum verticillatum*, *Epipactis latifolia* and *Pirola secunda*. The third table, the result of 10 analyses

on the ridge below Koráb (at about 730 meters altitude) and one on Mt. Herštý, represents best this *Majanthemum* type in which the leading species shows the greatest dominance; it is constantly accompanied by *Hieracium murorum*, sometimes by *Poa nemoralis* and occasionally by some other species, mostly of the beech forests.

Also the *Oxalis Majanthemum* type, described by Klika (<sup>1</sup>, p. 49) from the Velká Fatra Mts., is already a rather impoverished beech forest type of more xerophytic character and floristically poor. Of grasses, *Poa nemoralis* is characteristic, sometimes even *Vaccinium myrtillus* is present, indicating less favourable soil conditions.

Another type of beech forests from the Velká Fatra Mts. which Klika (<sup>1</sup> c.) quotes under Cajander's name «*Oxalis-myrtillus-nigra*» corresponds already to acid raw humus. Analysis no. 7 from an altitude of 950 meters (with *Petasites albus* and *Impatiens noli tangere*) indicates, of course, a mixed herbaceous type; analysis no. 10. from an altitude of 1000 meters is more typical, in it occur also *Majanthemum*, *Calamagrostis villosa* and *Festuca silvatica*.

From the Krkonoše Mts. Zlatník (<sup>2</sup>) described the following three types which clearly belong to spurious beech forests. They are:

**Struthiopteris spicant — Homogyne type** («*Fagetum blechnosum spicant*») (in which grow with a constancy 5 *Vaccinium myrtillus*, *Struthiopteris spicant*, *Homogyne alpina*, *Dryopteris spinulosa* + *austriaca*, *Oxalis acetosella*, with a constancy 4 *Picea excelsa*, *Athyrium filix femina*, *Calamagrostis villosa*, *Gentiana asclepiadea*, *Hieracium murorum*, *Majanthemum bifolium*, *Dryopteris phegopteris*, *D. Pulchella*, *Polygonatum verticillatum*, *Prenanthes purpurea*, *Senecio nemorensis* — *Fuchsii*, *Polytrichum formosum*).

The **Calamagrostis villosa type** (*Fagetum calamagrostidetum villosae*), in which occur with a constancy 5 *Picea excelsa*, *Athyrium filix femina*, *Calamagrostis villosa*, *Dryopteris austriaca* + *spinulosa*, *Oxalis acetosella*, *Prenanthes purpurea*, with a constancy 4 *Sorbus aucuparia*, *Vaccinium myrtillus*, *Gentiana asclepiadea*, *Homogyne alpina*.

The **Vaccinium myrtillus — Calamagrostis villosa type** (*Fagetum myrtillosum cum Calamagrostis villosa*), in which grow with a constancy 5 *Picea excelsa*, *Vaccinium myrtillus*, *Athyrium filix femina*, *Homogyne alpina*, *Majanthemum bifolium*,

*Dryopteris austriaca* + *spinulosa*, *Oxalis acetosella*, *Calamagrostis villosa* (with a constancy 4), *Dryopteris pulchella*, *Lycopodium annotinum*, *Polygonatum verticillatum*, *Prenanthes purpurea*.

Also Zlatník's third type, *Dryopteris pulchella* — *Oxalis* (see also p. 120), belongs to atypical beech forest types approaching the spruce forests.

The woodruff type, common in our beech forests in very numerous variants, goes over sometimes into the impoverished *Galeobdolon-Oxalis* type. Two variants from Subcarpathian Russia I have described above (p. 101). Also the *Luzula nemorosa* type (see p. 133) belongs to the impoverished types; it is not, however, of wide distribution in our beech forests. The *Myrtillus* type always belongs into this category and cannot be added to the *Fagetum verum*. *Vaccinium myrtillus* penetrates into beech forests on acid humous soils, often using stumps and decomposing logs as a starting point (Domin<sup>5</sup>). Usually it takes foothold only on isolated spots as we may observe, for instance in the virgin beech forests of Subcarpathian Russia, where locally even small *Myrtillaeta* occur with their accompanying species; among these we sometimes find also two typical Eastern Carpathian spruce forest elements, *Hieracium transsilvaticum* and *Aposeris foetida* incorrectly attributed by some authors to the beech forests. If the beech forest is interspersed with spruces, the origin of such colonies is sometimes favoured by the acid spruce humus. If the spruces are more abundant and aggregated into groups or even small growths, two sociations, beech and spruce, sometimes intermingle in the undergrowth. From the sociological as well as the ecological standpoints, we must strictly distinguish these two sociations even when they are intermixed. Such analyses which combine elements of both sociations, misrepresent, of course, the true character of the beech forest undergrowth.

To the spurious beech forests I count also mixed deciduous forests with predominating oaks (respectively hornbeam) in which beeches are more or less scattered, but their influence is to be seen in the composition of the undergrowth. With such forests, which are in reality only in their ground vegetation of a beech forest character, I am familiar, for instance, from the dolomitic Tematín hills and the Mt. Rokoš, where such a forest is developed as

a *Quercetum lanuginosae* (with scattered *Fagus*, *Quercus cerris*, *Quercus sessilis*). Analogous examples Mikyška gives from the eruptive rocks (mostly andesites) in the Štiavnické Středohoří Mts. where, however, *Quercus robur* is the dominant tree.

From a sociological standpoint, we may distinguish in this category besides the sociations already described (as for instance *Oxalis-Galeobdolon*, *Luzula nemorosa* sociations) especially the following:

1. *Majanthemum* sociation.

2. *Festuca ovina* — *Luzula nemorosa* sociation (see p. 141).

3. *Myrtillus-Homogyne* sociation, to the Sudetic-Hercynian facies of which two variants belong, namely *Struthiopteris spicant* and *Calamagrostis villosa* described by Zlatník from the Krkonoše Mts. and besides also Western Carpathian and Eastern Carpathian facies, regionally specific species of the latter are *Aposeris foetida*, *Hieracium transsilvanicum*, *Campanula abietina*.

4. *Calamagrostis villosa* sociation, as for instance described from the Krkonoše Mts. by Zlatník.

#### XIV. Spore plants.

In typical beech forests, the ground is wholly or practically destitute of mosses. We find them, however, on the roots, trunks, and stumps of beeches and not seldom even on stones where the soil is stony. Likewise the humid to damp beech communities are sometimes mossy (see p. 117) as may also be the «spruce» types of spurious beech forests. The epiphytic vegetation of mosses, lichens, and algae however, is usually very interesting and has been in some regions of Bohemia thoroughly studied by A. Hilitzer<sup>(2)</sup> who deals in great detail also with the ecological factors and distinguishes many sociations, some of which are specific for the beech. As far as the local distribution of these sociations on the trunk itself is concerned, we find on the beech usually on the trunk base the sociations *Pyrenula nitida*, *Thelotrema lepadinum* or *Pertusaria amara*, in the middle part of the trunk *Parmelia saxatilis* sociation, and on the upper part the *Evernia prunastri* sociation. Sometimes we notice on the base a differentiation of moss and lichen sociations, for instance on beech roots the sociation *Isothecium myurum* or *Pteriginandrum filiforme*, on the trunk base *Thelotrema lepadinum* or