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Autor: Ralska-Jasiewiczowa, Magdalena

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The history of vegetation in the Bieszczady Mts. (S.E. Poland) during the past 12'000 years

Magdalena RALSKA-JASIEWICZOWA

INTRODUCTION

The Bieszczady Mts. (Polish part) consist of parallel NW-SE ranges with steep slopes, dissected by perpendicular, deep river gorges which are generally wet while the slopes are rather dry. To the east, the area borders on the wide and flat valley of the upper San river (state frontier), and in the west, on the Oslawa river valley and the Lupkowska Pass, the boundary between the West and East Carpathians. The elevation of the ridges increases towards the east, where the highest peaks are grouped. Six peaks rise above 1300 m, and twelve peaks above 1200 m a.s.l.

The arrangement of the main forest zones is different from that in the West Carpathians, which is connected with the reduced vitality of *Picea abies* in this area and the lack of spruce forests in the upper montane forest zone (ZARZYCKI 1963, JASIEWICZ 1966, ZEMANEK 1992). The foothill forest zone of mixed deciduous forests (*Tilio-Carpinetum*) up to 450-500 m a.s.l. with azonal stands up to 700 m a.s.l. forms only less than 3.5% of the area. The beech forests (*Fagetum carpaticum*) of the lower montane forest zone which absolutely dominate on the slopes between 450 and 1180 m a.s.l. (c. 90% of the area) border directly on the mountain meadows which cover the tops and ridges and are, to a high extent, secondary anthropogenic communities. Spruce forests (*Piceetum abietetosum*) scarce nowadays in the area, occupy parts of the large valley bottoms and flats to c. 800 m a.s.l. with a damp and cool microclimate. The riverside alder wood (*Alnetum incanae*) accompany-

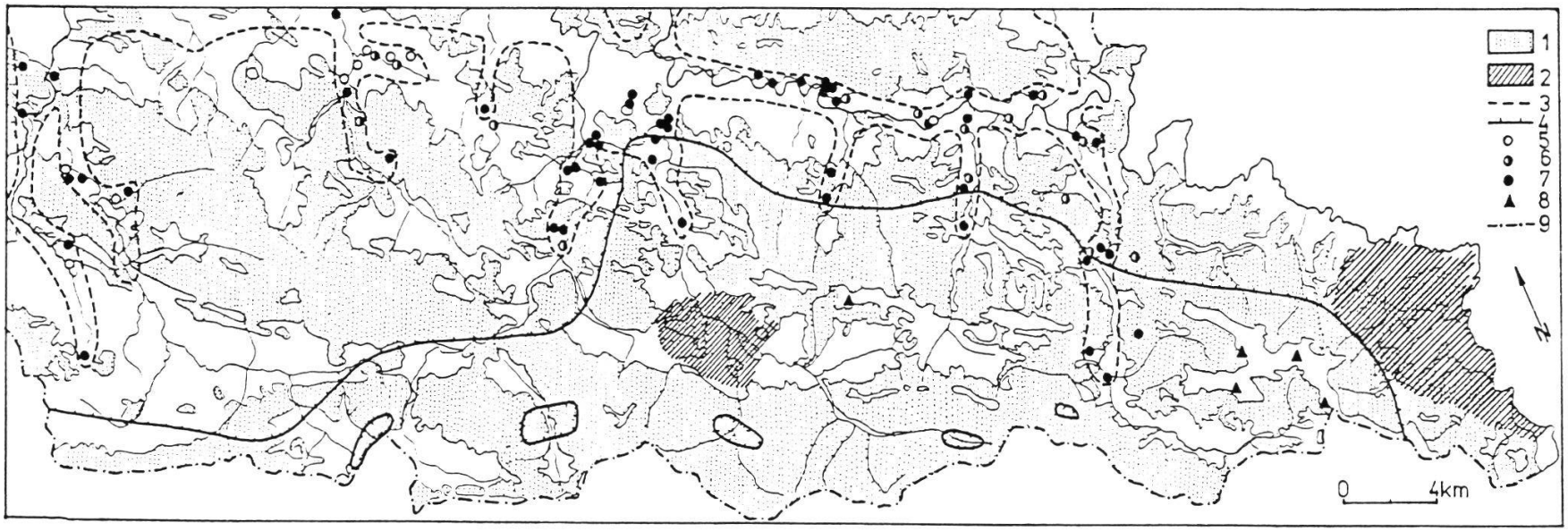

Fig. 1. Distribution of forests and some tree species in the Western Bieszczady Mts. (ZARZYCKI 1963, slightly modified).
1 - forest limit, 2 - natural "islands" of *Picea abies* and concentration of characteristic species of spruce forests (*Lycopodium annotinum, Pirola uniflora, Ptilium crista-castrensis*, etc), 3 - limit of the hornbeam and the high oak-hornbeam forest distribution, 4 - southern limit of mass occurrence of *Abies alba*, 5 - localities of *Quercus pedunculata*, 6 - localities of *Carpinus betulus* or small hornbeam forests, 7 - localities of *Tilia platyphyllos*, 8 - groups of dwarf *Picea abies* above the upper beech wood limit, 9 - State boundary.

ing rivers and streams is one of the richest woodland associations of the area (distribution of forests and some tree species in the Western Bieszczady Mts. are given in Fig. 1). The contribution of East-Carpathian plants to the flora, conspicuous in the SE part of the Polish Bieszczady Mts. (27 species), decrease towards the west (ZEMANEK 1992, this volume).

HISTORY OF REGIONAL CHANGES IN VEGETATION (Fig. 2)

The pollen analyses carried out at four peat bogs gave grounds for the reconstruction of the Late-Glacial and Holocene development of vegetation in the Bieszczady Mts. (RALSKA-JASIEWICZOWA 1972, 1980, 1989, RALSKA-JASIEWICZOWA et al. 1987). Its main stages can be summarized as follows:

1. During the Allerod the forests, composed mostly of conifers, *Pinus cembra*, *Pinus sylvestris*, *Larix* and *Picea* (the latter present from c. 11'300 B.P.), probably reached altitudes of c. 800-1000 m a.s.l. The open areas were occupied by grasslands and tall herbs with thickets of *Alnus viridis*. The latter, as well as a very high concentration of *Larix*, are East-Carpathian features of the Bieszczady vegetation during the Late-Glacial period.
2. During the Younger Dryas the forest areas were reduced, but clusters of trees grew at least up to 700 m a.s.l.
3. The Holocene vegetation changes were preceded by a regeneration phase of Late-Glacial conifer forests between c. 9'900 and 9'500 B.P., with a substantial contribution of *Betula*.
4. *Picea* and *Ulmus* expanded around 9'500 B.P., forming mixed forests, with *Pinus* dominating till c. 8'500 B.P.
5. *Corylus* and *Alnus*, as well as other thermophilous trees of minor importance (*Tilia, Fraxinus*), spread in the area around 8'500 B.P. From then until around 4'500 B.P., the composition of forests was rather stable. *Ulmus* (mountain elm) and *Corylus* were dominant on the slopes. Some other deciduous trees (*Tilia cordata* and *Tilia platyphyllos*, *Fraxinus*, *Acer*, possibly some *Quercus*) occurred mostly at the lowest elevations. *Alnus* (both *Alnus glutinosa* and *Alnus incana*) and *Picea* occupied valley bottoms.
6. *Carpinus* and *Fagus* started expanding at about 4'400 B.P. forming what became the modern forest zones. The zonal differentiation of *Carpinus* and *Fagus* communities was initially less distinct than in the West-Carpathian ranges. From c. 3'500 B.P., *Fagus* dominated absolutely on the slopes; from c. 2'800 B.P., *Abies* contributed to beech forests and spruce forests on the valley bottoms.
7. The formation of modern forest zones was more or less concluded shortly after 2'800 B.P. The mixed deciduous forests with the dominant *Carpinus* occupied the foothill zone up to c. 600-700 m a.s.l. This zone was the earliest to be affected by human activities and was most heavily destroyed by them. The beech forests, with maple (*Acer pseudoplatanus*) and a small contribution of fir (*Abies alba*) on northern exposed slopes, formed the lower montane forest zone up to the timberline at c. 1200-1250 m a.s.l., where some small groups of spruce and thickets of *Alnus viridis* were present. The treeless rocky crests supported grasslands with colonies of alpine and subalpine plants which had persisted probably since the Late-Glacial period.

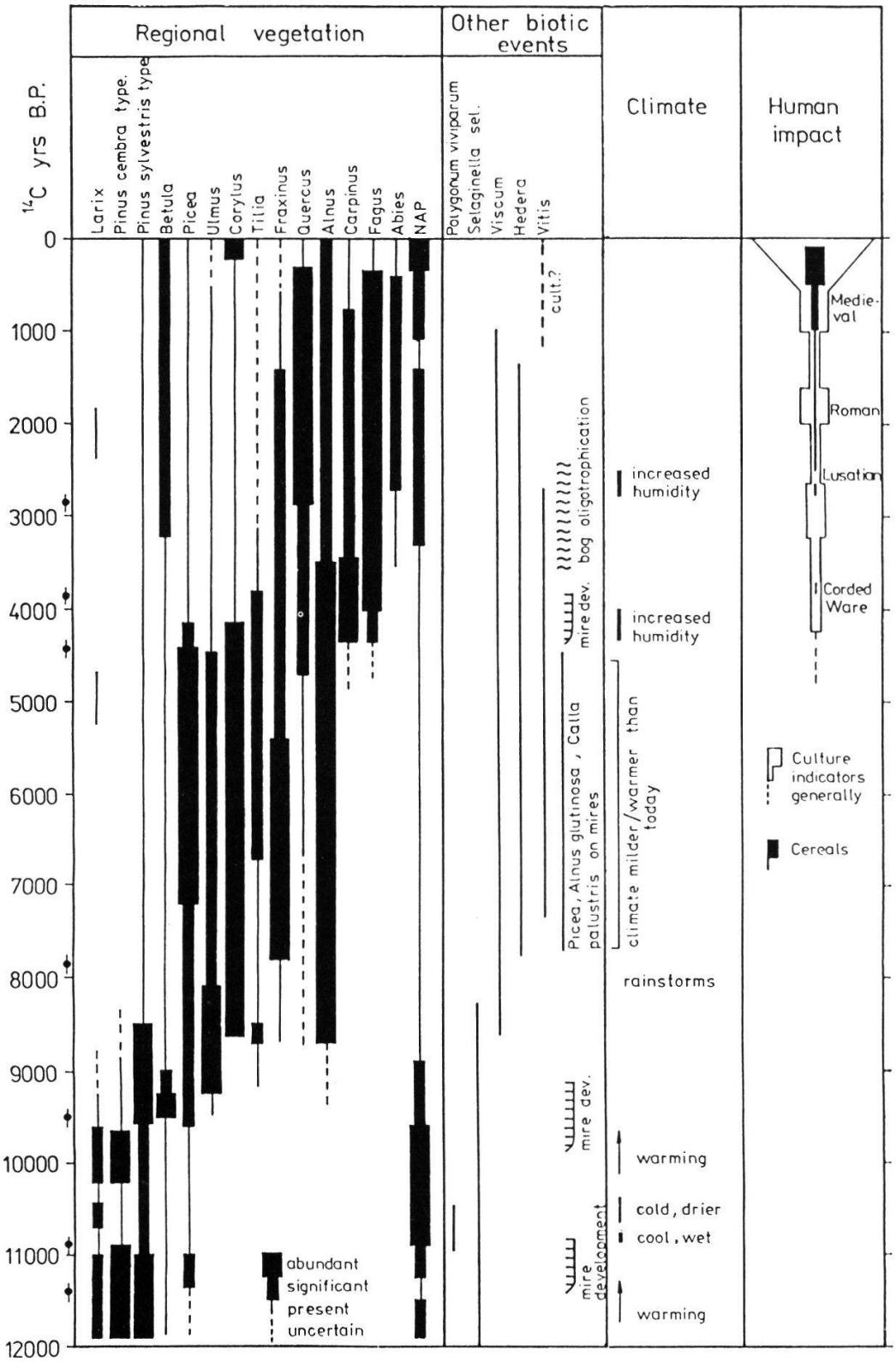

Fig. 2. Event stratigraphy table for the Bieszczady Mts.
B.P. - before present.

HUMAN IMPACT

1. The earliest pollen evidence of human activities at c. 4'400 (4'300) B.P. indicate the presence of Late Neolithic, probably Corded Ware Tribes practicing mostly cattle breeding.
2. The settlement intensified at about 3'200 (3'000) B.P., in connection with the expansion of the Late Bronze Lusatian Culture which depended mostly on animal husbandry and pasturing. Its influence lasted about 700 years. The clearings were located primarily in low-lying mixed deciduous forests, but later extended up the slopes into the beech forests. The cultivation of cereals started during the later phase of this culture.
3. During the Roman Empire, trade routes and ensuing settlements increased the human impact on this area.
4. Large-scale deforestation and the development of continuously grazed meadows and secondary forests occurred during the Early Medieval and Medieval colonization periods after 1'000 B.P.

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Address of the author: Prof. Dr. hab. Magdalena RALSKA-JASIEWICZOWA
W. Szafer Institute of Botany
Polish Academy of Sciences
Lubicz 46
31-512 Krakow, Poland