

VEGETATION AND POINT-MAPPING SURVEY IN THE STRICTLY PROTECTED AREAS OF THE LANDSCAPE PROTECTION AREA OF THE PILIS MTS (HUNGARY)

T. SZERDAHELYI¹, K. PENKSZA¹, K. Z. DOBOLYI²,
GY. SZOLLÁT², J. KAPOCSI³ and G. FIGECZKY¹

¹*Dept. of Botany and Plant Physiology, Agricultural University
H-2103 Gödöllő, Páter K. u. 1, Hungary*

²*Dept. of Botany, Hungarian Natural History Museum
H-1476 Budapest, Pf. 222, Hungary*

³*Körös-Maros National Park
H-5540 Szarvas, Anna-liget, Pf. 72, Hungary*

The studied regions located in the Landscape Protection Area of the Pilis Mts, Hungary, have a considerably varied geographical character. Because of the configurations of the terrain several associations and sub-associations can be distinguished. The area is predominated by forests, however scrub woods, steppes and rocky grasslands play an important role as well. Most part of the studied vegetation is close to the native condition, whereas some other places are disturbed by the overpopulated stock of game, especially the moufflon. For each management unit a brief description of its vegetation is given together with the list of protected or notable vascular plants registered.

Key words: point-mapping, Pilis Mts, vegetation map

INTRODUCTION

Several conditions have to be realized for a satisfactory functioning of a landscape protection area and to fulfil its tasks in nature conservation. The protection of stands of all associations is necessary in order to preserve rare species and to fulfil the gene bank function. It is absolutely indispensable that silviculture has to be planned in conformity with these aims and views of nature conservation could get across considerably on the strictly protected areas. The preservation of the gene pool of a species can be realized only by sustaining, large, continuous stands. Consequently, all the activities have to be ceased, which have opposite effect, which make the stands poor, getting the species to the verge of extinction, and ultimately uniformized stands are evolved. The maintenance and protection of the transitional zone between the associations is very important also, because these can ensure the tolerance, the possibility of migration for a species if the climatic or other changes occur. In practice it is very important to respect the protective forest character of stands where it is needed. Where it is possible the res-

toration of the original natural vegetation would be desirable (to prevent the artificial transformation of mountain meadows, careful and gradual reconstruction of the stands full of ash trees).

The flora of the Pilis Mts, especially the southern parts close to Budapest, were studied by several noted botanists during the 18th–20th centuries. There are some plants from the Pilis Mts even in the KITAIBEL herbarium (JÁVORKA 1926–1936). SADLER (1825, 1840) made detailed botanical investigations in the region. KERNER (1857) gave an overview of the Pilis Mts, too. The studies of BORBÁS (1872, 1879) were concentrated on the parts of the mountains belonging to Pest county.

Floristical data on the northern part of the Pilis Mts were reported by FEICHTINGER (1864, 1899). Contrary to his other floristical studies he enumerated the occurring species by their localities.

Numerous authors published floristical data on the Pilis Mts (BOROS 1917, 1919, 1923, 1938, 1970, CSAPODY 1935, 1939, DOMOKOS 1939, GRUNDL 1863, FEKETE and JAKUCS 1957, HORÁNSZKY 1957, JÁVORKA 1904, 1915, 1940, LENGYEL 1906, 1909). However, few studies contain data on Kesztlőc and its close surroundings. Floristical data on the marshlands in the vicinity of Kesztlőc and on the meadow Hosszú-rét between Piliscsaba and Piliscsaba-Jászfalu were published by PENKSZA (1991). The most important floristical data on the cliff Fehérszirt (PENKSZA 1992a) and the coenological characterization of the marshlands found here were provided by PENKSZA (1992b).

The phytogeographical features of the Pilis Mts and its surroundings were described by BOROS (1953) and FEKETE (1988). BORHIDI (1956) studied the sandy vegetation of the Kisalföld. The “embayment” south of Esztergom was given the name “the vicinity of Esztergom” by ZÓLYOMI (1958). SIMON (1962) provided an overview on the natural vegetation of the Kisalföld. The monograph of the marshlands by KOVÁCS (1962) contains information on the region, too. The detailed potential vegetation map by SIMON *et al.* (1980) refers the area, as well as JAKUCS and FEKETE (1987) in the serial “The landscape geography of Hungary”. The vegetation of the hills Kétágú-hegy and Csévi-szirtek were compared by SZERDAHELYI (1988, 1989). The vegetation map of Kétágú-hegy and its surroundings was described by PENKSZA *et al.* (1997).

Our vegetation mapping studies started in 1982 at some regions of the Landscape Protection Area of the Pilis Mts, Hungary, with the aims of searching and point-mapping of rare, protected species in the strictly protected areas. The data were re-examined by fieldwork in 1996. Therefore the changes of habitats since 1982 are appeared in the results presented below.

MATERIALS AND METHODS

The fieldwork was carried out between April and October in 1982 based on silvicultural maps at the scale of 1 : 10 000.

The area of Leányfalu (I – strictly protected area), and the areas of Piliszentkereszt (IV – strictly protected area) and Pilisszántó (V and VI – strictly protected areas) (Fig 1).

During the fieldwork the following species were mapped: *Adonis vernalis*, *Amygdalus nana*, *Aster amellus*, *Dianthus serotinus* var. *Soói*, *Dictamnus albus*, *Iris graminea*, *Iris variegata*, *Orchis pallens*, *Polystichum aculeatum*, *Pulsatilla grandis*, *Sempervivum hirtum* (*Jovibarba hirta*), *Sorbus danubialis*, *Stipa pulcherrima*, *Vicia sparsiflora*.

Nomenclature of the vascular plant names follows SIMON (1992).

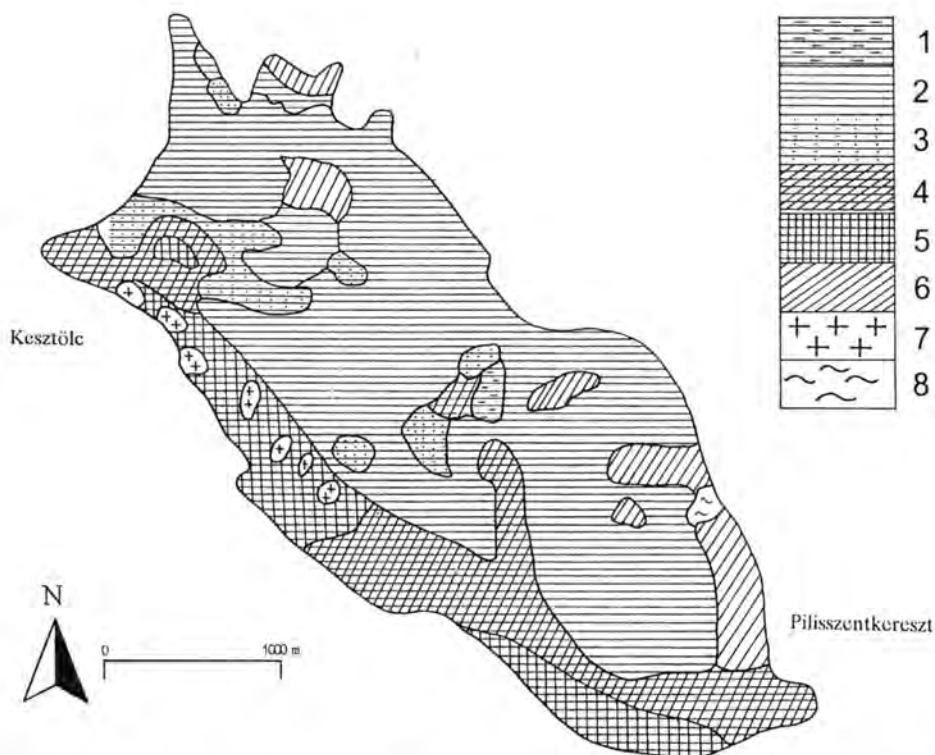


Fig. 1. Vegetation map of Mt Pilis and Mt Kétágú-hegy. – 1. *Carex pilosa* type of *Fagetum* and *Carpino-Quercetum*. – 2. *Asperula odorata* type of *Fagetum* and *Carpino-Quercetum*. – 3. *Melica uniflora* type of *Fagetum* and *Carpino-Quercetum*. – 4. *Quercetum petrae-cerris*. – 5. Rocky grassland communities, steppes. – 6. *Mercuriali-Tilietum*. – 7. *Corno-Quercetum pubescentis*. – 8. *Seslerio-Fagetum*

RESULTS AND DISCUSSION

Surroundings of Kis-Szoplák and Nagy-Szoplák

Strictly protected area on the forestry area of Pilisszentkereszt (IV)

Forest ranges 1–6: On the larger part of the area *Melitti-Fagetum hungaricum* and *Quercus petraeae-Carpinetum pannonicum* stands can be found. On the top and the eastern rocky slope of the hills Kis-Szoplák and Nagy-Szoplák *Mercuriali-Tilietum* can be seen on this area. On the upper part of both peaks the forests are degraded, damaged by the gnawing, treading, grubbing of wild animals. The soil is very shallow and full of bare rocks. When planning the silviculture of the stands on rocky slopes or on the upper part of the peak priority should be given to soil conservation standpoints. On these areas cautious thinning is recommended because of the increased danger of soil erosion. The northern and northwestern slopes of Nagy-Szoplák hill are surrounded by *Melitti-Fagetum hungaricum* and *Quercus petraeae-Carpinetum pannonicum* associations. *Mercurialis perennis* dominates in the herb layer, which also indicates relatively shallow and rocky soil. This is why soil conservation respects have to be taken into consideration as well. At the other parts of the forest where the soil is deeper *Mercurialis* is replaced by *Asperula odorata*.

In the surroundings of the hill Kis-Szoplák the above mentioned *Melitti-Fagetum hungaricum* stand is continuous with that of in forest ranges 5 and 6. In forest ranges 3 and 4 young *Melitti-Fagetum* and *Quercus petraeae-Carpinetum* grows mixed with *Pinus sylvestris* and *Picea abies* trees. *Orchis pallens* is the floristical value of range 5.

Surroundings of Nagy-Bodzás-hegy

Ranges 7–8, 12, 18: The vegetation of the hill Nagy-Bodzás-hegy is similar to that of the hills Nagy-Szoplák and Kis-Szoplák, that is *Mercuriali-Tilietum* on the top around the eminence. According to the characteristics of the surface *Mercuriali-Tilietum* forest is replaced by beech forests. Four of the characteristic herb layer dominants of beech forests: *Mercurialis perennis*, *Asperula odorata*, *Carex pilosa* or *Melica uniflora* were observed, indicating habitat heterogeneity (SZŐCS 1971) (Pilisszentkereszt ranges 7, 8, 18A and 12).

In range 8 on the side of the hill Nagy-Bodzás-hegy facing the valley Vaskapu-völgy a drier, *Melica uniflora*-type oak forest can be found.

Vaskapu-völgy and surroundings of Vaskapu-hegy

Ranges 10–11, 14–15: In the valley Vaskapu-völgy (10 and 11B) *Mercuriali-Tilietum* forest extends. North to the valley Vaskapu-völgy a young beech forest mixed with conifers (*Pinus nigra*, *Pinus sylvestris*, *Picea abies*) is present.

The northwest-southeast ridge of the hill Vaskapu-hegy and the areas south of it (14, 15A) are covered with characteristic beech forest stands. Outstanding floristical value of the area is *Pyrola rotundifolia* which can be found on a steep northeast slope in a ruined pine forest. In the surroundings of the gully Vaskapu-szurdok and north and west rocky slopes of the hill Vaskapu-hegy facing the valley Vaskapu-völgy *Seslerio-Fagetum* can be found, among which the most valuable stand is that of in the vicinity of the Vaskapu rock. The rock and its surroundings are favourable practising places for rock-climbers. Since it is on a strictly protected area, and treading and littering endanger the *Sesleria sadleriana* stands, it would be necessary to designate a new practising place somewhere else in agreement with rock-climbers. The protection of *Sesleria sadleriana* and its punctual occurrence in Hungary makes it absolutely necessary.

Pilis-oldal

Ranges 16, 26–28: Deforestation of *Quercus petraeae-Carpinetum* stands on the eastern steep slope caused soil erosion, and this is why *Mercuriali-Tilietum* stands have extended that had been here before. Now *Quercus petraeae-Carpinetum* and *Mercuriali-Tilietum* are present with *Fraxinus excelsior*, *Tilia*, *Acer* and *Ulmus* species. The change of the original vegetation at the same time indicates the necessity of careful planning of the future silviculture. On the western edge of Pilis-oldal facing Pilis-tető, rocky grasslands and steppe grasslands can be found. The spread of *Urtica dioica* can be explained by the disturbance of military activities.

Pilis-tető and its south and southwest slopes

Ranges 13, 17–19, 23, 25: The central part of Pilis-tető (ranges 17 and 25) is a military object. On the northeast slope of the northwest process of the peak beech forests can be found (13B). Outstanding floristical value is *Allium ursinum* (appr. 20 plants) in the vicinity of landmark 18. The connected *Quercus petraeae-Carpinetum* forests (at the border of 13B and 19A) living on the top are forests on shallow soil with bare rocks. This and the partly *Fraxinus* dominated stands show deficiencies of earlier silviculture. *Quercus petraeae-Carpinetum* forests transform into a *Quercetum petraeae-cerris pannonicum* forest as the peak goes on to a southwest low gradient slope (13A, 18A, 19A, 23B).

These *Quercetum petraeae-cerris pannonicum* forests are situated extrazonally at the height of 700 m above sea level. Its special location is also indicated by the relatively large number of Fagetalia elements in the herb layer that is dominated by *Asperula odorata* in some places. One part of them is also a degraded stand with full of *Fraxinus* trees. Such interesting transitional stands would be worth studying more detailed and the discussion with botanists would be necessary during the planning of forest management.

From this point of view the attainable aim would be the restoration or regeneration of the original stands. It is impossible to draw the borders of *Quercetum petraeae-cerris* and *Quercus petraeae-Carpinetum* stands because of the military object. (The same holds in respect of *Quercetum petraeae-cerris* and *Orno-Quercetum pannonicum* on the peak).

Ranges 1, 4–5, 10–11 and 20–24: The south and southwest slopes of Mt Pilis are covered with *Orno-Quercetum pannonicum*.

In the lower part of valleys and gullies running to south and southwest directions (ranges 4, 5, on the border of 10 and 11) where the surface is covered with thick brash motley forest with *Fraxinus ornus*, *Tilia* species and a few *Acer campestre* trees can be found in some places with scattered herb layer and dense shrub layer. On the steep slope and verge of the valleys and on the ridge the *Orno-Quercetum* stand is thinned and replaced by *Ceraso-Quercetum pubescentis*. On the exposed, rocky habitats with shallow soil the forest is thinned therefore in some places it becomes an open slope steppe grassland (*Caricetum humilis balatonicum*) and more often a closed grassland (*Diplachno-Festucetum sulcatae balatonicum*). (First of all on the area of 4A, 5B, 10, 11 and 24A in Pilisszentkereszt).

The principle of nature conservation, which says that the protection of species can be successful via the protection of habitats and associations, refers to most of all for the *Quercetum petraeae-cerris* stands of the IV. strictly protected area and the latter mentioned stands and habitats (and also for the above mentioned Vaskapu rock). Many protected plants, among them many strictly protected species, live on these areas forming a scattered population on a large area or an endangered population on a dwindled area (for example *Ferula sadleriana* at ranges 24A, 10, 11).

Significant protected species are: small population of *Sesleria sadleriana* in 4A, *Iris graminea* and *Iris variegata* in oak forests, *Orchis pallens* in shrub forests, and *Anemone sylvestris*, *Orchis purpurea*, *Adonis vernalis* and *Vicia sparsiflora*.

Pilisszentlélek

Ranges 11, 12, 20 and 21: On the area of these four ranges on the north-northeast slope of the hill Fekete-hegy *Asperula odorata*-type *Quercus petraeae-Carpinetum* and *Melitti-Fagetum* stands can be found. In the herb layer, beside or instead of *Asperula odorata*, larger or smaller spots of *Carex pilosa* are present. The presence of *Mercurialis perennis* in great quantities is typical especially in the ranges 12 and 20, where it is a dominant element of grass in habitats with shallow soil and rocks. On the steep slopes *Quercus petraeae-Carpinetum* and *Melitti-Fagetum* stands mixed with a lot of *Tilia cordata* and *Tilia platyphyllos* are already transitions towards *Tilio-Fraxinetum*. On the three northern ridges of

the range 12 in the canopy of the little fragment of *Tilio-Fraxinetum* stand – beside the dominant *Fagus sylvatica* and *Tilia cordata* – *Carpinus betulus*, *Tilia platyphyllos*, *Fraxinus excelsior*, *Acer pseudoplatanus*, *Acer campestre*, *Acer platanoides* are typical. (Otherwise these tree species can be found scattered on the steep slopes with northern exposure where the rate of *Quercus petraea* is low in the *Quercus petraeae-Carpinetum* association). Along the central line of the above mentioned ridges grass spots, and on the eastern ridge and slope, partly because of the low regeneration rate of the forest, shrub forests (*Corylus avellana*) and degraded fragments of *Corno-Quercetum pubescenti-petraeae* can be found (*Quercus pubescens*, *Fraxinus ornus*, *Acer campestre*, *Cornus mas*, *Viburnum lantana*, *Melica uniflora*, *Oryzopsis virescens*, *Lithospermum purpureo-coeruleum* etc.). On the eastern side of the eminence close to the eastern border of the range *Pinus sylvestris* plantation is present. In the northern edge of the range 21 on the plateau of the hill Fekete-hegy *Melica uniflora*-type *Quercus petraeae-Carpinetum* stand can be found in a very narrow, dry zone which has no importance in forestry. Here the rate of *Quercus petraea* and *Quercus cerris* is larger than in the nearby stands.

The select-cutting of *Pinus sylvestris* from the above mentioned area during forest management practice is recommended. The successive clear cuts in the ranges 12 and 20 should be carried out carefully in order to protect the rocky and shallow soil and to make sure the proper regeneration of the forest with late thinnings and only in the case of sufficient number of new shoots. It results tolerable, moderate disturbance of the habitat and also drives back the growth rate of *Tilia* species, while in the case of clear-felling the opposite happens, the deleterious effects become stronger.

Keszölc

Range 2: The very dense and young *Quercus petraeae-Carpinetum* stand on the top of the hill Borostás-hegy is *Asperula odorata*-type. In some places *Melica uniflora*-type stands occur as well.

Range 6: The patch of *Corno-Quercetum pubescenti-petraeae* shows the characteristics of associations living on smaller rock-ridges. The habitat is very rocky and covered with little, shallow soil which can dry out easily. The low oak forest is full of trees with low growing rate (*Quercus cerris*, *Quercus petraea*, *Quercus cerris* x *pubescens*). There are a lot of *Fraxinus ornus*, the shrub layer is rich (*Cornus mas*, *Crataegus monogyna*, *Fraxinus ornus*) and the herb layer is scattered (*Melica uniflora*, *Brachypodium pinnatum*, *Oryzopsis virescens*, *Lithospermum purpureo-coeruleum*, *Carex michelii*, *Primula veris*). South of the fragment of *Corno-Quercetum pubescenti-petraeae* an altered *Quercetum petraeae-cerris* forest can be found with a herb layer rich in disturbance tolerator species

(*Poa nemoralis*, *Dactylis polygama*, *Rubus* sp.). Originally this stand was a *Melica uniflora*-type *Quercus petraeae*-*Carpinetum* association.

Ranges 5, 7 and 9: Before the description of the ranges some general remarks are needed. First of all the bedrock is not limestone under these three ranges. On differently acidic soils on sandstone and mixed (limestone + sandstone) bedrock two associations are present: *Quercetum petraeae-cerris* with a few species in the herb layer and the type of *Corno-Quercetum pubescenti-petraeae* living on acidic soil. The diversity of forest stands and generally the richness of the vegetation are increased by the fact that the area is at margin of the hill, the diversity of relief and the different climatic and edaphic conditions caused by the relatively large differences in altitude. This is why transitional stands of *Quercus petraeae*-*Carpinetum* and *Quercetum petraeae-cerris* associations are found at some sites. Moreover, in range 9 on the border of *Corno-Quercetum pubescenti-petraeae*, *Quercus petraeae*-*Carpinetum* and *Quercetum petraeae-cerris* associations in a vast zone *Fraxinus ornus* grows together with *Carpinus betulus* in a significant rate. The *Corno-Quercetum pubescenti-petraeae* stands in ranges 1, 3 and 4 are also good, typical stands, and this is why these will not be described separately, only local characteristics, valuable and protected species and suggestions for managements will be emphasized. Common characteristic of *Corno-Quercetum pubescenti-petraeae* associations is that *Quercus cerris* x *pubescens* occurs in high rate in the stands (beside the *Quercus pubescens*, *Quercus cerris* and *Fraxinus ornus*).

Range 7: On the steep slope of the southeastern border of the range the following herbaceous plants are dominant in the oak forest living on mixed bedrock (limestone + sandstone) with acidic soil: *Luzula albida*, *Carex montana*, *Melica uniflora*, *Festuca heterophylla*. Beside the acidofrequent species of *Quercetum petraeae-cerris* (*Achillea distans*, *Genista elata*, *Anthoxanthum odoratum*, *Astragalus glycyphyllos*, *Digitalis grandiflora*, *Melittis grandiflora*, *Chrysanthemum corymbosum*, *Lathyrus niger*) some species typical of *Corno-Quercetum pubescenti-petraeae* also occur (*Anthericum ramosum*, *Cynanchum vincetoxicum*, *Teucrium chamaedrys*). *Cephalanthera longifolia* and *Epipactis helleborine* are also remarkable species.

On the southern part of the range a *Quercetum petraeae-cerris* stand extends on acidic soil, too, but it is very poor in species. In the herb layer of the thinned forests (in the case of the stand which is almost in placor situation and contiguous with range 6) *Poa nemoralis* and *Dactylis polygama* dominate partly because of thinning. *Festuca heterophylla* that prefers dry and acidic habitat is frequent. In the thinned forest *Rubus* sp. is common as a forest weed. In the middle of the oak forest stripe the herb layer of the stand in southeast exposure is extremely scattered, the cover of bare ground is 80%.

The southern part of the *Quercus petraeae*-*Carpinetum*, bordering the oak forest stripe from north and growing on acidic soil, is disturbed, intersected by roads and ditches and similarly the stand is on acidic soil and the herb layer is rather scattered. In the western part *Carpinus betulus* trees were thinned, but it can be found as new growth and nibbled saplings abundantly in the herb layer of the planted oak forest. As a result of plantation dominant species of the herb layer are *Poa nemoralis*, *Dactylis polygama* and *Rubus* species. (The southwest corner of range 7, i.e. the shelving part of the plateau of the hill Fekete-hegy can be considered as a transitional habitat between *Quercus petraeae*-*Carpinetum* and *Quercetum petraeae-cerris* associations owing to the above mentioned reasons).

The *Melica uniflora*-type *Quercetum petraeae-cerris* stand near the range 6 also contains a smaller rocky projection with shallow soil and dry climate. A transitional stand towards the *Corno-Quercetum pubescenti-petraeae* association can be found here, as indicated by the occurrence of *Fraxinus ornus*, *Cornus mas*, *Cynanchum vincetoxicum* and *Lithospermum purpureo-coeruleum* in it.

The small *Melica uniflora*-type *Quercetum petraeae-cerris* stand can be found on the edge and the upper part of a southern steep slope. In spite of its small area many oak forest species are present in its herb layer: *Silene nutans*, *Serratula tinctoria*, *Festuca heterophylla*, *Achillea distans*, *Iris graminea*, *Teucrium chamaedrys*, *Lathyrus niger*, *Lithospermum purpureo-coeruleum*, and even steppe and shrub forest species: *Inula ensifolia*, *Anthericum ramosum*, *Betonica officinalis*. In the tree layer *Quercus cerris* x *pubescens* and *Fraxinus ornus* occur as well. Towards southeast of the oak forest patch at lower elevation on a steep slope with shallow soil a zone of *Sesleria hungaricae*-*Fagetum* extends.

Not far from the 25/1 border stone hornbeams could not reach their normal height therefore forming a second tree layer in some places. The majority of the old *Quercus cerris* individuals are frost-injured which indicates the boundary location and the transitional character of the stand. In the southern part of this *Quercus petraeae*-*Carpinetum* stand, on the southwest slope and top of the ridge (see contour map) a *Corno-Quercetum pubescenti-petraeae*-like stand fragment is found on rocky, shallow soil with many shrubs (*Cornus mas*, *Crataegus monogyna*) and the oak forest species indicating a drier and warmer habitat: *Sedum maximum*, *Teucrium chamaedrys*, *Brachypodium pinnatum*, *Cynanchum vincetoxicum*, *Lithospermum purpureo-coeruleum*.

The same description refers to the little, therefore not marked spot in the southeast corner of *Melica uniflora*-type *Quercus petraeae*-*Carpinetum* stand that is near the glade between ranges 6 and 7, where *Festuca sulcata* and *Anthericum ramosum* are also present.

Range 9: The oak patch stretching into the *Carex pilosa*-type *Quercus petraeae*-*Carpinetum* stand is situated on the western side of a ridge of northwest di-

rection; here even *Lithospermum purpureo-coeruleum* and on the northwest facing steep slope of the ridge *Luzula albida* are also present.

In the herb layer of the narrow oak stand on the ridge near the road, south to the *Carex pilosa*-type *Quercus petraeae*-*Carpinetum* stripe, partly because its closeness *Carex pilosa* dominates; *Melica uniflora*, *Poa nemoralis* and *Festuca heterophylla* are also present with large cover. In the western end of this oak forest stripe, on the slope of the ridge with western exposure *Luzula albida*-type *Quercetum petraeae-cerris* can be found on acidic soil. The border and the southern slope of the hilltop in the eastern corner is the *Corno-Quercetum pubescenti-petraeae* fragment mentioned several times. On the southern side of this hilltop and on the range running to west very dry oak forest is present (*Poa nemoralis*, *Dactylis polygama*, *Festuca heterophylla*, *Melica uniflora*), and a *Pinus nigra* forest replacing the former association. The soil is acidic as the bedrock is also sandstone mixed with limestone.

The most remarkable botanical values are *Corno-Quercetum pubescenti-petraeae* stands on the steep south, southwest slopes and the shrub forest stand or the variant of both evolved on acidic bedrock and soil. The herb layer has lower cover rates than in the other cases on limestone, slower regeneration, shallower and detrital soil, this is why the treading of moufflon and red deer can cause increased damage. Valuable (protected) species are: *Adonis vernalis*, *Aster amellus*, *Vicia sparsiflora*, *Stipa pulcherrima*.

On the gently inclined area at the bottom of the steep slope a *Quercetum petraeae-cerris* stand is found. Large part of this stand is transitional, *Fraxinus ornus* and *Carpinus betulus* trees of the same height are present together in some places and their cover rate can reach 15–15%. The transitional character of these particular stands is enhanced by the composition of the herb layer of the *Melica uniflora*-type *Quercus petraeae*-*Carpinetum* stand near the eastern border of the range. Beside *Melica uniflora* the quantity of *Oryzopsis virescens* and *Lithospermum purpureo-coeruleum* is also considerable.

The characteristics of *Quercetum petraeae-cerris* are also the large rate of *Quercus cerris* (40–60%) in some places, the dense shrub layer (in many places cut), the considerable quantity of *Oryzopsis virescens* and *Lithospermum purpureo-coeruleum* beside the dominance of *Melica uniflora* in the herb layer. As a result of the shrub cuttings and forest thinning the quantity of *Poa nemoralis* and *Dactylis polygama* is large. Both grasses, but especially *Poa nemoralis*, played an important role in other disturbed sessile oak-turkey oak stands, too (FEKETE et al. 1987, 1994, CSONTOS 1994, 1996).

Ranges 1, 3 and 4: Beside the *Corno-Quercetum pubescenti-petraeae* stands the shrub forests, the slope steppe and rocky grasslands of these three ranges are the most valuable nature conservational values. (The conservation of the gene pool of any nudum-type beech forest has naturally the same importance as

maintaining the habitat of any rare, protected species). Protected species are: *Adonis vernalis*, *Aster amellus*, *Iris graminea*, *Iris variegata*, *Stipa pulcherrima*, *Sempervivum hirtum* and *Dictamnus albus*.

Pilisszentlélek

Range 8: Beech forest and *Quercus petraeae*-*Carpinetum* mixed with *Fagus sylvatica* on damp soil. The shrub layer is missing, type-indicating plant is predominantly *Asperula odorata*, in some places *Mercurialis perennis*, or missing (nudum-type).

Range 9: A very steep (45–60°) hillside with N–NE exposure. Part A is an *Asperula odorata*-type *Quercus petraeae*-*Carpinetum* association mixed with *Fagus sylvatica*. Part B is mostly an *Asperula odorata*-type *Quercus petraeae*-*Carpinetum*, but in the upper third *Melica uniflora*, and *Mercurialis perennis* and *Carex pilosa* patches are also present. The soil is shallow and sometimes rocky, the forest is partly grown from coppice, but the elements of *Tilio-Fraxinetum* can be found as well, for example *Fraxinus excelsior*, *Tilia cordata*, *Acer pseudoplatanus* and *Ulmus glabra*. The threat of soil erosion has to be considered in management practice.

Range 10: The northern part of the range is a *Melica uniflora*-type, the southern part is an *Asperula odorata*-type *Quercus petraeae*-*Carpinetum*. In some places the *Carex pilosa*-type is also present. In part A *Pinus sylvestris* is mixed in *Quercus petraeae*-*Carpinetum* with lots of died or decaying individuals. In the herb layer of the range *Galium aparine* and *Urtica dioica* have increased cover (in some places occurring in great quantities), which is the joint result of the large game stock and forest thinning. Extensive game stock is also indicated by the treading, gnawing and dung around the feeder.

Esztergom, Nagy-Cserepes-tető (Árpád-vár)

Range 28B: The bedrock is andesite, the soil is shallow, detrital. The southern-southwestern slope of the hill is covered with *Corno-Quercetum pubescenti-petraeae*, and the upper part with rocky grassland patches. On the rocky parts the soil is missing in many places, the foot of the hill is very detrital therefore the forests has to be maintained for the protection of soil.

Range 30: In the northern part of the range *Asperula odorata*-type, in the southern part *Melica uniflora*-type *Quercus petraeae*-*Carpinetum* and *Melitti-Fagetum* can be found, in some places *Carex pilosa*-type is also present. These three type-indicating species occur together in many cases.

Range 31: *Tilio-Fraxinetum* covers the steep, rocky, northern hillside called Háromszáz garádics. In other parts of the range mainly *Asperula odorata*-type, in smaller amount *Melica uniflora*-type *Quercus petraeae*-*Carpinetum* can be found. The *Tilio-Fraxinetum* forest of Háromszáz garádics requires careful silviculture.

Range 32: On the steep slope of the northern part of the range (part A) *Tilio-Fraxinetum* is present. South and southwest to the József Berda house an old *Quercetum petraeae-cerris* stand stretches. Its shrub layer and the undergrowth are rich, in the herb layer *Melica uniflora* dominate. *Orchis pallens*, *Iris graminea* and *Iris variegata* are present as protected plants. In the stand oak disease can be observed to a small extent.

In part C a young stand of *Quercus petraeae-Carpinetum* can be found. Its healthy growth is endangered by game damage.

Range 33: These are *Melica uniflora*-type *Melitti-Fagetum* and *Quercus petraeae-Carpinetum* forests, the latter one mixed with *Fagus sylvatica*. In the shrub layer *Tilia cordata* has considerable cover. In the herb layer, beside the dominant *Melica uniflora*, *Asperula odorata* and some patches of *Carex pilosa* are also present.

Range 5: In the southwest edge of the range the *Corno-Quercetum pubescenti-petraeae* stand that was formed on mixed (limestone + sandstone) bedrock is similar in its growth rate to a *Quercetum petraeae-cerris* living on acidic soil, but the herb layer is relatively well developed with a cover of 50–60% and the number of real acidofrequent species is low. On the western border of this stand the *Melica uniflora*-type *Quercetum petraeae-cerris* stand is also transitional. In its herb layer, beside the high cover value of *Melica uniflora*, that of *Oryzopsis virescens* and *Lithospermum purpureo-coeruleum* are also significant.

At lower elevation and south of the *Corno-Quercetum pubescenti-petraeae* stripe that covers a large part of the range *Tilio-Fraxinetum* is found on detritic rocks with *Tilia platyphyllos*, *Quercus petraea*, *Carpinus betulus* and *Sorbus torminalis*. Along the valley running west (on the border of ranges 5 and 9) and in the valley *Acer pseudoplatanus* and *Acer platanoides* are also present.

Corno-Quercetum pubescenti-petraeae stand, that is enclosed between the *Tilio-Fraxinetum* and the *Melica uniflora*-type *Quercus petraeae-Carpinetum*, looks similar to a *Quercetum petraeae-cerris* stand in its tree height and canopy structure, however, the species composition and the dominance hierarchy of its herb layer definitely identify it as a *Corno-Quercetum pubescenti-petraeae* stand.

The part of the *Quercetum petraeae-cerris* stand near the border between ranges 4 and 5, south of the large *Corno-Quercetum pubescenti-petraeae* stand, is a little bit different from the middle or eastern typical stands of *Melica uniflora*- or *Poa nemoralis*-type *Quercetum petraeae-cerris* stands. This stand with closed tree layer, dense shrub layer and scattered herb layer (*Melica uniflora*, *Oryzopsis virescens*, *Lithospermum purpureo-coeruleum*) grows on mixed bedrock with acidic soil, in contrast with the nearby oak forests, and is related to the non-typical *Corno-Quercetum pubescenti-petraeae* stands described later at the foot of the hill in ranges 3 and 4.

Ranges 3 and 4: On the southern part of the ranges, on the gentle slopes of the steep southwest side of the hill Borostás-hegy the shrub layer of the *Corno-Quercetum pubescenti-petraeae* is dense (*Cornus mas*, *Crataegus monogyna*, *Ligustrum vulgare*, etc.), the herb layer is scattered, exclusively with *Oryzopsis virescens*, *Lithospermum purpureo-coeruleum* and only a small amount of *Melica uniflora*. At some sites the stand is more similar to *Quercetum petraeae-cerris* in the respect of growth of trees and the species composition of the tree layer, but at these sites *Fraxinus ornus*, *Quercus cerris* x *pubescens* grow to the size of a tree and the typical species of *Quercetum petraeae-cerris* are missing from the herb layer.

Kétágú-hegy

Ranges 34 and 35: In the plateau of the hill a *Melica uniflora*-type *Quercetum petraeae-cerris* stand extends with dense shrub layer. South to this association *Orno-Quercetum pubescenti-cerris* is present, on the steep slopes it turns into a complex of *Cotino-Quercetum pubescentis* and rocky grasslands (range 1 of Keszölc). On the northern slopes and on the hillsides of the valley *Melica uniflora*-type *Quercetum petraeae-Carpinetum* is found.

Kis-hegy

Range 36: On the plateau of the hill Kis-hegy an *Asperula odorata*-type *Quercetum petraeae-cerris* association stretches, but some elements of the herb layer (e.g. *Asarum europaeum*, *Pulmonaria officinalis*) show the former presence of *Quercetum petraeae-Carpinetum* on this territory. On the southwestern side *Orno-Quercetum pubescenti-cerris* can be found with some patches of dry steppe, where elements typical of rocky grasslands are also abundantly present (*Sempevivum hirtum*, *Sedum* species). These steppe stands have significant botanical importance not only because of the large number of protected species (*Amygdalus nana*, *Sempervivum hirtum*, *Adonis vernalis*, *Iris variegata*, *Iris graminea*, *Dictamnus albus* and *Stipa pulcherrima*), but also by their high diversity. This *Orno-Quercetum pubescenti-cerris* stand requires considerate management, because of the fragile balance of its coenological structure.

At the lower part of the hill and in the valley a *Melica uniflora*-type *Quercetum petraeae-Carpinetum* association extends.

Range 37: In the surroundings of the cliff Fehér-szirt situated in part C *Tilio-Fraxinetum* can be found. On the top of the ledge a smaller rocky grassland patch is present. In part A and B mainly an *Asperula odorata*-type, in part D and E a *Melica uniflora*-type *Quercetum petraeae-Carpinetum* stand and *Melitti-Fagetum* can be found. Under the ledge the area is colonized by weeds.

Range 38: In this range *Asperula odorata* and *Melica uniflora*-type *Quercetum petraeae-Carpinetum* stands and *Melitti-Fagetum* stands are present. The two

types of herb layer can not be differentiated sharply from each other, but instead it has a mosaic-like structure or their species pools are mixed.

Range 39: Predominantly *Asperula odorata*-type *Quercus petraeae*-*Carpinetum* stands and *Melitti-Fagetum* stands with smaller *Carex pilosa* patches are present.

Range 40: On Kis-Cserepes-tető a *Melica uniflora*-type *Quercetum petraeae-cerris* stand stretches. On the southeastern slope facing the valley *Asperula odorata*-type *Quercus petraeae*-*Carpinetum* stands extend.

Pilisszentlélek

Range 22: Its southern part is covered by a *Quercus petraeae*-*Carpinetum* association on a plateau, mainly with the dominance of oak trees. On the north facing slope *Asperula odorata*-type *Quercus petraeae*-*Carpinetum* is present, too. On the plateau *Carex pilosa* also appears in small patches.

Fekete-kő and surroundings

Range 23: Part A and B are nudum-type *Melitti-Fagetum* stands on a steep northern slope. The stands are approximately 80–100 years old, the trees are almost even-aged, without considerable amount of saplings. In some places bare rocks appear indicating the shallow soil. We suggest gradual thinning instead of clear cutting as regeneration method to protect the habitat.

Part C includes the cliff Fekete-kő and its surroundings. In the western side it is bordered by *Sesleria hungaricae*-*Fagetum*, on the eastern border the *Quercus petraeae*-*Carpinetum* stand is replaced by rocky grassland patches. Fekete-kő itself is a projecting dolomite cliff with habitat suitable for *Seseli leucospermum*-*Festucetum pallentis* association. The observed protected and further characteristic species of the area are the following: *Dianthus serotinus* var. *Soó*i, *Pulsatilla grandis*, *Sempervivum hirtum*, *Carex humilis*, *Carex distans*, *Centaurea sadleriana*, *Festuca pallens*, *Allium montanum*, *Allium flavum*, *Sorbus danubialis*, *Inula ensifolia*, *Achillea distans*, *Seseli osseum* and *Oryzopsis virescens*. The cliff Fekete-kő and its surroundings are popular recreation areas with a crossing point of tourist footpaths. Although the rock-climbing school officially does not exist here any more, the sites were frequently visited by climbers, according to our experiences. Treading endangers rare plants, and induces degradation processes. To prevent or decrease these dangers we suggest to put up a guard-rail on the top of the cliff Fekete-kő.

Range 34: There is a continuous stand of nudum-type *Melitti-Fagetum* on the northern slope. The same silvicultural consideration holds as in the case of 23A, B, i.e. we suggest gradual thinning as regeneration method when the forest reaches the cut age.

Range 35: Nudum-type *Melitti-Fagetum* stand on a plateau. The stand is approximately 80 years old, almost even-aged without saplings.

Range 36: In part A and B an *Asperula odorata*-type *Melitti-Fagetum* stand can be found. On the northern corner extremely old *Sorbus torminalis* individuals have to be mentioned. Part C descends to western direction, *Melitti-Fagetum* is mixed with *Quercus petraeae*-*Carpinetum* close to the south peak.

Range 37: Part A is a *Quercus petraeae*-*Carpinetum* mixed with *Fagus sylvatica*, in some places with patches of *Carex pilosa*. In the nearby part B its gradual change into a clear *Asperula odorata*-type *Melitti-Fagetum* can be seen.

Range 38: Similarly to the former range, part A is a *Quercus petraeae*-*Carpinetum* mixed with *Fagus sylvatica*, with some *Carex pilosa* patches. To the east *Asperula odorata*-type *Melitti-Fagetum* is being formed gradually, and it is continued to the direction of the hills Kis- és Nagy-Szoplák. In the southern part dry habitat is indicated by the presence of *Melica uniflora*.

Range 39: A large part of the range is a *Quercus petraeae*-*Carpinetum* stand, with a *Carex pilosa*-type herb layer at the site facing the valley. On the western edge a nudum-type *Melitti-Fagetum* stand stretches. The habitat has shallow soil with bare rocks on the surface. The growing rate is low here and *Tilia cordata* also appears.

Range 40: Adjacent to the former range *Melitti-Fagetum* can be found, where going further less and less bare rocks are seen. In the middle part the herb layer is *Asperula odorata*-type. On the plateau it transforms into a *Melica uniflora*-type indicating the drier habitat.

Range 41: Part A is mostly *Quercus petraeae*-*Carpinetum*, on the northern part it is mixed with *Fagus sylvatica*. On the steep sites with bare rocks the growing rate is lower. *Sorbus torminalis* and *Fraxinus excelsior* individuals are mixed one by one. On the southern part it is mixed with *Fagus sylvatica*, its herb layer is *Carex pilosa*-type. On a gentle slope *Melica uniflora* appears.

Part B is shared by an old *Melitti-Fagetum* stand and a *Quercus petraeae*-*Carpinetum* stand mixed with *Fagus sylvatica* and *Fraxinus excelsior*.

Range 42: The largest difference in altitude and the most diverse features of the terrain are found here. The western part of the range is *Quercus petraeae*-*Carpinetum* which stretches along the valley. To the east with the increasing altitude it is transformed into *Melitti-Fagetum*. Bare rocks and diverse rock formations, two large caves and rock-glaciers make the silviculture difficult. Because of the large angle of slope gradual thinning can be applied as harvesting method for habitat protection. On large areas continuous stands can not be formed due to the rock-glaciers. Scrubs composed of mostly *Cotinus* are impenetrable at several sites. In connection with this gnawing of animals and treading has also large importance. This degradation is caused mainly by the excessive moufflon population.

Range 43: This range stretching along the valley holds a continuous *Quercus petraeae*-*Carpinetum* stand with a *Carex pilosa*-type herb layer. In the drier habitats it transforms into *Melica uniflora*-type stand.

Range 44: A continuous *Melica uniflora*-type *Quercus petraeae*-*Carpinetum* stand can be found here. In some places it is mixed with *Fraxinus excelsior*. Its northern part, that is connected to the rock-glacier leading to the cave, is a nudum-type *Melitti-Fagetum*.

Range 45: It is a *Corno-Quercetum pubescenti-petraeae* stand on a very steep slope facing southwest. In areas with bare rocks on the surface rocky grassland patches occur. Their species pool can hardly be identified here, because the treading and gnawing activity of moufflons impoverish the flora of these grasslands allowing only annual or perennial treading-tolerant species to grow. We are sure that because of the large game stock some rocky grassland species have already become extinct from here.

Range 46: In part A and B *Quercus petraeae*-*Carpinetum* mixed with *Fagus sylvatica* can be found. In part D an old stand of *Quercetum petraeae-cerris* is present on the southwest slope. In the herb layer *Melica uniflora* dominates. Among the protected species *Iris graminea* has a large stand here. It is present in several little patches along the tourist pathway facing Mt Pilis.

Kesztölc

Range 8: In its northern part similarly to the nearby ranges *Quercus petraeae*-*Carpinetum* mixed with *Fagus sylvatica* extends with *Asperula odorata*-type herb layer. In its southern part *Carex pilosa*-type herb layer can be found.

Range 10: Northern part is a nudum-type *Quercus petraeae*-*Carpinetum* stand mixed with *Fagus sylvatica*. On the plateau it is replaced by *Quercetum petraeae-cerris*, which is continued in southwest direction by a *Melica uniflora*-type herb layer.

Range 11: Part D is the continuation of *Quercetum petraeae-cerris* in 10A. On the habitat with shallow soil these trees are dwarfed and their stand is interrupted by rocky grasslands together forming a mosaic-like landscape.

Part A is a *Quercus petraeae*-*Carpinetum* stand mixed with *Fagus sylvatica* with nudum-type herb layer. In the middle it is transformed to *Carex pilosa*-type. On the southwest slope of part B *Quercetum petraeae-cerris* stand can be found.

Suggestions for management, remarks

In the Landscape Protection Area of the Pilis Mts on the strictly protected areas, and the core areas of biosphere reserve the main purpose is the conservation and the maintenance of natural values. The activities of silviculture has to be subordinated to this purpose.

Habitat conservation and prevention of soil erosion have primary importance in the protection of vegetation. To achieve this the most considerate regeneration method of silviculture, gradual thinning has to be applied on every steep, rocky habitat with shallow soil, particularly on acidic soil, where, in spite of the open tree layer, the cover rate of the herb layer is low.

In case of the unmanaged stands: 1) *Orno-Quercetum pubescenti-cerris* stands (including its type living on sandstone bedrock and acidic soil); 2) *Cotino-Quercetum pubescentis* stands; 3) slope steppe vegetation; and 4) rocky grassland stands where the greatest dangers are treading, gnawing and dung of wild animals.

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