

**Zeitschrift:** Veröffentlichungen des Geobotanischen Institutes Rübel in Zürich  
**Herausgeber:** Geobotanisches Institut Rübel (Zürich)  
**Band:** 8 (1932)

**Artikel:** The beech forests of Czechoslovakia  
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**Kapitel:** III: Climatic factors  
**DOI:** <https://doi.org/10.5169/seals-307034>

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at the same time the forest limit; 1220 meters where the spruce zone is still above them; and 1340 meters for the shrubby beech. The average lower limit of sporadically scattered beeches is 250 meters, of beech growths 350 meters and as an exception beeches sometimes come down to 150 meters or less. Detailed statistics show that the width of the zone of tall-trunk beeches is about 1000 meters, of which 100 meters is of a sporadic growth and the lower 900 meters of a continuous growth. Further, the zone of shrubby beeches is 80 meters so that the entire beech zone, clear up to the forest limit, is about 1080 meters wide. However, where the beech does not form the upper forest and tree limit but extends only to the spruce zone, the beech forest zone has an average width of 1030 meters.

In the Tatra region, beech forests are very poorly developed and on southern slopes are entirely lacking due to the continental climate which favours the larch. On the limestone mountains of the Western Carpathians, the beech is richly developed, rising on Mt. Choč to 1359 meters. For the High Tatras, Fekete-Blattny have given the following figures: average upper and, at the same time, the forest limit 1300 meters (1366 meters, max. limit), below the spruce zone 1260 meters (max. 1370 meters), highest ascent of beech in spruce forests 1290 meters (max. 1347 meters), and shrubby beeches to 1340 meters (max. 1404 meters). In the Low Tatras, the upper limit of the beech forests, and at the same time the forest limit, is at an average of 1290 meters (max. 1376 meters), below the spruce zone at 1250 meters (max. 1410 meters), beech in spruce forests at 1270 meters (max. 1443 meters), and shrubby beeches at 1390 meters (max. 1484 meters).

### III. Climatic Factors.

In this brief survey it is impossible to describe all the variations of the main climatic factors influencing our beech forests since we have beech forests in very diverse climates, from the typically dry continental climate of the Pannonian lowlands and hills to the damp, almost oceanic climate of the Eastern Carpathians. Beech forests are found in places with only 450 mm of yearly rainfall as well as in mountainous areas with a yearly rainfall of 1300 mm.

The following facts can be given in general:

a) In territories where the climate is sufficiently humid without any long, dry summer periods, that is a general climate favourable for beeches, the beech forest is spread on all exposures. In territories with a general climate less favourable or unfavourable for the beech, the conditions of the microclimate are the determining factor. Beech forests, located here on the colder, damper, northern and northwestern slopes, themselves help to create more favourable conditions by maintaining greater atmospheric humidity and a lower temperature. Measurements have shown that the evaporation from beech forests is markedly less than that of oak forests and that the thick leaf canopy helps to maintain a lower temperature. In the lower Carpathian range, we therefore frequently notice that oak forests (often *Quercetum lanuginosae*) and occasionally steppes (especially *Caricetum humilis*, sometimes *Festuceta*) occupy the southern slopes, whereas the northern slopes are covered to the ridge with beech forests. In narrow, wooded valleys this zonation is so modified that the beech forests are in the lower, narrow or broad zone of the southern slopes and the oak forests come in only above them, thus clearly reversing the situation.

b) The influence of exposure and wind manifests itself unequally in the altitudinal distribution of beech forests, although a clear correlation can usually be observed with the climatic and soil conditions. The beech, as a tree that loves a more humid and cooler climate, descends lower down the valley floor than on the slopes. In the beech forests of Subcarpathian Russia (see Fekete-Blattny) there is a marked lowering of the upper beech limit on the south and southwestern exposures, while on the southeastern exposures the beeches attain their greatest altitudes. Such is the case, for instance, on Mt. Plaj where the beech limit at the ridge is 1186 meters, on the southern side 1068 meters, southeastern and eastern 1132 meters, northeastern and northwestern 1200 meters, southwestern 1195 meters, northern 1169 meters, western 1144 meters. Similarly, on Mt. Menčul near Jasina, we have the beech limit at the ridge at 1165 meters, on the eastern slope at 1226 meters, north and northeastern 1252 meters, and western at 1185 meters. On the top of a ridge with a steep drop on one side and a gentle slope on the other, the effect of a mountain wind is shown by the presence

of a wider treeless zone at the crest on the side of the gentle slope, than on the steep side.

The upper limit of the tall-trunk beech forest in our Eastern Carpathians is, when it forms the forest limit, at an average of 1280 meters (max. 1376 meters), and of the shrubby beech forest at 1350 meters (max. 1484 meters). This limit is usually regarded as climatic, but detailed study in the Svidovec range has convinced me that very often it is a secondary forest limit. The formation of this shrubby beech zone is not a conclusive proof of the natural upper forest limit, since it can also arise after the artificial lowering of the forest limit due to deforestation. In some cases, the formation of the upper forest limit by the beeches is due to the fact that the mountain spruce zone, once lying directly above it, has been destroyed by grazing and is now covered, about half-way up, with grass or subalpine shrubby thickets (*Alnetum viridis*, *Juniperetum nanae*).

c) In conformity with the principles of substitution of ecological factors, beech forests may also develop in a climate unfavourable to them provided the soil conditions are favourable, such as a limestone substratum, or a high soil-water content.

#### IV. Soils.

Beech forests in Czechoslovakia develop on all types of rocks, be they limestone, dolomite, marly limestone, granit, gneiss, amphibolite, schists, sandstones, basalt, andesite, or other eruptive rocks, conglomerates, etc. This, and the different climatic conditions explain the great lack of uniformity in the character of the beech soils, in their reaction (soil acidity) and in their lime, nitrogen, and water contents. The production of humus depends not only on the rock strata, but also on the climatic conditions and often on the exposure of the slope. In a dry continental climate, the decay of the fallen leaves is delayed and the substratum is loamy to the surface, without humus, and covered with a thick layer of dried and slightly-decayed leaves. In a humid climate, leaf decay is much more intensive and often forms a very thick layer of humus. The acidity of the soil also varies greatly, although, even on siliceous soils, the beech itself aids in lowering the acidity. Typical beech forests have generally slightly acid to alkaline soils, while degraded