

Human Activity at the Forest Limit in the Czechoslovakian Mountains and its Influence on Vegetation

Abstract

With the exception of the Alps, the Vosges and perhaps also the Schwarzwald Mts. there are two main orographic systems in Central Europe which reach the alpine forest limit, namely the Sudeten Mts. and the Western Carpathians, both of which are situated in Czechoslovakia.

The Krkonoše Mts. (the Giant Mts. with the highest point Sněžka, 1602 m) form the biggest mountain range of the Sudeten. The present mean forest limit is at 1210 m but it has been calculated that it was about 25 m higher before it was effected by man (Jeník & Lokvenc, 1962). Pollen analyses indicate that the native forest was composed of *Picea abies*, *Fagus sylvatica*, *Abies alba*, *Sorbus aucuparia* and *Acer pseudoplatanus* even at the forest limit (Firbas & Losert, 1949; Hüttemann & Bortenschlager, 1987), but *Picea abies* is the only dominant species there at present. Spruce stands are greatly influenced by air contamination at the forest limit and, therefore, a lowering of this limit is in progress.

The commencement of human impact on the forest limit vegetation is dated back to 15th century in the central parts of the mountains. The first interest of the people in the mountain valleys was mining. Later extensive wood cutting in 2nd half of 16th century practically deforested the mountain slopes.

The introduction of the so-called « Baudewirtschaft » (or « Almwirtschaft ») with its cattle and sheep breeding influenced the subalpine vegetation of *Pinus mugo* stands which existed at that time so that they were converted to subalpine grazing areas and meadows dominated by *Nardus stricta*. The existence of permanent mountain farms, inhabited all the year round and situated close to or above the forest line, is typical of the « Baudewirtschaft » in the Krkonoše Mts.

The Hrubý Jeseník Mts. (the highest point Praděd, 1490 m) form the second highest mountain range of the Sudeten. The forest limit was also originally formed by *Fagus sylvatica*, *Picea abies*, *Abies alba* and *Sorbus aucuparia* (cf. pollen analyses by Rypl, 1980) but here too spruce is the main tree at the forest limit today. The existence of subalpine vegetation and the forest limit is conditioned rather by edaphic, geomorphological and mechanical

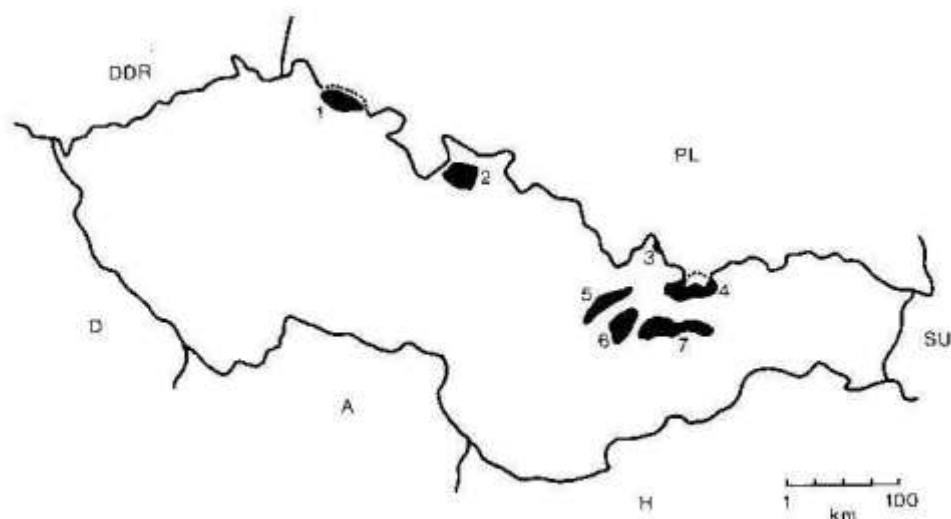


Fig. 1. Survey map of Czechoslovakia showing areas discussed in the text.
 1 = Krkonose Mts ; 2 = Hrubý Jeseník Mts. ; 3 = Babia Góra Massif ; 4 = High and West Tatras ; 5 = Malá Fatra Mts. ; 6 = Velká Fatra Mts. ; 7 = Low Tatras.

(wind, snow, water motion) barriers than by climatic ones. The original forest limit, 1440 m in some places, has been artificially lowered to its present altitude of about 1350-1400 m since the 15th century by human activity, mainly summer grazing and timber cutting (Alblová, 1970). Air contamination continues to lower the forest limit at present. No permanent settlement has existed in the mountains. (See also Jeník, 1961).

Pollen analyses indicate that there was a relatively rapid transformation of the earlier mixed forests of *Picea abies*, *Fagus sylvatica*, *Abies alba*, *Sorbus aucuparia* and *Acer pseudoplatanus* into the spruce dominated coniferous forests in the uppermost parts of the Sudeten Mts. This abrupt change is dated to 16th-18th centuries (cf. Firbas & Losert, 1949; Rybníčková, 1966; Rypl, 1980; Hüttemann & Bortenschlager, 1987). This means that the formation of the present climax-like mountain spruce forests started during that time span due to the selective cutting of beech for charcoal production and heating. Even though spruce was exploited simultaneously, its natural reproduction was much better and quicker than that of beech. The contemporary climatic deterioration during the so-called « little ice age » certainly also reinforced the competitive advantage of *Picea abies*. The existence of the present mountain spruce forests has to be regarded as the result of a combination of anthropogenic and climatic events at the forest limit and in the uppermost parts of the Sudeten Mts.

The forest limit and its reconstruction are extremely complicated in the Western Carpathians. In the High Tatra Mts. (the highest point Gerlach, 2663 m) the present forest limit varies between 1620 and 1720 m, originally it was about 120-140 m higher (Plesník, 1971). Pollen analyses (Krippel, 1963; Hüttemann & Bortenschlager, 1987) indicate that the present forest limit vegetation (*Picea abies*, *Larix europaea*, *Pinus cembra* and *P. mugo*) is very

similar to that which existed before the time of human impact. The subalpine treeless vegetation was represented mainly by *Pinus mugo* stands. For the description of Tatra vegetation see Krajina (1933), Hadač (1956, 1962, 1969), and a map by Michalko *et al.* (1987).

The lowering of the forest limit is primarily due to regular summer grazing in the subalpine belt. This Walachian way of cattle and sheep breeding dates back to 16th century (Houdek & Bohuš, 1972), and resulted in the transformation of the *Pinus mugo* stands into subalpine pastures and meadows. No permanent farms are known in the mountains. The selective cutting of *Pinus cembra* and *Larix europaea* for wood for furniture as well as the exploitation of *Pinus cembra* and *P. mugo* for oil distillation (*Oleum limbae*) also contributed to the vegetation changes at the forest limit. Several other negative factors associated with grazing such as trampling, soil erosion, the creation of new avalanche fields, and eutrophication, have also had some influence on the subalpine treeless vegetation. Grazing was stopped after the establishment of the Tatra National Park in 1953, and attempts to encourage regeneration up to the original forest limit are in progress.

The present forest limit is consistently lower in other parts of the Western Carpathians. In the Low Tatra Mts. it is at 1440-1450 m on the average, in the Malá Fatra Mts. 1600-1625 m, in the West Tatras about 1450-1550 m and in the Babia Góra Massif about 1500 m (according to Sillinger, 1933, Svoboda, 1939, Plesnik, 1956, 1959, Rybníček & Rybníčková, 1985). The Velká Fatra Mts. and some other West Carpathian ranges have an entirely artificial forest limit. In all cases the present timber line has been lowered by Walachian grazing activity. Originally it was at least 100 m higher.

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