

Plant Science & Biodiversity Center Slovak Academy of Sciences, Institute of Botany



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Plant communities in changing environment

Excursion guide







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Edited by

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Excursion 1. Riparian plant communities along the Danube River

Guides: Mária Šibíková, Ivan Jarolímek & Richard Hrivnák

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Location

Číčovské mŕtve rameno: 47°45'56.58."N, 17°43'40.18"E, 111 m a.s.l. Veľkolélsky ostrov Island: 47°45'05.27"N, 17°56'24.19"E, 108 m a.s.l.

Climate

Climate of the region is warm and dry. Mean annual precipitation is 550–600 mm and mean annual temperature is 10 °C. Winters are mild, almost snow-free and summers are hot with 74 summer days (temperature \ge 25 °C).

Geology

The Danube Plain was formed in the Pliocene and Quaternary and consists mainly of sediments of gravels and sands of the Danube. It is actually a huge alluvial cone that created the Danube below Bratislava at a time when the river cut through the Little Carpathians and entered the descending Little Danube Basin. Western part of the territory between the Little Danube and Danube – Žitný ostrov (Rye Island) is a huge reservoir of groundwater. Below the surface there is about 10 billion m3 of quality drinking water.



Soils

Alluvial soils predominate in both excursion localities near the Danube.

Geography

The excursion will take place in a part of the geomorphological unit Podunajská nížina Lowland, where the main landscape-forming factor was the Danube River that changed its course regularly in the past. Rapid rates of lateral erosion at the one side and the creation of extensive deposits of gravel and sand, on the other hand, contributed to the constantly changing landscape. The network of river branches formed the Danube inland delta.

Nature conservation

Číčovské mŕtve rameno Nature Reserve and the Veľkolélsky ostrov Island are a part of the Special Protected Area SKCHVU007 Dunajské luhy and so they were included in the European network of protected areas Natura 2000. The Číčovské mŕtve rameno was declared in 1964 on an area of 79.87 hectares and ranked in the 5-th degree of protection. The territory represents the rest of the isolated river arm of the River Danube with the occurrence of various aquatic biocenoses, the rare waterfowl and flora and a rare glacial relic of the Nordic vole (*Microtus economus*). The Veľkolélsky ostrov Island is also an independent Special Area of Conservation SKUEV0183 Veľkolélsky ostrov covering 328.65 hectares. After 2006 many conservation and management activities led by BROZ (Bratislava Regional Center for Nature Conservation) were implemented in this area, including reconnection of the river branch with the main Danube stream.

Habitats (according to Natura 2000 habitat classification)

- 91E0 Alluvial forests
- 91F0 Riparian mixed forests
- 6440 Alluvial meadows of river valleys of the Cnidion dubii alliance
- 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation

Vegetation synopsis

Class Salicetea purpureae Moor 1958 Order Salicetalia purpureae Moor 1958 Alliance Salicion albae Soó 1951 (+secondary plantations of Populus × canadensis) Class Alno glutinosae-Populetea albae P. Fukarek et Fabijanić 1968 Order Alno-Fraxinetalia excelsioris Passarge 1968 Alliance Fraxino-Quercion roboris Passarge 1968 Class Phragmito-Magnocaricetea Klika in Klika et Novák 1941 Order Phragmitetalia Koch 1926 Alliance Phragmition communis Koch 1026 Alliance Magnocaricion elatae Koch 1926



Order Oenanthetalia aquaticae Hejný ex Balátová-Tuláčková et al. 1993 Alliance Eleocharito palustris-Sagittarion sagittifoliae Passarge 1964 Class Molinio-Arrhenatheretea Tx. 1937 Order Arrhenatheretalia elatioris Tx. 1931 Alliance Arrhenatherion elatioris Luguet 1926 Order Molinietalia caeruleae Koch 1926 Alliance Deschampsion caespitosae Hovatić 1930 Class Festuco-Brometea Br.-Bl. et Tx. ex Soó 1947 Order Festucetalia valesiacae Soó 1947 Alliance Festucion valesiacae Klika 1931 (Class Lemnetea O. de Bolos et Masclans 1955) Order Lemnetalia minoris O. de Bolos et Masclans 1955 Alliance Lemnion minoris O. de Bolos et Masclans 1955 Alliance Utricularion vulgaris Passarge 1964 Alliance Stratiotion Den Hartog et Segal 1964 (Class Potamogetonetea Klika in Klika et Novák 1941) Order Potamogetonetalia Koch 1926 Alliance Potamogetonion Libbert 1931 Alliance Nymphaeion albae Oberd. 1957 Order Callitricho hamulatae-Ranunculetalia aquatilis Passarge ex Theurillat in Theurillat et al. 2015 Alliance Ranunculion aquatilis Passarge ex Theurillat in Theurillat et al. 2015 (Class Bidentetea Tx. et al. ex von Rochow 1951) Order Bidentetalia Br.-Bl. et Tx. ex Klika et Hadač 1944

Alliance Bidention tripartitae Nordhagen ex Klika et Hadac 1944



Two different localities will be visited during the excursion. The first one, Číčovské mŕtve rameno Nature Reserve, represents one of the largest river oxbows in the Slovak part of the Danube catchment as well as one of the last places within inland delta with preserved natural character. The second locality, Veľkolélsky ostrov Island, was affected by human impacts in the same way as the rest of the inland delta area, but from 2006 several Life projects were implemented in the area, and recently it is a



great example of successful revitalization of Natura 2000 habitats and traditional land use.



Forest and grassland communities

Nature Reserve Číčovské mŕtve rameno is part of this area, and it was the Danube riverbed in the past, which turned into a large oxbow lake, the last preserved representative of this type in the Slovak section of the Danube. Until the early 20th century, adjacent part of river oxbow was covered by a mosaic of meadows, pastures, and flood-plain forests. Recently, the site represents a well-developed mosaic of different habitats with domination of aquatic vegetation (3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation). Littoral zone is created by marshy plants followed by willow shrubs along hydrological gradient. Forest habitats are formed by hardwood floodplain forests, habitat type 91F0 Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, and 91E0 Alluvial forests (Salicion albae). An extensive remnant of a much older riverbed of the Danube is present at the north-eastern border of the site. This large shallow depression is covered mainly by reed beds and wet meadows. The flora of area contains 341 vascular plant species, including rare ones, e.g. Cirsium brachycephalum, Hottonia palustris, Leucojum aestivum, Lycopus exaltatus, Najas minor, Nuphar lutea, Nymphaea alba, Nymphoides peltata, Salvinia natans, Thalictrum flavum, Trapa natans, Utricularia vulgaris, etc.





This site is the lowermost part of the huge branch system of the Danube inland delta. The dynamic of this part was not so high compared to the upstream parts of the inland delta, and the river tended to concentrate within one main channel. At the beginning of the 20th century, the main channel was rebuilt into a straighter form. This site wasn't influenced by the Gabčíkovo water dam construction. Since Nagymarosi part of the dam system wasn't built, this area remains unaffected, and the water regime didn't change so much.

The second excursion site covers one of the biggest Danube islands in Slovak Republic – Veľkolélsky ostrov Island. The gravel-sand deposits form the geological basement of the area. The site represents unique mosaic of forests, meadows and water habitats and that in combination with low human disturbances provide favourable conditions for high biodiversity of the area. The island is regularly flooded during higher water levels of the Danube River. "Veľkolélske rameno" river branch that surrounds the island is one of the broadest river branches in the Slovak part of the Danube. It is an important breeding habitat for many fish species and feeding habitat for birds.





In the past, this huge island was accessible only by fording place, so it was an ideal place for the grazing of farm animals. The surrounding country was used as agricultural land. Veľkolélske rameno river branch was connected with the Danube until regulation after 1980. After the abandonment of grazing, wet meadows were affected by invasive species spreading, and natural forests were replaced by poplar plantations.

Recently, vegetation is represented by softwood and transitional floodplain forests (91E0 Alluvial forests of *Salicion albae*) with great number of old tree individuals in some cases more than 400 years old. Most preserved part of the floodplain forest was designated as Nature Reserve Zlatniansky luh. Alluvial meadows (*Alopecurion*) influenced by regular flooding of Danube are important habitats for many species of pannonic flora.

Management and threats

A considerable part of the inland delta was covered by floodplain forests in the neolithic era before humans settled the territory (Krippel 1986, Michalko 1987). The hardwood floodplain forests were situated in higher positions on older river terraces affected by groundwater table fluctuations and, irregularly, by short-term flooding. Willow-poplar softwood floodplain forests covered lower terraces with regular floods. The Danube River formed large and dynamic branch systems until the need for river transport resulted in the regulation of the branch system into one large riverbed. The decreased groundwater table in the remaining branch system encouraged agriculture



in the regulated area. In addition, the vegetation cover changed considerably due to deforestation and fragmentation of the area (Generel 1976). The main intervention in the floodplain forests during the last few decades has been the Gabčíkovo Dam construction, joining the Hrušovská zdrž water reservoir constructed between 1977 and 1992.

After 2006 many conservation and management activities led by BROZ (Bratislava Regional Center for Nature Conservation) were implemented in this area, including reconnection of the river branch with the main Danube stream. Other management actions were replacement of plantations by native trees seedlings and renewal of traditional land use. Nowadays the site is used once again as extensive pasture for cattle and horses. Pollard willows are present in high numbers and are traditionally coppiced and used for firewood.

Taxon	Family	Note
Aegopodium podagraria	Daucaceae	
Alliaria petiolata	Brassicaceae	
Alopecurus pratensis	Poaceae	
Arenaria serpyllifolia agg.	Caryophyllaceae	
Arrhenatherum elatius	Poaceae	
Aster lanceolatus	Asteraceae	
Batrachium circinatum	Ranunculaceae	
Bidens frondosa	Asteraceae	
Bidens tripartita	Asteraceae	
Bothriochloa ischaemum	Poaceae	
Bromus hordeaceus	Poaceae	
Carex hirta	Cyperaceae	
Carex praecox	Cyperaceae	
Carex acuta	Cyperaceae	
Carex acutiformis	Cyperaceae	
Carex riparia	Cyperaceae	
Cerastium arvense	Caryophyllaceae	
Cerastium brachypetalum	Caryophyllaceae	
Ceratophyllum demersum	Ceratophyllaeceae	
Clematis integrifolia	Ranunculaceae	
Convallaria majalis	Asparagaceae	
Cornus mas	Cornaceae	
Cornus sanguinea (Swida		
sanguinea)	Cornaceae	
Corydalis cava	Papaveraceae	
Corylus avellana	Corylaceae	
Crataegus laevigata	Rosaceae	
Crataegus monogyna	Rosaceae	
Cruciata laevipes	Rubiaceae	

List of selected vascular plants



Taxon	Family	Note
Dactylis glomerata	Poaceae	
Daucus carota	Apiaceae	
Echium vulgare	Boraginaceae	
Elytrigia repens	Poaceae	
Erigeron canadensis (Conyza		
canadensis)	Compositae	
Euonymus europaeus	Celastraceae	
Euphorbia cyparissias	Euphorbiaceae	
Euphorbia seguieriana	Euphorbiaceae	
Festuca rubra	Poaceae	
Festuca stricta subsp. sulcata		
(Festuca rupicola)	Poaceae	
Festuca pseudovina	Poaceae	
Fraxinus excelsior	Oleaceae	
Fraxinus angustifolia subsp.	01	
danubialis Calaathaa airralia	Oleaceae	
Galanthus nivalis	Amaryllidaceae	
Geum urbanum	Rosaceae	
Glechoma hederacea	Lamiaceae	
Hedera helix	Araliaceae	
Heracleum sphondylium	Apiaceae	
Hippuris vulgaris	Hippuridaceae	
Hottonia palustris	Primulaceae	
Hydrocharis morsus-ranae	Hydrocharitaceae	
Hypericum perforatum	Clusiaceae	
Iris pseudacorus	Iridaceae	
Lamium galeobdolon	Lamiaceae	
Lamium purpureum	Lamiaceae	
Lamium maculatum	Lamiaceae	
Lemna minor	Lemnaceae	
Lemna trisulca	Lemnaceae	
Leucojum aestivum	Amaryllidaceae	
Lycopus europaeus	Lamiaceae	
Lysimachia nummularia	Primulaceae	
Lysimachia vulgaris	Primulaceae	
Medicago falcata	Fabaceae	
Medicago lupulina	Fabaceae	
Myosotis ramosissima	Boraginaceae	
Myosotis scorpioides	Boraginaceae	
Myriophyllum spicatum	Haloragaceae	
Negundo aceroides	Aceraceae	
Nuphar lutea	Nymphaeaceae	
Nymphaea alba	Nymphaeaceae	



Taxon	Family	Note
Ornithogalum umbellatum		
agg.	Asparagaceae	
Padus avium	Rosaceae	
Persicaria amphibia	Polygonaceae	
Persicaria hydropiper	Polygonaceae	
Pilosella bauhinii	Compositae	
Plantago lanceolata	Plantaginaceae	
Phragmites australis	Poaceae	
Phalaroides arundinacea	Poaceae	
Poa angustifolia	Poaceae	
Poa bulbosa	Poaceae	
Poa pratensis	Poaceae	
Polygonatum multiflorum	Asparagaceae	
Polygonatum latifolium	Asparagaceae	
Populus canescens	Salicaceae	
Populus nigra	Salicaceae	
Populus tremula	Salicaceae	
Populus × canescens	Salicaceae	
Potamogeton lucens	Potamogetonaceae	
Potamogeton pectinatus	Potamogetonaceae	
Prunella vulgaris	Lamiaceae	
Pulmonaria officinalis	Boraginaceae	
Quercus robur	Fagaceae	
Ranunculus polyanthemos	Ranunculeae	
Robinia pseudoacacia	Fabaceae	
Rubus caesius	Rosaceae	
Salix alba	Salicaceae	
Salix fragilis	Salicaceae	
Salix × rubens	Salicaceae	
Salvia pratensis	Lamiaceae	
Salvinia natans	Salviniaceae	
Sanguisorba minor	Rosaceae	
Scabiosa ochroleuca	Dipsacaceae	
Securigera varia	Cichorieae	
Schedonorus pratensis		
(Festuca pratensis)	Poaceae	
Spirodela polyrhiza	Lemnaceae	
Trapa natans	Trapaceae	
Ulmus laevis	Ulmaceae	
Ulmus minor	Ulmaceae	
Veronica sublobata	Plantaginaceae	
Veronica chamaedrys	Plantaginaceae	
Viburnum lantana	Viburnaceae	



Taxon	Family	Note
Vicia angustifolia	Fabaceae	
Viola ambigua	Violaceae	
Viola hirta	Violaceae	
Viola mirabilis	Violaceae	
Viola reichenbachiana	Violaceae	
Viola riviniana	Violaceae	

Excursion 2. Steppes and thermophilous forests of the southwestern part of the Little Carpathians at the confluence of the Morava and Danube Rivers

Guides: Katarína Hegedüšová, Iva Hodálová & Iveta Škodová

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Location

Sandberg: 48°12'02.96"N, 16°58'26.08"E, 197 m a.s.l. Weitov lom quarry: 48°11'37.97"N, 16°58'47.60"E, 192 m a.s.l. Thermophilous oak forests: 48°08'53"N, 17°06'26"E, 336 m a.s.l. Devín Castle: 48°10'25.92"N, 16°58'41.83"E, 212 m a.s.l.

Climate

Sub-continental, summer-warm, moderate dry with mild winter, the extra warm and dry climate is characteristic for sun-exposed, south-western steep slopes. Mean annual temperature: 9 °C (maximum temperature 32.8 °C, minimum temperature -15.5 °C)



Mean annual precipitation: 604.9 mm (360.1 mm falls in the vegetation season)

Geology

About 300 million years ago the territory of Devínska Kobyla was part of the precontinent Pangea. Several times subsequently the area was covered by the sea and during this period limestone and dolomite were formed. Southern slopes of the NNR are created mainly by grey limestones, dolomites and carbonate breccia, the strata are 160–180 million years old. The top of the hill Devínska Kobyla is formed by Mesozoic quartzite. In geological and paleontological terms the abandoned sandpit Sanberg is one of the most important sites in Slovakia. It is extremely rich in fossil remains of marine, coastal and terrestrial fauna and flora. It represents a stratotype locality for stratigraphical sub-stage called "devín". Rock remains of Neogene Sea that covered the Vienna basin create its area. It is also a Neogene paleontological locality of European importance (Feráková et al. 1997, Hegedüšová 2009).



Sandberg

Soils

The prevailing soil types on shallow and dry places are Eutric Cambisols developed on the Mesozoic quartzite and on diluvia of carbonate-silicate deposits. They are mostly covered with oak-hornbeam forests. Rendzic Leptosols are developed on limestones and dolomites covered mainly with dry grasslands and open Mediterranean xero-thermophilous oak forests. Regosols and sands are less frequent (Sandberg, Merice) developed on sandstones (Bedrna 1997).

Geography

The National Natural Reserve (NNR) Devínska Kobyla and the protected site Sandberg are the southern-most parts of the Protected Landscape Area Malé Karpaty Mts, called also Devínske Karpaty Mts, located between the Morava and Danube rivers, where the Carpathian Mountains meet with the Pannonian Basin. The Slovak-



Austrian border, the municipal parts of Bratislava, former villages Devínska Nová Ves and Devín, surround it also. This unique geographical position resulted in the extraordinary physical-geographical conditions, such as topography and climate, with specific, rare and rich species steppe flora and fauna. From a morphometrical point of view Devínska Kobyla Mt. has an approximately symmetrical shape and is distinctive by its peripheral slopes with an inclination from 25 to 30°, and by the vaulted central part where slope angles range from 10 to 15°. Its elevation ranges from 135 at the Danube, and Morava floodplain, to 514 m, at its highest point. The altitudinal difference between the Morava River (135 m) and the top of Devínska Kobyla Hill (514 m) is 379 m. Total area of reservation is 114.38 ha and it represents one of the NATURA 2000 sites and also Important Plant Area (IPA). It is located about 10 km from centre of Bratislava, capital city of Slovakia. The unique area of the instructive path is 2880 m long and 825 m width, with plenty of natural details to look at and the breathtaking panoramathic view of the confluence of the Danube and Morava rivers, the Devín castle and the Austrian Hainburg hills. In good weather conditions, even the Alps may be visible.

Nature conservation

Devínska Kobyla is included nowadays in the Protected Landscape Area Malé Karpaty Mts (PLA). It was proposed as an Important Plant Area with total area of 127 ha in 2004. The NNR Devínska Kobyla was originally established as two separate reserves, the first one Sandberg in 1964 and the State Nature Reserve Devínska Kobyla on SW slopes with thermophilous vegetation (27.97 ha) in 1965. Both reserves were united in 1986 and the part Merice above Devín village was added. This area is under the fifth level of nature protection (the highest possible in Slovakia). An instructive path across the western slope was opened in 1988 and renewed in 2000.

Habitats (according to Natura 2000 habitat classification)

6190 Rupicolous pannonic grasslands (*Stipo-Festucetalia pallentis*)

6240 Sub-Pannonic steppic grasslands

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)

40A0* Continental deciduous thickets

91H0 Pannonian woods with Quercus pubescens

9130 Asperulo-Fagetum beech forests

9180* *Tilio-Acerion* forests on slopes, screes and ravines

Vegetation synopsis

Class Festuco-Brometea Br.-Bl. et Tüxen ex Soó 1947

Order Stipo pulcherrimae-Festucetalia pallentis Pop 1968

Alliance Bromo pannonici-Festucion pallentis Zólyomi 1966

Ass. Poo badensis-Festucetum pallentis Klika 1931 corr. Zólyomi 1966

Ass. Festuco pallentis-Caricetum humilis Sillinger 1930 corr. Guterman et Mucina 1993

Order Festucetalia valesiacae Br.-Bl. et R. Tx. ex Br.-Bl. 1949



Alliance Festucion valesiacae Klika 1931 Ass. Festuco valesiacae-Stipetum capillatae Sillinger 1930 Order Brometalia erecti Br.-Bl. 1936 Alliance Cirsio-Brachypodion pinnati Hadač et Klika ex Klika 1951 Ass. Polygalo majoris-Brachypodietum pinnati Wagner 1941 Class Trifolio-Geranietea sanguinei T. Müller 1962 Order Origanetalia vulgaris T. Müller 1962 Alliance Geranion sanguinei R. Tx. in T. Müller 1962 Ass. Geranio sanguinei-Dictamnetum albi Wendelberger 1954 ex T. Müller 1962 Ass. Geranio sanguinei-Peucedanetum cervariae T. Müller 1962 Class Crataego-Prunetea R. Tx. 1962 Order Prunetalia spinosae R. Tx. 1952 Alliance Prunion fruticosae R. Tx. 1952 Ass. Prunetum fruticosae Dziubałtowski 1926 Ass. Waldsteinio geoidis-Spiraeetum mediae Zólyomi 1936 Alliance Berberidion vulgaris Br.-Bl. ex R. Tx. 1952 nom. cons. Ass. Ligustro-Prunetum R. Tx. 1952 Class Quercetea pubescentis Doing-Kraft ex Scamoni et Passarge 1959 Order Quercetalia pubescenti-petraeae Klika 1933 Alliance Quercion pubescenti-petraeae Br.-Bl. 1932 nom. corr. Ass. Lithospermo purpurocaerulei-Quercetum pubescentis Michalko 1957 Ass. Euphorbio-Quercetum Knapp ex Hübel 1959 Alliance Quercion petraeae Issler 1931 Ass. Sorbo torminalis-Quercetum Svoboda ex Blažková 1962 Class Carpino-Fagetea sylvaticae Jakucs ex Passarge 1968 Order Carpinetalia betuli P. Fukarek 1968 Alliance Carpinion betuli Issler 1931 Ass. Carici pilosae-Carpinetum betuli Neuhäusl et Neuhäuslová-Novotná 1964 Order Fagetalia sylvaticae Pawłowski ex Pawłowski et al. 1928 Alliance Fagion sylvaticae Luquet 1926 Ass. Carici pilosae-Fagetum sylvaticae Oberd. 1957 Order Aceretalia pseudoplatani Moor 1976 nom. cons. propos. Alliance Melico-Tilion platyphylli Passarge et G. Hofmann 1968 Ass. Aceri platanoidis-Tilietum platyphylli Faber 1936

The high flora and fauna biodiversity due to the unique location, heterogeneity of the geological substratum, specific climatic conditions, human influence and vicinity of the Malé Karpaty Mts is a typical feature of Devínská Kobyla and Sandberg.

Forest communities

The original vegetation was formed by oak-hornbeam forests, xero-thermophilous oak forests with *Quercus pubescens* agg. on steep slopes with a limestone base and rocky grasslands, which are conserved in spite of human influence (vineyards, orchards,



grazing, burning of grasslands, afforestation by non-native trees e.g. Pinus nigra, Fraxinus ornus). Since 1949, a continuous area of xero-thermophilous pastures (at the time 85.8 % of the total area) has been greatly fragmented into the present mosaic vegetation of rocky and dry grasslands (33.4 %) - steppe communities along with sub-Mediterranean xero-thermophilous oak woods Lithospermo purpurocaerulei-Quercetum pubescentis and Euphorbio-Quercetum. Among the trees on the southwestern slopes we can find Prunus fruticosa, P. mahaleb, Cornus mas, Quercus pubescens agg., Q. cerris and Ulmus minor. In those parts of the forests that are more exposed to sunlight it is possible to find the originally Mediterranean species Smyrnium perfoliaum, which was rare in the past and is quickly spreading nowadays. On the northern slopes beech forests fragments of Carici pilosae-Fagetum are developed. Fagus sylvatica reaches here the lowest altitudes in the Western Carpathians Mts. On screes there are stands with *Tilia cordata* and *Acer campestre*, which belong to the alliance *Melico-Tilion platyphylli*. The most frequently occurring community in the NNR is Carici pilosae-Carpinetum with characteristic spring aspect created by Galanthus nivalis, later replaced by Hepatica nobilis, Corydalis cava and Anemone ranunculoides. Among non-native trees Robinia pseudoacacia and Syringa vulgaris are the most common. The continuous human impact on the area has increased the diversity of plant species.



Clematis recta

Carici pilosae-Carpinetum



Grassland communities

Cutting down and burning the woods created more space for plant species and communities typical of rocky areas. Dry calcareous grasslands have developed in the territory of Devínska Kobyla due to traditional land use such as grazing and/or mowing. In phytosociological terms they belong to the class of Euro-Siberian steppes, *Festuco-Brometea*. The prevailing vegetation types of the xero-thermophilous grasslands communities are *Poo badensis-Festucetum pallentis*, *Festuco pallentis-Caricetum humilis*, *Festuco valesiacae-Stipetum capillatae*, *Polygalo majoris-Brachypodietum pinnati* and Pannonian fringe vegetation *Geranio sanguinei-Dictamnetum albae* and *Geranio sanguinei-Peucedanetum cervariae*.



Geranio sanguinei-Dictamnetum albae

The stands of *Festuco valesiacae-Stipetum capillatae* (alliance *Festucion valesiacae*) represent a type of continental steppe.



Poo badensis-Festucetum pallentis

Festuco pallentis-Caricetum humilis



These communities were traditionally maintained by extensive grazing, mowing and burning.

According to the phytogeographical division of Slovakia (Futák 1984), Devínska Kobyla is situated on the border of two phytogeographical regions: the region of Pannonian flora and the region of West Carpathian flora. Finally, it belongs to the region Eupannonicum with close phytogeographic relationship to the Hundsheimer hills in Austria. In Devínska Kobyla we can find Western Carpathian, Pannonian and Mediterranean species growing together, and reaching the most western or northern boundaries of their natural occurrence. In the species composition of vegetation xerothermophilous and calciphilous elements dominate. Altogether, more than 1500 vascular plant species and subspecies including adventive taxa (Feráková et Hodálová unpubl.) were recorded here. All communities host a high number of endangered and rare species. 376 are threatened and 33 of them categorized as critically endangered (CR), endangered (EN) and vulnerable (VU), as well as 10 species in the category extinct (EX) are included in the Red Data Book, Vol. 5 of the Slovak and Czech Republics (Čeřovký et al., 1999). Species such as Conringia austriaca, Ononis pussila, Orobanche artemisiae-campestris, O. teucrii, Peucedanum arenarium and on the limestone rocks Rhamnus saxatilis subsp. saxatilis were recorded here and nowhere else in Slovakia. Gypsophila paniculata is on the verge of extinction.



Ophrys apifera

Neotinea ustulata



A famous spring aspect is created by *Adonis vernalis*, *Pulsatilla pratensis* and *P. vulgaris* subsp. *grandis*, later joined by *Iris pumila* in three colour tones – purple, yellow and white. The rare orchids *Anacamptis morio*, *A. pyramidalis*, *Neotinea tridentata* subsp. *tridentata*, *N. ustulata* subsp. *ustulata*, *Ophrys apifera*, *O. holoserica*, *O. insectifera*, *O. sphegodes* bloom in May together with *Stipa* grasses.



Iris pumila

On the steep slopes and open sands with the shallowest substratum calcareous grasslands can be found. The dominating *Festuca pallens* is accompanied by *Fumana procumbens, Linum tenuifolium, Potentilla incana* and *Scorzonera austriaca*. On the gentle slopes *Carex humilis* is dominant with numerous chamaephytes and ephemeral therophytes such as *Allysum montanum, Globularia bisnagarica, Helianthemum nummularium* subsp. grandiflorum, Jurinea mollis, Teucrium montanum, T. chamaedrys and Thymus praecox. On the rocky and moderately deep soils *Stipa capillata* and *Festuca valesiaca* stands are developed. The extra-zonal vegetation is represented by Pannonian fringe vegetation with common species *Geranium sanguineum, Dictamnus albus, Cyanus triumfettii, Anemone sylvestris* and *Tephroseris integrifolia*. An important feature of the floristic composition of the NNR is important also because of diversity of cryptogams: 110 lichen species, 100 bryophyte species and 331 fungi have been recorded.



Fauna

From the zoological point of view Devínska Kobyla is one of the places with the highest biodiversity in Slovakia. According to the zoogeographical classification of the terrestrial bio-cycle of Slovakia (Jedlička & Kalivodová 2002), the area of the NNR belongs to the region of West Carpathians, province of Pannonian steppe, part Devínska Kobyla Mts, on a border of the region of deciduous forests and steppes. It is particularly characterized by a high abundance of thermophilous and xerophilous species of insects, which create unique zoological communities. A lot of species reach the most northern boundary of their natural occurrence. Many species are rare, such as insect Mantispa styriaca, beetles Lucanus cervus, Oryctes nasicornis, Rosalia alpina and butterflies Zanclegnatha tarsicristalis, Yponemeuta vigintipunctatus and Procris gerryon. Xerothermic species including cicadas (Tibicina haematodes), crickets (Gryllus desertus), neuroptera (Ascalaphus macaronius), spiders (Eresus cinnaberinus), grasshoppers (Saga pedo) and Mantis religiosa contribute to the exotic atmosphere. Mantis religiosa, with two coloured varieties, is the only representative of Mantodae. A lot of them are protected and endangered, e.g. Papilio machaon, Iphiclides podalirius, Ascalaphus macaronius, Lucanus cervus, Parnassius mnemosine. On the open sandy places Meloe violaceus is also frequent. Altogether, 44 species of terrestrial gastropods were found here. The most abundant are Granaria frumentum, Balea biplicata and Truncatellina cylindrical. The amphibians are represented by Bufo bufo, Bufo viridis and Salamandra salamandra. In the southern slopes emerald coloured male lizard Lacerta viridis can be frequently seen.



Lacerta viridis



From the reptiles there are also Anguis fragilis, Natrix natrix and N. tesselata. The deciduous forests are the home of Elaphe longissima, the biggest snake in Slovakia. The endangered bird species, which nest here, are Corvus corax, Falco subbuteo, Tichodroma muraria and Upupa epops. The sandstone walls of Sandberg are attractive with the appearance of European bee-eaters Merops apiaster. Mammals are not as strongly represented as other animal groups. Among the typical representative of rodents (Rodentia) are Sciurus vulgaris, Microtus arvalis and Glis glis. Lagomorpha represents Lepus europaeus. Typical representatives of Carnivora are Meles meles and Vulpes vulpes. Artiodactyla are here represent by Capreolus capreolus and Sus scrofa.

Management and threats

The present state of vegetation on the Devínska Kobyla NNR is still conditioned predominantly by succession (Hegedüšová 2009). The xero-thermophilous grassland vegetation is strongly threatened by changes in management, and soil conditions, the first of all by the abandonment of the traditional use of the landscape and inappropriate human intervention in the past. During the state afforestation programme from 1956 many non-native species were planted, mostly *Pinus nigra*, further *Prunus serotina* and *Aesculus hippocastanum* (Kaleta 1968). Obscuration and needles cast, which chang the pH of soils, are liable for the threat of many rare endangered species. At the beginning of 2016, *Pinus nigra* and shrubs were cut down and permanent monitoring plots were gradually established to study the restoration of xero-thermophilous grassland vegetation. Soil erosion caused by cyclists riding on the sensitive south-western slopes and the construction of new open fires can damage the valuable plant communities in the area. Another problem represents non-native plant species, which grow in the surroundings of gardens, spread to the protected area and make it more difficult for native species to survive.





The results of the monitoring of permanent plots showed that goat grazing and shrub cutting/mulching resulted in the suppression of the spreading of competitively strong grasses such as *Bromus erectus*, *Arrhenatherum elatius* and shrubs *Crataegus* sp., *Rosa* spec. div. and *Prunus spinosa* and to an increase in the species diversity of grasslands.

Devín castle (9–15th century), 212 m a.s.l.

Due to its favourable geographical location and climatic conditions, Devínska Kobyla and its surrounding were one of the first parts of Slovakia to be inhabited (Viceníková et al. 2002). Neolithic people built the first dwellings in this area on the left side of the riverbank Dunaj between 5000 and 3500 BC. The strategic position of this place, the cliff (altitude of 212 m) at the confluence of the Dunaj and Morava rivers was an ideal place for a fort. Its owner could control the famous trade route along the Danube as well as one branch of the Amber Road. That is why the site had become a strategic military post during the time of the Bronze and Iron Ages (900 BC). In the Younger Iron Age, the territory was populated by Celts, which started to cut down the trees. At the times of the Roman Empire, Devin was still an important military station. In that period the Romans started growing wine grapes in vineyards on the Devínska Kobyla hills. Devín fortress was first mentioned in the documents from 864 AD under the name Dowina and Devín castle is one of the oldest castles in Slovakia. A pre-romanesque church was built on the castle approximately between 850 and 863/870.



During the Greater Moravian Empire (9th century), the castle was a significant boundary fortress as well as one of the political and administrative centres. Two Slavonic fortresses (Sandberg and quarry) were built on the hillsides of Devínska Kobyla to protect the kingdom of Prince Rastislav. After the fall of the Greater Moravian Empire, the castle served as a boundary castle of the Hungarian state. In the 13th century, a stone castle was built to protect the western frontier of the



Hungarian Kingdom and in the 15th century, the palace was added. It witnessed also the invasion of Turkish armies, German and Croatian colonisation (Devínska Nová Ves village). The last owners of the Devín Castle were the Counts of the Pálffy family. In the 19th century the castle was destroyed by the retreating forces of Napoleon I of France. Since 1965 archaeological research in the castle area and partial reconstruction of the ruins have been made. The castle hosts an interesting museum.

Taxon	Family	Note
Acer campestre	Sapindaceae	
Adonis vernalis	Ranunculaceae	
Aegonychon purpurocaeruleum		
(Lithospermum purpurocaeruleum)	Boraginaceae	
Agrostis capillaris	Poaceae	
Achillea collina	Compositae	
Achillea pannonica	Compositae	
Achillea setacea	Compositae	
Allium flavum	Amaryllidaceae	
Alyssum montanum	Brassicaceae	
Anacamptis morio (Orchis morio)	Orchidaceae	
Anacamptis pyramidalis	Orchidaceae	
Anemone sylvestris	Ranunculaceae	
Anthericum ramosum	Asparagaceae	
Arabis hirsuta	Brassicaceae	
Arenaria serpyllifolia agg.	Caryophyllaceae	
Arrhenatherum elatius	Poaceae	
Artemisia campestris	Compositae	
Asparagus officinalis	Asparagaceae	
Asperula cynanchica	Rubiaceae	
Asperula tinctoria	Rubiaceae	
Aster amellus	Compositae	
Astragalus onobrychis	Fabaceae	
Bothriochloa ischaemum	Poaceae	
Brachypodium pinnatum	Poaceae	
Brachypodium sylvaticum	Poaceae	
Briza media	Poaceae	
Bromopsis erecta (Bromus erectus)	Poaceae	
Bromus hordeaceus	Poaceae	
Bupleurum falcatum	Apiaceae	
Camelina microcarpa	Brassicaceae	
Campanula bononiensis	Campanulaceae	
Campanula glomerata	Campanulaceae	
Campanula sibirica	Campanulaceae	
Carex alba	Cyperaceae	

List of selected vascular plants



Taxon	Family	Note
Carex caryophyllea	Cyperaceae	
Carex hirta	Cyperaceae	
Carex humilis	Cyperaceae	
Carex michelii	Cyperaceae	
Carex pilosa	Cyperaceae	
Carex supina	Cyperaceae	
Carlina acaulis	Compositae	
Carlina vulgaris	Compositae	
Centaurea scabiosa (Colymbada	O a man a si ta a	
scabiosa)	Compositae	
	Compositae	
	Caryophyllaceae	
	Caryophyllaceae	
Cerastium giomeratum Cerastium pumilum subsp. alutinosum	Caryophyllaceae	
(Cerastium glutinosum)	Caryophyllaceae	
Cerastium semidecandrum	Caryophyllaceae	
Clematis recta	Ranunculaceae	
Clinopodium acinos (Acinos arvensis)	Lamiaceae	
Conringia austriaca	Brassicaceae	
Cornus mas	Cornaceae	
Cotoneaster integerrimus	Rosaceae	
Cruciata glabra	Rubiaceae	
Cyanus triumfettii (Centaurea triumfettii)	Compositae	
Cynodon dactylon	Poaceae	
Cytisus austriacus (Chamaecytisus		
austriacus) Cytisus hirsutus (Chamaocytisus	Fabaceae	
hirsutus)	Fabaceae	
Dianthus deltoides	Caryophyllaceae	
Dianthus pontederae	Caryophyllaceae	
Dictamnus albus	Rutaceae	
Dichoropetalum carvifolia		
(Peucedanum carvifolia)	Apiaceae	
herbaceum	Fabaceae	
Eryngium campestre	Apiaceae	
Erysimum diffusum agg.	Brassicaceae	
Erysimum odoratum	Brassicaceae	
Euonymus europaeus	Celastraceae	
Euonymus verrucosus	Celastraceae	
Falcaria vulgaris	Apiaceae	
Fallopia convolvulus	Polygonaceae	
Festuca pallens subsp. pallens	Poaceae	
Festuca rubra	Poaceae	



Taxon	Family	Note
Festuca stricta subsp. sulcata (Festuca		
rupicola)	Poaceae	
	Poaceae	
Fragaria Vesca	Rosaceae	
Fragaria Viridis	Rosaceae	
Fraxinus ornus	Oleaceae	
Fumana procumbens	Cistaceae	
Galanthus nivalis	Amaryllidaceae	
Galatella linosyris (Crinitina linosyris)	Compositae	
Galium album subsp. pycnotrichum	Rubiaceae	
Galium glaucum	Rubiaceae	
Galium odoratum	Rubiaceae	
Galium verum	Rubiaceae	
Genista germanica	Fabaceae	
Genista pilosa	Fabaceae	
Genista tinctoria	Fabaceae	
Geranium sanguineum	Geraniaceae	
Globularia bisnagarica (Globularia	Diantaginagaa	
punciala) Gynsonhila naniculata	Convention	
Hedera heliy	Araliaaaaa	
Helianthemum canum (Rhoday canus)	Ciatagogo	
Helianthemum nummularium subsp.	Cistaceae	
grandiflorum	Cistaceae	
Helianthemum nummularium subsp.	Oistassa	
obscurum Helictochloa pratensis (Avenula	Cistaceae	
pratensis)	Poaceae	
Helichrysum arenarium	Compositae	
Hepatica nobilis	Ranunculaceae	
Hesperis tristis	Brassicaceae	
Himantoglossum adriaticum	Orchidaceae	
Holosteum umbellatum	Caryophyllaceae	
Hypochaeris maculata	Compositae	
Hypochaeris radicata	Compositae	
Chondrilla juncea	Compositae	
Chrysopogon gryllus	Poaceae	
Inula conyzae	Compositae	
Inula ensifolia	, Compositae	
Inula hirta	, Compositae	
Inula oculus-christi	Compositae	
Iris pumila	Iridaceae	
Iris variegata	Iridaceae	
Jacobaea vulgaris (Senecio jacobaea)	Compositae	
Juniperus communis	Cupressaceae	



Taxon	Family	Note
Jurinea mollis	Compositae	
Koeleria macrantha	Poaceae	
Lembotropis nigricans	Fabaceae	
Leontodon hispidus	Compositae	
Leopoldia comosa	Asparagaceae	
Linaria genistifolia	Plantaginaceae	
Linum catharticum	Linaceae	
Linum flavum	Linaceae	
Linum hirsutum	Linaceae	
Linum tenuifolium	Linaceae	
Lotus borbasii	Fabaceae	
Medicago falcata	Fabaceae	
Medicago lupulina	Fabaceae	
Medicago minima	Fabaceae	
Medicago monspeliaca	Fabaceae	
Melica ciliata	Poaceae	
Melica nutans	Poaceae	
Melica transsilvanica	Poaceae	
Melica uniflora	Poaceae	
Melilotus officinalis	Fabaceae	
Minuartia glaucina	Caryophyllaceae	
Minuartia rubra	Caryophyllaceae	
Minuartia setacea	Caryophyllaceae	
Muscari neglectum	Asparagaceae	
Neotinea tridentata subsp. tridentata (Orchis tridentata subsp. tridentata) Neotinea ustulata (Orchis ustulata	Orchidaceae	
subsp. ustulata) Noccaea perfoliata (Thlaspi	Orchidaceae	
perfoliatum)	Brassicaceae	
Nonnea pulla	Boraginaceae	
Odontites luteus (Orthantha lutea)	Orobanchaceae	
Onobrychis viciifolia	Fabaceae	
Ononis pusilla	Fabaceae	
Ononis spinosa	Fabaceae	
Ophrys apifera	Orchidaceae	
Ophrys holoserica	Orchidaceae	
Ophrys insectifera	Orchidaceae	
Ophrys sphegodes	Orchidaceae	
Orchis militaris	Orchidaceae	
Ornithogalum orthophyllum subsp. kochii (Ornithogalum kochii)	Asparagaceae	
Orobanche artemisiae-campestris	Orobanchaceae	
Orobanche caryophyllacea	Orobanchaceae	



Taxon	Family	Note
Orobanche lutea	Orobanchaceae	
Orobanche teucrii	Orobanchaceae	
Petrorhagia saxifraga	Caryophyllaceae	
Peucedanum alsaticum	Apiaceae	
Peucedanum arenarium	Apiaceae	
Peucedanum cervaria	Apiaceae	
Peucedanum oreoselinum	Apiaceae	
Phelipanche arenaria	Orobanchaceae	
Pilosella hoppeana (Pilosella	0	
macrantha) Dilagalla officinarium	Compositae	
	Compositae	
Pimpinella saxilraga agg.	Apiaceae	
Poa angustilolla	Poaceae	
Poa bulbosa	Poaceae	
Poa pratensis	Poaceae	
Potentilla incana (Potentilla arenaria)	Rosaceae	
Primula veris	Primulaceae	
Prunella laciniata	Lamiaceae	
Prunella vulgaris	Lamiaceae	
Prunus fruticosa (Cerasus fruticosa)	Rosaceae	
Prunus mahaleb (Cerasus mahaleb)	Rosaceae	
Prunus spinosa	Rosaceae	
Pseudoturritis turrita (Arabis turrita)	Brassicaceae	
Pulsatilla pratensis (Pulsatilla pratensis	Ranunculaceae	
Pulsatilla vulgaris subsp. grandis	Randheulaceae	
(Pulsatilla grandis)	Ranunculaceae	
Quercus cerris	Fagaceae	
Quercus petraea	Fagaceae	
Quercus pubescens	Fagaceae	
Rhamnus saxatilis subsp. saxatilis	Rhamnaceae	
Rosa rubiginosa	Rosaceae	
Rosa spinosissima (Rosa pimpinellifolia)	Rosaceae	
Salvia nemorosa	Lamiaceae	
Salvia pratensis	Lamiaceae	
Sanguisorba minor	Rosaceae	
Scabiosa ochroleuca	Dipsacaceae	
Scorsonera hispanica	Compositae	
Scorzonera austriaca	Compositae	
Scorzonera purpurea	Compositae	
Securigera varia	Cichorieae	
Sedum acre	Crassulaceae	
Sedum album	Crassulaceae	



Taxon	Family	Note
Sedum sexangulare	Crassulaceae	
Seseli hippomarathrum	Apiaceae	
Seseli libanotis (Libanotis pyrenaica)	Apiaceae	
Seseli osseum	Apiaceae	
Silene otites	Caryophyllaceae	
Silene vulgaris	Caryophyllaceae	
Smyrnium perfoliatum	Apiaceae	
Stachys officinalis (Betonica officinalis)	Lamiaceae	
Stachys recta	Lamiaceae	
Stipa capillata	Poaceae	
Stipa pennata (Stipa joannis)	Poaceae	
Stipa pulcherrima	Poaceae	
Tanacetum corymbosum (Pyrethrum corymbosum)	Compositae	
Taraxacum sect. Erythrosperma	Compositae	
Taraxacum serotinum	Compositae	
Tephroseris integrifolia	Compositae	
Teucrium chamaedrys	Lamiaceae	
Teucrium montanum	Lamiaceae	
Thalictrum minus	Ranunculaceae	
Thesium linophyllon	Santalaceae	
Thymus praecox	Lamiaceae	
<i>Thymus pulegioides</i> subsp. <i>pannonicus</i> (<i>Thymus pannonicus</i>)	Lamiaceae	
Tragopogon dubius	Cichorieae	
Tragopogon pratensis subsp. orientalis (Tragopogon orientalis)	Cichorieae	
Trifolium alpestre	Fabaceae	
Verbascum lychnitis	Scrophulariaceae	
Verbascum phoeniceum	Scrophulariaceae	
Veronica austriaca	Plantaginaceae	
Veronica hederifolia agg.	Plantaginaceae	
Veronica chamaedrys	Plantaginaceae	
Veronica officinalis	Plantaginaceae	
Veronica prostrata	Plantaginaceae	
Veronica spicata (Pseudolysimachion spicatum)	Plantaginaceae	
Vincetoxicum hirundinaria	Apocynaceae	
Viola ambigua	Violaceae	
Viola kitaibeliana	Violaceae	
Viola rupestris	Violaceae	
Viola suavis	Violaceae	
Viola tricolor	Violaceae	
Xeranthemum annuum	Compositae	



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Excursion 3. Dry calcareous grasslands of the Tematínske vrchy: conservation and restoration

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Location

Lúka nad Váhom: 48.66°N, 17.88°E, 175 m a.s.l. Tematínsky hrad Castle: 48.68°N, 17.93°E, 576 m a.s.l.

Climate

Annual precipitation total: 611 mm (at the nearest station in Piešťany)

Mean annual temperature: 9.4°C (-2.2°C in winter months; and 19.7°C in summer months)





Geology

The geological bedrock of the visited area is built by Mesosoic (Triasic) dolomite and limestone.

Soils

The most common soil type in the area is a shallow protorendzina.

Geography and nature conservation

Tematínske vrchy is the Area of European importance (SKUEV0380, 2471.27 ha, elevation range 215–684 m a.s.l.). It includes three protected areas: the National Natural Reserves Javorníček (15.06 ha) and Tematínska lesostep (59.67 ha), and the Nature Reserve Kňaží vrch (150.94 ha).

Habitats (according to Natura 2000 habitat classification)

6110 Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi

6190 Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates

6240 Sub-pannonic steppic grasslands

6510 Extensively managed hay meadows of the planar to submontane zones (*Arrhenatherion*)

8160 Medio-European calcareous scree of hill and montane levels

9130 Asperulo-Fagetum beech forests

- 9150 Medio-European limestone beech forests of the Cephalanthero-Fagion
- 9180 Tilio-Acerion forests of slopes, screes and ravines
- 91H0 Pannonian woods with Quercus pubescens

Vegetation synopsis

Class Quercetea pubescentis Doing-Kraft ex Scamoni et Passarge 1959

Order Quercetalia pubescenti-petraeae Klika 1933

Alliance Quercion pubescenti-petraeae Br.-Bl. 1932 nom. corr.

Alliance Quercion petraeae Issler 1931

Class Carpino-Fagetea sylvaticae Jakucs ex Passarge 1968

Order Carpinetalia betuli P. Fukarek 1968

Alliance Carpinion betuli Issler 1931

Order *Fagetalia* Pawłowski ex Pawłowski et al. 1928

Alliance Fagion sylvaticae Luquet 1926

Alliance Lonicero alpigenae-Fagion sylvaticae Dierschke 1998

Order Aceretalia pseudoplatani Moor 1976 nom. cons. propos.

Alliance Tilio platyphylli-Acerion Klika 1955

Class Festuco-Brometea Br.-Bl. et Tüxen ex Soó 1947

Order Stipo pulcherrimae-Festucetalia pallentis Pop 1968



Alliance Bromo pannonici-Festucion pallentis Zólyomi 1966
Ass. Poo badensis-Festucetum pallentis Klika 1931 corr. Zólyomi 1966
Ass. Festuco pallentis-Caricetum humilis Sillinger 1930 corr. Guterman et Mucina 1993
Alliance Diantho lumnitzeri-Seslerion (Soó 1971) Chytrý et Mucina in Mucina et al. 1993
Ass. Minuartio setaceae-Seslerietum calcariae Klika 1931
Order Festucetalia valesiacae Br.-Bl. ex R. Tx. Ex Br.-Bl. 1949
Alliance Festucion valesiacae Klika 193
Class Molinio-Arrhenatheretea R. Tx. 1937
Order Arrhenatheretalia R. Tx. 1931
Alliance Arrhenatheretum elatoris Koch 1926

Forest communities

Forests are dominant vegetation in the region. The habitat conditions on the southern and northern slopes differ strongly, so that different types of climax communities have developed. Most common are the Carpathian oak-hornbeam forests (*Carpinion betuli*), with islands of oak forests with *Quercus cerris* (*Quercion petraeae*) and sub-Mediterranean xero-thermophilous oak forests (*Quercion pubescentis-petraeae*). In the latter, *Quercus pubescens* dominates the tree layer, and *Cornus mas* the shrub layer. They are distributed at the periphery of the Pannonian Basin, on extremely dry, south-facing slopes, on shallow, calcareous soils.



Patches of rocky steppes surrounded by *Quercus pubescens*-dominated forests. The view to Bôrovište from Hradlová nivka.



Because of these extreme site conditions, the woods are often fragmentary and lowgrowing, sometimes only shrubby. The herb layer is rich in species, and often contains xerothermic species from dry grasslands or forest fringes. Occasionally, *Tilia platyphyllos* and *Fraxinus excelsior* can become dominant. White-oak woods often form mosaics with dry grasslands.



Beech forests of the Lonicero alpigenae-Fagion sylvaticae

At higher altitudes and on north-facing slopes, calciphilous beech forests (*Lonicero alpigenae-Fagion sylvaticae*) develop. A restricted area is occupied by the mixed lime-maple forests (*Tilio-Acerenion*).

Plantations of Pinus nigra and Fraxinus ornus

About fourty years ago the forest management in the area carried out a project of antierosion measures. Plantations of non-native woody species such as pine (*Pinus nigra*), and ash (*Fraxinus ornus*) were planted on many of species-rich grassland



areas. At that time conservation efforts in the area were weak and could not prevent the afforestation. Due to the afforestation some localities with grasslands were overgrown by pines and became lost. The rest of the grassland habitats became threatened by succession towards forest communities caused by agressive nonnative species (mainly *Pinus nigra*).

Grassland communities

Rupicolous Pannonian grasslands of the *Bromo pannonici-Festucion pallentis* represent open dry grasslands on limestone and dolomite bedrock in the Pannonian region and lower peri-Carpathian mountain ranges or Inner-Carpathian basins (intermontane basins of northern and central Slovakia) with warm and dry climate. They are restricted to mild or steep sun-exposed slopes with shallow soils and karst rocky fields. The regular periods of summer drought act as limiting factor in formation of open communities dominated by competitively weak but stress-tolerant species. Caespitose grasses (*Festuca pallens*) or graminoids (*Carex humilis*) dominate in these communities and determine substantially their syntaxonomical position.



Rocky steppe of the Poo badensis-Festucetum pallentis

Dealpine Sesleria-grasslands of the Diantho lumnitzeri-Seslerion represent communities dominated by Sesleria albicans at lower altitudes (colline to submontane belt). They occupy usually cooler and moister (often north-facing or inverse) locations in the warm peri-Carpathian calcareous mountains. Typical is the presence of



numerous dealpine species, which are usually distributed in the subalpine and alpine belt but occasionally also occur in relic localities of lower altitudinal belts. Among them, *Acinos alpinus, Biscutella laevigata, Leontodon incanus, Phyteuma orbiculare, Polygala amara* subsp. *brachyptera, Saxifraga paniculata* and *Thesium alpinum* are the most frequent. These communities are bound to calcareous bedrock (limestones and dolomites) and to rendzina soils which are rather deep with high humus content. They cover upper ridge slopes or steep rock cliffs. In some places, dealpine Sesleriagrasslands has presumably never been covered by closed forests.



Minuartio setaceae-Seslerietum calcariae on the north-facing slope

Sub-pannonic steppic grasslands of the Festucion valesiacae alliance are distributed on deeper soils. They are much less widespread nowdays, due to abandonment of pastures and forest encroachment. Tussock grasses (*Festuca valesiaca*, *F. rupicola*, *Koeleria macrantha*, *Bothriochloa ischaemum*, *Stipa capillata* Sub-pannonic steppic grasslands) dominate these communities.

List of the selected bryophytes and lichens occurring in the dry grassland communities of the Tematínske vrchy Mts (the rare species are in bold):

Arthothelium lirellans, Bacidina neosquamulosa, Bryum argenteum, Catapyrenium laniculatum, Cladonia furcata, Cladonia polycarpoides, Cladonia pyxidata subsp. chlorophaea, Coelocaulon muricatum, Ctenidium molluscum, Ditrichum flexicaule,



Fulgensia fulgens, Grimmia pulvinata, Hylocomium splendens, Hypnum cupressiforme, Neckera crispa, Parmelina quercina, Peltigera rufescens, Placolecis opaca, Plagiomnium undulatum, Pleurochaete squarrosa, Rhytidiadelphus triquetrus, Rhytidium rugosum, Thuidium abietinum, Toninia sedifolia, Tortella inclinata, Tortella tortuosa, Tortula intermedia

Fauna

List of interesting animal species occurring in the region of the Tematínske vrchy Mts (species of European importance are in bold)

Molluscs: *Vertigo moulinsiana* (periglacial relict, inhabits calcareous springs with tufa formation, recorded in Modrová valley, critically endangered), *Petasina filicina* (East-alpine element, the only site in Slovakia where this species was found, is in Modrová valley, critically endangered)

Spiders: Eresus niger (thermophilous species, rare in Slovakia), Atypus piceus (rare).

Insects: *Mantis religiosa* (Praying Mantis, thermophilous species), *Saga pedo* (very rare thermophilous species of locust).

Cicadas: *Lyristes plebejus* (Mediteranean species, very rare, records from Modrová 1946, and Kňaží vrch 2000), *Cicada orni* (Mediteranean species, very rare, records from Modrová 1946, and Kňaží vrch 2001).

Butterflies: Parnassius mnemosyne (Clouded Apollo), Maculinea arion, Polyommatus slovacus (a new species for fauna of Slovakia described from Lúka in 1997, thermophilous, threatened by loss of open habitats by succession, afforestation, the most vital population in Slovakia was found in the area), Colias myrmidone (extremely endangered, life cycle tied to Cytisus, recorded at the edges of the area).

Other insects: *Marumba quercus, Lycaena dispar, Euplagia quadripunctaria, Eriogaster catax.*

Beetles: (life cycle of the following species is tied to decaying trees (oak, beech), *Rosalia alpina, Cerambyx cerdo, Lucanus cervus* (Stag Beetle).

Amphibians: Bufo bufo (Common Toad), B. viridis (Green Toad), Rana dalmatina (Spring-frog), R. temporaria, Salamandra salamandra (Salamander), Bombina variegata.

Reptiles: Zamenis longissimus (syn. Elaphe longissima, Aesculap-adder, thermophilous species, the biggest snake species in Slovakia), Coronella austriaca (Smooth-snake), Anguis fragilis (Slow-worm), Natrix natrix, Podarcis muralis (Wall-lizard), Lacerta agilis (Sand-lizard), Lacerta viridis (Green-lizard, the biggest lizard species in Slovakia, thermophilous species).

Birds: Aquila heliaca, Bubo bubo, Columba oenas, Upupa epops, Caprimulgus europaeus, Dendrocopos leucotos, Ficedula parva.



Bats: *Pipistrellus pipistrellus, Plecotus austriacus, Eptesicus serotinus, Rhinilopus hipposideros, Barbastella barbastellus, Myotis mystacinus, Nyctalus noctula, Myotis myotis.*

Other mammals: Erinaceus concolor, Felis silvestris, Glis (Myoxus) glis, Martes foina, Martes martes, Meles meles, Micromys minutus, Mustela erminea, Muscardinus avellanarius, Mustela nivalis, Mustela putorius, Sciurus vulgaris, Sorex araneus, Sorex minutus.

Management and threats

Since 1999, the non-governmental organization Pre Prírodu (Civic Association For Nature), and since 2015 the NGO Bratislavské regionálne ochranárske združenie – BROZ have been active in the area of Tematínske vrchy Mts. It associates volunteers, professional conservationists and the public to protect natural values of the Middle Považie region. The number of active members varies between 20 and 30. The activities of this organisation were supported by foundations, sponsors, municipalities and individual donors. In the Tematínske vrchy, the conservation management was completed on the most valuable habitats and included mainly cutting of non-native conifers.



The spread of pine trees in the rocky steppes was stopped by a restoration activity of the local NGOs.



Ruine of the Tematín Castle (13th century), 576 m a.s.l.



Tematín castle surrounded by rocky steppe of Festuco pallentis-Caricetum humilis

The castle was originally built in the second half of the 13th century in the Kingdom of Hungary. It was completely reconstructed by the Thurzó family, owners of the castle since 1524. The last owner was Miklós Bercsényi, general of the anti-Habsburg insurrection army during Rákóczi's War of Independence. The castle fell into ruins after it was besieged in 1710 as a part of the suppression of the anti-Habsburg uprising.



The rocky steppe areas of Bôrovište recovering after removal of Pinus sylvestris and Fraxinus ornus

List of vascular plants ocurring in dry and sub-xerophilous grasslands and in their contact communities (mainly fringes and transitions to the termophilous oak forests) in the Tematínske vrchy Mts. Cb = Carpinion betuli, Ae = Arrhenatherion elatioris, Fv = Festucion valesiacae, Qpp = Quercion pubescenti-petraeae, SF = Stipo pulcherrimae-Festucetalia pallentis, WC = endemic to the Western Carpathians, WCs = subendemic to the Western Carpathians, C4 = C4 carbon fixation, FP = Forest plantation.

Taxon	Family	Target habitat	Note
Acer campestre	Sapindaceae	Cb	
Achillea millefolium	Compositae	Ae	
A. pannonica (A. seidlii)	Compositae	Fv	
Acinos alpinus	Lamiaceae	SF	
A. arvensis (Clinopodium acinos)	Lamiaceae	Fv	
Acosta rhenana (Centaurea stoebe)	Compositae	Fv	
Adonis vernalis	Ranunculaceae	Fv	
Agrimonia eupatoria	Rosaceae	Ae	
Allium flavum	Amaryllidaceae	SF	
A. ochroleucum	Amaryllidaceae	SF	
A. senescens	Amaryllidaceae	SF	
Alyssum montanum	Brassicaceae	SF	
Anemone sylvestris	Ranunculaceae	Fv	
Anthericum ramosum	Asparagaceae	SF	



Taxon	Family	Target habitat	Note
Anthyllis vulneraria	Fabaceae	SF	
Arabis hirsuta agg.	Brassicaceae	Ae	
Arabis turrita	Brassicaceae	Qpp	
Arenaria serpyllifolia	Caryophyllaceae	SF	
Asperula cynanchica	Rubiaceae	SF	
A. tinctoria	Rubiaceae	Fv	
Aster amelloides (A. amellus)	Compositae	Fv	
Astragalus onobrychis	Fabaceae	Fv	
Avenula (Helictotrichon) pubescens	Poaceae	Ae	
Betonica (Stachys) officinalis	Lamiaceae	Ae	
Biscutella laevigata	Brassicaceae	SF	
Bothriochloa ischaemum	Poaceae	Fv	C4
Brachypodium pinnatum	Poaceae	Qpp	
Briza media	Poaceae	Ae	
Bromus erectus	Poaceae	Ae	
Bromus monocladus (B. pannonicus subsp. monocladus)	Poaceae	SF	
Bupleurum falcatum	Apiaceae	SF	
Campanula bononiensis	Campanulaceae	SF	
C. glomerata	Campanulaceae	Ae	
C. moravica	Campanulaceae	SF	
C. rapunculoides	Campanulaceae	Cb	
C. sibirica	Campanulaceae	SF	
Cardaminopsis (Arabidopsis) arenosa	Brassicaceae	SF	
Carex caryophyllea	Cyperaceae	Fv	
C. humilis	Cyperaceae	SF	
C. michelii	Cyperaceae	Qpp	
C. pilosa	Cyperaceae	Cb	
Carlina vulgaris	Compositeae	Fv	
Carpinus betulus	Betulaceae	Cb	
Carum carvi	Apiaceae	Ae	
Cerastium brachypetalum	Caryophyllaceae	SF	
C. pumilum	Caryophyllaceae	SF	
Chamaecytisus supinus	Fabaceae	SF	
Chrysopogon gryllus	Poaceae	Fv	C4
Clematis recta	Ranunculaceae	Qpp	
Clinopodium vulgare	Lamiaceae	Qpp	
Cornus mas	Cornaceae	Qpp	
Corylus avellana	Betulaceae	Cb	



Taxon	Family	Target habitat	Note
Crinitina (Galatella) linosyris	Compositeae	SF	
Dactylis glomerata	Poaceae	Ae	
Daphne cneorum		SF	
Dianthus carthusianorum	Caryophyllaceae	Ae	
D. praecox subsp. lumnitzeri (D. plumarius subsp. lumnitzeri)	Caryophyllaceae	SF	wc
Dictamnus albus	Rutaceae	Qpp	
Dorycnium pentaphyllum	Fabaceae	SF	
Draba lasiocarpa	Brassicaceae	SF	
Echium vulgare	Boraginaceae	SF	
Elytrigia intermedia (Elymus hispidus)	Poaceae	Fv	
Erophila verna agg.	Brassicaceae	SF	
Eryngium campestre	Apiaceae	Fv	
Erysimum odoratum	Brassicaceae	Fv	
Festuca pallens	Poaceae	SF	
F. rubra	Poaceae	Ae	
F. rupicola	Poaceae	Fv	
F. valesiaca	Poaceae	Fv	
Fragaria viridis	Rosaceae	Fv	
Fraxinus ornus	Oleaceae	FP	
Fumana procumbens	Cistaceae	SF	
Galium glaucum	Rubiaceae	Qpp	
G. mollugo	Rubiaceae	Ae	
G. odoratum	Rubiaceae	Cb	
G. schultesii (G. intermedium)	Rubiaceae	Cb	
Genista pilosa	Fabaceae	SF	
Geranium sanguineum	Geraniaceae	Qpp	
Globularia punctata	Plantaginaceae	SF	
Helianthemum obscurum (H.ovatum)	Cistaceae	SF	
Hippocrepis comosa	Fabaceae	SF	
Holosteum umbellatum	Caryophyllaceae	SF	
Hornungia petraea	Brassicaceae	SF	
Hypericum perforatum	Hypericaceae	Ae	
Inula ensifolia	Compositeae	SF	
I. hirta	Compositeae	Qpp	
Jovibarba globifera (Sempervivum globiferum)	Crassulaceae	SF	
Juniperus communis	Cupressaceae	Fv	
Jurinea mollis	Compositeae	Fv	
Knautia kitaibelii	Caprifoliaceae	Ae	WCs



Taxon	Family	Target habitat	Note
Koeleria macrantha	Poaceae	Fv	
Lathyrus niger	Fabaceae	Cb	
L. vernus	Fabaceae	Cb	
Leontodon hispidus	Compositeae	Ae	
L. incanus	Compositeae	SF	
Leopoldia comosa	Asparagaceae	Ae	
Leucanthemum vulgare	Compositeae	Ae	
Ligustrum vulgare	Oleaceae	Qpp	
Limodorum abortivum	Orchideaceae	Qpp	
Linaria genistifolia	Plantaginaceae	SF	
Linum tenuifolium	Linaceae	SF	
Lithospermum purpurocaeruleum (Buglossoides purpurocaerulea)	Boraginaceae	Qpp	
Lonicera xylosteum	Caprifoliaceae	Cb	
Lotus corniculatus	Fabaceae	Ae	
Medicago falcata	Fabaceae	Fv	
M. lupulina	Fabaceae	Ae	
Melampyrum nemorosum	Orobanchaceae	Cb	
Melica ciliata	Poaceae	Fv	
M. transsilvanica	Poaceae	SF	
M. uniflora	Poaceae	Qpp	
Melittis melissophyllum	Lamiaceae	Qpp	
Onosma visianii	Boraginaceae	SF	
Orchis militaris	Orchideaceae	Fv	
Origanum vulgare	Lamiaceae	Fv	
Ornithogalum umbellatum	Asparagaceae	Ae	
Oryzopsis (Piptatherum) virescens	Poaceae	Qpp	
Petrorhagia prolifera	Caryophyllaceae	Fv	
Peucedanum cervaria	Apiaceae	Fv	
Phleum phleoides	Poaceae	Fv	
Phyteuma orbiculare	Campanulaceae	SF	
Pilosella bauhinii (Pilosella piloselloides subsp. bauhinii)	Compositeae	Fv	
Pimpinella saxifraga	Apiaceae	Ae	
Pinus nigra	Pinaceae	FP	
P. sylvestris	Pinaceae	FP	
Plantago lanceolata	Plantaginaceae	Ae	
Poa angustifolia	Poaceae	Ae	
P. badensis	Poaceae	SF	
P. bulbosa	Poaceae	SF	



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Taxon	Family	Target habitat	Note
P. nemoralis	Poaceae	Cb	
Polygala amara subsp. brachyptera	Polygalaceae	SF	
Potentilla arenaria (P. incana)	Rosaceae	SF	
P. heptaphylla	Rosaceae	SF	
P. tabernaemontani	Rosaceae	SF	
Prunella laciniata	Lamiaceae	Ae	
Pulmonaria officinalis	Boraginaceae	Cb	
Pulsatilla grandis	Ranunculaceae	SF	
Pulsatilla subslavica	Ranunculaceae	SF	WC
Pyrethrum corymbosum	Compositeae	Qpp	
Quercus cerris	Fagaceae	Qpp	
Q. petraea	Fagaceae	Cb	
Q. pubescens	Fagaceae	Qpp	
Ranunculus acris	Ranunculaceae	Ae	
R. bulbosus	Ranunculaceae	Ae	
Sanguisorba minor	Rosaceae	SF	
Saxifraga paniculata	Saxifragaceae	SF	
S. tridactylites	Saxifragaceae	SF	
Scabiosa canescens	Caprifoliaceae	SF	
S. ochroleuca	Caprifoliaceae	SF	
Scorzonera austriaca	Compositeae	SF	
Securigera varia	Fabaceae	SF	
Sedum acre	Crassulaceae	SF	
S. album	Crassulaceae	SF	
S. sexangulare	Crassulaceae	SF	
Senecio jacobaea (Jacobaea vulgaris)	Compositeae	Ae	
Seseli hippomarathrum	Apiaceae	SF	
Seseli osseum	Apiaceae	SF	
Sesleria albicans	Poaceae	SF	
Silene nemoralis (Silene italica subsp. nemoralis)	Caryophyllaceae	Qpp	
S. nutans	Caryophyllaceae	Ae	
S. otites agg.	Caryophyllaceae	SF	
S. vulgaris	Caryophyllaceae	Ae	
Sorbus torminalis	Rosaceae	Qpp	
Stachys recta	Lamiaceae	Fv	
Stellaria holostea	Caryophyllaceae	Cb	
Stipa capillata	Poaceae	Fv	
S. eriocaulis (S. pennata)	Poaceae	SF	



Taxon	Family	Target habitat	Note
Symphytum tuberosum	Boraginaceae	Cb	
Teucrium chamaedrys	Lamiaceae	SF	
T. montanum	Lamiaceae	SF	
Thesium alpinum	Santalaceae	SF	
T. linophyllon	Santalaceae	SF	
Thlaspi montanum	Brassicaceae	SF	
T. perfoliatum	Brassicaceae	SF	
Thymus praecox	Lamiaceae	SF	
Tithymalus (Euphorbia) amygdaloides	Euphorbiaceae	Cb	
T. (E.) cyparissias	Euphorbiaceae	SF	
T. (E.) epithymoides	Euphorbiaceae	Qpp	
Tragopogon orientalis	Compositeae	Ae	
Trifolium pratense	Fabaceae	Ae	
T. repens	Fabaceae	Ae	
Trinia glauca	Apiaceae	SF	
Veronica austriaca	Plantaginaceae	Fv	
Viburnum lantana	Adoxaceae	Qpp	
Vincetoxicum hirundinaria	Apocynaceae	Qpp	
Viola reichenbachiana	Violaceae	Cb	



Excursion 4. Sand kingdom of the Záhorie Lowland

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Locations

Mešterova lúka Protected Landscape Area (1.33 km2): 48°28'45"N, 17°03'35"E, ca. 185 m a.s.l

Lakšárska duna dune (5.27 ha): N 48°34'56"N, 17°10'33"E, ca. 220 m a.s.l Borský Mikuláš/Borský Peter: N 48°38'32" N, 17°13'47" E, ca. 199 m a.s.l Šaštín: 48°38'17.6"N, 17°08'34.61"E, ca. 183 m a.s.l

Climate

The region is a plain behind mountains, so the climate is much drier than that of the rest of Slovakia. Average year temperature is 9-10 degrees, the hottest month is July with 19.4 degrees; the coldest one is January with 1.8 degrees. Rainfalls are at average rate of 560 mm. Záhorie is the area with hot and mild wet climate with mild winters.



Geology and geography

The peculiar part of Slovakia – Záhorie represent the lowland of triangular shape situated in the northwestern margin of the Pannonian Basin. Záhorie is a region of natural beauties, possessions of earth, thermal healing waters, plains, foothills and hills covered by woods. Is bounded by the west by Morava river and the eastern border is formed by Malé Karpaty Mts (Little Carpathian Mountains). Specific geology – aeolian sand dunes and oligotrophic sandy soils are manifested in different vegetation cover comparing other parts of Slovakia.

Nature conservation

Mešterova lúka Protected Landscape Area is located in the cadastral territory of the Malacky town and in the military district of Záhorie, in the district of Malacky (Bratislava region). The area was declared in 2011. The subject of protection are habitats of European importance: old acidophilous oak woods with Quercus robur on sandy plains, natural dystrophic lakes and ponds, transition mires and quaking bogs and bog woodlands. This area is under the 2nd, 4th and 5th level of nature protection.

Habitats (according to Natura 2000 habitat classification)

2330 Open grassland with *Corynephorus* and *Agrostis* of continental dunes
2340* Pannonic inland dunes
3160 Natural dystrophic lakes and ponds
7140 Transition mires and quaking bogs
91D0* Bog woodland
9190 Old acidophilous oak woods with *Quercus robur* on sandy plains
91T0 Central European lichen Scots pine forests
Vegetation synopsis

Class Koelerio-Corynephoretea Klika in Klika et Novák 1941 Order Corynephoretalia canescentis Klika 1934 Alliance Corynephorion canescentis Klika 1931 Ass. Thymo angustifolii-Corynephoretum canescentis Krippel 1954 Ass. Festuco dominii-Corynephoretum Borhidi (1958) 1996 Alliance Armerion elongatae Passarge 1964 Ass. Erysimo diffusi-Agrostietum capillaris Vicherek in Chytrý et al. 1997 Class Lemnetea de Bolós et Masclans 1955 Order Lemno-Utricularietalia Passarge 1978 Alliance Utricularion vulgaris Passarge 1964 Ass. Lemno-Utricularietalia Passarge 1964 Class Quercetea robori-petraeae Br.-Bl. et R. Tx. ex Oberd. 1957 Order Quercetalia roboris R. Tx. 1931 Alliance Quercion roboris Malcuit 1929 Ass. Festuco ovinae-Quercetum roboris Šmarda 1961



Ass. *Molinio arundinaceae-Quercetum roboris* Neuhäusl et Neuhäuslová-Novotná 1967 nom. cons.

Class Dicrano-Pinetea Hartmann et Jahn 1967

Order Pinetalia sylvestris Oberd. 1957

Alliance Dicrano-Pinion (Libbert 1933) W. Matuszkiewicz 1962

Ass. Cladonio-Pinetum sylvestris Juraszek 1928

Ass. Hylocomium splendens-Pinus sylvestris community

Forests and grasslands communities

The first stop Mešterova lúka PLA is an example of extrazonal vegetation inside the pine forests.

The terrain depressions between sandy dunes occupy the acidophilous oak woods with *Quercus robur* on sandy plains with dominance of *Molinia arundinacea* in the understory. Typical are the alder swamp woodlands often admixed by *Betula pendula* and oak trees considered probably as fragments of bog woodlands. Water table represent natural dystrophic ponds with *Utricularia* communities and small patches of transitional mires with *Sphagnum* species. Common taxa are *Caltha palustris*, in water relatively rare are *Comarum palustre*, *Hottonia vulgaris*, *Hydrocharis morsus-ranae*, *Hydrocotyle vulgaris*. On edges of water grows *Iris pseudacorus* and othe helophytes such as *Lycopus europaeus*, *Lysimachia vulgaris*, *Lythrum salicaria*, *Scutellaria galericulata*. Typical are tall sedges (*Carex elata*, *C. elongate*, *C. pseudocyperus*, *C. riparia*, *C. vesicaria*) as well as rushes (*Juncus bulbosus*, *J. conglomeratus*, *J. effuses*).





Second stop is in intravilan of village Lakšárska Nová Ves. On the outskirt of the village can be observed an example of sand dune, partly open and partly covered by pine woodland with typical sand dunes species *Corynephorus cannescens*, *Cynodon dactylon*, *Dianthus serotinus* subsp. *borussicus*, *Koeleria glauca*, *Jasione montana*, Spergula *morisonii*, *S. pentandra* or *Scorzonera purpurea*. Typical taxon on locality is *Viola saxatilis* subsp. *curtisii*.



Third stop brings a view of the interior of the dry lichen pine forest of the *Cladonio-Pinetum* association. Acidophytes, such as *Calluna vulgaris*, *Carex ericetorum*, *Veronica officinalis*, very rare are some *Pyrolaceae*, e.g. *Chimaphila umbellata*, also the *Daphne cneorum*. Conspicuous picture gives a synusia of lichens, *Cetraria islandica*, and various *Cladonia* species, and some bryophytes (*Leucobryum glaucum*).





Possible stop could be also by railway station of Borský Mikuláš village, where could be demonstrate open to dense siliceous grasslands with *Corynephorus* and *Agrostis* on sandy soils assigned as the *Armerion elongatae* alliance. These were found in Slovakia firstly only last year, in past were overlooked. The success to see some taxa depends on amount of precipitation during spring season. The habitat represent taxa such as *Acosta rhenana*, *Armeria vulgaris* subsp. *elongata*, *Chondrilla juncea*, *Erysimum diffusum*, *Festuca trachyphylla*, *Helichrysum arenarium*, *Jasione montana*, *Rumex thyrsiflorus* and others.

Final stop is planned as lunch in small town Šaštín – in recreation area Gazárka. Originally two separate villages, now it is one of the youngest towns in Slovakia, having received town privileges on 1 September 2001. The first written mention about Šaštín was in 1218. The Šaštín is one of the most important Marian shrines in



Slovakia. Several pilgrimages are held there annually, especially on 15 September. Last year the basilica was visited also by Pope Francis.



Management and threats

The main vegetation represent plantations of the Scots pine (*Pinus sylvestris* L.), which forests cover extensive majority of the area. Most of them are considered to be the results of relatively recent plantation-oriented forest management. We investigated the long-term history of lowland pine forests in the Záhorie Lowland region of aeolian sands. Pine monocultures were planted there already in the mid-seventeenth century and currently prevail in the land cover of the region.

But pine trees were a natural part of forests of the Early Holocene. Palaeoecological data suggested a distinct compositional linkage of recent pine-dominated forests with their Early Holocene predecessors. Moreover, no significant change was detected in tree dominants in at least the past two millennia. Contrary to palaeoecology, archeaeobotany suggested that broadleaved trees (mostly oak) dominated during the past 4000 years. However, this result is probably strongly biased by human preferences for wood for specific purposes. On the other hand, pine in palaeoecological data is doubtless overrepresented because of its abundant pollen production. We conclude that pine forests with a significant admixture of oak continuously covered the sandy substrates of the Záhorie Lowland throughout the

Holocene. The present pine forests can therefore be considered fairly close to the original vegetation of the study region.

List of selected vascular plants

Taxon	Family	Note
Acosta rhenana	Asteraceae	
Alnus glutinosa	Betulaceae	
Armeria vulgaris subsp. elongata	Plumbaginaceae	
Artemisia campestris	Asteraceae	
Berteroa incana	Brassicaceae	
Betula pendula	Betulaceae	
Callitriche palustris	Callitrichaceae	
Calluna vulgaris	Ericaceae	
Caltha palustris	Ranunculaceae	
Carex elata	Cyperaceae	
Carex elongata	Cyperaceae	
Carex ericetorum	Cyperaceae	
Carex pseudocyperus	Cyperaceae	
Carex riparia	Cyperaceae	
Carex vesicaria	Cyperaceae	
Cerastium semidecandrum	Caryophyllaceae	
Ceratodon purpureus	Bryophyta	
Cetraria islandica	Lichenophyta	
Cladonia arbuscula	Lichenophyta	
Cladonia foliacea	Lichenophyta	
Cladonia furcate	Lichenophyta	
Cladonia phyllophora	Lichenophyta	
Cladonia portentosa	Lichenophyta	
Cladonia rangiferina	Lichenophyta	
Cladonia rangiformis	Lichenophyta	
Comarum palustre	Rosaceae	
Conyza canadensis	Asteraceae	
Corynephorus cannescens	Poaceae	
Cynodon dactylon	Poaceae	
Danthonia decumbens	Poaceae	
Daphne cneorum	Thymeleaceae	
Dianthus deltoides	Caryophyllaceae	
Dianthus serotinus subsp. borussicus	Caryophyllaceae	
Dicranum polysetum	Bryophyta	
Dicranum scoparium	Bryophyta	
Dryopteris cristata	Aspidiaceae	



Taxon	Family	Note
Erysimum diffusum	Brassicaceae	
Festuca dominii	Poaceae	
Festuca guestfalica	Poaceae	
Festuca trachyphylla	Poaceae	
Filago vulgaris	Asteraceae	
Frangula alnus	Rhamnaceae	
Galium verum	Rubiaceae	
Helichrysum arenarium	Asteraceae	
Hottonia vulgaris	Primulaceae	
Hydrocotyle vulgaris	Hydrocotylaceae	
Hydrocharis morsus-ranae	Hydrocharitaceae	
Hylocomium splendens	Bryophyta	
Hypochoeris radicata	Cichoriaceae	
Chimaphila umbellata	Pyrolaceae	
Chondrilla juncea	Asteraceae	
Iris pseudacorus	Iridaceae	
Jasione montana	Campanulaceae	
Juncus bulbosus	Juncaceae	
Juncus conglomeratus	Juncaceae	
Juncus effusus	Juncaceae	
Koeleria glauca	Poaceae	
Leucobryum glaucum	Bryophyta	
Lycopus europaeus	Lamiaceae	
Lysimachia vulgaris	Primulaceae	
Lythrum salicaria	Lythraceae	
Molinia arundinacea	Poaceae	
Peucedanum oreoselinum	Apiaceae	
Peucedanum palustre	Apiaceae	
Phragmites australis	Poaceae	
Pilosella officinarum	Cichoriaceae	
Pleurozium schreberi	Bryophyta	
Polytrichum formosum	Bryophyta	
Polytrichum piliferum	Bryophyta	
Potentilla argentea	Rosaceae	
Psylium arenarium	Plantaginaceae	
Rumex thyrsiflorus	Polygonaceae	
Salix cinerea	Salicaceae	
Scirpus sylvaticus	Cyperaceae	
Scorzonera purpurea	Cichoriaceae	
Scutellaria galericulata	Lamiaceae	



Taxon	Family	Note
Senecio jacobaea	Asteraceae	
Solanum dulcamara	Solanaceae	
Spergula morisonii	Caryophyllaceae	
Spergula pentandra	Caryophyllaceae	
Teesdalia nudicaulis	Brassicaceae	
Thelypteris palustris	Thelypteridaceae	
Thymus serpyllum	Lamiaceae	
Trifolium arvense	Fabaceae	
Utricularia vulgaris	Lentibulariaceae	
Verbascum phlomoides	Scrophulariaceae	
Veronica dillenii	Scrophulariaceae	
Veronica officinalis	Scrophulariaceae	
Vicia lathyroides	Fabaceae	
Viola palustris	Violaceae	
<i>Viola saxatilis</i> subsp. <i>curtisii</i>	Violaceae	



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