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Characteristics of 3rd (*Querci-fageta* s. lat.) and 4th (*Fageta (abietis)* s. lat.) vegetation tiers of north-eastern Moravia and Silesia (Czech Republic)

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ABSTRACT: Detailed characteristics (tree species composition, tree representation, identification features) are presented by 3rd (i.e. geobiocenoses of *Querci-fageta* s. lat.) and 4th (*Fageta (abietis)* s. lat.) vegetation tiers in north-eastern Moravia and Silesia. 3rd VT occupies 45.6% of the study area – from 190 m a.s.l. up to 430 m a.s.l. *Fagus sylvatica* is a dominant tree (with the height of 35–40 m). *Quercus robur* and *Quercus petraea* have their ecological optimums there with the representation of up to 30%. *Abies alba* occurs in the crown level with the representation of up to 10%. 4th occupies 35.2% of the study area – from 310 m a.s.l. up to 650 m a.s.l. *Fagus sylvatica* is dominant (the height over 50 m). *Abies alba* occurs in the co-dominant level (sporadically in the level exceeding the main level) with the representation of ±20% and the height of up to 50 m. *Quercus petraea* and *Quercus robur* occur only as an interspersed species with the representation of up to 10%, they do not reach the co-dominant tree level any more. *Carpinus betulus* is represented regularly only in the overtopped tree level.

Keywords: forest-typological classification system; vegetation tiers; *Querci-fageta* s. lat.; *Fageta (abietis)* s. lat.; characteristics of forest ecosystems; north-eastern Moravia and Silesia; Czech Republic

The vegetation arrangement in tiers (Kolektiv 1995) means a phenomenon of changes of the species composition of natural phytocenoses including their edificators with a change of macroclimate in vertical direction in a certain geographical entity. The height arrangement in tiers is very often expressed according to the orography of the terrain in geographical zones. When taking into account the continuity of vegetation differences with the continuity of differences of height and exposure climate, it is referred to as vegetation tiers (Zlatník 1975, 1976a).

Vegetation tiers (futher only the VT) were determined and already used by Professor Alois Zlatník at the end of the 60th of the 20th century (Zlatník 1959, 1963) but without the definition of the VT and their characterictics. Zlatník (1976a) published the first definition in his further work: "VT is the ecological superstructure unit of geobiocenological units in relation to the climate which has an influence on the landscape sections. VTs are determined according to the ecological manifestation of different species combination of sections of "guide" series, where the difference of the climate influence on the composition of tree and undergrowth synusia is minimally disrupted by the local absence of water, or on the contrary, other than atmospheric water." A

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more comprehensible formulation was published by Králíček and Povolný (1978): "VT is a biocenological (geobiocenological) construction unit which reflects the influence of climate on the composition of chtonophytic synusia of biocenoses (geobiocenoses) and which is determined by this composition." A similar definition was published by Randuška et al. (1986): "VT is an overall prevailing climax geobiocenosis which is determined by vegetation including alternate geobiocenoses in certain regions and which is subject to the macroclimate and mesoclimate in conditions with a changing altitude."

Zlatník (1976b) states that VTs are determined by differentiation species, that are, in the first place, tree or shrub determinants of the main level synusia of natural forest and shrub geobiocenoses and by vascular plants in general responding to the vegetation period length and negative features of the climate in a significant way. It means that VTs are recognisable mainly on the basis of representation and life manifestation of tree species (s. lat.). Zlatník (1976a) distinguishes 8 vegetation tiers, one VT as alpine and one VT subnival (however, AZ subnival has been identified in the High Tatras only) in the former Czechoslovakia. The terms of VTs were defined according to the names of the main trees in the natural geobiocenoses. The systematics of Plíva (1971) comes from Zlatník's classification of VT, with the difference that the forest VTs are the subject of the main interest. The main difference is in the division of 6th VT (*Abieti-fageta piceae* s. lat.) on the basis of the proportional representation of *Fagus sylvatica* L. and *Picea abies* (L.) Karsten into two VTs: 6th VT (*Picei-fageta* s. lat.) and 7th VT (*Fageti-piceeta* s. lat.).

The following tree species are the carriers of the vegetation tiers in the Czech Republic: the sessile oak (*Quercus petraea* (Mattuschka) Liebl.), English oak (*Quercus robur* L.), European beech (*Fagus sylvatica*), silver fir (*Abies alba* Mill.), Norway spruce (*Picea abies*), and Carpathian pine (*Pinus mugo* Turra). VTs were named according to these tree species because of their dominance in certain zones. Some other tree species also occur in particular VTs and their occurrence and representation help to determine the relevant VTs: the pubescent oak (*Quercus pubescens* Willd.), Turkey oak (*Quercus cerris* L.), European hornbeam (*Carpinus betulus* L.), Norway maple (*Acer platanoides* L.), small-leaved linden (*Tilia cordata* Mill.), large-leaved linden (*Tilia platyphyllos* Scop.), field maple (*Acer campestre* L.), European larch (*Larix decidua* Mill.), wild service tree (*Sorbus torminalis* (L.) Crantz), cherry tree (*Padus avium* (L.) L.), sycamore maple (*Acer pseudoplatanus* L.), and Scotch elm (*Ulmus glabra* Huds.). On the contrary, some eurytopic tree species have no relation to any particular VT and they occur in a large range of VTs – f.e. The European birch (*Betula pendula* Roth), Scotch pine (*Pinus sylvestris* L.), and European mountain ash (*Sorbus aucuparia* L.) (Holuša, Holuša 2001).

Any detailed characteristics including determination characters have not yet been processed. Plíva (1971) published an approximate climatic characteristics for "vegetation forest tiers" with brief information about the tree species composition with notes about the vitality of particular species. A very brief characteristics for "forest vegetation tiers (including the VT of *Pineta mugi* i.e. 9th)" with information about the tree species composition, records of tree species optimums, and climatic characteristics were published by Plíva (1991). Buček and Lacina (1999) published detailed characteristics of the VT which include the biogeographical frame and occurrence, ecotype features, and decription of the biocenoses state. Viewegh et al. (2003) made the survey of forest-typological system public, but without any definitions of frames (e.g. vegetation tiers, ecological series, edaphica categories) and lower units. Some brief information (occurrence, climatic characteristics, verbal decription of tree species participation, information about tree species optimums and brief tree species occurrence) about forest vegetation tiers (including the VT of *Pineta mugi*) were published by Viewegh (2003). Detailed characteristics with the decription of biogecenosis natural state (occurrence of plant species, occurrence of tree species, and relationship to geobotanical units) were published by Buček et al. (2005).

The aim of the article is to bring out detailed characteristics of 3rd and 4th vegetation tiers with respect to the occurrence, representation, and life state of trees species as the main edificators.

Study area

The study area lies in the north-eastern Moravia and Silesia (i.e. the very eastern part of the Czech Republic – see Fig. 1). The study area is approximately defined by this line: the state border between the Czech Republic and Slovakia and Poland near Hrčava village – the state border between the CZ and Slovakia up Makyta Mt. – Pulčín village – Pozděchov village – Liptál village – Držková village – Humenec Mt. – Kelč village – Lipník nad Bečvou town – Potštát village – Staré Oldřůvky village – Dvorce village – Lichnov village – Krnov town – Vrbno pod Pradědem town – Rejvíz village – Heřmanovice

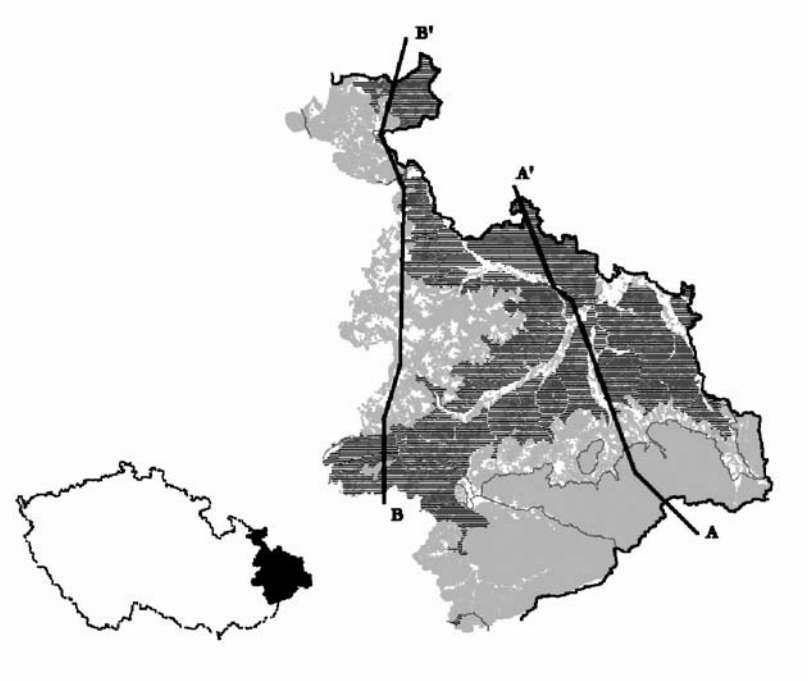

Fig. 1. Spread of 3rd vegetation tier (*Querci-fageta* s. lat.) in the study area (azonal geobiocenoses of flood plains are not marked in the frame of the territory of the VT); lines A–A´, B–B´ represent positions of profiles (see Figs. 9, 10); on the left side drawing of the study area in the Czech Republic

village – Petrovice village – the state border with Poland to the state border with Slovakia. As far as the division of Natural Forest Areas (futher only the NFA) (Plíva, Žlábek 1986) is concerned, the following Natural forest areas are these: 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: the eastern half of the NFA 29 Nízký Jeseník hills and the eastern half of the NFA 41 the Hostýnsko-vsetínské vrchy hills and the Javorníky Mts., the 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. The study area represents the region where forest-typological mapping was carried out by the authors.

The study area comprises the following subprovincies with respect to the biogeographical division (Culek 1996): Hercynic subprovincy (i.e. NFAs 28, 27, 29), Polonic subprovincy (i.e. NFAs 32, 39), and West-Carpathian subprovincy (i.e. NFAs 39, 40 and 41).

The lowest point of the study area lies in the lowland of the Odra River at elevation 193 m a.s.l. – i.e. the point where the Odra River leaves the territory of the Czech Republic. The alluvium of the Odra River is followed eastwards by flat hills that change into uplands and later highlands of the Moravskoslezské Beskydy Mts. with the highest point – Lysá hora Mt. (1,328.4 m a.s.l.). The alluvium of the Odra River is followed eastwards by flat hills that change into uplands and later highlands of the Hrubý Jeseník Mts. with the highest point of the study area in this part – Medvědí vrch Mt. (1,216 m a.s.l.).

MATERIAL AND METHODS

The forest-typological classification system was used for the classification of ecological conditions

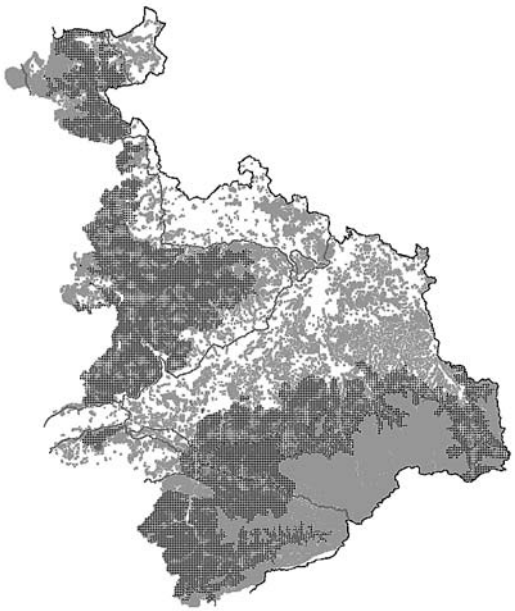

Fig. 2. Spread of 4th vegetation tier (*Fageta (abietis)* s. lat.) in the study area (azonal communities of flood plains are not marked in the frame of the territory of the VT)

of geobiocenoses. It is used in the forest practice in the Czech Republic (Plíva 1971, 1991).

The author's records were found by our own forest-typological mappings in the study area during the period 1971–2002. The forest-typological mappings in the study area including the determination of the vegetation tiers were done by the authors in the frame of the recovery of Forest management plans of individual Management-plan areas, later by the "examination" of natural conditions within the Regional plans for forest development. The individual Management-plan areas (futher only the MPA) were elaborated in the following years: 1971 – the MPA Velké Karlovice, 1972 – the MPA Hrozenkov, 1973 – the MPA Bečvy, 1974 – the MPA Rožnov pod Radhoštěm, the MPA Valašské Meziříčí, 1975 – the MPA Opava, 1976 – the MPA Hlučín, the MPA Opava, the MPA Vsetín, 1977, 1978 – the MPA Albrechtice, the MPA Jablůnka, 1982 – the MPA Vítkov, 1983, 1984 – the MPA Ostravice, the MPA Velké Karlovice, 1985 – the MPA Rožnov pod Radhoštěm, 1986 – the MPA Rožnov pod Radhoštěm, 1987 – the MPA Jablunkov, the MPA Opava, the MPA Šenov, 1988 – the MPA Vsetín, 1989 – the MPA Frýdek-Místek, 1990 – the MPA Albrechtice, 1991 – the MPA Vítkov, 1992 – the MPA Frenštát pod Radhoštěm, 1993 – the MPA Ostravice, 1994 – the MPA Velké Karlovice, 1995 – the MPA Rožnov pod Radhoštěm, 1996 – the MPA Jablunkov, the MPA Opava, 1998 – the former MPA Vsetín, 1999 – the MPA Frýdek-Místek, 2001 – the MPA Frenštát pod Radhoštěm and 2002 – the MPA Ostravice.

Total revision of the forest-typological mapping was done over the whole territory of the MPA. 150 to 220 phytosociological releves were surveyed in the geobiocenological research areas in each MPA. The soil was sampled in geobiocenological areas. After the year 1981, ca 20 geobiocenological areas (per ca 20,000 ha) were revised and also ca 40 pedological samples were taken there. This methodology was used within the frame of the field mapping of the Regional plans for forest development.

Phytosociological releves were revised at the geobiocenological plots as squares of 20 × 20 m. The best-preserved geobiocenoses were in the study focus (i.e. the level of naturalness 1 or 2 according to Ellenberg 1973, 1978). Transects of the size of 10 × 60 m were set out for the description of the forest stand structure at the best-preserved plots. Dendrological measurements were made on the plots with regard to the highest trees. Photos were taken at some representative geobiocenoses in the vegetation period. Phytosociological releves 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 and Štykar (2001) for the evaluation of the vegetation band representatives in the interpretation of Schmid (1939, 1949). The following abbreviations are used for the vegetation bands: *QTA – Quercus–Tilia–Acer, QRC– Quercus robur–Calluna, FA – Fagus–Abies, P – Picea* and *LPC – Larix–Pinus cembra*. The nomenclature of the plant and tree species is used according to Kubát et al. (2002). The climatic characteristics are defined according to Tolasz (2007). The classification of the soil types and subtypes is used according to Němeček et al. (2001).

RESULTS AND DISCUSSION

Characteristics of the vegetation tiers

3rd vegetation tier – *Querci-fageta* s. lat. – oak-beech

The composition and structure of geobiocenosis

Fagus sylvatica is a dominant tree which creates the main level of geobiocenosis. It reaches the height of 35–40 m (see Figs. 5 and 7). Rambousek (1990) characterises the *Fagus sylvatica* in the 3rd vegetation tier as a hillock climatype with above-average characteristic (the height, diameter at breast height, differential position of trees, the size of crowns, dichotomy, branch massive), the representation of straight trunks is up to 20% (as a significant determination character). Of *Fagus sylvatica* trees ca 30–40% exceed the main level in the constitution of stands. *Quercus* sp. (*Quercus robur, Quercus petraea*) have their ecological optimum in 3rd VT. They occur with the representation of up to 30%. They reach also into the crown level (see Fig. 5). *Quercus petraea* occurs in the western and southern parts of the study area (i.e. NFAs 28, 29, 32, 37 and 41) and *Quercus robur* occurs in the north-eastern part (i.e. NFAs 39 and 40). *Abies alba* occurs in the crown level with the representation in oligotrophic and also eutrophic series up to 10%. Buček and Lacina (1999) admit the representation of *Abies alba* in 3rd VT exclusively in limited series only. *Carpinus betulus* is very common (only in the subordinate tree level with the representation of up to 10%), further in the co-dominant tree level occur individually *Tilia cordata*, *Tilia platyphyllos*, *Acer platanoides*, *Fraxinus excelsior*, *Ulmus glabra*, *Padus avium*, locally also *Acer pseudoplatanus*, in the subordinate tree level occur individually *Acer campestre* and *Malus sylvestris*. *Sorbus torminalis* occurs in the study area sporadically (only

in the NFA 41). Buček and Lacina (1999) report that the occurrence of *Tilia cordata* and *Sorbus torminalis* ends in 3rd VT. *Quercus dalechampii* and *Quercus polycarpa* occur in 3rd VT in the region of southern Moravia. The following shrub species occur in 3rd VT in the shrub level: *Sambucus nigra*, *Hedera helix*, *Crataegus laevigata*, *Crataegus praemonticola*, *Daphe mezereum*, locally also *Evonymus europaea* and in bright places *Frangula alnus.* The occurrence is possible of *Lonicera xylosteum* (Buček, Lacina 1999). The occurrence of termophilous shrub species ends there in 3rd VT (f.e. *Ligustrum vulgare*).

Differential signs

The dominance of *Fagus sylvatica*; *Quercus* sp. stay in the forest stand structure in the co-dominant tree level; higher representation of *Carpinus betulus*; coppice forests consist of the following tree species: *Quercus petraea*, *Carpinus betulus*, *Tilia cordata*, *Betula pendula*, and *Populus tremula*. The plant species *Polygonatum multiflorum* is an indication species which does not reach higher VTs.

Is it possible to expect the natural representation of *Pinus sylvestris* in 3rd VT in the western part of the NFA 32 and the northern part of the NFA 29 (i.e. western part of the Opavský biogeographical region, up to the crossing in the Krnovský biogeographical region – Culek 1996). *Pinus sylvestris* has occurred in natural geobiocenoses of 3rd VT in the Krnovský biogeographical region (above all in the habitats of Forest type complexes 3H, 3C, 3O) (Holuša, Holuša 2000). Its occurrence is determined there by specific soil and climatic conditions.

The plant species typical of Central-European deciduous forests (= broadleaved forest in the concept of Jeník 1995) are dominant in the undergrowth – e.g. *Senecio ovatus, Oxalis acetosella, Asperula odorata, Viola reichenbachiana,* and *Asarum europaeum*. There are species typical of higher VTs – *Rubus idaeus* and *Rubus hirtus*. *Carex brizoides* is a very common and dominant species in the undergrowth in the study area. The plant species of the *FA* vegetation band are dominant, further the species of the *QTA* and *QRC* vegetation bands, possibly also the species belonging to two vegetation bands *FA* (*QTA*), *P* representatives individually descend there from higher VTs.

Character of ecotope

3rd VT occupies places of table-lands and gentle slopes of uplands (see Figs. 1, 9 and 10), along the alluviums of rivers in the lowest parts of the study area. It occupies places in the altitude from 190 to 440 m a.s.l. with the centre of occurrence in the interval of 260–280 m a.s.l. The upper border of 3rd VT can stand out sporadically in southern aspects up to 460 m a.s.l. (Fig. 3). 3rd VT occurs from 300 to 500 m a.s.l. according to Buček and Lacina (1999), exceptionally up to 600 m a.s.l. Great overlapping of loess loams is very common on the table-lands in NFA 32 and NFA 39. Soil types are represented by luvisols (typical, pseudogley, arenic) and cambisols (arenic, typical, pseudogley), sporadically pararendzinas, podzols, and regosols are represented there.

3rd VT occurs in the W2 climatical regions with the average year temperature of 7.8°C and the average annual precipitation of 750 mm, the average length of the vegetative period being 162 days.

Occurrence

3rd VT dominates in the whole NFA 32. It occupies large areas in the lowest parts of NFA 39 which are

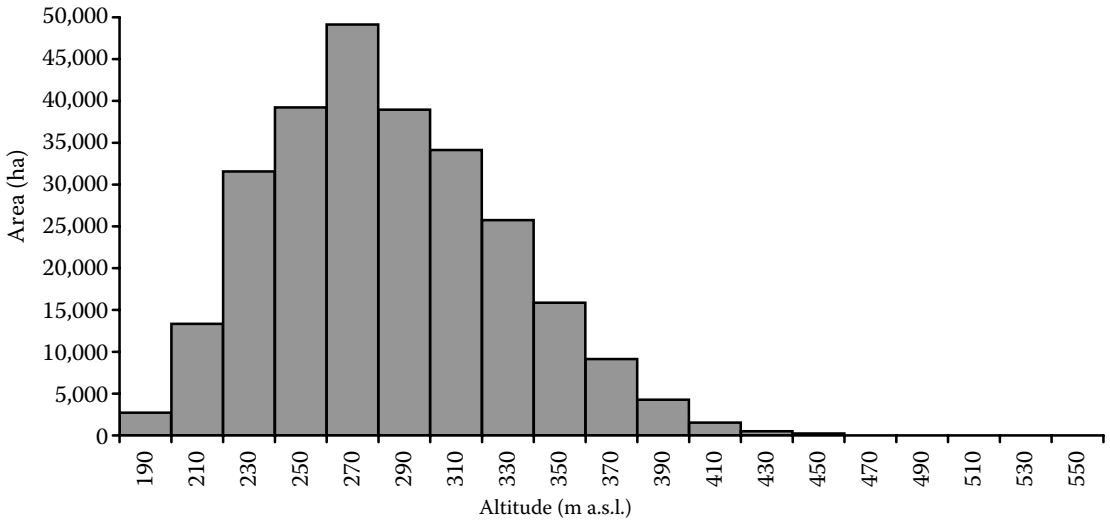

Fig. 3. Graph of the occurrence of 3rd vegetation tier (*Querci-fageta* s. lat.) in the intervals of the altitude in the study area

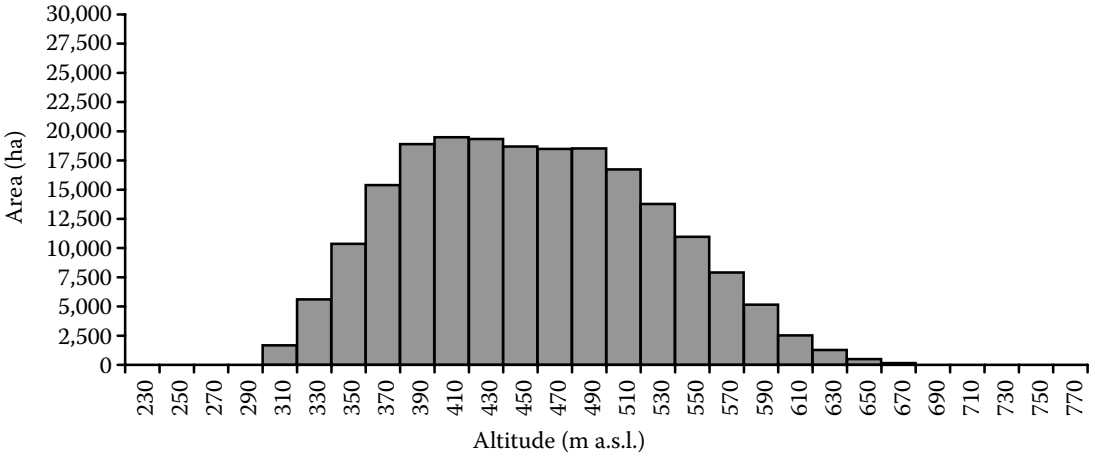

Fig. 4. Graph of the occurrence of 4th vegetation tier (*Fageta* (*abietis*) s. lat.) in the intervals of the altitude in the study area

in contact with broad alluviums of the Opava, Odra, Ostravice and Olše rivers. 3rd VT is sporadical in the lowest parts on the foothills of NFA 40. It has a relatively extensive occurrence in NFAs 29 and 37 (Fig. 1). The most widespread communities in 3rd VT in the study area are: forest type complexes (further FTC) 3H (*Querceto-Fagetum illimerosum trophicum*), FTC 3S (*Querceto-Fagetum mesotrophicum*),

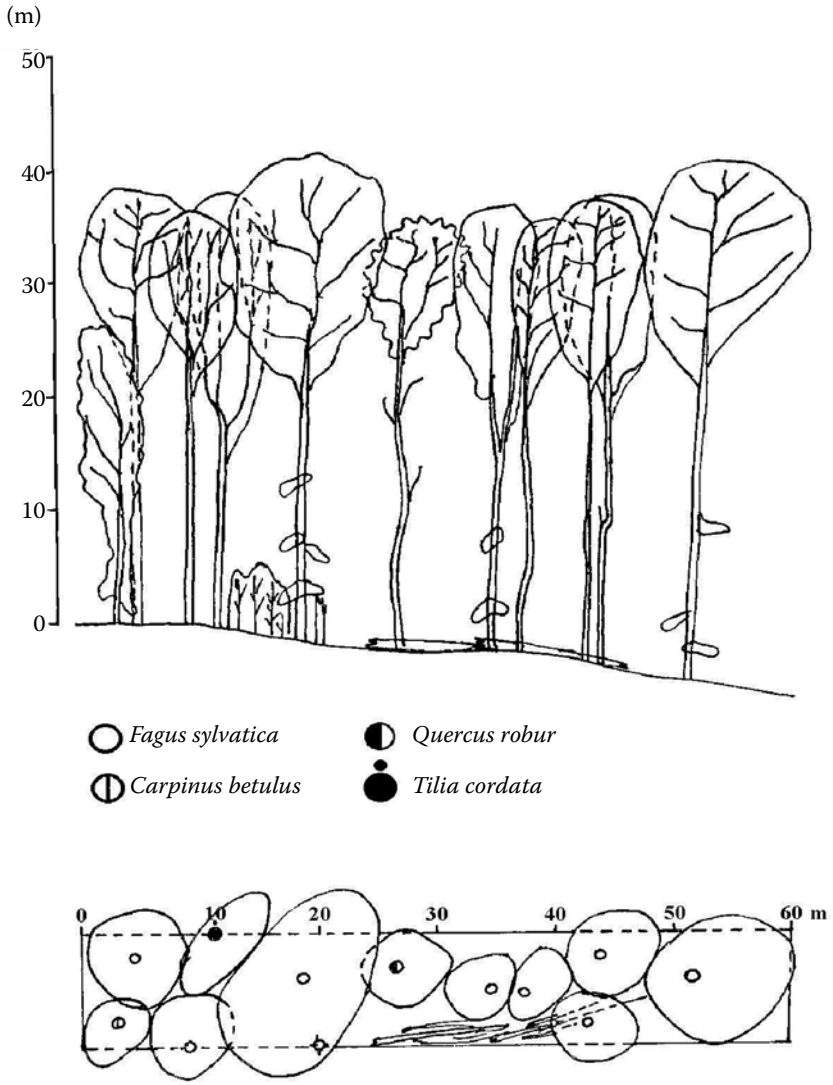

Fig. 5. Transect of the forest stand structure of 3rd vegetation tier (*Querci-fageta* s. lat.) (locality Šilheřovice – Černý les, 248 m a.s.l.)

FTC 3D (*Querceto-Fagetum acerosum deluvium*), FTC 3B (*Querceto-Fagetum eutrophicum*) and FTC 3O (*Abieti-Querceto-Fagetum variohumidum trophicum*). 3rd VT occurs at present on 45.6% of the study area (including also non-forest land) (Fig. 1). It is dominant in the territory of Moravia and Silesia in the Středomoravské Karpaty hills, in the part of the Bílé Karpaty Mts., in the foothills of the Českomoravská vrchovina hills, in the foothills of the Nízký Jeseník hills, in the Zábřežská vrchovina hills, in the Moravská brána, in the lower parts of the Podbeskydská pahorkatina hills and the Opavská pahorkatina hills; in the whole territory of the Czech Republic it occupies 18% of the area (according to Buček, Lacina 1999). It occurs on the 22.91% of the territory of Slovakia – Križová (2000).

3rd VT belongs to the zonobiome of temperate decidious broadleaved forests of the moderate band in the sorting conception by Walter (1979) and Míchal (1988).

Present condition of forest geobiocenosis

The tree species composition was changed by the elimination of *Fagus sylvatica* in major parts of forest geobiocenoses. Stands composed of *Quercus robur*, *Q. petraea* and *Carpinus betulus* were created by cultivation of coppice forest. *Abies alba* is almost completely missing at present. Large areas were changed into monocultures of *Picea abies*. Geobiocenoses with natural characteristic are preserved only sporadically – in the study area in the Natural reserve of the Černý les I. (cadastral territory of the Šilheřovice village) (Fig. 7).

4th vegetation tier – *Fageta (abietis)* s. lat. – beech

The composition and structure of geobiocenosis

Fagus sylvatica is dominant in 4th VT, which has its ecological optimum there. It can reach the height

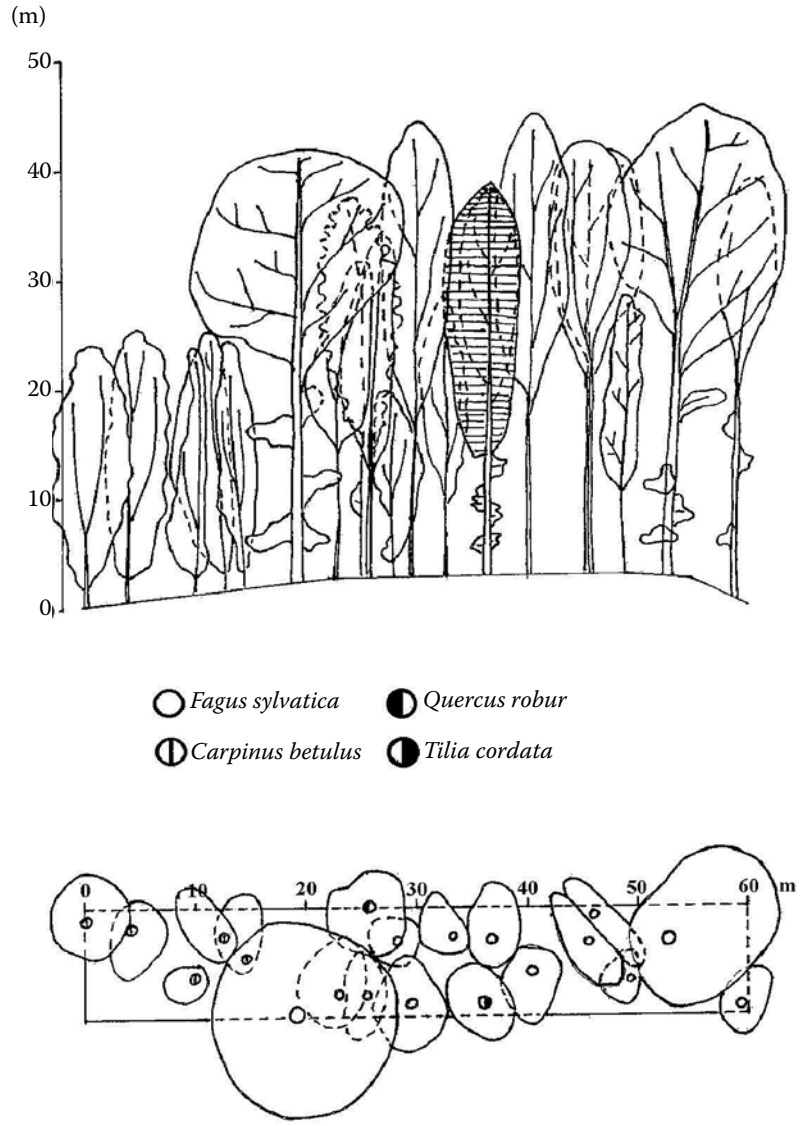

Fig. 6. Transect of forest stand structure of 4th vegetation tier (*Fageta (abietis)* s. lat.) (locality Rychaltice – Palkovické hůrky, 522 m a.s.l.)

over 50 m (Fig. 6). The highest specimen measured of *Fagus sylvatica* in the study area has the height of 47.5 m. Rambousek (1990) characterised *Fagus sylvatica* in 4th VT as a hillock climatype with the same signs as for 3rd VT. *Abies alba* occurs in the co-dominant level, sporadically in the level exceeding the main level. It can reach the representation of ±20% and the height of up to 50 m. Randuška et al. (1986), also Ambros (1991), admit the occurrence of *Abies alba* only on the contact band with 5th VT (i.e. *Abieti-fageta* s. lat.). *Quercus* sp. – *Quercus petraea* and *Quercus robur* – occur only as interspersed species with the representation to 10%, they do not reach the co-dominant tree level. *Quercus petraea* is substituted by *Quercus robur*, as in 3rd VT, in a part of the study area (in NFAs 39 and 40). *Quercus robur* occurs also in higher places of uplands in the altitude 500–600 m a.s.l. *Carpinus betulus* is represented regularly, but in the forest stand structure only in the overtopped tree level. Buček and Lacina (1999) reported only a sporadical occurrence of *Carpinus betulus* in 4th VT. Plíva (1991) does not admit it for natural communities. *Tilia cordata*, *Tilia platyphyllos*, and *Fraxinus excelsior* occur in the co-dominant tree level. Also *Acer platanoides*, *Acer pseudoplatanus*, *Ulmus glabra*, and *Padus avium* are co-dominant and overtopped tree levels. *Tilia cordata*, *Tilia platyphyllos*, and *Acer platanoides* have their ecological optimum. All the above-mentioned tree species occur also on hydric normal mesotrophic ecological habitats (Holuša, Holuša 2000). *Acer campestre* and *Taxus baccata* can occur individually in the overtopped tree level. *Sorbus torminalis* also occurs in the southern part of the study area (i.e. the NFA 41) in 4th. The occurrence of *Sorbus torminalis*, *Acer campestre* and *Carpinus betulus* ends towards higher VTs. The participation of some tree species (above all of *Quercus petraea* and *Abies alba*) is stated by Buček and Lacina (1999) only for mineral-poor underbed, they do not admit the occurrence of *Tilia cordata* and *Sorbus torminalis* in 4th. *Sambucus nigra*, *Euonymus europaea*, *Crataegus laevigata*, *Crataegus premonticola*, *Daphne mezereum*, *Grossularia uva-crispa* are present in the shrub level, in bright places *Frangula alnus*, locally *Sambucus racemosa*, and sporadically *Ribes alpinum*. *Lonicera xylosteum* and *Rosa pendulina* can also occur according to Buček and Lacina (1999). *Fagus sylvatica* can create clear forest stands in some parts (Plíva 1991; Buček, Lacina 1999).

Fig. 7. Demonstration of natural geobiocenosis of 3rd vegetation tier (*Querci-fageta* s. lat.) (locality Šilheřovice – Černý les, 248 m a.s.l.)

Fig. 8. Demonstration of natural geobiocenosis of 4th vegetation tier (*Fageta (abietis)* s. lat.) (locality Rychaltice – Palkovické hůrky, 518 m a.s.l.)

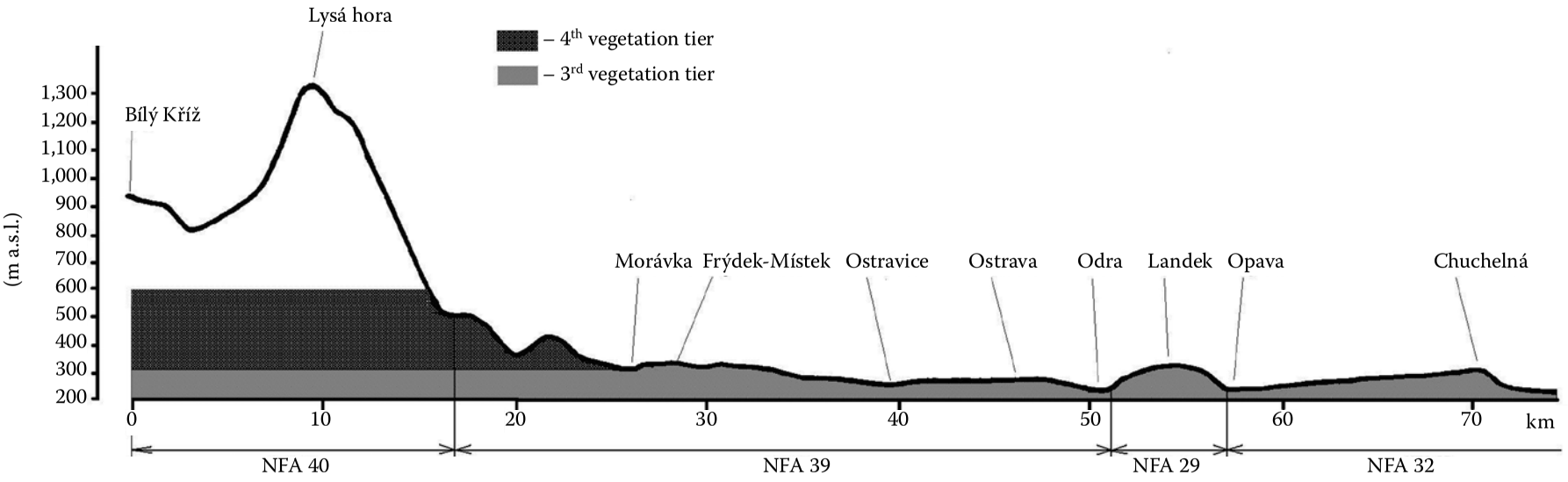

Fig. 9. Profile in the A–A´ profile terrain in the study area with marked 3rd and 4th vegetation tiers

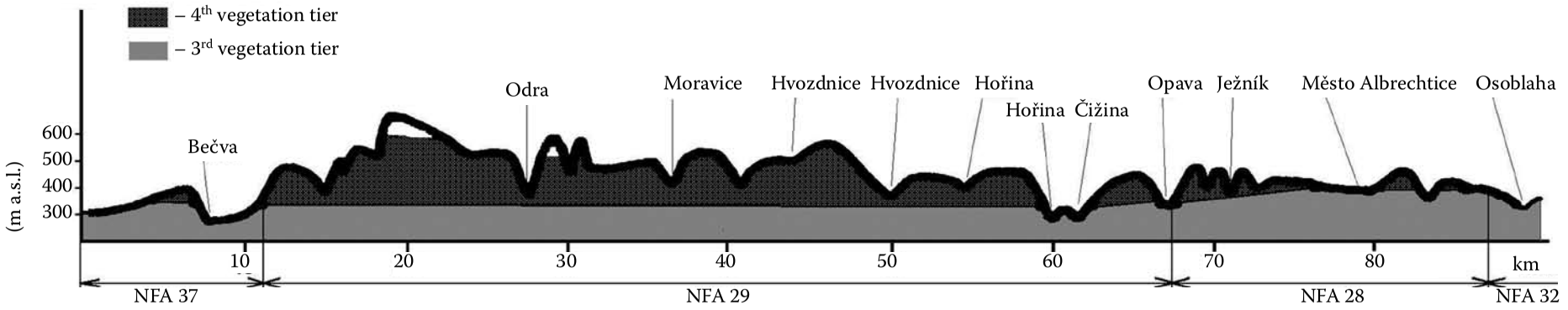

Fig. 10. Profile in the B–B´ profile terrain in the study area with marked 3rd and 4th vegetation tiers

Differential signs

The dominance of *Fagus sylvatica* which reaches the heights of up to 40 m in cutivated forest stands; *Quercus* sp. are present only in the overtopped tree level; *Carpinus betulus* is strongly overtopped (Fig. 6); coppice forests compositions contain *Quercus robur* (*Quercus petraea*), *Betula pendula, Tilia cordata*, and *Carpinus betulus* (only as admixture species); in contrary to 3rd VT, *Polygonatum verticilatum* also occurs, individually also some plant species typical of higher VTs – f.e. *Prenanthes purpurea*.

Plant species of Central-European broadleaved forest (= deciduous broadleaved forest in the concept of Jeník 1995), are dominant in the undergrowth – f.e. *Senecio ovatus, Oxalis acetosella, Asperula odorata*, *Actea spicata*, *Rubus idaeus*, *Rubus hirtus*, commonly occurring ferns are – *Athyrium filix-femia*, *Dryopteris filix-mas*. Species, which are typical of higher VTs begin to occur – *Prenanthes purpurea*, *Calamagrostis villosa*, and *Polygonatum verticilatum*. Plant species of the *FA* vegetation band are strongly dominant (the most of all VTs), *FA (QTA)* vegetation bands species are very common, and also species of *QTA*, only sporadically there are species of *QRC* or *P* vegetation bands. Individually, species occur of three vegetation bands *FA (P, LPC)* or of two bands *LPC, P.*

Character of ecotope

4th VT occupies places of the uplands and lowest parts of mountains (Figs. 2, 9 and 10). It occurs in the altitude from 300–640 m a.s.l. with the centre of occurrence in the interval of 380–440 m a.s.l., locally up to 680 m a.s.l. (Fig. 4). Buček and Lacina (1999) give the occurrence from 400 to 700 m a.s.l., in the Carpathians Mts. up to 800 m a.s.l. Cambisols (typical, eutrophic, sporadically also dystric and pseudogley), are less frequent then podzols (cambic, typical), rarely do occur the soil types (subtypes) pararendzinas, rankers or regozems.

The territory of 4th VT belongs to climatic regions MW7 and MW2 with the average year temperature of 6.8°C, average annual precipitation of 960 mm, average length of the vegetative period of 144 days.

Occurrence

4th VT occupies large areas in NFA 41, coherent areas in the highest parts of NFA 39, and some proportions of the lowest parts of NFA 40. Large areas of 4th VT are also in NFA 29 (Fig. 2). The most widespread communities in the study area are the following ones: FTC SoLT 4B (*Fagetum eutrophicum*), FTC 4S (*Fagetum mesotrophicum*), and FTC 4D *Fagetum acerosum deluvium*). 4th VT occurs on the 35.2% of the study area (including also non-forest land) (Fig. 2). Buček and Lacina (1999) reported a widespread occurrence of 4th VT in the Českomoravská and Drahanská vrchovina hills, the Nízký Jeseník hills, in the Carpathian Mts., then in the Chřiby Mts., Bílé Karpaty Mts., in the Hostýnsko-vsetínská and Vizovická vrchovina hills. 4th VT is according to these authors the most widespread VT in the Czech Republic with the area of 36%. 4th VT covers 19.70% (Križová 2000) in Slovakia. 4th VT was not marked by the first forest-typological mapping, its area having been involved into 5th VT, and partially into 3rd VT. It was mapped additionally and it has not been mapped yet in some areas (Kusbach 2000). Plíva (1991) states that it is similarly strongly underrated at present in the Czech Republic (total area covers only 5.7%!).

4th VT represents the suborobiome which is analogical to the zonobiome of temperate decidious broadleaved forests of the moderate band in the interpretation of sorting by Walter (1979) and Míchal (1988). The authors state that 4th VT belongs directly to the zonobiome, because it occurs in the region of this zonobiome and is not extrazonal orobiome which would correspond to other zonobiomes occurring out of the temperate decidious broadleaved forests of the moderate band.

Present state of forest geobiocenosis

Forest geobicenoses have been influenced in 4th VT by strong human activities as deforestation, and also by radical changes of the tree species composition. Major areas have been changed to monocultures of *Picea abies*. A typical lower representation occurs of *Abies alba*, *Quercus robur*, *Acer platanoides*, and *Ulmus glabra* etc. in the forest stands of *Fagus sylvatica*. The highest decrease has been recorded with *Abies alba* which occurs individually at present. *Abies alba* has a more common representation in the forest stands in NFA 41. Geobiocenoses having natural character with a very rich tree species composition (*Fagus sylvatica*, *Abies alba, Quercus robur, Acer platanoides, Acer pseudoplatanus*, *Ulmus glabra*, *Fraxinus excelsior*, *Tilia cordata*, *Tilia platyphyllos*, and *Carpinus betulus*) are preserved in the Natural Reserve of the Palkovické hůrky (cadastral territory Rychaltice village, see Fig. 8), partly also in the Natural Monument of the Hradní vrch Hukvaldy (cadastral territory Sklenov).

Tichý (1970, 1971) used the name of 4th VT as "beech with fir" (i.e. *Fageta abietis* s. lat.) on the basis of numerous natural representations of *Abies alba* in this VT. Those areas were incorrectly marked in the first mappings in 5th VT due to this occurrence of

Abies alba. The authors of this article propose the use of the term "*Fageta abietis* s. lat." with respect to the representation of *Abies alba* in the natural and near-natural forest geobiocenoses in the study area, also with respect to the natural composition published by Plíva (1991) and also to the records by Tichý (1970, 1971). The term will be useful for an easier marking of this VT and also for an easier understanding of the forest-typological classification system.

CONCLUSION AND SUMMARY

Vegetation tiers represent the basic superstructure units of the forest-typological (or geobiocenological) classification systems. VTs are marked according to the ecological manifestation of differential species combination of sections of "guide" series, being determined by different species (in the first place tree or shrub determinants!) of the main level synusia of natural forest and shrub geobiocenoses and by vascular plants in general responding in a significant way to the vegetation period length and negative features of climate. Not only the occurrence of tree or shrub determinants is very significant for the evaluation and characteristics of the vegetation tiers, but also their life manifestations – the position in the forest stand structure, growth, regeneration.

3rd VT represents the geobiocenosis of *Quercifageta* s. lat., it occupies 45.6% of the study area – from 190 m a.s.l. up to 430 m a.s.l. with the centre of occurrence in the interval of 270–290 m a.s.l. *Fagus sylvatica* is a dominant tree which creates the main level of geobiocenosis (with the height of 35–40 m) there. *Quercus* sp. (*Quercus robur, Quercus petraea*) have their ecological optimum there with the representation of up to 30%. They also reach into the crown level. *Abies alba* occurs in the crown level with the representation of up to 10%. In the co-dominant tree level *Tilia cordata*, *Tilia platyphyllos*, *Acer platanoides*, *Fraxinus excelsior*, *Ulmus glabra*, and *Padus avium* occur individually, locally also *Acer pseudoplatanus*, in the subordinate tree level occur individually *Carpinus betulus* (with the representation of up to 10%), *Acer campestre*, and *Malus sylvestris*. *Sorbus torminalis* occurs sporadically in the study area.

4th VT represents the geobiocenosis of *Fageta abietis* s. lat., it occupies 35.2% of the study area – from 310 m a.s.l. up to 650 m a.s.l. with the centre of occurrence in the interval of 470–490 m a.s.l. *Fagus sylvatica* is dominant in 4th VT, which has its ecological optimum there (the height over 50 m). *Abies alba* occurs in the co-dominant level (sporadically in the level exceeding the main level) with the representation of ±20% and the height of up to 50 m. *Quercus petraea* and *Quercus robur* occur only as interspersed species with the representation of up to 10%, they do not reach the co-dominant tree level. *Carpinus betulus* is represented regularly only in the overtopped tree level. *Tilia cordata*, *Tilia platyphyllos*, and *Fraxinus excelsior* occur in the co-dominant tree level. There are also *Acer platanoides*, *Acer pseudoplatanus*, *Ulmus glabra* and *Padus avium* as co-dominant and overtopped tree levels. *Tilia cordata*, *Tilia platyphyllos*, and *Acer platanoides* have their ecological optimum. *Acer campestre* and *Taxus baccata* can occur individually in the overtopped tree level. *Sorbus torminalis* also occurs in the southern part of the study area (i.e. the NFA 41) in 4th VT.

The characteristics have been drawn up on the basis of the records from Hercynic, Polonic, and West Carpathian biogeographical subprovinces, i.e. the study area involves all significant biogeographical regions of the Czech Republic with an extensive representation of forests. It is presumed that the same (or very similar) characteristics can be applied for the whole area of the Czech Republic, or with small corrections for the zone of the Central-European broadleaved forest.

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Charakteristiky 3. dubo-bukového (*Querci-fageta* s. lat.) a 4. bukového (*Fageta (abietis)* s. lat.) vegetačního stupně severní Moravy a Slezska (Česká republika)

ABSTRAKT: Jsou prezentovány detailní charakteristiky (dřevinné druhové složení, porostní struktura, determinační znaky) pro 3. dubo-bukový (tj. geobiocenózy *Querci-fageta* s. lat.) a 4. bukový (geobiocenózy *Fageta (abietis)* s. lat.) vegetační stupeň z oblasti severovýchodní Moravy a Slezska. 3. vegetační stupeň je zastoupen na 45,6 % studované oblasti – od nadmořské výšky 190 do 430 m. Dominantní dřevinou je zde *Fagus sylvatica*, který tvoří hlavní úroveň a dosahuje výšek 35–40 m. Optimum ve 3. VS mají dále duby (*Quercus robur, Quercus petraea*) se zastoupením

do 30 %, které se výškově dostávají i do úrovně. *Abies alba* dosahuje úrovně se zastoupením v kyselé i živné řadě do 10 %. 4. vegetační stupeň je zastoupen na 35,2 % území studované oblasti – od nadmořské výšky 310 do 650 m. Dominantní je zde *Fagus sylvatica*, který má zde své optimum, a může dosahovat výšky přes 50 m. V úrovni, výjimečně v nadúrovni, se vyskytuje *Abies alba*, která může dosahovat zastoupení ±20 % a výšky až 50 m. Duby – *Quercus petraea*, *Quercus robur* – se vyskytují jen vtroušeně se zastoupením do 10 % a již úrovně nedosahují. Pravidelně je vtroušeně zastoupen *Carpinus betulus*, dosahující jen podúrovně.

Klíčová slova: lesnicko-typologický systém; vegetační stupně; *Querci-fageta* s. lat.; *Fageta (abietis)* s. lat.; charakteristiky lesních ekosystémů; severovýchodní Morava a Slezsko; Česká republika

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