

Acidophilous oak forests of the Wielkopolska region (West Poland) against the background of Central Europe

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Abstract: This monograph gives the phytosociological characteristics of acidophilous oak forests from the class *Quercetea robori-petraeae* (*Aulacomnio androgyni-Quercetum*, *Molinio caeruleae-Quercetum*, and *Calamagrostio arundinaceae-Quercetum*) and the closely related forest communities from the classes *Quercus-Fagetum* (*Potentillo albae-Quercetum* and acidophilous forms of *Galio sylvatici-Carpinetum*) and *Vaccinio-Piceetea* (*Quercus roboris-Pinetum* and *Serratulo-Pinetum*) in the Wielkopolska region and adjacent areas. The report is based on 1655 relevés selected from 59 published or unpublished studies. The analysed and revised syntaxa are described in accordance with the International Code of Phytosociological Nomenclature. The distribution of the documented localities of all associations and subassociations in the study area is shown in cartograms on the ATPOL grid (squares of 10 km × 10 km). The classical phytosociological methods are complemented with multivariate ordination methods (detrended correspondence analysis and/or principal component analysis) and analyses taking into account Ellenberg indicator values. The natural geographical and site differentiation of all the plant associations is presented, and stages of degeneration are distinguished in some of them. The separation of degenerated forms and substitute forest communities has allowed a clearer classification of the studied syntaxa. This study shows that the analysed associations can be subdivided into 16 subassociations and 23 variants. For 5 subassociations, nomenclatural types are designated here. The most common association in the study area is *Calamagrostio arundinaceae-Quercetum*, but most of its relevés represent various stages of degeneration. Among communities from the order *Quercetalia roboris*, patches of *Aulacomnio androgyni-Quercetum* and *Molinio caeruleae-Quercetum* are rare. On the basis of this detailed study, a coherent system of classification of acidophilous oak forests from the order *Quercetalia roboris* in Central Europe is proposed. The results are important for biodiversity conservation and sustainable forest management.

Key words: phytosociology, Ellenberg indicator values, ATPOL-grid, forest communities, acidophilous oak forests, *Quercetea robori-petraeae*, *Vaccinio-Piceetea*, *Quercus-Fagetum*, Wielkopolska region

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1. Introduction

Acidophilous oak forests, in the narrow sense, are deciduous forests with the canopy dominated by native *Quercus* spp. (mostly *Quercus petraea* and *Q. robur*), found on acidic soils. So-defined forest ecosystems constitute a clearly distinguished unit, taken into account in modern sustainable forest management (Barbati *et al.* 2007), in actions aimed at biodiversity conservation (Barbati & Marchetti 2005; Bradshaw & Møller 2005), and in phytosociological classification. In the last mentioned aspect, acidophilous oak forests are assigned by various authors to the classes *Quercetalia robori-petraeae* or *Quercus-Fagetalia*, or even (rarely) to the class *Vaccinio-Piceetalia*. Oak forests of this group are distributed in extensive areas of the temperate zone in Europe, from the Atlantic coast in northern Portugal, to western Ukraine near Kiev. They reach their northern limit of distribution in Ireland, southern Scandinavia, Lithuania, and Belarus, while the southern limit, in Ukraine, Romania, Croatia, southern France, northern Spain and northern Portugal. The easternmost, isolated locality is found on the river Volga, near Kazan (Barbati *et al.* 2007). On the map of natural European vegetation, their range of distribution was marked as formation F1, comprising floristically poor, acidophilous (oligo-mesotrophic) oak forests and mixed oak forests (Cross *et al.* 2003). However, W. Matuszkiewicz (2003)

when describing formation F1, noted that its centre of distribution is in Atlantic and sub-Atlantic Europe. It must be remembered that initially the distribution range of plant communities of the class *Quercetalia robori-petraeae* was supposed to be limited to the western and south-western parts of the continent (Braun-Blanquet 1950).

So-defined acidophilous oak forests did not include Central European meso-eutrophic oak-hornbeam forests from the class *Quercus-Fagetalia* (order *Fagetalia sylvaticae*, alliance *Carpinion betuli*), south-eastern European oak forests from the order *Quercetalia pubescenti-petraeae* (alliance *Potentillo albae-Quercion petraeae*), and mixed coniferous forests from the class *Vaccinio-Piceetalia*, where *Quercus* spp., more or less abundant, accompanied the dominant coniferous trees (in central Europe, mostly *Pinus sylvestris*). However, a complete characterization of acidophilous oak forests and a clear separation of this controversial group of forests would not be possible without taking into account some of the above-mentioned communities, namely pine-oak forests, thermophilous oak forests, and poorer forms of oak-hornbeam forests. All these communities are distinguished by penetration of some characteristic species of the classes *Vaccinio-Piceetalia*, *Quercus-Fagetalia*, and *Quercetalia robori-petraeae* (Fig. 1). This results from both natural conditions and human impact. Tüxen (1975) indicated also that some associations from the

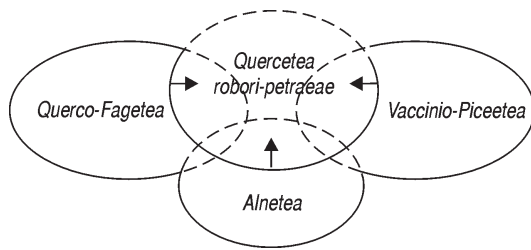


Fig. 1. Floristic connections between acidophilous oak forests from the class *Quercetea robori-petraeae* and related communities (after Tüxen 1975, simplified)

class *Quercetea robori-petraeae* (*Violo-Quercetum* and *Betulo-Quercetum*) are characterized by a small contribution of species of the class *Alnetea glutinosae*. This class is represented by an undoubtedly specific oak forest type described as the association *Carici elongatae-Quercetum* Sokołowski 1972 from the Białowieża Forest (Sokołowski 1972). The association was reported for the first time from Wielkopolska by Brzeg *et al.* (1989). It was later characterized by Brzeg (1995), Wojterska (2003), and Klimko *et al.* (2004). This syntaxon is clearly distinct from the other oak forests types, mentioned above, so such forests have not been taken into account in this study.

The Wielkopolska region (also known as Greater Poland or Great Poland), and the adjacent areas, constitute an important part of the distribution range of Central European acidophilous oak forests (see also Matuszkiewicz J. M. 2001a). In this region, the new association *Aulacomnium androgyni-Quercetum roboris* (new for science) was described a decade ago. It represented the alliance *Dicrano-Quercion* Passarge 1968 (Brzeg *et al.* 2000a), which was earlier unknown in Poland. Moreover, a broader definition of *Calamagrostio arundinaceae-Quercetum petraeae* was proposed (Brzeg *et al.* 1989, 1998, 2001) and the first Polish localities of *Molinio caeruleae-Quercetum roboris* were documented in this region (Brzeg *et al.* 1989).

The analysis of variation and functioning of oak forests in Wielkopolska is important not only for this region but also on a broader scale. Wielkopolska is the first large region relatively well studied by phytosociologists and located east of the natural limit of distribution of *Fagus sylvatica*. Cross *et al.* (2003) emphasized that as a result of competition from that species, acidophilous oak forests, especially in the sub-Atlantic and central parts of Europe, were forced out into sites that are too moist or too dry for natural regeneration of *F. sylvatica* and thus do not allow development of stable beech forests. That is one of the reasons why natural-like oak forest stands in those areas form relatively small and scattered patches. Their larger patches are found also east of the limits of distribution of *Fagus*: in Poland, Belarus, and northern Ukraine (Cross *et al.* 2003).

Thus it can be assumed that in Wielkopolska, acidophilous oak forests show a higher habitat variation. Knowledge of this variation should be used as a reference for comparative analyses of acidophilous oak forests in the eastern part of their range. It will also be useful for assessment of the influence of *F. sylvatica* on the development of patches of acidophilous oak forests in central and western parts of their range.

The current state of knowledge about acidophilous oak forests in Poland, particularly about their variation and distribution, is very unsatisfactory. Most of the existent documentation, also from Wielkopolska, was not summarized in the monograph of mixed coniferous forests and acidophilous oak forests of Poland (Matuszkiewicz J. M. 1988), and in later reviews of forest communities in our country (Matuszkiewicz W. & Matuszkiewicz J. M. 1996; Matuszkiewicz J. M. 2001a) or of plant communities in Poland (Matuszkiewicz W. 2001). Phytosociological classification of acidophilous oak forests proposed in the European literature in the last decades was inconsistent (see the works cited above and Oberdorfer 1988, 1992a, 1992b; Härdtle & Wells 1992; Pott 1992, 1995; Pallas 1996, 2000, 2003; Härdtle *et al.* 1997). The knowledge of the ecology of acidophilous oak forests was also highly insufficient, in many aspects.

That is why the major objectives of this study were:

- (1) to analyse the variation of acidophilous oak forests (also known as mixed oak forests) in Wielkopolska and in neighbouring areas and precise separation of plant associations and syntaxa of lower rank, i.e. subassociations, variants, and geographic races;
- (2) to map the distribution ranges of communities of this group in the study area;
- (3) to document and systematize degenerated forms of the studied plant associations and substitute forest communities on their potential sites;
- (4) to present floristic and general characteristics of other forest types with a high contribution of *Quercus*, because they are usually partly misidentified or considered as synonymous or combined into one group with acidophilous oak forests. This applies mostly to mixed coniferous forests from the class *Vaccinio-Piceetea* (*Quercus roboris-Pinetum*, "*Pino-Quercetum*"), as well as thermophilous oak forest *Potentillo albae-Quercetum* and acidophilous forms of oak-hornbeam forest *Galio sylvatici-Carpinetum* from the class *Querceto-Fagetea*.

2. Natural and anthropogenic conditions allowing the development of oak forests

The present distribution and functioning of forest ecosystems including oak forests is obviously related to the earlier events that took place during the Holocene.

The Holocene history of vegetation (also its early stages) is relatively well studied in Poland, primarily thanks to numerous palynological studies. This chapter describes selected ecological processes (partly modified by human activity), which according to researchers have shaped oak forests in Central Europe or still affect their development.

Oak (*Quercus*) immigrated to Poland relatively early, about 9000 BP (Milecka *et al.* 2004). Linden (*Tilia*) appeared slightly later, whereas elm (*Ulmus*) was already present at that time. The gradual increase in frequencies of these trees and hazel (*Corylus*) lead to strong transformations of the earlier forest communities – dominated by birch (*Betula*) and pine (*Pinus*) – in the late Boreal and early Atlantic period. It is assumed that at that time, light-demanding (heliophilous) species started to decline, whereas earlier on they found favourable conditions under the sparse canopy of pine forests (Ralska-Jasiewiczowa 1999). According to Chytrý (1997), the present thermophilous oak forests are relicts of that time. In the early Atlantic period, *Quercus* played an important role in the vegetation of river valleys as well as in forests on poor soils, while *Tilia cordata* dominated on more fertile soils, later accompanied by beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*). In areas with low precipitation, pine forests generally prevailed (Kalis *et al.* 2003).

Brzeg *et al.* (2001) regard acidophilous oak forests as an old type of forest ecosystem, formed as early as in the Atlantic period. In many publications, forests of the Atlantic period are described as tall and dense forest stands, which created a specific forest microclimate (Ralska-Jasiewiczowa 1999; Soepboer & Lotter 2009). Until recently, the forests were commonly believed to develop according to the gap-phase model (Watt 1947) or the cyclical model (Leibundgut 1959, 1978). Such a picture of forest ecosystem is described by the high-forest hypothesis (Bradshaw *et al.* 2003). This hypothesis does not explain, however, the relatively high frequency of the light-demanding *Quercus* as well as *Corylus*, observed also in the Atlantic period. Ralska-Jasiewiczowa (1999) reported that both *Q. robur* and *Q. petraea* could survive in unfavourable light conditions, according to its ecological spectrum, and occupied very wet or dry sites on sandy soils. A much more radical view was adopted by Vera (2000), who formulated the wood-pasture hypothesis, assuming that the landscape at that time was more similar to present-day parks or savannas. The landscape, initially shaped (without human interference) by large herbivores, i.e. deer, bison, aurochs, and wild horses, could be a mosaic of cyclically alternating natural pastures, shrub communities, and forests. A key role was attributed to spiny or thorny shrubs, which supposedly protected oak seedlings. Recent research has shown that currently *Quercus*

robur populations can be naturally regenerated in north-western Europe in areas exposed to grazing by large herbivores, if protected by thorny thickets of *Prunus spinosa* (Bakker *et al.* 2004). However, results of research conducted in the Białowieża Forest indicate that such protection is not a necessary condition of effective regeneration of this species (Bobiec & Jaszcz 2010).

As noted by Birks (2005), the above-mentioned cycle of forest development roughly corresponds to the classic gap-phase model of Watt (1947). However, the wood-pasture hypothesis is distinguished by a larger scale of the phenomenon and by attribution of a major role to large herbivores rather than to natural processes of tree decline in the above-mentioned system. The wood-pasture hypothesis has aroused much interest also because of its potential importance for both current forest management and nature conservation in Europe (Kirby 2004; Birks 2005; Hodder *et al.* 2005).

Mitchell (2005), on the basis of palynological and other data from north-western Europe and eastern North America, rejected Vera's (2000) hypothesis, mostly because of the overestimated role of large herbivores. He advocated that forests at that time were less dense than believed previously, and animals grazing in them affected their function, but only human interference, rather than wild animals, could effectively change their spatial structure. Already earlier on, Ralska-Jasiewiczowa *et al.* (2003) suggested that the *Corylus-Quercus* vegetation is strongly related to Neolithic human activity. They noted that the *Corylus-Quercus* vegetation is probably the oldest anthropogenic shrub-forest community. Important palaeoecological arguments against the major assumptions of Vera's (2000) hypothesis were presented by Feijen (2003: 29). Many authors suggested that Neolithic human impact on forest structure, by means of livestock grazing, started in north-western Europe at least 6000 BP, while in south-eastern Central Europe, 7500 BP (Bergmeier *et al.* 2010).

Bradshaw *et al.* (2003) showed that both the above hypotheses, i.e. high-forest hypothesis and wood-pasture hypothesis, have many weak points and do not fully explain the function of forest ecosystems. Those authors indicated that fire was another important factor affecting the structure of forests at that time. This seems to be evidenced by the presence of charcoal in sediments even before the invasion of beech (*Fagus*) and spruce (*Picea*). Both the natural forest dynamics and fire, as well as the impact of large herbivores, could – according to those authors – create favourable conditions for regeneration of light-demanding trees and shrubs, such as *Quercus*, *Corylus* as well as *Pinus*. The importance of fire for long-term persistence of oak forests was shown by Abrams (1992) in eastern North America, as well as by Niklasson *et al.* (2002) in

southern Sweden. Svenning (2002) assumed that fire and grazing by large herbivores were the major factors allowing the formation of open habitats in north-western Europe. However, according to Kuiters & Slim (2002), it is unlikely that fire was a factor generating the cycle of forest development in climatic conditions of Central Europe. According to those authors, also windthrows did not play any significant role, because of the relatively small spatial scope and low frequency of this phenomenon.

Quercus reached its maximum Holocene range between 4500 and 4000 BP, undoubtedly partly thanks to Neolithic people. Since 3500 BP, its frequency gradually decreased, while frequencies of *Fagus* and *Corylus* clearly increased (Milecka *et al.* 2004). Their spread is clearly related to human activity. Polish palynological data indicate that the expansion of *Fagus* was accelerated by climatic change in the Sub-Atlantic period, about 2500 BP (Ralska-Jasiewiczowa *et al.* 2003). The expansion of *Carpinus* was clearly associated with the decline of Lusatian culture (about 2500 BP). Slightly later or at the same time, in similar anthropogenic conditions in north-western Poland, oak forests were replaced by beech forests (Ralska-Jasiewiczowa 1999; Latałowa *et al.* 2004). Ralska-Jasiewiczowa (1999) reported that the present forests dominated by *Carpinus*, as well as acidophilous beech forests and beech-oak forests in north-western Poland, should be classified as anthropogenic communities in the historical sense.

The mechanism shaping the Holocene range of *Fagus* was a subject of many publications, reviewed recently by Tinner & Lotter (2006). Out of the 5 alternative hypotheses explaining the expansion of *Fagus*, those authors favour the view that at least in southern Central Europe its range of distribution was shaped by climatic conditions. Those authors and Zerbe (2004) considered also contrasting opinions of some researchers, who believed that its expansion was mostly due to human activity. It is believed that *Fagus* is still expansive and continuously extends its range northwards and eastwards (Kielland-Lund 1993; Latałowa *et al.* 2004; Czajkowski *et al.* 2006; Bolte *et al.* 2007; Sułkowska *et al.* 2008). The part of the eastern range limit of *Fagus* that crosses Poland, is probably not conditioned by the climate but by history (Matuszkiewicz J. M. 2001a). Svenning & Skov (2004) report that most of European tree species have not reached the limits of their potential climatic ranges.

The present beech forests in Europe, as well as oak-hornbeam forests and acidophilous oak forests, are commonly regarded as zonal natural communities, conditioned by climate and constituting units of potential natural vegetation (Matuszkiewicz W. *et al.* 1995; Ellenberg 1988; Hannon *et al.* 2000; Matuszkiewicz

W. 2001, 2003). A vast majority of forest communities of Poland have the same status, i.e. are regarded as natural communities (Ratyńska *et al.* 2010). However, Bobiec & Jaszcz (2010), who studied natural regeneration of *Quercus robur*, suggested that patches of subcontinental oak-hornbeam forest *Tilio-Carpinetum* in the Białowieża Forest may derive from some relict, culturally conditioned oak forests. Many authors emphasize that as a result of strong human impact in the last 5000 years, no primeval plant communities have been preserved in Europe (Peterken 1996; Vera 2000).

The distribution range of acidophilous oak forests from the order *Quercetalia roboris*, covers the western and central Europe, in a wider classification including also some parts of Belarus, Russia, and Ukraine (Cross *et al.* 2003). It is dominated by the expansive *Fagus* and *Carpinus*, which form shaded forest stands (see Peterken 1996: Fig. 3.1). *Fagus* within its natural range is highly competitive and outcompetes also the co-existent *Carpinus*. However, *Carpinus* is highly competitive on mesotrophic and thermophilous sites located outside the natural range of *Fagus*. Both *Q. robur* and *Q. petraea* in natural conditions, grow slower and thus are subsequently shaded by both *Fagus* and *Carpinus*. Grazing by herbivores is commonly believed to be an important factor eliminating the self-sown seedlings of *Quercus* (Danielewicz & Pawlaczyk 2006), but some studies cited by Bobiec & Jaszcz (2010) indicate that its significance in some cases may be overestimated. Additionally, interactions between roots play a role in the competition between *Fagus* and *Quercus*, so that on poorer sites *Fagus* clearly prevails (Leuschner *et al.* 2001). On fertile sites, fine root weight of *Quercus petraea* tends to be reduced in the presence of roots of both *Fagus* and *Carpinus* (Rewald & Leuschner 2009). Reif & Gärtner (2007) reported that effective natural regeneration of *Quercus robur* and *Q. petraea* is very rare, conditioned by a combination of several factors. It takes place in less dense forest stands with a low ground layer.

Results of many studies suggest that, in recent decades, *Quercus* has been replaced by more shade-tolerant trees: *Acer*, *Fagus*, and *Tilia*. In this process, *Fagus* plays a major role, particularly on poorer sites. This phenomenon is observed not only in Europe but also in North America (Taylor & Lorimer 2003). Usually it is interpreted as a symptom of regeneration of forest ecosystems previously disturbed by human activity (Mountford *et al.* 1999; Timbal & Aussenac 1996; Zerbe 2004; von Oheimb *et al.* 2007; Rütger & Walentowski 2008). The heliophilous nature of *Quercus* was the basic argument used by Timbal & Aussenac (1996), who suggested that oak forests are not climax communities in French lowlands, and the higher percentage contribution of *Quercus* is caused there by both modern forest

management and historical forest use. Those authors noted, however, that in some locations, climax oak forests can be found, composed of *Quercus robur* (valley of the river Saône) or *Q. petraea* (central France). Both the species, considering their dynamic trends, are classified as postpioneers, i.e. an intermediate group between pioneers, appearing early, and dryads, appearing in late seral stages (Rameau *et al.* 1989, cited by Falińska 1997: 357).

According to latest research, beech forests prove to have a wider ecological spectrum than assumed until recently, and may constitute units of potential natural vegetation of some site types, earlier classified as potential sites of the fertile and humid sub-Atlantic oak-hornbeam forest *Stellario-Carpinetum*, poor birch-oak forest *Betulo-Quercetum*, or even dry, thermophilous oak forests (Leuschner 1997). Nevertheless, Pott (2000) emphasizes that extremely poor sites in north-western Europe are free from *Fagus*. According to that author, they are covered by birch-oak forests from the class *Quercetea roboris*, which are probably an endemic European vegetation type. A similar view was expressed earlier by van der Werf (1991), who suggested also that other forests, dominated by *Quercus*, occupy the sites of beech forests. This results from coppicing, which was very common in the past and favoured oak trees. According to that author, e.g. on more fertile sites, the sub-Atlantic oak-hornbeam forest *Stellario-Carpinetum* substitutes for the fertile lowland beech forest *Melico-Fagetum*, while the poorer sites of acidophilous beech forest *Luzulo-Fagetum* are occupied by the submontane acidophilous oak forest *Luzulo-Quercetum* or, if the sites are more degraded, by the sessile oak-birch forest *Quercus petraeae-Betuletum*. Härdtle *et al.* (2005) claim that *Quercus* dominates in patches of *Betulo-Quercetum* mostly because it is favoured by forest management. Some authors suggest that raking of leaf litter, as well as livestock grazing in forests on poor soils, at least locally, has led to irreversible soil disturbance, through leaching of nutrients, podzolization, and as well as increase in aluminium content. In such conditions, beech forests were replaced by the sub-climax communities of sub-Atlantic pine forest *Leucobryo-Pinetum* on very poor and periodically dry soils or by pine-oak forests of the alliance *Quercion robori-petraeae* on somewhat more fertile soils (Walentowski & Scheuerer 2004).

The increased percentage contribution of *Fagus* in the regenerating forests results in shading of the forest floor. This leads to elimination of the relatively heliophilous species, typical for acidophilous oak forests, and the whole community is transformed into acidophilous beech forests. Such spontaneous changes in vegetation are observed also in patches of sub-Atlantic acidophilous oak forest *Fago-Quercetum*. According to Jahn (1984), this indicates that this community is not

natural and occupies potential sites of poor beech forest *Deschampsio-Fagetum* (= *Luzulo pilosae-Fagetum*). Recently, a decline of patches of the association *Fago-Quercetum* was observed also in north-western Poland, where it was replaced in many areas by *Luzulo pilosae-Fagetum* (Matuszkiewicz J. M. 2007a).

A widely held view is that *Quercus* was favoured by humans for centuries. This was largely due to a specific type of forest use, known as coppice-with-standards, initiated in the Middle Ages (Ellenberg 1988: 27). Such forests were composed of scattered tall trees (standards), and of much lower, regularly coppiced trees and shrubs. They were sources of brushwood (used as fuel), timber, and acorns for pigs, which were commonly reared at that time (Machar 2009). As emphasized by Ellenberg (1988), mostly *Quercus* was allowed to grow on (as the standards), since it performed best the last 2 of the above-mentioned functions of the forests, whereas *Fagus* was discriminated, as it was less useful. In the past, the common use of coppicing favoured *Carpinus*, *Tilia*, *Acer*, *Fraxinus*, and *Corylus*. It was less favourable for *Quercus*, and completely unfavourable for *Fagus*, and caused a large decrease in abundance of this tree species (Ellenberg 1988).

The value of oak forest stands was estimated on the basis of the number of pigs that could be supported by them (Broda 2006; Danielewicz & Pawlaczyk 2006; Modrzyński *et al.* 2006, and literature cited therein). There is much less information on a similar use of beech forests (Björkman 1997). Earlier on, acorns were also consumed by people. Kooistra (2008) considered it as proven that in the Bronze and Iron Ages, acorns were collected, stored, and used as human food. The high value of *Quercus* for people in the past is best evidenced by the fact that this tree was protected in Poland as early as in 1347, by the Wiślica Statutes, which was one of the first collections of laws issued in Poland (Broda 2006).

The observed decrease in the percentage contribution of *Quercus* in European forests is related to the phenomenon of oak decline, initiated nearly 300 years ago. In the last few decades, the phenomenon was confirmed in nearly the whole distribution range of *Q. petraea* and *Q. robur*, and is described in many publications (Thomas *et al.* 2002). In Poland, as reported by Ceitel (2007), on the basis of published literature, large-scale oak-decline was recorded as late as in the 1930s and 1940s, initially in the so-called Krotoszyn Plateau. The current knowledge on oak decline was recently reviewed by Modrzyński *et al.* (2006), who favoured the view of many authors, indicating that there are many causes of this phenomenon. Thomas *et al.* (2002), in a model representing acidic sites (pH in H₂O ≤ 4.2) in Central Europe, showed that oak decline results from an interaction of biotic and abiotic factors.

It is usually preceded by severe defoliation of the trees in 2 successive years, caused by insect foraging combined with extreme weather conditions, e.g. summer drought and/or severe frost in winter or spring. Additional factors deteriorating the condition of *Quercus robur*, in particular, include water deficit as well as an increased deposition of nitrogen compounds. Those authors noted also that on less acidic soils, oak decline may be caused by pathogenic fungi of the genus *Phytophthora*.

The above data indicate that acidophilous oak forests decline within the range of *Fagus*. One of the major reasons of this phenomenon is the expansion of *Fagus*, which at least partly reflects the regeneration of natural vegetation, disturbed earlier by human activity. It is also noteworthy that the largest patches of oak forests are distributed in Europe outside the natural range of *Fagus*, i.e. in north-western Spain and Portugal, south-western France, Ireland, Great Britain, Poland, Belarus, as well as in northern Ukraine (Barbati *et al.* 2007: 50).

Oak forests located east of the limits of distribution of *Fagus*, particularly in northern Ukraine and adjacent parts of Belarus, as well as Russia, are particularly important for assessing the range of site variation and dynamics of acidophilous oak forests from the order *Quercetalia roboris* throughout their distribution range. As late as in the last few years, researchers documented there some plant communities including *Quercus* and representing mixed coniferous forests from the class *Vaccinio-Piceetea* or acidophilous oak forests from the order *Quercetalia roboris*. According to various authors, some of the plant communities found there can be identified as syntaxa known from Central Europe, while others are novel associations (Goncharenko 2001; Didukh *et al.* 2003; Onyshchenko *et al.* 2003; Vorobyov 2003; Yuglichek & Onyshchenko 2003; Onyshchenko 2006; Shelyag-Sosonko *et al.* 2008; Solomakha 2008; Semenishchenkov 2009). This issue will be discussed in detail on pp. 24-25). This means that those countries broaden the distribution range of acidophilous oak forests, within the borders defined already earlier by Cross *et al.* (2003, see also Barbati *et al.* 2007). According to Tüxen (cited by Géhu 1975: 86), their range included only Central and West Europe, and extended from north-western Spain, Ireland, southern Scandinavia, southern Finland, Poland, and northern Balkans. Outside the range of *Fagus*, the major competitor of *Quercus* is *Carpinus*. Its invasion is most probably a direct cause of oak decline in the Białowieża Forest (Faliński 1986; Kwiatkowska 1986, 1996; Kwiatkowska & Wyszomirski 1988, 1990). A similar situation was observed in patches of thermophilous oak forest located in other parts of Poland (Jakubowska-Gabara 1993). In the Białowieża Forest, the success of *Carpinus* probably results from a change in the impact of large herbivores

(Kwiatkowska 1996). Little is known about the possibility of expansion of *Carpinus* to patches of acidophilous oak forests. However, as evidenced by patches of acidophilous hornbeam-oak forest *Aulacomnion androgyni-Quercetum roboris*, and the relatively high frequency of *Carpinus* in some forms of Central European acidophilous oak forest *Calamagrostio arundinaceae-Quercetum* (Brzeg *et al.* 2001), acidic sites are no barrier for the expansion of this species. The much lower threat posed by this species, as compared with *Fagus*, may result from the influence of forest management. In modern forestry, *Carpinus* is tolerated at best. In many situations, if it only potentially threatens the regeneration of favoured trees (i.e. usually *Quercus*), it is regarded as a weed and felled.

When predicting the future contribution of *Quercus* to European forests, 2 particularly important factors need to be taken into account: climate change and the possibility of *Quercus* regeneration under the canopy of planted pine forests.

The observed climate change, generally leading to its continentalization in West and Central Europe, are not favourable for *Fagus*. That is why some authors assume that in West Europe its competitiveness will decrease (Rennenberg *et al.* 2004). That hypothesis was questioned, partly because of factual errors (Ammer *et al.* 2005), but the transformations of forest vegetation caused by climate change are investigated also by other researchers. Franke & Köstner (2007) suggest that the noticeable decrease in precipitation during the growing season in the last 50 years, and the probable persistence of this trend, must be taken into account when constructing maps of potential natural vegetation. Those authors assume that the contribution of oak forest will increase at the expense of beech forest. This contradicts the above-mentioned views of Leuschner (1997). If temperature increases and precipitation declines in the northern part of West Europe, *Carpinus* may start to be more competitive in relation to *Fagus* (Lawesson *et al.* 2004).

For several decades, spontaneous regeneration has been observed in pine stands (Sokołowski & Paluch 2003, cited by Modrzyński *et al.* 2006). This process – conditioned mostly by birds, which disperse acorns – may lead to formation of high-quality mixed forest stands (Modrzyński *et al.* 2006). Considering the large total area of potential sites of acidophilous oak forests occupied currently by pine monocultures, this phenomenon may play a major role in regeneration of these ecosystems.

When considering the potential for *Quercus* regeneration, a recent study by Bobiec and Jaszcz (2010) is particularly noteworthy. In senile spruce stands in the Białowieża Forest, those authors found that very numerous oak seedlings develop from acorns dispersed

mostly by jays on various sites, ranging from the fertile potential sites of deciduous forest to the relatively poor potential sites of mixed coniferous forest. However, the developing oak trees can dominate the tree layer only at the poorer sites. This result confirms the much earlier observations made by Paczoski (1930: 415), who noted that oak stands in the Białowieża Forest can be formed more easily on sites similar to those of coniferous forests than on those classified as potential sites of oak-horn-beam forest. In patches of *Tilio-Carpinetum*, oak seedlings quickly die, as they are outcompeted by the numerous self-sown seedlings of the shade-tolerant *Tilia* and *Carpinus*. Bobiec & Jaszcz (2010) evidenced that *Quercus* is regenerated most numerous along fallen spruce trees. Those authors suggest that fallen logs do not offer any mechanical protection against grazing by herbivores, as it was assumed earlier. Their neighbourhood seems to be preferred by jays, which tend to store their acorns there. The highest and most numerous oak seedlings were usually accompanied by light-demanding grass species: *Calamagrostis arundinacea* and *Molinia caerulea*. The cited authors emphasize that this seems to contradict the common belief that both the plant species have a negative effect on oak regeneration. Modrzyński *et al.* (2006), referring to a study by

Krahl-Urban (1959), mentioned also by Bobiec & Jaszcz (2010), reported that natural *Quercus* regeneration is not possible without special silvicultural practices if the ground layer is dominated by *Pteridium aquilinum*, *Sarothamnus scoparius*, *Calamagrostis* sp., as well as *Molinia caerulea*.

The research results presented above attest to a high regenerative potential of *Quercus* primarily on poorer sites. An effective use of this potential in forest management or in protected areas is of major importance for preservation and regeneration of the existent oak forests, as well as for reconstruction of those that no longer exist.

3. Study area

The geographic boundaries of the Wielkopolska region are sometimes differently defined by various authors (for a review, see Krygowski 1961; Bartkowski 1970; Kondracki 1978; Jackowiak *et al.* 2007). In the present study, its boundaries (Figs. 2 and 3) follow the description of Wojterski (in Brzeg *et al.* 1989): the Toruń-Eberswalde Glacial Valley (Pradolina Toruńsko-Eberswaldzka, also known as Pradolina Noteci) in the north; the rivers Obra and Obrzyca and the depression

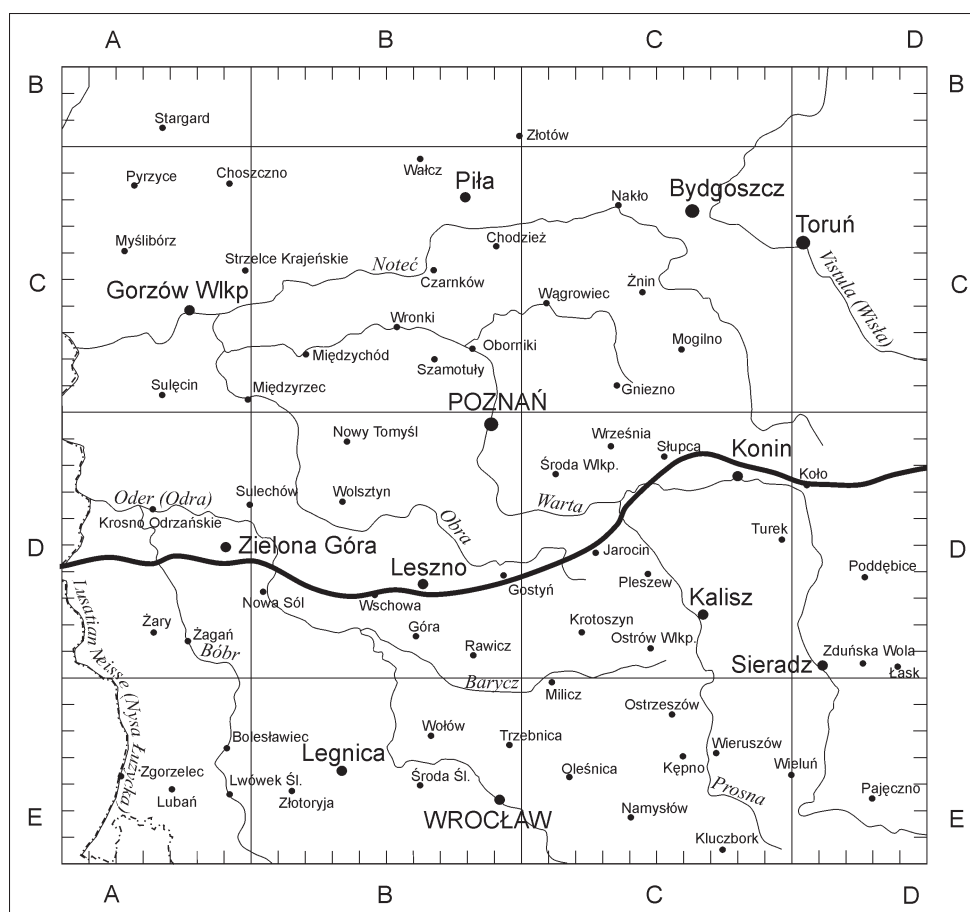


Fig. 2. Map of the study area, against the background of the ATPOL grid (10 km × 10 km). The boundary of Vistulian glaciation after Gilewska (1999)

of Lake Ślaskie in the west; edges of the Łódź Hills (Powiśle Łódzkie, between the towns of Grabów and Warta) in the southeast; meridional section of the river Warta (to the town of Koło) and the upper section of the river Noteć (to the town of Nakło) in the east (see also Brzeg *et al.* 1989). Such limits have been adopted also in many other research projects. Only slight corrections were made here to include rich materials documenting the studied group of forest communities near the boundaries described above. This applies mostly to relevés from the Trzebnica Ridge (Wał Trzebnicki), delimiting Wielkopolska in the south (Fig. 3, 4d – macroregion 318.4). Taking into account this correction, nearly all localities of the relevés analysed here (Fig. 3) are within the geographic boundaries of Wielkopolska designated by Jackowiak *et al.* (2007), who presented a more detailed environmental description of this region.

With respect to geomorphology, Wielkopolska includes 2 clearly separated parts (Krygowski 1961; Kondracki 1998). The southern part, shaped by the South Polish glaciation (= Saalian), is bordered in the south by hills of the Trzebnica Ridge (Wał Trzebnicki, Fig. 4d – macroregion 318.4; Fig. 4b – Podkraina B4b: Okręgi 10, 13, and 14). These hills reach a relative height of 100-150 m, with culminations exceeding 250 m a.s.l., and are regarded as a limit of the Warta stadial. The southern limit of the northern part, shaped by the Vistulian glaciation (= Weichselian) is less well-defined in the field (Fig. 2).

The climate of Wielkopolska (like the climate of Poland in general) is intermediate between temperate oceanic climate in the west and temperate continental climate in the east. Temperatures are the highest (annual mean $> 8.2^{\circ}\text{C}$) in the western and south-western parts, while the lowest (annual mean $> 7.6^{\circ}\text{C}$) in the north-eastern part of the Wielkopolska Lowland (Fig. 5). Precipitation is relatively low in the Wielkopolska region, but the highest (> 600 mm) in the southern and south-western parts, while the lowest (< 500 mm) in central and eastern parts of the study area (Fig. 6).

The variation in environmental conditions is multifactorial, which is illustrated well by the maps comparing the main Polish systems of regionalization of the study area (Fig. 4). Most of the study area lies within the Wielkopolska-Kujawy Region (Kraina Wielkopolsko-Kujawska, Fig. 4a), the Brandenburg-Wielkopolska Division (Dział Brandenbursko-Wielkopolski, Fig. 4b), the Wielkopolska-Pomeranian Region (Kraina Wielkopolsko-Pomorska, Fig. 4c), and the South Baltic Lakeland Subprovince (Podprowincja Pojezierza Południowobałtyckie, Fig. 4d).

Its above-mentioned location in the intermediate climatic zone is reflected also in features of geographic regions distinguished by J. M. Matuszkiewicz (1993).

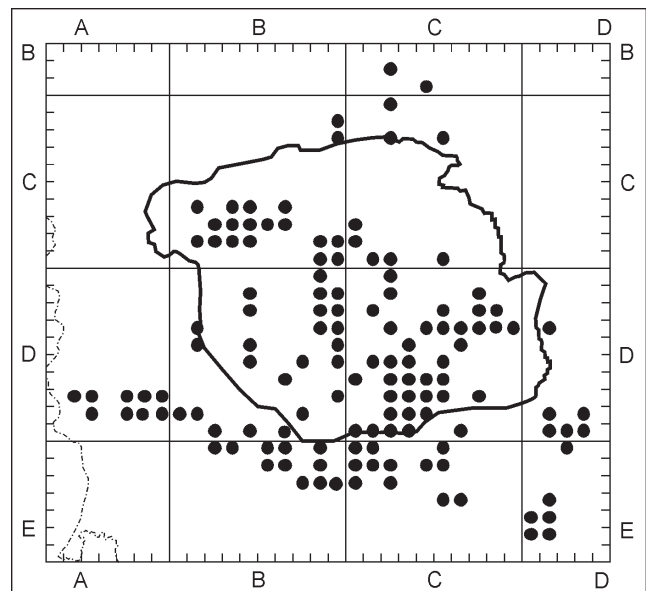


Fig. 3. Location of study sites, comprising the analysed relevés, within the ATPOL grid (10 km $\times$ 10 km). The curve indicates the boundary of the Wielkopolska region

On the basis of potential natural vegetation, the cited author showed that the Central Wielkopolska Region and Kujawy Region (B2 and B3, Fig. 4b) have the smallest contributions of the Atlantic element and the largest contributions of the continental element. All the geobotanical units located within the study area have similar contributions of the Central European element, which are larger there than further east.

Oak forest stands are not evenly distributed in the study area. They are concentrated in the south, where some districts (Dzielnice) and mesoregions (according to the regionalization of Trampler *et al.* 1990) rank very high on the scale of Poland in respect of areal contribution of oak forests (Fig. 7, Ceitel 2006). These include the Krotoszyn District (Dzielnica Krotoszyńska, III.8), and, outside the study area, 2 mesoregions of the Silesian Region (Kraina Śląska): the Wrocław Plain (Równina Wrocławska, V.2.e) and Sudetes Foothills (Przedgórze Sudeckie, V.3.a) (Fig. 4c). The Krotoszyn District comprises the largest of 6 Polish aggregations of the most valuable oak forest stands on the scale of Central Europe (Sabor 1993). Among them, as much as 3700 hectares are more than 100-year-old (Ceitel 2006). They are located on the so-called Krotoszyn Plateau, between the towns of Krotoszyn, Gostyń, Jarocin, Pleszewo, and Ostrów Wielkopolski (see Fig. 2). Its vegetation has been described in many articles (Szulczewski 1951; Jelinowski 1958; Krotoska & Piotrowska 1962; Brzeg *et al.* 1989, 2000a, 2001; Borysiak *et al.* 1992; Brzeg 1995; Czarna 1999, Pawłowski 2001). The first description of oak forest stands of the Krotoszyn Plateau was presented by Krahel-Urban (1943). Its natural environment is protected as a Landscape Protection Area (see

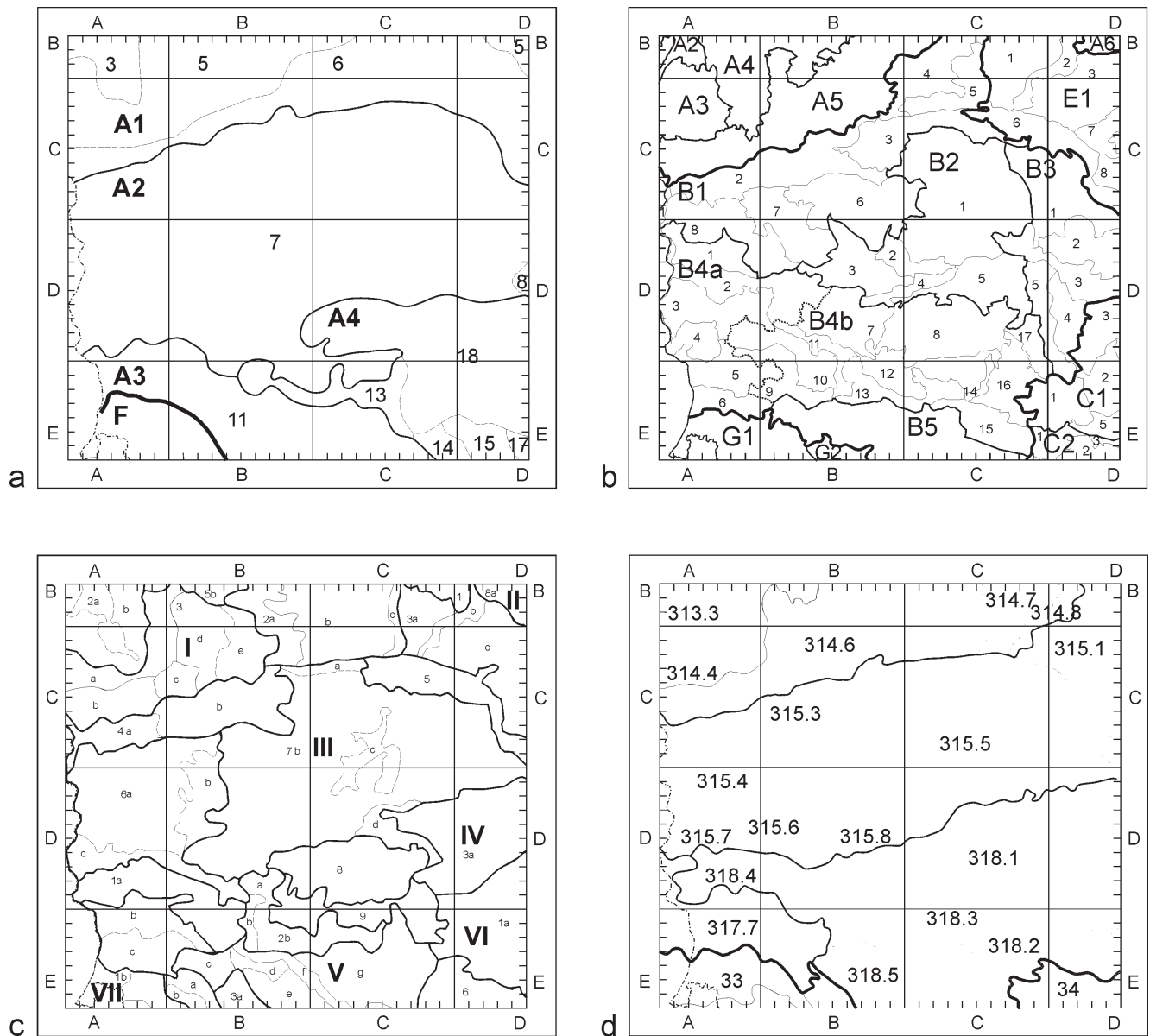


Fig. 4. Various regionalizations of Poland, against the background of the ATPOL grid

a) Geobotanical division (Szafer 1972): A – Dział Bałtycki; A1 – Poddział Pas Równin Przymorskich i Wysoczyzn Pomorskich, with subunits (Krainy), 3 – Nizina Szczecińska, 5 – Pojezierze Pomorskie, 6 – Pomorski Południowy Pas Przełściowy; A2 – Poddział Pas Wielkich Dolin, with subunits (Krainy), 7 – Wielkopolsko-Kujawska, 8 – Mazowiecka; A3 – Poddział Pas Kotlin Podgórskich, with subunit (Kraina), 11 – Kotlina Śląska; A4 – Poddział Pas Wyżyn Środkowych, with subunits (Krainy), 13 – Wzgórza Trzebnicko-Ostrzeszowskie, 14 – Wyżyna Śląska, 15 – Wyżyna Krakowsko-Wieluńska, 17 – Świętokrzyska, 18 – Północne Wysoczyzny Brzeźne; F – Dział Sudety

b) Geobotanical regionalization (J. M. Matuszkiewicz 2008a): A – Dział Pomorski; B – Dział Brandenbursko-Wielkopolski, B.1 – Kraina Notecko-Lubuska, with subunits (Okregi), 1 – Kotlina Frainwaldzka, 2 – Bory Noteckie, 3 – Chodzieski, 4 – Złotowsko-Chojnicki, 5 – Nakielski, 6 – Poznański, 7 – Międzyrzecko-Nowotomyski, 8 – Pojezierze Łagowskie, B.2 – Kraina Środkowowielkopolska, with subunits (Okregi), 1 – Pojezierze Gnieźnieńskie, 2 – Kórnicko-Miłosławski, 3 – Kościański-Opalenicki, 4 – Wzgórza Żerkowskie, 5 – Jarociński-Rychwański, B.3 – Kraina Kujawska, with subunits (Okregi), 1 – Czarnych Kujaw, 2 – Kutnowski, 3 – Łęczycki, 4 – Sieradzko-Uniejowski, 5 – Burzeński, B.4. Kraina Południowowielkopolsko-Łużycka, B.4a – Podkraina Łużycka, with subunits (Okregi): 1 – Puszcza Rzepińska, 2 – Kotlina Środkowej Odry, 3 – Zielonogórsko-Gubiński, 4 – Wzgórza Żarsko-Trzebielskie, 5 – Bory Dolnośląskie, 6 – Bolesławiecko-Zgorzelecki, B.4b – Podkraina Południowowielkopolska, with subunits (Okregi), 7 – Wysoczyzna Leszczyńska, 8 – Wysoczyzna Kaliska, 9 – Szprotawsko-Prochowidzki, 10 – Wzgórza Dalkowskie, 11 – Nadodrzańskie Kotliny Ścinawsko-Głogowskie, 12 – Dolina Baryczy, 13 – Wzgórza Trzebnickie, 14 – Wzgórza Ostrzeszowskie, 15 – Byczyńsko-Rychtański; 16 – Dolina Górnej Prosn, 17 – Błaskowski, B.5. Kraina Dolnośląska; C – Dział Wyżyn Południowopolskich, C.1 – Kraina Wysoczyzn Łódzko-Wieluńskich, with subunits (Okregi), 1 – Wieluńsko-Złoczewski, 2 – Szczercowsko-Łaski, 3 – Zduńskowolsko-Strykowski, 5 – Tomaszowsko-Pajęczański, C.2 – Kraina Wyżyn Środkowomazowieckich, with subunits (Okregi), 1 – Praszecko-Działoszyński, 2 – Olesko-Częstochowski, 3 – Niecka Włoszczowska; E – Dział Mazowiecko-Poleski; E.1 – Kraina Chełmińsko-Dobrzyńska, with subunits (Okregi), 1 – Wysoczyzna Świecka, 2 – Dolina Dolnej Wisły, 3 – Pojezierze Chełmińskie, 6 – Nadwiślański Włocławsko-Bydgoski, 7 – Rypiński, 8 – Dobrzyńsko-Skępski; G – Dział Sudecki

c) Forest regionalization (Trampler *et al.* 1990): I – Kraina Bałtycka; II – Kraina Mazursko-Podlaska; III – Kraina Wielkopolsko-Pomorska, 1 – Dzielnic Borów Tucholskich, 2 – Dzielnic Pojezierza Krajeńskiego, with mesoregions, a – Równina Wałecka, b – Wysoczyzna Krajeńska, c – Dolina Brdy, 3 – Dzielnic Pojezierza Chełmińskiego-Dobrzyńskiego, with mesoregions, a – Wysoczyzna Świecka, b – Kotlina

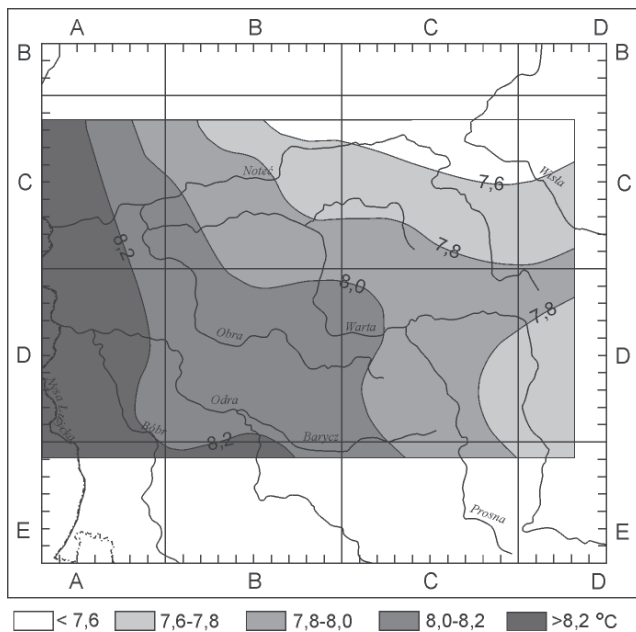


Fig. 5. Mean annual air temperature in Wielkopolska in 1951-1980 (according to Woś 1994)

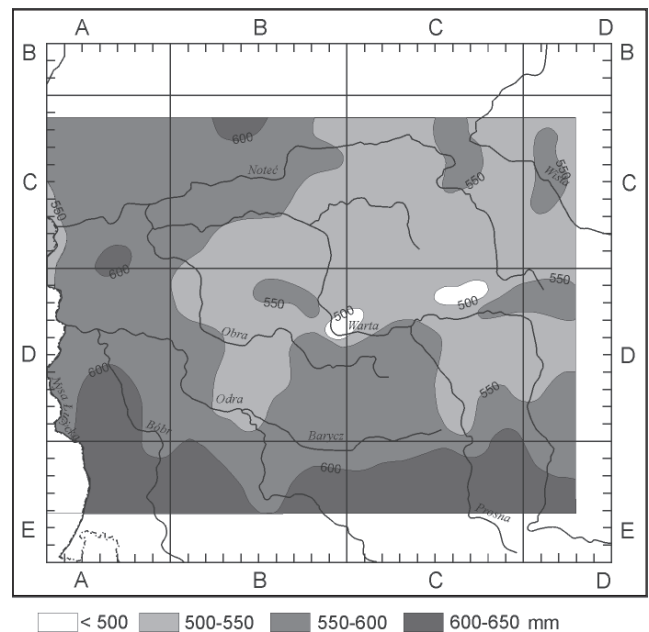


Fig. 6. Mean annual precipitation in Wielkopolska in 1951-1980 (according to Woś 1994)

Borysiak *et al.* 1991), and several years ago it also became a Special Area of Conservation „Dąbrowy Krotoszyńskie” (PLH300002) within the Natura 2000 network (Brzeg *et al.* 2002a, 2002b).

4. Materials and methods

This study is based on 1655 relevés from Wielkopolska and adjacent areas. The methodological justification of the scope of research is presented in the introduction. The analysed database includes all relevés (without any prior selection) diagnosed by their authors as acidophilous oak forests from the class *Quercetea robori-petraeae* or from the order *Quercetalia roboris*

(at least at the rank of community, including substitute forest communities); mixed coniferous forests from the class *Vaccinio-Piceetea* (including those classified as *Festuco ovinae-Pinetum*, *Pino-Quercetum* or *Quercus roboris-Pinetum*); or thermophilous oak forest (identified as *Potentillo albae-Quercetum* or its synonyms) and substitute forest communities on its potential sites. Similar criteria were applied to oak-hornbeam forests, but they were limited here to those classified in the literature as their acidophilous forms, i.e. the *Galio sylvatici-Carpinetum* (*Quercus-Carpinetum*) *holcetosum*, *Gs-C* (*Q-C*) *calamagrostietosum* or *Gs-C* (*Q-C*) *polytrichetosum*. On the basis of results of synoptic tables of Krotoska (1966) as well as W. Matuszkiewicz and

Grudziądzka, c – Wysoczyzna Dobrzyńsko-Chełmińska, d – Równina Urszulewska, 4 – Dzielnicza Kotliny Gorzowskiej, with mesoregions, a – Pradolina Warty, b – Puszcza Notecka, 5 – Dzielnicza Kotliny Toruńsko-Płockiej, 6 – Dzielnicza Pojezierza Lubuskiego, with mesoregions, a – Ziemia Lubuska, b – Równina Nowotomysko-Kargowska, c – Pradoliny Głogowskiej, 7 – Dzielnicza Niziny Wielkopolsko-Kujawskiej, with mesoregions, a – Dolina Środkowej Noteci, b – Pojezierze Wielkopolskie, c – Sandry Gnieźnieńskie, d – Dolina Konińska, 8 – Dzielnicza Krotoszyńska, 9 – Dzielnicza Kotliny Żmigrodzko-Grabowskiej; IV – Kraina Mazowiecko-Podlaska, 3 – Dzielnicza Równiny Warszawsko-Kutnowskiej, with mesoregion, a – Wysoczyzna Kłódawsko-Turecka; V – Kraina Śląska, 1 – Dzielnicza Równiny Dolnośląskiej, with mesoregions, a – Wzgórze Dalkowskie, b – Bory Dolnośląskie, c – Pogórze Nowogrodzkie, 2 – Dzielnicza Wrocławska, with mesoregions, a – Obniżenie Ścinawskie, b – Wzgórze Trzebnicko-Ostrzeszowskie, c – Legnicki, d – Wysoczyzna Średzka, e – Równina Wrocławska, f – Pradolina Wrocławska, g – Równina Oleśnicka, Przedgórze Sudeckie, and Płaskowyż Głubczycki; VI – Kraina Małopolska, 1 – Dzielnicza Łódzko-Opoczyńska, 6 – Dzielnicza Wyżyny Woźnicko-Wieluńskiej; VII – Kraina Sudecka

d) Physical-geographic division (Kondracki & Rychling 1994), 31 – Prowincja Niż Środkowoeuropejski, 313 – Podprowincja Pobrzeża Południowobałtyckie, with makroregion, 313.3 – Pobrzeże Szczecińskie, 314-315 – Podprowincja Pojezierza Południowobałtyckie, with makroregions, 314.4 – Pojezierze Zachodniopomorskie, 314.6-7 Pojezierze Południowopomorskie, 314.8 – Dolina Dolnej Wisły, 315.1 – Pojezierze Chełmińsko-Dobrzyńskie, 315.3 – Pradolina Toruńsko-Eberswaldzka, 315.4 – Pojezierze Lubuskie, 315.5 – Pojezierze Wielkopolskie, 315.6 – Pradolina Warciańsko-Odrzańska, 315.7 – Wzniesienia Zielonogórskie, 315.8 – Pojezierze Leszczyńskie; 317 – Podprowincja Niziny Sasko-Łużyckie, with makroregions, 317.2 – Obniżenie Dolnołużyckie, 317.4 – Wzniesienia Łużyckie, 317.7 – Nizina Śląsko-Łużycka; 318 – Podprowincja Niziny Środkowopolskie, with makroregions, 318.1-2 – Nizina Południowowielkopolska, 318.3 – Obniżenie Milicko-Głogowskie, 318.4 – Wał Trzebnicki, 318.5 – Nizina Śląska; 33 – Prowincja Masyw Czeski; 34 – Prowincja Wyżyny Polskie

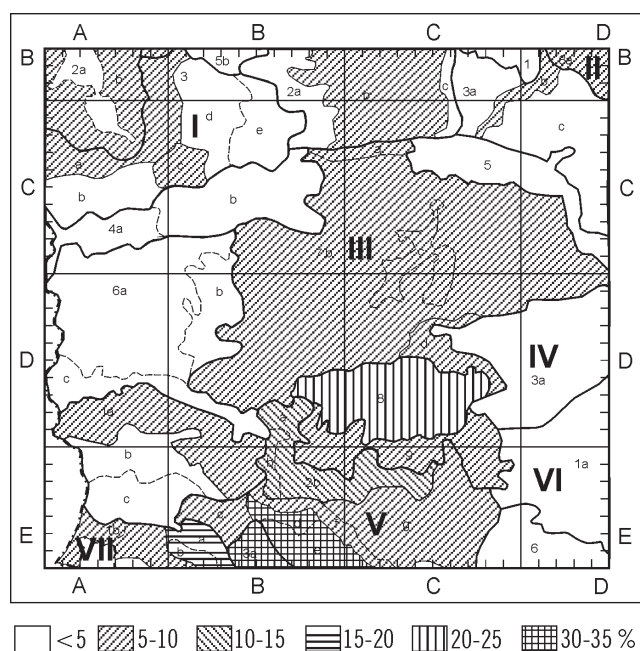


Fig. 7. Area of oak forest stands in mesoregions of the forest regionalization of Trampler *et al.* (1990), modified from Ceitel (2006)
 Explanations: see Fig. 4c

A. Matuszkiewicz (1985), it is assumed here that other subassociations of oak-hornbeam forests form a floristically well-defined group, clearly distinct from acidophilous oak forests. Acidophilous forms of oak-hornbeam forests were also selected from the tables of the association where no syntaxa of lower rank were identified. Additionally, communities that did not fit within the hierarchic system were taken into account. Their relevés were added to the database if their species composition was similar to the syntaxa listed above. All the relevés included in the database were recorded according to the classic method of Braun-Blanquet (1964), with 7 classes of cover-abundance (5 = cover >75%; 4 = 50-75%; 3 = 25-50%; 2 = 5-25%; 1 = numerous or scattered, but cover <5%; + = few, with small cover; and r = rare, solitary, with small cover). The relevés were extracted from 59 publications (40 of them contributing 69% of all relevés) and from unpublished works listed below. The numbers given in round brackets help to identify the relevés in the analytic tables presented here.

List of sources of the 1655 relevés analysed in this study. Numbers of relevés extracted from individual sources are given in square brackets

(1) Balcerkiewicz *et al.* 1994 [14]; (2) Berdowski & Kwiatkowski 1992 [9]; (3) Błachuta 1995 [4]; (4) Boiński 1973 [56]; (5) Borysiak *et al.* 1998 [5]; (6) Brzeg 1989 [7]; (7) Brzeg 2004 [20]; (8) Brzeg 2006 [3]; (9) Brzeg & Kasprowicz 2001 [3]; (10) Brzeg *et al.* 1989 [33] (11) Brzeg *et al.* 2000a [25]; (12) Brzeg *et al.* 2001 [123]; (13) Brzeg *et al.* 2000b [2]; (14)

Fabiszewski & Faliński 1967 [11]; (15) Ferchmin 1966 [22]; (16) Ferchmin 1980 [35]; (17) Gmaj 1997 [40]; (18) Hegenbart-Magdans & Brzeg 1999 [69]; (19) Jakubowska-Gabara 1994 [46]; (20) Jaroszewska 2007 [34]; (21) Jelinowski 1958 [30]; (22) Kaczyńska 1964 [15]; (23) Kamionka 1971 [28] (24) Kasprowicz 2006 [29]; (25) Klimko *et al.* 2003 [1]; (26) Krotoska 1966 [25]; (27) Krotoska 1978 [29]; (28) Krotoska 1983 [4]; (29) Krotoska 1991 [43]; (30) Krotoska & Piotrowska 1962 [39]; (31) Kubiś 1982 [20]; (32) Kulińska 1991 [5]; (33) Kuświk *et al.* 1999 [1]; (34) Lisiewska & Reszel 2000 [5]; (35) Macicka 1984 [67]; (36) Macicka & Wilczyńska 1990 [83]; (37) Macicka & Wilczyńska 1991 [64]; (38) Macicka & Wilczyńska 1992 [20]; (39) Macicka-Pawlik & Wilczyńska 1996 [26]; (40) Maciejewska-Rutkowska *et al.* 2001 [2]; (41) Marcysiak 2001 [13]; (42) Nachotko 1982 [83]; (43) Nowaczyk 1964 [37]; (44) Olaczek 1986 [24]; (45) Paciejewska 1981 [5]; (46) Pawłow & Czech 1959 [22]; (47) Ratyńska 2001 [9]; (48) Robińska 1977 [39]; (49) Ryszewska 1977 [6]; (50) Siwczak 1977 [30]; (51) Sroka 1982 [70]; (52) Szwed 1979 [36]; (53) Wojterska & Wojterski 1953 [11]; (54) Wojterska 1976 [6]; (55) Wojterska 2003 [46]; (56) Wojterska *et al.* 2006 [61]; (57) Wojterska & Wiszniewska 1996 [17]; (58) Wojterska *et al.* 2001 [10]; (59) Zielińska 1994 [33].

A detailed list of all the analysed relevés is presented below. They are grouped into syntaxonomic units and forms of transformation according to the original diagnoses made by authors of the relevés. Most of the communities were initially identified as *Calamagrostio arundinaceae-Quercetum* (31% of all relevés), mixed coniferous forest *Pino-Quercetum* (19%) or thermophilous oak forest *Potentillo albae-Quercetum* (17%). Poor oak-hornbeam forests, identified as the *Galio sylvatici-Carpinetum holcetosum mollis* or *Gs-C calamagrostietosum*, account for 11% of all the analysed relevés. A relatively large group (13%) is composed of relevés assigned only to higher phytosociological units or termed as “community”, not included in the phytosociological classification (category: “others”; see the list of analysed relevés below). Relatively small numbers of relevés were available for *Aulacomnio androgyni-Quercetum* (2% of all relevés), *Molinio caeruleae-Quercetum* (2%), *Fago-Quercetum* (2%), *Quercus roboris-Pinetum*, and *Festuco ovinae-Pinetum* (jointly 3%), and *Serratulo-Pinetum*, which was documented by only 6 relevés (Fig. 8).

List of relevés analysed in this study

This list includes all the relevés (1655) grouped into syntaxonomic units and forms of transformation according to the original diagnoses made by authors of the relevés. The numbers of relevés included in the analysed database are given in square brackets.

Aulacomnio androgyni-Quercetum roboris (Aa-Q) or *Carpino-Quercetum* (C-Q) [31]

Błachuta 1995 (C-Q, Table 4: relevés 3-4 [2]); Brzeg *et al.* 2001 (Aa-Q, Table 1: 1-25 [25]); Kulińska 1991 (C-Q, Table 2: 4-5 [2]); Lisiewska & Reszel 2000 (Aa-Q, Table 3: 1-2 [2]).

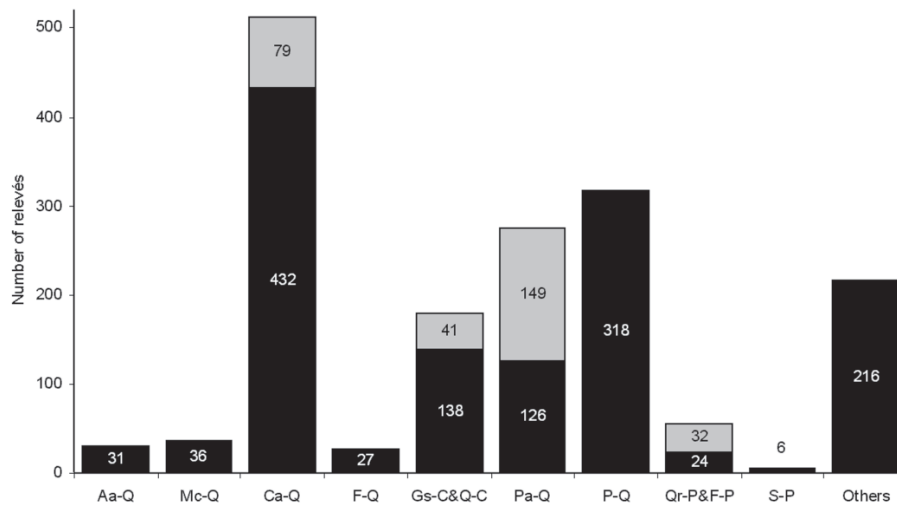


Fig. 8. Numbers of studied relevés of the plant associations, according to the original diagnoses of their authors

Explanations: black – untransformed communities, grey – degenerated or substitute forest communities (further explanations in the text)

Molinio caeruleae-Quercetum roboris (Mc-Q) [36]

Brzeg *et al.* 1989 (Table 2: 1-33 [33]); Kulińska 1991 (Table 2: 1 [1]); Lisiewska & Reszel 2000 (Table 3: 4 [1]); Wojterska 2003 (Table 17: 1 [1]).

Calamagrostio arundinaceae-Quercetum petraeae (Ca-Q) [511]

A. 432 relevés of untransformed phytocoenoses, including:

167 relevés diagnosed to the association level:

Borysiak *et al.* 1998 (Table 2: 7-11 [5]); Fabiszewski & Faliński 1967 (Table 9: 1-11 [11]); Krotoska 1978 (Table 1: 1-29 [29]), 1991 (Table 10: 1-12 [12]); Macicka & Wilczyńska 1991 (Table 13: 1-5 [5]); Nachotko 1982 (Table 1: 1-14, form with *Calamagrostis arundinacea* [14], Table 2: 1-14, form with *Festuca ovina* [14]); Olaczek 1986 (Table 4: 1-5 [5]); Ryszewska 1977 (Table 5: 1-6 [6]); Siwczak 1977 (Table 3: 1-30 [30]); Sroka 1982 (Table 1: 1-17, 24-36 [32]); Szwed 1979 (Table 12: 1-4 [4]).

116 relevés diagnosed to the subassociation level:

Ca-Q convallarietosum [27]: Błachuta 1995 (Table 4: 1 [1]); Gmaj 1997 (Table 9: 14-19 [6]); Ratyńska 2001 (Table 176: 1-9 [9]); Zielińska 1994 (Table 6: 1-11 [11]).

Ca-Q molinietosum [8]: Błachuta 1995 (Table 4: 2 [1]); Gmaj 1997 (Table 9: 1-4 [4]); Kuświk *et al.* 1999 (Table 1: 8 [1]); Kulińska 1991 (Table 2: 2 [1]); Wojterska 2003 (Table 16: 17 [1]).

Ca-Q polygonatetosum [51]: Hegenbart-Magdans & Brzeg 1999 (Table 1: 1-36 [36]); Jaroszewska 2007 (Table 1: 1-11 [11]); Wojterska 2003 (Table 16: 1-4 [4]).

Ca-Q typicum [30]: Gmaj 1997 (Table 9: 5-13 [9]); Klimko *et al.* 2003 [1]; Kulińska 1991 (Table 2: 3 [1]); Wojterska 2003 (Table 16: 5-16, 18-24 [19]).

149 relevés diagnosed to the variant level:

Ca-Q molinietosum variant with *Anemone nemorosa* [49]: Brzeg *et al.* 2001 (Table 1: 6-50 [45]); Kasprowicz 2006 [3]; Lisiewska & Reszel 2000 (Table 3: 3 [1]).

Ca-Q molinietosum typical variant [6]: Brzeg *et al.* 2001 (Table 1: 1-5 [5]); Kasprowicz 2006 [1].

Ca-Q polygonatetosum variant with *Anemone nemorosa* [39]: Brzeg *et al.* 2001 (Table 3: 13-41 [29]); Kasprowicz 2006 [10].

Ca-Q polygonatetosum typical variant [17]: Brzeg *et al.* 2001 (Table 3: 1-12 [12]); Kasprowicz 2006 [5].

Ca-Q typicum variant with *Anemone nemorosa* [25]: Brzeg *et al.* 2001, Table 2: 9-32 [24]; Kasprowicz 2006 [1].

Ca-Q typicum typical variant [13]: Brzeg 2006 [1]; Brzeg *et al.* 2001 (Table 2: 1-8 [8]); Kasprowicz 2006 [4].

B. 79 relevés of transformed phytocoenoses: Gmaj 1997 (Table 11: 3,5, Table 12: 1,3 [4]); Hegenbart-Magdans & Brzeg 1999 (Table 2: 1-11 [11], Table 3: 1-10 [10]); Kasprowicz 2006 [2]; Krotoska 1983 (Table 3: 3-4 [2]), 1991 (Table 10: 13-21 [9]); Maciejewska-Rutkowska *et al.* 2001 [1]; Nachotko 1982 (Table 3: 1-12 [12]); Olaczek 1986 (Table 4: 6-13 [8]); Sroka 1982 (Table 1: 20-23 [4]); Zielińska 1994 (Table 5: 1-16 [16]).

Fago-Quercetum (F-Q) [27]

F-Q holcetosum mollis: Boiński 1973 (Table 50: 1-27).

Galio sylvatici-Carpinetum & *Quercus-Carpinetum* (Gs-C & Q-C) [179]

A. 138 relevés of untransformed phytocoenoses, including:

7 relevés diagnosed to the association level: Brzeg 1989, *Gs-C* 131 relevés diagnosed to the subassociation level:

Gs-C holcetosum mollis [108]: Gmaj 1997 (Table 4: 7-9 [3]); Kamionka 1971 (Table 10: 15-25 [11]); Krotoska 1966 (Table 10: 1-17, typical variant [17]), Table 11: 1-5, typical variant, form with *Vaccinium myrtillus* [5]); Kubiś 1982 (Table 2: 1-8 [8]); Macicka 1984 (Table 10: 37-48 [12]); Macicka & Wilczyńska 1990 (Table 9: 1-14 [14], 1991, Table 9: 1-14 [14], 1992, Table 4: 18-29 [12]); Kasprowicz 2006 [2]; Maciejewska-Rutkowska *et al.* 2001, (Table 2: 1 [1]); Wojterska 2003 (Table 14: 27-35 [9]).

Gs-C calamagrostietosum [23]: Boiński 1973 (Table 31: 1-23)

- B. 41 relevés of transformed phytocoenoses (*Gs-C* & *Q-C*):
 “Form of deformation of *Galio-Carpinetum* with the share of some acidophilous (pine forest) species”
 Krotoska 1991, Table 6: 1-8 [8]
Q-C holcetosum mollis aff. (Ferchmin 1980, Table 17: 12-15 [4]).
Q-C calamagrostietosum variant with *Pinus sylvestris* (Ferchmin 1966, Table 8: 2-14, 15-23 [22]).
Q-C calamagrostietosum aff. (Ferchmin 1980, Table 17: 5,6 [2]).
Q-C transitional community (Ferchmin 1980, Table 17:7-11 [5]).

Potentillo albae-Quercetum (*Pa-Q*) or *Querco-Potentilletum albae* [275]

- A. 126 relevés of untransformed phytocoenoses, including:
 42 relevés diagnosed to the association level:
Pa-Q [13]: Wojterska 2003 (Table 14: 36-38 [3]); Wojterska *et al.* 2001 (Table 1: 4-9, 11-14 [10]).
Querco-Potentilletum [31]: Nowaczyk 1964 (Table 9: 1-18 [18]); Wojterska & Wojterski 1953 (Table 1: 1-13 [13]).
 84 relevés diagnosed to the subassociation or the variant level:
Pa-Q astrantietosum (cfr.) [1] Wojterska & Wiszniewska 1996 (Table 1: 17).
Pa-Q molinietosum [10]: Brzeg & Kasproicz 2001 (variant with *Asarum europaeum* [1]); Wojterska *et al.* 2006 (Table 2: 1-9 [9]).
Pa-Q brachypodietosum pinnati [34]: Brzeg 2006 (variant with *Pleurozium schreberi* [1]); Brzeg & Kasproicz 2001 (typical variant [1]); Jaroszewska 2007 (Table 2: 1-8, variant with *Pleurozium schreberi*, and 9-11, typical variant [11]); Wojterska *et al.* 2006 (Table 1: 7, 10, 11, 13, 15, 19, 20, 22 [8]); Wojterska & Wiszniewska 1996 (Table 1: 1-13 [13]).
Pa-Q lathyrestosum verni [2]: Gmaj 1997 (Table 6: 1-2 [2]); Wojterska & Wiszniewska 1996 (Table 1: 14 [1]).
Pa-Q poetosum [10]: Jakubowska-Gabara 1994 (Table 1: 1-10).
Pa-Q typicum [26]: Brzeg 2006 (variant with *Pleurozium schreberi* [1]); Brzeg & Kasproicz 2001 (variant with *Pleurozium schreberi* [1]); Jakubowska-Gabara 1994 (Table 1: 16-23 [8]); Jaroszewska 2007 (Table 3: 1-5 [5]); Marcysiak 2001 (Table 1: 1-9 [9]); Wojterska & Wiszniewska 1996 (Table 1: 15, 16 [2]).
- B. 149 relevés of transformed phytocoenoses or substitute forest communities: Boiński 1973 (Table 46: 1-6; [6]); Ferchmin 1980 (Table 19: 1-19 [19]); Gmaj 1997 (Table 6: 3-4 [2]; Table 7: 1-10 [10]); Hegenbart-Magdans & Brzeg 1999 (Table 5: 1-12 [12]); Jakubowska-Gabara 1994 (Table 1: 11-15, 24-30 [12]); Jaroszewska 2007 (Table 4: 1-7 [7]); Krotoska 1983 (Table 3: 1,2 [2]); Krotoska 1991 (Table 11: 1-14 [14]); Marcysiak 2001 (Table 1: 10-13 [4]); Olaczek 1986 (Table 2: 1-3 [3], Table 3: 1-8 [8]); Wojterska *et al.* 2006 (Table 1: 23-31 [9], Table 3: 1-35 [35]); Zielińska 1994 (Table 4: 1, 2, 4-7 [6]).

Pino-Quercetum (*P-Q*) [318]

203 relevés diagnosed to the association level:

Ferchmin 1980 (Table 21: 1-5 [5]); Jelinowski 1958 (Table 1: 1-30 [30]); Kaczyńska 1964 (Table 5: 1-15 [15]); Macicka & Wilczyńska 1991 (Table 14: 1-22 [22]), 1992 (Table 6: 1-8 [8]); Macicka-Pawlik & Wilczyńska 1996 (Table 28: 1-7 [7]); Nowaczyk 1964 (Table 7: 1-19 [19]); Robińska 1977 (Table 3: 1-34 [34], Table 5: 1-5 [5]); Sroka 1982 (Table 2: 1-20 [20]); Szwed 1979 (Table 16: 1-32 [32]); Wojterska 1976 (Table 11: 1-6 [6]).

115 relevés diagnosed to the subassociation level:

P-Q caricetosum brizoides [8]: Krotoska & Piotrowska 1962 (Table 5: 1-8);
P-Q fagetosum [35]: Macicka 1984 (Table 20: 18-30 [18]); Macicka & Wilczyńska 1990 (Table 16: 1-17 [17]).
P-Q typicum [72]: Krotoska & Piotrowska 1962 (Table 5: 10-34, typical variant, and 35-40, variant with *Molinia caerulea* [31]); Macicka 1984 (Table 20: 1-12 [12]); Macicka & Wilczyńska 1990 (Table 17: 1-29 [29]).

Querco roboris-Pinetum (*Qr-P*) & *Festuco ovinae-Pinetum* (*F-P*) [56]

- A. 24 relevés of untransformed phytocoenoses including:
F-P molinietosum [2]: Brzeg *et al.* 2000b (Table 2: 41-42 [2]).
Qr-P molinietosum [11]: Brzeg 2004 (Table 1: 1-10 [10]); Jakubowska-Gabara 1994 (Table 2: 15 [1]).
Qr-P typicum [11]: Brzeg 2004 (Table 1: 11-14 [4]); Jakubowska-Gabara 1994 (Table 2: 1-5, 10 [6]); Kasproicz 2006 [1].
- B. 32 relevés of transformed phytocoenoses or substitute forest communities: Berdowski & Kwiatkowski 1992 (Table 7: 1-9 [9]); Jakubowska-Gabara 1994 (Table 2: 6-8, 12-14, 16-18 [9]); Balcerkiewicz *et al.* 1994 (Table 3: 1-14 [14]).

Serratulo-Pinetum (*S-P*) [6]

Brzeg 2004 (Table 1: 15-20).

Others [216]

Mixed coniferous forest (Pawłow & Czech 1959, Table 3: 1-22 [22]).
 Acidophilous oak forests from the class *Quercetea robori-petraeae* (Wojterska 2003, Table 17: 3-11 [9]).
 Oak forest with *Holcus mollis* (Nachotko 1982, Table 5: 1-14 [14]).
 Oak forest from the class *Querco-Fagetea*, with thermophilous species (Paciejewska 1981, Table 11: 1-4, 6 [5]).
 Oak forest from the class *Querco-Fagetea*, with *Pinus sylvestris* (Nachotko 1982, Table 6: 1-7 [7]).
 Oak forest with thermophilous species (Nachotko 1982, Table 4: 1-22 [22]).
 Oak-pine forest with *Molinia caerulea* (Sroka 1982, Table 3: 1-14 [14]).
 Substitute forest community (Macicka-Pawlik & Wilczyńska 1996, Table 31: 1-19 [19]).

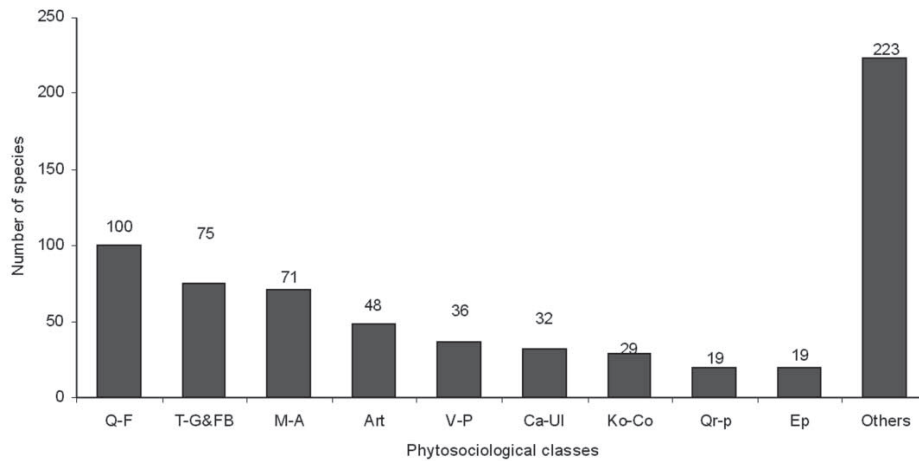


Fig. 9. Numbers of recorded characteristic species of phytosociological classes (total number of species 652, recorded in 1655 relevés)

Plantation of *Pinus sylvestris* on potential sites of deciduous and mixed forests (Macicka 1984, Table 29: 1-18 [18]). Oak-hornbeam forest with *Vaccinium myrtillus* (Krotoska 1966, Table 21: 1-3 [3]).

Community *Carex brizoides-Quercus* (Lisiewska & Re-szel 2000, Table 3: 5 [1]).

Community *Polytrichum attenuatum-Carpinus betulus* (Kubiś 1982, Table 4: 1-5, 7-10, 12-15 [12]).

Community from the alliance *Quercion robori-petraeae* Br.-Bl. 1932 (Macicka 1984, Table 18: 1-7 [7]; Macicka & Wilczyńska 1990, Table 13: 1-23 [23]; Macicka & Wilczyńska 1991, Table 12: 1-23 [23]).

Acidophilous oak forest (Kamionka 1971, Table 12: 1-17 [17]).

In the 1655 relevés analysed in this study, 16 species of lichens and 636 plant taxa were recorded (including 546 vascular plants, 83 bryophytes, and 7 liv-

erworts). The syntaxonomic structure of the analysed set of relevés is presented in Fig. 9.

The relevés were recorded in 1951-2007, mostly (60%) in 1971-1990 (Fig. 10). Plot size varied from 70 to 2000 m² (Fig. 11), but only 11 relevés were smaller than 100 m² and only 10 relevés exceeded 1000 m². They were included in the analysed database mostly to enable comparisons with earlier classifications of other authors. A vast majority (83%) of the relevés covered 100-400 m². Patches of this size are also documented most frequently in European phytosociological studies of forest communities (Chytrý 2001, see also Chytrý & Otýpková 2003). The recommended size of relevés of forest communities is usually 100-200 m² (Chytrý & Otýpková 2003; Dierschke 1994; Dzwonko 2007), up to 200-500 m², for coniferous forests from the class *Vaccinio-Piceetea* (van der Maarel 2005).

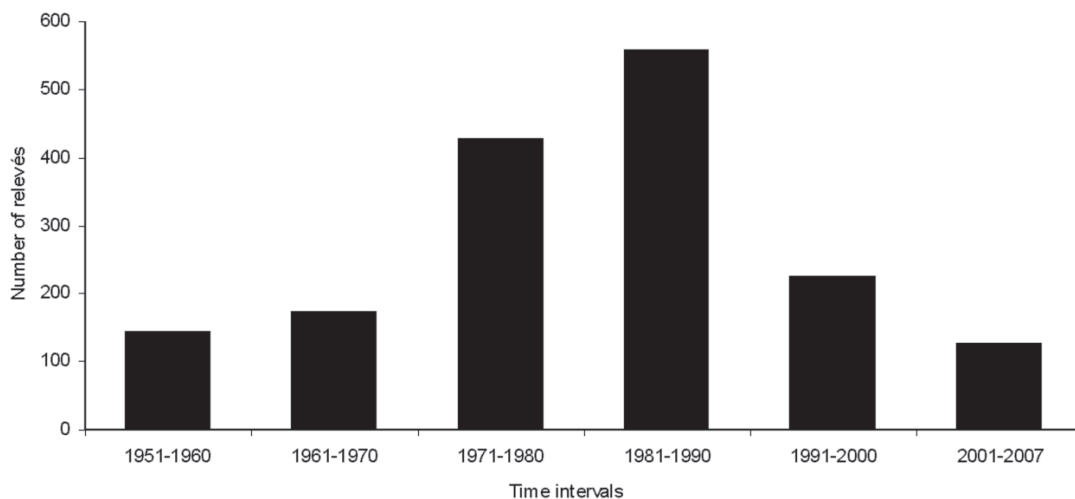


Fig. 10. Numbers of relevés recorded in given time intervals (analysis based on 1655 relevés)

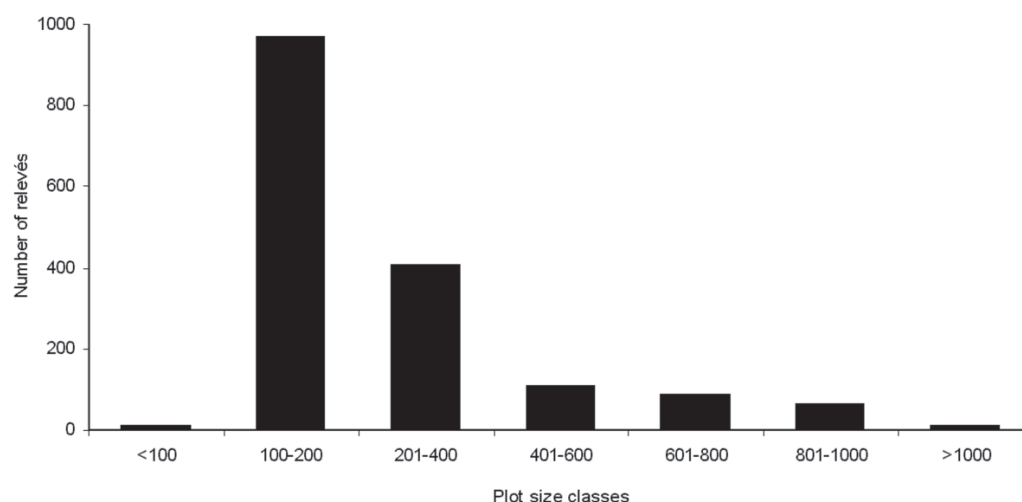


Fig. 11. Numbers of relevés in plot size classes (analysis based on 1650 relevés, as the size of 5 relevés is unknown)

In the analysed set of relevés, no significant correlation was found between the date of the relevé and plot size (see Chytrý 2001). The oldest relevés covered 100-800 m² (Wojterska & Wojterski 1953). The largest number of relevés (155) documenting relatively large patches (500-900 m²) were recorded in 1984-1992, mostly (97%) by Macicka & Wilczyńska (1990, 1991, 1992) or Macicka-Pawlik & Wilczyńska (1996).

The extracted relevés were stored in a database by Profit software (Balcerkiewicz & Sławnikowski 1988). The software was used to generate analytic and synoptic tables. It enabled also calculation of major statistics for groups of relevés and for plant communities (primarily: constancy expressed as percentage, the cover index, number of species in individual tables or in an analysed group of relevés, and mean number of species per relevé).

Localities of 1622 relevés were mapped on a grid of basic ATPOL squares of 10 km × 10 km (Zajac 1978). The relevés were recorded in 135 squares (Fig. 3). Localization of the remaining 33 relevés was impossible because of a lack of precise data about geographic location. Cartograms of distribution of the studied plant communities were generated by Gnomon software (2006).

Syntaxonomic research was conducted by the classical phytosociological method of the Braun-Blanquet school (Braun-Blanquet 1964; Pawłowski 1972; Matuszkiewicz W. 2001), i.e. with the use of successive series of comparisons in analytic and synoptic tables (see Brzeg 2005). It must be emphasized that at an early stage of sorting of the materials, individual relevés were analysed in detail, intentionally disregarding their initial diagnosis in the original publications. They were diagnosed on the basis of the presence or relative contributions of individual groups of diagnostic species,

with the use of existent standards from the literature and nomenclatural types designated earlier, referred to in later sections of the present monograph. The syntaxonomic and nomenclatural revision of the above syntaxa was made in accordance with the International Code of Phytosociological Nomenclature (Weber *et al.* 2000). Syntaxonomic units of various ranks were identified and diagnosed on the basis of floristic criteria, i.e. the presence or lack of some groups of diagnostic species (characteristic and/or differential).

In many cases, particularly when analysing degenerated forms of various associations, also accidental features were helpful (see Matuszkiewicz W. 2001). Among them, special attention was paid to vertical structure, species composition, and forest dynamics (especially spontaneous regeneration of tree populations) as well as site conditions. Strongly transformed plant communities, which could not be assigned to any known plant associations, were classified as substitute forest communities (see Jakubowska-Gabara 1989).

The basic diagnostic features used to assess the stage of degeneration of forest stands were: contributions of characteristic and differential species for individual associations and units of higher rank, as well as relative contributions of those species and species alien to those ecosystems, and thus attesting to the process of degeneration (see Olaczek 1972, 1974a, 1974b; Krotoska 1991). The application of so-defined diagnostic criteria made it possible to assess the degree of transformation of plant communities in the system of stages of degeneration defined by Faliński (1966). Untransformed patches of an association are characterized by a high constancy of diagnostic species. In stage I of degeneration, the constancy of characteristic species of the association is low. In stage II of degeneration, these species are nearly absent. In stage III of degeneration,

also the contribution of characteristic species of the class is reduced.

The sorted phytosociological documentation of the distinguished syntaxa is presented in analytic (A1-A37) and synoptic (3, 5-12) tables. Each relevé in the analytic tables contains descriptive elements (ID-1, ID-2, ID-3), which allow their unambiguous identification. These elements are explained at the end of this section. Lists of sporadic species include the number of the relevé in the table and cover-abundance in brackets. Values of “sociability” were not taken into account. In synoptic tables, species frequency was expressed as a percentage. The cover index was calculated according to Pawlowski (1972). The index is a mean percent cover of the given species in relevés of the table multiplied by 100, with cover-abundance of 5 interpreted as 87.5%, 4 as 62.5%, 3 as 37.5%, 2 as 17.5%, 1 as 5%, + as 0.5%, and r as 0.1. If the index was =0.09, it was denoted as 0.

In the calculations and numerical analyses, the cover-abundance scale of Braun-Blanquet was transformed into a scale of 1-9 (van der Maarel 1979, 2007).

For each relevé, mean Ellenberg indicator values were calculated: light (L), soil moisture (F), soil reaction (R), soil productivity (N), continentality (K) (Ellenberg *et al.* 1992). For indicator L, a weighed mean was calculated, taking into account the cover-abundance of individual species. For the other indicators, arithmetic means were used. Ellenberg indicator values calculated in this way are most similar to results of measurements in field conditions (Dzwonko 2001, 2007; Dzwonko & Loster 2000, see also Diekmann 1995, 2003; Schaffers & Sykora 2000; Seidling & Fischer 2008). In the calculations, all species of vascular plants, bryophytes, and lichens were taken into account (see Ewald 2003), except canopy trees, because the species composition of the canopy often results from human activity and does not reflect fully the natural site conditions (see Diekmann 1995, 2003; McCollin *et al.* 2000; Lawesson & Skov 2002; Hédél 2004). Ertsen *et al.* (1998) excluded trees and shrubs from calculations of mean Ellenberg indicator values, pointing to the fact that they are rooted in deeper soil horizons.

It has been assumed here that the above-mentioned variation in plot size does not affect significantly the calculated Ellenberg indicator values (see Otýpková & Chytrý 2006; Otýpková 2009).

In the interpretation of test results, recent findings were taken into account, showing that values of Ellenberg indicator N are not strongly correlated with the concentration of bioavailable nitrogen in the soil. Values of this indicator are strongly and positively correlated with biomass production (Ertsen *et al.* 1998; Wamelink *et al.* 1998; Schaffers & Sykora 2000; Diekmann 2003) as well as with concentrations of potassium

and phosphorus (see Dzwonko 2001; Cornwell & Grubb 2003). The diagnostic importance of Ellenberg indicator N was discussed in detail e.g. by Roo-Zielińska (2004) and Sutton *et al.* (2004). Moreover, Schaffers & Sykora (2000) reported that values of the Ellenberg indicator R reflect well not only the soil reaction but also calcium content.

To characterize the major directions of variation of the studied communities, relevé data were subjected to detrended correspondence analysis (DCA) or principal component analysis (PCA). CANOCO 4.5 software (ter Braak & Šmilauer 2002) was used for the calculations and graphic presentation of the results. The choice of the method (DCA or PCA) was based on the type of analysed data, determined by the lengths of gradient (ter Braak & Prentice 1988; Lepš & Šmilauer 2003). To avoid an excessive effect of rare species, the option “downweighting of rare species” was used in DCA (ter Braak & Šmilauer 2002). In PCA, species found in less than 5% of relevés were not included. In both DCA and PCA, species cover-abundance values were used. Mean Ellenberg indicator values and the other data describing the species composition of patches of individual relevés were included in the analysis as passive variables, i.e. those excluded from axis construction (ter Braak & Šmilauer 2002). The interpretation of DCA ordination results took into account also Spearman’s rank correlation coefficient between scores of individual variables and ordination axes. The significance of differences between the analysed plant communities in respect of selected Ellenberg indicator values or floristic features was assessed by the Kruskal-Wallis test or the Mann-Whitney U test. The 0.05 level of probability was accepted as significant throughout the work. The analyses were performed by Statistica software (StatSoft, Inc. 2006).

In the studied flora, the so-called “species of old deciduous forests” were distinguished on the basis of a list proposed by Dzwonko & Loster (2001). This list includes 155 taxa. As emphasized by the cited authors, it should be verified for regional uses. In the study area, e.g. *Dryopteris filix-mas* is found not only in old but also in young forests, planted on former farmland (Janyszek 2004). However, considering the lack of detailed analyses of this group of species in Wielkopolska, the whole list of Dzwonko & Loster (2001) was used here. Pilot tests showed that exclusion of *D. filix-mas* had no significant effect on the results.

The taxonomic nomenclature followed is that of Mirek *et al.* (2002) for vascular plants, Ochrya *et al.* (2003) for mosses, Szweykowski (2006) for liverworts, and Fałtynowicz (2003) for lichens. Diagnostic ranks of plant species in the phytosociological classification of acidophilous oak forests from the class *Quercetea robori-petraeae* follow those proposed by Brzeg *et al.* (2000a, 2001) and Brzeg & Kaspróvicz (2001). For

other syntaxa of forest and non-forest communities, those proposed by Brzeg & Wojterska (2001) were used. Species abbreviations in the DCA and PCA diagrams are based on the first 3 letters of the generic name and the first 3 letters of the specific name.

Appendix

The analytic tables, because of their large volume, are available as PDF files (Portable Document Format, Adobe Systems) on the website of the journal *Biodiversity: Research and Conservation* (<http://www.brc.amu.edu.pl>). Ordinal numbers of all the analytic tables (A1-A37) were additionally marked with the letter "A".

Unambiguous identification of the relevés presented in the analytic tables is ensured by the data recorded in table headings: ID-1 = number of the original publication (as in the list of sources of the analysed 1655 relevés above); ID-2 = table number in the original publication; and ID-3 = relevé number in the original table.

5. Acidophilous oak forests and mixed coniferous forests including *Quercus*: a review of the literature

5.1. Evolution of opinions and major syntaxonomic concepts

Pine-oak forests, distinguished initially as the association *Pineto-Quercetum*, were in Poland studied by phytosociologists as early as in the 1920s. The first documentation of this association, from the area of the Małopolska Upland, as well as its first suggested name, were presented by Kozłowska (1926a, 1926b), in 2 independently published, but equivalent articles in French and Polish. It is noteworthy that both the papers were published in 1926, rather than in 1925 (when only their oral presentation took place), as commonly mentioned misleadingly by many authors citing one of the articles (e.g. Matuszkiewicz & Polakowska 1955; Medwecka-Kornaś 1959; Matuszkiewicz J. M. 1988, 2001a; Pallas 1996). Slightly later, several other publications also documented this association (Dziubałtowski 1928; Niedziałkowski 1929; Kobendza 1933). The cited authors, without referring to the articles written by Kozłowska (1926a, 1926b), indicated that human activity substantially affected the species composition of this community. They emphasized, in particular, the increased frequency of *Pinus*, due to its planting. A current analysis of the species composition of those relevés confirms their conclusions. The relevés document transformed plant communities of more fertile deciduous forests. A similar species composition was observed also in the patches described by A. Kozłowska, especially in the last 2 of the 3 relevés of her original table. However, the association *Pino-Quercetum* still raises many doubts. Pallas (1996) designated the first relevé from her table as a lectotype of the association *Pino-Quercetum* Kozłowska

1925, although he did not consider this syntaxon as valid. By contrast, J. M. Matuszkiewicz (1988, 2001a) classified Kozłowska's relevés as the acidophilous oak forest *Luzulo-Quercetum*. In her own interpretation (Kozłowska 1926a, 1926b), the *Pineto-Quercetum* Kozł. 1926 in the process of succession colonizes the sites of xerothermic grassland *Inuletum ensifoliae*, which certainly does not belong to the dynamic circle of communities of acidophilous mixed coniferous forests.

One of the first phytosociological studies of acidophilous oak forests and mixed coniferous forests in the Wielkopolska region was presented by Preising (1943), who reported on acidophilous oak-birch forests *Periclymeno-Quercetum* (Hartm. 1934) Prsg. et Knapp 1942 in western Wielkopolska. On the basis of that study, Piotrowska (1950) regarded mixed coniferous forests of the Wielkopolska National Park as synonymous with the *Periclymeno-Quercetum*, and assigned this association to the class *Betulo-Pinetea*. Soon afterwards, poor oak forests of the Kraków-Częstochowa Upland were distinguished as the *Quercetum medioeuropaeum* Br.-Bl. 1932 from the class *Querceto-Ulicetea* Br.-Bl. 1947 (Medwecka-Kornaś 1952), while mixed coniferous forests in the Białowieża National Park, as the *Querceto-Betuletum* Tx. 1930, identical with the *Quercetum medioeuropaeum* (Matuszkiewicz W. 1952). All the communities were assigned to the alliance *Quercion robori-sessiliflorae* Br.-Bl. 1932. The cited authors noted that this syntaxon in Poland, in contrast to western Europe, is floristically very similar to coniferous forests, and suggested that this alliance should be included in the class *Vaccinio-Piceetea*, within the order *Quercetalia robori-petraeae* (Medwecka-Kornaś 1952), or even (Matuszkiewicz W. 1952) directly in the order *Vaccinio Piceetalia* (after Matuszkiewicz & Polakowska 1955).

In that period, West European researchers usually assigned acidophilous oak forests to the class *Quercetea robori-petraeae*. Only Doing (1962) noticed similarities between this group of plant communities and mixed coniferous forests. On the basis of the floristic variation of acidophilous oak forests and birch forests in the central part of their range, he included them in the new class *Querco-Piceetea*, composed of 2 orders: the *Quercetalia robori-petraeae* and *Betulo-Vaccinietalia uliginosi*.

In the first Polish synoptic study of mixed coniferous forests (Matuszkiewicz & Polakowska 1955), 3 associations were assigned to this group in our country: the *Periclymeno-Quercetum* (within the alliance *Quercion robori-sessiliflorae* (Malc. 1929) Br.-Bl. 1932 and class *Querceto-Ulicetea*); *Pineto-Quercetum* Kozł. 1925; and *Querceto-Piceetum* Mat. 1955 (class *Vaccinio-Piceetea* Br.-Bl. 1932). The first one, the *Periclymeno-Quercetum*, was to be found exclusively in the western part of Polish Pomerania and in the Lubusz Land (Ziemia Lubuska), which marked the eastern limit of the range

of sub-Atlantic forests of the alliance *Quercion robori-sessiliflorae*. The second association, *Querceto-Piceetum* (= *Querceto-Betuletum lycopodietosum* Mat. 1952), was distributed only in north-eastern Poland, within the boreal range of *Picea abies*. The most important association of mixed coniferous forests in that classification was the *Pineto-Quercetum*, distributed over most of Poland. It was supposed to include many plant communities reported earlier from Poland: the *Quercetum medioeuropaeum*, most of the forms of *Querceto-Betuletum*, and mixed coniferous forest *Periclymeno-Quercetum* in the Wielkopolska National Park. The association *Pineto-Quercetum* was described in detail in the cited publication. Its high floristic variation allowed its division into 4 provisional subassociations: the *P-Q berberidetosum*, *P-Q luzuletosum*, *P-Q fagetosum*, and *P-Q serratuletosum*.

Another classification of mixed coniferous forests was presented in the first review of plant communities of Poland (Medwecka-Kornaś 1959), included in the monumental work entitled *Szata roślinna Polski*. In that book, describing the vegetation of Poland, this group was represented only by the Pomeranian oak forest *Periclymeno-Quercetum*, Central Polish mixed coniferous forest *Pineto-Quercetum*, and (not without doubts) also the *Querceto-Piceetum*. The cited author included these associations in a new alliance *Pino-Quercion* Medwecka-Kornaś in Medwecka-Kornaś *et al.* 1959 (class *Vaccinio-Piceetea*). She did not exclude that some patches of the *Periclymeno-Quercetum* and *Pineto-Quercetum* were anthropogenic.

Pomeranian birch-oak forest was classified by Piotrowska (1960) as the *Periclymeno-Quercetum pteridetosum*. Several years later, Celiński & Piaczyńska (1966) renamed this association as the *Betulo-Pinetum*. It was assigned to the class *Quercetea robori-petraeae*, and in their opinion it was similar to the *Quercus robori-Betuletum molinietosum* both in ecological preferences and in species composition. However, because of the lack of several species with a western distribution, it could not be classified as its synonym.

The first documentation of acidophilous oak forests in southern Wielkopolska was presented by Krotoska and Piotrowska (1962). Initially, they classified these oak forests as the *Pino-Quercetum* Kozł. 1925, but indicated that they were closely related to the association *Querceto roboris-Betuletum* as defined by Tüxen (1937). Later, Krotoska (1966) came to a conclusion that some of them represent the acidophilous oak-hornbeam forest *Galio sylvatici-Carpinetum holcetosum mollis*, while the others should be classified as acidophilous oak forests, related to communities of the alliance *Quercion robori-petraeae*.

A next stage of the revision of the phytosociological classification of mixed coniferous forests and

acidophilous oak forests, was the systematic review of plant communities of Poland made by W. Matuszkiewicz (1967). Acidophilous, oligo- and mesotrophic, mixed *Quercus*-dominated forests, were included in the class *Quercetea robori-petraeae* Br.-Bl. et R.Tx. 1943 (with the order *Quercetalia robori-petraeae* R.Tx. 1931, and the single alliance *Quercion robori-petraeae* Br.-Bl. 1932). This group consisted in Poland of 4 provisional associations found here at the eastern limits of their ranges. Two of them, most widely distributed, were earlier classified as subassociations of *Pino-Quercetum*, i.e. (1) the *Quercetum medioeuropaeum* Br.-Bl. 1932 (= *Pino-Quercetum luzuletosum* Mat et Pol. 1955) and (2) *Fago-Quercetum* R.Tx. 1955 (= *Pino-Quercetum fagetosum* Mat. et Pol. 1955 p.p)¹. The other 2 associations are: (3) the evidently sub-Atlantic, poor birch-oak forest *Querceto-Betuletum* R.Tx. 1937 (= *Periclymeno-Quercetum* auct.), distributed along the Baltic coast; and (4) the pine-oak forest *Calamagrostio arundinaceae-Quercetum* (Hartm. 1934) Scam. 1959, known at that time from Brandenburg, the Lubusz Land and Wielkopolska. The acidophilous oak forest *Calamagrostio-Quercetum* was characterized by W. Matuszkiewicz (1967) as the most poorly defined association within this alliance, and most similar to the *Pino-Quercetum*. He emphasized that the 3 associations of the alliance *Quercion robori-petraeae* mentioned above (except the *Querceto-Betuletum*) may in fact be various forms of one association. In the same year, Fabiszewski & Faliński (1967) published the first relevés of *Calamagrostio arundinaceae-Quercetum*, in Poland from the vicinity of Wolsztyn. After over a decade, further documentation on this association was given by Krotoska (1978) and Szwed (1979).

In the above-mentioned review (Matuszkiewicz W. 1967), typical mixed coniferous forests dominated by *Pinus* with *Quercus* were represented by the association *Pino-Quercetum* (alliance *Dicrano-Pinion* Libb. 1933, class *Vaccinio-Piceetea*). Also the classification of *Pino-Quercetum* required new, more detailed research.

In the same period, the syntaxonomic classification of communities of poor oak forests from the class *Quercetea robori-petraeae* was revised in the western part of former Czechoslovakia (Neuhäusl & Neuhäuslová-Novotná 1967). A major result of this revision was a proposal to replace the alliance *Quercion robori-petraeae* by 2 vicariant alliances. The older one, *Quercion roboris* (Malcuit 1929) Tx. 1930, was reserved for the Atlantic and sub-Atlantic parts of the range of acidophilous oak forests, while the new one, *Genisto germaniceae-Quercion*, comprised its subcontinental part. The latter

¹ See, however, J. M. Matuszkiewicz (1988), who argued that the *Fago-Quercetum* is not a synonym of *Pino-Quercetum fagetosum*

alliance included a newly described association, *Molinio arundinaceae-Quercetum*, as well as the *Luzulo-Quercetum* Hiltner 1932 and *Vaccinio vitis-idaeae-Quercetum* Oberd. 1957.

Hartmann and Jahn (1967) came to a conclusion that communities from the class *Quercetea robori-petraeae* have a northern, temperate-Atlantic range of distribution, and its centre is located in northern France and in the area affected by the older glaciation in north-western Germany. The eastern limit of the range of acidophilous oak forests was indicated by those authors in western Brandenburg. Further east, in the coastal belt extending to Poland, only moist birch-oak forests *Betulo-Quercetum molinietosum* were recorded (Hartmann & Jahn 1967: 558).

Medwecka-Kornaś (1972) consistently believed that the acidophilous beech-oak and pine-oak forests found in Poland, lack many “sub-Atlantic” characteristic species and should not be assigned to the class *Quercetea robori-petraeae*. These forests, represented by the associations *Fago-Quercetum petraeae* and *Periclymeno-Quercetum* Hartm. 1934 em. Piotrowska 1960, were supposed to be intermediate between the West European alliance *Quercion robori-petraeae* and the alliance *Pino-Quercion* from the class *Vaccinio-Piceetea*. The latter alliance still included 2 associations of mixed coniferous forests: the *Pino-Quercetum* Kozł. 1925 em. Mat. et Polak. 1955 and *Quercu-Piceetum* Mat. (1952) 1955 (Medwecka-Kornaś 1972).

In the first edition of a comprehensive guide to identification of plant communities of Poland (Matuszkiewicz W. 1981), Central European acidophilous, oligo- and mesotrophic, deciduous forests dominated by *Quercus*, were classified as impoverished, extreme forms of associations from the class *Quercetea robori-petraeae*. That author emphasized that Poland is located in the intermediate zone between distribution ranges of communities of the classes *Quercetea robori-petraeae* (widespread in Central Europe) and *Vaccinio-Piceetea* (especially of the alliance *Dicrano-Pinion*, prevailing in the eastern part of the continent). Thus he regarded the *Vaccinio-Piceetea* and *Quercetea robori-petraeae* as vicariant classes. As compared with his earlier work (Matuszkiewicz W. 1967), the 1981 edition does not bring any major changes in the classification of the group of interest. He listed the same 4 basic syntaxa, but described them more precisely and corrected their names. These included the *Betulo-Quercetum roboris*, *Fago-Quercetum petraeae*, *Luzulo-Quercetum petraeae* (= *Quercetum medioeuropaeum*, *Pino-Quercetum luzuletosum*), and *Calamagrosti-Quercetum petraeae* (= *Pino-Quercetum* (Hartm. 1934) Reinh. (1939) 1944 non Kozł. 1925). Greater changes can be noticed in the group of mixed coniferous forests from the class *Vaccinio-Piceetea*. It was enriched with 2 new, provisional

associations: the *Serratulo-Pinetum* J. Mat. (mscr.) (= *Pino-Quercetum serratuletosum*) and *Quercu roboris-Pinetum* J. Mat. (mscr.). The latter included partly the former *Pino-Quercetum*.

The first phytosociological revision of mixed coniferous forests and acidophilous oak forests on the scale of Poland was made by J. M. Matuszkiewicz (1988). His analytic and synoptic tables allowed a detailed separation of these 2 groups of forest communities. He was also first to present maps of the distribution of these communities in Poland. Acidophilous oak forests, divided into 5 associations, were included in the class *Quercetea robori-petraeae*, order *Quercetalia robori-petraeae*, and alliance *Quercion robori-petraeae*. Apart from the 4 associations listed in earlier works of W. Matuszkiewicz (1967, 1981), the alliance comprised also the acidophilous submontane oak forest *Molinio arundinaceae-Quercetum*, reported from the former Czechoslovakia (Neuhäusl & Neuhäuslová-Novotná 1967). The group of mixed coniferous forests was composed of 2 newly described associations: the *Serratulo-Pinetum* and *Quercu roboris-Pinetum*. They were assigned to the alliance *Dicrano-Pinion*, and class *Vaccinio-Piceetea*. Their detailed descriptions are presented in section 5.2.3.

Our research team (Brzeg *et al.* 1989) proposed a substantial broadening of the list of plant communities in the group of acidophilous oak forests. The range of habitat variation of *Calamagrostio arundinaceae-Quercetum* was also corrected remarkably. It is noteworthy that when submitting that article, we did not know J. M. Matuszkiewicz's (1988) monograph. We reported that in Wielkopolska there are 3 major associations of acidophilous oak forests (within the class *Quercetea robori-petraeae* and alliance *Quercion robori-petraeae*): the *Calamagrostio-Quercetum*; *Molinio caeruleae-Quercetum roboris* (R. Tx. 1937) Scam. et Pass. 1959 em. Brzeg, Kaspr. et Krot. 1989 (not reported earlier from Poland); and the new association *Carpino-Quercetum* (Kubiś 1982) Brzeg, Kaspr. et Krot. 1989. The *Calamagrostio-Quercetum* was subdivided into 3 new subassociations: the *Ca-Q molinietosum*, *Ca-Q typicum*, and *Ca-Q convallarietosum*. The association *Molinio caeruleae-Quercetum roboris* was described in detail in that article, while the other 2 associations, in successive publications (Brzeg *et al.* 2000a, 2001). This group was supplemented with the community *Carex brizoides-Quercus* and the acidophilous beech-oak forest *Fago-Quercetum*, which was not well-developed in Wielkopolska, because of its location at the limit of its distribution range. Besides, in the group of acidophilous oak forests, we included also a poor subassociation of the oak-hornbeam forest *Galio sylvatici-Carpinetum holcetosum mollis* (Prsg. 1943) Krotoska 1966, and wet oak forest *Carici elongatae-*

Quercetum Sokoł. 1972 (class *Alnetea glutinosae*). Results of that study showed that the wet oak forest with *Molinia caerulea* from Wielkopolska can be identified with the association *Molinio (caeruleae)-Quercetum* Scam. et Pass. 1959, distinguished and described in Brandenburg and with the subassociation *Quercu roboris-Betuletum molinietosum*, reported from mid-eastern Germany, mostly from Brandenburg (Passarge 1956, 1957). However it differs from the West European, sub-Atlantic forms of this subassociation. In the proposed classification, the *Molinio caeruleae-Quercetum* was a vicariant (i.e. geographic equivalent) of the *Betulo-Quercetum molinietosum* and *Luzulo-Quercetum molinietosum*, and perhaps also of the possible moist forms of *Fago-Quercetum*. An analysis of 33 relevés documenting the *Molinio caeruleae-Quercetum* in Wielkopolska showed that this association has its centre of distribution in this region, within the so-called Krotoszyn Plateau.

In the history of the phytosociological classification of European deciduous forests, an important role was played by the concepts of Oberdorfer (1987, 1988, 1992a, 1992b). He proposed a very broad definition of the class *Quercu-Fagetea*, including mesotrophic and acidophilous deciduous forests and the corresponding shrub communities (occupying similar sites). These communities were divided into 4 orders: the *Prunetalia spinosae*, *Quercetalia robori-petraeae*, *Quercetalia pubescentis*, and *Fagetalia sylvaticae*. The idea to include the order *Quercetalia roboris* (of particular interest for us) in the class *Quercu-Fagetea*, was already presented earlier, independently by 2 botanists (Rivas-Martinez 1975; Tombal 1975), during a symposium on acidophilous oak forests. However, that view gained wide acceptance only after the appearance of the above-mentioned publications of E. Oberdorfer (see Mucina 1997). My original table summarizing the major concepts of classification of acidophilous oak forests (Table 1²) shows that their concept has been accepted mostly in West Europe, i.e. in Spain (Rivas-Martinez *et al.* 2001), France (Bardat *et al.* 2004), Denmark (Lawesson 2004³), the Netherlands (Sykora 2007), United Kingdom (Rodwell *et al.* 2000), Austria (Wallnöfer *et al.* 1993), and Germany (Müller 1991; Härdtle & Welss 1992; Dierschke 1994, 2004; Härdtle *et al.* 1997; Wilmanns 1998). Also Scandinavian acidophilous oak forests and beech forests, at the northern edges of their ranges of distribution, were assigned to the class *Quercu-Fagetea* (Dierssen 1996). It must be emphasized that some Dutch (Schaminée & Stortelder 2008) and German phytosociologists (Pott 1992, 1995; Pallas 1996, 2000, 2003) consistently placed the order *Quercetalia roboris* in a

separate class, *Quercetea robori-petraeae*, very much like Berg *et al.* (2004), Schubert (2001), and Schubert *et al.* (2001). However, authors of the last 3 cited publications are supporters of a completely different concept of the whole phytosociological classification, distinguished by very narrowly defined units. Deciduous forests with some participation of *Quercus*, are assigned in those publications to several classes, e.g. the *Quercetea robori-petraeae*, *Quercetea pubescenti-petraeae*, and *Carpino-Fagetea*, which correspond to the above-mentioned orders advocated by Oberdorfer (1987, 1992a). Retention of the class *Quercetea robori-petraeae* is also supported by most of Polish researchers, who usually accept the phytosociological system of W. Matuszkiewicz (2001, see Table 1). Only rarely Polish authors accept the concept of Medwecka-Kornaś (1959, 1972), who included mixed coniferous forests and acidophilous oak forests in one, broadly defined association *Pino-Quercetum* from the class *Vaccinio-Piceetea* (Medwecka-Kornaś 1972, 2006). The class *Quercetea robori-petraeae* comprises, according to latest publications, acidophilous oak forests of the Czech Republic (Chytrý & Tichý 2003) and Slovakia (Jarolímek *et al.* 2008). Both the cited publications indicated a high degree of floristic similarity between the classes *Quercetea robori-petraeae* and *Quercu-Fagetea*. However, it is noteworthy that in Slovakia the similarity is much smaller. Also in earlier studies, Czech authors usually placed the order *Quercetalia roboris* in the class *Quercetea robori-petraeae* (e.g. Neuhäusl & Neuhäuslová-Novotná 1967; Grulich & Chytrý 1993), and rarely in the class *Quercu-Fagetea* (e.g. Chytrý & Vicherek 1995).

Many authors place all associations of acidophilous oak forests in one alliance, *Quercion roboris* Malcuit 1929 (or synonymous syntaxa, see Table 1). At most, they suggest that the regional and ecological variation of acidophilous oak forests may be expressed by indicating groups of associations (Matuszkiewicz J. M. 2001a; Matuszkiewicz W. 2001; Willner *et al.* 2005). Czech and Slovakian authors support, however, the earlier concept of Neuhäusl and Neuhäuslová-Novotná (1967), and regard the alliance of Atlantic and sub-Atlantic acidophilous oak forests as geographically distinct from their subcontinental counterparts (Chytrý & Tichý 2003; Jarolímek *et al.* 2008) (Table 1). A similar view was expressed also, many years ago, by Austrian researchers (Wallnöfer *et al.* 1993), but they have recently published another classification, with the single alliance *Quercion roboris* (Willner *et al.* 2005). The classification of the geographic variation of acidophilous oak forests from the order *Quercetalia robori-petraeae* at the level of alliances was also advocated by Rameau (1985). He reported that in France these communities are grouped in 3 alliances: the *Quercion pyrenaicae*

² For tables see appendix at the end of the monograph.

³ However, in his publication in 2000, he accepted the class *Quercetea robori-petraeae*.

(best developed in north-western Spain), *Quercion robori-petraeae* (typical for France), and *Genisto germanicae-Quercion petraeae* (continental vicariant). The regional variation of acidophilous oak forests was also taken into account by Oberdorfer (1987, 1992b). However, since it was difficult to indicate their characteristic species, he distinguished 3 suballiances within the *Quercion robori-petraeae*: the *Quercenion robori-petraeae* (Br.-Bl. 32) Riv. Mart. 82; *Genisto germanicae-Quercenion petraeae* (R. et Z. Neuh. 1967) Oberd. 1992; and *Ilici-Fagenion* (Br.-Bl. 1967) Tx. 1979 em. Oberd. 1984). The first 2 of them correspond geographically to the alliances of Neuhäusl & Neuhäuslová-Novotná (1967). A regional division of acidophilous oak forests of that alliance was also proposed by Doing

(1975). He distinguished the suballiance *Violo-Quercion*, characterized by species of more fertile and warmer sites, with a centre of distribution in West and South Europe; and the suballiance *Vaccinio-Quercion*, characterized by the presence of species shared with coniferous forests.

A very different classification of acidophilous deciduous forests from the order *Quercetalia roboris* was proposed by Pallas (1996). On the basis of a critical revision of the above syntaxa, according to the principles of the Code of Phytosociological Nomenclature, he assumed that these forests, represented by 23 associations in broadly defined Central Europe, are grouped in 6 alliances (Fig. 12). So narrowly defined units – both associations and alliances – are mostly lacking

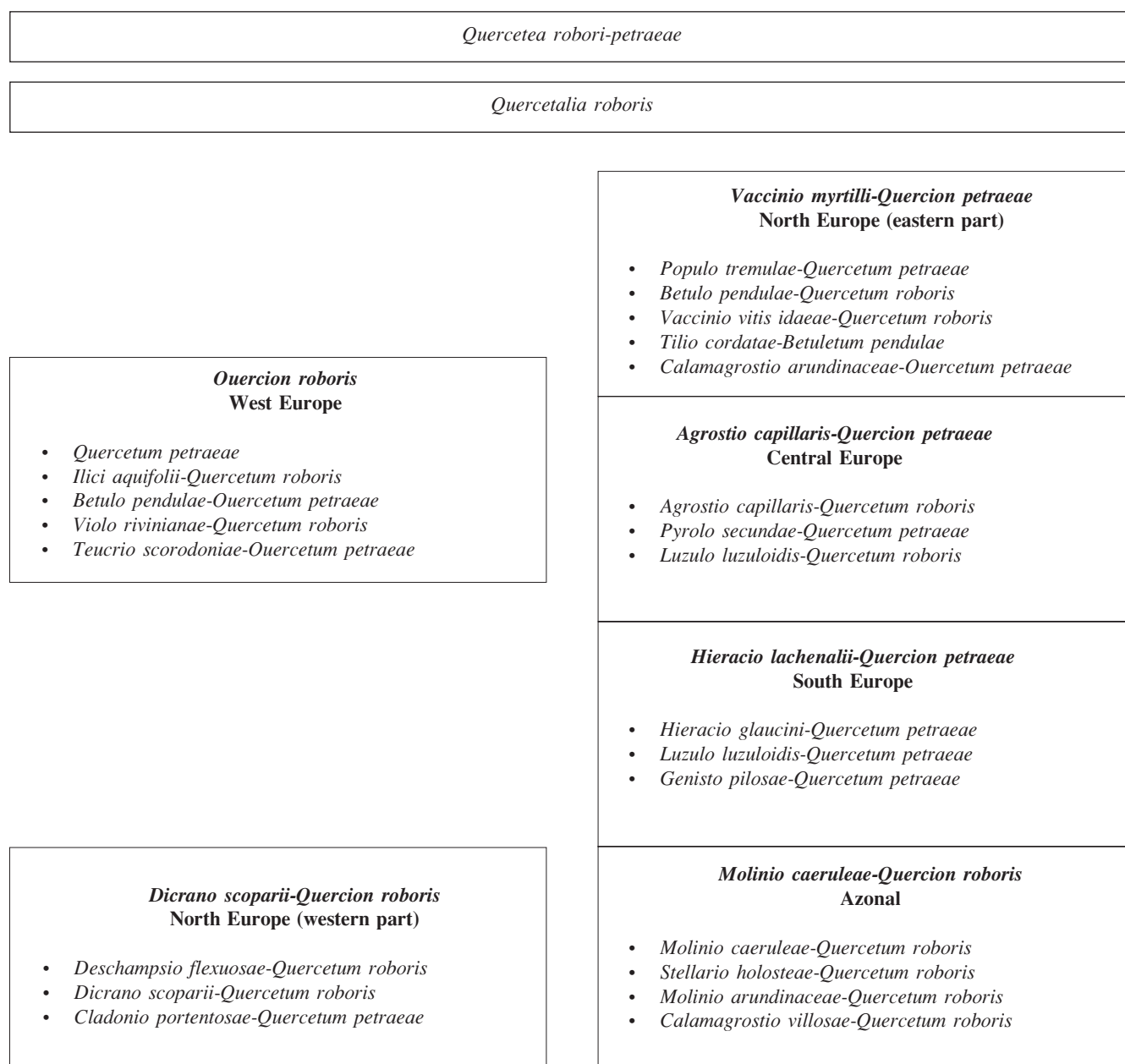


Fig. 12. Syntaxonomic structure of the class *Quercetea robori-petraeae* according to Pallas (1996, simplified)

characteristic species, and their floristic distinctness is based on groups of differential species. As emphasized by W. Matuszkiewicz (2001), such an approach is not consistent with the Zürich-Montpellier school of phytosociology, and corresponds with the so-called “Eberswalde school”. Some syntaxonomic solutions suggested by Pallas (1996) were also criticized by J. M. Matuszkiewicz (2001a) and our research team (Brzeg *et al.* 2001). In the cited publication we emphasized that J. Pallas interpreted too rigorously or even wrongly some principles of the Code of Phytosociological Nomenclature (Barkman *et al.* 1995). The requirement of the presence of both plant species forming the name of the syntaxon, applied also to valid syntaxa, leads to retention or creation of very narrowly defined syntaxa, which are hard to distinguish. However, the system proposed by Pallas (1996, 2000) was taken into account in a review of the broadly defined class *Querco-Fagetea*, where acidophilous beech-oak forests were included in the separate order *Quercetalia roboris* (Dierschke 2004). The syntaxonomic system of Pallas (1996) was accepted by Kwiatkowski (2001) and, after major corrections, by Brzeg *et al.* (2000a, 2001). Consequently, it was also included in the system of plant communities of Wielkopolska (Brzeg & Wojterska 2001), and of Polish lowlands (Ratyńska *et al.* 2010). In such a modified shape, the system has also been accepted in the present study.

An extremely different concept of syntaxonomic classification of forests from the order *Quercetalia roboris* was proposed by Härdtle & Welss (1992). Those authors assumed that Central European acidophilous oak forests are represented by only 3 associations grouped in one alliance (Fig. 13). Admittedly, Pallas (1996) defined Central Europe somewhat more broadly, but most of the plant associations listed by him (except some eu-Atlantic ones of the alliance *Quercion roboris*) are distributed in areas covered by Härdtle & Welss (1992).

In the latest classification (Pallas 2003), covering the whole of Europe, communities from the order

Quercetalia roboris were assigned to as many as 7 alliances. In comparison to his earlier work (Pallas 1996), he added 3 new alliances: the *Hymenophyllo-Quercion petraeae* (north-western eu-Atlantic part of Europe); *Quercion robori-pyrenaicae* (southern Atlantic part of Europe); and *Castaneo-Quercion* (central part of the sub-Mediterranean province). By contrast, he cancelled 2 other alliances: the *Hieracio lachenalii-Quercion petraeae* and *Dicrano scoparii-Quercion roboris*. It must be emphasized that in his monograph, the eastern limit of the distribution range of acidophilous oak forests has been greatly extended. The easternmost associations are those from the alliances *Vaccinio myrtillo-Quercion petraeae* (Central and Sarmatic parts of Europe) and *Agrostio capillaris-Quercion petraeae* (southern Central and Sarmatic parts of Europe). The first one is composed of 2 associations: the *Calamagrostio arundinaceae-Quercetum petraeae* (including some ill-defined, eastern forms of this association) and the new association *Serratulo tinctoriae-Quercetum roboris* (described by that author). The second alliance, *Agrostio capillaris-Quercion petraeae*, comprises 4 associations: the *Pyrolo-Quercetum*, *Luzulo luzuloidis-Quercetum petraeae*, *Molinio arundinaceae-Quercetum*, and the *Quercus*-dominated form of the Sarmatic race of *Serratulo-Pinetum*.

Complicated phytosociological classifications of communities from the order *Quercetalia roboris* were also proposed by Spanish and Portuguese (Rivas-Martinez *et al.* 2001) and French botanists (Bardat *et al.* 2004). Their complexity is only partly reflected in the data compiled in Table 1 since it does not cover the level of suballiances.

Because of the diversity of the used concepts, the phytosociological classification of poor deciduous forests on a wider geographic scale is unclear and ambiguous at the level of higher syntaxa. This may be easily noticed in Table 1. At the level of associations, the situation is even more complicated. For example, the *Betulo pendulae-Quercetum roboris*, i.e. one of floristically the

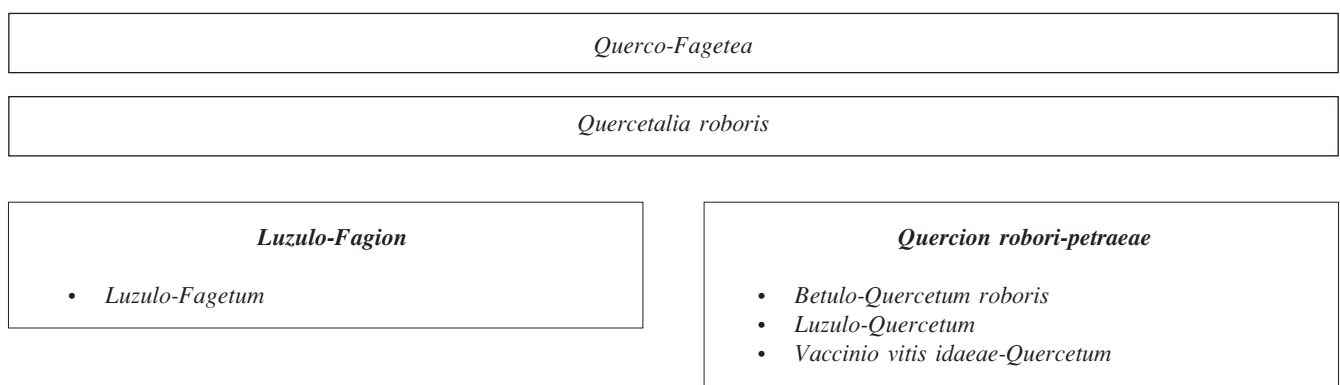


Fig. 13. Syntaxonomic structure of the order *Quercetalia roboris* according to Härdtle and Welss (1992)

poorest associations (not only in the group of acidophilous oak forests, see Tüxen 1975), has over 30 synonyms, homonyms, and pseudonyms, very much like the *Luzulo-Quercetum petraeae* (see Rennwald 2000).

Apart from acidophilous oak forests proper (dominated by *Quercus*, sometimes with a substantial contribution of *Betula*, *Fagus*, or *Pinus*), the order *Quercetalia roboris* in some systems includes the alliances *Luzulo-Fagion* and *Ilici-Fagion*, which group nearly pure acidophilous beech forests (e.g. Doing 1975; Korotkov *et al.* 1991; Müller 1991; Wallnöfer *et al.* 1993; Dierschke 1994; Härdtle & Welss 1992; Härdtle *et al.* 1997; Rennwald 2000; Rivas-Martinez *et al.* 2001). This solution is quite common in phytosociological classifications placing the order *Quercetalia roboris* in the class *Querco-Fagetea* (see Table 1), but is exceptionally used if the class *Quercetea robori-petraeae* is recognized as separate unit. However, Härdtle *et al.* (1997) consider 2 solutions – and in one of them the possibility to include in this class also acidophilous beech forests as the order *Luzulo-Fagetalia* Scam. et Pass. 1959 with the alliance *Luzulo-Fagion*. Dierssen (1996), as well as Schaminée and Stortelder (2008), assigned acidophilous beech forests, represented by the association *Deschampsio-Fagetum*, directly to the alliance *Quercion robori-petraeae*. According to Schaminée & Stortelder (2008), the association *Luzulo luzuloidis-Fagetum* belongs to the alliance *Luzulo-Fagion*, included in the order *Quercetalia roboris* and class *Quercetea robori-petraeae*.

Already previously, Medwecka-Kornaś (1972) proposed to accord poor beech forests a special status, and placed them in the group of associations intermediate between the alliances *Fagion* and *Pino-Quercion*, whereas in her very early report (Medwecka-Kornaś 1959), she did not exclude placing of this group of communities in the alliance *Pino-Quercion*.

In the eastern part of the range of forests from the order *Quercetalia roboris*, the importance of *Pinus* is relatively high, while the contribution of *Quercus* and of species with a more western distribution is lower. In that region, also mixed coniferous forests of the alliance *Pino-Quercion* are assigned to this syntaxon by Ukrainian researchers (Onyshchenko *et al.* 2003; Yuglichek & Onyshchenko 2003; Onyshchenko 2006; Solomakha 2008). Slovakian authors suggest that the alliance *Pino-Quercion* should be included in the order *Pino-Quercetalia* within the class *Quercetea robori-petraeae* (Mikuška 2005; Jarolímek *et al.* 2008). However, in Slovakia, the class is floristically more similar to the class *Pulsatillo-Pinetea* than to *Querco-Fagetea*, and the alliance *Genisto germanicae-Quercion* is very similar floristically to thermophilous oak forests of the alliance *Quercion petraeae* from the class *Querco-Fagetea* (Jarolímek *et al.* 2008). This confirms an earlier opinion that in the southern part of their range, acido-

philous oak forests are gradually replaced eastwards by thermophilous oak forests (Härdtle 2004). Even further east, open forests from the class *Pulsatillo-Pinetea* substitute for them (Goncharenko & Didukh 2003).

It is very difficult to identify the diversity of acidophilous oak forests from the order *Quercetalia robori-petraeae* in the marginal part of their range, and especially to designate their eastern limit of distribution. This results from both natural conditions and human impact (e.g. Tüxen 1975; Härdtle *et al.* 1997; Matuszkiewicz J. M. 2001a; Matuszkiewicz W. 2001, 2003; Pallas 2003; Härdtle 2004). Another problem is that this group includes floristically poor communities, so even at the centre of its distribution range it is poor in characteristic species (Matuszkiewicz W. 2001). Moreover, Tüxen (1975) noted that locally, in north-western Germany, the alliance *Quercion robori-petraeae* is well-defined floristically, but none of its diagnostic species is useful in the whole distribution range of acidophilous oak forests. It is difficult to build a coherent phytosociological classification covering the whole distribution range of this group of communities also because the group has been relatively poorly studied, particularly in the areas located east of Poland.

Some authors emphasized the western type of the ranges of many plant species typical for acidophilous oak forests. They conclude that the plant associations of this group that are known in West Europe have their limit of distribution in Poland. In Ukraine and in Russia, their geographic equivalents are found, so it can be expected that new syntaxa (alliances and associations) will be described there (Goncharenko & Didukh 2003). A similar view was expressed by Pallas (2003), who noted that the *Calamagrostio-Quercetum* has its limit in Central Europe. As emphasized by W. Matuszkiewicz (2001), it is to a large extent a matter of convention where the eastern limit of the class *Quercetea robori-petraeae* is designated, because there is a wide transitional zone where acidophilous oak forests are gradually replaced by mixed coniferous forests from the class *Vaccinio-Piceetea*, in the eastern direction. However, J. M. Matuszkiewicz (2007c) claims that the class *Quercetea robori-petraeae*, including sub-Atlantic submontane communities in Poland, reaches in our country the eastern limit of its distribution range. The gradual disappearance of diagnostic species of acidophilous oak forests, as the observer moves from the west to the eastern part of Europe, was documented by Ellenberg (1988: 183). As reported by Rameau (1985), this reduction can be noticed as far west as in France. It is reflected, for example, in the geographic variation of the association *Fago-Quercetum*, represented by 4 geographic races: hyper-Atlantic (with *Taxus*, *Ruscus*, *Blechnum*, etc.), Atlantic (with *Ilex aquifolium*), sub-Atlantic, and Central European.

The history of research on acidophilous oak forests, using a syntaxonomic approach similar to the West European one, is relatively short in Eastern Europe. In a phytosociological review of the former Soviet Union (Korotkov *et al.* 1991), acidophilous deciduous forests were included in the class *Querc-Fagetea*, order *Quercetalia robori-petraeae*, and alliance *Quercion robori-petraeae*. The only association within this alliance was the *Calamagrostio-Quercetum petraeae*, reported exclusively from Lithuania. As reported by Patalauskaite (2007), those oak forests were initially identified as the *Pino-Quercetum* Kozł. 1925, and next as the *Calamagrostio-Quercetum* from the class *Querc-Fagetea* (Balevičiene 1984, 1991, cited by Patalauskaite 2007). Recently, considering chorological and floristic aspects, these forests were classified as the *Tilio-Carpinetum* Traczyk 1962 *calamagrostietosum* (Patalauskaite 2007). This diagnosis was justified by, for example, a much smaller contribution of species of the order *Quercetalia roboris*, and a markedly increased contribution of species of the class *Querc-Fagetea* in the species composition of Lithuanian oak forests, as compared with the *Calamagrostio-Quercetum* in Poland. Localities of the *Calamagrostio-Quercetum* reported from Estonia are even more distant (in the north-eastern direction) from its main distribution range (Paal 1998). Recently, the acidophilous oak forest *Vaccinio myrtilli-Quercetum roboris* Bulokhov et Solomeshch 2003 has been documented in western Russia, near Bryansk. This association was included in the alliance *Vaccinio myrtilli-Quercion roboris* Bulokhov et Solomeshch 2003, order *Quercetalia roboris*, and class *Querc-Fagetea* (Semenishchenkov 2009). Its species composition, presented in that publication, shows that it is similar to the above-mentioned *Serratulo tinctoriae-Quercetum roboris*. It is also noteworthy that the alliance *Vaccinio myrtilli-Quercion roboris* is sometimes included in the more broadly defined alliance *Pino-Quercion* Medwecka-Kornaś in Medwecka-Kornaś *et al.* 1959, within the class *Quercetea robori-petraeae* (Onyshchenko 2006).

In the last 2 decades, a very fast progress was achieved in phytosociological research in Ukraine. In that period, basic phytosociological documentation was obtained for at least several classes, not reported earlier from Ukraine (Shelyag-Sosonko *et al.* 2008). That group comprises also the class *Quercetea robori-petraeae*. Ukrainian authors, who study mixed coniferous forests and poor pine-oak forests, apply various concepts. Some of them include mixed coniferous forests in the class *Vaccinio-Piceetea* within the alliance *Dicrano-Pinion* Libb. 1933 (Fitsailo 2003) or *Pino-Quercion* Medw.-Korn. 1959 (Vorobyov 2003). Others place the same alliance *Pino-Quercion* in the order *Quercetalia robori-petraeae* and class *Quercetea robori-petraeae* (Onysh-

chenko 2006; Onyshchenko *et al.* 2003; Yuglichek & Onyshchenko 2003). The same solution was used in the latest synthesis of Ukrainian vegetation (Solomakha 2008). Mixed coniferous forests of Ukraine represent several associations, but patches of *Querc-Pinetum* J.Mat. 1988 are most widely distributed and can be subdivided into several subassociations, depending on environmental conditions.

The proposal to include mixed coniferous forests as the alliance *Pino-Quercion*, or as the separate order *Pino-Quercetalia* (Jarolímek *et al.* 2008) in the class *Quercetea robori-petraeae*, is very controversial. W. Matuszkiewicz (2004) emphasizes that mixed coniferous forests dominated by pine with oak undoubtedly belong to the alliance *Dicrano-Pinion*, where they may form, at most, a separate suballiance.

Acidophilous oak and pine-oak forests from the order *Quercetalia robori-petraeae* in Ukraine are found mostly in the north-western part of the country and are best studied in Polesie. Like in West and Central Europe, also in Ukraine this order is sometimes placed in the class *Querc-Fagetea* (Vorobyov 2003) or more often in the class *Quercetea robori-petraeae* (Goncharenko 2001; Didukh *et al.* 2003; Onyshchenko 2006; Solomakha 2008). In the review of plant communities of Ukraine, these forests are represented by 3 associations of the alliance *Quercion robori-petraeae*: the *Calamagrostio arundinaceae-Quercetum petraeae* (Hart. 1934) Scam. 1959; *Holco lanati-Quercetum roboris* ass. prov. Vorobyov, Balashov, Solomakha 1997; and *Carici brizoidi-Quercetum* Orlov, Yakushenko, Vorobyov 1999 (Solomakha 2008). The association *Calamagrostio arundinaceae-Quercetum* is also sometimes included in the alliance *Genisto germanicae-Quercion* R. et Z. Neuh. 1967 (Vorobyov 2003). The diversity of Ukrainian acidophilous oak forests was interpreted differently by Goncharenko (2001), who near Suma (central part of northern Ukraine) recorded the presence of 2 associations: the *Querceto roboris-Betuletum* R.Tx. 1930 (alliance *Molinio-Quercion* Scam. et Pass. 1959) and *Violo-Quercetum* (alliance *Agrostio-Quercion* Scam. et Pass. 1959). Supposedly the above-mentioned association *Querceto-Betuletum* corresponds to the *Molinio caeruleae-Quercetum* (R. Tx. 1937) Scam. et Pass. 1959, which was reported, beside the *Calamagrostio-Quercetum petraeae*, from Polesie (Yakushenko 2005). Other researchers considered it necessary to include within the order *Quercetalia robori-petraeae* the alliance *Convallario majali-Quercion roboris* Shevchyk *et al.* 1996, reported from Ukraine (Didukh *et al.* 2003; Onyshchenko 2006). One of the associations included in this alliance is the *Calamagrostio arundinaceae-Pinetum sylvestris* Shevchyk et V.Sl. 1996. It is noteworthy that the same name was used to describe mixed coniferous forest in north-eastern Poland (Sokołowski 1980).

According to J. M. Matuszkiewicz (1988), the latter syntaxon is identical with the *Serratulo-Pinetum pulmonarietosum*. This association was already reported from Ukraine (Onyshchenko *et al.* 2003; Vorobyov 2003).

The above-mentioned monograph of J. M. Matuszkiewicz (1988) was used as a basis for 2 later works (Matuszkiewicz W. & Matuszkiewicz J. M. 1996; Matuszkiewicz J. M. 2001a). The classification of mixed coniferous forests proper and acidophilous oak forests presented there was accepted by W. Matuszkiewicz (2001). Both W. Matuszkiewicz and J. M. Matuszkiewicz (1996) and J. M. Matuszkiewicz (2001a) discussed 2 latest taxonomic concepts: first of all, the results of Pallas' (1996) revision of acidophilous oak forests of West and Central Europe (Fig. 12), but also our above-mentioned proposal (Brzeg *et al.* 1989). J. M. Both and W. Matuszkiewicz did not accept the Pallas' system, but added the association *Molinio caeruleae-Quercetum roboris* to the list of forest communities of Poland. They did not accept the broader definition of *Calamagrostio arundinaceae-Quercetum*, either, and did not legitimize the new association *Aulacomnio androgyni-Quercetum roboris* (= *Carpino-Quercetum*). Detailed descriptions of both the associations were presented in 3 successive publications (Brzeg *et al.* 2000a, 2001; Brzeg & Kasprowicz 2001), where subdivision of the class *Quercetea robori-petraeae* followed the solutions of Pallas (1996), but with considerable modifications.

5.2. Major characteristics of associations of acidophilous deciduous forests from the classes *Quercetea robori-petraeae* and *Querceto-Fagetea*, and of mixed coniferous forests from the class *Vaccinio-Piceetea*

Associations of acidophilous oak forests of the class *Quercetea robori-petraeae*, the closely related acidophilous deciduous forests of the class *Querceto-Fagetea*, and mixed coniferous forests of the class *Vaccinio-Piceetea* are described below on the basis of research results presented in the publications cited above (especially the latest ones).

5.2.1. Acidophilous oak forests from the class *Quercetea robori-petraeae* Br.-Bl. *et* R. Tx. 1943 *nom. mut.*

Betulo pendulae-Quercetum roboris R. Tx. 1930 *nom. invers.* Syn.: *Querceto roboris-Betuletum molinietosum* Tx. 1937, *Querceto sessiliflorae-Betuletum* R. Tx. 1937 sub-Atlantic race *p.p.*; *Betulo pendulae-Quercetum roboris* R. Tx. 1937 *nom. invers. sensu auct. p.p.*; *Betulo pendulae-Quercetum roboris* R. Tx. (1936) 1937 *sensu auct.*; *Molinio caeruleae-Quercetum* (R. Tx. 1937) Scam. *et* Pass. 1959 *p.p.*; *Fago-Quercetum* R. Tx. 1955 *sensu auct. polon. p.p.*, *Pino-Quercetum* Kozłowska 1925 *sensu auct. polon. p.p.*, *Periclymeno-Quercetum*

(Hartm. 1934) Prsg. *et* Knapp 1942 *nom. inval. sensu auct. p.p.*, *Periclymeno-Quercetum pteridetosum* Piotrowska 1960, *Betulo-Pinetum* Celiński *et* Piaczyńska 1966.

This community is known as Pomeranian acidophilous birch-oak forest. In the accepted classification, it is limited in Poland to the narrow coastal zone extending from the Szczecin Lowland to the Hel Peninsula (Matuszkiewicz J. M. 2001a), or even to the Vistula Spit (Piotrowska 2003). On the map of potential natural vegetation, this association reaches, however, only the town of Ustka (Matuszkiewicz J. M. 2008b). They are absent also on an earlier map, covering the areas located west of that town (Wojterski *et al.* 1994). Patches of *Betulo-Quercetum* are developed in Poland mostly at moist sites, as the subassociation *B-Q molinietosum* Tx. 1937 (Matuszkiewicz J. M. 1988). The original diagnosis of this association in Poland was based on 74 relevés (Matuszkiewicz J. M. 1988, 2001a; Matuszkiewicz W. & Matuszkiewicz J. M. 1996).

The Pomeranian birch-oak forest *B-Q molinietosum* occurs on marine, dune, and sandur sands, either loose or clayey, on which podzolic-gley soils develop. The soils are characterized by high acidity of the surface layer and seasonal variation in groundwater level: 0.5–1.5 m under the surface (Piotrowska 2003). Patches of this association are found also on brown-rusty soil (Trzciński 1989). They colonize many types of forest sites: moist mixed coniferous forest (labelled by Polish foresters as BMw), moist mixed deciduous forest (LMw), fresh mixed coniferous forest (BMśw) in the most humid variants, and the drier variants of wet mixed coniferous forest (BMb) (Brzeg *et al.* 2005; Schechtel 1984, 2005).

Piotrowska (1997, 2003) suggested another classification of this association. She divided it into 6 subassociations: the *B-Q prunetosum*, *B-Q typicum*, *B-Q loniceretosum xylostei*, *B-Q convallarietosum*, *B-Q molinietosum caeruleae*, and *B-Q deschampsietosum flexuosae*. Some of them are not limited to oligo-mesotrophic sites, which are typical for the *Betulo-Quercetum* according to most of phytosociologists (Hartmann & Jahn 1967; Tüxen 1975; Pallas 1996; Matuszkiewicz W. 2001; Feijen 2003; Brzeg *et al.* 2005) and the European Commission (Interpretation Manual 2007), but are found also at more fertile sites, related to oak-hornbeam forests. Pomeranian acidophilous birch-oak forest in this form is considered to be the only representative of habitat 9190, in the Natura 2000 network in Poland (Danielewicz & Pawlaczyk 2004a). The cited authors emphasize that it can be confused with alluvial forests, because of their floristic similarity. Thus the spectrum of sites colonized by such a broadly-defined association markedly exceeds the formal description of habitat 9190, quoted by them. According to W. Matuszkiewicz

(2001), one of the distinguishing features of this association is a nearly complete lack of *Quercus-Fagetea* species, and its species composition in Poland is completely consistent with the characteristic species combination typical for West European *Betulo-Quercetum*. A similar view was expressed earlier by J. M. Matuszkiewicz (1988).

Pallas (1996) initially assigned the *Betulo-Quercetum roboris* to the alliance *Vaccinio myrtilli-Quercion petraeae*. In his later publication, he included the association in the alliance *Molinio caeruleae-Quercion roboris* (Pallas 2003). Considering the regional variation, this association is part of formation F8 (Pallas 2003). This formation extends from central England, through Belgium, the Netherlands, Denmark, north-western Germany, the south-western Sweden, and southern Norway. Its easternmost localities are on the Darss Peninsula and the island of Bornholm. Only some of the Polish localities of this association – those found at the north-western edges of our country – were in this classification probably assigned to the *Molinio caeruleae-Quercetum roboris*, and presented in the map of distribution of formation F9 (Bohn *et al.* 2003). The distribution range of *Betulo-Quercetum roboris*, presented earlier by Härdtle & Welss (1992), corresponds in Poland to its distribution accepted by Polish authors (see Matuszkiewicz J. M. 2001a).

Tüxen (1975), bearing in mind the low level of floristic distinctness of *Betulo-Quercetum*, considered the possibility of joining this association with the *Fago-Quercetum*. Results of later research indicate that the *Betulo-Quercetum* is not a stable community and can be replaced by the poor beech forest *Deschampsio-Fagetum* (Elgersma 1998; Härdtle *et al.* 2005). It is outcompeted by *Fagus* on the soils where increasing amounts of humus are accumulated as a result of plant succession. However, *Fagus* avoids poor sites with a high groundwater level (Härdtle *et al.* 2003; 2005; see Rode 1999a, 1999b). This feature of *Fagus* is probably responsible for the limited habitat differentiation of *Betulo-Quercetum*, which is usually found at moist sites.

Fago-Quercetum petraeae R. Tx. 1955 *nom. inval. et nom. ambig.*

In this study, acidophilous beech-oak forest was not distinguished as a valid syntaxon, on the basis of the arguments explained below and syntaxonomic solutions presented by Brzeg *et al.* (2001), Brzeg & Wojterska (2001), as well as Ratyńska *et al.* (2010). According to other authors, the *Fago-Quercetum* is distributed mostly in Pomerania, west of the lower Vistula, and in the Lubusz Land (Matuszkiewicz J. M. 1988, 2001a). Its southern and eastern limit in Poland needs to be determined (Matuszkiewicz W. 2001). The *Fago-Quercetum*

is represented by 2 subassociations: the *F-Q typicum* on fresh (i.e. moderately moist) sites and the *F-Q molinietosum* on moist sites. Until recently it was the best-documented association of acidophilous oak forests in Poland. It was described on the basis of 398 relevés (Matuszkiewicz J. M. 1988, 2001a; Matuszkiewicz W. & Matuszkiewicz J. M. 1996).

Beech-oak forest is found chiefly on acid brown, rusty or grey-brown (lessivé) soils. Its sites are moist or fresh, varying in fertility, but mostly classified as sites of fresh mixed coniferous forest (BMśw) or mixed deciduous forest (LMśw) (Matuszkiewicz J. M. 1988, 2001a; Trzciński 1989; Świącicki 2000).

The *Fago-Quercetum petraeae* is highly controversial, as emphasized by many authors. W. Matuszkiewicz (2001), supported the retention of this association, but emphasized that the validity of its name, phytosociological position, and its distinctness are questionable. He did not agree with Pallas (1996), who suggested that woods identified as the *Fago-Quercetum* are in fact acidophilous beech forests in north-western Germany, while in the east (including Polish Pomerania) they are a form of *Calamagrostio arundinaceae-Quercetum*. That proposal of J. Pallas was also completely rejected by J. M. Matuszkiewicz (2001a). By contrast, like in the present study, the proposal was accepted by Brzeg *et al.* (2001) and Brzeg & Kasproicz (2001), considering the *Fago-Quercetum* as the West Pomeranian race of *Calamagrostio arundinaceae-Quercetum*.

It must be emphasized that in later publications, the association *Fago-Quercetum* is usually not distinguished as a separate syntaxon. This question was not resolved by authors of the map of European vegetation (Bohn *et al.* 2003). Bohn (2003) placed the *Fago-Quercetum* in the class *Quercus-Fagetea*, as the only component of the alliance *Quercion roboris*. All the other associations of this alliance were placed in the class *Quercetea robori-petraeae* in another section of explanations to this map (Pallas 2003). Additionally, the explanation to formation F8 on that map, informs that the formation includes the *Fago-Quercetum* Tüxen 1955 p.p. (*Quercus*-dominated part). In contrast, Pallas (2003), who described this formation and within it also the subdivision of the class *Quercetea robori-petraeae*, did not even mention the name *Fago-Quercetum*.

One of the first critics of the definition of *Fago-Quercetum* was Doing (1975). He emphasized that according to that definition, its ecological range was too broad, including very heterogeneous sites. He did not find any place for it in the proposed system of plant communities. He described also the association *Solidagini-Quercetum*, including the western part of the distribution range of the former *Fago-Quercetum* in the forms lacking *Fagus*. Its forms with *Fagus* are some-

times classified as the association *Periclymeno-Fagetum* Pass. 1957 (Pott 1995; Pallas 1996, 2002), which corresponds with an earlier suggestion of Passarge (1957), or as the *Luzulo-Fagetum* Meusel 1937 (Rennwald 2000). Bohn *et al.* (2003) consider *F-Q typicum* as synonymous with the *Deschampsio-Fagetum* Pass. 1956. Similarly, Brzeg *et al.* (2000a, 2001) as well as Brzeg & Wojterska (2001), agreed with the suggestion of Pallas (1996), and regarded its *Fagus*-dominated forms as the acidophilous beech forest *Luzulo pilosae-Fagetum*, while the *Quercus*-dominated forms were included in the association *Calamagrostio arundinaceae-Quercetum petraeae*. In other classifications, the *Quercus*-dominated form of *Fago-Quercetum* (Härdtle 1997), and probably the corresponding typical subassociation *F-Q typicum* (Böhnert *et al.* 2001) or an undefined part of this association, *Fago-Quercetum* p.p. (Rennwald 2000) were included in the *Betulo-Quercetum roboris*. A similar solution was also accepted by Ratyńska *et al.* (2010). They listed 3 separate forms of the broadly defined *Fago-Quercetum* as synonyms of the associations *Betulo-Quercetum roboris*, *Calamagrostio-Quercetum petraeae*, and *Deschampsio flexuosae-Fagetum*. Yet another concept, accepted also by Schubert *et al.* (2001), was proposed by Oberdorfer (1992b), who included the *F-Q typicum* in the *Holco mollis-Quercetum* Lemeé 1937, according to his broader definition of the association.

The *Fago-Quercetum petraeae* Tx. 1955 was indicated on the map of European vegetation as a component of 4 formations within the group of lowland oligo- and mesotrophic beech forests or mixed deciduous forests with *Fagus* (Bohn *et al.* 2003). Western Poland and eastern Germany are within the range of formation F80, which includes the *Fago-Quercetum* and poor beech forests, e.g. the *Luzulo pilosae-Fagetum* (= *Deschampsio flexuosae-Fagetum*). Both the associations, described as poor beech forests, were assigned to the order *Quercetalia robori-petraeae* and class *Querco-Fagetea* (the former as a component of *Quercion roboris*, while the latter was placed in the *Deschampsio flexuosae-Fagion*) (Bohn 2003).

J. M. Matuszkiewicz (2007a) reported a decline of patches of the association *Fago-Quercetum* in Kashubia. In that region, in a relatively short period of 40 years, they were transformed in extensive areas into the poor beech forest *Luzulo pilosae-Fagetum*. This process probably reflects a regeneration of poor beech forest deformed earlier by forest management, which favoured *Pinus* and/or *Quercus*. Floristic relationships of beech-oak forests were probably modified by extensive sheep grazing. Thus the *Fago-Quercetum* may be a community conditioned by zoo-anthropogenic impact, i.e. livestock grazing, very much like thermophilous oak forests (Matuszkiewicz 2007a). According to the cited author,

the expansion of beech forest (at the expense of beech-oak forest) is unlikely to be due to climate change. The decline of *Fago-Quercetum* also seems to be confirmed by results of a biodiversity survey on permanent plots of forest monitoring (Czerepko *et al.* 2008). The monitoring showed that the frequency of patches corresponding to this association is about 5-fold lower than expected according to the estimations of J. M. Matuszkiewicz (2001a).

Luzulo luzuloidis-Quercetum petraeae Hilitzer 1932

Syn.: *Genisto germanicae-Quercetum* Aichinger 1933, *Genisto tinctoriae-Quercetum* Klika 1932, *Querceto sessiliflorae-Betuletum* R. Tx. 1937 p.p.; *Luzulo luzuloidis-Quercetum* Hartm. 1953; *Luzulo (nemorosae)-Quercetum petraeae* Pass. 1953 em. R. et Z. Neuh. 1967

The submontane acidophilous oak forest is found in Poland in lower parts of the Sudetes, in the submontane zone and foothills of the Sudetes and Western Carpathians, and locally in the southern part of the Kraków-Częstochowa Upland. Because of its geographic variation, it is subdivided into the Sudetian (typical) race and the Małopolska race. The latter is regarded as its marginal form because of the presence of species typical of coniferous forests (Matuszkiewicz J. M. 2001a). Ecological variation was initially observed exclusively in the western, Sudetian part of its range (Matuszkiewicz J. M. 1988). The association is clearly differentiated into 2 subassociations: the *L-Q typicum* and *L-Q genistetosum tinctoriae*. The latter syntaxon, highly xerothermophilous, is a submontane equivalent of thermophilous oak forest (Matuszkiewicz W. 2001). The basic description of this association in Poland was based on 72 relevés (Matuszkiewicz J. M. 1988, 2001a; Matuszkiewicz W. & Matuszkiewicz J. M. 1996).

The well-drained, rocky sites of submontane oak forest are characterized by the presence of loess or loamy deposits, on which podzolic or grey-brown (lessivé) soils develop (after J. M. Matuszkiewicz 2001a). The cited author reported that this association is found on potential sites of fresh mixed coniferous forest (BMśw). Patches of *Luzulo-Quercetum* studied by Kwiatkowski (2001) in the western foothills of the Sudetes developed on soils classified as rankers (*L-Q typicum*) or erosive lithosols (*L-Q genistetosum*).

The distribution of the association in Poland, described above, is consistent with the map of European vegetation. The centre of its distribution is in the western and south-western Czech Republic (Bohn *et al.* 2003).

One of the northernmost localities was reported from Dalków Hills in the Głogów Forest District (Lisiewska & Sekuła-Woźniak 1998; Lisiewska 2006). The relevés published in the first of the cited articles do not allow

this diagnosis. The documented plant communities undoubtedly represent the association *Calamagrostio arundinaceae-Quercetum*. The habitats of *Luzulo-Quercetum* were also wrongly identified on the map of potential natural vegetation of the catchment area of the river Barycz, where its biotopes were marked between Twardogóra and Milicz and near Sułów, Żmigród, Milicz, and Oborniki Śląskie (Wojterski *et al.* 1981). All the sites on a later map of potential natural vegetation of Poland were classified as sites of *Calamagrostio arundinaceae-Quercetum* (Matuszkiewicz W. *et al.* 1995; Matuszkiewicz J. M. 2008b).

Recently, a comparison of changes in species composition over 30 years has indicated that patches of *Luzulo-Quercetum* tend to disappear on its sites in the Ojców National Park. They are gradually transformed into *Fagus*-dominated forests, which will probably develop into poor beech forests *Luzulo pilosae-Fagetum* (Matuszkiewicz 2007c). The cited author regards air pollution, the ban on grazing, and changes in forest management as the major reasons of the decline of *Luzulo-Quercetum*. Those conclusions are based on results of research documented in several articles of Medwecka-Kornaś and Gawroński, recently summarized by Medwecka-Kornaś (2006). Those authors provide evidence that the major cause of the observed changes in species composition of those forests is air pollution. In all those articles, the forests are diagnosed currently as the *Pino-Quercetum*. Earlier on (Medwecka-Kornaś 1952), this association was reported under the name *Quercetum medioeuropaeum* Br.-Bl. 1932, which according to Medwecka-Kornaś (2006) can be regarded as a synonym of *Pino-Quercetum*. Yet another diagnosis was made by Pallas (1996). He noted that the nearly complete lack of *Pinus* in the relevés of *Quercetum medioeuropaeum* from the Kraków-Częstochowa Upland (Medwecka-Kornaś 1952), does not make it possible – for formal reasons – to regard this community as a synonym of *Pino-Quercetum*. At least some of the relevés, in his opinion, represent the *Calamagrostio-Quercetum luzuletosum luzuloidis*.

Calamagrostio arundinaceae-Quercetum petraeae (Hartm. 1934) Scam. *et* Pass. 1959 *em.* Brzeg, Kaspr. *et* Krot. 1989

Syn.: *Pino-Quercetum* Kozł. 1925 *sensu aut. p.p.*, *Quercetum medioeuropaeum* Br.-Bl. 1932 *ex* Libbert 1933, *Querceto-Betuletum calamagrostidetosum vel Quercetum medioeuropaeum calamagrostidetosum* Hartm. 1934, *Periclymeno-Quercetum marchicum* Preising 1943, *Fago-Quercetum petraeae* Tx. 1955 *p.p.* (*excl. Deschampsio flexuosae-Fagetum* Schröder 1938), *Pyrolo secundae-Quercetum petraeae* Pass. 1957, *Stellario holostaeae-Quercetum roboris* Scam. *et* Pass. 1959 *p.p.*, *Agrostio capillaris-Quercetum* Pass. 1968

sensu aut. p.p., *Quercus roboris-Pinetum* J. M. Matuszkiewicz 1988 *sensu aut. p.p.*⁴

Until recently, this association, known as Central European acidophilous oak forest with *Calamagrostis*, has been very poorly studied and aroused controversy (Matuszkiewicz W. 1967, 1981). J. M. Matuszkiewicz (1988) characterized it on the basis of 43 relevés, but 17 of them represented only “a community similar to the *Calamagrostio-Quercetum*”. This association had been documented from the Lubusz Land, Wielkopolska, and Upper Silesia, but its hypothetical range was supposed to include also the Upper Silesia and the Częstochowa-Wieluń Upland. The ecological variation of the association was not known at that time. It was assumed that this oak forest type occupies sites similar to those of *Quercus-Pinetum* in central Poland. Its patches known at that time developed on fresh soils, but their presence on moist sites was not excluded (J. M. Matuszkiewicz 1988). Later research showed that this association (narrowly defined in that study), is limited to fresh sites and shows a low ecological variation. Although quite many local forms of *Calamagrostio arundinaceae-Quercetum* were reported in the literature, also the interpretation of its regional variation was not clearly determined (Matuszkiewicz J. M. 2001a). W. Matuszkiewicz (2001) accepted the view of German authors and described the *Calamagrostio arundinaceae-Quercetum* as a marginal form of acidophilous oak forests from the class *Quercetea robori-petraeae*. According to his definition, the association should be dominated by *Quercus petraea* and nearly completely lack *Fagus* in the canopy. In its species composition, all-forest acidophilous mesotrophic species should prevail, and the contribution of characteristic species of the class *Quercetea robori-petraeae* should be high. Characteristic species of the class *Vaccinio-Piceetea* (e.g. sometimes abundant *Vaccinium myrtillus*) and of the class *Quercus-Fagetea* (represented by several more eurytopic species) should not play any important role there.

The association *Calamagrostio arundinaceae-Quercetum* is more broadly defined by Brzeg *et al.* (1989, 2001) as well as Brzeg & Kasprowicz (2001). Already in the first cited article, devoted chiefly to the *Molinio caeruleae-Quercetum roboris* (another association from the group of acidophilous oak forests), 3 subassociations of *Calamagrostio arundinaceae-Quercetum* were distinguished: the *Ca-Q molinietosum*, *Ca-Q typicum*, and *Ca-Q convallarietosum*. They are conditioned mostly by differences in soil moisture content (Brzeg *et al.* 1989). This association includes acidophilous oak forests developed chiefly on sites of

⁴ After Brzeg *et al.* (2001), modified

fresh mixed coniferous forest (BMśw), but also of fresh mixed deciduous forest (LMśw). According to that definition, the *Calamagrostio arundinaceae-Quercetum* is ecologically and floristically related to moist forest communities dominated by *Molinia caerulea* (the *Molinio caeruleae-Quercetum*, *Quercio-Pinetum molinietosum*, and *Molinio-Pinetum*), but also to thermophilous oak forest from the order *Quercetalia pubescentis*. The distribution range of *Calamagrostio arundinaceae-Quercetum* was reported to include the central and western part of the Polish Lowlands. According to that classification, the association was distinct both from the *Fago-Quercetum*, found in Poland in Pomerania, and from the *Luzulo-Quercetum*, distributed in uplands and in the submontane zone.

A detailed description of the association *Calamagrostio-Quercetum* from Wielkopolska, based on 123 relevés, was presented by our research team (Brzeg *et al.* 2001), after the revision of the syntaxonomy and nomenclature of acidophilous oak forests made by Pallas (1996). As a result of a critical analysis and discussion of his classification, we assigned this association to the alliance *Agrostio capillaris-Quercion* Scam. et Pass. 1959 em. Brzeg, Kasprowicz et Krotoska 2001. We also documented the reported earlier (Brzeg *et al.* 1989) differentiation of the association into 3 subassociations: the *Ca-Q molinietosum* Brzeg, Kasprowicz, Krotoska 1989 ex Lisiewska et Reszel 2000; *Ca-Q typicum* Grosser 1964; and *Ca-Q polygonatetosum odorati* Pass. in Pallas 1996 (= *Ca-Q convallarietosum* (Fab. et Fal. 1964) Brzeg, Kasprowicz, Krotoska 1989 nom. inval.). The differentiation is mostly due to variation in soil moisture content. This is confirmed by the ecological scale of their differential species, i.e. for the moist subassociation *Ca-Q molinietosum*: *Agrostis canina*, *Carex leporina*, *C. nigra*, *C. pallescens*, *Deschampsia caespitosa*, *Frangula alnus* (opt.), *Hypericum maculatum*, *Juncus effusus*, *Lysimachia vulgaris*, *Molinia caerulea*, *Potentilla erecta*, and *Trientalis europaea*; while for the driest and warmest subassociation *Ca-Q polygonatetosum odorati*: *Campanula persicifolia*, *Convallaria majalis* (opt.), *Corylus avellana*, *Festuca heterophylla*, *Fragaria vesca*, *Galium album* fo. *dumetorum*, *Hieracium murorum*, *H. pilosella*, *Hypericum perforatum*, *Moehringia trinervia* (opt.), *Mycelis muralis*, *Poa angustifolia*, *Polygonatum odoratum*, *Veronica officinalis*, and *Viola riviniana*. Patches of the typical subassociation are associated with fresh (i.e. moderately moist) sites. The *Ca-Q typicum* has no differential species. The varied fertility of its sites is less important for floristic variation of this association. It is reflected in the separation of typical variants (poorer) from variants with *Anemone nemorosa* (more fertile) within each subassociation. The more fertile variants are distinguished also by other species of the class

Quercio-Fagetea, e.g. *Atrichum undulatum*, *Melica nutans*, *Poa nemoralis*, *Stellaria holostea*, and *Viola reichenbachiana*.

Mazur (1994), on the basis of his research on the *Calamagrostio-Quercetum petraeae* in the Niemodlin Forest in Silesia, distinguished its 4 trophic variants: variant with *Carex montana* (on dry sites, with species of the order *Quercetalia pubescentis*), variant with *Rubus saxatilis* (on more fertile sites, with the canopy dominated by planted *Pinus*), typical variant, and variant with *Circaea alpina* (on relatively poor and wet sites).

Recently, Kurowski (2009) reported from central Poland (Łagiewniki Forest at the northern limits of the city of Łódź) a new subassociation, the *Ca-Q festucetosum*. Earlier on (Kurowski & Andrzejewski 2000), this syntaxon was classified as a form *Calamagrostio-Quercetum* with *Festuca ovina*. It was described (Kurowski *et al.* 2001) as dry and much poorer floristically than the subassociation *Ca-Q polygonatetosum* documented by us (Brzeg *et al.* 2001).

The habitat variation of *Calamagrostio-Quercetum* was also discussed by Grosser (1964), who described the *Ca-Q typicum* and *Ca-Q scorzonetetosum humilis*, and by Pallas (1996), who assumed that this association may form 4 subassociations, i.e. the 2 mentioned above and additionally also the *Ca-Q luzuletetosum luzuloidis* and *Ca-Q polygonatetosum odorati*. The subassociation *Ca-Q luzuletetosum luzuloidis* was described on the basis of relevés diagnosed earlier as the *Quercetum medioeuropaeum* (Medwecka-Kornaś 1952) and *Pino-Quercetum* (Celiński 1965). Data shown by Pallas (1996, Table 5), contrary to his interpretation, indicate that in fact this subassociation is not conditioned by local ecological variation but by geographic variation. It corresponds primarily to the *Luzulo luzuloidis-Quercetum*, and probably partly also to the South Polish race of *Calamagrostio arundinaceae-Quercetum*, described below.

Pallas (1996) indicated that in Poland there is yet another association from the group of acidophilous oak forests, namely the *Pyrolo secundae-Quercetum petraeae* Pass. 1957. He assigned to this association also some relevés originally identified as the association *Calamagrostio arundinaceae-Quercetum* by Celiński & Wika (1974-1975), Fabiszewski & Faliński (1967 – by Pallas wrongly recorded as 1964), and Krotoska (1978). Disregarding the question of the definition of the association *Pyrolo-Quercetum* (see Brzeg *et al.* 2001), it is important here to go back to the phytosociological table of Krotoska (1978, Table 1). The *Calamagrostio-Quercetum* in the Włoszakowice Forest is relatively homogeneous, floristically poor, differentiated into several facies. As emphasized by T. Krotoska, the facies correspond to its forms distinguished by Scamoni (1961). By contrast, Pallas (1996)

identified one of the facies as the *Pyrolo-Quercetum*, while the facies with *Vaccinium myrtillus* (partly also the facies with *Calamagrostis arundinacea*), as the *Ca-Q scorzoneretosum humilis* Grosser 1964⁵. Moreover, he assigned these 2 associations to different alliances: the *Pyrolo-Quercetum* to the *Agrostio capillaris-Quercion petraeae* Scam. et Pass. 1959 em. Pallas 1996, while the *Calamagrostio-Quercetum* to the *Vaccinio myrtilli-Quercion petraeae* Pallas 1996. In his original synoptic table (Pallas 1996, Table 5), showing various subassociations of *Calamagrostio-Quercetum* and *Pyrolo-Quercetum*, neither characteristic nor differential species were given. The lack of significant floristic differences indicates that the table presents in fact the species composition of one association, the *Calamagrostio arundinaceae-Quercetum* (except the 2 columns corresponding to the *Luzulo-Quercetum*).

Patches of *Calamagrostio arundinaceae-Quercetum* are found on sandy and loamy sites, either fresh or moderately moist, on rusty, gley-podzolic, leached brown, podzolic brown, and grey-brown (lessivé) soils. As emphasized by authors of a detailed study of the soils under the patches of *Calamagrostio-Quercetum*, their common feature is a high acidity and leached surface layer (Lasota *et al.* 2005). These sites are classified by foresters as fresh mixed deciduous forest (LMśw), fresh mixed coniferous forest (BMśw), less frequently also as moist mixed deciduous forest (LMw) and moist mixed coniferous forest (BMw), as well as poorer variants of fresh deciduous forest (Lśw) (Szwed 1979; Matuszkiewicz J. M. 1988, 2001a; Zaręba 1988a; Trzciniński 1989; Kosakowski 1995, 1999; Sokołowski *et al.* 1997; Święcicki Z. 2000; Brzeg *et al.* 2001; Brzeg & Kasprowicz 2001; Lasota *et al.* 2005).

According to J. M. Matuszkiewicz (2001a), the general range of *Calamagrostio-Quercetum* covers about 1/3 of the area of Poland, mostly in 4 geobotanical regions: South Wielkopolska with Lusatia, Central Wielkopolska, Lower Silesia, and Upper Silesia, and partly also Central Małopolska Uplands, Kraków-Częstochowa Upland, Łódź-Wieluń Hills, Noteć-Lubusz Land, and perhaps also the Świętokrzyskie Mts. However it is estimated that forest site types suitable for the *Calamagrostio-Quercetum* account for about only 3.7% of Polish forests (Matuszkiewicz J. M. 2001a). According to BioSoil data, the areal contribution of *Calamagrostio-Quercetum* may be even lower (Czerepko *et al.* 2008). In contrast, we reported (Brzeg *et al.* 2001; Brzeg & Kasprowicz 2001) that the *Calamagrostio-Quercetum* is widespread in the lowlands and uplands of western Poland, but 3 geographic races can be distinguished: the West Pomeranian,

Wielkopolska, and South Polish. Floristic characteristics of those units, accepted also in the present study, are shown above (Table 2). Recently, in the Silesian-Kraków Upland, Greń and Wika (2009) found patches of *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati*, representing the South Polish race of the association.

On the European scale, the *Calamagrostio-Quercetum* is a major plant community of Central Europe and is a component of 3 formations: F11, F12, and F19 (Pallas 2003). The last one covers the uplands and the submontane zone in the north-western part of the Czech Republic and the adjacent part of Germany. Formation F11, including the *Calamagrostio-Quercetum* and *Pyrolo-Quercetum*, covers mostly Silesia and the south-eastern part of the German Lowland (Bohn *et al.* 2003). It is noteworthy that the description of vegetation, e.g. of formation F12, by Pallas (2003) is not consistent with the map of its range of distribution (Bohn *et al.* 2003). According to his description, formation F12 comprises exclusively the eastern form of *Calamagrostio arundinaceae-Quercetum*, and this association reaches in Poland the eastern limit of its range. On the map, the same formation is marked as a sum of the ranges of *Calamagrostio-Quercetum* and *Quercio roboris-Pinetum*, reaching further east, to the junction of the borders of Belarus, Russia, and Ukraine. However, as emphasized by Pallas (2003), most of the patches of *Quercio-Pinetum* are dominated by *Pinus*, and thus cannot be included in formation F, comprising deciduous forests.

Molinio caeruleae-Quercetum roboris (R. Tx. 1937) Scam et Pass. 1959 em. Brzeg, Kasprowicz et Krotoska 1989

Central European wet oak forest with *Molinia caerulea* was identified in Poland about 20 years ago (Brzeg *et al.* 1989). According to the initial definition, this association may be treated as a vicariant of the coastal *Betulo-Quercetum molinietosum* – the most moist form of acidophilous birch-oak forest (Brzeg *et al.* 1989; Brzeg & Kasprowicz 2001; Matuszkiewicz W. 2001). We included in the *Molinio caeruleae-Quercetum roboris* the following syntaxa: *Molinio-Quercetum* (R. Tx. 1937) Scam. et Pass. 1959 p.p. (except the forms corresponding to the *Betulo-Quercetum molinietosum*), *Quercio roboris-Betuletum molinietosum* R. Tx. 1937 (only the forms from Brandenburg, described by Passarge 1956, 1957); *Tilio-Betuletum molinietosum* Pass. 1957 p.p.; *Stellario-Quercetum* Scam. 1959 p.p.; *Pino-Quercetum typicum* var. with *Molinia caerulea* (documented by Krotoska and Piotrowska 1962); and pine-oak forest with *Molinia caerulea* (Sroka 1982). In Poland, the *Molinio caeruleae-Quercetum* was assigned to the alliance *Quercion robori-petraeae* (Brzeg *et al.*

⁵ As indicated on p. 59, these relevés show *Ca-Q typicum*, in a floristically impoverished form

1989; Brzeg & Wojterska 1996; Matuszkiewicz J. M. 2001a; Matuszkiewicz W. 2001) or recently to the alliance *Agrostio capillaris-Quercion* (Brzeg *et al.* 2001; Brzeg & Kasprowicz 2001; Brzeg & Wojterska 2001; Greń 2007; Greń & Wika 2010; Ratyńska *et al.* 2010). The distribution of *Molinio-Quercetum* is not well studied. Most often, this association was documented from southern and central Wielkopolska, especially from the so-called Krotoszyn Plateau (Brzeg *et al.* 1989; Brzeg & Kasprowicz 2001). The area is located at the border between 3 geobotanical regions: South Wielkopolska with Lusatia, Central Wielkopolska, and Noteć-Lubusz Land (Matuszkiewicz J. M. 2001a). Recently, the *Molinio caeruleae-Quercetum* has been documented also from Silesia (Greń 2007; Kącki & Stefańska-Krzaczek 2009; Stefańska-Krzaczek & Kącki 2009; Greń & Wika 2010). Authors of the latest Polish handbook on ecological principles of forest management (Kliczkowska *et al.* 2003) report that the association is found in the Silesian and Wielkopolska-Pomeranian Regions, distinguished in the forest regionalization system. In the latter region, it is limited to 3 districts: the Wielkopolska-Kujawy Lowland, Krotoszyn District, and Żmigród-Grabów Basin. On BioSoil plots, only potential sites of this association were found. One of them is located in the Silesian and another in the Małopolska forest region (Czerepko *et al.* 2008). According to the cited author, the lack of real patches of *Molinio caeruleae-Quercetum* suggests that J. M. Matuszkiewicz (2001a) overestimated its contribution, or many of its patches have been transformed. It is noteworthy that in an earlier study (Brzeg *et al.* (1989), we indicated that sites of this association are widespread in Wielkopolska. However, many of them have been transformed by planting of *Pinus* and they are now covered by substitute forest communities, similar to moist mixed coniferous forests, or even moist coniferous forests *Molinio-Pinetum*.

Within the range of *Betulo-Quercetum* there is no floristic justification for distinguishing the *Molinio caeruleae-Quercetum* as defined by Scamoni & Passarge (1959). Thus Rennwald (2000) are right to include this association in the *Betulo-Quercetum*. In the areas located outside the range of the latter association, but within the limits of distribution of communities from the order *Quercetalia roboris*, sites similar in respect of fertility and soil moisture content, at least in western Poland, are occupied by the *Molinio caeruleae-Quercetum* as defined by Brzeg *et al.* (1989). Some of the sites may also be suitable for patches of *Calamagrostis arundinaceae-Quercetum molinietosum*. Anyway, it seems wrong to extend the range of *Betulo-Quercetum* to areas with continental climate, as suggested by Goncharenko (2001), who reported from Ukraine the association *Querceto roboris-Betuletum* R.Tx. 1930.

That community, assigned by him to the alliance *Molinio-Quercion* Scam. et Pass. 1959, is distinguished with a canopy dominated by *Betula pubescens*, with addition of *B. pendula* and *Pinus sylvestris*. According to that author, its regionally diagnostic species is *Potentilla erecta*, while the major herbaceous species of its ground layer of vegetation are *Molinia caerulea*, *Deschampsia caespitosa*, *Vaccinium myrtillus*, and *Pyrola rotundifolia*. More data are needed to verify its distinctness from the *Vaccinio uliginosi-Betuletum pubescentis* and *Molinio caeruleae-Quercetum roboris*. The latter syn-taxon, without phytosociological documentation, was included in the list of plant communities of northern Ukraine (Polissya) (Yakushenko 2005).

The distribution range of *Molinio caeruleae-Quercetum* on the map of European vegetation corresponds to the range of *Betulo-Quercetum roboris molinietosum*, considered as its synonym according to the syntaxonomic system accepted there (Bohn *et al.* 2003). The *Molinio-Quercetum* defined in that way is the only component of formation F9. This formation has its centre of distribution in northern Germany, but it reaches south to Saxony (Böhnert *et al.* 2001). In Poland it reaches its eastern limit, and occupies only a small part of the country in the north-west, near Szczecin (Bohn *et al.* 2003). Thus it does not comprise most of the Polish distribution range of *Betulo-Quercetum* (see J. M. Matuszkiewicz 1988, 2001a; W. Matuszkiewicz 2001) and of *Molinio-Quercetum*.

Within its known range of distribution, the *Molinio caeruleae-Quercetum* has 3 geographic races. Two of them were described by our research team (Brzeg *et al.* 1989; see also Matuszkiewicz J. M. 2001a): from Brandenburg (western) and Wielkopolska (eastern). The last, South Polish race has been distinguished recently by Greń and Wika (2010). Differential species for the western race include: *Lonicera periclymenum*, *Deschampsia flexuosa*, *Hypnum cupressiforme*, and *Fagus sylvatica*; for the eastern race: *Calamagrostis arundinacea*, *Solidago virgaurea*, *Sphagnum girgensohnii*, and *Trientalis europaea*; and for the South Polish race: *Calamagrostis villosa*, *Rubus hirtus*, *Senecio ovatus*, *Carex brizoides*, and (like for the western race) *Deschampsia flexuosa*.

The *Molinio caeruleae-Quercetum* does not show any significant ecological variation. Two variants can be distinguished depending on soil moisture content. The typical variant is found on less moist sites, while the variant with *Calamagrostis arundinacea*, distinguished also by the presence of *Betula pubescens*, occupies more moist and wet sites. The latter variant can be subdivided into a typical subvariant and a subvariant with *Carex canescens* and *Sphagnum girgensohnii* (Brzeg *et al.* 1989; Brzeg & Kasprowicz 2001; Matuszkiewicz J. M. 2001a).

Gley soils (both groundwater gley soils or surface-water gley soils) are typical for patches of *Molinio*

caeruleae-Quercetum. Surface-water gley soils are particularly frequent in the Krotoszyn Plateau. Those sites are classified by foresters as moist mixed coniferous forest (BMw) or moist mixed deciduous forest (LMw) (see Matuszkiewicz J. M. 1988, 2001a; Brzeg *et al.* 1989; Kliczkowska *et al.* 2003).

Molinio arundinaceae-Quercetum Samek 1962

Syn.: *Molinio arundinaceae-Quercetum* R. *et* Z. Neuh. 1967

The upland-submontane moist acidophilous oak forest is poorly studied in Poland. Until recently, its patches were reported in our country only from lower altitudes in the Sudetes and their foothills. The *Molinio arundinaceae-Quercetum* does not show any regional variation. In Poland mostly its moist forms have been documented, but it cannot be excluded that a drier variant exists here as well (Matuszkiewicz J. M. 1988, 2001a). W. Matuszkiewicz (2001) regards this association as a submontane equivalent of *Molinio caeruleae-Quercetum*.

Poor sites of *Molinio arundinaceae-Quercetum* are formed in often extensive local depressions, on sandy or loamy soils. A characteristic feature of the sites is a high seasonal variation in groundwater level (Matuszkiewicz J. M. 2001a; Matuszkiewicz W. 2001). Greń (2007) found its patch on a surface-water gley soil.

The description of *Molinio arundinaceae-Quercetum* in Poland was based on only 15 relevés of Kuczyńska (1973) and Celiński & Wika (1974-75), and it was insufficient to determine the range of its distribution in our country (Matuszkiewicz J. M. 1988, 2001a; Matuszkiewicz W. & Matuszkiewicz J. M. 1996). The estimated area of its well-developed patches is only several square kilometres (Matuszkiewicz J. M. 2001a).

The *Molinio arundinaceae-Quercetum* was recently recorded in the Silesian Upland and in the Oświęcim Basin (Babczyńska-Sendek *et al.* 2007; Greń 2007). These new localities, documented jointly by 37 relevés, represent mostly the moist variant, and are its easternmost records in Poland and probably also in Central Europe. Those results suggest that this association may be more widespread in the northern part of the upland zone. Brzeg and Wojterska (1996, 2001) included it in the list of plant communities of Wielkopolska on the basis of fragmentary materials and observations made near Rychtal and Kępno, and moved its hypothetical border northwards. Patches of the association *Molinio arundinaceae-Quercetum* in this part of Wielkopolska have been found recently by Rutkowski (2007), but he did not publish its phytosociological documentation.

Pallas (1996) initially assigned the *Molinio arundinaceae-Quercetum* to the alliance *Molinio caeruleae-Quercion roboris*, which groups azonal, moist acidophilous oak forests. Later on, he assigned it to the alli-

ance *Agrostio capillaris-Quercion petraeae*, which includes acidophilous oak forests of the southern part of Central and Sarmatic Europe (Pallas 2000, 2003). Brzeg & Wojterska (2001), followed by Ratyńska *et al.* (2010), placed this association in the alliance *Agrostio capillaris-Quercion petraeae* amended by Brzeg *et al.* (2001). It was defined more broadly in respect of ecological variation, and with a different geographic distribution.

On the map of European vegetation, the *Molinio arundinaceae-Quercetum* and *Carici brizoidis-Quercetum roboris* jointly constitute formation F22 (Bohn *et al.* 2003). This formation has an eastern distribution and covers more extensive areas in western Ukraine and the adjacent parts of Romania, Hungary, and Slovakia. It must be emphasized that it covers a very small area in the Czech Republic, where it has been reported only from north-eastern part of the country and near Ostrava. Neuhäuslová (2001) indicates, however, that the *Molinio arundinaceae-Quercetum* is found also in the central and eastern part of the country. It is unclear why the map does not show any localities of submontane moist acidophilous oak forest in Poland. This association was identified very early in our country, only a few years after the publication of its formal description by Neuhäusl and Neuhäuslová-Novotná (1967), which until recently was regarded as its first description. Potential biotopes of *Molino arundinaceae-Quercetum*, although indicated jointly with the *Luzulo luzuloidis-Quercetum* as one category, were shown also on the map of potential vegetation of Poland (Matuszkiewicz W. *et al.* 1995, Matuszkiewicz J. M. 2008b).

Aulacomnio androgyni-Quercetum roboris Brzeg *et* Kasprowicz in Brzeg *et al.* 2000

Syn.: Community *Polytrichum attenuatum-Carpinus betulus* Kubiś 1982, *Carpino-Quercetum* (Kubiś 1982 mscr.) Brzeg, Kasprowicz, Krotoska 1989 nom. illeg. et nom. inval.⁶

The relatively recently described association of acidophilous hornbeam-oak forest was earlier reported in several publications (Brzeg *et al.* 1989, 1998; Borysiak *et al.* 1992; Brzeg 1995; Brzeg & Wojterska 1996) under the invalid name *Carpino-Quercetum* (Theurillat and Moravec 1993). J. M. Matuszkiewicz (2001a), on the basis of works by Brzeg *et al.* (1989) as well as Brzeg & Wojterska (1996), which lack phytosociological documentation, came to a conclusion that this community cannot be regarded as a plant association, partly because of the lack of its sufficient and convincing description.

The original diagnosis of this syntaxon, renamed as the *Aulacomnio androgyni-Quercetum roboris*, was presented by our research team (Brzeg *et al.* 2000a). In a

⁶ After Brzeg *et al.* (2000a)

synoptic table, composed of 25 relevés, its 2 subassociations were documented: the *Aa-Q anemonetosum nemorosae* on more fertile sites and the *Aa-Q typicum* on poorer sites. Within both subassociations, 2 variants were distinguished: typical and with *Pleurozium schreberi*.

The *Aulacomnio androgyni-Quercetum roboris* is floristically well-defined. The relatively long list of its characteristic and differential species consists mostly of bryophytes, which justifies its assignment to the alliance *Dicrano-Quercion* Pallas 1996.

The association is known only from southern Wielkopolska, where its patches are particularly frequent in the Krotoszyn Plateau. They have been reported also from the Rychwał Plain (Równina Rychwalska), Valley of the Barycz (Dolina Baryczy), Leszno Plateau (Wysoczyzna Leszczyńska), and Trzebnica-Ostrzeszów Hills (Wzgórza Trzebnicko-Ostrzeszowskie) (Brzeg & Kasprowicz 2001).

Patches of *Aulacomnio-Quercetum* develop exclusively on surface-water gley soils, formed mostly from clayey sands overlying more compact deposits. The soils are very acidic in the upper part of the soil profile, which contrasts with the neutral or even slightly alkaline pH of the bedrock containing calcium carbonate (Kosakowski 1995). These sites cannot be identified with any specific forest site type. Kosakowski (1995) diagnosed them as locally the most moist form of fresh deciduous forest (Lśw2A). However, the soil acidity and humus type (moder, partly decomposed) do not match the characteristics of this forest site type (see Brzeg *et al.* 2000a).

The scanty published phytosociological documentation of *Aulacomnio-Quercetum* is supplemented by 2 relevés included in an article about macrofungi in its patches (Lisiewska & Reszel 2000). Detailed data are also available for extensive patches of this association, found in the reserve “Dąbrowa koło Biadek Krotoszyńskich”. This study concerned the flora of vascular plants (Klimko *et al.* 2004) and liverworts (Górski 2006).

Cladonio portentosae-Quercetum petraeae Pallas 1996

Acidophilous lichen oak forest is very poorly studied. In Poland it has no published phytosociological documentation. Nevertheless, the *Cladonio-Quercetum* was included in the list of plant communities of Wielkopolska (Brzeg & Wojterska 2001) and of Poland (Ratyńska *et al.* 2010). It was also mentioned by Brzeg & Kasprowicz (2001).

Patches of this association occupy poor sites, drier than those of all the other acidophilous oak forests. They cover small areas, interspersed with the thermophilous oak forest *Potentillo albae-Quercetum*, and dry forms of *Calamagrostio arundinaceae-Quercetum*. It cannot be excluded that, at least in Poland, this community

results from human transformation of patches of the above-mentioned associations.

The distribution of *Cladonio-Quercetum*, both in Poland and in Europe, is very poorly studied. Initially, this association was assigned to the alliance *Dicrano scoparii-Quercion roboris*, which groups communities that are distributed mostly in north-western Europe (Pallas 1996). More recently, the same author placed the *Cladonio-Quercetum* in the alliance *Quercion roboris*, whose range includes the southern part of Atlantic and sub-Atlantic Europe. It is one of 2 components of formation F18 (Pallas 2003), but on the map of European vegetation (Bohn *et al.* 2003), this formation – covering only a very small part of mid-western Germany – does not include the *Cladonio-Quercetum*.

5.2.2. Oak forests from the class *Querco-Fagetea* Br.-Bl. *et* Vlieger 1937

Galio sylvatici-Carpinetum (R.Tx. 1937) Oberd. 1957
Syn.: *Querco-Carpinetum medioeuropaeum* 1937 nom. illeg. *p.max.p.*

The association of Central European oak-hornbeam forest shows a clear ecological and regional variation. A vast majority of the studied patches represent the Wielkopolska race in its lowland form (Matuszkiewicz J. M. 2001a). Only several relevés from southern Wielkopolska are distinguished by the presence of species with more southern distribution. The question of separateness of this type of oak-hornbeam forest will be discussed in detail in section 6.3.4. Oak-hornbeam forests in Wielkopolska have been thoroughly investigated by Krotoska (1966, 1972). She documented 5 subassociations of *Galio sylvatici-Carpinetum*, subdivided into units of lower rank: variants and forms. Those subassociations were assigned to 3 larger ecological groups: (1) moist oak-hornbeam forests: the *Gs-C corydalidetosum* (*corydaletosum*), *Gs-C stachyetosum silvaticae*, and *Gs-C caricetosum brizoidis*; (2) moderately dry oak-hornbeam forests: the *Gs-C lathyretosum*; and (3) slightly acidophilous oak-hornbeam forests: the *Gs-C holcetosum mollis*. The third group is supplemented by the *Gs-C calamagrostietosum*. As emphasized by Krotoska (1966, pp. 20 and 98), this subassociation, not detected by later studies in Wielkopolska, corresponds to the *Querco-Carpinetum wartyvistulense calamagrostietosum*, described by Preising (1943).

Traczyk (1962b) analysed 11 subassociations of oak-hornbeam forest described from Poland, and simplified their ecological differentiation into 4 subassociations. Within the *Galio (sylvatici)-Carpinetum*, these included the *Gs-C corydaletosum*, *Gs-C stachyetosum*, *Gs-C typicum* (broadly defined subassociation, comprising, e.g. also subassociations with *Lathyrus vernus* and with

Polytrichum attenuatum, syn. *Polytrichastrum formosum*), and the *Gs-C calamagrostietosum* (with *Calamagrostis arundinacea*). The first 2 subassociations were assigned to the group of moist oak-hornbeam forests, while the other 2 to moderately dry oak-hornbeam forests.

Matuszkiewicz W. & Matuszkiewicz A. (1985) distinguished within the range of *Galio sylvatici-Carpinetum* in Poland, 5 subassociations depending on site conditions: the *Gs-C polytrichetosum* (poor oak-hornbeam forests), *Gs-C lathyretosum* (moderately dry oak-hornbeam forests), *Gs-C luzuletosum* (submontane oak-hornbeam forests), *Gs-C typicum*, and *Gs-C corydalisetosum* (fertile oak-hornbeam forests, less moist). Their classification has been accepted in the latest geobotanical reviews (Matuszkiewicz W. & Matuszkiewicz J. M. 1996; Matuszkiewicz J. M. 2001a; Wysocki & Sikorski 2002; Danielewicz & Pawlaczyk 2004b).

Considering the main subject of this study, the major differences between the above concepts can be summarized as follows.

- The synoptic table of *Gs-C holcetosum mollis* presented by Krotoska (1966), and that of *Gs-C polytrichetosum* presented by Matuszkiewicz W. & Matuszkiewicz A. (1985), document similar units. Considering the priority principle (Weber *et al.* 2000, Art. 22), the first name is considered valid. It must be emphasized that in Wielkopolska and in adjacent areas, acidophilous oak-hornbeam forests identified as the *Galio sylvatici-Carpinetum holcetosum mollis*, were described not only by Krotoska (1966), but also by other researchers (e.g. Kamionka 1971; Macicka 1984; Macicka & Wilczyńska 1990, 1991, 1992; Wojterska 2003). There is no published information from this region about the *Gs-C polytrichetosum*.
- The *Gs-C lathyretosum*, as defined by Matuszkiewicz W. & Matuszkiewicz A. (1985), comprises in my opinion also at least some slightly acidophilous oak-hornbeam forests with a greater contribution of *Calamagrostis arundinacea*. This grass species, in the table of the cited authors, reaches the third degree of constancy in the Wielkopolska race of this subassociation. By contrast, in tables of Krotoska (1966), it is recorded with the lowest degree of constancy (r-I).
- The subassociations with *Calamagrostis arundinacea* defined by Krotoska (1966) and Traczyk (1962b) are synonymous. They were described on the basis of the same pool of 11 relevés of Preising (1943), documenting the subassociation *Quercus-Carpinetum warty-vistulense calamagrostidetosum*.

This study takes into account only the poorest forms of Central European oak-hornbeam forest, closely related to acidophilous oak forests. Undoubtedly these include the *Gs-C holcetosum mollis* (= *Gs-C poly-*

trichetosum) (see Krotoska 1966; Matuszkiewicz J. M. 2001a), and at least some forms of moderately dry oak-hornbeam forests with *Calamagrostis arundinacea*, classified by Krotoska (1966) and Boiński (1973) as the *Gs-C calamagrostietosum*, or identified with the *Quercus-Carpinetum calamagrostietosum* (Ferchmin 1966). The *Gs-C lathyretosum* was taken into account only in comparisons. In patches of this subassociation some acidophilous species (*Polytrichastrum formosum* and *Vaccinium myrtillus*) may be abundant, but the constant presence of the group of species of more fertile sites (*Aegopodium podagraria*, *Lathyrus vernus*, *Galium odoratum*, *Pulmonaria obscura*, etc.) makes it clearly distinct from acidophilous oak forests (see Krotoska 1966; Matuszkiewicz W. & Matuszkiewicz A. 1985).

A leading subassociation of acidophilous oak-hornbeam forests in Wielkopolska is the *Galio sylvatici-Carpinetum holcetosum mollis*. It was described in detail by Krotoska (1966), who indicated the features that distinguish this form of oak-hornbeam forest from the similar subassociation *Gs-C calamagrostietosum*, and from acidophilous oak forests and mixed coniferous forests. It is noteworthy that the connections between acidophilous oak-hornbeam forests and communities from the order *Quercetalia robori-petraeae* were noted much earlier by Preising (1943, after Krotoska 1966). On the basis of synoptic tables, Krotoska (1966: 102) indicated species regionally differentiating the *Gs-C holcetosum* from the other subassociations of oak-hornbeam forests in Wielkopolska: *Polytrichastrum formosum* (= *Polytrichum attenuatum*), *Carex pilulifera*, *Holcus mollis*, *Hieracium lachenalli*, and *Vaccinium myrtillus*, and to a smaller extent also *Solidago virgaurea*, *Melampyrum pratense*, *Dryopteris carthusiana* (= *D. spinulosa*), and *Veronica officinalis*.

The site variation of both acidophilous subassociations of oak-hornbeam forest (*Gs-C holcetosum mollis* and *Gs-C calamagrostietosum*) is poorly studied. They grow on acid brown (typical and podzolic), lessivé (Krotoska 1966; Trzciński 1989), rusty soils (Boiński 1973), and para-rendzinas (Święcicki 2000). Krotoska (1966), when describing the ecological specificity of *Gs-C holcetosum*, emphasized that these oak-hornbeam forests grow on a shallow layer of sands, overlying clay deposits. The soils are characterized by a low groundwater level and surface-water gleying. Patches of *Gs-C holcetosum* can be identified with sites of moist mixed deciduous forest (LMw), while the *Gs-C calamagrostietosum*, those of fresh mixed deciduous forest (LMśw).

Potentillo albae-Quercetum Libbert 1993 *nom invers.* Syn.: *Carici montanae-Quercetum* (Kuhn 1937) Förster 1968 *sensu* Fijałkowski 1991

The association of thermophilous oak forest, described from the area of Poland (Libbert 1933), presumably

has its centre of distribution in our country and in Germany, but is found also in northern Austria, southern Germany, the Czech Republic, and Slovakia (Chytrý & Horák 1996; Chytrý 1997). According to Roleček (2005), the status of its patches documented from Austria and Hungary is unclear and needs to be verified. According to other data, this association is distributed mostly in Poland and the Czech Republic, while its marginal localities are in Germany and Slovakia (Doniř 2003). The distribution range of *Potentillo albae-Quercetum* includes also northern Ukraine and an adjacent part of Russia (Brzeg *et al.* 2009a, 2009b). The image of its distribution presented on the map of European vegetation (formation G1 Bohn *et al.* 2003) is very incomplete. For example, it does not take into account the numerous localities reported from the Czech Republic (Chytrý 1997; Neuhäuslová 2001; Roleček 2005).

Poland is crossed by the northern limit of its distribution, which at the same time is the limit of the whole group of thermophilous oak forests from the order *Quercetalia pubescenti-petraeae* (Matuszkiewicz J. M. & Kozłowska 1991; Jakubowska-Gabara 1993; Matuszkiewicz W. 2001). Patches of thermophilous oak forest are found in extensive areas within 3 geobotanical units of a high rank: Mazovia-Polesie, South Wielkopolska Uplands, and Brandenburg-Wielkopolska (Matuszkiewicz J. M. 1993).

The *Potentillo albae-Quercetum* shows regional variation, diagnosed initially by Głazek (1973), Matuszkiewicz J. M. & Kozłowska (1991), as well as Wojterska and Wiszniewska (1996). Jakubowska-Gabara (2004) lists 3 geographic races of this association: the Wielkopolska, North Podlasie, and Mazovia-Małopolska races. Our recent studies (Wojterska *et al.* 2007; Brzeg *et al.* 2009a, 2009b), taking into account the previous concept of Wojterska & Wiszniewska (1996), show that 4 geographic races of this association can be distinguished in Poland. The Wielkopolska race is distinguished by e.g. *Deschampsia flexuosa*, *Rubus sprengei*, and *Galium sylvaticum*; Mazovian by *Chamaecytisus ratibonensis*; Podlasie by *Aquilegia vulgaris*, *Geranium sylvaticum*, *Centaurea phrygia*, and *Dracocephalum ruyschiana*; while Małopolska-Lublin by *Berberis vulgaris* (opt.), *Cerasus fruticosa*, *Euphorbia angulata*, *Lembotropis nigricans*, *Pulmonaria mollis*, *Rosa gallica*, *Viola collina*, and *Tanacetum corymbosum*.

The local ecological variation of *Potentillo albae-Quercetum* has been documented in many publications, also in the area of Poland (Matuszkiewicz A. 1955; Matuszkiewicz W. & Matuszkiewicz A. 1956; Kaźmierczakowa 1971; Sokołowski 1979, 1980; Matuszkiewicz J. M. & Kozłowska 1991; Jakubowska-Gabara 1993; Wojterska & Wiszniewska 1996). In

Wielkopolska, this association develops at least 3 subassociations, depending on soil moisture content: the *Pa-Q molinietosum*, *Pa-Q typicum*, and *Pa-Q brachypodietosum*. Each of them can be subdivided into variants (with *Asarum europaeum*, typical, and with *Pleurozium schreberi*) depending on site fertility (Brzeg & Kasprowicz 2001). A similar scheme of ecological variation of this association applies also to the whole documented distribution range of *Potentillo albae-Quercetum*. An analysis of 1445 relevés of *Potentillo albae-Quercetum* from 6 countries (Germany, the Czech Republic, Slovakia, Poland, Ukraine, and Russia) shows that ecological forms of this association, in that region, can be divided into 3 groups of subassociations: xerothermophilous, mesophilous, and hygrophilous (Brzeg *et al.* 2009b). Subassociations within these groups can be subdivided into trophic variants, similar to those mentioned above.

An important feature of the sites of this association is a sandy or gravelly soil with layers of clay (Matuszkiewicz J. M. & Kozłowska 1991). The soils are well-drained, but gleying may be observed in some periods at the borders between the layers (Wojterska & Wiszniewska 1996). Both groundwater and surface-water gleying are regarded as a factor eliminating thermophilous oak forests (Matuszkiewicz J. M. & Kozłowska 1991). In soil profiles, disproportions can be often noticed in calcium carbonate content. In the upper, leached horizons, it is present in trace amounts or even absent, while soil pH is slightly acidic, or sometimes moderately acidic. By contrast, the bedrock may be rich in carbonates and its pH may be strongly alkaline (Matuszkiewicz J. M. & Kozłowska 1991; Wojterska & Wiszniewska 1996; Matuszkiewicz J. M. 2001a). Most often, thermophilous oak forests are found on brown soils (Matuszkiewicz J. M. & Kozłowska 1991). They grow also on rusty soils (Trzcinski 1989; Wojterska *et al.* 2006), lessivé soils, and rendzinas in the south of Poland (Święcicki 2000; Jakubowska-Gabara 2004). They are mainly identified with sites of fresh mixed deciduous forest (LMśw), whereas poorer forms with sites of fresh mixed coniferous forest (BMśw) and the most fertile ones, as fresh deciduous forest (Lśw).

The *Potentillo albae-Quercetum* is one of several associations whose patches have declined in Poland over the last few decades. They are gradually transformed, mostly into oak-hornbeam forests, while in the western part of the country, also into acidophilous oak forests *Calamagrostio-Quercetum*, or even into acid beech forests. This process has been reported many times in our country (Jakubowska-Gabara 1991, 1993, 1996; Kwiatkowska 1986, 1994; Kwiatkowska *et al.* 1997; Kwiatkowska & Wyszomirski 1988, 1990; Matejczuk 2007; Matuszkiewicz A. 1977; Matuszkiewicz J. M. 2007b, 2007c, Orzechowski 2007). In Wielkopolska,

like in other parts of Poland (Jakubowska-Gabara 1993, 1996) patches of *Potentillo albae-Quercetum* completely disappeared from many of its earlier localities (Wojterska & Wiszniewska 1996). These transformations, according to the cited authors as well as to many others (e.g. Faliński 1986, Müller 1992; Chytrý 1997; Ellenberg 1988; Vera 2000; Matuszkiewicz W. 2001), indicate that at least some of its patches (and other thermophilous oak forests, see Hédli *et al.* 2010) are conditioned by zoo-anthropogenic impact, which consists in long-term livestock grazing and removal of the leaf litter. According to Jakubowska-Gabara (1993), this applies to more fertile forms of this association, occupying potential sites of oak-hornbeam forest and beech forest, whereas the forms developed on relatively dry, mesotrophic sites, are autogenic. This concept was accepted by Chytrý (1997). He regards thermophilous oak forests as relict communities, which were more widespread before the Atlantic period of the Holocene. Similarly, Vera (2000) indicates that thermophilous oak forest may be a relict of the Boreal and Atlantic periods. In the present landscape, its patches have been preserved only at the sites where the microclimatic and soil conditions limit the expansion of mesophilous species of broadleaved trees. Recently, however, J. M. Matuszkiewicz (2007b) assigned the *Potentillo albae-Quercetum* to the group of semi-natural plant communities.

5.2.3. Mixed coniferous forests from the class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. *et al.* 1939

Quercus roboris-Pinetum Kozłowska 1926 *em.* J. M. Mat. 1998 *nom. invers. nom. conserv.*

Syn.: *Pino-Quercetum* Kozłowska 1925 p.min.p.; *Pino-Quercetum* Kozł. 1925 *em.* W. Mat. et Polak. 1955 p.p.; *Pinetum fruticoso-herbosum* Juraszek 1928 *nom. illeg. p.p.*; *Populo tremulae-Quercetum roboris* Sokołowski 1980; *Quercus roboris-Pinetum* J. M. Mat. 1988 *nom. illeg. et nom. inval.*; *Quercus roboris-Pinetum* Kozłowska 1925 *em.* J. M. Mat. 1998⁷

In an early diagnosis of J. M. Matuszkiewicz (1988), this association was named the Central European pine-oak mixed coniferous forest. It was considered to be common in central and eastern Poland, but its range of distribution covered most of our country, except its small north-eastern part as well as central and western Pomerania, Lower Silesia, and the submontane zone. Both earlier (Matuszkiewicz W. 1981), and later (Matuszkiewicz W. & Matuszkiewicz J. M. 1996; Matuszkiewicz J. M. 2001a; Matuszkiewicz W. 2001), the *Quercus-Pinetum* was described as continental mixed coniferous forest. Its range of distribution covers over

90% of Poland, but it is most common in central and eastern parts of the country (Matuszkiewicz J. M. 2001a). W. Matuszkiewicz (2001) noted that the *Quercus-Pinetum* is found in the subcontinental part of Polish lowlands, where *Picea* and *Fagus* are rare. It is particularly difficult to determine the distribution range of this association, because of both natural and anthropogenic factors (Matuszkiewicz J. M. 2001a). The *Quercus-Pinetum* shows a low geographic variation, but 3 major geographic races can be distinguished: sub-boreal, Małopolska, and Mazovian (Matuszkiewicz J. M. 1988, 2001a). By contrast, its ecological variation is very clear. Three subassociations can be distinguished: the *Qr-P coryletosum* on relatively dry and most fertile sites, the *Qr-P molinietosum* on moist sites, and the *Qr-P typicum* (Matuszkiewicz J. M. 1988).

Soils of mixed coniferous forest are formed from clayey sands and loose sands on outwash plains, riverine accumulation terraces, eskers, and terminal moraines. Typical forms of *Quercus-Pinetum* (*Qr-P typicum*) and more fertile forms (*Qr-P coryletosum*) develop on podzolic or rusty soils, while patches of the poorer and more moist subassociation with *Molinia caerulea* (*Qr-P molinietosum*), on the less fertile, groundwater gley (Matuszkiewicz J. M. 2001a) and gley-podzolic soils (Trzcíński 1989; Święcicki 2000). They are identified with sites of fresh mixed coniferous forest (BMśw) or moist mixed coniferous forest (BMw).

The association has a relatively rich documentation. Its original diagnosis is based on 530 relevés (Matuszkiewicz J. M. 1988, 2001a; Matuszkiewicz W. & Matuszkiewicz J. M. 1996). The nomenclatural type of the association, with the old name *Pino-Quercetum*, was designated by Pallas (1996), who indicated that its lectotype is the first relevé in Table 3 of Kozłowska (1926a). Recently, the name *Festuco ovinae-Pinetum* (Juraszek 1928) Kobendza 1930 *nom. invers.*, proposed slightly earlier for this syntaxon (Brzeg & Wojterska 2001) was abandoned by Brzeg (2004). He indicated that the name *Festuco-Pinetum* is ambiguous, and supported the retention of the old name *Quercus roboris-Pinetum nom. invers.* proposed by Kozłowska (1926a, 1926b) – but as defined by J. M. Matuszkiewicz (1988) – as *nomen conservandum*. Brzeg (2004) argued that the name introduced by J. M. Matuszkiewicz (1988) was illegitimate (*nom. illeg.*, Art. 31), and invalid (*nom. inval.*, Art. 5) in light of the Code of Phytosociological Nomenclature (Weber *et al.* 2000).

The species composition of *Pineto-Festucetum*, shown in the table of Kobendza (1930), roughly corresponds to the description of sub-boreal mixed coniferous forest *Serratulo-Pinetum*, presented by J. M. Matuszkiewicz (2001a). Relatively small floristic differences between those units may be due to the very poorly

⁷ After Brzeg (2004), modified

developed canopy or even a lack of the tree layer in some patches documented by R. Kobendza. Thus it is not possible to accept the suggestion of W. Matuszkiewicz (2001, 2004), who wanted to reactivate the name *Festuco ovinae-Pinetum*, to replace the nomenclaturally incorrect name *Quercus roboris-Pinetum*, on condition that the syntaxa are identical (Matuszkiewicz W. 2004).

Recently, a nomenclatural type (lectotype) of the association *Festuco-Pinetum* Kobendza 1930 nom. invers. was designated from the original table of R. Kobendza (Dengler *et al.* 2004). The cited authors report that it is distinguished by the presence of continental species: *Chamaecytisus ratisbonensis*, *Cytisus nigricans*, and *Viola rupestris*.

Festuca ovina and *Pinus sylvestris* gave their names to 2 very different associations from the class *Vaccinio-Piceetea*: (1) *Festuco ovinae-Pinetum sylvestris* Ermakov 1991, found in western Siberia (Hoffmann & Ermakov 2008), and (2) *Pino-Festucetum ovinae* Eggler 1954, reported from eastern Austria (Eggler 1954). Also the name *Pino-Quercetum* is ambiguous. For example, Eggler (1959) in one article described 2 new associations from the class *Quercetea robori-petraeae*, namely the *Pineto-Quercetum roboris* Eggler 1948 and *Querceto-Pinetum sylvestris* Eggler 1959. In both communities, the canopy was dominated by *Pinus sylvestris* and *Quercus robur*.

Serratulo-Pinetum J. M. Mat. 1988 ex Brzeg in Brzeg et M. Wojterska 2004

Syn.: *Pino-Quercetum* Kozł. 1925 em. W. Mat. et Polak. 1955 p.p.; *Pinetum fruticoso-herbosum* Juraszek 1928 nom. illeg. p.p.; *Festuco ovinae-Pinetum* (Juraszek 1928) Kobendza 1930 nom. invers. p.p.; *Calamagrostio arundinaceae-Pinetum* Sokołowski 1980.⁸

Sub-boreal mixed coniferous forest has a continental type of distribution and is found mostly in north-eastern Poland. It is rarer in the mid-eastern part of the country. The association has a clear regional variation and can develop in the sub-boreal race (within the sub-boreal range of *Picea*) or the Sarmatic race. Its ecological variation is poor, observed chiefly in north-eastern Poland, where the *Serratulo-Pinetum* is represented by 2 subassociations: the *S-P typicum* and *S-P pulmonarietosum*. The latter syntaxon is related to thermophilous oak forest (Matuszkiewicz J. M. 1988, 2001a). According to W. Matuszkiewicz (2001) it is probably a vicariant of *Potentillo albae-Quercetum*.

As emphasized by J. M. Matuszkiewicz (2001a), the *Serratulo-Pinetum* is linked with local elevations, especially near its western range limit. Its patches occupy

mostly warm sites on hill tops or south-facing slopes. Rusty or podzolic soils are regarded as typical for this association. They are identified as sites of fresh mixed coniferous forest (BMśw) (Matuszkiewicz J. M. 1988, 2001a; Świącicki 2000).

The association was described in Poland on the basis of 257 relevés (Matuszkiewicz J. M. 1988, 2001a; Matuszkiewicz W. & Matuszkiewicz J. M. 1996). Its westernmost localities were reported from eastern Wielkopolska (Brzeg 2004). The cited author designated as the nomenclatural type (holotype) of *Serratulo-Pinetum* one of the relevés of the Sarmatic race of this association in an article of J. M. Matuszkiewicz (1988).

Recently, Pallas (2003) described a new association, the *Serratulo tinctoriae-Quercetum roboris* J. M. Matuszkiewicz 1988 ex Pallas 2003, by separating the *Quercus*-dominated form from the sub-boreal race of *Serratulo-Pinetum*. He suggested that the *Quercus*-dominated form of its Sarmatic race should be classified in the same way. The resultant 2 new associations of acidophilous oak forests, in his classification, would belong to 2 different alliances: the *Vaccinio myrtillic-Quercion petraeae* and *Agrostio capillaris-Quercion petraeae*, respectively.

The sub-boreal race of *Serratulo-Pinetum* is very similar to the *Melico nutantis-Piceetum* of the alliance *Piceion abietis* Pawł. et al. 1928. The latter is common in southern Finland and Sweden (Matuszkiewicz W. 2001, 2004). Their canopy is devoid of *Quercus*, which results from natural conditions (Matuszkiewicz W. 2004; see also Kasprowicz & Wojterska 2004). Thus the sub-boreal race of *Serratulo-Pinetum* may in fact include 2 associations: the *Serratulo-Quercetum* and *Melico nutantis-Piceetum*.

Recent studies (Szczypiński 2007; Solon 2007) suggest that the association *Serratulo-Pinetum* is conditioned by zoo-anthropogenic impact. Its patches are declining and gradually transformed into the mixed coniferous forest *Quercus-Pinetum* or oak-hornbeam forest (Matuszkiewicz J. M. 2007c).

6. Phytocoenotic and ecological characteristics of acidophilous forests with a high contribution of *Quercus*

6.1. A systematic review

Cl. *Quercetea robori-petraeae* Br.-Bl. et R. Tx. 1943 nom. mut.

Syn.: *Quercetea robori-sessiliflorae* Br.-Bl. et R. Tx. 1943, *Quercus-Ulicetea* Br.-Bl. 1947 p.p., *Vaccinio-Piceetea* Br.-Bl. in Br. Bl. et al. 1939 em. auct. p.min. p., *Quercus-Fagetalia* Br.-Bl. et Vlieger 1937 em. auct. p.min. p. O. *Quercetalia roboris* R. Tx. 1931

Syn.: *Quercetalia robori-sessiliflorae* Br.-Bl. et R. Tx. 1943 nom. superfl., *Quercetalia robori-petraeae* Br.-Bl.

⁸ After Brzeg (2004), modified

- et R. Tx. 1943 *nom. mut. auct. nom. superfl.*, *Pteridio-Quercetalia* Scamoni et Passarge 1959 *nom. superfl.*
All. Agrostio capillaris-Quercion Scamoni et Pass. 1959 *em.* Brzeg, Kasproicz et Krotoska 2001
 Syn.: *Quercion robori-petraeae* Br.-Bl. 1932 *nom. superfl. ex auct. p.p.*, *Agrostio-Quercion* Scamoni et Passarge 1959 *p.p.*, *Molinio caeruleae-Quercion roboris* Scamoni et Passarge 1959, *Pino-Quercion* Medwecka-Kornaś et al. 1959 *p.p.*, *Dicrano-Pinion* (Libbert 1933) W. Matuszkiewicz 1962 *ex auct. p.min.p.*, *Vaccinio myrtilli-Quercion petraeae* Pallas 1996
 Non: *Quercion roboris* Malcuit 1929 *em.* Pallas 1996, *Agrostio capillaris-Quercion petraeae* Scamoni et Passarge 1959 *em.* Pallas 1996, *Genisto germanicae-Quercion* R. et Z. Neuhäusl 1967 = *Hieracio lachenalii-Quercion petraeae* Pallas 1996 *nom. superfl.*, *Dicrano scoparii-Quercion roboris* Passarge 1968
 Ass. *Molinio caeruleae-Quercetum roboris* (R. Tx. 1937) Scam et Pass. 1959 *em.* Brzeg, Kasproicz et Krotoska 1989
 Ass. *Calamagrostio arundinaceae-Quercetum petraeae* (Hartm. 1934) Scam. et Pass. 1959 *em.* Brzeg, Kasproicz et Krotoska 1989
 Ca-Q molinietosum Brzeg et al. 1989 *ex* Lisiewska et Reszel 2000
 Ca-Q typicum Großer 1964
 Ca-Q polygonatetosum Passarge in Pallas 1996
All. Dicrano scoparii-Quercion roboris Pass. 1968
 Ass. *Aulacomnio androgyni-Quercetum roboris* Brzeg et Kasproicz in Brzeg et al. 2000
 Aa-Q typicum Brzeg et Kasproicz in Brzeg et al. 2000
 Aa-Q anemonetosum nemorosae Brzeg et Kasproicz in Brzeg et al. 2000
Cl. Querco-Fagetea Br.-Bl. et Vlieger 1937
 O. Fagetalia sylvaticae Pawłowski in Pawłowski et al. 1928
 Syn.: *Carpino-Fagetalia* Scamoni et Pass. 1959
 All. Carpinion betuli Issler 1931 *em.* Oberd. 1957
 Ass. *Galio sylvatici-Carpinetum* (R. Tx. 1937) Oberd. 1957
 Gs-C holcetosum mollis Preising 1943 *ex* Krotoska 1966
O. Quercetalia pubescenti-petraeae Klika 1933 *nom. mut.*
 All. Potentillo albae-Quercion petraeae (Zólyomi et Jakucs 1957) Jakucs 1967
 Ass. *Potentillo albae-Quercetum* Libbert 1933 *nom. invers.*
 Pa-Q astrantietosum Jakubowska-Gabara 1993
 Pa-Q molinietosum Brzeg et Kasproicz 2001 *ex* Kasproicz 2010 *subass. nova*
 Pa-Q typicum Preising 1943 *ex* W. et A. Mat. 1956
 Pa-Q brachypodietosum pinnati M. Wojterska et Wiszniewska 1996 *ex* Kasproicz 2010 *subass. nova*
Cl. Vaccinio-Piceetea Br.-Bl. in Br.-Bl. et al. 1939
 O. Piceetalia excelsae Pawłowski in Pawłowski et al. 1928 *em.* Br.-Bl. in Br.-Bl. et al. 1939
 Syn.: *Vaccinio-Piceetalia* Br.-Bl. in Br.-Bl. et al. 1939; *Pulsatillo-Pinetalia* Oberd. in Th. Müller 1966; *Cladonio-Vaccinietalia* Kiell.-Lund 1967 *sensu* W. Mat. 2001
 All. Dicrano-Pinion (Libbert 1933) W. Mat. 1962
 Ass. *Querco roboris-Pinetum* Kozł. 1926 *em.* J. M. Mat. 1988 *nom. invers. nom. conserv.*
 Qr-P molinietosum J. M. Mat. 1988 *nom. inval.*
 Qr-P typicum J. M. Mat. 1988 *nom. inval.*
 Qr-P coryletosum J. M. Mat. 1988 *nom. inval.*
 Ass. *Serratulo-Pinetum* J. M. Mat. 1988 *ex* Brzeg in Brzeg et M. Wojterska 2004

6.2. General differentiation at the level of associations

Basic documentation

The plant communities diagnosed below are described in detail in the next section of this monograph. The diagnoses presented here concern their easily recognizable, typologically well-defined forms. They do not take into account the forms that markedly deviate from the type, e.g. those impoverished floristically or transformed by human activity. An exception is the documentation of *Serratulo-Pinetum*. All its relevés presented here were recorded in its degenerated forms. The species composition of the plant communities defined so, is shown in a synoptic table based on 787 relevés (Table 3). It presents 3 associations from the class *Quercetea robori-petraeae* (*Aulacomnio androgyni-Quercetum roboris*, col. 1; *Molinio caeruleae-Quercetum roboris*, col. 2; and *Calamagrostio arundinaceae-Quercetum petraeae*, col. 3); as well as 2 associations from the class *Querco-Fagetalia* (*Galio sylvatici-Carpinetum* – acidophilous forms, col. 4, and *Potentillo albae-Quercetum*, col. 5); and 2 associations from the class *Vaccinio-Piceetea* (*Querco roboris-Pinetum*, col. 6; and *Serratulo-Pinetum*, col. 7). Footnotes to the table,

list the sources of the relevés as well as the species that were omitted in the table (for each species, constancy and cover index are given).

Major floristic and phytosociological characteristics of the studied plant associations

- The association *Aulacomnio androgyni-Quercetum* is poorly documented. In the present study, 37 relevés have been assigned to this syntaxon. These include the 25 relevés that constituted the basic documentation of this syntaxon (Brzeg *et al.* 2000a). This association is the only member of the alliance *Dicrano scoparii-Quercion roboris*. The high frequency of characteristic species of the association (*Aulacomnium androgynum*, *Dicranella hetheromalla*, *Herzogiella seligerii*, *Mnium hornum*, *Plagiothecium denticulatum*, *P. laetum*), and the alliance (*Dicranum scoparium*, *Lophocolea heterophylla*, *Plagiothecium curvifolium*, *Pohlia nutans*) indicates that *Aulacomnio-Quercetum* is clearly distinct from other, comparable communities.

An important species, distinguishing the association from other communities of the class *Quercetea robori-petraeae*, is *Carpinus betulus*. Its constant presence in the tree layer makes this association similar to the oak-hornbeam forest *Galio sylvatici-Carpinetum* (Table 3, col. 4). Significant floristic differences, which can be noticed in that table, resolve any possible doubts about their separateness. The common feature of *Aulacomnio-Quercetum* and other acidophilous oak forests is the presence of characteristic and differential species of the class *Quercetea robori-petraeae* (*Carex pilulifera*, *Holcus mollis*, *Melampyrum pratense*, and *Polytrichastrum formosum*).

The alliance *Agrostio capillaris-Quercion* is represented by 2 associations: the *Molinio caeruleae-Quercetum* (Table 3, col. 2) and *Calamagrostio arundinaceae-Quercetum* (Table 3, col. 3).

- *Molinio caeruleae-Quercetum roboris* – in this study, 56 relevés (Table 3, col. 2) have been classified as wet oak forest with *Molinia caerulea*. These include 33 relevés from the analytic table of Brzeg *et al.* (1989), and another 18 relevés from the synoptic table of Brzeg and Kasprowicz (2001). This association has no characteristic species, but is usually distinguished by the presence of *Betula pubescens*, *Molinia caerulea*, *Polytrichum commune*, *Rubus nessensis*, and *Sphagnum girgensohnii*. It is noteworthy that *B. pubescens* and *Sph. girgensohnii* are limited only to some forms of this association, while *M. caerulea*, which reaches in *Molinio caeruleae-Quercetum* the highest constancy and a high cover index, is also a constant component of moist subassociations of 3 other associations: the *Calamagrostio arundinaceae-Quercetum*, *Potentillo albae-Quercetum*, and *Quercus roboris-Pinetum*. Addi-

tionally, *Trientalis europaea* and partly *Picea abies* in lower layers of the vegetation have a similar diagnostic value. The *Molinio-Quercetum* is distinguished from the *Calamagrostio-Quercetum* (particularly from its moist subassociation *Ca-Q molinietosum*) by the negligible contribution of characteristic and differential species of *Calamagrostio-Quercetum* (except for *Calamagrostis arundinacea*). Separation of these 2 units was questioned by J.M. Matuszkiewicz (2001a). He supposed that a regionally characteristic species of the association *Molinio caeruleae-Quercetum* could be *Holcus mollis*. Similarly, W. Matuszkiewicz (2001) considered this species as differential for the association. An analysis of Table 3 shows that those suggestions were wrong. *H. mollis* is a constant component of *Calamagrostio-Quercetum* – not only of *Ca-Q molinietosum*, but also of the other 2 subassociations: the *Ca-Q typicum* and *Ca-Q polygonatetosum* (Table 7). It is also not justifiable to include in the list of regionally differential species of the association *Molinio-Quercetum*, plants like *Carex canescens*, *Lysimachia vulgaris*, *Rubus gracilis* (= *R. villicaulis*) (Brzeg *et al.* 1989), *Oxalis acetosella* (Brzeg & Wojterska 2001), or *Rubus plicatus*, *Agrostis canina*, *Carex nigra*, and *Juncus effusus* (Ratyńska *et al.* 2010). The last 3 species are equally common in the *Aulacomnio-Quercetum* (Table 3) and in the *Ca-Q molinietosum* (Table 7), being an important differential species for this subassociation (Brzeg *et al.* 2001). Constant characteristic or differential species for the class *Quercetea robori-petraeae* in patches of *Molinio caeruleae-Quercetum* are: *Carex pilulifera*, *Holcus mollis*, *Melampyrum pratense*, *Polytrichastrum formosum*, and *Pteridium aquilinum*.

- *Calamagrostio arundinaceae-Quercetum* – in this study, 304 relevés (Table 3, col. 3) have been classified as untransformed patches of the association. It is noteworthy that an earlier description of the association was based on a much lower number of relevés: either 47 (Matuszkiewicz J. M. 1988, 2001a) or 123 (Brzeg *et al.* 2001; Brzeg & Kasprowicz 2001). From the latter group, 80 relevés were selected in the present study, because nearly all the other relevés (42) represent degenerated forms of the association (Table 7). The *Calamagrostio arundinaceae-Quercetum* is well-defined floristically. Its characteristic species (*Hieracium lachenalii*, *H. laevigatum*, and *H. sabaudum*), at least on the regional scale, have their phytosociological optimum in patches of this association. The same applies to *Lathyrus montanus*, which plays an more important role in the other 2 regional races of the association (Brzeg & Kasprowicz 2001). The presented data do not confirm the diagnostic value of *Calamagrostis arundinacea*, which was indicated as one of the characteristic species of the association (see Brzeg *et al.* 2001). Considering the high constancy and cover index, this species

as well as *Festuca ovina* and *Quercus petraea*, were indicated as regionally differential for the *Calamagrostio arundinaceae-Quercetum* within the class *Quercetea robori-petraeae*. In contrast to an earlier report (Brzeg *et al.* 2001), *Festuca heterophylla* does not have such a diagnostic value. This grass species is more strongly associated with poor oak-hornbeam forest and thermophilous oak forest (Table 3). The characteristic species combination of the association includes also diagnostic species of the class *Quercetea robori-petraeae* (*Carex pilulifera*, *Holcus mollis*, *Melampyrum pratense*, *Polytrichastrum formosum* i *Pteridium aquilinum*), and differential species of the alliance *Agrostio capillaris-Quercion* (*Convallaria majalis*, *Luzula pilosa*, *Maianthemum bifolium*, *Moehringia trinervia*, *Poa angustifolia* and *Vaccinium myrtillus*).

The association *Calamagrostio-Quercetum* in the study area develops exclusively as its Wielkopolska race (see p. 31). It must be emphasized that although many relevés were located near the southern limits of Wielkopolska (Fig. 30-32), the contribution of differential species for the South Polish race was negligible.

- The oak-hornbeam forest *Galio sylvatici-Carpinetum* is represented in this study by 114 relevés (Table 3, col. 4) of its acidophilous forms: the *Gs-C holcetosum* and *Gs-C calamagrostietosum arundinaceae*. Most of them (105) have been classified here as the former syntaxon. The present study does not take into account the subassociation *Gs-C lathyretosum*, as this unit is clearly distinct from acidophilous oak forests. Only its relevés reported by Boiński (1973) are considered in later chapters of the present monograph, because he classified them as the *Gs-C calamagrostietosum arundinaceae*.

Characteristic species of the association (*Galium sylvaticum* i *Ranunculus auricomus*) are infrequent in the analysed forms of *Galio-Carpinetum*. This is not a specific feature of the data presented here but is noticeable also in tables of other authors (Krotoska 1966; Matuszkiewicz W. & Matuszkiewicz A 1985; Matuszkiewicz J. M. 2001a). By contrast, its different species, *Carpinus betulus* and *Stellaria holostea* (Table 3, col. 4), have a high diagnostic value. Among other species of the class *Querco-Fagetea*, the most frequent are: *Anemone nemorosa*, *Atrichum undulatum*, *Poa nemoralis*, and *Viola reichenbachiana*. Another significant feature is the constant participation of diagnostic species of the class *Quercetea robori-petraeae* (*Holcus mollis* and *Polytrichastrum formosum*), and of the *Vaccinio-Piceetea* (*Vaccinium myrtillus*). The species composition of this forest type is very similar to that of *Gs-C polytrichetosum* presented by W. Matuszkiewicz and A. Matuszkiewicz (1985).

- *Potentillo albae-Quercetum* – an average species composition of the association is presented in the syn-

optic Table 3, (col. 5), on the basis of 98 relevés. In comparison with the other analysed communities, the *Potentillo-Quercetum* is distinguished by a particularly numerous group of diagnostic species. The most frequent among them are characteristic species of the association (*Carex montana*, *Potentilla alba*, and *Ranunculus polyanthemos*), and of the order *Quercetalia pubescentis* (*Campanula persicifolia*). Differential species include xerothermophilous plants, especially those of the class *Trifolio-Geranietea* (e.g. *Fragaria vesca*, *Poa angustifolia*, *Polygonatum odoratum*, and *Trifolium alpestre*) and of the class *Festuco-Brometea* (e.g. *Euphorbia cyparissias* and *Pimpinella saxifraga*); plants of periodically humid meadows of the class *Molinio-Arrhenatheretea* (e.g. *Betonica officinalis* and *Galium boreale*); and plants of mesophilous deciduous forests from the class *Querco-Fagetea* (*Melica nutans* and *Ajuga reptans*). Specific site conditions in patches of *Potentillo albae-Quercetum* are distinguished also by a constant participation of acidophilous species of the classes *Quercetea robori-petraeae*, *Vaccinio-Piceetea*, and *Calluno-Ulicetea*. However, 3 other species of the class *Quercetea robori-petraeae* are infrequent (*Carex pilulifera*, *Holcus mollis*, and *Polytrichastrum formosum*).

Mixed coniferous forests from the class *Vaccinio-Piceetea* (the *Querco roboris-Pinetum* and *Serratulo-Pinetum*) are a well-defined group, clearly distinct from the other communities presented in Table 3. Their differential species include: *Dicranum polysetum*, *Pleurozium schreberi*, *Pinus sylvestris*, and *Vaccinium vitis-idaea*.

- The *Querco roboris-Pinetum* is described here on the basis of 165 relevés (Table 3, col. 6). Among them, as many as 93% were initially identified by their authors as mixed coniferous forest and assigned to the *Pino-Quercetum* (120 relevés), *Querco-Pinetum* (30 relevés), or *Festuco ovinae-Pinetum* (3 relevés). Another 121 relevés, diagnosed initially as the *Pino-Quercetum*, in the present study, have been classified as other communities, mostly substitute forest communities (47%) or unidentified communities from the class *Quercetea robori-petraeae* (28%), which cannot be assigned to any association. The rich documentation of *Querco-Pinetum* presented by J.M. Matuszkiewicz (1988, 2001a) originates primarily from central and eastern Poland. It comprises 530 relevés, including 55 located in Wielkopolska. Identification of 32 of them as the *Querco-Pinetum* has been confirmed. The other 23 relevés were classified mostly as substitute forest communities.

In the present study, the *Querco roboris-Pinetum* is defined as by J. M. Matuszkiewicz (1988). This syntaxon has no characteristic species. It is unambiguously distinguished from other mixed coniferous forests and acidophilous deciduous forests by the combination of

differential species (Matuszkiewicz J. M. 2001a). The association is represented here by relevés that meet the criteria formulated in the publications cited above. A high diagnostic value is assigned to characteristic species of the alliance *Dicrano-Pinion* (*Pinus sylvestris* and *Dicranum polysetum*), and of the class *Vaccinio-Piceetea*, which are less frequent in acidophilous oak forests (*Hylocomium splendens*, *Pleurozium schreberi*, *Pseudoscleropodium purum*, and *Vaccinium vitis-idaea*). Whenever those species were absent or scanty, but the other floristic criteria were met, the relevés were diagnosed as substitute forest communities from the class *Vaccinio-Piceetea* (Table A35).

The species composition of phytocoenoses identified as the association *Quercus-Pinetum* (Table 3, col. 6) is distinguished by the presence of the above-mentioned characteristic species of the alliance *Dicrano-Pinion* and of the class *Vaccinio-Piceetea*. This contrasts with all the other analysed associations from the classes *Quercus-Fagetum* and *Quercetea roboris-petraeae*. Species of the class *Quercetea roboris-petraeae* (*Carex pilulifera*, *Hieracium lachenalii*, *H. laevigatum*, *H. sabaudum*, and *Holcus mollis*) were infrequent in mixed coniferous forests. Also the *Quercus roboris-Pinetum* (Table 3, col. 6) is clearly distinct from the *Serratulo-Pinetum* (col. 7). Numerous species typical for the latter association are the most useful for differentiating between them.

The above synthetic picture of the species composition of *Quercus-Pinetum* is similar to that presented by J. M. Matuszkiewicz (1988, his Table 4). However, his table is distinguished by e.g. a higher frequency of several species of the class *Quercus-Fagetum* (*Anemone nemorosa*, *Atrichum undulatum*, *Carex digitata*, *Corylus avellana*, and *Poa nemoralis*), which are components of the above-mentioned combination of differential species (Matuszkiewicz J. M. 2001a). The differences result partly from the prevalence of relevés of *Quercus-Pinetum coryletosum* (62%) in the compilation of J. M. Matuszkiewicz (1988), whereas in the present study, 28% of relevés represent this most fertile form of mixed coniferous forest, and partly from the generally lower contribution of these species in mixed coniferous forests in the study area. This question is described in greater detail on p. 82.

- The mixed coniferous forest *Serratulo-Pinetum* is represented by 13 relevés (col. 7). In Poland, this association finds optimum conditions in the north-west (Matuszkiewicz J. M. 1988, 2001a), while the phytocoenoses described here develop at the western edge of its distribution range. Thus it can be assumed that they are impoverished, incompletely developed forms of *Serratulo-Pinetum*. Its definition used here is consistent with the concept of J.M. Matuszkiewicz (1988). The studied phytocoenoses represent the Sarmatic race,

distinguished by the presence of *Galium verum*, *Genista tinctoria*, and *Pimpinella saxifraga*. In the analysed table, an important role is played by species of all the syntaxonomic groups regarded by J.M. Matuszkiewicz (2001a) as diagnostic. Species of the alliance *Dicrano-Pinion* (*Dicranum polysetum*, *Pinus sylvestris*) and of the class *Vaccinio-Piceetea* (*Hylocomium splendens*, *Orthilia secunda*, *Pleurozium schreberi*, *Vaccinium myrtillus*, *V. vitis-idaea*) are frequent, and only *Trientalis europaea* is less common. Plants associated with thermophilous oak forest and other xerothermophilous species of the class *Trifolio-Geranietea* appear in large numbers. Species of the class *Quercus-Fagetum* are represented mainly by *Anemone nemorosa* and *Viola riviniana*. In comparison with the other associations, it is confirmed that regionally characteristic species for the *Serratulo-Pinetum* include *Orthilia secunda* (as indicated earlier by J. M. Matuszkiewicz 1988, 2001a) as well as *Chamaecytisus ratisbonensis*, *Koeleria grandis*, and *Pulsatilla vernalis* (as indicated also by Ratyńska et al. 2010).

Interpretation of the floristic variation of the studied plant associations

The presented differentiation of the studied communities at the level of associations (Table 3) is confirmed by results of detrended correspondence analysis DCA (Fig. 14). Interpretation of this diagram, taking into account diagnoses of individual relevés by the classical phytosociological analysis, allowed separation of quite homogeneous and compact clusters of the relevés documenting the studied plant associations. The most homogeneous are clusters of relevés of 3 associations. The designated cluster of *Potentillo albae-Quercetum* comprises 103 relevés, including 89 of this association, which constitutes 91% of all its analysed relevés. The cluster of *Galio sylvatici-Carpinetum* is composed of 114 relevés, including 101 (89%) of this association, while the cluster of *Calamagrostio arundinaceae-Quercetum* encompasses 308 relevés, including 270 (89%) of this association.

DCA does not allow to distinguish between mixed coniferous forests *Quercus roboris-Pinetum* and *Serratulo-Pinetum*, and between moist forms of acidophilous oak forests, i.e. the *Molinio caeruleae-Quercetum*, and *Aulacomnium androgyni-Quercetum*. However, both the pairs of associations form clear, isolated clusters. The former cluster comprises 170 relevés, including 90% of all relevés of *Quercus-Pinetum*, and 92% of *Serratulo-Pinetum*. The second cluster consists of 91 relevés, which account for 96% of analysed relevés of *Molinio caeruleae-Quercetum*, and for 89% of *Aulacomnium androgyni-Quercetum*.

Distribution of the points (relevés) in the DCA ordination space is justified by differences in floristic

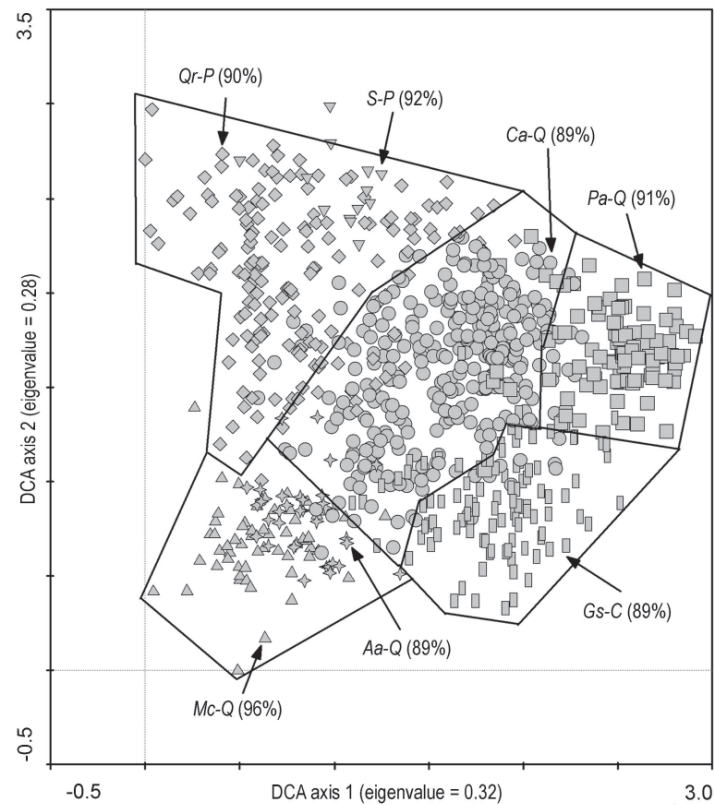


Fig. 14. DCA ordination of 787 relevés classified according to the classical phytosociological method
 Explanations: Calculations for quantitative data with down-weighting of rare species. Tree species were not taken into account. The percentage of relevés of the given association located within a delimited area is enclosed in brackets

structure, reflected in numbers of species from various syntaxonomic groups (Fig. 15, Table 4). The cluster of relevés of *Potentillo albae-Quercetum* is the richest in herbaceous species, correlated with a high contribution of xerothermophilous species of the order *Quercetalia*

pubescentis, as well as of the classes *Festuco-Brometea* and *Trifolio-Geranietea*. The cluster of relevés of mixed coniferous forest is clearly separated from that of thermophilous oak forest. The *Quercus-Pinetum* is characterized by a high contribution of species of the moss

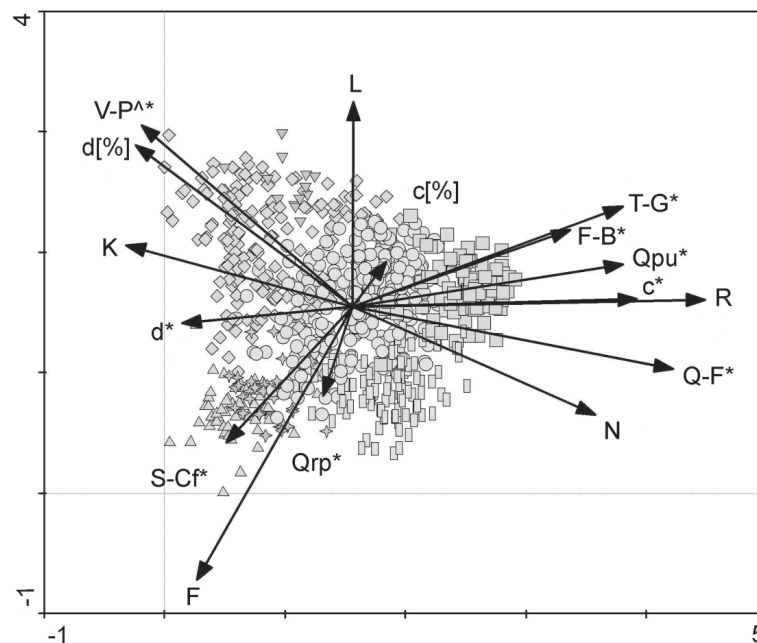


Fig. 15. Passive projection (arrows) of mean Ellenberg indicator values and floristic diversity as percentage [%] or number of species (*), onto the DCA ordination diagram of 787 relevés
 Explanations: F – soil moisture, K – continentality, L – light, N – soil productivity, R – soil reaction; others abbreviations as in Table 4

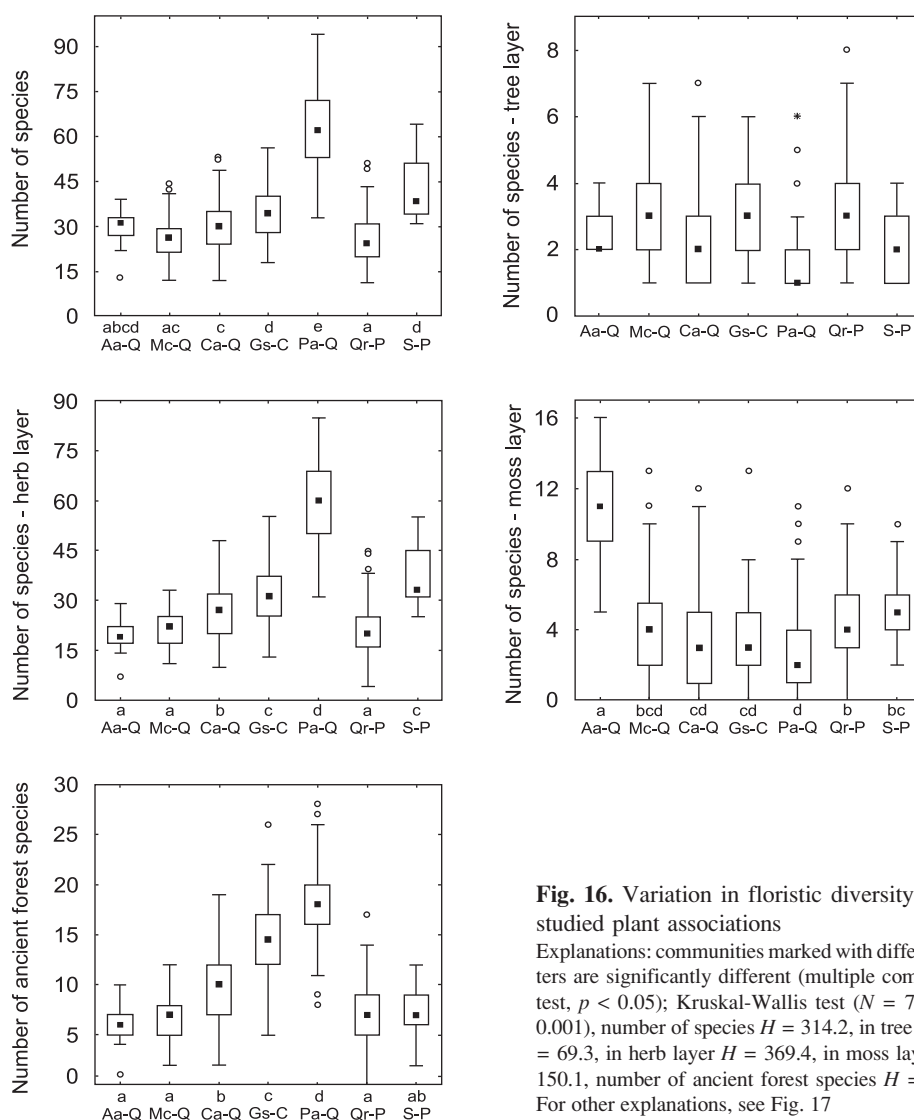


Fig. 16. Variation in floristic diversity of the studied plant associations

Explanations: communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$); Kruskal-Wallis test ($N = 787$, $p < 0.001$), number of species $H = 314.2$, in tree layer $H = 69.3$, in herb layer $H = 369.4$, in moss layer $H = 150.1$, number of ancient forest species $H = 407.9$. For other explanations, see Fig. 17

layer (reaching high coverage), as well as species of the class *Vaccinio-Piceetea*. The high soil moisture content of the sites of *Aulacomnio-Quercetum* and *Molinio-Quercetum* is reflected in a significantly higher contribution of species of the class *Scheuchzerio-Caricetea fuscae*.

The general variation of the major floristic features of the analysed communities is illustrated in Fig. 16. Their tree layer was composed of a relatively low number of species. This applies particularly to patches of *Potentillo albae-Quercetum* (composed mostly of *Quercus petraea*), *Aulacomnio-Quercetum* (*Q. robur* and *Carpinus betulus*), *Calamagrostio-Quercetum* (*Q. petraea* and *Q. robur*), and *Serratulo-Pinetum* (dominated by *Pinus sylvestris*, with an admixture of *Betula pendula* and both numbers of species). The other 3 communities had a slightly more diverse canopy: the *Molinio-Quercetum* (dominated by *Q. robur* with an admixture of *B. pendula*, *P. sylvestris*, *Picea abies*, *Carpinus betulus*, etc.), *Galio-Carpinetum* (oak-hornbeam forest stands with an admixture of *B. pendula*,

etc.), and *Quercio-Pinetum* (mostly *P. sylvestris*, with the participation of *Q. robur*, *Q. petraea*, *B. pendula*, etc.).

The phytocoenoses of *Potentillo-Quercetum* were most diverse floristically and significantly different from the other syntaxa (Fig. 16). The *Serratulo-Pinetum* is also very rich in herbaceous species. The lowest diversity of herbaceous plants was recorded in patches of *Quercio-Pinetum*, *Molinio-Quercetum*, and *Aulacomnio-Quercetum*. The last mentioned association was distinguished by the highest number of species in the moss layer.

Ancient forest plant species (AFS) were most numerous in relevés of *Potentillo aalbae-Quercetum* and *Galio sylvatici-Carpinetum*. Those patches comprised additionally the largest number of species of the class *Quercio-Fagetea*, which includes many species of the ecological group considered here. The contribution of AFS was relatively high also in the *Calamagrostio-Quercetum*, while the lowest in both mixed coniferous forest associations from the class *Vaccinio-Piceetea*

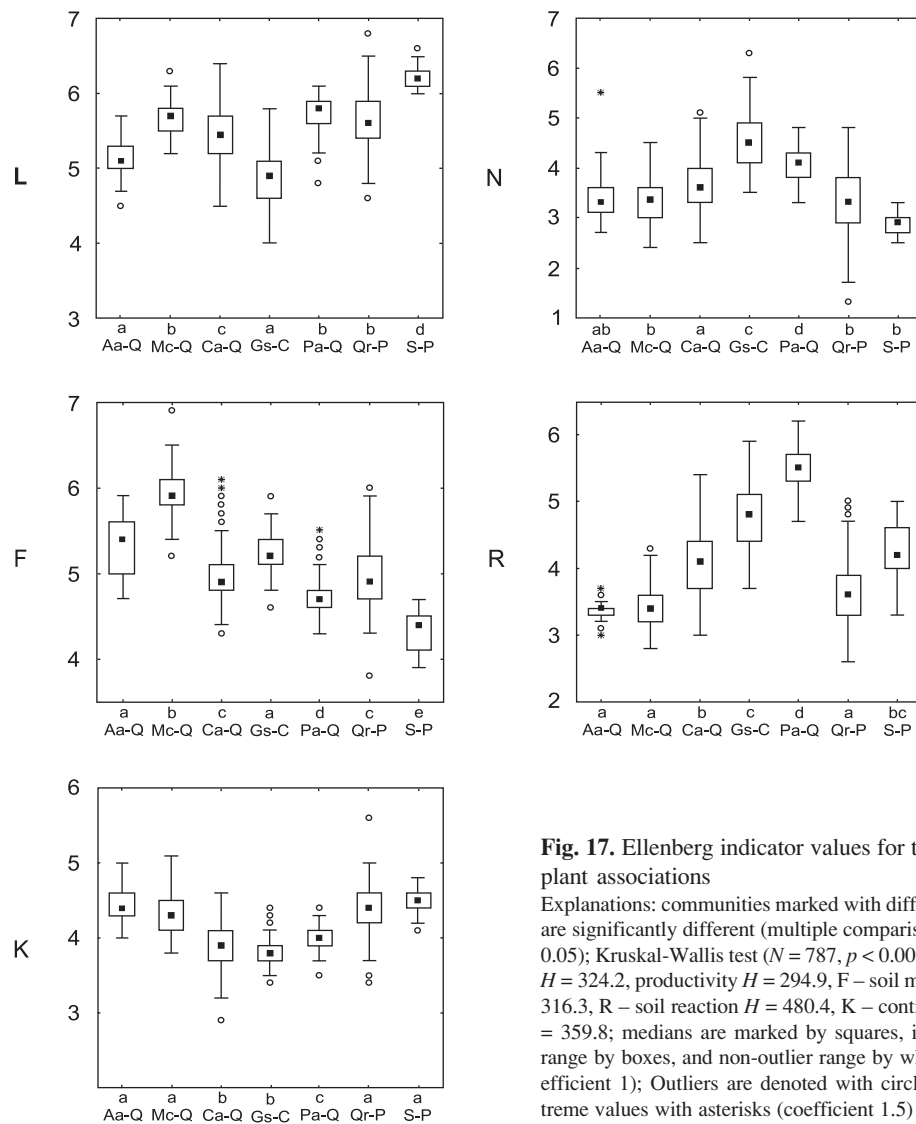


Fig. 17. Ellenberg indicator values for the studied plant associations

Explanations: communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$); Kruskal-Wallis test ($N = 787$, $p < 0.001$), L – light $H = 324.2$, productivity $H = 294.9$, F – soil moisture $H = 316.3$, R – soil reaction $H = 480.4$, K – continentality $H = 359.8$; medians are marked by squares, interquartile range by boxes, and non-outlier range by whiskers (coefficient 1); Outliers are denoted with circles, and extreme values with asterisks (coefficient 1.5)

(*Serratulo-Pinetum* and *Querceto-Pinetum*) and the other acidophilous oak forests, i.e. the *Aulacomnio-Quercetum* and *Molinio-Quercetum*. The small number of species of the order *Quercetalia robori-petraeae* (5%) in the European list of AFS, including 132 species, was emphasized earlier by Hermy *et al.* (1999). Thus it can be assumed that the small contribution of AFS in the 4 communities mentioned above may be natural, rather than associated with human impact.

Analysis of selected site indicators

The DCA diagram of variation of the analysed relevés, taking into account mean Ellenberg indicator values, indicates that relevés distributed along the first ordination axis differ in soil reaction and calcium content (R), productivity (N), and continentality (K). The second axis shows differences between the communities in their plant preferences with respect to light (L) and moisture (F) (Fig. 15). These differences, statistically significant (Table 4), are confirmed by results of analysis of variance (Kruskal-Wallis test, Fig. 17).

Summarizing the above analyses (Fig. 15-17, Table 4), the following conclusions can be drawn.

- The value of L did not vary widely. Mean L values of individual relevés indicate that most species were typical of half shade (L=5). The most shaded conditions were under the canopy of *Carpinus*-dominated forest stands of *Aulacomnio-Quercetum* and *Galio-Carpinetum*. Access to light was the highest in the mixed coniferous forest *Serratulo-Pinetum*, whose canopy was less dense, dominated by *Pinus*. More light-demanding plants (L=7) found favourable conditions in several relevés of *Querceto-Pinetum*.
- The phytocoenoses of *Molinio caeruleae-Quercetum* were composed mostly of plants preferring relatively moist sites (F=6). The contribution of plant indicators of intermediate soil moisture (F=5) was significantly higher in patches of *Aulacomnio androgyni-Quercetum* and *Galio sylvatici-Carpinetum*. Slightly lower but significantly different F values were recorded in relevés of *Calamagrostio-Quercetum* and *Querceto-Pinetum*. Patches of *Potentillo-Quercetum*

and *Serratulo-Pinetum* consisted primarily of plant indicators of soils intermediate between fresh and dry ($F=4$).

- c) Mixed coniferous forests (*Querco-Pinetum* and *Serratulo-Pinetum*) and 2 associations of acidophilous oak forests (*Aulacomnio-Quercetum* and *Molinio-Quercetum*) were composed mostly of plant indicators of nutrient-poor sites ($N=3$). Oak forests from the class *Querco-Fagetea* (*Galio-Carpinetum* and *Potentillo-Quercetum*) were dominated by plant indicators of medium fertility ($N=5$).
- d) Soil reaction indicator values in all the studied relevés varied from $R=3$ (acidic soils) to $R=5$ (moderately acidic soils). R values were significantly lowest in the mixed coniferous forest *Querco-Pinetum* and 2 associations of acidophilous oak forests *Aulacomnio-Quercetum* and *Molinio-Quercetum*, while the highest in the thermophilous oak forest *Potentillo-Quercetum*.
- e) The studied associations only slightly varied in continentality, but formed 2 significantly different groups. One group composed of *Calamagrostio-Quercetum* and *Galio-Carpinetum* is dominated by plant species whose centre of distribution is in Central Europe ($K=4$). This group is composed of *Calamagrostio-Quercetum* and *Galio-Carpinetum*. The second group includes mixed coniferous forests (*Querco-Pinetum* and *Serratulo-Pinetum*) and the remaining 2 associations of acidophilous oak forests (*Aulacomnio-Quercetum* and *Molinio-Quercetum*). They are distinguished by a significantly higher contribution of species intermediate between weakly oceanic and weakly subcontinental ones ($K=5$). The thermophilous oak forest *Potentillo albae-Quercetum* in this analysis is intermediate between the 2 groups mentioned above.

6.3. Detailed descriptions of plant communities

6.3.1. *Aulacomnio androgyni-Quercetum roboris* Brzeg et Kasproicz in Brzeg et al. 2000

Basic documentation

The 37 relevés representing this association here (Tables 5 and A1) include all (25) relevés from the table of Brzeg et al. (2000a).

Distribution

Phytocoenoses of *Aulacomnio-Quercetum* were documented in the study area in 10 basic ATPOL squares (10 km × 10 km each, Fig. 18), which are regarded as localities here. Most of them (8), according to the geobotanical regionalization of J. M. Matuszkiewicz (1993, 2008a, Fig. 4b here) are located in the Kalisz Plateau (Wysoczyzna Kaliska) within the South Wielkopolska Subregion (Podkraina Południowo-wielkopolska), and is associated mostly with the part

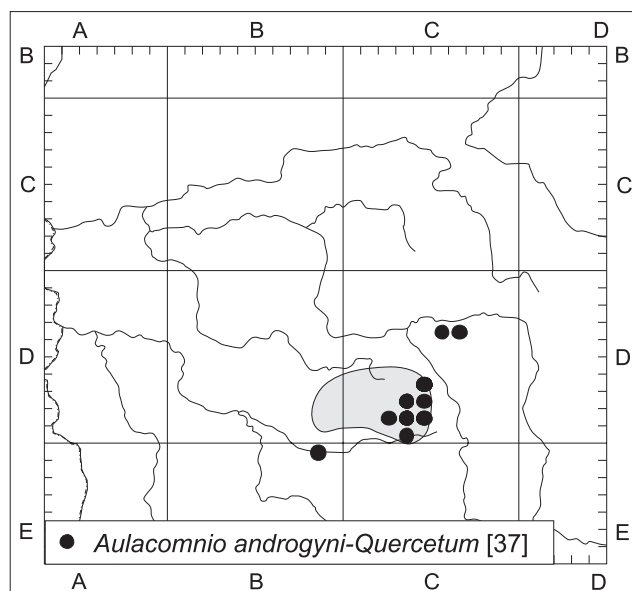


Fig. 18. Distribution of localities of *Aulacomnio androgyni-Quercetum* (number of relevés given in brackets). The Krotoszyn Plateau (Płyta Krotoszyńska) is shaded

known as the Krotoszyn Plateau. According to the forest regionalization (Trampler et al. 1990), the *Aulacomnio-Quercetum* is distributed mostly in the Krotoszyn District (Dzielnica Krotoszyńska) within the Wielkopolska-Pomeranian Region (Kraina Wielkopolsko-Pomorska).

Vertical structure and species composition

In respect of vertical structure, phytocoenoses of the association did not vary at the level of subassociations (Fig. 19). Generally, the studied patches had well-defined upper and lower tree layers. In the upper layer (a1), coverage reached 25-70%, compared to 20-90% in the lower layer (a2). In individual relevés, usually 2-3 tree species were found in the canopy. These included mostly *Quercus robur* in a1 and *Carpinus betulus* in a2. The most frequent admixture was *Betula pendula*. Both *Picea abies* and *Pinus sylvestris* were very rare.

The shrub layer (b) was absent in several of the studied phytocoenoses. Usually, however, its coverage was negligible, and it was composed mostly of *Frangula alnus* and *Carpinus betulus*. The coverage of the herb

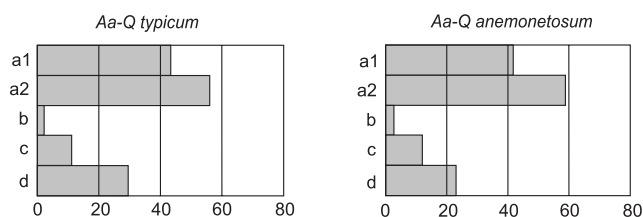


Fig. 19. Scheme of the vertical structure of subassociations of *Aulacomnio androgyni-Quercetum*.

Explanations: bars denote the percent cover of vegetation layers

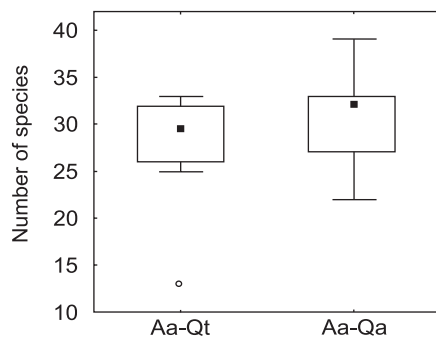


Fig. 20. Variation in number of species in relevés of subassociations of *Aulacomnium androgyni-Quercetum*

Explanations: Aa-Qt – *Aulacomnium androgyni-Quercetum* typicum, Aa-Qa – *Aulacomnium androgyni-Quercetum* with *anemonetosum*

layer (c) typically varied from negligible to 40% (Table A1), but in one relevé (23) it reached 80%, thanks to *Vaccinium myrtillus*. That relevé documented a forest stand with only one tree layer, so it was not taken into account when constructing the synthetic picture of the vertical structure of the association (Fig. 19). The highest constancy (4 or 5) in the table was reached by several species. Among them, *Carex pilulifera*, *Luzula pilosa*, *Maianthemum bifolium*, and *Vaccinium myrtillus* were most abundant (usually 1-2, exceptionally 5). Minor components of that layer were *Carpinus betulus*, *Deschampsia caespitosa*, *Frangula alnus*, *Holcus mollis*, *Melampyrum pratense*, and *Sorbus aucuparia*. Bryophytes were recorded in all relevés, and their coverage reached 5- 60% (mean 26%). Most constant com-

ponents of that layer were *Aulacomnium androgynum*, *Dicranella heteromalla*, *Dicranum scoparium*, *Hypnum cupressiforme*, *Mnium hornum*, *Plagiothecium curvifolium*, *P. laetum* and *Pohlia nutans*.

In Table A1 (see also Table 3), 113 plant species were recorded. These include a particularly large group of 32 species of bryophytes and lichens. In individual relevés, their number varied from 5 to 16. The number of vascular plant species ranged from 7 to 29 (Fig. 20).

Subdivision based on habitat variation

In the present study (in accordance with Brzeg *et al.* 2000a; see also Brzeg & Kasproicz 2001), 2 subassociations are distinguished:

- *Aulacomnium androgyni-Quercetum roboris typicum* Brzeg *et* Kasproicz in Brzeg *et al.* 2000 (Table 5, col. 1 i 2),
- *Aulacomnium androgyni-Quercetum roboris anemonetosum nemorosae* Brzeg *et* Kasproicz in Brzeg *et al.* 2000 (Table 5, col. 3 i 4).

Each of them is subdivided into 2 variants. Their species composition is presented in the synoptic Table 5 and the analytic Table A1.

The number of species recorded in individual relevés of these subassociations varied from 13 to 33 in the *Aa-Q* typicum, and from 22 to 39 in the *Aa-Q* anemonetosum. The differences are not statistically significant (Fig. 20).

The *Aa-Q* typicum is characterized by a very small contribution of mesophilous species of deciduous forests from the class *Querco-Fagetea* (except *Carpinus*

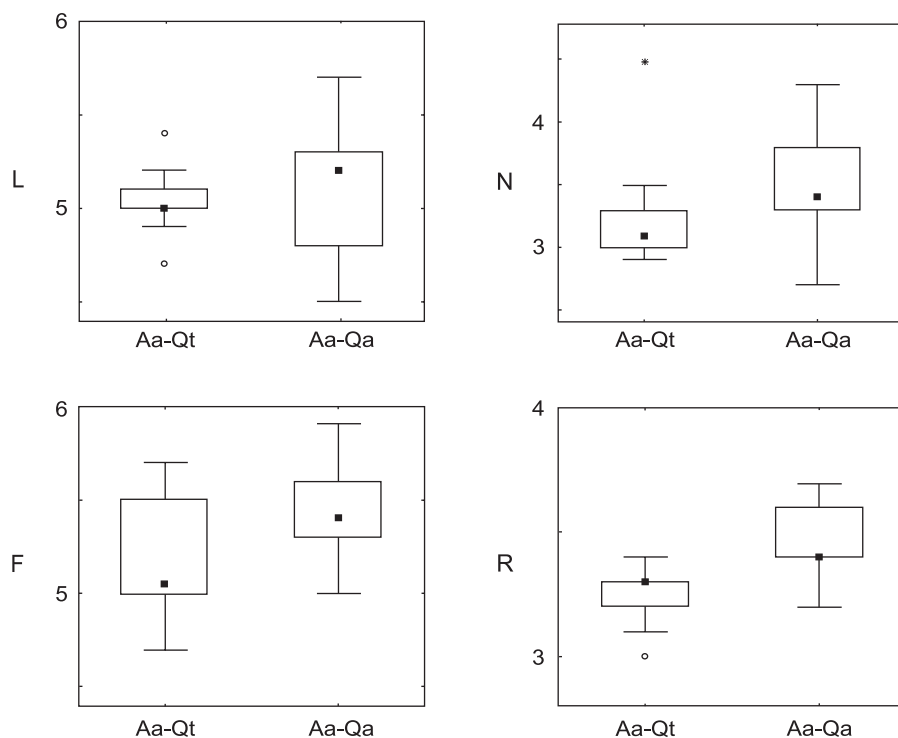


Fig. 21. Ellenberg indicator values for subassociations of *Aulacomnium androgyni-Quercetum*

Explanations: Mann-Whitney *U* test, L – light *U* = 117.5, *Z* = -1.378, *p* = 0.175, F – soil moisture *U* = 89, *Z* = -2.288, *p* = 0.024, N – soil productivity *U* = 75.5, *Z* = -2.69, *p* = 0.0062, R – soil reaction *U* = 42, *Z* = -3.805, *p* < 0.001. For other explanations, see Fig. 17

betulus and *Fagus sylvatica*). Also the role of species of coniferous forests from the class *Vaccinio-Piceetea* in the typical variant of the subassociation is relatively low, while in the variant with *Pleurozium schreberi* they are classified as differential species: *Hylocomium splendens*, *Picea abies*, *Pleurozium schreberi*, *Trientalis europaea*, and *Vaccinium myrtillus* (Table 5).

The subassociation *Aa-Q anemonetosum* is well distinguished by a group of differential species. Among them, the highest constancy in the table was reached by *Anemone nemorosa*, *Agrostis canina*, *Juncus effusus*, and *Oxalis acetosella* (see Brzeg *et al.* 2000a; Brzeg & Kasprowicz 2001). Differentiation of this subassociation into variants is equally conspicuous and based on the same species (except *Vaccinium myrtillus*) as within the typical subassociation (Table 5). In the typical variant of *Aa-Q anemonetosum*, a greater role is played by *Milium effusum* and *Stellaria holostea*.

Analysis of selected site indicators

Authors of the formal description of the association *Aulacomnio androgyni-Quercetum* reported that its variation, presented above, results from differences in site conditions, mostly in fertility (Brzeg *et al.* 2000a). This opinion is confirmed here by the analysis of Ellenberg indicator values (Fig. 21, N and R). Additionally the subassociations differ in the contribution of species varying in moisture requirements (Fig. 21 F).

Patches of the association were dominated by plants preferring fresh soils (F=5), poor in nutrients (N=3), and highly acidic (R=3). However, values of these indicators were slightly but significantly higher in the *Aa-Q anemonetosum*. The forest floor was most favourable for half shade plants (L=5) in both subassociations.

6.3.2. *Molinio caeruleae-Quercetum roboris* (R. Tx. 1937) Scam *et Pass.* 1959 *em.* Brzeg, Kasprowicz *et* Krotoska 1989

Basic documentation

This association is poorly documented. Most (51) of the 56 relevés shown in Table 6 and A2 were previously presented in a synoptic table by Brzeg & Kasprowicz (2001), including 7 relevés of Krotoska and Piotrowska (1962), who classified them as the *Pino-Quercetum*.

Distribution

Phytocoenoses of this association were found in 12 ATPOL squares. Their distribution pattern (Fig. 22) resembles the above-mentioned distribution of localities of *Aulacomnio-Quercetum* (Fig. 18). As many as 10 of them, according to the geobotanical regionalization of J. M. Matuszkiewicz (1993), are located in the Kalisz Plateau within the South Wielkopolska Sub-region. According to the forest regionalization (Tram-

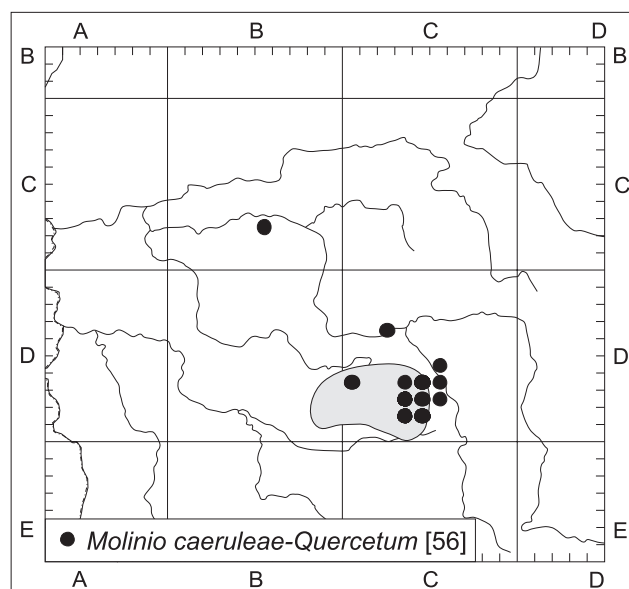


Fig. 22. Distribution of localities of *Molinio caeruleae-Quercetum* (number of relevés given in brackets). The Krotoszyn Plateau (Płyta Krotoszyńska) is shaded

pler *et al.* 1990), it lies in the Krotoszyn District within the Wielkopolska-Pomeranian Region (see also Fig. 4c here). The centre of distribution of *Molinio caeruleae-Quercetum* is the Krotoszyn Plateau (Brzeg *et al.* 1989, Brzeg & Kasprowicz 2001).

Vertical structure and species composition

In the studied patches of *Molinio-Quercetum*, the canopy was composed of 1-2 layers (Fig. 23). One-layered canopy was formed by 1-4 species, while 2-layered by 2-5 (exceptionally 6-7) species. In both groups, *Quercus robur* was the dominant. However, if the canopy was 2-layered, *Q. robur* was found mostly in

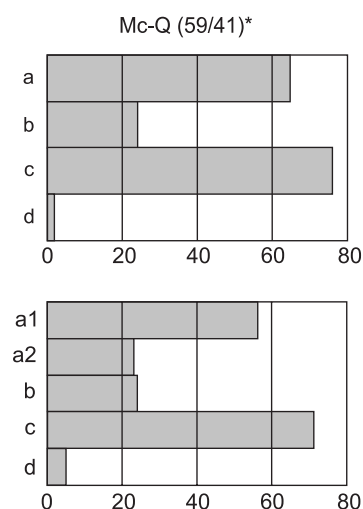


Fig. 23. Scheme of the vertical structure of *Molinio caeruleae-Quercetum roboris*

Explanations. One and two-layered tree-stands are shown on separate diagrams; bars denote the percent cover of vegetation layers; * – percent contributions of relevés with one/two-layered canopy

the upper layer (a1), accompanied by *Betula pendula* and *Pinus sylvestris*. Major components of the lower tree layer (a2) were: *Picea abies*, *B. pubescens*, *Betula pendula*, *Sorbus aucuparia*, and *Carpinus betulus*. The last mentioned species was quite abundant in several relevés. The coverage of a1 as well as a2 varied between relevés from 30% to 80%. If the canopy was one-layered, its coverage ranged from 40% to 90%.

The shrub layer was absent in only 2 relevés. In the others, irrespective of tree layer structure, its coverage varied from negligible to 70% (mean 24%). Its major component was *Frangula alnus*. *Picea abies* reached also a high constancy in the table. Its presence is probably natural, as evidenced by its abundant natural regeneration and location of the studied relevés near the northern limit of *Picea abies* distribution range in Wielkopolska (see also Boratyńska 1998).

The herb layer (c) was always well-developed, and its cover varied between relevés from 50% to 95%. In most of the relevés (53) it was dominated by *Molinia caerulea*, whose Braun-Blanquet cover-abundance reached 3-5. In single relevés, also *Calamagrostis arundinacea*, *Deschampsia caespitosa*, *Pteridium aquilinum*, *Triantalis europaea*, and *Vaccinium myrtillus* were more abundant. The moss layer was nearly always present but poorly developed (its coverage ranging from negligible to 30%), and its most frequent species was *Polytrichastrum formosum*.

In the 56 analysed relevés of the association, 135 plant species were recorded. Individual relevés included

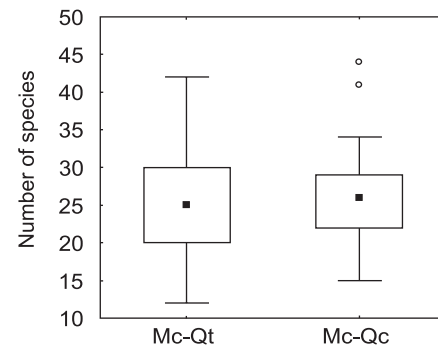


Fig. 24. Variation in number of species in relevés of variants of *Molinio caeruleae-Quercetum*

Explanations: Mc-Qt – *Molinio caeruleae-Quercetum* typical variant, Mc-Qc – *Molinio caeruleae-Quercetum* variant with *Calamagrostis arundinacea*

12-44 species (mean 26). There were no significant differences in species richness between the variants of *Molinio-Quercetum* described below (Fig. 24).

Subdivision based on habitat variation

Patches of the association *Molinio-Quercetum* are relatively homogenous in respect of species composition. In the basic table of the community, a form with *Calamagrostis arundinacea* was distinguished, and it was subdivided into 2 variants: with *Carex canescens* and with *Sphagnum girgensohnii* (Brzeg *et al.* 1989). Later on, that subdivision was improved by the separation of 2 variants: typical and with *Calamagrostis arundinacea*, and within the latter, 2 subvariants: typical and with *Sphagnum girgensohnii* (Brzeg & Kasproicz

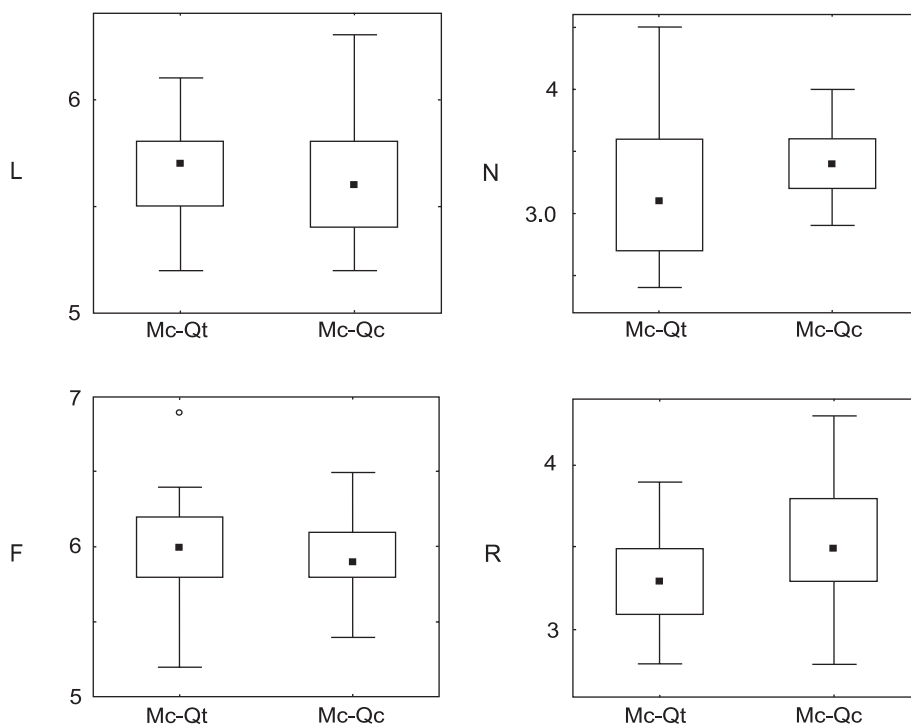


Fig. 25. Ellenberg indicator values for variants of *Molinio caeruleae-Quercetum*

Explanations: Mann-Whitney *U* test, L – light $U = 313.5$, $Z = 1.293$, $p = 0.1196$, F – soil moisture $U = 339.0$, $Z = 0.898$, $p = 0.385$, N – soil productivity $U = 282$, $Z = -1.802$, $p = 0.072$, R – soil reaction $U = 241.5$, $Z = -2.477$, $p = 0.013$. For other explanations, see Fig. 17

2001). The species composition of the association, as defined above, is shown in the analytic Table A2 and in the synoptic Table 6.

The typical variant, represented by 27 relevés, has no differential species. However, it is distinguished by a higher constancy of *Pinus sylvestris* and a very low frequency of *Carpinus betulus* in the tree layer (Table 6). In the analytic Table A2, probably because of differences in forest management, 2 forms of the community were distinguished. The first one (relevés 1-18) has a canopy dominated by *Quercus robur* and a well-developed shrub layer. In many relevés, this layer is composed mostly of *Frangula alnus*. The second form (relevés 19-27) is distinguished by *Quercus petraea* as a major component of the tree layer.

The variant with *Calamagrostis arundinacea*, documented by 29 relevés (28-56), is also characterized by the presence of *Betula pubescens*. In some of its patches, the contribution of *Carpinus betulus* to the tree layer was higher. This community is divided into 2 subvariants: typical (relevés 37-56), and with *Sphagnum girgensohnii* (relevés 28-36), distinguished also by the presence of *Carex canescens* (Table A2).

Analysis of selected site indicators

Ellenberg indicator values of plant species recorded in the studied variants of *Molinio-caeruleae-Quercetum* show that these syntaxa differ significantly only in soil reaction (Fig. 25). Patches of both variants were characterized by the presence of plant indicators of moderately moist soils (F=6, intermediate between fresh and moist), poor in nutrients (N3) and highly acidic (R=3). The forest floor was most favourable for half shade plants (L=5), or slightly more light-demanding species (L=6).

6.3.3. *Calamagrostio arundinaceae-Quercetum petraeae* (Hartmann 1934) Scamoni *et Pass.*
1959 *em.* Brzeg, Kasprowicz *et* Krotoska 1989

Basic documentation

As a result of a classical phytosociological analysis, 792 relevés have been assigned to the *Calamagrostio arundinaceae-Quercetum* in the present study. These include most of the 588 relevés representing this syntaxon according to the author's diagnosis, and relevés initially identified as other associations, mostly the *Pino-Quercetum* (125), *Fago-Quercetum* (18), and *Galio (Quercus)-Carpinetum* (16). All the relevés were collected in 17 analytic tables (A3-A19), which show the species composition of subassociations and variants of *Calamagrostio arundinaceae-Quercetum*, taking into account the symptoms of its degeneration. The high habitat variation, observed in both well-preserved and degenerated phytocoenoses, is shown in the synoptic Tables 7-9. They include 780 relevés. Twelve relevés were excluded, as they represented mixed patches with

indicator species of both *Ca-Q molinietosum* and *Ca-Q polygonatetosum*. Those relevés are compiled in the analytic Table A19.

Distribution

The *Calamagrostio arundinaceae-Quercetum* represents the Central European lowlands type of distribution (Matuszkiewicz J. M. 2001b). The first map of its distribution in Poland was presented by J. M. Matuszkiewicz (1988). As mentioned above, it is based on only 47 relevés (Fig. 26a). Later research did not change its distribution pattern dramatically. The distribution pattern of the continuous part of the potential biochore of *Calamagrostio-Quercetum* on the map of potential natural vegetation of Poland (W. Matuszkiewicz *et al.* 1995; Fig. 26b) is similar to its distribution pattern suggested on the latest map of European vegetation (Bohn *et al.* 2003; see Fig. 26e).

Localities or potential sites of this oak forest type are very unevenly distributed. They are concentrated in the western and southern parts of its distribution range (Fig. 26a-c). This is noticeable also on the original map of J. M. Matuszkiewicz (2001a), whose simplified version is presented in Fig. 26d. The cited author indicated the *Calamagrostio-Quercetum* as an association characteristic for the Brandenburg-Wielkopolska Division (Dział Brandenbursko-Wielkopolski) according to the geobotanical regionalization of J. M. Matuszkiewicz (1993). The importance of *Calamagrostio arundinaceae-Quercetum* differs between geobotanical regions of the Division. In the Lower Silesia Region (Kraina Dolnośląska) and the South Wielkopolska-Lusatia Region (Kraina Południowowielkopolsko-Łużycka), the *Calamagrostio-Quercetum* is common and prevails over the *Quercus-Pinetum* on sites of mixed coniferous forest (BM). In the Noteć-Lubusz Region (Kraina Notecko-Lubuska) and Central Wielkopolska Region (Kraina Środkowowielkopolska), the *Calamagrostio-Quercetum* is less common, and the *Quercus-Pinetum* prevails on sites of mixed coniferous forest. The latter association nearly completely dominates on sites of mixed coniferous forest in the Kujawy Region (Kraina Kujawska), where the *Calamagrostio-Quercetum* is rare (Matuszkiewicz J. M. 1993, 2001b).

In the present study, the cartogram of distribution of *Calamagrostio-Quercetum* in Wielkopolska and in neighbouring areas is based on 595 relevés of the association (including 291 documenting stage I of degeneration) found in 91 basic ATPOL squares (Fig. 26f, see also Figs. 30-31). However, 185 relevés were excluded, as they represented its more degenerated forms (stages II and III of degeneration, see also Table 7, col. 7-12). The distribution of localities of the more degenerated forms of *Calamagrostio-Quercetum* is presented in separate cartograms (Figs. 32-33).

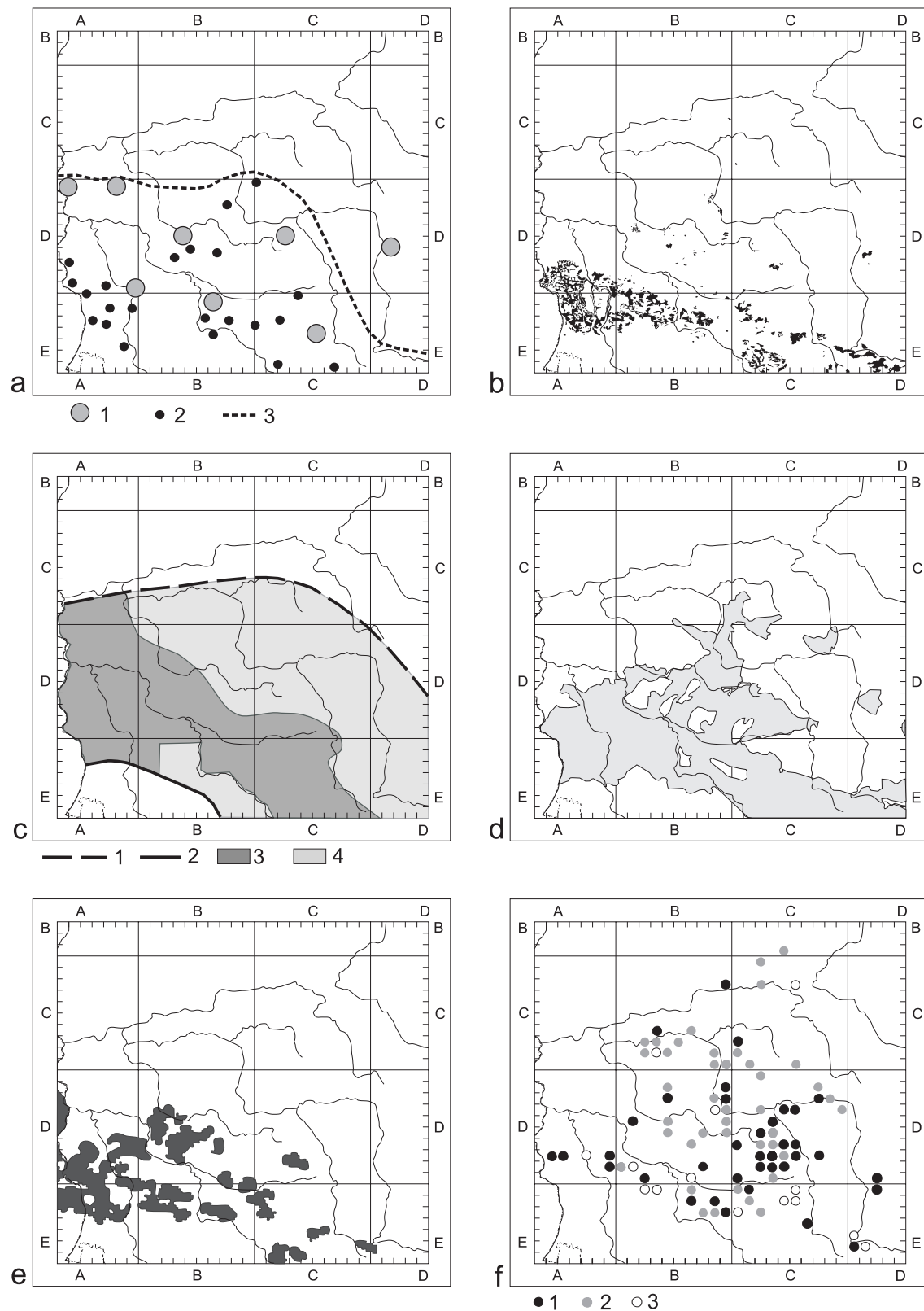


Fig. 26. Actual and potential distribution of *Calamagrostio arundinaceae-Quercetum petraeae*

- Matuszkiewicz J. M. (1988), simplified, 1 – distribution of relevés, 2 – localities without phytosociological documentation, 3 – presumed eastern limit of distribution
- Matuszkiewicz W. *et al.* (1995), potential distribution of the association's biochore
- Matuszkiewicz W. & Matuszkiewicz J. M. (1996), Matuszkiewicz W. (2001), simplified, 1 – location of the association's range limit uncertain or conventional, 2 – location of the range limit certain, 3 – moderate role of the association in the landscape: the association or its potential habitat are constant elements of the landscape, 4 – unimportant role of the association in the landscape: the association or its potential habitat are rare and cover small surfaces
- Matuszkiewicz J. M. (2001a), simplified, geographic range of the association
- Bohn *et al.* (2003), potential range of the association
- Kasprowicz (original), distribution of relevés on the ATPOL grid, 1 – untransformed patches, 2 – untransformed or in stage I of degeneration, 3 – in stage I of degeneration

It is interesting to interpret the distribution of localities of *Calamagrostio-Quercetum* in comparison with the above-mentioned geobotanical regionalization (J.M. Matuszkiewicz 1993; Fig. 4b). Disregarding Silesia, which is located outside the study area, nearly half of localities (ATPOL squares) of untransformed patches of the association (46%) are located in the South Wielkopolska-Lusatia Region. The Noteć-Lubusz Region and the Central Wielkopolska Region include 25% and 23%, respectively, while the Kujawy Region includes 6% of all its localities in the Brandenburg-Wielkopolska Division. Degenerated forms of *Calamagrostio-Quercetum* have a similar distribution pattern. Thus the structure of its range corresponds to an earlier assessment of its distribution, presented by J.M. Matuszkiewicz (1993, 2001a) on the basis of preliminary data. When commenting on its distribution in Poland, he noted also that its range and proportions of its localities in individual regions are uncertain, mostly because of difficulties in separating oak forests of this type from mixed coniferous forests, particularly in managed forests, and the available data are far from complete (Matuszkiewicz J. M. 2001b: 267). The diagram (Fig. 26f) presenting a part of the range of *Calamagrostio-Quercetum* is devoid of many of those drawbacks. However, it still may reflect, to some extent, the availability of data on these forests. A clear relationship between the areal contribution of oak forests (Fig. 7) and distribution of localities of the association, seems to contradict this argument.

The resultant picture of distribution of *Calamagrostio-Quercetum* in the study area is most similar to that presented by J.M. Matuszkiewicz (2001a), but it moves its limit northwards (Fig. 26). The relevés located near this limit represent mostly the Wielkopolska race rather than the West Pomeranian race (see also Table 2). According to J.M. Matuszkiewicz (1988, 2001a) and W. Matuszkiewicz (2001), its West Pomeranian race should be classified as the *Fago-Quercetum*.

In light of results of this study, the distribution of potential sites of *Calamagrostio-Quercetum* needs to be corrected to a large extent, especially in the central and northern parts of its range. It is noteworthy that the map of potential natural vegetation of Poland (Matuszkiewicz W. *et al.* 1995; Matuszkiewicz J. M. 2008b) includes data from earlier published maps of potential vegetation of Lubusz Lakeland (Pojezierze Lubuskie), recorded in 1969-1971 (Wojterski 1972; Wojterski *et al.* 1974), central Wielkopolska (Wojterski *et al.* 1978; field research in 1972-1977, see also Wojterski *et al.* 1981), and the catchment area of the river Barycz (Wojterski *et al.* 1981). The first 2 publications, covering the areas that are most controversial in this respect, appeared at the time when the *Calamagrostio-Quercetum* was first reported from Wielkopolska and

known from practically only one locality in Poland (Fabiszewski & Faliński 1967). Moreover, at that time, both the phenomenon of degeneration of plant communities (Faliński 1966; Olaczek 1972, 1974a, 1974b; see also Łaska 2001) and the process of synanthropization of vegetation (Faliński 1972; Kostrowicki 1972) only started to be investigated. That is why patches of degenerated acidophilous oak forests, especially those with *Pinus* in the canopy, were in most cases diagnosed as the *Pino-Quercetum*, as a unit of both actual and potential vegetation. Identification of potential sites of acidophilous oak forests in deforested areas was at that time very difficult or even impossible (Wojterski *et al.* 1981).

Subdivision based on habitat variation and anthropogenic dynamics

The association *Calamagrostio arundinaceae-Quercetum* is defined here in accordance with Brzeg *et al.* (2001). The relevés representing them, document the whole range of its habitat variation proposed in that study, i.e. 3 subassociations conditioned by soil moisture content, each of them subdivided into trophic variants. A synthetic picture of variation of *Calamagrostio arundinaceae-Quercetum* at the level of subassociations, taking into account also its more or less degenerated forms, is presented in Table 7. The following subassociations are distinguished:

- *Calamagrostio arundinaceae-Quercetum petraeae molinietosum* Brzeg *et al.* 1989 *ex* Lisiewska *et* Reszel 2000 (col. 1, 4, 7, 10),
- *Calamagrostio arundinaceae-Quercetum petraeae typicum* Großer 1964 (col. 2, 5, 8, 11),
- *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati* Passarge *in* Pallas 1996 (col. 3, 6, 9, 12).

The basic diagnostic feature used to determine the stage of degeneration of phytocoenoses was mainly the contribution of characteristic and differential species of the association *Calamagrostio arundinaceae-Quercetum* and the class *Quercetea robori-petraeae*.

Untransformed patches of the association are characterized by a high constancy of diagnostic species (Table 7, col. 1-3). In stage I of degeneration, relevés are distinguished by a markedly smaller constancy of characteristic species of the association (col. 4-6). In stage II of degeneration, these species and *Calamagrostis arundinacea*, i.e. one of its differential species, are nearly absent (col. 7-9). In stage III of degeneration, a decrease is observed also in the contribution of characteristic species of the class *Quercetea robori-petraeae* (col. 10-12). Moreover, in stages II and III of degeneration, the contribution of species characteristic of forest clearings, of the class *Epilobietea angustifolii* is higher (e.g. *Calamagrostis epigejos* and *Rubus idaeus*).

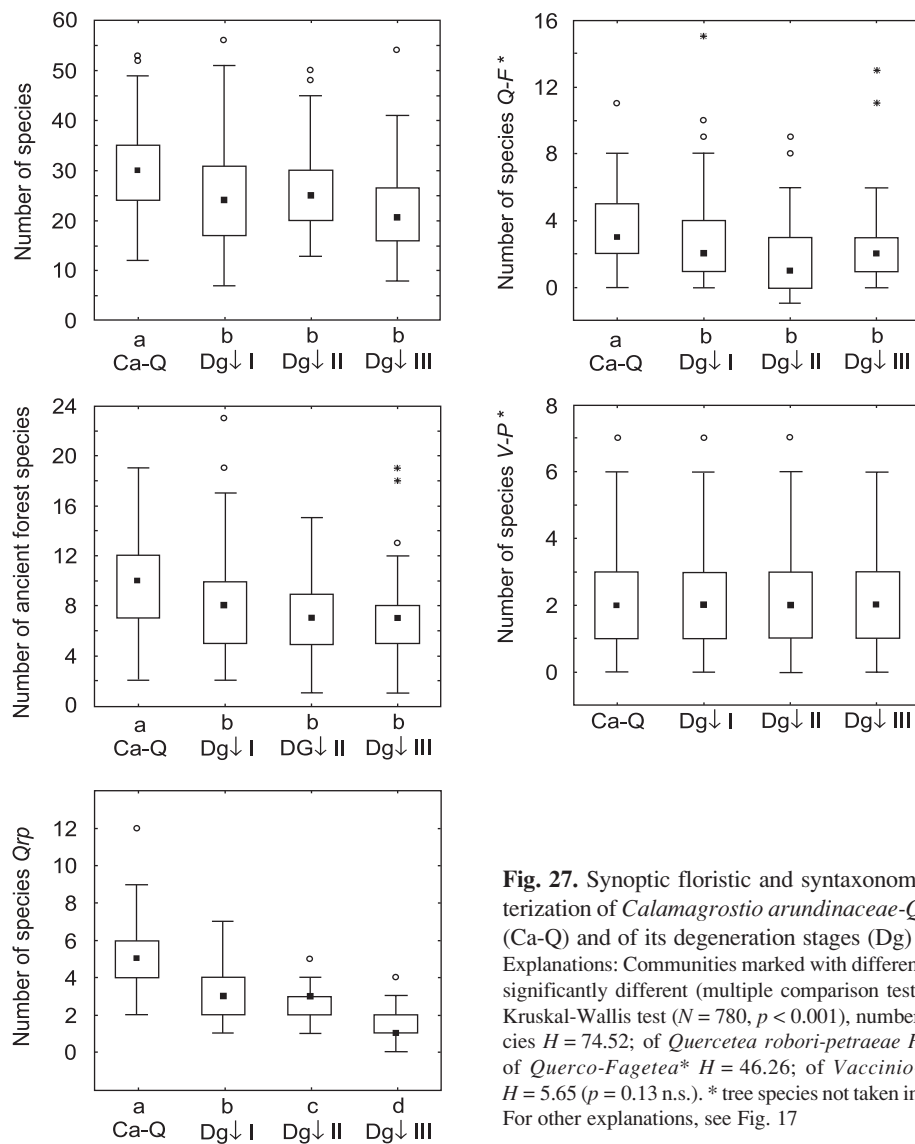


Fig. 27. Synoptic floristic and syntaxonomic characterization of *Calamagrostio arundinaceae-Quercetum* (Ca-Q) and of its degeneration stages (Dg) Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 780$, $p < 0.001$), number of all species $H = 74.52$; of *Quercetum robori-petraeae* $H = 358.46$; of *Quercus-Fagetea** $H = 46.26$; of *Vaccinio-Piceetea** $H = 5.65$ ($p = 0.13$ n.s.). * tree species not taken into account. For other explanations, see Fig. 17

The significant decrease in the contribution of diagnostic species of the class *Quercetum robori-petraeae* in successive stages of degeneration is not clearly related to other floristic features (Fig. 27). Untransformed patches of *Calamagrostio-Quercetum* are characterized by a significantly higher number of species, including those of the class *Quercus-Fagetea*, which partly overlap with ancient forest plant species (AFS). However, values of those parameters did not differ between successive stages of degeneration. The number of species of the class *Vaccinio-Piceetea* is stable.

Untransformed, well-defined patches of *Calamagrostio-Quercetum* are represented in this study by 304 relevés. Its degenerated forms are also well documented (476 relevés: 291 in stage I, 110 in stage II, and 75 in stage III of degeneration). Before the present study, little attention was paid to its degenerated forms. This issue has been discussed so far only on the basis of 79 relevés.

The habitat variation of *Calamagrostio-Quercetum* is reflected in the PCA ordination diagrams both for its

untransformed patches (Fig. 28), and for stages I (Fig. 29), II, and III of degeneration. Results of the last 2 analyses are not shown. The relevés classified as untransformed communities form 2 clusters (Fig. 28a), unambiguously characterized floristically by the distribution of differential species of its subassociations in the ordination space (Fig. 28b). One cluster comprises 96% of relevés of *Ca-Q molinietosum*, while the other one, 91% of patches of *Ca-Q polygonatetosum*. Relevés of the typical subassociation are located mostly in the central part of the diagram, and are found in both the clusters. In the diagram for relevés representing this association in stage I of degeneration, the cluster of *Ca-Q polygonatetosum* is not so well-defined, and includes 79% of its relevés (Fig. 29).

Phytocoenoses of the above-mentioned subassociations of *Calamagrostio-Quercetum* can develop in 2 trophic variants: typical and with *Anemone nemorosa*. A synthetic picture of their species composition is presented for untransformed communities and for stage I of degeneration (Tables 8 and 9). This community in

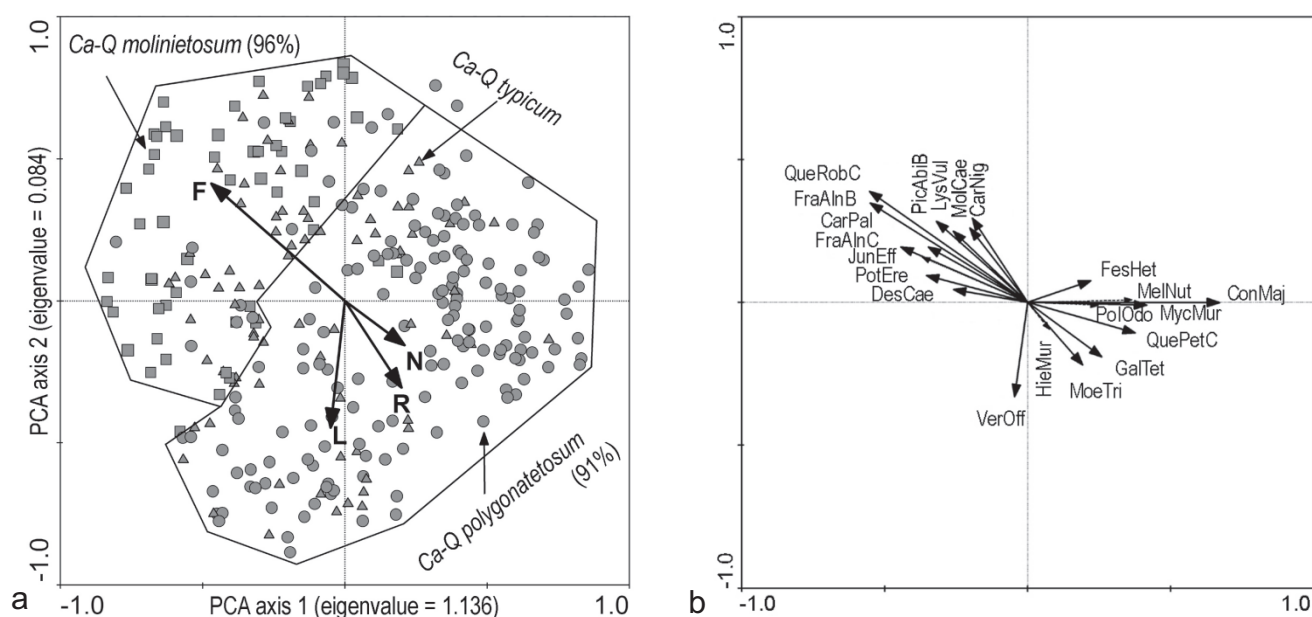


Fig. 28. PCA ordination of untransformed plots of subassociations of *Calamagrostio arundinaceae-Quercetum* (Ca-Q)

- a) Distribution of 304 relevés classified according to the classical phytosociological method, and passive projection (arrows) of mean Ellenberg indicator values: F – soil moisture, L – light, N – soil productivity, R – soil reaction
b) Distribution of differential species of *Ca-Q molinietosum* and *Ca-Q polygonatetosum* (see Table 8)

stages II and III of degeneration is documented only in the form of the analytic Tables A6, A7, A12, A17, and A18.

Calamagrostio arundinaceae-Quercetum petraeae molinietosum Brzeg *et al.* 1989 *ex* Lisiewska *et* Reszel 2000

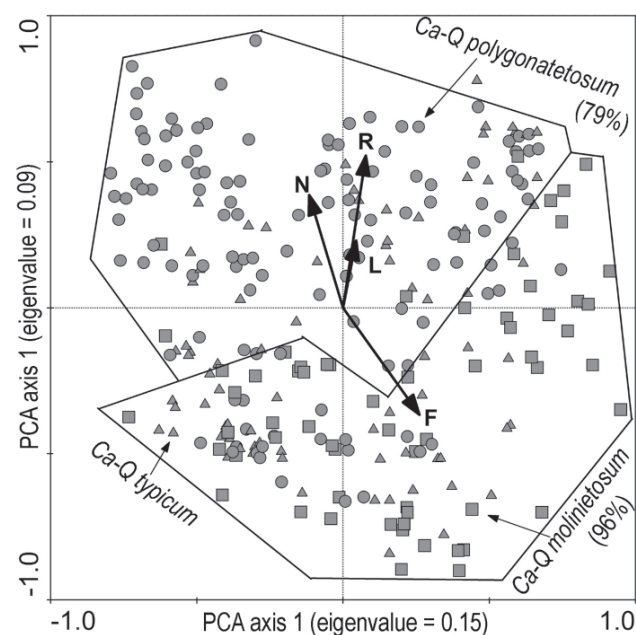


Fig. 29. PCA ordination of plots of *Calamagrostio arundinaceae-Quercetum* in stage I of degeneration

Explanations: Distribution of 291 relevés classified according to the classical phytosociological method, and passive projection (arrows) of mean Ellenberg indicator values: F – soil moisture, L – light, N – soil productivity, R – soil reaction

In this study, 182 relevés have been classified as this subassociation. Most of them (66%) represent untransformed form (56) or stage I of degeneration (64). Out of the 50 relevés documenting the *Ca-Q molinietosum* according to Brzeg *et al.* (2001) and Brzeg & Kasprowicz (2001), in the present study 24 relevés have been classified as untransformed patches of the subassociation. Another 24 relevés of this pool have been assigned to stage I (19 relevés) or stage II of degeneration (5 relevés).

The distribution of 20 localities of untransformed *Ca-Q molinietosum* is presented in Fig. 30. According to the geobotanical regionalization of J.M. Matuszkiewicz (2008a; see also Fig. 4b in the present study), most of them (65%) are located in the South Wielkopolska Subregion, particularly within the Krotoszyn Plateau, which is part of the Kalisz Plateau. Localities of the subassociation in stages I (Fig. 31), II (Fig. 32), and III of degeneration (Fig. 33) have similar distribution patterns.

The canopy of *Ca-Q molinietosum* was composed of 1-2 layers (Figs. 34-35). In individual relevés, 1-7 tree species were found in the canopy (mean 3). Irrespective of the degree of degeneration, the mean coverage of the tree layer slightly exceeded 60% if the canopy was not subdivided. If the canopy was 2-layered, the mean coverage of the upper tree layer (a1) did not exceed 60%, while that of the lower tree layer a2) was usually about 30%. The canopy was dominated by *Quercus robur*, or rarely by *Quercus petraea* or *Pinus sylvestris*. The contribution of *Pinus* was higher in forest stands

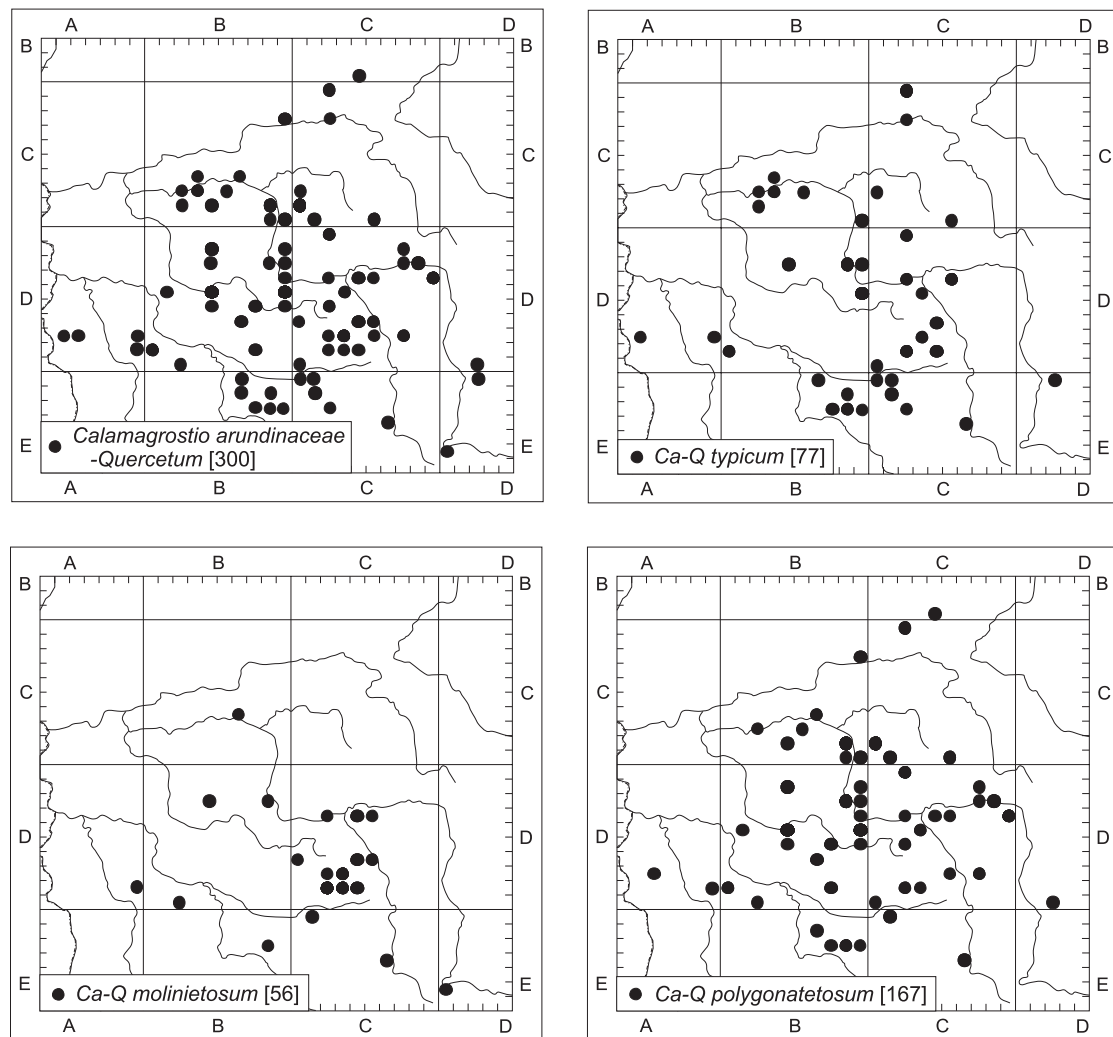


Fig. 30. Distribution of localities of untransformed patches of *Calamagrostio arundinaceae-Quercetum*

Explanations: Number of relevés given in brackets. The localization of 4 relevés was impossible (2 of *Ca-Q typicum* and 2 of *Ca-Q polygonatetosum*)

of the typical variant and in more degenerated forms of the subassociation (Table 7, see also Tables A3-A7). The lower tree layer was composed mostly of *Quercus robur*, *Carpinus betulus*, and *Picea abies*.

The shrub layer (b) was present in most of the relevés, and its mean coverage reached about 20%, mainly thanks to *Frangula alnus*. In patches representing stage III of degeneration, *Carpinus betulus* and *Picea abies* were more frequent.

The herb layer (c) generally had a high coverage (mean 70% under a single tree layer or 60% if the canopy was 2-layered). In individual relevés, herbaceous species covered 10-100% of plot area. The extreme values were recorded chiefly in its degenerated forms. Several species formed facies (most often *Vaccinium myrtillus* or *Holcus mollis*, less often *Calamagrostis arundinacea* or *Pteridium aquilinum*, and rarely *Convallaria majalis*, *Festuca ovina*, *F. rubra*, *Luzula pilosa*, *Maianthemum bifolium* or *Melampyrum pratense*). Only in transformed phytocoenoses, facies were formed by *Calamagrostis epigejos* and *Deschampsia flexuosa* (Tables A5 and A7).

Bryophytes were recorded in most relevés. The mean cover of the moss layer did not exceed 20%. The most frequent species of this layer was *Polytrichastrum formosum*.

In the table of untransformed patches of *Ca-Q molinietosum*, 216 plant species are found (Table A3), and individual relevés contain 20-53 species (mean 35). The relevés classified as stage I of degeneration (Tables A4 and A5) include jointly 225 species (in individual relevés 12-60, mean 30). The *Ca-Q molinietosum* in stages II (Table A6) and III of degeneration (Table A7) are much poorer in species. Their tables comprise 167 species (in individual relevés 14-48, mean 26) and 104 species (11-34, mean 22), respectively. It is noteworthy that the compared units differ also in the number of relevés: 56, 64, 47, and 15, respectively.

The *Ca-Q molinietosum* is well-defined floristically, also among the more degenerated forms (Table 7). A list of differential species of the subassociation, proposed by Brzeg *et al.* (2001), must be supplemented with *Quercus robur* and *Picea abies*. Other diagnostic species

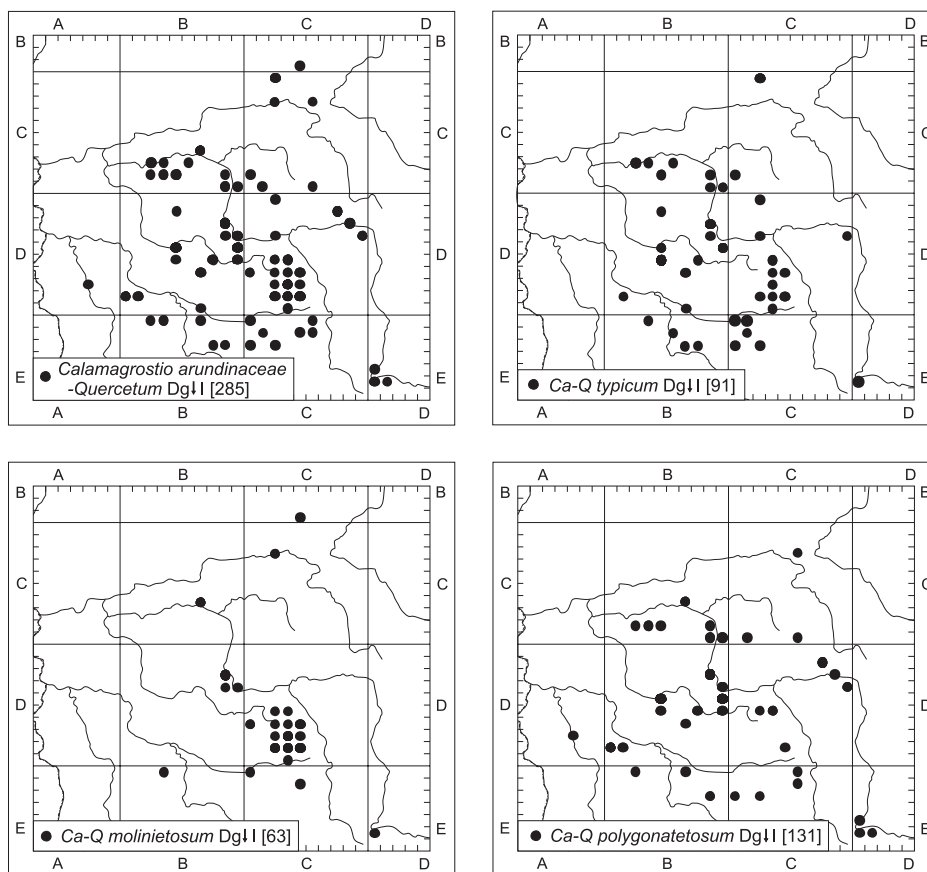


Fig. 31. Distribution of localities of *Calamagrostio arundinaceae-Quercetum* in stage I of degeneration

Explanations: Number of relevés given in brackets. The localization of 6 relevés was impossible (1 of *Ca-Q molinietosum* and 5 of *Ca-Q polygonatetosum*)

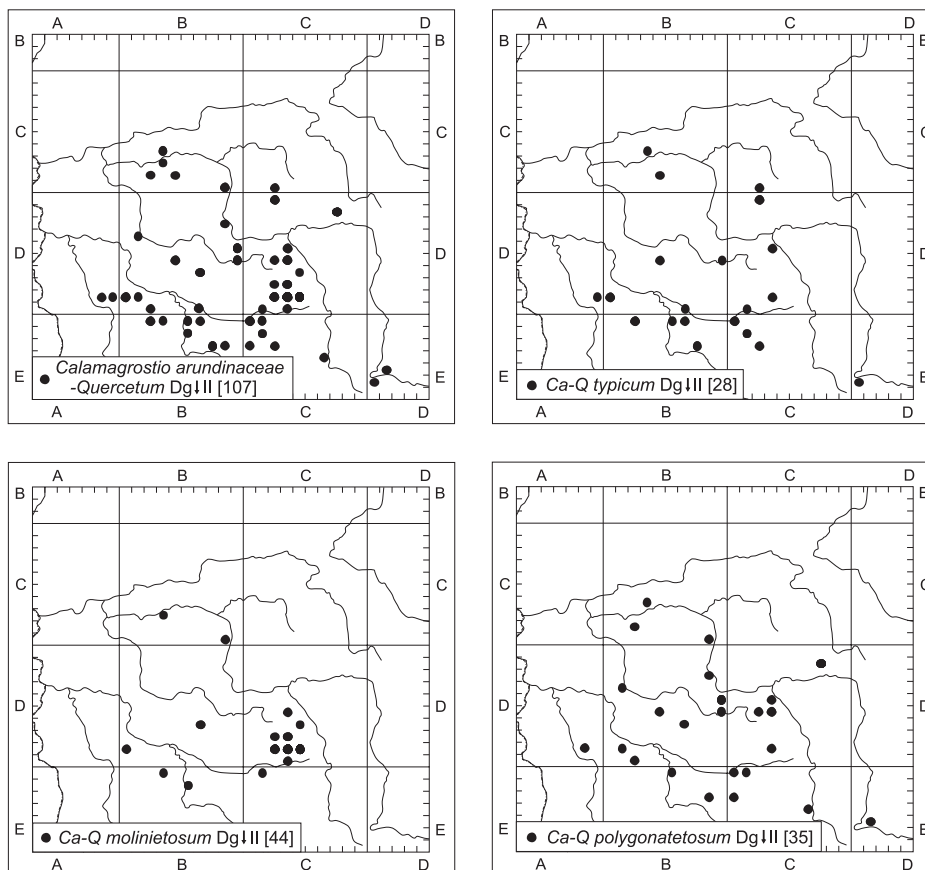


Fig. 32. Distribution of localities of *Calamagrostio arundinaceae-Quercetum* in stage II of degeneration

Explanations: Number of relevés given in brackets. The localization of 3 relevés of *Ca-Q molinietosum* was impossible

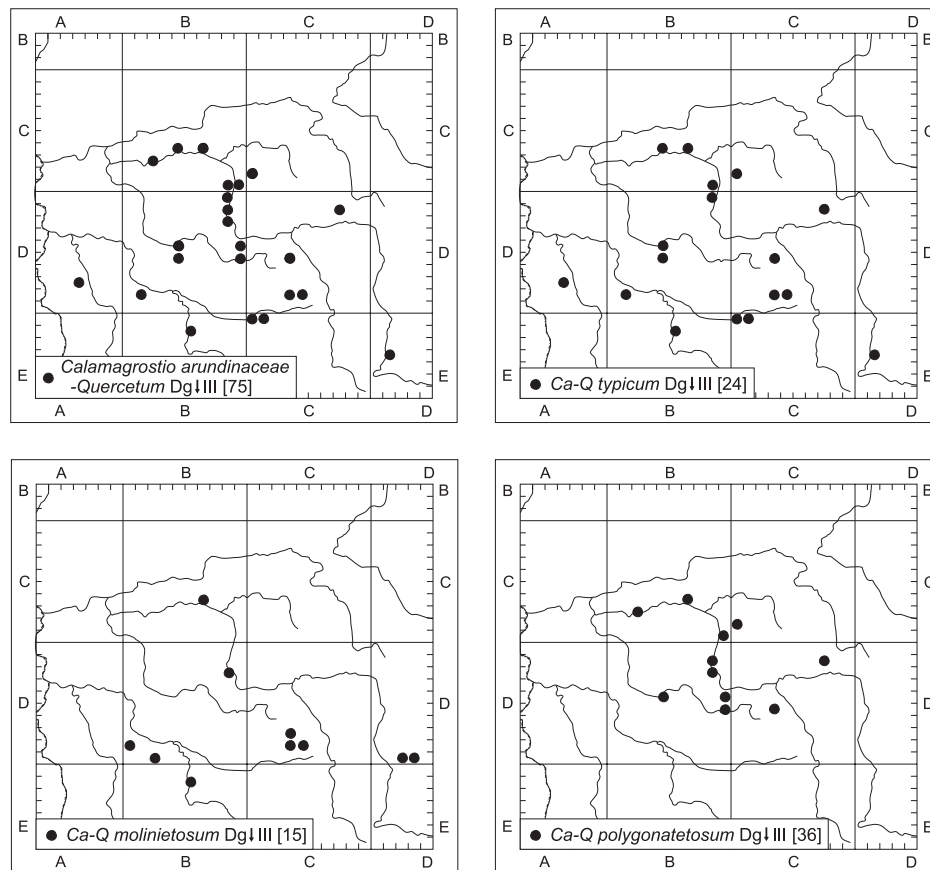


Fig. 33. Distribution of localities of *Calamagrostio arundinaceae-Quercetum* in stage III of degeneration (number of relevés given in brackets)

of the subassociation *Ca-Q molinietosum* are still valuable. These include *Carex nigra*, *C. pallescens*, *Deschampsia caespitosa*, *Frangula alnus*, *Juncus effusus*, *Lysimachia vulgaris*, *Molinia caerulea*, *Potentilla erecta* and *Trientalis aeuropaea*. The above-mentioned tree species, as well as *Frangula alnus* and *Carex nigra*, lose their diagnostic value in more degenerated forms of *Calamagrostio arundinaceae-Quercetum* (Table 7).

This subassociation, as mentioned above, is clearly subdivided into 2 trophic variants: typical and with *Anemone nemorosa* (Tables 8 and 9, as well as Tables A3-A7). Within those units, individual relevés include a similar number of species. However, patches of the typical variant are poorer in species than patches of the variant with *Anemone nemorosa* (Figs. 36-37). The typical variant of *Ca-Q molinietosum* does not have any diagnostic species, while the variant with *Anemone nemorosa* has many differential species (e.g. *Anemone nemorosa*, *Poa nemoralis*, *Viola reichenbachiana*, and *Oxalis acetosella*), with a high contribution of plants of the class *Quercio-Fagetea*. In the compilations of Brzeg *et al.* (2001) as well as Brzeg and Kasproicz (2001), also *Carpinus betulus* had a high diagnostic value. It must be emphasized that in the cited publications the typical variant of *Ca-Q molinietosum* was represented by only 5 relevés, while 45 relevés documented

the variant with *Anemone nemorosa*. Their documentation presented here is much richer: 77 and 105 relevés, respectively. These include relatively high numbers of untransformed patches (14 and 42 relevés, Table 8) and those classified as stage I of its degeneration (26 and 38 relevés, Table 9). In the relevés classified as stage III of degeneration, the differentiation at the level of variants is poorly defined (Table A7).

Calamagrostio arundinaceae-Quercetum petraeae typicum Großer 1964

In the present study, 222 relevés have been assigned to this subassociation (Table 7, col. 2, 5, 8, 11). This is several-fold more than the number of its relevés (32) presented earlier by Brzeg *et al.* (2001) or Brzeg and Kasproicz (2001). A vast majority (77%) of the relevés represent untransformed form (79, including 19 relevés from the table of Brzeg *et al.* 2001) or slightly transformed ones (91, including 10 from the table of Brzeg *et al.* 2001). The distribution pattern of localities of *Ca-Q typicum* (Fig. 30) does not deviate from the above-mentioned distribution range of the association in the study area. Untransformed phytocoenoses were recorded in 37 basic ATPOL squares. A similar number (39) of localities was recorded for the subassociation in stage I of degeneration (Fig. 31).

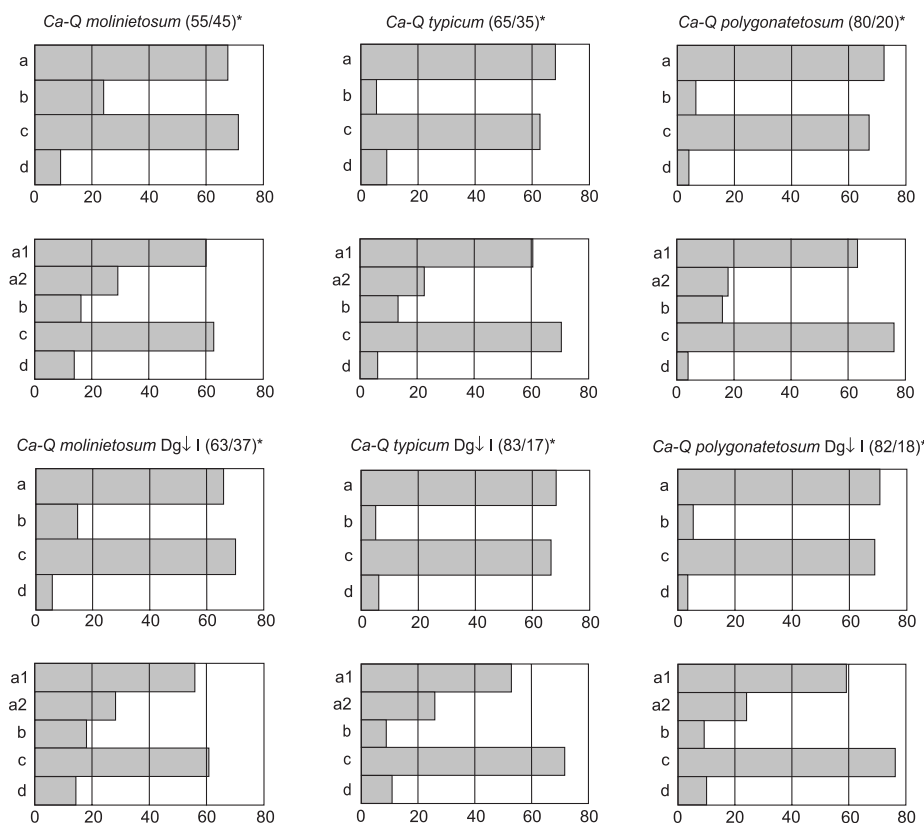


Fig. 34. Scheme of the vertical structure of subassociations of *Calamagrostio arundinaceae-Quercetum* – untransformed and in stage I of degeneration

Explanations: One and two-layered tree-stands are shown on separate diagrams; bars denote the percent cover of vegetation layers; * percent contributions of relevés with one/two-layered canopy

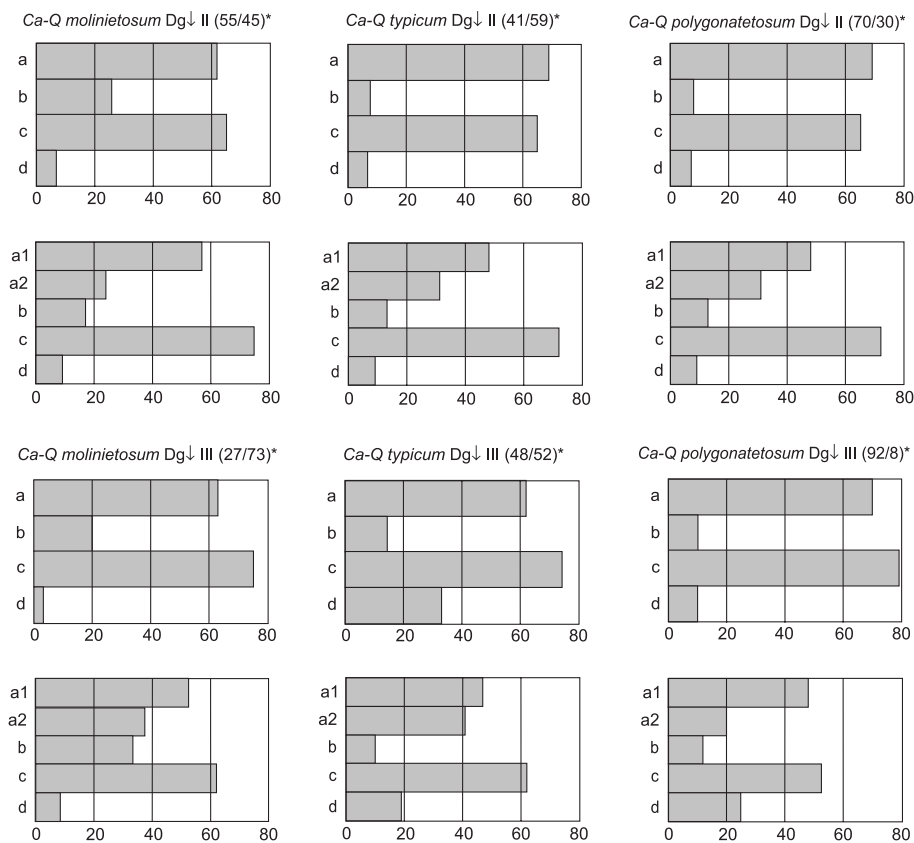


Fig. 35. Scheme of the vertical structure of subassociations of *Calamagrostio arundinaceae-Quercetum* in stages II and III of degeneration

Explanations. One and two-layered tree-stands are shown on separate diagrams; bars denote the percent cover of vegetation layers; * percent contributions of relevés with one/two-layered canopy

Forest stands of untransformed form of *Ca-Q typicum* usually had only one tree layer (65% of relevés). In stage I of degeneration, the contribution of relevés with only one tree layer was even higher (83%), while in stages II and III, the canopy was usually 2-layered (Fig. 35). These forests had a very small number of species in the canopy. In most of the relevés (66% of untransformed form and 80% of those in stage I of degeneration), the canopy was composed of up to 2 tree species. Many forest stands were composed of only one species (38% and 45% of relevés, respectively). They were usually dominated by *Quercus petraea* or *Q. robur*. As a rule, *Pinus sylvestris* was only a minor component of untransformed patches, but it was more frequent in relevés of the typical variant (Tables 8 and 9). In degenerated communities, its contribution markedly increased. In stages II and III of degeneration, this species was one of the major components of both variants (Tables A12 and A7). The lower tree layer was dominated by *Carpinus betulus*. Its contribution was higher in the variant with *Anemone nemorosa* than in the typical variant. Its contribution was also higher in more degenerated phytocoenoses.

The shrub layer in many relevés (52%) was absent or scanty. In other relevés, its coverage varied from 5% to 50% (only exceptionally 65%). *Frangula alnus* was most frequent, but it usually covered less than 5% of plot area. In some relevés, *Carpinus betulus* and *Picea abies* were more abundant in this layer.

The herb layer covered 5-100% of the area of the studied relevés. The higher values were recorded more often under a 2-layered canopy. In many patches, facies were formed by *Vaccinium myrtillus* or *Holcus mollis*, while in some others, by *Pteridium aquilinum*, *Calamagrostis arundinacea*, *Festuca ovina*, etc. The moss layer was generally poorly developed or absent in many relevés.

Like the other 2 subassociations, also the typical subassociation of *Calamagrostio-Quercetum*, analysed with respect to its stages of degeneration, varies widely in floristic richness (Table 9). The untransformed forms and those in stage I of degeneration have similar ranges of species number, but clearly differ in the mean number of species per relevé: 26 (range: 12-42) and 19 (range: 7-37), respectively. In tables of stages II and III of degeneration of the subassociation, species number was much smaller. It should be noted, however, that both the tables comprised a markedly smaller number of relevés (Table 7).

The typical variant and the one with *Anemone nemorosa* are distinguished both in untransformed form and in successive stages of degeneration of the subassociation. Constant differential species of the variant with *A. nemorosa* in untransformed patches of *Ca-Q typicum* or in stage I of degeneration include: *A.*

nemorosa, *Carpinus betulus*, *Oxalis acetosella*, *Poa nemoralis*, *Veronica chamaedrys*, and *Atrichum undulatum*. The variant with *A. nemorosa* in stage III of degeneration, as in the case of *Ca-Q molinietosum*, is poorly distinguished (Table A7).

Relevés of *Ca-Q typicum* vary in species richness but generally patches of typical variant have a significantly lower number of species, not only in comparison to the variant with *A. nemorosa* within the *Ca-Q typicum*, but also to the other analysed subassociations (Figs. 36 and 37). Phytocoenoses of the typical variant are the poorest in stage I of degeneration (Fig. 37). This is mostly due to the inclusion of many relevés (22 of the 59 compiled in Table A10) of *Calamagrostio-Quercetum* from the Włoszakowice Forest near Leszno (Krotoska 1978). They contained 7-15 species (mean 11). It is noteworthy that Pallas (1966) classified 15 of the 22 relevés as the *Ca-Q scorzonetum humilis* (see p. 31 of the present monograph).

Some patches of *Ca-Q typicum* with the canopy dominated by *Pinus* (Table A10, relevés 53-59, and Table A11, relevés 31-32) did not differ considerably from other patches of this subassociation in stage I of degeneration, while in stage III of degeneration (Table A7, relevés 25-31), this community with share of *Pinus* resembles the mixed coniferous forest *Quercus roboris-Pinetum*, e.g. because of the increased contribution of *Pleurozium schreberi*.

Calamagrostio arundinaceae-Quercetum patraeae polygonatetosum odorati Passarge in Pallas 1996

In the study area, 376 relevés have been classified as this subassociation (Table 7), of which 169 represent the within untransformed form (Tables A13 and A14) and 136 are communities in stage I of degeneration (Tables A15 and A16). In the untransformed group, relevés identified by their authors as *Calamagrostio-Quercetum*, account for 77%. These include e.g. 8 of 11 relevés of Fabiszewski and Faliński (1967), 34 of 41 relevés of *Ca-Q polygonatetosum* of Brzeg *et al.* (2001), and 17 of 36 relevés of *Ca-Q polygonatetosum* of Hegenbart-Magdans and Brzeg (1999). In the group of phytocoenoses in stage I of degeneration, 65% of relevés were identified by their authors as the above-mentioned association. These include e.g. most of the remaining relevés contained in the tables cited above. The more degenerated forms are represented by less numerous relevés: stage II of degeneration (Table A17) by 35, whereas stage III, by 36 relevés (Table A18).

Localities of the subassociation are quite evenly distributed in the study area. Untransformed patches of the community are documented in 52 (Fig. 30), while those in stage I of degeneration, in 37 ATPOL squares (Fig. 31).

The canopy of *Ca-Q polygonatetosum*, both untransformed and degenerated ones, were in most

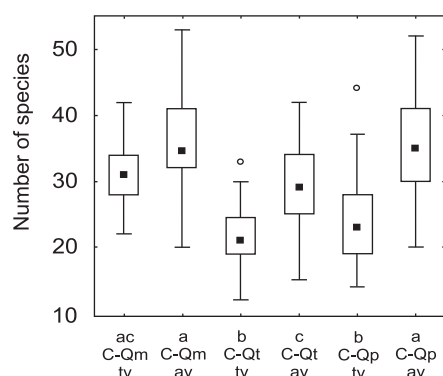


Fig. 36. Variation in number of species in relevés of untransformed patches of variants of subassociations of *Calamagrostio arundinaceae-Quercetum*

Explanations: tv – typical variant, av – variant with *Anemone nemorosa*; communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$); Kruskal-Wallis test ($N = 304$, $p < 0.001$), $H = 139.86$. For other explanations, see Fig. 17

relevés (about 80%) one-layered (Figs. 34 and 35). In that group, the canopy was usually composed of up to 2 tree species (81% of untransformed phytocoenoses and 91% of those in stage I of degeneration), and many of only one species (49% and 59%, respectively). The major component of the tree layer was *Quercus petraea*, accompanied by *Q. robur* and *Pinus sylvestris*. In patches of the typical variant, *Pinus sylvestris* was more frequent than *Q. robur*, and its contribution increased with increasing degeneration of the subassociation. In stage III of degeneration, *P. sylvestris* was a dominant species in many relevés (Table A18). The lower tree layer reached a higher coverage (up to 90%) in only few relevés. It was composed mostly of both the native *Quercus* spp., and in some cases also by *Fagus sylvatica*. In Tables A13-A18, the constancy of *Carpinus betulus* was low and this species did not play any major role except for one patch (Table A16, relevé 40).

The shrub layer in many relevés was poorly defined or absent. In other, less numerous patches, its percent cover increased, and one of the major species was *Corylus avellana*. *Frangula alnus* in patches of *Ca-Q polygonatetosum* did not form any facies, in contrast to the *Ca-Q molinietosum*.

The herb layer covered 10-100% (usually 65-75%) of the area of the studied relevés. Like in the typical subassociation (except for the most transformed phytocoenoses) higher values were recorded under a 2-layered canopy (Fig. 34). The *Ca-Q polygonatetosum* was characterized by a relatively high frequency of patches with facies in the herb layer. The facies were most often formed by *Calamagrostis arundinacea*, *Convallaria majalis*, *Vaccinium myrtillus*, *Pteridium aquilinum*, and rarely by *Holcus mollis*, *Festuca ovina*, and *Melampyrum pratense*. Some patches of this subassociation in stage III of degeneration were char-

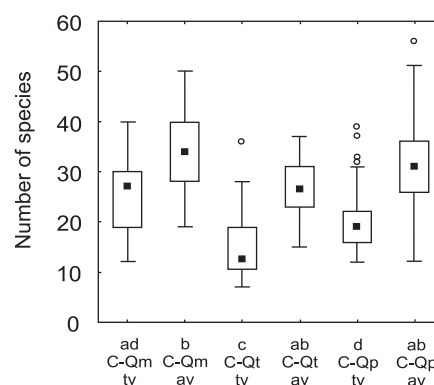


Fig. 37. Variation in number of species in relevés of variants of subassociations of *Calamagrostio arundinaceae-Quercetum* in stage I of degeneration

Explanations: tv – typical variant, av – variant with *Anemone nemorosa*; communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$); Kruskal-Wallis test ($N = 291$, $p < 0.001$), $H = 134.71$. For other explanations, see Fig. 17

acterized by a greater contribution of *Calamagrostis epigejos*, *Rubus idaeus*, *Deschampsia flexuosa*, or *Agrostis capillaris* (Table A18).

Bryophytes, although present in most of the studied relevés, rarely formed a well-developed layer. Only in stage III of degeneration, *Pleurozium schreberi* and *Pseudoscleropodium purum* were more abundant (Table A18).

The *Ca-Q polygonatetosum* is rich in species. Tables of untransformed form and of those in stage I of degeneration include similar numbers of species (273 and 271, respectively). The much lower species numbers in tables of the subassociation in stages II and stage III of degeneration (194 and 172, respectively), is mostly due to the much lower numbers of relevés (Table 7). This subassociation is distinguished, from the above subassociations (*Ca-Q molinietosum* and *Ca-Q typicum*), by many species: *Convallaria majalis*, *Hieracium murorum*, *Melica nutans*, *Moehringia trinervia*, *Mycelis muralis*, *Polygonatum odoratum*, and *Veronica officinalis* (see also Brzeg *et al.* 2001; Brzeg & Kasproicz 2001). Most of them have a high diagnostic value also in degenerated forms of the subassociation (Table 7).

The *Ca-Q polygonatetosum* can be subdivided into 2 variants reported earlier by Brzeg *et al.* (2001, see also Brzeg & Kasproicz 2001). Their description here is based on much larger numbers of relevés. In the cited articles, the typical variant was represented by 12, while the variant with *Anemone nemorosa*, by 29 relevés, while in Table 8 (untransformed form), these syntaxa comprise 78 and 91, and in Table 9 (community in stage I of degeneration), 73 and 63 relevés, respectively. These variants in their more degenerated forms are documented by smaller numbers of relevés (Tables A17 and A18). Patches of the typical variant were poorer in species than the variant with *Anemone nemorosa*. This was

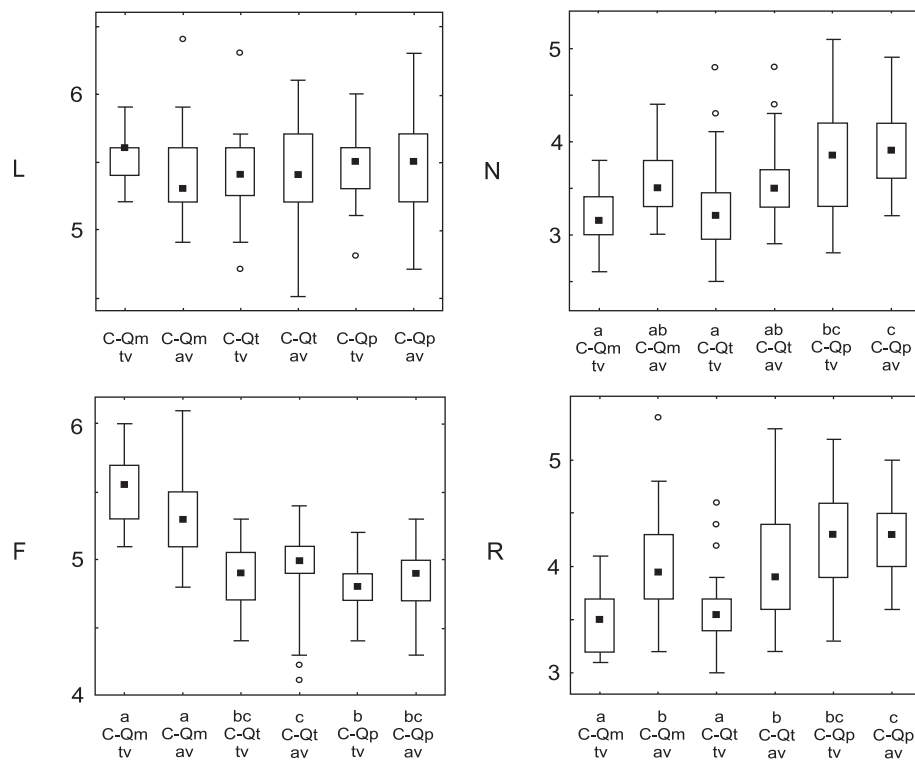


Fig. 38. Ellenberg indicator values for variants of untransformed subassociations of *Calamagrostio arundinaceae-Quercetum*

Explanations: tv – typical variant; av – variant with *Anemone nemorosa*; communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$); Kruskal-Wallis test ($N = 304$), L – light $H = 9.94$, $p = 0.0770$ n.s., F – soil moisture $H = 121.51$, $p < 0.001$, R – soil productivity $H = 70.38$, $p < 0.001$, soil reaction $H = 88.91$, $p < 0.001$. For other explanations, see Fig. 17

observed irrespective of the stage of degeneration of the subassociation (Tables 8 and 9, as well as A17 and A18) (Fig. 36 and 37).

Differential species of *Ca-Q polygonatetosum* in the variant with *Anemone nemorosa* include: *Fragaria vesca*, *Hypericum perforatum*, *Veronica chamaedrys*, *Anemone nemorosa*, *Viola riviniana*, etc. In comparison to the article cited above (Brzeg *et al.* 2001), the variant with *Anemone nemorosa* is better defined floristically here. Out of the 4 differential species listed in the cited publication, only *Anemone nemorosa* has preserved its status. By contrast, *Melica nutans* and *Galeopsis tetrahit* proved to be differential species of the subassociation, while *Malus sylvestris* is too rare.

Analysis of selected site indicators

The habitat variation of the association *Calamagrostio-Quercetum*, determined on the basis of floristic features, is noticeable irrespective of the stage of degeneration of the studied phytocoenoses. This conclusion is additionally confirmed by results of PCA Figs. 28 and 29) and Kruskal-Wallis test (Figs. 38 and 39), taking into account Ellenberg indicator values.

Patches of both variants of *Ca-Q typicum* and *Ca-Q polygonatetosum* were dominated by plants of moderately moist sites ($F=5$), while patches of *Ca-Q molinietosum* contained significantly more plants typical of slightly more moist soils. The distribution of values of Ellenberg

indicators of fertility (N) and soil reaction (R) indicate that sites of this oak forest type were poor ($N=3$), or – at most – intermediate ($N=4$) between poor and moderately rich in nutrients, while their pH is highly acidic ($R=3$) or moderately acidic ($R=5$). Significantly lowest values of indicators N and R were recorded in patches of the typical variant, within both the *Ca-Q molinietosum* and *Ca-Q typicum*. Light conditions of the forest floor were nearly the same in all relevés of *Calamagrostio-Quercetum*, favourable mostly for half shade plants ($L=5$).

6.3.4. *Galio sylvatici-Carpinetum* (R. Tx. 1937)

Oberd. 1957

Basic documentation

As mentioned above, the present study of acid oak forests includes only some oak-hornbeam forests, i.e. those classified in the literature as their acidophilous forms. In the classification proposed by Krotoska (1966), they include the *Gs-C holcetosum mollis* and *Gs-C calamagrostietosum arundinaceae*. According to W. Matuszkiewicz & A. Matuszkiewicz (1985), both the syntaxa jointly correspond to one subassociation, the *Gs-C polytrichetosum*, which is more broadly defined (see also p. 35 of the present monograph). The oak-hornbeam forest *Gs-C holcetosum* (= *Quercus-Carpinetum holcetosum*) is represented here by 112

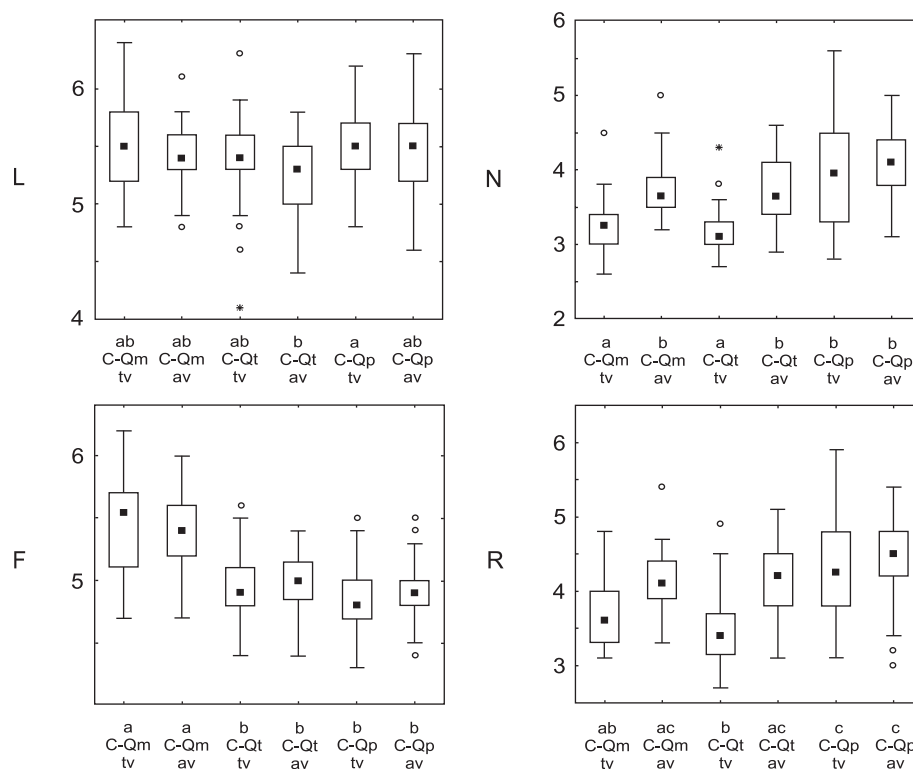


Fig. 39. Ellenberg indicator values for variants of subassociations of *Calamagrostis arundinaceae-Quercetum* in stage I of degeneration. Explanations: communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$); Kruskal-Wallis test ($N = 291$), L – light $H = 11.17$, $p = 0.0482$ n.s., F – soil moisture $H = 89.80$, $p < 0.001$, N – soil productivity $H = 98.24$, $p < 0.001$, R – soil reaction $H = 91.81$, $p < 0.001$. For other explanations, see Fig. 17

relevés found in 11 publications. Many of them (52) were extracted from articles by Macicka (1984) or Macicka & Wilczyńska (1990, 1991, 1992), and 22 from Krotoska (1966). The *Gs-C calamagrostietosum* was reported in only 3 publications and documented with 47 relevés: 24 presented by Ferchmin (1966, 1980), and 23 by Boiński (1973). Results of the phytosociological analysis presented below, in many cases did not confirm the original authors' diagnoses, for both the *Gs-C holcetosum mollis* and *Gs-C calamagrostietosum*, at least in relation to their definitions presented here. Out of the initial set of 112 relevés, in the table of *Gs-C holcetosum* (Table 10, col. 1-4), only 84 are left. These include 61 relevés classified here as the variant with *Lysimachia vulgaris* (including 9 of its degenerated form), 11 as the typical variant, and 12 as the variant with *Solidago virgaurea*. The second subassociation, *Gs-C calamagrostietosum*, is represented by only 9 relevés (Table 10, col. 5) out of the initial set of 47 relevés. The other relevés are assigned to other forms of *Galio-Carpinetum*, substitute forest communities, or even to the *Ca-Q molinietosum*. It must be emphasized once again that the present study was not aimed at description of the other subassociations of *Galio-Carpinetum* presented in Table 10 (col. 6 and 7), namely the *Gs-C lathyretosum* and *Gs-C typicum*. That is why their phytosociological documentation is incomplete here, and the tables below include probably only their

poorest, fragmentary, and at least partly transformed forms. Thus the present section describes the floristic structure, major diagnostic features and variation of the 2 acidophilous subassociations of Central European oak-hornbeam forest (the *Gs-C holcetosum mollis* and *Gs-C calamagrostietosum arundinaceae*), as well as their transformation by human activity, in comparison with the other units of *Galio-Carpinetum* in the analysed material.

Distribution

Patches of the analysed forms of the association *Gs-C* (Table 10, col. 1, 3-7) are distributed in 37 ATPOL squares (Fig. 40). According to the forest regionalization system (see Fig. 4c), 23 of them are located in the Wielkopolska-Pomeranian Region, 13 in the Silesian Region (Kraina Śląska), and only one in the Mazovia-Polesie Region (Kraina Mazowiecko-Podlaska). Most of them are concentrated in the southern part of the study area, i.e. in the Krotoszyn District, Wrocław District (Dzielnica Wrocławska), and Lower Silesian Plan (Równina Dolnośląska). The first 2 districts belong to a group of several regions where Central European oak-hornbeam forest is most frequent in Poland (Matuszkiewicz J. M. 1996, 2001a). The cited author estimated also that this association covers the largest areas in the districts: Wielkopolska-Kujawy Lowland (Nizina Wielkopolsko-Kujawska) and the Wrocław Lowland

(Nizina Wrocławska). The small number of localities (4) within the Wielkopolska-Kujawy Lowland results from the exclusion of other (i.e. not acidophilous) forms of oak-hornbeam forest in the present study. Krotoska (1966) suggested that the oak-hornbeam forest *Gs-C holcetosum* is associated with the areas affected by the older glaciation. Thus she confirmed the earlier opinion of Preising (1943), who noted also that the subassociation with *Lathyrus vernus* is linked with the areas affected by the last glaciation (after Krotoska 1996). As shown below, the variant with *Lysimachia vulgaris* of the subassociation *Gs-C holcetosum* corresponds to the *Gs-C holcetosum* as defined by Krotoska (1966). Its distribution pattern remains roughly the same, although its documentation has been supplemented with more recent relevés. Most of its 25 localities (80%), according to the geobotanical regionalization of J. M. Matuszkiewicz (1993; see Fig. 4b here), are found in the South Wielkopolska Subregion, mostly in the Kalisz Plateau, Trzebnica Hills (Wzgórza

Trzebnickie), and the Barycz Valley (Dolina Baryczy). Krotoska (1966) analysed 41 relevés of *Gs-C holcetosum*, including 13 identified by Krotoska and Piotrowska (1962), as the association *Pino-Quercetum*. Except one relevé, all the others were located in the Kalisz Plateau (corresponding to the Krotoszyn District according to the forest regionalization system). Thus they show a clear relationship with the so-called Krotoszyn Plateau.

The small number of relevés representing subassociations with *Calamagrostis arundinacea* and with *Lathyrus vernus* does not allow a reliable description of their distribution in the study area. However, it is noteworthy that all its localities are found in the northern part of the study area, where the landscape has clearly been shaped by the last glaciation.

Subdivision based on habitat variation and anthropogenic dynamics

A detailed phytosociological analysis revealed that the relevés classified here as the association *Galio*

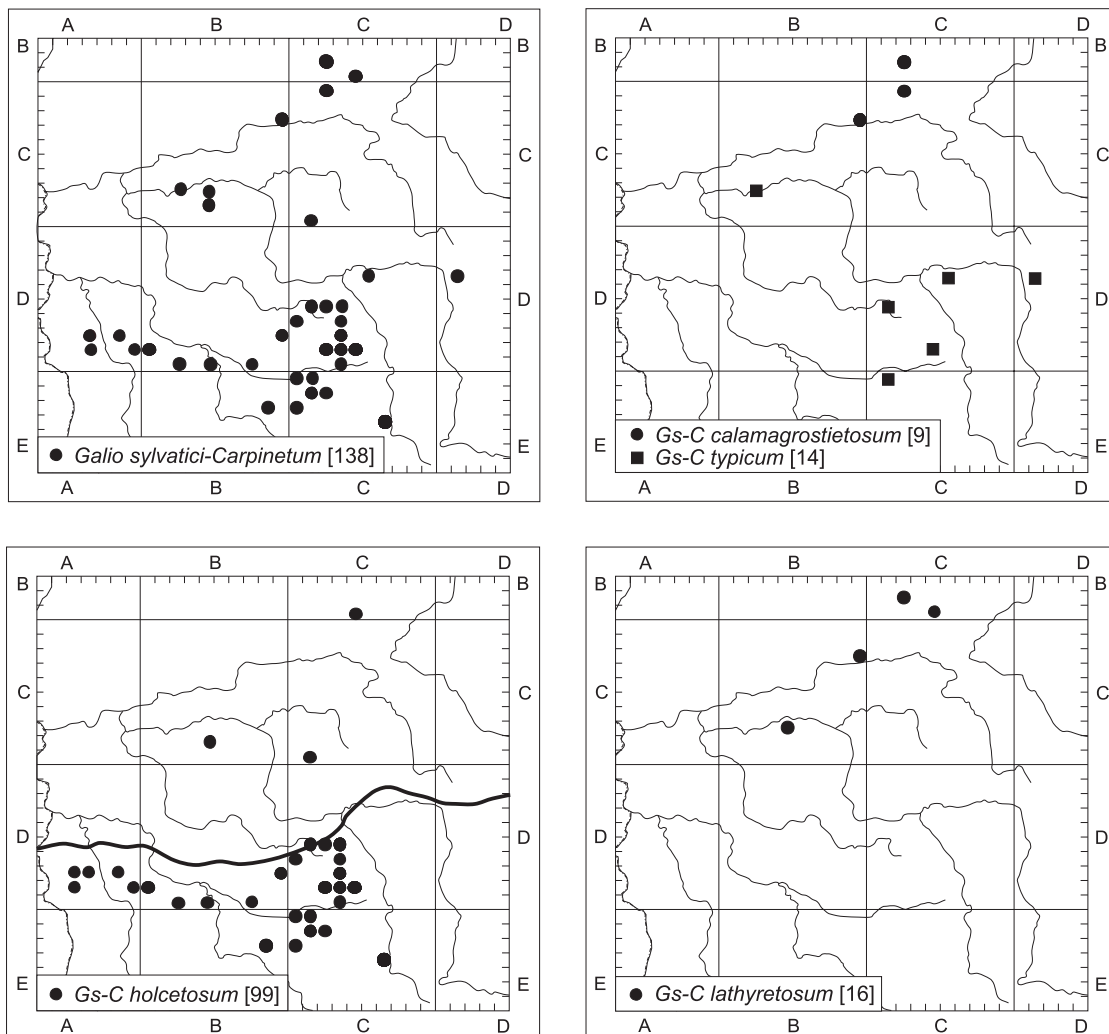


Fig. 40. Distribution of localities of *Galio sylvatici-Carpinetum*
 Explanations. Number of relevés given in brackets. The localization of 6 relevés of *Gs-C holcetosum* was impossible. The boundary of the Vistulian glaciation after Gilewska (1999)

sylvatici-Carpinetum represent several subassociations (Table 10). These include:

- *Gs-C holcetosum mollis* Preising 1943 ex Krotoska 1966 (col. 1, 2, 3, 4, 8) – as shown above, is well documented in Wielkopolska. The performed analysis showed that it is differentiated into 3 variants: with *Lysimachia vulgaris*, typical, and with *Solidago virgaurea*.
- *Gs-C calamagrostietosum arundinaceae* Preising 1943 ex Krotoska 1966 (col. 5) – is very poorly studied; its floristic distinctness was not confirmed by W. Matuszkiewicz and A. Matuszkiewicz (1985). Similarly, it is not taken into account in the monograph of J.M. Matuszkiewicz (2001a).
- *Gs-C lathyretosum verni* Preising 1943 ex Krotoska 1966 (col. 6) – thoroughly investigated by Krotoska (1966, 1972). Its distinctness was confirmed by W. Matuszkiewicz & A. Matuszkiewicz (1985).
- *Gs-C typicum* Oberd. 1957 (col. 7) – is exceptionally well documented in Poland. In the synoptic table of W. Matuszkiewicz & A. Matuszkiewicz (1985), the Wielkopolska race of this syntaxon includes 499 relevés. The cited authors assigned to the subassociation, as a variant, also its forms classified by Krotoska (1966), and many other authors, as a separate subassociation: the *Gs-C stachyetosum sylvaticae sensu auct.* (the proper name: *Gs-C circaetosum* Oberd. 1957).

Column 9 of that table presents the species composition of a substitute forest community on a potential site of deciduous forest from the class *Quercus-Fagetea*. The habitat variation of *Galio sylvatici-Carpinetum*, outlined above, was fully confirmed by the results of

PCA analysis of 130 relevés (Fig. 41a). All the relevés of *Gs-C holcetosum mollis* form a well-defined cluster. The second cluster is differentiated into 2 groups, more similar floristically. One of them comprises 78% of relevés of *Gs-C calamagrostietosum*, while the other, 94% of relevés of *Gs-C lathyretosum*. The floristic justification of such an arrangement of the relevés is presented in Fig. 41b. It illustrates the distribution of the species that distinguish the analysed subassociations on the plot of the first two PCA components.

Galio sylvatici-Carpinetum holcetosum mollis Preising 1943 ex Krotoska 1966

Nomenclature type: *Galio sylvatici-Carpinetum* (R. Tx. 1937) Oberd. 1957 *holcetosum mollis* Preising 1943 ex Krotoska 1966 Tab. 10, rel. 2 (Krotoska 1966) *lectotypus hoc loco*

Synonym: *Galio sylvatici-Carpinetum polytrichetosum* W. Matuszkiewicz, A. Matuszkiewicz 1985 *nom. inval.* (Art. 5) p.p.

D. subass.: *Dicranella heteromalla*, *Frangula alnus*, *Hieracium laevigatum*, *Holcus mollis*, *Hypnum cupressiforme*, *Melampyrum pratense*, *Pohlia nutans*, *Polytrichastrum formosum*, [*Quercus robur* dominant in the group of acidophilous subassociations]

In the present study, 145 relevés have been assigned to this subassociation, and 40 of them describe degenerated form (Table 10, col. 1-4 and 8). Their species composition is presented in Tables A20-A22.

The canopy of untransformed phytocoenoses of the subassociation was usually composed of several tree

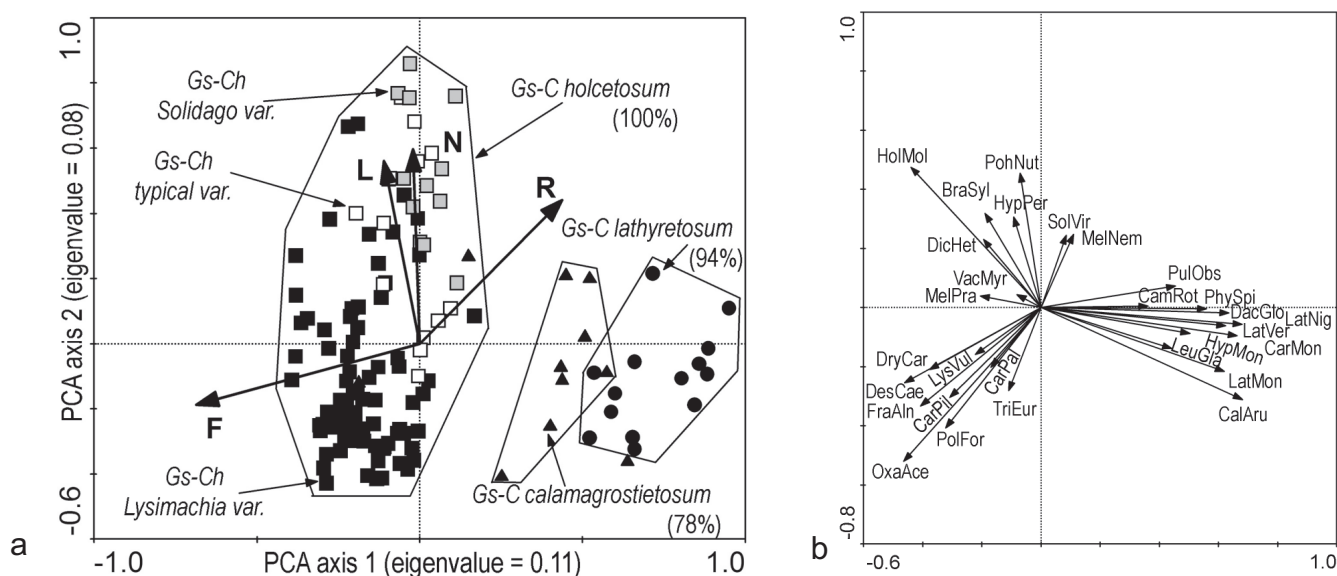


Fig. 41. PCA ordination of plots of *Galio sylvatici-Carpinetum*

- a) distribution of 130 relevés of *Gs-C holcetosum mollis* (variants typical, with *Lysimachia vulgaris* and with *Solidago virgaurea*), *Gs-C lathyretosum* and *Gs-C calamagrostietosum*, classified according to the classical phytosociological method, and passive projection (arrows) of mean Ellenberg indicator values: F – soil moisture, L – light, N – soil productivity, R – soil reaction
- b) distribution of differential species of the subassociations (see Table 10)

species (mean 3; range 1-6), which most often formed 2 layers (Fig. 42). The upper tree layer (a1) had a mean coverage of 58% (range 15-90%) and was dominated by *Quercus robur*. The contribution of *Q. petraea* was higher in the typical variant and in the variant with *Solidago virgaurea*. The dominant tree species was accompanied by *Betula pendula*, *Fagus sylvatica*, *Pinus sylvestris*, *Picea abies*, and *Tilia cordata*. The lower tree layer (a2) had a mean coverage of 49% (range 5-100%), and its major component was *Carpinus betulus*. It was accompanied by the above-mentioned tree species except *Pinus sylvestris*. Much less often, the canopy was composed of only one layer. Its coverage ranged from 50% to 100% (mean 73%), mainly due to *Quercus robur*, which was accompanied by *Carpinus betulus* (often as a codominant). In some patches of that group, the tree layer included also some minor components: *Pinus sylvestris*, *Betula pendula*, and *Fagus sylvatica*. In degenerated phytocoenoses of *Gs-C holcetosum mollis* (Table A 21, relevés 1-30), the canopy was more often one-layered, and its coverage varied from 55% to 85% (Fig. 42). If the canopy was 2-layered, the coverage of the lower tree layer ranged from 5% to 70% (mean 36%), so it was lower than in untransformed patches. The canopy, irrespective of its structure, was composed mostly of *Quercus robur*, like in untransformed patches. However, the degenerated phytocoenoses were clearly distinguished by smaller contributions of *Carpinus betulus* and *Tilia cordata*, certainly due to human impact. Moreover, in some relevés, the contribution of *Pinus sylvestris* was considerable, and *Quercus rubra* was present in 2 relevés.

The coverage of the shrub layer (b) in both the degenerated and untransformed patches of *Gs-C holcetosum*, ranged from 0% to 75%. In untransformed phytocoenoses, this layer was composed mostly of *Carpinus betulus*, but substantial contributions of *Corylus avellana*, *Tilia cordata*, *Padus avium*, and *Picea abies* were recorded in several relevés. In degenerated patches, contributions of *Carpinus* and *Tilia* were lower.

The percent cover of the herb layer (c) varied widely (from 15% to 100%) but was not dependent on the stage of degeneration. In many relevés (40%), facies were formed mostly by *Stellaria holostea*, *Holcus mollis*, *Maianthemum bifolium*, *Convallaria majalis*, and *Poa nemoralis*. Facies of the last 2 mentioned species were particularly frequent in the typical variant and in the variant with *Solidago virgaurea*. The degenerated form was distinguished by a higher frequency of facies with *Vaccinium myrtillus*.

The moss layer was very poorly developed in a vast majority of relevés. Only rarely the contribution of bryophytes was higher, reaching up to 50% of the area. Constant components of this layer were *Polytrichastrum formosum* and *Atrichum undulatum*.

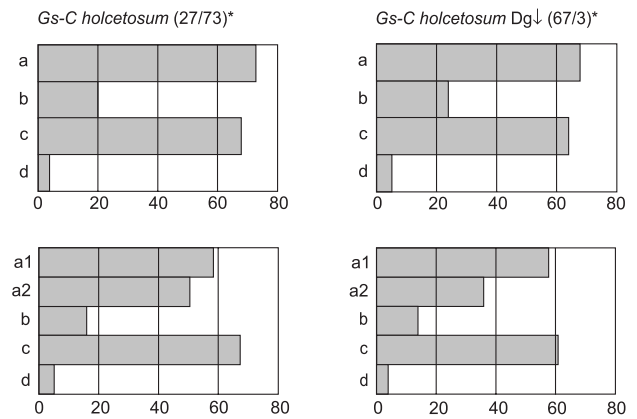


Fig. 42. Scheme of the vertical structure of untransformed *Galio sylvatici-Carpinetum holcetosum mollis* and of its degeneration stages

Explanations. One and two-layered tree-stands are shown on separate diagrams; bars denote the percent cover of vegetation layers; * percent contributions of relevés with one/two-layered canopy

The *Gs-C holcetosum*, in comparison with the other subassociations, is well-defined, distinguished by species of acidic sites (Table 10). Two of them (*Holcus mollis* and *Polytrichastrum formosum*), as well as *Vaccinium myrtillus*, were also differential species of *Gs-C polytrichetosum* in the table of W. Matuszkiewicz and A. Matuszkiewicz (1985), which presented the whole range of habitat variation of *Galio-Carpinetum* in Poland.

Table 10, composed of 105 relevés of this subassociation, includes 256 plant species. In individual relevés, 18-56 plant species were recorded (mean 34). The characteristic species combination of *Gs-C holcetosum* consists of diagnostic species of the association (with low constancy in the table) and of the alliance *Carpinion betuli* (*Carpinus betulus*, *Stellaria holostea*, etc.), other species of the order *Fagetalia sylvaticae*, and class *Querco-Fagetea* (*Anemone nemorosa*, *Viola reichenbachiana*, *Atrichum undulatum*, *Poa nemoralis*, etc.), class *Quercetea robori-petraeae* (*Holcus mollis*, *Polytrichastrum formosum*, etc.), class *Vaccinio-Piceetea* (mostly *Vaccinium myrtillus*), and general forest species (*Quercus robur*, *Luzula pilosa*, and *Maianthemum bifolium*).

The subassociation *Gs-C holcetosum mollis* can be subdivided into 3 moisture variants: with *Lysimachia vulgaris* (wet; Table 10, col. 1 and 2), typical (col. 3), and with *Solidago virgaurea* (fresh; col. 4). Most of the species that distinguish the first variant (*Carex pallescens*, *C. pilulifera*, *Deschampsia caespitosa*, *Dryopteris carthusiana* and *Lysimachia vulgaris*) were regarded by Krotoska (1966) as differential species of the subassociation *Gs-C holcetosum mollis*. The typical variant has no diagnostic species. Differential species of the last mentioned variant include: *Brachypodium sylvaticum*, *Hypericum perforatum*,

Melampyrum nemorosum, and *Solidago virgaurea*, as well as (in common with the *Gs-C calamagrostietosum* and *Gs-C lathyretosum*) *Campanula persicifolia*, *Hieracium sabaudum*, and *Quercus petraea*. The subassociation *Gs-C holcetosum* defined in this way, differs from its original definition by Krotoska (1966). In the classification proposed here, this syntaxon includes not only the phytocoenoses developed, according to the cited author, on specific moist sites with compact soils and surface-water gleying (which correspond to the variant with *Lysimachia vulgaris*), but also the forms of *Galio-Carpinetum* (variants: typical and with *Solidago virgaurea*) occupying less moist and less acidic sites.

The *Gs-C holcetosum* in the variant with *Lysimachia vulgaris* can be further subdivided (Table A20) into 2 subvariants and geographic races. The subvariant with *Pulmonaria obscura* (relevés 1-6) is distinguished by the presence of several species typical of more fertile oak-hornbeam forest sites (*Corylus avellana*, *Adoxa moschatellina*, *Asarum europaeum*, *Glechoma hederacea*, *Lysimachia nummularia*, and *Plagiomnium affine*). This is the most fertile form of *Gs-C holcetosum*, most similar to the *Gs-C typicum*. It corresponds to, and is represented by the same relevés as the local variant with *Pulmonaria obscura*, distinguished by Krotoska (1966) within the *Gs-C holcetosum*. All the other relevés in Table A20 were classified as the typical subvariant (relevés 6-81). It comprises the other local variants (typical, with *Carex brizoides*, and with *Calamagrostis arundinacea*), distinguished by the cited author. Those syntaxa did not have any clear groups of differential species, so they are not retained in the present study. Some relevés of the variant with *Carex brizoides* are grouped in that table (relevés 77-81), and distinguished as a facies. It is noteworthy that the cited author described also the *Gs-C caricetosum brizoidis*. That subassociation, as defined by Krotoska (1966, 1972) belongs to the group of moist and fertile oak-hornbeam forests, where it forms a poorer subgroup.

Several relevés of the variant with *Lysimachia vulgaris* within the subassociation *Gs-C holcetosum* (Table A20, relevés 70-76) represent the south-eastern race of this syntaxon, distinguished already by Krotoska (1966). The cited author emphasized that this form of oak-hornbeam forest is loosely linked with the regional association *Galio-Carpinetum*. The constant participation of *Cruciata glabra*, one of differential species of subcontinental oak-hornbeam forest *Tilio-Carpinetum*, indicates that this form is related to it.

All the relevés of impoverished *Gs-C holcetosum* have been classified here as the variant with *Lysimachia vulgaris* (Table 10, col. 2; Table A21). In original authors' diagnoses, they were usually included in tables of *Galio-Carpinetum* (12 relevés) or *Pino-Quercetum* (8 relevés). They are distinguished by a much smaller

contribution of *Carpinus betulus* to the tree layer, and, at most, a very small admixture of other diagnostic species of *Gs-C* and of the alliance *Carpinion betuli*. Moreover, some relevés are characterized by a low number (3-4) of species of the class *Querco-Fagetea*. According to the criteria proposed by Faliński (1966), they must be diagnosed as the Central European oak-hornbeam forest *Galio sylvatici-Carpinetum holcetosum* in stages II or III of degeneration. Apart from the markedly lower contribution of *Carpinus*, human impact is reflected also in a considerable admixture of *Pinus sylvestris* or *Quercus rubra* in the tree layer.

A specific form of degeneration of *Galio sylvatici-Carpinetum*, provisionally identified as the community *Oxalis acetosella-Pinus sylvestris*, is documented in col. 8 of Tables 10 and A21 (relevés 31-40). The canopy was 2-layered, dominated by *Pinus* and *Carpinus* (or *Quercus*). The shrub layer was usually absent. The herb layer reached a high coverage and was dominated by *Oxalis acetosella*. Bryophytes were usually absent. Most of the relevés of this type of oak-hornbeam forest were poor in species (17-28 species, only exceptionally up to 47). Its species composition is distinguished by a lower contribution of species of the class *Querco-Fagetea*, but first of all, by a lack of diagnostic species of both the association *Galio sylvatici-Carpinetum* and the alliance *Carpinion betuli*, except for *Carpinus betulus*. Thus the classification of the community *Oxalis acetosella-Pinus sylvestris* as *Galio sylvatici-Carpinetum* is doubtful. However, bearing in mind the constant participation of *Carpinus* and several species of the order *Fagetalia sylvaticae* and of the class *Querco-Fagetea*, as well as the lack of species locally characteristic of the association *Calamagrostio-Quercetum*, it is assumed here that this community is a degeneration/regeneration form of the subassociation *Gs-C holcetosum mollis* in the variant with *Lysimachia vulgaris*. Among the differential species of the subassociation, only *Holcus mollis* shows a high constancy.

Galio sylvatici-Carpinetum calamagrostietosum arundinaceae Preising 1943 ex Traczyk 1962

Nomenclature type (protologue): *Galio-Carpinetum calamagrostietosum* (Preising 1943), tab. synopt. I, col. 35 (Traczyk 1962b)

Nomenclature type: *Galio (sylvatici)-Carpinetum calamagrostietosum* (Oberd. 1957), tab. 31, rel. 15 (Boiński 1973) *neotypus hoc loco*

Synonym: *Galio sylvatici-Carpinetum polytrichetosum* W. Matuszkiewicz, A. Matuszkiewicz 1985 *nom. inval.* (Art. 5) *p.max.p.*

D. subass.: *Campanula rotundifolia*, *Festuca ovina* (?), *Leucobryum glaucum*, *Polygonatum odoratum*

D. subass. in relation to *Gs-C holcetosum mollis*: *Astragalus glycyphyllos*, *Calamagrostis arundinacea*,

Campanula persicifolia, *Carex digitata*, *Hepatica nobilis*, *Lathyrus montanus*, *Lilium martagon*, *Viola riviniana*, *Quercus petraea* and others in common with the *Gs-C. lathyretosum verni*.

This subassociation is represented in the present study by only 9 relevés (Table 10, col. 5; Table A23, relevés 1-9). All of them were originally reported by Boiński (1973), who diagnosed most of them as the *Gs-C calamagrostietosum arundinaceae* (in the typical variant or with *Fagus sylvatica*).

The canopy of *Gs-C calamagrostietosum* was composed of 1-2 layers. The upper layer consisted of *Quercus petraea* and/or *Q. robur*. The dominant species of the lower tree layer was *Carpinus betulus*. Minor species in both tree layers were *Fagus sylvatica* and rarely *Tilia cordata*. The shrub layer was relatively well-developed. It was composed mostly of *Carpinus*, *Fagus*, and *Quercus petraea*. The herb layer was dominated by one of the following species: *Calamagrostis arundinacea* (sometimes accompanied by *Convallaria majalis* or *Athyrium filix-femina* as co-dominants), or *Poa nemoralis* and *Oxalis acetosella*. A well-developed moss layer was present in only few relevés. The most frequent moss species was *Polytrichastrum formosum*.

In individual relevés of this subassociation, 26-46 species were recorded (Fig. 43). The characteristic species combination of *Gs-C calamagrostietosum* includes diagnostic species of the association and of the alliance *Carpinion* (*Carpinus betulus*, *Galium sylvaticum*, *Festuca heterophylla* and *Stellaria holostea*), but also the relatively frequent other species of the classes *Querco-Fagetea* (*Carex digitata*, *Melica nutans*, *Galeobdolon luteum*, *Poa nemoralis*, etc.) and *Quercetea robori-petraeae* (*Calamagrostis arundinacea*, *Hieracium sabaudum*, *H. lachenalii*, *Lathyrus montanus*), the less frequent plants of mixed coniferous forests from the class *Vaccinio-Piceetea* (mainly *Vaccinium myrtillus*), and finally forest species with a wider ecological scale (*Convallaria majalis*, *Majanthemum bifolium*, *Mycelis muralis*, etc.).

Differential species of *Gs-C calamagrostietosum* are: *Campanula rotundifolia*, *Leucobryum glaucum*, *Polygonatum odoratum*, *Trientalis europaea*, and *Vaccinium myrtillus* (Table 10, col. 5). The diagnostic value of the last 2 mentioned species is confirmed only regionally. Boiński (1973: 63) indicated the following differential species of the subassociation: *Quercus petraea*, *Sorbus aucuparia*, *Calamagrostis arundinacea*, *Vaccinium myrtillus*, *Pteridium aquilinum*, *Solidago virgaurea*, *Hieracium lachenalii*, *Polytrichastrum formosum*, *Pleurozium schreberi* and *Leucobryum glaucum*. He emphasized that they are “nearly exclusively characteristic species of the classes *Quercetea robori-petraeae* and *Vaccinio-Piceetea*.”

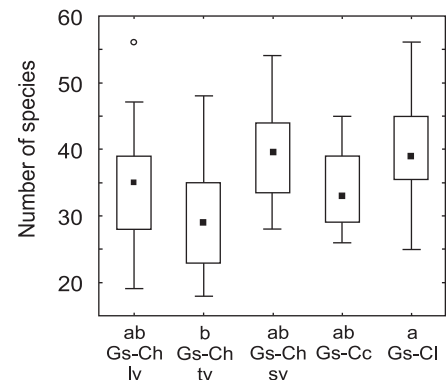


Fig. 43. Variation in number of species in relevés of subassociations and variants of *Galio sylvatici-Carpinetum*

Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 130$), $H = 11.98$, $p = 0.0175$. GCh – *Galio sylvatici-Carpinetum holcetosum*, lv – variant with *Lysimachia vulgaris*, tv – typical variant, sv – variant with *Solidago virgaurea*; GCc – *Gs-C calamagrostietosum arundinaceae*; GCI – *Gs-C lathyretosum verni*. For other explanations, see Fig. 17

The *Gs-C calamagrostietosum* is synonymous with the *Querco-Carpinetum wartyo-vistulense calamagrostietosum*, described by Preising (1943) from Wielkopolska (Traczyk 1962b; Krotoska 1966).

Galio sylvatici-Carpinetum lathyretosum verni Preising 1943 ex Krotoska 1966

Most of the 16 relevés assigned here to this subassociation (Table 10, col. 6; Table A23, relevés 10-25) were initially diagnosed by Boiński (1973) as the *Galio sylvatici-Carpinetum calamagrostietosum*.

The canopy of *Gs-C lathyretosum* was usually 2-layered. The upper layer was dominated by *Quercus petraea* (with admixture of *Q. robur*, *Fagus sylvatica*, or *Tilia cordata*), while the lower layer, by *Carpinus*. The shrub layer was usually well-developed, composed mostly of the species that formed also the canopy, but with a lower contribution of *Quercus*. Plants of the herb layer in many relevés reached a high coverage. In individual patches, facies were formed by *Calamagrostis arundinacea*, *Convallaria majalis*, *Poa nemoralis*, and *Galium odoratum*. The moss layer was well-developed in only several relevés, and its major components were *Polytrichastrum formosum* and *Atrichum undulatum*.

The relevés documenting the *Gs-C lathyretosum* (Fig. 43) were usually rich in species (25-56). In Tables 10 and A23, this subassociation is distinguished by e.g. the presence of many relatively constant species diagnostic for the *Galio-Carpinetum* and the alliance *Carpinion betuli* (*Carpinus betulus*, *Galium sylvaticum*, *Festuca heterophylla*, *Stellaria holostea*, and *Tilia cordata*). Other well-represented groups are also characteristic species of the order *Fagetalia sylvaticae* and of the class *Querco-Fagetea* (*Carex digitata*, *Galeobdolon luteum*, *Lathyrus niger*, *Melica nutans*, *Poa nemoralis*, *Pulmonaria obscura*, *Viola reichenbachiana* etc.), as well

as of the class *Quercetea robori-petraeae* (*Calamagrostis arundinacea*, *Hieracium lachenalii*, *Lathyrus montanus*, etc.). Among the plants with a wider ecological scale, a high constancy in the table was reached by e.g. *Convallaria majalis*, *Dactylis glomerata*, *Maianthemum bifolium*, *Mycelis muralis*, *Sorbus aucuparia*, and *Veronica chamaedrys*. It must be stressed that species of the class *Vaccinio-Piceetea* are infrequent in this subassociation.

Assignment of the relevés described above to the subassociation *Gs-C lathyretosum* is not problematic. In comparison with the other subunits of oak-hornbeam forest compiled in Table 10, this subassociation is characterized by a relatively long list of differential species (Table 10, col. 6). Four of them (*Lathyrus niger*, *L. vernus*, *Phyteuma spicatum*, and *Pulmonaria obscura*) were also classified as differential species of the subassociation by Krotoska (1966) and/or W. Matuszkiewicz & A. Matuszkiewicz (1985). Other species of this rank, indicated by the cited authors, are included in Table 10 in the group of differential species of moderately dry oak-hornbeam forests (*Calamagrostis arundinacea*, *Campanula persicifolia*, *Carex digitata*, *Festuca heterophylla*, *Lathyrus montanus*, and *Quercus petraea*). A high constancy in the table was reached by *Galium sylvaticum*. As emphasized by both Traczyk (1962a) and Krotoska (1966), this species reaches its phytosociological optimum in patches of *Gs-C lathyretosum*. This is consistent with results of an analysis of the synoptic table of W. Matuszkiewicz & A. Matuszkiewicz (1985). This finding is also confirmed in Table 10.

The above description of the subassociation *Gs-C lathyretosum* is not typical for this syntaxon. In comparison with the synoptic table of W. Matuszkiewicz & A. Matuszkiewicz (1985), which presents e.g. the species composition of the Wielkopolska race of the subassociation, the contribution of acidophilous species is increased here (e.g. *Calamagrostis arundinacea*, *Hieracium lachenalii*, and *H. sabaudum*). In my opinion, this form of *Gs-C lathyretosum* should be distinguished as a variant with *Calamagrostis arundinacea*. This variant would be the poorest syntaxon within the subassociation. The presence of the above-mentioned species indicates that it is related to the acidophilous oak forest *Ca-Q polygonatetosum*. Because of the presence of xerothermophilous species, it is also somewhat similar to the thermophilous oak forest *Potentillo albae-Quercetum*.

Galio sylvatici-Carpinetum typicum Oberd. 1957

In the present study, 14 relevés have been assigned to this subassociation. Their authors diagnosed them as the *Gs-C holcetosum mollis* (7 relevés), or did not identify them to the level of subassociation. Their common feature is the presence of several acidophilous species.

Among them, constant components of the table are *Hieracium sabaudum* and *Vaccinium myrtillus*.

The studied phytocoenoses are characterized by a 2-layered canopy, composed of *Quercus robur* and *Carpinus betulus* (Table A22, relevés 25-38). Such a structure is typical for oak-hornbeam forest. The presence of diagnostic species (most constant in the table: *Carpinus betulus*, *Tilia cordata*, and *Ranunculus auricomus*) indicates that they represent the association *Galio sylvatici-Carpinetum*. The diagnosis at the level of subassociation is justified by the lack or very low contribution of differential species of the known subassociations within the syntaxon (see Table 10). The above-mentioned acidophilous species (*Hieracium sabaudum* and *Vaccinium myrtillus*), as shown in Table 10, are not associated with the *Gs-C holcetosum*. The relatively small number of species in individual relevés and the low constancy in that table of some species of the class *Quercio-Fagetea* indicate that this is a impoverished form of the subassociation.

Analysis of selected site indicators

The above description of the habitat variation of *Galio-Carpinetum* is additionally confirmed by results of analyses of Ellenberg indicator values. The PCA ordination diagram (Fig. 41a) indicates that the distribution of relevés along the first ordination axis is related to decreasing moisture (F) and increasing soil reaction (R), while along the second axis, it is related to increasing light (L) and soil fertility values (N). Kruskal-Wallis test brings similar results (Fig. 44). Values of the indicators change only slightly, fitting within the range reflecting moderate soil moisture (F=5), moderate acidity (R=5), and moderate fertility (N=5). Light conditions at the forest floor were favourable for half shade plants (L=5). The most wet and acidic sites are indicated in the patches of *Gs-C holcetosum* in the variant with *Lysimachia vulgaris* (Fig. 44).

Substitute forest communities from the class *Quercio-Fagetea*

Column 9 of the synoptic Table 10 (see also Table A24) includes relevés whose simplified and impoverished species composition enables their identification only to the class level. Individual relevés were assigned by their authors to several associations, sometimes as degenerated forms. Most often they were identified as the *Galio-Carpinetum* (13 relevés, including 9 as the *Gs-C holcetosum* and 4 as the *Gs-C calamagrostietosum*), mixed coniferous forest (8 relevés including *Pino-Quercetum* and *Quercio-Pinetum*), *Potentillo albae-Quercetum* (7), *Calamagrostio-Quercetum* (6), or as "oak forest from the class *Quercio-Fagetea* with *Pinus*" (5).

The canopy in some of the relevés was dominated by *Pinus sylvestris*. In the others, usually pure stands

of *Q. petraea* or *Q. robur* prevailed. It is noteworthy that the floristic composition included many species of the order *Fagetalia sylvaticae* and of the class *Querco-Fagetea*, as well as of the class *Quercetea robori-petraeae*. Among species of the class *Vaccinio-Piceetea*, apart from *Pinus sylvestris*, also *Vaccinium myrtillus* and *Pleurozium schreberi* were frequent. They indicated that those communities are related to pine forest stands. Another well-represented group was the class *Artemisietea vulgaris* (Table A24).

The lack or very low contribution of regionally differential species of *Querco-Pinetum* (*Dicranum polysetum*, *Hylocomium splendens*, and *Vaccinium myrtillus*) indicates that this association is not represented in Table 10, not even as strongly degenerated forms. The floristic analysis does not make it possible to confirm or exclude that the relevés describe potential sites of *Galio sylvatici-Carpinetum*, *Potentillo albae-Quercetum* or even *Calamagrostio arundinaceae-Quercetum*.

6.3.5. *Potentillo albae-Quercetum* Libbert 1933 nom. invers.

Basic documentation

The habitat variation of thermophilous oak forest *Potentillo albae-Quercetum*, presented in the synoptic

Table 11, is documented by 242 relevés. These include degenerated forms (88 relevés) and substitute forest communities occupying potential sites of thermophilous oak forest (56 relevés). The remaining 98 relevés have been classified here as untransformed form of the association (Table 11, col. 1-8, and Tables A25, A27, and A28). Additionally, analytic tables show the separated groups of relevés recorded probably in heterogeneous patches (Table A25, relevés 38-45), and older relevés documenting patches that presumably include also fragments of shrub communities of forest edges (Table A27, relevés 24-36). Those 21 relevés are not taken into account in the above-mentioned synoptic tables. The relevés of untransformed form of *Potentillo-Quercetum* were usually diagnosed (38 relevés) by their authors only to the association level. Another 58 relevés were assigned to several subassociations: the *Pa-Q brachypodietosum* (32), *Pa-Q poëtosum* (10), *Pa-Q typicum* (6), *Pa-Q molinietosum* (8), *Pa-Q lathyretosum* (1), and *Pa-Q astrantietosum* aff. (1). It is noteworthy that only 4 relevés were diagnosed as a variant of the association of thermophilous oak forest, as defined by Brzeg & Kasproicz (2001).

Degenerated forms of *Potentillo albae-Quercetum* and substitute forest communities on potential sites of the association are documented in the synoptic Table

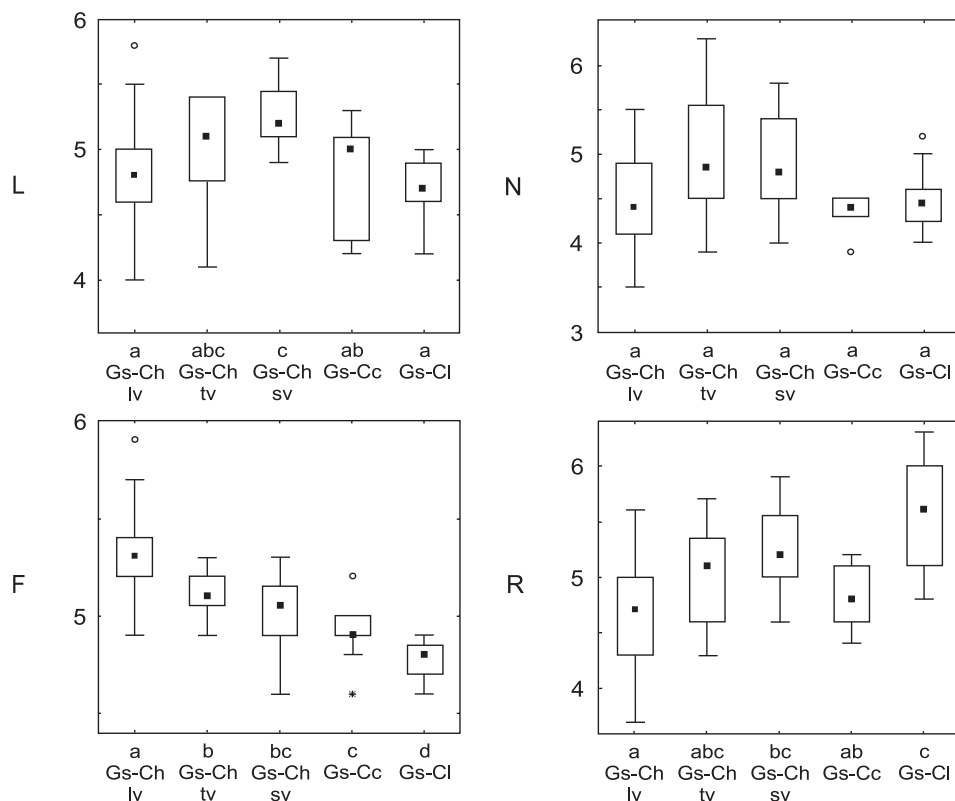


Fig. 44. Ellenberg indicator values for variants of subassociations of *Galio sylvatici-Carpinetum*

Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 130$), L – light $H = 23.26$, $p < 0.001$; F – soil moisture $H = 71.42$, $p < 0.001$; N – soil productivity $H = 13.61$, $p = 0.009$; R – soil reaction $H = 37.42$, $p < 0.001$. GCh – *Galio sylvatici-Carpinetum holcetosum*, lv – variant with *Lysimachia vulgaris*, tv – typical variant, sv – variant with *Solidago virgaurea*; GCc – *Gs-C calamagrostietosum arundinaceae*, GCl – *Gs-C lathyretosum*. For other explanations, see Fig. 17

11 (col. 9-11 and 12-14) and in the analytic Tables A26, A29, and A30.

Distribution

Well-developed patches of *Potentillo albae-Quercetum* (98 relevés) are located in 13 basic ATPOL squares (Fig. 45). Most of them (12), according to the geobotanical regionalization of J.M. Matuszkiewicz (2008a), are situated in the Brandenburg-Wielkopolska Division, mostly in the eastern and north-eastern parts of the Noteć-Lubusz Region and in the southern part of the Kujawy Region. This association is less frequent in the eastern part of the Central Wielkopolska Region. One locality is situated in the western part of the South Polish Upland Division (Dział Wyżyn Południowopolskich), more precisely in the Łódź-Wieluń Plateau Region (Kraina Wysoczyzn Łódzko-Wieluńskich).

According to the forest regionalization system (Trampl *et al.* 1990), most of the analysed localities (10) of *Potentillo albae-Quercetum* in the study area are distributed in the Wielkopolska-Pomeranian Region, especially in its subunit, the Wielkopolska-Kujawy Lowland.

Patches of thermophilous oak forest in stage II of degeneration are documented in 23 localities (Fig. 46). Their distribution roughly corresponds to the location of untransformed patches of the association. Much more common are the degenerated forms of *Potentillo albae-Quercetum*, particularly those representing the typical subassociation. They were found in 13 basic ATPOL squares, while untransformed ones, only in 5.

Subdivision based on habitat variation and anthropogenic dynamics

Results of the classical phytosociological analysis show that in the collected database, 261 relevés represent the association *Pa-Q* or its substitute forest communities. It must be emphasized that most of them were similarly identified in the original publications. Results of this study indicate that thermophilous oak forest can develop in the study area as several syntaxa of various ranks, conditioned by natural site variation. At the level of subassociations, these include (Table 11):

- *Potentillo albae-Quercetum astrantietosum* Jakubowska-Gabara 1993 (col. 1),

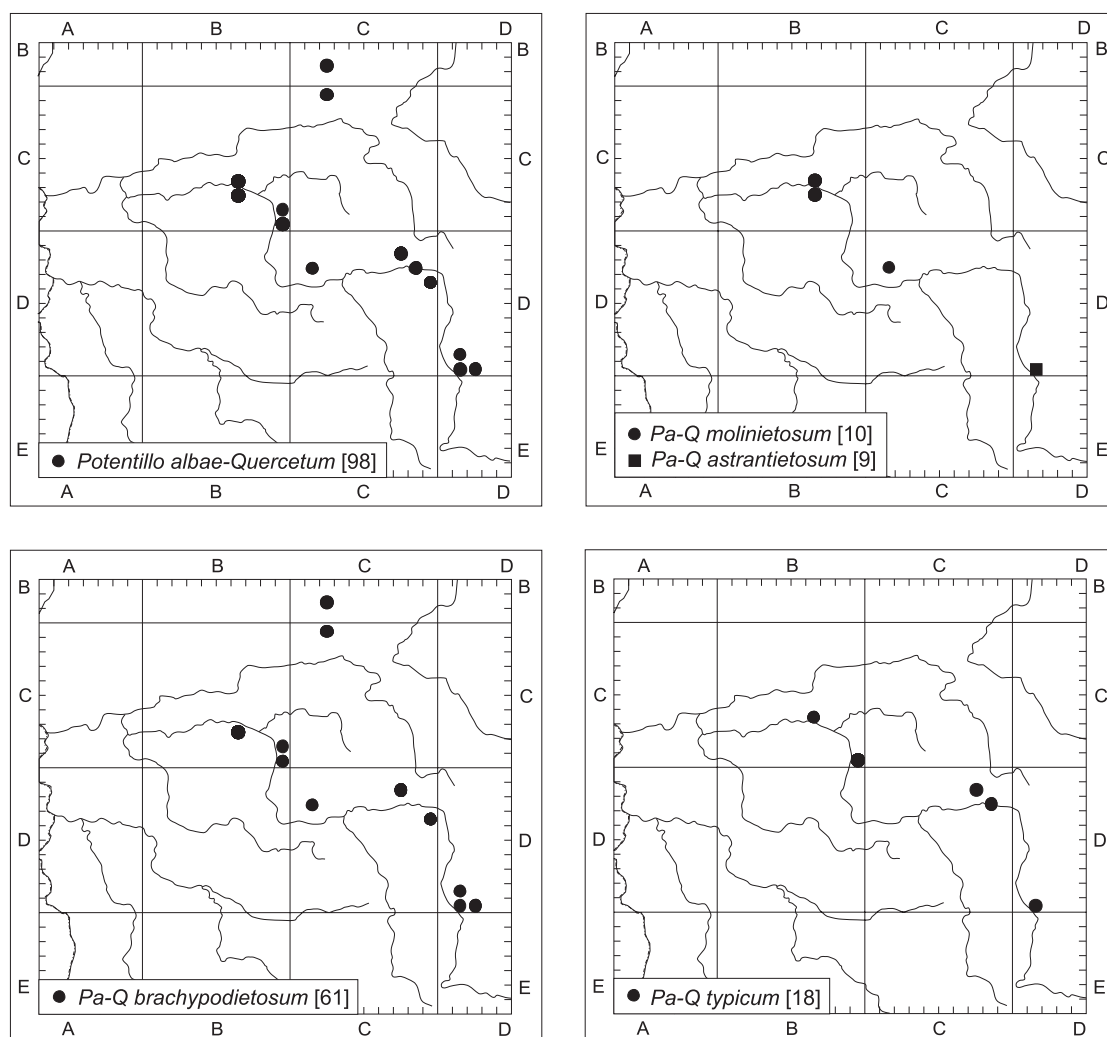


Fig. 45. Distribution of localities of untransformed *Potentillo albae-Quercetum* (number of relevés in brackets)

- *Potentillo albae-Quercetum molinietosum* Brzeg et Kasprowicz 2001 ex Kasprowicz 2010 subass. nova (col. 2, 3, 9),
- *Potentillo albae-Quercetum typicum* Preising 1943 ex W. et A. Mat. 1956 (col. 4, 5, 10),
- *Potentillo albae-Quercetum brachypodietosum pinnati* M. Wojterska et Wiszniewska 1996 ex Kasprowicz 2010 subass. nova (col. 6-8, 11)

Table 11 comprises also a substitute forest community on a potential site of this association (col. 12-14).

The present analysis of the habitat variation of the association *Potentillo albae-Quercetum* is based on the concept of Brzeg & Kasprowicz (2001), briefly described already on p. 36 of the present monograph. The cited authors suggested that 3 subassociations should be distinguished. They are conditioned by soil moisture: the *Pa-Q molinietosum* on moist sites, *Pa-Q typicum* on fresh sites, and *Pa-Q brachypodietosum pinnati* on the driest and warmest sites. Within the subassociations, trophic variants were distinguished, reflecting the varied fertility of the soils (with *Asarum europaeum*, typical, and with *Pleurozium schreberi*).

The subassociation *Pa-Q astrantietosum*, which was initially regarded as a synonym of *Pa-Q molinietosum* (Wojterska & Wiszniewska 1996; Wojterska et al. 2006), is in the present study considered to be a separate unit within moist sites. All the syntaxa except the typical subassociation (which was also variously defined), have been distinguished relatively recently and do not have a sufficient phytosociological documentation, not only in Wielkopolska, but also throughout the distribution range of the association. Presumably, some of the relevés documenting it, represent heterogeneous patches, including various subassociations or variants. In Table A25, relevés 38-45 are distinguished as a separate group, whose species composition includes a mixture of differential species of subassociations found on more moist sites (*Pa-Q astrantietosum* and *Pa-Q molinietosum*), and of the subassociation found on drier soils (*Pa-Q brachypodietosum*).

The picture of variation of *Pa-Q*, based on results of a PCA analysis of 98 well-developed patches of the association (Fig. 47), does not fully reflect its habitat variation presented above. In the PCA ordination diagram, a well-defined unit is the *Pa-Q astrantietosum*.

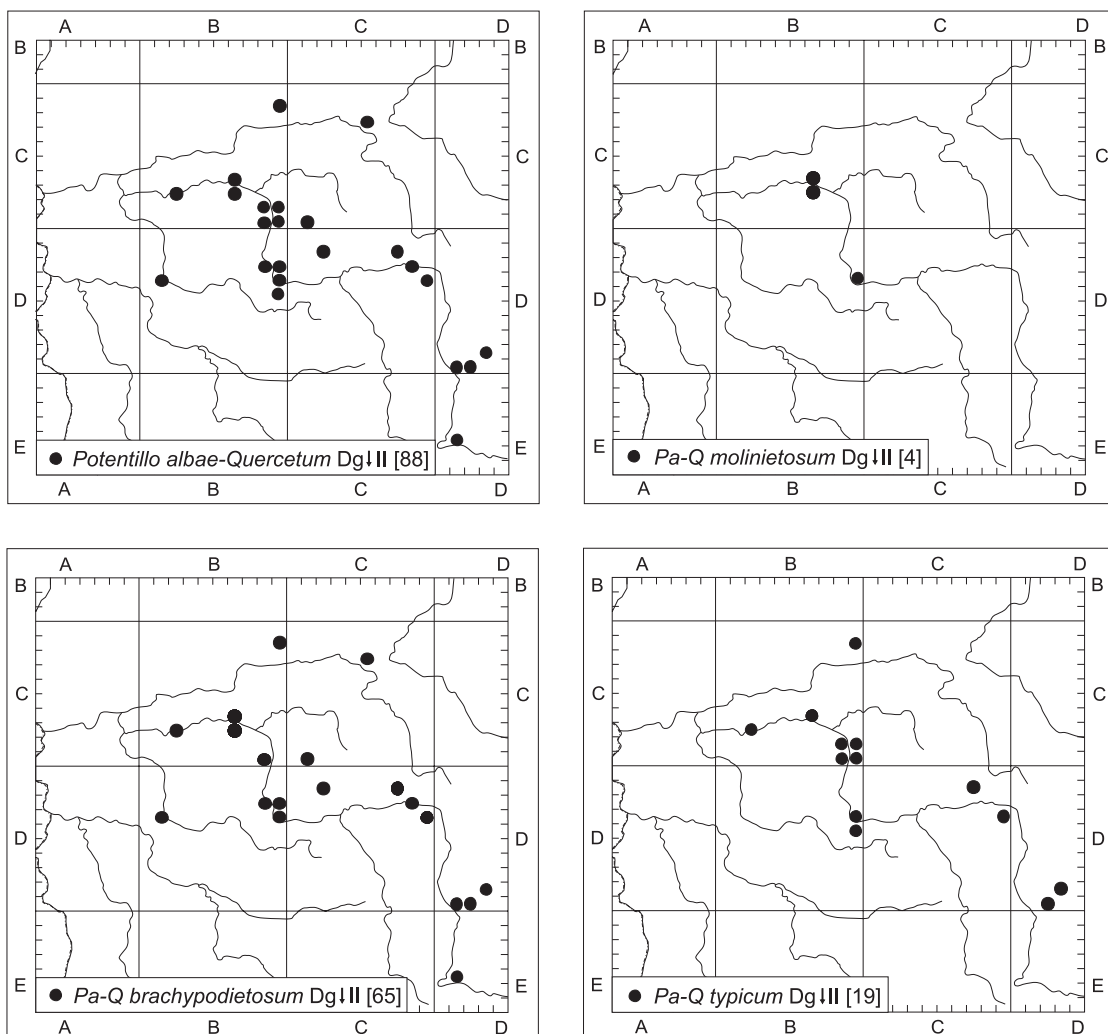


Fig. 46. Distribution of localities of *Potentillo albae-Quercetum* in stage II of degeneration (number of relevés in brackets)

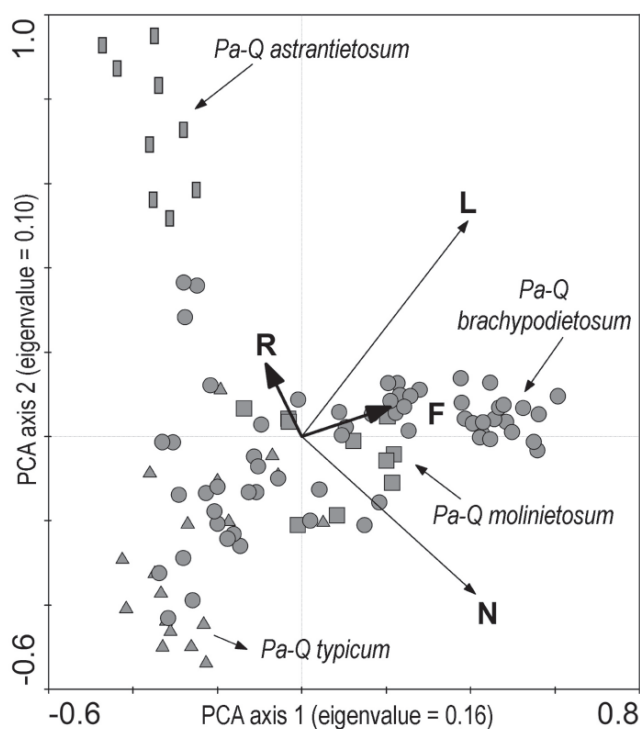


Fig. 47. PCA ordination of plots of subassociations of *Potentillo albae-Quercetum*, relevés classified according to the classical phytosociological method, and passive projection (arrows) of mean Ellenberg indicator values

Explanations: F – soil moisture, L – light, N – soil productivity, R – soil reaction

This is consistent with results of an earlier report (Jakubowska-Gabara 1993: Fig. 48). Relevés of the other subassociations form one cluster, where only the *Pa-Q typicum* can be partly distinguished.

The species composition of untransformed patches of *Potentillo albae-Quercetum* (Table 11, col. 1-8) was briefly described on p. 41. Its analysis shows that, in the study area, the association has a typical species combination. Its characteristic species are well-represented. These include e.g. *Ranunculus polyanthemus*, *Potentilla alba*, *Pulmonaria angustifolia*, and *Festuca amethystina* ssp. *ritschlii*. The first 2 of them reach a high constancy in at least some forms of thermophilous oak forest presented in this table. By contrast, the last 2 species are found mostly in patches of *Pa-Q brachypodietosum*. This, however, is probably not typical of the subassociation, but is mostly due to the inclusion of relevés from the “Świetlista Dąbrowa” Reserve near Obrzycko, which protects exceptionally well-developed phytocoenoses of *Potentillo albae-Quercetum*. Among species of the order *Quercetalia pubescentis*, the most abundant are *Campanula persicifolia* and *Carex montana*, and in some subassociations also *Lathyrus niger* and *Hypericum montanum*.

The degenerated form of *Pa-Q* (Table 11, col. 9-11) is characterized by a lower frequency (or even absence

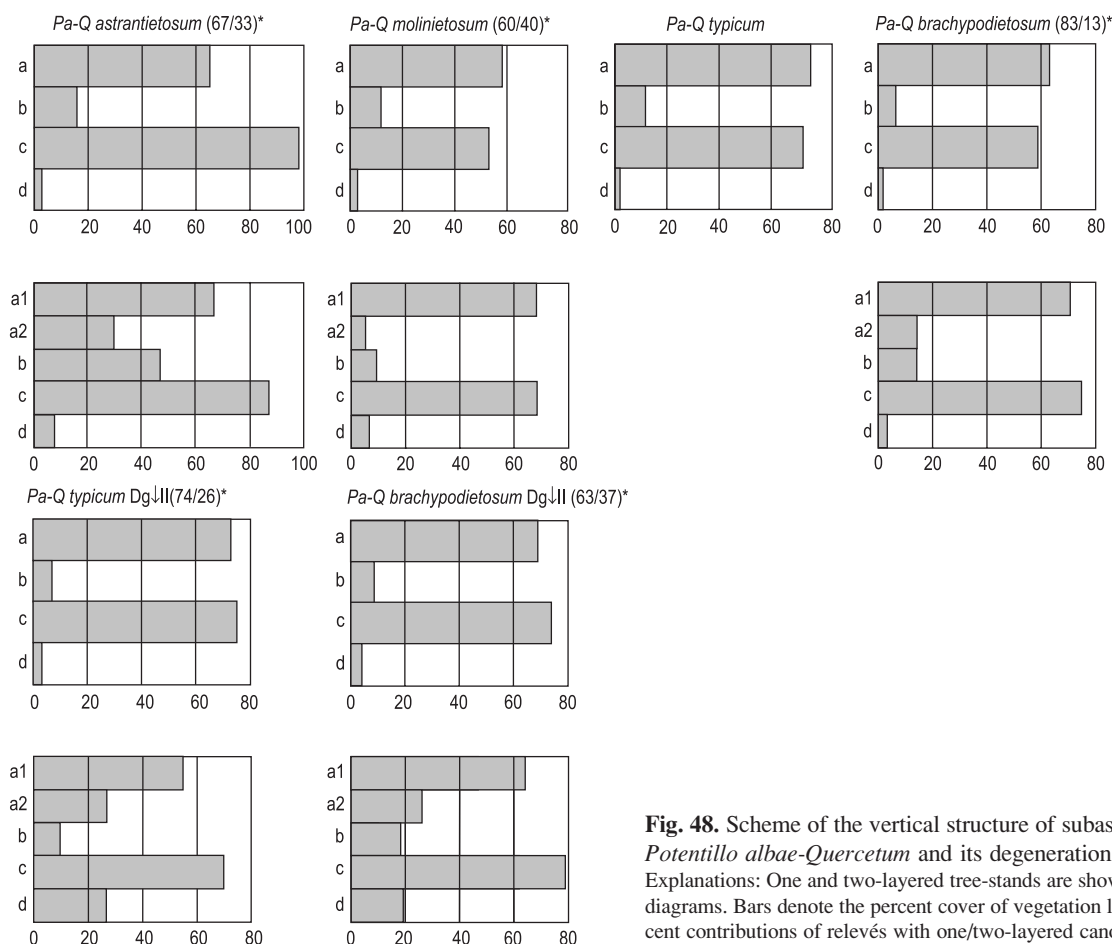


Fig. 48. Scheme of the vertical structure of subassociations of *Potentillo albae-Quercetum* and its degeneration stages (Dg) Explanations: One and two-layered tree-stands are shown on separate diagrams. Bars denote the percent cover of vegetation layers; * – percent contributions of relevés with one/two-layered canopy

in some subassociations) of characteristic species of the association and of the order *Quercetalia pubescentis*. Considering the concept of Faliński (1966), these features suggest that this form of thermophilous oak forest represents stage II of its degeneration.

Potentillo albae-Quercetum astrantietosum Jakubowska-Gabara 1993

In this study, only 9 relevés are identified as this subassociation (Table 11, col. 1, Table A25). Most of its patches had a one-layered canopy composed of *Quercus robur*, sometimes with a small contribution of *Q. petraea*, *Pinus sylvestris*, *Populus tremula*, and *Betula pendula* (Fig. 48). If the canopy was 2-layered, then the lower tree layer included *Carpinus betulus*, but the major component was *Corylus avellana*. Due to the latter species, the coverage of the shrub layer in several relevés was exceptionally high, as compared to other patches of thermophilous oak forest. In comparison with the other subassociations, patches of *Pa-Q astrantietosum* are distinguished by an exceptionally dense herb layer, in most relevés reaching full coverage under a one-layered canopy. *Galium schultesii* and *Melampyrum nemorosum* were most abundant, forming facies in some patches. Bryophytes were represented by only 1-3 species in individual relevés, and did not form a well-defined layer.

The relevés were floristically rich and included 61-86 (on average 72) species (Fig. 49). The species composition of this subassociation is typical for thermophilous oak forest. Despite the lack of *Potentilla alba* in the studied relevés, their identification as the association *Potentillo albae-Quercetum* does not raise any doubts.

All the relevés classified here as representing the *Pa-Q astrantietosum* were identified by their author (Jakubowska-Gabara 1994) as the subassociation *Pa-Q poëtosum* Sokołowski 1963. According to the cited author, the latter subassociation is developed on brown soils and is characterized by a high contribution of species of the class *Querco-Fagetea* as well as meadow plants. This makes it somewhat similar to the *Potentillo albae-Quercetum trollietosum* described from the Białowieża Forest by W. Matuszkiewicz & A. Matuszkiewicz (1956). However, these features are typical not only for the *Pa-Q poëtosum*, but also for the *Pa-Q astrantietosum*. Jakubowska-Gabara (1994), who described this subassociation, indicated that its differential species are: *Astrantia major*, *Angelica sylvestris*, *Succisa pratensis*, *Molinia caerulea*, *Lathyrus pratensis*, and *Sanguisorba officinalis*. In her Table 12, comparing the *Pa-Q typicum* and *Pa-Q astrantietosum*, the latter subassociation is clearly distinguished also by *Laserpitium prutenicum* (Jakubowska-Gabara 1994). The diagnostic value of 4 of these species for the *Pa-Q astrantietosum* (*A. major*, *A. sylvestris*, *L. prutenicum*,

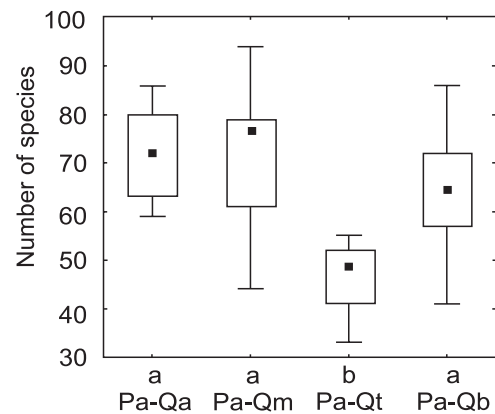


Fig. 49. Variation in number of species in relevés of subassociations of untransformed *Potentillo albae-Quercetum*

Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 98$), $H = 34.67$, $p < 0.001$. For other explanations, see Fig. 17

and *L. pratensis*) is confirmed also in tables presented here (Tables 11 and A25). Thus the subassociation is very different from the *Pa-Q poëtosum*. It must be emphasized that in the original table of Sokołowski (1963), who described *Pa-Q poëtosum*, 3 species of that group and *Molinia caerulea* are missing, while *Laserpitium prutenicum* is present in 30% of relevés. Apart from that group, most of the species reaching in the study area an optimum in patches of *Pa-Q astrantietosum*, or even found exclusively in its patches (see Table 11), are probably not differential for the subassociation in other areas (see also e.g. the *Pa-Q rosetosum gallica*, Kaźmierczakowa 1971). Some of them (*Galium schultesii*, *Melittis melissophyllum*) are differential for other geographic races of thermophilous oak forest (Wojterska et al. 2006).

According to Jakubowska-Gabara (1993), the *Pa-Q astrantietosum* is a thermophilous oak forest type conditioned by livestock grazing, and it is found on potential sites of oak-hornbeam forest.

In Table A25 (relevés 1-9) of the subassociation *Pa-Q astrantietosum*, 2 forms can be clearly distinguished. One of them has no differential species, while the other (with *Geranium sanguineum*) is characterized by the presence of several xerothermophilous species generally regarded as diagnostic for the *Pa-Q brachypodietosum* (*G. sanguineum*, *Pimpinella saxifraga*, *Sedum maximum*, etc.). At the current stage of research on this subassociation, it is difficult to determine if those forms reflect natural site conditions, or the form with *Geranium sanguineum* illustrates mixed patches of *Pa-Q astrantietosum* and *Pa-Q brachypodietosum pinnati*. If we compare the ecological spectrum of the above-mentioned plants and differential species of *Pa-Q astrantietosum*, the latter hypothesis seems more likely.

The studied patches of *Pa-Q astrantietosum* show a low variation in species composition, irrespective of

local site conditions. They probably represent the typical variant.

Potentillo albae-Quercetum molinietosum Brzeg *et* Kasprowicz 2001 *ex* Kasprowicz 2010 *subass. nova*

Nomenclature type: *Potentillo albae-Quercetum petraeae molinietosum* M. Wojterska *et* Wiszniewska 1996 *Asarum* var. (rel. M12 in the text, Brzeg & Kasprowicz 2001: 189) *holotypus hoc loco*

Synonym: *Potentillo albae-Quercetum molinietosum* M. Wojterska *et* Wiszniewska 1996 *in* Brzeg *et* Kasprowicz 2001 *nom. inval.* (Art. 5)

D. subass.: *Carex nigra*, *C. ovalis*, *Cnidium dubium*, *Hypericum maculatum*, *Juncus effusus*, *Lysimachia vulgaris*, *L. nummularia*, *Molinia caerulea* [and locally as differential for a group of humid subassociations: *Carex pallescens*, *Deschampsia caespitosa*, *Hieracium sabaudum*, *Platanthera bifolia*, *Ranunculus acris*, *Scorzonera humilis*, *Selinum carvifolia*, *Succisa pratensis*]

In this study, only 10 relevés represent the *Pa-Q molinietosum* (Table A25, relevés 10-19). Most of them were recorded in the „Świetlista Dąbrowa” Reserve, which protects one of the best-preserved patches of the association *Potentillo albae-Quercetum*, not only on the scale of Wielkopolska (Wojterska *et al.* 2006; see also Wojterska *et al.* 2001; Wojterska & Wiszniewska 1996). Patches of this subassociation were found in small local depressions. They were much rarer there than the *Pa-Q brachypodietosum pinnati*, which covered larger areas.

The canopy in the studied relevés of *Pa-Q molinietosum* was usually one-layered. In some cases, an ill-defined lower tree layer developed, but its coverage did not exceed 5% (Fig. 48). The number of species forming the canopy in individual patches varied from 1 to 6 (mean 3). However, the major species was *Quercus robur*, and only rarely *Q. petraea* or their hybrid (*Quercus x rosacea*). In one relevé, *Pinus sylvestris* was a major admixture. Minor admixtures were sometimes *Fagus sylvatica* or *Sorbus aucuparia*. The shrub layer, with coverage varying from 5% to 25%, was present in all relevés. It was composed of *Corylus avellana*, *Frangula alnus*, young *Fagus sylvatica*, *Quercus robur*, etc. The herb layer covered 40-90% of plot area (Fig. 48). In only 2 relevés, facies were formed by *Convallaria majalis* (relevé 10) or *Vaccinium myrtillus* (relevé 19). In the other relevés, the cover-abundance of any herbaceous species did not exceed 2 on the Braun-Blanquet scale. The moss layer was poorly developed (coverage ranging from negligible to 15%) or absent. In several relevés, the number of moss species was relatively high (up to 10).

The *Pa-Q molinietosum* is represented by floristically rich relevés, with 44-94 species (on average 71) (Fig. 49). In total, 178 plant taxa were recorded there.

The table of this subassociation includes most of characteristic and differential species of the association (Table A25). Moreover, this syntaxon is well-defined floristically by a clearly distinguished group of differential species. Among them, the highest constancy in the table was reached by *Molinia caerulea*, *Hypericum maculatum*, *Lysimachia vulgaris*, and (in common with the *Pa-Q astrantietosum*) *Deschampsia caespitosa*.

The studied phytocoenoses of *Pa-Q molinietosum* represent 2 variants (Table A25): typical (relevés 10-15) and with *Pleurozium schreberi* (relevés 16-19). The latter variant is distinguished by species of highly acidic sites (*Hypnum cupressiforme*, *Pseudoscleropodium purum*, and *Pyrola minor*).

Transformed patches of *Pa-Q molinietosum*, representing stage II of degeneration, are documented by 4 relevés (Table A26, relevés 1-4). In comparison with untransformed patches, the degenerated form has a shorter list of differential species and is poorly distinguished.

Potentillo albae-Quercetum typicum Preising 1943 *ex* W. *et* A. Mat. 1956

Nomenclature type (protologue): *Querceto-Potentilletum albae typicum* (Preis. 1943) *em.* Mat. 1956, tab. synopt. 1,2,3, col. 17 acc. Libbert 1933 (Matuszkiewicz W. & Matuszkiewicz A. 1956: 34-35, 38-39, 52)

Nomenclature type: Die *Quercus-Potentilla alba*-Assoziation, tab. XXV, rel. 2 (Libbert 1933, p. 297-299) *neotypus hoc loco* (*lectotypus ass. propos.*)

In the present study, 37 relevés have been assigned to this subassociation. These include 18 relevés representing untransformed communities (Table 11, col. 4-5; Table A25, relevés 20-37), while the other 19 have been classified as stage II of degeneration (Table 11, col. 10; Table A26, relevés 5-23).

The canopy in all patches of *Pa-Q typicum* was one-layered (Fig. 48). Its coverage ranged from 40% to 90% (mean 75%). In individual patches, it was composed of only 1-2, rarely 3 species. The dominant species was usually *Quercus petraea* or (less often) *Q. robur*. In many relevés, *Pinus sylvestris* was an admixture. However, this species was recorded nearly exclusively in phytocoenoses of the fertile variant with *Asarum europaeum*. This suggests that it was planted there. In degenerated patches, the canopy is usually one-layered (Fig. 48), with a similar species composition as in untransformed phytocoenoses. Two-layered canopies varied widely. The coverage of the upper layer (a1) ranged from 30 to 100%, while that of the lower layer (a2), from 5% to 70%. The a1 layer was composed mostly of various proportions of *P. sylvestris* and *Q. petraea*, and rarely also of *Q. robur*. The a2 layer consisted of both *Quercus* spp., and in one relevé also of *Fagus sylvatica*.

The shrub layer (b) in untransformed patches was absent in some relevés, very poorly developed in some others, but sometimes reached a relatively high coverage (15-50%). It was composed of *Carpinus betulus*, *Corylus avellana*, *Q. petraea*, *Q. robur*, *Fagus sylvatica*, and *Sorbus aucuparia*. In degenerated phytocoenoses, the shrub layer consisted of the same species, and its coverage varied from negligible to 20%, or this layer was absent (in several relevés).

Plants of the herb layer in untransformed patches covered 40-90% of plot area. In several relevés, poorly defined facies were formed by *Convallaria majalis*, *Melica nutans*, *Melampyrum pratense*, *Vaccinium myrtillus*, etc. Degenerated phytocoenoses had similar herbaceous vegetation, but in several relevés *Vaccinium myrtillus* was more abundant. In well-developed phytocoenoses, the moss layer was absent in a few relevés, while in others it was composed of 1-5 species, but the layer was poorly developed. In many degenerated forest stands, the structure and species composition of the moss layer were similar. In several relevés, however, bryophytes played a more important role, covering 15-35% or even 70%.

Relevés of untransformed *Pa-Q typicum* contained 33-55 species (mean 47). In comparison with relevés of the other subassociations of thermophilous oak forest, they were poorer in species (Fig. 49). The typical subassociation has no differential species. The studied patches can be identified with 2 of the 3 variants proposed by Brzeg and Kasproicz (2001). These include the typical variant without differential species (Table A25, relevés 31-37; Table 11, col. 4) and the variant with *Asarum europaeum*, distinguished mostly by plants of mesophilous deciduous forests from the class *Querc-Fagetea* (*Carex digitata*, *Galium sylvaticum*, *Lathyrus vernus*, and *Viola reichenbachiana*) (Table A25, relevés 20-30; Table 11, col. 5).

All the 11 relevés documenting the variant with *Asarum europaeum* are extracted from a table of *Querc-Potentilletum*, containing 18 relevés (Nowaczyk 1964). They were recorded in 1957-1959 in the Zielonka Forest (Puszcza Zielonka) near Poznań. Out of the remaining 7 relevés in that table, 2 have been assigned in the present study to the degenerated form of the typical subassociation (Table A26, relevés 7 and 23), while the others (5) to the *Pa-Q brachypodietosum* (Table A27, relevés 25; Table A28, relevés 1, 2, 4, and 8). According to M. Wojterska and Wiszniewska (1996), all the relevés of Nowaczyk (1964) represent the *Pa-Q lathyretosum verni* nom. inval, proposed by those authors. Jakubowska-Gabara (1993, 1996) analysed repeated relevés in the patches studied by Nowaczyk (1964), and showed that over the period of 32 years, the floristic features specific to thermophilous oak forest disappeared to a large extent. For example, all species of the order

Quercetalia pubescentis disappeared completely, while contributions of all groups of species to the herb layer (except those of the order *Fagetalia*) decreased dramatically. According to Jakubowska-Gabara (1993), thermophilous oak forest had been transformed there into plant communities similar to the *Calamagrostio-Quercetum*, while some patches represented an impoverished form of *Galio-Carpinetum*. The species composition of phytocoenoses documented from the Zielonka Forest by Jakubowska-Gabara (1993), presented in synoptic tables, suggests that their diagnosis as the *Calamagrostio-Quercetum* (at least as defined here) is not justifiable. The features highlighted in the table of the cited author, seem to indicate an on-going regeneration of oak-hornbeam forests: (1) increased contributions of *Carpinus betulus* (in the tree and shrub layer), *Corylus avellana*, and *Festuca gigantea*; (2) high frequency of other species of the order *Fagetalia sylvaticae* (*Galium sylvaticum*, *Atrichum undulatum*, *Viola reichenbachiana*) and of the class *Querc-Fagetea* (*Carex digitata*, *Brachypodium sylvaticum*, *Festuca heterophylla*, and *Hepatica nobilis*); and (3) lowered contributions of some acidophilous species, which are diagnostic for *Calamagrostio arundinaceae-Quercetum* (*Festuca ovina*, *Melampyrum pratense*, *Polytrichastrum formosum*). It is also noteworthy that the studied patches lacked the regionally characteristic species of the association *Calamagrostio-Quercetum* (*Hieracium lachenalii*, *H. laevigatum*, *H. sabaudum*). M. Wojterska & Wiszniewska (1996) reported that in the study area in the 1990s, impoverished patches of *Potentillo-Quercetum* were found, and in fact they still exist.

The relevés classified as the *Pa-Q typicum* in stage II of degeneration varied widely in species number (19-62, mean 39). In Table A26 (relevés 5-23), 2 groups of relevés were distinguished, corresponding to the variant with *Pleurozium schreberi* (relevés 5-12) and the typical variant (relevés 13-23). Nearly all the relevés of the former variant are distinguished by a considerable admixture of *Pinus sylvestris*, which may be the major cause of the increased contribution of acidophilous species.

Potentillo albae-Quercetum brachypodietosum pinnati
M. Wojterska et Wiszniewska 1996 ex Kasproicz
2010 subass. nova

Synonym: *Potentillo albae-Quercetum brachypodietosum* M. Wojterska et Wiszniewska 1996 nom. inval. (Art. 3g, 5 KNF)

Nomenclature type: *Potentillo albae-Quercetum* Libb. 1933, tab. 1, rel. 2 (Wojterska, Wiszniewska 1996: 48-52) *holotypus hoc loco*

D. subass. (reg.): *Anthericum ramosum*, *Brachypodium pinnatum*, *Euphorbia cyparissias*, *Galium verum*, *Geranium sanguineum*, *Peucedanum cervaria*, *Pimpinella*

saxifraga and locally others of Ch. *Festuco-Brometea* et *Trifolio-Geranietea sanguinei*

In the present study, 126 relevés have been assigned to this subassociation. Among them, 61 have been classified as untransformed form (Table 11, col. 6-8), while 65 as the degenerated form (Table 11, col. 11). Their detailed floristic structure is presented in the analytic Tables A27-A29.

In patches of *Pa-Q brachypodietosum* the canopy was usually one-layered (Fig. 48). This tendency was less conspicuous in degenerated phytocoenoses. The coverage of the canopy varied widely, from 35% to 85% (mean 61%) in the untransformed form, and from 25% to 100% (mean 69%) in the degenerated form. In both the forms, if the canopy was one-layered, it usually consisted of only one species (63% and 68%, respectively). It was typically composed of *Quercus* sp. (*Q. robur* or, less often, *Q. petraea* or *Quercus* × *rosacea*), but in several degenerated patches it consisted of *Pinus sylvestris*. Other forest stands with one-layered canopy were generally composed of 2-3 tree species. If the canopy was 2-layered, the upper layer consisted of *Quercus* spp. and an admixture of *Pinus sylvestris*. The less dense lower tree layer was dominated by *Q. robur* and *Q. petraea*.

The shrub layer (b), mostly formed by *Frangula alnus*, was usually poorly developed. Its coverage was higher in degenerated patches.

The herb layer (c) covered 30% to 100% of plot area. Its coverage was the lowest in untransformed patches with a one-layered canopy. In many relevés no facies were formed, while in other relevés, the herb layer was dominated mostly by *Brachypodium pinnatum*, *Convallaria majalis*, and *Melica nutans*.

In most phytocoenoses of this subassociation, the moss layer was poorly developed (coverage ranging from negligible to 10%, exceptionally 35%) or even absent. Only in some degenerated patches, mosses (chiefly *Pleurozium schreberi*), covered 50% to 80% of plot area.

The studied patches of *Pa-Q brachypodietosum* were rich in species: 41-86 in the untransformed form (Fig. 49) and 22-92 in degenerated ones. In comparison with the other subassociations presented in the synoptic Table 11, the *Pa-Q brachypodietosum* is well-defined floristically. This applies both to untransformed communities (col. 6-8) and degenerated ones (col. 11). Differential species of this subassociation include only plants whose phytosociological optimum is in non-forest communities: xerothermic grasslands from the class *Festuco-Brometea* (*Euphorbia cyparissias*, *Brachypodium pinnatum*, *Pimpinella saxifraga*, etc.), or thermophilous forest edge communities from the class *Trifolio-Geranietea* (*Anthriscum ramosum*, *Geranium sanguineum*, etc.).

In the study area, the *Pa-Q brachypodietosum* can develop in 3 trophic variants distinguished by Brzeg & Kasprowicz (2001): with *Pleurozium schreberi*, typical, and with *Asarum europaeum*. In well-developed patches of this subassociation (Table 11, col. 6-8), these syntaxa clearly differ in species composition.

Among differential species of *Pa-Q brachypodietosum* in the variant with *P. schreberi*, particularly noteworthy are species of the class *Vaccinio-Piceetea* (*P. schreberi*, *Pseudoscleropodium purum*, and *Vaccinium vitis-idaea*) (Table 11, col. 6, Table A27, relevés 1-23). Within the trophic variant with *Pleurozium schreberi*, 2 forms of this community are distinguished (Table A27): with *Filipendula vulgaris* (relevés 1-13) and with *Polygonatum odoratum* (relevés 14-23). The first one is a group of relevés that are richer in species, also those diagnostic for thermophilous oak forest. These communities were usually pure stands of *Quercus robur*. They are also distinguished by the constant presence of species of the class *Artemisietea vulgaris* (*Geum urbanum*, *Galeopsis pubescens*, *Impatiens parviflora*, *Urtica dioica*, etc.). All of them were recorded on the Natura 2000 site "Dąbrowy Obrzyckie". The form with *Polygonatum odoratum*, documented mostly by more recent relevés, is distinguished by the presence of *Geranium sanguineum*, *Hieracium murorum*, *Peucedanum oreoselinum*, *Polygonatum odoratum*, and *Pteridium aquilinum*, as well as *Quercus petraea*, which is the major component of the forest stands, usually formed by 2-3 tree species. These floristic differences between the 2 forms probably reflect differences in their state of preservation and are mostly due to human impact. In light of results of this study, further research is needed to explain the influence of the structure and species composition of forest stands (especially the pure stands of *Q. robur* or *Q. petraea*, resulting from forest management) on the species composition of patches of thermophilous oak forest.

The group of relevés classified in this study as the *Pa-Q brachypodietosum* in the variant with *Pleurozium schreberi* includes also 8 historical relevés of thermophilous oak forest from Dziewicza Góra near Poznań (Wojterska & Wojterski 1953). They are presented in the analytic Table A27 (relevés 24-31). The other 5 relevés of the cited authors are listed in separate columns of table (relevés 32-36). Four of them were recorded in patches of non-forest communities, perhaps only temporarily lacking the canopy. The last one represents the *Pa-Q brachypodietosum* in the typical variant. The analysed group of relevés is characterized by the presence of many diagnostic species of *Potentillo-Quercetum*. In contrast to average patches of this association, those relevés are characterized by: (1) the presence of many species reaching their phytosociological optimum in non-forest communities (especially in thermophil-

ous forest edge communities from the class *Trifolio-Geranietea*, or xerothermic swards from the class *Festuco-Brometea*; (2) a relatively small contribution of mesophilous deciduous forests from the class *Querceto-Fagetea*; and (3) a relatively small contribution of species typical of coniferous forests from the class *Vaccinio-Piceetea*. Those relevés of Wojterska & Wojterski (1953) were probably recorded in sparsely wooded patches, perhaps comprising also fragments of forest edge communities. Nearly 40 years later, in 10 of the above-mentioned 13 patches, phytosociological investigations were repeated (Jakubowska-Gabara 1993). The cited author reported significant changes in the vertical structure and species composition of the community. First of all, the contribution of *Pinus sylvestris* decreased in the upper tree layer. Secondly, the lower tree layer developed, composed of *Quercus petraea* and *Sorbus aucuparia*. Thirdly, species number per relevé decreased remarkably (on average it was 39% lower). This applies especially to plants of the order *Quercetalia pubescentis* and of the class *Trifolio-Geranietea*. Finally, species with a wider ecological scale became more abundant (particularly *Calamagrostis arundinacea* and *Impatiens parviflora*). According to the cited author, the species composition of the studied phytocoenoses indicates that thermophilous oak forest was replaced there by communities similar to the *Calamagrostio-Quercetum*. An analysis of the synoptic table of Jakubowska-Gabara (1993), in light of the definition of that association proposed in the present study, does not confirm her diagnosis. In both the tables, diagnostic species of *Calamagrostio arundinaceae-Quercetum* are represented nearly exclusively by *Calamagrostis arundinacea*, while the others are absent (*Hieracium lachenalii*, *H. laevigatum*, *H. sabaudum*) or much less frequent (*Festuca ovina*). Some characteristic or differential species of the class *Quercetea robori petraeae*, except *Pteridium aquilinum*, are infrequent (*Melampyrum pratense*, *Polytrichastrum formosum*) or absent (*Carex pilulifera*, *Holcus mollis*).

The typical variant of *Pa-Q brachypodietosum* has no differential species, but is characterized by a constant presence of many diagnostic species of the association and of the subassociation (Table 11, col. 7; Table A28, relevés 16-38). Most of the relevés documenting the *Pa-Q brachypodietosum* in the typical variant were recorded on the above-mentioned Natura 2000 site "Dąbrowy Obrzyckie".

The *Pa-Q brachypodietosum* in the variant with *Asarum europaeum* is dominated by plants of the class *Querceto-Fagetea* (Table 11, col. 8; Table A28, relevés 1-15). These include also species of the order *Fagetalia sylvaticae* (*Galium sylvaticum*, *Lathyrus vernus* and *Stellaria holostea*), but their constancy in the table is not high. In comparison with the typical variant, this

variant is poorer in species, also in diagnostic species of the association. The higher contribution of plants of mesophilous deciduous forests, and in some relevés also of *Carpinus betulus*, indicates that those communities are dynamically associated with basiphilous moderately dry oak-hornbeam forests.

The habitat variation of *Pa-Q brachypodietosum* in stage II of degeneration (Table A29) resembles that of well-preserved forms of thermophilous oak forest. The variant with *Pleurozium schreberi* (relevés 1-21) has similar differential species. In some of its patches (relevés 1-9), the forest stand was dominated by *Pinus sylvestris*. Presumably, like in the above-mentioned degenerated patches of the typical subassociation, the contribution of acidophilous species in this group of relevés was not associated with natural site conditions. The typical variant (relevés 22-56) has no differential species. The variant with *Asarum europaeum* (relevés 57-65) is poorly distinguished, and its differential species are present, but infrequent, also in relevés of the other 2 variants.

Analysis of selected site indicators

Results of the statistical analysis taking into account Ellenberg indicator values (Fig. 50) illustrate well the habitat variation of the association *Potentillo albae-Quercetum* presented above. Light conditions at the forest floor were favourable for plants that were slightly more light-demanding (L=6) than half shade plants (L=5). The lowest L values were recorded in patches of *Pa-Q typicum*. Soil indicators values varied only slightly between the subassociations, and generally showed that the sites were poor in nutrients (N=4), moderately acidic (R=5), and moderately moist (F=5). The significantly highest contribution of plants typical of more moist and acidic sites was recorded in the *Pa-Q molinietosum*. The typical subassociation is distinguished by the significantly lowest L values. This may explain the lowest number of species recorded in its patches (Fig. 49). Values calculated for the *Pa-Q astrantietosum* are probably not representative, because of the above-mentioned shortcomings of the group of relevés representing the subassociation.

Substitute forest communities on potential sites of *Potentillo albae-Quercetum*

Most (33) of the 56 relevés collected in the last 3 columns of Table 11 were initially diagnosed by their authors as substitute forest communities on potential sites of thermophilous oak forest. However, as many as 17 relevés were classified by their authors as the association *Potentillo albae-Quercetum*.

In the canopy of substitute forest communities, a major role is played by *Pinus sylvestris*, accompanied by *Quercus robur* and *Q. petraea* or their hybrids and

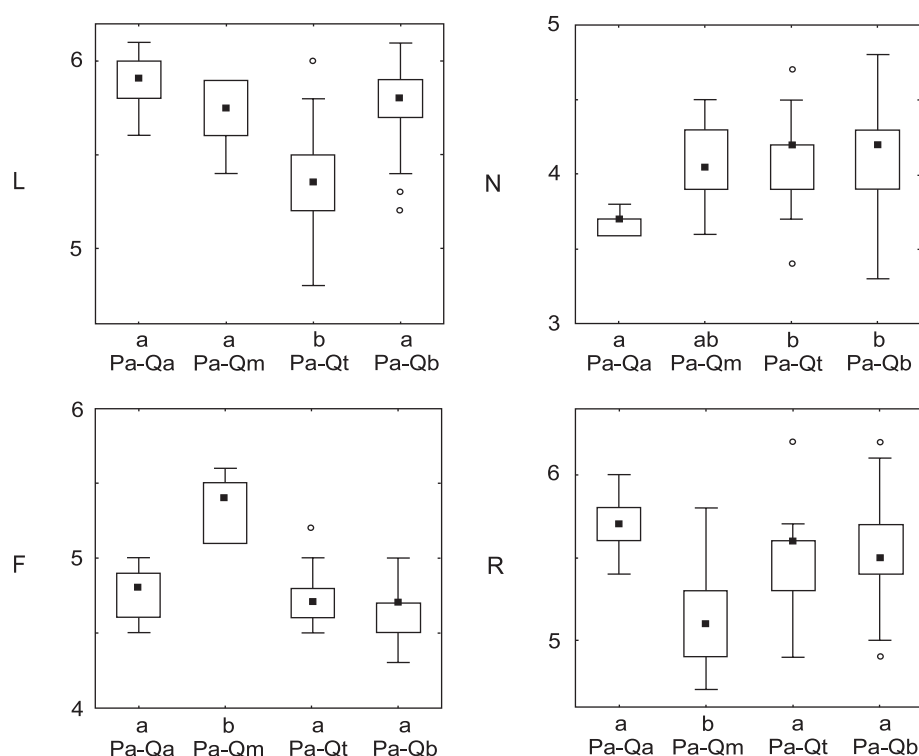


Fig. 50. Ellenberg indicator values for subassociations of untransformed *Potentillo albae-Quercetum*

Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 98$), L – light $H = 29.57$, $p < 0.001$, F – soil moisture $H = 30.52$, $p < 0.001$, N – soil productivity $H = 13.77$, $p = 0.0032$, R – soil reaction $H = 16.01$, $p = 0.0011$. For other explanations, see Fig. 17

Betula pendula (Table A30). In individual relevés, 2 other tree species were recorded: *Fagus sylvatica* and *Picea abies*. Both of them are definitely not typical for thermophilous oak forest. The shrub layer was composed mostly of the species listed above, as well as *Frangula alnus* and *Padus serotina*. The last mentioned species was present in most relevés, and its coverage usually varied from negligible to 25%, but in some cases it reached 40-80%. The herb layer was characterized by a high variation in structure, and covered 15-100% of plot area. In relatively many relevés, as compared to thermophilous oak forest in general, facies were formed by *Brachypodium pinnatum*, *Convallaria majalis*, *Deschampsia flexuosa*, *Calamagrostis epigejos*, *Rubus idaeus*, etc. The moss layer did not play any major role as a rule (coverage ranging from negligible to 25%), and was absent in many relevés. In only several relevés, mosses (chiefly *Pleurozium schreberi* and *Pseudoscleropodium purum*) covered a higher proportion of plot area (40-80%).

The substitute forest communities, as shown in the analytic Table A30, can be divided into 3 forms: with *Deschampsia caespitosa* (relevés 1-15), typical (relevés 16-36), and with *Peucedanum oreoselinum* (relevés 37-56). They directly correspond to subassociations of *Potentillo-Quercetum*, presented above, i.e. the *Pa-Q molinietosum*, *Pa-Q typicum*, and *Pa-Q brachypodietosum*, respectively. Within those forms, groups of species dif-

ferential for trophic forms (of lower rank) are marked in Table A30. These units correspond to variants within subassociations of thermophilous oak forest. The unit corresponding to the variant with *Asarum europaeum* is distinguished by species of the class *Quercio-Fagetea* (*Carex digitata*, *Galium sylvaticum*, *Hepatica nobilis*). Species of the class *Vaccinio-Piceetea* (*Juniperus communis*, *Pleurozium schreberi*, *Pseudoscleropodium purum* and *Vaccinium vitis-idaea*) are differential for the form corresponding to the variant with *Pleurozium schreberi*. All the forms are not as well-defined floristically as the corresponding variants among well-developed patches of the association *Potentillo albae-Quercetum*. Moreover, most of the phytocoenoses corresponding to the variant with *Pleurozium schreberi* are characterized by a high contribution of *Pinus* in the tree layer.

6.3.6. *Quercus roboris*-Pinetum Kozł. 1926 em. J. M. Mat. 1988 nom. invers. nom. conserv.

Basic documentation

As a result of a critical analysis of the collected set of relevés, 172 relevés have been classified as this association in the present study. In the synoptic Table 3 (discussed above), which describes typologically the well-developed forest communities, the association *Quercus roboris*-Pinetum is represented by 165 relevés. The other 7 relevés probably document mixed patches of *Qr-P molinietosum* and *Qr-P coryletosum* (Table A34).

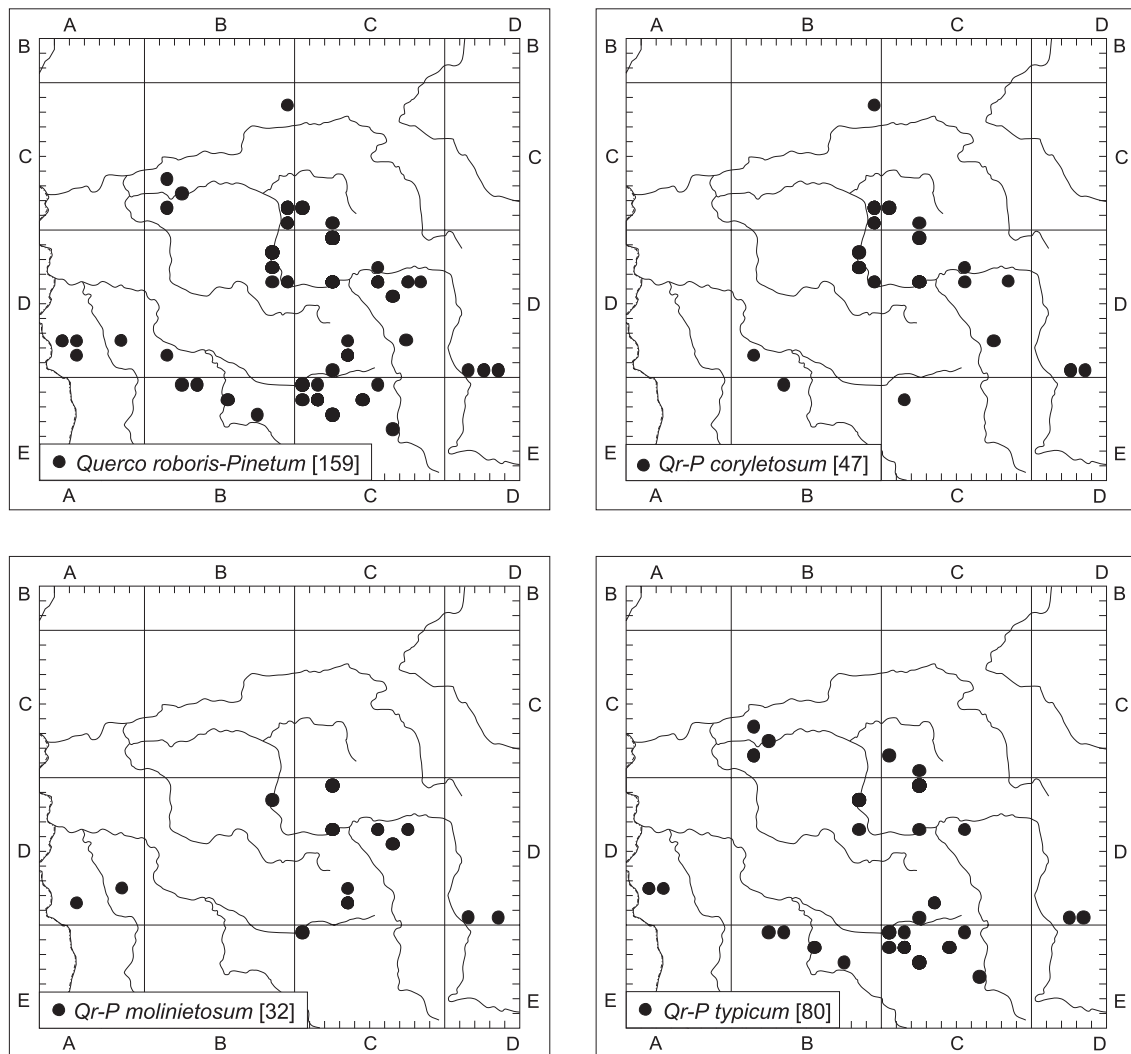


Fig. 51. Distribution of localities of *Quercus roboris-Pinetum*
 Explanations: Number of relevés given in brackets. The localization of 6 relevés was impossible (4 of *Qr-P molinietosum* and 2 of *Qr-P typicum*)

Those relevés were not taken into account in synoptic tables. The habitat variation of the association is presented in the synoptic Table 12 and in the analytic Tables A31-A33. Additionally, separate columns of Table 12 (col. 4 and 5) and Table A35, include substitute forest communities that probably develop on potential sites of *Quercus-Pinetum*.

Distribution

Relevés of this association are distributed in 44 basic ATPOL squares (Fig. 51). According to the geobotanical regionalization of Poland by J.M. Matuszkiewicz (2008a, see Fig. 4b here), they are located mostly in the South Wielkopolska Subregion (36%) as well as in the Central Wielkopolska Region (35%) and the Noteć-Lubusz Region (20%). Patches of 2 of its subassociations, i.e. the *Qr-P molinietosum* (situated in 14 localities) and *Qr-P coryletosum* (19 localities) are linked with the eastern part of the study area. The most widespread subassociation of mixed coniferous forest in the study area is the *Qr-P typicum*, found in 29 localities.

On the scale of Poland, phytosocioses of *Qr-P molinietosum* are quite frequent in the eastern part, while rare in other regions (Matuszkiewicz J. M. 1988). However, in the works of J. M. Matuszkiewicz (1988, 2001), the subassociation was relatively poorly documented, as it was represented there by 72 relevés, and none of them was recorded in Wielkopolska. As emphasized by W. Matuszkiewicz and J. M. Matuszkiewicz (1996), in some parts of Poland its documentation needs to be supplemented.

Subdivision based on habitat variation and anthropogenic dynamics

Forest stands of this association can develop in the study area in 3 forms, which clearly differ in species composition. J. M. Matuszkiewicz (1988) accorded them the rank of subassociations. Individual authors documenting this association usually did not take into account its internal variation. In the tables of subassociations of this association, only about 20% of relevés were identified by their authors to the level of

subassociations (22% of *Qr-P molinietosum*, 15% of *Qr-P typicum*, and 24% of *Qr-P coryletosum*). Despite this, only 7 relevés represent the above-mentioned mixed patches of several subassociations (Table A34). This indicates that patches of individual subassociations of continental mixed coniferous forest in the field are clearly separated and probably cover relatively large and homogeneous areas.

The habitat variation of the association *Quercus roboris-Pinetum*, presented in the synoptic table (Table 12), is additionally confirmed by PCA results (Fig. 52a). The relevés diagnosed by the classical phytosociological analysis as the *Qr-P molinietosum* and *Qr-P coryletosum*, form 2 clusters in the PCA ordination diagram. These clusters include, respectively, 94% and 79% of relevés of those subassociations. Relevés of *Qr-P typicum* are intermediate between them. The floristic justification of results of this ordination procedure is the distribution of species along the first and second ordination axes (Fig. 52b).

Quercus roboris-Pinetum molinietosum J. M. Mat. 1988 nom. inval.

In the present study, 36 relevés have been assigned to this subassociation (Table A31). The number of species in individual relevés varied from 17 to 42 (Fig. 53).

The canopy in patches of *Qr-P molinietosum* was subdivided into 2 layers slightly more frequently than composed of only one layer (Fig. 54). The coverage of the upper layer (a1) usually did not exceed 70%, compared to 25% in the lower layer (a2). If the canopy was one-layered, its coverage reached 40-80%. Its major component was *Pinus sylvestris*. If the canopy was 2-

layered, this species was often the only component of a1. Presumably the contribution of *Pinus* in all subassociations of *Quercus-Pinetum* was artificially increased as a result of forest management (see J.M. Matuszkiewicz 1988). It was often accompanied by *Betula pendula* and *Quercus robur*. Other species, like *Q. petraea*, *Populus tremula*, *Picea abies*, and *Sorbus aucuparia*, were recorded in a smaller number of relevés (Table A31). The coverage of the shrub layer (b) varied from negligible to 60% (Fig. 54). In only few relevés, *Frangula alnus*, *Picea abies*, *Quercus robur*, or *Sorbus aucuparia* were abundant.

The herb layer (c) was always well-developed, and covered 40-100% of the area of the studied relevés. In most of the communities, facies were formed, usually by *Vaccinium myrtillus*, *Pteridium aquilinum*, *Molinia caerulea* and/or *Festuca ovina*.

The moss layer (d) in most of the relevés (61%) reached a high coverage of 50-90%. In individual relevés, it was composed of 3-12 species. Facies were formed most often by *Pleurozium schreberi*. In the other 39% of relevés, bryophytes represented by 1-8 species covered up to 40% of plot area. The highest constancy in the table was reached by *Polytrichastrum formosum*, *Dicranum polysetum*, and *Pseudoscleropodium purum*.

The group of differential species of *Qr-P molinietosum* in the study area includes 10 taxa (Table A31). Like in the reviews of phytosociological data from all parts of Poland (Matuszkiewicz J. M. 1988: Table 1; 2001: Table 3.1), *Molinia caerulea* has the highest diagnostic value. This group includes also *Populus tremula*. It is one of differential species of the association *Populo tremulae-Quercetum*, described by Sokołowski

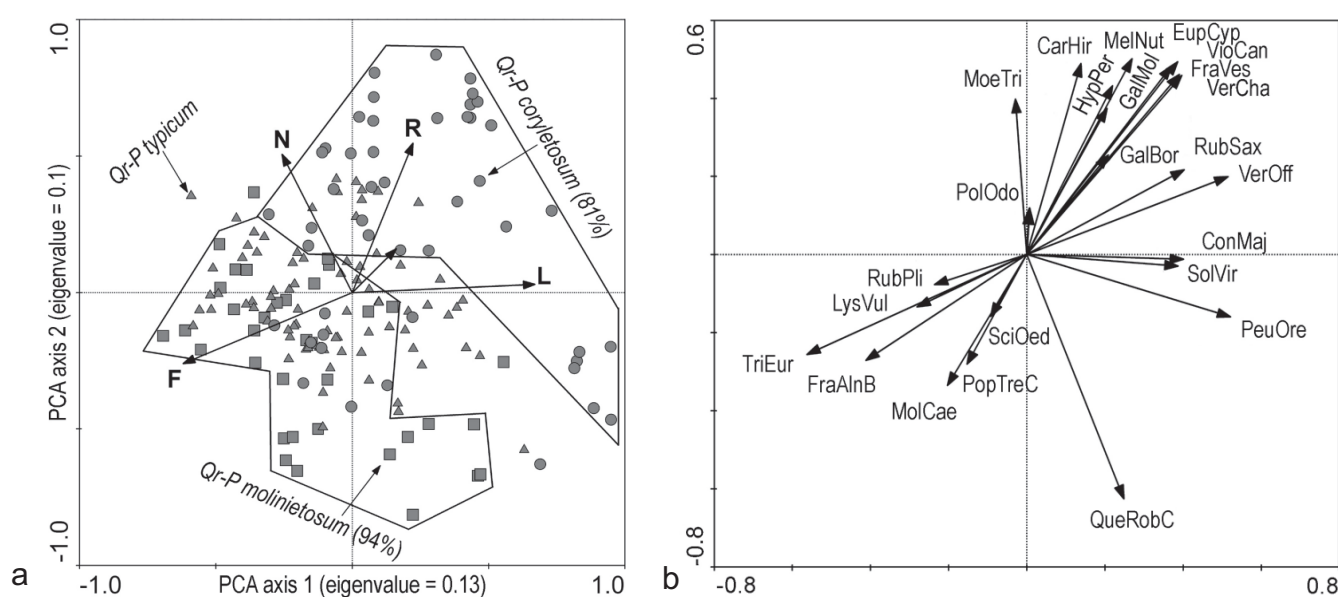


Fig. 52. PCA ordination of plots of *Quercus roboris-Pinetum*

- a) Distribution of 165 relevés classified according to the classical phytosociological method, and passive projection (arrows) of mean Ellenberg indicator values, F – soil moisture, L – light, N – soil productivity, R – soil reaction
- b) Distribution of differential species of *Qr-P molinietosum* and *Qr-P coryletosum* (see Table 12)

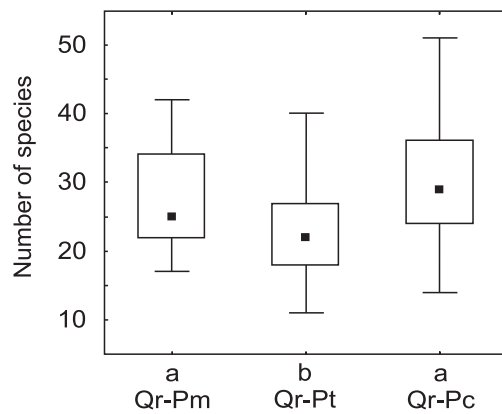


Fig. 53. Variation in number of species in relevés of subassociations of *Quercus roboris-Pinetum*

Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 165$), $H = 23.93$, $p < 0.001$. For other explanations, see Fig. 17

(1980). However, J.M. Matuszkiewicz (1988) concluded that its separation is not sufficiently justified, so it must be classified as a synonym of *Qr-P molinietosum*. Such a solution was also accepted by Ratyńska *et al.* (2010) and earlier by Brzeg & Wojterska (2001; under the name *Festuco ovinae-Pinetum*).

Quercus roboris-Pinetum typicum J. M. Mat. 1988 *nom. inval.*

The typical subassociation is represented by 82 relevés, i.e. nearly half of all relevés documenting the association in the study area (Table 12). In comparison with the other subassociations, relevés of *Qr-P typicum* are significantly poorer in species (Fig. 53).

In most (62%) of relevés of *Quercus-Pinetum typicum*, the canopy was 2-layered (Fig. 54). The mean coverage of the upper layer (a1) (51%) was then lower than the mean coverage of one-layered canopy in the remaining forest stands (61%). In all relevés, the dominant canopy species was *Pinus sylvestris*, accompanied by *Quercus robur*, *Q. petraea*, *Betula pendula*, and rarely also *Picea abies*. The coverage of the lower layer (a2), usually dominated by *Quercus* spp., ranged from several to 65% (mean 26%). In some communities, *Picea abies* or *Fagus sylvatica* were relatively abundant (Table A32).

The shrub layer (b) was present in most of the relevés (96%), but only in some of them (9%) its coverage was high (40-70%).

Plants of the herb layer (c) covered a large proportion of plot area (mean 71%). In as many as 90% of the analysed relevés, facies were formed, composed mostly of *Vaccinium myrtillus*, and rarely of *Pteridium aquilinum*, *Calamagrostis arundinacea*, or several other species (Table A32).

The moss layer (d) was highly variable. In 40% of relevés, bryophytes (mostly *Pleurozium schreberi*) covered at least 50% of plot area. The number of species of this layer in individual relevés varied from 0 to 10.

Within the subassociation *Qr-P typicum*, 2 variants can be distinguished: typical (Table A32, relevés 1-63), and with *Fagus sylvatica*. Differential species of the latter variant include also *Calluna vulgaris*, *Leucobryum glaucum*, and *Deschampsia flexuosa* (Table A32, relevés 64-82). The typical variant has no differential species.

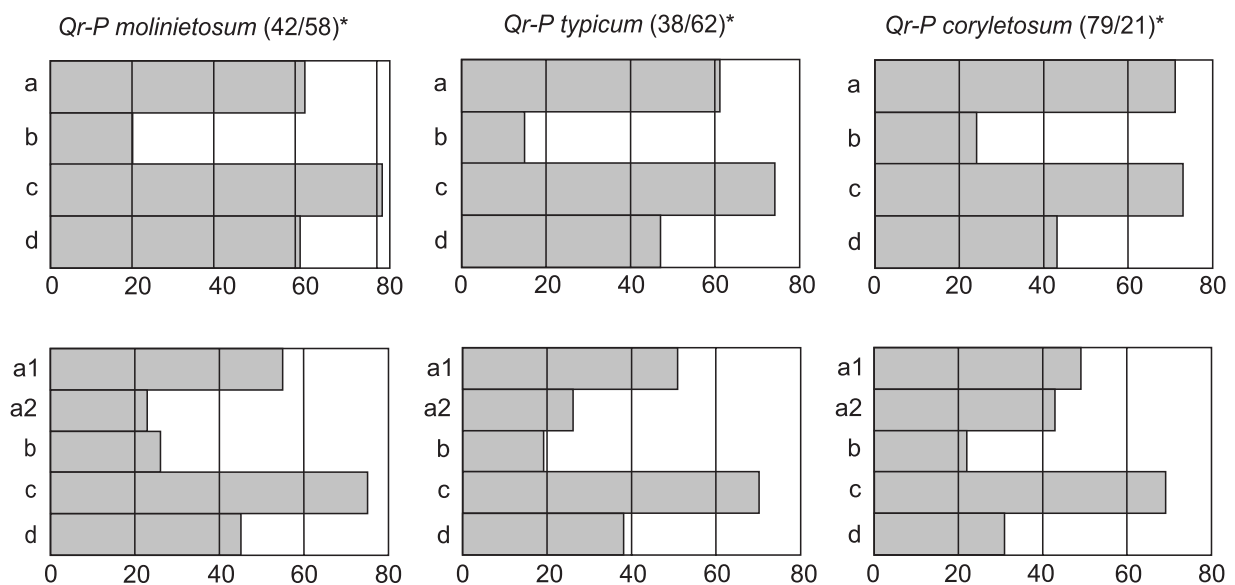


Fig. 54. Scheme of the vertical structure of subassociations of *Quercus roboris-Pinetum*

Explanations: One and two-layered tree-stands are shown on separate diagrams. Bars denote the percent cover of vegetation layers; * percent contributions of relevés with one/two-layered canopy

Quercus roboris-Pinetum coryletosum J. M. Mat. 1988 nom. inval.

In the present study, 47 relevés have been assigned to this subassociation (Table 12, col. 3; Table A33). In respect of species richness, they are similar to the *Qr-P molinietosum* (Fig. 53).

In most patches of this subassociation (79%), the canopy was one-layered, and its coverage varied from 40% to 85% (Fig. 54). Its major component was *Pinus sylvestris*, often accompanied by *Quercus robur*. If the canopy was 2-layered, *Pinus* was found exclusively in the upper layer. Other components of the canopy were then most often *Q. robur* and *Betula pendula*.

The coverage of the shrub layer in individual relevés of *Qr-P coryletosum* varied widely, from negligible to 60%. It was composed of *Q. robur*, *Q. petraea*, *B. pendula*, and *Frangula alnus*. In 17% of relevés, the shrub layer was absent (Table A33).

The herb layer, irrespective of canopy structure, reached a mean coverage of 70%. In most of the relevés, the herb layer formed facies composed of abundant *Vaccinium myrtillus*, rarely of *Calamagrostis arundinacea*, *Pteridium aquilinum*, etc. (Table A33).

In respect of the contribution of bryophytes, the subassociation can be divided into 2 forms represented in Table A33 by similar numbers of relevés. One form is distinguished by a well-developed moss layer (coverage 40-90%), and facies composed mostly of *Pleurozium schreberi* or rarely of *Pseudoscleropodium purum* and *Dicranum polysetum*. The other form includes communities where bryophytes were absent or their coverage was up to 30%. The number of species of bryophytes and (rarely) lichens, varied between relevés and ranged from 0 to 7.

The synoptic Table 12, showing the floristic structure of the 3 subassociations of *Quercus roboris-Pinetum*, provides convincing evidence confirming their separateness. The *Qr-P coryletosum* has the longest list of differential species. Among them, the most valuable diagnostic species are: *Convallaria majalis*, *Moehringia trinervia*, *Fragaria vesca*, *Rubus saxatilis*, and *Veronica officinalis*. Most of them, except e.g. *Convallaria majalis* and *Moehringia trinervia*, are considered as differential for this subassociation also by J.M. Matuszkiewicz (1988: Table 1). At the same time, the cited author reported that this subassociation is distinguished by the presence of species of the class: *Quercus-Fagetum*, such as *Carex digitata*, *Viola reichenbachiana* (= *V. sylvestris*), *Melica nutans*, *Corylus avellana*, *Anemone nemorosa*, and *Atrichum undulatum*. By contrast, in Table 12, out of this group only *Melica nutans* proves to be differential for the *Qr-P coryletosum*. Most of the other species of that group have a low constancy or, like *Viola reichenbachiana* and *Anemone nemorosa*, show other site preferences.

Analysis of selected site indicators

Ellenberg indicator values (Fig. 55) vary only slightly between the relevés. They correspond to moderately moist soils (F=5), which are acidic (R=3), poor in nutrients (N=3), while light conditions of the forest floor are favourable for shade-tolerant plants (L=3). Phytocoenoses of *Qr-P molinietosum* are colonized by plants typical of relatively wet and most acidic sites, whereas in the *Qr-P coryletosum* a majority of plants are typical of more fertile sites, less moist and less acidic. A similar picture of the habitat variation of *Quercus-Pinetum* is presented by PCA results (Fig. 52a).

Substitute forest communities related to the *Quercus roboris-Pinetum*

Two main criteria were used in this study when assigning relevés to the group of substitute forest communities closely related to the *Quercus-Pinetum* (Table 12, col. 4 and 5): (1) absence or scanty contribution of differential species for the *Quercus-Pinetum*, e.g. *Dicranum polysetum*, *Vaccinium vitis-idaea*, *Hylocomnium splendens* or *Calluna vulgaris* (except *Pleurozium schreberi*, which was often abundant, and *Pseudoscleropodium purum*, which was sometimes abundant); and (2) poor representation of characteristic species of the class *Quercetum robori-petraeae*. Considering the species composition of the whole group of communities (see also Table A35), and the constant participation of *Pleurozium schreberi* and *Vaccinium myrtillus* in the relevés, they belong to the class *Vaccinio-Piceetum*. Probably the patches occupy potential sites of *Quercus roboris-Pinetum*. However, it cannot be excluded that at least some of the more fertile communities of this group (Table 12, col. 5) occupy potential sites of acidophilous oak forests, poor oak-hornbeam forests, and perhaps also of thermophilous oak forest. Zerbe (2003) noted that the anthropogenic association *Pleurozium schreberi-Pinetum*, distinguished by him, occupies potential sites of forests from the order *Quercetalia robori-petraeae*. This was supposedly evidenced by the contribution of diagnostic species of that order (*Carex pilulifera*, *Deschampsia flexuosa*, *Polytrichum formosum*, *Veronica officinalis*), and of self sown *Quercus petraea* and *Q. robur*.

This group of communities can be divided into 3 floristically well-defined forms. They correspond to the habitat variation of the association *Quercus roboris-Pinetum*. The first form, with *Molinia caerulea* (Table A35, relevé 1) is represented by only one relevé and is not included in Table 12. The typical form includes relevés that are generally poor in species (13-38, mean 20). Their canopy was usually dominated by *Pinus sylvestris*. In the herb layer, facies were usually formed by *Pteridium aquilinum*, *Calamagrostis arundinacea* or *Vaccinium myrtillus*, and rarely also by *Deschampsia*

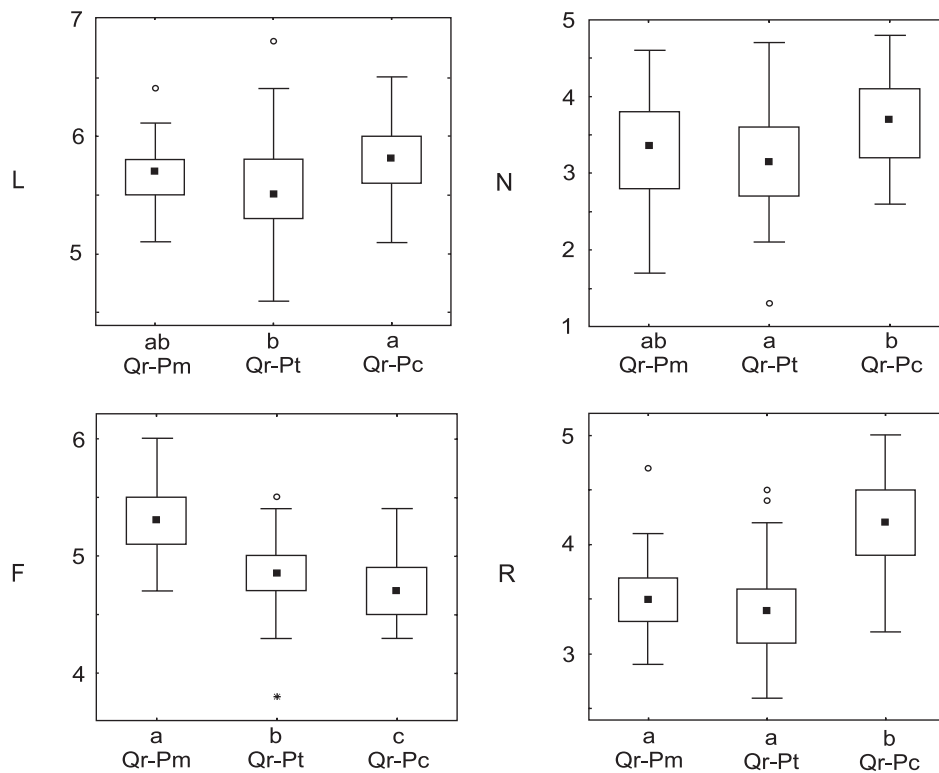


Fig 55. Ellenberg indicator values for subassociations of *Quercus robur*-*Pinetum*

Explanations: Communities marked with different letters are significantly different (multiple comparison test, $p < 0.05$). Kruskal-Wallis test ($N = 165$), L – light $H = 2078$, $p < 0.001$, F – soil moisture $H = 52.77$, $p < 0.001$, R – soil reaction $H = 63.14$, $p < 0.001$, N – soil productivity $H = 12.55$, $p = 0.0019$. For other explanations, see Fig. 17

flexuosa, *Festuca ovina*, *Calamagrostis epigejos* or *Rubus* sp. The moss layer in several relevés was poorly developed, while in others, well-developed, and most often dominated by *Pleurozium schreberi*. The third form, with *Hypericum perforatum*, is distinguished also by the presence of *Fragaria vesca*, *Moehringia trinervia*, etc., and corresponds to the subassociation *Qr-P coryletosum*. In the relevés representing it, the major component of the tree layer was *Pinus sylvestris*. In most of them, the herb layer was well-developed and dominated by *Vaccinium myrtillus*, *Calamagrostis epigejos*, *Rubus idaeus* or *Pteridium aquilinum*.

6.3.7. *Serratulo-Pinetum* J. M. Mat. 1988 ex Brzeg in Brzeg et M. Wojterska 2004

Basic documentation

The association *Serratulo-Pinetum* in Wielkopolska is located near the western limit of its range. Its patches (Table A36 relevés 1-6) found and documented by Brzeg (2001) are its only localities known so far in this region. According to the cited author, they seem to be natural and even ancient on the Rychwał Plain (Równina Rychwalska). One of the factors maintaining them in the landscape for centuries was extensive livestock grazing. Table A36 includes also relevés documenting phytocoenoses with similar species composition (relevés

7-13). Olaczek (1986), their author, reported that most of them were young *Pinus* stands on potential sites of thermophilous oak forest (relevés 7 and 10-13). These pure *Pinus* stands, planted on former farmland, were subject to grazing, removal of the leaf litter, and uncontrolled felling. The other 2 relevés (8 and 9), according to the cited author, document acidophilous oak forest (named “*Calamagrosti-Quercetum petraeae*”), developed in a natural form on an undoubtedly primeval site (Olaczek 1986).

Distribution

The analysed patches are located in 4 basic ATPOL squares (Fig. 56). According to the geobotanical regionalization of J. M. Matuszkiewicz (1993), these are south-eastern parts of the Central Wielkopolska Region and the north-western part of the Central Małopolska Upland Region (Kraina Wyżyn Środkowo-małopolskich).

Vertical structure and species composition

The canopy was dominated by *Pinus sylvestris* in most of the studied relevés. It was composed of 1-2 layers, and its coverage was relatively low, up to 60%. The dominant was sometimes accompanied by single specimens of *Betula pendula*, *Picea abies*, *Quercus robur*, and *Q. petraea*. The last mentioned species was

the dominant in one relevé (9). The coverage of the shrub layer, composed mostly of *Juniperus communis* and young *Pinus*, ranged from 0 to 40%. Plants of the herb layer covered 40-90% of plot area. This layer was composed mostly of *Calluna vulgaris*, *Convallaria majalis*, *Festuca ovina*, *Vaccinium myrtillus*, and *V. vitis-idaea*. The moss layer reached a high coverage (20-95%) and was formed by 15 species. Among them, the most abundant was *Pleurozium schreberi*, while *Dicranum polysetum* and *Hylocomium splendens* were also frequent.

In the 13 relevés of *Serratulo-Pinetum*, 148 plant species were recorded, including 18 taxa of bryophytes and lichens. Individual relevés contained 31-64 plant species. Patches of *Serratulo-Pinetum* were much richer in species than relevés of subcontinental mixed coniferous forest *Quercus roboris-Pinetum* and of most of the other associations analysed in this study (Fig. 16).

Variation

The studied patches of *Serratulo-Pinetum*, in respect of habitat variation, represent a homogeneous form of this association. Its characteristic species combination was presented above (see p. 42). Presumably, all the relevés in Table A36 represent a degenerated, impoverished floristically form of the association. This results both from the location of the studied plant communities (near the western limit of the distribution range of the association) and from the human impact. Some of them (relevés 1-6) are more similar to untransformed patches, as they contain many characteristic and differential species of the association. In the group of more degenerated communities (relevés 7-13), 2 patches (relevés 8 and 9) include *Quercus petraea*, and thus are

apparently related to the association *Serratulo-Quercetum*, described by Pallas (2003).

6.3.8. Substitute forest communities

Basic documentation

Substitute forest communities were partly discussed above: those occupying potential sites of thermophilous oak forest *Potentillo albae-Quercetum* (Table 11), continental mixed coniferous forest *Quercus roboris-Pinetum* (Table 12), or some ill-defined forests from the class *Quercus-Fagetum* (Table 10). Here, yet another group of relevés is presented. They cannot be identified with types of natural vegetation even at the class level. These communities, described by 63 relevés collected in Table A37, were usually diagnosed by their authors as the *Pino-Quercetum* (18), substitute forest communities (11), or *Calamagrostis arundinaceae-Quercetum* (11).

Vertical structure and species composition

In many relevés, the canopy was dominated by *Pinus sylvestris* (Table A37, relevés 1-33). In quite many of them (11), this species formed monocultures. In the other relevés, it was accompanied by *Quercus petraea*, *Q. robur* (or their hybrids), *Betula pendula* and, only in single relevés, by *Carpinus betulus* and *Fagus sylvatica*. Only few forest stands were dominated by deciduous trees: *Quercus* spp. (relevés 34-43, and 49-54), or *Betula* spp. (relevés 44-48). Moreover, some of the forest stands were monocultures of *Picea abies*, *Robinia pseudacacia*, and *Larix decidua*. The shrub layer usually did not play any major role. In only several relevés, its coverage reached higher values (40-80%), thanks to abundant *Frangula alnus*, *Picea abies*, *Sorbus aucuparia*, or *Quercus robur*. The studied patches varied also in the coverage of the herb layer, ranging from negligible to 100%. In many relevés, facies were formed, mostly by *Calamagrostis epigejos*, *Pteridium aquilinum*, and *Vaccinium myrtillus*. Bryophytes were absent in numerous relevés. In several relevés, their coverage reached 35-50%, thanks to mosses typical of coniferous forests: *Pleurozium schreberi* or *Pseudoscleropodium purum*.

The documented patches of forest communities were relatively poor in species (6-26, exceptionally 34). Beside *Pinus sylvestris* in the tree layer, a high constancy in the table was reached mostly by forest species with a wider ecological scale (*Dryopteris carthusiana*, *Deschampsia flexuosa*, *Frangula alnus*, *Oxalis acetosella*, *Sorbus aucuparia*, and *Quercus robur* in the herb layer) and plants of cleared areas and forest gaps, of the class *Epilobietea angustifolii* (*Calamagrostis epigejos*, and *Rubus idaeus*). Among forest species with a narrower ecological spectrum, only *Vaccinium myrtillus* was recorded more often.

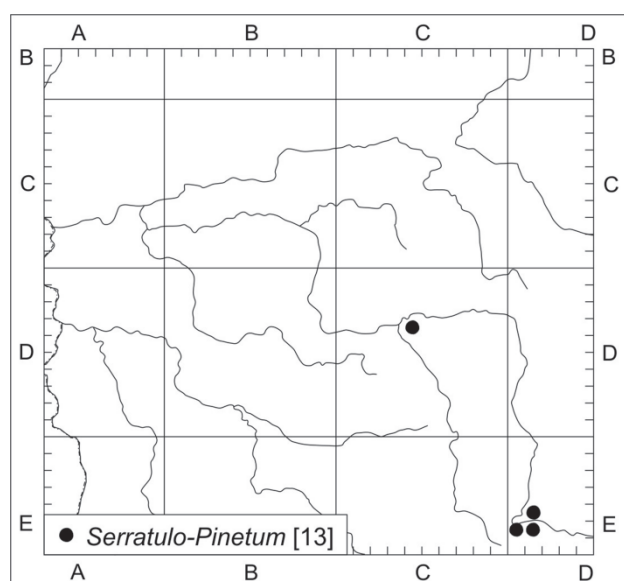


Fig. 56. Distribution of localities of *Serratulo-Pinetum* (number of relevés given in brackets)

The relevés collected in Table A37 represent unspecific communities, often synusial: *Pinus sylvestris-Vaccinium myrtillus*, *Pinus sylvestris-Deschampsia flexuosa*, *Pinus sylvestris-Calamagrostis epigejos*, *Betula pendula-Frangula alnus* or *Quercus petraea-Calamagrostis arundinacea*. Less numerous relevés are characterized by both short floristic list and sparse vegetation of the forest floor.

7. Discussion

Many issues have already been discussed above. This chapter is focussed on controversial questions whose solutions require further research. These questions concern the syntaxonomy, geographic variation, origin, dynamics, and protection of the studied forest types.

7.1. Syntaxonomy

During the last several dozen years, various concepts of classification of acidophilous oak forests were proposed, but none of them has been widely accepted. Thus it is reasonable to present the system used in this study against the wider, Central European background. This enables its precise justification, especially in the phytogeographic context (Table 13). The proposed concept of classification of acidophilous oak forests is based on an earlier suggestion of Pallas (1996), modified by Brzeg *et al.* (2000a, 2001).

Acidophilous oak forests have been assigned here to the class *Quercetea robori-petraeae*, with the single order *Quercetalia roboris*. The status of the latter syntaxon is widely disputed (e.g. Oberdorfer 1987, 1988, 1992a, 1992b; Pott 1995; Härdtle *et al.* 1997; Dierschke 2004; Härdtle 2004). As shown above (section 5.1), this order is often placed in the class *Quercio-Fagetea* (Table 1). According to that classification, the class comprises a vast majority of European deciduous and mixed forests (except *Alnetea glutinosae* and usually also *Salicetea purpureae*), including all forms of beech and oak forests characteristic for Europe. However, that syntaxon is then very heterogeneous and comprises also extremely oligotrophic forms of acidophilous oak forests, which in West Europe correspond to coniferous forests from the class *Vaccinio-Piceetea*, well-developed in the eastern and northern parts of the continent. The contribution of characteristic species of *Quercio-Fagetea* in these oak forests is very low. According to the broader definition of the class, it is represented there only by *Quercus petraea*, *Q. robur*, *Anemone nemorosa*, and *Convallaria majalis* (see Oberdorfer 1992a; Härdtle *et al.* 1997). In contrast, W. Matuszkiewicz (2001, see also 2003) concluded that the distinct species composition and site preferences of acidophilous oak forests, as compared to other deciduous forests, justify their in-

clusion in a separate class, regionally vicariant to coniferous forests. An analysis of Table 1, discussed above, suggests that syntaxonomic decision at the class level is associated neither with geographic region nor with study period, and seems to be a matter of convention. Nevertheless, Pallas (2003) argued that authors' decisions may be affected by the geographic scope of their research, because in north-western Europe the order *Quercetalia roboris* includes a lower contribution of the more demanding deciduous forests than in the southern part of their range. Formally, each syntaxonomic solution is correct. Härdtle *et al.* (1997) presented both versions of phytosociological system placing the order *Quercetalia roboris* either in the class *Quercio-Fagetea* or in *Quercetea robori-petraeae*. Confusion is raised, however, when in one publication on European vegetation, the order *Quercetalia roboris* Tx. 1931, defined in the same way, is assigned to the class *Quercio-Fagetea* (Bohn 2003) or *Quercetea robori-petraeae* (Pallas 2003). Thus it is advisable to promote consistently only one system.

The first alliance from the order *Quercetalia roboris* (Table 13) is the narrowly defined *Quercion roboris* Malcuit 1929 *em.* Pallas 1996. It includes Atlantic acidophilous oak forests, found in West Europe and Germany. They are not shown in the table because their ranges of distribution do not comprise the area of Poland.

Advocates of the inclusion of the order *Quercetalia roboris* in the class *Quercio-Fagetea*, most often place in this order also poor beech forests, as the alliance *Luzulo-Fagion*, parallel to the alliance *Quercion roboris* (Table 1). However, in the present study, the group of poor beech forests is excluded from this order and also from the class *Quercetea robori-petraeae*. This is based on the justification of W. Matuszkiewicz (2001), who consistently assigned acid beech forests to the suballiance *Luzulo-Fagenion*, alliance *Fagion sylvaticae*, order *Fagetalia*, and class *Quercio-Fagetea*. He emphasized that such a solution is justified by floristic, ecological, biogeographic, and silvicultural aspects. Acidophilous beech forests, in their extreme forms, are very poor in species. Frequently, *Fagus sylvatica* is the only species of the class *Quercio-Fagetea* playing an important role in them. Moreover, the *Fagus*-dominated forests are very shaded, which is unfavourable for many light-demanding species typical for acidophilous oak forests (Härdtle *et al.* 2003, 2005). The poor beech forest *Deschampsio flexuosae-Fagetum* (= *Luzulo pilosae-Fagetum*) is distinguished by the absence or negligible contribution of those species (*Pteridium aquilinum*, *Hieracium umbellatum*, *H. laevigatum*, *H. sabaudum*, *Lathyrus montanus*, etc.). W. Matuszkiewicz & A. Matuszkiewicz (1973) considered it as a significant feature differentiating between the 2 groups of communities.

Thus acidophilous beech forests are poor in species of both the *Quercio-Fagetea* and *Quercetea robori-petraeae*, but their inclusion in the *Quercio-Fagetea*, maintains the coherence of beech forests in the syntaxonomic system.

The classification proposed here accepts also the above-mentioned proposal to separate from the alliance *Quercion roboris* Malcuit 1929 the narrowly defined alliances *Agrostio capillaris-Quercion* Scam. et Pass. 1959 em. Brzeg, Kasprowicz et Krotoska 2001 and *Dicrano scoparii-Quercion roboris* Pass. 1968 (Brzeg et al. 2000a, 2001; Brzeg & Kasprowicz 2001). In comparison to the initial concept of Pallas (1996), the *Agrostio capillaris-Quercion* is more broadly defined here, i.e. including the alliances *Molinio caeruleae-Quercion roboris* and *Vaccinio myrtilli-Quercion*. Previously, the alliance defined in this way was named *Vaccinio myrtilli-Quercion* (Brzeg et al. 2000a). Brzeg et al. (2001) renamed it as *Agrostio capillaris-Quercion* and precisely described the alliance (defined as in the present study), presenting the nomenclatural type (lectotype) of this syntaxon, a list of its synonyms and pseudonyms, and a list of characteristic and geographically differential species (see Table 13). The alliance comprises acidophilous oak forests distributed in the northern and eastern Central European (i.e. sub-boreal-sub-continental) parts of the range of the class *Quercetea robori-petraeae*. Thus the alliance embraces most of acidophilous oak forests found in Poland: the *Betulo pendulae-Quercetum roboris*, *Calamagrostio arundinaceae-Quercetum petraeae* (incl. *Fago-Quercetum petraeae* R.Tx. 1955 nom. inval.), *Molinio caeruleae-Quercetum roboris*, and *Molinio arundinaceae-Quercetum roboris*.

The alliance *Dicrano scoparii-Quercion roboris* Pass. 1968 includes oak forests rich in lichens and mosses, and its geographic distribution is azonal. In Poland it is represented by 2 poorly studied associations. The first one, *Aulacomnio androgyni-Quercetum roboris*, has been described relatively recently (Brzeg et al. 2000a), and its phytosociological documentation is poor. The second one, *Cladonio portentosa-Quercetum petraeae*, included in the regional (Brzeg & Wojterska 2001) and national (Ratyńska et al. 2010) lists of plant communities, was only announced by Brzeg & Kasprowicz (2001), and its basic documentation has not been published so far.

The last association of acidophilous oak forest, the *Luzulo luzuloidis-Quercetum petraeae*, undoubtedly found in Poland, represents the alliance *Hieracio lachenalii-Quercion petraeae* Pallas 1996 (= *Genisto germanicae-Quercion roboris* R. et Z. Neuh. 1967 nom. inval.). The alliance is a vicariant of the *Agrostio capillaris-Quercion*, and of the Atlantic *Quercion roboris*, and comprises moderately thermophilous, acidophilous

oak forests found in the submontane-upland, southern and south-eastern parts of the Central European range of communities of the class *Quercetea robori-petraeae*. Table 13 does not show other associations of this alliance, reported from the Czech Republic and Slovakia, where this syntaxon has its centre of distribution, namely the *Vaccinio vitis-idaeae-Quercetum* Oberd. 1957, *Viscario-Quercetum* Stöcker 1965, *Genisto germanicae-Quercetum roboris* Aichinger 1933, *Festuco ovinae-Quercetum roboris* Šmarda 1961 (Neuhäuslová 2001; Jarolímek et al. 2008). According to both cited publications, the alliance includes also the association *Molinio arundinaceae-Quercetum roboris*, but according to the classification proposed in the present study, it must be assigned to the alliance *Agrostio capillaris-Quercion* (see Table 13).

The system presented above applies to Central Europe and is supported by a rich documentation. The eastern part of the range of acidophilous oak forests from the class *Quercetea robori-petraeae* still needs to be studied. Results of research conducted in recent years in Ukraine move the eastern limit of distribution of those forests markedly outside Central Europe (see section 5.1). Thus it can be assumed that acidophilous oak forests of the alliance *Agrostio capillaris-Quercion* are found at least in north-western Ukraine. Probably this area includes also localities of 2 associations known from Central Europe, i.e. the *Calamagrostio arundinaceae-Quercetum* and *Molinio caeruleae-Quercetum*.

7.2. Geographic diversity

The study area is located in the intermediate zone between the western sub-Atlantic region and the eastern sub-continental region, so it could be expected that this would be reflected in the distribution of localities of the studied plant associations. An analysis of the maps of their distribution, presented above, does not confirm this assumption in the case of localities of the association *Calamagrostio arundinaceae-Quercetum* (Figs. 26f and 30-33), which is the most widespread acidophilous oak forest type in Wielkopolska. Localities of this association (and its subassociations) in the study area do not show any density gradient in the east-west direction. This applies both to well-preserved communities and those showing slight symptoms of degeneration (Fig. 26f) or those classified as stages II and III of degeneration (Figs. 32-33). A detailed analysis did not reveal any significant floristic differences in geographic distribution of *Calamagrostio arundinaceae-Quercetum*, either. By contrast, such differences are noticeable among localities and phytocoenoses of the association *Quercus roboris-Pinetum*, which in the study area is found in its marginal, northernmost localities.

Maps of distribution of localities of subassociations of *Quercus roboris-Pinetum* (Fig. 51) show that patches

of *Qr-P molinietosum* and *Qr-P coryletosum* are located mostly in the eastern part of the study area. As shown above (p. 82 in section 6.3.6), in Wielkopolska the relevés of the latter subassociation are characterized by a smaller contribution of species of the class *Quercus-Fagetea*, as compared to the relevés documenting the subassociation in central and eastern Poland (Matuszkiewicz J. M. 1988). The cited author emphasized that the documentation of the subassociation *Quercus roboris-Pinetum coryletosum* probably includes some relevés recorded in anthropogenic communities on potential sites of poorer oak-hornbeam forest. His hypothesis was confirmed in many later studies reporting that patches of „*Pino-Quercetum*” are spontaneously transformed into mesophilous woods (Medwecka-Kornaś & Gawroński 1990; Michalik 1991; Mitchell & Cole 1998; Woziwoda 2002; Brzezicki 2008). Thus it can be assumed that the contribution of species of the class *Quercus-Fagetea* in the table 1 of this subassociation, presented by J.M. Matuszkiewicz (1988), is overestimated to some extent. Nevertheless, in the relevés of *Qr-P coryletosum* presented here, the canopy is dominated by *Pinus sylvestris*, while the contribution of deciduous trees is relatively low. This undoubtedly results from forest management and causes a decrease in the contribution of also other plants of mesophilous broadleaved forests. It is impossible to determine the natural species composition of this association, as most or even all of its phytocoenoses have been markedly modified by human interference. To some extent, its reconstruction can be partly based on an analysis of mixed coniferous forests in areas where woods from the class *Vaccinio-Piceetea* find optimum sites and mesophilous broadleaved forests from the class *Quercus-Fagetea* are near the limit of their range. In comparison with their counterparts in Central Europe, mixed coniferous forests in e.g. Lithuania and southern Finland are characterized by a richer representation of characteristic species of the classes *Vaccinio-Piceetea* and *Quercus-Fagetea* (see also Čiuplys 2004; Kasproicz & Wojterska 2004). Thus the decrease in contribution of species of both the classes in mixed coniferous forests, progressing towards the western limit of distribution of communities from the class *Vaccinio-Piceetea*, and especially of the alliance *Dicrano-Pinion*, may be natural phenomenon. However, in many cases, it is distorted by forest management, which commonly favoured *Pinus sylvestris* until recently.

7.3. Vegetation dynamics

Individual species of trees significantly affect soil-forming processes, cycling of elements, organic matter decomposition, and productivity of ecosystems. This issue has been studied for a long time (e.g. Binkley & Giardina 1998; Augusto *et al.* 2002; Hobbie *et al.* 2006;

Jacob *et al.* 2010). Results of research conducted in an experimental plot established in 1970-1971, in a clear-cut area of an about 80-year-old pine monoculture (Szymański 1982) show that individual species of trees forming pure stands have a very significant, specific influence on environmental conditions, observed within a relatively short time. A detailed description of that experimental plot, and results of various studies conducted there, can be found, for example, in a paper by Knight *et al.* (2008). The phytosociological data presented below in 2 relevés (Kasproicz unpubl. data), collected in 2 parts of that plot, show very significant floristic differences between spontaneous plant communities developed under the canopy of *Quercus*. After 36 years, a relatively rich plant community developed in the young oak stand. Its species composition clearly indicates that it represents the acidophilous oak forest *Calamagrostio arundinaceae-Quercetum*. A similar species composition was recorded in 2 other patches, developed under the canopy of *Quercus robur* in a potential site of a mixed deciduous forest (labelled by Polish foresters as LMśw). After the same 36-year period, at initially identical environmental conditions, only 12 species were recorded under *Fagus*, i.e. about a quarter of the number of species recorded under *Quercus*. The plant community with *Fagus* includes hardly any diagnostic species, so it is a substitute forest community. This comparison clearly illustrates the above-mentioned differences in habitat-forming features of *Quercus* and *Fagus*, manifested not only in the very different light conditions under the canopy of each species (Knight *et al.* 2008), but also in litter production and soil properties (Reich *et al.* 2005).

Calamagrostio arundinaceae-Quercetum (Plot No. 11, 10.07.2006 (a 65%, b 0.5%, c 40%, d 15%, 225 m², 44 species): Ch. Ass.: *Hieracium lachenalii* +, *H. sabaudum* r; Ch. et D. *Quercetea robori-petraeae*: *Carex pilulifera* 2, *Dicranella heteromalla* +, *Holcus mollis* 2, *Lophocolea heterophylla* +, *Polytrichastrum formosum* +, Ch. *Quercus-Fagetea*: *Acer platanoides* c +, *A. pseudoplatanus* b +, c 1, *Atrichum undulatum* 2, *Fagus sylvatica* c r, *Poa nemoralis* +, *Tilia cordata* b +, c 1; *Viola riviniana* 2; Ch. *Molinio-Arrhenatheretea*: *Juncus effusus* r, *Poa pratensis* +, *Taraxacum officinale* r; Ch. *Calluno-Ulicetea*: *Agrostis capillaris* 1, *Carex ovalis* +, *Luzula multiflora* +, *Veronica officinalis* +. Others: *Quercus robur* a 4, c +, *Brachythecium rutabulum* +, *Calamagrostis epigejos* +, *Conyza canadensis* +, *Fallopia convolvulus* +, *Frangula alnus* c +, *Kindbergia praelonga* +, *Larix decidua* subsp. *decidua* c r, *Moehringia trinervia* 2; *Padus serotina* b +, c +, *Plagiomnium affine* 2, *Poa palustris* +, *Pseudotsuga menziesii* c r, *Rubus corylifolius* +, *R. idaeus* +, *R. pedemontanus* 1, *R. seebergensis* +, *Rubus sp.* +, *Rumex acetosella* r, *Sambucus nigra* c +, *S. racemosa* c r, *Sciurohypnum oedipodium* +, *Sorbus aucuparia* c +.

Substitute forest community (Plot No. 13, 10.07.2006 (a 95%, c +, d +, 399 m², 12 species): Ch. *Quercus-Fagetea*: *Fagus*

sylvatica a 5, *Acer pseudoplatanus* c +, *Atrichum undulatum* +; Ch. *Calluno-Ulicetea*: *Pohlia nutans* +. Others: *Brachythecium albicans* r, *Ceratodon purpureus* +, *Conyza canadensis* r, *Fallopia convolvulus* r, *Moehringia trinervia* r, *Padus serotina* c r, *Quercus robur* c r, *Q. rubra* c r.

In all the communities analysed here, the canopy was composed of a small number of species. The mean number was the lowest in patches of *Aulacomnium androgyni-Quercetum*, *Serratulo-Pinetum*, *Calamagrostis arundinaceae-Quercetum*, and *Potentillo albae-Quercetum* (Fig. 16). In relevés of the last 2 mentioned associations, the canopy was usually one-layered, dominated by *Quercus* sp. (*Q. petraea* or *Q. robur*, Figs. 34 and 48), and in many communities it consisted of only one species. Thus, considering also the above evidence of the habitat-forming role of *Quercus*, it can be hypothesized that existence of these communities is determined by the *Quercus*-dominated canopy. The hypothesis is commonly accepted in relation to the *Potentillo-Quercetum*. In this context, the question of naturalness of oak forest stands is particularly important. Undoubtedly, in the past, many oak forests were intensively utilized (mostly through livestock grazing and raking of leaf litter), and the dominance of oak trees in the present forest stands is an intentional or side effect of forest management, which was already discussed in chapter 2. Neuhäusl & Neuhäuslová-Novotná (1967) came to a conclusion that in European lowlands, no ancient oak woodland unaffected by human activity has been preserved, so “the classification of acidophilous oak forests and mixed forests with oak is somewhat hypothetical and based only on a comparison of cultural modifications initial associations”. Results of later studies, cited above, not only confirmed this opinion but some of them also indicate that acidophilous oak forests are secondary communities (see section 5.2). Anthropogenic origin of oak forest stands seems to be additionally confirmed by the commonly observed lack of effective natural regeneration of both major *Quercus* species (*Q. petraea* and *Q. robur*) in oak woodlands. Thus it cannot be excluded that not only thermophilous oak forest, as argued recently by J. M. Matuszkiewicz (2007b), but also acidophilous oak forests are semi-natural communities, dependent on both natural conditions and human activity. However, it is also probable that human impact disturbed to a large extent a still unknown natural mechanism of functioning of oak forest ecosystems, as apparently evidenced by recent reports on spontaneous regeneration of *Quercus* under the canopy of pine forests (see chapter 2) or on fenced plots (as observed e.g. in oak forests on the Krotoszyn Plateau).

If the hypothesis about the anthropogenic origin of acidophilous oak forests and their secondary character was accepted, then it would be necessary to determine

the corresponding type of potential natural vegetation or initial community. For oak forests distributed within the range of *Fagus*, it could be acidophilous beech forest. This diagnosis is justified by the gradual replacement of acidophilous oak forests by beech forests, commonly observed in the last few decades. Many authors cited above (chapter 2), regard it as a symptom of regeneration of beech forests earlier replaced by foresters with oak forest stands. A similar opinion was earlier expressed by J. M. Matuszkiewicz (2007a, 2007c, see section 5.2.1) in relation to the decreasing area of patches of *Fago-Quercetum* and *Luzulo luzuloidis-Quercetum*. In areas located outside the range of distribution of *Fagus*, no such clear directional changes are recorded in acidophilous oak forests. Their patches there, also those protected as nature reserves, seem to be stable. In the study area their species composition is highly variable, because of the wide range of sites occupied by them. The poorest communities among them are moist, closely related to coniferous forests from the class *Vaccinio-Piceetea*. The richest ones (within the class *Quercetea robori-petraeae*) are similar to deciduous forests from the class *Querco-Fagetea* (oak-hornbeam forests and thermophilous oak forests). These features seem to indicate the natural character of those communities. Utilization of oak forests, practiced for centuries, could lead to strong, sometimes irreversible soil degradation (see Walentowski & Scheuerer 2004). Thus it cannot be excluded that some patches of acidophilous oak forests colonize disturbed sites of poorer forms of oak-hornbeam forest. However, it seems unlikely that this mechanism is responsible for the genesis of acidophilous oak forests, regarded as a forest ecosystem type.

The questions discussed above require further research on permanent fenced plots, excluded from direct human impact and located throughout the distribution range of communities from the class *Quercetea robori-petraeae*. It would be particularly interesting to determine the role of various tree species in shaping and functioning of acidophilous oak forests. This applies not only to *Quercus* spp. (*Q. petraea*, *Q. robur*), and *Fagus sylvatica*, but also to *Carpinus betulus*, *Pinus sylvestris*, *Betula pentula*, *B. pubescens*, and *Populus tremula*.

7.4. Nature protection

All associations of acidophilous oak forests were classified both in Wielkopolska and generally in Poland as threatened communities: vulnerable (V) or of indeterminate threat (I) (Brzeg & Wojterska 2001; Ratyńska *et al.* 2010). However, in the Polish NATURA 2000 network, among communities from the class *Quercetea robori-petraeae*, only the Pomeranian acidophilous birch-oak forest *Betulo pendulae-Quercetum*

roboris is protected⁹. This association is in Poland the only identifier of habitat 9190 (“old acidophilous oak woods with *Quercus robur* on sandy plains”) according to the Decrees of the Minister of Environment (Regulation... 2005, 2010). These Decrees are based on an interpretation of that unit for the purposes of Natura 2000 by Danielewicz & Pawlaczyk (2004a). As shown above (see section 5.2.1), the definition of this association proposed by the cited authors, in relation to its habitat variation, is controversial. However, the map of distribution of *Betulo-Quercetum*, presented in the cited publication, does not raise any doubts. The association is found exclusively in the narrow coastal zone (a few dozen km away from the sea coast). The cited authors claim that their interpretation of habitat 9190 is consistent with its definition presented in the Interpretation Manual of European Union Habitats. So far in Poland (updated in March 2011), habitat 9190 has been recorded in 154 Special Areas of Conservation, and in one Special Protection Area (<http://natura2000.gdos.gov.pl/>). In all their Standard Data Forms (SDFs) (available exclusively in Polish), habitat 9190 is named “Pomeranian birch-oak forest (*Betulo-Quercetum*)”. However, only about 25 of them are situated within the potential range of distribution of the association. All the others are located in western Poland, from Pomerania to lower altitudes in the Western Sudetes, where the *Betulo-Quercetum* (at least as defined in Poland and West Europe, see section 5.2.1) is certainly absent. This error is partly corrected in the descriptive section of SDFs, whose authors listed names of recorded associations of acidophilous oak forests, but this was the case in only 12 SDFs. The major cause of the confusion is Annex 1 to Decision no. 5 of Director-General of the State Forests of 30 January 2007, about inventories of habitats and plants. The Annex recommends to include in habitat 9190 “all acid oak forests (*Calamagrostio-Quercetum*, *Molinio-Quercetum*, *Fago-Quercetum*, *Luzulo-Quercetum*), and not only the Pomeranian *Betulo-Quercetum*”. The text of the Annex also emphasized that the Decree of the Minister of Environment of 2005 would be corrected. That Decision formed a basis for the work of special expert teams whose goals included the verification of habitats at the existent Natura 2000 sites.

In conclusion, considering the current Decree of the Minister of Environment of 2010, all the areas where habitat 9190 was recorded need to be verified soon. Perhaps it will be necessary to remove the information about habitat 9190 from most of the SDFs. Undoubtedly, however, for more effective nature conservation, not

only in Poland but also in Europe, it would be favourable to change the above-mentioned Decree and classify as habitat 9190 all acidophilous oak forests from the class *Quercetea robori-petraeae* found in Poland.

8. Conclusions

1. The 1655 vegetation relevés analysed in this study were recorded in patches of acidophilous oak forests from the class *Quercetea robori-petraeae* or closely related forest communities from the classes *Querceto-Fageteta* and *Vaccinio-Piceetea*. These numerous relevés were selected from 59 published or unpublished studies conducted in the Wielkopolska region and adjacent areas, so this is the first such a large-scale comparison of this group of plant communities.
2. A detailed analysis of the major concepts of classification of acidophilous oak forests from the order *Quercetalia roboris* (Table 1) allowed correction of the previous solutions. The resultant coherent system of classification of these communities in Central Europe is shown in Table 13.
3. The classical phytosociological methods, along with multivariate ordination (DCA and/or PCA) and analyses taking into account Ellenberg indicator values, were used to determine the range of habitat variation of the studied communities and following subdivision (subassociations, variants).
4. The analysis of species composition and vertical structure allowed identification of the major floristic and structural features that distinguish well-developed forms of the studied associations from their degenerated forms and substitute forest communities.
5. The distribution of the documented localities of all associations and subassociations in the study area is presented in cartograms on the ATPOL grid. For many syntaxa, this is the first cartographic presentation of their ranges of distribution in Wielkopolska. The range of distribution of *Calamagrostio arundinaceae-Quercetum*, analysed earlier by J. M. Matuszkiewicz (1988, 2001a) as well as W. Matuszkiewicz & J. M. Matuszkiewicz (1996), is expanded and presented in greater detail here.
6. In the study area, phytocoenoses of 7 plant associations of this group of forest communities were recorded (Fig. 57). These include: (a) acidophilous oak forests from the class *Quercetea robori-petraeae*, namely *Aulacomnio androgyni-Quercetum roboris* Brzeg et Kasproicz in Brzeg et al. 2000, *Molinio caeruleae-Quercetum roboris* (R. Tx. 1937) Scam. et Pass. 1959 em. Brzeg, Kasproicz et Krotoska 1989, and *Calamagrostio arundinaceae-Quercetum petraeae* (Hartm. 1934) Scam. et Pass. 1959 em. Brzeg, Kasproicz et Krotoska 1989; (b) closely related oak forests from the class *Querceto-Fageteta*,

⁹ Forms of *Betulo-Quercetum* and of *Fago-Quercetum* which developed on coastal dunes were assigned to the habitat 2180 (Namura-Ochalska 2004)

namely acidophilous forms of the oak-hornbeam forest *Galio sylvatici-Carpinetum* and the thermophilous oak forest *Potentillo albae-Quercetum*; and (c) mixed coniferous forests from the class *Vaccinio-Piceetea*, namely *Quercus roboris-Pinetum* and *Serratulo-Pinetum*).

7. The analysed and revised syntaxa are described here in accordance with the International Code of Phytosociological Nomenclature (Weber *et al.* 2000). Considering the priority principle, authors of descriptions of the considered syntaxa are given (to the level of subassociations), and their major synonyms are listed. Nomenclatural types are designated here for 2 subassociations of Central European oak-hornbeam forest *Galio sylvatici-Carpinetum*, namely the *Gs-C calamagrostietosum arundinaceae* Preising 1943 *ex* Traczyk 1962, and *Gs-C holcetosum mollis* Preising 1943 *ex* Krotoska 1966, and for 3 subassociations of thermophilous oak forest *Potentillo albae-Quercetum*: *Pa-Q typicum* Preising 1943 *ex* W. *et* A. Mat. 1956 and 2 subassociations new to science: the *Pa-Q molinietosum* Brzeg *et* Kasprowicz 2001 *ex* Kasprowicz 2010 *subass. nova* and *Pa-Q brachypodietosum pinnati* M. Wojterska *et* Wiszniewska 1996 *ex* Kasprowicz 2010 *subass. nova*). No nomenclatural types are designated for the association *Galio sylvatici-Carpinetum*, its subassociations *Gs-C lathyretosum verni* Preising 1943 *ex* Krotoska 1966, *Gs-C typicum* Oberd. 1957, and subassociations of the mixed coniferous forest *Quercus roboris-Pinetum* (the *Qr-P molinietosum* J.M. Mat. 1988 *nom. inval.*, *Qr-P typicum* J.M. Mat. 1988 *nom. inval.*, and *Qr-P coryletosum* J.M. Mat. 1988 *nom. inval.*), because these syntaxa are not represented in the collected set of relevés by their most typical forms. For the *Galio sylvatici-Carpinetum*, this results from the applied selection criteria (limitation to acidophilous forms), whereas for the *Quercus roboris-Pinetum*, from the location of the study area at the edge of its distribution range.
8. This study shows that the analysed associations can be subdivided into 16 subassociations and 23 variants. In some cases, an analysis of large sets of relevés confirmed and validated some of the earlier defined syntaxa of various ranks, including alliances (*Agrostio capillaris-Quercion* and *Dicrano scoparii-Quercion roboris*), associations (*Aulacomnium androgyni-Quercetum*, and *Molinio caeruleae-Quercetum*) or subassociations and/or variants of *Calamagrostio arundinaceae-Quercetum*, *Galio sylvatici-Carpinetum*, *Potentillo albae-Quercetum*, and *Quercus roboris-Pinetum*.
9. The presented results confirm the preliminary diagnoses of Brzeg *et al.* (1998, 2000) as well as Brzeg & Kasprowicz (2001), who reported that patches of *Aulacomnium androgyni-Quercetum roboris* and *Molinio caeruleae-Quercetum roboris* are rare in the study area. Their subdivision proposed in the cited articles, based on ecological variation, is maintained here. It is additionally justified by results of statistical tests of their relevés, taking into account Ellenberg indicator values. Among the considered forest communities from the classes *Quercetea robori-petraeae* and *Quercus-Fagetum*, these associations are distinguished by the lowest soil reaction value, which makes them similar to the *Quercus roboris-Pinetum*. They share with mixed coniferous forests also a low species diversity of the herb layer (including species of old deciduous forests) and the medium continentality index (intermediate between weakly sub-Atlantic and weakly subcontinental). The *Molinio caeruleae-Quercetum* has the highest soil moisture value (which indicates the wettest sites), as compared to all the other considered associations.
10. Clear separation of degenerated forms (at stages I, II, and III of degeneration, as defined by Faliński 1966), as well as of substitute forest communities, allowed a clearer classification of the studied syntaxa. The best example is the separation of the *Molinio caeruleae-Quercetum* from the *Calamagrostio arundinaceae-Quercetum molinietosum*.
11. This study shows that the association *Calamagrostio arundinaceae-Quercetum* is represented in the study area exclusively by its Wielkopolska race and it is common there. As many as 792 relevés (48% of all the analysed relevés) have been assigned to the association in this study (Fig. 57). However, most of them (476) are degenerated patches. Previously, only 79 relevés were identified as degenerated forest stands of this association.
12. The presented results confirm a clear habitat variation of *Calamagrostio arundinaceae-Quercetum*, in respect of both moisture (subassociations: the *Ca-Q molinietosum*, *Ca-Q typicum*, and *Ca-Q polygonatetosum*) and fertility (variants: typical and with *Anemone nemorosa*), reported earlier by Brzeg *et al.* (2001) as well as Brzeg and Kasprowicz (2001) but on the basis of a much smaller set of relevés. This study shows that the variation is noticeable also among degenerated forms, even among communities representing stage III of degeneration. The variation can be noticed easily in field conditions. Only 12 relevés (out of the total number of 792 relevés of the association) have mixed floristic features, of both the *Ca-Q molinietosum* and *Ca-Q polygonatetosum*. The analysed subassociations and variants of the association significantly differ in Ellenberg indicator values.
13. Individual subassociations of *Calamagrostio arundinaceae-Quercetum* differ in frequency. This

is most noticeable among untransformed communities and among those in stage I of degeneration. The *Ca-Q molinietosum* (20 and 23 localities, respectively) was much rarer than the other 2 subassociations: the *Ca-Q typicum* (36 and 40 localities) and *Ca-Q polygonatetosum* (52 and 40 localities).

14. This study did not confirm the presence of *Ca-Q scorzonetetosum humilis* Grosser 1964 and *Pyrolo secundae-Quercetum petraeae* Pass. 1957 in the study area. All the relevés from Wielkopolska that were included in the tables of those associations by Pallas (1996) in fact represent the *Calamagrostio arundinaceae-Quercetum*. This is consistent with the initial diagnoses made by authors of the relevés (Fabiszewski & Faliński 1967; Krotoska 1978). Relevés misidentified as the *Ca-Q scorzonetetosum* are classified here as stage I of degeneration of *Ca-Q typicum* in the typical variant, while those misidentified as the *Pyrolo-Quercetum*, represent in fact the *Ca-Q polygonatetosum* in the typical variant, partly in stage I of degeneration.
15. The documented acidophilous oak-hornbeam forests are represented in the study area by 2 subassociations of Central European oak-hornbeam forest: the *Galio sylvatici-Carpinetum holcetosum mollis* (105 relevés) and *Gs-C calamagrostietetosum arundinaceae* (9 relevés). These syntaxa correspond to a more broadly defined subassociation *Gs-C polytrichetosum*, described by W. Matuszkiewicz & A. Matuszkiewicz (1985). This study shows that the *Gs-C holcetosum mollis* can be subdivided into 3 earlier unknown variants: with *Lysimachia vulgaris* (corresponding to the subassociation *Gs-C holcetosum*,

as defined by Krotoska 1966), typical, and with *Solidago virgaurea*. The *Gs-C holcetosum mollis* in the variant with *Lysimachia vulgaris* can develop in 2 trophic subvariants: typical or with *Pulmonaria obscura*. The latter subvariant is the most fertile form of this subassociation, similar to *Gs-C typicum*.

16. The subassociation *Gs-C calamagrostietetosum* is very poorly studied, represented by only 9 relevés from the Krajna Lakeland (Pojezierze Krajeńskie) (Boiński 1973), and requires further research. The cited author defined the subassociation more broadly, as he included in it also relevés classified here as the *Gs-C lathyretetosum verni*.
17. The presented results confirm the concept of Brzeg & Kasprowicz (2001), summarizing earlier hypotheses of Jakubowska-Gabara (1993) as well as Wojterska & Wiszniewska (1996), about the ecological variation of the association *Potentillo albae-Quercetum*. This study shows that the 3 subassociations conditioned by soil moisture content (*Pa-Q molinietetosum*, *Pa-Q typicum*, and *Pa-Q brachypodietetosum pinnati*), distinguished by those authors, must be supplemented with the *Pa-Q astrantietetosum*. In the study area, the *Pa-Q brachypodietetosum* was the most frequent among them. Its patches developed in 3 trophic variants: with *Pleurozium schreberi*, typical, or with *Asarum europaeum*.
18. Results of this study do not support the hypothesis of Jakubowska-Gabara (1993) that as a result of regression, patches of the thermophilous oak forest *Potentillo albae-Quercetum* can be gradually transformed into the *Calamagrostio-Quercetum*. The present study shows that in both localities investi-

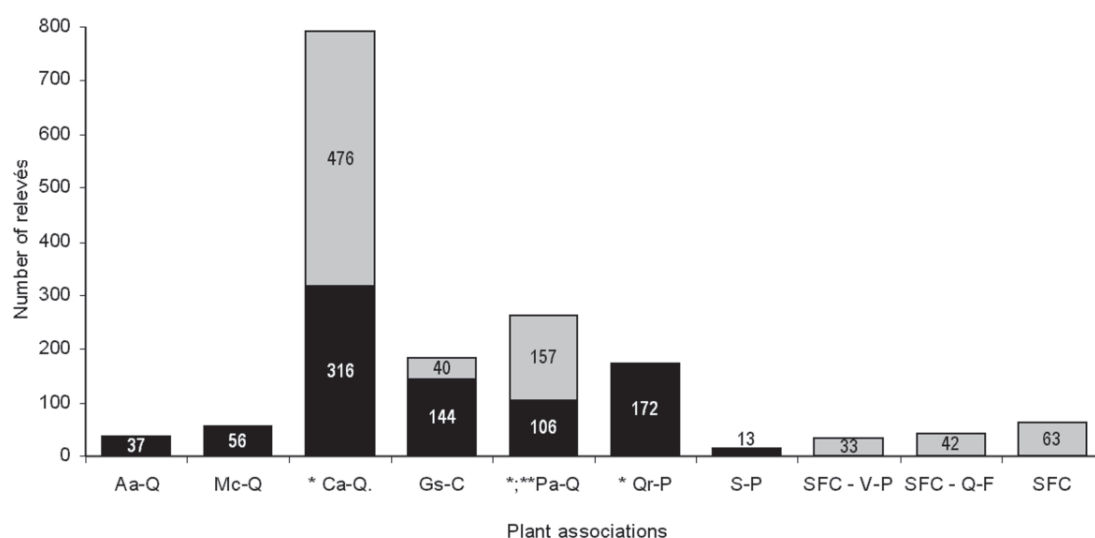


Fig. 57. Numbers of relevés assigned to major plant associations in this study

Explanations: black – untransformed communities, grey – degenerated or substitute forest communities (SFC), * untransformed communities include complexes of *Ca-Q molinietetosum/polygonatetosum* (12 relevés), *Pa-Q astrantietetosum/molinietetosum* (8), *Qr-P molinietetosum/coryletetosum* (7), ** – degenerated communities include 13 relevés of *Pa-Q* of Wojterska & Wojterski (1953) and 56 relevés classified as substitute forest communities (SFC) on potential sites of *Pa-Q*; further explanations in the text

gated by the cited author in the Zielonka Forest near Poznań, the analysed communities still represent the class *Querc-Fagetea*. Thus the available literature does not include any documented examples of transformation of patches of the *Potentillo albae-Quercetum* into the *Calamagrostio arundinaceae-Quercetum* or other communities from the class *Quercetea robori-petraeae*.

19. The continental mixed coniferous forest *Quercus roboris-Pinetum* is represented in the study area by all its known subassociations conditioned by ecological variation. The most widespread is *Qr-P typicum*, found in 28 localities, while the *Qr-P coryletosum* and *Qr-P molinietosum* were recorded in 19 and 13 localities, respectively.
20. The phytosociological documentation of subassociations of *Quercus roboris-Pinetum* has been greatly enriched in this study. So far, most researchers in the study area did not take into account this aspect in their publications. Despite this, only 7 of the 172 relevés identified here as this association were recorded in mixed or intermediate patches.
21. Most of the moisture-demanding associations (or subassociations) are distributed chiefly in the southern part of the study area. This part is located outside the range of the last glaciation (Vistulian), and is characterized by higher precipitation. Such a distribution pattern is typical for the *Aulacomnium androgyni-Quercetum*, *Molinio caeruleae-Quercetum*, *Calamagrostio arundinaceae-Quercetum molinietosum*, and *Galio sylvatici-Carpinetum holcetosum mollis* in the variant with *Lysimachia vulgaris*. According to the geobotanical regionalization of J. M. Matuszkiewicz

(1993, 2008a), their localities are found mainly within the South Wielkopolska Subregion. The first 2 of them, and to a lesser extent also the *Ca-Q molinietosum*, are concentrated within the Krotoszyn Plateau, and can be regarded as characteristic for the Kalisz Plateau, which is part of that Subregion. Also most of localities of the moist mixed coniferous forest *Quercus roboris-Pinetum molinietosum*, are situated south of the limit of the last glaciation. Like localities of *Qr-P coryletosum*, they are concentrated in the eastern part of the study area.

22. An analysis of 318 relevés identified by their authors as the association *Pino-Quercetum* revealed their heterogeneity. According to the adopted syntaxonomic criteria, these relevés represent 5 plant associations as well as substitute forest communities (Fig. 58). These include:

- *Calamagrostio arundinaceae-Quercetum* – most of the 125 relevés (92) represent stage I (45), II (34), or III (13) of degeneration. Untransformed patches are documented by 30 relevés, while another 3 were recorded in intermediate or mixed communities of 2 subassociations: the *Ca-Q molinietosum* and *Ca-Q polygonatetosum*. The best documented subassociation was the *Ca-Q molinietosum* (53 relevés, including 15 of untransformed communities and 38 of degenerated ones). *Ca-Q typicum* was represented by 44 relevés (10 and 34 relevés, respectively), while the *Ca-Q polygonatetosum*, by only 25 relevés (5 and 20 relevés, respectively).
- *Quercus roboris-Pinetum* – 122 relevés have been classified as this association. These include 20

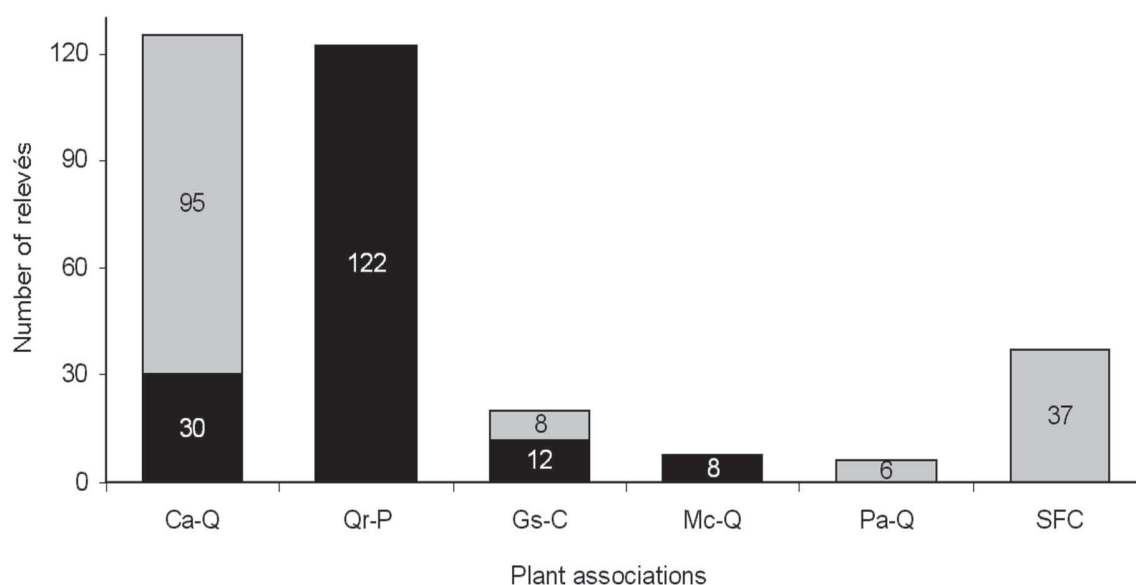


Fig. 58. Proper classification of 318 relevés originally identified as *Pino-Quercetum*

Explanations: black – untransformed communities, grey – degenerated or substitute forest communities (SFC); further explanations in the text

of *Qr-P molinietosum*, 65 of *Qr-P typicum*, 35 of *Qr-P coryletosum*, and 2 of mixed *Qr-P molinietosum*/*Qr-P coryletosum*.

- *Galio sylvatici-Carpinetum* – Central European oak-hornbeam forest is represented here by 20 relevés, earlier classified as the *Pino-Quercetum*. All of them were recorded in patches of *Gs-C holcetosum mollis* in the variant with *Lysimachia vulgaris*, and 8 of them document degenerated communities.
- *Molinio caeruleae-Quercetum roboris* – 6 of the 8 relevés derive from a table of *Pino-Quercetum* in the variant with *Molinia caerulea* (Krotoska & Piotrowska 1962). Earlier on, Brzeg and Kasproicz (2001) identified them as the association *Molinio caeruleae-Quercetum*.
- *Potentillo albae-Quercetum* – its documentation includes 6 relevés, diagnosed earlier as the *Pino-Quercetum*. All of them represent this community in stage II of degeneration.
- The group of substitute forest communities comprises 37 relevés. Many of them (18) have a very simple floristic structure and cannot be identified even to the class level. Substitute forest communities from the class *Vaccinio-Piceetea* are represented by 15 relevés, while those from the class *Quercio-Fagetea*, by 4 relevés. In the last group, one of the documented patches occupied the potential site of the thermophilous oak forest *Potentillo albae-Quercetum*.

23. The available literature data indicate that the range of distribution of acidophilous oak forests from the alliance *Agrostio capillaris-Quercion* and from the class *Quercetea robiori-petraeae* extends outside the eastern limits of Poland and comprises north-western Ukraine and the adjacent parts of Russia and probably also of Belarus. Further research is needed to determine which communities represent acidophilous oak forests and whether they are distinct from the associations found in Poland.

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References

- ABRAMS M. D. 1992. Fire and the development of oak forests. *BioScience* 42: 346-353.
- AMMER CH., ALBRECHT L., BORCHERT H., BROISINGER F., DITTMAR CH., ELLING W., EWALD J., FELBERMEIER B., VON GILSA H., HUSS J., KENK G., KÖLLING CH., KOHNLE U., MEYER P., MOSANDL R., MOOSMAYER H.-U., PALMER S., REIF A., REHFUESS K.-E. & STIMM B. 2005. Zur Zukunft der Buche (*Fagus sylvatica* L.) in Mitteleuropa. Kritische Anmerkungen zu einem Beitrag von Rennenberg *et al.* (2004). *Allg. Forst- u. J.-Ztg.* 176: 60-67.
- AUGUSTO L., RANGER J., BINKLEY D. & ROTHE A. 2002. Impact of several common tree species of European temperate forests on soil fertility. *Ann. For. Sci.* 58: 233-253.
- BABCZYŃSKA-SENDEK B., WIKI S. & BARĆ A. 2007. *Molinio arundinaceae-Quercetum roboris* – nowy zespół leśny dla Wyżyny Śląskiej. *Fragm. Flor. Geobot. Polonica. Suppl.* 9: 59-72.
- BAKKER E. S., OLFF H., VANDENBERGHE C., DE MAEYER K., SMIT R., GLEICHMAN J. M. & VERA F. W. M. 2004. Ecological anachronisms in the recruitment of temperate light-demanding tree species in wooded pastures. *J. Appl. Ecol.* 41: 571-582.
- BALCERKIEWICZ S., BRZEG A. & KASPROWICZ M. 1994. Szata roślinna rezerwatu „Nadwarciański Bór Sosnowy” w Wielkopolskim Parku Narodowym. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 43: 51-83.
- BALCERKIEWICZ S. & SŁAWNIKOWSKI O. 1988. Profit 2.0. Pakiet programów komputerowych do analiz geobotanicznych. Profit s.c., Poznań.
- BARBATI A., CORONA P. & MARCHETTI M. 2007. European forest types. Categories and types for sustainable forest management reporting and Policy. 111 pp. EEA Technical report No 9/2006.
- BARBATI A. & MARCHETTI M. 2005. Forest types for biodiversity assessment (FTBAs) in Europe: the revised classification scheme. In: M. MARCHETTI (ed.).

- Monitoring and indicators of forest biodiversity in Europe – from ideas to operationality, pp. 105-126. EFI Proceedings No. 51, 2004. European Forest Institute.
- BARDAT J., BIORET F., BOTINEAU M., BOULLET V., DELPECH R., GÉHU J.-M., HAURY J., LACOSTE A., RAMEAU J.-C., ROYER J.-M., ROUX G. & TOUFFET J. 2004. *Prodrome des végétations de France*. 171 pp. Museum National d'Histoire Naturelle, Paris.
- BARKMAN J. J., MORAVEC J. & RAUSCHERT S. 1995. Kodeks Nomenklatury Fitosocjologicznej. In: K. CZYŻEWSKA & W. MATUSZKIEWICZ (eds.). *Polish Bot. Stud. Guidebook Series 16*: 1-56. PAN. Kraków.
- BARTKOWSKI T. 1970. Wielkopolska i Środkowe Nadodrze. 384 pp. PWN, Warszawa.
- BERDOWSKI W. & KWIATKOWSKI P. 1992. Roślinność rezerwatów “Dalkowskie Jary” i “Uroczysko Obiszów” w zachodniej części Wału Trzebnickiego. *Acta Univ. Wratisl. Prace. Bot.* 48: 151-202.
- BERG C., DENGLE J. & ABDANK A. 2004. Klasse: *Quercetea robori-petraeae* Br.-Bl. & Tx. ex Br.-Bl. 1950 nom. mut. propos. – Bodensaure Eichen- und Buchen-Mischwälder. In: C. BERG, J. DENGLE, A. ABDANK & M. ISERMANN (eds.). *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*, pp. 469-476. Weissdorn-Verlag, Jena.
- BERGMEIER E., PETERMANN J. & SCHRÖDER E. 2010. Geobotanical survey of wood-pasture habitats in Europe: diversity, threats and conservation. *Biodiversity and Conservation* 19: 2995-3014.
- BINKLEY D. & GIARDINA C. 1998. Why do tree species affect soils. The Warp of Woolf of tree-soil interaction. *Bio-geochemistry* 42: 89-106.
- BIRKS H. B. J. 2005. Mind the gap: how open were European primeval forests? *Trends Ecol. Evol.* 24: 154-156.
- BJÖRKMAN L. 1997. The role of human disturbance in the local Late Holocene establishment of *Fagus* and *Picea* forests at Flahult, western Småland, southern Sweden. *Veget. Hist. Archaeobot.* 6:79-90.
- BŁACHUTA D. 1995 (mscr.). *Macromycetes na tle lasów dębowych projektowanego rezerwatu “Chruszczyn” w Nadleśnictwie Krotoszyn*. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- BOBIEC A. & JASZCZ E. 2010. Dąb szypułkowy w Białowieskim Parku Narodowym: fala naturalnego odnowienia? *Parki Narodowe i Rezerwaty Przyrody* 29: 63-80.
- BOHN U. 2003. F5 Beech and mixed beech forest. In: U. BOHN & R. NEUHÄUSL (eds.). *Map of the Natural Vegetation of Europe. Part 1 Explanatory Text with CD-ROM*, pp. 279-306. Landwirtschaftsverlag Münster.
- BOHN U., NEUHÄUSL R., GOLLUB G., HETTWER C., NEUHÄUSLOVÁ Z., RAUS TH., SCHLÜTER H. & WEBER H. 2003. *Map of the Natural Vegetation of Europe. Part 3. Maps*. Landwirtschaftsverlag, Münster.
- BOIŃSKI M. 1973. Lasy liściaste środkowej części Pojezierza Krajeńskiego. *Stud. Soc. Scient. Torun.* 9(5): 1-105.
- BOLTE A., CZAJKOWSKI T. & KOMPA T. 2007. The north-eastern distribution range of European beech – a review. *Forestry* 80: 413-429.
- BORATYŃSKA K. 1998. Rozmieszczenie geograficzne. In: A. BORATYŃSKI & W. BUGAŁA (eds.). *Biologia świerka pospolitego*, pp. 63-78. Bogucki Wyd. Nauk., Poznań.
- BORYSIK J., BRZEG A. & KASPROWICZ M. 1991 (mscr.). *Wstępna waloryzacja przyrodnicza projektowanego Obszaru Chronionego Krajobrazu “Dąbrowy Krotoszyńskie”*. Ekspertyza dla Wojewódzkiego Konserwatora Przyrody w Kaliszu. Poznań.
- BORYSIK J., BRZEG A. & KASPROWICZ M. 1992. Materiały do znajomości szaty roślinnej oraz godne ochrony obiekty przyrodnicze województwa kaliskiego. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 41: 63-107.
- BORYSIK J., MELOSIK I. & STACHNOWICZ W. 1998. Szata roślinna i ochrona torfowiska przejściowego “Gogulec” koło Poznania. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 47:159-175.
- BÖHNERT W., GUTTE P. & SCHMIDT P. A. 2001. *Verzeichnis und Rote Liste der Pflanzengesellschaften Sachsens*. 304 pp. Materialien zu Naturschutz und Landschaftspflege. Dresden.
- BRADSHAW R. H. W., HANNON G.E. & LISTER A. M. 2003. A long-term perspective on ungulate-vegetation interactions. *Forest Ecol. Manage.* 181: 267-280.
- BRADSHAW R. H. W. & MÜLLER P. F. 2005. European forest types for biodiversity assessment – a qualitative approach. In: M. MARCHETTI (ed.). *Monitoring and indicators of forest biodiversity in Europe – from ideas to operationality*, pp. 127-133. EFI Proceedings No. 51, 2004. European Forest Institute.
- BRAUN-BLANQUET J. 1950. Übersicht der Pflanzengesellschaften Rätians (VI). *Vegetatio* 2: 341-360.
- BRAUN-BLANQUET J. 1964. *Pflanzensoziologie. Grundzüge der Vegetationskunde*. 3rd ed. Springer, Wien, New York.
- BRODA J. 2006. Dęby w czasach historycznych. In: W. BUGAŁA (ed.). *Grab zwyczajny *Carpinus betulus* L.*, pp. 21-37. Sorus, Poznań-Kórnik.
- BRZEG A. 1989 (mscr.). *Roślinność północnej części międzyrzecza Prosnny, Czarnej Strugi i Warty*. PhD thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- BRZEG A. 1995. Szata roślinna. In: D. KOSIŃSKI, R. MARCINIAK & J. J. PARYSEK (eds.). *Krotoszyn, I*, pp. 81-100. Bogucki Wyd. Nauk., Krotoszyn-Poznań.
- BRZEG A. 2004. The occurrence of subcontinental mixed coniferous forests of the Rychwał Plain (eastern Wielkopolska) – some remarks. In: A. BRZEG & M. WOJTERSKA (eds.). *Coniferous forest vegetation – differentiation, dynamics and transformations*. Wyd. Nauk. UAM, seria Biologia, 69, pp. 93-104.
- BRZEG A. 2005. Zespoły kserotermofilnych ziołorośli okrajowych z klasy *Trifolio-Geranieta sanguinei* Th. Müller 1962 w Polsce. 230 pp. Bogucki Wyd. Nauk., Poznań.
- BRZEG A. 2006 (mscr.). *Materiały do charakterystyki zbiorowisk roślinnych Wielkopolski*.
- BRZEG A., JACKOWIAK B. & KASPROWICZ M. 2005 (mscr.). *Operat zbiorowisk leśnych i zaroślowych*. In: J. KORZEŃ (ed.). *Plan ochrony Słowińskiego Parku Narodowego*. Jelenia Góra.

- BRZEG A. & KASPROWICZ M. 2001. Dąbrowy Wielkopolski ze szczególnym uwzględnieniem Płyty Krotoszyńskiej. In: M. WOJTERSKA (ed.). Szata roślinna Wielkopolski i Pojezierza Południowopomorskiego. Przewodnik sesji terenowych 52. Zjazdu PTB, 24-28 września 2001, pp. 179-192. Bogucki Wyd. Nauk., Poznań.
- BRZEG A., KASPROWICZ M. & KROTOSKA T. 1989. Acidofilne lasy z klasy *Quercetea robori-petraeae* Br.-Bl. et R.Tx. 1943 w Wielkopolsce. I. *Molinio (caeruleae)-Quercetum roboris* Scam et Pass. 1959 emend. – środkowoeuropejska mokra dąbrowa trzęślicowa. Bad. Fizjogr. Pol. Zach., seria B-Botanika 39: 5-36.
- BRZEG A., KASPROWICZ M. & KROTOSKA T. 1998. Acidofilna dąbrowa trzcinnikowa *Calamagrostio-Quercetum petraeae* (Hartm. 1934) Scam. 1959 em. Brzeg et al. 1989 w Wielkopolsce. In: J. MIADLIKOWSKA (ed.). Materiały konferencji i obrad sekcji 51 Zjazdu PTB – Gdańsk, 15-19 września 1998, pp. 59. Bogucki Wyd. Nauk., Poznań.
- BRZEG A., KASPROWICZ M. & KROTOSKA T. 2000a. Acidofilne lasy z klasy *Quercetea robori-petraeae* Br.-Bl. et R. Tx. 1943 w Wielkopolsce. Cz. II. *Aulacomnion androgenum-Quercetum roboris* Brzeg et Kasproicz in Brzeg et al. 2000 ass. nova – acidofilny las grabowo-dębowy. Bad. Fizjogr. Pol. Zach., seria B-Botanika 49: 59-71.
- BRZEG A., KUŚWIK H. & WYRZYKIEWICZ-RASZEWSKA M. 2000b. Szata roślinna projektowanego rezerwatu "Ciświckie Bagna" koło Grodzca we wschodniej Wielkopolsce. Rocz. AR w Poznaniu, 322, Bot. 3: 21-67.
- BRZEG A., KASPROWICZ M. & KROTOSKA T. 2001. Acidofilne lasy z klasy *Quercetea robori-petraeae* Br.-Bl. et R. Tx. 1943 w Wielkopolsce. Cz. III. *Calamagrostio arundinaceae-Quercetum petraeae* (Hartmann 1934) Scamoni et Passarge 1959 em. Brzeg, Kasproicz et Krotoska 1989 – Śródkowoeuropejska kwaśna dąbrowa trzcinnikowa. Bad. Fizjogr. Pol. Zach., seria B-Botanika 50: 41-61.
- BRZEG A., KASPROWICZ M., PAWŁOWSKI J., KOŚIŃSKI Z. & STACHNOWICZ W. 2002a. SOO "Dąbrowy Płyty Krotoszyńskiej". Natura 2000 – Standardowy Formularz Danych. Materiały Wojewódzkiego Zespołu Realizacyjnego w Poznaniu. Instytut Ochrony Przyrody PAN, Kraków. Narodowa Fundacja Ochrony Środowiska, Centrum UNEP/GRID, Warszawa.
- BRZEG A., KASPROWICZ M., PAWŁOWSKI J. & STACHNOWICZ W. 2002b. "Dąbrowy Płyty Krotoszyńskiej". Natura 2000 – formularz zgłoszeniowy ostoi siedliskowej. Materiały Wojewódzkiego Zespołu Realizacyjnego w Poznaniu. Instytut Ochrony Przyrody PAN, Kraków. Narodowa Fundacja Ochrony Środowiska, Centrum UNEP/GRID, Warszawa.
- BRZEG A., KASPROWICZ M., RAKOWSKI W., WOJTERSKA M. & YAKUSHENKO D. 2009a. Differentiation of thermophilous oak forest *Potentillo albae-Quercetum* Libb. 1933 nom. invers. in Europe. In: E. AGRILLO & L. CASELLA (eds.). Thermophilous Vegetation. Abstracts of 18th International Workshop of European Vegetation Survey Roma, March 25th-28th, 2009, p. 81. Roma.
- BRZEG A., KASPROWICZ M., RAKOWSKI W., WOJTERSKA M. & YAKUSHENKO D. 2009b. Habitat and geographical differentiation of thermophilous oak forest *Potentillo albae-Quercetum* Libb. 1933 nom. invers. in Europe. In: Challenges for Contemporary Biology, Biotechnology and Environmental Protection. 1th Scientific-Didactic Conference of the Faculty of Biology of the Adam Mickiewicz University. 21-23 May 2009, Poznań, Poland. Adam Mickiewicz University, Poznań, pp. 83-84.
- BRZEG A. & WOJTERSKA M. 1996. Przegląd systematyczny zbiorowisk roślinnych Wielkopolski wraz z oceną stopnia ich zagrożenia. Bad. Fizjogr. Pol. Zach., seria B-Botanika 45: 7-40.
- BRZEG A. & WOJTERSKA M. 2001. Zespoły roślinne Wielkopolski, ich stan poznania i zagrożenie. In: M. WOJTERSKA (ed.). Szata roślinna Wielkopolski i Pojezierza Południowopomorskiego. Przewodnik sesji terenowych 52. Zjazdu PTB, 24-28 września 2001, pp. 39-110. Bogucki Wyd. Nauk., Poznań.
- BRZEZIECKI B. 2008. Wieloletnia dynamika drzewostanów naturalnych na przykładzie dwóch zbiorowisk leśnych Białowieskiego Parku Narodowego: *Pino-Quercetum* i *Tilio-Carpinetum*. Studia Nat. 54: 9-22.
- CEITEL J. 2006. Lasy dębowe w Polsce. In: W. BUGAŁA (ed.). Dęby. Nasze drzewa leśne 11, pp. 114-145. Bogucki Wyd. Nauk., Poznań.
- CEITEL J. 2007. Zamieranie drzewostanów dębowych a hodowla lasu. In: P. RUTKOWSKI (ed.). Hodowla dębów w Polsce. Wybrane zagadnienia. Idee Ekologiczne 16: 21-33. Sorus, Poznań.
- CELIŃSKI F. 1965. Fragmenty lasów naturalnych w Górach Kaczawskich. Ochrona Przyr. 31: 53-76.
- CELIŃSKI F. & PIACZYŃSKA M. 1966. Lasy bagienne i wilgotne okolic Stepnicy nad Zalewem Szczecińskim. Bad. Fizjogr. Pol. Zach., seria B-Botanika 18: 111-153.
- CELIŃSKI F. & WIKI S. 1974-1975. Zespoły leśne projektowanego rezerwatu w Rozumicach w pow. głubczyskim. Oplskie Tow. Przyj. Nauk 14-15: 109-130.
- CHYTRÝ M. 1997. Thermophilous oak forests in the Czech Republic: Syntaxonomical revision of the *Quercetalia pubescenti-petraeae*. Folia Geobot. Phytotax. 32(3): 221-258.
- CHYTRÝ M. 2001. Phytosociological data give biased estimates of species richness. J. Veg. Sci. 12: 439-444.
- CHYTRÝ M. & HORÁK J. 1996. Plant communities of the thermophilous oak forests in Moravia. Preslia 68(3): 193-240.
- CHYTRÝ M. & OTÝPKOVÁ Z. 2003. Plot sizes used for phytosociological sampling of European vegetation. J. Veg. Sci. 14: 563-570.
- CHYTRÝ M. & TICHÝ L. 2003. Diagnostic, constant and dominant species of vegetation classes and alliances of the Czech Republic: a statistical revision. Folia Fac. Sci. Nat. Univ. Masaryk. Brun., Biol. 108: 1-231.
- CHYTRÝ M. & VICHÉREK J. 1995. Lesní vegetace Národního parku Podyjí/Thayatal. 167 pp. Academia, Praha.
- CORNWELL W. K. & GRUBB P. J. 2003. Regional and local patterns in plant species richness with respect to resource availability. Oikos 100: 417-428.
- CROSS J. R., PALLAS J. & BOHN U. 2003. F.1 Species-poor oak and mixed oak forests (*Quercus robur*, *Q. petraea*, *Q. pyrenaica*, *Pinus sylvestris*, *Betula pendula*, *B.*

- pubescens*, *B. pubescens* subsp. *celtibérica*, *Castanea sativa*). In: U. BOHN & R. NEUHÄUSL (eds.). Map of the Natural Vegetation of Europe. Part 1 Explanatory Text with CD-ROM, pp. 229-244. Landwirtschaftsverlag Münster.
- CZAJKOWSKI T., KOMPA T., BOLTE A. 2006. Zur Verbreitungsgrenze der Buche (*Fagus sylvatica* L.) im nordöstlichen Mitteleuropa. Forest Archiv. 77: 203-216.
- CZARNA A. 1999. Materiały do flory naczyniowej Lasu Taczanowskiego koło Pleszewa. Bad. Fizjogr. Pol. Zach., seria B-Botanika 48: 11-134.
- CZEREPEK J., BOCZOŃ A., CIEŚLA A., FORYCKA A., KSEPKO M., OBIDZIŃSKI A., PALUCH R., RODZIEWICZ A., RÓŻAŃSKI W., SOKOŁOWSKI K., SZWED W. & WRÓBEL M. 2008. Stan różnorodności biologicznej lasów w Polsce na podstawie powierzchni obserwacyjnych monitoringu. Synteza wyników uzyskanych w ramach realizacji projektu BioSoil Forest Biodiversity. 135 pp. Instytut Badawczy Leśnictwa. Sękocin Stary.
- ČIUPLYS R. 2004. Notes on the diversity and distribution of communities of the *Vaccinio-Piceetea* class in Lithuania. In: A. BRZEG & M. WOJTERSKA (eds.). Coniferous forest vegetation – differentiation, dynamics and transformations. Wyd. Nauk. UAM, seria Biologia, 69, pp. 35-47. Poznań.
- DANIELEWICZ W. & PAWLACZYK P. 2004a. Pomorski kwaśny las dębowo-brzozowy (*Betulo-Quercetum*). In: J. HERBICH (ed.). Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny, 5, pp. 164-170. Ministerstwo Środowiska, Warszawa.
- DANIELEWICZ W. & PAWLACZYK P. 2004b. Grąd środkowo-europejski i subkontynentalny (*Galio-Carpinetum*, *Tilio-Carpinetum*). In: J. HERBICH (ed.). Lasy i bory. Poradniki ochrony siedlisk i gruntów Natura 2000 – podręcznik metodyczny, 5, pp. 113-137. Ministerstwo Środowiska, Warszawa.
- DANIELEWICZ W. & PAWLACZYK P. 2006. Rola dębów w strukturze i funkcjonowaniu fitocenoz. In: W. BUGAŁA (ed.). Dęby. Nasze drzewa leśne 11: 474-564. Bogucki Wyd. Nauk., Poznań.
- DENGLER J., KOSKA I., TIMMERMAN T., BERG C., CLAUSNITZER U., ISERMANN M., LINKE C., PÄZOLT J., POLTE T. & SPANGENBERG A. 2004. New descriptions and typifications of syntaxa within the project Plant communities of Mecklenburg-Vorpommern and their vulnerability – Part II. Feddes Repert. 115: 343-392.
- DIDUKH YA. P., KUZEMKO A. A., HAIJOVA YU. YU. & KOVTUN Í. V. 2003. Sosnovita dubovo-sosnovi lisi czerkasko-czigirinskogo geobotanicznego rajonu. In: YU. R. SHEL'YAG-SOSONKO & YA. P. DIDUKH (eds.). Roslinnist hvoynih lisiv Ukrađni. Materiali roboczoj narađi (Kyiv, listopad 2003), pp. 80-95. Fitosociocentr, Kyiv.
- DIEKMANN M. 1995. Use and improvement of Ellenberg's indicator values in deciduous forests of the Boreo-nemoral zone in Sweden. Ecography 18: 178-189.
- DIEKMANN M. 2003. Species indicator values as an important tool in applied plant ecology – A review. Basic Appl. Ecol. 4: 493-506.
- DIERSCHKE H. 1994. Pflanzensoziologie – Grundlagen und Methoden. 683 pp. Ulmer, Stuttgart, Germany.
- DIERSCHKE H. 2004. Sommergrüne Laubwälder (*Quercio-Fagetalia s.l.*) in Europa – Einführung und Übersicht. Tuexenia 24: 13-17.
- DIERSEN K. 1996. Vegetation Nordeuropas. 838 pp. Ulmer, Stuttgart.
- DOING H. 1962. Systematische Ordnung und floristische Zusammensetzung niederländischer Wald- und Gebüschgesellschaften. 85 pp. North-Holland Publishing Company, Amsterdam.
- DOING H. 1975. Subdivision of the alliance *Quercion roboripetraeae* into *Vaccinio-Quercion* and *Violo-Quercion*. Coll. Phytosoc. 3: 73-87.
- DONIȚĂ N. 2003. G Thermophilous mixed deciduous broad-leaved forests. In: U. BOHN, R. NEUHÄUSL (eds.). Map of the Natural Vegetation of Europe. Part 1 Explanatory Text with CD-ROM, pp. 319-341. Landwirtschaftsverlag Münster.
- DZIUBAŁTOWSKI S. 1928. Étude phytosociologique du massif de S-te Croix. 1. Les forêts de la partie centrale de la chaîne principale et des montagnes "Stawiana" et Miejska". Acta Soc. Bot. Pol. 5: 1-42.
- DZWONKO Z. 2001. Assessment of light and soil conditions in ancient and recent woodlands by Ellenberg indicator values. J. Appl. Ecol. 38: 942-951.
- DZWONKO Z. 2007. Przewodnik do badań fitosocjologicznych. Vademecum Geobotanicum. 304 pp. Sorus, Instytut Botaniki UJ, Poznań-Kraków.
- DZWONKO Z. & LOSTER S. 2000. Testing of Ellenberg and Zarzycki indicator values as predictors of soil and light conditions in woodlands. Fragm. Flor. Geobot. 45: 49-62.
- DZWONKO Z. & LOSTER S. 2001. Wskaźnikowe gatunki roślin starych lasów i ich znaczenie dla ochrony przyrody i kartografii roślinności. IGiPZ PAN, Prace Geograficzne 178: 119-132.
- EGGLER J. 1954. Vegetationsaufnahmen und Bodenuntersuchungen von den Serpentinegebieten bei Kirchdorf in Steiermark und bei Berstein im Burgenland. Mitt. Naturwiss. Ver. Steiermark 84: 25-37.
- EGGLER J. 1959. Wiesen und Wälder im oststeirisch-burgenländischen Grenzgebiet. Mitt. Naturwiss. Ver. Steiermark 89: 5-34.
- ELLENBERG H. 1988. Vegetation Ecology of Central Europe. 731 pp. Fourth edition. Cambridge University Press. Cambridge, New York.
- ELLENBERG H., WEBER H. E., DÜLL R., WIRTH W., WERNER W. & PAULISSEN D. 1992. Zeigerwerte von Pflanzen in Mitteleuropa. 2nd ed. Scripta Geobot. 18: 1-258.
- ELGERSMA A. M. 1998. Primary forest succession on poor sandy soils as related to site factors. Biodiversity and Conservation 7: 193-206.
- ERTSEN A. C. D., ALKEMADE J. R. M. & WASSEN M. J. 1998. Calibrating Ellenberg indicator values for moisture, acidity, nutrient availability and salinity in the Netherlands. Plant Ecology 135: 113-124.
- EWALD J. 2003. The sensitivity of Ellenberg indicator values to the completeness of vegetation relevés. Basic Appl. Ecol. 4: 507-513.
- FABISZEWSKI J. & FALIŃSKI J. B. 1967. O roślinności okolic Przemętu. Prz. Pol. Zach. 8(1-4): 23-45.
- FALIŃSKA K. 1997. Ekologia roślin. 453 pp. Wyd. Nauk. PWN, Warszawa.

- FALIŃSKI J. B. 1966. Próba określenia zniekształceń fitocenoz. System faz degeneracyjnych zbiorowisk roślinnych. *Ekologia Polska* 12: 31-42.
- FALIŃSKI J. B. 1972. Synantropizacja szaty roślinnej – próba określenia istoty procesu i głównych kierunków badań. *Phytocoenosis* 1(3): 157-170.
- FALIŃSKI J. B. 1986. Vegetation dynamics in temperate lowland primeval forests. *Ecological studies in Białowieża Forests. Geobotany* 8, 537 pp. Dr W. Junk Publ. Dordrecht, Boston, Lancaster.
- FAŁTYNOWICZ W. 2003. The lichens, lichenicolous and allied fungi of Poland. An annotated checklist. In: Z. MIREK (ed.). *Biodiversity of Poland* 6, 435 pp. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- FEIJEN J. M. 2003. Oak, King or Villain? Is the common oak (*Quercus robur* and *Q. petraea*) an anachronism in the Dutch forests? A literature study. Thesis nr. AV 2003-17. FEM 80328.
- FERCHMIN M. 1966. Zespoły leśne Nadleśnictwa Laski pod Kępem. PTPN, Prace Kom. Nauk Roln i Kom. Nauk Leśn. 26 (1): 51-92.
- FERCHMIN M. 1980. Lasy wybranych rezerwatów Wielkopolski. PTPN, Prace Kom. Biol. 55: 1-119. Poznań.
- FITSALO T. V. 2003. Sintaksonomija roslinnosti kiivckogo plato. *Klas Vaccinio-Piceetea* Br.-Bl. 1939. In: YU. R. SHEL'YAG-SOSONKO & YA. P. DIDUKH (eds.). *Roslinnist hvoynih lisiv Ukraïni. Materiali roboczoj naradi* (Kyiv, listopad 2003), pp. 195-204. Fitosociocentr, Kyiv.
- FRANKE J. & KÖSTNER B. 2007. Effects of recent climate trends on the distribution of potential natural vegetation in Central Germany. *Int. J. Biometeorol.* 52: 139-147.
- GEHU J.-M. 1975 (ed.). *La vegetation des forêts caducifolies acidiphiles*. 395 pp. Coll. Phytosoc. 3.
- GILEWSKA S. 1999. Rzeźba. In: L. STARKEL (ed.). *Geografia Polski. Środowisko przyrodnicze*, pp. 243-288. Wyd. Nauk. PWN, Warszawa.
- GŁAZEK T. 1973. Zespoły leśne północno-wschodniego przedpola Gór Świętokrzyskich. *Monogr. Bot.* 38: 1-158.
- GMAJ M. 1997 (mscr.). Charakterystyka geobotaniczna kompleksu leśnego, otaczającego projektowany rezerwat świetlistej dąbrowy, w leśnictwie Daniele k. Obrzycka. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- GNOMON 3.3. 2006. Desmodus. Usługi informatyczne. Jarocin.
- GONCHARENKO I. V. 2001. Florystyczna klasyfikacja lisiv lisostiepovoi Sumszczini. *Ukr. Fitocen. Zb. Ser. A*, 1: 3-17.
- GONCHARENKO I. & DIDUKH YA. P. 2003. The Braun-Blanquet method: a history and modern tendencies. *Naukovi Zapiski* 21: 82-91.
- GÓRSKI P. 2006. Liverworts of the nature reserves in Wielkopolska. 3. "Dąbrowa koło Biadek Krotoszyńskich". *Rocz. AR w Poznaniu, Bot. Sec.* 10: 103-108.
- GREŃ C. 2007 (mscr.). Zróżnicowanie fitosocjologiczne kwaśnych dąbrów z klasy *Quercetea robori-petraeae* Br.-Bl. et R. Tx. 1943 na Wyżynie Śląskiej i terenach przyległych. Ph. D. Thesis, Uniwersytet Śląski, Katowice.
- GREŃ C. & WIK A. S. 2009. Ciepłolubny podzespół środkowo-europejskiej kwaśnej dąbrowy trzcinnikowej *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati* Passarge in Pallas 1996 na Wyżynie Śląsko-Krakowskiej. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 58: 7-17.
- GREŃ C. & WIK A. S. 2010. Zróżnicowanie fitosocjologiczne i status regionalny środkowoeuropejskiej mokrej dąbrowy trzęslicowej *Molinio caeruleae-Quercetum* (Tüxen 1937) Scamoni et Passarge 1959 em. Brzeg et al. 1989 na Wyżynie Śląskiej i terenach przyległych. *Bad. Fizjogr. R. 1 B (B59)*: 113-136.
- GROSSER K. H. 1964. Die Wälder am Jagdschloss bei Weisswasser. *Abh. Ber. Naturkdemus.* 39(2): 1-101.
- GRULICH V. & CHYTRÝ M. 1993. Botanische Untersuchungen im Nationalpark Podyji (Thayatal) und im grenznahen Österreich. *Verh. Zool.-Bot. Ges. Österreich* 130: 1-31.
- HANNON G. E., BRADSHAW R. & EMBORG J. 2000. 6000 years of forest dynamics in Suserup Skov, a seminatural Danish woodland. *Global Ecology & Biogeography* 9: 101-114.
- HÄRD TLE W. 2004. Bodensaure Eichen- und Eichenmischwälder Europas. *Tuexenia* 24: 52-72.
- HÄRD TLE W., HEINKEN T., PALLAS J. & WELSS W. 1997. *Querco-Fagetea (H5). Sommergrüne Laubwälder Teil 1: Quercion roboris, Bodensaure Eichenmischwälder. Synopsis der Pflanzengesellschaften Deutschlands* 2: 1-51. Göttingen.
- HÄRD TLE W., v. OHEIMB G. & WESTPHAL C. 2003. The effects of light and soil conditions on the species richness of the ground vegetation of deciduous forests in northern Germany (Schleswig-Holstein). *Forest Ecol. Manage.* 182: 327-338.
- HÄRD TLE W., v. OHEIMB G. & WESTPHAL C. 2005. Relationships between the vegetation and soil conditions in beech and beech-oak forests of northern Germany. *Plant Ecology* 177: 113-124.
- HÄRD TLE W. & WELLS W. 1992. Vorschlag zur Synsystematik und Syntaxonomie bodensaurer Buchen-Eichen- und Eichenmischwälder (*Quercion robori-petraeae* Br.-Bl. 1932) Mitteleuropas. *Berichte der Reinhold-Tüxen-Gesellschaft* 4: 95-104.
- HARTMANN F.-K. & JAHN G. 1967. *Waldgesellschaften des mitteleuropäischen Gebirgsraumes nördlich der Alpen*. 636 pp. Gustav Fischer Verlag, Stuttgart.
- HÉDL R. 2004. Vegetation of beech forests in the Rychlebské Mountains, Czech Republic, re-inspected after 60 years with assessment of environmental changes. *Plant Ecology* 170: 243-265.
- HÉDL R., KOPECKÝ M. & KOMÁREK J. 2010. Half a century of succession in a temperate oakwood: from species-rich community to mesic forest. *Diversity Distrib.* 16: 267-276.
- HEGENBART-MAGDANS R. & BRZEG A. 1999. Zbiorowiska leśne i zaroślowe rezerwatu "Wyspa Konwaliowa" na jeziorze Radomierskim w południowo-zachodniej Wielkopolsce. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 48:63-96.

- HERMY M., HONNAY O., FIRBANK L., GRASHOF-BOKDAM C. & LAWESON J.E. 1999. An ecological comparison between ancient and other forest plant species of Europe, and the implications for forest conservation. *Biological Conservation* 91: 9-22.
- HOBBIE S. E., REICH P. B., OLEKSYN J., OGDahl M., ŻYTKOWIAK R., HALE C. & KAROLEWSKI P. 2006. Tree species effects on decomposition and forest floor dynamics in a common garden. *Ecology* 87: 2288-2297.
- HODDER K. H., BULLOCK J. M. & KIRBY K. J. 2005. Large herbivores in the wildwood and modern naturalistic grazing systems. *English Nature Research Reports*, No 648. 177 pp. Peterborough: English Nature.
- HOFFMANN M. H. & ERMAKOV N. 2008. Biogeographical study of West Siberian hemiboreal forest associations with species range overlay methods. *Flora* 203: 234-242.
- INTERPRETATION MANUAL OF EUROPEAN UNION HABITATS – EUR27. 2007. European Commission.
- JACKOWIAK B., CELKA Z., CHMIEL J., LATOWSKI K. & ŻUKOWSKI W. 2007. Red list of vascular flora of wielkopolska (Poland). *Biodiv. Res. Conserv.* 5-8: 95-127.
- JACOB M., LEUSCHNER C. & THOMAS F. M. 2010. Productivity of temperate broad-leaved forest stands differing in tree species diversity. *Ann For Sci.* 67: 503p1-503p9.
- JAHN G. 1984. Eichenmischwälder in Nordwestdeutschland – naturnah oder anthropogen? *Phytocoenologia* 12: 363-372.
- JAKUBOWSKA-GABARA J. 1989. Leśne zbiorowiska zastępcze. *Wiad. Bot.* 33: 9-18.
- JAKUBOWSKA-GABARA J. 1991. Recesja zespołu świetlistej dąbrowy *Potentillo albae-Quercetum* Libb. 1933 w rezerwacie „Trębaczew”. *Parki Narodowe i Rezerwaty Przyrody* 10(3/4): 69-79.
- JAKUBOWSKA-GABARA J. 1993. Recesja zespołu świetlistej dąbrowy *Potentillo albae-Quercetum* Libb. 1933 w Polsce. 190 pp. Wyd. Uniw. Łódzkiego, Łódź.
- JAKUBOWSKA-GABARA J. 1994. Naturalne i antropogeniczne zróżnicowanie zbiorowisk leśnych południowo-wschodniej części Niziny Południowowielkopolskiej. Część II. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 43:85-103.
- JAKUBOWSKA-GABARA J. 1996. Decline of *Potentillo albae-Quercetum* Libb. 1933 phytocoenoses in Poland. *Vegetatio* 124: 45-59.
- JAKUBOWSKA-GABARA J. 2004. Świetlista dąbrowa *Potentillo albae-Quercetum*. In: J. HERBICH (ed.). *Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny*, 5, pp. 261-265. Ministerstwo Środowiska, Warszawa.
- JANYSEK S. 2004 (mscr.). Kształtowanie się fitocenoz na zalesionych gruntach porolnych w Wielkopolskim Parku Narodowym. Ph. D. Thesis, Department of Plant Ecology and Environment Protection, Adam Mickiewicz University, Poznań, Poland.
- JAROLÍMEK I., ŠIBIK J., HEGEDUŠOVÁ K., KLIMENT J., KUČERA P., MÁJEKOVÁ J., MICHÁLKOVÁ D., SADLONOVÁ J., ŠIBIKOVÁ J., ŠKODOVÁ I., UJHÁZY K., UJHÁZYOVÁ M., VALACHOVIČ M. & ZALIBEROVÁ M. 2008. A list of vegetation units of Slovakia. In: I. JAROLÍMEK & J. ŠIBIK (eds.). *Diagnostic, constant and dominant species of the higher vegetation units of Slovakia*, pp. 295-329. Veda, Bratislava.
- JAROSZEWSKA I. 2007 (mscr.). Zróżnicowanie dąbrów koło Dąbrowic w Nadleśnictwie Koło (wschodnia Wielkopolska). Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- JELINOWSKI T. 1958 (mscr.). Badania fitosocjologiczne w leśnictwie Smoszew w powiecie krotoszyńskim. Master's thesis from the Department of Systematics and Plant Geography. Adam Mickiewicz University, Poznań.
- KACZYŃSKA Cz. 1964. Zespoły leśne okolic Miłosławia (powiat Września). *Zesz. Nauk. UAM. Biologia* 5: 3-46.
- KALIS A. J., MERKT J. & WUNDERLICH J. 2003. Environmental changes during the Holocene climatic optimum in central Europe – human impact and natural causes. *Quaternary Science Reviews* 22: 33-79.
- KAMIONKA S. 1971. Zespoły leśne środkowej części dorzecza Lutyni (południowa Wielkopolska). *PTPN, Prace Kom. Biol.* 34(2): 1-55.
- KASPROWICZ M. 2006 (mscr.). Materiały do charakterystyki zbiorowisk roślinnych Wielkopolski.
- KASPROWICZ M. & WOJTERSKA M. 2004. The coniferous forest communities of the Seili island in SW Finland. In: A. BRZEG & M. Wojterska (eds.). *Coniferous forest vegetation – differentiation, dynamics and transformations*. Wyd. Nauk. UAM, seria Biologia, 69, pp. 23-34. Poznań.
- KAŻMIERCZAKOWA R. 1971. Ekologia i produkcja runa świetlistej dąbrowy i grądu w rezerwach Kwiatkówka i Lipny Dół na Wyżynie Małopolskiej. *Studia Naturae A* 5: 1-104.
- KĄCKI Z. & STEFAŃSKA-KRZACZEK E. 2009. Fitosocjologiczna charakterystyka leśnych siedlisk przyrodniczych Europejskiej Sieci Ekologicznej Natura 2000 w Nadleśnictwie Oleśnica Śląska. *Acta Botanica Silesiaca* 4: 15-42.
- KIELLAND-LUND J. 1993. Syntaxonomy of Norwegian forest vegetation. *Phytocoenologia* 24: 299-310.
- KIRBY K. J. 2004. A model of a natural wooded landscape in Britain as influenced by large herbivore activity. *Forestry* 77: 406-420.
- KLICZKOWSKA A., ZIELONY A., CZĘPIŃSKA-KAMIŃSKA D., KOWALKOWSKI A., SIKORSKA E., KRZYŻANOWSKI A., CIEŚLA A. & CZEREPEKO J. 2003. Siedliskowe podstawy hodowli lasu. Załącznik nr 1 do Zasad hodowli i użytkowania lasu wielofunkcyjnego. 253 pp. Dyrekcja Generalna Lasów Państwowych, Warszawa.
- KLIMKO M., CZARNA A., GÓRSKI P., KARANDYS S. & URBAŃSKI P. 2003 (mscr.). Plan ochrony rezerwatu „Dąbrowa koło Biadek Krotoszyńskich” położonego w Nadleśnictwie Krotoszyn. Wlkp. Urząd Wojewódzki w Poznaniu. Wydział Ochr. Środ., Poznań.
- KLIMKO M., GÓRSKI P. & CZARNA A. 2004. Rośliny naczyniowe rezerwatu przyrody „Dąbrowa koło Biadek Krotoszyńskich”. *Rocz. AR w Poznaniu* 363, Bot. 7: 85-93.
- KNIGHT K., OLEKSYN J., JAGODZIŃSKI J., REICH P. & KASPROWICZ M. 2008. Overstorey tree species regulate colonization by native and exotic plants: a source of positive

- relationships between understorey diversity and invasibility. *Diversity Distrib.* 14: 666-675.
- KOBENDZA R. 1930. Stosunki fitosocjologiczne Puszczy Kampinoskiej. *Planta Polonica* 2: 1-200.
- KOBENDZA R. 1933. Las Wawerski ze stanowiska fitosocjologii. *Ochrona Przyr.* 13: 41-59.
- KONDRACKI 1978. *Geografia fizyczna Polski*. 463 pp. PWN, Warszawa.
- KONDRACKI J. 1998. *Geografia regionalna Polski*. 441 pp. Wyd. Nauk. PWN, Warszawa.
- KONDRACKI J. & RICHLING A. 1994. Regiony fizyczno-geograficzne. Mapa w skali 1:1 500 000. PPWiK im. E. Romera. In: J. KONDRACKI 1998. *Geografia Polski. Mezoregiony fizyczno-geograficzne*. Wyd. Nauk. PWN, Warszawa.
- KOOISTRA L. I. 2008. Vegetation history and agriculture in the cover-sand area west of Breda (province of Noord-Brabant, The Netherlands). *Veget. Hist. Archaeobot.* 17:113-125.
- KOROTKOV K. O., MOROZOVA O. V. & BELONOVSKAJA E. A. 1991. The USSR vegetation syntaxa prodromus. 346 pp. Dr. Gregory E. Vilchek, Moscow.
- KOSAKOWSKI A. 1995 (mscr.). Operat glebowosiedliskowy nadleśnictwa Krotoszyn wg stanu na 1993 r. Zakł. Usług Ekol. i Urządz.-Leśn. Poznań.
- KOSAKOWSKI A. 1999 (mscr.). Wyniki prac glebowo-siedliskowych na terenie LZD Siemianice i Nadl. Syców w LKP "Łasy Rychalskie". Zakł. Usług Ekol. i Urządz.-Leśn. Poznań.
- KOSTROWICKI A. 1972. Zagadnienia teoretyczne i metodyczne oceny synantropizacji szaty roślinnej. *Phytocoenosis* 1(3): 171-191.
- KOZŁOWSKA A. 1926a. La variabilité de *Festuca ovina* L. en rapport avec la succession des associations steppiques du plateau de la Petite Pologne, pp. 325-377. *Bull. Intern. Acad. Pol. Sc. Lett. Sér. B, Sc. Nat.* (Cracovie).
- KOZŁOWSKA A. 1926b. Zmienność kostrzewy owczej (*Festuca ovina* L.) w związku z sukcesją zespołów stepowych na Wyżynie Małopolskiej. *Spraw. Kom. Fizjogr. PAU Kraków* 60: 63-112.
- KRAHL-URBAN J. 1943. Die Eiche im Reichsgau Wartheland. 72 pp. J. Neumann Verl. Neudamm.
- KRAHL-URBAN J. 1959. Die Eichen. Forstliche Monografie der Traubeneiche und der Stieleiche. 288 pp. Paul Parey, Hamburg/Berlin.
- KROTOSKA T. 1966. Lasy dębowo-grabowe Wielkopolski. PTPN, Prace Kom. Biol. 26: 1-146.
- KROTOSKA T. 1972. Floristical, geographical and ecological differentiation of oak-hornbeam forest in Wielkopolska (West Poland). *Bull. Soc. Amis Sci. Lett. Poznań, ser. biol. D*, 12/13: 79-94.
- KROTOSKA T. 1978. Acidofilna dąbrowa *Calamagrostio-Quercetum* (Hartm. 1934) Scam. 1959 w lasach Włoszakowickich koło Leszna. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 30: 59-67.
- KROTOSKA T. 1983. Zespoły leśne rezerwatu "Las liściasty w Promnie" pod Poznaniem. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 34: 5-21.
- KROTOSKA T. 1991. Grądy i dąbrowy okolic Konina oraz ich formy zniekształcone. PTPN, Prace Komis. Biol. 40: 165-210.
- KROTOSKA T. & PIOTROWSKA H. 1962. Dąbrowy na glebach "typu krotoszyńskiego". *Bad. Fizjogr. Pol. Zach.*, 10: 133-185.
- KRYGOWSKI B. 1961. *Geografia fizyczna Niziny Wielkopolskiej. Cz. 1. Geomorfologia*. 203 pp. PTPN, PWN, Poznań.
- KUBIŚ B. 1982 (mscr.). Lasy dębowo-grabowe leśnictwa Łąkociny (województwo kaliskie). Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- KUCZYŃSKA I. 1973. Stosunki geobotaniczne Opolszczyzny. I. Zbiorowiska leśne. *Acta Univ. Wratisl. Prace Bot.* 15: 1-91.
- KULIŃSKA K. 1991 (mscr.). Macromycetes na tle zróżnicowania acidofilnych dąbrów w nadleśnictwie Taczanów (województwo kaliskie). Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- KUITERS A. T. & SLIM P. A. 2002. Regeneration of mixed deciduous forest in a Dutch forest-heathland, following a reduction of ungulate densities. *Biological Conservation* 105: 65-94.
- KUROWSKI J. K. 2009. Roślinność leśna. In: J. K. KUROWSKI (ed.). *Szata roślinna Polski środkowej*, pp. 103-123. Wydawnictwo EKO-GRAF, Łódź.
- KUROWSKI J. K. & ANDRZEJEWSKI H. 2000. Roślinność rzeczywista rezerwatu Las Łągiewnicki w Łodzi. *Acta Univ. Lodz. Folia bot.* 14: 25-32.
- KUROWSKI J. K., ANDRZEJEWSKI H., WITOSŁAWSKI P. & MAMIŃSKI M. 2001. Mapa roślinności rzeczywistej Lasu Łągiewnickiego. In: J. K. KUROWSKI (ed.). *Szata roślinna Lasu Łągiewnickiego w Łodzi*, pp. 97-108 + mapy.
- KUŚWIK H., BRZEG A. & WYRZYKIEWICZ-RASZEWSKA M. 1999. Nowe stanowiska długosza królewskiego (*Osmunda regalis* L.) we wschodniej Wielkopolsce. *Rocz. Nauk. AR w Poznaniu* 316, Bot. 2: 77-86.
- KWIATKOWSKA A. J. 1986. Reconstruction of the old range and the present-day boundary of a *Potentillo albae-Quercetum* (Libb. 1933) phytocoenosis in the Białowieża primeval forest landscape. *Ekologia Polska* 34(1): 31-45.
- KWIATKOWSKA A. J. 1994. Changes in the species richness, spatial pattern and species frequency associated with the decline of oak forest. *Vegetatio* 112: 171-180.
- KWIATKOWSKA A. J. 1996. Zmiana presji roślinożerców jako przyczyna regresji świetlistych dąbrów w Puszczy Białowieskiej. *Wiad. Ekol.* 42: 137-162.
- KWIATKOWSKA A. J., SPALIK K., MICHALAK E., PALIŃSKA A. & PANUFNIK D. 1997. Influence of the size and density of *Carpinus betulus* on the spatial distribution and rate of deletion of forest-floor species in thermophilous oak forest. *Plant Ecology* 120: 1-10.
- KWIATKOWSKA A. J. & WYSZOMIRSKI T. 1988. Decline of *Potentillo albae-Quercetum* phytocoenoses associated with the invasion of *Carpinus betulus*. *Vegetatio* 75: 49-55.
- KWIATKOWSKA A. J. & WYSZOMIRSKI T. 1990. Species deletion in *Potentillo albae-Quercetum* phytocoenoses reversed by the removal of *Carpinus betulus*. *Vegetatio* 87: 115-126.

- KWIATKOWSKI P. 2001. Zbiorowiska leśne Pogórza Złotyryjskiego. *Fragm. Flor. Geobot.* 8: 173-218.
- LASOTA J., KARP M. & BISKUP S. 2005. Siedliska kwaśnej dąbrowy trzcinnikowej (*Calamagrostio arundinaceae-Quercetum petraeae*) w środkowej Wielkopolsce. *Acta Sci. Pol. Silv. Colendar. Rat. Ind. Lignar.* 4: 23-39.
- LATAŁOWA M., RALSKA-JASIEWICZOWA M., MIOTK-SZPIGANOWICZ G. & ZACHOWICZ J. 2004. *Fagus sylvatica* L. – beech. In: M. RALSKA-JASIEWICZOWA, M. LATAŁOWA, K. WASYLIKOWA, K. TOBOLSKI, E. MADEYSKA, H. E. WRIGHT JR. & CH. TURNER (eds.). Late Glacial and Holocene history of vegetation in Poland based on isopollen maps, pp. 95-104. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- LAWESSON J. E. 2000. Danish deciduous forest types. *Plant Ecology* 151: 199-221.
- LAWESSON J. E. 2004. A tentative annotated checklist of Danish syntaxa. *Folia Geobotanica* 39: 73-95.
- LAWESSON J. E. & SKOV F. 2002. The phytogeography of Denmark revisited. *Plant Ecology* 158: 113-122.
- LAWESSON J. E., BALSLEV H. & FORCHHAMMER M. C. 2004. Predicting the distribution of *Carpinus betulus* in Denmark with Ellenberg's Climate Quotient. *Nord. J. Bot.* 23: 57-67.
- LEIBUNDGUT H. 1959. Über Zweck und Methodik der Struktur- und Zuwachsanalyse von Urwäldern. *Schweiz. Zeitschr. f. Forstwesen* 110: 111-124.
- LEIBUNDGUT H. 1978. Über die Dynamik europäischer Urwälder. *All. Forstzeitschr.* 24: 689-690.
- LEPŠ J. & ŠMILAUER P. 2003. Multivariate analysis of ecological data using CANOCO. 269 pp. Cambridge University Press, Cambridge.
- LEUSCHNER C. 1997. Das Konzept der potentiellen natürlichen Vegetation (PNV): Schwachstellen und Entwicklungsperspektiven. *Flora* 192: 379-391.
- LEUSCHNER C., HERTEL D., CONERS H. & BÜTTNER V. 2001. Root competition between beech and oak: a hypothesis. *Oecologia* 126: 276-284.
- LIBBERT W. 1933. Die Vegetationseinheiten den neu-märkischen Staubeckenlandschaft unter Berücksichtigung der angrenzenden Landschaften. *Verh. Bot. Ver. Prov. Brandenburg* 74(3): 229-348.
- LISIEWSKA M. 2006. Endangered macrofungi of selected nature reserves in Wielkopolska. *Acta Mycologica* 41: 241-252.
- LISIEWSKA M. & RESZEL I. 2000. Macromycetes na tle zróżnicowania acidofilnych dąbrów środkowej części uroczyska Teresiny (nadleśnictwo Krotoszyn). *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 47: 7-57.
- LISIEWSKA M. & SEKUŁA-WOŹNIAK W. 1998. Udział macromycetes w lasach dębowych rezerwatu "Uroczysko Obiszów" (nadleśnictwo Głogów). *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 47: 45-81.
- ŁASKA G. 2001. The disturbance and vegetation dynamics: a review and an alternative framework. *Plant Ecology* 157: 77-99.
- MACHAR I. 2009. Coppice-with-standards in floodplain forests – a new subject for nature protection. *J. For. Sci.* 55: 306-311.
- MACICKA T. 1984. Zbiorowiska leśne południowo-zachodniej części Kotliny Milickiej i Wzgórz Krośnickich. *Acta Univ. Wratisl., Prace Bot.* 29: 3-57.
- MACICKA T. & WILCZYŃSKA W. 1990. Zbiorowiska leśne wschodniej części Wału Trzebnickiego (Wzgórz Trzebnickie, Twardogórskie, Ostrzeszowskie). *Acta Univ. Wratisl., Prace Bot.* 44: 39-140.
- MACICKA T. & WILCZYŃSKA W. 1991. Fitosocjologiczne zróżnicowanie lasów Wzgórz Dalkowskich. *Acta Univ. Wratisl., Prace Bot.* 45: 31-87.
- MACICKA T. & WILCZYŃSKA W. 1992. Lasy i bory Wzniesień Żarskich. *Acta Univ. Wratisl., Prace Bot.* 48: 203-246.
- MACICKA-PAWLIK T. & WILCZYŃSKA W. 1996. Szata roślinna projektowanego rezerwatu "Uroczysko Wrzosey" koło Wołowa (studium florystyczno-fitosocjologiczne). *Acta Univ. Wratisl., Prace Bot.* 64: 121-194.
- MACIEJEWSKA-RUTKOWSKA I., RUTKOWSKI P. & WROŃSKA-PILAREK D. 2001. Zbiorowiska leśne rezerwatu "Las liściasty w Promnie" koło Poznania oraz ich przemiany w ciągu ostatnich 25 lat. *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 50: 81-103.
- MATEJCZUK G. 2007. Zmiany w świetlistych dąbrowach Wysoczyzny Siedleckiej i jej obrzeża od czasów badań Aleksandra Sokołowskiego. In: J. M. MATUSZKIEWICZ (ed.). *Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski*. IGiPz PAN Monografie 8: 495-503. Warszawa.
- MATUSZKIEWICZ A. 1955. Stanowisko systematyczne i tendencje rozwojowe dąbrów białowieskich. *Acta Soc. Bot. Pol.* 24(2): 459-494.
- MATUSZKIEWICZ A. 1977. Der thermophile Eichenwald als antro-po-zoogene Gesellschaft. In: R. TÜXEN (ed.). *Vegetation und Fauna. Berichte der Internat. Symp. IVV*: 529-540. Cramer. Vaduz.
- MATUSZKIEWICZ J. M. 1988. Przegląd fitosocjologiczny zbiorowisk leśnych Polski. Bory mieszane i acidofilne dąbrowy. *Fragm. Flor. Geobot.* 33(1-2): 107-190.
- MATUSZKIEWICZ J. M. 1993. Krajobrazy roślinne i regiony geobotaniczne Polski. *Prace Geograficzne* 158: 5-107.
- MATUSZKIEWICZ J. M. 1996. Stan i znaczenie nizinnych lasów liściastych. In: Łonkiewicz B. (ed.) *Ochrona i zrównoważone użytkowanie lasów w Polsce*, pp. 99-111. Fundacja IUNC Poland, Warszawa.
- MATUSZKIEWICZ J. M. 2001a. Zespoły leśne Polski. 358 pp. Wyd. Nauk. PWN, Warszawa.
- MATUSZKIEWICZ J. M. 2001b. Zróżnicowanie zasięgów geograficznych zespołów leśnych Polski. *IGiPz PAN Prace Geograficzne* 179: 263-295.
- MATUSZKIEWICZ J. M. 2007a. Analiza zmian w buczynach i acydo-filnych lasach bukowo-dębowych w nadleśnictwie Kartuzy. In: J. M. MATUSZKIEWICZ (ed.). *Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski*. IGiPz PAN Monografie 8: 59-96. Warszawa.
- MATUSZKIEWICZ J. M. 2007b. Zmiany w dąbrowach świetlistych leśnictwa Korytów koło Żyrardowa. In: J. M. MATUSZKIEWICZ (ed.). *Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski*. IGiPz PAN Monografie 8: 343-354. Warszawa.

- MATUSZKIEWICZ J. M. 2007c. Ogólne kierunki zmian w zbiorowiskach leśnych Polski, ich przyczyny oraz prognoza przyszłych kierunków rozwojowych. In: J. M. MATUSZKIEWICZ (ed.). Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski. IGiPz PAN Monografie 8: 555-816. Warszawa.
- MATUSZKIEWICZ J. M. 2008a. Regionalizacja geobotaniczna Polski. IGiPz PAN, Warszawa.
- MATUSZKIEWICZ J. M. 2008b. Potencjalna roślinność naturalna Polski. IGiPz PAN, Warszawa.
- MATUSZKIEWICZ J. M. & KOZŁOWSKA A. B. 1991. Przegląd fitosocjologiczny zbiorowisk leśnych Polski – ciepłolubne dąbrowy. *Fragm. Flor. Geobot.* 36(1): 203-256.
- MATUSZKIEWICZ J. M., ŁONKIEWICZ B., KLICKOWSKA A. & HILDEBRAND R. 2001. Mikroregionalizacja przyrodniczo-leśna Polski na podstawach geobotanicznych. IGiPz PAN, *Prace Geogr.* 178: 215-229.
- MATUSZKIEWICZ W. 1952. Zespoły leśne Białowieskiego Parku Narodowego. *Annales UMCS, Sec. C, Suppl.* 6: 1-218.
- MATUSZKIEWICZ W. 1967. Przegląd systematyczny zbiorowisk roślinnych Polski. In: A. SCAMONI (ed.). Wstęp do fitosocjologii praktycznej, pp. 175-229. PWRiL, Warszawa.
- MATUSZKIEWICZ W. 1981. Przewodnik do oznaczania zbiorowisk roślinnych Polski. 298 pp. PWN, Warszawa.
- MATUSZKIEWICZ W. 2001. Przewodnik do oznaczania zbiorowisk roślinnych Polski. In: J. B. FALIŃSKI (ed.). *Vademecum Geobotanicum* 3, 537 pp. Wyd. Nauk. PWN, Warszawa.
- MATUSZKIEWICZ W. 2003. F Mesophytic broadleaved deciduous and mixed broadleaved/conifer forests. In: U. BOHN & R. NEUHÄUSL (eds.). *Map of the Natural Vegetation of Europe. Part 1 Explanatory Text with CD-ROM*, pp. 222-228. Landwirtschaftsverlag Münster.
- MATUSZKIEWICZ W. 2004. On the systematics of coniferous forests. In: A. BRZEG & M. WOJTERSKA (eds.). *Coniferous forest vegetation – differentiation, dynamics and transformations*. Wyd. Nauk. UAM, seria Biologia, 69, pp. 15-22.
- MATUSZKIEWICZ W. & MATUSZKIEWICZ A. 1956. Materiały do fitosocjologicznej systematyki ciepłolubnych dąbrów w Polsce. *Acta Soc. Bot. Pol.* 25: 27-72.
- MATUSZKIEWICZ W. & MATUSZKIEWICZ A. 1973. Przegląd fitosocjologiczny zbiorowisk leśnych Polski Cz. 1. Lasy bukowe. *Phytocoenosis* 2(2): 143-202.
- MATUSZKIEWICZ W. & MATUSZKIEWICZ A. 1985. Zur Syntaxonomie der Eichen-Hainbuchenwälder in Poland. *Tuexenia* 5: 473-489.
- MATUSZKIEWICZ W. & MATUSZKIEWICZ J. M. 1996. Przegląd fitosocjologiczny zbiorowisk leśnych Polski (Synteza). *Phytocoenosis* 8 NS Seminarium Geobot. 3: 3-79.
- MATUSZKIEWICZ W. & POLAKOWSKA M. 1955. Materiały do fitosocjologicznej systematyki borów mieszanych w Polsce. *Acta Soc. Bot. Pol.* 24:421-458.
- MATUSZKIEWICZ W., FALIŃSKI J. B., KOSTROWICKI A. S., MATUSZKIEWICZ J. M., OLACZEK R. & WOJTERSKI T. (eds.). 1995. Potencjalna roślinność naturalna Polski. Mapa przeglądowa 1 300 000. IGiPz PAN, Warszawa.
- MARCYSIAK K. 2001. *Potentillo albae-Quercetum* Libb. 1933 na Osowej Górze w Bydgoszczy. *Zeszyty Nauk. Akad. Bydgoskiej, Stud. Przyr.* 15: 97-112.
- MAZUR S. 1994. Charakterystyka fitosocjologiczna zbiorowisk leśnych z klasy *Vaccinio-Piceetea* i *Quercetea robori-petraeae* Puszczy Niemodlińskiej. *Prace Opolskiego TPN, Zesz. Przyr.* 30: 23-86.
- MCCOLLIN D., JACKSON J. I., BUNCE R. G. H., BARR C. J. & STUART R. 2000. Hedgerows as habitat for woodland plants. *Journal of Environmental Management* 60: 77-90.
- MEDWECKA-KORNAŚ A. 1952. Zespoły leśne Jury Krakowskiej. *Ochrona Przyr.* 20: 133-236.
- MEDWECKA-KORNAŚ A. 1959. Zespoły leśne i zaroślowe. In: W. SZAFAER (ed.). *Szata roślinna Polski*, 1, pp. 368-427. PWN, Warszawa.
- MEDWECKA-KORNAŚ A. 1972. Zespoły leśne i zaroślowe. In: W. SZAFAER & K. ZARZYCKI (eds.). *Szata roślinna Polski*, 1, pp. 383-441. PWN, Warszawa.
- MEDWECKA-KORNAŚ A. 2006. Present state of mixed forest (*Pino-Quercetum*) in Ojców National Park Southern Poland). *Polish Botanical Studies* 22: 365-385.
- MEDWECKA-KORNAŚ A. & GAWROŃSKI S. 1990. The dieback of fir *Abies alba* Mill. and changes in the *Pino-Quercetum* stands in the Ojców National Park (Southern Poland). *Vegetatio* 87: 175-186.
- MICHALIK S. 1991. Zmiany powierzchni zespołów leśnych w Ojcowskim Parku Narodowym w ostatnim trzydziestolecu. *Prądnik* 4: 65-71.
- MIKUŠKA B. 2005. Syntaxonomia dubovo-borovicových kultúrnych lesov na Borskej nížine. *Bull. Slov. Bot. Spoločn., Bratislava* 27: 157-169.
- MILECKA K., KUPRYJANOWICZ M., MAKOHONIENKO M., OKUNIEWSKA-NOWACZYK I. & NALEPKA D. 2004. *Quercus* L. – Oak. In: M. RALSKA-JASIEWICZOWA, M. LATAŁOWA, K. WASYLIKOWA, K. TOBOLSKI, E. MADEYSKA, H. E. WRIGHT JR. & CH. TURNER (eds.). *Late Glacial and Holocene history of vegetation in Poland based on isopollen maps*, pp. 189-197. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- MIREK Z., PIĘKOŚ-MIRKOWA H., ZAJĄC A. & ZAJĄC M. 2002. Flowering plants and pteridophytes of Poland. A checklist. In: Z. MIREK (ed.). *Biodiversity of Poland* 1, 442 pp. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- MITCHELL F. J. G. 2005. How open were European primeval forests? Hypothesis testing using palaeoecological data. *Journal of Ecology* 93: 168-177.
- MITCHELL F. J. G. & COLE E. 1998. Reconstruction of long-term successional dynamics of temperate woodland in Białowieża Forest, Poland. *Journal of Ecology* 86: 1042-1059.
- MODRZYŃSKI J., ROBAKOWSKI P. & ZIENTARSKI J. 2006. Zarys ekologii. In: W. BUGAŁA (ed.). *Grab zwyczajny *Carpinus betulus* L.*, pp. 411-474. Sorus, Poznań-Kórnik.
- MOUNTFORD E. P., EDWARDS P. J., PETERKEN G. F. & MANNERS J. G. 1999. Long-term change in growth, mortality and regeneration of trees in Denny Wood, an old-growth wood-pasture in the New Forest (UK). *Perspectives in Plant Ecology, Evolution and Systematics* 2: 223-272.

- MUCINA L. 1997. Conspectus of classes of European vegetation. *Folia Geobot. Phytotax.* 32: 117-172.
- MÜLLER T. 1991. Zur synsystematischen Stellung des *Luzulo-Fagetum*. *Hoppea, Denkschr. Regensb. Bot. Ges.* 50: 189-202.
- MÜLLER T. 1992. 3. Ordnung: *Quercetalia pubescenti-petraeae*. Klika 33 corr. Moravec in. Béguin et Theurillat 84. In: E. OBERDORFER (ed.). *Süddeutsche Pflanzengesellschaften*. 4. Textband: 119-137, Tabellenband: 200-209. Gustav Fischer Verlag Jena, Stuttgart, New York.
- NACHOTKO K. 1982 (mscr.). Acidofilne dąbrowy okolic Dolska. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- NAMURA-OCHALSKA A. 2004. Lasy mieszane i bory na wydmach nadmorskich. In: J. HERBICH (ed.). *Siedliska morskie i przybrzeżne, nadmorskie i śródlądowe solniska i wydmy. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny*, 1, pp. 157-167. Ministerstwo Środowiska, Warszawa.
- NEUHÄUSLOVÁ Z. 2001. Acidofilní doubravy. In: M. CHYTRÝ, T. KUČERA & M. KOČI (eds.). *Katalog biotopů České republiky*, pp. 206-212. Agentura ochrany přírody a krajiny ČR, Praha.
- NEUHÄUSL R. & NEUHÄUSLOVÁ-NOVOTNÁ Z. 1967. Syntaxonomische Revision der azidophilen Eichen- und Eichenmischwälder im westlichen Teile der Tschechoslowakei. *Folia Geobot. Phytotax.* 2: 1-41.
- NIEDZIAŁKOWSKI W. 1929. Zarys stosunków geobotanicznych i typologicznych leśnictwa Rogów-Strzelna. *Sylvan* 47: 418-472.
- NIKLASSON M., LINDBLADH M. & BJÖRKMAN L. 2002. A long-term record of *Quercus* decline, logging and fires in a southern Swedish *Fagus-Picea* forest. *J. Veg. Sci.* 13: 765-774.
- NOWACZYK Cz. 1964. Zespoły leśne doświadczalnego nadleśnictwa Zielonka pod Poznaniem. *PTPN, Prace Kom. Nauk Roln. i Kom. Nauk Leśn.* 17(2): 213-271.
- OBERDORFER E. 1987. *Süddeutsche Wald- und Gebüschgesellschaften im europäischen Rahmen*. *Tuexenia* 7: 459-468.
- OBERDORFER E. 1988. Gedanken zur Umgrenzung der Klasse *Quercus-Fagetum* und zur Verknüpfung der Pflanzensoziologie mit Formationkunde auf der Grundlage der Kennartenmethode. *Tuexenia* 8: 375-379.
- OBERDORFER E. 1992a. Klasse: *Quercus-Fagetum* Br.-Bl. et Vlieg. 37 em. In: E. OBERDORFER (ed.). *Süddeutsche Pflanzengesellschaften*, Teil IV: Wälder und Gebüsch (Textband), pp. 81-106. 2. Auflage, Stuttgart.
- OBERDORFER E. 1992b. Ordnung: *Quercetalia roboris-petraeae* Tx (31) 37. In: E. OBERDORFER (ed.). *Süddeutsche Pflanzengesellschaften*, Teil IV: Wälder und Gebüsch (Textband), pp. 107-118. 2. Auflage, Stuttgart.
- OCHYRA R., ŻARNOWIEC J. & BEDNAREK-OCHYRA H. 2003. Census Catalogue of Polish Mosses. In: Z. MIREK (ed.). *Biodiversity of Poland* 3, 372 pp. Polish Academy of Sciences, Institute of Botany, Kraków.
- OLACZEK R. 1972. Formy antropogenicznej degeneracji leśnych zbiorowisk roślinnych w krajobrazie rolniczym Polski niżowej. 170 pp. Wyd. Uniwersytetu Łódzkiego, Łódź.
- OLACZEK R. 1974a. Kierunki degeneracji fitocenoz leśnych i metody ich badania. *Phytocoenosis* 3: 179-190.
- OLACZEK R. 1974b. Etapy pinetyzacji grądu. *Phytocoenosis* 3: 201-214.
- OLACZEK R. 1986. Roślinność leśna Załęczańskiego Parku Krajobrazowego. *Acta Univ. Lodz., Folia Soz.* 2: 393-470.
- ONYSHCHENKO V. A. 2006. Floristical classification of vegetation of the Ukrainian Polissia. In: T. L. ANDRIENKO (ed.). 2006. *Phytodiversity of the Ukrainian Polissia and its conservation*, pp. 43-84. Phytosociocentre, Kyiv.
- ONYSHCHENKO V. A., ANDRIENKO T. L. & PRIADKO O. I. 2003. *Asociacija Serratulo-Pinetum* (W. Mat. 1981) J. Mat. 1988 na Ukraïnskomu polissi. In: YU. R. SHEL'YAG-SOSONKO & YA. P. DIDUKH (eds.). *Roslinnist hvoynih lisiv Ukraïni*, pp. 123-130. Materiali roboczoy naradi (Kyiv, listopad 2003). Fitosociocentr, Kyiv.
- ORZECZOWSKI M. 2007. Przemiany zbiorowisk leśnych Puszczy Kozienskiej od czasów Ryszarda Zaręby. In: J. M. MATUSZKIEWICZ (ed.). *Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski*. IGiPZ PAN Monografie 8: 504-553. Warszawa.
- OTÝPKOVÁ Z. 2009. The influence of sample plot size on evaluations with Ellenberg indicator values. *Biologia* 64: 1123-1128.
- OTÝPKOVÁ Z. & CHYTRÝ M. 2006. Effects of plot size on the ordination of vegetation samples. *J. Veg. Sci.* 17: 465-472.
- PAAL J. 1998. Rare and threatened plant communities of Estonia. *Biodiversity and Conservation* 7: 1027-1049.
- PACIEJEWSKA J. 1981 (mscr.). Lasy dębowe okolic Targowej Górki (woj. poznańskie). Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- PACZOSKI J. 1930. *Lasy Białowieży*. Monografie naukowe 1. 575 pp. Państwowa Rada Ochrony Przyrody, Poznań.
- PALLAS J. 1996. Beitrag zur Syntaxonomie und Nomenklatur der bodensauren Eichenmischwälder in Mitteleuropa. *Phytocoenologia* 26(1): 1-79.
- PALLAS J. 2000. Zur Synsystematik und Verbreitung der europäischen bodensauren Eichenmischwälder (*Quercetum roboris* Tüxen 1931). *Abh. Westf. Mus. Naturkde.* 62 (1/2): 1-125. Münster.
- PALLAS J. 2002. Typisierung und Verbreitung einiger Assoziationen der bodensauren Buchenwälder. *Osnabrücker Naturwissenschaftliche Mitteilungen* 28: 149-152.
- PALLAS J. 2003. Position in the phytosociological system (syntaxa). In: U. BOHN & R. NEUHÄUSL (eds.). *Map of the Natural Vegetation of Europe. Part 1 Explanatory Text with CD-ROM*, pp. 232-236. Landwirtschaftsverlag Münster.
- PASSARGE H. 1956. Die Wälder von Magdeburgforst (NW-Fläming). *Wiss. Abhandl.* 18: 1-112. Berlin.
- PASSARGE H. 1957. Waldgesellschaften des nördlichen Havellandes. *Wiss. Abhandl.* 26: 1-139. Berlin.
- PATALAUSKAITE D. 2007. Communities of *Quercus petraea* in Lithuania. Research and conservation of biological diversity in Baltic Region. Book of abstracts. 4th International Conference. Daugavpils, 25-27 April, 2007, pp. 81-82.

- PAWŁOW M. & CZECH L. 1959. Zespoły leśne uroczyska Nowy Las pod Czerniejewem. Zesz. Nauk. UAM, Biologia 2: 27-78.
- PAWŁOWSKI B. 1972. Skład i budowa zbiorowisk roślinnych oraz metody ich badania. In: W. SZAFER & K. ZARZYCKI (eds.). Szata roślinna Polski, pp. 237-269. T. 1. PWN, Warszawa.
- PAWŁOWSKI J. 2001. Rzadkie i chronione gatunki roślin naczyniowych okolic Odolanowa na Płycie Krotoszyńskiej. Bad. Fizjogr. Pol. Zach., seria B-Botanika 50: 131-141.
- PETERKEN G. F. 1996. Natural Woodland. Ecology and Conservation in Northern Temperate Regions. 522 pp. Cambridge University Press, Cambridge.
- PIOTROWSKA H. 1950. Materiały do znajomości szaty leśnej Wielkopolskiego Parku Narodowego. PTPN. Prace Monogr. nad Przyrodą WPN 2(5): 1-31.
- PIOTROWSKA H. 1960. Lasy południowo-wschodniego Uznamu. Bad. Fizjogr. Pol. Zach. 6: 69-158.
- PIOTROWSKA H. 1997. Wstępne wyniki badań nad zróżnicowaniem nadmorskich lasów liściastych na podłożu wydymowym. In: W. FAŁTYNOWICZ, M. LATAŁOWA & J. SZMEJA (eds.). Dynamika i ochrona roślinności Pomorza, pp. 19-31. Mater. z Sympozjum, 28-30 września 1995. Bogucki Wyd. Nauk., Gdańsk-Poznań.
- PIOTROWSKA H. 2003. Zróżnicowanie i dynamika nadmorskich lasów i zarośli w Polsce. 102 pp. Bogucki Wyd. Nauk., Poznań-Gdańsk.
- POTT R. 1992. Die Pflanzengesellschaften Deutschlands. 427 pp. Ulmer, Stuttgart.
- POTT R. 1995. Die Pflanzengesellschaften Deutschlands. 622 pp. 2 Auflage. Ulmer, Stuttgart.
- POTT R. 2000. Paleoclimate and vegetation – long-term vegetation dynamics in central Europe with particular reference to beech. Phytocoenologia 30: 285-333.
- PREISING E. 1943. Die Waldgesellschaften des Warthe und Weichsellandes, Als Manuskript vervielfältigt.
- RAŁSKA-JASIEWICZOWA M. 1999. Ewolucja szaty roślinnej. In: L. STARKEL (ed.). Geografia Polski. Środowisko przyrodnicze, pp. 105-127. Wyd. Nauk. PWN, Warszawa.
- RAŁSKA-JASIEWICZOWA M., NALEPKA D. & GOSLAR T. 2003. Some problems of forest transformation at the transition to the oligocratic/Homo sapiens phase of the Holocene interglacial in northern lowlands of central Europe. Veget. Hist. Archaeobot. 12: 233-247.
- RAMEAU J. C. 1985. L'intérêt chorologique de quelques groupements forestiers du Morvan, France. Vegetatio 59: 47-65.
- RATYŃSKA H. 2001. Roślinność Poznańskiego Przełomu Warty i jej antropogeniczne przemiany. 486 pp. Wyd. Akademii Bydgoskiej, Bydgoszcz.
- RATYŃSKA H., WOJTERSKA M. & BRZEG A. 2010. Multi-medialna encyklopedia zbiorowisk roślinnych Polski. NFOSiGW, UKW, IETI.
- REIF A. & GÄRTNER S. 2007. Die natürliche Verjüngung der laubabwerfenden Eichenarten Stieleiche (*Quercus robur* L.) und Traubeneiche (*Quercus petraea* Liebl.) – eine Literaturstudie mit besonderer Berücksichtigung der Waldweide. Waldoekologie online 5: 79-116.
- RENNENBERG H., SEILER W., MATYSSEK R., GESSLER A. & KREUZWIESER J. 2004. Die buche (*Fagus sylvatica* L.) – Ein waldbaum ohne zukunft im südlichen Mitteleuropa? Allg. Forst- u. J.-Ztg. 175: 210-224.
- RENNWALD E. (ed.) 2000. Verzeichnis der Pflanzengesellschaften Deutschlands mit Synonymen und Formations-einteilung. In: E. RENNWALD (ed.). Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands. Schriftenreihe für Vegetationskunde 35: 121-391.
- REWALD B. & LEUSCHNER C. 2009. Belowground competition in a broad-leaved temperate mixed forest: pattern analysis and experiments in a four-species stand. Eur. J. Forest Res. 128: 387-398.
- RIVAS-MARTINEZ S. 1975. Observaciones sobre la syntaxonomia de los Bosques acidofilos europeos, datos sobre la *Quercetalia robori-petraeae* en la Peninsula Iberica. Coll. Phytosoc. 3: 255-260.
- RIVAS-MARTINEZ S., FERNÁNDEZ-GONZÁLEZ F., LOIDI J. & LOUSÀ A. 2001. Syntaxonomical checklist of vascular plant communities of Spain and Portugal to association level. Itinera Geobotanica 14: 5-341.
- ROBIŃSKA T. 1977 (mscr.). Bory mieszane kompleksu leśnego na południe od Krajkowa. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- RODE M. W. 1999a. Influence of forest growth on former heathland on nutrient input and its consequences for nutrition and management of heath and forest). Forest Ecol. Manage. 114: 31-43.
- RODE M. W. 1999b. The interaction between organic layer and forest growth and forest development on former heathland. Forest Ecol. Manage. 114: 117-127.
- RODWELL J. S., DRING J. C., AVERIS A. B. G., PROCTOR M. C. F., MALLOCH A. J. C., SCHAMINÉE J. N. J. & DARGIE T. C. D. 2000. Review of coverage of the National Vegetation Classification. JNCC Report, No. 302. 69 pp.
- ROLEČEK J. 2005. Vegetation types of dry-mesic oak forests in Slovakia. Preslia 77: 241-261.
- ROO-ZIELIŃSKA E. 2004. Fitoindykacja jako narzędzie oceny środowiska fizycznogeograficznego. Podstawy teoretyczne i analiza porównawcza stosowanych metod. IGiPz PAN Prace Geograficzne 199: 1-258.
- REGULATION 2005. Regulation of the Minister of Environment of 16 May 2005 on the types of natural habitats and plant and animal species requiring protection in the form of Natura 2000 areas. Journal of Laws No 94, item 795.
- REGULATION 2010. Regulation of the Minister of Environment of 13 April 2010 on natural habitats and species that are the subject of interest of the European Union and on the selection criteria for the area qualifying as Natura 2000 areas. Journal of Laws No 77, item 510.
- RUTKOWSKI P. 2007. Lasy dębowe Nadleśnictwa Doświadczalnego Siemianice. In: P. RUTKOWSKI (ed.). Hodowla dębów w Polsce. Wybrane zagadnienia. Idee Ekologiczne 16: 145-155. Sorus, Poznań.
- RÜTHER C. & WALENTOWSKI H. 2008. Tree species composition and historic changes of the Central European oak/ beech region. In: A. FLOREN & J. SCHMIDL (eds.). Canopy arthropod research in Europe, pp. 61-88. Bioform, Nuremberg.

- RYSZEWSKA D. 1977 (mscr.). Lasy liściaste obrębu Klenica w nadleśnictwie Sulechów. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- SABOR J. 1993. Conditions for oak selection in Poland. *Ann. Sci. For.* 50, Suppl. 1: 452-455.
- SCAMONI A. 1961. Der märkische Kiefern-Traubeneichenwald (*Calamagrostido-Quercetum*) als pflanzengeographische Erscheinung. *Archiv für Forstwesen* 10(3): 270-307.
- SCAMONI A. & PASSARGE H. 1959. Gedanken zu einer natürlichen Ordnung der Waldgesellschaften. *Archiv für Forstwesen* 8(5): 386-426.
- SCHAFFERS S. A. & SYKORA K. V. 2000. Reliability of Ellenberg indicator values for moisture, nitrogen and soil reaction: a comparison with field measurements. *J. Veg. Sci.* 11: 225-244.
- SCHAMINÉE J. & STORTELDER A. (ed.). 2008. SynBioSys, versie 1.2 2000-2008). Alterra (<http://www.synbiosys.alterra.nl>)
- SCHECHTEL A. 1984 (mscr.). Plan urządzania Gospodarstwa Leśnego na okres 1.1.1983 do 31.12.1992. Słowiński Park Narodowy. BULiGL, oddz. w Szczecinku.
- SCHECHTEL A. 2005 (mscr.). Opis taksacyjny drzewostanów Słowińskiego Parku Narodowego. In: J. KORZEŃ (ed.). Plan ochrony Słowińskiego Parku Narodowego. Jeleń Góra.
- SCHUBERT R. 2001. Prodrum der Pflanzengesellschaften Sachsen-Anhalts. Mitteilungen zur floristischen Kartierung Sachsen-Anhalt. 688 pp. Sonderheft 2. Botanischer Verein Sachsen-Anhalt. Halle (Saale).
- SCHUBERT R., HILBIG W. & KLOTZ S. 2001. Bestimmungsbuch der Pflanzengesellschaften Deutschlands. 472 pp. Spektrum, Heidelberg.
- SEIDLING W. & FISCHER R. 2008. Deviances from expected Ellenberg indicator values for nitrogen are related to N through fall deposition in forests. *Ecological Indicators* 8: 639-646.
- SEMENISHCHENKOV J. A. 2009. Fitocenoticeskoje raznoobrazie Sudost-Densanskowo mieźdurieczia. 400 pp. RIO Braianskogo gosudarstwiennowo uniwersiteta. Briansk.
- SHELYAG-SOSONKO YU. R., SOLOMAKHA V. A., DIDUKH YA. P., DUBYNA T. P., DZIUBA T. P., KUZEMKO A. A., YAKUSHENKO D. M. & SOLOMAKHA T. D. 2008. Review of the classes of the vegetation of Ukraine. In: M. CHYTRÝ (ed.). Using phytosociological data to address ecological questions, pp. 16. Abstracts and Excursion Guides. 17th International Workshop European Vegetation Survey, Brno, 1-5 May 2008. Masaryk University, Brno.
- SIWCZAK E. 1977 (mscr.). Lasy dębowe kompleksu leśnego na południe od Krajowa. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- SOEPBOER W. & LOTTER A. F. 2009. Estimating past vegetation openness using pollen-vegetation relationships: A modelling approach. *Review of Palaeobotany and Palynology* 153: 102-107.
- SOKOŁOWSKI A. W. 1963. Zespoły leśne południowo-wschodniej części Niziny Mazowiecko-Podlaskiej. *Monogr. Bot.* 16: 1-176. Warszawa.
- SOKOŁOWSKI A. W. 1972. Zespół *Carici elongatae-Quercetum* – dębniak turzycowy. *Acta Soc. Bot. Pol.* 41(1): 113-120.
- SOKOŁOWSKI A. W. 1979. Zespół świetlistej dąbrowy *Potentillo albae-Quercetum* Libbert 1933 Knapp 1942 w północno-wschodniej Polsce. *Fragm. Flor. Geobot.* 25(3): 421-427.
- SOKOŁOWSKI A. W. 1980. Zbiorowiska leśne północno-wschodniej Polski. *Monogr. Bot.* 60: 1-205.
- SOKOŁOWSKI A. W., KLICZKOWSKA A. & GRZYB W. 1997. Określenie jednostek fitosocjologicznych wchodzących w zakres siedliskowych typów lasu. *Prace IBL, B* 32: 3-55.
- SOLOMAKHA V. A. 2008. Sintaksonomija roslinnosti Ukraini. 294 pp. Fitosociocentr, Kyiv.
- SOLON J. 2007. Przemiany zbiorowisk leśnych Kampinoskiego Parku Narodowego w ciągu 80 lat. In: J. M. MATUSZKIEWICZ (ed.). Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski. IGIpZ PAN Monografie 8: 290-343. Warszawa.
- SROKA Z. 1982 (mscr.). Acidofilne lasy i bory mieszane w kompleksie leśnym na zachód od Ostrowa Wlkp. (w obrębie Glińnica). Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- STEFANŃSKA-KRZACZEK E. & KACKI Z. 2009. Identyfikacja leśnych siedlisk przyrodniczych NATURA 2000 na przykładzie Nadleśnictwa Oleśnica Śląska. *Leśne Prace Badawcze* 70: 77-88.
- STATSOFT, Inc. 2006. STATISTICA (data analysis software system), version 7.1. www.statsoft.com.
- SUŁKOWSKA M., KOWALCZYK J. & PRZYBYLSKI P. 2008. Zmienność genetyczna i ekotypowa buka zwyczajnego (*Fagus sylvatica* L.) w Polsce. *Leśne Prace Badawcze* 69(2): 133-142.
- SUTTON M. A., PITCAIM C. E. R. & WHITFIELD C. P. 2004. Bioindicator and biomonitoring methods for assessing the effects of atmospheric nitrogen on statutory nature conservation sites. *JNCC Report No. 356*, 230 pp.
- SVENNING J.-C. 2002. A review of natural vegetation openness in north-western Europe. *Biological Conservation* 104: 133-148.
- SVENNING J.-C., SKOV F. 2004. Limited filling of the potential range in European tree species. *Ecology Letters* 7: 565-573.
- SYKORA K. V. 2007. Field Guide Dutch Plant Communities. Species composition and ecology. 146 pp. (<http://www.ncp.wur.nl/UK/Staff/Sykora/>)
- SZAFER W. 1972. Geobotaniczny Podział Polski (mapa 1:2 000 000). In: W. SZAFER & K. ZARZYCKI (eds.). *Szata roślinna Polski*, 2. PWN, Warszawa.
- SZCZYGIELSKI M. 2007. Zmiana charakterystyki subborealnego boru mieszanego (*Serratulo-Pinetum*) w Puszczy Piskiej. In: J. M. MATUSZKIEWICZ (ed.). Geobotaniczne rozpoznanie tendencji rozwojowych zbiorowisk leśnych w wybranych regionach Polski. IGIpZ PAN Monografie 8: 116-128. Warszawa.
- SZULCZEWSKI J. W. 1951. Wykaz roślin naczyniowych w Wielkopolsce dotąd stwierdzonych. *Prace Kom. Biol. PTPN* 12(6): 1-128.

- SZWED W. 1979. Zespoły leśne okolic Nekli w Lasach Czerniejewskich (środkowa Wielkopolska). *Bad. Fizjogr. Pol. Zach., seria B-Botanika* 31: 89-130.
- SZWEYKOWSKI J. 2006. An annotated checklist of Polish liverworts and hornworts. In: Z. MIREK (ed.). *Biodiversity of Poland* 4, 114 pp. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- SZYMAŃSKI S. 1982. Wzrost niektórych gatunków drzew leśnych w pierwszych 10 latach życia na siedlisku boru mieszanego świeżego. *Sylvan* 126(7): 11-29.
- ŚWIECICKI Z. (ed.). 2000. *Klasyfikacja gleb leśnych Polski*. 123 pp. Centrum Informacyjne Lasów Państwowych, Warszawa.
- TAYLOR S. O. & LORIMER C. G. 2003. Loss of oak dominance in dry-mesic deciduous forests predicted by gap capture methods. *Plant Ecology* 167: 71-88.
- TER BRAAK C. J. F. & PRENTICE I. C. 1988. A theory of gradient analysis. *Adv. Ecol. Res.* 18: 271-317.
- TER BRAAK C. J. F. & ŠMILAUER P. 2002. *CANOCO Reference manual and CanoDraw for Windows User's guide: Software for Canonical Community Ordination (version 4.5)*. 500 pp. Microcomputer Power (Ithaca, NY, USA).
- THEURILLAT J. P. & MORAVEC J. 1993. Index of Names of Syntaxa Typified in 1990. *Folia Geobot. Phytotax.* 28: 207-210.
- THOMAS F. M., BLANK R. & HARTMANN G. 2002. Abiotic and biotic factors and their interactions as causes of oak decline in Central Europe. *For. Path.* 32: 277-307.
- TIMBAL J. & AUSSÉNAC G. 1996. An overview of ecology and silviculture of indigenous oaks in France. *Ann. Sci. For.* 53: 649-661.
- TINNER W. & LOTTER A. F. 2006. Holocene expansions of *Fagus sylvatica* and *Abies alba* in Central Europe: where are we after eight decades of debate? *Quaternary Science Reviews* 25: 526-549.
- TOMBAL P. 1975. Diagnose phytocoenologique des forets proclimaciques acidiphiles de la region de Paris. *Coll. Phytosoc.* 3: 301-309.
- TRACZYK T. 1962a. Materiały do geograficznego zróżnicowania grądów w Polsce. *Acta Soc. Bot. Pol.* 31(2): 275-304.
- TRACZYK T. 1962b. Próba podsumowania badań nad ekologicznym zróżnicowaniem grądów w Polsce. *Acta Soc. Bot. Pol.* 31(4): 621-635.
- TRAMPLER T., KLICZKOWSKA A., DMYTERKO E. & SIERPIŃSKA A. 1990. Regionalizacja przyrodniczo-leśna na podstawach ekologiczno-fizjograficznych. 133 pp. PWRiL Warszawa.
- TRZCIŃSKI W. (ed.). 1989. *Systematyka gleb Polski. Roczniki Gleboznawcze*. 40 (3/4): 1-62.
- TÜXEN R. 1937. Die Pflanzengesellschaften Nordwestdeutschlands. *Mitt. Flor.-soz. Arbeitsgem in Niedersachsen* 3: 1-170. Hannover.
- TÜXEN R. 1975. Le *Betulo-Quercetum* de l'Allemagne du nord-ouest est-il veritable association ou non? *Coll. Phytosoc.* 3: 311-317.
- VAN DER MAAREL E. 1979. Transformation of cover-abundance values in phytosociology and its effects on community similarity. *Vegetatio* 39: 97-114.
- VAN DER MAAREL E. 2005. Vegetation ecology – an overview. In: E. van der MAAREL (ed.). *Vegetation ecology*, pp. 1-51. Blackwell Publishing, Oxford, UK.
- VAN DER MAAREL E. 2007. Transformation of cover-abundance values for appropriate numerical treatment – Alternatives to the proposals by Podani. *J. Veg. Sci.* 18: 767-770.
- VAN DER WERF S. 1991. The influence of coppicing on vegetation. *Vegetatio* 92: 97-110.
- VERA F. W. M. 2000. *Grazing Ecology and Forest History*. CABI, Wallingford Oxon, UK.
- VON OHEIMB G., WESTPHAL C. & HÄRDTL W. 2007. Diversity and spatio-temporal dynamics of dead wood in a temperate near-natural beech forest (*Fagus sylvatica*). *Eur. J. Forest Res.* 126: 359-370.
- VOROBYOV YE. O. 2003. Preliminary Prodrôme of plain forests and light forests of natural and man-made origin with prevailing or considerable participation of *Pinus sylvestris* L.s.l. in the plain part of Ukraine. In: YU. R. SHELYAG-SOSONKO & YA. P. DIDUKH (eds.). *Roslinnist hvoynih lisiv Ukraïni. Materiali roboczoi naradi*, pp. 13-42. Fitosociocentr, Kyiv.
- WALENTOWSKI H. & SCHEUERER M. 2004. Das landschaftstypische Waldgesellschaftsmosaik in der Schöllnacher Bucht (Lallinger Winkel). *Archiv für Naturschutz und Landschaftsforschung* 3: 39-78.
- WALLNÖFER S., MUCINA L. & GRASS V. 1993. *Quercus-Fagetum*. In: L. MUCINA, G. GRABHERR & S. WALLNÖFER (eds.). *Die Pflanzengesellschaften Österreichs. Teil III*, pp. 85-236. Gustav Fischer Verlag, Jena.
- WAMELINK G. W. W., van DOBBEN H. F. & van der EERDEN L. J. M. 1998. Experimental calibration of Ellenberg's indicator value for nitrogen. *Environmental Pollution* 102: 371-375.
- WATT A. S. 1947. Pattern and process in plant communities. *J. Ecol.* 35: 1-22.
- WILLNER W., STARLINGER F. & GRABHERR G. 2005. Deciduous oak forests in Austria – preliminary results from a new survey of the Austrian forest communities. *Bot. Chron.* 18: 301-316.
- WILMANN S. O. 1998. *Ökologische Pflanzensoziologie. Eine Einführung in die Vegetation Mitteleuropas*. 405 pp. Quelle & Meyer Verlag, Wiesbaden.
- WEBER H. E., MORAVEC J. & THEURILLAT J. P. 2000. *International Code of Phytosociological Nomenclature*. 3rd Edition. *J. Veg. Sci.* 11: 739-768.
- WOJTERSKA M. 1976 (mscr.). Zespoły leśne i flora roślin naczyniowych projektowanego Obszaru Chronionego Krajobrazu na Pojezierzu Międzychodzko-Sierakowskim. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.
- WOJTERSKA M. 2003. *Struktura krajobrazów roślinnych Pojezierza Międzychodzko-Sierakowskiego*. 415 pp. Bogucki Wyd. Nauk., Poznań.
- WOJTERSKA M., BRZEG A., KASPROWICZ M. & RAKOWSKI W. 2006 (mscr.). Charakterystyka świetlistej dąbrowy *Potentillo albae-Quercetum* Libb. 1933 nom. invers. na obszarze Natura 2000 "Dąbrowy Obrzyckie".
- WOJTERSKA M., RAKOWSKI W., BRZEG A., YAKUSHENKO D. & KASPROWICZ M. 2007. Zróżnicowanie zespołu świetlistej dąbrowy *Potentillo albae-Quercetum* Libb. 1933 nom. invers. w Polsce i Europie In: E. KĘPCZYŃSKA & J. KĘPCZYŃSKI (eds.). *Botanika w Polsce – sukcesy*,

- problemy, perspektywy. Streszczenia referatów i plakatów 54. Zjazdu Polskiego Towarzystwa Botanicznego, Szczecin 3-8 września 2007, p. 73.
- WOJTERSKA M. & WISZNIEWSKA K. 1996. Świetlista dąbrowa *Potentillo albae-Quercetum* Libb. 1933 w leśnictwie Daniele koło Obrzycka na tle świetlistych dąbrów Wielkopolski. Stan zachowania i projekt ochrony. Bad. Fizjogr. Pol. Zach., seria B-Botanika 45: 41-77.
- WOJTERSKA M., WISZNIEWSKA K. & GMAJ M. 2001. Roślinność rezerwatu "Świetlista dąbrowa koło Obrzycka". In: M. WOJTERSKA (ed.). Szata roślinna Wielkopolski i Pojezierza Południowopomorskiego. Przewodnik sesji terenowych 52. Zjazdu PTB, 24-28 września 2001, pp. 228-242. Bogucki Wyd. Nauk., Poznań.
- WOJTERSKA H. & WOJTERSKI T. 1953. Roślinność Dziewiczej Góry pod Poznaniem. PTPN, Prace Kom. Biol. Pozn. 14(4): 1-126.
- WOJTERSKI T. 1972. Próba podziału geobotanicznego w oparciu o mapę potencjalnej roślinności naturalnej. Wiad. Bot. 16: 229-240.
- WOJTERSKI T., LESZCZYŃSKA M. & PIASZYK M. 1974. Potencjalna roślinność naturalna Pojezierza Lubuskiego. Bad. Fizjogr. Pol. Zach. 26: 107-142.
- WOJTERSKI T., WOJTERSKA H. & WOJTERSKA M. 1978. Mapa potencjalnej roślinności naturalnej środkowej Wielkopolski. Bad. Fizjogr. Pol. Zach. seria B-Botanika 32: 7-35.
- WOJTERSKI T., WOJTERSKA H. & WOJTERSKA M. 1981. Potencjalna roślinność naturalna dorzecza Baryczy. PPWK, Wrocław.
- WOJTERSKI T., WOJTERSKA H. & WOJTERSKA M. 1994. Podział geobotaniczny Pomorza Gdańskiego na podstawie mapy potencjalnej roślinności naturalnej, potencjalnych fitokompleksów krajobrazowych i krajobrazów roślinnych. Bad. Fizjogr. Pol. Zach., seria B-Botanika 43: 9-49.
- Woś A. 1994. Klimat Niziny Wielkopolskiej. 192 pp. Wyd. Nauk. UAM, Poznań.
- WOZIWOŁA B. 2002. Changes in oak-horbeam forest in the north part of the Wysoczyzna Łaska mesoregion (Central Poland). Ecological Questions 2: 117-129.
- WYSOCKI C. & SIKORSKI P. 2002. Fitosocjologia stosowana. 449 pp. Wyd. SGGW, Warszawa.
- YAKUSHENKO D. M. 2005. The classification of Zhytomyr Polissya ecosystems. Ukrainian Phytosociological Collection C 1(23): 15-35.
- YUGLICHEK L. S. & ONYSHCHENKO V.A. 2003. Sosnovi ta dubovo-sosnovi lisi na meži malogo ta žitomirskogo polissja. In: YU. R. SHEL'YAG-SOSONKO & YA. P. DIDUKH (eds.). Roslinnist hvoynih lisiv Ukrađni, pp. 233-243. Materiali roboczoy naradi (Kyiv, listopad 2003). Fitosociocentr, Kyiv.
- ZAJĄC A. 1978. Atlas of distribution of vascular plants in Poland (ATPOL). Taxon 27(5-6): 481-484.
- ZARĘBA R. 1988a. Dąb szypułkowy i dąb bezszypułkowy – ich naturalne występowanie w zespołach leśnych i typach siedliskowych lasu. Prace IBL B 684: 129-178.
- ZARĘBA R. 1988b. Fitosocjologia i typologia leśna. 244 pp. Wyd. SGGW-AR, Warszawa.
- ZERBE S. 2003. The differentiation of anthropogenous forest communities: a synsystematical approach. Mitt. naturwiss. Ver. Steiermark 133: 109-117.
- ZERBE S. 2004. Influence of historical land use on present-day forest patterns: A case study in south-western Germany. Scandinavian Journal of Forest Research 19: 261-273.
- ZIELIŃSKA A. 1994 (mscr.). Grądy i dąbrowy kompleksów leśnych obrębu Biedrusko w Nadleśnictwie Oborniki. Master's thesis from the Department of Plant Ecology and Environmental Protection, Adam Mickiewicz University, Poznań.

Appendix

Tables

Table 1. Major concepts of classification of acidophilous oak forests and beech forests from the classes *Quercetea robori-petraeae* or *Querceto-Fagetea*

Syntaxon	Source																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 <i>Quercetea robori-petraeae</i>	a	•	•	b	•	•	c	c	•	•	c	•	•	•						
2 <i>Querceto-Fagetea</i>															•	•	•	•	•	a
3 <i>Quercetalia roboris</i>	a*	•	b	•	•	a	•	?	•	•	•	•	•	•	•	•	•	•	•	c
4 <i>Quercion roboris</i>	a*	•	b	•	a	c														a
5 <i>Violo-Quercenion</i>																				
6 <i>Vaccinio-Quercenion</i>																				
7 <i>Quercenion robori-petraeae</i>																				
8 <i>Genisto germanicae-Quercenion petraeae</i>																				
9 <i>Illici-Fagenion</i>																				
10 <i>Hieracio lachenalii-Quercion</i>							a	a		a	•	•	•		•				a	
11 <i>Agrostio capillaris-Quercion</i>									•											
12 <i>Dicrano scoparii-Quercion roboris</i>									•											
13 <i>Quercion roboris</i>										a		•	b	b	b	b		b		
14 <i>Vaccinio myrtilli-Quercion petraeae</i>											•	•	•	•	•					
15 <i>Agrostio capillaris-Quercion</i>												•	•	•	•					
16 <i>Quercion robori-pyrenaicae</i>													a	•	a	b		a		
17 <i>Molinio caeruleae-Quercion roboris</i>												•		•		•				
18 <i>Hymenophyllo-Quercion petraeae</i>														•	•			•		
19 <i>Castaneo-Quercion petraeae</i>														•	•					
20 <i>Convallario majali-Quercion roboris</i>					•															
21 <i>Pino-Quercion</i>					a	b														
22 <i>Vaccinio myrtilli-Quercion roboris</i>																	•			
23 <i>Luzulo-Fagion</i>																		•	•	•
24 <i>Illici-Fagion</i>																		•		
25 <i>Luzulo-Fagetalia</i>				•																
26 <i>Luzulo-Fagion</i>				•																
27 <i>Pino-Quercetalia</i>							•													
28 <i>Pino-Quercion</i>							•													

Explanations: Black dots indicate classification according to the name given in the second column of the table, while synonyms denoted with small letters are listed under the table. Source: 1 – Braun-Blanquet (1950), Matuszkiewicz W. (1967, 1981, 2001); Hartmann & Jahn (1967); Matuszkiewicz J. M. (1988, 2001); Zaręba (1988b); Brzeg & Wojterska (1996); Matuszkiewicz W. & Matuszkiewicz J. M. (1996); Wysocki & Sikorski (2002); 2 – Pott (1995); 3 – Schubert *et al.* (2001); 4 – Härdtle *et al.* (1997); 5 – Onyshchenko (2006); 6 – Solomakha (2008); 7 – Jarolímek *et al.* (2008); 8 – Chytrý & Tichý (2003); 9 – Brzeg *et al.* (2000a, 2001), Brzeg & Wojterska (2001), Ratyńska *et al.* (2010), Danielewicz & Pawlaczyk (2006); 10 – Neuhäusl & Neuhäuslová-Novotná (1967); 11 – Kwiatkowski (2001); 12 – Pallas (1996); 13 – Pallas (2000); 14 – Pallas (2003); 15 – Dierschke (2004); 16 – Bardat *et al.* (2004); 17 – Semenishchenkov (2009); 18 – Rivas-Martínez *et al.* (2001); 19 – Wallnöfer *et al.* (1993), Chytrý & Vicherek (1995); 20 – Korotkov *et al.* (1991); 21 – Dierschke (1994); 22 – Härdtle *et al.* (1997); 23 – Rennwald (2000); 24 – Härdtle & Welss (1992); 25 – Rodwell *et al.* (2000); 26 – Lawesson (2004); 27 – Müller (1991); 28 – Oberdorfer (1992b); 29 – Doing (1975); 30 – Willner *et al.* (2005); Syntaxon: 1 – *Quercetea robori-petraeae* Br.-Bl. & R.Tx. 1943 = [a] *Quercetea robori-sessiliflorae* Br.-Bl. *et* R. Tx. 1943, [b] *Quercetea roboris* Br.-Bl. *et* R. Tx. 1943, [c] *Quercetea robori-petraeae* Br.-Bl. *et* R. Tx. *ex* Oberd. 1957; 2 – *Querceto-Fagetea* Br.-Bl. *et* Vlieg. in Vlieg. 1937 = [a] *Querceto-Fagetea* Br.-Bl. *et* Vlieg. 1937 *em.* Klika 1939, [b] *Querceto-Fagetea* Br.-Bl. *et* Vlieg. 1937 *em.* Oberd. 1992, [c] *Querceto-Fagetea* Br.-Bl. *et* Vlieg. in Vlieg. 1937 *em.* Oberd. *et* Th. Müller 1979; 3 – *Quercetalia roboris* R.Tx. 1931 = [a] *Quercetalia robori-petraeae* R.Tx. 1931, [a*]: *Quercetalia robori-sessiliflorae* Tx. 1931 acc. to Braun-Blanquet (1950), *Quercetalia roboris* Tx. 1931 acc. to W. Matuszkiewicz (2001), [b] *Quercetalia robori-petraeae* R.Tx. (1931) 1937, [c] *Quercetalia robori-petraeae* Tx. 1931 *em.* Doing Kraft *et* Westhoff 1959, [d] *Quercetalia robori-petraeae* Tx. 1931 *ex* Tx. 1937 *em.* Riv.-Mart. 1973, [e] *Quercetalia robori-petraeae* – no author given; 4 – *Quercion roboris* Malcuit 1929 = [a] *Quercion robori-petraeae* Br.-Bl. 1932, [a*]: *Quercion robori-sessiliflorae* (Malcuit 1929) Br.-Bl. 1932 acc. to Braun-Blanquet 1950, *Quercion robori-petraeae* (Malcuit 1929) Br.-Bl. 1937 acc. to Matuszkiewicz J. M. (2001), *Quercion robori-petraeae* Br.-Bl. 1937 acc. to Matuszkiewicz W. & Matuszkiewicz J. M. 1996, [b] *Quercion robori-petraeae* Malcuit 1929, [c] *Quercion robori-petraeae* Br.-Bl. *et* Tx. 1932, [d] *Quercion robori-petraeae* (Malcuit 1929) Br.-Bl. 1937; 5 – *Violo-Quercenion* Doing 1975; 6 – *Vaccinio-Quercenion* Doing 1975; 7 – *Quercenion robori-petraeae* (Br.-Bl. 1932) Riv.-Mart. 1982; 8 – *Genisto germanicae-Quercenion petraeae* (R. *et* Z. Neuh. 1967) Oberd. 1992; 9 – *Illici-Fagenion* (Br.-Bl. 67) Tx. 79 *em.* Oberd. 84; 10 – *Hieracio lachenalii-Quercion* Pallas 1996 = [a] *Genisto germanicae-Quercion* Neuhäusl *et* Neuhäuslová-Novotná 1967 nom. inval.; 11 – *Agrostio capillaris-Quercion* Scam. *et* Pass. 1959 *em.* Brzeg, Kaspr. *et* Krot. 2001; 12 – *Dicrano scoparii-Quercion roboris* Passarge 1968; 13 – *Quercion roboris* Malcuit 1929 *em.* Pallas 1996 = [a] *Quercion roboris* (Malcuit 1929) Tx. 1930, [b] *Quercion roboris* Malcuit 1929; 14 – *Vaccinio myrtilli-Quercion petraeae* Pallas 1996; 15 – *Agrostio capillaris-Quercion* Scam. *et* Pass. 1959 *em.* Pallas 1996; 16 – *Quercion robori-pyrenaicae* (Br.-Bl. *et* al. in P. Silva *et al.* 1950) Riv.-Mart. 1975 = [a] *Quercion pyrenaicae* Rivas Goday *ex* Rivas-Martínez 1963, [b] *Quercion robori-pyrenaicae* (Br.-Bl., P. Silva, Rozeira & Fontes 1956) Rivas-Mart. 1975 nom. nud.; 17 – *Molinio caeruleae-Quercion roboris* Scam. *et* Pass. 1959; 18 – *Hymenophyllo-Quercion petraeae* Pallas 2000; 19 – *Castaneo-Quercion petraeae* Soó 1964; 20 – *Convallario majali-Quercion roboris* Shevchyk *et al.* 1996; 21 – *Pino-Quercion* Medwecka-Kornaś in Medwecka-Kornaś *et al.* 1959 = [a] incl. *Vaccinio myrtilli-Quercion roboris* Bulokhov *et* Solomeshch 2003, [b] *Pino-Quercion* Medwecka-Kornaś 1959; 22 – *Vaccinio myrtilli-Quercion roboris* Bulokhov *et* Solomeshch 2003; 23 – *Luzulo-Fagion* Lohm. *et* Tx. in Tx. 1954 = [a] *Deschampsio flexuosae-Fagion* Soó (1962) 1964 *em.* Tx. 1979; 24 – *Illici-Fagion* Br.-Bl. 1967; 25 – *Luzulo-Fagetalia* Scam. *et* Pass. 1959; 26 – *Luzulo-Fagion* Lohm. *et* Tx. in Tx. 1954; 27 – *Pino-Quercetalia* Soó 1962; 28 – *Pino-Quercion* Medwecka-Kornaś in Medwecka-Kornaś *et al.* 1959; ? – no data

Table 3. Floristic differentiation of the studied plant associations (based on 787 relevés)

Successive number of syntaxon	1	2	3	4	5	6	7
Number of relevés	37	56	304	114	98	165	13
Number of taxa	113	135	343	284	319	267	148
Mean number of taxa in relevé	30	26	30	34	62	26	43
Ch., *D. Aulacomnium androgyni-Quercetum roboris							
<i>Pohlia nutans</i> * (C-U)	92 364	38 27	30 43	21 26	12 5	38 110	38 19
<i>Dicranella heteromalla</i> (opt.)	84 246	29 22	30 50	32 39	4 2	5 5	- -
<i>Plagiothecium curvifolium</i> * (V-P)	65 32	14 7	3 15	3 1	- -	10 19	- -
<i>Aulacomnium androgynum</i>	65 93	2 1	3 1	- -	- -	- -	- -
<i>Dicranum scoparium</i> * (V-P)	73 73	- -	9 22	2 1	2 1	37 119	46 92
<i>Hypnum cupressiforme</i> *	70 205	9 4	29 28	25 25	17 9	13 20	38 88
<i>Mnium hornum</i>	68 80	2 1	4 9	7 22	- -	1 3	- -
<i>Plagiothecium laetum</i> (opt.)	65 69	18 9	3 2	4 6	1 1	4 2	- -
<i>Lophocolea heterophylla</i>	54 27	12 6	3 1	- -	1 1	4 25	- -
<i>Plagiothecium denticulatum</i>	54 39	21 11	3 2	4 2	- -	1 1	- -
<i>Herzogiella seligeri</i>	30 15	- -	1 0	3 5	- -	- -	- -
<i>Thuidium tamariscinum</i> * (V-P)	27 26	7 4	1 1	4 2	- -	2 14	- -
<i>Cladonia coniocraea</i> * (C-U)	22 23	- -	1 0	- -	- -	- -	- -
D. Molinia caeruleae-Quercetum roboris							
<i>Betula pubescens</i> subsp. a	- -	29 186	2 8	4 10	- -	3 5	- -
<i>Betula pubescens</i> (V-P)	- -	- -	- -	- -	- -	- -	- -
<i>Betula pubescens</i> subsp. b-c	- -	20 18	- -	1 0	- -	7 15	- -
<i>Betula pubescens</i> (V-P)	- -	- -	- -	- -	- -	- -	- -
<i>Molinia caerulea</i> (M-A)	19 9	100 5518	12 30	5 18	11 106	21 307	15 8
<i>Rubus nessensis</i>	5 3	34 49	2 1	- -	- -	3 4	- -
<i>Polytrichum commune</i> (S-C)	11 64	21 49	- -	- -	- -	- -	- -
<i>Sphagnum girgensohnii</i> (V-P)	- -	12 61	- -	- -	- -	- -	- -
Ch., *D. Calamagrostis arundinaceae-Quercetum petraeae							
<i>Quercus petraea</i> * a	8 217	12 930	70 3688	24 1008	45 2165	31 727	15 500
<i>Quercus petraea</i> * b-c	5 3	16 86	62 317	21 128	42 268	42 485	23 504
<i>Calamagrostis arundinacea</i> * (Qrp)	19 34	50 307	62 1297	18 363	41 258	40 749	54 488
<i>Festuca ovina</i> * (Qrp)	22 57	18 41	69 589	17 16	53 164	70 694	92 1338
<i>Hieracium lachenalii</i>	5 3	2 1	75 122	28 41	44 38	10 5	38 19
<i>Hieracium sabaudum</i>	16 6	2 1	56 96	22 38	17 31	1 1	- -
<i>Hieracium laevigatum</i>	5 3	2 1	38 57	17 47	12 5	3 1	- -
<i>Lathyrus montanus</i>	- -	- -	6 19	15 50	5 29	1 3	- -
*Ch., D. Galio sylvatici-Carpinetum; ^Ch. Carpinion betuli							
<i>Carpinus betulus</i> a	95 5197	23 530	12 295	75 3225	6 30	2 25	- -
<i>Carpinus betulus</i> b-c	81 163	57 32	27 135	85 770	27 128	19 92	8 4
<i>Tilia cordata</i> a	- -	- -	2 15	20 580	2 5	- -	- -
<i>Tilia cordata</i> b-c	- -	2 1	5 3	21 352	4 7	2 1	8 4
<i>Stellaria holostea</i> ^	19 46	16 16	14 42	62 654	9 44	1 1	- -
<i>Melampyrum nemorosum</i> *	- -	- -	5 18	29 213	15 213	- -	- -
<i>Festuca heterophylla</i> *	5 3	2 1	16 38	24 69	40 201	3 17	- -
<i>Galium sylvaticum</i> *	- -	- -	- -	8 67	15 76	1 1	- -
<i>Dactylis polygama</i> ^	- -	- -	3 14	17 71	17 35	- -	- -
<i>Ranunculus auricomus</i> *	- -	- -	- -	12 14	2 0	1 0	- -
<i>Galium schultesii</i> ^	- -	- -	- -	- -	14 322	- -	- -
*Ch., D. Potentilla albae-Quercetum; ^Ch. Quercetalia pubescentis							
<i>Galium boreale</i> (M-A)	- -	- -	12 39	3 16	89 471	10 18	38 19
<i>Betonica officinalis</i> (M-A)	- -	- -	3 3	1 0	77 287	- -	- -
<i>Potentilla alba</i> *	- -	- -	1 0	- -	72 509	1 1	- -
<i>Ranunculus polyanthemus</i> *	- -	- -	- -	- -	60 51	- -	- -
<i>Carex montana</i> *	- -	- -	4 8	- -	74 404	- -	- -
<i>Campanula persicifolia</i> ^	- -	- -	9 6	11 21	84 174	- -	38 51
<i>Hypericum montanum</i> ^	- -	- -	2 1	2 1	41 38	2 1	8 4
<i>Lathyrus niger</i> ^	- -	- -	3 4	2 1	38 157	1 0	- -
<i>Primula veris</i> ^	- -	- -	1 0	3 1	29 13	- -	- -
<i>Pulmonaria angustifolia</i> *	- -	- -	- -	- -	33 97	- -	- -
<i>Serratula tinctoria</i> (M-A)	- -	- -	1 0	- -	24 131	1 0	15 39
<i>Platanthera bifolia</i> ^	- -	- -	3 1	4 2	12 5	- -	- -
<i>Festuca amethystina</i> subsp. ritschlii*	- -	- -	- -	- -	7 2	- -	- -
D. Quercus roboris-Pinetum et Serratulo-Pinetum							
<i>Pinus sylvestris</i> (V-P) a	3 47	32 271	31 522	12 67	31 359	100 4558	100 4461
<i>Pinus sylvestris</i> (V-P) b-c	27 6	14 6	15 7	4 1	5 2	50 179	85 908
<i>Dicranum polysetum</i> (V-P)	3 1	4 2	1 1	- -	1 5	49 452	62 885
<i>Pleurozium schreberi</i> (V-P)	41 20	20 18	29 118	7 34	17 83	91 2963	100 4558
<i>Vaccinium vitis-idaea</i> (V-P)	3 1	2 9	9 12	- -	23 10	77 582	100 1127
<i>Hylocomium splendens</i> (V-P)	27 26	5 3	4 2	1 0	1 1	27 137	69 662
<i>Calluna vulgaris</i> (C-U)	- -	2 1	1 0	- -	- -	35 173	92 827
<i>Pseudoscleropodium purum</i> (V-P)	3 1	12 14	12 49	- -	20 76	41 625	15 138
<i>Rubus saxatilis</i> (V-P)	- -	2 1	10 25	7 7	47 198	19 76	31 50
<i>Leucobryum glaucum</i> (V-P)	14 53	11 5	13 20	6 3	2 1	25 109	8 4
*Ch., D. Serratulo-Pinetum							
<i>Juniperus communis</i> (V-P) b-c	3 1	5 3	15 11	6 7	32 94	12 19	92 858
<i>Orthilia secunda</i> *	- -	- -	5 5	2 1	- -	13 28	62 135
<i>Chimaphila umbellata</i> (V-P)	- -	- -	- -	- -	- -	1 1	62 65

Successive number of syntaxon	1	2	3	4	5	6	7
<i>Danthonia decumbens</i> (C-U)	3 1	- -	2 1	- -	3 6	7 3	62 65
<i>Hieracium pilosella</i> (C-U)	- -	- -	6 4	- -	8 4	12 38	62 100
<i>Peucedanum oreoselinum</i> (T-G)	- -	- -	9 12	1 0	20 28	7 80	54 96
<i>Carex ericetorum</i> (C-U)	- -	- -	- -	- -	- -	6 6	54 62
<i>Thymus serpyllum</i> (K-C)	- -	- -	- -	- -	- -	3 2	54 62
<i>Koeleria grandis</i> *	- -	- -	- -	- -	1 1	- -	46 258
<i>Dianthus carthusianorum</i> (F-B)	- -	- -	- -	- -	- -	1 1	38 19
<i>Pulsatilla vernalis</i> *	- -	- -	- -	- -	- -	- -	31 12
<i>Lathyrus sylvestris</i> (T-G)	- -	- -	1 2	1 15	2 1	- -	31 119
<i>Chamaecytisus ratisbonensis</i> *	- -	- -	- -	- -	- -	1 0	31 119
<i>Genista tinctoria</i> (C-U)	- -	- -	3 2	- -	24 16	1 0	23 12
Ch. Vaccinio-Piceetea (V-P)							
<i>Picea abies</i> a	11 18	23 143	5 48	5 209	4 89	16 342	8 4
<i>Picea abies</i> b-c	41 55	70 191	33 151	26 5	29 7	40 366	23 12
<i>Vaccinium myrtillus</i>	78 628	98 1354	78 1708	55 477	78 714	98 3972	92 1185
<i>Trientalis europaea</i>	27 50	79 579	19 51	17 24	6 3	37 175	31 50
Ch., ^D. Quercetea robori-petraeae (Qrp)							
<i>Carex pilulifera</i>	97 592	80 104	65 169	37 45	31 33	37 54	23 12
<i>Holcus mollis</i>	78 192	41 97	55 1038	64 757	16 75	15 21	15 8
<i>Polytrichastrum formosum</i> ^	100 2155	84 237	63 390	73 400	30 63	49 362	31 15
<i>Peltandrium pratense</i> ^	62 79	62 148	74 418	25 67	82 298	50 332	46 223
<i>Pteridium aquilinum</i> ^	3 1	41 395	62 851	19 214	50 446	65 1568	54 523
<i>Hieracium umbellatum</i>	- -	- -	10 9	4 2	13 25	1 3	- -
Ch. Quercu-Fagetea (Q-F)							
<i>Fagus sylvatica</i> a	3 101	5 3	9 84	22 374	32 24	13 289	- -
<i>Fagus sylvatica</i> b-c	14 7	21 28	23 91	36 107	29 186	21 93	8 4
<i>Corylus avellana</i> b-c	- -	7 22	29 129	27 453	44 329	4 4	15 8
<i>Anemone nemorosa</i>	35 42	18 39	32 172	70 524	59 627	11 58	31 15
<i>Poa nemoralis</i>	11 5	20 17	47 207	75 1146	52 329	4 8	- -
<i>Atrichum undulatum</i>	16 8	9 4	21 24	63 172	47 99	6 3	- -
<i>Melica nutans</i>	- -	- -	26 84	37 247	99 1141	13 47	- -
<i>Ajuga reptans</i>	- -	- -	8 4	37 58	76 200	2 1	- -
<i>Viola riviniana</i>	3 1	- -	18 31	16 43	46 106	4 2	46 23
<i>Brachypodium sylvaticum</i>	- -	- -	4 6	18 110	34 183	2 11	- -
<i>Festuca gigantea</i>	3 1	- -	4 9	18 24	39 25	1 3	- -
<i>Hepatica nobilis</i>	- -	- -	2 1	4 21	31 164	- -	- -
<i>Viola reichenbachiana</i> et <i>riviniana</i>	- -	- -	3 3	8 8	22 30	1 1	- -
<i>Scrophularia nodosa</i>	5 1	2 1	9 4	33 21	37 21	2 1	8 1
<i>Carex digitata</i>	- -	- -	6 10	20 71	27 177	5 25	- -
<i>Viola reichenbachiana</i>	- -	5 3	23 38	65 241	18 63	22 38	- -
<i>Milium effusum</i>	19 9	12 14	8 7	35 125	20 14	2 4	- -
<i>Galeobdolon luteum</i>	- -	- -	1 2	22 79	8 39	- -	- -
<i>Polygonatum multiflorum</i>	- -	4 1	3 1	23 19	4 2	1 1	- -
<i>Sanicula europaea</i>	- -	- -	1 2	24 43	2 1	- -	- -
<i>Carex sylvatica</i>	- -	- -	1 0	17 16	- -	- -	- -
Ch. Trifolio-Geranietea (T-G) et Festuco-Brometea (F-B)							
<i>Fragaria vesca</i> (T-G)	- -	2 1	21 45	26 75	93 840	23 96	62 31
<i>Poa angustifolia</i> (T-G)	8 4	- -	23 127	4 10	65 464	4 10	62 135
<i>Polygonatum odoratum</i> (T-G)	- -	- -	25 36	3 1	59 82	8 10	54 96
<i>Hypericum perforatum</i> (T-G)	- -	- -	25 15	15 7	55 55	12 11	69 32
<i>Trifolium alpestre</i> (T-G)	- -	- -	2 8	4 2	74 349	1 0	23 12
<i>Anthericum ramosum</i> (T-G)	- -	- -	4 3	- -	56 96	1 0	31 50
<i>Euphorbia cyparissias</i> (F-B)	- -	- -	4 2	1 0	52 88	8 7	23 12
<i>Pimpinella saxifraga</i> (F-B)	- -	- -	2 1	- -	53 34	3 4	38 19
<i>Astragalus glycyphyllos</i> (T-G)	- -	- -	4 5	4 10	57 59	- -	- -
<i>Brachypodium pinnatum</i> (F-B)	- -	- -	1 5	- -	49 741	- -	- -
<i>Vicia sepium</i> (T-G)	- -	- -	3 1	5 7	51 74	2 1	- -
<i>Clinopodium vulgare</i> (T-G)	- -	- -	7 25	8 8	48 189	1 0	8 4
<i>Knautia arvensis</i> (T-G)	- -	- -	1 1	- -	47 60	2 1	46 20
<i>Sedum maximum</i> (T-G)	3 1	- -	4 2	5 2	36 20	1 0	8 4
<i>Vicia cassubica</i> (T-G)	- -	- -	8 22	2 9	35 95	2 7	- -
<i>Filipendula vulgaris</i>	- -	- -	- -	- -	40 96	- -	- -
<i>Galium verum</i> (T-G)	- -	- -	4 2	1 0	26 17	2 1	31 12
<i>Geranium sanguineum</i> (T-G)	- -	- -	- -	- -	23 92	1 0	23 12
<i>Peucedanum cervaria</i> (T-G)	- -	- -	- -	- -	14 6	- -	23 12
Ch. Molinio-Arrhenatheretea (M-A); Ch. Scheuchzerio-Caricetea fuscae (S-C)							
<i>Deschampsia caespitosa</i> (M-A)	62 68	23 94	10 8	53 113	24 67	3 4	8 4
<i>Festuca rubra</i> s. s. (M-A)	46 35	16 16	32 141	13 14	55 148	7 16	15 42
<i>Juncus effusus</i> (M-A)	35 18	39 44	7 3	5 2	8 3	1 1	- -
<i>Carex nigra</i> (S-C)	38 65	43 46	5 2	- -	5 7	3 2	- -
<i>Agrostis canina</i> (S-C)	38 31	27 98	2 4	1 0	- -	- -	- -
<i>Lysimachia vulgaris</i> (M-A)	27 11	62 164	10 9	23 34	6 38	9 10	8 4
<i>Veronica chamaedrys</i> (M-A)	- -	2 1	28 56	44 111	93 329	10 13	23 12
<i>Achillea millefolium</i> (M-A)	- -	- -	5 5	4 2	38 27	4 2	38 19
<i>Galium mollugo</i> (M-A)	- -	- -	5 7	11 9	36 98	8 10	15 42
<i>Rumex acetosa</i> (M-A)	- -	- -	2 1	4 2	3 1	1 1	8 4
<i>Dactylis glomerata</i> (M-A)	- -	- -	4 5	18 17	20 33	1 3	- -
<i>Succisa pratensis</i> (M-A)	- -	- -	- -	- -	17 57	- -	23 12

Successive number of syntaxon		1	2	3	4	5	6	7
Ch. Artemisieta vulgaris								
<i>Moehringia trinervia</i>		3 1	14 15	44 102	48 150	77 141	27 68	8 4
<i>Mycelis muralis</i>		- -	2 1	32 53	35 33	62 104	9 21	8 4
<i>Urtica dioica</i>		- -	2 1	6 11	6 3	54 150	4 2	- -
<i>Geum urbanum</i>		- -	- -	2 1	16 8	47 41	1 0	- -
<i>Galeopsis pubescens</i>		- -	4 2	10 6	17 16	43 67	6 3	- -
<i>Galeopsis tetrahit</i>		3 1	20 10	22 42	10 5	38 26	6 6	- -
<i>Impatiens parviflora</i>		- -	2 9	10 24	13 128	30 198	5 13	- -
Ch. Calluno-Ulicetea (C-U)								
<i>Carex pallescens</i>		49 24	29 22	16 18	36 26	20 28	4 2	- -
<i>Carex ovalis</i>		32 16	5 3	4 2	5 7	4 2	5 2	8 4
<i>Agrostis capillaris</i>		24 24	30 15	36 199	12 40	67 388	27 52	46 58
<i>Veronica officinalis</i>		3 1	- -	32 38	27 21	59 66	18 44	46 23
<i>Solidago virgaurea</i> s. s.		3 1	11 5	37 46	29 58	47 54	16 29	38 123
<i>Potentilla erecta</i>		- -	14 7	10 8	12 14	59 107	5 8	8 4
<i>Hypericum maculatum</i>		3 1	2 1	5 15	8 31	33 87	- -	- -
<i>Luzula multiflora</i>		22 11	12 6	25 17	9 4	14 7	7 6	23 12
<i>Scorzonera humilis</i>		- -	- -	5 7	1 0	14 6	7 3	23 81
<i>Viola canina</i>		- -	- -	1 0	2 1	13 15	12 27	31 15
Others								
<i>Quercus robur</i>	a	97 3873	93 4429	49 2236	88 3930	66 3827	45 887	23 81
<i>Quercus robur</i>	b-c	95 211	82 213	44 130	67 128	62 256	65 781	54 280
<i>Betula pendula</i>	a	27 130	46 412	24 113	22 168	14 54	32 328	38 376
<i>Betula pendula</i>	b-c	27 12	32 16	21 47	7 5	3 7	43 109	77 77
<i>Sorbus aucuparia</i>	a	- -	14 97	5 13	2 9	1 5	7 67	- -
<i>Sorbus aucuparia</i>	b-c	86 53	95 118	68 178	81 101	83 75	72 357	85 50
<i>Frangula alnus</i>	b-c	81 256	100 2554	58 427	67 232	77 194	55 402	54 32
<i>Maianthemum bifolium</i>		95 319	91 162	61 302	76 587	58 211	28 75	15 8
<i>Luzula pilosa</i>		92 443	57 44	74 212	70 333	86 160	70 269	54 165
<i>Convallaria majalis</i>		24 12	23 20	53 684	37 305	89 978	31 185	62 527
<i>Oxalis acetosella</i>		46 21	32 56	26 91	63 623	56 443	30 162	8 4
<i>Plagiomnium affine</i>		19 9	9 13	18 31	15 7	49 102	15 57	23 12
<i>Dryopteris carthusiana</i>		57 28	55 51	28 48	42 59	19 13	42 78	38 19
<i>Anthoxanthum odoratum</i>		19 9	20 18	47 156	17 54	64 159	29 129	77 308
<i>Calamagrostis epigejos</i>		43 92	11 13	21 54	11 21	12 33	27 185	46 223
<i>Rubus idaeus</i>		3 1	20 26	13 21	24 39	42 123	34 161	- -
<i>Rubus plicatus</i>		- -	21 35	6 7	12 14	4 6	10 61	15 8
<i>Deschampsia flexuosa</i>		- -	4 2	13 74	14 57	26 26	18 116	8 4
<i>Hieracium murorum</i>		3 1	2 1	31 40	31 39	28 41	11 11	- -
<i>Campanula rotundifolia</i>		- -	- -	16 21	6 23	45 31	13 9	31 154
<i>Padus serotina</i>	a-c	- -	- -	15 19	4 6	33 34	12 45	- -
<i>Rhamnus cathartica</i>	b-c	- -	2 2	1 1	4 2	36 21	2 1	8 4
<i>Crataegus monogyna</i>	a-c	- -	- -	6 4	23 16	22 32	3 2	- -
<i>Prunus spinosa</i>	b-c	- -	- -	3 3	3 1	38 19	- -	- -
<i>Pyrus pyraister</i>	b-c	- -	- -	- -	- -	33 19	2 1	15 5

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics)

1. Aulacomnion androgyni-Quercetum roboris (37 relevés): Brzeg *et al.* (2000a), tab. 1: 1-25 (*Aa-Q*); Blachuta (1995), tab. 4: 3,4 (*Carpino-Quercetum*); Krotoska (1966), tab. 21: 2 (Community with undefined rank); Kubiś (1982), tab. 4: 2,3,15 (*Polytrichum attenuatum-Carpinus betulus*); Kulińska (1991), tab. 2: 4,5 (*Carpino-Quercetum*); Lisiewska & Reszel (2000), tab. 3: 1,2 (*Aulacomnion androgyni-Quercetum*); Sroka (1982), tab. 1: 3,4 (*Calamagrostio-Quercetum*). **Taxa not included in the table:** *Ch. Quercus-Fagetea*: *Acer pseudoplatanus* c 8,2; *Carex remota* 5,3; *Malus sylvestris* c 8,4; *Ulmus minor* a 3,14; c 3,14; *Ch. Artemisieta*: *Rubus caesius* 3,1; *Ch. Molinio-Arrhenatheretea*: *Agrostis gigantea* 3,14; *Poa palustris* 3,1; *P. trivialis* 5,3; *Ranunculus repens* 3,1; *Ch. Scheuchzeria-Caricetea fuscae*: *Carex canescens* 3,1; *Juncus conglomeratus* 3,1; *Ch. Calluno-Ulicetea*: *Cladonia chlorophaea* 3,1; *Luzula campestris* 3,1; *Polytrichum juniperinum* 3,1; **Others:** *Brachythecium velutinum* 11,5; *Brachythecium salebrosum* 3,1; *Cladonia digitata* 3,1; *C. glauca* 8,4; *Crataegus laevigata* c 5,2; *Crataegus* sp. b 3,1; c 3,1; *Dicranodontium denudatum* 11,5; *Kindbergia praelonga* 3,1; *Luzula pallescens* 5,3; *Orthodictyon montanum* 8,4; *Polygonum minus* 3,1; *Rubus corylifolius* 3,1; *Rubus* sp. 3,1; *R. spengelii* 11,5; *Sciuro-hypnum oedipodium* 19,9; *Sphagnum* sp. 5,3.

2. Molinio caeruleae-Quercetum roboris (56 relevés): Brzeg *et al.* (1989), tab. 1: 1-33 (*Mc-Q*); Krotoska, Piotrowska (1962), tab. 5: 25,35-40 (*Pino-Quercetum*); Kulińska (1991), tab. 2: 1 (*Molinio-Quercetum*); Lisiewska & Reszel (2000), tab. 3: 4 (*Mc-Q*); Sroka (1982), tab. 1: 36 (*Calamagrostio-Quercetum*), tab. 2: 13 (*Pino-Quercetum*), tab. 3: 4-14,35 (Pine-oak forest with *Molinia caerulea*). **Taxa not included in the table:** *Ch. Quercus-Fagetea*: *Eurhynchium angustirete* 2,1; *Hedera helix* 9,13; *Malus sylvestris* bc 2,1; c 9,4; *Sorbus torminalis* c 2,1; *Ch. Vaccinio-Piceetea*: *Lycopodium annotinum* 2,1; *Ch. Molinio-Arrhenatheretea*: *Agrostis stolonifera* 2,1; *Poa pratensis* 4,10; *P. trivialis* 12,6; *Nardus stricta* 4,2; *Ch. Scheuchzeria-Caricetea fuscae*: *Carex canescens* 9,13; *Juncus conglomeratus* 5,11; **Others:** *Athyrium filix-femina* 4,2; *Aulacomnium palustre* var. *palustre* 9,4; *Betula obscura* a2 2,1; *Brachythecium velutinum* 2,1; *Brachythecium rutabulum* 4,2; *Calamagrostis canescens* 4,2; *Carex elongata* 5,3; *C. panicea* 2,1; *C. vesicaria* 2,31; *Crataegus laevigata* c 2,1; *Larix decidua* subsp. *decidua* c 2,1; *Lepidozia reptans* 7,4; *Lophocolea bidentata* 9,4; *Lycopodium europaeus* 2,1; *Plagiothecium ruthe* 2,1; *Plagiothecium* sp. 7,4; *Polygonum hydropiper* 2,1; *Populus tremula* a 2,9; a1 2,31; a2 4,18; b 4,10; bc 2,1; c 12,6; *Prunus* sp. c 4,2; *Pyrus communis* a2 2,1; b 2,1; c 9,4; *Rubus corylifolius* 12,61; *R. gracilis* c 12,14; *R. hirtus* 2,1; *R. pallidus* 4,2; *Rubus* sp. 1,5; *Salix cinerea* c 2,1; *Sciuro-hypnum oedipodium* 16,8; *S. starkei* 2,1; *Sphagnum capillifolium* 2,1; *Sph. fimbriatum* 2,1; *Sph. palustre* 2,1; *Sph. russowii* 2,31.

3. Calamagrostis arundinaceae-Quercetum petraeae (304 relevés): Brzeg (oryg.), tab. A13: 45; Brzeg *et al.* (2001), tab. 1: 2-4,8,9,11-13,15,17,21-26,28,30,31,35-38,40,45,46,49 (*Ca-Q molinietosum*); tab. 2: 1,4,7,9,11,13,16,18,20-26,28,29 (*Ca-Q typicum*); tab. 3: 1,2,4-6,8,9,12-19,21-36,38-41 (*Ca-Q polygonatetosum*); Blachuta (1995), tab. 4: 1,2 (*Calamagrostio-Quercetum*); Boinński (1973), tab. 50: 2,9,13,17,19,21,23-27 (*Fago-Quercetum*); Fabiszewski & Faliński (1967), tab. 9: 1,5-11 (*Calamagrostido-Quercetum*); Ferchmin (1980), tab. 17: 10,11 (*Quercus-Carpinetum* – acidophilous subassociations), 14 (*Quercus-Carpinetum holcetosum mollis*); Gmaj (1997), tab. 9: 15 (*Calamagrostio-Quercetum convallarietosum*); Hegenbart-Magdans, Brzeg (1999), tab. 1: 2,5-10,14,15,18,20,22,29,30,33-35 (*Ca-Q*); Jakubowska-Gabara (1994), tab. 2: 1,8 (*Quercus-Pinetum*); Jaroszewska (2007), tab. 1: 1-8 (*Ca-Q polygonatetosum odorati*); Jelinowski (1958), tab. 1: 1,2,4,5,6,9,10,12,15-17,23-25 (*Pino-Quercetum*); Kasprowicz (oryg.) – tab. A3: 12,46, tab. A8: 29, tab. A13: 3, 59,60; tab. A14: 1,9,10,11,26,40,54,62,64,77,86; Krotoska (1978), tab. 1: 29 (*Calamagrostio-Quercetum*); Krotoska (1983), tab. 3: 3,4 (Oak forest); Krotoska (1991), tab. 10: 15,16,20 (*Calamagrostio-Quercetum*);

Krotoska & Piotrowska (1962), tab. 5: 9,10,14,22 (*Pino-Quercetum*); Kubiś (1982), tab. 2: 6 (*Galio sylvatici-Carpinetum holcetosum mollis*), tab. 4: 1,10 (*Polytrichum attenuatum-Carpinum betulus*); Kulińska (1991), tab. 2: 2 (*Calamagrostio-Quercetum molinietosum*); Lisiewska & Reszel (2000), tab. 3: 3 (*Ca-Q molinietosum*); Macicka (1984), tab. 10: 43 (*Pino-Quercetum*), tab. 18: 1-3,5-7 (Community from the *Quercion robori-petraeae* alliance); tab. 20: 27 (*Pino-Quercetum*); Macicka & Wilczyńska (1990), tab. 13: 2-5,7,8,10,11,13-16,18,20-23 (Community from the *Quercion robori-petraeae* alliance), tab. 16: 2 (*Pino-Quercetum fagetosum*), tab. 17: 13,18,21 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 2,4,8,9,11-13,15,16,18 (Community from the *Quercion robori-petraeae* alliance), tab. 13: 5 (*Calamagrostio-Quercetum*); Macicka & Wilczyńska (1992), tab. 4: 27 (*Galio-Carpinetum holcetosum*), tab. 6: 1,4 (*Pino-Quercetum*); Nachotko (1982), tab. 1: 3-6,14 (*Calamagrosti-Quercetum* form with *Calamagrostis arundinacea*), tab. 2: 1-8,10-12 (*Calamagrosti-Quercetum* form with *Festuca ovina*), tab. 3: 3,4,8,9,12 (*Calamagrosti-Quercetum* form with *Festuca ovina*), tab. 4: 1,5,6,9,13,14,21,22 (Oak forest with share of thermophilous species); tab. 5: 4,6,9,10,14 (Oak forest with *Holcus mollis*); Olaczek (1986), tab. 4: 9 (*Calamagrosti-Quercetum petraeae*); Ratińska (2001), tab. 176: 5,6 (*Calamagrostio-Quercetum petraeae convallarietosum*); Róbińska (1977), tab. 3: 5,23,33 (*Pino-Quercetum*), tab. 5: 5 (*Pino-Quercetum* – degenerated forms); Siwczak (1977), tab. 3: 8,9,10,11,14,16-20,23,27,28 (*Calamagrostio-Quercetum*); Sroka (1982), tab. 1: 5,12,14,18 (*Calamagrostio-Quercetum*), tab. 2: 3 (*Pino-Quercetum*); Szwed (1979), tab. 12: 3,5 (*Calamagrostio-Quercetum*); Wojterska (2003), tab. 16: 2,5,7,11,15,16,18,20 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 5: 2,4,5,7,8-10,12,13 (*Calamagrostio-Quercetum convallarietosum*); tab. 6: 3-6,10 (*Calamagrostio-Quercetum convallarietosum*). **Taxa not included in the table:** Ch. Quercus-Fagetea: *Acer platanoides* b 1,6; c 4,2; *A. pseudoplatanus* b 0,2; bc 0,0; c 4,2; *Alnus incana* a2 0,0; c 0,0; *Cerasus avium* b 1,0; c 4,1; *Dryopteris filix-mas* 4,3; *Epipactis helleborine* 0,0; *Eurhynchium angustirete* 0,0; *Fraxinus excelsior* c 2,1; *Galium odoratum* 1,2; *Hedera helix* 1,4; *Hypochoeris maculata* 0,0; *Impatiens noli-tangere* 1,0; *Lilium martagon* 1,0; *Malus sylvestris* b 2,1; bc 1,0; c 8,4; *Melica uniflora* 0,0; *Padus avium* a2 0,2; b 1,2; c 2,1; *Phyteuma spicatum* 1,0; *Ribes uva-crispa* b 0,0; c 1,0; *Stachys sylvatica* 0,0; *Ulmus minor* c 0,0; *Viburnum opulus* c 2,1; *Viola mirabilis* 0,2; Ch. Vaccinio-Picetea: *Cladonia furcata* 1,0; *Diphasiastrum complanatum* 0,0; *Dryopteris dilatata* 2,1; *Galium rotundifolium* 2,2; *Lycopodium annotinum* 0,2; *L. clavatum* 1,2; *Monotropa hypopitys* s. s. 1,1; *Ptilium crista-castrensis* 0,0; *Pyrola minor* 1,2; *P. rotundifolia* 1,0; *Viscum album* subsp. *austriacum* 1,0; Ch. Trifolio-Geranietea (TG) et Festuco-Brometea (FB): *Carex caryophylla* (FB) 0,2; *Galium album* (TG) 3,3; *G. album* fo. *dumetorum* (TG) 3,2; *Poa compressa* (FB) 1,2; *Seseli annuum* (FB) 0,0; *Silene nutans* subsp. *nutans* (TG) 2,1; *Thalictrum minus* (FB) 0,0; *Trifolium medium* (TG) 0,0; *Vicia dumetorum* (TG) 1,6; *Vincetoxicum hirsutifolium* 1,0; Ch. Artemisietea: *Aegopodium podagraria* 1,0; *Chaerophyllum temulum* 0,0; *Epilobium montanum* 0,0; *Fallopia dumetorum* 5,5; *Galium aparine* 3,4; *Geranium robertianum* 3,3; *Glechoma hederacea* 0,0; *Heracleum sphondylium* 0,0; *Lapsana communis* s. s. 0,0; *Linaria vulgaris* 1,0; *Rubus caesius* 5,2; *Torilis japonica* 1,0; Ch. Molinio-Arrhenatheretea: *Agrostis gigantea* 1,0; *A. stolonifera* 1,3; *Alopecurus pratensis* 0,0; *Angelica sylvestris* 1,2; *Arrhenatherum elatius* 5,10; *Campanula patula* s.s. 3,2; *Carex hirta* 1,0; *Cerastium holosteoides* 0,0; *Dianthus superbus* s. s. 0,0; *Festuca pratensis* 1,13; *Galium uliginosum* 1,0; *Geum rivale* 0,0; *Holcus lanatus* 2,1; *Lathyrus pratensis* 1,7; *Leontodon autumnalis* 0,0; *L. hispidus* 0,0; *Leucanthemum vulgare* 0,0; *Lotus corniculatus* 1,0; *L. uliginosus* 0,0; *Lychnis flos-cuculi* 0,0; *Lysimachia nummularia* 0,0; *Poa pratensis* 10,29; *P. trivialis* 1,0; *Potentilla reptans* 0,0; *Prunella vulgaris* 2,1; *Ranunculus acris* s. s. 0,0; *Rhytidadelphus squarrosus* 0,0; *Selinum carvifolia* 1,0; *Stellaria graminea* 3,3; *Taraxacum officinale* 5,2; *Vicia cracca* 1,1; Ch. Scheuchzerio-Caricetea fuscae: *Juncus conglomeratus* 2,1; Ch. Calluno-Ulicetea: *Cladonia pyxidata* 0,0; *Genista germanica* 1,0; *Hypnum jutlandicum* 1,7; *Luzula campestris* 1,2; *Nardus stricta* 1,0; *Polytrichum juniperinum* 3,3; *Potentilla anglica* 1,0; Others: *Abies alba* c 0,0; *Aesculus hippocastanum* c 1,0; *Agrostis* sp. 0,0; *Athyrium filix-femina* 3,1; *Aulacomnium palustre* var. *palustre* 0,0; *Berberis vulgaris* b 0,0; *Brachythecium velutinum* 3,3; *Brachythecium rutabulum* 3,7; *B. salebrosum* 0,0; *Brachythecium* sp. 1,2; *Bryum* sp. 1,0; *Calamagrostis canescens* 0,2; *Carex acutiformis* 0,6; *C. brizoides* 0,0; *Cephalozia* sp. 1,0; *Cerastium semidecandrum* 0,0; *Ceratodon purpureus* 1,1; *Chamaenerion angustifolium* 2,1; *Cladonia glauca* 1,1; *Cladonia* sp. 0,0; *Conyza canadensis* 1,1; *Cornus sanguinea* b 1,2; c 2,1; *Crataegus laevigata* b 1,4; c 2,0; *Cruciata glabra* 0,6; *Dicranum bonjeanii* 1,0; *Equisetum hyemale* 0,0; *Euonymus europaea* c 2,1; *Fallopia convolvulus* 7,11; *Galium palustre* 0,0; *Gnaphalium sylvaticum* 0,0; *Hieracium barbatum* 0,0; *H. cymosum* 1,0; *Hieracium* sp. 0,0; *Kindbergia praelonga* 2,3; *Larix decidua* subsp. *decidua* a 1,2; a1 0,0; *Larix decidua* subsp. *decidua* c 1,0; *Lepidozia reptans* 0,0; *Ligustrum vulgare* c 0,0; *Lonicera periclymenum* b 0,2; c 0,6; *Lophocolea bidentata* 0,0; *Luzula pallescens* 1,0; *Malus* sp. c 0,0; *Melandrium rubrum* 0,0; *Mnium* sp. 1,0; *Orthodicranum montanum* 1,0; *Oxyrrhynchium hians* var. *hians* 0,2; *Plagiomnium cuspidatum* 1,1; *P. rostratum* 1,0; *Plagiothecium* sp. 1,1; *Platanthera chlorantha* 0,0; *Polypodium vulgare* 1,16; *Populus alba* c 0,0; *P. tremula* a 0,2; a1 1,3; a2 1,0; b 4,7; bc 1,0; c 9,7; *Prunus* sp. c 1,0; *Pseudotsuga taxifolia* a 0,6; b 0,0; c 0,0; *Pyrus communis* a 0,0; a2 1,0; b 2,1; bc 0,0; c 7,3; *Quercus rubra* a 0,2; a1 0,6; b 1,2; c 2,3; *Quercus x rosacea* a 5,203; a1 2,46; a2 1,3; b 1,0; c 4,9; *Ranunculus sardous* 1,0; *Ribes nigrum* c 0,0; *Robinia pseudacacia* a 1,13; b 1,8; c 1,4; *Rosa canina* b 0,0; c 0,0; *Rosa* sp. bc 0,0; *Rubus* cfr. *hirtus* 1,0; *R. corylifolius* 2,4; *R. gracilis* c 2,1; *R. hirtus* 0,0; *R. pallidus* 1,2; *R. radula* 0,0; *R. schleicheri* 1,0; *R. serpens* 0,0; *Rubus* sp. 7,7; *R. sprengelii* 5,5; *R. x corylifolius* 1,1; *Rumex acetosella* 6,4; *Sagina procumbens* 0,0; *Salix cinerea* c 1,0; *Sambucus nigra* b 0,0; . c 1,1; *Sambucus racemosa* c 0,0; *Sarothamnus scoparius* c 2,3; *Sciuro-hypnum oedipodium* 16,23; *Scutellaria galericulata* 0,2; *Senecio ovatus* 0,0; *S. sylvaticus* 0,0; *S. vulgaris* 0,0; *Silene vulgaris* 1,0; *Sphagnum capillifolium* 0,0; *S. fimbriatum* 0,0; *Stellaria media* 3,19; *Symphoricarpos albus* c 0,0; *Thalictrum aquilegifolium* 0,2; *Trichodon cylindricus* 0,0; *Trifolium arvense* 0,0; *Vicia sativa* 0,0; *Viscaria vulgaris* 1,1.

4. Galio sylvatici-Carpinetum betuli (114 relevés): Boinński (1973), tab. 31: 12,14,15-17,19,20,22 (*Galio-Carpinetum calamagrostietosum*), tab. 50: 1,3,6,7,12 (*Fago-Quercetum*); Ferchmin (1966), tab. 8: 2-5, 7-14 (*Quercus-Carpinetum calamagrostietosum*); Ferchmin (1980), tab. 17: 8,15 (*Quercus-Carpinetum*); Jelinowski (1958), tab. 1: 11,18-20,27 (*Pino-Quercetum*); Kamionka (1971), tab. 10: 15-25 (*Galio-Carpinetum holcetosum*); Krotoska & Piotrowska (1962), tab. 10: 1-4, 6-12, 14 (*Gs-C holcetosum mollis*), tab. 11: 1-5 (*Gs-C holcetosum mollis* typical variant, form with *Vaccinium myrtillus*); Krotoska & Piotrowska (1962), tab. 5: 1,3-5,16,17,19 (*Pino-Quercetum*); Kubiś (1982), tab. 2: 1,2 (*Gs-C holcetosum mollis*); Maciejewska-Rutkowska et al. (2001), tab. 2, zdj. 1 (*Gs-C holcetosum*); Macicka (1984), tab. 10: 37,41,44,45,47 (*Galio-Carpinetum holcetosum*); Macicka & Wilczyńska (1990), tab. 9: 1-7,9,10,12-14 (*Gs-C holcetosum*); Macicka & Wilczyńska (1991), tab. 9: 1-14 (*Gs-C holcetosum*); Macicka & Wilczyńska (1992), tab. 4: 18-24,28,29 (*Gs-C holcetosum*); Kasproicz (oryg.) – tab. A20: 40,44; Wojterska (2003): 14: 28,31 (*Gs-C holcetosum mollis*); Sroka (1982), tab. 1: 19 (*Calamagrostio-Quercetum*). **Taxa not included in the table:** Ch. Quercus-Fagetea: *Acer campestre* a2 3,38; b 3,5; c 8,4; *A. platanoides* a2 1,4; b 1,0; c 10,4; *A. pseudoplatanus* a1 1,4; a2 2,20; b 1,0; c 11,9; *Adoxa moschatellina* 10,28; *Asarum europaeum* 6,7; *Campanula trachelium* 2,5; *Carex remota* 1,0; *Cephalanthera longifolia* 1,0; *Cerasus avium* a1 1,4; a2 1,4; b 4,10; c 4,2; *Circaea lutetiana* 1,4; *Daphne mezereum* c 1,0; *Dryopteris filix-mas* 23,35; *Equisetum sylvaticum* 1,0; *Eurhynchium angustirete* 14,11; *Festuca altissima* 2,20; *Ficaria verna* 4,2; *Fraxinus excelsior* b 5,11; c 9,4; *Galium odoratum* 9,57; *Hedera helix* 8,23; *Impatiens noli-tangere* 3,1; *Lathyrus vernus* 2,1; *Lilium martagon* 1,0; *Lonicera xylosteum* c 1,0; *Malus sylvestris* bc 4,2; c 4,2; *Melica uniflora* 2,0; *Mercurialis perennis* 1,0; *Padus avium* a 2,0; b 12,84; c 15,15; *Paris quadrifolia* 3,1; *Phyteuma spicatum* 5,3; *Plagiomnium undulatum* 1,0; *Pulmonaria obscura* 12,26; *Ranunculus lanuginosus* 1,0; *Ribes spicatum* b 1,0; bc 1,0; c 2,1; *R. uva-crispa* b 2,1; *Sorbus torminalis* a2 1,0; b 1,0; c 4,2; *Stachys sylvatica* 8,3; *Tilia platyphyllos* b 1,0; c 1,0; *Ulmus laevis* a1 1,0; *U. minor* b 1,4; *Viburnum opulus* c 9,12; *Viola odorata* 1,0; Ch. Vaccinio-Picetea: *Dryopteris dilatata* 1,0; *Galium rotundifolium* 10,32; *Pyrola minor* 1,0; *P. rotundifolia* 2,1; Ch. Trifolio-Geranietea: *Silene nutans* subsp. *nutans* 2,9; *Vicia dumetorum* 5,3; Ch. Artemisietea: *Aegopodium podagraria* 16,35; *Alliaria petiolata* 4,6; *Anthriscus sylvestris* 3,1; *Chaerophyllum temulum* 4,6; *Epilobium montanum* 1,0; *Euphorbia esula* 1,0; *Fallopia dumetorum* 4,2; *Galeopsis bifida* 1,0; *Galium aparine* 10,36; *Geranium robertianum* 12,10; *Glechoma hederacea* 9,8; *Heracleum sphondylium* 4,2; *Humulus lupulus* 3,1; *Lapsana communis* s. s. 1,0; *Melandrium album* 1,0; *Rubus caesius* 10,5; *Torilis japonica* 3,1; *Tussilago farfara* 1,0; Ch. Molinio-Arrhenatheretea: *Angelica sylvestris* 3,1; *Arrhenatherum elatius* 4,16; *Campanula patula* s.str. 1,0; *Carex cespitosa* 1,0; *C. hirta* 1,0; *Holcus lanatus* 3,1; *Lathyrus pratensis* 2,1; *Lotus corniculatus* 1,0; *Lychnis flos-cuculi* 1,0; *Lysimachia nummularia* 8,16; *Pimpinella major* 1,0; *Poa palustris* 1,0; *Poa pratensis* 12,25; *P. trivialis* 6,11; *Potentilla reptans* 3,1; *Prunella vulgaris* 2,1; *Ranunculus acris* s. s. 1,0; *R. repens* 2,1; *Saxifraga granulata* 2,1; *Selinum carvifolia* 4,2; *Stellaria graminea* 4,2; *Taraxacum officinale* 4,2; *Vicia cracca* 3,20; Ch. Calluno-Ulicetea: *Agrostis stolonifera* 2,1; Others: *Abies alba* a 1,4; c 2,1; *Athyrium filix-femina* 19,100; *Brachythecium velutinum* 8,4; *Brachythecium rutabulum* 6,3; *Carex brizoides* 7,203; *C. elongata* 1,0; *Carex* sp. 1,0; *Cerastium arvense* 1,0; *Chamaenerion angustifolium* 1,0; *Cornus sanguinea* b 4,6; c 1,4; *Crataegus laevigata* b 2,9; c 1,0; *C. monogyna* et *laevigata* b 2,16; bc 4,2; c 6,7; *Crataegus* sp. c 5,7; *Cruciata glabra* 10,17; *Euonymus europaea* b 9,4; c 11,10; *Eurhynchium* sp. 1,0; *Fallopia convolvulus* 3,1; *Fissidens taxifolius* 2,1; *Galium palustre* 2,1; *Larix decidua* subsp. *decidua* a1 1,0; *Listera ovata* 1,0; *Lonicera periclymenum* b 1,4; 1,33; *Luzula pallescens* 1,0; *Oxalis fontana* 1,0; *Oxyrrhynchium hians* 11,6; *Plagiomnium cuspidatum* 1,0; *Plagiothecium cavifolium* 1,0; *Poa annua* 1,0; *Pohlia lescuriana* 21,26; *Polygonatum verticillatum* 3,5; *Polypodium vulgare* 1,0; *Populus tremula* a 1,4; a1 3,24; a2 3,1; b 4,6; bc 1,0; c 5,3; *Pyrus communis* a2 2,5; b 4,6; c 6,3; *Quercus rubra* a 3,24; a2 1,0; b 1,0; c 3,1; *Q. x rosacea* a1 1,33; b 1,0; c 2,1; *Ranunculus sardous* 1,0; *Rhizomnium punctatum* 1,0; *Rhodobryum roseum* 1,0; *Robinia pseudacacia* a 2,5; a1 1,0; *Rosa canina* c 3,1; *Rosa* sp. bc 1,0; c 2,1; *Rubus corylifolius* 1,0; *R. gracilis* 1,0; *R. hirtus* 6,7; *R. cfr. hirtus* 4,17; *R. serpens* 1,0;

Rubus sp. 11,5; *Rumex acetosella* 4,2; *Sambucus nigra* b 3,9; 5,3; *Sambucus racemosa* b 1,0; c 1,0; *Sciuro-hypnum oedipodium* 2,1; *Silene* sp. 1,0; *Solanum dulcamara* 1,0; *Stellaria media* 17,32; *Thuidium philibertii* 1,0; *Thuja gigantea* c 1,0; *Veronica hederifolia* 2,5.

5. *Potentilla albae-Quercetum petraeae* (98 relevés): Brzeg & Kasproicz (2001): 1 (*Pa-Q brachypodietosum*), 2 (*Pa-Q typicum*), 3 (*Pa-Q molinietosum*); Boiński (1973), tab. 46: 1-4,6 (*Pa-Q*); Gmaj (1997), tab. 6: 3 (*Pa-Q lathyretosum verni*), tab. 7: 1,3 (*Pa-Q* – degenerated forms); Jakubowska-Gabara (1994), tab. 1: 1-10 (*Pa-Q poëtosum*), 16-18,23 (*Pa-Q typicum*); Jaroszewska (2007), tab. 2: 1,4-6,8,9,11 (*Pa-Q brachypodietosum pinnati*); Krotoska (1991), tab. 11: 2,4-6,9,10,12 (*Pa-Q*); Nowaczyk (1964), tab. 9: 1-16 (*Quercu-Potentilletum albae*); Wojterska et al. (2006), tab. 1: 7,10,11,13,15,19,20,22-26 (*Pa-Q brachypodietosum*), tab. 2: 1-5,8,9 (*Pa-Q molinietosum*); Wojterska & Wiszniewska (1996), tab. 1: 1-13 (*Pa-Q brachypodietosum pinnati*), 16 (*Pa-Q typicum*), 17 (*Pa-Q astrantietosum*); Wojterska et al. (2001), tab. 1: 4-9, 11-14 (*Pa-Q*). **Taxa not included in the table:** *Ch. Quercu-Fagetea*: *Acer platanoides* c 3,1; *A. pseudoplatanus* b 1,1, c 1,1; *Adoxa moschatellina* 1,1; *Asarum europaeum* 3,2; *Astrantia major* 5,7; *Campanula trachelium* 1,1; *Cerasus avium* b 1,1, c 13,5; *Daphne mezereum* b 1,1, c 5,3; *Dryopteris filix-mas* 4,2; *Epipactis helleborine* 3,6; *Equisetum sylvaticum* 1,1; *Euonymus verrucosus* b 2,6, c 3,2; *Eurhynchium angustirete* 2,1; *Fraxinus excelsior* b 2,1 c 12,4; *Galium odoratum* 4,11; *Hierochloë australis* 1,1; *Hypochoeris maculata* 5,16; *Lathyrus vernus* 14,16; *Lilium martagon* 13,16; *Malus sylvestris* a2 2,1, b 5,3, c 16,7; *Melittis melissophyllum* 10,63; *Neottia nidus-avis* 1,1; *Padus avium* b 14,6, c 17,7; *Phyteuma spicatum* 4,1; *Pulmonaria obscura* 4,2; *Ribes uva-crispa* c 1,1; *Sorbus torminalis* c 1,1; *Stachys sylvatica* 1,1; *Ulmus glabra* c 1,1; *U. minor* c 1,1; *Viburnum opulus* b 5,3, c 9,5; *Ch. Vaccinio-Piceetea*: *Cladonia furcata* 1,1; *Pyrola minor* 3,10; *Ch. Trifolio-Geranietea et Festuco-Brometea*: *Acinos arvensis* (F-B) 1,1; *Agrimonia eupatoria* (T-G) r,2; *Ajuga genevensis* (F-B) 3,2; *Asparagus officinalis* (F-B) 1,1; *Asperula tinctoria* (F-B) 1,1; *Avenula pratensis* (F-B) s,2; *Campanula bononiensis* (T-G) 1,0; *C. glomerata* (F-B) 12,24; *C. rapunculoides* (T-G) 2,18; *Coronilla varia* (T-G) 8,8; *Festuca trachyphylla* (F-B) 1,1; *Galium album* (T-G) 11,24; *Origanum vulgare* (T-G) 2,6; *Poa compressa* (F-B) 1,1; *Silene nutans* subsp. *nutans* (T-G) 18,9; *Thalictrum minus* (F-B) 11,9; *Trifolium medium* (T-G) 4,2; *T. montanum* (F-B) 1,1; *Veronica spicata* (F-B) 1,1; *Vicia dumetorum* (T-G) 3,6; *Vincetoxicum hirundinaria* (T-G) 6,8; *Ch. Artemisietae*: *Aegopodium podagraria* 2,6; *Alliaria petiolata* 19,23; *Anthriscus sylvestris* 8,22; *Chaerophyllum temulum* 6,2; *Epilobium montanum* 2,1; *Equisetum arvense* 2,1; *Fallopia dumetorum* 2,1; *Galium aparine* 20,62; *Geranium pratense* 2,1; *G. robertianum* 22,42; *Glechoma hederacea* 2,1; *Heracleum sibiricum* 3,2; *H. sphondylium* 4,1; *Lapsana communis* s. s. 11,6; *Linaria vulgaris* 7,4; *Rubus caesius* 2,23; *Tanacetum vulgare* 1,1; *Torilis japonica* 16,60; *Ch. Molinio-Arrhenatheretea*: *Agrostis gigantea* 4,19; *Angelica sylvestris* 8,22; *Arrhenatherum elatius* 5,7; *Avenula pubescens* 2,1; *Briza media* 4,2; *Campanula patula* s.str. 2,0; *Carex hirta* 16,48; *Centaurea jacea* 2,1; *Cerastium holosteoides* 1,1; *Cnidium dubium* 16,126; *Dianthus superbus* s. s. 2,1; *Festuca pratensis* 2,1; *Laserpitium prutenicum* 8,31; *Lathyrus pratensis* 7,4; *Leontodon autumnalis* 1,0; *Lysimachia nummularia* 3,6; *Phleum pratense* 2,1; *Pimpinella major* 6,12; *Plantago lanceolata* 4,2; *Poa pratensis* 17,13; *P. trivialis* 4,2; *Prunella vulgaris* 2,1; *Ranunculus acris* s. s. 10,9; *Sanguisorba officinalis* 2,1; *Selinum carvifolia* 13,16; *Stellaria graminea* 9,18; *Taraxacum officinale* 27,7; *Trollius europaeus* 3,2; *Vicia cracca* 2,1; *Ch. Scheuchzerio-Caricetea fuscae*: *Juncus conglomeratus* 1,1; *Ch. Calluno-Ulicetea*: *Polytrichum juniperinum* 2,1; *Others*: *Abies alba* c 1,1; *Acer negundo* c 1,0; *Adenophora liliifolia* 2,1; *Agrostis gigantea* x *canina* 1,5; *Aquilegia vulgaris* 2,1; *Athyrium filix-femina* 1,1; *Berberis vulgaris* b 2,1; *Brachythecium velutinum* 11,6; *Brachythecium rutabulum* 21,10; *B. salebrosum* 2,1; *Bromus benekenii* 2,1; *Carex acutiformis* 1,1; *C. flacca* 4,7; *C. guestphalica* 1,1; *C. spicata* 1,0; *Centaurea phrygia* 2,1; *Ceratodon purpureus* 1,1; *Chamaenerion angustifolium* 3,1; *Chenopodium album* 2,1; *Cladonia glauca* 1,1; *Conyza canadensis* 2,1; *Cornus sanguinea* b 4,7, c 4,2; *Crataegus laevigata* b 18,34; c 9,4; *Crataegus* sp. c 1,1; *Cruciata glabra* 1,18; *Digitalis grandiflora* 6,3; *Euonymus europaea* c 7,4; *Fallopia convolvulus* 37,32; *Galium mollugo* et *dumetorum* 5,7; *Hypochoeris radicata* 1,0; *Kindbergia praelonga* 1,1; *Koeleria pyramidata* 1,1; *Lupinus polyphyllus* 11,22; *Luzula pallescens* 1,1; *Malus* sp. C 1,1; *Mentha arvensis* 2,1; *Oxyrrhynchium hians* var. *hians* 1,1; *Phalaris arundinacea* 2,1; *Plagiomnium cuspidatum* 5,24; *Poa nemoralis* x *compressa* 1,1; *Pohlia lescuriana* 12,5; *Populus tremula* a 2,6; a2 1,1, b 6,8, c 9,9; *Pyrus communis* b 7,8, c 11,5; *Quercus* x *rosacea* a 3,133, a1 5,80, a2 3,19, b 2,6, c 4,7; *Robinia pseudacacia* c 1,0; *Rosa canina* b 1,1, c 8,3; *Rosa* sp. C 1,1; *R. tomentosa* b 2,1; *Rosulabryum capillare* 1,1; *Rubus corylifolius* 14,13; *R. gracilis* 4,2; *Rubus* sp. 1,1; *R. sprengelii* 9,13; *Rumex acetosella* 3,1; *Sambucus nigra* c 1,1; *Sarothamnus scoparius* c 1,1; *Sciuro-hypnum oedipodium* 14,38; *Scutellaria galericulata* 2,6; *Senecio sylvaticus* 3,0; *S. vernalis* 1,0; *Silene vulgaris* 1,1; *Stellaria media* 5,20; *Thalictrum aquilegifolium* 14,26; *Vicia hirsuta* 3,1; *Vicia* sp. 1,0; *Viola* sp. 2,1; *Viscaria vulgaris* 12,11.

6. *Quercu roboris-Pinetum* (165 relevés): Balcerkiewicz et al. (1994) tab. 3: 2,3,5-7,9,11-14 (*Qr-P*); Berdowski & Kwiatkowski (1992), tab. 7: 2 (*Qr-P*); Brzeg et al. (2000a), tab. 2: 41,42 (*Festuco ovinae-Pinetum*); Brzeg (2004), tab. 1: 1,2,4-14 (*Qr-P*); Ferchmin (1980), tab. 21: 3-5 (*Pino-Quercetum*); Jakubowska-Gabara (1994), tab. 2: 2-7,10,13-15 (*Quercu-Pinetum*); Kaczyńska (1964), tab. 5: 1-6,8-15 (*Pino-Quercetum*); Krotoska & Piotrowska (1962), tab. 5: 34 (*Pino-Quercetum*); Macicka (1984), tab. 20: 3,4,6,7,11-13,17,19,22,24,29,30 (*Pino-Quercetum*); tab. 29: 14,17 (Plantation of pine on the habitat of deciduous and mixed forests); Macicka & Wilczyńska (1990), tab. 16: 1,4,5,8,9,12-15,17 (*Pino-Quercetum fagetosum*); tab. 17: 1-3,6,8,15-17,22,26-29 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 14: 5,6,14,21 (*Pino-Quercetum*); Macicka & Wilczyńska (1992), tab. 6: 2,3,5,7,8 (*Pino-Quercetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 28, 24 (*Pino-Quercetum*); Kasproicz (oryg.), tab. A32: 12,69; Nowaczyk (1964), tab. 7: 1-12, 14-18 (*Pino-Quercetum*); Ratińska (2001), tab. 176, 8 (*Calamagrostio-Quercetum petraeae*); Robińska 1977, tab. 3: 4,6-8,10,12,13, tab. 5: 1 (*Pino-Quercetum* – degenerated forms); Sroka (1982), tab. 2: 4,6,8-12,15 (*Pino-Quercetum*); Szwed (1979), tab. 16: 1-4,10-11,16-18,20-22,24-32 (*Pino-Quercetum*); Wojterska (1976), tab. 11: 1,2,3 (*Pino-Quercetum*); Pawłó & Czech (1959), tab. 3: 13,16 (Mixed coniferous forest); Wojterska (2003), tab. 16: 23 (*Calamagrostio-Quercetum polygonatetosum*); **Taxa not included in the table:** *Ch. Quercu-Fagetea*: *Acer platanoides* a2 1,3; b 2,1; bc 1,3; c 7,3; *A. pseudoplatanus* a2 2,17; b 5,18; bc 2,1; c 5,5; *Cerasus avium* a2 1,0; b 1,0; bc 1,0; c 1,0; *Dryopteris filix-mas* 7,3; *Equisetum sylvaticum* 1,0; *Eurhynchium angustirete* 1,0; *Fraxinus excelsior* c 1,0; *Lilium martagon* 1,0; *Luzula luzuloides* 1,0; *Malus sylvestris* b 1,1; bc 1,0; c 2,1; *Padus avium* b 1,0; *Ribes spicatum* bc 1,3; *R. uva-crispa* c 1,0; *Ulmus laevis* b 1,0; *Ch. Vaccinio-Piceetea*: *Cladonia arbuscula* 1,1; *C. furcata* 3,2; *C. rangiferina* 1,0; *Diphasiastrum complanatum* 1,3; *Dryopteris dilatata* 8,25; *Galium rotundifolium* 5,5; *Lycopodium annotinum* 1,3; *L. clavatum* 3,7; *Ptilium crista-castrensis* 2,14; *Pyrola minor* 1,0; *P. rotundifolia* 1,1; *Viscum album* subsp. *austriacum* 2,1; *Ch. Trifolio-Geranietea* (TG) et *Festuco-Brometea* (FB): *Artemisia campestris* (FB) 1,0; *Campanula rapunculoides* (TG) 1,0; *Festuca pallens* (FB) 2,23; *F. trachyphylla* (FB) 1,11; *Galium album* (TG) 1,0; *Silene nutans* subsp. *nutans* (TG) 1,1; *S. oites* (FB) 1,0; *Ch. Artemisietae*: *Epilobium montanum* 1,0; *Galium aparine* 1,0; *Geranium robertianum* 2,1; *Lapsana communis* s.s. 1,0; *Linaria vulgaris* 2,1; *Medicago lupulina* 1,0; *Rubus caesius* 5,5; *Tussilago farfara* 1,0; *Ch. Molinio-Arrhenatheretea*: *Agrostis gigantea* 1,11; *Arrhenatherum elatius* 5,29; *Campanula patula* s.s. 1,0; *Carex hirta* 8,46; *Poa pratensis* 2,4; *Potentilla reptans* 1,0; *Ranunculus acris* s.s. 1,0; *R. repens* 1,3; *Selinum carvifolia* 1,0; *Stellaria graminea* 2,1; *Ch. Scheuchzerio-Caricetea fuscae*: *Juncus conglomeratus* 1,0; *Ch. Calluno-Ulicetea*: *Cladonia chlorophaea* 2,1; *C. fimbriata* 1,0; *C. pyxidata* 2,4; *Hypnum jutlandicum* 4,18; *Nardus stricta* 1,0; *Polytrichum juniperinum* 4,2; *Ptilidium ciliare* 2,4; *Scabiosa canescens* 1,0; *Others*: *Abies alba* a1 1,11; a2 2,20; b 1,6; c 2,4; *Agrostis vinealis* 1,1; *Amelanchier ovalis* bc 1,0; *Athyrium filix-femina* 3,4; *Atrichum tenellum* 1,0; *Brachythecium velutinum* 1,1; *Brachythecium rutabulum* 2,4; *Carex divulsa* 1,3; *Carex* sp. 1,0; *C. vulpina* 1,0; *Cerastium arvense* 1,0; *C. semidecandrum* 1,1; *Cerastium* sp. 1,0; *Ceratodon purpureus* 2,1; *Chamaenerion angustifolium* 5,2; *Chondrilla juncea* 1,0; *Cladonia digitata* 1,0; *C. macilenta* 1,0; *Corynephorus canescens* 2,4; *Crataegus laevigata* b 2,1; c 1,0; *C. x subsphaerica* c 1,0; *Cruciata glabra* 1,0; *Euonymus europaea* b 1,0; c 1,0; *Fallopia convolvulus* 1,0; *Funaria hygrometrica* 1,0; *Hieracium* sp. 1,0; *Koeleria glauca* 1,0; *Larix decidua* subsp. *decidua* a1 1,11; a2 1,3; bc 1,0; c 1,0; *Lophocolea bidentata* 1,1; *Marchantia polymorpha* 1,0; *Musci* indet 1,0; *Orthodicranum montanum* 1,0; *Oxyrrhynchium hians* var. *hians* 1,0; *Pinus strobus* a2 1,0; c 1,0; *Plagiomnium cuspidatum* 1,1; *P. elatum* 1,1; *P. rostratum* 2,1; *Plagiothecium* sp. 1,11; *Pohlia lescuriana* 1,0; *Polypodium vulgare* 1,11; *Populus nigra* a 1,0; c 1,0; *P. tremula* a 1,3; a1 1,14; a2 7,30; b 10,50; *Pyrus communis* b 2,1; c 1,0; *Quercus rubra* a1 1,0; a2 4,28; b 1,0; bc 4,5; c 1,0; *Q. x rosacea* a 3,144; a2 1,45; c 5,16; *Rhizomnium punctatum* 1,0; *Robinia pseudacacia* b 1,0; *Rosa* sp. c 1,0; *Rosulabryum capillare* 1,0; *Rubus* cfr. *hirtus* 4,18; *R. grabowskii* 2,1; *R. gracilis* c 5,14; *R. schleicheri* 1,1; *Rubus* sp. 14,106; *R. sprengelii* 5,11; *Rumex acetosella* 21,56; *Salix caprea* c 1,1; *Sambucus nigra* c 1,0; *S. racemosa* c 1,0; *Sarothamnus scoparius* c 2,1; *Sciuro-hypnum oedipodium* 11,42; *Senecio sylvaticus* 4,2; *S. vernalis* 1,0; *S. vulgaris* 1,1; *Sphagnum capillifolium* 1,0; *Stellaria media* 3,4; *Vicia* sp. 1,0; *Viola* sp. 1,1; *Viscum album* subsp. *album* 2,1.

7. *Serratulo-Pinetum* (13 relevés): Brzeg (2004), tab. 1: 15-20 (*Serratulo-Pinetum*); Olaczek (1986), tab. 3: 4-8 (Pine tree-stands in the habitat of light oak forest), tab. 4: 4,5 (*Calamagrosti-Quercetum petraeae*). **Taxa not included in the table:** *Ch. Quercu-Fagetea*: *Cerasus avium* bc 8,1; *Dryopteris filix-mas* 15,8; *Viburnum opulus* b 8,4; *Cladonia furcata* 31,15; *Cl. rangiferina* 8,4; *Diphasiastrum complanatum* 8,4; *Monotropa hypopitys* s.s. 38,16; *Pyrola chlorantha* 8,4; *P. minor* 8,4; *Viscum album* subsp. *austriacum* 8,4; *Ch. Trifolio-Geranietea* (TG) et *Festuco-Brometea* (FB): *Ajuga genevensis* (FB) 8,4; *Coronilla varia* (TG) 8,4; *Potentilla heptaphylla* (FB) 8,4; *Silene nutans* subsp. *nutans* (TG) 8,4; *Trifolium montanum* (FB) 15,8; *Veronica spicata* (FB) 8,4; *Vincetoxicum hirundinaria* (TG) 8,4; *Ch. Artemisietae*: *Equisetum arvense* 8,4; *Ch. Molinio-Arrhenatheretea*: *Carex hirta* 15,8; *Cerastium holosteoides* 31,12; *Holcus lanatus* 8,4; *Plantago*

lanceolata 8,4; Ch. Calluno-Ulicetea; *Arctostaphylos uva-ursi* 15,8; *Luzula campestris* 15,8; *Ptilidium ciliare* 8,4; *Scabiosa canescens* 15,8; Others; *Agrostis vinealis* 8,4; *Armeria maritima* 15,5; *Cetraria islandica* 8,4; *Chamaenerion angustifolium* 8,4; *Cladonia cervicornis* subsp. *verticillata* 8,4; *C. foliacea* 8,4; *Corynephorus canescens* 8,4; *Festuca psammophila* 8,4; *Helichrysum arenerium* 8,4; *Hypochoeris radicata* 8,4; *Hypogymnia physodes* 8,4; *Jasione montana* 15,8; *Populus tremula* a1 8,38; a2 8,38; b 8,4; c 15,8; *Pyrus communis* c 8,4; *Quercus rubra* bc 8,481; *Rosa* sp. b 15,8; c 8,4; *Rubus grabowskii* 8,4; *Rubus* sp. 8,4; *Rumex acetosella* 31,15; *Sarothamnus scoparius* b 15,42; c 8,4; *Sciuro-hypnum oedipodium* 23,46; *Scleranthus perennis* 8,4; *Silene vulgaris* 8,4.

Table 4. Spearman rank correlation between mean values of: Ellenberg indicator values (A), cover of layers (B), number of species (C) and ordination scores of relevés for the DCA axes

	DCA axis 1	DCA axis 2	DCA axis 3	DCA axis 4
(A) Ellenberg indicator values				
R (soil reaction)	0.8805 **	0.0079 ns	-0.0411 ns	-0.0181 ns
N (soil fertility)	0.6488 **	-0.2516 **	0.0262 ns	-0.1581 **
F (soil moisture)	-0.3376 **	-0.7556 **	-0.0911 *	0.1104 *
L (light)	-0.0580 ns	0.5100 **	0.0447 ns	0.6074 **
K (continentality)	-0.6156 **	0.0946 *	0.0575 ns	0.2036 **
(B) Cover of layers [%]				
Herb layer (d)	-0.5501 **	0.2411 **	0.3121 **	-0.0337 ns
Moss layer (c)	0.0833 *	0.0842 *	-0.1845 **	-0.0367 ns
(C) Number of species				
<i>Quercus-Fagetea</i> [^] (Q-F)	0.8300 **	-0.2431 **	0.0244 ns	-0.1457 **
<i>Trifolio-Geranietea</i> (T-G)	0.6609 **	0.3215 **	-0.0295 ns	0.2509 **
<i>Quercetalia pubescentis</i> (Q.pu)	0.6061 **	0.1168 *	-0.1001 *	0.1506 **
Herb layer (c)	0.6390 **	-0.0920 *	0.0611 ns	0.3041 **
Moss layer (d)	-0.4284 **	-0.0344 ns	0.4242 **	0.0659 ns
<i>Festuco-Brometea</i> (F-B)	0.4403 **	0.2511 **	0.0038 ns	0.3279 **
<i>Vaccinio-Piceetea</i> [^] (V-P)	-0.5812 **	0.4075 **	0.0545 ns	0.1517 **
<i>Scheuchzerio-Caricetea fuscae</i> (S-Cf)	-0.3535 **	-0.3803 **	-0.0829 *	0.3164 **
<i>Quercetea robori-petraeae</i> (Qrp)	-0.0093 ns	-0.2098 **	0.1754 **	0.0972 *

Explanations: ** $p < 0.001$; * $0.01 < p \leq 0.05$; ns – non significant. [^] Tree species were not taken into account

Table 5. Floristic differentiation of *Aulacomnio androgyni-Quercetum roboris* reflecting habitat variation

Successive number of syntaxon	1		2		3		4	
Number of relevés	4		10		11		12	
Number of taxa	51		67		84		78	
Mean number of taxa in relevé	25		30		32		30	
Ch., *D. Aulacomnio androgyni-Quercetum roboris								
Pohlia nutans* (C-U)	75	575	100	615	91	200	92	233
Dicranella heteromalla (opt.)	75	263	100	365	64	268	92	121
Plagiothecium curvifolium* (V-P)	50	25	50	25	64	32	83	42
Dicranum scoparium* (VP)	100	163	80	130	73	36	58	29
Mnium hornum	100	475	60	30	36	18	92	46
Hypnum cupressiforme*	75	263	90	360	45	105	75	150
Lophocolea heterophylla	75	38	60	30	36	18	58	29
Aulacomnium androgynum	50	25	80	130	45	105	75	75
Plagiothecium laetum (loc. opt.)	75	150	70	125	73	36	50	25
Plagiothecium denticulatum (loc. opt.)	25	13	70	35	45	23	58	67
Thuidium tamariscinum* (V-P)	75	38	30	15	18	9	17	46
Herzogiella seligeri	25	13	20	10	18	9	50	25
Cladonia coniocraea* (C-U)	25	13	30	60	9	5	25	13
D. Aa-Q anemonetosum nemorosae								
Oxalis acetosella	-	-	30	7	45	23	75	38
Agrostis canina (S-C)	25	13	-	-	64	73	50	25
Juncus effusus (M-A)	-	-	10	5	64	32	42	21
Anemone nemorosa (Q-F)	-	-	-	-	45	105	67	33
Milium effusum (Q-F)	-	-	-	-	18	9	42	21
Stellaria holostea (Q-F)	-	-	-	-	9	5	50	138
Plagiomnium affine	-	-	10	5	36	18	17	8
Atrichum undulatum (Q-F)	25	13	-	-	27	14	17	8
Poa nemoralis (Q-F)	-	-	-	-	27	14	8	4
Ch., *D. Quercetea robori-petraeae								
Polytrichastrum formosum*	100	2250	100	2025	100	2545	100	1875
Carex pilulifera	75	263	100	580	100	491	100	804
Holcus mollis	50	25	80	85	73	273	92	263
Melampyrum pratense*	75	38	70	121	73	118	42	21
Calamagrostis arundinacea	-	-	20	55	27	14	17	46
Festuca ovina	25	13	30	15	27	168	8	4
Hieracium sabaudum	25	3	10	5	18	9	17	5
Hieracium lachenalii	25	13	-	-	9	5	-	-
Ch. Vaccinio-Piceetea (V-P)								
Pinus sylvestris a	-	-	-	-	-	-	8	146
Pinus sylvestris c	25	3	10	5	45	12	25	3
Picea abies a	-	-	-	-	18	50	17	8
Picea abies b-c	-	-	80	155	45	37	17	8
Pleurozium schreberi	-	-	90	45	55	27	-	-
Hylocomium splendens	-	-	40	20	55	68	-	-
Trientalis europaea	-	-	60	120	36	59	-	-
Vaccinium myrtillus	25	13	100	400	100	1550	58	179
Leucobryum glaucum	25	13	10	175	9	5	17	8
Ch. Quercio-Fagetea (Q-F)								
Carpinus betulus a	100	5000	90	4625	91	5454	100	5501
Carpinus betulus b-c	75	38	80	225	73	132	92	183
Ch. Calluno-Ulicetea (C-U)								
Carex pallescens	25	13	50	25	64	32	42	21
Carex ovalis	-	-	30	15	45	23	33	17
Agrostis capillaris	25	13	10	5	27	55	33	17
Luzula multiflora	-	-	40	20	18	9	17	8
Ch. Scheuchzerio-Caricetea fuscae (S-C) et Molinio-Arrhenatheretea (M-A)								
Deschampsia caespitosa (M-A)	75	150	40	20	73	36	67	108
Festuca rubra s. s. (M-A)	-	-	50	25	64	73	42	21
Carex nigra (S-C)	25	13	50	25	55	182	17	8
Lysimachia vulgaris (M-A)	-	-	30	7	27	14	33	17
Molinia caerulea (M-A)	-	-	20	10	27	14	17	8
Others								
Quercus robur a	75	2813	100	4250	91	3954	100	3833
Quercus robur b-c	75	38	100	470	100	91	100	163
Sorbus aucuparia c	75	38	90	37	82	41	92	83
Betula pendula a	-	-	10	5	54	378	25	50
Betula pendula c	25	13	30	15	36	18	17	5
Frangula alnus b-c	50	150	60	145	100	286	92	358
Luzula pilosa	75	263	90	385	100	409	92	583
Maianthemum bifolium	100	1013	100	185	91	209	92	300
Dryopteris carthusiana	25	13	30	15	64	32	83	42
Calamagrostis epigejos	75	38	30	15	55	182	33	92
Anthoxanthum odoratum	50	25	40	20	9	5	-	-
Convallaria majalis	25	13	30	15	27	14	17	8
Rubus sprengelii	-	-	40	20	-	-	-	-

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics).

1. *Aulacomnio androgyni-Quercetum roboris typicum* typical variant (4 relevés): Brzeg *et al.* (2000a), tab. 1: 1-3 (*Aa-Q typicum* typical variant; Kubiś (1982), tab. 4: 15 (*Polytrichum attenuatum-Carpinus betulus*).

2. *Aulacomnio androgyni-Quercetum roboris typicum* variant with *Pleurozium schreberi* (10 relevés): Brzeg *et al.* (2000a), tab. 1: 4-10; Lisiewska & Reszel (2000), tab. 3: 1 (*Aa-Q typicum*); Kulińska (1991), tab. 4: 4,5 (*Carpino-Quercetum*).

3. *Aulacomnio androgyni-Quercetum roboris anemonetosum nemorosae* variant with *Pleurozium schreberi* (11 relevés): Brzeg *et al.* (2000a), tab. 1: 11-17 (*Aa-Q anemonetosum nemorosae* variant with *Pleurozium schreberi*); Krotoska (1966), tab. 21: 2; Kubiś (1982), tab. 4: 2,3 (Community *Polytrichum attenuatum-Carpinus betulus*); Sroka (1982), tab. 1: 3 (*Calamagrostio arundinaceae-Quercetum*).

4. *Aulacomnio androgyni-Quercetum roboris anemonetosum nemorosae* typical variant (12 relevés): Brzeg *et al.* (2000a), tab. 1: 18-25 (*Aa-Q anemonetosum nemorosae* typical variant; Błachuta (1995), tab. 4: 3,4 (*Carpino-Quercetum*); Lisiewska & Reszel (2000), tab. 3: 2 (*Aa-Q anemonetosum nemorosae*); Sroka (1982), tab. 1: 4 (*Calamagrostio arundinaceae-Quercetum*).

Table 6. Floristic differentiation of *Molinio caeruleae-Quercetum roboris* reflecting habitat variation

Successive number of syntaxon		1	2	3
Number of relevés		27	9	20
Number of taxa		113	79	87
Mean number of taxa in relevé		25	31	25
D. <i>Molinio caeruleae-Quercetum roboris</i>				
<i>Molinia caerulea</i>		100 5806	100 5417	100 5175
<i>Rubus nessensis</i>		26 46	56 28	35 63
<i>Polytrichum commune</i>		19 89	44 22	15 8
Ch., *D. <i>Quercetea robori-petraeae</i> (Qrp)				
<i>Polytrichastrum formosum</i> *		85 221	100 478	75 150
<i>Carex pilulifera</i>		78 89	89 94	80 130
<i>Melampyrum pratense</i> *		52 156	78 39	70 188
<i>Holcus mollis</i>		41 100	33 17	45 130
<i>Pteridium aquilinum</i> *		22 378	44 261	65 478
<i>Dicranella heteromalla</i>		33 33	44 22	15 8
<i>Festuca ovina</i>		33 83	11 6	- -
<i>Plagiothecium laetum</i> (loc. opt.)		22 11	33 17	5 3
<i>Plagiothecium denticulatum</i>		15 7	56 28	15 8
<i>Lophocolea heterophylla</i>		11 6	33 17	5 3
Ch. <i>Vaccinio-Picetea</i> (V-P)				
<i>Picea abies</i>	a	19 43	33 306	25 206
<i>Picea abies</i>	b-c	70 106	78 35	70 376
<i>Pinus sylvestris</i>	a	52 440	11 15	15 138
<i>Pinus sylvestris</i>	c	19 8	11 6	10 3
<i>Vaccinium myrtillus</i>		100 1259	100 1644	95 1350
<i>Trientalis europaea</i>		81 631	78 739	75 438
<i>Pleurozium schreberi</i>		26 30	22 11	10 5
<i>Plagiothecium curvifolium</i>		11 6	22 11	15 8
<i>Hylocomium splendens</i>		4 2	22 11	- -
<i>Leucobryum glaucum</i>		22 11	- -	- -
Ch. <i>Quercio-Fagetea</i>				
<i>Fagus sylvatica</i>	a	- -	33 17	- -
<i>Fagus sylvatica</i>	b-c	19 8	33 72	20 35
<i>Carpinus betulus</i>	a	4 19	33 617	45 1183
<i>Carpinus betulus</i>	b-c	44 70	100 728	55 1238
<i>Anemone nemorosa</i>		15 70	22 11	20 8
<i>Milium effusum</i>		11 22	22 11	10 5
<i>Stellaria holostea</i>		4 2	11 6	35 40
<i>Poa nemoralis</i>		15 24	- -	35 16
Ch. <i>Scheuchzerio-Caricetea fuscae</i> et <i>Molinio-Arrhenatheretea</i>*				
<i>Lysimachia vulgaris</i> *		52 143	78 89	70 228
<i>Carex nigra</i>		37 52	78 39	35 40
<i>Juncus effusus</i> *		33 50	67 33	35 40
<i>Agrostis canina</i>		26 93	44 72	20 118
<i>Deschampsia caespitosa</i> *		26 46	22 11	20 195
<i>Festuca rubra</i> s. s.*		11 6	33 17	15 30
D. var. et subvar.				
<i>Betula pubescens</i> (V-P)	a	7 4	56 589	45 248
<i>Betula pubescens</i> (V-P)	c	11 6	44 22	20 33
<i>Calamagrostis arundinacea</i> (Qrp)		- -	89 522	100 625
<i>Sphagnum girgensohnii</i>		- -	78 378	- -
<i>Carex canescens</i> (S-C)		- -	56 78	- -
<i>Sphagnum fimbriatum</i>		- -	11 6	- -

Successive number of syntaxon	1		2		3	
Ch. <i>Calluno-Ulicetea</i> (C-U)						
<i>Pohlia nutans</i>	41	37	56	28	25	13
<i>Agrostis capillaris</i>	30	15	33	17	30	15
<i>Carex pallescens</i>	19	26	44	22	35	18
<i>Solidago virgaurea</i> s. s.	-	-	11	6	25	13
Others						
<i>Quercus robur</i> a	85	3699	100	4639	100	5321
<i>Quercus robur</i> b-c	74	90	100	534	85	236
<i>Betula pendula</i> a	52	575	56	289	35	248
<i>Betula pendula</i> c	37	19	33	17	25	13
<i>Quercus petraea</i> a	37	1463	11	700	5	313
<i>Quercus petraea</i> b-c	26	111	11	6	5	88
<i>Sorbus aucuparia</i> a	11	159	22	61	15	30
<i>Sorbus aucuparia</i> b-c	93	135	100	56	95	123
<i>Frangula alnus</i> b-c	100	2863	100	2594	100	2118
<i>Maianthemum bifolium</i>	85	219	100	200	95	68
<i>Dryopteris carthusiana</i>	63	65	44	68	50	25
<i>Luzula pilosa</i>	52	59	44	22	70	33
<i>Rubus idaeus</i>	30	48	11	6	10	5
<i>Oxalis acetosella</i>	30	81	33	17	35	40
<i>Anthoxanthum odoratum</i>	22	11	11	6	20	33
<i>Convallaria majalis</i>	11	22	44	22	30	15
<i>Aulacomnium palustre</i> var. <i>palustre</i>	4	2	33	17	5	3
<i>Rubus gracilis</i>	11	6	22	7	10	28
<i>Plagiomnium affine</i>	7	20	22	11	5	3
<i>Sciuro-hypnum oedipodium</i>	15	7	22	11	15	8
<i>Galeopsis tetrahit</i>	19	9	11	6	25	13
<i>Populus tremula</i> a	4	19	-	-	15	138
<i>Populus tremula</i> b-c	7	6	11	6	25	38
<i>Rubus plicatus</i>	37	52	-	-	10	28
<i>Rubus corylifolius</i>	26	126	-	-	-	-

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics).

1. *Molinio caeruleae-Quercetum roboris* typical variant (27 relevés): Brzeg *et al.* (1989), tab. 2: 1-14 (*Mc-Q* typical form; Sroka (1982), tab. 1: 35 (*Calamagrostis arundinaceae-Quercetum*), tab. 2: 13 (*Pino-Quercetum*), tab. 3: 4-14 (Pine-Oak forest with *Molinia caerulea*).

2. *Molinio caeruleae-Quercetum roboris* variant with *Calamagrostis arundinacea* subvariant with *Carex canescens* (9 relevés): Brzeg *et al.* (1989), tab. 2: 27-33 (*Mc-Q* form with *Calamagrostis arundinacea* variant with *Carex canescens* and *Sphagnum girgensohnii*); Lisiewska & Reszel (2000), tab. 3: 4 (*Molinio caeruleae-Quercetum* variant with *Anemone nemorosa*); Kulińska (1991), tab. 2: 1 (*Molinio-Quercetum*).

3. *Molinio caeruleae-Quercetum roboris* variant with *Calamagrostis arundinacea* typical subvariant (20 relevés): Brzeg *et al.* (1989), tab. 2: 15-26 (*Mc-Q* form with *Calamagrostis arundinacea* typical variant; Krotoska & Piotrowska (1962), tab. 5: 25, 36-40 (*Pino-Quercetum*); Sroka (1982), tab. 1: 36 (*Calamagrostis arundinaceae-Quercetum*).

Table 7. Floristic composition of subassociations of *Calamagrostio arundinaceae-Quercetum*, depending on stage of degeneration

Successive number of syntaxon	1	2	3	4	5	6	7	8	9	10	11	12
Number of relevés	56	79	169	64	91	136	47	28	35	15	24	36
Number of taxa	216	210	273	225	222	271	167	120	194	104	132	172
Mean number of taxa in relevé	35	26	30	30	19	25	26	22	27	22	21	23
Ch., *D. Calamagrostio arundinaceae-Quercetum petraeae												
<i>Quercus petraea</i> * a-c	41	63	88	30	79	93	49	64	77	27	54	86
<i>Festuca ovina</i> *	59	70	72	64	81	72	64	71	89	27	42	17
<i>Calamagrostis arundinacea</i> *	61	48	70	53	49	60	2	21	9	20	21	72
<i>Hieracium lachenalii</i>	80	77	73	28	31	26	2	-	6	7	29	6
<i>Hieracium laevigatum</i>	43	43	34	8	5	5	-	-	3	7	-	3
<i>Hieracium sabaudum</i>	52	59	56	14	16	15	2	4	-	-	12	3
<i>Lathyrus montanus</i>	4	9	5	2	4	1	-	-	-	-	-	-
Ch., *D. Quercetia robori-petraeae												
<i>Carex pilulifera</i>	89	70	55	69	57	38	83	75	74	33	38	11
<i>Holcus mollis</i>	86	62	41	64	42	38	72	68	43	27	17	6
<i>Polytrichastrum formosum</i> *	86	68	54	69	43	38	83	68	66	47	46	8
<i>Melampyrum pratense</i> *	84	82	66	66	59	52	64	39	60	60	33	28
<i>Pteridium aquilinum</i> *	43	72	63	58	59	71	53	57	57	33	46	61
<i>Dicranella heteromalla</i>	25	46	24	22	31	30	23	46	29	7	12	3
D. Ca-Q molinietosum												
<i>Quercus robur</i> a-c	93	61	33	81	35	21	74	57	51	60	58	25
<i>Picea abies</i> (V-P) a-c	64	39	20	56	20	19	57	50	6	40	33	17
<i>Frangula alnus</i> b-c	96	58	45	80	41	47	100	46	54	73	58	33
<i>Molinia caerulea</i>	50	4	4	44	5	3	55	-	-	67	-	3
<i>Lysimachia vulgaris</i>	39	1	4	58	3	5	38	-	6	73	4	3
<i>Trientalis europaea</i> (V-P)	64	20	4	53	9	5	49	11	14	40	-	6
<i>Carex pallescens</i> (C-U)	57	8	7	55	8	7	43	11	9	27	-	6
<i>Potentilla erecta</i> (C-U)	41	1	4	34	2	3	19	4	11	47	-	6
<i>Deschampsia caespitosa</i>	34	5	4	39	2	3	28	-	6	20	4	6
<i>Juncus effusus</i>	29	4	1	27	2	2	23	-	-	27	-	3
<i>Carex nigra</i>	27	-	-	16	1	-	19	-	-	20	4	-
<i>Carex ovalis</i> (C-U)	16	-	1	14	1	1	11	4	-	7	4	-
<i>Agrostis canina</i>	11	-	-	19	-	-	13	-	-	7	-	-
D. Ca-Q polygonatetosum odorati												
<i>Convallaria majalis</i>	29	27	73	47	45	74	23	7	43	7	12	75
<i>Moehringia trinervia</i>	18	22	63	22	12	58	26	36	49	27	25	67
<i>Mycelis muralis</i>	16	11	47	8	3	38	11	7	26	7	25	22
<i>Galeopsis tetrahit</i>	12	10	30	9	13	30	17	4	20	20	12	36
<i>Melica nutans</i> (Q-F)	4	9	41	11	11	39	2	4	34	13	-	53
<i>Hieracium murorum</i>	4	11	49	8	7	29	2	7	34	-	12	11
<i>Veronica officinalis</i> (C-U)	9	14	48	14	10	24	11	14	49	-	17	8
<i>Polygonatum odoratum</i>	-	8	41	5	1	25	-	4	17	-	-	33
<i>Festuca heterophylla</i> (Q-F)	5	4	25	6	3	18	2	-	3	7	-	11
<i>Fallopia convolvulus</i>	2	4	10	2	1	12	-	4	11	-	-	28
<i>Urtica dioica</i>	2	-	9	2	3	12	2	-	6	7	-	28
<i>Rubus caesius</i>	4	3	6	6	-	9	2	-	9	-	-	22
Ch. Vaccinio-Piceetea (V-P)												
<i>Pinus sylvestris</i> a-c	39	38	40	45	31	46	47	71	51	73	79	67
<i>Vaccinium myrtillus</i>	86	78	75	92	75	62	96	96	63	93	75	69
<i>Pleurozium schreberi</i>	41	29	24	38	20	25	32	61	43	33	58	28
<i>Pseudoscleropodium purum</i>	20	6	12	14	4	7	17	11	9	27	17	17
<i>Juniperus communis</i> b-c	14	18	14	11	13	17	13	7	23	-	4	14
<i>Dicranum scoparium</i>	5	11	9	3	11	8	9	25	14	7	33	-
<i>Rubus saxatilis</i>	4	5	14	16	9	15	2	-	14	7	4	25
Ch. Quercio-Fagetea (Q-F)												
<i>Carpinus betulus</i> a-c	68	30	17	59	19	9	53	11	17	40	25	6
<i>Fagus sylvatica</i> a-c	36	29	19	34	18	24	40	32	20	33	21	17
<i>Malus sylvestris</i> a-c	23	6	6	23	-	4	9	-	-	-	-	-
<i>Corylus avellana</i> b-c	7	22	40	6	13	32	4	-	20	13	-	22
<i>Anemone nemorosa</i>	50	29	27	38	19	19	34	14	17	13	8	33
<i>Viola reichenbachiana</i>	32	20	22	38	14	15	23	32	31	27	12	22
<i>Poa nemoralis</i>	36	42	53	17	23	40	17	21	23	20	8	39
<i>Atrichum undulatum</i>	12	24	22	20	12	18	13	29	20	7	-	6
<i>Stellaria holostea</i>	30	20	7	22	7	1	13	4	3	-	4	3
<i>Viola riviniana</i>	11	11	24	12	5	8	2	4	11	7	8	8
Ch. Calluno-Ulicetea (C-U)												
<i>Agrostis capillaris</i>	54	33	31	36	16	22	30	54	37	20	25	22
<i>Pohlia nutans</i>	36	35	25	27	35	31	23	54	29	13	38	3
<i>Luzula multiflora</i>	29	25	24	20	19	18	11	18	20	-	25	6
<i>Solidago virgaurea</i> s.s.	25	29	44	27	13	31	19	-	17	7	12	-
<i>Hypericum maculatum</i>	21	1	1	20	1	1	9	-	14	-	-	3
Others												
<i>Betula pendula</i> a-c	39	44	30	30	23	18	38	57	29	53	50	25
<i>Sorbus aucuparia</i> a-c	86	67	63	86	59	68	83	57	80	67	71	64

Successive number of syntaxon	1	2	3	4	5	6	7	8	9	10	11	12
<i>Luzula pilosa</i>	89	68	71	80	77	67	87	57	80	60	54	58
<i>Maianthemum bifolium</i>	88	61	52	80	38	32	66	32	17	80	29	44
<i>Oxalis acetosella</i>	62	23	16	48	19	6	53	29	20	33	21	25
<i>Dryopteris carthusiana</i>	61	13	24	47	23	18	55	36	26	53	42	47
<i>Festuca rubra</i> s.s.	54	20	31	31	18	24	30	7	29	20	21	8
<i>Anthoxanthum odoratum</i>	52	48	44	39	21	30	36	36	46	13	17	14
<i>Hypnum cupressiforme</i>	36	28	27	16	12	17	17	21	9	13	21	6
<i>Veronica chamaedrys</i>	27	24	30	19	13	28	4	-	37	7	12	17
<i>Calamagrostis epigejos</i>	27	15	21	23	13	17	45	50	37	33	38	33
<i>Rubus idaeus</i>	16	8	15	19	12	14	32	36	17	27	38	22
<i>Deschampsia flexuosa</i>	7	16	13	8	14	14	11	39	23	13	46	25
<i>Fragaria vesca</i>	18	13	26	17	14	24	13	-	23	13	4	25
<i>Hypericum perforatum</i>	18	16	32	11	13	18	11	18	31	13	8	17
<i>Poa angustifolia</i>	25	5	31	17	13	17	11	-	34	13	8	22
<i>Plagiomnium affine</i>	11	11	24	11	10	18	15	7	26	7	17	14
<i>Rubus</i> sp.	11	8	6	12	8	10	15	18	20	20	21	11
<i>Campanula rotundifolia</i>	2	15	21	5	4	10	2	14	3	7	4	8
<i>Padus serotina</i> b-c	5	8	21	5	2	7	-	4	6	-	17	17
<i>Rumex acetosella</i>	4	3	8	6	8	6	6	25	11	-	21	6

Explanations: Shortened table comprises in each column the frequency of species (in %).

1-3. *Calamagrostio arundinaceae-Quercetum petraeae* – untransformed form – source of the relevés as given under the Table 8

1. *Ca-Q molinietosum* (56 relevés)
2. *Ca-Q typicum* (79 relevés)
3. *Ca-Q polygonatetosum odorati* (169 relevés)

4-6. *Calamagrostio arundinaceae-Quercetum petraeae* in stage I of degeneration – source of the relevés as given under the Table 9

4. *Ca-Q molinietosum* (64 relevés)
5. *Ca-Q typicum* (91 relevés)
6. *Ca-Q polygonatetosum odorati* (136 relevés)

7-9. *Calamagrostio arundinaceae-Quercetum petraeae* in stage II of degeneration

7. *Ca-Q molinietosum* (47 relevés): Brzeg *et al.* (2001), tab. 1: 1,10,20,32,43 (*Ca-Q molinietosum*); Borysiak *et al.* (1998), tab. 2: 9 (*Calamagrostio-Quercetum*); Jakubowska-Gabara (1994), tab. 2: 18 (*Quercus-Pinetum molinietosum* – degenerated form); Jelinowski (1958), tab. 1: 21,28,29,30 (*Pino-Quercetum*); Kamionka (1971), tab. 12: 2 (Community of acidophilous oak forest); Krotoska & Piotrowska (1962), tab. 5: 2,29,33 (*Pino-Quercetum*); Kubiś (1982), tab. 2 (*Galio-Carpinetum holcetosum*), tab. 4: 7 (*Polytrichum attenuatum-Carpinus betulus*); Macicka (1984), tab. 29: 11 (Plantation of pine on the habitat of deciduous and mixed forests); Macicka & Wilczyńska (1991), tab. 12: 3,23 (Community from the *Quercion robori-petraeae* alliance); Macicka-Pawlik & Wilczyńska (1996), tab. 31: 12,13 (Substitute forest communities); Olaczek (1986), tab. 4: 8 (*Calamagrostio-Quercetum petraeae*); Sroka (1982), tab. 1: 2, 15-17,21,22,24-27,29,30,32-34 (*Calamagrostio-Quercetum*), tab. 2: 14,16,17,19,20 (*Pino-Quercetum*), tab. 3: 1-3 (Pine-oak forest with *Molinia caerulea*); Wojterska (2003), tab. 17: 5 (Acidophilous oak forests from the *Quercetum robori-petraeae* class).

8. *Ca-Q typicum* (28 relevés): Kamionka (1971), tab. 12: 13 (Community of acidophilous oak forest); Krotoska (1978), tab. 1: 23, 27 (*Calamagrostio-Quercetum*); Macicka (1984), tab. 18: 4 (Community from the *Quercion robori-petraeae* alliance); tab. 20: 16,21,26 (*Pino-Quercetum fagetosum*); Macicka & Wilczyńska (1990), tab. 13: 9 (Community from the *Quercion robori-petraeae* alliance), tab. 16: 16 (*Pino-Quercetum fagetosum*), tab. 17: 4,5,10,11,14 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 21 (Community from the *Quercion robori-petraeae* alliance), tab. 14: 4,15,16,17,20 (*Pino-Quercetum*); Nachotko (1982), tab. 3: 10 (*Calamagrostio-Quercetum* form with *Festuca ovina*); Olaczek (1986), tab. 4: 12 (*Calamagrostio-Quercetum petraeae*); Pawłowski & Czech (1959), tab. 3: 14 (Mixed coniferous forest); Sroka (1982), tab. 2: 5 (*Pino-Quercetum*); Szwed (1979), tab. 16: 6,12 (*Pino-Quercetum*); Wojterska (2003), tab. 16: 14,21 (*Calamagrostio-Quercetum typicum*).

9. *Ca-Q polygonatetosum odorati* (35 relevés): Berdowski & Kwiatkowski (1992), tab. 7: 4 (*Quercus roboris-Pinetum*); Brzeg *et al.* (2001), tab. 2: 15 (*Ca-Q typicum* variant with *Anemone nemorosa*); Borysiak *et al.* (1998), tab. 2: 10 (*Calamagrostio-Quercetum*); Ferchmin (1980), tab. 19: 12 (*Potentilla albae-Quercetum*); Kamionka (1971), tab. 12: 3,7,10,12 (Community of acidophilous oak forest); Krotoska (1978), tab. 1: 24 (*Calamagrostio-Quercetum*); Krotoska (1991), tab. 6: 7 (*Galio-Carpinetum* – Form of deformation with the share of some acidophilous species), tab. 10: 3,4,8,9 (*Calamagrostio-Quercetum*), 13 (*Calamagrostio-Quercetum* – degenerated forms); Macicka (1984), tab. 20: 14 (*Pino-Quercetum fagetosum*), 29: 18 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1990), tab. 17: 20,23 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 10,14 (Community from the *Quercion robori-petraeae* alliance), tab. 14: 7 (*Pino-Quercetum*); Kasprówicz (orig.), tab. A17: 31; Nachotko (1982), tab. 1: 9,12,13 (*Calamagrostio-Quercetum* form with *Calamagrostis arundinacea*), tab. 3: 11 (*Calamagrostio-Quercetum* form with *Festuca ovina*), tab. 4: 3,19 (Oak forest with share of thermophilous species), tab. 6: 3,5: (Oak forest from the *Quercus-Fagetea* class with share of *Pinus sylvestris*); Olaczek (1986), tab. 4: 2,3 (*Calamagrostio-Quercetum petraeae*); Robińska (1977), tab. 3: 11 (*Pino-Quercetum*); Sroka (1982), tab. 1: 7 (*Calamagrostio-Quercetum*); Wojterska (2003), tab. 16: 12,13 (*Calamagrostio-Quercetum typicum*).

10-12. *Calamagrostio arundinaceae-Quercetum petraeae* in stage III of degeneration

10. *Ca-Q molinietosum* (15 relevés): Brzeg *et al.* (2001), tab. 1: 42 (*Ca-Q molinietosum*); Gmaj (1997), tab. 9: 3 (*Calamagrostio-Quercetum molinietosum*); Jakubowska-Gabara (1994), tab. 2: 12 (Community *Picea-Vaccinium* on the habitat of *Quercus-Pinetum typicum*), 16 (*Quercus-Pinetum molinietosum* – degenerated form); Krotoska & Piotrowska (1962), tab. 5: 28,31 (*Pino-Quercetum*); Kubiś (1982), tab. 4: 4,5 (*Polytrichum attenuatum-Carpinus betulus*); Macicka & Wilczyńska (1991), tab. 14: 2,3 (*Pino-Quercetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 31: 9 (Substitute forest communities); Robińska (1977), tab. 3: 26,31 (*Pino-Quercetum*); Sroka (1982), tab. 1: 11,13 (*Calamagrostio-Quercetum*).

11. *Ca-Q typicum* (24 relevés): Brzeg *et al.* (2001), tab. 2: 32 (*Ca-Q typicum*, variant with *Anemone nemorosa*); Borysiak *et al.* (1998), tab. 2: 8 (*Calamagrostio-Quercetum*); Gmaj (1997), tab. 9: 7 (*Calamagrostio-Quercetum typicum*); Hegenbart-Magdans & Brzeg (1999), tab. 1: 36 (*Calamagrostio-Quercetum polygonatetosum*); Kamionka (1971), tab. 12: 14 (Community of acidophilous oak forest); Krotoska (1978), tab. 1: 28 (*Calamagrostio-Quercetum*); Krotoska (1991), tab. 10: 1,2 (*Calamagrostio-Quercetum*); Kubiś (1982), tab. 4: 9,12 (*Polytrichum attenuatum-Carpinus betulus*); Macicka (1984), tab. 20: 2 (*Pino-Quercetum typicum*), 15 (*Pino-Quercetum fagetosum*), tab. 29: 5 (Plantation of pine on the habitat of deciduous and mixed forests); Macicka & Wilczyńska (1991), tab. 14: 8,18 (*Pino-Quercetum*); Macicka & Wilczyńska (1992), tab. 6: 6 (*Pino-Quercetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 31: 4,8 (Substitute forest communities); tab. 28: 5 (*Pino-Quercetum*); Kasprówicz (orig.), tab. A7: 27 (Substitute forest communities on the habitat of *Calamagrostio arundinaceae-Quercetum typicum*); Olaczek (1986), tab. 4: 13 (*Calamagrostio-Quercetum petraeae*); Ratińska (2001), tab. 176: 9 (*Calamagrostio-Quercetum petraeae convallarietosum*); Wojterska (2003), tab. 16: 4 (*Calamagrostio-Quercetum polygonatetosum*).

12. *Ca-Q polygonatetosum odorati* (36 relevés): Gmaj (1997), tab. 9: 5,6 (*Calamagrostio-Quercetum typicum*), 16-18 (*Calamagrostio-Quercetum convallarietosum*), tab. 11: 3 (*Calamagrostio-Quercetum* – degenerated forms), tab. 12: 1,3 (*Calamagrostio-Quercetum* – degenerated forms); Hegenbart-Magdans & Brzeg (1999), tab. 3: 2-7 (*Calamagrostio-Quercetum* – degenerated forms, tab. 1: 16,17,27 (*Calamagrostio-Quercetum polygonatetosum odorati*);

Kamionka (1971), tab. 12: 8 (Community of acidophilous oak forest); Krotoska (1991), tab. 10: 2,10,12 (*Calamagrostio-Quercetum*); Kasproicz (orig.), tab. A18: 3,13,21 (Substitute forest communities on the habitat of *Calamagrostio arundinaceae-Quercetum polygonatetosum*); Nachotko (1982), tab. 1: 9,12,13 (*Calamagrostio-Quercetum* form with *Calamagrostis arundinacea*), tab. 3: 11 (*Calamagrostio-Quercetum* form with *Festuca ovina*), tab. 6: 6 (Oak forest from the *Quercus-Fagetea* class with share of *Pinus sylvestris*); Nowiński (1964), tab. 7: 19 (*Pino-Quercetum*); Ratyńska (2001), tab. 176: 4,7 (*Calamagrostio-Quercetum petraeae convallarietosum*); Siwczak (1977), tab. 3: 15,21 (*Calamagrostio-Quercetum*); Wojterska (2003), tab. 16: 3 (*Calamagrostio-Quercetum polygonatetosum*).

Table 8. Floristic differentiation of *Calamagrostio arundinaceae-Quercetum* reflecting habitat variation in untransformed communities

Successive number of syntaxon	1				2				3				4				5				6			
Subassociations	<i>molinietosum</i>				<i>typicum</i>								<i>polygonatetosum</i>											
Number of relevés	14				42				36				43				78				91			
Number of taxa	114				198				143				181				170				254			
Mean number of taxa in relevé	31				36				22				29				24				35			
Ch., *D. <i>Calamagrostio arundinaceae-Quercetum petraeae</i>																								
<i>Quercus petraea</i> *	a-c	50	1575	38	924	72	4515	56	2192	96	6416	80	4385											
<i>Hieracium lachenalii</i>		93	143	76	69	81	76	74	140	62	104	82	169											
<i>Calamagrostis arundinacea</i> *		71	1318	57	329	44	876	51	841	76	2235	65	1320											
<i>Festuca ovina</i> *		64	393	57	163	75	996	65	334	71	690	74	688											
<i>Hieracium laevigatum</i>		43	21	43	43	42	46	44	74	28	47	40	73											
<i>Hieracium sabaudum</i>		36	82	57	60	58	78	60	114	53	65	59	140											
<i>Lathyrus montanus</i>		7	4	2	1	3	1	14	88	-	-	9	19											
Ch., *D. <i>Quercetia robori-petraeae</i>																								
<i>Carex pilulifera</i>		100	575	86	180	69	192	70	198	41	87	67	150											
<i>Holcus mollis</i>		71	871	90	2339	33	458	86	1915	19	251	60	951											
<i>Polytrichastrum formosum</i> *		93	1225	83	773	72	579	65	355	41	131	65	249											
<i>Melampyrum pratense</i> *		79	136	86	506	78	402	86	517	58	353	74	436											
<i>Pteridium aquilinum</i> *		43	771	43	314	78	813	67	1124	69	1072	58	808											
<i>Dicranella heteromalla</i>		43	21	19	31	58	101	35	38	22	69	26	33											
D. <i>Ca-Q molinietosum</i>																								
<i>Betula pubescens</i> (V-P)	a-c	14	7	10	57	-	-	-	-	-	-	-	-											
<i>Quercus robur</i>	a-c	79	4329	98	4999	39	1271	79	3872	13	337	49	2308											
<i>Picea abies</i> (V-P)	a-c	57	394	67	692	31	311	47	210	10	5	29	61											
<i>Frangula alnus</i>	b-c	93	2236	98	1277	47	182	67	434	38	33	51	186											
<i>Trientalis europaea</i> (V-P)		50	89	69	217	8	16	30	78	1	6	7	8											
<i>Carex pallescens</i> (C-U)		64	96	55	70	3	1	12	6	-	-	12	11											
<i>Molinia caerulea</i>		79	200	40	130	6	3	2	1	5	8	2	1											
<i>Potentilla erecta</i> (C-U)		29	14	45	33	-	-	2	1	1	1	5	8											
<i>Carex nigra</i>		50	25	19	10	-	-	-	-	-	-	-	-											
<i>Lysimachia vulgaris</i>		29	46	43	41	-	-	2	1	1	1	5	3											
<i>Deschampsia caespitosa</i>		21	11	38	40	6	3	5	2	3	1	4	2											
<i>Juncus effusus</i>		29	14	29	13	6	3	2	1	-	-	2	1											
<i>Carex ovalis</i> (C-U)		21	11	14	7	-	-	-	-	-	-	2	1											
<i>Hylocomium splendens</i> (V-P)		21	11	14	7	-	-	2	1	-	-	1	1											
<i>Agrostis canina</i>		14	39	10	15	-	-	-	-	-	-	-	-											
D. <i>Ca-Q polygonatetosum odorati</i>																								
<i>Convallaria majalis</i>		14	39	33	149	28	206	26	202	88	1513	59	737											
<i>Moehringia trinervia</i>		29	46	14	18	14	7	28	44	60	158	65	165											
<i>Hieracium murorum</i>		-	-	5	2	11	6	12	16	33	51	62	80											
<i>Veronica officinalis</i> (C-U)		7	4	10	4	8	4	19	9	31	33	63	91											
<i>Mycelis muralis</i>		7	4	19	10	19	35	5	2	41	71	52	98											
<i>Polygonatum odoratum</i>		-	-	-	-	8	17	7	3	50	60	34	60											
<i>Melica nutans</i> (Q-F)		7	36	2	12	11	6	7	3	37	146	44	141											
<i>Galeopsis tetrahit</i>		14	4	12	6	8	17	12	6	35	122	26	22											
<i>Festuca heterophylla</i> (Q-F)		-	-	7	4	3	14	5	2	21	49	30	77											
<i>Galium boreale</i>		-	-	2	12	-	-	9	187	21	33	15	7											
D. <i>Anemone nemorosa</i> var.																								
<i>Carpinus betulus</i> (Q-F)	a-c	50	93	74	1249	11	238	47	1114	-	-	25	223											
<i>Poa nemoralis</i> (Q-F)		7	4	45	208	47	74	37	197	54	171	53	326											
<i>Anemone nemorosa</i> (Q-F)		36	171	55	70	3	1	51	371	6	25	45	317											
<i>Oxalis acetosella</i>		14	7	79	246	3	14	40	172	-	-	30	104											
<i>Veronica chamaedrys</i>		-	-	36	61	3	1	42	112	6	37	51	74											
<i>Fragaria vesca</i>		-	-	24	33	-	-	23	122	9	4	41	72											
<i>Viola riviniana</i> (Q-F)		-	-	14	7	6	2	16	69	-	-	45	67											
<i>Viola reichenbachiana</i> (Q-F)		-	-	43	64	6	15	33	48	9	4	33	65											
<i>Stellaria holostea</i> (Q-F)		7	36	38	82	3	1	35	99	-	-	12	49											
<i>Atrichum undulatum</i> (Q-F)		-	-	17	8	6	3	40	62	5	3	37	43											
<i>Hypericum perforatum</i>		-	-	24	33	3	1	28	14	6	3	54	26											
<i>Hypericum maculatum</i>		7	4	26	54	-	-	2	41	-	-	2	6											
<i>Milium effusum</i> (Q-F)		-	-	14	7	3	1	16	8	-	-	10	15											
<i>Ajuga reptans</i> (Q-F)		-	-	19	9	3	1	5	2	6	3	9	4											

Successive number of syntaxon		1		2		3		4		5		6	
Ch. Vaccinio-Piceetea (V-P)													
<i>Pinus sylvestris</i>	a-c	64	1863	31	431	44	682	33	253	40	575	41	424
<i>Juniperus communis</i>	b-c	21	11	12	6	19	9	16	21	17	10	11	11
<i>Vaccinium myrtillus</i>		93	3061	83	1946	72	2208	84	1802	68	1187	80	1593
<i>Pleurozium schreberi</i>		64	482	33	210	31	100	28	171	21	33	27	73
<i>Vaccinium vitis-idaea</i>		29	46	-	-	17	33	7	14	9	4	9	9
<i>Pseudoscleropodium purum</i>		29	311	17	40	8	4	5	23	8	10	16	75
<i>Leucobryum glaucum</i>		21	11	10	15	14	44	26	34	8	10	11	15
Ch. Quercu-Fagetea (Q-F)													
<i>Fagus sylvatica</i>	a-c	36	279	36	173	36	424	23	59	9	99	27	180
<i>Malus sylvestris</i>	a-c	14	7	26	15	-	-	9	7	-	-	10	5
<i>Corylus avellana</i>	b-c	-	-	7	5	25	25	19	22	45	373	35	90
Ch. Calluno-Ulicetea (C-U)													
<i>Agrostis capillaris</i>		64	64	50	318	17	21	47	197	14	30	46	382
<i>Pohlia nutans</i>		36	18	36	29	33	113	37	19	21	43	29	38
<i>Luzula multiflora</i>		29	14	29	14	28	26	23	12	22	22	25	13
<i>Solidago virgaurea</i> s. s.		21	11	26	12	28	38	30	36	36	35	52	84
Others													
<i>Betula pendula</i>	a-c	64	250	31	39	39	172	49	276	10	63	46	224
<i>Sorbus aucuparia</i>	a-c	79	339	88	173	56	105	77	208	56	140	69	248
<i>Populus tremula</i>	a-c	36	54	14	17	14	32	21	35	-	-	9	18
<i>Padus serotina</i>	b-c	14	11	-	-	-	-	7	13	21	34	22	23
<i>Luzula pilosa</i>		93	407	88	348	69	207	67	226	68	146	74	173
<i>Maianthemum bifolium</i>		79	611	90	524	56	185	65	392	56	138	48	297
<i>Anthoxanthum odoratum</i>		50	25	52	187	39	32	56	227	32	39	55	279
<i>Dryopteris carthusiana</i>		43	54	67	95	14	6	12	6	15	25	31	81
<i>Festuca rubra</i> s. s.		36	171	60	194	11	6	28	171	19	60	41	219
<i>Calamagrostis epigejos</i>		29	46	26	86	19	69	12	6	12	28	30	81
<i>Poa angustifolia</i>		21	11	26	88	6	3	5	2	22	127	38	271
<i>Hypnum cupressiforme</i>		14	7	43	75	28	26	28	24	22	16	31	20
<i>Rubus plicatus</i>		21	11	10	5	3	1	5	2	-	-	8	19
<i>Rubus idaeus</i>		14	7	17	8	8	3	7	3	8	10	21	53
<i>Sciuro-hypnum oedipodium</i>		14	7	14	29	8	17	12	6	13	35	24	22
<i>Campanula rotundifolia</i>		7	4	-	-	6	3	23	51	17	30	25	18
<i>Plagiommium affine</i>		-	-	14	29	14	32	9	5	19	27	29	53
<i>Deschampsia flexuosa</i>		7	4	7	14	25	269	9	55	4	2	21	104

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics).

1. Calamagrostio arundinaceae-Quercetum petraeae molinietosum typical variant (14 relevés): Brzeg *et al.* (2001), tab. 1 (*Ca-Q molinietosum*); 2-4 (*Ca-Q molinietosum* typical variant), 8,13,23,24,26 (*Ca-Q molinietosum* variant with *Anemone nemorosa*); Krotoska & Piotrowska (1962), tab. 5: 10,22 (*Pino-Quercetum*); Kasprowicz (orig.) tab. A3: 12; Olaczek (1986), tab. 4: 9 (*Calamagrosti-Quercetum petraeae*); Robińska (1977), tab. 3: 23 (*Pino-Quercetum*); Sroka (1982), tab. 2: 3 (*Pino-Quercetum*).

2. Calamagrostio arundinaceae-Quercetum petraeae molinietosum variant with Anemone nemorosa (42 relevés): Brzeg *et al.* (2001), tab. 1: 9,11,12,15,17,21,22,25,28,30,31,35,37,38,40,45,46,49 (*Ca-Q molinietosum* variant with *Anemone nemorosa*); Blachuta (1995), tab. 4: 2 (*Calamagrostio-Quercetum*); Ferchmin (1980), tab. 17: 14 (*Querceto-Carpinetum holcetosum mollis*); Jelinowski (1958), tab. 1: 2,4,6,12,16,23-25 (*Pino-Quercetum*); Krotoska & Piotrowska (1962), tab. 5: 9,14 (*Pino-Quercetum*); Kulińska (1991), tab. 2: 2 (*Calamagrostio-Quercetum molinietosum*); Lisiewska & Reszel (2000), tab. 3: 3 (*Ca-Q molinietosum*); Macicka (1984), tab. 10: 43 (*Pino-Quercetum*); Macicka & Wilczyńska (1990), tab. 13: 3 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1991), tab. 12: 8,15 (Community from the *Quercion robori-petraeae* alliance); Kasprowicz (orig.), tab. A3: 46; Sroka (1982), tab. 1: 5,12,14,18 (*Calamagrostio-Quercetum*).

3. Calamagrostio arundinaceae-Quercetum petraeae typicum typical variant (36 relevés): Brzeg *et al.* (2001), tab. 2 (*Ca-Q typicum*); 1,4-7 (*Ca-Q typicum* typical variant), 9 (*Ca-Q typicum* variant with *Anemone nemorosa*); Jelinowski (1958), tab. 1: 1,17 (*Pino-Quercetum*); Kubiś (1982), tab. 4: 1 (*Polytrichum attenuatum-Carpinus betulus*); Macicka (1984), tab. 18: 7 (Community from the *Quercion robori-petraeae* alliance); tab. 20: 27 (*Pino-Quercetum*); Macicka & Wilczyńska (1990), tab. 13: 2,10 (Community from the *Quercion robori-petraeae* alliance), 17: 18 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 12 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1992), tab. 6: 1 (*Pino-Quercetum*); Wojterska (2003), tab. 16: 5,11,15,18,20 (*Calamagrostio-Quercetum*); Nachotko (1982), tab. 1: 4,5 (*Calamagrosti-Quercetum* form with *Calamagrostis arundinacea*), tab. 2: 1,2,11,12 (*Calamagrosti-Quercetum* form with *Festuca ovina*), tab. 3: 4,9 (*Calamagrosti-Quercetum* form with *Festuca ovina*), tab. 4: 1 (Oak forest with share of thermophilous species); Robińska (1977), tab. 3: 5,33 (*Pino-Quercetum*); Siwcak (1977), tab. 3: 9,23 (*Calamagrostio-Quercetum*); Szwed (1979), tab. 12: 3 (*Calamagrostio-Quercetum*).

4. Calamagrostio arundinaceae-Quercetum petraeae typicum variant with Anemone nemorosa (43 relevés): Brzeg *et al.* (2001), tab. 2: 11,13,16,18,20-26,28,29 (*Ca-Q typicum* variant with *Anemone nemorosa*), tab. 3: 1 (*Ca-Q polygonatetosum odorati* typical variant); Boiński (1973), tab. 50: 9,13,17,19,23 (*Fago-Quercetum*); Jakubowska-Gabara (1994), tab. 2: 1 (*Querceto-Pinetum*); Jelinowski (1958), tab. 1: 5 (*Pino-Quercetum*); Kubiś (1982), tab. 2: 6 (*Galio sylvatici-Carpinetum holcetosum mollis*), tab. 4: 10 (*Polytrichum attenuatum-Carpinus betulus*); Macicka (1984), tab. 18: 3,6 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1990), tab. 13: 8,13,15,16,18,21 (Community from the *Quercion robori-petraeae* alliance), tab. 16: 2 (*Pino-Quercetum fagetosum*), tab. 17: 21 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 2,11 (Community from the *Quercion robori-petraeae* alliance); Nachotko (1982), tab. 4: 5 (Oak forest with share of thermophilous species); tab. 5: 6 (Oak forest with *Holcus mollis*); Ratińska (2001), tab. 176: 6 (*Calamagrostio-Quercetum petraeae convallarietosum*); Siwcak (1977), tab. 3: 20 (*Calamagrostio-Quercetum*); Szwed (1979), tab. 12: 5 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 6: 5,6 (*Calamagrostio-Quercetum convallarietosum*).

5. Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati typical variant (78 relevés): Brzeg (orig.), tab. A13: 45; Brzeg *et al.* (2001), tab. 3 (*Ca-Q polygonatetosum odorati*): 12 (*Ca-Q polygonatetosum* typical variant), 38,39 (*Ca-Q polygonatetosum* variant with *Anemone nemorosa*); Fabiszewski & Faliński (1967), tab. 9: 1,5-11 (*Calamagrostido-Quercetum sessilis*); Hegenbart-Magdans & Brzeg (1999), tab. 1: 2,5-10,14,15,18,20,22,29,30,33-35 (*Calamagrostio arundinaceae-Quercetum petraeae*); Jakubowska-Gabara (1994), tab. 2: 1 (*Querceto-Pinetum*); Jaroszewska (2007), tab. 1: 1,4-7 (*Ca-Q polygonatetosum odorati*); Krotoska (1978), tab. 1: 29 (*Calamagrostio-Quercetum*); Krotoska (1983), tab. 3: 4 (Oak forest); Macicka (1984), tab. 18: 1 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1990), tab. 17: 13 (*Pino-Quercetum typicum*); Kasprowicz (orig.), tab. A13: 3,59,60; Nachotko (1982), tab. 1: 3,6 (*Calamagrosti-Quercetum* form with *Calamagrostis arundinacea*), tab. 2: 3-8,10 (*Calamagrosti-Quercetum* form with *Festuca ovina*), tab. 3: 12 (*Calamagrosti-Quercetum* form with *Festuca ovina*), tab. 4: 6,13 (Oak forest with share of thermophilous species); tab. 5: 4,14 (Oak forest with *Holcus mollis*); Ratińska (2001),

tab. 176: 5 (*Calamagrostio-Quercetum petraeae convallarietosum*); Robińska (1977), tab. 5: 5 (*Pino-Quercetum* Dg); Siwczak (1977), tab. 3: 8,10,11,14,16-19,27 (*Calamagrostio-Quercetum*); Wojterska (2003), tab. 16: 7 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 5: 4,5,7,8,10,12,13 (*Calamagrostio-Quercetum convallarietosum*); tab. 6: 3,4,10 (*Calamagrostio-Quercetum convallarietosum*).

6. *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati* variant with *Anemone nemorosa* (91 relevés): Brzeg *et al.* (2001), tab. 3 (*Ca-Q polygonatetosum odorati*): 2,4-68,9, (*Ca-Q polygonatetosum* typical variant), 13-19,21-36,40-41 (*Ca-Q polygonatetosum* variant with *Anemone nemorosa*); Błachuta (1995), tab. 4: 1 (*Calamagrostio-Quercetum*); Boinński (1973), tab. 50: 2,21,24-27 (*Fago-Quercetum*); Ferchmin (1980), tab. 17: 10,11 (*Quercio-Carpinetum* – acidophilous subassociations); Gmaj (1997), tab. 9: 15 (*Calamagrostio-Quercetum convallarietosum*); Jaroszevska (2007), tab. 1: 2,3,8 (*Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati*); Jelinowski (1958), tab. 1: 9,10 (*Pino-Quercetum*); Krotoska (1983), tab. 3: 3 (Oak forest); Krotoska (1991), tab. 10: 15,16,20 (*Calamagrostio-Quercetum*); Macicka (1984), tab. 18: 2,5 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1990), tab. 13: 4,7,11,14,20,23 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1991), tab. 12: 4,9,12,13,16 (Community from the *Quercion robori-petraeae* alliance), tab. 13: 5 (*Calamagrostio-Quercetum*); Macicka & Wilczyńska (1992), tab. 6: 4 (*Pino-Quercetum*); Kasproicz (orig.), tab. A14: 1,9,10,11,26,40,54,62,64,77,86; Nachotko (1982), tab. 1: 14 (*Calamagrostio-Quercetum* form with *Calamagrostis arundinacea*), tab. 3: 3,8 (*Calamagrostio-Quercetum* form with *Festuca ovina*), tab. 4: 9,14,21,22 (Oak forest with share of thermophilous species); tab. 5: 9,10 (Oak forest with *Holcus mollis*); Siwczak (1977), tab. 3: 28 (*Calamagrostio-Quercetum*); Wojterska (2003), tab. 16: 2,16 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 5: 2,9 (*Calamagrostio-Quercetum convallarietosum*).

Table 9. Floristic differentiation of *Calamagrostio arundinaceae-Quercetum* reflecting habitat variation in stage I of degeneration (Dg ↓ I)

Successive number of syntaxon	12				34				56				
Subassociations	<i>molinietosum</i>				<i>typicum</i>				<i>polygonatetosum</i>				
Number of relevés	26		38		59		32		73		63		
Number of taxa	136		200		146		172		174		242		
Mean number of taxa in relevé	26		34		15		27		20		31		
Ch., *D. <i>Calamagrostio arundinaceae-Quercetum petraeae petraeae</i>													
<i>Quercus petraea</i> *	a-c	42	1402	21	482	78	4671	62	2995	88	4974	81	4598
<i>Calamagrostis arundinacea</i> *		77	1285	37	611	68	1318	16	386	78	2578	40	806
<i>Festuca ovina</i> *		62	248	66	442	88	469	69	380	73	712	71	881
<i>Hieracium lachenalii</i>		19	62	34	41	20	25	50	39	19	28	35	86
<i>Hieracium laevigatum</i>		4	2	11	5	2	1	12	6	3	1	8	4
<i>Hieracium sabaudum</i>		4	0	21	22	12	14	25	13	11	17	21	44
<i>Lathyrus montanus</i>		-	-	3	1	-	-	12	63	-	-	2	1
Ch., *D. <i>Quercetea robiori-petraeae</i>													
<i>Carex pilulifera</i>		62	135	74	266	56	103	59	125	32	63	44	72
<i>Holcus mollis</i>		58	337	68	1804	20	626	81	2711	26	164	52	1252
<i>Polytrichastrum formosum</i> *		58	412	76	584	39	165	50	267	32	98	46	161
<i>Melampyrum pratense</i> *		65	215	66	341	54	311	69	667	40	149	67	314
<i>Pteridium aquilinum</i> *		62	808	55	1026	56	823	66	1180	81	1072	60	775
<i>Dicranella heteromalla</i>		23	29	21	11	34	61	25	41	26	37	35	39
<i>Hieracium umbellatum</i>		-	-	-	-	2	1	9	5	21	69	6	3
D. <i>Ca-Q molinietosum</i>													
<i>Betula pubescens</i> (V-P)	a-c	15	44	13	68								
<i>Quercus robur</i>	a-c	69	3165	89	4230	25	832	56	2222	10	314	33	1214
<i>Picea abies</i> (V-P)	a-c	50	365	61	632	10	44	38	178	19	73	21	124
<i>Frangula alnus</i>	b-c	81	1102	79	897	29	191	62	175	44	41	51	88
<i>Molinia caerulea</i>		69	494	26	117	8	19	-	-	3	8	3	9
<i>Lysimachia vulgaris</i>		50	125	63	103	3	2	3	16	8	40	2	1
<i>Trientalis europaea</i> (V-P)		42	73	61	337	2	8	22	106	3	8	8	52
<i>Carex pallescens</i> (C-U)		38	37	66	149	-	-	22	11	5	3	10	5
<i>Potentilla erecta</i> (C-U)		31	15	37	18	-	-	9	5	-	-	6	3
<i>Deschampsia caespitosa</i>		27	13	47	59	-	-	6	2	-	-	6	3
<i>Juncus effusus</i>		15	25	34	17	2	1	3	2	1	1	3	1

Successive number of syntaxon		1		2		3		4		5		6		
<i>Carex nigra</i>		19	75	13	7	2	1	-	-	-	-	-	-	
<i>Carex ovalis</i> (C-U)		12	6	16	20	2	1	-	-	1	1	2	1	
<i>Agrostis canina</i>		19	44	18	33	-	-	-	-	-	-	-	-	
D. <i>Ca-Q polygonatetosum odorati</i>														
<i>Convallaria majalis</i>		62	456	37	223	56	200	25	302	88	1680	62	824	
<i>Moehringia trinervia</i>		-	-	37	17	7	3	22	11	52	104	65	122	
<i>Mycelis muralis</i>		-	-	13	18	-	-	9	5	33	63	44	112	
<i>Galeopsis tetrahit</i>		-	-	16	7	8	12	22	11	37	229	22	37	
<i>Melica nutans</i> (Q-F)		12	88	11	74	5	31	22	25	18	80	43	152	
<i>Hieracium murorum</i>		-	-	13	30	7	11	6	17	18	21	41	90	
<i>Veronica officinalis</i> (C-U)		4	2	21	9	10	5	9	5	12	6	38	55	
<i>Polygonatum odoratum</i>		8	4	3	1	-	-	3	2	32	32	17	30	
<i>Festuca heterophylla</i> (Q-F)		-	-	11	50	2	1	6	119	25	155	11	13	
D. <i>Anemone nemorosa</i> var.														
<i>Carpinus betulus</i> (Q-F)		a-c	58	1187	61	1357	10	184	34	733	7	5	19	185
<i>Oxalis acetosella</i>			19	10	68	563	2	8	50	322	-	-	13	185
<i>Anemone nemorosa</i> (Q-F)			4	0	61	158	2	1	50	161	10	70	30	263
<i>Viola reichenbachiana</i> (Q-F)			4	2	61	167	3	9	34	84	4	2	29	43
<i>Poa nemoralis</i> (Q-F)			4	2	26	49	8	41	50	109	23	66	60	443
<i>Veronica chamaedrys</i>			-	-	32	164	-	-	38	89	3	1	57	124
<i>Fragaria vesca</i>			4	2	26	114	2	1	38	114	3	1	48	87
<i>Atrichum undulatum</i> (Q-F)			-	-	34	41	3	2	28	28	3	1	35	52
<i>Hypericum perforatum</i>			-	-	18	45	3	2	31	30	1	1	38	26
<i>Hypericum maculatum</i> (C-U)			4	2	32	182	2	1	-	-	-	-	2	1
<i>Ajuga reptans</i> (Q-F)			-	-	32	15	-	-	12	20	3	8	25	54
<i>Stellaria holostea</i> (Q-F)			15	6	26	117	-	-	19	66	-	-	2	8
<i>Crataegus monogyna</i>		b-c	-	-	24	28	2	1	3	2	5	3	5	11
<i>Galium boreale</i>			4	19	8	28	-	-	28	81	14	48	22	32
<i>Pyrus communis</i>		b-c	15	10	11	5	7	3	12	6	5	9	21	10
<i>Clinopodium vulgare</i>			-	-	5	3	-	-	9	5	3	1	25	41
Ch. <i>Vaccinio-Picetea</i> (V-P)														
<i>Pinus sylvestris</i>		a-c	54	1863	39	509	44	1227	22	597	58	1961	32	477
<i>Juniperus communis</i>		b-c	4	2	16	8	8	4	22	149	18	9	16	35
<i>Vaccinium myrtillus</i>			100	3540	87	1393	85	2830	56	1884	63	1384	60	915
<i>Pleurozium schreberi</i>			27	48	45	400	15	117	28	134	21	109	30	208
<i>Leucobryum glaucum</i>			15	90	16	53	20	54	6	17	10	58	5	10
<i>Rubus saxatilis</i>			19	62	13	42	6	19	12	20	10	23	22	54
Ch. <i>Quercus-Fagetea</i> (Q-F)														
<i>Fagus sylvatica</i>		a-c	42	319	29	99	12	120	31	422	21	84	27	417
<i>Malus sylvestris</i>		a-c	19	10	26	13	5	3	-	-	3	1	5	2
<i>Corylus avellana</i>		b-c	-	-	8	141	7	12	25	122	32	220	33	176
Ch. <i>Calluno-Ulicetea</i> (C-U)														
<i>Solidago virgaurea</i> s. s.			38	54	18	8	7	3	25	13	23	23	40	33
<i>Agrostis capillaris</i>			27	79	42	336	10	57	28	42	11	12	35	225
<i>Pohlia nutans</i>			27	13	26	13	37	54	31	97	33	82	29	120
<i>Luzula multiflora</i>			15	8	24	24	15	7	25	13	11	35	25	20
<i>Danthonia decumbens</i>			23	29	3	1	3	2	3	2	1	1	-	-
Others														
<i>Betula pendula</i>		a-c	38	237	24	224	24	198	25	13	19	86	16	71
<i>Sorbus aucuparia</i>		a-c	88	56	84	76	59	53	62	69	63	73	71	173
<i>Luzula pilosa</i>			77	125	82	195	76	263	78	322	60	150	75	175
<i>Maianthemum bifolium</i>			65	119	89	504	22	49	69	317	23	66	43	179
<i>Dryopteris carthusiana</i>			46	39	47	34	15	22	38	33	16	14	21	9
<i>Anthoxanthum odoratum</i>			19	10	53	232	15	52	31	150	18	27	44	37
<i>Festuca rubra</i> s. s.			19	27	39	332	15	8	22	11	12	12	37	383
<i>Calamagrostis epigejos</i>			12	23	32	63	12	76	16	166	16	79	17	64
<i>Poa angustifolia</i>			12	6	21	34	14	22	12	20	11	103	24	121
<i>Rubus idaeus</i>			19	10	18	155	7	3	22	25	11	5	17	43
<i>Plagiomnium affine</i>			12	6	11	49	7	40	16	8	14	42	22	52

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics).

1. *Calamagrostio arundinaceae-Quercetum petraeae moliniotosum* typical variant in stage I of degeneration (26 relevés): Brzeg *et al.* (2001), tab. 1: 5 (*Ca-Q moliniotosum* typical variant), 27,29,34,47,48 (*Ca-Q moliniotosum* variant with *Anemone nemorosa*); Krotoska (1966), tab. 21: 1; Krotoska, Piotrowska (1962), tab. 5: 13,15,18,20,21,26 (*Pino-Quercetum*); Kuświk *et al.* (1991), tab. 1: 8 (*Ca-Q moliniotosum*); Macicka (1984), tab. 20: 23 (*Galio-Carpinetum holcetosum*); Macicka & Wilczyńska (1991), tab. 12: 22 (Community from the *Quercion robori-petraeae* alliance); Kasprowicz (orig.), tab. A4: 3; Olaczek (1986), tab. 4: 10 (*Calamagrosti-Quercetum petraeae*); Robińska (1977), tab. 3: 17,19,27,29,30 (*Pino-Quercetum*); Siwczak (1977), tab. 3: 12,25 (*Calamagrostio-Quercetum*); Sroka (1982), tab. 1: 23 (*Calamagrostio-Quercetum*).

2. *Calamagrostio arundinaceae-Quercetum petraeae moliniotosum* variant with *Anemone nemorosa* in stage I of degeneration (38 relevés): Brzeg *et al.* (2001), tab. 1: 6,7,14,16,18,19,33,36,39,41,44,50 (*Ca-Q moliniotosum* variant with *Anemone nemorosa*); Boińska (1973), tab. 50: 5,8,11 (*Fago-Quercetum*); Ferchmin (1980), tab. 17: 12,13 (*Quercus-Carpinetum holcetosum mollis*); Ferchmin (1980), tab. 21: 2 (*Pino-Quercetum*); Gmaj (1997), tab. 9: 1,4 (*Calamagrostio-*

Quercetum convallarietosum), tab. 11: 5 (*Ca-Q* – degeneration forms); Jelinowski (1959), tab. 1: 7,8 (*Pino-Quercetum*); Kamionka (1971), tab. 12: 5,11 (Acidophilous oak forest); Krotoska & Piotrowska (1962), tab. 5: 11,12 (*Pino-Quercetum*); Kubiś (1982), tab. 2: 3,7 (*Galio sylvatici-Carpinetum holcetosum mollis*); Kasprończ (orig.), tab. A5: 17; Robińska (1977), tab. 3: 20 (*Pino-Quercetum*); Sroka (1982), tab. 2: 2 (*Pino-Quercetum*); Sroka (1982), tab. 1: 6,8,10,20,31 (*Calamagrostio-Quercetum*).

3. *Calamagrostio arundinaceae-Quercetum petraeae typicum* typical variant in stage I of degeneration (59 relevés): Brzeg *et al.* (2001), tab. 2: 3,8 (*Ca-Q typicum* typical variant), 10,19,27 (*Ca-Q typicum Anemone nemorosa* var.); Borysiak *et al.* (1988), tab. 2: 11 (*Calamagrostio-Quercetum*); Jaroszewska (2007), tab. 1: 11 (*Ca-Q polygonatetosum odorati*); Kamionka (1971), tab. 12: 15 (Acidophilous oak forest); Krotoska (1978), tab. 1: 1-19, 21,22,26 (*Calamagrostio-Quercetum*); Kubiś (1982), tab. 4: 14 (*Polytrichum attenuatum-Carpinus betulus*); Macicka & Wilczyńska (1991), tab. 12: 17,19 (Community from the *Quercion robori-petraeae* alliance), tab. 17: 12 (*Pino-Quercetum typicum*); Nachotko (1982), tab. 2: 13 (*Ca-Q* form with *Festuca ovina*), tab. 3: 2 (*Ca-Q* form with *Festuca ovina* with share of meso- and thermophilous species); Nachotko (1982), tab. 5: 1 (Oak forest with *Holcus mollis*); Ratyńska (2001), tab. 176: 3 (*Calamagrostio-Quercetum petraeae convallarietosum*); Robińska (1977), tab. 3: 1,3,24,25,32 (*Pino-Quercetum*); Siwczak (1977), tab. 3: 7,24 (*Calamagrostio-Quercetum*); Sroka (1982), tab. 1: 28 (*Calamagrostio-Quercetum*); Szwed (1979), tab. 12: 1 (*Calamagrostio-Quercetum*); Szwed (1979), tab. 16: 19 (*Pino-Quercetum*); Wojterska (2003), tab. 16: 1 (*Ca-Q polygonatetosum*) 8,12 (*Ca-Q typicum*).

4. *Calamagrostio arundinaceae-Quercetum petraeae typicum* variant with *Anemone nemorosa* in stage I of degeneration (32 relevés): Brzeg *et al.* (2001), tab. 2:12,14,17,30,31 (*Ca-Q typicum* variant with *Anemone nemorosa*); Boiński (1973), tab. 50: 14,16,20,22 (*Fago-Quercetum*); Kamionka (1971), tab. 12: 17 (Acidophilous oak forest); Kubiś (1982), tab. 2: 5 (*Galio sylvatici-Carpinetum holcetosum mollis*); Kubiś (1982), tab. 4: 8 (*Polytrichum attenuatum-Carpinus betulus*); Kulińska (1991), tab. 2: 3 (*Calamagrostio-Quercetum typicum*); Macicka & Wilczyńska (1990), tab. 13: 1,6 (Community from the *Quercion robori-petraeae* alliance), tab. 16: 6 (*Pino-Quercetum fagetosum*), tab. 17: 24 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 1 (Community from the *Quercion robori-petraeae* alliance); Wojterska (2003), tab. 16: 10 (*Ca-Q typicum*); tab. 17: 4 (Acidophilous oak forests from the *Quercetia robori-petraeae* class); Nachotko (1982), tab. 4: 4,15 (Oak forest with share of thermophilous species); tab. 5: 3,8,11,12 (Oak forest with *Holcus mollis*); Ryszewska (1977), tab. 5: 1 (*Calamagrostio-Quercetum*); Sroka (1982), tab. 1: 9 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 5: 6 (*Calamagrostio-Quercetum convallarietosum*); tab. 6: 3 (*Calamagrostio-Quercetum convallarietosum*).

5. *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati* typical variant in stage I of degeneration (73 relevés): Brzeg *et al.* (2001), tab. 3: 3 (*Ca-Q polygonatetosum* typical variant); Fabiszewski & Faliński (1967), tab. 9: 2-4 (*Calamagrostio-Quercetum*); Hegenbart-Magdans & Brzeg (1999), tab. 1: 3,4,11,12,13,19,21,23-26,28,31,32 (*Ca-Q polygonatetosum*); tab. 5: 6-9 (*Potentillo albae-Quercetum*); Jaroszewska (2007), tab. 1: 1,4-7 (*Ca-Q polygonatetosum*); Kamionka (1971), tab. 12: 16 (Acidophilous oak forest); Krotoska (1978), tab. 1: 20,25 (*Calamagrostio-Quercetum*); Macicka & Wilczyńska (1990), tab. 16: 7 (*Pino-Quercetum fagetosum*), tab. 17: 7 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 20 (Community from the *Quercion robori-petraeae* alliance), tab. 13: 3 (*Calamagrostio-Quercetum*), tab. 14: 11-13 (*Pino-Quercetum*); Wojterska (1976), tab. 11: 5 (*Pino-Quercetum*); Nachotko (1982), tab. 1: 2,7,8 (*Calamagrostio-Quercetum* form with *Calamagrostis arundinacea*), tab. 2: 9,14 (*Ca-Q* form with *Festuca ovina*), tab. 4: 2,12,16,18,20 (Oak forest with share of thermophilous species); Olaczek (1986), tab. 4: 1,7 (*Calamagrostio-Quercetum petraeae*); Ratyńska (2001), tab. 176: 2 (*Calamagrostio-Quercetum petraeae convallarietosum*); Robińska (1977), tab. 3: 2,9,18,21 (*Pino-Quercetum*); Siwczak (1977), tab. 3: 1,3-6,22,26 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 5: 11 (*Calamagrostio-Quercetum convallarietosum*), tab. 6: 7 (*Calamagrostio-Quercetum convallarietosum*).

6. *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati* variant with *Anemone nemorosa* in stage I of degeneration (63 relevés): Brzeg *et al.* (2001), tab. 3: 7,10,11 (*Ca-Q polygonatetosum* typical variant), 20,37 (*Ca-Q polygonatetosum Anemone nemorosa* var.); Ferchmin (1980), tab. 17: 7 (*Quercio-Carpinetum holcetosum mollis*); Gmaj (1997), tab. 9: 9,11,13 (*Calamagrostio-Quercetum convallarietosum*); Hegenbart-Magdans & Brzeg (1999), tab. 3: 1 (Other forms of degeneration of *Calamagrostio-Quercetum*); Jaroszewska (2007), tab. 1: 9 (*Ca-Q polygonatetosum odorati*), tab. 4: 6 (*Potentillo albae-Quercetum* – degenerated or impoverished forms); Kamionka (1971), tab. 12: 4,6,9 (Acidophilous oak forest); Krotoska (1991), tab. 10: 6,7,11 (*Calamagrostio-Quercetum*), 14,17-19,21 (*Ca-Q* – degenerated forms); Kubiś (1982), tab. 2: 8 (*Galio-Carpinetum holcetosum mollis*); Marcysiak (2001), tab. 1: 13 (Community *Pinus-Quercus*); Macicka & Wilczyńska (1990), tab. 13: 12,17,22 (Community from the *Quercion robori-petraeae* alliance); Macicka & Wilczyńska (1990), tab. 16: 10 (*Pino-Quercetum fagetosum*), tab. 17: 9 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 12: 6,7 (Community from the *Quercion robori-petraeae* alliance); tab. 13: 1,2,4 (*Calamagrostio-Quercetum*); Nachotko (1982), tab. 1: 1,10 (*Calamagrostio-Quercetum* form with *Calamagrostis arundinacea*), tab. 3: 5,7 (*Calamagrostio-Quercetum* form with *Festuca ovina*), tab. 4: 7,8,10,17 (Oak forest with share of thermophilous species), tab. 5: 2,5,7,13 (Oak forest with *Holcus mollis*); tab. 6: 4 (Oak forest from the *Quercio-Fagetea* class); Olaczek (1986), tab. 4: 6 (*Calamagrostio-Quercetum petraeae*); Ratyńska (2001), tab. 176: 1 (*Calamagrostio-Quercetum petraeae convallarietosum*); Robińska (1977), tab. 3: 14,16 (*Pino-Quercetum*); Ryszewska (1977), tab. 5: 2,3,4 (*Calamagrostio-Quercetum*); Siwczak (1977), tab. 3: 2,29,30 (*Calamagrostio-Quercetum*); Zielińska (1994), tab. 5: 3, tab. 6: 1 (*Calamagrostio-Quercetum convallarietosum*), tab. 6: 1 (*Calamagrostio-Quercetum convallarietosum*).

Table 10. Floristic differentiation of *Galio sylvatici-Carpinetum* reflecting habitat variation and human impact: untransformed communities (col. 1, 3-5), transformed form (col. 2, 6, 7, 8), and substitute forest communities (col. 9). Mainly acidophilous forms of this association are included

Successive number of syntaxon		1	2	3	4	5	6						
Subassociation			holcetosum				calamagr.	lathyr.					
Number of relevés		81	30	12	12	9	16						
Number of taxa		256	213	122	136	98	115						
Mean number of taxa in relevé		34	34	30	40	34	40						
*Ch. <i>Carpinion betuli</i> et ^Ch., D. <i>Galio sylvatici-Carpinetum</i>													
<i>Carpinus betulus</i> *	a	80	3702	27	404	67	3917	58	900	67	1112	75	2578
<i>Carpinus betulus</i> *	b-c	88	795	50	278	7	471	67	562	100	1227	100	1441
<i>Tilia cordata</i> *	a	12	350	7	34	50	1312	58	1792	11	56	31	610
<i>Tilia cordata</i> *	b-c	16	280	7	18	58	613	50	488	56	478	81	972
<i>Acer campestre</i>	a	1	1	3	17	8	38	8	313	-	-	-	-
<i>Acer campestre</i>	b-c	6	3	-	-	23	20	8	46	-	-	-	-
<i>Stellaria holostea</i> *		63	733	40	132	42	238	67	738	78	389	94	831
<i>Festuca heterophylla</i>		19	31	17	68	17	8	42	58	56	506	81	444
<i>Galium sylvaticum</i> ^		4	7	7	3	-	-	25	500	33	117	62	463
<i>Dactylis polygama</i> *		17	81	10	20	17	8	33	54	33	67	69	572
<i>Ranunculus auricomus</i> ^		11	11	-	-	8	4	33	54	-	-	25	69
D. <i>Galio sylvatici-Carpinetum holcetosum mollis</i>													
<i>Quercus robur</i>	a	95	4266	83	4427	83	3646	75	3230	44	2222	13	891
<i>Quercus robur</i>	b-c	73	158	80	119	58	71	50	71	11	6	13	65
<i>Frangula alnus</i>		79	241	90	720	33	24	58	558	11	6	-	-
<i>Polytrichastrum formosum</i>		84	496	43	205	50	100	25	13	67	461	19	222
<i>Holcus mollis</i> (Qrp)		68	687	70	982	58	1108	83	1129	11	417	12	6
<i>Pohlia nutans</i> (C-U)		15	19	17	8	42	58	58	67	-	-	-	-
<i>Dicranella heteromalla</i> (Qrp)		32	33	23	27	50	63	33	92	-	-	-	-
<i>Deschampsia flexuosa</i>		11	38	17	38	17	46	42	238	-	-	-	-
<i>Hypnum cupressiforme</i>		30	31	27	43	17	8	25	13	-	-	-	-
<i>Melampyrum pratense</i>		27	64	50	178	33	196	25	13	-	-	-	-
<i>Festuca ovina</i> (Qrp)		16	14	20	148	25	13	25	50	-	-	-	-
<i>Hieracium laevigatum</i> (Qrp)		19	52	7	3	17	46	17	46	-	-	6	1
D. <i>Gs-C holcetosum mollis</i> variant with <i>Lysimachia vulgaris</i> (moist form)													
<i>Oxalis acetosella</i>		81	811	77	295	-	-	17	8	44	583	19	94
<i>Deschampsia caespitosa</i>		72	158	47	23	-	-	-	-	22	11	6	3
<i>Dryopteris carthusiana</i>		54	81	60	119	8	4	17	8	11	6	6	3
<i>Lysimachia vulgaris</i>		31	48	53	127	-	-	-	-	11	6	-	-
<i>Carex pallescens</i> (C-U)		49	36	30	30	8	4	-	-	-	-	25	41
<i>Carex pilulifera</i> (Qrp)		46	60	27	13	25	13	8	4	11	6	-	-
D. <i>Gs-C holcetosum mollis</i> variant with <i>Solidago virgaurea</i>													
<i>Solidago virgaurea</i> s. s. (C-U)		26	35	20	67	8	4	83	304	11	6	44	50
<i>Melampyrum nemorosum</i> *		22	125	10	5	8	4	83	1042	44	172	31	228
<i>Hypericum perforatum</i> (T-G)		12	6	20	25	-	-	58	29	-	-	12	6
<i>Brachypodium sylvaticum</i> (Q-F)		17	119	30	158	8	4	50	242	-	-	6	31
D. group of moderately dry subassociations													
<i>Quercus petraea</i>	a	15	535	20	1074	33	1646	50	2526	67	2389	81	3375
<i>Quercus petraea</i>	b-c	14	86	17	43	33	21	50	263	44	466	63	203
<i>Hieracium sabaudum</i> (Qrp)		15	18	13	5	8	4	58	179	56	78	69	175
<i>Campanula persicifolia</i> (Q-F)		-	-	3	2	-	-	67	183	44	22	56	28
<i>Convallaria majalis</i>		36	246	33	47	17	354	42	58	67	1094	75	1597
<i>Calamagrostis arundinacea</i> (Qrp)		16	189	27	115	-	-	-	-	89	2894	88	2253
<i>Lathyrus montanus</i> (Qrp)		11	33	7	18	8	4	-	-	78	328	81	684
<i>Mycelis muralis</i> (Av)		32	33	60	132	33	17	17	8	89	94	69	119
<i>Galeobdolon luteum</i> (Q-F)		20	63	10	200	17	46	8	146	67	183	75	644
<i>Carex digitata</i> (Q-F)		16	57	23	42	17	150	-	-	89	194	69	253
<i>Galium odoratum</i> (Q-F)		7	36	-	-	-	-	-	-	44	400	81	1447
<i>Viola riviniana</i> (Q-F)		15	45	13	78	8	4	-	-	56	128	62	200
<i>Hieracium lachenalii</i> (Qrp)		25	29	20	25	17	8	33	129	67	83	56	84
<i>Hepatica nobilis</i> (Q-F)		2	1	7	3	-	-	-	-	22	250	69	550
<i>Astragalus glycyphyllos</i> (T-G)		2	7	7	3	-	-	-	-	33	67	31	44
<i>Galium boreale</i>		-	-	3	17	-	-	-	-	33	206	25	41
<i>Vicia sepium</i> (T-G)		5	2	-	-	-	-	-	-	22	61	31	44
<i>Trifolium alpestre</i> (T-G)		1	1	-	-	-	-	8	4	22	11	31	16
<i>Lilium martagon</i> (Q-F)		-	-	7	3	-	-	-	-	11	6	31	44
<i>Clinopodium vulgare</i> (T-G)		5	2	3	2	17	8	25	50	-	-	19	38
D. <i>Galio sylvatici-Carpinetum calamagrostietosum</i>													
<i>Vaccinium myrtillus</i> (V-P)		49	459	70	1515	58	479	58	696	100	339	44	106
<i>Leucobryum glaucum</i> V-P)		2	1	-	-	-	-	-	-	56	28	25	41
<i>Trientalis europaea</i> (V-P)		19	26	33	32	-	-	-	-	44	72	-	-
<i>Campanula rotundifolia</i>		2	1	10	5	-	-	8	42	44	222	6	31
<i>Polygonatum odoratum</i> (T-G)		1	1	-	-	-	-	-	-	22	11	6	3
D. <i>Galio sylvatici-Carpinetum lathyretosum</i>													
<i>Sorbus torminalis</i>	a2	1	1	-	-	-	-	-	-	-	-	6	31
<i>Sorbus torminalis</i>	b-c	5	3	-	-	-	-	-	-	11	6	25	100
<i>Lathyrus niger</i> (Q-F)		1	1	-	-	-	-	-	-	11	6	94	344
<i>Pulmonaria obscura</i> (Q-F)		12	28	10	5	8	4	25	50	-	-	69	544
<i>Dactylis glomerata</i>		14	7	10	5	17	8	33	54	33	67	69	572
<i>Lathyrus vernus</i> (Q-F)		1	1	-	-	8	4	-	-	-	-	62	481

7 <i>typicum</i>	8 Ox-Pi	9 SFC
14	10	42
121	87	266
28	27	29
93 5339	90 4550	7 66
100 1179	90 285	17 33
36 557	- -	7 55
43 339	- -	12 16
8 4	- -	- -
23 12	- -	7 3
29 257	- -	12 57
- -	10 5	10 56
- -	- -	- -
15 42	- -	26 107
57 29	- -	- -
100 3899	20 975	45 2085
71 269	20 10	36 138
50 254	90 270	55 212
14 7	- -	17 60
- -	60 120	19 299
- -	- -	10 5
- -	- -	5 2
- -	10 5	19 152
- -	- -	7 36
8 4	10 50	19 93
7 4	10 5	19 20
- -	- -	5 13
79 875	100 5750	33 170
86 43	10 175	14 7
14 7	70 125	36 50
7 4	40 231	2 1
14 7	10 5	2 1
7 4	60 30	10 5
- -	- -	7 14
- -	- -	2 12
- -	10 5	33 17
29 168	10 5	45 363
- -	- -	50 2245
- -	10 5	38 231
50 25	- -	5 13
- -	- -	2 1
29 168	- -	31 326
- -	10 5	19 170
- -	30 15	- -
14 7	60 120	50 276
29 143	- -	12 149
43 86	- -	10 174
- -	- -	5 101
7 4	- -	17 19
21 11	- -	21 10
- -	- -	14 28
- -	20 6	2 1
- -	- -	5 2
7 4	- -	5 2
- -	- -	- -
- -	- -	5 2
- -	- -	12 17
64 129	70 125	48 725
- -	- -	- -
- -	40 20	2 12
- -	- -	12 17
7 36	10 5	12 17
- -	- -	- -
- -	- -	- -
- -	- -	- -
- -	- -	2 1
7 36	- -	5 13
- -	- -	10 26
- -	- -	2 1

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics).

1. *Galio sylvatici-Carpinetum holcetosum mollis* variant with *Lysimachia vulgaris* (81 relevés): Boinński (1973): tab. 50: 1,3,6,7 (*Fago-Quercetum holcetosum mollis*); Ferchmin (1966), tab. 8: 2-4,5,7-9 (*Quercus-Carpinetum calamagrostietosum*); Ferchmin (1980), tab. 17: 8 (*Quercus-Carpinetum*), 15 (*Quercus-Carpinetum holcetosum mollis*); Jelinowski (1958), tab. 1: 11,18-20,27 (*Pino-Quercetum*); Kamionka (1971), tab. 10: 15-20,25 (*Galio-Carpinetum holcetosum*); Krotoska (1966), tab. 10: 1-4,6-12,14 (*Galio-Carpinetum holcetosum*), tab. 11: 1-5 (*Galio-Carpinetum holcetosum mollis* – typical variant, form with *Vaccinium myrtillus*); Krotoska & Piotrowska (1962), tab. 5: 1,3-5,16,17,19 (*Pino-Quercetum*); Kubiś (1982), tab. 2: 1,2 (*Galio-Carpinetum holcetosum mollis*); Macicka (1984), tab. 10: 37,41,44,45 (*Gs-C holcetosum*); Macicka & Wilczyńska (1990), tab. 9: 2-7,9,10,13,14,29 (*Gs-C holcetosum*); Macicka & Wilczyńska (1991), tab. 9: 1-5,9 (*Gs-C holcetosum*); Macicka & Wilczyńska (1992), tab. 4: 29 (*Gs-C holcetosum*); Kasprzowicz (orig.), tab. A20: 40,44 (*Gs-C holcetosum mollis*); Sroka (1982), tab. 1: 19 (*Calamagrostio-Quercetum*), Wojterska (2003), tab. 14: 28,31 (*Gs-C holcetosum mollis*).

2. *Galio sylvatici-Carpinetum holcetosum mollis* – degenerated forms (30 relevés): Boinński (1973): tab. 50: 18 (*Fago-Quercetum holcetosum mollis*); Ferchmin (1966), tab. 8: 6,16 (*Quercus-Carpinetum calamagrostietosum*); Gmaj (1997), tab. 4: 7 (*Gs-C holcetosum mollis*); Jelinowski (1958), tab. 1: 14,22,26 (*Pino-Quercetum*); Krotoska (1991), tab. 6: 2,4,5 (*Galio-Carpinetum* – form of deformation with the share of some acidophilous species); Krotoska & Piotrowska (1962), tab. 5: 6,23,24,30 (*Pino-Quercetum*); Lisiewska & Reszel (2000), tab. 3: 5 (*Carex brizoides-Quercus*); Macicka (1984), tab. 10: 40,42 (*Gs-C holcetosum*), tab. 20: 8 (*Pino-Quercetum*); Macicka & Wilczyńska (1990), tab. 9: 1,8,11 (*Gs-C holcetosum*); Macicka & Wilczyńska (1992), 4: 25,26 (*Gs-C holcetosum*); Macicka-Pawlik & Wilczyńska (1996), tab. 31: 3 (Substitute forest communities); Pawlow & Czech (1959), tab. 3: 4,6 (Mixed coniferous forest); Wojterska (2003), tab. 14: 33 (*Galio sylvatici-Carpinetum holcetosum mollis*), tab. 16: 17 (*Calamagrostio-Quercetum molinietosum*), tab. 17: 3,8 (Acidophilous oak forests from the *Quercetea roburi-petraeae* class).

3. *Galio sylvatici-Carpinetum holcetosum mollis* typical variant (12 relevés): Ferchmin (1966), tab. 8: 10 (*Quercus-Carpinetum calamagrostietosum*); Kamionka (1971), tab. 10: 21,23,24 (*Galio-Carpinetum holcetosum*); Macicka & Wilczyńska (1991), tab. 9: 6,8,11 (*Gs-C holcetosum*); Macicka & Wilczyńska (1992), tab. 4: 22-24,28 (*Gs-C holcetosum*); Maciejewska-Rutkowska *et al.* (2001), tab. 2: 1 (*Gs-C holcetosum*).

4. *Galio sylvatici-Carpinetum holcetosum mollis* variant with *Solidago virgaurea* (12 relevés): Kamionka (1971), tab. 10: 22 (*Galio-Carpinetum holcetosum*); Macicka (1984), tab. 10: 47 (*Gs-C holcetosum*); Macicka & Wilczyńska (1990), tab. 9: 12 (*Gs-C holcetosum*); Macicka & Wilczyńska (1991), tab. 9: 7,10,12-14 (*Gs-C holcetosum*); Macicka & Wilczyńska (1992), tab. 4: 18-21 (*Gs-C holcetosum*).

5. *Galio sylvatici-Carpinetum calamagrostietosum arundinaceae* (9 relevés): Boinński (1973), tab. 31: 12, 14-17, 19,20,22 (*Galio sylvatici-Carpinetum calamagrostietosum*), tab. 50: 12 (*Fago-Quercetum holcetosum mollis*).

6. *Galio sylvatici-Carpinetum lathyretosum verni* (16 relevés): Boinński (1973), tab. 31: 1-11, 13, 18,21,23 (*Galio sylvatici-Carpinetum calamagrostietosum*); Wojterska (2003), tab. 14: 36 (*Potentillo albae-Quercetum*).

7. *Galio sylvatici-Carpinetum typicum* – impoverished form (14 relevés): Brzeg (1989), tab. 22: 6-10,13,14 (*Galio sylvatici-Carpinetum*); Krotoska (1966), tab. 10: 5,13,15-17 (*Galio sylvatici-Carpinetum holcetosum mollis*); Macicka (1984), tab. 10: 38 (*Galio sylvatici-Carpinetum holcetosum*); Wojterska (2003), tab. 14: 34 (*Galio sylvatici-Carpinetum holcetosum*).

8. Community *Oxalis acetosella-Pinus sylvestris* (10 relevés): Ferchmin (1966), tab. 8: 9,15,17-23 (*Quercus-Carpinetum*

Successive number of syntaxon		1		2		3		4		5		6	
<i>Carex montana</i> (Q-F)		-	-	-	-	-	-	-	-	-	-	62	469
<i>Phyteuma spicatum</i> (Q-F)		1	1	-	-	-	-	25	13	22	11	50	138
<i>Hypericum montanum</i> (Q-F)		2	1	3	0	-	-	-	-	-	-	44	22
<i>Vicia cassubica</i> (T-G)		1	6	7	60	-	-	-	-	11	56	38	19
<i>Campanula rapunculoides</i> (T-G)		-	-	-	-	-	-	-	-	-	-	25	350
<i>Brachypodium pinnatum</i> (F-B)		-	-	-	-	-	-	-	-	-	-	25	331
Ch. <i>Quercus-Fagetum</i> (Q-F)													
<i>Fagus sylvatica</i>	a	23	334	17	227	8	459	8	42	44	1056	25	1266
<i>Fagus sylvatica</i>	b-c	41	67	27	276	8	8	17	4	67	745	44	615
<i>Fraxinus excelsior</i>	a-c	9	11	13	63	33	50	25	17	-	-	-	-
<i>Acer pseudoplatanus</i>		1	6	3	58	8	188	-	-	-	-	6	140
<i>Acer pseudoplatanus</i>	b-c	9	4	7	20	25	50	8	4	33	17	56	400
<i>Corylus avellana</i>	b-c	22	494	30	242	25	238	58	713	11	6	6	3
<i>Padus avium</i>	a-c	10	86	13	114	67	146	33	205	-	-	-	-
<i>Viburnum opulus</i>	b-c	9	15	7	3	17	8	8	4	-	-	-	-
<i>Anemone nemorosa</i>		80	571	47	177	58	179	33	571	44	500	81	953
<i>Viola reichenbachiana</i>		56	198	43	150	92	300	100	521	67	183	69	91
<i>Atrichum undulatum</i>		69	210	40	50	50	175	67	33	22	11	38	334
<i>Poa nemoralis</i>		67	485	47	248	100	3275	100	2646	89	2261	100	1184
<i>Melica nutans</i>		28	147	43	468	58	696	42	379	78	378	75	644
<i>Ajuga reptans</i>		44	72	27	28	25	13	25	50	-	-	19	66
<i>Milium effusum</i>		42	146	37	213	-	-	8	4	56	267	44	50
<i>Scrophularia nodosa</i>		36	18	27	27	8	4	25	13	56	78	62	31
<i>Polygonatum multiflorum</i>		26	24	3	2	17	8	17	8	11	6	38	19
<i>Eurhynchium angustirete</i>		16	14	7	3	17	8	-	-	11	6	31	72
<i>Platanthera bifolia</i>		2	1	3	2	-	-	-	-	22	11	19	38
<i>Dryopteris filix-mas</i>		27	36	10	20	17	83	8	4	11	6	12	6
<i>Sanicula europaea</i>		26	57	10	35	17	8	33	17	-	-	25	41
<i>Festuca gigantea</i>		22	32	30	87	-	-	25	13	-	-	-	-
<i>Adoxa moschatellina</i>		9	10	3	17	-	-	33	196	-	-	6	3
<i>Stachys sylvatica</i>		5	1	-	-	8	4	33	17	-	-	-	-
<i>Carex sylvatica</i>		23	23	3	2	-	-	-	-	-	-	6	3
<i>Viola reichenbachiana et riviniana</i>		11	11	10	50	-	-	-	-	-	-	-	-
<i>Anemone ranunculoides</i>		-	-	-	-	-	-	-	-	-	-	-	-
<i>Ulmus minor</i>	a	-	-	-	-	-	-	-	-	-	-	-	-
<i>Ulmus minor</i>	b-c	1	6	7	4	-	-	-	-	6	1	-	-
Ch. <i>Artemisietum vulgaris</i>													
<i>Moehringia trinervia</i>		43	144	60	75	83	296	67	146	22	11	12	34
<i>Aegopodium podagraria</i>		11	6	3	2	33	54	33	233	11	6	44	184
<i>Geranium robertianum</i>		7	4	17	8	33	54	33	17	-	-	-	-
<i>Galeopsis pubescens</i>		11	11	20	10	25	13	58	67	-	-	-	-
<i>Geum urbanum</i>		14	7	13	7	17	8	42	21	-	-	12	6
<i>Heracleum sphondylium</i>		-	-	-	-	-	-	42	21	-	-	-	-
<i>Urtica dioica</i>		4	2	23	12	8	4	25	13	-	-	-	-
<i>Impatiens parviflora</i>		11	68	17	95	42	717	8	42	-	-	-	-
<i>Rubus caesius</i>		11	6	3	2	-	-	17	8	-	-	-	-
Ch. <i>Vaccinio-Piceetum</i> (V-P)													
<i>Picea abies</i>	a	6	57	10	93	8	42	-	-	-	-	-	-
<i>Picea abies</i>	b-c	36	232	47	502	-	-	-	-	11	61	-	-
<i>Pinus sylvestris</i>	a	14	88	37	1551	17	46	8	4	-	-	-	-
<i>Pinus sylvestris</i>	b-c	5	1	10	5	-	-	8	4	-	-	6	3
<i>Rubus saxatilis</i>		5	8	10	62	17	8	-	-	22	11	-	-
<i>Galium rotundifolium</i>		14	44	10	35	-	-	-	-	-	-	-	-
<i>Pleurozium schreberi</i>		4	23	20	25	17	46	-	-	33	167	25	41
Others													
<i>Betula pendula</i>	a	20	157	20	77	42	404	42	133	-	-	-	-
<i>Betula pendula</i>	b-c	5	3	10	5	8	4	8	8	22	11	-	-
<i>Sorbus aucuparia</i>	a	-	-	10	20	-	-	17	83	-	-	-	-
<i>Sorbus aucuparia</i>	b-c	84	91	97	140	75	79	75	196	78	95	75	38
<i>Pyrus communis</i>	a-c	5	2	17	8	17	8	42	104	11	6	6	3
<i>Crataegus monogyna</i>	b-c	20	12	13	7	33	17	42	58	-	-	19	97
<i>Euonymus europaea</i>	b-c	12	7	13	8	25	12	50	71	-	-	12	6
<i>Populus tremula</i>	a-c	9	40	13	23	25	50	25	50	-	-	19	66
<i>Abies alba</i>	a	1	6	-	-	-	-	-	-	-	-	-	-
<i>Abies alba</i>	c	2	1	-	-	-	-	-	-	-	-	-	-
<i>Sambucus nigra</i>	b-c	5	8	7	5	25	50	17	8	-	-	-	-
<i>Luzula pilosa</i>		81	409	57	130	50	333	33	17	44	72	56	84
<i>Maianthemum bifolium</i>		86	672	63	328	42	379	50	279	67	511	81	506
<i>Veronica chamaedrys</i>		38	95	37	119	25	13	83	154	67	322	88	206
<i>Pteridium aquilinum</i>		21	293	47	388	17	46	-	-	33	17	44	78
<i>Fragaria vesca</i> (T-G)		25	72	50	168	42	58	33	17	11	194	25	41
<i>Rubus idaeus</i>		25	46	50	182	33	54	8	4	22	11	-	-
<i>Agrostis capillaris</i> (C-U)		10	31	33	217	8	4	25	13	22	200	-	-
<i>Veronica officinalis</i> (C-U)		25	18	30	30	33	17	42	58	22	11	6	3
<i>Stellaria media</i>		11	22	13	22	33	129	50	25	-	-	-	-
<i>Hieracium murorum</i>		32	33	17	23	58	142	17	8	-	-	31	16
<i>Anthoxanthum odoratum</i>		11	38	27	43	17	46	33	17	44	261	6	3
<i>Athyrium filix-femina</i>		23	94	17	23	-	-	-	-	33	428	-	-
<i>Brachythecium rutabulum</i>		5	2	13	7	8	4	17	8	-	-	-	-

7		8		9	
-	-	-	-	-	-
7	36	-	-	2	1
-	-	-	-	10	4
-	-	-	-	5	2
-	-	-	-	-	-
-	-	-	-	-	-
14	71	20	350	5	125
-	-	-	-	19	31
43	154	10	50	17	43
-	-	-	-	5	101
14	8	-	-	14	19
7	4	20	15	24	320
-	-	20	385	17	71
14	8	10	5	5	2
79	2232	90	730	24	273
57	189	90	530	45	138
71	407	10	5	21	102
21	11	10	5	57	496
36	50	70	80	60	425
71	100	90	135	10	5
14	7	-	-	24	85
50	22	10	5	17	18
14	7	-	-	-	-
7	4	-	-	-	-
14	7	-	-	2	42
21	43	40	20	24	231
7	4	-	-	2	12
7	4	10	5	26	35
-	-	-	-	10	4
14	7	-	-	2	1
29	168	-	-	2	42
36	139	-	-	5	43
21	43	-	-	-	-
29	200	-	-	-	-
21	43	-	-	-	-
36	18	100	865	74	496
43	329	-	-	7	4
7	4	10	50	31	265
-	-	40	61	26	34
7	4	-	-	29	36
-	-	-	-	2	1
7	4	10	5	21	54
-	-	10	175	19	310
50	146	10	5	12	17
-	-	10	350	5	143
-	-	20	10	10	57
21	76	100	4050	60	2047
-	-	10	5	5	3
-	-	80	85	14	110
-	-	70	760	7	14
-	-	-	-	24	63
64	275	20	100	26	180
7	4	-	-	14	22
29	168	-	-	5	54
64	161	80	230	64	157
7	1	-	-	12	16
7	4	-	-	12	8
29	50	10	55	5	13
21	132	-	-	14	48
-	-	-	-	-	-
-	-	40	16	-	-
7	1	40	20	12	17
64	64	60	30	52	139
100	332	70	655	26	24
43	16	10	5	43	236
21	11	50	21	48	467
21	11	40	65	45	188
7	4	20	55	48	199
7	36	-	-	24	155
7	4	30	15	17	70
-	-	60	75	5	2
14	7	30	15	21	109
-	-	-	-	26	45
14	7	50	25	2	12
36	18	-	-	5	13

calamagrostietosum variant with *Pinus sylvestris*); Ferchmin (1980), tab. 17: 9 (*Quercus-Carpinetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 31: 11 (Substitute forest communities).

9. Substitute forest communities on the habitat of forests from the *Quercus-Fagetum* class (42 relevés): Berdowski, Kwiatkowski (1992), tab. 7: 3,7 (*Quercus roboris-Pinetum*); Ferchmin (1980), tab. 19: 5,7,10,13 (*Potentillo albae-Quercetum*); Gmaj (1997), tab. 4: 8,9 (*Gs-C holcetosum mollis*), tab. 9: 12,19 (*Calamagrostio arundinaceae-Quercetum*); Jakubowska-Gabara (1994), tab. 1: 15 (*Pinus-Rubus* - secondary community of *Potentillo albae-Quercetum*); Jaroszewska (2007), tab. 4: 7 (*Potentillo albae-Quercetum* - degenerated form); Krotoska 1991, tab. 6: 1,3,6,8 (*Galio-Carpinetum* - form of deformation with the share of some acidophilous species); Macicka (1984), tab. 10: 39,46,48 (*Gs-C holcetosum*), tab. 20: 20 (*Pino-Quercetum*), tab. 29: 4 (Plantation of pine on habitat of deciduous and mixed forests); Macicka & Wilczyńska (1990), tab. 16: 3 (*Pino-Quercetum fagetosum*); Macicka & Wilczyńska (1991), tab. 14: 9 (*Pino-Quercetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 31: 19 (Substitute forest communities); Marcysiak (2001), tab. 1: 12 (*Potentillo albae-Quercetum*); Nachotko (1982), tab. 6:1,2,7 (Oak forest from the *Quercus-Fagetum* class); Pawłow & Czech (1959), tab. 3: 5,7,21 (Mixed coniferous forest); Ryszewska (1977), tab. 5: 5 (*Calamagrostio-Quercetum*); Wojterska (2003), tab. 14: 27,29,30,32 (*Galio sylvatici-Carpinetum holcetosum mollis*), 38 (*Potentillo albae-Quercetum*; Zielińska (1994), tab. 5: 14-16 (*Calamagrostio-Quercetum convallarietosum*).

Table 11. Floristic differentiation of *Potentillo albae-Quercetum* reflecting habitat variation and human impact: untransformed communities (col. 1-8), stage II of degeneration (col. 9-11), and substitute forest communities (col. 12-14)

Successive number of syntaxon	1	2	3	4	5	6	7	8								
Number of relevés	9	4	6	7	11	23	23	15								
Number of taxa	126	132	155	123	111	204	186	200								
Mean number of taxa in relevé	72	81	64	43	49	69	65	56								
*Ch., ^D. <i>Potentillo albae-Quercetum</i>																
Ch. <i>Quercetalia pubescentis</i>																
<i>Campanula persicifolia</i>	67	83	75	28	67	108	57	29	64	155	91	259	96	191	100	219
<i>Galium boreale</i> ^ (M-A)	67	133	100	588	100	200	71	100	100	491	96	450	96	773	73	497
<i>Betonica officinalis</i> ^ (M-A)	100	1367	100	30	100	200	29	14	73	33	70	230	91	293	60	141
<i>Carex montana</i> ^	78	756	100	275	100	350	86	171	-	-	91	448	83	394	67	591
<i>Ranunculus polyanthemus</i> *	89	194	75	38	50	18	29	9	36	15	74	51	83	64	20	9
<i>Lathyrus niger</i>	89	622	-	-	-	-	43	86	100	255	4	22	13	5	73	363
<i>Potentilla alba</i> *	-	-	100	255	100	200	43	16	91	250	74	652	91	1116	67	331
<i>Primula veris</i>	-	-	-	-	17	2	14	7	18	9	22	9	68	34	25	13
<i>Hypericum montanum</i>	33	17	-	-	-	-	43	86	64	73	30	35	35	31	80	41
<i>Platanthera bifolia</i>	-	-	25	13	67	33	-	-	9	5	4	0	22	8	-	-
<i>Pulmonaria angustifolia</i> *	-	-	-	-	17	2	-	-	-	-	52	163	74	237	13	34
<i>Festuca amethystina</i> subsp. <i>ritschlii</i> *	-	-	-	-	-	-	14	7	-	-	17	5	9	3	-	-
D. Group of moist subassociations																
<i>Succisa pratensis</i> (M-A)	100	489	75	263	50	18	14	1	-	-	-	-	5	2	-	-
<i>Deschampsia caespitosa</i> (M-A)	56	28	100	588	50	592	14	7	-	-	9	3	22	6	27	13
<i>Carex pallescens</i> (C-U)	56	78	100	50	67	183	-	-	-	-	13	26	14	3	6	3
<i>Hieracium sabaudum</i> (Qrp)	78	139	75	263	50	93	-	-	-	-	13	5	-	-	6	3
<i>Selinum carvifolia</i> (M-A)	44	22	75	150	33	92	-	-	-	-	4	2	14	7	-	-
<i>Scorzonera humilis</i> (C-U)	56	28	-	-	50	12	14	7	-	-	13	5	-	-	12	6
<i>Ranunculus acris</i> s. s. (M-A)	67	33	50	138	17	2	-	-	-	-	-	-	-	-	6	3
D. <i>Pa-Q astrantietosum</i>																
<i>Viburnum opulus</i> (Q-F)	b-c	67	56	-	-	-	-	-	18	9	-	-	-	-	12	6
<i>Pyrus communis</i>	a-c	78	117	-	-	-	14	7	-	-	13	5	-	-	12	6
<i>Cornus sanguinea</i>	b-c	44	89	-	-	17	8	-	-	-	-	-	-	-	-	-
<i>Euonymus europaea</i>	b-c	44	22	-	-	17	8	14	7	-	-	-	5	2	-	-
<i>Populus tremula</i>	a-c	67	161	-	-	17	8	-	-	-	9	7	5	25	6	3
<i>Crataegus monogyna</i>	b-c	78	272	-	-	33	17	29	14	-	26	10	14	5	12	9
<i>Galium schultesii</i> (Q-F)	100	3000	-	-	-	-	14	71	-	-	4	22	-	-	19	222
<i>Melampyrum nemorosum</i> (Q-F)	100	1950	-	-	-	-	14	7	-	-	4	2	-	-	25	203
<i>Serratula tinctoria</i> (M-A)	100	1144	-	-	17	8	43	86	-	-	13	26	13	3	33	75
<i>Melittis melissophyllum</i> (Q-F)	89	622	-	-	-	-	14	7	-	-	-	-	-	-	6	31
<i>Campanula glomerata</i> (M-A)	89	194	-	-	17	8	-	-	-	-	4	2	5	2	6	3
<i>Hieracium umbellatum</i> (Qrp)	89	194	-	-	17	8	14	7	-	-	9	24	-	-	6	3
<i>Holcus mollis</i> (Qrp)	78	428	-	-	-	-	-	-	-	-	4	22	5	80	44	78
<i>Laserpitium prutenicum</i> (M-A)	89	333	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Angelica sylvestris</i> (M-A)	89	244	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Peucedanum cervaria</i> (T-G)	67	33	-	-	-	-	-	-	-	-	17	3	14	5	6	3
<i>Stellaria graminea</i> (M-A)	67	133	-	-	-	-	-	-	9	5	-	-	-	-	12	34
<i>Astrantia major</i> (Q-F)	56	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Hypochoeris maculata</i> (Q-F)	56	178	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pimpinella major</i> (M-A)	56	128	-	-	-	-	-	-	-	-	4	2	-	-	-	-
<i>Plantago lanceolata</i> (M-A)	44	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Trifolium medium</i> (T-G)	44	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lathyrus pratensis</i> (M-A)	44	22	25	13	-	-	-	-	-	-	-	-	-	-	12	6
<i>Coronilla varia</i> (T-G)	33	67	-	-	-	-	-	-	9	5	9	4	9	3	-	-
<i>Trollius europaeus</i> (M-A)	33	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Pulmonaria obscura</i> (Q-F))	33	17	-	-	-	-	14	7	-	-	-	-	-	-	-	-
<i>Phyteuma spicatum</i> (Q-F)	22	11	-	-	-	-	-	-	-	-	-	-	9	1	-	-
D. <i>Pa-Q molinietosum</i>																
<i>Crataegus laevigata</i>	b-c	-	-	100	613	83	133	-	-	-	13	1	41	15	12	6
<i>Hypericum maculatum</i> (C-U)	-	-	100	163	67	108	-	-	-	-	48	81	50	219	12	34
<i>Molinia caerulea</i> (M-A)	-	-	100	1125	100	975	-	-	-	-	-	-	5	2	-	-
<i>Lysimachia vulgaris</i> M-A)	-	-	25	13	67	600	-	-	-	-	4	2	-	-	-	-
<i>Cnidium dubium</i> (M-A)	-	-	75	150	33	300	-	-	-	-	26	126	23	320	-	-
<i>Juncus effusus</i> (M-A)	-	-	50	15	50	18	-	-	-	-	-	-	9	3	6	3
<i>Carex nigra</i> (S-C)	-	-	50	138	33	17	14	7	-	-	-	-	-	-	-	-
<i>Carex ovalis</i> (C-U)	-	-	25	13	50	18	-	-	-	-	-	-	-	-	-	-
<i>Carex flacca</i>	-	-	100	163	-	-	-	-	-	-	-	-	-	-	-	-
<i>Lupinus polyphyllus</i>	-	-	75	463	17	2	14	7	-	-	13	5	14	7	-	-
<i>Plagiomnium cuspidatum</i>	-	-	50	138	17	8	-	-	-	-	4	76	5	2	-	-
<i>Lysimachia nummularia</i> M-A)	-	-	50	128	17	8	-	-	-	-	-	-	-	-	-	-
D. <i>Pa-Q brachypodietosum</i>																
<i>Anthericum ramosum</i> T-G)	22	11	-	-	33	10	29	14	-	-	83	178	91	166	60	88
<i>Euphorbia cyparissias</i> (F-B)	22	11	-	-	17	8	-	-	18	46	87	102	74	120	60	186
<i>Brachypodium pinnatum</i> (F-B)	44	222	-	-	17	8	14	7	-	-	61	913	91	1870	47	522
<i>Pimpinella saxifraga</i> (F-B)	67	83	-	-	17	2	-	-	-	-	96	64	78	37	33	16
<i>Sedum maximum</i> (T-G)	56	28	-	-	-	-	14	7	27	10	39	18	39	13	53	56
<i>Galium verum</i> (T-G)	-	-	-	-	-	-	-	-	-	-	52	23	48	25	13	34

Successive number of syntaxon	1	2	3	4	5	6	7	8
<i>Peucedanum oreoselinum</i> (T-G)	22 61	- -	17 8	14 71	18 9	30 35	9 23	33 16
<i>Geranium sanguineum</i> (T-G)	56 506	- -	- -	- -	18 9	39 78	9 23	33 129
D. <i>Pleurozium schreberi</i> var.								
<i>Vaccinium vitis-idaea</i> (V-P)	- -	- -	- -	- -	18 9	70 30	14 5	12 4
<i>Pleurozium schreberi</i> (V-P)	- -	25 125	- -	14 7	9 5	61 326	- -	- -
<i>Pseudoscleropodium purum</i> (V-P)	- -	100 1125	- -	- -	- -	52 120	18 9	- -
<i>Hypnum cupressiforme</i>	- -	75 38	- -	- -	9 5	48 24	5 2	6 3
<i>Hieracium laevigatum</i> (Qrp)	- -	25 13	17 8	- -	- -	26 11	18 5	- -
<i>Pohlia nutans</i> (C-U)	- -	- -	17 2	- -	- -	30 15	18 7	- -
D. <i>Asarum europaeum</i> var.								
<i>Hepatica nobilis</i>	11 6	50 15	33 167	43 86	73 550	9 4	9 5	67 510
<i>Galium mollugo</i> (M-A)	67 133	- -	- -	14 7	55 68	26 11	26 89	67 338
<i>Thalictrum aquilegifolium</i>	44 22	- -	- -	- -	64 114	- -	- -	13 66
<i>Carex digitata</i> (Q-F)	- -	25 13	- -	29 14	91 795	17 155	- -	56 303
<i>Galium sylvaticum</i> (Q-F)	- -	- -	- -	- -	100 573	- -	- -	25 69
<i>Viola reichenbachiana</i> (Q-F)	- -	- -	33 167	- -	64 73	- -	9 25	47 241
<i>Lathyrus vernus</i> (Q-F)	- -	- -	- -	- -	64 114	9 4	- -	33 16
<i>Stellaria holostea</i> (Q-F)	- -	- -	17 8	- -	27 55	- -	- -	33 228
<i>Lilium martagon</i> (Q-F)	11 6	- -	- -	14 7	9 5	4 2	- -	56 84
Ch. <i>Quercus-Fagetea</i> (Q-F)								
<i>Carpinus betulus</i>	a 33 167	- -	17 8	- -	- -	- -	- -	7 117
<i>Carpinus betulus</i>	b-c 67 205	25 13	33 17	29 21	73 309	4 4	4 4	33 457
<i>Corylus avellana</i>	a-c 100 1872	75 30	33 3	57 43	73 427	26 183	22 5	40 588
<i>Fagus sylvatica</i>	a-c - -	75 275	83 417	43 93	27 555	57 113	78 105	20 334
<i>Padus avium</i>	a-c - -	50 5	50 33	43 21	- -	57 21	23 12	19 9
<i>Malus sylvestris</i>	a-c - -	50 38	33 25	- -	- -	30 12	36 17	6 3
<i>Melica nutans</i>	100 1506	100 813	100 842	86 1714	100 614	100 915	100 1120	100 1597
<i>Anemone nemorosa</i>	100 2311	50 25	83 683	57 514	55 223	26 146	65 752	73 653
<i>Poa nemoralis</i>	89 344	75 140	100 350	57 93	18 50	61 443	39 341	33 472
<i>Brachypodium sylvaticum</i>	78 667	100 163	17 292	29 14	45 300	17 100	22 10	33 228
<i>Ajuga reptans</i>	89 433	100 275	83 117	57 93	82 245	83 159	65 112	67 278
<i>Atrichum undulatum</i>	78 89	100 700	17 83	- -	73 118	43 135	57 48	20 13
<i>Festuca heterophylla</i>	33 17	- -	- -	29 786	82 245	35 37	52 21	33 625
<i>Milium effusum</i>	33 17	75 38	17 8	14 71	- -	17 9	17 5	13 16
<i>Scrophularia nodosa</i>	56 28	25 13	17 8	14 7	9 5	52 42	30 10	53 23
<i>Viola riviniana</i>	100 250	100 275	83 42	- -	- -	43 41	48 168	40 131
<i>Festuca gigantea</i>	- -	100 50	67 108	57 29	27 14	43 34	52 20	7 3
<i>Dactylis polygama</i>	- -	25 13	50 308	14 7	- -	30 54	23 10	- -
<i>Galeobdolon luteum</i>	- -	- -	17 8	43 264	9 5	- -	- -	20 116
<i>Viola reichenbachiana et riviniana</i>	- -	- -	17 83	71 36	- -	35 37	30 57	7 3
<i>Galium odoratum</i>	- -	- -	- -	29 79	- -	- -	4 23	4 3
Ch., ^D. <i>Quercetea robiori-petraeae</i> (Qrp)								
<i>Melampyrum pratense</i> ^	78 89	100 388	83 752	57 800	91 682	83 139	87 166	73 148
<i>Pteridium aquilinum</i> ^	22 11	50 450	50 308	57 579	100 1251	35 346	35 375	73 369
<i>Festuca ovina</i>	67 233	75 38	33 92	43 21	36 141	78 320	35 16	53 244
<i>Polytrichastrum formosum</i> ^	78 89	75 463	50 25	14 7	45 64	26 13	- -	26 147
<i>Hieracium lachenalii</i>	78 39	75 150	67 33	57 93	- -	52 63	30 9	40 19
<i>Carex pilulifera</i>	44 22	50 25	67 33	71 36	- -	30 15	17 9	27 119
<i>Calamagrostis arundinacea</i>	- -	75 150	17 83	57 336	91 795	35 130	13 5	73 622
<i>Lathyrus montanus</i>	- -	- -	- -	- -	- -	- -	4 23	27 178
Ch. <i>Vaccinio-Piceetea</i> (V-P)								
<i>Pinus sylvestris</i>	a 56 128	25 938	- -	14 7	64 1364	35 424	13 105	33 209
<i>Pinus sylvestris</i>	b-c - -	- -	- -	- -	- -	13 46	9 2	- -
<i>Picea abies</i>	a - -	50 25	17 8	- -	- -	26 74	- -	20 10
<i>Picea abies</i>	b-c - -	25 3	33 302	43 336	- -	- -	52 145	7 3
<i>Juniperus communis</i>	b-c 78 106	- -	- -	14 79	- -	48 220	36 10	27 154
<i>Rubus saxatilis</i>	11 6	100 275	100 842	43 86	91 527	30 74	43 158	33 100
<i>Vaccinium myrtillus</i>	44 72	100 1825	100 767	86 1121	100 1550	83 780	65 211	73 622
<i>Trientalis europaea</i>	- -	25 13	- -	- -	- -	- -	4 5	27 16
Ch. <i>Artemisietea vulgaris</i>								
<i>Moehringia trinervia</i>	44 72	75 28	33 85	57 29	73 159	91 183	87 164	87 175
<i>Galeopsis pubescens</i>	- -	75 150	33 92	29 14	18 9	52 143	70 75	33 16
<i>Galeopsis tetrahit</i>	- -	75 38	50 100	29 14	9 5	48 20	43 40	47 19
<i>Geum urbanum</i>	- -	50 25	50 100	29 14	27 14	61 50	70 31	40 75
<i>Mycelis muralis</i>	- -	75 150	50 100	43 21	64 155	74 135	78 76	67 147
<i>Urtica dioica</i>	- -	100 50	50 100	14 7	45 23	57 402	83 180	53 26
<i>Impatiens parviflora</i>	- -	100 163	50 175	29 900	- -	57 220	27 209	6 109
<i>Geranium robertianum</i>	- -	- -	50 18	- -	- -	30 35	39 39	20 144
<i>Alliaria petiolata</i>	- -	25 125	17 83	14 7	- -	26 33	39 18	7 6
<i>Galium aparine</i>	- -	- -	17 83	29 14	- -	26 103	48 140	- -
<i>Lapsana communis</i> s. s.	- -	- -	- -	- -	9 5	30 15	4 2	13 6
<i>Linaria vulgaris</i>	- -	- -	- -	- -	- -	26 13	4 2	- -
Ch. <i>Molinio-Arrhenatheretea</i> (M-A)								
<i>Veronica chamaedrys</i>	100 400	100 475	100 50	71 343	100 532	83 193	100 173	93 619
<i>Dactylis glomerata</i>	67 83	- -	33 17	14 7	27 55	- -	17 25	27 72

9		10		11		12		13		14	
-	-	16	6	49	152	7	3	5	24	50	301
-	-	5	3	20	24	-	-	-	-	5	25
50	25	21	58	12	20	-	-	14	29	5	25
-	-	32	85	25	374	27	157	19	31	45	880
50	450	32	322	22	103	73	890	24	217	20	428
-	-	16	32	18	82	-	-	19	10	30	270
25	125	11	95	5	9	-	-	-	-	-	-
-	-	16	8	12	70	20	10	14	7	20	33
-	-	26	150	17	81	7	3	5	2	5	3
25	3	16	32	22	38	-	-	10	5	20	10
-	-	-	-	11	62	-	-	5	2	-	-
-	-	21	147	15	126	7	3	-	-	5	3
-	-	11	5	2	8	-	-	-	-	5	25
25	125	26	37	25	26	13	7	19	10	10	5
-	-	11	29	2	8	-	-	-	-	-	-
-	-	-	-	5	2	7	33	-	-	-	-
-	-	11	5	23	16	-	-	19	6	5	3
-	-	5	3	-	-	7	33	5	0	5	1
-	-	-	-	-	-	-	-	-	-	-	-
25	138	37	229	23	149	20	74	24	179	15	35
25	128	16	229	28	153	40	137	33	471	10	30
25	3	16	11	18	18	53	323	19	55	10	30
50	25	-	-	-	-	47	46	19	8	10	1
100	700	84	606	78	945	87	337	76	312	50	470
-	-	21	124	38	198	7	3	5	24	15	115
75	263	58	213	49	728	87	1203	81	1067	50	758
75	150	16	97	17	100	53	200	19	52	20	31
75	38	21	34	48	72	27	43	33	38	25	13
25	13	32	105	20	83	47	197	24	55	5	3
-	-	26	450	11	141	-	-	14	110	5	25
25	13	21	100	11	45	33	9	5	2	-	-
25	13	11	5	17	15	27	43	33	13	5	3
75	263	32	35	32	97	93	314	48	43	45	173
50	25	11	5	17	8	47	45	24	31	5	25
25	13	11	95	15	98	40	163	24	114	5	3
-	-	5	3	-	-	-	-	-	-	5	88
25	13	5	3	11	12	7	3	-	-	5	3
-	-	-	-	2	8	-	-	-	-	-	-
50	450	63	566	48	145	27	13	24	12	35	99
75	1065	47	624	52	495	60	687	52	1005	35	238
50	138	68	597	57	375	-	-	19	133	50	920
25	438	32	39	11	19	27	157	24	33	5	3
25	13	26	58	31	49	-	-	10	5	25	11
50	25	-	-	29	62	60	27	38	17	5	3
75	263	68	793	49	285	47	330	48	345	35	248
-	-	-	-	-	-	-	-	-	-	-	-
50	1876	47	1421	57	1514	87	2617	62	1715	85	2091
-	-	11	5	8	4	7	3	5	2	15	96
-	-	5	3	2	1	27	157	14	88	-	-
50	16	16	56	12	38	60	63	5	190	25	186
-	-	21	155	31	119	-	-	10	7	40	348
-	-	47	142	48	184	60	180	52	67	40	86
75	1500	68	1479	60	784	100	880	76	858	45	878
-	-	11	5	9	12	20	7	10	26	10	28
75	38	68	611	60	357	67	121	57	89	60	538
50	25	16	55	12	6	-	-	10	5	15	30
50	25	26	35	31	61	47	18	33	115	30	36
25	13	16	8	34	15	33	14	19	10	30	98
50	138	47	184	49	174	60	115	52	67	35	223
25	13	16	6	35	72	67	28	33	295	15	28
75	688	16	6	14	161	67	151	24	31	15	93
-	-	16	8	26	86	7	1	10	181	20	388
50	138	-	-	11	5	20	37	14	29	-	-
-	-	16	29	23	78	7	3	5	179	10	50
-	-	-	-	-	-	-	-	5	2	5	3
-	-	5	3	11	12	13	7	10	26	15	6
50	25	74	155	80	162	53	114	52	69	35	85
25	13	5	3	12	27	13	7	5	2	15	93

30 (*Pinus-Anthoxanthum* – secondary community of *Pa-Q*); Jaroszevska (2007), tab. 3: 1 (*Pa-Q typicum*), tab. 4: 1 (*Pa-Q* – degenerated forms); Krotoska (1991), tab. 11: 3 (*Pa-Q*); Nachotko (1982), tab. 4: 11 (Oak forest with share of termophilous species); Nowaczyk (1964), tab. 7: 13 (*Pino-Quercetum*), tab. 9: 17,18 (*Quercus-Potentilletum albae*); Robińska (1977), tab. 3: 15,28 (*Pino-Quercetum*); Wojterska *et al.* (2006), tab. 3: 19, 30 (Substitute forest communities on the habitat of *Pa-Q*); Zielińska (1994), tab. 4: 2,6 (*Pa-Q*), tab. 6: 11: (*Calamagrostio arundinaceae-Quercetum convallarietosum*); Wojterska (2003), tab. 14: 37 (*Pa-Q*).

11. *Potentillo albae-Quercetum brachypodietosum* in stage II of degeneration (65 relevés): Brzeg (orig.), tab. A29: 39, Ferchmin (1980), tab. 19: 1-4, 8,11,15,16,18 (*Pa-Q*); Gmaj (1997), tab. 6: 1,4 (*Pa-Q lathyretosum verni*); tab. 7: 2,5-10 (*Pa-Q* – degenerated forms); Jakubowska-Gabara (1994), tab. 1: 11,14,19,20,22,24,26 (Secondary communities of *Pa-Q*); Jaroszevska (2007), tab. 2: 2,7,10 (*Pa-Q brachypodietosum*); tab. 3: 2,3,4,5 (*Pa-Q typicum*); Krotoska (1983), tab. 3: 2 (*Pa-Q aff.*); Krotoska (1991), tab. 11: 7,8,11 (*Pa-Q*); Marcysiak (2001), tab. 1: 1-8 (*Pa-Q*); Olaczek (1986), tab. 2: 1,2 (*Pa-Q*); Paciejewska (1981), 11: 2-4,6,11 (Oak forest from the *Quercus-Fagetea* class with share of termophilous species); Robińska (1977), tab. 5: 2,3 (*Pino-Quercetum* – degenerated forms); Wojterska *et al.* (2006) tab. 1: 23,27,28,29,30,31 (*Pa-Q brachypodietosum* – degenerated forms), tab. 3: 20 (Substitute forest communities on the habitat of *Pa-Q*); Wojterska & Wiszniewska (1996), tab. 1: 14 (*Pa-Q*); Zielińska (1994), tab. 4: 1,5,5 (*Pa-Q*).

12. Substitute forest communities on the habitat of *Potentillo albae-Quercetum molinietosum* (15 relevés): Robińska (1977), tab. 3: 22 (*Pino-Quercetum*); Wojterska *et al.* (2006), tab. 3: 8,9,11,12,14-17,21,23,33 (secondary communities of *Pa-Q*).

13. Substitute forest communities on the habitat of *Potentillo albae-Quercetum typicum* (21 relevés): Ferchmin (1980), tab. 19: 17,19 (*Pa-Q*); Hegenbart-Magdans & Brzeg (1999), tab. 5: 10-12 (*Pa-Q*); Jakubowska-Gabara (1994), tab. 1: 27,28 (secondary communities of *Pa-Q*); Jaroszevska (2007), tab. 4: 2 (*Pa-Q* – degenerated forms); Marcysiak (2001), tab. 1: 9-11 (*Pa-Q*); Wojterska *et al.* (2006), tab. 3: 2,4,5,13,25, 26,28 (Substitute forest communities on the habitat of *Pa-Q*); Zielińska (1994), tab. 4: 7 (*Pa-Q*).

14. Substitute forest communities on the habitat of *Potentillo albae-Quercetum brachypodietosum* (20 relevés): Ferchmin (1980), tab. 19: 9,14 (*Pa-Q aff.*); Hegenbart-Magdans & Brzeg (1999), tab. 5: 1,2,5 (*Pa-Q*); Jakubowska-Gabara (1994), tab. 1: 13,29 (secondary communities of *Pa-Q*); Jaroszevska (2007), tab. 2: 3 (*Pa-Q brachypodietosum*), tab. 4: 3,4,5 (*Pa-Q* – degenerated forms); Krotoska (1991), tab. 11: 1 (*Pa-Q*); Olaczek (1986), tab. 2: 3 (*Pa-Q*), tab. 3: 1-3 (Pine plantations on the habitat of *Pa-Q*); Wojterska *et al.* (2006), tab. 3: 1,18,24 (Substitute forest communities on the habitat of *Pa-Q*).

Successive number of syntaxon	1	2	3	4	5	6	7	8
<i>Festuca rubra</i> s. s.	78 139	75 150	50 25	43 21	-	87 200	65 250	20 144
<i>Rumex acetosa</i>	33 17	50 5	67 20	-	-	30 7	57 16	7 6
<i>Achillea millefolium</i>	44 72	-	17 8	-	-	70 53	48 23	33 16
<i>Poa pratensis</i>	67 83	-	-	14 7	36 18	9 4	-	27 13
<i>Carex hirta</i>	-	100 163	17 83	14 7	9 5	4 76	22 28	20 66
<i>Taraxacum officinale</i>	-	100 30	-	29 14	-	43 10	30 5	20 7
Ch. Trifolio-Geranietea (T-G)								
<i>Clinopodium vulgare</i>	100 578	25 125	17 8	43 393	82 205	26 13	35 16	67 444
<i>Fragaria vesca</i>	100 489	75 1000	100 1333	86 350	100 295	96 1052	87 1195	87 606
<i>Hypericum perforatum</i>	78 39	50 25	33 17	29 14	27 14	78 137	74 57	20 9
<i>Poa angustifolia</i>	100 350	75 688	33 167	71 100	-	87 1061	78 436	47 241
<i>Vicia sepium</i>	89 333	25 13	17 8	43 21	91 209	13 7	61 26	67 59
<i>Trifolium alpestre</i>	89 144	-	17 2	43 86	82 205	83 216	87 439	87 966
<i>Polygonatum odoratum</i>	67 272	-	50 25	86 107	73 77	48 81	52 46	80 63
<i>Vicia cassubica</i>	33 17	-	17 8	43 21	91 332	22 50	9 45	67 200
<i>Knautia arvensis</i>	56 128	-	33 17	14 7	9 5	65 111	83 84	20 9
<i>Astragalus glycyphyllos</i>	44 122	-	33 17	43 21	45 19	70 53	83 125	47 19
<i>Silene nutans</i> subsp. <i>nutans</i>	-	-	17 8	-	18 9	30 15	26 10	13 9
<i>Galium album</i>	-	25 13	17 8	-	-	26 72	13 27	-
Ch. Festuco-Brometea (F-B)								
<i>Filipendula vulgaris</i>	-	50 15	67 108	-	-	57 161	86 223	6 3
<i>Thalictrum minus</i>	-	-	-	-	55 24	13 7	-	12 32
Ch. Calluno-Ulicetea (C-U)								
<i>Agrostis capillaris</i>	33 67	75 888	83 267	57 336	36 59	74 583	91 487	60 325
<i>Potentilla erecta</i>	56 78	100 265	83 192	29 79	45 23	61 128	78 164	33 13
<i>Solidago virgaurea</i> s. s.	67 222	25 13	50 25	86 43	27 14	61 70	30 14	40 47
<i>Veronica officinalis</i>	44 22	100 50	33 17	29 14	27 55	78 116	65 30	67 119
<i>Genista tinctoria</i>	56 78	25 13	-	-	-	52 24	26 14	-
<i>Luzula multiflora</i>	44 22	-	-	-	-	26 11	9 5	13 6
<i>Viola canina</i>	-	-	-	-	55 27	13 26	9 3	12 34
Others								
<i>Quercus robur</i> a	100 6029	100 5751	83 4541	57 3571	-	65 3665	91 5444	47 2594
<i>Quercus robur</i> b-c	67 206	100 413	83 691	29 150	27 14	61 152	91 405	40 240
<i>Quercus petraea</i> a	22 111	25 125	50 716	43 2679	91 5681	39 1739	26 920	80 4047
<i>Quercus petraea</i> b-c	-	25 13	33 92	43 86	91 805	35 430	30 79	67 288
<i>Betula pendula</i> a	22 61	-	-	-	9 10	26 131	9 27	-
<i>Betula pendula</i> c	11 62	-	-	-	9 5	4 2	-	13 63
<i>Sorbus aucuparia</i> a-c	78 94	100 30	33 100	57 29	100 110	96 103	91 63	69 69
<i>Frangula alnus</i> b-c	67 261	100 625	83 700	86 643	36 18	91 84	91 48	62 144
<i>Prunus spinosa</i> b-c	44 33	50 15	83 43	-	-	48 35	41 43	25 41
<i>Rhamnus cathartica</i> b-c	22 11	25 3	17 8	43 87	9 5	48 17	45 24	38 19
<i>Crataegus rhipidophylla</i> b-c	-	50 38	17 8	-	-	52 26	36 20	6 1
<i>Convallaria majalis</i>	100 1678	100 588	100 817	86 1429	100 1214	87 1091	83 450	80 944
<i>Maianthemum bifolium</i>	89 811	100 378	100 50	57 514	55 109	43 61	48 84	53 219
<i>Luzula pilosa</i>	67 83	75 150	100 50	71 36	73 477	96 163	96 44	80 238
<i>Anthoxanthum odoratum</i>	78 428	25 13	50 100	43 86	45 64	74 209	87 186	47 53
<i>Oxalis acetosella</i>	44 533	100 1325	50 458	29 79	64 155	52 696	74 428	40 181
<i>Plagiomnium affine</i>	22 11	100 388	50 25	14 7	64 227	87 180	39 61	13 6
<i>Dryopteris carthusiana</i>	11 6	100 30	67 27	-	45 64	4 2	4 2	20 9
<i>Campanula rotundifolia</i>	-	75 28	67 108	-	27 14	70 33	52 27	40 47
<i>Rubus idaeus</i>	-	75 38	50 93	29 14	27 209	61 222	61 93	13 113
<i>Fallopia convolvulus</i>	-	25 13	33 92	29 14	9 5	52 65	57 28	33 16
<i>Brachythecium rutabulum</i>	-	75 38	17 8	14 7	18 9	35 17	26 12	-
<i>Deschampsia flexuosa</i>	-	75 38	17 8	14 7	-	52 65	30 14	7 31
<i>Calamagrostis epigejos</i>	-	25 125	50 25	-	-	22 30	9 5	7 109
<i>Pyrus pyraister</i> b-c	-	50 15	33 25	14 7	-	48 29	73 41	-
<i>Padus serotina</i> b-c	-	100 50	50 18	-	-	57 32	48 104	7 3
<i>Sciuro-hypnum oedipodium</i>	-	50 138	17 8	-	-	30 109	13 27	7 3
<i>Rubus x corylifolius</i>	-	50 25	17 8	-	-	30 15	9 25	-
<i>Brachytheciastrum velutinum</i>	-	-	-	29 14	9 5	22 11	4 2	13 6
<i>Galium mollugo et dumetorum</i>	-	-	-	29 14	-	4 22	-	13 6
<i>Hieracium murorum</i>	22 11	-	-	29 79	82 205	35 37	4 2	33 16
<i>Viscaria vulgaris</i>	44 22	-	-	14 7	9 5	22 30	-	5 3

9		10		11		12		13		14	
50	25	26	84	29	146	20	10	5	2	10	190
25	3	-	-	11	12	-	-	-	-	15	8
25	3	5	3	26	33	-	-	10	5	25	33
-	-	16	226	6	24	-	-	-	-	15	30
50	875	21	8	26	52	53	117	5	2	35	148
-	-	16	4	11	4	7	1	5	2	10	3
25	13	32	111	40	194	13	37	29	14	25	58
75	463	53	455	63	361	87	420	48	248	40	171
25	125	32	39	66	67	60	120	29	12	45	66
50	250	32	39	48	379	20	40	33	60	55	248
25	125	26	13	15	22	-	-	-	-	5	3
25	125	11	53	35	38	-	-	-	-	15	30
25	125	47	71	54	120	27	13	57	129	65	74
-	-	37	243	31	135	27	11	14	7	25	243
-	-	11	5	37	45	7	1	-	-	30	15
-	-	21	11	34	31	7	3	5	2		
-	-	5	3	17	22	-	-	10	5	15	8
50	25	16	121	14	21	33	17	-	-	10	28
-	-	-	-	17	29	-	-	-	-	10	5
-	-	21	8	6	3	-	-	5	2	5	3
50	25	32	153	34	522	80	423	48	88	40	273
75	18	11	5	22	10	20	7	5	0	15	30
75	263	53	95	32	51	-	-	19	29	20	10
50	25	53	48	45	122	67	61	38	17	30	38
25	3	11	5	3	2	-	-	-	-	5	3
-	-	11	5	12	6	-	-	-	-	5	3
-	-	21	58	14	14	-	-	-	-	25	35
75	4188	21	644	44	2036	60	2040	24	1634	20	888
25	26	26	135	25	131	60	217	43	157	180	313
-	-	68	4224	43	2197	67	1000	71	1455	55	2738
-	-	63	474	46	268	60	264	76	444	65	861
25	125	13	223	22	218	48	1357	29	322	20	265
25	3	5	26	17	32	27	127	9	7	15	36
50	138	79	93	69	46	80	168	62	160	50	50
75	700	47	87	63	120	47	171	67	318	65	148
50	5	-	-	32	75	53	55	19	6	10	90
-	-	16	11	23	12	-	-	10	5	15	30
25	25	5	3	6	4	27	13	-	-	10	1
75	263	79	1279	74	1215	93	328	95	1198	55	1395
100	275	21	124	34	85	93	453	62	402	10	5
100	163	63	148	58	92	87	131	62	117	30	60
25	13	26	232	43	351	-	-	19	31	25	265
75	575	21	122	25	118	93	703	38	224	10	28
25	13	37	113	32	84	40	80	48	126	15	53
75	150	32	39	29	35	93	107	52	107	40	128
25	3	16	6	23	25	13	7	5	2	20	10
75	463	32	39	42	179	93	1340	52	472	25	368
75	28	21	100	32	57	67	58	29	117	35	125
-	-	5	3	12	20	47	197	14	7	10	28
25	125	11	29	22	72	87	247	43	621	15	263
25	125	21	34	42	286	87	587	52	605	40	250
-	-	-	-	12	6	53	49	5	0	10	1
75	28	21	35	35	117	87	306	48	306	30	248
25	13	32	87	20	17	47	363	24	312	10	5
25	3	5	26	11	12	20	40	5	2	20	55
-	-	11	5	8	11	7	3	-	-	5	3
-	-	5	3	5	2	-	-	-	-	5	3
-	-	42	45	32	30	-	-	10	5	10	5
-	-	-	-	5	2	-	-	-	-	5	3

Table 12. Floristic differentiation of *Quercus roboris*-*Pinetum* reflecting habitat variation and human impact: untransformed communities (col. 1-3) and substitute forest communities (col. 4-5)

Successive number of syntaxon	1	2	3	4	5
Number of relevés	36	82	47	23	9
Number of taxa	147	185	179	113	102
Mean number of taxa in relevé	28	23	30	20	31
D. <i>Quercus roboris</i>-<i>Pinetum</i>					
<i>Pinus sylvestris</i> (V-P) a-c	100 4733	100 4273	100 5548	100 4339	100 5989
<i>Pleurozium schreberi</i> (V-P)	94 3274	94 2961	83 2728	74 2076	89 1072
<i>Pseudoscleropodium purum</i> (V-P)	50 640	23 348	66 1096	30 861	89 1294
<i>Vaccinium vitis-idaea</i> (V-P)	78 867	82 468	68 563	22 30	- -
<i>Dicranum polysetum</i> (V-P)	56 351	49 396	45 629	13 167	11 1
<i>Hylocomium splendens</i> (V-P)	36 200	16 51	40 240	9 4	22 11
<i>Calluna vulgaris</i> (C-U)	39 236	35 161	30 145	4 22	- -
<i>Leucobryum glaucum</i> (V-P)	22 190	34 122	11 24	13 167	- -
D. <i>Quercus roboris</i>-<i>Pinetum</i> molinietosum					
<i>Quercus robur</i> a-c	86 2106	66 1126	57 2281	65 1320	78 873
<i>Populus tremula</i> a-c	42 326	11 89	11 39	9 4	- -
<i>Betula pubescens</i> subsp. pubescens a-c	19 68	5 7	- -	- -	- -
<i>Frangula alnus</i> b-c	89 1172	46 232	43 110	74 548	67 94
<i>Molinia caerulea</i>	92 1392	- -	2 11	- -	- -
<i>Trientalis europaea</i> (V-P)	67 369	37 179	15 17	43 120	44 22
<i>Sciuro-hypnum oedipodium</i>	31 125	5 29	6 3	4 76	11 6
<i>Lysimachia vulgaris</i>	31 28	4 7	2 1	- -	- -
<i>Rubus plicatus</i>	25 222	4 23	9 4	4 76	- -
<i>Rubus nessensis</i>	11 18	1 1	- -	- -	- -
D. <i>Quercus roboris</i>-<i>Pinetum</i> coryletosum					
<i>Convallaria majalis</i>	11 90	17 61	70 474	13 26	22 11
<i>Fragaria vesca</i> (T-G)	14 7	5 2	62 328	- -	67 79
<i>Rubus saxatilis</i> (V-P)	11 18	2 1	55 251	4 2	22 61
<i>Moehringia trinervia</i>	28 39	13 23	51 167	22 50	78 84
<i>Veronica officinalis</i> (C-U)	6 3	6 9	47 136	4 2	44 72
<i>Hypericum perforatum</i> (T-G)	- -	9 4	26 32	- -	89 44
<i>Carex hirta</i>	- -	1 1	26 160	- -	56 217
<i>Campanula rotundifolia</i>	3 1	6 3	34 27	- -	44 22
<i>Mycelis muralis</i>	- -	6 3	21 68	9 4	44 72
<i>Veronica chamaedrys</i>	3 1	1 1	30 44	- -	22 11
<i>Galium boreale</i>	6 3	1 1	30 61	- -	22 11
<i>Hieracium pilosella</i> (C-U)	- -	9 25	28 90	9 24	22 7
<i>Euphorbia cyparissias</i> (F-B)	- -	1 1	28 23	- -	33 12
<i>Galium mollugo</i>	3 1	- -	28 33	- -	33 17
<i>Melica nutans</i> (Q-F)	- -	5 8	38 151	- -	11 6
<i>Viola canina</i> (C-U)	3 1	2 1	34 93	- -	- -
<i>Solidago virgaurea</i> s. s. (C-U)	8 4	9 4	34 91	- -	- -
<i>Peucedanum oreoselinum</i> (T-G)	- -	- -	26 281	- -	- -
<i>Polygonatum odoratum</i> (T-G)	- -	4 2	23 31	9 4	11 6
Ch. <i>Vaccinio-Piceetea</i> (V-P)					
<i>Picea abies</i> a-c	44 567	50 1091	26 150	52 491	- -
<i>Juniperus communis</i> b-c	14 7	11 19	11 27	- -	- -
<i>Vaccinium myrtillus</i>	97 4042	96 4379	100 3209	91 1413	89 2450
<i>Dicranum scoparium</i>	36 115	43 155	28 60	30 215	11 6
<i>Orthilia secunda</i>	11 18	5 8	30 70	- -	11 6
<i>Plagiothecium curvifolium</i>	14 19	12 28	4 2	4 2	11 6
<i>Dryopteris dilatata</i>	17 81	9 15	- -	17 28	11 56
Ch., ^D. <i>Quercetea robori-petraeae</i>					
<i>Polytrichastrum formosum</i> ^	69 538	56 475	21 30	57 396	56 28
<i>Pteridium aquilinum</i> ^	78 2482	67 1535	53 926	52 1326	11 417
<i>Festuca ovina</i>	61 1032	68 479	79 811	39 630	11 56
<i>Melampyrum pratense</i> ^	36 411	55 302	53 324	9 165	22 111
<i>Calamagrostis arundinacea</i>	28 201	29 615	68 1403	22 1415	22 11
<i>Carex pilulifera</i>	28 51	52 70	17 28	17 28	11 6
Ch. <i>Quercus-Fagetea</i>					
<i>Fagus sylvatica</i> a-c	8 19	39 757	9 4	22 248	22 67
<i>Carpinus betulus</i> a-c	22 88	11 57	32 244	43 163	56 294
<i>Anemone nemorosa</i>	22 121	6 14	11 87	- -	11 6
<i>Viola reichenbachiana</i>	8 17	24 23	28 81	17 9	56 23
Ch. <i>Calluno-Ulicetea</i> (C-U)					
<i>Pohlia nutans</i>	39 129	49 112	19 91	35 111	11 6
<i>Agrostis capillaris</i>	25 75	23 23	36 85	26 87	78 278
Others					
<i>Betula pendula</i> a-c	81 1051	46 205	47 376	61 296	56 101
<i>Quercus petraea</i> a-c	28 397	56 1498	49 1338	48 553	44 600
<i>Sorbus aucuparia</i> a-c	86 792	61 155	79 374	70 202	89 528
<i>Luzula pilosa</i>	89 386	60 195	72 307	70 348	44 72
<i>Oxalis acetosella</i>	53 290	24 143	23 96	35 170	67 83

Successive number of syntaxon	1	2	3	4	5
<i>Dryopteris carthusiana</i>	61 189	35 45	40 49	74 224	89 194
<i>Rubus idaeus</i>	39 185	20 25	55 381	52 233	100 611
<i>Anthoxanthum odoratum</i>	28 51	16 19	53 382	9 4	56 78
<i>Calamagrostis epigejos</i>	25 97	34 112	17 380	35 487	56 1228
<i>Rumex acetosella</i>	11 43	16 19	38 131	17 9	67 33
<i>Maianthemum bifolium</i>	47 86	28 73	13 71	39 39	33 17
<i>Plagiomnium affine</i>	22 96	15 65	9 14	17 170	22 11
<i>Deschampsia flexuosa</i>	3 1	35 234	- -	30 626	33 206

Explanations: Shortened table comprises in each column the frequency of species (in %) and cover index (italics).

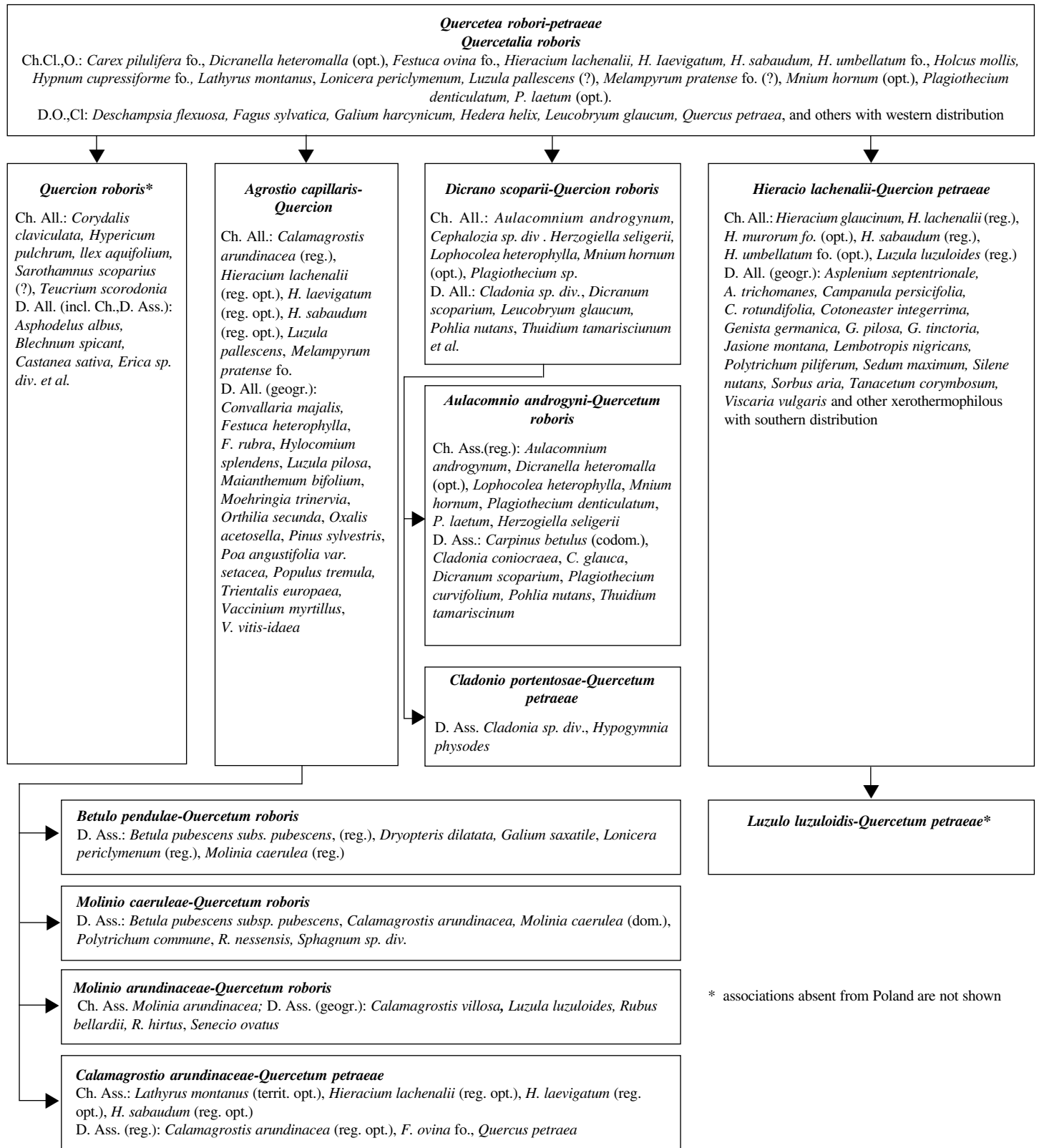
1. *Quercus roboris*-Pinetum molinietosum (36 relevés): Balcerkiewicz *et al.* (1994), tab. 3: 3 (*Qr-P*); Brzeg *et al.* (2000b), tab. 2: 41,42 (*Festuco ovinae*-Pinetum); Brzeg (2004), tab. 1: 1,2,4-9 (*Qr-P*); Jakubowska-Gabara (1994), tab. 2: 6 (*Quercus*-Pinetum typicum), 13-15 (*Quercus*-Pinetum molinietosum); Kaczyńska (1964), tab. 5: 4,10-14 (*Pino-Quercetum*); Krotoska & Piotrowska 1962, tab. 5, 34 (*Pino-Quercetum*); Macicka 1984, tab. 20: 3 (*Pino-Quercetum typicum*), tab. 29: 13 (Plantation of pine on the habitat of deciduous and mixed forests); Macicka & Wilczyńska (1991), tab. 14: 21 (*Pino-Quercetum typicum*), Macicka & Wilczyńska (1992), tab. 6: 7-8 (*Pino-Quercetum*); Sroka (1982), tab. 2: 9-12,15 (*Pino-Quercetum*); Szwed (1979), tab. 16: 1-4 (*Pino-Quercetum*).

2. *Quercus roboris*-Pinetum typicum (82 relevés): Balcerkiewicz *et al.* (1994), tab. 3: 2,5-7,9,11,14 (*Qr-P*); Brzeg (2004), tab. 1: 12 (*Qr-P*); Ferchmin (1980), tab. 21: 3,4 (*Pino-Quercetum*); Jakubowska-Gabara (1994), tab. 2: 3,7 (*Quercus*-Pinetum); Kaczyńska (1964), tab. 5: 15 (*Pino-Quercetum*); Macicka 1984, tab. 20: 4,6,7,11,17,19,22,24,29,30 (*Pino-Quercetum typicum*), tab. 29: 14,17 (Plantation of pine on the habitat of deciduous and mixed forests); Macicka & Wilczyńska (1990), tab. 16: 1,4,5,8,9,12-15,17 (*Pino-Quercetum fagetosum*), tab. 17: 1-3,6,8,15-17,22,26-29 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 14: 5,14 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1992), tab. 6: 2,3,5 (*Pino-Quercetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 28: 2,4 (*Pino-Quercetum*); Kasproicz (orig.) tab. A32: 12, 69 (*Qr-P typicum*); Wojterska (2003), tab. 16: 23 (*Calamagrostio-Quercetum typicum*); Wojterska (1976), tab. 11: 1-3 (*Pino-Quercetum*); Pawłow & Czech (1959), tab. 3: 13 (Mixed coniferous forest); Ratyńska (2001), tab. 176: 8 (*Calamagrostio-Quercetum petraeae typicum*); Robińska (1977), tab. 3: 7 (*Pino-Quercetum*); Sroka (1982), tab. 2: 4,6,8 (*Pino-Quercetum*); Szwed (1979), tab. 16: 10,11,17,18,20-22,25-32 (*Pino-Quercetum*).

3. *Quercus roboris*-Pinetum coryletosum (47 relevés): Balcerkiewicz *et al.* (1994), tab. 3: 12,13 (*Qr-P*); Berdowski & Kwiatkowski (1992), tab. 7: 2 (*Qr-P*); Brzeg (2004), tab. 1: 10,11,13,14 (*Qr-P*); Ferchmin (1980), tab. 21: 5 (*Pino-Quercetum*); Jakubowska-Gabara (1994), tab. 2: 2,4,5,10 (*Quercus*-Pinetum typicum); Kaczyńska (1964), tab. 5: 1-3,5,6,8,9 (*Pino-Quercetum*); Macicka 1984, tab. 20: 12 (*Pino-Quercetum typicum*); Macicka & Wilczyńska (1991), tab. 14: 6 (*Pino-Quercetum typicum*), Nowaczyk (1964), tab. 7: 1-9, 11,12,14-18 (*Pino-Quercetum*); Pawłow & Czech (1959), tab. 3: 16 (Mixed coniferous forest); Robińska (1977), tab. 5: 1 (*Pino-Quercetum* – degenerated forms), tab. 3: 4,6,8,10,12,13 (*Pino-Quercetum*); Szwed (1979), tab. 16: 16,24 (*Pino-Quercetum*).

4. Substitute forest communities on the habitat of *Quercus roboris*-Pinetum typicum (23 relevés): Macicka (1984), tab. 20: 5,18 (*Pino-Quercetum*), tab. 29: 2,7,8,12 (Plantation of pine on the habitat of deciduous and mixed forests); Macicka & Wilczyńska (1990), tab. 17: 25 (*Pino-Quercetum*); Macicka-Pawlik & Wilczyńska (1996), tab. 28: 1,6 (*Pino-Quercetum*); Pawłow & Czech (1959), tab. 3: 10,11,17 (Mixed coniferous forest); Sroka (1982), tab. 2: 1 (*Pino-Quercetum*); Szwed (1979), tab. 12: 2 (*Calamagrostio arundinaceae-Quercetum*), tab. 16: 7, 13-15,23 (*Pino-Quercetum*); Wojterska (1976), tab. 11: 4 (*Pino-Quercetum*); Wojterska (2003), tab. 16: 19 (*Calamagrostio arundinaceae-Quercetum typicum*), tab. 17: 7 (Acidophilous oak forests from the *Quercetea robori-petraeae* class); Wojterska *et al.* (2006), tab. 3: 27 (Substitute forest communities).

5. Substitute forest communities on the habitat of *Quercus roboris*-Pinetum coryletosum (9 relevés): Gmaj (1997), tab. 9: 14 (*Calamagrostio arundinaceae-Quercetum convallarietosum*); Macicka & Wilczyńska (1990), tab. 17: 19 (*Pino-Quercetum typicum*); Nowaczyk (1964), tab. 7: 10 (*Pino-Quercetum*); Pawłow, Czech (1959), tab. 3: 1-3,12,19 (Mixed coniferous forest); Wojterska *et al.* (2006), tab. 3: 22 (Substitute forest communities).

Table 13. Proposed syntaxonomic structure of the class *Quercetea robori-petraeae* in Central Europe

* associations absent from Poland are not shown

Successive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37				
ID-1	11	11	31	11	11	11	11	11	11	11	11	11	32	32	51	11	11	11	11	11	11	26	31	31	51	11	11	11	34	11	11	11	11	3	3	3	3	3	3		
ID-2	1	1	4	1	1	1	1	1	1	1	1	1	3	2	2	1	1	1	1	1	1	21	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4		
ID-3	1	2	15	3	4	5	6	7	8	9	10	11	4	5	3	11	12	13	14	15	16	17	2	2	3	4	18	19	20	2	21	22	23	24	25	3	3	3	3		
Date (year)	1994	1994	1990	1993	1993	1990	1993	1992	1989	1989	1984	1997	1989	1989	1989	1991	1990	1992	1992	1990	1993	1995	1980	1981	1992	1992	1992	1993	1997	1992	1993	1993	1992	1992	1992	1992	1992	1992	1992		
Density of tree layer	a1,a [%]	50	40	45	30	40	40	30	40	30	60	50	30	30	60	70	30	25	40	40	40	35	30	85	60	30	70	35	90	40	35	50	40	40	60	40	40	60	60		
Density of tree layer	a2 [%]	50	70	60	40	50	50	50	60	70	60	40	50	70	60	40	35	25	30	50	60	60	80	80	50	20	70	10	60	70	50	70	60	50	75	60	50	60			
Density of shrub layer	b [%]	+	3	-	-	-	+	+	+	5	5	-	5	-	5	-	5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Cover of herb layer	c [%]	10	3	5	10	15	7	30	30	30	25	5	10	10	5	5	40	20	20	15	10	5	5	80	20	15	40	10	15	10	15	5	5	5	5	10	10	10	10		
Cover of moss layer	d [%]	40	25	10	60	40	20	30	30	25	30	25	40	10	30	25	40	35	25	30	25	25	10	10	40	60	25	25	30	25	10	25	10	10	10	10	10	5	5		
Area of relevé		CO36	150	400	400	400	100	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400
Location (ATPOL)		CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400	CO383	400
Total number of species		26	33	13	28	27	32	25	33	32	32	26	27	31	32	30	32	39	37	37	32	35	27	31	30	22	23	30	33	33	29	37	27	33	23	27	33	27	33		
Number of mosses, liverworts and lichens species		12	16	6	12	9	14	10	10	13	13	10	13	12	12	7	10	10	9	15	11	13	10	8	9	6	6	8	11	8	14	12	12	12	14	5	12	14	14		

Sporadic species: III.: *Hieracium lachenalii* 4,19; *H. laevigatum* 23,29; *Luzula pallescens* 12,21; *Pteridium aquilinum** 26; IV.: *Dicranum polysetum* 18; *Juniperus communis* c 17; *Leucobryum glaucum* 2,11(2),15,34,37; *Pseudoscleropodium purum* 25; *Vaccinium vitis-idaea* 16; V.: *Acer pseudoplatanus* c 3,33(r),36(r); *Carex remota* 5,18; *Fagus sylvatica* a2 11(3), b 11, c 11,12,18,28,30(r); *Festuca gigantea* 32; *F. heterophylla* 17,32; *Malus sylvestris* 20,29,30; *Scrophularia nodosa* 34(r),37(r) *Ulmus minor* a 23(1), c 23(1); *Viola riviniana* 35; VI.: *Cladonia chlorophaea* 4; *Danthonia decumbens* 8; *Hypericum maculatum* 35; *Luzula campestris* 1; *Polytrichum juniperinum* 4; *Solidago virgaurea* s. s. 30; *Veronica officinalis* 23; VII.: *Agrostis gigantea* (M-A) 26(1); *Carex canescens* (S-C) 18; *Juncus conglomeratus* (S-C) 24; *Poa palustris* (M-A) 17; *P. trivialis* (M-A) 1,12; *Polytrichum commune* (S-C) 11,17(1),18,26(2); *Ranunculus repens* (M-A) 16; VIII.: *Brachytheciastrum velutinum* 6,21,34,37; *Brachythecium salebrosum* 12; *Cladonia digitata* 30; *C. glauca* 1,4,19; *Crataegus laevigata* c 10,14(r); *C. rhipidophylla* var. *rhipidophylla* 8,9,13(r),34(r),37(r); *Crataegus* sp. b 23, c 23; *Dicranodontium denudatum* 9,13,33,36; *Galeopsis tetrahit* 32; *Hieracium murorum* 1; *Kindbergia praelonga* 35; *Moehringia trinervia* 35; *Orthodicranum montanum* 2,4,8; *Poa angustifolia* 8,15,18; *Polygonum minus* 32; *Pyrus pyraister* 2; *Quercus petraea* a1 3(3),11(1),26(3), a2 26, c 21,26; *Rubus caesius* 26; *R. corylifolius* 29; *R. idaeus* 15; *R. nessesensis* 10,14; *Rubus* sp. 23; *Rubus sprengelii* 9,10,13,14; *Sciuro-hypnum oedipodium* 2,5,22,24,31,34,37; *Sedum maximum* 15; *Sphagnum* sp. 15,26.

[illegible]

Sporadic species: II.: *Aulacomnium androgynum* 36; *Hieracium lachenalii* 11; *H. laevigatum* 6; *H. sabaudum* 21; *Mnium hornum* 30; III.: *Dicranum polysetum* 2,19; *Hylocomium splendens* 13,28,36; *Juniperus communis* c 5,21,27; *Lycopodium annotinum* 24; *Plagiothecium curvifolium* 7,18,22,31,33,38,45,52; *Pseudoscleropodium purum* 3(1),10,13,19,23,42,48; *Rubus saxatilis* 11; *Thuidium tamariscinum* 9,13,28,42; *Vaccinium vitis-idaea* 3(1); IV.: *Atrichum undulatum* 2,11,13,19,50; *Corylus avellana* b 1,15(1),56, c 1,13,15(1),56; *Eurhynchium angustirete* 42; *Fagus sylvatica* a 31, a2 32,36, b 31(1),36,51, bc 37,42, c 4,22,23,25(r),26,31,35,45(1),51; *Festuca heterophylla* 42; *Hedera helix* 12(1),36,44,50,55; *Malus sylvestris* bc 43, c 6,36,39,54,55; *Polygonatum multiflorum* 36(r),41; *Scrophularia nodosa* 2; *Sorbus torminalis* 36; *Tilia cordata* bc 44; *Viola reichenbachiana* 1,11,47; V.: *Agrostis stolonifera* (M-A) 41; *Juncus conglomeratus* (S-C) 13,19(1),54; *Poa pratensis* (M-A) 17,43; *P. trivialis* (M-A) 7,22,26,30,47,52,56; *Veronica chamaedrys* (M-A) 11; VI.: *Calluna vulgaris* 3; *Carex ovalis* 10,12,33; *Luzula multiflora* 7,8,11,14,29,38,43; *Nardus stricta* 14,27; *Solidago virgaurea* s. s. 36,37,39,40,41,55; VII.: *Athyrium filix-femina* 6,12; *Aulacomnium palustre* var. *palustre* 14,28,30,32,38; *Betula obscura* a2 8; *Brachytheciastrum velutinum* 42; *Brachythecium rutabulum* 30,33; *Calamagrostis canescens* 12,28; *C. epigejos* 7,11,13,18,52,56(1); *Carex elongata* 12,34,46; *C. panicea* 13; *C. vesicaria* 12(2); *Crataegus laevigata* 46; *C. monogyna* 55; *C. rhipidophylla* var. *rhipidophylla* 6,13; *Deschampsia flexuosa* 10,11; *Fragaria vesca* 1; *Galeopsis pubescens* 1,47; *Hieracium murorum* 11; *Hypericum maculatum* 11; *Hypnum cupressiforme* 3,19,22,23,36; *Impatiens parviflora* 21(1); *Larix decidua* subsp. *decidua* 7; *Lepidozia reptans* 6,31,45,48; *Lophocolea bidentata* 16,19,27,28,38; *Lycopus europaeus* 56; *Moehringia trinervia* 2,6,21,24,30,47,50,53(1); *Mycelis muralis* 24; *Plagiomnium affine* 2,21(1),30,33,42; *Plagiothecium ruthei* 38; *Plagiothecium* sp. 3,17,24,27; *Polygonum hydropiper* 13; *Populus tremula* a 38(1), a1 55(2), a2 8(1),39(1), b 16,55(1), bc 37, c 16,23,32,38,39,46,55; *Prunus* sp. 30,33; *Pyrus communis* a2 46, b 46, c 6,10,43,49,55; *Rhamnus cathartica* b 53, c 53; *Rubus gracilis* 6,12,15,29,34(r),46(1),54; *R. hirtus* 14; *R. pallidus* 14,36; *Rubus* sp. 1,18,33,41,43,50; *Salix cinerea* 19; *Sciuro-hypnum oedipodium* 6,10,14,19,30,36,37, 38,42; *S. starkei* 9; *Sphagnum capillifolium* 49; *S. palustre* 19; *S. russowii* 9(2); *Urtica dioica* 2.

Table A3. *Calamagrostis arundinaceae*-*Quercetum petraeae molinietosum* (untransformed form)

[illegible]

Sporadic species: II.: *Aulacomnium androgynum* 22,25,26; *Hieracium umbellatum* 28,43,49,54; *Lonicera periclymenum* b 7(1), c 7(2); *Lophocolea heterophylla* 3; *Luzula pallescens* 29,36; *Mnium hornum* 13(1),15,34,50(1); *Plagiothecium denticulatum* 15,24,25,26,44,45; *P. laetum* 15(r),17,22,34; **V.:** *Betula pubescens* a1,a 41(2),55(1), b 14,32,42, c 6,32(r),42; *Dicranum polysetum* 6; *D. scoparium* 33,38,40; *Dryopteris dilatata* 4,7,17,20,43; *Galium rotundifolium* 20(1); *Juniperus communis* b 8,17,18,51(r), c 9,13,18,36,50; *Lycopodium annotinum* 30; *L. clavatum* 51; *Monotropa hypopitys* s.s. 8,53; *Orthilia secunda* 6,30; *Plagiothecium curvifolium* 15; *Pyrola minor* 20; *Rubus saxatilis* 42(1),46(r); *Sphagnum girgensohnii* 45; *Thuidium tamariscinum* 51; *Viscum album* subsp. *austriacum* 7; **VI.:** *Acer pseudoplatanus* bc 29; *Ajuga reptans* 16,17,18,20,22(r),27,37,47; *Brachypodium sylvaticum* 54(1); *Campanula persicifolia* 38,43; *Carex digitata* 31,33,51(1); *Corylus avellana* b 35,54,56, c 5(r),35; *Dactylis polygama* 28; *Dryopteris filix-mas* 18,23,30(1),51,52; *Eurhynchium angustirete* 43; *Festuca heterophylla* 26,40,42; *Galeobdolon luteum* 38,39; *Hedera helix* c 19,44(1),45(1); *Malus sylvestris* b 44,45, bc 6,55, c 5,15,18,23,25,26,33,34,35,44,45; *Melampyrum nemorosum* 43,54(1); *Melica nutans* 1(1),46(1); *M. uniflora* 30; *Milium effusum* 15,16,22,39,46,56; *Padus avium* a2 13(1), b 13(1), c 13,50; *Platanthera bifolia* 18,21; *Polygonatum multiflorum* 33; *Ribes uva-crispa* c 46(r); *Scrophularia nodosa* 1,27,28,30; *Tilia cordata* b 27, c 14; *Viburnum opulus* c 17; *Viola reichenbachiana* et *riviniana* 1; **VII.:** *Danthonia decumbens* 10,14,24; *Genista tinctoria* 28,38,49,54; *Nardus stricta* 2,34; *Polytrichum juniperinum* 6; *Potentilla anglica* 23,47; *Scorzonera humilis* 49; *Veronica officinalis* 10,15,31,36(r),52; **VIII.:** *Abies alba* c 21; *Aegopodium podagraria* 46(r); *Agrostis gigantea* 16,43; *Agrostis* sp. 16; *A. stolonifera* 10(1),43; *Alnus glutinosa* a 37(1); *Arrhenatherum elatius* 49(1); *Astragalus glycyphyllos* 38; *Athyrium filix-femina* 18,22,33,40(r),47,51; *Aulacomnium palustre* var. *palustre* 2; *Betonica officinalis* 10,28(1); *Brachythecium rutabulum* 30,39; *Calamagrostis canescens* 50(1); *Campanula patula* s.s. 17,27,28,51,55; *C. rotundifolia* 3; *Carex acutiformis* 46(2); *C. brizoides* 10; *Cladonia* sp. 10; *Clinopodium vulgare* 30; *Crataegus laevigata* c 25(r),26(r),46(r); *C. monogyna* b 17,28,33,42,49,51, c 30,33,38,41,42,46,49; *C. rhipidophylla* var. *rhipidophylla* b 9,24,36,46,47, c 9,19,24,25,26,27,35,52; *Deschampsia flexuosa* 7,20,35(1),42; *Dicranum bonjeanii* 44,45; *Euonymus europaea* c 28; *Euphorbia cyparissias* 20,49; *Fallopia convolvulus* 46; *Festuca pratensis* 49(3); *Galeopsis pubescens* 20,46,49; *G. tetrahit* 7(r),11,15,27,43,48,54; *Galium album* 45; *G. boreale* 54(1); *G. mollugo* 17,28(1),38; *G. palustre* 16; *G. uliginosum* 18,47; *Geum urbanum* 27; *Hieracium barbatum* 43; *H. cymosum* 15,36; *H. murorum* 38,51; *Holcus lanatus* 54; *Impatiens parviflora* 7(1),20,46(1); *Juncus conglomeratus* 11,19,24,34,47; *Kindbergia praelonga* 3,31,34,36,44(1); *Larix decidua* subsp. *polonica* a142(3), b 42(1), c 42(1); *L. decidua* subsp. *decidua* 7(r); *Lepidozia reptans* 9; *Ligustrum vulgare* c 17; *Linaria vulgaris* 49; *Lophocolea bidentata* 17; *Lotus corniculatus* 21,27,47; *L. uliginosus* 43; *Lychnis flos-cuculi* 55; *Mycelis muralis* 5,17,20,31,37,38,40,46,50; *Orthodicranum montanum* 51; *Oxyrrhynchium hians* var. *hians* 45(1); *Padus serotina* b 7, c 7,12,46; *Peucedanum oreoselinum* 54; *Pimpinella saxifraga* 49; *Plagiomnium affine* 18,30,44(1),45(1),47,48; *P. cuspidatum* 38; *Plagiothecium* sp. 11; *Platanthera chlorantha* 55; *Poa compressa* 10,43; *P. pratensis* 10,19,29,43,47,54,55; *P. trivialis* 15; *Polytrichum commune* 21; *Populus tremula* b 8,36,41(1), bc 10,43,55, c 8(1),12,13,14,32(r),36,39(r); *Prunella vulgaris* 11; *Prunus spinosa* c 30,46(r); *Pyrus communis* a 2, b 36, c 2,28,47,49; *Quercus rubra* b 5, c 5,42; *Q. x rosacea* a1,a 30(1),33(2),38(2),1(3), a2 33(1), b 56, c 19(1),33,56; *Ranunculus sardous* 29; *Rhamnus cathartica* c 28; *Rosa canina* 27; *Rubus caesius* 6,13; *R. corylifolius* 5(1),46; *R. gracilis* 9,23,35,50,52; *R. idaeus* 5,13,17,22,28,30,36,39,46; *R. nessensis* 2,27,36,37,44,45; *R. pallidus* 44,45; *R. plicatus* 4,5,9,25,26,35,47; *R. serpens* 42; *Rubus* sp. 6,8(1),29,30,33,51; *R. sprengelii* 7(1),21,27,32,46; *Rumex acetosella* 13,20; *Salix cinerea* 9,47; *Sciuro-hypnum oedipodium* 3,4,18,24,43,44(1),45(1),53; *Scutellaria galericulata* 46(1); *Selinum carvifolia* 30; *Silene vulgaris* 49; *Sphagnum capillifolium* 2; *S. fimbriatum* 44; *Stellaria graminea* 17,18,43; *Thalictrum aquilegifolium* 46(1); *Urtica dioica* 3; *Vicia cracca* 28; *V. sepium* 30,38.

Table A4. *Calamagrostis arundinaceae*-*Quercetum molinietosum* typical variant in stage I of degeneration

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26			
ID-1		30	30	24	33	12	50	12	50	26	12	51	37	30	12	12	12	30	48	48	35	30	48	48	30	48	44			
ID-2		5	5	-	1	1	3	1	3	21	1	1	12	5	1	1	1	5	3	3	20	5	3	3	5	3	4			
ID-3		18	15	-	8	34	12	48	25	1	47	23	22	21	5	27	29	20	19	29	23	26	30	17	13	27	10			
Date (year)		1957	1955	2006	1999	1993	1076	1993	1976	1965	1981	1987	1965	1993	1993	1982	1956	1976	1976	1967	1957	1976	1976	1955	1976	1979		1-16	17-26	
Density of tree layer	a1,a [%]	90	50	65	70	65	80	50	85	80	55	60	80	40	60	70	65	50	70	65	60	50	75	85	60	80	60	%	%	
Density of tree layer	a2 [%]	-	60	+	5	5	-	30	-	10	10	-	-	20	40	5	-	-	5	70	-	-	75	-	-	-				
Density of shrub layer	b [%]	-	10	+	10	+	-	25	-	15	30	50	40	50	50	5	5	30	-	20	10	-	-	-	-	10				
Cover of herb layer	c [%]	30	25	40	40	80	40	50	80	70	80	80	95	75	60	75	60	90	90	70	80	50	80	50	25	50	70			
Cover of moss layer	d [%]	5	+	-	10	-	3	10	-	5	5	20	-	5	5	5	10	+	+	+	+	+	+	+	+	10				
Area of relevé		900	900	200	300	200	200	200	200	200	200	200	800	800	200	200	250	150	200	100	1000	1000	200	200	400	200	400			
Location (ATPOL)		CD73	CD73	BC66	200	-	CD73	200	BD28	200	CD73	200	BD28	200	CD64	200	CD84	100	BE03	800	CD73	400	CD93	200	CD83	200	CD73	100		
Total number of species		17	28	30	32	28	15	30	12	29	40	33	21	26	38	34	35	30	24	22	19	19	12	22	20	19	28			
Number of mosses, liverworts and lichens species		1	5	-	7	-	4	3	-	4	7	7	-	1	6	3	5	2	-	7	-	1	3	1	2	-	3			
I. Ch., D.* <i>Calamagrostis arundinaceae</i> - <i>Quercetum petraeae</i>																														
* <i>Quercus petraea</i>	a1,a	.	.	.	4	.	5	1	5	.	2	+	1	.	1	3	.	.	.	.	.	.	.	.	.	.	1	56	10	
* <i>Quercus petraea</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	19	—	
* <i>Quercus petraea</i>	b/c	.	.	1+	+	1	1	1	1	1	1	1	1	1	1	2	.	.	.	.	.	.	.	.	.	1+	56	10		
* <i>Calamagrostis arundinacea</i> (Qrp)		2	+	2	.	4	3	3	2	+	3	.	+	+	+	1	.	2	+	+	3	3	+	1	.	.	81	70		
* <i>Festuca ovina</i> (Qrp)		.	+	.	.	+	.	.	2	+	+	.	.	2	+	1	+	1	1	+	.	+	1	.	.	.	56	70		
<i>Hieracium lachenalii</i>		.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.	.	.	.	.	.	1	1	13	30		
<i>Hieracium laevigatum</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	—	10		
<i>Hieracium sabaudum</i>		.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	—		
II. D. <i>Ca-Q molinietosum</i>																														
<i>Picea abies</i> (V-P)	a1*,a2	.	.	.	.	1	.	1	.	.	.	.	.	2	3	.	.	.	.	+	.	.	.	.	.	.	.	25	10	
<i>Picea abies</i> (V-P)	bc*,b	.	+	.	.	.	.	1	.	2*	+	+	.	+	+	+	.	+	.	+	+	.	.	.	.	+	.	44	40	
<i>Picea abies</i> (V-P)	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	10	
<i>Quercus robur</i> [Q. x rosacea ^]	a1,a	4	3	4	2	4	.	3	.	3	3	4	4	3	4	3	4	4^	.	2	3^	3^	2	3^	.	.	88	80		
<i>Quercus robur</i>	a2	.	.	.	+	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	19	—		
<i>Quercus robur</i>	b	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	13	10		
<i>Quercus robur</i> [Q. x rosacea ^]	c	+	.	+	+	1	.	2	.	.	1	+	1	.	1	2	+	1^	+	+	.	1^	1^	+	+	+	63	60		
<i>Frangula alnus</i>	b	+	1	+	1	+	2	.	.	3	3	3	3	3	1	1	1	.	.	.	.	.	.	.	.	2	88	30		
<i>Frangula alnus</i>	c	+	+	.	1	1	.	1	.	+	1	+	1	1	+	+	+	+	+	+	+	+	+	+	+	+	81	60		
<i>Molinia caerulea</i>		+	.	1	2	1	1	.	2	.	+	+	3	+	+	+	+	2	1	.	.	1	1	.	1	.	75	60		
<i>Lysimachia vulgaris</i>		.	+	1	.	1	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	2	.	63	30		
<i>Dryopteris carthusiana</i>		.	+	.	.	+	.	.	r	.	+	+	+	.	+	+	.	.	.	.	.	1	+	+	.	.	50	40		
<i>Trientalis europaea</i> (V-P)		.	.	.	.	.	.	.	.	.	+	+	+	.	+	+	1	.	1	.	.	.	.	.	1	.	44	40		
<i>Carex pallescens</i> (C-U)		+	+	+	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	.	50	20		
<i>Potentilla erecta</i> (C-U)		.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	38	20		
<i>Deschampsia caespitosa</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	+	31	20		
<i>Juncus effusus</i>		.	.	.	1	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	—		
<i>Agrostis canina</i>		.	.	.	1	.	.	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	31	—		
<i>Carex nigra</i>		.	.	.	2	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	31	—		
III. Ch., D.* <i>Quercetum robori-petraeae</i> (Qrp)																														
<i>Carex pilulifera</i>		+	+	1	1	.	.	.	+	+	1	.	1	+	1	+	+	.	+	.	1	.	.	.	.	.	75	40		
* <i>Pteridium aquilinum</i>		+	.	2	1	.	.	+	2	.	3	.	.	.	.	.	1	2	2	3	.	2	+	2	2	.	50	80		
<i>Holcus mollis</i>		.	1	.	1	+	.	.	.	1	+	4	.	.	+	+	+	+	+	.	.	.	.	1	.	.	69	40		
* <i>Polytrichastrum formosum</i>		2	1	.	+	.	.	2	.	+	1	2	.	1	1	1	2	+	.	.	.	.	1	.	1	.	69	40		
* <i>Melampyrum pratense</i>		.	.	.	.	+	.	.	.	1	+	.	2	+	+	+	1	+	2	1	.	.	.	.	.	.	63	40		
<i>Dicranella heteromalla</i>		.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25	20		
IV. Ch. <i>Vaccinio-Piceetea</i> (V-P)																														
<i>Pinus sylvestris</i>	a1,a	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3	4	3	3	3	4	3	3	4	13	100	
<i>Pinus sylvestris</i>	a2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	—		
<i>Pinus sylvestris</i>	b*,c	.	.	.	1*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19	10		
<i>Vaccinium myrtillus</i>		1	2	2	1	1	+	.	3	4	4	3	3	3	4	4	4	3	4	4	3	3	3	4	2	2	2	100	100	
<i>Pleurozium schreberi</i>		.	+	.	.	.	.	.	.	+	1	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	44	—		
<i>Rubus saxatilis</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	1	.	.	13	30		
V. Ch. <i>Quercus-Fagetea</i>																														
<i>Carpinus betulus</i>	a,a2	4	4	.	.	.	+	2	.	3	1	1	.	.	.	+	+	.	.	3	.	.	4	.	.	.	50	30		
<i>Carpinus betulus</i>	b*,bc	+	+	.	.	.	.	.	+	.	.	.	1	.	.	1	.	.	+	.	.	.	.	.	.	.	31	30		
<i>Carpinus betulus</i>	c	.	.	.	.	.	.	.	.	+	r	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	50	10		
<i>Fagus sylvatica</i>	a1,a	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	1	.	.	13	40		
<i>Fagus sylvatica</i>	a2	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	6	10		
<i>Fagus sylvatica</i>	bc*,b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	2	.	.	.	+	.	13	30		
<i>Fagus sylvatica</i>	c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19	20		
VI. Ch. <i>Calluno-Ulicetea</i> (C-U)																														
<i>Solidago virgaurea</i> s. s.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	1	+	31	50		
<i>Agrostis capillaris</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	38	10		
<i>Pohlia nutans</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	31	20		
<i>Danthonia decumbens</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	31	10		
VII. Others																														
<i>Betula pendula</i>	a1,a	.	.	.	.	+	.	1	.	.	.	+	1	.	.	.	1	.	.	1	.	.	.	.	.	.	31	10		
<i>Betula pendula</i>	a2	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13	—		
<i>Betula pendula</i>	b/c	.	.	.	2/1	1+	.	1+	.	.	1+	.	.	1+	.	.	.	.	.	.	.	.	.	.	1/1+	.	31	10		
<i>Sorbus aucuparia</i>	a2*,b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	31	20		
<i>Sorbus aucuparia</i>	c	+	+	+	+	r	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	94	80		
<i>Luzula pilosa</i>		+	+	+	.	.	+	+	1	+	1	.	+	+	1	+	.	1	+	.	1	+	.	+	1	.	81	70		
<i>Maianthemum bifolium</i>		+	+	1	.	.	+	+	+	+	1	.	+	+	+	+	1	1	1	.	.	.	.	.	.	.	75	50		
<i>Convallaria majalis</i>		+	.	1	.	2																								

Sporadic species: III.: *Aulacomnium androgynum* 19; *Herzogiella seligeri* 24; *Lophocolea heterophylla* 16; *Luzula pallescens* 12; *Plagiothecium denticulatum* 7,10; *P. laetum* 6; IV.: *Betula pubescens* subsp. *pubescens* a 2(1), b 4(1),14, c 4,13; *Dicranum polysetum* 2; *D. scoparium* 19; *Hylocomium splendens* 7,10,14; *Juniperus communis* b 26; *Leucobryum glaucum* 4(2),10,17,26(1); *Orthilia secunda* 18(1); *Plagiothecium curvifolium* 6,19,22; *Pseudoscleropodium purum* 11(1),15,16; *Thuidium tamariscinum* 2,16; *Vaccinium vitis-idaea* 4,8(1),25,26; V.: *Anemone nemorosa* 9(r); *Brachypodium sylvaticum* 3; *Carex montana* 23; *C. sylvatica* 13; *Corylus avellana* c 3; *Equisetum sylvaticum* 26(1); *Fraxinus excelsior* a2 3(1); *Malus sylvestris* c 5,9,10,15,18; *Melica nutans* 6,18(1),23(2); *Milium effusum* 5,13,16,25; *Padus avium* b 3, c 3; *Poa nemoralis* 16; *Sorbus torminalis* 9; *Stellaria holostea* 1,5,7(r),24; *Viburnum opulus* 12; *Viola reichenbachiana* 20; *V. reichenbachiana et riviniana* 23(1); *V. riviniana* 3; VI.: *Calluna vulgaris* 4,26(1); *Carex ovalis* 5,7,14; *Cladonia coniocraea* 4; *Luzula multiflora* 4,12,13,26; *Nardus stricta* 4,26(1); *Polytrichum juniperinum* 2; *Potentilla anglica* 5; *Scorzonera humilis* 6,18(1),26(2); *Veronica officinalis* 2; VII.: *Amblystegium serpens* 4; *Athyrium filix-femina* 12; *Betonica officinalis* 25; *Brachytheciastrum velutinum* 19; *Calamagrostis epigejos* 2,16(1),26; *Campanula rotundifolia* 26; *Carex acutiformis* 3; *C. brizoides* 2,17(1); *C. hirta* 12; *Crataegus laevigata* b 15; *C. rhipidophylla* var. *rhipidophylla* b 10,15, c 15; *Crataegus* sp. b 9, c 9; *Dactylis glomerata* 23(1),25; *Eriophorum angustifolium* 4; *Fragaria vesca* 23; *Galeopsis pubescens* 3; *Galium boreale* 23(1); *G. palustre* 12; *Hypericum maculatum* 15; *Hypnum cupressiforme* 4,19,26(2); *Impatiens parviflora* 3(1); *Kindbergia praelonga* 10; *Lepidozia reptans* 14; *Lophocolea bidentata* 11; *Melampyrum arvense* 1,8,21(1),25; *Osmunda regalis* 4; *Padus serotina* c 3; *Plagiomnium affine* 11,14,23; *Poa angustifolia* 16,18,19; *P. trivialis* 11; *Polygonatum odoratum* 18,23; *Polygonum hydropiper* 4; *Polytrichum commune* 14; *Populus tremula* a 12(1), b 10(1),12(1),16, bc 17, c 3,10,16; *Prunus spinosa* c 3(r); *Pyrus communis* b 5,10, c 7,9,10; *Ranunculus repens* 12; *Rhamnus cathartica* bc 21, c 11; *Rubus caesius* 18; *R. corylifolius* 3(1); *R. gracilis* 5,15; *R. nessensis* 7,10; *Rubus pallidus* 7; *R. sprengelii* 7,14(r); *Serratula tinctoria* 18.

Table A5. *Calamagrostio arundinaceae-Quercetum molinietosum* variant with *Anemone nemorosa* in stage I of degeneration

[illegible]

Sporadic species: IV.: *Aulacomnium androgynum* 21; *Lophocolea heterophylla* 2,21; *Luzula pallescens* 5; *Mnium hornum* 19(2); *Plagiothecium denticulatum* 2(1); *P. laetum* 1,12,21,22,36; V.: *Betula pubescens* subsp. *pubescens* a 20(1), a2 22(1),23(1), c 19(1),22,23(1),35; *Dicranum polysetum* 9,22(1),23(1),32; *D. scoparium* 23(2); *Galium rotundifolium* 7; *Hylocomium splendens* 32; *Juniperus communis* c 1,8,12,14,34,38; *Leucobryum glaucum* 9,19,25,28,34,38(2); *Rubus saxatilis* 17,22,23(1),29(1),33(1); *Thuidium tamariscinum* 19(1),35; *Vaccinium vitis-idaea* 28; VI.: *Brachypodium sylvaticum* 16; *Campanula persicifolia* 4,33; *Carex digitata* 18,19(1); *Corylus avellana* b 16(3),17(1),33(1), bc 16, c 17(1),33; *Dactylis polygama* 23(1); *Dryopteris filix-mas* 27; *Festuca gigantea* 37; *F. heterophylla* 4,22,23(2),33; *Fraxinus excelsior* b 6, c 6; *Galium odoratum* 7; *Hedera helix* c 20; *Lilium martagon* 17,29(1); *Malus sylvestris* a 3, bc 23,32, c 9,24,26,27,28,29,34; *Melampyrum nemorosum* 33(1); *Melica nutans* 17,19(2),29(1),37(1); *Milium effusum* 8,17,18(1),20,27; *Padus avium* b 16(1),37; *Platanthera bifolia* 5,14,15(1); *Polygonatum multiflorum* 3,20,21; *Pulmonaria obscura* 33(r); *Ranunculus auricomus* 4; *Scrophularia nodosa* 3,8,10; *Sorbus torminalis* c 24; *Viburnum opulus* c 5,10; VII.: *Carex ovalis* (CU) 8,9,11,23(1),32,34; *Genista germanica* 10; *G. tinctoria* 33; *Hieracium pilosella* 15,38(1); *Nardus stricta* 3; *Viola canina* 15; *Danthonia decumbens* 32; VIII.: *Abies alba* c 1; *Achillea millefolium* 14; *Agrostis gigantea* 20,32,38; *A. stolonifera* 32; *Alnus glutinosa* 18; *Anthriscus sylvestris* 10; *Athyrium filix-femina* 10,30; *Brachythecium rutabulum* 33; *Campanula patula* s.s. 7,12,14,32,35; *C. rapunculoides* 15; *C. rotundifolia* 4(1),6; *Carex acutiformis* 17(1); *C. brizoides* 32; *C. canescens* 2; *C. divulsa* 19; *C. hirta* 23; *C. nigra* 2,8,9,34,37; *Chamaenerion angustifolium* 2(r); *Clinopodium vulgare* 7,33; *Crataegus laevigata* b 17; *C. monogyna* b 1(1),2,12,24,26,27, bc 20(r),32, c 1,2,23,24,27; *C. rhipidophylla* var. *rhipidophylla* b 9, c 9,34; *Dactylis glomerata* 16; *Deschampsia flexuosa* 16(2),19(1),23(4),30(2),37; *Euonymus europaea* c 7; *Fallopia convolvulus* 37(1); *Galeopsis pubescens* 6,10,22; *G. tetrahit* 7,8,9,34,37(r),38; *Galium boreale* 4,6(1),29(1); *G. mollugo* 4,6(1),10,12,14(2),15; *G. uliginosum* 32,34; *G. verum* 11,14(1); *Geranium robertianum* 10; *Geum urbanum* 15; *Hepaticae* indet. 38; *Hieracium murorum* 2,11(1),26,28,33(1); *Holcus lanatus* 27; *Hypnum cupressiforme* 5,17,19(2),23,26,27,28(1); *Impatiens parviflora* 17,37(2); *Juncus conglomeratus* 12,34; *Kindbergia praelonga* 3,8; *Lapsana communis* s.s. 10; *Larix decidua* ssp. *polonica* a1 22(4),23(3), c 22(1); *Lathyrus pratensis* 4(2); *Lepidozia reptans* 2; *Lophocolea bidentata* 22; *Lotus corniculatus* 7,13; *L. uliginosus* 32; *Lysimachia nummularia* 17(r),32; *Melampyrum arvense* 23(1); *Mycelis muralis* 7,10(1),26,28,37; *Padus serotina* b 37, c 17; *Peucedanum oreoselinum* 29; *Phleum pratense* 7; *Pimpinella saxifraga* 14; *Plagiomnium affine* 2,3,19(2),33(r); *P. elatum* 19(1); *Plagiothecium* sp. 38(1); *Poa compressa* 3; *P. palustris* 32; *P. pratensis* 7,11,13,26,27,32,34; *P. trivialis* 33,37(1); *Polygonatum odoratum* 33; *Populus tremula* a 4(1), c 1,4,27; *Prunus spinosa* c 20,37; *Pyrus communis* c 5,8,9,24; *Quercus rubra* c 22; *Ranunculus acris* s.s. 7,32; *R. repens* 17(r); *Rosa canina* c 8,34; *Rubus caesius* 16(3),29(1),30; *R. corylifolius* 17(1); *R. gracilis* 1,9,12,34; *R. idaeus* 10(1),16(2),17(2),30,34,37(2),38; *R. nessensis* 18; *Rubus plicatus* 2,9; *R. serpens* 22(1),23; *Rubus* sp. 20,27; *R. sprengelii* 5,16,17,24,35; *Rumex acetosa* 7,11; *R. acetosella* 7,14(1),19,38; *Salix caprea* c 26,27; *Sambucus nigra* c 30; *Sanguisorba officinalis* 16; *Sciuro-hypnum oedipodium* 5(1),33; *Scutellaria galericulata* 17; *Sedum maximum* 14(1),15; *Stellaria graminea* 4,10(1),11,13,32; *Thuja gigantea* c 22; *Torilis japonica* 4,6,10; *Trifolium alpestre* 4; *Urtica dioica* 10; *Vicia cracca* 15.

Table A6. *Calamagrostio arundinaceae-Quercetum molinietosum* in stage II of degeneration

Explantion: Q-F - *Querco-Fagetea*

Sporadic species: I.: *Aulacomnium androgynum* 36; *Calamagrostis arundinacea* 35(1); *Hieracium lachenalii* 45(1); *H. sabaudum* 46; *Lophocolea heterophylla* 23; *Plagiothecium denticulatum* 23,30; IV.: *Betula pubescens* subsp. *pubescens* a,a2 22(1),23,36(1),46(1), b 21,37,46(1), c 21,22,23,25,29,35,46; *Dicranum polysetum* 8,28,46; *D. scoparium* 6,26,36,46; *Dryopteris dilatata* 21; *Hylocomium splendens* 1,28; *Juniperus communis* b 33, c 10,24,26,34; *Leucobryum glaucum* 6,28(1),36,46; *Monotropa hypopitys* s.s. 45(1); *Rubus saxatilis* 19(1); *Thuidium tamariscinum* 1,6,7; *Vaccinium vitis-idaea* 45; V.: *Calluna vulgaris* 45; *Carex ovalis* 7,13,15,20,24; *Danthonia decumbens* 45(1); *Genista tinctoria* 37; *Hieracium pilosella* 45(1); *Hypericum maculatum* 2,6,19,25; *Luzula multiflora* 2,6,7,31,42; *Nardus stricta* 41; *Polytrichum juniperinum* 19; *Solidago virgaurea* s.s. 2,6,17,19(1),23,27(r),37,44,45; *Veronica officinalis* 2,6,13,17,45(1); *Viola canina* 45; VI.: *Abies alba* c 39; *Acer pseudoplatanus* (QF) b 39; *Agrostis canina* 1(2),15(1),25,29(3),30,38; *A. cfr. canina* 36; *A. gigantea* 2,7,10,15(1),24(1),38(1); *Agrostis* sp. 24; *A. stolonifera* 2; *Ajuga reptans* (QF) 4,5,19; *Alnus glutinosa* b 37; *Arrhenatherum elatius* 13; *Athyrium filix-femina* 6(1),45; *Aulacomnium palustre* var. *palustre* 24; *Brachypodium sylvaticum* (QF) 43(1); *Brachytheciastrum velutinum* 2,6; *Brachythecium rutabulum* 2; *Campanula persicifolia* (QF) 19; *C. rotundifolia* 45; *Carex brizoides* 2(4); *C. hirta* 15,16(1); *Carex* sp. 32; *Chamaenerion angustifolium* 21,46; *Convallaria majalis* 4(1),5(1),6,7,8,9(r),30,31,32(1),35,44(1); *Corylus avellana* (QF) b 19(3), c 19,21; *Crataegus laevigata* b 9(r); *C. monogyna* b 6,7,15(1), c 1,5,6,7,15; *C. rhipidophylla* var. *rhipidophylla* c 14,23(r); *Crepis paludosa* 4,34; *Dactylis polygama* (QF) 43; *Deschampsia flexuosa* 21(3),23,39,45,46(2); *Dryopteris filix-mas* (QF) 6(r),9,25,26,39; *Epilobium montanum* 3; *Equisetum sylvaticum* 45(1); *Festuca gigantea* (QF) 10(1),17,43; *F. heterophylla* (QF) 19(1); *Fragaria vesca* 1,3,30,25,29; *Galeopsis tetrahit* 1,3(2),4,5,8,16(1),17,34; *Galium aparine* 13; *Geranium robertianum* 4; *Hieracium murorum* 3; *Holcus lanatus* 31,46; *Hypericum perforatum* 14,15,16(1),26,45; *Hypnum cupressiforme* 6(1),7,9,23,26,31,40,46(1); *Impatiens noli-tangere* (QF) 10; *I. parviflora* 3(2),17,18(2),21,39,43; *Juncus conglomeratus* 2; *Kindbergia praelonga* 20; *Larix decidua* subsp. *decidua* a,a2 20(1),46, b 21, c 46; *Lophocolea bidentata* 40; *Lysimachia thyrsiflora* 43(r); *Malus sylvestris* (QF) a 6(1), b 6(r),7, c 6,7,20,30; *Melica nutans* (QF) 25; *Milium effusum* (QF) 1,7,11(1),30,33(1),35,40; *Mycelis muralis* 4,19,20,45(1),46; *Orthodicranum montanum* 6; *Padus serotina* b 43(1); *Peucedanum oreoselinum* 45; *Plagiomnium affine* 3(1),13,15(1),17,20,22,38; *Plagiomnium rostratum* 39(1); *Plagiothecium* sp. 1,26; *Poa angustifolia* 6(5),14,15,16(1),23; *P. pratensis* 2,25; *P. trivialis* 13,16(1); *Polygonatum multiflorum* (QF) 6; *Polygonum hydropiper* 31; *Polytrichum commune* 6; *Populus tremula* a1 13(3), a2 13(3),37(2), b 13, bc 2, c 37,40; *Prunus spinosa* c 30; *Pyrus communis* a 36, b 37, c 1,18; *Quercus cerris* b 30; *Q. rubra* a 47(4), b 13, c 13,20,45(1),47(2); *Rhamnus cathartica* c 40; *Ribes spicatum* (QF) 43; *Robinia pseudacacia* a1 37(1), b 37, c 37; *Rubus caesius* 5; *R. corylifolius* 26; *R. gracilis* 3(1); *R. nessensis* 23,30(r); *R. plicatus* 40; *Rubus* sp. 6,7,22,31,39(4),45(2),46; *R. sprengelii* 25; *Rumex acetosella* 21,45(1),46; *Sambucus nigra* c 3; *S. racemosa* b 39(1); *Scirpus sylvaticus* 14,15; *Sciuro-hypnum oedipodium* 8,19,28,43; *Senecio vulgaris* 46; *Sorbus torminalis* (QF) c 23; *Sphagnum capillifolium* 7; *Stellaria media* 46; *Ulmus minor* (QF) c 6; *Urtica dioica* 18; *Veronica chamaedrys* 17,19(1); *Viola riviniana* (QF) 7.

Table A7. *Calamagrostio arundinaceae-Quercetum petraeae molinietosum* (relevés 1-15) and *Ca-Qp typicum* (relevés 16-39) in stage III of degeneration

Sporadic species: I.: *Hieracium laevigatum* 11; *Mnium hornum* 13(1); *Plagiothecium denticulatum* 32; *P. laetum* 15,24; IV.: *Betula pubescens* subsp. *pubescens* a2 36(1), c 2,7; *Dicranum polysetum* 31,37,38; *Dryopteris dilatata* 2,19(1); *Hylocomium splendens* 2; *Juniperus communis* b 31(2), c 3,4,31; *Leucobryum glaucum* 33,37(3); *Lycopodium annotinum* 2; *Plagiothecium curvifolium* 32,39; *Rubus saxatilis* 9(1),16; *Thuidium tamariscinum* 5(1); *Vaccinium vitis-idaea* 23,28; V.: *Acer platanoides* c 18,28; *A. pseudoplatanus* b 29, c 24; *Ajuga reptans* 3; *Atrichum undulatum* 5; *Brachypodium sylvaticum* 17(1); *Carex digitata* 18; *Corylus avellana* b 1,11,28, c 11; *Dactylis polygama* 17(1),20(1); *Dryopteris filix-mas* 20,24(2),29(1); *Festuca heterophylla* 2; *Fraxinus excelsior* c 38,39(r); *Gymnocarpium dryopteris* 13; *Impatiens noli-tangere* 30; *Lathyrus niger* 20; *Malus sylvestris* bc 2; *Melica nutans* (QF) 1(1),9(1); *Milium effusum* 2,5,35(1); *Stellaria holostea* 21; *Tilia cordata* c 19; *Viola riviniana* 6,20(1),31; VI.: *Calluna vulgaris* 18(2),26(1); *Carex ovalis* 11,31; *Danthonia decumbens* 31; *Hieracium pilosella* 31; *Hypnum jutlandicum* 7; *Polytrichum juniperinum* 31; *Scorzonera humilis* 6; *Solidago virgaurea* s.s. 2,17,20,25; *Veronica officinalis* 17,18,20(1),31; VII.: *Abies alba* a1 12(2), a2 12(2), b 12(3), c 12,29; *Agrostis canina* 5(2); *Alnus glutinosa* c 17; *Anthoxanthum odoratum* 2,6(1),16,18,26,37; *Arrhenatherum elatius* 18,35; *Astragalus glycyphyllos* 18,20(1); *Athyrium filix-femina* 8,13,18,24,30; *Brachypodium pinnatum* 16; *Brachythecium rutabulum* 36; *B. albicans* 39; *Campanula rotundifolia* 1,20; *Cardaminopsis arenosa* 31; *Carex brizoides* 5,7; *C. echinata* 11(1); *C. hirta* 4,16,27; *Chamaenerion angustifolium* 26,29; *Cladonia furcata* 39; *Cladonia* sp. 38; *Convallaria majalis* 10,22(1),23(1),37; *Crataegus laevigata* b 16, c 16; *C. rhipidophylla* var. *rhipidophylla* 4; *Crataegus* sp. c 17; *Dactylis glomerata* 18; *Dianthus deltoides* 31; *Galeopsis pubescens* 1,35; *G. tetrahit* 9,13,15,19,32,38; *Galium mollugo* 3,4(1),18,20(1),27,31; *G. verum* 20(1); *Geranium robertianum* 31; *Geum urbanum* 31; *Hieracium murorum* 24,25,35; *Holcus lanatus* 17,29; *Impatiens parviflora* 25,29,35(2),36; *Larix decidua* subsp. *decidua* a1 32(1), bc 26, c 27(r); *Leontodon autumnalis* 31; *Padus serotina* b 26, c 17,20(r),27; *Phragmites australis* 17(r); *Pimpinella saxifraga* 20; *Plagiomnium affine* 12,17(1),36,38,39(1); *P. rostratum* 1(1),29(2); *Plagiothecium nemorale* 29; *Poa angustifolia* 3,4,20(2),31; *P. compressa* 2; *P. pratensis* 2,18(1); *Pogonatum aloides* 24; *Polypodium vulgare* 20(1); *Polytrichum commune* 3(1),5; *Populus tremula* a1,a 2,7,12(1), a2 12(1), b 12,17,20(1), bc 2,7, c 12,17(2),21; *Pseudotaxiphyllum elegans* 24; *Pyrus communis* c 2,7; *Quercus rubra* a2 32(1); *Robinia pseudacacia* a1 24(1), b 19,24, c 24; *Rosa canina* c 3; *Rubus plicatus* 16(2); *Rubus* sp. 6(3),8,12,19,27,29(4),31,32; *R. sprengelii* 5,11,16(1); *Salix caprea* b 8; *Sciuro-hypnum oedipodium* 2,23,38(2); *Senecio vulgaris* 13; *Stellaria media* 13(1),32,35; *S. uliginosa* 13; *Trifolium alpestre* 18; *T. pratense* 18; *Urtica dioica* 13; *Veronica spicata* 31; *Viscum album* subsp. *album* 13.

Table A8. *Calamagrostio arundinaceae-Quercetum petraeae* typicum (untransformed form)

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36																																			
ID-1		42	50	12	42	48	35	42	52	12	36	12	36	12	50	21	37	38	48	12	21	12	55	42	36	42	42	42	24	31	35	42	55	55	55	55	55																																			
ID-2		1	3	2	1	3	20	3	12	2	13	2	17	2	3	1	12	6	3	2	1	2	16	2	13	2	2	2	4	-	4	18	3	16	16	16	16																																			
ID-3		5	9	1	4	5	27	9	3	4	2	6	18	7	23	1	18	1	33	5	17	9	15	2	10	11	12	1	1	-	1	7	4	5	11	18	20																																			
Date (year)		1981	1976	1993	1981	1976	1976	1980	1973	1992	1977	1998	1985	1998	1976	1957	1986	1984	1976	1998	1957	1981	1991	1981	1985	1980	1980	1981	1981	2006	1980	1975	1981	1992	1989	1992	1978	1-36																																		
Density of tree layer	a1,a [%]	60	80	60	75	70	60	70	75	60	75	85	70	80	80	70	75	75	70	80	55	80	60	70	45	50	65	55	55	80	30	65	60	70	80	80	70	%																																		
Density of tree layer	a2 [%]	-	-	10	-	-	15	-	20	-	10	-	5	-	+	5	5	-	+	-	-	+	+	+	+	+	+	+	-	60	-	-	-	-	-	-																																				
Density of shrub layer	b [%]	-	-	5	+	+	+	-	+	10	-	+	5	-	-	+	5	25	-	5	65	5	+	-	5	-	-	-	-	+	30	-	5	10	-	5																																				
Cover of herb layer	c [%]	80	50	50	85	70	90	95	10	60	70	70	95	70	70	65	90	85	70	60	30	40	40	45	75	50	50	40	40	30	35	60	45	10	20	20	30																																			
Cover of moss layer	d [%]	-	10	5	+	10	+	+	80	5	5	+	+	5	-	20	-	+	+	5	35	15	30	+	5	+	+	+	+	10	5	20	+	-	10	15	40																																			
Area of relevé		BD49	100																																																																					
Location (ATPOL)		BD28	200	BD29	150	BD49	100	BD28	150	CE11	300	BD49	100	CC64	130	CC70	200	BE28	200	BD24	200	CE22	800	BD24	200	BD28	200	CD82	350	BD80	700	AD74	200	BD28	250	CC95	200	CD82	350	CD35	100	BC63	100	BD49	100	BE27	800	BD49	100	BD49	120	BD49	100	BD49	100	CE36	200	CD84	100	CE01	100	BD49	100	BC73	200	BC82	100	BC73	100	BC72	100	
Total number of species		12	19	23	20	20	17	20	27	33	24	23	29	21	15	30	17	22	16	28	21	24	26	21	33	13	19	20	19	33	19	20	19	13	25	22	24																																			
Number of mosses, liverworts and lichens species		-	9	5	2	2	1	2	5	8	4	3	3	4	-	5	-	1	2	5	6	5	3	2	7	1	2	2	2	4	1	4	3	-	3	6	8																																			
I. Ch., D.* <i>Calamagrostio arundinaceae-Quercetum petraeae</i>																																																																								
* <i>Quercus petraea</i>	a1,a	4	5	3	4	.	.	4	4	3	.	5	4	4	4	.	4	2	.	4	.	1	.	4	.	3	4	4	4	5	.	.	4	4	3	5	2	72																																		
* <i>Quercus petraea</i>	a2	.	.	1	.	.	.	.	2	.	2	.	+	.	1	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19																																		
* <i>Quercus petraea</i>	b	.	.	.	+	.	.	.	2	.	.	+	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17																																		
* <i>Quercus petraea</i>	c	+	.	+	1	.	.	+	1	.	1	+	1	+	.	+	1	.	2	.	+	.	+	.	+	+	+	.	2	.	.	.	+	+	+	+	64																																			
<i>Hieracium lachenalii</i>		.	.	+	+	+	+	+	+	+	+	.	.	r	1	1	+	+	+	+	+	1	+	+	+	+	+	+	+	+	+	+	+	.	r	+	81																																			
* <i>Festuca ovina</i> (Qrp)		.	1	1	1	1	+	2	.	+	+	+	.	1	2	2	.	+	2	+	+	1	3	3	3	3	2	2	.	.	.	2	2	.	2	2	75																																			
<i>Hieracium sabaudum</i>		+	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	.	1	r	+	1	+	+	+	+	.	+	+	+	1	.	1	58																																				
* <i>Calamagrostis arundinacea</i> (Qrp)		5	3	3	4	3	.	.	+	+	1	.	+	+	2	1	.	.	2	+	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	44																																			
<i>Hieracium laevigatum</i>		.	1	.	.	.	.	.	.	+	+	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	42																																			
<i>Lathyrus montanus</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3																																			
II. Ch., D.* <i>Quercetia robori-petraeae</i> (Qrp)																																																																								
* <i>Melampyrum pratense</i>		+	.	+	+	2	.	+	.	1	1	.	.	+	+	1	2	1	1	1	1	1	2	1	1	1	1	+	1	.	+	1	2	.	+	r	78																																			
* <i>Pteridium aquilinum</i>		2	+	1	2	1	3	5	.	1	+	2	2	1	1	+	.	1	1	+	2	2	1	+	.	+	+	2	+	.	.	.	+	r	+	.	78																																			
* <i>Polytrichastrum formosum</i>		.	2	1	+	.	.	.	4	+	+	+	+	1	.	1	.	.	.	+	2	2	2	+	1	.	+	+	+	2	1	2	+	.	1	1	72																																			
<i>Carex pilulifera</i>		+	.	.	1	+	+	.	.	.	.	.	+	+	+	+	.	1	1	1	+	+	+	+	+	+	+	+	2	1	.	+	+	2	.	69																																				
<i>Dicranella heteromalla</i>		.	.	.	+	+	.	1	+	+	.	.	+	.	+	.	.	+	.	.	.	.	.	.	+	+	+	+	+	+	+	+	+	2	1	+	58																																			
<i>Holcus mollis</i>		.	.	+	.	.	.	.	3	4	+	1	.	+	+	.	.	.	.	.	.	.	.	.	.	2	.	.	.	+	2	2	.	.	.	1	33																																			
III. Ch. <i>Vaccinio-Piceetea</i>																																																																								
<i>Pinus sylvestris</i>	a1,a	.	.	2	.	3	3	.	.	1	.	+	1	1	.	.	3	3	+	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	33																																		
<i>Pinus sylvestris</i>	b*,c	.	.	.	.	.	+	.	+	r	+	.	.	.	.	.	.	.	r	.	.	.	.	.	.	1*	.	.	.	.	r	.	.	.	.	.	22																																			
<i>Picea abies</i>	a1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3																																		
<i>Picea abies</i>	b/c	.	.	.	/+	.	.	.	/+	.	.	+/	1/	.	.	1/	.	.	.	4/2	.	/+	/+	/+	.	.	.	/+	.	/+	.	.	.	.	.	.	31																																			
<i>Pleurozium schreberi</i>		.	+	1	.	.	.	.	.	+	.	+	+	.	1	.	+	+	2	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	31																																			
<i>Vaccinium myrtillus</i>		.	.	1	3	3	3	.	+	2	+	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	+	1	.	+	+	2	1	1	.	.	72																																		
IV. Ch. <i>Quercio-Fagetea</i>																																																																								
<i>Fagus sylvatica</i>	a1,a	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	11																																		
<i>Fagus sylvatica</i>	a2	.	.	+	.	.	.	.	+	.	.	.	.	1	.	1	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	19																																			
<i>Fagus sylvatica</i>	b	.	.	1	.	+	.	.	+	.	.	1	.	1	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	1	.	28																																				
<i>Fagus sylvatica</i>	c	.	.	.	.	.	+	.	+	+	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	r	+	.	25																																			
<i>Poa nemoralis</i>		+	.	+	.	.	.	+	1	.	+	.	.	.	.	+	1	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.	+	+	1	+	47																																			
V. Ch. <i>Calluno-Ulicetea</i>																																																																								
<i>Luzula multiflora</i>		.	.	.	+	.	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	.	.	1	28																																		
<i>Pohlia nutans</i>		.	r	.	.	1	+	.	2	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	1	33																																			
<i>Solidago virgaurea</i> s. s.		.	.	.	+	1	.	.	.	.	.	.	.	.	.	r	+	.	1	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	28																																				
VI. Others																																																																								
<i>Quercus robur</i>	a1,a	.	.	1	.	.	+	.	.	.	4	.	.	.	.	4	.	.	.	2	3	4	3	.	3	.	.	.	.	.	2	4	+	.	.	.	33																																			
<i>Quercus robur</i>	a2	.	.	1	.	.	2	.	.	1	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14																																			
<i>Quercus robur</i>	b/c	.	.	+/	.	.	/+	.	/+	/+	.	.	.	.	/+	1/1	.	1	/+	+	.	.	/+	.	.	.	.	.	.	/+	/+	.	.	.	.	.	33																																			
<i>Sorbus aucuparia</i>	a2/b	.	.	/+	.	.	.	.	.	.	.	.	.	.	.	.	/2	.	+/	/+	.	+/2	.	.	.	.	.	.	.	.	.	.	.	.	.	14																																				
<i>Sorbus aucuparia</i>	c	.	.	1	+	+	.	+	+	+	.	.	+	.	+	.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	.	r	.	r	.	53																																				
<i>Frangula alnus</i>	b	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	+	3	.	.	.	.	22																																				
<i>Frangula alnus</i>	c	.	.	.	.	.	.	.	r	+	.	.	.	.	.	.	.	+	+	+	+	+	+	+	+	+	+	+	+	+	1	.	+	+	.	39																																				
<i>Luzula pilosa</i>		.	2	+	+	1	1	+	1	1	1	1	+	+	1	1	.	+	+	.	1	+	.	.	.	+	+	+	+	1	.	.	.	+	+	69																																				
<i>Maianthemum bifolium</i>		+	.	+	1	.	.	+	+	+	+	+	+	+	+	.	1	.	+	1	1	.	1	.	.	+	+	+	2	+	.	.	2	.	.	56																																				
<i>Anthoxanthum odoratum</i>		.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	.	+	+	.	.	.	39																																			

Sporadic species: II.: *Aulacomnium androgynum* 2; *Hieracium umbellatum* 9; *Lophocolea heterophylla* 9,36; *Mnium hornum* 34(1); III.: *Dicranum scoparium* 2,20,24,35(2),36(2); *Diphasiastrum complanatum* 15; *Dryopteris dilatata* 12; *Galium rotundifolium* 12; *Juniperus communis* b 11,22(r), c 4,25,26,28,34; *Leucobryum glaucum* 9,20(1),25,31(1),35(1); *Monotropa hypopitys* s. s. 15; *Orthilia secunda* 36; *Plagiothecium curvifolium* 22(1),35(2),36(2); *Pseudoscleropodium purum* 3,9,19; *Rubus saxatilis* 18,34; *Thuidium tamariscinum* 20; *Trientalis europaea* 6(1),15,20(r); *Vaccinium vitis-idaea* 5(1),6(1),9,13,17,19; IV.: *Acer platanoides* c 33(r); *A. pseudoplatanus* c 19,34; *Ajuga reptans* 19; *Anemone nemorosa* 21; *Atrichum undulatum* 2,10; *Brachypodium sylvaticum* 34; *Campanula persicifolia* 15,36(r); *Carex digitata* 15; *C. montana* 2; *Carpinus betulus* a,a2 14(1),30(4) c 14(2),15,29(r); *Cerasus avium* b 24; *Corylus avellana* b 34(1),36, bc 32, c 4,8,23,25,26,27; *Dactylis polygama* 16(r),34; *Festuca gigantea* 12(1),19; *F. heterophylla* 14(1); *Galium odoratum* 34(1); *Hypericum montanum* 7; *Malus sylvestris* c 35(r); *Melica nutans* 17,19,28,33; *Milium effusum* 30; *Scrophularia nodosa* 7,14,28,36; *Stellaria holostea* 31; *Tilia cordata* 16; *Viola reichenbachiana* 7,12(1); *V. riviniana* 29(r),34; V.: *Agrostis capillaris* 9,11,13,22,24,31(1); *Calluna vulgaris* 25; *Carex pallescens* 17; *Cladonia coniocraea* 21; *Genista tinctoria* 24; *Hypnum jutlandicum* 22(2),36(1); *Polytrichum juniperinum* 8,24(1); *Veronica officinalis* 8,24,26; VI.: *Aesculus hippocastanum* c 17; *Astragalus glycyphyllos* 35; *Betula pendula* a 4,21,22(1), a1 6,9(1),13,16(2),17(1),19,24(1), a2 11, b 4,17,24,29, c 9,11,14(2),23,29; *Brachytheciastrum velutinum* 2,24; *Brachythecium rutabulum* 29; *Calamagrostis epigejos* 3,6,11(1),12,13,29(2),31; *Campanula rotundifolia* 3,19; *Carex caryophylla* 8(1); *Cerastium semidecandrum* 8; *Cladonia glauca* 8; *Crataegus laevigata* 6; *C. rhipidophylla* var. *rhipidophylla* 34; *Dactylis glomerata* 17; *Deschampsia caespitosa* 29,32; *D. flexuosa* 3(1),6,8,9,10,17(2),22(2),29(2),31(3); *Dryopteris carthusiana* 9(r),11,12,22,29; *Euonymus europaea* c 34; *Fallopia convolvulus* 1,7,27; *Festuca rubra* s. s. 9,24,26,30; *Galeopsis pubescens* 7,29; *G. tetrahit* 1,12(1),32; *Geranium robertianum* 9(r); *Geum urbanum* 24; *Hieracium murorum* 10,16,23,36; *Hieracium* sp. 5; *Holcus lanatus* 8; *Hypericum perforatum* 24; *Hypnum cupressiforme* 2,3,9,13,15,20(1),21,24,29,31; *Impatiens parviflora* 29; *Juncus effusus* 29,31; *Knautia arvensis* 25; *Moehringia trinervia* 9,10,12,29,35; *Molinia caerulea* 18,30; *Mycelis muralis* 7,12(1),15,29,33,34(1),35; *Orthodicranum montanum* 2; *Oxalis acetosella* 12(1); *Padus serotina* c 1,22,29; *Plagiomnium affine* 3,11,15(1),19,36(1); *Plagiothecium* sp. 32; *Poa angustifolia* 5,23; *P. pratensis* 8,10,23,28; *Polygonatum odoratum* 5(1),15,32; *Polypodium vulgare* 22(1),36(3); *Populus tremula* b 36(1), c 8,16,27,33(r),36(1); *Pseudotsuga taxifolia* a 22(2), b 22(r), c 22; *Pyrus communis* c 27; *Quercus rubra* a 22(1), c 21(1),22; *Q. x rosacea* a 5(3),18(3), 5(1),18(1); *Rhamnus cathartica* c 21; *Rubus caesius* 34; *R. cfr. hirtus* 12; *R. idaeus* 9(r),11,12; *R. plicatus* 21; *Rubus* sp. 7,12(1),17; *Rumex acetosella* 8; *Sambucus nigra* c 35(r); *Sarothamnus scoparius* c 24; *Sciuro-hypnum oedipodium* 9,11,19(1); *Silene nutans* subsp. *nutans* 36(r); *S. vulgaris* 16; *Veronica chamaedrys* 36; *Vicia cassubica* 2,28; *V. cracca* 23.

Successive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43		
ID-1	12	2	47	12	60	36	52	12	42	12	37	4	37	36	36	12	59	12	12	31	12	21	12	36	36	12	12	4	19	36	36	4	42	12	35	36	59	12	4	31	4	35	36		
ID-2	2	2	176	2	3	13	12	2	5	2	12	50	12	13	13	2	6	2	2	4	3	1	2	16	17	2	2	50	2	13	13	50	4	2	18	13	6	2	50	2	50	18	13		
ID-3	24	11	6	25	20	18	5	16	6	20	11	17	2	16	21	21	6	18	22	10	1	5	26	2	21	29	28	23	8	15	5	19	5	23	6	8	5	13	13	6	9	3	13		
Date (year)	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	1965	
Density of tree layer	a1,a	75	60	70	70	80	70	60	75	40	60	70	80	60	45	70	50	80	70	60	40	30	45	75	60	25	70	60	65	40	40	60	75	65	65	60	65	60	75	70	60	80	65	70	
Density of tree layer	a2	-	5	-	10	-	-	-	-	-	20	5	20	5	20	50	20	40	80	40	60	50	30	30	15	35	-	10	-	5	-	5	-	30	-	5	-	5	-	70	-	80	-	70	
Density of shrub layer	b	-	-	+	15	-	-	5	-	-	+	35	20	30	20	15	-	-	+	10	10	35	10	15	20	10	5	10	10	-	+	+	5	-	10	+	35	-	5	-	20	-	+	40	
Cover of herb layer	c	80	+	60	70	80	60	80	80	60	75	95	90	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Cover of moss layer	d	80	+	60	70	80	60	80	80	60	75	95	90	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	
Area of relevé		CD64	250	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Location (ATPOL)		CD64	250	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Total number of species		26	31	25	29	29	25	25	30	20	28	25	34	39	27	33	35	31	15	25	17	19	29	35	36																				

Sporadic species: III.: *Aulacomnium androgynum* 16; *Hieracium umbellatum* 2,27,30(1),37,43; *Lophocolea heterophylla* 24,27; *Mnium hornum* 27; *Plagiothecium denticulatum* 27; *P. laetum* 15,20,40; IV.: *Dicranum scoparium* 6(1),15,24(1),43; *Hylocomium splendens* 27; *Juniperus communis* b 12(1),24,28, c 4,8,12,28,32,39; *Orthilia secunda* 12,28,32; *Plagiothecium curvifolium* 24(1); *Pseudoscleropodium purum* 27(1),29(1); *Pyrola rotundifolia* 6; *Rubus saxatilis* 3,9; *Vaccinium vitis-idaea* 26,29(1),34; V.: *Acer platanoides* c 15,24; *A. pseudoplatanus* b 24(1),c 24; *Ajuga reptans* 1,5; *Brachypodium sylvaticum* 14; *Campanula persicifolia* 9,12,32,37,39,41; *Carex digitata* 8,12(1),39(1); *C. montana* 5; *C. sylvatica* 30,39; *Corylus avellana* b 3,11,15,17,43(1), c 7,9,15,33,43; *Epipactis helleborine* 7; *Fagus sylvatica* a1,a 4,19(1),24(1), a2 2,19(1),23, b 23(1),24,26, c 1,19,21,22,23,42; *Festuca heterophylla* 8,13; *Hedera helix* c 4; *Hepatica nobilis* 3,17; *Lathyrus niger* 3,5,14; *Malus sylvestris* b 2,4, c 1,2,4,16; *Melampyrum nemorosum* 11(2),33,43; *Melica nutans* 3,5,34; *Milium effusum* 2,4,10,18,21,28,40; *Phyteuma spicatum* 5; *Polygonatum multiflorum* 4,11(r),15,22; *Primula veris* 12; *Sanicula europaea* 5; *Scrophularia nodosa* 9,27(r),31,43; *Tilia cordata* b 15,26, c 18; *Viburnum opulus* 12,42; *Viola reichenbachiana* et *riviniana* 5; VI.: *Calluna vulgaris* 6; *Carex pallescens* 5,14,18,28,43; *Danthonia decumbens* 36; *Hieracium pilosella* 22,35,43; *Hypericum maculatum* 41(2); *Luzula campestris* 23; *Polytrichum juniperinum* 25; *Potentilla erecta* 9; *Scorzonera humilis* 34,37; *Veronica officinalis* 11,12,13,25,28,29,30,36; VII.: *Agrostis stolonifera* 7(1); *Angelica sylvestris* 11,30; *Arrhenatherum elatius* 11,13,31,43; *Astragalus glycyphyllos* 12,28,32,39(1); *Athyrium filix-femina* 1,10; *Betula pendula* a 8,26(2),38,41(1), a1 4,15(1),16(2),19(1),24(1),25(1),31(1),36(1), a2 4,10,23,25,27(1),34(2), b 27,34(2),36, c 12,18,23,33,35,36,38,43; *Brachytheciastrum velutinum* 30; *Calamagrostis epigejos* 15,25,27,31,38; *Carex hirta* 38(r); *Ceratodon purpureus* 17; *Chaerophyllum temulum* 14; *Clinopodium vulgare* 3,9,11(1),14(1),32,33,39(1); *Cornus sanguinea* b 14, c 11,14,15; *Crataegus laevigata* c 7; *C. monogyna* c 4,30; *C. rhipidophylla* var. *rhipidophylla* c 19(r),40; *Dactylis glomerata* 30; *Deschampsia caespitosa* 5,39; *D. flexuosa* 24(1),25(2),35,38; *Dryopteris carthusiana* 1,7,27,38,41; *Euphorbia cyparissias* 14,31; *Festuca pratensis* 12,39; *Galeopsis pubescens* 11,15; *G. tetrahit* 2,29,31,33,43; *Galium aparine* 14; *G. boreale* 3,12(3),32(1),39(3); *G. mollugo* 5,11,14,32(1),39(1),41,43; *G. verum* 9,33; *Geranium sanguineum* 3; *Geum urbanum* 41; *Glechoma hederacea* 31; *Hieracium murorum* 6,22(1),36,39,43; *Holcus lanatus* 35; *Impatiens parviflora* 4,15,24,31,37; *Juncus effusus* 7; *Kindbergia praelonga* 23; *Knautia arvensis* 3; *Lathyrus pratensis* 12(1),39(2); *L. sylvestris* 32(1),41; *Linaria vulgaris* 11; *Lysimachia vulgaris* 13; *Molinia caerulea* 36; *Mycelis muralis* 7,41; *Padus serotina* b 14(1), c 23(r),25; *Peucedanum oreoselinum* 11,29,43; *Pimpinella saxifraga* 3; *Plagiomnium affine* 16,31,37,38; *Poa angustifolia* 3,22; *P. pratensis* 7,11(1),12(2),28(1),32,39,43(2); *P. trivialis* 4; *Polygonatum odoratum* 21,22,37; *Populus tremula* a 29(1), a2 34, b 13,24,25,34(1), c 2,5,25,29,34,35,38(r); *Potentilla reptans* 35; *Prunella vulgaris* 15,30,35; *Pyrus communis* bc 9, c 26,27,37; *Quercus rubra* b 13, c 13; *Q. x rosacea* a 17(5),37(4), b 37; *Ranunculus acris* s. s. 7; *Rhamnus cathartica* b 11, c 11; *Rosa* sp. bc 11; *Rubus caesius* 34; *R. cfr. hirtus* 24; *R. idaeus* 7,11,40; *R. pallidus* 4; *R. plicatus* 15,36; *Rubus* sp. 24,25,33; *R. sprengelii* 2,38; *R. acetosa* 11; *R. acetosella* 7; *Sarothamnus scoparius* 31(1); *Sciuro-hypnum oedipodium* 10,25,27,34,43; *Sedum maximum* 22,37,41; *Stellaria graminea* 12,39(1),41; *S. media* 31; *Taraxacum officinale* 31; *Thalictrum minus* 17; *Torilis japonica* 41; *Trifolium alpestre* 12(2),32(1); *T. medium* 3; *Vicia cassubica* 12(1),14,32(1),33,37,39(3),41; *V. cracca* 7,9; *V. dumetorum* 12(2),39; *V. sativa* 14; *V. sepium* 7,14,28.

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Sporadic species: III.: *Aulacomnium androgynum* 33; *Hieracium umbellatum* 58; *Lophocolea heterophylla* 4,57; *Mnium homum* 50(3); *Plagiothecium denticulatum* 49; IV.: *Cladonia furcata* 31; *Dicranum majus* 50; *D. polysetum* 54; *D. scoparium* 5,33,49(1),50,57(1); *Juniperus communis* b 41, bc 37, c 14,34,48(r); *Lycopodium clavatum* 53; *Monotropa hypopitys* s.s. 31,34,48(r); *Orthilia secunda* 32,41,48(r); *Picea abies* a2 30, b 27,30,59 c 24,27,37,45,59; *Plagiothecium curvifolium* 13,16,26,30(1),42,50(1); *Pleurozium schreberi* 14(1),26,59; *Pseudoscleropodium purum* 41(3),56(4),57(3); *Rubus saxatilis* 9(1),36; *Trientalis europaea* 15(1); *Vaccinium vitis-idaea* 4,14(1),16,22,31,41,47,55,58; V.: *Agrostis capillaris* 30,36(1),40(1),41(2),47,50(1); *Calluna vulgaris* 53,54; *Carex ovalis* 30; *Cladonia coniocraea* 31; *C. deformis* 53; *Danthonia decumbens* 1,49; *Hypericum maculatum* 38; *Nardus stricta* 49; *Polytrichum juniperinum* 41,49,50; *Scorzonera humilis* 26; *Solidago virgaurea* s.s. 1,37,45,54(r); VI.: *Acer platanoides* c 29; *A. pseudoplatanus* c 53; *Agrostis stolonifera* 49; *Anemone nemorosa* (QF) 15; *Anthericum ramosum* 14,45; *Anthoxanthum odoratum* 28,30,36,40(1),43,45,50(2),53,56(1); *Arrhenatherum alatum* 40(1); *Astragalus glycyphyllos* 36,48; *Athyrium filix-femina* 36; *Atrichum undulatum* (QF) 17,45; *Betula pendula* a 28(1),31,41(2),51(2),55,56(1),59(1), a1 53(2), a2 40(1), b 15(1),30,40,53,57(2),59(2), c 27,38(r),57,59; *Brachypodium pinnatum* 9(1); *B. sylvaticum* 30; *Calamagrostis epigejos* 14,30,38,53(1),55,58(3),59; *Campanula persicifolia* 48; *C. rotundifolia* 37,40; *Carex caryophyllea* 49; *C. hirta* 57; *C. nigra* 49; *Carpinus betulus* a2 29(2),51(4), b 10(2), c 15(1),27,29(1),53; *Cerasus avium* c 30,38; *Chamaenerion angustifolium* 3,30; *Corylus avellana* b 3,15(1). c 15,44,46; *Crataegus monogyna* c 25; *C. rhipidophylla* var. *rhipidophylla* c 36,57(r); *Dactylis polygama* 50; *Deschampsia flexuosa* 14,30,40(1),55(2),56,57,59; *Dryopteris carthusiana* 15(1),28,30(1),36,41,55,56(r),57; *D. filix-mas* 41(r); *Fagus sylvatica* a1 52(4), a2 29(1), b 27,56, c 2,25,27,35,52; *Fallopia convolvulus* 37; *Festuca heterophylla* 48; *F. rubra* s.s. 18,23,34,39,40,50,51; *Fragaria vesca* 41; *Galeopsis pubescens* 30,37,40; *G. tetrahit* 30,36,46,55(1),59; *Galium mollugo* 41(r),57; *G. verum* 56(r); *Geranium robertianum* 55; *Hedera helix* 53; *Hieracium murorum* 14,30(1),50,53; *Hypericum perforatum* 40,53; *Hypnum cupressiforme* 1(r),29,33,49,50,54(2),57; *Impatiens parviflora* 30(1); *Juncus effusus* 30; *Koeleria macrantha* 17; *Larix decidua* subsp. *decidua* a 57; *Lathyrus niger* 37; *Lysimachia vulgaris* 28,36; *Malus* sp. c 16; *M. sylvestris* c 9,26,36; *Melica nutans* 2(2),36,47; *Milium effusum* 27; *Moehringia trinervia* 28,30,38,59; *Molinia caerulea* 2(1),27,32(1),47,59; *Oxalis acetosella* 36(1); *Padus serotina* c 30,50(1); *Peucedanum oreoselinum* 26,45; *Plagiomnium affine* 2,41,57(2),59(1); *Plagiothecium ruthei* 50; *Poa angustifolia* 1(1),2,14,24,25(1),26,29,36; *P. annua* 50; *P. compressa* 38; *P. nemoralis* (QF) 1,38,44,52(2),55(1); *P. pratensis* 39,40(1),48(r); *Polypodium vulgare* 41(1); *Polytrichum commune* 15; *Populus tremula* c 41(r),58(1); *Pyrus communis* bc 37; *P. communis* c 31,38,57(r); *P. pyraister* c 14; *Quercus palustris* a 55; *Q. rubra* a 27, c 27; *Quercus* sp. 50; *Rhamnus cathartica* b 24; *Rubus* cfr. *hirtus* 30(1); *R. corylifolius* 36(1); *R. idaeus* 15,30,53,59; *Rubus* sp. 30(2),53,57; *Rumex acetosella* 30,38(r),50,59; *Salix caprea* b 57; *Sarothamnus scoparius* 40; *Stellaria graminea* 36,55; *Tilia cordata* 29; *Veronica officinalis* 2,25,37,40,45,49; *Vicia cassubica* 48(r); *V. sepium* 57(r); *Viola reichenbachiana* (QF) 55(1),59; *V. reichenbachiana* et *riniana* 9.

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
ID-1		42	42	42	42	51	12	12	4	49	4	55	4	42	37	59	36	12	4	36	23	12	59	36	42	36	55	32	31	12	31		31	32	
ID-2		5	5	5	5	1	2	2	50	5	50	17	50	4	12	6	17	2	50	13	12	2	5	13	4	16	16	2	2	2	4		29	4	
ID-3		11	3	8	12	9	14	17	16	1	20	4	14	15	1	3	24	30	22	6	17	12	6	1	4	6	10	3	5	31	8		10	11	
Date (year)		1981	1981	1980	1980	1981	1961	1985	1985	1965	1976	1964	1984	1967	1981	1986	1993	1993	1986	1988	1985	1985	1985	1985	1985	1975	1981	1981	1981	1985	1981		1-30	1975	
Density of tree layer	a1,a [%]	65	65	55	45	60	65	80	70	60	80	60	70	65	85	80	50	70	75	40	70	90	80	60	75	45	80	50	50	85	30		40	60	
Density of tree layer	a2 [%]	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	+	+	10	-	10	-	-	+	-	20	-	40	35	-	50		10	20	
Density of shrub layer	b [%]	+	-	+	15	+	+	-	5	-	-	5	20	-	20	20	5	-	10	5	+	-	-	+	-	5	-	15	10	-	-		20	10	
Cover of herb layer	c [%]	85	-	80	95	100	85	100	80	80	70	85	100	100	100	100	70	5	25	+	80	100	80	80	80	35	55	30	75	10	10	90		5	20
Cover of moss layer	d [%]	-	+	+	+	10	5	-	+	90	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		80	50
Area of relevé		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		150	300
Location (ATPOL)		BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49	BD49		CE01	DE50
Total number of species		31	17	23	28	27	31	28	34	26	29	27	35	25	37	15	34	25	20	37	24	20	23	24	20	32	16	30	24	31	21		24	35	
Number of mosses, liverworts and lichens species		-	1	1	1	2	6	4	-	-	-	2	3	2	4	4	3	3	2	-	5	3	1	-	-	2	6	4	7	2	8	5		1	5
I. Ch., D.* Calamagrostio arundinaceae-Quercetum petraeae																																			
* Quercus petraea [Q. x rosacea^]	a1,a	4	4	4	3	4	.	4	.	.	.	.	4	4	2	4^	3	3	.	2	4	5	3	.	4	1	4	.	1	.	2		70	.	
* Quercus petraea	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	1	.	.	.	.	1	.	.	.							

Sporadic species: III.: *Aulacomnium androgynum* 27,29; *Hieracium umbellatum* 1,11,13; *Luzula pallescens* 19; *Mnium hornum* 25(1),26; IV.: *Betula pubescens* subsp. *pubescens* a 27(2); *Chimaphila umbellata* 32; *Dicranum scoparium* 13,16,25(1),30(1),32; *Dryopteris dilatata* 25; *Galium rotundifolium* 5(1),19; *Hylocomium splendens* 12(1); *Juniperus communis* b 11,12(2),18(1),32(2), c 5(1),10,12,18,26(r),32; *Leucobryum glaucum* 11(1),25; *Monotropa hypopitys* s.s. 20; *Orthilia secunda* 19; *Plagiothecium curvifolium* 29; *Pleurozium schreberi* 12(2),24; *Pseudoscleropodium purum* 7; *Ptilium crista-castrensis* 12; *Pyrola chlorantha* 8,12(1),19; *Rubus saxatilis* 1,20; V.: *Acer pseudoplatanus* b 25(1), c 14,25(1); *Ajuga reptans* 5(1),7,15,16; *Anemone ranunculoides* 11; *Anthriscus sylvestris* 12; *Brachypodium sylvaticum* 9,16; *Campanula persicifolia* 5,8,13; *Carex digitata* 6,16(1),21,26; *Corylus avellana* b 3,4(2),14,15(2),22, c 1,2,3,4,24; *Dactylis polygama* 22(1); *Dryopteris filix-mas* 7; *Festuca gigantea* 16; *F. heterophylla* 12(3),14; *Fraxinus excelsior* 1,9; *Galeobdolon luteum* 6; *Galium odoratum* 6; *Hepatica nobilis* 8; *Hypericum montanum* 3,13; *Impatiens noli-tangere* 14(r); *Lilium martagon* 21; *Melampyrum nemorosum* 1,4; *Melica uniflora* 6; *Milium effusum* 6(2),31; *Padus avium* b 23, c 9; *Platanthera bifolia* 1,13; *Potentilla alba* 1,4; *Pulmonaria obscura* 8; *Scrophularia nodosa* 3,4,8,10,12,24; *Stachys sylvatica* 14(r); *Ulmus minor* c 29; *Viburnum opulus* c 4,14,19; *Viola riviniana* 8(1),9,10,18(1),32; VI.: *Chamaecytisus ratisbonensis* 32(1); *Danthonia decumbens* 32; *Genista germanica* 8; *Hieracium pilosella* 13,32; *Polytrichum juniperinum* 6,19; *Potentilla erecta* 1,3,4; VII.: *Achillea millefolium* 5,13; *Aegopodium podagraria* 8(1); *Agrimonia eupatoria* 9; *Agrostis gigantea* 9(1); *Alnus glutinosa* a2 19(1); *Astragalus glycyphyllos* 8,10(2); *Athyrium filix-femina* 17; *Betula pendula* a 7,21, a1 19,32, a2 14,25,31; *Bromus hordaceus* 32; *Calamagrostis epigejos* 14(1),16(1),24,25(1),32(3); *Campanula patula* s.s. 4; *C. rotundifolia* 8; *Carex hirta* 7; *Chaerophyllum temulum* 1; *Clinopodium vulgare* 1,3,4; *Crataegus laevigata* c 29; *C. monogyna* c 28; *Deschampsia caespitosa* 6,16(r); *D. flexuosa* 6,14,19(2),23(1),25,31; *Euphorbia cyparissias* 32; *E. serrulata* 32; *Festuca pratensis* 12; *Galeopsis pubescens* 2,11(r),14,23; *Galium mollugo* 8(1),10,12(1),17; *G. palustre* 9; *Hieracium barbatum* 9; *H. murorum* 19(1),20; *Hypnum cupressiforme* 6,14,27,32(1); *Impatiens parviflora* 16(1),22,23; *Juncus effusus* 7; *Knautia arvensis* 1; *Lapsana communis* s.s. 6(r); *Larix decidua* subsp. *decidua* a 7(1), a1 19, a2 31, c 25; *Lathyrus sylvestris* 8; *Linaria vulgaris* 11(1); *Lophocolea bidentata* 6; *Lysimachia vulgaris* 9(1); *Mycelis muralis* 3,6,25; *Peucedanum oreoselinum* 1,13; *Pimpinella saxifraga* 9; *Plagiomnium affine* 3,7,14,27,29; *P. rostratum* 19; *Poa angustifolia* 5(1),6,21,32; *P. pratensis* 1,9,12(2),13,18(1); *Populus tremula* b 19, c 19; *Pyrus communis* b 28, c 7,15,27; *Ranunculus acris* s.s. 11; *Robinia pseudacacia* a1 32; *Rubus* cfr. *hirtus* 16; *R. corylifolius* 29; *Rubus* sp. 8,23,31; *Rumex acetosa* 23; *R. acetosella* 13,25,32; *Sarothamnus scoparius* 32; *Sciuro-hypnum oedipodium* 7,15,19; *Scutellaria galericulata* 11(1); *Sedum maximum* 9; *Sphagnum* sp. 30; *Stellaria graminea* 8,10,12(1),18; *Thymus serpyllum* 32; *Trifolium alpestre* 8(1),10; *Urtica dioica* 11(r),16; *Veronica officinalis* 4,6,29; *Vicia cassubica* 8(3),10(1),24; *V. cracca* 2,10.

Table A12. *Calamagrostis arundinaceae-Quercetum petraeae* typicum in stage II of degeneration

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
ID-1		23	42	36	35	37	36	36	36	37	36	35	35		37	46	35	37	55	51	37	36	37	36	27	27	52	44	52	55	
ID-2		12	3	17	20	14	17	17	16	14	13	18	20		14	3	20	16	16	2	12	17	14	17	1	1	16	4	14	16	
ID-3		13	10	5	26	16	10	11	16	17	9	4	21		15	14	16	6	14	5	21	14	20	4	27	23	12	12	4	21	
Date (year)		1965	1981	1976	1977	1987	1985	1985	1976	1987	1985	1976	1976	1-12	1986	1954	1976	1973	1984	1981	1986	1985	1986	1976	1975	1975	1973	1979	1984	1994	13-28
Density of tree layer	a1,a [%]	75	80	50	60	60	25	25	50	60	75	95	60		70	55	50	60	55	80	75	30	40	70	60	50	60	60	55	60	
Density of tree layer	a2 [%]	-	-	15	5	20	50	25	5	10	-	10	20		10	40	5	-	-	-	5	35	45	10	-	-	-	-	5	-	
Density of shrub layer	b [%]	-	-	20	5	35	10	25	30	35	35	20	+		5	5	30	50	30	10	15	5	45	+	+	+	10	5	-		
Cover of herb layer	c [%]	65	85	80	70	85	90	90	60	90	40	30	45	%	65	40	60	40	30	90	90	90	95	90	40	30	75	100	50	40	%
Cover of moss layer	d [%]	+	+	20	+	+	10	5	35	5	5	20	+		+	15	35	40	15	80	+	5	5	20	5	5	50	10	+	20	
Area of relevé		CD43 200	BD59 100	BE27 200	CE00 200	BD80 600	BE06 900	BD96 800	CE11 200	BD80 900	BE27 800	CD91 100	CE00 100		BE02 700	CD92 1200	CE11 200	CD02 100	BC84 100	CD83 150	BE02 800	CE22 800	AD89 900	BE27 200	BD54 100	BD54 80	CD02 200	DE50 400	BE05 500	BC63 100	
Location (ATPOL)		CD43 200	BD59 100	BE27 200	CE00 200	BD80 600	BE06 900	BD96 800	CE11 200	BD80 900	BE27 800	CD91 100	CE00 100		BE02 700	CD92 1200	CE11 200	CD02 100	BC84 100	CD83 150	BE02 800	CE22 800	AD89 900	BE27 200	BD54 100	BD54 80	CD02 200	DE50 400	BE05 500	BC63 100	
Total number of species		19	23	24	20	29	33	30	23	24	21	23	21		24	21	24	17	18	21	15	18	22	28	18	14	14	30	28	17	
Number of mosses, liverworts and lichens species		2	2	3	2	3	4	5	3	6	1	5	5		6	3	3	2	3	5	3	5	4	6	6	5	2	1	2	4	
I. Ch., D.* <i>Quercetea robori-petraeae</i>																															
<i>Festuca ovina</i>		+	1	.	1	1	+	1	.	.	+	+	.	67	1	1	.	.	1	1	+	+	.	3	3	2	+	.	1	2	75
<i>Carex pilulifera</i>		+	+	1	+	.	+	+	.	1	+	1	+	83	1	.	.	1	+	+	+	+	+	1	1	.	+	.	.	+	69
<i>Holcus mollis</i>		4	.	1	+	1	.	1	+	+	2	2	+	83	2	.	+	.	1	1	1	.	1	2	.	3	.	1	.	.	56
* <i>Pteridium aquilinum</i>		.	5	3	+	.	.	2	2	2	.	.	.	50	1	.	2	3	2	+	.	.	.	.	.	+	2	2	3	.	63
<i>Dicranella heteromalla</i>		+	+	.	.	+	+	.	.	.	.	+	+	50	+	.	.	.	+	1	+	.	.	+	+	.	.	.	.	.	44
* <i>Melampyrum pratense</i>		1	+	.	1	1	.	.	.	.	.	+	+	50	.	.	.	.	+	.	1	.	+	.	.	.	.	.	+	+	31
* <i>Polytrichastrum formosum</i>		+	.	+	.	.	1	.	+	+	1	2	+	67	+	+	+	1	2	2	.	1	+	.	2	.	+	.	+	.	69
<i>Calamagrostis arundinacea</i>		.	.	.	.	.	.	.	+	.	.	.	.	8	.	+	+	3	.	.	.	.	.	.	.	+	.	5	.	.	31
II. D. <i>Anemone</i> var. (rich var.)																															
<i>Viola reichenbachiana</i> (Q-F)		.	.	+	.	+	+	+	+	.	+	+	+	67	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
<i>Atrichum undulatum</i> (Q-F)		.	+	.	+	.	+	1	.	+	.	+	.	50	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	13
<i>Oxalis acetosella</i> (Q-F)		+	.	1	+	.	.	.	+	.	+	.	2	50	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	13
<i>Poa nemoralis</i> (Q-F)		+	+	.	.	2	+	+	.	.	+	.	.	50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
<i>Anemone nemorosa</i> (Q-F)		+	+	.	.	.	.	.	.	+	.	.	.	25	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	6
III. Ch. <i>Vaccinio-Piceetea</i>																															
<i>Picea abies</i>	a1,a	.	.	.	.	.	.	.	1	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
<i>Picea abies</i>	a2	.	.	.	+	.	.	1	.	.	.	1	.	25	.	.	1	.	.	1	1	.	.	.	.	.	.	.	.	.	19
<i>Picea abies</i>	b	.	.	2	1	.	.	1	3	.	.	2	+	50	1	.	3	.	.	2	2	+	.	.	.	.	.	.	.	.	31
<i>Picea abies</i>	c	.	.	+	+	.	.	.	.	.	.	3	+	33	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	19
<i>Pinus sylvestris</i>	a1,a;a2^	.	.	3;+^	2	3	2	2	3	3	.	2	.	67	2	4	3	4	.	2	.	3	2	2;+^	.	.	4	4	3	+	75
<i>Pinus sylvestris</i>	b/c	.	.	.	.	.	.	1/+	1/+	.	.	.	.	17	.	.	1/+	.	1/+	.	.	.	1/+	.	.	.	.	.	.	.	19
<i>Pleurozium schreberi</i>		.	.	2	+	.	1	1	3	1	.	.	.	50	.	.	3	3	.	+	+	1	+	1	.	3	2	+	2	.	69
<i>Vaccinium myrtillus</i>		+	+	3	4	4	4	3	3	4	.	1	2	92	2	3	3	+	1	5	5	5	5	3	+	+	1	+	2	+	100
<i>Dicranum scoparium</i>		.	.	.	.	.	.	1	.	.	.	+	.	17	.	.	.	.	.	.	+	+	.	+	+	.	.	.	2	.	31
IV. Ch. <i>Quercio-Fagetea</i> (Q-F)																															
<i>Fagus sylvatica</i>	a1,a	.	.	.	1	.	.	.	.	.	.	3	.	17	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	6
<i>Fagus sylvatica</i>	a2	.	.	.	1	.	.	1	1	.	1	2	.	42	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	6
<i>Fagus sylvatica</i>	b/c	.	1/+	.	+/+	.	.	.	+/	1/	.	+/+	.	42	.	.	+/	.	2/+	.	.	.	+/	.	.	.	.	.	.	.	19
V. Ch. <i>Calluno-Ulicetea</i>																															
<i>Pohlia nutans</i>		.	.	+	.	+	.	+	+	1	.	.	+	50	+	.	+	.	1	.	+	+	+	2	.	+	.	.	.	2	56
<i>Agrostis capillaris</i>		.	.	+	.	+	+	.	1	.	1	+	+	58	.	+	1	.	.	+	+	+	+	.	.	.	3	.	1	.	50
VI. Others																															
<i>Quercus petraea</i> [Q. x rosacea ^]	a1,a	4	5	.	.	2	.	1	.	2	.	.	.	42	3	0	.	.	3	3	4	.	1	.	4	3^	.	.	1	3	63
<i>Quercus petraea</i>	a2	.	.	.	.	2	2	2	.	1	.	.	.	33	1	+	.	.	.	.	3	2	.	.	.	.	.	.	1	.	31
<i>Quercus petraea</i>	b/c	1/	1/	.	.	2/+	1/+	2/+	.	2/1	.	.	.	50	+/2	+/	.	.	1/+	+/2	1/1	2/1	.	1/+	1/+	1/+	.	1/+	.	1/	69
<i>Quercus robur</i>	a1,a	.	.	1	3	.	.	.	.	.	4	5	.	33	.	.	.	.	2	.	.	1	3	.	.	.	.	.	2	.	25
<i>Quercus robur</i>	a2	.	.	2	1	.	3	.	.	.	.	.	.	25	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	13
<i>Quercus robur</i>	b/c	.	.	+/	+/+	.	1/	.	+/+	.	.	1/+	.	42	.	+/+	+/+	1/+	.	1/	.	.	2/+	+/	.	.	1/+	+/+	.	.	56
<i>Betula pendula</i>	a1,a	.	.	.	+	.	.	.	.	.	+	.	.	17	.	+	.	.	2	.	+	.	2	2	.	.	.	.	1	3	44
<i>Betula pendula</i>	a2	.	.	.	.	+	+	.	.	.	.	.	.	17	.	.	.	.	.	.	.	2	+	.	.	.	.	.	.	.	13
<i>Betula pendula</i>	b/c	.	.	.	.	2/	.	.	.	.	.	.	.	8	+/	+/	1/+	1/+	.	+/+	1/+	1/	+/	.	.	.	1/+	1/+	.	.	63
<i>Sorbus aucuparia</i>	a	.	.	.	.	.	.	.	1	.	.	.	.	8	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	6
<i>Sorbus aucuparia</i>	b/c	1/+	.	.	.	+/+	+/+	.	.	2/+	.	1/+	.	42	1/+	+/+	.	+/+	+/+	.	.	1/+	1/	.	.	1/+	1/+	1/+	1/+	1/+	69
<i>Frangula alnus</i>	b/c	.	1/+	.	.	.	1/	1/	.	.	.	1/+	+/	42	.	+/	.	4/	1/+	1/+	.	.	+/+	.	.	.	+/1	1/+	1/+	.	50
<i>Luzula pilosa</i>		+	+	+	1	+	.	.	.	1	.	+	1	67	+	.	.	1	+	.	1	+	+	+	1	.	.	.	.	.	50
<i>Calamagrostis epigejos</i>		.	.	+	+	+	+	1	1	.	+	.	.	58	+	.	1	.	.	+	.	+	.	.	.	.	3	+	.	.	44
<i>Moehringia trinervia</i>		.	1	+	+	+	+	1	+	.	.	.	.	58	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	19
<i>Deschampsia flexuosa</i>		.	.	.	.	+	+	.	.	.	.	+	2	50	1	.	.	.	.	+	1	+	.	.	.	.	.	.	.	.	31
<i>Rubus idaeus</i>		+	+	.	.	+	.	1	+	.	.	.	.	42	.	.	+	2	.	.	.	+	.	.	.	.	2	+	.	.	31
<i>Anthoxanthum odoratum</i>		.	+	.	.	.	+	+	.	+	.	.	.	33																	

Sporadic species: I.: *Hieracium sabaudum* 25; *Plagiothecium laetum* 11,22; III.: *Betula pubescens* subsp. *pubescens* a2 5, c 9; *Dicranum polysetum* 12; *Dryopteris dilatata* 3,6(1),8,13,15; *Galium rotundifolium* 4,10; *Hylocomium splendens* 14(1); *Juniperus communis* b 26(2), c 23,26(1); *Leucobryum glaucum* 23; *Plagiothecium curvifolium* 7,24,27; *Pseudoscleropodium purum* 14(2),18(2),28(2); *Trientalis europaea* 8,11,15; *Vaccinium vitis-idaea* 22; IV.: *Acer pseudoplatanus* c 7; *Ajuga reptans* 1; *Brachypodium sylvaticum* 3,6,7; *Carpinus betulus* a2 14(2), b 14,17(2), c 5,17(1); *Cerasus avium* c 7; *Dryopteris filix-mas* 3,6; *Festuca gigantea* 3; *Melica nutans* 2; *Milium effusum* 8,11,15; *Padus avium* c 3; *Scrophularia nodosa* 3,5,10; *Stellaria holostea* 16; *Tilia cordata* b 5,6; *Viola riviniana* 1; V.: *Calluna vulgaris* 5,9,19; *Carex ovalis* 14(1); *C. pallescens* 2,6(1),21; *Cladonia coniocraea* 24; *Danthonia decumbens* 26; *Genista tinctoria* 10; *Hieracium pilosella* 26(1); *Luzula multiflora* 4,12,22,23,27; *Potentilla erecta* 22; *Veronica officinalis* 10(1),14,26(2),28; *Viola canina* 14,26; VI.: *Abies alba* b 21(1), c 21; *Achillea millefolium* 26; *Agrostis gigantea* 25(1); *A. stolonifera* x *capillaris* 23; *Anthericum ramosum* 2; *Brachythecium rutabulum* 22; *Campanula rotundifolia* 5,10,11,22; *Carex hirta* 26; *Cephalozia bicuspidata* 13; *Cerastium holosteoides* 26; *Chamaenerion angustifolium* 6,27; *Convallaria majalis* 9(1),23; *Fallopia convolvulus* 2; *Festuca rubra* s.s. 6,26(1); *Fraxinus excelsior* c 16; *Galeopsis tetrahit* 2; *Geranium robertianum* 2,7; *Hieracium murorum* 1,12; *Hieracium* sp. 24; *Impatiens parviflora* 6(1),7(2); *Larix decidua* subsp. *decidua* a1 6(1), bc 9; *Leontodon autumnalis* 22,26; *Mycelis muralis* 2(1),7; *Padus serotina* b 7(1), c 7; *Plagiomnium affine* 9 ,20; *P. cuspidatum* 9; *P. rostratum* 13; *Poa pratensis* 26(3); *P. pratensis* 28; *P. trivialis* 1; *Polygonatum odoratum* 18; *Populus tremula* c 21; *Pyrus communis* a1 6; *Quercus rubra* a1 13(1), a2 13(1), b 19, bc 9,13,27; *Robinia pseudacacia* b 5; *Rubus* cfr. *hirtus* 3,6(2),22; *R. plicatus* 16(2),21(1); *Rubus* sp. 5,7(2),15,26(2),27; *Salix caprea* b 21; *Sarothamnus scoparius* b 26(1), c 9,10,19; *Stellaria media* 6,7,10; *Thymus pulegioides* 26; *Viscum album* subsp. *album* a 27.

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Sporadic species: III.: *Herzogiella seligeri* 68; *Hieracium umbellatum* 4,8(r),10,11,21,28,29,45,49,54,73; *Lophocolea heterophylla* 46; *Mnium hornum* 71; IV.: *Dicranum polysetum* 61,63; *D. scoparium* 41,43,44(1),58,59; *Galium rotundifolium* 37; *Juniperus communis* b 39,55,57,62, c 21,24,25,36,52,54,55,57,62,71,75,76; *Leucobryum glaucum* 10,40,42,43(1),44,51; *Lycopodium clavatum* 75; *Orthilia secunda* 6,15(1),35,37,58; *Picea abies* a 16, b 48, c 26,38,58,60(r),76,78; *Plagiothecium curvifolium* 9,40,73; *Pseudoscleropodium purum* 21,45,50(1),55,57,62; *Trientalis europaea* 56(1); *Vaccinium vitis-idaea* 10,24,35,50,54,59(r),70; V.: *Acer platanoides* c 4,38; *A. pseudoplatanus* c 4,38,60; *Ajuga reptans* 8,26,28,61,63; *Anemone nemorosa* 9,38(2),53,55,71; *Atrichum undulatum* 12,58,67,75; *Brachypodium sylvaticum* 17,22(1),31,50,74; *Campanula persicifolia* 39,40,43; *Carex digitata* 78(r); *C. montana* 8(1),16(1),18(1),23,35; *Carpinus betulus* c 3,15,42,51,56; *Cerasus avium* b 55,57; c 13,43(r),45(r),55,57(r); *Dactylis polygama* 19,34,46,50(1),68(2); *Dryopteris filix-mas* 69; *Fagus sylvatica* a 48(3), b 78(3), c 4,6,10,38,49(r); *Festuca gigantea* 2(1),14,26(1),64(1); *Fraxinus excelsior* 22,37,38; *Galeobdolon luteum* 50(1); *Hepatica nobilis* 34,69; *Lathyrus niger* 5(1),24(1); *Lilium martagon* 16,34,54; *Malus sylvestris* c 28; *Melampyrum nemorosum* 39; *Padus avium* b 44, c 38; *Platanthera bifolia* 18; *Scrophularia nodosa* 2,4,5,14,28,33,74; *Tilia cordata* a 5(1),23(2),24(1),25,29(1),65(1) c 4,49; *Ulmus minor* c 22; *Viola mirabilis* 15(1); *V. reichenbachiana* 19,34,47,50,68,69,78; *V. reichenbachiana et riviniana* 8,15,17(1); VI.: *Agrostis capillaris* 3,8(1),16(1),41,44,45(1),56,58,59,60,71(1); *Calluna vulgaris* 36; *Cladonia coniocraea* 73; *Danthonia decumbens* 45,73; *Genista tinctoria* 54; *Hieracium pilosella* 8,44,45,61(1),63,71; *Luzula campestris* 45(1); *Potentilla erecta* 18; *Scorzonera humilis* 8(1),11(1),19,34,35,46,53,67(r),69; VII.: *Achillea millefolium* 39,45(r),62; *Aesculus hippocastanum* c 32,74; *Anthericum ramosum* 9,10,35(1),45,54,71; *Arrhenatherum elatius* 45; *Betonica officinalis* 8,15,69; *Betula pendula* a 14,21(r),64(1), a2 71, b 57,62(r), c 18(3),43(r); *Brachypodium pinnatum* 16(1),18(1),65(1); *Calamagrostis epigejos* 35(2),38,55,57,58,61,62,70,76; *Campanula patula* s.s. 47; *C. rotundifolia* 3,4,6,7,8,10,40,45(2),49,67(r),72,73,76; *Ceratodon purpureus* 46,69; *Chamaenerion angustifolium* 58; *Clinopodium vulgare* 15(2),18(2),39,47(1); *Cornus sanguinea* c 72; *Crataegus laevigata* b 19; *C. monogyna* b 56, c 56; *Dactylis glomerata* 16(1),39,48; *Deschampsia caespitosa* 7,29; *D. flexuosa* 44,45,58; *Dianthus superbus* s.s. 33; *Dryopteris carthusiana* 3,14,50,55(1),57,58,59,60(1),62(1),68,69,70; *Equisetum hyemale* 2; *Euonymus europaea* 23,49; *Euphorbia cyparissias* 3,71; *Fallopia convolvulus* 1,13,15(2),17,18,19,21,42,48,68,72(1); *F. dumetorum* 2,3,20,22(1),27(1),28(r),29,31,60,64; *Fragaria vesca* 17,55,57,59,61,62,63; *Galeopsis pubescens* 3,12,15(1),16,17,38,41,51,55,57(r),59,62,73; *Galium album* 55,61(1),63; *G. album* fo. *dumetorum* 71; *G. aparine* 61; *G. mollugo* 35,77; *G. verum* 7,8,78(r); *Geranium robertianum* 39,47,68; *Geum urbanum* 38; *Hypericum perforatum* 3,39,45,60,76; *Impatiens parviflora* 3,9,19(1),34(1),45,50,58,68(1), 69(1),70,72; *Kindbergia praelonga* 45; *Leontodon hispidus* 36; *Lysimachia vulgaris* 72; *Mnium* sp. 75; *Molinia caerulea* 6,15(1),16,71; *Padus serotina* b 45(1),55,57,62(r),78, c 2,3(1),20,25,32,38,45,55,57(r),59,60,62,64(1),65,74(r); *Peucedanum oreoselinum* 6,7,18,39,47,54,61(1),62,63,67,73,77; *Pimpinella saxifraga* 8(r),35; *Plagiomnium rostratum* 58; *Plagiothecium* sp. 51; *Populus alba* c 18; *P. tremula* c 44,71; *Prunus spinosa* 15,19; *Pyrus communis* b 71, c 38,71; *Quercus robur* a 37(1),40,44(3),50(2),52(1), a1 3(2),45(4),56(2),71(3), a2 56(3), b 45,56(2), c 43,44,45,56(1),71; *Q. x rosacea* a 9(4),35(4),45(2),46(4),50(3),61,63,69(3), c 35,63(1); *Ribes nigrum* c 27; *Robinia pseudacacia* a 20(2),65(2) b 20(2),c 20(1),27(1); *Rubus caesius* 30,42,66,72,76; *R. idaeus* 38,55,57,58(1),60,61; *Rubus* sp. 58,60,66; *R. sprengelii* 26; *R. x corylifolius* 37,55,57,62,63; *Rumex acetosella* 35,44,45; *Sciurohypnum oedipodium* 6,7,45(1),55(1),57(1),59,61, 62,63(1),68(1); *Selinum carvifolia* 47; *Serratula tinctoria* 8,18; *Seseli annuum* 18; *Silene nutans* subsp. *nutans* 8,46,71; *Symphoricarpos albus* 37; *Taraxacum officinale* 37,45(r),62; *Urtica dioica* 3,14,26,28,29,31(1),33,60(r),64; *Veronica chamaedrys* 6(1),8,15(1),18(2),37; *Vicia cassubica* 4,6,9,11,14,24(1),25,39,54,76; *Vicia sepium* 49; *Vincetoxicum hirundinaria* 21,26; *Viscaria vulgaris* 18.

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Sporadic species: IV.: *Aulacomnium androgynum* 61,72,80,85; *Herzogiella seligeri* 83; *Hieracium umbellatum* 6,27(1),33,39,55(1),73,84,91; *Lophocolea heterophylla* 61,83; *Luzula pallescens* 80; *Mnium hornum* 2(1),7(1),12,13; *Plagiothecium denticulatum* 10,38,64; *P. laetum* 35,55,67; **V.:** *Cladonia furcata* 15,80; *Dicranum polysetum* 59; *D. scoparium* 11,20,25,52,54,62,67,68(1),79,80,87; *Dryopteris dilatata* 11; *Galium rotundifolium* 79,82; *Hylocomium splendens* 45; *Juniperus communis* b 28(1),60,67, c 4,24,28,30(r),43,47,48,52,67(r); *Leucobryum glaucum* 2,7(1),11,12,13,35,39,50, 75(1),87; *Lycopodium clavatum* 21; *Monotropa hypopitys* s.s. 18; *Orthilia secunda* 15,79,85(1),88; *Picea abies* b 4(2),15(1),22,23,27,28,29,36,40(r),41,61,80,87(2),90,91, c 6(r),8,21,42,43,45,48,49,52,70,85,87; *Pseudoscleropodium purum* 1(2),6(1),8,15(1),17,39,45,47(1),60(1),62(2),64(1),65,66(1),85,87; *Ptilium crista-castrensis* 13; *Pyrola minor* 55(1); *P. rotundifolia* 36; *Rubus saxatilis* 60,62(1),64(1),83; *Thuidium tamariscinum* 34,39; *Trientalis europaea* 3,7,17,28,50,63(1); *Vaccinium vitis-idaea* 15,45,46,47,51,56(1),82,85; *Viscum album* subsp. *austriacum* a 46; **VI.:** *Acer platanoides* b 35,44(2),89, c 2,12,20,22,44,58(r); *A. pseudoplatanus* c 35,46,74,85,90; *Ajuga reptans* 6,14,34(r),46,59,84,85,89; *Alnus incana* a2 55, c 55; *Brachypodium sylvaticum* 26,77,81(1); *Campanula persicifolia* 5,6,7,8,12,15,18,33,34,37,48,63,67,81(r), 88(1); *Carex digitata* 13,18,28,38,46,63,67,81(1),90(1); *C. montana* 18,24,51(1),60; *Cerasus avium* c 27,45,67,75(r),76,80,84; *Dactylis polygama* 83(2),90; *Dryopteris filix-mas* 1,5,36,40,64,83; *Festuca gigantea* 28,30,49,65,66(1),81(r); *Fraxinus excelsior* c 74,90; *Galeobdolon luteum* 67; *Galium odoratum* 13,90; *Hepatica nobilis* 18,83; *Hypericum montanum* 18,42,49,71; *Hypochoeris maculata* 67(r); *Impatiens noli-tangere* 5,27; *Lathyrus niger* 22,36,40,82; *Malus sylvestris* b 17,89, c 6,17(r),19, 47,54,61,63,74; *Melampyrum nemorosum* 21,24,27(1),32,33,41(1),88,89(2); *Milium effusum* 7(1),14,36,54,72(1),84,89,90,91; *Padus avium* c 56,84; *Phyteuma spicatum* 41; *Platanthera bifolia* 12,19(r),21,24,71(r); *Polygonatum multiflorum* 14,35,50; *Potentilla alba* 32,33,61; *Primula veris* 28; *Ribes uva-crispa* b 89, c 1; *Sanicula europaea* 41,84; *Scrophularia nodosa* 2,4,23,28,29,31,42,46(r),49; *Stachys sylvatica* 41; *Tilia cordata* a2 82(1), b 35,57,82, c 22,41,68,72,88; *Viburnum opulus* 27,37,56; *Viola reichenbachiana* et *riviniana* 18,45,69; **VII.:** *Carex ovalis* 30,62; *C. pallescens* 21,23,24,27,34, 47,51,63,68,82,84(1); *Cladonia pyxidata* 80; *Genista germanica* 7,12,13; *G. tinctoria* 36,48,79,84; *Hieracium pilosella* 24,30, 59,67,69,75,76,80,84; *Hypericum maculatum* 23,31(1); *Luzula campestris* 39,60; *Polytrichum juniperinum* 8,18,44,67,69; *Potentilla erecta* 31(1),32,33,34,71; *Scorzonera humilis* 6,26,47,84(1); *Viola canina* 71,76; **VIII.:** *Achillea millefolium* 14,19,41,44,59(1),65(1),67,69,74,75,76; *Aegopodium podagraria* 2; *Alopecurus pratensis* 84; *Angelica sylvestris* 89(1); *Anthericum ramosum* 19,25,38,52,53; *Arrhenatherum elatius* 20,22,41(1),44(1),49,68,89(1),91(1); *Astragalus glycyphyllos* 16,24,34,51,64,66(1),75; *Berberis vulgaris* b 81; *Betonica officinalis* 32,68; *Betula pendula* a 3,15,16(1),19(2), 48,52,71,72,81(2),84,87,88(1), a1 4,6,22(1),35(1),44(1), 51(1),55(2),60,79(1),86(1),89(1),91(1), a2 17(1),20(1),39(1),51(1), 56(2),57(1),60(1),73, b 6(2),7,12,15(1),16,55(1),56(1),70, 71,82, c 1(1),2,6,15,16,17,21,23, 34,39,62,71,72,76,77,86; *Brachypodium pinnatum* 75; *Brachythecium velutinum* 35,46,67,69,79,83(1); *Brachythecium rutabulum* 11,19,37,61,78(2); *B. salebrosum* 69; *Brachythecium* sp. 18(1),21; *Bryum* sp. 45,69; *Campanula patula* s.s. 32,33,68,69; *Carex hirta* 1,56; *Cephalozia* sp. 80,87(r); *Cerastium holosteoides* 68; *Ceratodon purpureus* 82; *Chamaenerion angustifolium* 20,37,47,55,89; *Cladonia glauca* 15,80,87; *Clinopodium vulgare* 18,22(1),23,24,31(1),32,33,61,85; *Conyza canadensis* 9,10,26,86; *Cornus sanguinea* b 1, c 14,89; *Crataegus laevigata* b 39(1),61(1),86; *C. monogyna* b 14,47,58,84, c 70; *C. rhipidophylla* var. *rhipidophylla* b 81, c 1,64,76(r),88(r); *Cruciata glabra* 40(2); *Dactylis glomerata* 7,14,20,41,47,49,67,84(1); *Deschampsia caespitosa* 9,39,67,69; *Epilobium montanum* 67(r); *Euonymus europaea* c 57; *Euphorbia cyparissias* 41,45,64,75,76,86; *Fallopia convolvulus* 5,19,38,70,78,81,83; *F. dumetorum* 10,26,77,86; *Galeopsis pubescens* 21,22,31,32,35,38,40,55,67,73; *Galium album* 18,45,59,65,66; *G. album* fo. *dumetorum* 8,15,17,46,48,53,60,67,71; *G. aparine* 15(r),20,44,56,57,65(1),66(1),69; *G. boreale* 1,8,10,19,26,28,33,34,46, 59(r),64,70,85,86; *G. mollugo* 30,31,70; *G. verum* 1,24,30,31,71,76,84; *Geranium robertianum* 20,56(1),57,69,82,84; *Geum rivale* 90(r); *G. urbanum* 31; *Gnaphalium sylvaticum* 67; *Heracleum sphondylium* 89; *Holcus lanatus* 36,45,67; *Impatiens parviflora* 30(2),62,78,79(1),81,82(1),84(1),86,91; *Juncus effusus* 40,49; *Knautia arvensis* 30(r),33; *Lapsana communis* s. s. 31; *Larix decidua* subsp. *decidua* a 29(1),49, a1 79, c 49; *Leontodon autumnalis* 67; *Leucanthemum vulgare* 41; *Linaria vulgaris* 20; *Lysimachia nummularia* 67(r); *Lysimachia vulgaris* 3,54,56,57,78; *Malus* sp. c 38; *Melandrium rubrum* 68; *Mnium* sp. 21,23; *Molinia caerulea* 39,55; *Peucedanum oreoselinum* 6,16,24,33,38,59,64,65,66,70(2); *Pimpinella saxifraga* 45,75,76(r); *Plagiomnium cuspidatum* 36,63,75; *Plagiomnium rostratum* 47; *Plagiothecium* sp. 5; *Poa compressa* 67(1),76; *P. pratensis* 20,27(1),28(2),36(1),39,40,42,67,75,80(r),89(1); *P. trivialis* 69; *Polypodium vulgare* 6(1); *Populus tremula* a1 55(1),89(1) a2 17, b 20,32,33,78,88, c 17,20,32,33,55,88,89; *Prunella vulgaris* 35; *Prunus* sp. c 62,86(r); *P. spinosa* b 81,84(1), c 26,37; *Pyrus communis* a2 14,39, b 27,46,60, c 16(r),19,24,34,44,46,54(r),60,69,71,75; *Quercus rubra* a1 40(2), b 55(1), c 17(r),40; *Q. x rosacea* a 30(1),59(1),69(4), a1 50(3),63(4), a2 50(1), c 50,59(1),63,66; *Ranunculus sardous* 41; *Rhytidadelphus squarrosus* 63; *Robinia pseudacacia* a 82(1), b 36,82, c 71,74; *Rosa canina* b 84; *Rubus caesius* 5,21,23,24,56(r); *R. cfr. hirtus* 79; *R. hirtus* 40; *R. nessensis* 3; *R. pallidus* 3(1); *R. plicatus* 6(1),17,30(1),56(1),57,71,73; *R. radula* 3; *R. schleicheri* 34,71; *Rubus* sp. 1,54,55,62,64,77,82, *R. sprengelii* 3(1),6,16,46,74,87,90; *R. x corylifolius* 3(1),37,40; *Rumex acetosa* 20,36,47,76(r),89; *R. acetosella* 20,56(1),57,60,67,70,74,79,80(r),91; *Sagina procumbens* 67; *Sambucus nigra* b 55, c 5,35,84; *S. racemosa* c 56; *Sarothamnus scoparius* c 22,44,46,58,79; *Sedum maximum* 19,20,27,34,38,63,67,70,71; *Selinum carvifolia* 68; *Senecio ovatus* 84; *S. sylvaticus* 9; *S. vulgaris* 20; *Silene nutans* subsp. *nutans* 42; *Stellaria graminea* 7,31,34; *S. media* 20,27,35,65(2),66(3),79,82,91; *Taraxacum officinale* 20,22,27, 45,59,65,69,75(r),76(r),88(r); *Torilis japonica* 31,45; *Trichodon cylindricus* 69; *Trifolium alpestre* 13,84,88; *T. arvense* 22; *Urtica dioica* 7,9,10,26,65(2),66(1),77; *Vicia cassubica* 7(1),12,27,46,67,79; *V. sepium* 1,40,62; *Viscaria vulgaris* 34,52,67.

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Sporadic species: III.: *Lophocolea heterophylla* 43,49; *Plagiothecium laetum* 12,58; IV.: *Chimaphila umbellata* 44; *Dicranum polysetum* 64,71,73(1); *D. scoparium* 42,44,53,55,70(1),72; *Galium rotundifolium* 47,53,54; *Hylocomium splendens* 44; *Juniperus communis* b 30,44, c 7,24,35,40,41,42,56,64,65,66,69; *Leucobryum glaucum* 3,8,44(2),60,66(1),71(2),73; *Monotropa hypopitys* s.s. 56; *Orthilia secunda* 62(1); *Picea abies* a1 60(1), a2 48(2), b 48(1), 54(1), 60(1), 63(1), c 10,18,19,32,35,41,42,47,48(1),63,64,69; *Plagiothecium curvifolium* 42,58; *Pseudoscleropodium purum* 51,64,65; *Pyrola minor* 62(2); *Rubus saxatilis* 10,39,45,46(1),52(1),58(1),61; *Thuidium tamariscinum* 55; *Trientalis europaea* 53(1),56; *Vaccinium vitis-idaea* 48,51,54,56,64,65,69,72; *Viscum album* subsp. *austriacum* 22,66,73; V.: *Acer platanoides* c 53,62(r); *A. pseudoplatanus* b 53, c 20,53; *Ajuga reptans* 5(1),56; *Anemone nemorosa* 11(1),20,31(1),43(2),45(2),48(1),60; *Atrichum undulatum* 51,55; *Brachypodium sylvaticum* 6(1),59(1),72; *Campanula persicifolia* 41,42,64; *Carex montana* 3,31,48; *Carpinus betulus* b 51,56, c 20,30,51,56,57; *Dactylis polygama* 16,55(r); *Dryopteris filix-mas* 46; *Festuca gigantea* 5,7(1),18,21(1),28(1); *Hypericum montanum* 27; *Lathyrus niger* 10,27,32(1),69; *Lilium martagon* 10(r),19,20,24,31,32(1),52,68; *Luzula luzuloides* 72; *Malus sylvestris* 52,58; *Milium effusum* 36,60,72; *Platanthera bifolia* 47; *Ribes spicatum* c 7; *Scrophularia nodosa* 5,6(r),18(1),28; *Tilia cordata* b 43, c 6(r),47,68; *Ulmus glabra* a 59(1), c 59(r); *U. minor* c 19,52; *Viburnum opulus* c 59; *Viola reichenbachiana* 46,53,62; VI.: *Agrostis capillaris* 38,39(1),47,53,54,56,57,72; *Carex ericetorum* 56; *C. ovalis* 47; *C. pallescens* 1,41,42,51; *Cladonia coniocraea* 40; *Danthonia decumbens* 56; *Hieracium pilosella* 14,47,56; *Luzula multiflora* 1,3(1),30,38(2),40,42,44,55; *Polytrichum juniperinum* 60,73(1); *Ptilidium ciliare* 43; *Scorzonera humilis* 14(1),16(r),36,58; *Veronica officinalis* 16,17,39,43,44,47,54,56,72; VII.: *Agrostis stolonifera* 40; *A. vinealis* 66,73; *Alliaria petiolata* 5; *Anthericum ramosum* 6,14(1),21,23,41,68; *Astragalus glycyphyllos* 15; *Betonica officinalis* 58; *Betula pendula* a 2,27(1),66(1),73, a1 34(1),55(1),56(1),57(1),60(1), a2 34(2), b 34(1),35,54,55, c 2,23,24,54,57,68; *Brachypodium pinnatum* 10(1),18(1),19,31,37,63(1); *Brachythecium rutabulum* 65,67; *Calamagrostis canescens* 71(1); *C. epigejos* 29,34(2),44,47,53(1), 55(2),60, 63(1),65(1),69(1),73; *C. patula* s.s. 43; *C. rotundifolia* 14,50(1),72; *Carex acutiformis* 33(2); *Chamaenerion angustifolium* 57(1),60(1); *Cladonia* sp. 42; *Clinopodium vulgare* 41,47; *Crataegus laevigata* b 45; *C. monogyna* b 27,34,60, c 20; *Dactylis glomerata* 52; *Deschampsia flexuosa* 34,43,44,46,53,60,72(2); *Dianthus superbus* s.s. 9,59; *Euonymus europaea* c 59(1); *Fallopia convolvulus* 1,2,12,21,35,63,68; *Festuca rubra* s.s. 3,34,39,40,45,47(1),50,55,57; *Fragaria vesca* 56,58; *Galeopsis pubescens* 14,31,41,53; *Galium album* fo. *dumetorum* 47; *G. boreale* 5(2),8,14(r),19(1),24,27(1),41,42,43,58(1); *G. verum* 27,47; *Geranium robertianum* 19(r),52; *Hieracium* sp. 58; *Holcus lanatus* 57; *Hypericum perforatum* 41; *Hypnum cupressiforme* 13,42,43,44(1),47,53,56(1),58,66,71,73; *Impatiens parviflora* 36,53,55(1); *Juncus effusus* 60; *Koeleria* sp. 73; *Lamium maculatum* 72; *Larix decidua* subsp. *decidua* a2 60(1); *Leontodon hispidus* 47; *Lysimachia vulgaris* 21,26(1),27(2),45,49(1),66; *Molinia caerulea* 52(1),58; *Orthodicranum montanum* 53; *Padus serotina* c 22,28,47; *Peucedanum oreoselinum* 14,19(r),24,30,31,39,41,42,44,51,64,73; *Phragmites australis* 66,73; *Pimpinella saxifraga* 72; *Plagiomnium affine* 7,12,44(1),46,47(1),51,55,56(2),64,65; *Poa angustifolia* 19,27(1),40,41,44,47(4),48,50(1); *P. pratensis* 15; *Polypodium vulgare* 62; *Populus tremula* b 19,55,57(1), c 16,19,55,57(1),71; *Prunus spinosa* b 34, c 46,52; *Pyrus communis* b 45(1),72, c 47,56; *Ranunculus acris* s.s. 56; *Rhamnus cathartica* c 49; *Robinia pseudacacia* c 22,28,64; *Rosa canina* c 7,19,59; *Rubus caesius* 9,15,19; *R. idaeus* 6,11,20,34,45,53,60,72; *Rubus* sp. 2,34(1),38,53(2),55,56,57,60; *Rumex acetosa* 47; *R. acetosella* 44,64,66(1),73; *Sambucus nigra* c 5; *S. racemosa* b 60; *Sciuro-hypnum oedipodium* 12,47,64(1); *Sedum maximum* 31,39; *Selinum carvifolia* 47; *Silene nutans* subsp. *nutans* 16; *Stellaria graminea* 72; *S. media* 34,55; *Urtica dioica* 5(1),6(r),15(1),19,21,22,25,26(1),27(1),33,37(1),33,37(1),68,72; *Veronica chamaedrys* 39,44; *Viscum album* subsp. *album* 55.

Table A16. *Calamagrostio arundinaceae-Quercetum petraeae polygonatetosum odorati* variant with *Anemone nemorosa* in stage I of degeneration

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Sporadic species: IV.: *Aulacomnium androgynum* 51; *Hieracium umbellatum* 17,30,33,35; *Hypericum pulchrum* 21; *Plagiothecium laetum* 7,38,45; **V.:** *Betula pubescens* subsp. *pubescens* c 55; *Dicranum polysetum* 18,52; *D. scoparium* 19,39(1),52,55(3),56; *Dryopteris dilatata* 7,38,48,61(1); *Galium rotundifolium* 32(1); *Hylocomium splendens* 19,21,52; *Juniperus communis* b 18, bc 9,21(2),26,30, c 3,6,11,15,17; *Leucobryum glaucum* 19,39(1),56; *Monotropa hypopitys* s.s. 21; *Orthilia secunda* 45,52(1); *Picea abies* a 33(2),58, a1 61, a2 45(1),57(1), b 32,45(2),48(1),58(2),61, c 3,11,12,55,56,57,58,63; *Plagiothecium curvifolium* 63; *Pseudoscleropodium purum* 19,24,31,43,51(1),52; *Pyrola minor* 45(1); *Trientalis europaea* 25(1),31,41(2),58(1),61(1); *Vaccinium vitis-idaea* 28,59,60(1); *Viscum album* subsp. *austriacum* 45; **VI.:** *Acer platanoides* b 32, c 1,8(r),32; *A. pseudoplatanus* b 32(1), c 10,32,34,44; *Adoxa moschatellina* 43,52; *Brachypodium sylvaticum* 15,50,55,62(2); *Campanula persicifolia* 5,27,28; *Carex digitata* 9,47; *C. montana* 3,28,31,59,60(1); *Carpinus betulus* a 58(1), a2 33(1),40(4),55(1), b 40(2),46,47(1),55(1),57,58, c 27,28,31,33(1),40,46(r),47,52,55,56,57,58; *Cerasus avium* c 17,37(r),39(r); *Dactylis polygama* 24(1),33,55; *Daphne mezereum* 4(r); *Dryopteris filix-mas* 24(1),25,33,61; *Epipactis helleborine* 32; *Eurhynchium angustirete* 31; *Festuca gigantea* 6,26,62,63; *F. heterophylla* 9,31,36(1),41,49,62,63; *Fraxinus excelsior* b 45,50, c 19(r),22,26,34,43,44,45(1),50,52,57; *Galeobdolon luteum* 9(1),55; *Galium sylvaticum* 55; *Hepatica nobilis* 47(1); *Hypericum montanum* 3,15,21,27,31,53(r); *Lathyrus niger* 4(1),9,11,21,26,32,33,55; *Lonicera xylosteum* b 47, c 47(1),55; *Malus sylvestris* b 58, c 21,59; *Melampyrum nemorosum* 16,17,26, 30,41(1),47,49(1); *Milium effusum* 47,57(1); *Padus avium* b 50, c 25,34,43; *Phyteuma spicatum* 47; *Poa remota* 25; *Polygonatum multiflorum* 48; *Potentilla alba* 16; *Pulmonaria obscura* 47,49; *Scrophularia nodosa* 3,5,17,22,23,27,29,33,47,53; *Stellaria holostea* 40; *Tilia cordata* b 32(3), c 6,32,49(1),53; *Ulmus minor* b 55(2), c 55; *Viburnum opulus* c 17,26,31; *Viola reichenbachiana* et *riviniana* 9,13,21,28,31,36,42,43,52,59,60(1); **VII.:** *Carex ovalis* 53; *C. pallescens* 2,17,34,37,41,49; *Hieracium pilosella* 18,21,28,31,42,49,52; *Hypericum maculatum* 54; *Polytrichum juniperinum* 19,21,35; *Potentilla erecta* 16,26,27,30; *Scorzonera humilis* 59,60; *Viola canina* 20,53(r); **VIII.:** *Abies alba* 45(r); *Achillea millefolium* 16,17,18,20,21,27,34,42,44,46,49; *Agrimonia eupatoria* 46,50; *Agrostis gigantea* 54(1); *Ajuga genevensis* 37; *Alliaria petiolata* 25; *Anthericum ramosum* 15,47,55; *Arrhenatherum elatius* 35(1),45(1); *Astragalus glycyphyllos* 26,28,30,31,36,37,42,43,45,53; *Athyrium filix-femina* 31; *Avenula pubescens* 30; *Betonica officinalis* 15,41,42(2); *Betula pendula* a 24(1),54(1),56(r),58(1), a1 4,20(2),35(1),57(1), c 39,40,58; *Brachypodium pinnatum* 24,58(1); *Brachytheciastrum velutinum* 9,19,28, 31,32,36,43,45,47,52,59; *Brachythecium albicans* 52; *B. rutabulum* 19,20(1),21,31,33(1),43,52; *B. salebrosum* 28,36; *Bryum* sp. 36; *B. subapiculatum* 36,43; *Calamagrostis canescens* 53(r); *C. epigejos* 18,20(1),23,25(1),40,44(1),48,54(2),57,58,61(1); *Campanula rotundifolia* 4,11,13,17,27,30,32,42,59,60(1),61; *Carex hirta* 14,20,25(r),54; *C. panicea* 34; *Carex* sp. 25; *Ceratodon purpureus* 18,19,36; *Chaerophyllum temulum* 55; *Chamaenerion angustifolium* 57(1); *Cladonia* sp. 52; *Colutea arborescens* 42; *Cornus sanguinea* b 4(2),20,51(1), c 20; *C. stolonifera* c51(1); *Coronilla varia* 16,36; *Crataegus laevigata* b 58, c 55; *C. monogyna* b 4(1),35, c 4,34,35; *C. monogyna* et *laevigata* b 49, c 40; *Dactylis glomerata* 17,41,42,48,54; *Deschampsia caespitosa* 6,25,51,52; *D. flexuosa* 4,6,7,24(1),25(2),32,38,45,48,54,56(1),61; *Epilobium parviflorum* 53; *Euonymus europaea* c 55; *Euphorbia cyparissias* 6,20,34,42,52,55; *Euphorbia esula* 20; *Fallopia convolvulus* 2(1),10,12,14(1),17(1),24,43,50(1),51(1),54(1); *F. dumetorum* 48,53(2); *Galeopsis pubescens* 11,20,23,27,32(1),35,39(r),48(1),55; *Galium album* 18,21,28,31,36,43,46; *G. album* fo. *dumetorum* 45; *G. aparine* 46(1),48,53,57(1); *G. mollugo* 13,20,49; *G. palustre* 50; *G. verum* 17,27,34,41,49,53(1); *Geranium robertianum* 16,22,28,31,43,46,48(1),53; *G. sanguineum* 13; *Geum urbanum* 18(r),31,34,35,46(1); *Glechoma hederacea* 31,53(1); *Hieracium barbatum* 50; *Hypnum cupressiforme* 6,7,18,19,21, 35,38,39,45,52,56,60; *Hypochoeris radicata* 31; *Impatiens parviflora* 5(2),20,24(2),25,32,42,48(4),51(1),54; *Juncus effusus* 54,57(r); *Knaulia arvensis* 16,35; *Larix decidua* subsp. *decidua* a 24(2), a1 57, c 57; *Leontodon autumnalis* 19; *Linaria vulgaris* 14,53,55; *Lophocolea bidentata* 19,52; *Lycopus europaeus* 53; *Lysimachia nummularia* 34; *L. vulgaris* 50; *Mnium* sp. 12; *Molinia caerulea* 59,60(1); *Oxalis acetosella* 25(1),31(2),40,41,45(2),47(3),49,58(3); *Padus serotina* b 20,22(1),33(1), c 18(r),22,30,33(1),46(r),54; *Peucedanum oreoselinum* 11,13,14,16,17,18(1),42(1),55; *Pimpinella saxifraga* 3,13,28,36,42,44,49(1),50; *Plagiomnium cuspidatum* 3; *P. rostratum* 20; *Plagiothecium* sp. 27; *Plantago major* 46; *Poa pratensis* 3,30,34(1),35,44(1),47,50,52,56; *P. trivialis* 31,41,49; *Polygonatum odoratum* 9,13(1),15,17,18(1),46(1),47,55,58,59,60; *Populus tremula* a 58, a1 4(1), b 17, c 4,58; *Potentilla reptans* 34; *Prunus spinosa* b 55,57,58; c 55; *Pyrus communis* b 45,55, bc 27,30, c 16,21,23,28,34,36,43,44,62; *P. pyraeaster* b 18,46; *Ranunculus acris* s.s. 31; *Rhamnus cathartica* c 24,55; *Ribes nigrum* c 53(r); *Robinia pseudacacia* c 44; *Rosa canina* c 26; *Rosulabryum capillare* 59; *Rubus caesius* 1,10(1), 12,23(1),27,44,50,53(2),59; *R. cfr. hirtus* 48(1),61(2); *R. idaeus* 24,32,35,41,43,46(2),48,51,55,57(1),61; *R. plicatus* 32(1); *Rubus* sp. 2,17,36,56,58(4); *R. sprengelii* 25(1),37(r); *R. x corylifolius* 22(1),46; *Rumex acetosa* 43,47; *R. acetosella* 18,48,55,61(r); *Salix* sp. c 31; *Sambucus nigra* c 7,53(r),55; *S. racemosa* b 57(2), c 57; *Sarothamnus scoparius* c 35; *Sciurohypnum oedipodium* 3,5,6,9(1), 19,21,28,31,36,43,52; *Sedum maximum* 35,50,55; *Silene nutans* subsp. *nutans* 45; *Stellaria graminea* 56; *S. media* 20,46,48; *Taraxacum officinale* 28,31,36,42,43,46; *Torilis japonica* 28; *Trifolium alpestre* 31; *Urtica dioica* 24,53(1),62; *Vicia cassubica* 5,19,30,39,51; *V. cracca* 11,27; *V. sepium* 47,53; *Viola* sp. 25; *Viscaria vulgaris* 42,55.

Table A17. *Calamagrostis arundinaceae-Quercetum petraeae polygonatetosum odorati* in stage II of degeneration

Successive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35			
ID-1	37	51	42	29	12	23	42	29	42	5	55	37	23	23	55	16	36	36	29	2		29	42	23	37	44	44	48	42	42	35	24	27	29	29	35			
ID-2	12	1	4	10	2	12	4	10	3	2	16	12	12	12	16	19	17	17	16	7		10	3	12	14	4	4	3	6	6	29	-	1	10	10	20			
ID-3	14	7	19	8	15	10	3	13	6	10	13	10	3	7	12	12	20	23	7	4		9	1	12	7	3	2	11	3	5	18	-	24	3	4	14			
Date (year)	1984	1981	1981	1980	1984	1985	1981	1979	1981	1984	1975	1986	1985	1985	1991	1972	1985	1986	1977	1988		1977	1981	1985	1986	1976	1976	1976	1981	1981	1976	2006	1975	1977	1977	1976			
Density of tree layer	a1,a [%]	75	80	70	70	60	60	60	60	70	70	70	60	75	70	20	35	40	70	60		70	75	80	20	60	70	80	70	85	60	20	60	70	75	50			
Density of tree layer	a2 [%]	-	10	-	-	-	-	-	-	-	-	5	-	-	-	90	20	35	-	-		-	-	-	50	15	10	-	-	5	70	-	-	-	30				
Density of shrub layer	b [%]	+	+	-	5	-	-	+	+	30	-	+	75	20	+	60	5	15	+	+		+	+	-	5	20	20	-	25	20	+	+	+	+	5	20			
Cover of herb layer	c [%]	45	90	75	70	80	90	45	10	65	10	45	30	90	50	20	50	5	95	80		50	5	45	85	55	5	10	30	50	35	75	30	20	30	90			
Cover of moss layer	d [%]	+	+	+	20	+	5	+	10	5	+	10	70	10	+	100	80	90	90	10		50	5	45	85	55	5	10	30	50	35	75	30	20	30	90			
Area of relevé		600	150	100	150	400	200	100	200	100	200	100	200	300	300	100	200	900	900	200		150	100	100	200	600	400	200	200	100	150	200	150	100	200	100			
Location (ATPOL)		BE05	CD83	BD49	CD17	BD66	CD52	BD49	CD17	BD49	BC98	BC82	AD88	CD53	CD53	CD53	BC31	BE28	CE20	CD17		CD17	BD49	CD43	BD92	DE41	DE41	BD28	BD59	BD59	CE00	CE36	BD54	CD17	CD17	CE01			
Total number of species		34	32	27	34	24	25	17	35	27	25	28	29	32	33	29	20	25	27	45	25		28	19	15	27	34	24	22	19	15	28	24	13	21	20	23		
Number of mosses, liverworts and lichens species		3	2	2	10	3	3	2	3	3	4	4	2	5	4	-	7	5	3	2	3		3	1	1	3	3	1	4	1	-	3	3	3	7	6	2		
I. Ch., D.* Quercetia robori-petraeae																																							
<i>Festuca ovina</i>		3	.	2	2	+	+	2	1	2	1	2	+	1	+	1	.	.	.	1	+		80	3	3	+	1	+	+	1	+	2	2	2	2	2	2	+	100
<i>Carex pilulifera</i>		+	+	+	+	+	+	.	1	+	+	.	.	.	1	.	1	1	.	.		60	+	+	+	1	+	+	.	+	+	+	+	+	+	+	+	93	
* <i>Polytrichastrum formosum</i>		.	+	1	+	1	+	.	+	.	1	+	1	1	.	1	1	+	.	1		75	.	+	.	1	1	.	.	.	.	2	+	+	.	+	+	53	
* <i>Pteridium aquilinum</i>		+	3	3	.	.	.	+	2	.	2	1	1	.	2	.	+	1	+	1		65	+	+	.	.	+	1	2	.	+	1	+	+	.	.	47		
* <i>Melampyrum pratense</i>		+	+	+	3	.	.	.	2	.	.	2	1	.	.	.	.	.	.	1		45	2	1	+	.	1	+	1	+	3	.	+	.	1	.	80		
<i>Holcus mollis</i>		.	1	.	4	5	.	.	.	.	2	+	1	1	2	.	1	+	.	.		50	.	.	5	.	2	2	.	.	.	.	.	.	+	.	33		
<i>Dicranella heteromalla</i>		+	.	.	.	+	+	.	.	1	.	.	.	.	.	.	.	.	.	+		35	.	.	.	+	.	.	.	.	.	+	1	.	.	.	20		
II. D. Ca-Q polygonatetosum odorati																																							
<i>Corylus avellana</i> (Q-F)		.	.	/+	/1	.	.	/+	.	.	.	.	4/+	2/+	.	+	.	.	.	.		30	.	.	.	.	/+	.	.	.	.	.	.	.	.	.	.	7	
<i>Veronica officinalis</i> (C-U)		1	.	.	.	.	+	.	+	1	+	.	.	.	.	+	.	+	+	+		50	+	+	.	.	+	+	.	.	.	.	.	.	+	+	.	47	
<i>Moehringia trinervia</i>		+	2	+	+	.	.	.	+	+	+	.	.	.	.	2	.	.	.	+		60	+	.	+	+	.	.	.	.	.	.	.	.	.	.	+	33	
<i>Convallaria majalis</i>		+	.	.	.	.	.	3	.	.	.	.	.	.	.	2	.	1	+	+		35	+	.	.	.	.	+	2	3	4	.	.	.	.	+	53		
<i>Melica nutans</i> (Q-F)		.	.	+	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	+		25	+	.	.	.	+	1	+	+	.	.	.	.	.	.	47		
<i>Hieracium murorum</i>		.	.	.	.	1	.	.	.	.	1	.	+	1	.	.	.	.	+	1		45	.	+	+	.	.	.	.	.	.	+	.	.	.	.	20		
<i>Mycelis muralis</i>		.	+	.	+	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.		35	.	.	.	+	.	.	.	.	.	.	.	.	.	+	13		
<i>Polygonatum odoratum</i>		.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.		15	.	.	.	.	.	1	.	.	.	.	+	+	.	.	20		
III. D. Anemone var. (rich var.)																																							
<i>Veronica chamaedrys</i>		+	1	+	+	+	+	.	.	.	2	.	1	2	1	.	.	.	.	+		60	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	7	
<i>Viola reichenbachiana</i> (Q-F)		1	1	.	.	+	+	.	+	.	.	+	1	+	+	.	.	.	+	.		55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-		
<i>Hypericum perforatum</i>		+	+	+	.	.	.	+	+	+	.	.	.	.	+	+	+	+	+	.		55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-		
<i>Oxalis acetosella</i>		.	1	.	.	.	.	.	.	.	2	.	+	1	.	.	1	1	.	.		30	.	.	.	1	.	.	.	.	.	.	.	.	.	.	7		
<i>Atrichum undulatum</i> (Q-F)		.	.	.	+	+	.	+	.	.	1	.	1	+	.	.	1	.	.	.		35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-		
<i>Carpinus betulus</i> (Q-F)		.	.	.	/+	/1	/+	.	/+	.	/1	.	.	.	.	.	.	.	.	.		25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-		
<i>Fragaria vesca</i>		.	2	.	+	.	.	+	.	.	.	+	.	.	.	.	.	.	+	+		30	.	+	.	.	.	.	+	.	.	.	.	.	.	.	13		
<i>Anemone nemorosa</i> (Q-F)		.	.	.	.	+	.	.	.	.	.	.	1	+	.	.	.	.	+	.		20	.	.	.	+	+	.	.	.	.	.	.	.	.	.	20		
<i>Poa nemoralis</i> (Q-F)		1	.	.	.	.	2	.	+	.	.	.	+	+	.	1	.	.	.	+		35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7		
IV. Vaccinio-Piceetia																																							
<i>Pinus sylvestris</i>	a1,a;a2^	.	+	.	.	.	.	1	+	.	.	.	.	.	.	2	2	2	3	4		40	1	.	.	2	1;1^	.	3	2	2	3	2	.	1	.	3	67	
<i>Pinus sylvestris</i>	b/c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		0	.	.	.	/+	+/+	.	.	/+	/+	.	.	.	.	.	27		
<i>Vaccinium myrtillus</i>		1	2	+	.	.	+	.	.	.	.	2	+	+	.	.	1	2	.	.		45	1	.	.	3	3	2	.	+	.	4	1	+	1	+	73		
<i>Pleurozium schreberi</i>		.	.	+	1	.	.	1	.	.	.	.	+	+	.	.	.	.	2	.		35	1	.	.	1	1	.	.	.	3	2	.	2	2	+	53		
V. Ch. Calluno-Ulicetia (C-U)																																							
<i>Agrostis capillaris</i>		.	.	.	+	+	.	2	+	2	.	+	.	.	1	.	.	.	.	.		35	.	.	.	+	+	+	1	.	.	.	.	.	.	.	1	40	
<i>Pohlia nutans</i>		+	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	+	+	+		30	.	.	.	+	+	+	.	.	.	.	+	.	.	.	27		
<i>Solidago virgaurea</i> s. s.		+	.	+	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.		25	.	+	.	.	.	.	.	.	.	.	.	.	.	.	7		
<i>Luzula multiflora</i>		.	.	+	+	.	1	.	.	+	.	.	.	.	.	+	.	.	.	.		25	.	+	.	.	.	.	.	.	.	.	.	.	+	.	13		
VI. Others																																							
<i>Quercus petraea</i>	a1,a	4	3	4	2	+	.	4	4	4	3	1	.	.	.	.	2	2	4	.		65	4	5	5	.	4	4	.	3	3	.	.	4	4	4	.	67	
<i>Quercus petraea</i>	a2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	3	.		15	.	.	.	3	2	1	.	.	.	.	2	.	.	.	27		
<i>Quercus petraea</i>	b/c	+/1	/+	/+	1/+	/+	/+	/+	/+	.	.	.	.	.	.	/+	.	+/1	/2	+/		60	/1	+/+	/1	+/+	2/1	2/2	.	+/	1/+	.	/+	+/	+/+	1/+	.	80	
<i>Quercus robur</i>	a1,a	2	2	.	3	4	4	.	.	.	3	3	4	4	4	3	.	1	.	.		60	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	
<i>Quercus robur</i>	a2	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.		10	.	.	.	1	.	.	.	.	.	.	.	.	.	2	20		
<i>Quercus robur</i>	b/c	.	/+	.	.	/+	.	/+	.	.	/+	+/+	/+	/+	/+	/+	/+	.	.	.		45	/+	.	.	.	.	.	.	.	+/+	.	.	.	.	2/+	20		
<i>Sorbus aucuparia</i>	b	.</																																					

Sporadic species: I.: *Calamagrostis arundinacea* 16(1),19,27(1); *Hieracium lachenalii* 27,30(1); *H. laevigatum* 16; *H. umbellatum* 22; *Lophocolea heterophylla* 17; *Plagiothecium laetum* 2(2); IV.: *Dicranum polysetum* 4,30; *D. scoparium* 10,17,27,33,34; *Galium rotundifolium* 30; *Hylocomium splendens* 4,33,34; *Juniperus communis* b 25(1), bc 4,8,19,21, c 22,25,26,30; *Leucobryum glaucum* 27(1),33,34; *Monotropa hypopitys* s.s. 26; *Orthilia secunda* 24; *Picea abies* a1,a 17(1), a2 17(1), b 17(1),18(2), c 18; *Plagiothecium curvifolium* 32; *Pseudoscleropodium purum* 4,13,23(1); *Pyrola minor* 11; *Rubus saxatilis* 8,13(1),14(1),19,27; *Trientalis europaea* 13(1),14(1),18(1),25,26; *Vaccinium vitis-idaea* 19,25(1),26,31; V.: *Calluna vulgaris* 25,30,31; *Carex pallescens* 9,12,13; *Danthonia decumbens* 5,30(1); *Hieracium pilosella* 4,6,8,30; *Hypericum maculatum* 5,6,13,14,23; *Luzula campestris* 1; *Polytrichum juniperinum* 4,11,34; *Potentilla erecta* 2,6,19,21(1); VI.: *Acer platanoides* (QF) a1 35, b 35, c 8,35; *A. pseudoplatanus* (QF) a 16, b 35, c 28,29; *Achillea millefolium* 6,8,19; *Agrostis gigantea* 2; *Arrhenatherum elatius* 1,12(1),30; *Astragalus glycyphyllos* 10(1); *Berberis vulgaris* b 16; *Betula pendula* a 1(1),33,34(1), a1 12(1),24, a2 17,30(2), b 15(r),25,30(1), c 9,24; *Brachypodium sylvaticum* (QF) 10,16(1); *Brachythecium albicans* 4; *B. rutabulum* 16(1),21; *Campanula patula* s.s. 5; *C. persicifolia* (QF) 5,19; *C. rotundifolia* 9; *Cardaminopsis arenosa* 16; *Carex brizoides* 1; *C. digitata* (QF) 4,21; *C. montana* (QF) 19,25; *C. pairae* 5; *Carex* sp. 19; *C. sylvatica* (QF) 13; *Cerastium holosteoides* 30; *Cerasus mahaleb* b 16; *Ceratodon purpureus* 4; *Chaerophyllum temulum* 34; *Chamaenerion angustifolium* 15(r),35; *Chelidonium majus* 16(3); *Chenopodium album* 3; *Clinopodium vulgare* 8,14; *Crataegus laevigata* c 8; *C. monogyna* b 19; *C. monogyna* et *laevigata* b 13,16, c 13; *Cruciata glabra* 25,26; *Dactylis polygama* (QF) 10,16(1); *Deschampsia caespitosa* 15,19; *D. flexuosa* 12(4),15(2),16,17(1),20(2),24,31(2),33(1); *Dryopteris carthusiana* 2,12,16,18(1),20(1),24(1),28,31,35(1); *D. filix-mas* (QF) 16,20(1); *Epilobium montanum* 25; *Euphorbia cyparissias* 8,30; *Fagus sylvatica* (QF) a1,a 15(4),35(1), a2 31(3),35(1), b 28(2), c 11,23,28(1),29,31; *Fallopia convolvulus* 3,7,9,28; *F. dumetorum* 16; *Festuca gigantea* (QF) 10,16,24(r); *F. heterophylla* (QF) 24; *F. pratensis* 12(1); *Fraxinus excelsior* (QF) c 23; *Galeobdolon luteum* (QF) 4; *Galeopsis pubescens* 7,18,22; *G. speciosa* 16; *G. tetrahit* 1,3,5,8,12,28,29; *Galium album* 8,21; *G. aparine* 3,16(1); *G. boreale* 19,21; *G. mollugo* 12,14,19,23; *G. schultesii* (QF) 16(1),25; *G. sylvaticum* (QF) 2; *G. verum* 10; *Geranium robertianum* 2(1),16(3),20(1); *Holcus lanatus* 15,19; *Hypericum montanum* (QF) 9,26; *Hypnum cupressiforme* 1,16(2),27; *Lamium purpureum* 20; *Lathyrus pratensis* 15; *Leontodon autumnalis* 16; *Lilium martagon* (QF) 28; *Linaria vulgaris* 15,16(1); *Lysimachia vulgaris* 10,17; *Malus sylvestris* (QF) 19; *Melampyrum nemorosum* (QF) 13(1),14(1); *Milium effusum* (QF) 24,35; *Padus avium* (QF) c 19; *P. serotina* a2 16(5), b 10(3),16(4), c 10(1),16(2); *Peucedanum oreoselinum* 22,31; *Pimpinella saxifraga* 19,21,30; *Plagiomnium rostratum* 16; *Plagiothecium ruthei* 10(1); *Plantago lanceolata* 20; *Platanthera bifolia* (QF) 13; *Poa compressa* 33; *P. pratensis* 1(1),4(1),5(1),6(1),32; *P. trivialis* 3,14; *Polygonatum multiflorum* (QF) 1; *Prunus spinosa* c 10; *Pulmonaria obscura* (QF) 14; *Pyrus communis* a 16(1), a2 16, c 8,11(r); *P. pyraeaster* c 31(r); *Quercus rubra* c 1; *Q. x rosacea* a 27(4), c 27; *Rhamnus cathartica* c 19; *Ribes spicatum* (QF) c 18; *Robinia pseudacacia* a2 16(1); *Rubus caesius* 1(1),7,9; *R. cfr. hirtus* 18(2); *R. idaeus* 2(1),12(1),15(1),20,24,35(1); *Rubus* sp. 3,18(2),19,25,29,31,35(4); *Rumex acetosa* 5,6,16; *R. acetosella* 1,15,16(1),20; *Sambucus nigra* b 16, c 16; *Sanicula europaea* (QF) 18; *Sarothamnus scoparius* c 12; *Scorzonera humilis* 19; *Scrophularia nodosa* (QF) 3,7,9,15; *Sedum maximum* 2; *Senecio ovatus* 20,24; *Silene nutans* subsp. *nutans* 16; *Stellaria holostea* (QF) 13; *Taraxacum officinale* 4; *Tilia cordata* (QF) a 20, c 14(2); *Trifolium alpestre* 30; *Urtica dioica* 2,16(1); *Viburnum opulus* (QF) c 21; *Vicia angustifolia* 11(r); *V. cassubica* 3,10(1),11,19; *V. sepium* 1; *Vicia* sp. 19; *Vincetoxicum hirundinaria* 16; *Viola reichenbachiana* et *riviniana* (QF) 8,19,21; *V. riviniana* (QF) 11(1),14,23(1),25.

[illegible]

Sporadic species: I.: *Dicranella heteromalla* 15; *Hieracium sabaudum* 35; *H. laevigatum* 32(r); *H. umbellatum* 27; IV.: *Dicranum polysetum* 16; *Juniperus communis* b 22(1), bc 8,9(2),33(1), 35; *Monotropa hypopitys* s.s. 8; *Orthilia secunda* 9,20; *Picea abies* a1 18 (2), a2 3 (1), b 10(2), c 4,22,23; *Trientalis europaea* 4(1),17; *Vaccinium vitis-idaea* 27(r); V.: *Acer campestre* b 15, c 15; *A. platanoides* b 36, c 7,19(r); *A. pseudoplatanus* c 5; *Adoxa moschatellina* 17; *Ajuga reptans* 9,15(1); *Atrichum undulatum* 3,15(1); *Brachypodium sylvaticum* 10,14,19; *Campanula persicifolia* 11,17; *Carex digitata* 8,9(2); *C. montana* 14; *C. sylvatica* 15; *Carpinus betulus* c 14,25(1); *Dryopteris filix-mas* 2,10,21; *Epipactis helleborine* 11; *Equisetum sylvaticum* 17(2); *Festuca gigantea* 17,19,23,28,29(1),30; *F. heterophylla* 15,22(1),29(1),31(1); *Galeobdolon luteum* 17(1); *Impatiens noli-tangere* 2; *Malus sylvestris* c 8,10(1); *Melampyrum nemorosum* 30; *Milium effusum* 15; *Padus avium* b 10(2),17(2), c 11; *Phyteuma spicatum* 15; *Pulmonaria obscura* 15(r); *Scrophularia nodosa* 7,31; *Stellaria holostea* 15; *Ulmus glabra* c 34(r); *Viola reichenbachiana* et *riviniana* 8,9,33; *V. riviniana* 13,17,21; VI.: *Achillea millefolium* 8(r),15; *Aesculus hippocastanum* c 26; *Agrostis gigantea* 7,11(2); *Alopecurus pratensis* 16; *Anthoxanthum odoratum* 8(1),12(1),14,15,21(2); *Arrhenatherum elatius* 11(3),12(2); *Astragalus glycyphyllos* 17; *Berberis vulgaris* b 19; *Bromus inermis* 24(1); *Campanula rotundifolia* 3,12,21(1); *Carex hirta* 12(2),14(r),17,21; *C. pallescens* 13,15; *C. rostrata* 31; *Cerastium arvense* 19(r); *Chaerophyllum temulum* 1; *Chelidonium majus* 12; *Clinopodium vulgare* 12; *Conyza canadensis* 3; *Cornus sanguinea* c 15; *Crataegus laevigata* b 17,21, c 10(1); *C. monogyna* et *laevigata* c 15; *Dactylis glomerata* 15,16; *Deschampsia caespitosa* 9,17; *Equisetum hyemale* 35; *Euonymus europaea* c 15,21(r); *Euphorbia cyparissias* 8,12,19; *E. esula* 19(r); *Festuca rubra* s.s. 3,8,20; *Galeopsis pubescens* 7,8; *Galium album* 8,9,33; *G. boreale* 10,11(1),17,21,35; *G. mollugo* 11(1),12,14,15; *G. verum* 19,20,21(1); *Genista tinctoria* 15; *Geranium robertianum* 1,2(1),7,12,30,31(2); *Glechoma hederacea* 19; *Hieracium murorum* 14,15(1),26,36; *H. pilosella* 15; *Hypericum maculatum* 15; *Hypnum cupressiforme* 1,15; *Impatiens parviflora* 10(1),17(1),32,36; *Juncus conglomeratus* 36; *J. effusus* 21; *Knautia arvensis* 12; *Lapsana communis* s.s. 15; *Larix decidua* subsp. *decidua* a 16; *Linaria vulgaris* 8,12; *Lupinus polyphyllus* 11; *Luzula multiflora* 13,15; *Lysimachia nummularia* 15(1); *L. vulgaris* 15(1); *Mentha arvensis* 15; *Molinia caerulea* 28(1); *Padus serotina* b 16(5), bc 12, c 7,13,16,21,26; *Peucedanum oreoselinum* 12; *Pimpinella saxifraga* 9(r),12(1),33(r); *Plagiomnium affine* 8,9(2),15,24(1),33(1); *Pohlia nutans* 3; *Polytrichum juniperinum* 8; *Populus tremula* c 16; *Potentilla erecta* 12,15; *Prunus spinosa* b 12, c 18; *Pyrus communis* c 2,14; *Rhamnus cathartica* c 10; *Robinia pseudacacia* b 29(3); *Rosa canina* bc 9; *Rosa* sp. c 13; *Rubus corylifolius* 13; *R. plicatus* 4,14(r); *Rubus* sp. 5,12,16,21(1); *R. sprengelii* 10(2),11(1),13,17(1); *Rumex acetosa* 21; *R. acetosella* 13(r),21(1); *Sambucus nigra* c 1,5; *Sciuro-hypnum oedipodium* 3,8,9,33; *Scorzonera humilis* 33,35; *Taraxacum officinale* 15; *Thalictrum minus* 3; *Veronica officinalis* 11,15,18(1); *Vicia cassubica* 10(1),11(2),12,17,22,23; *V. sativa* 11; *Vincetoxicum hirundinaria* 22(r),23(1), 24,29(1),30(1); *Viola* sp. 35.

Table A19. Calamagrostio arundinaceae-Quercetum petraeae – mixed form of Ca-Qp molinietosum and Ca-Qp polygonatetosum

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12
ID-1		16	16	21	16	30	4	25	37	4	23	4	36
ID-2		17	21	1	17	5	50	-	12	50	12	50	13
ID-3		6	1	3	5	27	15	-	5	4	1	10	19
Date (year)		1972	1972	1972	1972	1987	2003	1986	1986	1984	1985	1985	1985
Density of tree layer	a1,a [%]	80	40	50	80	50	60	60	65	75	60	65	60
Density of tree layer	a2 [%]	40	80	+	70	60	-	-	5	-	-	-	-
Density of shrub layer	b [%]	40	10	+	60	10	45	30	+	15	+	-	+
Cover of herb layer	c [%]	80	50	70	90	60	100	70	60	90	90	85	95
Cover of moss layer	d [%]	60	60	30	10	+	-	25	5	-	+	15	5
Area of relevé		CD96 200	CE14 200	CD82 450	CD96 250	CD73 1000	CD83 250	BD80 900	CB94 400	CD53 300	CB94 400		900
Location (ATPOL)		CD96	CE14	CD82	CD96	CD73	CD83	BD80	CB94	CD53	CB94		
Total number of species		48	41	45	44	24	37	34	28	38	47	37	45
Number of mosses, liverworts and lichens species		8	12	6	6	1	-	2	4	-	2	1	4
I. Ch., D.* Calamagrostio arundinaceae-Quercetum petraeae													
Hieracium sabaudum		1	.	.	.	.	+	r	+	.	+	+	1
Hieracium lachenalii		+	.	+	+	+	.	.	2	+	.	+	1
* Calamagrostis arundinacea (Qrp)		2	3	+	1	1	.	.	+	2	1	.	.
Hieracium laevigatum		.	.	.	+	.	+	+	.	.	.	.	1
* Festuca ovina (Qrp)		2	+	1	3	.	.	.	3	.	+	.	1
Lathyrus montanus		+	.	.	.	.	1	.	.	+	.	.	.
II. D. Ca-Q molinietosum													
Quercus robur	a1,a	3	.	2	2	2	4	4	.	4	4	4	4
Quercus robur	a2	1	.	1	3	.	.	.	.	.	.	.	.
Quercus robur	b/c	/+	.	/+	/+	+/	.	/r	.	+/	/+	+/	+/
Picea abies (V-P)	a1,a	2	2	.	.	.	.	+	.	.	.	.	.
Picea abies (V-P)	a2	2	5	.	1	.	.	.	.	.	.	.	.
Picea abies (V-P)	b/c	2/+	2/+	+/+	2/	.	3/	.	.	.	.	.	+/
Frangula alnus	b	.	.	1	2	1	.	1	+	+	+	.	.
Frangula alnus	c	+	.	+	.	+	.	+	+	+	+	.	.
Trientalis europaea (V-P)		1	1	+	1	1	1	.	.	+	1	.	.
Carex pallescens (C-U)		+	.	.	.	.	+	r	+	.	1	+	+
Lysimachia vulgaris		.	1	+	+	.	.	.	+	.	1	.	+
Dryopteris carthusiana		.	.	.	+	+	.	+	.	.	.	+	+
Deschampsia caespitosa		.	.	+	.	.	.	.	+	.	+	.	.
Molinia caerulea		.	.	.	+	+	.	+	.	.	.	.	.
Potentilla erecta (C-U)		+	.	.	.	.	.	.	.	+	.	+	.
III. D. Ca-Q polygonatetosum odorati													
Quercus petraea	a1/a2	.	.	.	.	.	.	.	4/1	.	.	.	.
Quercus petraea	b	.	.	.	.	.	.	.	+	.	.	.	.
Corylus avellana	b/c	+/	.	.	.	.	.	.	+/+	+/+	+/+	+/1	.
Veronica officinalis		.	.	+	.	+	.	.	+	+	+	+	+
Mycelis muralis		.	+	.	.	.	+	.	.	.	+	+	1
Moehringia trinervia		.	+	1	.	.	.	+	.	.	.	.	.
Hieracium murorum		+	.	.	+	.	.	.	.	+	+	.	.
Convallaria majalis		1	.	+	.	1	.	2	.	.	1	.	.
Melica nutans		.	1	.	3	.	.	.	.	.	.	.	.
Festuca heterophylla		+	.	.	.	.	+	.	.	.	.	.	.
Polygonatum odoratum		.	.	+	.	.	.	.	.	.	.	.	.
Galeopsis tetrahit		.	.	.	.	.	.	.	.	.	.	.	+
IV. D. Anemone var.													
Carpinus betulus (Q-F)	a,a2*	.	.	.	2*	3	.	1	.	.	.	.	.
Carpinus betulus (Q-F)	b-c	.	.	.	+/+	+/	/1	2/1	.	.	/+	/+	.
Oxalis acetosella		+	3	1	2	1	2	+	.	2	+	1	.
Poa nemoralis (Q-F)		1	.	+	1	.	.	+	1	.	+	+	4
Anemone nemorosa (Q-F)		.	.	+	.	+	2	.	.	.	1	2	.
Viola reichenbachiana (Q-F)		.	1	.	1	.	.	.	.	+	.	+	+
Viola riviniana (Q-F)		.	.	+	.	.	1	.	.	1	+	1	.
V. Ch., D.* Quercetea robori-petraeae (Qrp)													
Carex pilulifera		3	+	1	1	+	.	1	+	.	1	.	+
* Polytrichum formosum		2	2	1	1	+	.	2	.	.	.	2	1
Holcus mollis		1	.	1	.	.	2	r	.	3	3	3	1
* Melampyrum pratense		3	.	+	3	.	1	1	1	.	2	+	.
* Pteridium aquilinum		+	2	1	.	2	.	.	.	2	.	+	.
Dicranella heteromalla		2	+	.	+	.	.	1	.	.	.	.	.
Hieracium umbellatum		.	.	.	.	.	.	.	.	+	.	.	+
VI. Ch. Vaccinio-Piceetea (V-P)													
Pinus sylvestris	a1,a	3	2	3	4	3	.	.	.	.	.	.	.
Pinus sylvestris	b	2	1	.	+	.	.	.	.	.	.	.	.
Pinus sylvestris	c	+	.	+	.	.	.	r	.	.	.	.	.
Vaccinium myrtillus		1	1	4	3	4	2	2	1	+	+	.	.
Pleurozium schreberi		2	3	3	1	.	.	.	.	.	+	.	.
Betula pubescens subsp. pubescens	b/c	+/+	.	/+	.	.	.	/r	.	.	.	.	.
Vaccinium vitis-idaea		+	.	+	1	.	.	.	.	.	.	.	.
Pseudoscleropodium purum		2	+	+	.	.	.	.	.	.	.	.	.
VII. Ch. Quercio-Fagetea (Q-F)													
Stellaria holostea		1	.	+	2	+	.	+	.	.	+	.	+
Atrichum undulatum		.	1	.	+	.	.	.	.	.	+	.	+
Fagus sylvatica		.	+	+	.	.	.	.	.	+	.	.	.
Ajuga reptans		.	+	.	+	.	.	.	.	.	+	.	.
Milium effusum		.	.	.	.	.	.	1	.	.	+	.	.
VIII. Ch. Calluno-Ulicetea (C-U)													
Agrostis capillaris		.	.	.	.	.	.	r	+	1	.	2	1
Luzula multiflora		+	.	.	.	.	.	.	+	.	+	.	+
Pohlia nutans		+	.	+	+	.	.	.	.	.	.	.	.
Solidago virgaurea s. s.		+	.	.	.	1	.	.	+	.	.	.	.
Hypericum maculatum		.	.	+	.	.	.	.	.	2	1	.	.
IX. Others													
Sorbus aucuparia	a2*/b/c	/+	/+	/+	1/	+/+	/+	+/+	.	.	+/+	/+	/+
Luzula pilosa		2	+	1	1	+	+	1	+	.	1	1	1
Maianthemum bifolium		1	1	1	+	+	2	+	.	3	2	1	+
Fragaria vesca		.	+	+	+	.	1	r	.	1	+	2	+
Hypnum cupressiforme		1	1	+	1	.	.	1	+	.	.	.	.
Veronica chamaedrys		.	.	+	.	.	1	r	.	.	2	.	2
Anthoxanthum odoratum		.	.	1	.	.	2	.	.	.	1	.	+
Galeopsis pubescens		.	+	.	.	.	.	.	.	+	.	.	+
Calamagrostis epigejos		+	.	.	3	.	.	.	.	.	1	.	.
Galium mollugo		.	.	.	.	.	1	.	.	+	.	.	+
Stellaria graminea		.	.	.	.	.	+	.	.	+	.	.	.

Sporadic species: V.: *Lophocolea heterophylla* 2(1); *Plagiothecium laetum* 2; VI.: *Dicranum scoparium* 1(1); *Galium rotundifolium* 12; *Juniperus communis* b 3,4, c1; *Monotropa hypopitys* s. s. 3; *Orthilia secunda* 3; *Pyrola chlorantha* 6; *Rubus saxatilis* 10; *Thuidium tamariscinum* 2; VII.: *Acer platanoides* c 9; *A. pseudoplatanus* c 7; *Campanula persicifolia* 12; *Carex digitata* 1,2; *Dactylis polygama* 8; *Equisetum sylvaticum* 4; *Fagus sylvatica* a 5(4), a2 1(2), b 1,9; *Festuca gigantea* 9,11; *Fraxinus excelsior* b 9, c 8(r); *Hypericum montanum* 4; *Malus sylvestris* bc 5; *Polygonatum multiflorum* 3; *Ranunculus auricomus* 6; *Sanicula europaea* 11; *Scrophularia nodosa* 11,12; *Tilia cordata* c 10,12(1); VIII.: *Calluna vulgaris* 1; *Danthonia decumbens* 4; *Genista tinctoria* c 10; *Hieracium pilosella* 10; *Polytrichum juniperinum* 8; IX.: *Abies alba* a1 1(1),4(1), a2 1(1), b 1(2),4(2), c 2; *Aegopodium podagraria* 2; *Astragalus glycyphyllos* 6(10) *Athyrium filix-femina* 9,11; *Betula pendula* a 12, a1 8, a2 8, c 10; *Brachytheciastrum velutinum* 12; *Brachythecium rutabulum* 12; *Campanula rotundifolia* 9(1),12; *Cirsium vulgare* 2; *Clinopodium vulgare* 6(1),10; *Cornus sanguinea* b 4; *Dactylis glomerata* 11,12; *Deschampsia flexuosa* 12; *Euphorbia cyparissias* 2,12; *Festuca pratensis* 6(1); *F. rubra* s. s. 12; *Galium boreale* 6(2); *Hypericum perforatum* 12; *Juncus conglomeratus* 10; *Lathyrus sylvestris* 6(1); *Plagiochila asplenoides* 1; *Plagiomnium affine* 2(2),3; *P. elatum* 2; *Poa angustifolia* 3; *P. pratensis* 6; *Pohlia lescuriana* 2; *Pyrus communis* 4; *Quercus rubra* b 7(r); *Quercus x rosacea* a1 3(2), a2 3(1), c 3;; *Rhamnus cathartica* b 2, c2;; *Robinia pseudacacia* b 12; *Rubus idaeus* 9(1),11; *R. nessesensis* 1,4(1); *R. pedemontanus* 7(r); *R. plicatus* 10; *Rumex acetosella* 1,3; *Salix caprea* c 10; *Sarothamnus scoparius* c 12; *Silene vulgaris* 8; *Taraxacum officinale* 10; *Torilis japonica* 9(1); *Trifolium alpestre* 6(2),9; *Urtica dioica* 9,11; *Vicia cassubica* 6(3); *V. cracca* 9; *V. dumetorum* 6; *V. sepium* 8,9.

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Sporadic species: **V.:** *Acer platanoides* c 12,22,30,53,78; *A. a2* 20(1), b 38, c 20,22(r),37,40,64; *Brachypodium sylvaticum* 4,18,20(1),36(2),37(2),39,44,45(1),48,55(3),57,59(1),65(1),66; *Carex digitata* 9,10,27(1),28(1),30,31,36,60,67,70(2),71(1),72(1),76(1); *C. remota* 37; *Cephalanthera longifolia* 57; *Cerasus avium* b 38, c 18,23; *Circaea lutetiana* 20(1); *Daphne mezereum* 27; *Eurhynchium angustirete* 23,27,31,35,42,49,59,71(1),72,73,74,75,76; *Ficaria verna* 23,43,66; *Fraxinus excelsior* b 14,20(1),43, c 14,19,20,30,32,54; *Galium odoratum* 8,22(1),30,41(1),43(2),68; *Hedera helix* c 25,47,51,64,68,77(1),78; *Hepatica nobilis* 17,27; *Hypericum montanum* 22,30; *Impatiens noli-tangere* 18,32,38; *Lathyrus niger* 36; *L. vernus* 8; *Malus sylvestris* bc 11,53,69,78,81, c 47,51,61,62; *Melica uniflora* 25,27; *Padus avium* b7,20,32(3),55(2),59,66, c 1,7,18,20,32(1),55,59,66(1); *Paris quadrifolia* 14,20; *Phyteuma spicatum* 47; *Plagiomnium undulatum* 54; *Platanthera bifolia* 22,41; *Primula veris* 6,17; *Ranunculus lanuginosus* 19; *Ribes spicatum* c 55; *Sorbus torminalis* a2 47, b 47, c 11,24,47,51; *Stachys sylvatica* 12(r),18,22(r), 66; *Tilia platyphyllos* b 22, c 22; *Ulmus laevis* a1 32, b 32(1); *Viburnum opulus* c 1,2(1),13,14,19(1),32,59; *Viola odorata* 43; *Viola reichenbachiana et riviniana* 8,21,24,35,41,42(1),49,52,63; *Viola riviniana* 1,7,14(1), 16(1),17(1),19(2),25,26,27,40,44,77; **VI.:** *Herzogiella seligeri* 8; *Hieracium umbellatum* 10,74,76; *Lonicera periclymenum* b 38(1) c 38(3); *Luzula pallescens* 55; *Mnium hornum* 20,39,49,59,60(2),79; *Plagiothecium denticulatum* 2,34,47,59; *P. laetum* 8,11,32(1),55; **VII.:** *Betula pubescens* subsp. *pubescens* a 53(1)69(1), a2 10,35, c 11; *Dicranum scoparium* 26; *Dryopteris dilatata* 37; *Hylocomium splendens* 80; *Juniperus communis* b 10,25,28(1), c 9,14,74,75; *Orthilia secunda* 55,75; *Plagiothecium curvifolium* 24,34,64; *Pyrola minor* 13; *Pyrola rotundifolia* 71,74; *Rubus saxatilis* c 1,3,4,11(1); *Thuidium tamariscinum* 9,10,73,77; *Pleurozium schreberi* 11(2),12,77; *Leucobryum glaucum* 26,78; **VIII.:** *Agrostis capillaris* 14,16(1),19,24,57,62,65(2),77; *Carex ovalis* 26,40,44,48,54,57(1); *Hypericum maculatum* 14,16(2), 17(1),19(1),21,25,27(1),77; *Luzula multiflora* 18,26,34,38,62,77; *Pohlia nutans* 1,11,12,23,26,34,36,37,58,59,60(1),79(1); *Potentilla erecta* 11,13,14,16,17(1),19(1),25,27,38,56,58,77; *Scorzonera humilis* 38; *Viola canina* 70,77; **IX.:** *Abies alba* a 71(1), c 73,74; *Agrostis canina* 58; *A. stolonifera* 77,78; *Alliaria petiolata* 79; *Angelica sylvestris* 7; *Anthoxanthum odoratum* 12(1),18(2),25,31,40,56(1),62,77,78; *Anthriscus sylvestris* 14,16; *Arrhenatherum elatius* 12,18(r); *Astragalus glycyphyllos* 14,17(1); *Betonica officinalis* 7; *Brachytheciastrum velutinum* 1,32,37,39,59,81; *Brachythecium rutabulum* 5,21,45,59; *Calamagrostis epigejos* 10,26(1),31,36,38,39,44,56(1),62(1),70,77; *Calliergonella cuspidata* 74,76; *Campanula patula* s.s. 77; *C. rotundifolia* 14,19; *Carex cespitosa* 32; *C. elongata* 32; *C. hirta* 13; *Carex* sp. 61; *Chaerophyllum temulum* 7,65; *Chamaenerion angustifolium* 20; *Clinopodium vulgare* 7,27,56,65; *Cornus sanguinea* b 55(1), c 55(1); *Crataegus laevigata* c 66; *C. monogyna* b 11,18,27,39,55,62, bc 77,78,81, c 26,27,45,54,57,58,60,62,66; *C. monogyna et laevigata* b 72,73(2), bc 21,29,47,51 c 1,2,3,4,5,6(1); *C. rhipidophylla* var. *rhipidophylla* c 56; *Crataegus* sp. c 10,28,71,72,73(1),76; *Dactylis glomerata* 2,5,24,26,29,47,51,60,63,64,77; *Deschampsia flexuosa* 11(1),12,18,23,30(2),39,44,54,57(1); *Epilobium montanum* 55; *Euonymus europaea* b 7,20,23,37,59,60, c 1,3,4,7,32,37; *Festuca rubra* s.s. 12,26(1),27,31,38,39,40,46,50,52,58(1),77; *Fissidens taxifolius* 59,60; *Galeopsis bifida* 27; *G. pubescens* 13,14,16,36,47,55,60(1),65,79; *G. tetrahit* 8,12,13,15,18,37,50,52; *Galium aparine* 1,7(2),32,38, 54,55(1),57; *G. 12,13,16,17(1),19,39,52,56,57; G. palustre* 5,21; *G. verum* 19; *Geranium robertianum* 17,32,50,55,60,79; *Geum urbanum* 1,14,16,17,20,23,38,43,45,59,66; *Hieracium* sp. 76; *Holcus lanatus* 29,67,70; *Humulus lupulus* 55,79; *Hypericum perforatum* 3,12,13,18,36,39,48,56,75,76; *Impatiens parviflora* 15,18(1),38,39(1),44,45(3),54(1),60,79; *Juncus effusus* 2,10,12(r),33,40,58; *Lapsana communis* s.s. 14; *Larix decidua* ssp. *polonica* a1 11(4), b 11, c 11; *L. decidua* subsp. *decidua* a1 15; *Lathyrus pratensis* 14,17; *Listera ovata* 18; *Lotus corniculatus* 18(r); *Lychnis flos-cuculi* 18; *Molinia caerulea* 11(2),13,15,33,69,78; *Oxalis fontana* 65; *Oxyrrhynchium hians* var. *hians* 10,45,60,71,72,74,75,76,79; *Padus serotina* b 38(1),54, c 40,47,57; *Peucedanum oreoselinum* 55; *Pimpinella major* 13; *Plagiomnium cuspidatum* 42; *P. rostratum* 59(1); *Plagiothecium cavifolium* 36; *Poa angustifolia* 25(1),26(1),27,67; *P. palustris* 46; *P. pratensis* 9,10,18,28(1),31,52,62,70,75(2),77; *P. trivialis* 2,4,5,42,65(1),77; *Polygonatum odoratum* 25; *Polypodium vulgare* 37; *Populus tremula* a 12(1), a1 54(2),57(1), a2 7,59, b 18,54,57,59, bc 77, c 12,18,57; *Potentilla reptans* 3,6,39; *Prunella vulgaris* 58,65; *Prunus spinosa* b 38, c 1,7; *Pyrus communis* b 18, c 1,11,38; *Quercus rubra* a1 57(1), c 11; *Quercus x rosacea* a1 25(3), b 62, c 25,62; *Ranunculus sardous* 13; *Rhamnus cathartica* b 18,27, c 32; *Rhizomnium punctatum* 11; *Rhodobryum roseum* 42; *Robinia pseudacacia* a1 79; *Rosa canina* c 1,4,54; *Rosa* sp. bc 7, c 36; *Rubus caesius* 2,20,21,22,30,32,47,51,59; *R. cfr. hirtus* 36,38,39,43(2); *R. corylifolia* 40,56; *R. gracilis* 50; *R. plicatus* 1,2,9,10(1),18,28,32,45(1),54; *R. serpens* 11; *Rubus* sp. 12,13,23,26,29,61,65,66,81; *Rumex acetosa* 12; *R. acetosella* 11,13; *Sambucus nigra* b 55(1), c 7,32,50; *S. racemosa* b 18, c 32; *Sciuro-hypnum oedipodium* 77,80; *Sedum maximum* 16,37(r); *Selinum carvifolia* 7,13,58,65; *Solanum dulcamara* 45(r); *Stellaria graminea* 14,16,19; *S. media* 18,23,36(1),37(1),39, 45(1),55,60,74; *Taraxacum officinale* 18,20; *Thuidium philiberti* 77; *Thuja gigantea* c 11; *Torilis japonica* 16,17; *Trifolium alpestre* 19; *Tussilago farfara* 58; *Urtica dioica* 14,16,19; *Vicia cassubica* 16(1); *V. cracca* 14,17(1); *V. sepium* 17,58,77,80.

Table A21. *Galio sylvatici*-*Carpinetum holcetosum mollis* variant with *Lysimachia vulgaris*, transformed form (relevés 1-30); community *Oxalis acetosella*-*Pinus sylvestris* (relevés 31-40)

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Sporadic species: IV.: *Acer pseudoplatanus* a1 21(2), a2 21(o), b 21(1), c 15,21; *Adoxa moschatellina* 21(1); *Campanula persicifolia* 8; *Carex sylvatica* 21; *Cerasus avium* a2 21(1), c 15; *Circaea alpina* 24(2); *Daphne mezereum* c 2; *Dryopteris filix-mas* 13,21,30(1),37,38,39,40; *Epipactis helleborine* 16; *Equisetum pratense* 2; *Eurhynchium angustirete* 2,13; *Ficaria verna* 21(1); *Fraxinus excelsior* b 17,31(1), c 10,15,27(2); *Galeobdolon luteum* 22(3),24(2),27(1); *Galium schultesii* 9(2),19; *Gymnocarpium dryopteris* 9,37(2),39(2); *Hedera helix* 7,14,20(1); *Hepatica nobilis* 2,27; *Hypericum montanum* 25(r); *Impatiens noli-tangere* 12(r); *Lilium martagon* 9,29; *Luzula luzuloides* 36; *Malus sylvestris* bc 5,6(r), c 2,39; *Padus avium* b 17(2),26(1),29(1),31(3),32, c 17(1),26,27,29,32; *Paris quadrifolia* 8; *Platanthera bifolia* 3; *Polygonatum multiflorum* 18; *Pulmonaria obscura* 12,21,27; *Ribes spicatum* c 15; *R. uva-crispa* c 21(1),24,29(r); *Sanicula europaea* 12(1),14,19(1); *Ulmus minor* b 10, c 27; *Viburnum opulus* c 1,4,31; *Viola reichenbachiana* et *riviniana* 4(1),15(1),27(1); *V. riviniana* 2,3,8(2),25(1); **V.:** *Aulacomnium androgynum* 5; *Hieracium laevigatum* 12,14; *H. sabaudum* 1(r),12,16,17; *H. umbellatum* 13; *Lathyrus montanus* 8(1),13,33,34,35; *Luzula pallescens* 12(1); *Mnium hornum* 14; *Plagiothecium denticulatum* 32; *P. laetum* 31(2); **VI.:** *Betula pubescens* subsp. *pubescens* a 7(1); *Dicranum scoparium* 13; *Dryopteris dilatata* 5,32; *Juniperus communis* bc 15, c 8,20; *Monotropa hypopitys* s.s. 2(r); *Orthilia secunda* 8,15; *Plagiothecium curvifolium* 5; *Thuidium tamariscinum* 3,5,13; *Vaccinium vitis-idaea* 4; **VII.:** *Carex ovalis* 9,10,27; *Cladonia chlorophaea* 13; *Hieracium pilosella* 11; *Hypericum maculatum* 1,2(r); *Luzula multiflora* 1,2,3; *Potentilla erecta* 1,18,19; *Ptilidium ciliare* 13; *Viola canina* 9,11; **VIII.:** *Abies alba* c 33,34,36(r),39; *Aegopodium podagraria* 24; *Agrostis* cfr. *canina* 23; *A. stolonifera* 23; *Alliaria petiolata* 17; *Allium oleraceum* 21; *Alnus glutinosa* a 22,26(3), b 26(1); *Angelica sylvestris* 12; *Astragalus glycyphyllos* 15,27,34(r),40; *Athyrium filix-femina* 1,16,21,22(1),30,32,36,37,38,39; *Betula pendula* a1,a 10,11,12(1),26(2),28(1),32(1), a2 4,31(1), b 10, c 5,11; *Brachythecium velutinum* 15,27; *Brachythecium albicans* 5; *B. rutabulum* 1,12,17,21; *Bryum* sp. 27; *Calamagrostis epigejos* 9(1),10(2),12,16,30(1),31(1); *Campanula rotundifolia* 12,17; *Carex acutiformis* 24(2); *C. brizoides* 18(5),23(3); *C. canescens* 18(r); *C. hirta* 17,28; *C. nigra* 5; *Cerastium semidecandrum* 11; *Ceratodon purpureus* 5; *Chaerophyllum temulum* 14,15; *Chamaenerion angustifolium* 12,28,29; *Clinopodium vulgare* 12; *Cornus sanguinea* c 27; *Crataegus monogyna* b 3,11,21, bc 23; *Cruciata glabra* 9(1),13,33(1); *Dactylis glomerata* 8,10,12; *Deschampsia flexuosa* 14,16(1),17(1),26,30,32; *Epilobium montanum* 18(r); *Euonymus europaea* b 17,31(1), c 17,22,27,28,31; *Fallopia convolvulus* 24(1),28,29; *F. dumetorum* 17,26,32; *Festuca pratensis* 8; *F. rubra* s.s. 1(1),12(1),15,23,27(2); *Galeopsis pubescens* 9,11,22,26,27,28,34(1),37,39,40; *G. tetrahit* 15,18,25,29; *Galium aparine* 18(r),21,26,27,31; *G. boreale* 8(1); *G. mollugo* 4,8(2),11,15,17,27; *G. palustre* 18(r); *Geranium robertianum* 4,15,16,24,27,31(1); *Geum urbanum* 4,15,27,28; *Glechoma hederacea* 31,32(1); *Hieracium murorum* 12(1),13,15,27,30,31,38,40; *Humulus lupulus* 26(1),31,32; *Impatiens parviflora* 12,20(1),21,29(1),30(2),32(2); *Iris pseudacorus* 26; *Juncus effusus* 9,12(r),14(r),30; *Larix decidua* subsp. *decidua* a1 20(2),32; *Lysimachia nummularia* 3,17,31; *Molinia caerulea* 2,7,9,20(1),28; *Oxalis fontana* 12; *Padus serotina* b 29,30, c 29; *Peucedanum oreoselinum* 12; *Phalaris arundinacea* 26(1); *Plagiomnium affine* 1,3,5,15(1),23; *Plagiothecium cavifolium* 5; *Plagiothecium* sp. 36; *Poa angustifolia* 1,2,27,31; *P. pratensis* 2,9,12(1),13,27; *P. trivialis* 18,29; *Polygonatum odoratum* 38; *Populus tremula* a1,a 22,23(1), b 10, bc 23, c 1; *Potentilla reptans* 9,26,31,34; *Prunus spinosa* b 26(2), c 26(1); *Pyrus communis* c 11,15,22,23,27; *Quercus rubra* a1 12(3),14(2); *Q. x rosacea* a1 3(2), c 3; *Ranunculus repens* 18(r); *Rhamnus cathartica* b 2, c 17,22(r); *Robinia pseudacacia* b 17(1); *Rosa canina* c 4,15,37; *Rosa* sp. 30; *Rubus caesius* 15,31; *R. corylifolius* 4,15,24(1),27; *R. hirtus* 9,13; *R. plicatus* 31(1); *Rubus* sp. 3,5,6(r),19,32; *Rumex acetosella* 10,11; *Sambucus nigra* b 21,22, c 21,35,36,37,40; *S. racemosa* c 9,31; *Sciuro-hypnum oedipodium* 5,15,27; *Scutellaria galericulata* 24(2),31; *Sedum maximum* 12; *Stellaria graminea* 8; *S. media* 14,17(1),21,30,32(1),34,36,38,39,40; *S. uliginosa* 18; *Taraxacum officinale* 15; *Thuidium philibertii* 23; *Torilis japonica* 4; *Veronica hederifolia* 21; *Vicia cassubica* 8(2),12; *V. dumetorum* 13,34,35,39,40.

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Sporadic species: IV.: *Acer platanoides* a 33, a1 35,a2 13(1),b12,c1,8,13,15,19,22; *A. pseudoplatanus* a1 20(1), a2 20(2); b 33, c9,15,20(1),22,30; *Anemone ranunculoides* 27,31,32(1); *Campanula trachelium* 5,8; *Carex sylvatica* 26(2),34(1),37,38; *Cerasus avium* a1 14(1), a2 14(1), b 14(1), c 1,13,26; *Dryopteris filix-mas* 1,20,24,27,31,38; *Epipactis helleborine* 33; *Eurhynchium angustirete* 16,21,25; *Fagus sylvatica* a1 20(2), a2 9(1), 20 (3), 32(1), 36(1), c 5,20,21; *Festuca gigantea* 6,10,11,37; *Ficaria verna* 19,27,35; *Hedera helix* 1(2), 31(1); *Lathyrus vernus* 16; *Lonicera xylosteum* c 22(r); *Malus sylvestris* a2 28, c 29,36; *Milium effusum* 4,25,38; *Phyteuma spicatum* 9,10,11,25; *Plagiomnium undulatum* 31,35; *Platanthera bifolia* 37,38; *Polygonatum multiflorum* 1,4,14,17,25,38; *Primula veris* 27; *Ranunculus lanuginosus* 31,34,35; *Ribes spicatum* c 24; *Ribes uva-crispa* b 15,24; *Ulmus glabra* b 33; *Viburnum opulus* c 1,16,23,28,32; *Viola reichenbachiana et riviniana* 25,29,30,37,38(2); *Viola riviniana* 23,28. **V.:** *Herzogiella seligeri* 2(1),8; *Hieracium umbellatum* 10; *Lathyrus montanus* 21; *Mnium hornum* 8,12(1); *Plagiothecium denticulatum* 8; *P. laetum* 12. **VI.:** *Achillea millefolium* 4,17; *Agrostis capillaris* (C-U) 6,10,11,23; *Alliaria petiolata* 3,8(1),15; *Alnus glutinosa* a1 12(1), b 33; *Angelica sylvestris* 5,11; *Anthriscus sylvestris* 3,7,8; *Arrhenatherum elatius* 3,23(2); *Athyrium filix-femina* 37,38; *Betonica officinalis* 28(1); *Betula pubescens* subsp. *pubescens* (V-P) b 28; *Brachytheciastrum velutinum* 3,16,17,28; *Brachythecium salebrosum* 27,28,34; *Calamagrostis epigejos* 23; *Campanula rotundifolia* 6(1); *Carex brizoides* 8,12,20; *C. pallescens* (C-U) 16,28,38; *Chaerophyllum temulum* 3,24(1); *Cornus sanguinea* b 2,14,26; *Crataegus laevigata* b 2(1),24(1),28,35; c 28,35; *C. monogyna et laevigata* bc 24,25,29,30,37; *Cruciata glabra* 21; *Dicranum scoparium* (V-P) 23; *Dryopteris carthusiana* 8,11,20,37,38; *Euphorbia cyparissias* 14; *E. esula* 2; *Fallopia convolvulus* 4,17,22,36(1); *Fallopia dumetorum* 3; *Festuca rubra* s.s. 7,9,14; *Fissidens taxifolius* 27,31; *Galeopsis tetrahit* 3,13,22,37; *Galium aparine* 7(1),14(1),15; *Glechoma hederacea* 4,8,16; *Heracleum sphondylium* 1,2,3,7,8; *Humulus lupulus* 4; *Hypericum maculatum* (C-U) 17,29,38; *Impatiens parviflora* 6(1),15,19(1),20(2), 24(4); *Isothecium alopecuroides* 38; *Lapsana communis* s.s. 38; *Lophocolea bidentata* 28; *Luzula multiflora* (C-U) 3,7,22; *Lysimachia nummularia* 25; *Lysimachia vulgaris* 33; *Melandrium album* 8; *Monotropa hypopitys* s.s. (V-P) 37; *Picea abies* (V-P) a2 20(1), a1 22(1),36, a(36(1)); *Pinus sylvestris* (V-P) a 36(1), a1 2,22(1),38, a2 32(1), b 12; *Plagiomnium affine* 8,25,27,28(1); *Plagiomnium cuspidatum* 25,28, 38; *Pleurozium schreberi* (V-P) 17,23; *Poa annua* 17; *Poa pratensis* 7,9,23; *Poa trivialis* 7(1),38; *Polygonatum odoratum* 36(1); *Populus tremula* a1 13(1), a2 23,28(2); b 7(1), c 2,9,33,38; *Potentilla erecta* (C-U) 9,10; *Prunus spinosa* b 7,14, c16; *Pseudoscleropodium purum* (V_P) 28; *Pteridium aquilinum* 22(1),24,31,32,33; *Pyrus communis* a2 2(1),8, b 2(1),7,10,13; *Pyrus communis* b 2(1),7,10,13, c 3,7,17,36(r); *Quercus rubra* a1 7(1),13(2), b 7, c 7,13; *Ranunculus acris* s.s. 7; *R. repens* 7; *Rhamnus cathartica* b 2,7 c30, c 30; *Rhizomnium punctatum* 38; *Robinia pseudacacia* a1 15(1), b 15; *Rosa canina* c 32; *Rosa* sp. 8; *Rubus idaeus* 10,13,22,23(1),24,28; *R. plicatus* 1,9,10,11,24; *R. saxatilis* (V-P) 16,17; *Rubus* sp. 14,15,26; *Rumex acetosella* 7; *Sambucus nigra* b 15,24(1), c 3,8,19,36; *Sanguisorba officinalis* 28; *Saxifraga granulata* 3,8; *Sedum maximum* 2,12,22; *Selinum carvifolia* 26,28; *Serratula tinctoria* 28,35; *Silene nutans* subsp. *nutans* 2,3; *Taraxacum officinale* 3,8,17,25; *Trifolium alpestre* 2; *Urtica dioica* 7,9,10,24,33; *Vaccinium vitis-idaea* (V-P) 28; *Veronica hederifolia* 3(1),8; *Vicia sepium* 35.

Table A23. *Gallio sylvatici*-*Carpinetum* : *calamagrostietosum* (relevés 1-9), *lathyretosum* (relevés 10-25)

Successive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25			
ID-1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	55	4	4	4	4			
ID-2	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31			
ID-3	12	22	20	19	14	17	15	16	12	9	23	5	4	21	11	3	13	1	10	18	36	6	2	7	8			
Date (year)	1966	1966	1966	1967	1967	1964	1966	1966	1966	1966	1966	1966	1966	1964	1964	1966	1966	1965	1966	1964	1992	1996	1996	1996	1996			
Density of tree layer	a1,a [%]	40	60	50	85	80	50	50	65	70	70	75	65	70	65	60	70	75	85	45	75	70	45	80	75	85		
Density of tree layer	a2 [%]	50	-	40	30	-	-	30	10	-	-	25	45	-	40	60	40	85	-	60	40	-	25	45	30	-		
Density of shrub layer	b [%]	10	30	20	20	+	50	30	10	45	10	+	25	70	15	10	30	10	25	45	50	-	10	20	+	-		
Cover of herb layer	c [%]	100	100	100	100	95	95	95	90	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100			
Cover of moss layer	d [%]	20	+	-	+	+	15	10	5	-	25	+	-	15	+	-	-	-	-	-	-	+	+	+	+	-		
Area of relevé		BC29	500	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	500	400	400	400	400			
Location (ATPOL)		C882	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400			
Total number of species		32	29	26	42	26	35	33	45	39	36	35	40	38	30	48	44	25	36	41	46	28	53	37	41	56		
Number of mosses, liverworts and lichens species		4	2	-	2	1	3	2	4	-	3	2	-	3	1	2	-	-	-	3	1	3	1	-	5			
I. Ch.* <i>Carpinion betuli</i>, Ch.*A, D. <i>Gallio sylvatici</i>-<i>Carpinetum</i>																												
* <i>Carpinus betulus</i>	a1,a	-	-	-	1	-	-	-	-	-	-	-	-	1	2	3	4	-	3	2	3	2	3	1	3	4		
* <i>Carpinus betulus</i>	a2	3	-	2	2	-	2	1	-	-	-	3	-	1	2	3	4	-	3	2	3	2	3	1	1			
* <i>Carpinus betulus</i>	b	-	-	1	1	-	1	1	1	3	1	1	-	4	1	+	2	1	1	+	2	+	+	+	+	+		
* <i>Carpinus betulus</i>	c	1	1	-	1	1	1	2	1	+	1	1	2	2	1	+	1	+	1	+	1	+	3	+	+	+		
* <i>Tilia cordata</i>	a1,a	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-			
* <i>Tilia cordata</i>	a2	1	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	1	1	-	-	-	-	-			
* <i>Tilia cordata</i>	b	2	-	-	1	-	-	1	-	-	+	2	-	-	1	+	1	2	3	3	-	1	1	-	-			
* <i>Tilia cordata</i>	c	1	-	-	1	-	1	-	+	-	1	+	-	-	+	+	+	1	1	+	+	+	+	+	+			
* <i>Stellaria holostea</i>		1	1	1	1	-	1	1	1	-	1	+	1	1	2	2	1	1	1	1	1	1	2	1	2	2		
* <i>Festuca heterophylla</i> (Q-F)		1	-	-	-	+	2	1	2	-	+	1	2	2	+	+	+	1	+	+	+	+	+	1	2			
* <i>Melampyrum nemorosum</i>		-	1	+	1	1	-	-	-	-	-	2	2	-	+	+	+	+	+	+	+	+	+	+	+			
* <i>Galium sylvaticum</i>		-	-	-	1	-	-	1	+	-	+	1	2	-	2	+	+	-	2	1	-	1	-	1	-			
* <i>Ranunculus auricomus</i>		-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	1	-	-	-	-	-	-			
* <i>Dactylis polygama</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-			
II. D. Gs-C <i>calamagrostietosum arundinaceae</i>																												
* <i>Vaccinium myrtillus</i> (V-P)		+	+	1	+	1	2	+	+	+	1	1	-	+	+	-	1	+	-	+	-	-	-	-	-			
* <i>Leucobryum glaucum</i> (V-P)		+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	+	-	1	-	-	-			
* <i>Trientalis europaea</i> (V-P)		-	-	-	+	1	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
* <i>Campanula rotundifolia</i>		-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-			
* <i>Polygonatum odoratum</i>		-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-			
III. D. Gs-C <i>lathyretosum</i>																												
* <i>Sorbus torminalis</i> (Q-F)	a2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-			
* <i>Sorbus torminalis</i> (Q-F)	b/c	-	-	-	-	-	-	1	+	-	1/1	-	-	1	+	1	+	1	+	1	+	1	-	-	-	-		
* <i>Lathyrus niger</i> (Q-F)		-	-	-	-	-	-	+	-	-	+	+	1	+	+	1	+	+	+	+	2	2	+	+	+			
* <i>Pulmonaria obscura</i> (Q-F)		-	-	-	-	-	-	-	-	-	-	1	+	-	1	+	+	2	+	2	2	1	2	-	-			
* <i>Lathyrus vernus</i> (Q-F)		-	-	-	-	-	-	-	-	-	-	1	+	+	+	-	1	1	+	2	1	3	-	-	-			
* <i>Carex montana</i> (Q-F)		-	-	-	-	-	-	-	-	-	2	2	1	1	1	1	1	1	1	-	-	-	-	-	-			
* <i>Phyteuma spicatum</i> (Q-F)		+	-	-	-	-	-	+	-	-	1	-	-	-	-	+	1	1	+	+	+	+	1	-	-			
* <i>Solidago virgaurea</i> s. s.		-	+	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	1	-	+	+	+	+	+			
* <i>Aegopodium podagraria</i>		-	+	-	-	-	-	-	-	-	+	+	+	+	2	+	+	+	+	1	-	1	+	+	+			
* <i>Hypericum montanum</i> (Q-F)		-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
* <i>Vicia cassubica</i>		-	-	-	-	-	-	1	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+			
* <i>Hieracium murorum</i>		-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
* <i>Campanula rapunculoides</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	2	3	-	-	-			
* <i>Brachypodium pinnatum</i>		-	-	-	-	-	-	-	-	-	-	-	-	2	-	+	+	+	+	-	-	2	2	-	-			
IV. Ch. <i>Querceto-Fagetea</i> (Q-F)																												
* <i>Fagus sylvatica</i>	a1,a	-	2	-	3	1	-	-	-	-	-	-	-	2	-	-	5	-	-	-	-	4	-	-	-			
* <i>Fagus sylvatica</i>	a2	-	-	2	2	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-			
* <i>Fagus sylvatica</i>	b	-	3	1	2	-	-	-	-	-	-	-	1	-	-	3	1	-	+	-	2	-	-	-	-			
* <i>Fagus sylvatica</i>	c	-	+	-	1	+	+	+	+	-	2	-	1	-	-	-	1	-	-	-	1	+	-	-	-			
* <i>Fraxinus excelsior</i>	b/c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	+	1	1	+	+	+			
* <i>Acer pseudoplatanus</i>	a1/a2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
* <i>Acer pseudoplatanus</i>	b/c	-	-	-	1	+	-	1	+	-	-	-	1	+	1	+	1	+	1	+	1	+	1	+	1			
* <i>Poa nemoralis</i>		+	2	+	2	1	3	4	4	+	+	+	2	+	2	1	1	+	2	3	3	2	1	1	2	1		
* <i>Carex digitata</i>		+	+	+	1	+	1	1	+	+	+	1	2	-	1	+	+	+	+	+	+	+	+	+	+			
* <i>Melica nutans</i>		-	2	1	+	1	+	+	+	-	-	-	2	2	3	2	+	+	+	+	+	+	+	+	+			
* <i>Galeobdolon luteum</i>		+	+	1	-	+	1	1	-	-	+	+	+	+	+	+	+	+	1	2	3	2	2	1	-			
* <i>Viola reichenbachiana</i>		-	1	-	+	1	+	+	1	-	-	1	+	+	+	+	+	+	+	+	+	+	+	+	+			
* <i>Galium odoratum</i>		+	2	-	2	-	+	-	-	-	+	1	2	1	+	-	2	2	3	2	-	3	3	3	+			
* <i>Anemone nemorosa</i>		1	-	2	2	-	1	-	-	-	1	2	2	1	1	1	2	2	2	2	-	2	1	-	1			
* <i>Viola riviniana</i>		+	+	-	1	-	-	+	1	-	+	-	1	-	+	-	1	1	+	-	1	1	1	+	+			
* <i>Scrophularia nodosa</i>		+	-	-	-	+	1	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
* <i>Campanula persicifolia</i>		-	+	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+			
* <i>Hepatica nobilis</i>		-	-	-	2	1	-	-	-	-	1	1	-	1	2	1	-	1	+	2	2	1						

Sporadic species: IV.: *Acer platanoides* c 21; *Adoxa moschatellina* 16; *Ajuga reptans* 21,22,25; *Brachypodium sylvaticum* 21; *Carex sylvatica* 25; *Cephalanthera longifolia* 22; *Corylus avellana* c 4,16; *Dryopteris filix-mas* 1,22,24; *Equisetum sylvaticum* 3; *Hierochloa australis* 15,20; *Lonicera xylosteum* c 16; *Mercurialis perennis* 3; *Neottia nidus-avis* 15,21(r); *Paris quadrifolia* 4; *Potentilla alba* 16; *Primula veris* 9; *Ranunculus lanuginosus* 19,23; *Ulmus glabra* c 23; *U. minor* c 21(r); *Viola mirabilis* 18,22,25. V.: *Carex pilulifera* 4; *Hieracium laevigatum* 21; *Holcus mollis* 9(3),11,22. VI.: *Achillea millefolium* 7,8; *Agrostis capillaris* (C-U) 8,9; *Anthriscus sylvestris* 3; *Arctium nemorosum* 24; *Athyrium filix-femina* 2,3(3),4; *Avenula pubescens* 22; *Betula pendula* c 6,7; *Bromus* sp. 24; *Cerastium arvense* 9; *Clinopodium vulgare* 12,22(1),24; *Crataegus monogyna* b 15(1),19(1), c 19(1); *Deschampsia caespitosa* 7,9,12; *Dryopteris carthusiana* 4,22; *Euonymus europaea* c 19,25; *Eurhynchium* sp. 8; *Fallopia dumetorum* 6,7,8; *Frangula alnus* c 9; *Geum urbanum* 24,25; *Hypericum perforatum* 10,22; *Lapsana communis* s. s. 10,12,24(1); *Lathyrus sylvestris* 9(2); *Luzula multiflora* (C-U) 8,13,25; *Lysimachia vulgaris* 3; *Mnium* sp. 25; *Oxyrrhynchium hians* var. *hians* 25; *Picea abies* (V-P) b 9(1),c9; *Pinus sylvestris* (V-P) c 15; *Rubus saxatilis* (V-P) 3,4; *Poa pratensis* 9; *Polygonatum verticillatum* 2,3(1),4; *Populus tremula* c 16,20(1),25(1); *Prunus spinosa* c 25; *Pyrus communis* c 3,24; *Rosa* sp. c 10,24; *Rubus idaeus* 7,8; *Rubus* sp. 9; *Rumex acetosella* 6; *Sedum maximum* 8; *Serratula tinctoria* 10(2),13,25; *Silene* sp. 6; *Stellaria graminea* 9; *Thalictrum aquilegifolium* 16; *Torilis japonica* 8,24,25; *Veronica officinalis* (C-U) 2,5,20; *Vicia cracca* 9(2); *Vincetoxicum hirundinaria* 24.

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	
ID-1		39	46	19	42	35	46	46	2	2	35	29	20	37	36	29	42	29	16	17	29	42	55	16	55	17	59	17	17	41	35	55	49	35	35	55	59	59	55	55	16	16		
ID-2		31	3	1	6	20	3	3	7	7	29	6	4	14	16	6	6	6	19	4	6	6	14	19	14	4	5	9	9	1	10	14	5	10	10	14	5	5	14	17	17	19	19	
ID-3		19	5	15	1	20	21	7	3	7	4	8	7	9	3	3	7	6	7	9	1	2	27	10	29	8	15	12	19	12	39	32	5	46	48	30	14	16	38	9	11	5	13	
Date (year)		1991	1995	1988	1981	1975	1950	1955	1960	1988	1988	1975	1979	2007	1984	1985	1985	1979	1981	1979	1972	1995	1980	1975	1972	1980	1995	1995	1995	1997	1996	1992	1975	1976	1976	1976	1993	1993	1975	1976	1972	1972		
Density of tree layer	a1,a [%]	50	80	50	95	60	50	70	60	50	50	50	60	60	30	45	45	50	80	80	80	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90		
Density of tree layer	a2 [%]	10	-	-	60	-	-	70	60	50	60	60	75	50	60	70	-	55	30	-	70	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	1981	
Density of shrub layer	b [%]	55	+	60	+	20	60	5	+	+	+	+	10	25	5	+	+	40	5	5	45	-	60	20	+	-	60	20	+	5	40	-	-	20	-	-	20	-	10	-	+	60	10	
Cover of herb layer	c [%]	40	30	80	45	55	20	60	50	60	60	75	80	80	80	70	70	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Cover of moss layer	d [%]	-	+	3	+	-	+	10	+	+	-	+	+	+	+	+	-	5	60	-	-	-	50	+	20	-	-	-	+	+	+	+	+	5	+	-	-	-	-	-	80	40	-	
Area of relevé		500	1200	400	100	100	1400	200	200	200	150	200	200	600	800	150	150	180	300	150	120	100	200	100	200	100	200	150	150	200	300	100	200	100	200	200	100	200	300	200	200	200	200	200
Location (ATPOL)		BE15	CC92	DD91	BD59	CE01	CC92	BD81	CE00	CE00	CE00	CE00	CE00	CE00	BE06	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00	CE00
Total number of species		25	38	37	22	23	36	24	25	24	12	26	24	28	25	34	18	27	58	41	42	42	18	39	31	45	25	23	26	29	33	24	13	21	40	13	18	18	45	20	13	78	50	
Number of mosses, liver																																												

Sporadic species: I.: *Acer campestre* b 6, c 33,41; *A. platanoides* a2 23(1), b 22,36,38(1), c 13,22(1),23,27,30,35(r),38(2); *A. pseudoplatanus* a 4(3), a2 15(1), b 21,22(1), c 4,15,21,38,42; *Adoxa moschatellina* 14,19(r),20,41; *Ajuga reptans* 3,7,20,24; *Asarum europaeum* 20,36(1); *Campanula persicifolia* 19; *Carex digitata* 15,18(2),20(2),41(3); *C. sylvatica* 30(2); *Carpinus betulus* a1,a 7(2), a2 19(1),15(1), b 2,6,7,20,26(1),30, c 2,7,15(1),20; *Cerasus avium* c 30; *Circaea lutetiana* 15,39; *Elymus caninus* 1(1); *Equisetum pratense* 5; *E. sylvaticum* 13; *Eurhynchium striatum* 42(1); *Fagus sylvatica* a1,a 5(2), a2 5(2),14(2), b 13,14(1),22(1), c 4,16,21,22(r),24,25; *Festuca heterophylla* 18(1),24,40,41(2); *Ficaria verna* 38; *Fraxinus excelsior* a2 41(1), b 41(1), c 18,41(1); *Galeobdolon luteum* 19(1),20(1),26(2),36(2),37(2); *Galium odoratum* 15(1),24(3); *Gymnocarpium dryopteris* 13(1),29; *Hepatica nobilis* 3,15(1),19(r),20(1),26,36; *Hypericum montanum* 18,23,24(r),41; *Lathyrus niger* 29; *L. vernus* 29; *Lilium martagon* 4,29; *Lonicera xylosteum* b 18(1),41(2), c 41; *Luzula luzuloides* 9; *Malus sylvestris* c 25; *Melampyrum nemorosum* 34(1); *Melica uniflora* 2; *Padus avium* b 1(2),2,6,14,19(1), c 1(1),20,29; *Paris quadrifolia* 36; *Phyteuma spicatum* 29; *Plagiomnium undulatum* 34; *Platanthera bifolia* 34(2); *Primula veris* 42; *Pulmonaria obscura* 24,34(1); *Ribes spicatum* b 41, c 11,16,17; *R. uva-crispa* b 41, c 15,23; *Sanicula europaea* 34(1); *Scrophularia nodosa* 6,18(1),19(r),23,29,35,41; *Stachys sylvatica* 31; *Stellaria nemorum* 42; *Tilia cordata* a 8,29(1), a2 41(2), b 18,29,34(1),41, c 33; *T. platyphyllos* b 19, c 41; *Ulmus glabra* c 25; *U. laevis* c 38; *Viburnum opulus* c 3,4; *Viola mirabilis* 18,35; *V. reichenbachiana* et *riviniana* 15,20(2); II.: *Carex pilulifera* 4,14,21,41; *Dicranella heteromalla* 14,18; *Hieracium laevigatum* 30,34(1); *H. sabaudum* 24(1),27; *H. umbellatum* 38; *Lophocolea heterophylla* 18; *Luzula pallescens* 10,41; *Mnium hornum* 41; *Plagiothecium denticulatum* 29; *P. laetum* 18; III.: *Betula pubescens* subsp. *pubescens* b 41; *Chimaphila umbellata* 18; *Dicranum polysetum* 6; *Dryopteris dilatata* 13(2),14; *Galium rotundifolium* 30,33,34(1); *Juniperus communis* b 12(1),18, c 18,24(r); *Orthilia secunda* 18(1); *Picea abies* a1,a 18(2),41(3), a2 18(1), b 30,41(2), c 2,18,41(1); *Pseudoscleropodium purum* 2,6,7,17(1); *Pyrola minor* 41; *Rubus saxatilis* 3,11(1),12(2),15(2),17(1),36; *Thuidium tamariscinum* 41; *Trientalis europaea* 28(1); *Vaccinium vitis-idaea* 8(2),9,18; IV.: *Aegopodium podagraria* 9,19,29; *Alliaria petiolata* 19(1),25(2); *Bryonia alba* 8; *Chaerophyllum temulum* 18,38(1),41; *Chelidonium majus* 1,23(3),42(2); *Equisetum arvense* 25; *Fallopia dumetorum* 1,23,42(1); *Galium aparine* 12,25,29,38,41,42(1); *Glechoma hederacea* 8,25,30,38(1),42(3); *Heracleum sibiricum* 41; *H. sphondylium* 38; *Humulus lupulus* 8; *Lamium maculatum* 9; *Lapsana communis* s.s. 23(2),42(1); *Rubus caesius* 12,16,23,41(1),42; *Tanacetum vulgare* 38(1); *Torilis japonica* 29,42; V.: *Achillea millefolium* 3,34,38; *Agrostis gigantea* 25(2); *Angelica sylvestris* 34(1); *Arrhenatherum elatius* 8,34(1),38(1); *Carex hirta* 2,12,20,25,38,41; *Dactylis glomerata* 2(1),6,34,38(1); *Deschampsia caespitosa* 3,4,16,24,28,42; *Equisetum palustre* 1; *Festuca rubra* s.s. 3,11,20(1),42; *Galium boreale* 3,28; *Holcus lanatus* 8,30(1); *Juncus effusus* 25; *Lysimachia nummularia* 24,31,39; *L. vulgaris* 37; *Poa pratensis* 38; *P. trivialis* 1(1),19(1); *Prunella vulgaris* 24; *Ranunculus acris* s.s. 8,9(1),34,38(1); *Rumex acetosa* 38,42; *Selinum carvifolia* 30,34; *Taraxacum officinale* 20,34,38(r); *Vicia cracca* 41; VI.: *Agrimonia eupatoria* 34,38(1); *Anthericum ramosum* 24(1); *Astragalus glycyphyllos* 20; *Athyrium filix-femina* 13(1); *Brachythecium velutinum* 18(3),41(2); *Brachythecium albicans* 41(2); *B. rivulare* 41; *B. rutabulum* 13,42(1); *B. salebrosum* 42; *Bryum turbinatum* 41; *Campanula rotundifolia* 2,7,18(1),40,41; *Carex pallescens* 34; *Carex* sp. 27; *C. spicata* 20; *Chamaenerion angustifolium* 5(1),13(1),14,19(r); *Chenopodium album* 25; *Cirriophyllum piliferum* 41; *Clinopodium vulgare* 3,20,24(1),34,39; *Coryza canadensis* 25; *Cornus sanguinea* b 34, c 20,24(r),38; *Coronilla varia* 12; *Crataegus monogyna* b 3,13,20, c 15,20,25; *C. monogyna* et *laevigata* b 18,23(1), c 41; *Dicranoweisia cirrata* 41; *Epilobium ciliatum* 39; *Erysimum cheiranthoides* 25; *Euonymus europaea* b 23(1), c 24; *Euphorbia cyparissias* 18,34; *Fragaria viridis* 38; *Galium verum* 18,31; *Geranium sanguineum* 23; *Hieracium pilosella* 6; *Hypericum maculatum* 35; *Hypnum cupressiforme* 18(1),23(1),42(1); *Knautia arvensis* 34,38,41; *Knautia dipsacifolia* 41; *Larix decidua* subsp. *decidua* a 6,8; *Ligustrum vulgare* c 18; *Lophocolea bidentata* 42; *Lupinus polyphyllus* 19,25; *Luzula multiflora* 16,18; *Orthodricranum tauricum* 18(1),41; *Padus serotina* a 42(5), b 23(1),42(1), c 6,12,23,24(r),42(1); *Peucedanum oreoselinum* 23; *Pimpinella saxifraga* 3,38,41; *Plagiochila asplenoides* 41; *Plagiomnium affine* 3,11,17,23,41(1),42(2); *P. elatum* 41(1); *P. rostratum* 6,18,34,41(1),42(2); *Plagiothecium* sp. 4; *Poa angustifolia* 11,20; *Pohlia cruda* 18; *P. nutans* 13,14,18,41; *Polygonatum odoratum* 21,23,28,41,42(1); *P. lapathifolium* 25; *P. mite* 25; *Populus tremula* a 8, b 5,6,41(2), c 30,34; *Potentilla erecta* 25,34; *Prunus spinosa* b 3(1),23(3),41(2), c 3(1),23(1),38; *Pyrus communis* b 23(1),26, c 15,19,24(r); *P. pyraeaster* b 12; *Quercus palustris* a 9; *Q. rubra* b 41, c 18,41; *Rhamnus cathartica* b 18,41,42, c 38; *Robinia pseudacacia* a 42(1), b 42, c 42; *Rosa canina* c 18,41,42; *Rosulabryum capillare* 18; *Rubus* cfr. *hirtus* 14(1); *R. corylifolius* 15; *R. gracilis* 11(1); *R. plicatus* 23; *R. sprengelii* 27(1),28(1); *R. x corylifolius* 12; *Rumex acetosella* 1,2,6,18; *Sambucus nigra* b 14, c 5,23,29,42(1); *S. racemosa* b 5; *Sciurohypnum oedipodium* 3,11,12,17(1); *S. populeum* 41(2),42(1); *Scorzonera humilis* 28; *Sedum maximum* 20; *Senecio sylvaticus* 18,25,41; *S. vernalis* 42; *Silene nutans* subsp. *nutans* 31,38(1),41; *Solidago virgaurea* s.s. 2(1),4,30; *Sorbus intermedia* c 41; *Stellaria media* 1,33; *Syringa vulgaris* b 42(1); *Thalictrum aquilegifolium* 29; *Valeriana dioica* 37; *Veronica officinalis* 8(1),11,18(2),25,28,34,41(1); *Vicia cassubica* 23,26; *V. sepium* 25,41; *Vincetoxicum hirundinaria* 3(1),42; *Viola canina* 3,18,38; *Viola* sp. 28,34; *Viscum album* subsp. *album* a 1.

Successive number of relist	1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17	18	19		20	21	22	23
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[illegible]

Sporadic species: VIII.: *Acer platanoides* c 13(r); *A. pseudoplatanus* b 43, c 43; *Adoxa moschatellina* 10,43; *Asarum europaeum* 10,30; *Cerasus avium* b 7, bc 41, c 7,43; *Dactylis polygama* 13,14(2),15,19,35,38,39,43; *Daphne mezereum* c 21; *Dryopteris filix-mas* 13,19(r),42; *Epipactis helleborine* 13,16(1),17; *Euonymus verrucosus* b 7,33(1), c 7,33; *Eurhynchium angustirete* 14; *Fraxinus excelsior* b 10, c 10,12,29; *Galeobdolon luteum* 10,30,31,32(2),34; *Galium odoratum* 31,34(1); *Lilium martagon* 5,21,35; *Malus sylvestris* a2 17,18, b 10,18, c 10,14,39; *Neottia nidus-avis* 34; *Padus avium* b 10,43, c 10,14,15,16(r),18(r),31,36,37,38,43; *Phyteuma spicatum* 5,9,38; *Polygonatum multiflorum* 2,34; *Pulmonaria obscura* 1,3,4,34,42; *Ranunculus lanuginosus* 42; *Sanicula europaea* 34; *Stellaria holostea* (Q-F) 10,21,28(1),30; *Tilia cordata* a2 10(1), b 10(1), c 10,34; *Ulmus glabra* c 17; *Viola reichenbachiana* et *riviniana* 15(1),31,32,34,35,37,40(2),41(1); **IX.:** *Hieracium laevigatum* 15,17; *Plagiothecium laetum* 16; **X.:** *Chimaphila umbellata* 44; *Hylocomium splendens* 18; *Koeleria grandis* 44,45; *Picea abies* a2 14,17,18, b 39(r), bc 14,15(2),35,36(2),37(1),38(2),41, c 14(r),18(r),38,41; *Pleurozium schreberi* 18(1),30,37,43,44,45; *Trientalis europaea* 18; *Vaccinium vitis-idaea* 20,25,40,44,45(1); *Viscaria vulgaris* 5,6,7,9,30,33,44,45(1); **XI.:** *Acinos arvensis* (FB) 17; *Agrimonia eupatoria* 42; *Ajuga genevensis* (FB) 30,45; *Asperula tinctoria* (FB) 20; *Campanula rapunculoides* 41,42; *Coronilla varia* 2,6,7(1),30,40,41; *Dianthus superbus* s.s. (FB) 13,16(r); *Galium album* 10,18,43; *Knautia arvensis* 5,6(1),7(1),8,9,10,15,20,33,38,42,43,44; *Origanum vulgare* 22; *Poa compressa* (FB) 43; *Potentilla heptaphylla* (FB) 44; *Silene nutans* subsp. *nutans* 14,20,27,39,42; *Thalictrum minus* (FB) 20,24,25,27,29(r),30; *Trifolium medium* 5,7,8,9; *Veronica spicata* (FB) 44; *Vincetoxicum hirundinaria* 7,21,30(1),44,45; **XII.:** *Achillea millefolium* 1,4,7(1),8,10,40,41,43; *Agrostis gigantea* 15(2),38(1); *Arrhenatherum elatius* 43; *Bellis perennis* 40; *Campanula patula* s.s. 26; *Carex hirta* 13(1),16(1),17,18,19,27,33; *Centaurea jacea* 5,9; *Cerastium holosteoides* 42; *Festuca pratensis* 42; *Lysimachia nummularia* 10,16(1),17(r); *Phleum pratense* 8,9; *Pimpinella major* 3,5,6,7(1),9(1); *Plantago lanceolata* 5,6,7,8; *P. major* 40; *Prunella vulgaris* 16(r),17,41; *Sanguisorba officinalis* 13,16(r); *Taraxacum officinale* 16(r),17,18(r),19,31,34,39(r),40,41,42; *Trifolium pratense* 40; *T. repens* 40,41; *Trollius europaeus* 5,6,8; *Vicia cracca* 42; **XIII.:** *Danthonia decumbens* 44; *Genista tinctoria* 2,3,6,7(1),8,18,42,43(1); *Hieracium pilosella* 8,9,28,43,44; *Luzula multiflora* 1,2,5,8,43; *Pohlia nutans* 12(r); *Polytrichum juniperinum* 23,28; *Viola canina* 21,22,24,25,26,27; **XIV.:** *Cornus sanguinea* b 3,5,6(1),9, c 3,6,9,10; *Crataegus laevigata* b 10,11,12,13(1),14,16(1),17(2),18,19,39, c 10,13,16,18,38; *C. rhipidophylla* var. *rhipidophylla* b 16,17, c 14,16; *Euonymus europaea* c 5,6,7,9,10,32,42; *Rhamnus cathartica* b,bc 30,33(1), c 6,7,13,17(r),32,33,36(r),40; *Rosa canina* 10,17(r),32; *Rubus gracilis* 13,14; *R. plicatus* 16,18; **XV.:** *Abies alba* c 27; *Adenophora liliifolia* 4,8; *Alliaria petiolata* 14(1),19(1),35,38; *Aquilegia vulgaris* 40; *Betula pendula* a 4(1),9, a1 10,29, a2 29, b 1(1),30, c 1; *Brachytheciastrum velutinum* 28,31,34,40,41; *Brachythecium albicans* 40; *B. rutabulum* 14,16,17,19,22,25,34,43; *B. salebrosum* 31,34,40,41; *Calamagrostis epigejos* 11,13,14,19(1); *Carex acutiformis* 17; *C. spicata* 41; *Centaurea phrygia* 1,4; *Cerastium arvense* 43; *Ceratodon purpureus* 22; *Chaerophyllum temulum* 17(r),32; *Chamaenerion angustifolium* 30; *Crataegus* sp. c 14; *Cruciata glabra* 45(1); *Deschampsia flexuosa* 14,16,18,19,36,38; *Digitalis grandiflora* 4,5,31,44; *Epilobium montanum* 22; *Equisetum arvense* 13(r),16; *Erodium cicutarium* 38; *Fallopia convolvulus* 14,15(1),19,22,32,35,38(1); *Galium aparine* 15(1),35,36,38(1),39,42,43; *G. mollugo* et *dumetorum* 32,34,40(1),41; *Geranium pratense* 2,6; *G. robertianum* 10(r),14,15,41; *Glechoma hederacea* 13,16; *Heracleum sibiricum* 4,9; *Hypochoeris radicata* 16(r),40; *Juncus conglomeratus* 12; *Kindbergia praelonga* 18,43; *Lapsana communis* s.s. 30; *Linaria vulgaris* 43; *Lupinus polyphyllus* 13(r),16,17,18(2),36; *Mentha arvensis* 16,17(r); *Oxyrrhynchium hians* var. *hians* 43; *Padus serotina* b 13,17,43(1), c 14(r),15,16,18,19,43; *Phalaris arundinacea* 18; *Picris hieracioides* 42; *Plagiomnium cuspidatum* 14,16(1),18; *Populus tremula* a 1,4(1), b 3,4,9,10,45, c 1,3,4(1),6,8,9,45; *Prunus* sp. c 43; *Pyrus pyraister* b 14, c 13,14,16(r),18,37,39,43; *Robinia pseudacacia* c 39(r); *Rosa* sp. 15,38; *Rubus corylifolius* 12; *Rubus* sp. 44(2),45(1) *R. sprengelii* 14; *R. x corylifolius* 11,17,19; *Rumex acetosella* 5,19(r),44; *Sciuro-hypnum oedipodium* 10,16,18(1),40,41,43; *Scutellaria galericulata* 13,16(1); *Stellaria media* 14(2); *Torilis japonica* 22,40,42; *Vicia hirsuta* 12(r); *Viola* sp. 36,38.

Table A26. *Potentilla albae-Quercetum petraeae molinietosum* (relevés 1-4) and *typicum* (relevés 5-23) in stage II of degeneration

Successive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
ID-1	56	56	56	48	48	48	43	19	19	66	56	20	20	17	29	59	43	16	55	42	59	59	43	
ID-2	2	2	3	5	3	3	7	1	1	3	3	3	4	6	11	4	9	19	14	4	4	6	9	
ID-3	6	7	10	4	28	15	13	25	30	19	30	1	1	2	3	2	17	6	37	11	6	11	18	
Date (year)	2006	2006	2006	1976	1976	1976	1983	1987	2006	2006	2006	2006	1995	1990	2006	1993	1998	1972	1975	1981	1993	1993	1998	123
Density of tree layer	a1,a [%]	55	55	40	70	60	70	75	40	30	30	75	50	75	70	70	80	100	80	75	80	75	80	%
Density of tree layer	a2 [%]	-	-	40	-	-	-	-	10	40	70	5	-	-	-	-	-	10	-	-	-	-	-	
Density of shrub layer	b [%]	+	10	5	-	-	-	+	20	20	10	5	10	15	+	20	-	5	-	+	20	5	10	
Cover of herb layer	c [%]	65	50	50	70	80	80	70	70	70	60	60	80	80	75	+	80	90	80	80	80	80	70	
Cover of moss layer	d [%]	-	5	5	-	10	+	10	-	10	35	15	5	15	-	50	+	5	70	+	+	+	+	
Area of relevé		6066	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	
Location (ATPOL)		BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	BC66	
Total number of species		62	64	49	38	19	36	38	49	39	45	55	62	36	38	32	35	47	61	29	35	26	30	36
Number of mosses, liverworts and lichens species		-	4	3	-	6	3	3	-	3	5	4	4	4	4	1	2	4	12	3	4	-	4	
I. Ch., D.* <i>Potentilla albae-Quercetum</i>																								
Ch. <i>Quercetalia pubescentis</i>																								
^A <i>Galium boreale</i> (M-A)		-	1	+	-	1	2	-	+	+	1	+	-	1	+	1	+	-	1	2	2	1	70	
^A <i>Betonica officinalis</i> (M-A)		+	-	-	+	+	+	-	-	-	-	-	-	+	1	+	-	-	-	+	+	+	43	
<i>Campanula persicifolia</i>		-	-	-	-	-	+	+	+	-	-	-	-	+	+	-	-	1	-	-	-	+	35	
[*] <i>Carex montana</i>		1	+	+	+	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	
<i>Lathyrus niger</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	
[*] <i>Potentilla alba</i>		-	-	r	-	-	-	-	-	-	+	-	-	r	-	-	-	-	+	+	+	+	22	
<i>Hypericum montanum</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	17	
<i>Platanthera bifolia</i>		-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	9	
[*] <i>Ranunculus polyanthemus</i>		-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	
<i>Primula veris</i>		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	
II. D. <i>Pa-Q molinietosum</i>																								
<i>Molinia caerulea</i> (M-A)		3	+	-	2	+	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	
<i>Lysimachia vulgaris</i> (M-A)		+	2	+	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	
<i>Hypericum maculatum</i> (C-U)		1	1	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	17	
<i>Juncus effusus</i> (M-A)		r	+	r	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	
III. D. <i>Pleurozium schreberi</i> var.																								
<i>Pinus sylvestris</i> (V-P)	a1,a	-	-	3	3	3	3	3	2	3	3	3	-	-	-	1	1	-	-	-	2	-	52	
<i>Pinus sylvestris</i> (V-P)	c	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	
<i>Pseudoscleropodium purum</i> (V-P)		-	+	2	-	-	1	-	-	3	2	+	+	-	-	-	-	-	-	-	-	-	35	
<i>Vaccinium vitis-idaea</i> (V-P)		-	+	+	-	1	+	1	-	-	-	-	-	-	-	-	-	+	-	-	-	-	26	
<i>Pleurozium schreberi</i> (V-P)		-	-	-	-	-	-	1	1	1	1	+	-	-	-	-	-	-	-	-	-	-	26	
IV. Ch. <i>Querceto-Fagetea</i>																								
<i>Corylus avellana</i>	b	-	-	1	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	2	2	1	30	
<i>Corylus avellana</i>	c	-	-	-	-	-	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+	22	
<i>Melica nutans</i>		+	1	2	1	-	+	2	1	+	1	2	r	1	2	2	1	-	-	+	2	+	87	
<i>Poa nemoralis</i>		1	+	-	1	-	-	-	-	1	+	1	1	-	+	-	-	+	+	+	1	+	61	
<i>Viola riviniana</i>		1	1	+	-	-	-	+	+	r	+	1	r	-	-	-	-	-	-	-	-	-	39	
<i>Dryopteris filix-mas</i>		-	+	1	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	35	
<i>Ajuga reptans</i>		+	+	+	-	-	-	-	-	+	+	+	-	-	-	-	1	-	-	-	-	-	30	
<i>Atrichum undulatum</i>		-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	2	+	+	-	-	+	30	
<i>Brachypodium sylvaticum</i>		+	1	+	-	-	+	-	-	2	-	-	-	+	-	-	-	-	-	-	-	-	26	
<i>Viola reichenbachiana</i>		-	1	-	-	-	-	-	-	+	-	-	-	+	-	-	-	1	+	-	-	+	26	
<i>Milium effusum</i>		-	-	+	-	2	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	22	
<i>Festuca heterophylla</i>		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3	3	-	-	-	1	22	
<i>Hepatica nobilis</i>		-	-	-	-	-	-	-	-	-	-	-	-	1	+	1	2	-	-	-	-	-	22	
V. Ch., D.* <i>Quercetia robori-petraeae</i>																								
<i>Calamagrostis arundinacea</i>		-	+	1	1	2	2	2	1	-	2	-	r	1	-	1	-	1	+	-	3	1	2	70
<i>Festuca ovina</i>		+	-	-	1	1	1	1	2	+	-	-	1	+	1	1	2	1	3	1	-	-	65	
[*] <i>Polytichastrum formosum</i>		-	2	+	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	+	30	
<i>Hieracium lachenalii</i>		-	-	+	-	1	-	-	-	-	-	-	-	-	-	-	-	+	1	-	-	+	26	
VI. Ch. <i>Vaccinio-Piceetea</i> (V-P)																								
<i>Picea abies</i>	a2*b/c	-	+/	/r	-	-	-	-	-	+/	-	-	-	-	-	-	1/	-	+/	-	-	-	22	
<i>Vaccinium myrtillus</i>		2	1	-	3	4	3	3	4	+	1	1	2	-	r	-	2	-	-	+	2	2	70	
<i>Rubus saxatilis</i>		-	-	-	-	1	1	-	+	-	-	1	-	+	+	+	-	-	-	1	-	1	39	
VII. Ch. <i>Trifolio-Geranietea</i>, <i>Festuco-Brometea</i>																								
<i>Fragaria vesca</i>		+	2	+	-	1	2	2	1	-	2	1	+	-	-	-	+	2	-	-	-	+	57	
<i>Polygonatum odoratum</i>		-	-	-	1	-	+	+	+	-	-	-	-	1	+	-	-	1	+	-	-	+	43	
<i>Poa angustifolia</i>		1	-	-	1	-	+	-	1	+	-	-	-	-	-	-	-	-	-	-	-	-	35	
<i>Clinopodium vulgare</i>		-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	1	-	1	1	-	1	30	
<i>Hypericum perforatum</i>		-	-	-	1	+	-	-	+	-	-	1	-	-	-	-	-	-	-	-	-	-	30	
<i>Vicia cassubica</i>		-	-	-	-	-	-	+	-	r	-	-	-	-	-	2	1	-	-	2	+	1	30	
<i>Vicia sepium</i>		-	1	-	-	-	-	+	-	-	-	-	-	+	+	-	-	+	-	-	-	+	26	
[*] <i>Euphorbia cyparissias</i>		-	-	-	-	-	-	+	-	+	+	+	-	-	-	-	+	+	-	-	-	-	22	
<i>Galium album</i>		+	+	-	-	-	-	-	-	-	+	1	2	-	-	-	-	-	-	-	-	-	22	
VIII. Ch. <i>Molinio-Arrhenatheretea</i> (M-A)																								
<i>Veronica chamaedrys</i>		+	+	-	-	-	1	1	+	-	+	+	-	-	+	+	1	+	1	+	+	+	70	
<i>Festuca rubra</i> s. s.		+	+	-	-	1	-	-	-	+	1	-	-	1	-	-	-	-	-	-	-	-	30	
<i>Carex hirta</i>		2	2	-	-	-	-	-	+	-	+	r	-	-	-	-	+	-	-	-	-	-	26	
<i>Deschampsia caespitosa</i>		2	1	1	-	-	-	+	-	1	-	-	-	-	-	-	-	-	-	-	-	-	22	
IX. Ch. <i>Calluno-Ulicetea</i> (C-U)																								
<i>Veronica officinalis</i>		+	+	-	-	-	-	+	-															

Sporadic species: IV.: *Acer platanoides* b 16(2), c 11(r),19(r); *A. pseudoplatanus* b 16, c 20; *Anemone nemorosa* 8,9,16(2),21; *Carex digitata* 8(1),15,17(1),23(2); *Carpinus betulus* c 15; *Cephalanthera damasonium* 18; *Cerasus avium* b 12; *Dactylis polygama* 2,14,22(2); *Daphne mezereum* c 23; *Epipactis helleborine* 1(r); *Fagus sylvatica* a2 11(3), b 1(1),11(1),14, c 1(r),11,14; *Festuca gigantea* 2,3,11,14; *Fraxinus excelsior* c 20; *Galeobdolon luteum* 15; *Galium sylvaticum* 17,23; *Lathyrus vernus* 17,23(1); *Lilium martagon* 8,14; *Lonicera xylosteum* b 16; *Malus sylvestris* b 2, c 4,5,12; *Melampyrum nemorosum* 4(1),19(2); *Padus avium* b 10,11, c 3(r),10,11,14(r); *Phyteuma spicatum* 14; *Ribes spicatum* b 10,11; *R. uva-crispa* c 11; *Scrophularia nodosa* 2,6,12; *Ulmus glabra* a2 11, c 11; *U. minor* c 4,11; *Viburnum opulus* c 8,12; *Viola reichenbachiana* et *rivini* 4,6; V.: *Carex pilulifera* 1,2; *Dicranella heteromalla* 5,6,17,20; *Hieracium laevigatum* 4(1),18(2),22; *H. sabaudum* 1,16(1); *H. umbellatum* 4(1),19(1),20; *Holcus mollis* 8(1); *Plagiothecium laetum* 6,18; VI.: *Chimaphila umbellata* 8; *Dryopteris dilatata* 3,10; *Galium rotundifolium* 7; *Hieracium pilosella* 9,13(1),17; *Hypnum cupressiforme* 17,18(1),19; *Juniperus communis* b 8(1),13(1),18, c 8,13(2),18,20; *Leucobryum glaucum* 20; *Orthilia secunda* 4(1),8,18(1); *Plagiothecium curvifolium* 5; *Pyrola minor* 1,18; *Trientalis europaea* 8,9; VII.: *Acinos arvensis** 16,21; *Anthericum ramosum* 4,15; *Astragalus glycyphyllos* 9,12,14,18; *Brachypodium pinnatum** 2,3,10(1),14; *Carex praecox** 18; *Geranium sanguineum* 21; *Knautia arvensis* 12,20; *Peucedanum oreoselinum* 6,7(r),20; *Sedum maximum* 8,19(r); *Silene nutans* subsp. *nutans* 19; *Thalictrum minus** 14,15(r),16,17; *Trifolium alpestre* 2(1),17(1),19(1); *T. medium* 16; *T. montanum** 13; VIII.: *Achillea millefolium* 1(r),20; *Agrostis gigantea* 4,6(1); *Centaurea jacea* 13; *Cnidium dubium* 1; *Dactylis glomerata* 4,5; *Galium mollugo* 3(r),7,9,17(1); *Lysimachia nummularia* 2; *Pimpinella major* 21; *Poa pratensis* 8,17(1),20(3); *P. trivialis* 18; *Rumex acetosa* 1(r); *Serratula tinctoria* 16(1),21; *Succisa pratensis* 1(1); *Taraxacum officinale* 11(r),12(r),18; *Vicia cracca* 2(r),18; IX.: *Carex ovalis* 1; *C. pallescens* 3,12; *Genista tinctoria* 1(r),9,16; *Luzula multiflora* 6,12; *Pohlia nutans* 5,18,19; *Scorzonera humilis* 8,21; *Viola canina* 7(1),17(1),18,23; X.: *Acer negundo* a2 11, b 11; *Aegopodium podagraria* 14,17; *Alliaria petiolata* 1(1),3; *Berberis vulgaris* b 11,12,18, c 12,13(r); *Betula pendula* a 2(1),9(1), a1 9(1),10(1),18(1), a2 9(1),10(2), b 10(1), c 1(r); *Brachythecium velutinum* 16,23; *Brachythecium campestre* 18; *B. rutabulum* 16; *Bromus benekenii* 6; *Bromus* sp. 21; *Bryum* sp. 20; *Calamagrostis canescens* 10; *Campanula rotundifolia* 1(r),7,13(r),20; *Carex acutiformis* 4(1); *C. guestphalica* 2; *C. nigra* 1(1); *Chaerophyllum temulum* 14,18; *Cirsium arvense* 18; *Cornus sanguinea* c 19; *Crataegus laevigata* b 1,3(1),11, c 3; *C. monogyna* b 3,8(1), c 1,8; *C. rhipidophylla* var. *rhipidophylla* b 2,11, c 2; *Cruciata glabra* 8(3); *Deschampsia flexuosa* 2(1),10,11(1); *Epilobium montanum* 18; *Equisetum arvense* 1,2; *Euonymus europaea* c 15(r); *Fallopia dumetorum* 18; *Galium aparine* 12(1),13(r),14; *G. mollugo* et *dumetorum* 15; *Geranium robertianum* 11,12,18; *Geum urbanum* 2,8,11,12; *Glechoma hederacea* 2(2); *Heracleum sphondylium* 14; *Hieracium* sp. 6; *Ligustrum vulgare* b 12, c 12; *Linaria vulgaris* 18; *Lophocolea bidentata* 18; *Melandrium album* 18; *M. rubrum* 18; *Orthodicranum tauricum* 18(1); *Plagiochila asplenoides* 18; *Plagiomnium cuspidatum* 2(2); *P. rostratum* 18(2); *Polypodium vulgare* 18; *Prunus spinosa* b 2(r), c 1(r),8,12; *Pyrus communis* b 8, c 8,9; *Quercus rubra* c 18; *Rhamnus cathartica* b 11, c 11,14,20; *Rosa canina* b 10,12; *Rosulabryum capillare* 18; *Rubus caesius* 12,20; *R. grabowskii* 10; *R. gracilis* 1,2(1),3(1),10; *R. plicatus* 10(1); *Rubus* sp. 8,9(1); *R. sprengelii* 2,3(2),10(2),11(2); *R. x corylifolius* 2(r),12(1); *Rumex acetosella* 4,6; *Sciurohypnum populeum* 18(2); *Senecio sylvaticus* 18; *Silene vulgaris* 12(r); *Torilis japonica* 11(r),12; *Urtica dioica* 1,11,14,18(r); *Verbascum nigrum* 12; *V. phlomoide* 18(1); *Viola* sp. 14.

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Sporadic species: IV.: *Carex digitata* 1(r), 16,17(2),23(2); *Carpinus betulus* c 14,16; *Cerasus avium* c 9,12,15,18(r),27; *Corylus avellana* b 9,13(2),16(2),17,29(1),31(1), bc 30, c 8(r),13(1),15,16; *Fraxinus excelsior* c 11(r),16,30; *Galium schultesii* 15(1); *Hepatica nobilis* 14,16,24,26,34; *Lathyrus vernus* 12,23,30,31,34; *Lilium martagon* 20,27,30,36; *Lonicera xylosteum* c 30; *Malus sylvestris* b 18, c 1,2,4(r),5(r),13,14,33; *Melampyrum nemorosum* 17,28,36; *Milium effusum* 8,9,11,12,36; *Polygonatum multiflorum* 28,31(1),36; **V.:** *Dicranella heteromalla* 1,2,12,20; *Hieracium sabaudum* 3,6(r),13; *Hieracium umbellatum* 14,15(1); *Holcus mollis* 15(1); *Lophocolea heterophylla* 14; **VI.:** *Betula pubescens* subsp. *pubescens* a 30,31; *Cladonia furcata* 14; *Dicranum polysetum* 14(1),26,28,34(1),35; *D. scoparium* 14,23; *Hylocomium splendens* 30,33,34,35,36; *Leucobryum glaucum* 18,20; *Picea abies* b 7,11(1),12(1),15(1), c 1(r),5,12,15; **VII.:** *Agrimonia eupatoria* 3,4,5,20,27,32(1),33,35(1); *Coronilla varia* 18,20,30,33; *Lathyrus sylvestris* 20; *Potentilla rupestris* 31(1),35; *Veronica teucrium* 24(1),25; *Vicia tenuifolia* 25,26,31; *Viola hirta* 31,32,34,35; **VIII.:** *Acinos arvensis* 25; *Asparagus officinalis* 27; *Avenula pratensis* 1,2; *Campanula glomerata* 15,36; *Carex caryophyllea* 28,35; *C. 26*; *Carlina vulgaris* 32; *Helianthemum nummularium* ssp. *obscurum* 33; *Scorzonera purpurea* 29; *Thalictrum minus* 13,17,23,31; *Trifolium montanum* 24,25; *Viola rupestris* 26; **IX.:** *Agrostis gigantea* 2; *Avenula pubescens* 26,32; *Briza media* 11,23; *Centaurea jacea* 36; *Deschampsia caespitosa* 10(r),12; *Festuca pratensis* 1(r); *Holcus lanatus* 25; *Laserpitium prutenicum* 31; *Lysimachia vulgaris* 15; *Phleum pratense* 25,27; *Pimpinella major* 15,36; *Plantago lanceolata* 24,25; *Poa pratensis* 15,23,26(1),30,35(2); *P. trivialis* 4,8; *Selinum carvifolia* 13; **X.:** *Carex pallescens* 13,15(1),20; *Danthonia decumbens* 13(1),14,20,28; *Luzula campestris* 30,31,35; *Polygala vulgaris* 27; *Scorzonera humilis* 17,18(r),19; *Viola canina* 17,22,23(1),24,27,33,34; **XI.:** *Berberis vulgaris* b 19; *Crataegus laevigata* b 2(r), c 7(r),12(r); *C. monogyna* b 7(r),9,11,12,22, c 13(r); *Rubus gracilis* c 13(r); *R. plicatus* c 19(r),28; *Sarothamnus scoparius* c 12,32; **XII.:** *Agrostis gigantea* x *canina* 17(1); *Alliaria petiolata* 1,2,5,9(1),11,12; *Aquilegia vulgaris* 15; *Arabis glabra* 33; *Armeria maritima* 32(1),33,35; *Betula pendula* a 15(1),16,22, a1 14,15(2),19,21, a2 15(1), c 15,27,33; *Brachythecium albicans* 32,33; *Bromus benekenii* 26,27,33; *B. ramosus* 33; *Botrychium lunaria* 35; *Calamagrostis epigejos* 2,13,14(1),19,21,27,32(1),34; *Carex echinata* 27,33; *Cerastium semidecandrum* 31; *Chaerophyllum temulum* 1(r),3,7,9,30; *Chamaenerion angustifolium* 14(r); *Chenopodium album* 12; *Cladonia glauca* 14; *Conyza canadensis* 11,12(r),36; *Digitalis grandiflora* 29(1),34,36; *Dryopteris carthusiana* 12,27,28; *Fallopia dumetorum* 12,36; *Galium mollugo* et *dumetorum* 17(1); *Geranium robertianum* 3,8,9,10,12,19,21(1); *Glechoma hederacea* 29; *Gnaphalium sylvaticum* 28,31,32; *Helichrysum arenerium* 35; *Heracleum sphondylium* 1(r); *Hieracium caespitosum* 24; *Hieracium cymosum* 24; *Koeleria pyramidata* 2; *Lapsana communis* s.s. 2,3,4,5,6,7,11; *Laserpitium latifolium* 31; *Linaria vulgaris* 1,2,3,4,5,8,32,33; *Lupinus polyphyllus* 3,8(r),9; *Medicago lupulina* 25; *Myosotis stricta* 33; *Orobanche purpurea* 27; *Plagiomnium cuspidatum* 13(2); *Populus tremula* b 15,25,31(1), c 13,15; *Salvia pratensis* 24,31,33,34(2),35; *Vicia tetrasperma* 25(1),27,33,34,35; *Rhodobryum roseum* 26,30; *Robinia pseudacacia* c 6(r); *Rosa tomentosa* b 1; *Rubus* sp. 15; *Rubus sprengelii* 4(r),5,13(1); *Rubus x corylifolius* 2,5,10,12,13,19,21; *Sciuro-hypnum oedipodium* 14(2),16,17,18,20(1),21,22; *Sedum sexangulare* 33; *Senecio sylvaticus* 4(r); *Silene vulgaris* 15; *Tanacetum vulgare* 13; *Thymus serpyllum* 26; *Torilis japonica* 5,7,9(2),11(1),12(1); *Trifolium arvense* 24; *Vicia hirsuta* 22,25; *V. lathyroides* 25.

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Sporadic species: **IV.:** *Acer platanoides* c 3,17(r); *A. pseudoplatanus* b 5, c 5; *Adoxa moschatellina* 5; *Asarum europaeum* 9; *Campanula trachelium* 3; *Cerasus avium* c 1,16,28(r),29,30,31,33(r),35(r); *Dactylis polygama* 27,28,33,34(r),38; *Daphne mezereum* b 14, c 11,12,14,15; *Dryopteris filix-mas* 31,38; *Equisetum sylvaticum* 38; *Euonymus verrucosus* c 15; *Eurhynchium angustirete* 18; *Fraxinus excelsior* b 35(r); c 7,11,19,20(r),31,33(r),34(r); *Galeobdolon luteum* 3,9(2),10; *Galium odoratum* 3,29(1); *G. schultesii* 13,14(2),15(2); *Hierochloë australis* 19; *Malus sylvestris* b 17,19, c 19,22,27,29,32,33(r),38(r); *Melampyrum nemorosum* 11(1),12(1),13(1),18(2); *Melittis melissophyllum* 13(1); *Milium effusum* 11,12,18,22,34(r),35; *Padus avium* b 7,33,38, c 11,18,32,36(r),37,38; *Phyteuma spicatum* 27(r),29(r); *Polygonatum multiflorum* 3,18; *Ranunculus auricomus* 29(r),30(r); *Ribes uva-crispa* c 5; *Sanicula europaea* 4; *Sorbus torminalis* 3; *Stachys sylvatica* 11; *Tilia cordata* a2 19, b 19, c 3,19; *Ulmus minor* c 33; *Viburnum opulus* b 14, c 11; **V.:** *Hieracium laevigatum* 28,32,33(r),35(r); *Hieracium sabaudum* 14; *H. umbellatum* 14; *Holcus mollis* 3,5,11,12,13(1),15(1),18,20(2); *Lathyrus montanus* 3,7,11(2), 12(1),18(1); *Luzula pallescens* 20; **VI.:** *Pseudoscleropodium purum* 16,17,32,38; *Trientalis europaea* 7,11,14,15,18; *Vaccinium vitis-idaea* 1,6(r),27,30(r),36; **VII.:** *Ajuga genevensis* (F-B) 13; *Asparagus officinalis* (F-B) 16; *Asperula tinctoria* (F-B) 1,4,19,22,23,26,30,31; *Avenula pratensis* (F-B) 32; *Campanula bononiensis* (T-G) 30(r); *C. glomerata* (F-B) 18,19; *C. rapunculoides* (T-G) 12,18(2); *Coronilla varia* 16,30(r); *Festuca trachyphylla* (FB) 32; *Galium album* (T-G) 17(1),19,38; *Lathyrus sylvestris* (T-G) 7; *Peucedanum cervaria* (T-G) 15,26,27,28(r); *Poa compressa* (F-B) 9; *Thalictrum minus* (F-B) 2(r),4(1); *Trifolium montanum* (F-B) 10; *Vicia dumetorum* (T-G) 11,12,18(1); *Vincetoxicum hirundinaria* (T-G) 1,3; **VIII.:** *Agrostis gigantea* 1,32; *Arrhenatherum elatius* 12,18,22,31; *Avenula pubescens* 18,21; *Briza media* 31(r),33; *Carex hirta* 5,7(1),11(1),16,34(r),36(r),37,38(1); *Cerastium holosteoides* 17; *Cnidium dubium* 33(2),34,35(2),36(2),37(2); *Dactylis glomerata* 3(1),4,8,12(1),18,22,25(r),38(1); *Festuca pratensis* 11; *Juncus effusus* 5,25(r),38; *Lathyrus pratensis* 12,18; *Leontodon autumnalis* 5(r); *Molinia caerulea* 27; *Poa pratensis* 4,11,12,14; *P. trivialis* 6,13; *Ranunculus acris* s.s. 18; *Selinum carvifolia* 22,29,30; *Stellaria graminea* 7,15(1); *Succisa pratensis* 21; *Taraxacum officinale* 5,6(r),7,16(r),22,27(r),28(r),29(r),30(r),34(r); *Vicia cracca* 3,5; **IX.:** *Carex pallescens* 7,21(r),26(r),30; *Genista tinctoria* 20,30,31,32,33,35; *Hieracium pilosella* 17; *Luzula multiflora* 10,13,25,32; *Pohlia nutans* 31(r),32,34,36; *Scorzonera humilis* 10,14; *Viola canina* 2(1),4,30(r),31; **X.:** *Berberis vulgaris* b 16; *Crataegus laevigata* b 4,5,19,21, 22,24(r),30(r),36(r), c 25,28,29; *C. monogyna* b 8,14,29,36(r),37, c 14; *C. rhipidophylla* var. *ripidophylla* 30,32,33,34,35,36,37,38, c 5(r),38; *Euonymus europaea* c 19; *Rosa canina* b 19, c 7,8,16(r),33(r); *Rubus gracilis* c 5; *R. plicatus* c 38(1); *Sambucus nigra* 9; **XI.:** *Acer negundo* c 33(r); *Aegopodium podagraria* 12(1),18; *Anthriscus sylvestris* 7(1),18; *Aquilegia vulgaris* 12; *Athyrium filix-femina* 11; *Betula pendula* a 13(1),15(1), a1 19,38(1), a2 19; *Brachythecium velutinum* 1,9,16; *Brachythecium rutabulum* 17,25(r),32,36,37,38; *Bromus benekenii* 1,4; *Calamagrostis epigejos* 5(2),23,37; *Carex guestphalica* 5; *C. spicata* 30(r); *Chamaenerion angustifolium* 25; *Chenopodium album* 37; *Cruciata glabra* 13(2); *Deschampsia flexuosa* 5(1),22(r),24,32,33,35,36,38; *Digitalis grandiflora* 4(r),7,11; *Dryopteris carthusiana* 5,7,11,38; *Epilobium montanum* 21(r); *Fallopia dumetorum* 33; *Galium mollugo et dumetorum* 9,10; *Heracleum sibiricum* 12; *H. sphondylium* 25(r),27,32; *Hypnum cupressiforme* 8,19; *Impatiens parviflora* 5(2),33,34,35(1),36(2),37(2),38(1); *Lapsana communis* s.s. 6,11,33; *Linaria vulgaris* 32; *Lupinus polyphyllus* 20,22,27; *Malus* sp. 10; *Oxyrrhynchium hians* var. *hians* 19; *Phalaris arundinacea* 38; *Plagiomnium cuspidatum* 38; *Poa nemoralis* x *compressa* 9; *Polytrichastrum formosum* 1,2,13(2),15; *Populus tremula* a2 19, b 19(1), c 12; *Pyrus communis* c 9,14; *Rosa tomentosa* b 32; *Rosulabryum capillare* 1; *Rubus caesius* 7(2),11; *R. corylifolius* 24,30; *R. sprengelii* 5,16,33,35(r),38(1); *Rubus* x *corylifolius* 16,38(1); *Sciuro-hypnum oedipodium* 10,16,17,19(1); *Senecio sylvaticus* 24(r),29(r); *S. vernalis* 6(r); *Stellaria media* 3,11,17,36; *Thalictrum aquilegifolium* 4,12(1),18(1); *Torilis japonica* 3(1),8,9,11(1),16,25(r),31(r),33(2),36,37; *Vicia hirsuta* 17(r); *Vicia* sp. 30(r); *Viola* sp. 6; *Viscaria vulgaris* 15.

Table A29. *Potentillo albae-Quercetum petraeae brachypodietosum pinnati* in stage II of degeneration[illegible]

Sporadic species: V.: *Acer platanoides* a2 15(1), b 53(2), c 15,55,56; *A. pseudoplatanus* a2 25, b 25,53(1), c 25,32,57; *Adoxa moschatellina* 18,39,46,47; *Carex sylvatica* 52; *Carpinus betulus* a 41,44, b 20(r),42, c 1,41,42,44,45,57; *Cerasus avium* c 39; *Corylus avellana* a2 3(1),6(1),15(1),42, b 3(1),6(2),15(3),25(1),30(1),34,41,42,44,45, c 3,6,15(1),20,36(r),44,47,50,57; *Daphne mezereum* c 64; *Equisetum pratense* 61; *Equisetum sylvaticum* 18; *Eurhynchium angustire* 45; *E. striatum* 15(2),16(2); *Fagus sylvatica* a 59(1), a2 5(1),37(1),52(1), b 18,25(2),35,36(2),37(2),52,54(1),59(1),60(1), bc 42(1), c 5,30,47,51,54,55,59,61; *Festuca heterophylla* 16(3),20,41,42,47(2),48(2),52(2); *Fraxinus excelsior* a2 61(1), b 7(1),61, c 20,61(1); *Galium odoratum* 41(1); *G. schultesii* 22(2),23(3),62(2); *G. sylvaticum* 57(1); *Lathyrus vernus* 64(1); *Lonicera xylosteum* b 53, c 57; *Malus sylvestris* c 25,38(r),39(r),42,43,65(r); *Melampyrum nemorosum* 13,32,45(1),46(4),47(1),48(2),50,51; *Melica uniflora* 51(4); *Melittis melissophyllum* 3(1),23,62,63; *Milium effusum* 4,30(1),35(2),36,37,42,47(1); *Padus avium* b 18,30,35,36,47,65, c 25(1),35,38,39,48,50,55,65; *Phyteuma spicatum* 42; *Polygonatum multiflorum* 12; *Primula elatior* 28; *Pulmonaria obscura* 47; *Ranunculus auricomus* 32; *Ribes spicatum* b 15,25, c 18; *Ribes uva-crispa* b 15, c 1,18; *Sanicula europaea* 41; *Stachys sylvatica* 24,46,47(1),48,51,57; *Stellaria holostea* 46,47,51; *Tilia cordata* c 20,25(r),27,30; *Ulmus glabra* c 14,55,56,58; *Ulmus laevis* a2 15, b 24; *U. minor* a2 15(1), b 15,24(1), c 24(1); *Viola reichenbachiana* et *riviniana* 1(1),13,35,41,42,44,45; VI.: *Aulacomnium androgynum* 55; *Dicranella heteromalla* 42,55; *Hieracium laevigatum* 42,45,52(1); *H. sabaudum* 16,23,53; *H. umbellatum* 4,13,39,41,51; *Lophocolea heterophylla* 53(2); *Mnium hornum* 38; *Plagiothecium laetum* 16,61; *Polytrichastrum formosum* 8,22(1),25,37,39(1),45,61; *Plagiothecium denticulatum* 45; VII.: *Betula pubescens* subsp. *pubescens* 47(3),48,50(3),51; *Dicranum polysetum* 5(2),16; *D. scoparium* 5(1),24,61(2); *Dryopteris dilatata* 4,15; *Hylocomium splendens* 8(2),9(2),45; *Koeleria grandis* 12,34; *Monotropa hypopitys* s.s. 9; *Orthilia secunda* 9(1),16(1),44,61(1); *Picea abies* a2 37, b 23,27,36(2),42, c 12,23(1),28(r),38,46(1),47(1),48(1),50,51,65; VIII.: *Achillea pannonica* (F-B) 28; *Acinos arvensis* (F-B) 25(1),40,53; *Agrimonia eupatoria* (T-G) 33,42,46; *Ajuga genevensis* (F-B) 3,7,19,28,46,48; *Allium oleraceum* (F-B) 50; *Arabis hirsuta* (F-B) 24; *Asparagus officinalis* (F-B) 16; *Asperula tinctoria* (F-B) 19,28; *Campanula rapunculoides* (T-G) 57; *Carex caryophylla* (F-B) 4(1),7,32; *C. praecox* (F-B) 16; *Coronilla varia* (T-G) 3,8,11(r),20,21,41,46,47,63; *Dianthus carthusianorum* (T-G) 5,7,19(1); *Euphorbia angulata* (T-G) 32; *Festuca trachyphylla* (F-B) 19; *Filipendula vulgaris* (F-B) 1(r),26,28,38,46(1),47(1),48(1),50,51,65; *Fragaria viridis* (T-G) 7(3),46,51; *Galium album* (T-G) 2,11(1),19,20,21(1),33,37,43,65; *G. album fo. dumetorum* (T-G) 7,42,46,50(1); *Knautia dipsacifolia* (T-G) 7,52; *Koeleria macrantha* (F-B) 7; *Lathyrus sylvestris* (T-G) 5,8,20; *Peucedanum cervaria* (T-G) 3,8,39(r),63; *Phleum phleoides* (F-B) 19; *Potentilla arenaria* (F-B) 5,7,19,28; *Silene nutans* subsp. *nutans* (T-G) 1(1),6,7,10(r),19(1),20,21,33,40,41,44; *Silene otites* (F-B) 5,16,52; *Stachys recta* (F-B) 5; *Thalictrum minus* (F-B) 15,27,42,53; *Thymus pulegioides* (F-B) 7,53; *Trifolium medium* (T-G) 40(1),53(1); *Veronica spicata* (F-B) 5,7,15,19,32; *Vicia dumetorum* (T-G) 16,47(1); *Vicia sepium* (T-G) 22,41,44,46(1),55,56(1),63,65; *Viola collina* (T-G) 5; *Viola rupestris* (F-B) 19; IX.: *Achillea ptarmica* 7; *Agrostis gigantea* 1,26(1),28(1),29(2),30,49(2); *Arrhenatherum elatius* 18(1),19(2),34(1),38,39,43,53(1); *Avenula pubescens* 19; *Briza media* 7,48,53; *Cerastium holosteoides* 8,48; *Cirsium palustre* 49; *Holcus lanatus* 7,50(3); *Lathyrus pratensis* 7; *Leucanthemum vulgare* 6,7; *Lotus corniculatus* 7,49; *Lychnis flos-cuculi* 7; *Lysimachia nummularia* 24,32,59; *Phleum pratense* 14; *Pimpinella major* 6,34; *Plantago lanceolata* 7; *Poa pratensis* 4(1),7,12(1), 39(1); *Poa trivialis* 42,46(1),48(2),51(2); *Prunella vulgaris* 35,63; *Ranunculus acris* s.s. 7,8,9,28,48; *Sanguisorba officinalis* 35; *Scutellaria hastifolia* 7; *Stellaria graminea* 7,64; *Succisa pratensis* 12; *Taraxacum officinale* 11(r),16,25(r),41,48,52,65(r); *Trifolium pratense* 7; X.: *Calluna vulgaris* 8,9; *Carex ovalis* 37; *C. pallescens* 30,38,51,57,64; *Chamaecytisus ratisbonensis* 8,9; *Cladonia coniocraea* 61; *Danthonia decumbens* 8,9; *Genista germanica* 8; *G. tinctoria* 3,53; *Hypericum maculatum* 8,27,37,38(1),42,43; *Luzula multiflora* 2,20,21,24,26,39,45,62; *Nardus stricta* 7; *Pohlia nutans* 4,9,15,24,39,49(3),55,61(1); *Polytrichum juniperinum* 16,45; XI.: *Aesculus hippocastanum* c 31; *Alliaria petiolata* 17,18,35,38(r),42,60,61; *Anthriscus sylvestris* 20,21,52; *Armeria maritima* 7(1); *Berberis vulgaris* b 15(1),16(1),20,52(1) c 16,33(r); *Betula pendula* a 1,18(2),65(2), a1 3(1),7(2),10(r),16(2),19(1),23(2),24(1),61(2), a2 5(1),7(1),15(1),19,38,61(1), b 1,3,6,7,8,9,28(1),49(1),52, c 5,6,8,28,29(1); *Brachythecium velutinum* 20,21,38(1),39,41,44,61(1); *Brachythecium rutabulum* 25,31,32,41,44,61(1); *Bromus benekenii* 4(1); *B. inermis* 47,50(4); *Bryum uliginosum* 5,52; *Carex brizoides* 7; *C. echinata* 28(1); *Carex* sp. 24; *Cerastium arvense* 7,39; *Cerasus mahaleb* b 15(1); *C. vulgaris* c 7; *Ceratodon purpureus* 2,19(1); *Chaerophyllum temulum* 5,7,16,28,36,37(r),52,57,61; *Chamaenerion angustifolium* 8,49(1); *Chelidonium majus* 15(3),26,52(r),57; *Chenopodium album* 65(r); *Cirsium arvense* 52; *C. vulgare* 28,49; *Convolvulus arvensis* 19(r); *Conyza canadensis* 49; *Cornus sanguinea* b 7(2),15(1), c 15,25,31; *Crataegus laevigata* b 18,19,25,30(1),65(1), c 1(1); *C. monogyna* b 6,19,26,33(r),38(1),60, c 6,12,23,26,36,38,39(r),47,56,63; *C. monogyna* et *laevigata* b 24,31(1), c 15,16,32,52; *C. rhipidophylla* var. *rhipidophylla* b 27,37, c 37,43,44; *Crataegus x subsphaericea* c 65; *Cruciata glabra* 3(2),9,22(2),23(3),34,62(2); *Cucubalus baccifer* 59; *Deschampsia flexuosa* 1,5,18(2),19(1),25(1),26(1),27,28,36,37,38(1),43,49,65(1); *Dicranella varia* 61; *Digitalis grandiflora* 6,7,47,55,64; *Elymus repens* 28,30; *Epilobium montanum* 16(1),52(r); *Equisetum arvense* 28; *E. hyemale* 29; *Euonymus europaea* c 15,25,31,32,57; *Euphorbia esula* 19(2); *Fallopia dumetorum* 15,16,52; *Galeopsis bifida* 5,63; *G. pubescens* 16,35,36,42,43(r),48,52,57; *Glechoma hederacea* 7,15(2),26,32,46(2); *Heracleum sibiricum* 61; *H. sphondylium* 42; *Homalothecium sericeum* 61; *Impatiens parviflora* 18,25(1),30,35(5),36,37(1),65(1); *Juncus conglomeratus* 49; *J. effusus* 37,49,58; *Koeleria glauca* 7(2); *Larix decidua* subsp. *decidua* b 28; *Lembotropis nigricans* 8; *Linaria vulgaris* 7,19(1),31,32,49,52; *Lophocolea bidentata* 53(2); *Lupinus polyphyllus* 26(r),30,36; *Lysimachia vulgaris* 24,25,27,32(1),43(1),51(2),58; *Medicago lupulina* 53; *Melandrium rubrum* 16; *Molinia caerulea* 13,14,27,35,38,59,64,65; *Myosotis sparsilora* 7; *Orthodictyon tauricum* 16(1); *Oxalis acetosella* 11,18,22(2),23(1),25(1),27,30(2),35(1),36,37(2),38,42,43,54,55; *Oxyrrhynchium schleicheri* 24; *Plagiomnium cuspidatum* 37,41; *P. elatum* 7,52(1),61; *P. rostratum* 16; *Plagiothecium* sp. 55; *Polygonum minus* 48,50,51; *Polypodium vulgare* 52(1); *Populus tremula* a1 16(1), b 8,9,16(2), c 16,27(1),49,53(1); *Prunus* sp. c 39(r); *Pyrus communis* a2 15(1), b 3,6,8,12(1),15(1), c 3,6,7,22,23,34,38,41,46,48; *P. pyraeaster* b 17(r),20,21, c 20,33,39,42,43,65(r); *Quercus rubra* a2 52(1), b 52, c 16,61(r); *Rhamnus cathartica* b 1,5,15,16,52, bc 33,42,45, c 16,24,31,32,36,48,51,54; *Rhizomnium punctatum* 52; *Rosa canina* b 15,52, c 5,7,20(r),24,31,32,43,44; *Rosa* sp. c 19,38(r); *Rosulabryum elegans* 32; *Rubus caesius* 24(1),46,61(1); *R. gracilis* 19,38,65; *R. plicatus* 1,7,15(2),35,61; *Rubus* sp. c 3(2),6(3),8,9,12,22(1); *Rubus sprengelii* 18(2),19,25,26,28,29(1),37,38(r),65(1); *Rubus x corylifolius* 10,17(1),20,25,37,43(r),65; *Rumex acetosella* 7(2),8,12,16,26,27,28,49(2); *Sambucus nigra* b 15(1), c 15,26,42(r),57; *Sarothamnus scoparius* bc 9; *Sciuro-hypnum oedipodium* 2,14,20(1),21,39,44,45,47,48,54,56,60,64; *Sciuro-hypnum populeum* 52(2); *Scutellaria galericulata* 32,42(r); *Sedum acre* 7(1); *S. sexangulare* 7; *Senecio sylvaticus* 2(r),16,26,52; *Spergula morisonii* 49; *Stellaria media* 17(2),24; *Syringa vulgaris* c 15; *Tanacetum vulgare* 7,19(r),24,32,65(r); *Thalictrum aquilegifolium* 47(3),50,55,56,58,59; *Thymus serpyllum* 5,7(1); *Torilis japonica* 19(r),20,21(1),31,32,47,48,50,64; *T. arvense* 19(r); *Trifolium campestre*; *Verbascum nigrum* 19(2),28; *V. phlomoides* 16,52(1); *V. thapsus* 5; *Vicia angustifolia* 7; *V. sativa* 26(r),28; *Vicia* sp. 7,19,28(1),34,53; *Vicia tetrasperma* 26(r),28,30,36,49; *Viola* sp. 6; *Viscaria vulgaris* 33,39.

Table A30. Substitute forest communities on the habitat of *Potentillo albae-Quercetum*

[illegible]

Sporadic species: IV.: *Acer platanoides* a 17(1), a1 48(2), c 17,18,19,34,48(1); A. a2 10(1), b 22, c 14(r),24,34(1),45(r),48,49(r); *Anemone nemorosa* 3,36(1),50(2),51,54(1); *Asarum europaeum* 39; *Carpinus betulus* b 43(r); c 1(1),33(r); *Epipactis helleborine* 4; *Equisetum sylvaticum* 8; *Eurhynchium angustirete* 7(1); *E. striatum* 48(1); *Fraxinus excelsior* a2 27, b 27, c 11(r),27,39; *Galeobdolon luteum* 39(2); *Galium schultesii* 50(2); *Lathyrus vernus* 19; *Lilium martagon* 18(r),24,25(r),27,51; *Lonicera xylosteum* c 17; *Melampyrum nemorosum* 20(2); *Melittis melissophyllum* 54; *Milium effusum* 1, 5(r),6(r),9,11(r),16; *Paris quadrifolia* 4; *Potentilla alba* 17(r); *Ribes spicatum* b 4(r),6(r), c 48; *R. uva-crispa* b 15,31, c 13,32,33(r); *Stachys sylvatica* 38; *Stellaria holostea* 10(1); *Tilia cordata* a1 17(1),27(3), b 17,45, c 18,19,44; *Ulmus glabra* a 42(1), c 42; *U. minor* b 27; *Viburnum opulus* c 38; *Viola reichenbachiana et riviniana* 2,39; **V.:** *Aulacomnium androgynum* 2,17; *Dicranella heteromalla* 40(1); *Hieracium sabaudum* 14,24(r),31,38(1); *Hieracium umbellatum* 20,34,56; *Holcus mollis* 28,35(1),37,38,51; *Luzula pallescens* 11(r); **VI.:** *Dicranum polysetum* 51; *Dryopteris dilatata* 9,48; *Hylocomium splendens* 51(2); *Koeleria grandis* 47,50; *Monotropa hypopitys* s. s. 55; *Orthilia secunda* 35; *Plagiothecium curvifolium* 2; *Trientalis europaea* 6,8(r),11,25, 29(1),51,54(1); **VII.:** *Trifolio-Geranietae:* *Agrimonia eupatoria* 43(1), 44(r),48; *Astragalus glycyphyllos* 10,18; *Coronilla varia* 47; *Fragaria viridis* 48; *Galium album* 4,6,11,12,13,45,47(1); *G. verum* 37,48(1),49,56(1); *Geranium sanguineum* 56(1); *Lathyrus sylvestris* 44; *Peucedanum cervaria* 30,47; *Silene nutans subsp. nutans* 20,31,38,43,47; *Trifolium alpestre* 48(1),50,56; *T. medium* 20; *Vicia cassubica* 36; *V. sepium* 39. **Festuco-Brometea:** *Acinos arvensis* 20(2); *Allium oleraceum* 56; *Carex caryophylla* 2; *Cladonia rangiformis* 52; *Dianthus carthusianorum* 24,48,52,53,55(2); *Euphorbia cyparissias* 30(r); *Filipendula vulgaris* 45,56; *Poa compressa* 52, 55(1); *Potentilla heptaphylla* 48; *Silene otites* 52(1); *Thalictrum minus* 20,39; *Thymus pulegioides* 48,55; *Trifolium montanum* 46,47; *Verbascum lychnitis* 52; *Veronica spicata* 27,48,50; **VIII.:** *Calluna vulgaris* 51,52; *Carex ericetorum* 51,52,53,55(1); *Chamaecytisus ratisbonensis* 51,52,53(1); *Danthonia decumbens* 51,55; *Genista tinctoria* 48; *Luzula campestris* 52,55; *L. multiflora* 55; *Polytrichum juniperinum* 53,55(1); *Potentilla erecta* 4,8(r),15,25(r),45,51,54(1); *Scorzonera humilis* 21(r),34,51; *Solidago virgaurea* 28,29(r),30,34(1),38,48,51,54; **IX.:** *Aegopodium podagraria* 27; *Agrostis stolonifera* 27; *Alliaria petiolata* 3,5(r),14(1),19,23,24(1); *Angelica sylvestris* 50; *Arabidopsis thaliana* 55(1); *Arrhenatherum elatius* 9,48; *Astragalus arenarius* 52; *Athyrium filix-femina* 4(r); *Berberis vulgaris* b 56(1); *Brachytheciastrum velutinum* 2,44; *Campanula rotundifolia* 12,13,30,37,38,46,47; *Cardamine impatiens* 56; *Cardaminopsis arenosa* 52,53; *Carex brizoides* 48; *C. nigra* 4; *Cerastium arvense* 48(1); *C. holosteoides* 53; *Chaerophyllum temulum* 39; *Chamaenerion angustifolium* 34,49(r),55(2); *Chelidonium majus* 27,56; *Cirsium palustre* 4; *Cladonia foliacea* 52; *Convolvulus arvensis* 49(r); *Cornus sanguinea* b 48, c 40; *Crataegus laevigata* b 3(1),5(1),9(1),16,33,43(r),45,49, c 3,33,39; *C. monogyna* b 1,5(1),8,11(1),50(1),51, c 4,5(r),49,50; *C. monogyna et laevigata* b 27(1),34,56(3), c 48; *C. rhipidophylla* var. *rhipidophylla* b 3,9,13, c 1,37(r),45(r); *Crataegus xsubsp. xsubsp. xsubsp.* 28; *Dactylis glomerata* 2,15,31,38,48(2),50; *Digitalis grandiflora* 17(r), 18(r); *Epilobium montanum* 14; *Equisetum arvense* 4(r),6(r),8,15(r); *Euonymus europaea* b 48,56, c 3,13,27,39,40, 48,50, 56(1); *Eurhynchium hians* 3; *Fallopia dumetorum* 3,23(r),24(2),48,56(2); *Festuca pratensis* 48; *F. rubra* s. s. 2,3,15,28,48, 56(3); *Galeopsis bifida* 50(1); *G. pubescens* 19,27,38,43,48(1); *G. speciosa* 56; *Galium aparine* 14,30(3),43(1),44(1); *G. mollugo* 35,36,50,51,53,54; *G. mollugo et dumetorum* 39; *Geranium robertianum* 1(r),27(3),34,44(3),48(2),50(1),56(2); *Glechoma hederacea* 56(2); *Hieracium murorum* 17,34,38,43; *Holcus lanatus* 7,9,11(r),13(1),15; *Hypochoeris radicata* 53; *Jasione montana* 52,53,55; *Jovibarba sobolifera* 52(2); *Lapsana communis* s. s. 27,48; *Larix decidua subsp. decidua* a1 15,22(1),32; *Larix* sp. a 39; *Lathyrus pratensis* 4; *Lembotropis nigricans* 51; *Linaria vulgaris* 7,8,27(1),34,37,40(r),56; *Lycopus europaeus* 4(r); *Malus* sp. c 39; *Phalaris arundinacea* 32; *Plagiomnium medium* 48; *P. rostratum* 48(1); *Plantago lanceolata* 43; *Poa pratensis* 48,54(1),56; *Polypodium vulgare* 52(1),53; *Populus tremula* b 6(2),14(2),51, c 6(2),10,14,18; *Potentilla reptans* 4; *Prunella vulgaris* 4(r); *Pyrus communis* b 17,36,39,48,51,56, c 17,39,48; *Pyrus pyrausta* b 7,8,9,44(r), c 5(r),6(1),9,11(r),12(r),14(r),21(r),49(r); *Quercus rubra* c 11; *Ranunculus acris* s. s. 13(r); *Ranunculus repens* 1,4(r); *Rhamnus cathartica* c 27,34,39,48,56(1); *Rhodobryum roseum* 7; *Robinia pseudacacia* b 23(2), c 10(r),38; *Rosa canina* b 27,48, c 34,56; *Rosa canina* 34,56; *Rosa* sp. c 4(r),45(r); *Rosa tomentosa* c 48; *Rubus caesius* 5(2),27,33(1),40,41; *R. corylifolius* 1,9,13(1),21,43,44(1),46(1),47; *R. grabowskii* 32; *R. plicatus* 8,15(1),22(1),31,32(1),48; *Rubus* sp. 35(3),36(3),50(2),54(1); *Rumex acetosa* 48,53,56; *Sambucus nigra* b 19,48,56, c 34,48,56(1); *S. racemosa* c 49(r); *Sarothamnus scoparius* b 53, c 51(1); *Scleranthus perennis* 52; *Scutellaria hastifolia* 48,56; *Senecio sylvaticus* 34,46(r); *Serratula tinctoria* 18,47,51,54; *Solanum dulcamara* 33(r),44(r),56; *Sorbus intermedia* c 56; *Stellaria graminea* 13,27; *S. media* 56(1); *Tanacetum vulgare* 7,34; *Taraxacum officinale* 4(r),30,47(r),56; *Thalictrum aquilegifolium* 20; *Thymus serpyllum* 52(1),53; *Torilis japonica* 47; *Verbascum nigrum* 39; *Vicia cracca* 4(1), 49; *Viscaria vulgaris* 38.

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
ID-1		22	35	7	1	52	22	22	22	22	30	13	19	7	13	7	35	7	7	22	51	51	51	7	7	19	52	52	51	7	52	19	19	38	37	38	51	
ID-2		-	5	29	1	3	16	5	5	5	5	2	2	1	2	1	20	1	1	5	2	2	2	1	1	2	16	16	2	1	16	2	2	6	14	6	2	
ID-3		12	13	1	3	2	11	14	13	10	34	41	6	4	42	5	3	7	8	4	10	11	12	2	6	15	4	3	9	9	1	13	14	7	21	8	15	
Date (year)		1961	1976	1982	1990	1973	1961	1961	1961	1961	1965	1996	1977	1996	1999	1997	1976	1997	1995	1961	1981	1981	1981	1997	1977	1983	1973	1973	1981	1977	1973	1985	1977	1984	1987	1987	1981	
Density of tree layer	a1,a [%]	80	50	60	45	50	70	70	80	80	60	75	40	50	60	60	60	60	70	70	40	60	40	60	70	40	60	70	40	60	50	30	50	65	60	60	40	
Density of tree layer	a2 [%]	-	-	50	5	-	-	-	-	-	25	10	-	15	50	25	20	30	10	-	10	-	30	10	5	30	-	-	40	15	-	40	30	-	30	5	-	
Density of shrub layer	b [%]	10	20	10	20	25	5	10	+	20	15	30	50	25	30	50	5	40	20	+	10	+	10	40	20	30	50	50	+	25	20	60	60	15	25	20	20	
Cover of herb layer	c [%]	60	75	40	40	70	90	80	90	90	90	75	80	80	60	70	75	80	80	80	90	90	90	90	80	70	90	90	80	70	90	80	70	75	90	85	100	
Cover of moss layer	d [%]	80	60	30	80	50	90	90	90	90	50	80	60	75	60	80	60	80	80	80	90	90	90	30	40	10	30	10	15	30	10	15	20	10	5	+	5	80
Area of relevé		400	200	200	200	140	450	700	350	500	1500	150	400	150	200	200	200	150	200	200	800	200	200	200	150	100	100	250	180	150	200	180	500	400	200	600	500	100
Location (ATPOL)		CD32	CE00	CD35	BD18	CD02	CD32	CD32	CD32	CD32	CD73	-	DD91	CD37	-	CD37	CE00	CD46	CD46	CD32	CD83	CD83	CD83	CD46	CD35	DD93	DD03	CD02	CD83	CD35	CD02	DD92	-	AD85	AD78	-	CD83	
Total number of species		26	26	38	41	21	22	21	22	23	26	34	25	32	39	38	25	40	39	34	25	35	32	42	27	22	21	17	29	24	20	20	23	24	18	22	21	
Number of mosses, liverworts and lichens species		8	3	4	9	3	5	5	9	6	7	4	4	7	8	8	4	8	8	7	6	12	6	8	3	3	3	1	7	5	5	1	1	6	2	3	6	
I. D. Quercus roboris-Pinetum																																						
<i>Pinus sylvestris</i> (V-P)	a1,a	3	3	4	3	3	4	4	4	3	4	3	3	3	3	4	3	4</																				

Sporadic species: II.: *Betula pubescens* subsp. *pubescens* a 7,8, a2 11,23,32(1), b 11,15(1),32(1), c 11,15(1),23,28,32; *Diphasiastrum complanatum* 4(1); *Dryopteris dilatata* 2(2),11(1),13,15(1),17,18; *Galium rotundifolium* 22; *Juniperus communis* b 4,14, bc 15, c 11,22; *Lycopodium annotinum* 3(1); *L. clavatum* 1(1),9(1); *Orthilia secunda* 3,4,14,18(1); *Plagiothecium curvifolium* 23(1),24; *Rubus saxatilis* 4(1),10,18,19; *Viscum album* subsp. *austriacum* 11,17,23; **IV.:** *Dicranella heteromalla* 22(1),33; *Hieracium lachenalii* 4,12,13,18,22; *H. laevigatum* 34; *H. umbellatum* 33(1),35; *Holcus mollis* 1,2(1),9,16,20,28,35(1); *Lophocolea heterophylla* 14,15; *Plagiothecium denticulatum* 18; *P. laetum* 21,23,28; **V.:** *Carex ericetorum* 4,18; *C. ovalis* 11,14,18,24; *Chamaecytisus ratisbonensis* 25; *Cladonia chlorophaea* 8; *C. fimbriata* 8; *C. pyxidata* 1,19(1); *Danthonia decumbens* 4,22; *Hypnum jutlandicum* 4; *Nardus stricta* 11; *Scorzonera humilis* 4,13,19; *Solidago virgaurea* s. s. 12,15,33; *Veronica officinalis* 1,22; *Viola canina* 4; **VI.:** *Abies alba* a2 25(1), b 25(1); *Acer platanoides* b 4, bc 17,23(1),c 4(r),35; *A. pseudoplatanus* bc 13,23; *Ajuga reptans* 3; *Arrhenatherum elatius* 4; *Athyrium filix-femina* 2,16,27(1); *Atrichum undulatum* 21; *Brachythecium rutabulum* 33; *Campanula rotundifolia* 4; *Carex nigra* 7,32; *Carpinus betulus* a2 32(2), b 31(1),32, c 2,5,9,17,18,19,31,32(1); *Cerasus avium* a2 3, bc 3; *Ceratodon purpureus* 21; *Chamaenerion angustifolium* 17; *Convallaria majalis* 1(1),6(1),9(2),19(1); *Corylus avellana* b 36(1),c 18,25; *Crataegus monogyna* c 31,32; *C. x subsphaericea* c 22; *Deschampsia caespitosa* 3,21; *D. flexuosa* 9; *Dryopteris filix-mas* 1,2,6; *Epilobium montanum* 21; *Equisetum sylvaticum* 7; *Fagus sylvatica* a1,a 10(1), b 5, bc 10, c 5,26; *Festuca rubra* s. s. 20,21,22(1),23,28; *Fragaria vesca* 3,15,22,29,35; *Funaria hygrometrica* 21; *Galeopsis tetrahit* 19; *Galium aparine* 23; *G. boreale* 3,15; *G. mollugo* 35; *Geranium robertianum* 15,17,23; *Geum urbanum* 3,23(r) *Hypnum cupressiforme* 14,33(1),34; *Juncus conglomeratus* 22; *J. effusus* 11,15; *Malus sylvestris* b 24, bc 10, c 14; *Marchantia polymorpha* 21; *Milium effusum* 10,27; *Oxyrrhynchium hians* var. *hians* 30; *Padus serotina* b 4, c 23; *Pinus strobus* a2 16, c 2; *Plagiothecium* sp. 22,36(2); *Poa angustifolia* 15,23; *P. nemoralis* 33; *Polygonatum multiflorum* 16; *Polytrichum juniperinum* 2; *Populus nigra* a 19, c 21; *Potentilla erecta* 11,13, 14,19,22,31(1); *Pyrus pyraister* b 4; *Quercus rubra* a2 4; *Ranunculus acris* s. s. 3(r); *Rhamnus cathartica* b 15, c 26; *Ribes spicatum* bc 3(1); *Rubus caesius* 3(1),8,19; *R. gracilis* 3(1),17(1),24(1),28(1),29; *R. nessensis* 3,11(1),18,23; *Rubus* sp. 12,16,25,31(1),32(1),35(2),36(3); *R. sprengelii* 13(1),14(1),17,18,24; *Rumex acetosa* 23,35; *R. acetosella* 2(1),4,12(1),19(1); *Salix caprea* 21; *Selinum carvifolia* 3; *Senecio vulgaris* 35; *Serratula tinctoria* 3; *Sphagnum capillifolium* 10; *Stellaria holostea* 21,26; *Tilia cordata* a2 17, bc 17, c 1,9; *Tussilago farfara* 21; *Urtica dioica* 23; *Veronica chamaedrys* 1; *Viola reichenbachiana* 3(1),19,22; *V. riviniana* 3; *Viola* sp. 1; *Viscum album* subsp. *album* a 2.

[illegible]

Sporadic species: II. *Betula pubescens* subsp. *pubescens* b 33(r), c 54,55,61(1); *Cladonia arbuscula* 59; *C. furcata* 5,6,63; *C. rangiferina* 59; *Dryopteris dilatata* 13,19,22(1),30,60(1),76,77; *Galium rotundifolium* 15,36,43(1),47; *Juniperus communis* b 2,4,20,33,38(1),58,63, bc 29(1), c 2,3,31,38,63; *Lycopodium clavatum* 48,72,80; *Orthilia secunda* 3(1),22,23,43; *Plagiothecium curvifolium* 8,22(1),30(1),50,69,75,76(1),77,79(1),80; *Ptilium crista-castrensis* 13(2); *Pyrola rotundifolia* 42; *Rubus saxatilis* 20,58; *Thuidium tamariscinum* 54(2),61,62(1); **III.** *Dicranella heteromalla* 13,30,34,39,41,55,75; *Hieracium lachenalii* 3,12,31,36,42,51,64,66,67,72; *H. laevigatum* 3(r),37,60; *H. sabaudum* 18,26; *Holcus mollis* 12,19(1),21,31(1), 32,53,60,70,71,76(1),81,82; *Lophocolea heterophylla* 30(2),54(1),55(2),80; *Mnium hornum* 55(1),62; *Plagiothecium denticulatum* 20; *P. laetum* 16,34,51; **IV.** *Carex ericetorum* 2,4,5,8,20,59,63(1); *C. ovalis* 48,60; *C. pallescens* 19,22,38,64; *Cladonia chlorophaea* 7; *Danthonia decumbens* 3,4,20,29,60; *Hieracium pilosella* 2,3,4,5,6,31(2),63; *Hypnum jutlandicum* 2,4,5(2),6(1),63(1); *Ptilidium ciliare* 4,13,39,63(1); *Scabiosa canescens* 4; *Scorzonera humilis* 18; *Solidago virgaurea* s.s. 12,18,32,34,36,52,54; *Veronica officinalis* 21,23(1),29,41,44; *Viola canina* 4,27; **V.** *Abies alba* a1 55(2), a2 55(1),62(1), c55(1); *Acer platanoides* b 4, c 3,4,20,22,56; *A. pseudoplatanus* a2 3(1),6(1),22(2), b 3(1),4,5,15(1),22,47,80(2), bc 23, c 3,15,22,42,44,79,80; *Agrostis gigantea* 31; *A. vinealis* 4,6; *Ajuga reptans* 61; *Amelanchier ovalis* bc 6; *Anemone nemorosa* 14(1),19,51(r),52(1),57; *Anthericum ramosum* 4; *Anthoxanthum odoratum* 12(1),18(1),21,24,28,29,31,36,38,43, 44,51,53; *Arrhenatherum elatius* 4,21(1),63; *Artemisia campestris* 63; *Athyrium filix-femina* 14; *Atrichum tenellum* 55; *A. undulatum* 21,30,37,39,40,61,68,75,80; *Brachypodium sylvaticum* 75,77(2); *Brachytheciastrum velutinum* 30,40; *Brachythecium rutabulum* 64,65(1); *Campanula rotundifolia* 4,12,18,34,72; *Carex digitata* 52,55,61,62,78,80; *C. divulsa* 54,55(1); *C. hirta* 32; *C. nigra* 16,19,48; *C. vulpina* 76; *Carpinus betulus* a2 53,80(1), b 26(3),32(r),46,53, c 26,32(r),48,49,50,76; *Cerasus avium* b 3, c 5(r); *Chamaenerion angustifolium* 15,21,43,55; *Chondrilla juncea* 63; *Cladonia digitata* 49; *Convallaria majalis* 1,7,9(1), 11,17,24,25,26,28,34(2),46(1),49,56(2),57; *Corylus avellana* b 4(r), c 3; *Corynephorus canescens* 27,28(1),56; *Crataegus laevigata* b 53,56(r), c 53; *C. monogyna* b 77; *Deschampsia caespitosa* 35; *Dianthus carthusianorum* 29; *Dryopteris filix-mas* 14,22,43; *Euonymus europaea* c 50; *Euphorbia cyparissias* 63; *Festuca gigantea* 77(1); *Festuca pallens* 4,5, 63(3); *F. rubra* s.s. 6,16,31(2),76; *F. trachyphylla* 63(2); *Fragaria vesca* 29,30,52,62; *Galeopsis pubescens* 3(r),4,5,26,30,80; *G. tetrahit* 14,18,60; *Galium boreale* 58; *G. verum* 63; *Geranium robertianum* 22; *Hieracium murorum* 2,3,18,43,51,60,81,82; *Hypericum perforatum* 21,31,32,43,53,76,77; *Hypnum cupressiforme* 6,12,15,21,34,37,43,44,50,59(1),61,64,65(1),73, 79(1),82; *Impatiens parviflora* 15,19,22,30,47,56,76,77(2); *Koeleria glauca* 63; *Lapsana communis* s.s. 61; *Larix decidua* subsp. *decidua* a1 14(2), a2 14(1), bc 43, c 21; *Lathyrus niger* 77; *Lophocolea bidentata* 54; *Luzula luzuloides* 78; *L. multiflora* 17,21(1),23,44,66,67,72,78; *Lysimachia vulgaris* 10,54(1),61; *Malus sylvestris* c 20,34; *Medicago lupulina* 63; *Melica nutans* [Q-F] 19,38,61(1),76; *Milium effusum* 56,80(1); *Moehringia trinervia* 18,19,37,43(1),51(1),56,60,61,76, 77(1),80; *Musci* indet. 4; *Mycelis muralis* 22,48,51,53,61; *Orthodicranum montanum* 22; *Padus serotina* a2 20(1), b 12(2),20,44, c 20,43,66,67,69; *Plagiomnium affine* 4,22,40,44,51,52,54(2),61(1),62(2),63,77(1),80(1); *P. cuspidatum* 37,44; *P. elatum* 54,55(2); *P. rostratum* 15,36,37; *Poa nemoralis* 48(1),49; *Pohlia lescuriana* 55; *Polygonatum multiflorum* 45; *P. odoratum* 38,51,77; *Polytrichum juniperinum* 5,13; *Populus tremula* a1,a 29(1),44(2), a2 38(1),44(1),52(1), b 33(r),38(2), 52(1), c 19,21,29(1),38(1),42,44,47; *Potentilla reptans* 54; *Pyrus pyrausta* b 4(r); *Quercus rubra* a1 80, a2 2,3(1),4(1),20(2), b 65, bc 2,3(1),4,5,36, c 44; *Ranunculus auricomus* 55; *Rhizomnium punctatum* 54; *Ribes uva-crispa* 56; *Robinia pseudacacia* 44; *Rosa* sp. 77; *Rubus caesius* 10,11; *R. cfr. hirtus* 15,22(1),30,76,77(1),80(2); *R. grabowskii* 5,6; *R. gracilis* 4,52; *R. idaeus* 5(r)12(r),15, 19,22,30, 31(1),43,47,51(1),53,56,76,77(1),79,80; *R. nessensis* 54; *R. plicatus* 51,52,57(2); *R. schleicheri* 5,6; *Rubus* sp. 12,19,22, 42,45,47(3),48,53(2),60(3),69,77(1),80; *R. sprengelii* 6,52(1); *Rumex acetosella* 3,4,5(1),6,16,21, 22,31(1),51,60,73,74,76; *Sambucus nigra* 51; *S. racemosa* 20; *Sarothamnus scoparius* 36; *Sciuro-hypnum oedipodium* 12,63(2),77,80(1); *Scrophularia nodosa* 40; *Sedum maximum* 51; *Senecio sylvaticus* 58,60,63; *S. vernalis* 55; *S. vulgaris* 61; *Stellaria graminea* 55; *S. media* 22,43,68,76; *Ulmus laevis* b 3; *Veronica chamaedrys* 34; *Vicia cassubica* 63(1); *Viola riviniana* 38; *Viscum album* subsp. *album* a 74,81.

Table A33. *Quercus roboris*-*Pinetum coryletosum*

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	
ID-1		7	19	43	43	22	22	52	16	7	43	43	43	43	43	43	22	22	22	22	22	22	43	43	46	43	48	48	19	43	43	7	7	19	52	19	48	35	48	43	43	48	48	2	37	48	1	1	
ID-2		1	2	7	7	5	5	16	21	1	7	7	7	7	7	7	5	5	5	5	5	7	7	3	7	3	3	2	7	7	1	1	2	16	2	3	20	3	7	7	7	3	3	7	14	5	3	3	
ID-3		11	10	9	2	3	5	16	5	14	3	4	5	8	18	6	9	8	1	6	2	11	16	16	7	6	8	4	12	14	13	10	5	24	2	13	12	4	15	1	17	10	12	2	6	1	13	12	
Date (year)		1976	1983	1980	1989	1961	1973	1971	1994	1959	1961	1969	1969	1969	1958	1959	1961	1961	1961	1961	1969	1960	1960	1960	1960	1960	1976	1976	1977	1977	1969	1969	1977	1983	1983	1976	1976	1976	1976	1976	1976	1986	1986	1976	1990	1990			
Density of tree layer	a1,a [%]	50	50	70	70	80	70	50	90	60	85	75	70	80	80	70	60	80	70	60	80	70	80	70	80	75	80	70	70	50	60	70	70	40	70	50	60	70	70	80	70	60	80	80	60	40	20		
Density of tree layer	a2 [%]	-	40	-	-	-	-	20	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Density of shrub layer	b [%]	30	30	50	50	30	60	-	10	50	30	50	60	60	50	25	50	10	10	40	20	40	60	60	10	5	-	-	20	25	+	10	25	50	20	20	20	20	20	20	20	20	20	20	20	20	10	15	
Cover of herb layer	c [%]	50	50	80	80	80	70	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	
Cover of moss layer	d [%]	75	50	40	40	90	80	80	70	90	40	60	50	50	50	40	50	70	80	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	
Area of relevé		120	400	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	200	400	
Location (ATPOL)		CD77	DD93	DD93	BC89	BC89	BC89	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32	CD32		
Total number of species		32	29	36	49	20	29	19	51	35	32	38	37	41	32	30	22	25	36	29	28	29	36	43	29	36	24	14	27	34	42	29	36	23	15	24	20	24	18	30	35	31	20	27	23	27	23	24	33
Number of mosses, liverworts and lichens species		5	2	4	5	4	9	7	6	6	2	3	5	3	2	3	6	4	6	7	5	2	4	5	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
I. D. <i>Quercus roboris</i>-<i>Pinetum</i>																																																	
<i>Pinus sylvestris</i> (V-P)	a1,a	3	3	4	4	4	4	3	5	3	5	4	4	5	5	4	3	3	3	4	4	4	5	5	3	3	2	3	3	4	3	3	4	3	3	2	3	5	5	3	4	4	2	4	3	2		100	
<i>Pinus sylvestris</i> (V-P)	a2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pinus sylvestris</i> (V-P)	b,bc^	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pinus sylvestris</i> (V-P)	c	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pleurozium schreberi</i> (V-P)		4	3	3	3	5	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
<i>Vaccinium vitis-idaea</i> (V-P)		1	2	2	1	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pseudoscleropodium purum</i> (V-P)		1	1	2	1	2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Dicranum polysetum</i> (V-P)		1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Hylacomium splendens</i> (V-P)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Calluna vulgaris</i> (C-U)		1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Leucobryum glaucum</i> (V-P)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
II. D. <i>Quercus roboris</i>-<i>Pinetum coryletosum</i>																																																	
<i>Convallaria majalis</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Fragaria vesca</i> (T-G)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Rubus saxatilis</i> (V-P)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Moehringia trinervia</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Veronica officinalis</i> (C-U)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Melica nutans</i> (Q-F)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Viola canina</i> (C-U)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Solidago virgaurea</i> s. s. (C-U)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Veronica chamaedrys</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Galium boreale</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Hieracium pilosella</i> (C-U)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Euphorbia cyparissias</i> (F-B)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Galium mollugo</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Hypericum perforatum</i> (T-G)		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Carex hirta</i>		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Peucedanum oreoselinum</i> (T-G)		+	+	+	+																																												

Sporadic species: III.: *Betula pubescens* subsp. *pubescens* c 11,28,39; *Chimaphila umbellata* 11,39; *Cladonia furcata* 9,19; *Galium rotundifolium* 28,36,44; *Juniperus communis* b 2,8,27(1),46, bc 9, c 2,27(1),46(r); *Picea abies* a1,a 43; a2 2(1),8(1),32(2), b 2(1),8(1),10,15,21,27(1),32(2),39, c 2,23,27(1),32,36,39,42; *Plagiothecium curvifolium* 7,31; *Ptilium crista-castrensis* 7(1),22,24; *Pyrola minor* 41; *P. rotundifolia* 10; *Viscum album* subsp. *austriacum* a 47; **IV.:** *Carex pilulifera* 1,2,8,25,32,34(1),36,44(1); *Hieracium lachenalii* 2,34; *H. laevigatum* 23; *Holcus mollis* 8,13,16,34,40,44; *Lathyrus montanus* 8(1); *Lophocolea heterophylla* 23; **V.:** *Carex ericetorum* 9; *C. ovalis* 23,31; *C. pallescens* 2,34; *Cladonia chlorophaea* 16,19; *C. pyxidata* 6; *Danthonia decumbens* 9,13,22,47; *Genista tinctoria* 4; *Hypnum jutlandicum* 46; *Scorzonera humilis* 2,4,6,16,18,25,27; **VI.:** *Abies alba* a2 2(2), b 2(1), c 2,34; *Acer platanoides* a2 47(1), b 47, c 14,41,42,47(r); *A. pseudoplatanus* b 47, c 36(1),45; *Achillea millefolium* 3,4,11,22,39,43; *Agrostis gigantea* 45(2); *Ajuga reptans* 8,21; *Anemone nemorosa* 27,30(2),31(2),32(1),34; *Arrhenatherum elatius* 10(1),13,14(2),22,24(2); *Athyrium filix-femina* 44; *Brachypodium sylvaticum* 29; *Campanula patula* s.s. 38; *C. rapunculoides* 8; *Carex digitata* 8(3),29,31; *Carex* sp. 18; *Cerastium arvense* 11; *C. semidecandrum* 8,28; *Cerastium* sp. 18; *Cerasus avium* 47; *Ceratodon purpureus* 12,18,38; *Chamaenerion angustifolium* 22,30,46; *Cladonia macilenta* 6; *Clinopodium vulgare* 14; *Corylus avellana* b 47; *Crataegus laevigata* b 31; *C. monogyna* b 21, c 22; *Cruciata glabra* 8; *Dactylis glomerata* 3,45(1); *Deschampsia caespitosa* 31(1),33; *Dianthus carthusianorum* 3; *Dryopteris filix-mas* 13,14,15,21,40; *Euonymus europaea* b 9; *Eurhynchium angustirete* 20; *Fagus sylvatica* b 12, c 35,41,42; *Fallopia convolvulus* 22; *Festuca heterophylla* 4(2),28,29(1),38(1),39; *F. rubra* s. s. 25,31; *Fraxinus excelsior* c 28; *Galeopsis pubescens* 1,22,41,44; *G. tetrahit* 9(r),13,19,21,23,45(1); *Galium album* 31; *G. sylvaticum* 14,21; *G. verum* 12,22; *Geranium sanguineum* 18; *Hieracium* sp. 42; *Hypericum montanum* 4,8,38; *Hypnum cupressiforme* 1(1),33,37; *Impatiens parviflora* 44; *Knautia arvensis* 4,8,13; *Lilium martagon* 35(r),42; *Linaria vulgaris* 8,11,21,29; *Lophocolea bidentata* 23; *Luzula multiflora* 9,20,25; *Lysimachia vulgaris* 31; *Maianthemum bifolium* 1(1),30,34(2),36,42(1),45(1); *Malus sylvestris* b 31, c 25; *Molinia caerulea* 35(1); *Padus avium* b 47; *Pimpinella saxifraga* 4(1),13,14,18,43; *Plagiomnium affine* 4,25,27,31(1); *Poa angustifolia* 25(1),30(1),35(1),37,45; *P. nemoralis* 8,13,40,43(1); *P. pratensis* 11(1),39,40; *Polypodium vulgare* 9(2),22; *Polytrichum juniperinum* 7,8,44; *Populus tremula* a1,a 8, a2 8, b 1,8,9(1),30, c 1(1),9(1),27,30; *Potentilla alba* 4,29; *P. erecta* 4(1),27,29; *Pyrus communis* b 12,24,40, c 17; *P. pyraister* b 47, bc 9; *Quercus rubra* a2 47(2), bc 1,47; *Q. x rosacea* a 25(4),26(3),37(4),42(3), a2 35(3),41(3), c 25,26(1),35(1),37(1),41(1),42,45(1); *Ranunculus repens* 43(1); *Rhamnus cathartica* 42; *Rosulabryum capillare* 29; *Rubus caesius* 18,33,42; *R. grabowskii* 47; *R. gracilis* 30,31; *R. plicatus* 1,9,31,47; *Rubus* sp. 2(1),21,34,36; *R. sprengelii* 9; *Salix caprea* c 30; *Sarothamnus scoparius* c 13,22; *Sciuro-hypnum oedipodium* 1,25,30; *Scrophularia nodosa* 3,24; *Senecio sylvaticus* 8,29,39; *Silene nutans* subsp. *nutans* 11,40; *S. otites* 8; *Stellaria graminea* 14,24,43; *S. media* 43(1); *Thymus serpyllum* 3,4,11,15,19; *Trifolium alpestre* 11; *Urtica dioica* 10,14,21,22(r),24; *Vicia cassubica* 4(1),11,21; *Vicia sepium* 4,11,28; *Vicia* sp. 29; *Viola reichenbachiana* et *rinviniana* 42,44; *V. rinviniana* 2,23,27,34; *Viola* sp. 19; *Viscum album* subsp. *album* a 44.

Table A34. *Quercus roboris*-Pinetum - mixed form of *Qr-P molinietosum* and *Qr-P coryletosum*

Successive number of relevé		1	2	3	4	5	6	7
ID-1		51	22	1	7	1	1	1
ID-2		2	5	3	1	3	3	3
ID-3		7	7	1	3	8	4	10
Date (year)		1981	1961	1990	1982	1990	1990	1990
Density of tree layer	a1,a	70	70	25	60	30	30	25
Density of tree layer	a2	-	-	70	50	35	15	30
Density of shrub layer	b	5	30	15	15	10	10	40
Cover of herb layer	c	70	80	40	70	40	50	55
Cover of moss layer	d	40	90	10	10	25	65	30
Area of relevé		200	350	120	200	150	100	150
Location (ATPOL)		CD83	CD32	BD18	CD35	BD18	BD18	BD18
Total number of species		38	23	28	35	40	32	40
Number of mosses, liverworts and lichens species		7	7	6	3	9	7	7
I. D. <i>Quercus roboris</i>-Pinetum								
<i>Pinus sylvestris</i> (V-P)	a1,a	4	4	2	4	3	3	2
<i>Pinus sylvestris</i> (V-P)	a2	+	.	.	1	.	.	.
<i>Pinus sylvestris</i> (V-P)	b;bc ^A	.	+ ^A	.	+	.	.	.
<i>Pinus sylvestris</i> (V-P)	c	+	.	.	.	+	+	+
<i>Pleurozium schreberi</i> (V-P)		3	5	+	2	2	2	2
<i>Pseudoscleropodium purum</i> (V-P)		+	2	+	1	+	.	1
<i>Dicranum polysetum</i> (V-P)		1	1	.	.	+	+	+
<i>Vaccinium vitis-idaea</i> (V-P)		.	2	.	1	1	1	2
<i>Calluna vulgaris</i> (C-U)		.	1	.	.	+	.	.
<i>Hylocomium splendens</i> (V-P)		.	1	.	.	.	.	.
II. Ch. <i>Vaccinio-Piceetea</i> (V-P)								
<i>Vaccinium myrtillus</i>		3	4	3	4	3	+	2
<i>Dicranum scoparium</i>		.	.	.	.	+	2	+
<i>Trientalis europaea</i>		1	.	.	1	.	.	.
III. D. <i>Quercus roboris</i>-Pinetum molinietosum								
<i>Quercus robur</i>	a2	+	.	3	1	2	2	2
<i>Quercus robur</i>	b	.	3	+	.	+	1	3
<i>Quercus robur</i>	c	+	2	+	+	+	+	+
<i>Frangula alnus</i>	b	.	.	+	+	+	.	1
<i>Frangula alnus</i>	c	+	.	+	.	+	.	+
<i>Molinia caerulea</i>		+	1	+	1	+	+	2
<i>Lysimachia vulgaris</i>		+	.	.	.	.	.	.
IV. D. <i>Quercus roboris</i>-Pinetum coryletosum								
<i>Convallaria majalis</i>		.	2	+	.	.	3	2
<i>Rubus saxatilis</i> (V-P)		.	+	+	.	+	.	1
<i>Fragaria vesca</i>		+	.	.	1	.	.	.
<i>Veronica officinalis</i> (C-U)		+	.	.	.	.	.	+
<i>Viola canina</i> (C-U)		+	.	.	.	+	.	.
<i>Hypericum perforatum</i>		+	.	.	.	.	.	.
<i>Polygonatum odoratum</i>		+	.	.	.	.	.	.
<i>Hieracium pilosella</i> (C-U)		.	.	r	.	+	.	.
<i>Moehringia trinervia</i>		.	.	.	+	+	.	.
<i>Solidago virgaurea</i> s. s. (C-U)		.	.	.	+	.	.	.
<i>Peucedanum oreoselinum</i>		.	1	.	.	.	.	.
<i>Galium boreale</i>		.	.	.	.	.	.	+
V. Ch., D.* <i>Quercetea robori-petraeae</i>								
* <i>Melampyrum pratense</i>		+	2	+	+	2	2	1
<i>Festuca ovina</i>		2	3	.	1	2	2	+
* <i>Polytrichastrum formosum</i>		1	1	2	.	+	+	1
<i>Calamagrostis arundinacea</i>		.	3	.	.	+	1	+
* <i>Pteridium aquilinum</i>		3	4	.	1	.	.	.
<i>Hieracium lachenalii</i>		+	.	.	.	+	+	.
<i>Carex pilulifera</i>		+	.	.	+	.	.	.
VI. Ch. <i>Calluno-Ulicetea</i> (C-U)								
<i>Pohlia nutans</i>		+	+	.	.	+	+	.
<i>Hypnum jutlandicum</i>		.	.	+	.	+	2	.
<i>Danthonia decumbens</i>		.	.	.	.	+	+	.
<i>Agrostis capillaris</i>		+	.	.	.	.	+	.
VII. Others								
<i>Acer platanoides</i>	a2	.	.	2	.	.	.	+
<i>Acer platanoides</i>	b/c	.	.	1/+	.	1/+	1/+	1/+
<i>Betula pendula</i>	a1,a	+	.	.	.	.	.	.
<i>Betula pendula</i>	a2	.	.	1	3	.	+	1
<i>Betula pendula</i>	b/c	1/+	.	1/+	+/	1/+	+/+	+/
<i>Sorbus aucuparia</i>	a2 [a]	.	.	1	1	1	2	+
<i>Sorbus aucuparia</i>	b [bc]	.	[+]	.	2	+	1	1
<i>Sorbus aucuparia</i>	c	+	.	+	+	+	+	+
<i>Populus tremula</i>	a2	+	.	.	+	.	.	.
<i>Populus tremula</i>	b/c	1/+	.	2/+	+/	1/+	.	.
<i>Galeopsis pubescens</i>		.	.	r	.	r	+	r
<i>Plagiomnium affine</i>		.	.	+	.	1	+	1
<i>Sciuro-hypnum oedipodium</i>		.	.	+	+	2	.	1
<i>Chamaenerion angustifolium</i>		.	.	r	+	.	.	+
<i>Luzula pilosa</i>		+	1	.	+	.	.	.
<i>Rubus idaeus</i>		+	.	.	+	.	.	r
<i>Calamagrostis epigejos</i>		+	.	.	+	.	+	.
<i>Anthoxanthum odoratum</i>		+	.	.	+	+	.	.
<i>Rumex acetosella</i>		+	.	.	.	+	+	.

Sporadic species: II.: *Juniperus communis* b 7, c 7; *Picea abies* b 1; *Orthilia secunda* 7; *Lycopodium annotinum* 4(2); V.: *Holcus mollis* 1; *Hieracium laevigatum* 5; *Plagiothecium laetum* 1; VI.: *Scorzonera humilis* 5,7; *Carex ericetorum* 6; *Cladonia coniocraea* 2; VII.: *Quercus petraea* a2 3(1),7, c 5; *Acer pseudoplatanus* a 2 7; *Anemone nemorosa* 4(1); *Dryopteris carthusiana* 1; *Deschampsia flexuosa* 3; *Campanula rotundifolia* 5; *Ajuga reptans* 4; *Arrhenatherum elatius* 5(1); *Cerasus avium* a2 4, b 7, bc 4, c 5,7; *Carpinus betulus* c 2(1); *Corylus avellana* b 3(1), c 6; *Maianthemum bifolium* 1(1); *Crataegus monogyna* b 4,7; *Deschampsia caespitosa* 4; *Fagus sylvatica* a1 6(1), a2 6(1); *Festuca pallens* 5; *Festuca rubra* s.s. 4; *Galeopsis tetrahit* 1; *Hieracium murorum* 6; *Hypochoeris radicata* 6; *Lophocolea bidentata* 1; *Malus sylvestris* c 3(r),7; *Padus avium* a2 3, b 7, c 3; *P. serotina* a2 3,6, b 6,7(1), c 3,6,7; *Quercus rubra* a2 5(2),7(1), bc 5,7; *Ribes spicatum* bc 4; *Robinia pseudacacia* b 7; *Rubus corylifolius* 3,7; *R. gracilis* 4; *Serratula tinctoria* 4; *Tilia cordata* c 6.

Table A35. Substitute forest communities from the *Vaccinio-Piceetea* class

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33				
ID-1		51	35	55	35	52	52	52	52	51	55	35	35	54	46	52	35	39	39	56	46	46	35	36	52	36	46	46	56	46	46	17	43	46				
ID-2		2	20	17	29	16	16	16	2	16	20	29	11	3	12	29	28	28	3	3	29	17	16	17	3	3	3	3	3	3	9	7	3					
ID-3		18	5	7	12	7	13	15	14	1	19	18	7	4	17	2	8	1	6	27	10	11	2	25	23	19	2	12	22	3	1	14	10	19				
Date (year)		1980	1976	1994	1976	1973	1973	1973	1981	1978	1976	1975	1975	1954	1973	1976	1992	1992	2006	1954	1954	1975	1985	1973	1985	1955	1954	2006	1955	1955	1996	1959	1954					
Density of tree layer	a1,a [%]	55	70	80	60	60	60	70	70	30	30	55	40	75	50	60	50	60	40	60	60	80	60	65	80	70	50	50	65	80	70	45	70	60				
Density of tree layer	a2 [%]	30	20	-	-	-	-	-	-	-	-	5	5	-	60	-	+	-	50	-	-	+	15	-	5	85	60	-	-	-	-	-	-					
Density of shrub layer	b [%]	-	+	20	5	50	+	-	+	30	+	30	50		10	-	50	-	20	10	15	+	+	+	50	70	10	10	+	15	5	10	50	10				
Cover of herb layer	c [%]	80	95	50	-	100	80	80	90	80	60	65	65	40	70	5	90	65	85	15	40	20	40	60	40	50	20	90	75	85	5	30	30	60				
Cover of moss layer	d [%]	+	+	-	+	30	50	80	75	40	60	35	20	40	+	70	+	20	15	40	80	40	20	20	75	5	30	30	40	40	50	10	50	30	30			
Area of relevé		100	100	200	100	200	200	220	180	100	100	200	100	100	100	1000	120	100	500	400	400	900	600	100	900	150	900	800	1000	300	1500	1000	150	250	1200			
Location (ATPOL)		CD84	CE11	BC84	CE11	CD02	CD02	CD02	CD02	CD84	BC72	CE11	CE00	BC81	CC92	CD73	CE11	BE15	BE15	BC86	CC92	CC92	CE00	CE11	CD02	BE28	CC92	CC92	BC76	CC92	CC92	BC86	BC99	CC92				
Total number of species		14	28	16	18	18	16	20	19	24	13	27	15	13	16	17	18	27	26	38	18	15	17	33	19	31	22	18	43	30	36	31	40	31				
Number of mosses, liverworts and lichens species		1	2	-	4	4	4	6	2	6	2	4	2	6	2	4	1	9	3	4	3	3	3	5	2	4	2	3	5	3	4	3	3	4				
I. Ch. <i>Vaccinio-Piceetea</i> (V-P)																																						
<i>Pinus sylvestris</i>	a1,a;a2^	3	4	+	4	3	4	4	4		3	3	3	4		3	4	3;1^	4	4	4	4	2	3	4	3	4	4	4	5	3	4	4					
<i>Pinus sylvestris</i>	b/c								2/1	+/		+/	+/		+/									1/+				1/+	1/+				1/+					
<i>Picea abies</i>	a2;a1^	3;1^	1	3									+											1														
<i>Picea abies</i>	b/c	3/+	+/+	1/+	1/				1/+	1/+	+/+	2/				1/+	1/	2/		1/+				1/+														
<i>Pleurozium schreberi</i>		.	+	.	+	2	4	4	4	3	3	3	2			+	+	2	+				2	2	5	1	+	.	+	2	+	2	2	3				
<i>Vaccinium myrtillus</i>		1	1	2	+	2	1	1	2	1	.	2	+		2	+	+	1	2	+	2	3	3	4	3	5	3	1	2	+	.	2	2					
<i>Pseudoscleropodium purum</i>		.	.	.	.	1	2	3							2	+				4	3	3					+	3	3	1	+	2	2	+				
<i>Dicranum scoparium</i>		.	.	.	.	.	.	.	1	.				3	.	1	.	+					+	+	+	.	.	.	.	.	.	.	.					
<i>Vaccinium vitis-idaea</i>		.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.					
<i>Dryopteris dilatata</i>		.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.					
<i>Dicranum polysetum</i>		.	.	.	.	.	.	.	.	3	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	r	.	.					
<i>Hylocomium splendens</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.	.	.	.	+					
II. D. <i>Quercroboris-Pinetum molinietosum</i>																																						
<i>Frangula alnus</i>	b	.	.	2	4	+	.	.	.	.	+	.	.	+	.	1	1	1	+	+	+	+	1	+	1	+	.	.	.	.	.	.	.					
<i>Frangula alnus</i>	c	1	+	+	.	.	2	+	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	+	+	+	.	+	+	+	.	.	+					
<i>Trientalis europaea</i> (V-P)		2	+	+	+	.	.	1	1	+	.	1	.	.	.	.	.	.	.	+	.	.	.	1	1	.	+	+	.	+	+	.	.					
<i>Lysimachia vulgaris</i>		1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.					
<i>Molinia caerulea</i>		+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.					
III. D. <i>Quercroboris-Pinetum coryletosum</i>																																						
<i>Moehringia trinervia</i>		.	1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	+	.	.	.	.	.	.	.	+	.	r	+	+	+	1	+				
<i>Hypericum perforatum</i> (T-G)		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	+	.				
<i>Fragaria vesca</i> (T-G)		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	r	+	.	.	1	+				
<i>Veronica officinalis</i> (C-U)		.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	1	.				
<i>Carex hirta</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	2	.				
<i>Euphorbia cyparissias</i> (F-B)		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r				
<i>Galium mollugo</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+				
<i>Rubus saxatilis</i> (V-P)		.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.			
<i>Galium boreale</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.				
<i>Veronica chamaedrys</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+				
IV. Ch., D.* <i>Quercetea robori-petraeae</i>																																						
* <i>Polytrichastrum formosum</i>		.	+	.	.	2	2	1	+	.	1	+	.	+	3	.	+	.	.	+	+	.	1	.	.	.	+	.	.	+	+	+	.	+				
* <i>Pteridium aquilinum</i>		4	4	3	4	5	+	.	.	.	.	.	.	.	+	.	.	+	.	2	.	.	2	2	.	.	.	.	.	3	.	.	.					
<i>Festuca ovina</i>		.	+	.	.	.	.	.	.	.	3	4	.	.	3	+	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.					
<i>Calamagrostis arundinacea</i>		.	.	.	.	4	5	5	5	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+				
<i>Carex pilulifera</i>		.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.					
* <i>Melampyrum pratense</i>		.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	1	.	.	.	.					
<i>Holcus mollis</i>		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.					
V. Ch. <i>Quercro-Fagetea</i>																																						
<i>Carpinus betulus</i>	a1,a;a2	.	1^	.	.	.	.	.	.	.	.	.	.	2^	.	4	.	.	.	.	.	.	+	1^	.	.	2	1^	.	.	.	.	.					
<i>Carpinus betulus</i>	b/c	.	+/	.	+/	+/	.	.	1/	.	.	1/+	.	+/	.	.	.	.	.	+/	.	.	+/	+/	+/	+/	+/	+/	+/	+/	+/	.	1/					
<i>Fagus sylvatica</i>	a2;a1^	.	.	.	.	.	.	.	.	.	1;1^	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.					
<i>Fagus sylvatica</i>	b/c	.	.	.	+/	.	.	.	.	.	2/+	2/	.	.	.	.	.	.	1/+	.	.	.	.	+/	.	.	.	+/	.	+/	.	1/	.					
<i>Viola reichenbachiana</i>		.	+	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	r	+	.	+					
VI. Ch. <i>Calluno-Ulicetea</i> (C-U)																																						
<i>Agrostis capillaris</i>	c	.	.	.	+	.	.	.	.	+	.	2	.	.	.	.	+	.	+	.	+	.	.	.	.	+	.	.	.	+	+	2	+	1				
<i>Pohlia nutans</i>	d	.	.	.	+	.	.	+	.	+	.	.	1	.	2	.	+	+	.	+	.	.	.	+	.	.	.	.	.	+	.	.	.					
VII. Others																																						
<i>Quercus petraea</i>	a1,a	.	.	.	.	+	.	.	.	.	.	.	2	.	4	.	.	.	.	.	.	.	.	2	.	.	.	o	.	.	.	.	.					
<i>Quercus petraea</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	1	.	.	.	.	.	.	.					
<i>Quercus petraea</i>	bc^;b/c	.	.	.	+/	+/	1/	1/	.	.	1^	1/	1/	.	.	.	.	.	.	+/	.	.	.	1/	3/	.	+/	.	.	.	1/	.	.					
<i>Quercus robur</i>	a1,a	.	1	3	.	.	.	.	3	+	.	.	.	.	.	.	.	2	.	.	.	.	.	2	3	1	.	.	.	.	.	.	.					
<i>Quercus robur</i>	a2	.	2	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	3	.	.	.	+	1	.	1	2	1	.	.	.	.	.					
<i>Quercus robur</i>	b/c	.	+/	1/	.	.	.	.	.	1/+	.	.	.	+/	+/	+/	+/	+/	+/	+/	+/	+/	1/	2/+	3/+	+/	1/	1/	1/	1/	.	1/	1/					
<i>Betula pendula</i>	a1,a;a2	.	.	1/	+/	.	.	.	.	3/	1/	.	.	.	.	.	.	.	1/	.	.	.	.	.	.	.	.	.	+/	+/	.	1/	.	1/				
<i>Betula pendula</i>	b/c	.	.	.	1/	1/	1/	1/	.	1/+	.	1/	.	1/	.	1/	.	1/	.	1/	.	1/	.	.	+/	.	+/	+/	.	.	.	.	+/					
<i>Sorbus aucuparia</i>	b	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	+	.	+	1	+	.	.	2	+	.	.	.	.	+	.	3	+					
<i>Sorbus aucuparia</i>	c	.	.	+	+	.	1	1	+	.	.	.	.	.	+	+	+	+	+	+	+	.	.	1	.	+	+	+	+	+	+	1	+					
<i>Dryopteris carthusiana</i>		.	+	+	+	2	+	+	.	.																												

Explanations: F-B - *Festuco-Brometea* ; T-G - *Trifolio-Geranietea*

Sporadic species: I.: *Cladonia furcata* 13; *Galium rotundifolium* 2; *Leucobryum glaucum* 15(3),17,18; *Lycopodium clavatum* 9(1); *Orthilia secunda* 32; *Plagiothecium curvifolium* 23,25; *Thuidium tamariscinum* 11; IV.: *Dicranella heteromalla* 22; *Hieracium lachenalii* 9(1),11,19; *H. umbellatum* 10; *Luzula pallescens* 22; *Plagiothecium denticulatum* 17(2); V.: *Acer campestre* c 29; *A. platanoides* b 16, c 16,19,23; *A. pseudoplatanus* b 11,16(1),23, c 8,11,16,23,28; *Anemone nemorosa* 31; *A. ranunculoides* 30,33; *Brachypodium sylvaticum* 11,18; *Campanula persicifolia* 33; *Dryopteris filix-mas* 12,19(1),25,28; *Festuca gigantea* 26; *Hedera helix* 5; *Hypericum montanum* 32; *Impatiens noli-tangere* 1; *Melica nutans* 32; *Milium effusum* 1,2,26,29,30(1); *Padus avium* b 19(r); *Poa nemoralis* 15,18,22,24,28; *Ribes uva-crispa* c 28; *Stachys sylvatica* 30; *Stellaria holostea* 21(1),26,29(r),33; *Viola riviniana* 19,28,31; VI.: *Calluna vulgaris* 10(1); *Carex ovalis* 30; *C. pallescens* 26,30; *Cladonia coniocraea* 13; *Genista tinctoria* 9(2); *Hieracium pilosella* 10(1),19,29(r),32; *Luzula multiflora* 15; *Polytrichum juniperinum* 9(1); VII.: *Achillea millefolium* 9; *Agrostis gigantea* 7(1),8(1); *A. stolonifera* 15; *Alnus glutinosa* a2 26; *Arrhenatherum elatius* 19(1),32; *Astragalus glycyphyllos* (TG) 31; *Athyrium filix-femina* 25,33; *Brachythecium rutabulum* 17; *Calystegia sepium* 30; *Campanula rotundifolia* 28,29,30,31; *Carex caryophyllea* (FB) 15(1); *C. nigra* 33; *Chamaenerion angustifolium* 17,23; *Cladonia* sp. 9; *Convallaria majalis* 8(1),18,24,31,32; *Corylus avellana* b 14,29,31(1), c 14; *Crataegus monogyna* b 32; *C. rhipidophylla* var. *rhipidophylla* 28, c 19(r),28(r); *Dactylis glomerata* 30,32,33; *Deschampsia caespitosa* 2; *Fallopia convolvulus* 28(r),31; *Festuca rubra* s.s. 9(1); *Filipendula vulgaris* 31; *Galeopsis pubescens* 3(r),19,23; *G. tetrahit* 18,19,28(r),29,30,32; *Galium verum* 31; *Glechoma hederacea* 30; *Hieracium murorum* 9,32; *Holcus lanatus* 19; *Humulus lupulus* 19; *Hypnum cupressiforme* 4,13(1),17(1),25; *Hypochoeris radicata* 19(r); *Impatiens parviflora* 2,3(r),17,18,23,25; *Larix decidua* subsp. *decidua* a 28,33; *Leontodon autumnalis* 19(r); *Linaria vulgaris* 28(r); *Mycelis muralis* 2,22,28,29,30,32(1); *Oxyrrhynchium hians* var. *hians* 5(3),7; *Padus serotina* b 19(2),28, c 18,19,25,28(r); *Pimpinella saxifraga* 28; *Plagiomnium ellipticum* 11; *Poa pratensis* 32; *Polygonatum odoratum* 18,24,31; *Polypodium vulgare* 13(1),24(1); *Populus nigra* b 9, c 9(1); *P. tremula* b 14, c 23; *Prunus spinosa* c 28,31; *Pyrus pyraister* c 28(r); *Quercus x rosacea* c 9(2); *Rhizomnium punctatum* 4; *Ribes* sp. c 1; *Robinia pseudacacia* a1 16(1), a2 16, b 16(3), c 16; *Rubus caesius* 6(2); *R. cfr. hirtus* 23(1); *R. gracilis* 19; *R. plicatus* 8(2); *R. sprengelii* 19(1),28; *Rumex acetosa* 16,19; *Salix caprea* c 32; *Sambucus nigra* b 2; *S. racemosa* b 12(1); *Sciuro-hypnum oedipodium* 19(2),28; *Stellaria media* 18,19; *Urtica dioica* 31; *Vicia cassubica* 31(1); *V. sepium* 32; *Viscum album* subsp. *album* 18.

Table A36. *Serratulo-Pinetum*

Successive number of relevé		1	2	3	4	5	6	7	8	9	10	11	12	13
ID-1		7	7	7	7	7	7	44	44	44	44	44	44	44
ID-2		1	1	1	1	1	1	3	4	4	3	3	3	3
ID-3		15	16	17	18	19	20	4	5	4	5	8	7	6
Date (year)		1981	1981	1989	1981	1981	1977	1976	1976	1977	1976	1977	1977	1977
Density of tree layer	a1,a [%]	50	50	50	50	60	60	50	40	60	40	60	40	10
Density of tree layer	a2 [%]	5	-	-	5	10	-	5	5	10	15	5	5	40
Density of shrub layer	b [%]	5	5	-	10	5	5	15	40	20	10	30	40	20
Cover of herb layer	c [%]	60	40	80	50	60	40	60	60	70	70	80	80	80
Cover of moss layer	d [%]	75	95	60	90	80	95	30	60	20	60	60	50	50
Area of relevé		250	150	150	200	150	200	400	400	400	300	100	400	400
Location (ATPOL)		CD34	CD34	CD34	CD34	CD34	CD34	DE51	DE41	DE41	DE51	DE41	DE50	DE50
Total number of species		64	51	37	64	51	47	38	34	34	32	32	31	45
Number of mosses, liverworts and lichens species		10	4	4	9	6	6	5	2	3	4	4	6	6
I. Ch.*. D. <i>Serratulo-Pinetum</i>														
<i>Juniperus communis</i> (V-P)	bc*,b/c	+	1 ^A	.	+	1 ^A	+	2/+	/1	2/+	2/+	2/	1/+	2/+
<i>Danthonia decumbens</i> (C-U)		.	+	.	+	+	+	+	1	.	.	.	.	+
<i>Hieracium pilosella</i> (C-U)		.	+	+	+	1	.	+	+	.	1	.	.	+
<i>Peucedanum oreoselinum</i> (T-G)		+	.	1	+	1	.	.	.	+	.	+	.	+
<i>Carex ericetorum</i> (C-U)		.	+	.	.	.	.	.	+	+	1	.	.	+
<i>Dianthus carthusianorum</i> (F-B)		+	.	+	+	+	.	.	.	.	.	.	.	+
<i>Thymus serpyllum</i>		.	+	.	.	+	+	1	.	.	.	+	+	.
* <i>Orthilia secunda</i>		1	+	+	+	1	+	1	+	+	.	.	.	.
<i>Chimaphila umbellata</i> (V-P)		.	+	.	+	+	+	1	+	+	+	.	.	.
* <i>Koeleria grandis</i>		1	1	2	1	+	+	.	.	.	.	.	.	.
* <i>Pulsatilla vernalis</i>		+	r	+	.	.	+	.	.	.	.	.	.	.
<i>Lathyrus sylvestris</i> (T-G)		1	.	.	1	+	1	.	.	.	.	.	.	.
<i>Genista tinctoria</i> (C-U)		+	+	.	+	.	.	.	.	.	.	.	.	.
* <i>Chamaecytisus ratisbonensis</i>		.	.	.	.	.	.	.	+	1	1	.	1	.
II. Ch. <i>Vaccinio-Piceetea</i> (V-P)														
<i>Pinus sylvestris</i>	a1,a	3	3	3	3	4	4	3	3	2	3	4	3	1
<i>Pinus sylvestris</i>	a2	.	.	.	.	.	.	1	.	.	2	1	1	3
<i>Pinus sylvestris</i>	b	1	+	.	1	1	+	1	.	.	.	1	3	1
<i>Pinus sylvestris</i>	c	2	1	1	+	1	1	+	+	+	.	1	1	.
<i>Picea abies</i>	a2	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Picea abies</i>	b	.	+	.	+	.	+	.	.	.	.	.	.	.
<i>Pleurozium schreberi</i>		3	4	3	4	4	4	3	4	2	3	3	3	3
<i>Vaccinium vitis-idaea</i>		1	2	2	2	2	1	+	1	1	+	+	2	3
<i>Vaccinium myrtillus</i>		2	+	2	1	2	2	+	2	3	.	+	1	2
<i>Hylocomium splendens</i>		1	+	1	2	.	2	.	+	1	.	.	2	2
<i>Dicranum polysetum</i>		2	1	2	2	2	2	.	.	.	.	2	.	1
<i>Dicranum scoparium</i>		+	.	+	.	+	.	+	1	1	.	.	.	.
<i>Monotropa hypopitys</i> s. s.		.	r	.	.	.	.	+	+	+	.	.	+	.
<i>Rubus saxatilis</i>		1	+	+	.	+	.	.	.	.	.	.	.	+
<i>Cladonia furcata</i>		+	.	.	+	.	+	+	.	.	.	.	.	.
<i>Trientalis europaea</i>		.	+	.	+	.	.	1	.	.	.	.	+	.
<i>Pseudoscleropodium purum</i>		2	.	.	+	.	.	.	.	.	.	.	.	.
III. Ch., D.* <i>Quercetea robori-petraeae</i>														
<i>Festuca ovina</i>		1	1	2	+	1	2	.	2	+	3	4	1	+
<i>Calamagrostis arundinacea</i>		2	1	+	2	+	2	.	.	1	.	.	.	.
* <i>Melampyrum pratense</i>		+	.	+	1	.	.	.	2	1	.	.	+	.
* <i>Pteridium aquilinum</i>		.	.	.	.	.	.	2	1	1	1	2	.	2
<i>Hieracium lachenalii</i>		+	.	.	+	.	.	.	.	.	+	+	.	+
<i>Carex pilulifera</i>		.	+	.	.	.	.	.	+	.	.	.	.	+
* <i>Polytrichastrum formosum</i>		+	.	.	+	.	.	.	.	.	.	.	+	+
<i>Holcus mollis</i>		.	.	.	.	.	.	.	+	.	.	.	.	+
IV. Ch. <i>Calluno-Ulicetea</i> (C-U)														
<i>Calluna vulgaris</i>		2	2	2	1	+	1	.	+	+	1	+	3	+
<i>Agrostis capillaris</i>		+	+	.	.	.	+	+	+	.	.	.	.	1
<i>Veronica officinalis</i>		.	.	.	+	.	.	.	+	+	.	+	.	.
<i>Solidago virgaurea</i> s. s.		1	.	1	.	1	+	.	.	.	.	.	+	.
<i>Viola canina</i>		.	+	+	+	.	.	.	.	.	+	.	.	.
<i>Luzula multiflora</i>		.	.	+	+	.	.	.	.	+	.	.	.	.
<i>Scorzonera humilis</i>		1	.	1	.	.	.	.	.	+	.	.	.	.
<i>Pohlia nutans</i>		.	.	.	.	+	.	+	.	.	+	.	+	+
V. Ch. <i>Trifolio-Geranietea</i> (T-G), <i>Festuco-Brometea</i> (F-B)														
<i>Fragaria vesca</i> (T-G)		+	.	.	+	.	.	+	+	+	.	.	.	+
<i>Polygonatum odoratum</i> (T-G)		1	+	+	+	+	1	.	+	.	.	.	.	.
<i>Hypericum perforatum</i> (T-G)		r	+	.	.	.	+	+	+	+	.	+	.	+
<i>Poa angustifolia</i> (T-G)		.	+	+	1	.	+	1	.	.	.	.	+	1
<i>Knautia arvensis</i> (T-G)		+	.	+	+	r	+	+	.	.	.	.	.	.
<i>Pimpinella saxifraga</i> (F-B)		+	.	.	.	.	.	.	.	.	.	+	.	+
<i>Galium verum</i> (T-G)		+	r	.	.	.	+	.	.	.	.	+	.	.
<i>Geranium sanguineum</i> (T-G)		+	.	+	.	+	.	.	.	.	.	.	.	.
<i>Peucedanum cervaria</i> (T-G)		+	.	.	.	.	+	.	+	.	.	.	.	.
<i>Trifolium alpestre</i> (T-G)		+	.	.	+	.	.	.	.	.	.	.	.	.
<i>Anthericum ramosum</i> (T-G)		1	.	+	.	.	.	.	.	.	.	+	+	.
VI. Others														
<i>Betula pendula</i>	a1,a	1	+	.	.	.	+	1	.	.	.	.	1	1
<i>Betula pendula</i>	a2	1	.	.	+	2	.	.	.	.	.	.	.	1
<i>Betula pendula</i>	b/c	+/+	/+	.	/+	/1	.	.	/+	+	/+	/+	+/	+/
<i>Quercus petraea</i>	a1/a2	.	.	.	.	.	.	.	1/1	3/2	.	.	.	.
<i>Quercus petraea</i>	b/c	.	.	.	.	.	.	.	3/1	2/1	.	.	.	.
<i>Quercus robur</i>	a2	+	.	.	1	1	.	.	.	.	.	.	.	.
<i>Quercus robur</i>	b/c	+/1	1/1	.	2/+	+/+	+/+	+/+	.	.	.	.	.	+/
<i>Sorbus aucuparia</i>	b/c	/+	+/+	/+	+/+	/+	/+	.	/+	/+	.	/+	+/	+/
<i>Frangula alnus</i>	b/c	/+	/+	.	+/+	+/+	r	.	.	.	.	/+	.	+/
<i>Pyrus pyraeaster</i>	bc	r	.	.	+	.	.	.	.	.	.	.	.	.
<i>Anthoxanthum odoratum</i>		1	1	.	1	2	1	+	+	+	.	.	.	+
<i>Convallaria majalis</i>		2	1	1	2	1	2	.	.	.	+	.	.	.
<i>Luzula pilosa</i>		+	.	.	1	1	+	.	1	+	.	.	1	.
<i>Calamagrostis epigejos</i>		+	+	.	1	1	.	2	.	.	.	.	.	+
<i>Campanula persicifolia</i>		+	+	.	r	.	+	.	.	1	.	.	.	.
<i>Dryopteris carthusiana</i>		+	+	.	+	+	.	.	.	.	.	.	.	.
<i>Galium boreale</i>		+	+	+	+	+	.	.	.	.	.	.	.	.
<i>Anemone nemorosa</i>		+	+	.	+	.	.	.	.	.	.	.	.	.
<i>Campanula rotundifolia</i>		1	1	.	.	1	.	.	.	.	.	.	.	.
<i>Sciuroidium oedipodium</i>		1	.	.	+	.	+	.	.	.	.	.	.	.
<i>Succisa pratensis</i>		+	+	.	+	.	.	.	.	.	.	.	.	.
<i>Plagiomnium affine</i>		.	+	.	+	.	.	.	.	.	.	.	.	+
<i>Viola riviniana</i>		+	.	.	.	.	.	+	+	+	.	+	.	+
<i>Achillea millefolium</i>		.	.	+	.	.	.	+	+	.	+	.	.	+
<i>Hypnum cupressiforme</i>		+	.	.	.	.	.	1	.	.	1	.	.	+
<i>Cerastium holosteoides</i>		.	.	.	r	.	.	+	.	.	+	.	.	+
<i>Veronica chamaedrys</i>		.	.	.	+	.	.	.	.	+	.	.	.	+

Sporadic species: II.: *Vaccinio-Piceetea* [VP] *Cladonia rangiferina* 1; *Diphasiastrum complanatum* 4; *Leucobryum glaucum* 5; *Pyrola chlorantha* 13; *P. minor* 5; *Viscum album* subsp. *austriacum* 4; IV.: Ch. *Calluno-Ulicetea* (C-U) *Arctostaphylos uva-ursi* 2,3; *Carex ovalis* 2; *Luzula campestris* 7,10; *Potentilla erecta* 13; *Ptilidium ciliare* 5; *Scabiosa canescens* 1,5; V.: *Ajuga genevensis* (F-B) 11; *Clinopodium vulgare* (T-G) 4; *Coronilla varia* (T-G) 7; *Euphorbia cyparissias* (F-B) 7,11,13; *Potentilla heptaphylla* (F-B) 3; *Sedum maximum* (T-G) 5; *Silene nutans* subsp. *nutans* (T-G) 2; *Trifolium montanum* (F-B) 1,3; *Veronica spicata* (F-B) 3; *Vincetoxicum hirundinaria* (T-G) 5; VI.: Others: *Agrostis vinealis* 1; *Armeria maritima* 4(r),7; *Carex hirta* 7,13; *Carpinus betulus* c 4; *Cerasus avium* bc 4(r); *Cetraria islandica* 6; *Chamaenerion angustifolium* 6; *Cladonia cervicornis* subsp. *verticillata* 11; *C. foliacea* 11; *Corylus avellana* 8,10; *Corynephorus canescens* 7; *Deschampsia caespitosa* 10; *D. flexuosa* 1; *Dryopteris filix-mas* 2,4; *Equisetum arvense* 13; *Fagus sylvatica* c 4; *Festuca psammophila* 7; *F. rubra* s.s. 2(1),4; *Galium mollugo* 9,13(1); *Helichrysum arenerium* 7; *Holcus lanatus* 10; *Hypericum montanum* 8; *Hypochoeris radicata* 10; *Hypogymnia physodes* 4; *Jasione montana* 10,11; *Lysimachia vulgaris* 13; *Maianthemum bifolium* 5,6; *Moehringia trinervia* 13; *Molinia caerulea* 1,4; *Mycelis muralis* 11; *Oxalis acetosella* 5; *Plantago lanceolata* 10; *Populus tremula* a1 13(1), a2 13(1), b 13, c 10,13; *Pyrus communis* c 8; *Quercus rubra* 2(4); *Rhamnus cathartica* 5; *Rosa* sp. b 7,13; *Rosa* sp. c 11; *Rubus grabowskii* 1; *R. plicatus* 2,6; *Rubus* sp. 13; *Rumex acetosa* 5; *R. acetosella* 5,10,11,12; *Sarothamnus scoparius* b 12(1),13, c 1; *Scleranthus perennis* 7; *Scrophularia nodosa* 5(r); *Serratula tinctoria* 4(r),6(1); *Silene vulgaris* 11; *Tilia cordata* bc 6; *Viburnum opulus* b 13.

Table A37. Substitute forest communities on the habitat of don't identify forest community

[illegible]

Sporadic species: I.: *Betula pubescens* subsp. *pubescens* a2 63(1), b 63, c 16; *Dicranum polysetum* 22; *D. scoparium* 26,27,35,36,51; *Dryopteris dilatata* 13,16,63(1); *Galium rotundifolium* 31; *Hylocomium splendens* 25; *Juniperus communis* b 35, c 18(1),31; *Orthilia secunda* 28(2); *Pyrola minor* 28(1); *Rubus saxatilis* 2(1),19; *Trientalis europaea* 10(2),11(1),20; *Vaccinium vitis-idaea* 7(1),18; II.: *Aulacomnium androgynum* 38,51; *Carex pilulifera* 4(1),38(r),43(1),49,57; *Dicranella heteromalla* 23(1),58; *Festuca ovina* 20,24(3), 25,27,28(1),30; *Hieracium lachenalii* 2,3,8,10,28,31; *H. umbellatum* 18; *Luzula pallescens* 8; III.: *Acer platanoides* c 8,28; *A. pseudoplatanus* a2 9, b 9,14(2),24, c 14,41,50(r),58; *Atrichum undulatum* 31; *Brachypodium sylvaticum* 8,19,27(1),34,36(r); *Dryopteris filix-mas* 6,13,26,52; *Equisetum sylvaticum* 23; *Festuca gigantea* 15,22; *Hedera helix* 32,58(1); *Lathyrus niger* 2; *Malus sylvestris* c 29,38; *Melica nutans* 2,7,8,44(1),51,61; *M. uniflora* 6; *Milium effusum* 20,37(1); *Padus avium* b 16(1),23,61(1), c 43,63; *Sanicula europaea* 48; *Stellaria holostea* 1(1),5,33; *Ulmus laevis* a1 43(2), b 43(1); *U. minor* b 15, c 15,19,25; *Viola riviniana* 27,29,55(r),56(r); IV.: *Calluna vulgaris* 8; *Carex ovalis* 10,24; *C. pallescens* 4,20,22,38; *Danthonia decumbens* 20; *Hieracium pilosella* 22; *Hypericum maculatum* 44; *Luzula multiflora* 8(1),24,49,50(r),62; *Polytrichum juniperinum* 47,48(1),49; *Potentilla erecta* 45,60; *Scorzonera humilis* 49,51(r); *Solidago virgaurea* s.s. 44,49,50; *Veronica officinalis* 7,22,24,30; *Viola canina* 35; V.: *Alliaria petiolata* 55(r),61; *Chelidonium majus* 23,61(1); *Fallopia dumetorum* 18,43,46,61(1); *Galeopsis pubescens* 9,55(r),56,58; *G. tetrahit* 15,23,26,34,37,50(1),51,52,60; *Galium aparine* 23,61(2); *Geranium robertianum* 7,39,50,52,59,61; *Glechoma hederacea* 59(2); *Humulus lupulus* 23,61; *Lamium maculatum* 7; *Linaria vulgaris* 17(2),25; *Rubus caesius* 32,33,61; *Tanacetum vulgare* 19(2); *Urtica dioica* 59(2); VI.: *Abies alba* b 25; *Achillea millefolium* 59(1); *Agrostis gigantea* 42; *Alnus glutinosa* a 35,57(4), a2 29; *Anthericum ramosum* 50(r); *Anthoxanthum odoratum* 4,8(1),11,14,35(2),42,45,49,50(2),57(1),59; *Armeria maritima* 24; *Arrhenatherum elatius* 7,23,24,44; *Athyrium filix-femina* 26,39,63(1); *Brachythecium velutinum* 63(1); *Brachythecium rutabulum* 55(1),57(2); *Calamagrostis canescens* 47; *Campanula rotundifolia* 7; *Carex acutiformis* 23; *C. brizoides* 38(3),42(5); *C. hirta* 12,25(r),29,35(1); *C. nigra* 45; *Chamaenerion angustifolium* 13,14,16,23,26,43,63; *Colutea arborescens* b 27; *Crataegus laevigata* b 20; *C. monogyna* b 8,25, bc 38; *Dactylis glomerata* 6,15,29,49; *Deschampsia caespitosa* 38,57(1),63; *Euonymus europaea* b 9; *Fallopia convolvulus* 52,55,56(1),57(1); *Festuca rubra* s.s. 36(1),42,49; *Fragaria vesca* 22,29,35; *Galium mollugo* 22,29; *G. verum* 17,35; *Hieracium murorum* 9,27(1),50,54; *Holcus lanatus* 27; *Hypericum perforatum* 4,11,22,24; *Hypnum cupressiforme* 38,60; *Ilex aquifolium* c 9; *Juncus effusus* 42,57(1); *Larix decidua* subsp. *decidua* a1 7(1),26(1),62(2),63(4), a2 21(1),62,63(1), b 47; *Peucedanum oreoselinum* 17(1),19; *Plagiomnium affine* 19,35,46(1),55(2); *P. ellipticum* 24(1); *P. rostratum* 29,60; *Plagiothecium cavifolium* 1; *Plagiothecium ruthei* 36; *Plantago lanceolata* 7; *Poa angustifolia* 35; *P. palustris* 44(1); *P. pratensis* 42; *Polygonatum odoratum* 19(r),28,44,54,62; *Populus tremula* a 45(1),59(1), a1 13(1),45(1), a2 13(1), b 8,23,36, c 5,8,13,45,63; *Prunus spinosa* b 36; *Pyrus communis* a 36(2),38, c 50(r); *Quercus rubra* a 7, a2 29, b 29,45(1); *Ranunculus acris* s.s. 7; *R. repens* 27; *Robinia pseudacacia* a1 23(1),60(1),61(4), a2 23(1),61(2), b 23,61(2), c 23,61; *Rubus plicatus* 4(1),13; *R. sprengelii* 44(2),55,56; *Salix purpurea* c 25; *Sambucus nigra* b 62, c 23,25; *S. racemosa* b 20,21; *Sciuro-hypnum oedipodium* 57(1); *Sedum maximum* 17; *Senecio ovatus* 59; *Silene nutans* subsp. *nutans* 11; *Stellaria graminea* 42,59; *S. media* 4,9,13,24,27,34,58,59; *Thuidium philibertii* 42; *Veronica chamaedrys* 30,37,46(1); *V. hederifolia* 23,39,48,61(1); *Vincetoxicum hirsutinaria* 17(r),19(1).