

FOREST HABITATS AND VEGETATION OF DRAGOMAN
MUNICIPALITY, WESTERN BULGARIA

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Abstract

The study is focused on the investigation of the forest habitats and the vegetation of Dragoman municipality, located in western Bulgaria. Following the Braun-Blanquet approach, 212 relevés were collected in 2019 and 1054 field points were verified, as well. As a result, eight forest habitat types included in Directive 92/43/EEC were identified. They cover 85.96 km² or 26.5% of the total area and are located mainly in the northern, western and southern parts of the municipality. Pannonian-Balkan turkey oak–sessile oak forests (91M0) build up the vastest areas, followed by *Pannonian woods with *Quercus pubescens* (91H0), covering 67.2% and 12.97% of the territory, respectively.

Key words: classification, mapping, numerical methods

Introduction. Habitat investigations are of present-day importance. Nowadays, scientists focus their research on data collection, mapping, protection, assessment of ecosystem condition and services. During the last two decades, many global and national databases were established to help vegetation and habitat investigations at different scales. Such is the European Vegetation Archive by

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CHYTRÝ et al. [1] – a continental-integrated database delivering huge datasets for the execution of vegetation and habitats numerical analyses, following TICHÝ et al. [2].

As for the territory of Bulgaria, the NATURA 2000 network is being developed since 2002 and currently includes 228 zones, covering some 30% of the country's territory.

The current investigation focuses on the territory of Dragoman municipality, which is partly covered (39.6%) by two Sites of Community Interest – Dragoman (BG0000322) and Western Balkan Range and Forebalkan (BG0001040). Vegetation and habitat investigations on the territory of Dragoman municipality are still schematic. Several studies, concerning vegetation and habitat diversity, have been carried out so far. Among the more recent ones are those of VASSILEV et al. [3] and VELEV et al. [4,5] – focused on dry and mesic grasslands, and APOSTOLOVA et al. [6] and VASSILEV et al. [7] – dealing with the flora and vegetation of Aldomirovsko and Dragomansko marshes.

The aim of this study is a complete investigation and mapping of forest habitats on the territory of Dragoman municipality.

Materials and methods. Dragoman municipality is located in the western part of Bulgaria. It covers an area of 324 km² and is a part of Sofia district. The relief is semi-mountainous and the climate is temperate, characterized by warm summers and cold winters, as VELEV [8] points out. According to NINOV [9] soil types include predominantly rendzinas, leached and podzolized cinnamonic forest soils.

Data collection, analysis and mapping of habitats. The vegetation sampling was conducted in 2019. A total of 212 vegetation plots (relevés) were collected following the BRAUN-BLANQUET approach [10]. Additionally, vegetation and habitats were verified by 1054 points on the field (Fig. 1).

Vegetation was classified by JUICE 7.0, TICHÝ [11] and PC-ORD, McCUNE and MEFFORD [12] software packages. Habitat types were determined according to the Interpretation Manual of European Union Habitats [13] and KAVRAKOVA et al. [14]. Habitat maps were elaborated using the ArcGIS 10.0 software (ESRI). Spatial data from Forestry Management Plans and habitat mapping of NATURA 2000 in Bulgaria [15] were also used.

Results. Eight forest habitat types, included in Directive 92/43/EEC, were identified (Fig. 2).

91H0 *Pannonian woods with *Quercus pubescens*

This habitat is widespread on the territory of Dragoman municipality – from 600 to 1000 m a.s.l. and covers an area of 11.15 km². The bedrock type was mainly limestone. The vegetation had semi-open to closed horizontal structure and total cover between 80 and 95%. The dominant species was *Quercus pubescens* while subdominants were *Carpinus orientalis*, *Quercus cerris* and in some stands – *Fraxinus ornus*. Other woody species found were *Cornus mas*, *Acer tataricum*,

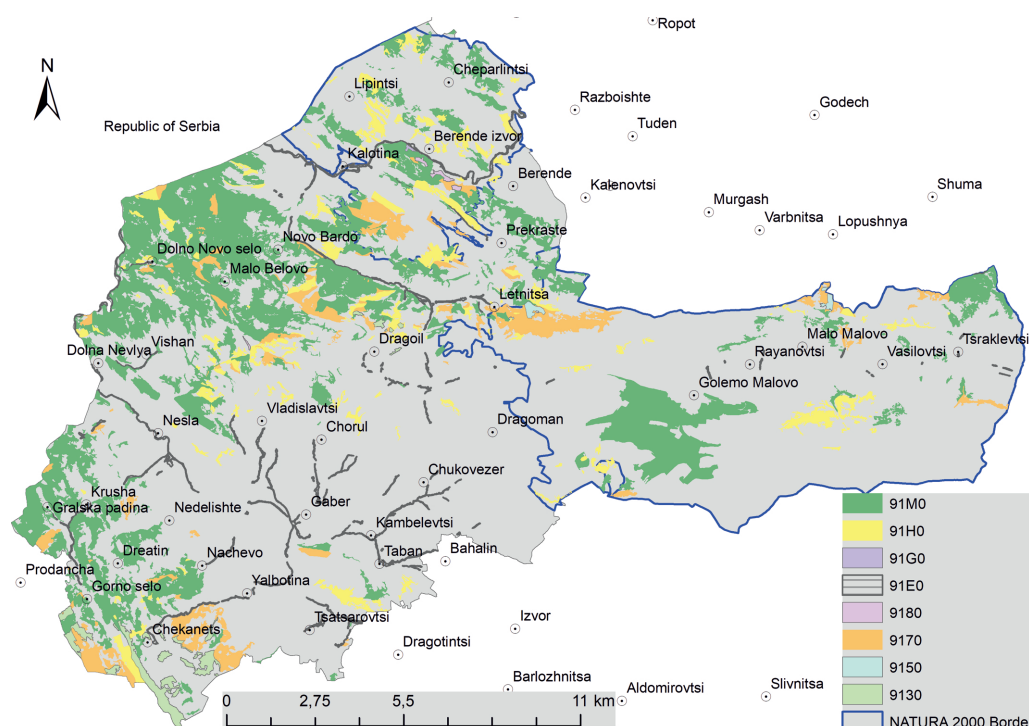


Fig. 2. Forest habitats in Dragoman municipality

91M0 Pannonian-Balkanic turkey oak–sessile oak forests

This habitat type has the widest distribution among all the forest types. It was found in hilly and semi-mountainous western, southern and northern parts of the municipality. It covers 57.8 km² and is distributed between 600 and 1000 m a.s.l. The vertical structure was distinguished and presented by four layers – trees, shrubs, herbs and cryptogams. The total vegetation cover was 80–100%. The dominant species were *Quercus cerris* and *Q. frainetto*. In the majority of the stands, the subdominant was *Q. daleschampii*. The tree layer covered 70–100%. The shrub layer had a cover between 10 and 65% and was mainly formed by the same species, discovered in the tree layer, along with *Crataegus monogyna*, *Rosa canina*, *Prunus spinosa*, *Euonymus europaeus*, *E. verrucosus*. These communities had a well-developed herb layer with highly abundant species such as *Poa nemoralis*, *Festuca heterophylla*, *Galium pseudoaristatum*, *Melica uniflora*, *Dactylis glomerata*. This vegetation was classified to class *Quercete apubescenti*, order *Quercetalia pubescenti-petreae* and alliance *Quercion confertae*. The association *Quercetum frainetto-cerridis* was the most common one or mixed communities of *Quercus frainetto*, *Q. cerris* and *Q. daleschampii*.

9170 *Galio-Carpinetum* oak-hornbeam forests

The habitat type is distributed in the range between 600 and 1204 m a.s.l.

and covers an area of 11.63 km². This vegetation was found on the bottom part of slopes or in the secluded valleys where it often formed narrow strips. It included mixed or monodominant forests dominated by *Quercus dalechampii* and *Carpinus betulus*, whereas the subdominant was *Fagus sylvatica*. The total vegetation cover was 95–100% and the tree layer coverage was 90–100%. The shrub layer was formed by the same species from the tree layer as well as *Chamaecytisus hirsutus*, *Euonymus europaeus* and *Corylus avellana*. The herb layer had a cover of 60–80% with uniform species composition where most abundant species were *Poa nemoralis*, *Festuca heterophylla*, *Luzula luzuloides*, *Melica uniflora*. This vegetation was classified to class *Carpino-Fagetea*, order *Fagetalia sylvaticae* and alliances *Carpinion betuli* and *Fagion sylvaticae* s.l.

9130 *Asperulo-Fagetum* beech forests

These beech forests are distributed between 600 and 1000 m a.s.l. and cover an area of 2.34 km². The habitat type included mesophyllous beech forests with a closed horizontal structure and four-layered vertical structure – trees, shrubs, herbs and cryptogams. The total vegetation cover was 95–100% with *Fagus sylvatica* as dominant. In some stands, *Carpinus betulus* appeared as subdominant. The shrub layer was generally with low cover (10–20%) and was formed from the same species in the tree layer along with *Rubus hirtus*, *R. idaeus*, *Prunus spinosa*, *Sambucus racemosa*. Herb layer had a cover between 25 and 80% with more frequent species like *Galium odoratum*, *Melica uniflora*, *Festuca drymeja*, *Cardamine bulbifera*, *Aremonia agrimonoides*. Generally, the species composition was rich in central European and Boreal species. This habitat had a narrow contact with *Galio-Carpinetum* oak-hornbeam forests (9170) and shared some common species, such as *Prenanthes purpurea*, *Galium odoratum*, *Rubus hirtus*, *Mycelis muralis*, *Carex remota*. This vegetation was classified to class *Carpino-Fagetea*, order *Fagetalia sylvaticae* and alliance *Asperulo-Fagion*.

9150 Medio-European limestone beech forests of the *Cephalanthero-Fagion*

This habitat can be discovered only on the northern slopes of Chepun Mt, eastwards of Letnitsa village. It covers an area of 0.31 km² and extends between 600 and 1204 m a.s.l. It was characterized by closed horizontal structure 90–100% with *Fagus sylvatica*, as a dominant. Other tree species were *Carpinus betulus*, *Quercus daleschampii*, *Tilia cordata*, *T. platyphyllos*, *Acer pseudoplatanus*. Shrub layer was well-developed and consisted of young trees from the aforementioned, as well as *Cornus mas*, *Ulmus minor*, *Carpinus orientalis*, *Fraxinus ornus*, *Euonymus verrucosus*, *Ligustrum vulgare*. Herb layer had a rich species composition, including some calciphilous species such as *Helleborus odorus*, *Polygonatum odoratum*, *Epipactis* spp., *Cephalanthera* spp., etc. A typical characteristic of this habitat was the wide distribution of some orchid species, such as *Neotia nidus-avis*, *Dactylorhiza cordigera*, *Cephalanthera longifolia*, etc. Other species found in the herb layer were *Mercurialis perennis*, *Melica uniflora*, *Melissa melissophy-*

lum, etc. This vegetation was classified to class *Carpino-Fagetea*, order *Fagetalia sylvaticae* and alliance *Cephalanthero-Fagion*.

91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

This habitat type is distributed along Nishava, Gaber, Ezhovitsa, Kalugeritsa and Shiroki Dol rivers and their tributaries, forming narrow strips. Its stands were characterized by closed horizontal structure (total cover 100%) and three-layered vertical structure – trees, shrubs and herbs. In some stands, a bryophyte layer was also formed and it was well-developed. The dominant species was *Salix fragilis* while some subdominants, such as *Salix purpurea*, *S. alba*, *Populus nigra* and *Alnus glutinosa* were also recorded. The same species formed the shrub layer, accompanied by *Sambucus nigra*, *Coryllus avelana*, *Ligustrum vulgare*, *Prunus spinosa*, *P. cerasifera*, *Clematis vitalba*, *Humulus lupulus*. The shrub layer cover was between 60 and 100%. The herb layer was also well presented by common species such as *Aegopodium podagraria*, *Ranunculus serbicus*, *Geum urbanum*, *Dactylis glomerata*, etc. Some invasive alien species were recognized too – *Bidens tripartita*, *B. frondosa*, *Conyza canadensis*, *Fallopia × bohemica*, *Impatiens glandulifera*, *Amorpha fruticosa*, *Robinia pseudoacacia*. This vegetation was classified to class *Salicetea purpureae*, order *Salicetalia purpureae* and alliance *Salicion albae*.

9180* *Tilio-Acerion* forests of slopes, screens and ravines

This habitat type is fragmentally distributed on steep slopes and covers a restricted area of 0.20 km². The closed horizontal structure was typical with a total cover of 85–100%. In the tree layer, the most abundant species, that formed a higher cover, were *Acer campestre*, *Tilia platyphyllos*, *Quercus daleschampii*, *Carpinus betulus*. The shrub layer consisted of younger individuals of the same trees that were already mentioned, as well as *Ligustrum vulgare*, *Euonymus europaeus*, *Cornus sanguinea*, *Coryllus avelana* and *Sambucus nigra*. The herb layer had a total cover ranging from 40 to 85%, depending on the stability of the substrate. This vegetation was classified to class *Carpino-Fagetea*, order *Fagetalia sylvaticae* and alliance *Tilio-Acerion*.

Discussion. The semi-natural forest vegetation of Dragoman municipality covers an area of 85.96 km² and is represented by eight types. They are located mainly in the northern, western and southern parts of the municipality in the semi-mountainous regions. The region is characterized by hilly and low mountainous relief, unsuitable for agricultural activities. The xerophyle forests are presented by Pannonian-Balkan turkey oak–sessile oak forests (91M0) and cover the vastest areas. They are followed by the *Pannonian woods with *Quercus pubescens* (91H0), which take up 57.2 km² (67.2% of the territory) and 11.12 km² (12.97%), respectively. The xeromesophyle and the mesophyle oak-hornbeam forests (9170) take the third place with an area of 11.63 km² or 13.53%. The forests, dominated by *Fagus sylvatica* on limestone (9150) and silicate (9130) substrates have a restricted distribution with only 0.31 km² and 2.34 km², respectively. Riverine

forest vegetation (91E0) can be discovered in areas with specific ecological conditions – near riverbeds and areas with high soil humidity. This vegetation type covers an area of 2.49 km².

The main threats for the forest vegetation are related to illegal timber harvesting and intensive exploitation, penetration of unnatural forest species (e.g. *Pinus nigra*), invasive species (*Robinia pseudoacacia* and *Amorpha fruticosa*), erosion, fires, forest pasturing, waste pollution during logging, etc.

Conclusions. The current investigation aimed at investigating forest habitats and vegetation in the territory of Dragoman municipality. After the verification of 1054 field points and the collection of 170 relevés in 2019, eight forest habitats, included in Directive 92/43/EEC were identified. The authors believe that these successful results can be used as a basis for widening the research in the neighbouring municipalities, aiming at uncovering the habitat diversity in western Bulgaria.

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