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Characteristics of the 7th (*Fageti-piceeta* s.lat.), 8th (*Piceeta* s.lat.) and 9th (*Pineta mugo* s.lat.) vegetation tiers of the northeastern Moravia and Silesia (Czech Republic)

Charakteristiky 7. buko-smrkového (*Fageti-piceeta* s.lat.), 8. smrkového (*Piceeta* s.lat.) a 9. klečového (*Pineta mugo* s.lat.) vegetačního stupně severovýchodní Moravy a Slezska (Česká republika)

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Abstract. Detailed characteristics (tree species composition, tree representation, identification features) are presented by 7th (*Fageti-piceeta* s.lat.), 8th (*Piceeta* s.lat.) and 9th (*Pineta mugo* s.lat.) vegetation tiers of northeastern Moravia and Silesia (Czech Republic). 7th vegetation tier creates the communities with dominant tree species (main edificator) of *Picea abies* (L.) Karsten (with the representation up to 70 %) which creates the main and the co-dominant level where it reaches up to maximum height of 40 m. *Fagus sylvatica* L. is already subdominant and it creates the overtopped level with the maximum height of 25 m and its representation is up to 20 %. *Abies alba* Mill. occurs in the main and overtopped level with the representation up to 10 %. 8th vegetation tier creates the communities with dominant tree species of *Picea abies* which reaches the maximum height of 25 m. *Abies alba* occurs in the main and the overtopped level as the admixture. *Fagus sylvatica* occurs only individually reaching a shrub height, exceptionally it reaches the height of 3-4 m. 9th vegetation tier creates the communities with dominant species of *Pinus mugo* Turra, which very often creates continuous stands. *Picea abies* occurs only as the individual admixture. It creates small groups on the lower border and it 2-3x exceeds the height of *Pinus mugo*-stands. *Picea abies* can have the representation up to 50 % here. The admixture of *Picea abies* has its representation up to 10-30 % in theses places and it is created by specimens or small groups with 2-4 specimens with the height of 1-3 m.

INTRODUCTION

The vegetation tier (further only the VT) is the ecological superstructure unit of geobiocenological units in relation to climate, which has influence on landscape sections (ZLATNÍK 1976a). VTs are determined according to the ecological manifestation of a differential species combination of sections of „guide“ series, where the difference of the climate influence on the composition of tree and undergrowth synusia is minimum disrupted by local absence of water, or on the contrary, other than atmospheric water. VTs were named according to the occurrence of individual carriers of VTs. The following tree species are the carriers of VTs that can be found in central Europe (and also in the Czech Republic): sessile oak (*Quercus petraea* (Mattuschka) Liebl.), English oak (*Quercus robur* L.), European beech (*Fagus sylvatica* L.), silver fir (*Abies alba* Mill.), Norway spruce (*Picea abies* (L.) Karsten) and Dwarf mountain pine (*Pinus mugo* Turra).

Any detailed characteristics containing determination characters still have not been processed (cf. PLÍVA 1971, 1991; VIEWEGH 2003; VIEWEGH et al. 2003). BUČEK & LACINA (1999) published a detailed characteristics of the VTs which include a biogeographical frame and occurrence, ecotype features, and a description of the biocenosis state. Detailed characteristics with a description of biogeocenosis natural state (occurrence of plant species, occurrence of tree species and relationship to geobotanical units) were published by BUČEK et al. (2005).

Present work is related to previous articles, where detailed characteristics of the 3rd (i.e. communities of *Querci-fageta* s.lat.) and of the 4th (i.e. communities of *Fageta (abietis)* s.lat.) vegetation tiers (HOLUŠA & HOLUŠA 2008), and of the 5th (i.e. communities of *Abieti-fageta* s.lat.) and 6th (i.e. communities of *Picei-fageta* s.lat.) vegetation tiers were presented (HOLUŠA & HOLUŠA 2010).

The aim of the article is to bring out detailed characteristics of the 7th, 8th and 9th vegetation tiers with respect to the occurrence, representation and life status of tree species, as main edificators.

STUDY AREA

The study area was described in previous articles (HOLUŠA & HOLUŠA 2008, 2010). It lies in the northeastern Moravia and Silesia (i.e. the very eastern part of the Czech Republic (Fig. 1). Detailed determination of the study area is specified in the work of HOLUŠA & HOLUŠA (2008). Study area includes, according to the division of Natural forest areas (further only the NFA) (PLÍVA & ŽLÁBEK 1986), the following NFA: the whole territory of the NFA 39 the Podbeskydská pahorkatina Hills, the NFA 40 the Moravskoslezské Beskydy Mts. and a predominant part of the NFA 32 Slezská nížina Lowland (except the region of Vidnava town), further the following parts of these NFAs: eastern half of the NFA 29 Nízký Jeseník Hills and eastern half of the NFA 41 the Hostýnsko-vsetínské vrchy Hills and the Javorníky Mts., eastern part of the NFA 28 the Předhůří Hrubého Jeseníku Mts. Foothills, and then only a small northern part of the NFA 37 Kelečská pahorkatina Hills and the very eastern hook of the NFA 34 Hornomoravský úval Dale. The very western part of the study area slightly penetrates into the NFA 27 Hrubý Jeseník Mts.

MATERIAL AND METHODS

Forest site classification system was used for classification of ecological conditions of geobiocenoses. It is used in the forest practice in the Czech Republic (PLÍVA 1971, 1991).

The records were found by the authors´ own forest site classification mappings in the study area during the period 1971-2002. Forest site classification mappings in the study area including the vegetation tiers determination were done by the authors in the frame of Forest management plans recovery of individual Management-plan areas, later by field examination of natural conditions within Regional plans for forest development.

In the geobiocenological research 220 phytosociological relevés were surveyed in every NFA. Soil was sampled in geobiocenological areas. After year 1981 cca 20 geobiocenological areas (per cca 20,000 ha) were revised and also cca 40 soil samples were taken there. This methodology was used within the frame of field mapping of Regional plans of forest development. Phytosociological relevés were revised on the geobiocenological plots with a square of 20x20 m. The most well-preserved geobiocenoses were focused in the study (i.e. the level of naturalness 1 or 2 according to ELLENBERG (1973, 1978). Transects with the size of 10x60 m were set out for the description of the forest stand structure at the most well-preserved plots, data in transect were measured by yardstick. Dendrological measurements were made on the plots with regard to the highest trees. Photos were taken in some representative geobiocenoses during the vegetation period. Phytosociological relevés were elaborated using the SW Turboweg for Windows and evaluated using the SW Juice, version 6.5.

The plant species were sorted into vegetation bands according to ZLATNÍK (1959) and added according to AMBROS & ŠTYKAR (2001) for evaluation of vegetation band representatives in the interpretation of SCHMIDT (1939, 1949). The following abbreviations are used for vegetation bands: *QTA – Quercus-Tilia-Acer, QRC– Qurcus robur-Calluna, FA – Fagus-Abies, P – Picea* and *LPC – Larix-Pinus cembra*. The nomenclature of plant and tree species is used according to KUBÁT et al. (2002). The climatical characteristics are defined according to TOLASZ (2007). The classification of soil types and subtypes is used according to NEMEČEK et al. (2001). Latin names of Forest Type Complexes were used accoring to MIKESKA & KUSBACH (2000).

7th vegetation tier – *Fageti-piceeta* s.lat. – spruce-beech

The composition and structure of geobiocenoses: *Picea abies* is a dominant tree species (Fig. 4), it creates the main level and the co-dominant level, where it reaches maximum height up to 40 m (the maximum measured height was 37 m). *P. abies*, as the main edificator of the geobiocenoses, reaches a 70% proportion occurrence in the VT. *Fagus sylvatica* is only a subdominant tree species, it creates the overtopped level, where it reaches the maximum height of 25 m (the maximum measured height was 23 m). It reaches the proportion occurrence of 20 %. *F. sylvatica* has not the ability to compete *Picea abies* any more. Forest stands visibly consist of two storeys. *Abies alba* occurs in the main and overtopped level with the representation up to 10 %. Also *Acer pseudoplatanus* L. creates only the admixture occurring in the overtopped level with the maximum height of 20 m. *Sorbus aucuparia* L. can occur as an admixture tree species in the advanced geobiocenoses in the overtopped level. There are the following representatives (the same as for 6th VT): *Sambucus racemosa* L., *Lonicera nigra* L., *Ribes alpinum* L. and *Salix silesiaca* Willd., and according to BUČEK & LACINA (1999) also *Rosa pendulina L.* in the layer of shrubs. Additionally *Ribes petraeum* Wulfen can occur individually there.

6th VT (i.e. *Abieti-fageta picae* s.lat.) of geobiocenological system (ZLATNÍK 1976b) was divided according to the occurrence and representation of *Fagus sylvatica*, *Picea abies* and *Abies alba* in the stand structure into two VTs in the forest-typological system (PLÍVA 1971), i.e. 6th (i.e. the communities of *Picei-fageta* s.lat., see HOLUŠA & HOLUŠA 2010) and the presented 7th VT (i.e. *Fageti-piceeta* s.lat.)

Differential features: *Fagus sylvatica* creates only the overtopped level, it does not reach more than 25 m; *Picea abies* has very good conditions for natural regeneration which is very common and very numerous. There is a very frequent occurrence of one plant species – e.g. *Athyrium distentifolium* Opiz, and continuous stands of *Vaccinium myrtillus* L. shrublets with the height of 50-70 cm.

There is still the occurrence of species of central-European deciduous forest, nevertheless there are the following montane und submontane species occurring with a higher representation – e.g. *Athyrium distentifolium*, *Vaccinium myrtillus*, *Calamagrostis villosa* (Chaix) J. F. Gmelin, *Luzula sylvatica* (Huds.) Gaudin, *Gentiana asclepiadea* L., *Homogyne alpina* (L.) Cass. and *Streptopus amplexifolius* (L.) DC.

The species of the *FA* vegetation band have a dominant proportion in the undergrowth; individually there are species belonging to more vegetation bands – *FA (P, LPC).* Significantly the species belonging to *P*-vegetation band, *LPC*-vegetation band and species belonging to two vegetation bands – *LPC*, *P* occur there (vegetation bands are used according to SCHMID 1939, 1949).

Character of ecotope: 7th VT occupies the highest parts of mountains (Fig. 1, 9) and central vertical parts of great mountains in the altitude from 1,040 to 1,240 m, exceptionally lower positions, starting from 1,020, and higher ones up to 1,260 m a.s.l. (Fig. 2, 9). According to BUČEK & LACINA (1999) the upper border of the 6th VT (see above) reaches up to 1,200 m a.s.l. Flysch series of rocks of sandstones with insular overlays of deluvial loams are pedogenic substrata, and gneisses, schists, phyllites in the Hrubý Jeseník Mts. Soils are represented by the following soil types: Dystric Cambisols (typical, ranker), individually Cambisols (subtypes haplic, individually skeletic) or Podzols (haplic, humic), and also Leptosols.

The territory of the 7th VT belongs to the C4 and C6 climatical regions with the following characteristics: mean January temperature: of -4 to -7°C, mean July temperature: 12-15°C, precipitation amount: 600-700 mm in the vegetation period, precipitation amount: 400-500 mm in winter period (horizontal atmospheric precipitation often occur), number of days with the mean temperature of 10°C and more: 80-140 days.

Occurrence: 7th VT occurs only in the highest peaks of the NFA 40 (Kněhyně–Čertův mlýn Mt., Smrk Mt., Lysá hora Mt. and Travný Mt.), and also in the NFA 27 (Medvědí vrch Mt. and Orlík Mt.) (Fig. 1). It occupies only 0.21 % of the study area. There are the following most widespread communities (units according to the system of PLÍVA 1971, 1991): FTC 7S (*Fageto-Piceetum mesotrophicum*), 7Z (*Fageto-Piceeto humile*) and 7F (*Piceeto-Fagetum fastigiosum lapidosum mesotrophicum*).

7th VT can be classified (as the previous 6th VT) as an analoggical oroboreal (lower) suborobiome to the zonobiome of boreal coniferous forests (southern taiga – i.e. broadleaf-coniferous) in the conception of sorting by WALTER (1979) (cf. MÍCHAL 1988).

Present condition of forest geobiocenoses: The geobiocenoses in the 7th VT were partly influenced by human activities. The representation of *Fagus sylvatica* significantly decreased, and *Abies alba* is mainly missing. Some forest stands were changed to *Picea abies*-monocultures very often with "unknown" geographical origin. In the places of the 7th VT, the original ecotype of "Beskidian" *Picea abies* (HOLUŠA & HOLUŠA 2001, 2003) has been relatively conserved. Natural and close to nature forest stands are conserved in the National Natural Reserve of Kněhyně–Čertův mlýn, and in the Natural Reserve of Smrk Mt. (HOLUŠA & HOLUŠA 2001).

8th vegetation tier – *Piceeta* s.lat. – spruce

The composition and structure of geobiocenoses: *Picea abies* is a dominant species, it reaches the maximum height of 25 m (Fig 4). *Fagus sylvatica* occurs only individually reaching a shrub height, exceptionally it reaches the height of 3-4 m. *Abies alba* occurs in the main and the overtopped level as the admixture, RANDUŠKA et al. (1986) admit the occurrence of dwarf specimens of *Abies alba* there. *Acer pseudoplatanus* can occur also in the dwarf height. Forest stands are naturally opening up. *Sorbus aucuparia* can occur in these opening places. Sometimes specimens of *S. aucuparia* reach the main level of stands. *Salix caprea* L., *Lonicera nigra, Ribes petraeum* and *Salix silesiaca* can occur in the shrub level. 8th VT represents the last VT where the tree layer has character of "the forest" i.e. upper border of the VT is the upper forest limit. The geobiocenoses at the peaks, which do not reach heigh altitude (the NFA 40 – peak of Lysá hora Mt., Smrk Mt.), are under the influence of "the peak phenomenon" and therefore tree layer has dwarf growth (the height reaches 10-16 m) (Fig. 5). The height decreases towards the peaks very rapidly up to cca 6 m.

Differential features: Dominant *Picea abies* reaches maximum height of 25 m; forest stands are naturally opening up; *P. abies* has problems with natural regeneration and it occurrs only on dead lying partially decomposed trunks; *Fagus sylvatica* has dwarf growth; very common continuous stands (with height up to 100 cm) of *Vaccinium myrtillus* or *Athyrium distentifolium* in the undergrowth.

Only montane species occur in the undergrowth, i.e. *Athyrium distentifolium*, *Gentiana asclepiadea, Homogyne alpina* and also submontane species, e.g. *Luzula sylvatica*. Continuous stands are often created by *Vaccinium myrtillus* or *Calamagrostis arundinacea* (L.) Roth and *C. villosa*. Species of the central-European deciduous forest, e.g. *Senecio ovatus* (G. M. et Sch.) Wild. or *Oxalis acetosella* L., occur there very rarely and

individually. There is very often developed the layer of moss represented by *Polytrichum* sp., thick covering of lichen occurs on the branches of *Picea abies* and *Sorbus aucuparia*.

The species of the *FA* vegetation band has dominant representation, however against the 6th VT their representation is significantly lower. Species belonging to more vegetation bands *FA (P, LPC),* occur there only individually, relativelly higher representation reach a group of species of the *P* vegetation band, *LPC* vegetation band and species belonging to two vegetation bands *LPC*, *P*.

Character of ecotope: 8th VT occurs at peaks of mountains (Fig. 9) in the altitude from 1,150 up to 1,323 m a.s.l. (Fig. 3, 9). BUČEK & LACINA (1999) write on the occurrence of the 8th VT in the territory of the Czech Republic from 1,100 to 1,350 m a.s.l. (sporadically from 1,000 m a.s.l.) with typical occurrence at the isolated peaks. Geological strata is there the flysch series of rocks of sandstones and gneisses, schists, phyllites in the Hrubý Jeseník Mts., where are represented the following soil types: Dystric Cambisols (haplic, skeletic), Podzols (haplic, humic) only individually Leptosols.

The territory of the 8th VT belongs to the C4 climatic region with the following characteristics: mean January temperature: of -6 to -7°C, mean July temperature: 12-14°C, precipitation amount in the vegetation period: 600-700 mm, precipitation amount in the winter period: 400-500 mm (horizontal atmospheric precipitation occur there significantly), number of days with mean temperature 10°C and more: 80-120 days.

Occurrence: In the study area the 8th VT occupies only the highest peaks of mountains in the NFA 40 – Smrk Mt., Lysá hora Mt. and in the NFA 27 – Orlík Mt., Medvědí vrch Mt. Its territory has only several hectares (Fig. 3) – therefore in the frame of whole study area it is 0.0 %. There are the following most widespread communities (units according to the system of PLÍVA 1971, 1991): FTC 8Z (*Sorbeto-Piceetum*), only rarely the FTC 8S (*Piceetum mesotrophicum*) and FTC 8K (*Piceetum acidophilum*). BUČEK & LACINA (1999) write on the occurrence in territory from Moravia and Silesia in the Králický Sněžník Mts., in the Hrubý Jeseník Mts. and also in the Moravskoslezské Beskydy Area, proportion in the Czech Republic is only 1% of all. KRIŽOVÁ (2000) for the territory of Slovakia writes about the occurrence of the VT at the 2.1 % of Slovak area (also according to the geobiocenological system).

8th VT can be understood as an oroboreal (middle) suborobiome analogical to the zonobiome of boreal coniferous forests (southern taiga) in the conception of sorting by WALTER (1979) (cf. MÍCHAL 1988).

Present condition of forest geobiocenoses: Geobiocenoses of the 8th VT at the peaks were deforested in last past therefore the border of forest was cut. This influence was displayed in the area in some parts, e.g. southern slope of Lysá hora Mt. In the NFA 40. some areas were afforested by *Picea abies*, however with unknown origin. Conversely the areas, which were under "immissions" influence, were afforested with "substitute" stands of *Pinus mugo* (e.g. the peak of Smrk Mt.). At present these parts of the 8th VT are under influence of intensive tourism. *Fagus sylvatica* and *Acer pseudoplatanus* were eliminated from tree species composition, now they are occurring only individually. In the places of the 7th VT, the original ecotype of "Beskidian" *Picea abies* (HOLUŠA & HOLUŠA 2003) has been conserved only individually in the rest of forest stands, some specimens reach the age of 245-275 years.

9th vegetation tier – *Pineta mugo* s.lat. – dwarf pine

9th VT is the first unforested vegetation tier, it is in the conception of JENÍK (1972) subalpine sublevel of alpine level. In the area of interest, 9th VT does not occur, and in

northern Moravia and Silesia occurs only at the top of Praděd Mt. and Králický Sněžník Mt. in "spruce variant" of the 9th VT (*Piceeta microfanerophyta* ŠTYKAR 2004, *Piceeta subalpinae* BUČEK et al. 2011), i.e. absence of *Pinus mugo* and origin edificatory of this VT *Picea abies* was there. For the purposes of characteristics of the zonal 9th VT, data were obtained during geobiocenological surveys of authors in the Oravské Beskydy Mts, which are geobiocenologically and biogeographically analogical as the Moravskoslezské Beskydy Mts.

The composition and structure of geobiocenoses: *Pinus mugo* is dominant species there which very often creates continuous stands. *Picea abies* occurs only as the individual admixture. It creates small groups on the lower border of VT which 2-3x exceed the height of *Pinus mugo*-stands. *Picea abies* can have the representation here up to 50 %. The representation of *Picea abies* decreases towards higher places. The admixture of *Picea abies* has its representation up to 10-30 % in theses places and it is created by specimens or small groups with 2-4 specimens with the height of 1-3 m. Specimens of *Picea abies* reach up to stands of *Pinus mugo* only slightly. Dwarf specimens of *Sorbus aucuparia* occur in opening places. There are also shrubs of *Salix caprea* and *S. silesiaca*. *Juniperus communis* subsp. *alpina* Čelak., is very common towards to upper border of the VT, at some places it creates continuous stands. *Pinus mugo* probably creates in natural conditions the continuous stands with 100% horizontal canopy with admixture of *Picea abies* and then *Juniperus communis* subsp. *alpina* occurs only near upper border of the VT by the crossing to alpine vegetation tier (=alpine meadows). Other species of trees with shrub growth occur in others mountains (BUČEK & LACINA 1999) – in the Krkonoše Mts.: *Sorbus sudetica* (Tausch) Bluff, Nees et Schauer, *Salix bicolor* Willd., *Betula carpathica* Willd., in the Krkonoše Mts. and the Hrubý Jeseník Mts.: *Salix lapponum* L., *S. herbacea* L. and in the Hrubý Jeseník Mts.: *Salix hastata* L. Progressive decreasing of *Picea abies*-occurrence is given by loss of regeneration ability. It is near upper border of the VT very slight (PLESNÍK 1968). Seed year of *Picea abies* in these places come very scarcely and the germination of seed is very low (ALBLOVÁ 1970). Regeneration of *Picea abies*-groups and "stands" is not so quick that stands or groups would be add next generation of young specimens and there would be "stands" with more dense canopy (PLESNÍK 1972).

Differential features: Dominance of *Pinus mugo*; *Picea abies* occur only individually or in small groups with "unwell-shaped" growth with the height of 1-4 m; undergrowth is created by shrublets with low growth; the presence of arcto-alpine species.

The undergrowth is created by subalpine and alpine species. There are common stands of the following species: *Avenella flexuosa* (L.) Drejer or *Calamagrostis villosa*, however shrublets of the following species are dominant: *Vaccinium myrtillus*, *V. vitis-idea* and *Empetrum hermafroditum* Hagerup. Moss layer is very numerous and represented by species of *Sphagnum* sp. and *Polytrichum* sp. Lichens cover very commonly the exposure of stones and rocks.

Undergrowth is represented only by species of *LPC*-vegetation band, *P*-vegetation band or *LPC*, *P*-vegetation bands.

MÍCHAL (1988) marked the 9th VT as an orohemiarctic suborobiome which is analogical to the zonoecotone of forest-tundra in the conception of sorting by WALTER (1979).

Character of ecotope: 9th VT does not occupy the study area (Fig. 1), but it occurs near the western border of study area in the Hrubý Jeseník Mts.

Eastwards the 9th VT occurs proximately in the highest parts of the Oravské Beskydy Mts. – peaks of Babia hora Mt. and Pilsko Mt. It occupies the highest parts of great mountains in the altitude from 1,450 to 1,600 m (individually up to 1,650 m a.s.l.).

SZAFER (1963) states the occurrence of lower border of the 9th VT in altitude of 1,390 m a.s.l. on the northern slopes of Babia Góra Mt., in places with avalanche roads even to 1,280 m a.s.l., on the southern slopes it occurs from 1,400 m a.s.l. Geological strata is there the flysch series of rocks of sandstones, where are represented the following soil types: Leptosols, Lithosols and Podzols (haplic, humic).

The territory of the 9th VT belongs to the C3 and C4 climatic regions with the following characteristics: mean January temperature: of -6 to -7°C, mean July temperature: 12-14°C, precipitation amount in the vegetation period: 600-700 mm, precipitation amount in the winter period: 400-500 mm (horizontal atmospheric precipitation occur there significantly), number of days with mean temperature 10°C and more: 80-120 days.

Occurrence: 9th VT occurs only insularly in the highest places of mountains. KRIŽOVÁ (2000) states the area of the VT at 0.99%. BUČEK & LACINA (1999) write about the occurrence of the VT in the Moravia and Silesia in the Králický Sněžník Mts. and in the Hrubý Jeseník Mts., where it occupies places from the altitude of 1,300 m a.sl.

Present condition of forest geobiocenoses: In the past the stands were influenced by pasture and also by deforestation (all territories in the Czech Republic and also in the Slovakia). The stands of *Pinus mugo* were destroyed and then the lower border of the 9th VT was significantly influenced. At present it can be said, that geobiocenoses recovering from pasture are returning into their natural state and at present are influenced only by tourism. In the northern Moravia and Silesia territory of the VT was under significant influence of deforestation with subsequent pasture, however JENÍK (1972) supposes that this factor is often overrated. BEDNÁŘ et al. (1966) writes that the Hrubý Jeseník Mts. was originally "forested" almost up to peaks – alpine meadows were only on the top of Praděd Mt., Vysoká hole Mt. and Keprník Mt. and also in the Králický Sněžník Mts.

CONCLUSION AND SUMMARY

Vegetation tiers, as a basic superstructure units of the forest-typological (or geobiocenological) classification systems, are marked according to ecological manifestation of differential species combination in sections of „guide" series, they are determined by differentiation species (at first place tree or shrub determinants!) of the main level synusia of natural forest and shrub geobiocenoses and by chtonophytes (vascular plants).

7th VT represents the geobiocenoses of *Fageti-piceeta* s.lat., it occupies 0.21 % of the study area – from 1,040 to 1,240 m a.s.l., with the centre of occurrence in the interval of 1,120-1,140 m a.s.l. *Picea abies* is a dominant tree species, it creates the main level and the co-dominant level with maximum height up to 40 m and with representation of 70 %. *Fagus sylvatica* is only a subdominant tree species, it creates the overtopped level with the maximum height of 25 m and with representation of 20 %. Forest stands visibly consist of two storeys. *Abies alba* occurs in the main and overtopped level with the representation up to 10 %. *Acer pseudoplatanus* occurs as the admixture species in the overtopped level with the maximum height of 20 m. There are the following shrub species: *Sambucus racemosa*, *Lonicera nigra*, *Ribes alpinum*, *Salix silesiaca*, *Rosa pendulina* and additionally *Ribes petraeum* can occur individually there.

8th VT represents the geobiocenoses of *Piceeta* s.lat., it occupies only several hectares in the study area – from 1,150 up to 1,323 m a.s.l. *Picea abies* is a dominant species, it reaches the maximum height of 25 m. *Fagus sylvatica* occurs only individually reaching a shrub height with maximum height of 3-4 m. *Abies alba* occurs in the main and

the overtopped level as the admixture. *Acer pseudoplatanus* can occur also in the dwarf height. Forest stands are naturally opening up. *Sorbus aucuparia* can occur in these opening places. *Salix caprea, Lonicera nigra, Ribes petraeum* and *Salix silesiaca* can occur in the shrub level. 8th VT represents the last VT where the tree layer has the character of "the forest" i.e. upper border of the VT is the upper forest limit. The geobiocenoses on the peaks are under the influence of "the peak phenomenon" and therefore the tree layer have a lower growth (with the height of 10-16 m).

"Mountain spruce forest" is a commonly used term, but its definition is usually not very clear and well understood. It is possible to use one of the vegetation classification systems – the geobiocenological system (ZLATNÍK 1959, 1976b; BUČEK & LACINA 1999) or the forest site classification system (PLÍVA 1971, 1991) to specify it. "Mountain spruce forest" is analogous to the 6th and 7th altitudinal vegetation tiers according to the geobiocenological system and according to the forest-typological system it corresponds with the 7th and 8th AVZ (cf. HOLUŠA 2003; HOLUŠA & HOLUŠA 2010).

9th VT does not occupy the study area (Fig. 1), however, it occurs near the western border of the study area in the Hrubý Jeseník Mts. on the massiv of Praděd Mt. Eastward the 9th VT occurs proximately in the highest parts of the Oravské Beskydy Mts. – the peaks of Babia hora Mt. and Pilsko Mt. 9th VT represents the geobiocenoses of *Pineta mugo* s.lat. *Pinus mugo* is a dominant species there that very often creates continuous stands. *Picea abies* occurs only as the individual admixture. It creates small groups on the lower border of the VT which 2-3x exceed the height of *Pinus mugo*-stands. The representation of *Picea abies* decreases towards higher places – from 50 % at lower border of the VT to individual admixture at the upper border of the VT. Dwarf specimens of *Sorbus aucuparia* occur in opening places. There are also shrubs of *Salix caprea* and *Salix silesiaca*. *Juniperus communis* subsp. *alpina* is very common towards to upper border of the VT, at some places it creates continuous stands. Progressive decrease of *Picea abies* occurrence is given by the loss of the regeneration ability. It is very weak near the upper border of the forest limit (PLESNÍK 1968).

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SOUHRN

Vegetačním stupněm (dále jen VS) se rozumí ekologická nadstavbová jednotka geobiocenologických jednotek ve vztahu ke klimatu uplatňujícího se na krajinných segmentech. VS jsou vymezovány podle ekologického projevu diferenciální druhové kombinace segmentů „vůdčích" řad. VS jsou určeny diferenciačními druhy, které jsou na prvním místě stromovité, popř. křovité determinanty synuzie hlavní úrovně původních lesních a křovitých biocenóz a vůbec chtonofyty, reagující rozhodným způsobem na délku vegetační doby a na negativní jevy klimatu (ZLATNÍK 1976a).

Charakteristiky uvedené v této práci jsou vyhotoveny pro oblasti východního Hercynika, Polonika a západních Karpat na území České republiky, tj. studovaná oblast zahrnuje všechny významné biogeografické oblasti ČR s dostatečným zastoupením lesů. Navazují na předcházející práci HOLUŠA & HOLUŠA (2008), kde byly charakterizovány 3. dubo-bukový (tj. geobiocenózy *Querci-fageta* s.lat.) a 4. bukový (tj. geobiocenózy *Fageta* (*abietis*) s.lat.) VS, a práci HOLUŠA & HOLUŠA (2010), kde byly charakterizovány 5. jedlo-bukový (tj. geobiocenózy *Abieti-fageta* s.lat.) a 6. smrko-bukový (tj. geobiocenózy *Picei-fageta* s.lat.) VS.

Jsou prezentovány detailní charakteristiky (dřevinné druhové složení, porostní struktura, determinační znaky) pro 7. (*Fageti-piceeta* s.lat.), 8. smrkový (*Piceeta* s.lat.) a 9. klečový (*Pineta mugo* s.lat.) VS na území severní Moravy a Slezska (Česká republika).

7.VS představuje společenstva s dominantní dřevinou *Picea abies*, který tvoří úroveň a nadúroveň, kde dosahuje max. výšky až 40 m. *Picea abies* jako hlavní edifikátor geobiocenóz dosahuje podílu 70 %. *Fagus sylvatica* je již subdominantní a tvoří podúroveň, kde dosahuje výšky max. 25 m, dosahuje podílu 20 %. Porosty jsou výrazně dvou-etážové. *Abies alba* se vyskytuje v úrovni a podúrovni se zastoupením do 10 %.

8.VS představuje společenstva s dominantní dřevinou *Picea abies*, který dosahuje výšky max. 25 m. *Fagus sylvatica* se vyskytuje jen jednotlivě a většinou je křovitého vzrůstu, výjimečně dosahuje výšky 3-4 m. *Abies alba* se vyskytuje v hlavní úrovni a podúrovni jako příměs.

9.VS představuje společenstva s dominancí *Pinus mugo*, která často tvoří souvislý porost. Jednotlivě až skupinovitě přimíšený je *Picea abies*. Při spodní hranici VS vytváří smrk ztepilý málo početné skupinky, které 2-3x převyšují úroveň porostů *Pinus mugo*. *Picea abies* má na spodní hranici VS zastoupení do 50 %, na horní hranici VS 10-30 %. Ve vyšších polohách jedinci *Picea abies* převyšují porosty *Pinus mugo* jen nepatrně. Vyskytuje se jednotlivě nebo ve skupinách 2-4 exemplářů s výškou 1-3 m.

Fig. 1. Spread of the 7th VT (*Fageti-piceeta* s.lat.) in the study area (azonal geobiocenoses of flood plains are not marked in the frame of the territory of the VT; line A–A´ represents positions of profile, Fig. 8)

Obr. 1. Rozšíření 7.VS (*Fageti-piceeta* s.lat.) v zájmové území (azonální geobiocenózy lužních stanovišť nejsou vyznačeny v rámci území VS; linie A–A´ znázorňuje umístění příčného profilu terénem, obr. 8)

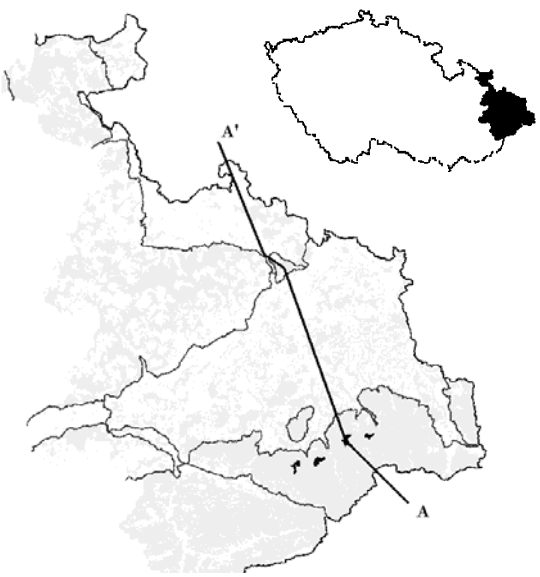

Fig. 2. Graph of the occurrence of the 7th VT (*Fageti-piceeta* s.lat.) in the intervals of the altitude in the study area

Obr. 2. Graf výskytu 7.VS (*Fageti-piceeta* s.lat.) v intervalech nadmořské výšky ve studované oblasti

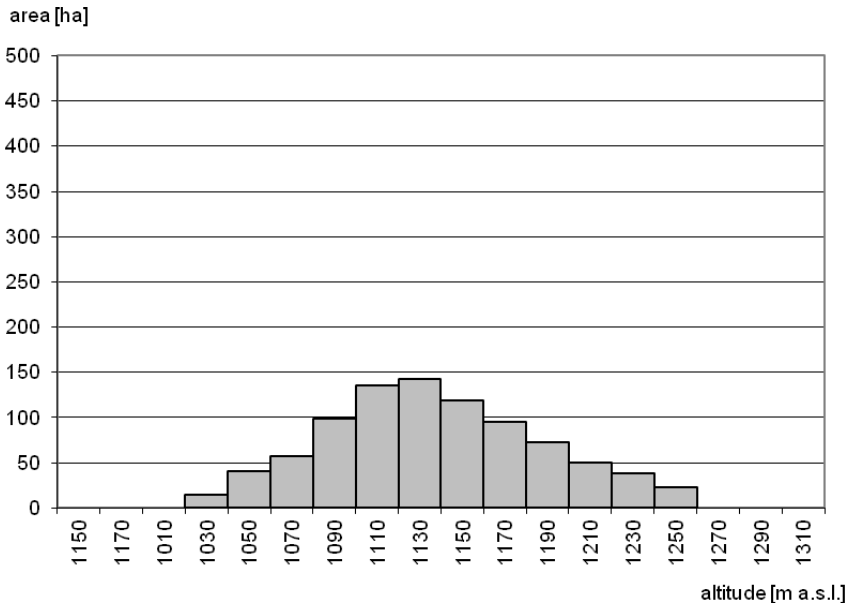

Fig. 3. Graph of the occurrence of the 8th VT (*Piceeta* s.lat.) in the intervals of the altitude in the study area
Obr. 3. Graf výskytu 8.VS (*Piceeta* s.lat.) v intervalech nadmořské výšky ve studované oblasti

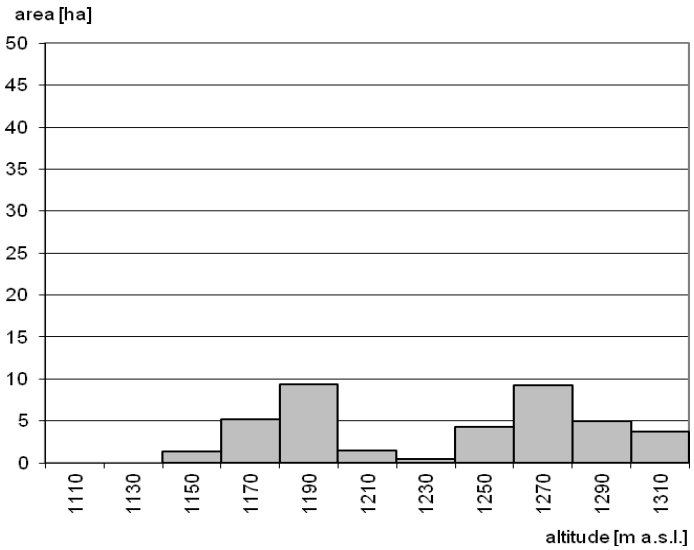

Fig. 4. Transect of the forest stand structure of the 7th VT (*Fageti-piceeta* s.lat.) (locality: the Moravskoslezské Beskydy Mts., c.t. Ostravice – the Nature Reserve of Smrk Mt.)
Obr. 4. Transekt znázorňující porostní strukturu 7.VS (*Fageti-piceeta* s.lat.) (lokalita: Moravskoslezské Beskydy, k.ú. Ostravice – Přírodní rezervace Smrk)

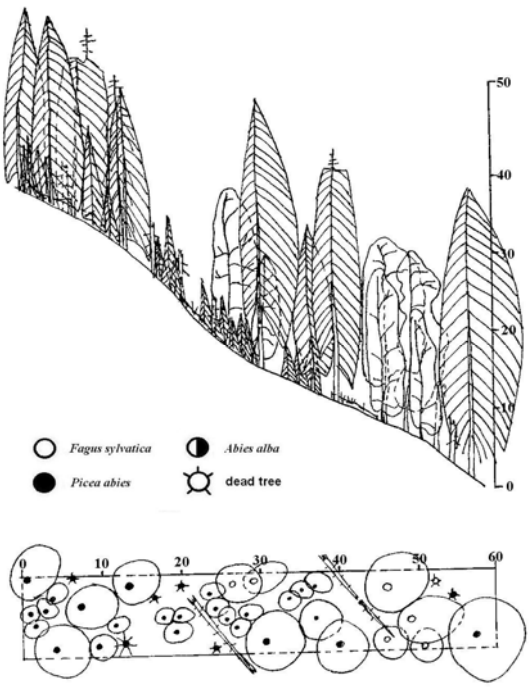

Fig. 5. Transect of forest stand structure of the 8th VT (*Piceeta* s.lat.) (locality: the Moravskoslezské Beskydy Mts., c.t. Staré Hamry – the National Nature Reserve of Mazák)

Obr. 5. Transekt znázorňující porostní strukturu 8.VS (*Piceeta* s.lat.) (lokalita: Moravskoslezské Beskydy, k.ú. Staré Hamry – Národní přírodní rezervace Mazák)

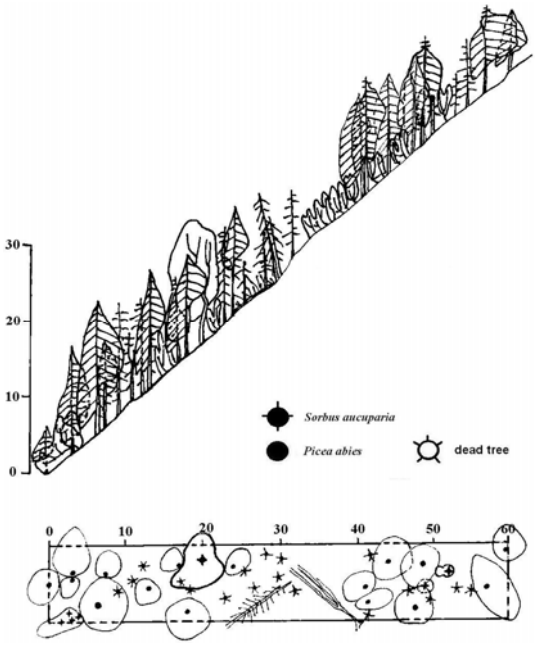

Fig. 6. Demonstration of natural geobiocenoses of the 7th VT (*Fageti-piceeta* s.lat.) (locality: the Moravskoslezské Beskydy Mts., c.t. Čeladná – the National Nature Reserve of Kněhyně–Čertův mlýn, 1,070 m a.s.l.)

Obr. 6. Ukázka přírozené geobiocenózy 7.VS (*Fageti-piceeta* s.lat.) (lokalita: Moravskoslezské Beskydy, k.ú. Čeladná – Národní přírodní rezervace Kněhyně–Čertův mlýn, 1070 m n.m.)

Fig. 7. Demonstration of natural geobiocenoses of the 8th VT (*Piceeta* s.lat.) (locality: the Moravskoslezské Beskydy Mts., c.t. Staré Hamry – the northern slope of the top of Lysá hora Mt., 1,305 m a.s.l.)

Obr. 7. Ukázka přírozené geobiocenózy 8.VS (*Piceeta* s.lat.) (lokalita: Moravskoslezské Beskydy, k.ú. Staré Hamry – severní svahy vrcholu Lysé hory 1305 m n.m.)

Fig. 8. Demonstration of natural geobiocenoses of the 8th VT (*Piceeta* s.lat.) – dwarf specimen of *Fagus sylvatica* (locality: the Moravskoslezské Beskydy Mts., c.t. Staré Hamry – the National Nature Reserve of Mazák – the peak of Lysá hora Mt., 1,315 m a.s.l.)

Obr. 8. Ukázka přírozené geobiocenózy 8.VS (*Piceeta* s.lat.) – zakrslý jedinec buku lesního (*Fagus sylvatica*) (lokalita: Moravskoslezské Beskydy, k.ú. Staré Hamry – vrchol Lysé hory, 1315 m n.m.)

Fig. 9. Profile in the A–A´ line in the study area with marked 7th and 8th VT
Obr. 9. Profil terénu na linii A–A´ v zájmové oblasti s vyznačením 7. a 8.VS