S. Konovaliuk, Student
T. Kurbet, PhD in Agr., As. Prof.,
S. Sukhovetska, Senior Lecturer
Zhytomyr Polytechnic State University

BEECH PHYTOCOENOSES OF THE UKRAINIAN CARPATHIANS AND THE UPPER LIMIT OF THEIR DISTRIBUTION

Beech tree is a mesotrophic species. Cultures of this species are distributed on such soils as: B_3 C_2, C_3, D_2, D_3. Beech is a mesotermophyte of a mild climate. Stioheliophyte – can remain in a depressed state for up to 50 years; it is frost-resistant, but sensitive to late frosts; moisture-loving, but resistant to water stagnation and long-term droughts.

A characteristic feature of beech forests is high shading, due to which light-loving shrubs rarely occur and sparse grass cover prevails in forests. In favorable conditions, the border of beech forests is formed by clean tall-stemmed stands. At higher altitudes, on the border with the meadows, beech trees are low or represented by meander forests, but such stands occur only in primary conditions. In the vast majority, the upper limit of beech forests is represented by tall stands and is secondary. As part of grass layer, there are numerous ephemeroids that develop and bloom before leaves of trees bloom [1].

Beech forests have the most phytocoenotic diversity. Characteristic indicators of *Querco - Fagetea* coenoses are *Acer platanoides, A. pseudoplatanus, Corylus avellana, Fraxinus excelsior, Ribes lucidum,* and herbaceous species are characterized by eutrophs: *Aegopodium podagraria, Anemone nemorosa, Carex digitata, Hepatica nobilis, Salvia glutinosa, Scilla bifolia . Daphne mezereum* is the characteristic for the order *Fagetalia sylvaticae*, and grass layer species are also represented by eutrophs: *Allium ursinum, Aposeris foetida, Asarum europaeum, Carex sylvatica, Dryopteris filix-mas, Euphorbia amygdaloides, Galeobdolon luteum, Galium odoratum, Impatiens noli-tangere , Isopyrum thalictroides, Lysimachia nemorum, Mercurialis perennis, Milium effusum, Paris quadrifolia, Primula elatior, Pulmonaria obscura, Ranunculus lanuginosus, Sanicula europaea, Stachys sylvatica, Veronica montana.* For Fagion community, in addition to *Fagus sylvatica*, typical indicators are both eutrophs *(Dentaria bulbifera, D. glandulosa, Polystichum braunii, Prenanthes purpurea)* and oligotroph *(Luzula luzuloides).*

According to many authors, the amount of precipitation cannot be a limiting factor for spreading beech forests in the Carpathians, since it exceeds the required minimum of 450-550 mm throughout the park. The limiting factor in this case is the temperature regime and the length of the vegetation period, which, according to Mayr, should be at least 1.5 months. The optimal conditions for beech tree are in the center of its range, where the average annual temperature is 6.5-8.2°, the average monthly temperature in January is from 2.5 to 0.2°, in July -13.7-17.5°; the amount of precipitation - 560-1340 mm, and relative air humidity – 79-85%. Beech finds such a soft and warm climate in the conditions of the temperate climate zone. Some authors were inclined to associate the growth of beech forests higher than conifers with temperature inversions. In the Beskids, such a phenomenon has long been noted, as well as the limitation of beech massifs to the northern slopes, but this fact remained unclear to many researchers. Meanwhile, this is observed, in particular, in the Western

Beskids, Beskid Sadecki, Beskid Zhivecki, on Babina Gora and in other areas of the Carpathian Mountains. However, it is caused not by the climate, but by the features of calcareous geological sediments deposition. It is especially clearly observed in the Skiba tectonic zone, where the core parts of the anticlines pushed to the northeast are composed of stria strata. In the Sansko-Stryiskyi highlands, where entire ridges are made up of the Krosnen strata, beech forests do not occupy the northern slopes.

According to the ecological characteristics of the habitats and phytozenotic features, the beech forests are divided into two groups. Among the first are the cenoses, which occupy the main area and are characterized by the eutrophil and mesothrophic mezzarine on the transit and accumulation parts of slopes; they include high- and medium-productivity, floristically rich groups, which are spread on brown soil with mull humus. The specialists of the French-Swiss school of phytosatologists distinguish them as a union of so-called real beech forests *EI-Fagenion* (synonym *Dentiario glandulosae - Fagenion*). The eutrophal species of the order *Fagetalia sylvaticae* and the union *Fagion sylvaticae* together with *Carex pilosa, Glechoma Hirsuta, Lunaria reduciva, Salvia glutinosa* belong to the indicative species of this group. *Atrichum undulatum (Hedw.) Beauv., Brachythecium velutinum (Hedw.) B. S. G., Isothecium myurum (Poll.) Brid., Plagiomnium undulatum (Hedw.) Kop., Rhizomnium punctatum (Hedw.) Kop*. should be referred to as the typical species of breiophors. However, the moss layer is usually not formed, and mosses occur in isolated microsynuses. The second group, the coenoses of which are occupied by mesooligotrophic and oligotrophic habitats in autonomous and transeluvial locations, mainly with leached burozems and with humus of the moder-mull type, includes the majority of low-productivity, floristically peculiar beech groups, which are close in species composition to spruce forests . These are the so-called "sour beeches" from the sub-union *Luzulo - Fagenion.* Oligotrophic species are the most typical for the coenoses of this group: *Calamagrostis arundinacea, C. vilosa, Gentiana asklepiadea, Luzula luzuloides, L sylvatica, Majanthemum bifolium, Polygonatum verticillatum, Senecio fuchsii, Solidago virgarea, Vaccinium myrtillus, Veronica officinalis*, and mosses - *Dicranum scoparium Hedw., Hypnum compression Hedw., Plagiothecium Cavifolium (Brid.) Iwats., Polytrictum formosum Hedw., P. juniperium Hedw.*

Beech forests of Ukrainian Carpathians are represented by the following groups: *Abieto (albae)–Fagetum (sylvaticae), Abieto (albae)–Piceeto (abietis)–Fagetum (sylvaticae), Acereto (pseudoplatani)–Fagetum (sylvaticae), Acereto (pseudoplatani)–Fraxineto(excelsioris)–Fagetum (sylvaticae), Carpineto (betuli)–Fagetum (sylvaticae), Fagetum (sylvaticae), Fraxineto (excelsioris)–Fagetum (sylvaticae), Fraxineto (exelsioris)– Ulmeto (glabrae)–Fagetum (sylvaticae), Piceeto (abietis)–Abieto (albae)–Fagetum (sylvaticae), Piceeto (abietis)–Acereto (pseudoplatani)–Fagetum (sylvaticae), Piceeto (abietis)–Fagetum (sylvaticae), Querceto (petraeae)–Fagetum (sylvaticae), Quercetum (roboris)–Fagetum (sylvaticae), Sorbeto (aucupariae)–Fagetum (sylvaticae), Tilieto (platyphyllae)–Fagetum (sylvaticae), Ulmeto (glabrae)–Fagetum (sylvaticae)* [2].

Beech forests are quite common in the Ukrainian Carpathians. Beech trees cover the Carpathian lowlands from the foothills (500 m) to a height of 900 m. Beech rises even higher, to 1150-1320 m. However, it is the only one of the components of the mixed coniferous-broad-leaved forests here. The development of beech in the lowland belt is determined by the presence of a moderate, fairly humid climate. Beech forms pure beech forests and mixed forests, dense, shady single-tier stands. On the north-eastern slope of the mountains, white spruce is often found next to beech. There are

few other species. The most characteristic of them are: sycamore, hornbeam. 70-80, 80-100-year-old plantations with a height of up to 40 m and with a trunk diameter of 120-150 cm predominate here. The understory and grass cover are poorly developed. The most permanent companions of beech in the undergrowth are wolfberries and red elderberry. There are different types of willow: sedge and eared willow. The grass cover is thin; it develops only on meadows and in the gaps between trees. It consists mainly of mesophilic species: hairy blackberry, bear's onion. Hygrophytes include ferns - asplenia and oleander. This wet clean beech of I-II bonitets is widespread on slopes of different exposure and steepness. The slopes of the southern exposures are covered with fresh, frequent beech of I bonitet. There are strips of raw beech (I and II bonitets) with a thick and high cover of hydrophilic grasses on the bottoms of valleys and on the concave areas of slopes.

The upper limit of beech forests ranks second in length after spruce forests. It passes through the following landscapes: Beskydy, Polonyna Krasna, Polonyna Runa, Polonyna Borzhava, the southern slopes of Gorgany, Svydovets, the southwestern part of Montenegro and the southern slopes of the Petros massif, where the upper limit of the forest (ULF) is lowered to a height of 1100–1200 m. On the southern mega slope of Svydovets massif, the beech borders reach a height of 1380 m above sea level. This is the highest border of beeches in the Ukrainian Carpathians. There are optimal conditions for beech forests on the Transcarpathian slopes.

In Transcarpathia, the average upper limit of beech forests is the following: 1190 m above sea level in the western part, 1280 m above sea level in the eastern part. The ULF, above which spruce is common, is 1250 m and 1360 m above sea level, respectively, and the upper limit of sycamore growth is 1160 and 1270 m above sea level. In Montenegro, ULF forms beech stands. The eastern border of beech at the southwestern macro slope of the Ukrainian Carpathians passes here. Bird cherry and mountain-ash are rare. To the east of the Rognieska tract, beech forests change to mixed forests. The border between them clearly coincides with the stratal boundaries and is marked on the ground by a shallow depression, which separates the natural and territorial complexes (NTC) of ridged convex slopes with beech forests on the calcareous deposits of the Belotysensk world and the NTC of steep slopes with frequent outcrops of native rocks of the Dukla tectonic zone, covered with fir forests. On the southern slope of the mountain Kvasivs'kyi Menchul, the ULF is also represented by a beech variant and has an anthropogenic character. The ULF on the southeastern slopes of Sheshul passes at an altitude of 1,300 m above sea level.

The upper boundary of the forest is characterized by the grouping of common mountain-ash and beech forests (*Sorbeto (aucupariae)–Fageta (sylvaticae))*. Beech meandering forest is with a canopy density of 0.4–0.5. Forest beech (Fagus sylvatica) and mountain-ash *(Sorbus aucuparia)* of 3–4 m high form the forest stand. The understory is usually not pronounced, in some places it is formed by raspberry *(Rubus idaeus)*. A dense (90–95%), but floristically poor, grass-shrub cover is formed by *Calamagrostis villosa, C. arundinacea,* bilberry *(Vaccinium myrtillus)* with an isolated presence of common goldenrod *(Solidago virgaurea)*, *Luzula luzuloides, Athyrium distentifolium, Senecio fuchsia* and *Rumex acetosa* [3].

Above the upper limit of the beech forests, there is a 10-15 m wide strip of elementary natural systems with sycamore, the average height of which is 8-10 m, and the maximum - up to 14 m. The derived natural complexes with green alder on mountain-meadow-brown earth low-strength soils occur above.

During the last two centuries, the area of beech forests has decreased significantly. Reduction of the area of beech forests occurred as a result of the process of "coniferization" and intensive pastoral influence. In modern climatic conditions, within the entire range of *F. sylvatica*, its intensive generative recovery has been ascertained, which indicates an increase in the vitality of the species. In the case of anthropogenic influence cessation, a gradual spontaneous spread of beech in mixed deciduous and coniferous-deciduous phytocenoses is observed. In contrast to natural regeneration, the creation of forest cultures on felled areas is quite difficult. Beech seedlings grow rather slowly, they suffer from solar heating and the apical shoot does not demonstrate intensive growth. In modern conditions of global warming, which is also observed in Ukraine, there are real opportunities to expand the area of beech forests in the Carpathians and the Prykarpattia. Precious beech forests, valuable from a scientific and natural point of view, are protected in national parks and biosphere reserves. They serve as models for forest management [2].

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