

Forest Habitats in Natura 2000 Protected Zone BG0000211 „Tvardishka planina“ - Floristic Composition and Conservation Status

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Abstract. The publication deals with the results of floristic study in Natura 2000 protected zone BG0000211 „Tvardishka planina“. The objects of investigation are forest habitats: 9110, 9130, 9150, 91G0, 9170, 9530, 9180, 91M0, 91E0, 91AA. The floristic composition of the habitats, abundance of each species by Braun-Blanquet scale and plant relevés are presented. The assessment of nature conservation status is made applying the developed methodology under the project “Mapping and determining of the natural conservation status of the nature habitats and species – phase I” that was adopted by Ministry of Environment and Water. As a result of conducted inventory the conservation status of all habitats was assessed as unfavourable-unsatisfactory.

Key words: forest habitat, floristic composition, conservation status, protected zone.

Introduction

„Tvardishka planina“ protected zone is part of the European ecological network Natura 2000, declared according to Directive 92/43/EEC for conservation of natural habitats and of wild fauna and flora. The zone is declared mainly for the conservation of forest habitats such as “9150 - Termophilous beech forests (*Cephalanthero-Fagion*)” and “9130 - Beech forests (*Asperulo-Fagetum*)”. The habitats 9110, 91G0, 9170, 9530, 9180, 91M0, 91E0, 91AA, as well as many non-forest (grass, shrub and rock) habitats can be also observed in the zone. The protected zone is with big importance, because of the large number of species with conservation status - rare, endangered and endemic animals and plants such as *Fritillaria pontica* Wahlenb., *Verbascum adrianopolitanum* Podp., *Taxus baccata* L.,

Anemone sylvestris L., *Aquilegia nigricans* Baumg., *Crocus veluchensis* Herb., etc. (NATURA 2000 Standard Data Form, 2013)

The main aim of the study is to present the floristic composition and characteristics of the forest habitats in protected zone „Tvardishka planina“ and to assess their contemporary conservation status.

Currently there is no floristic data available for the studied territory, but such habitats are researched in other areas by MICHALIK (1990), DZWONKO & LOSTER (2000), STOJANOV (1941), PENEV *et al.* (1969), BONDEV (1991), GARELKOV & STIPTCOV (1995), PAVLOV & DIMITROV (2003), TZONEV *et al.* (2006).

Materials and Methods

The site is located northern from Sliven Town with longitude E 26° 50' 36"

and latitude - N 42° 50' 25" (Fig.1). The altitude of the lowest point is 319 m and of the highest -1501 m a.s.l., the average altitude of the site is 892 m. The site covers 3864.95 ha. The area is related to continental and alpine bio geographic region.

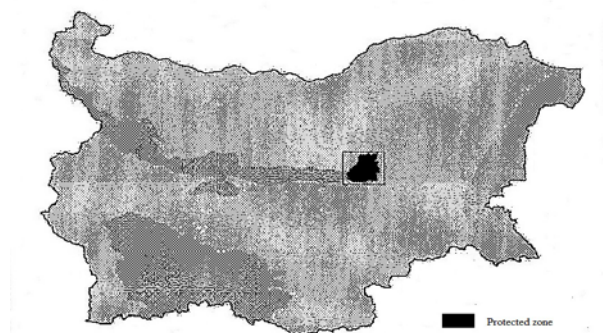


Fig.1. Location of the the study site - protected zone "Tvardishka planina" in Bulgaria.

The habitats were identified by KAVRAKOVA *et al.* (2009). The methodology for the assessment of habitats conservation status was developed under the realized project (ZINGSTRA *et al.*, 2009; GANEVA, 2013).

Plant relevés with area 350 m² were made in typical places of sample plots. They included: floristic composition of main horizons of community; total cover of the horizons; species abundance; data about environmental conditions (altitude, exposition, slope, soil). Species identification was carried out according to DELIPAVLOV *et al.* (2003) and IORDANOV (1973).

The species abundance in plant community was assessed through abundance and cover scale of BRAUN-BLANQUET (1964) – Table 1.

Table. 1. The Braun-Blanquet scale, used in the current study.

Abundance	Number	Cover, %
r	1 individual	under 1
+	2-5 individuals	under 1
1	6-50 individuals	under 5
2	over 50 individuals	6 - 25
3	without significance	26 – 50
4	without significance	51 – 75
5	without significance	over 75

Results and Discussion

Totally ten forest habitats were registered in the zone as we present the collected floristic data, plant communities' characteristics and conservation status assessments. The abundance of each species is given in brackets.

Nature habitat "9150 Thermophilous beech forests (Cephalanthero-Fagion)" (Fig. 2).

The habitat is one of well-presented in the zone (19% from the zone area). It can be observed between 500 and 900 m a.s.l. at slopes of 6-25° on east, northwest and southwest exposures on calcareous soils. The stand age is between 30 and 70 years. The tree layer is with cover 90%. Shrub and herbaceous layers are not well formed. The herbaceous layer has 10% cover. The plant community is formed from 6 tree, 1 shrub

and 8 herbaceous species. The tree species are: *Fagus sylvatica* L. (4-5), *Sorbus torminalis* (L.) Crantz (+), *Quercus petraea* (Matt.) Liebl. (+), *Carpinus betulus* L. (1-2), *Populus tremula* L. (2) and *Prunus avium* L. (2). *Ligustrum vulgare* L. (2) is the only shrub species. The established herbaceous species are as follows: *Physospermum cornubiense* (L.) DC (1-2), *Luzula luzuloides* (Huds.) Gaud. (+), *Mycelis muralis* (L.) Dumort (+), *Brachypodium pinnatum* (L.) Beauv (1-2), *Poa nemoralis* L. (1), *Cephalanthera* sp. (+), *Galium odoratum* (L.) Scop. (1), *Carex sylvatica* Huds (1).

„Tvardishka planina“ protected zone has favorable conditions for development of habitat 9150. Most of the parameters are at favorable conservation status. The habitat has characteristic species at all layers. Incorrectly planned and carried out cuttings, dead wood removal, non-regulated

gathering of non-wood forest resources, threat by construction and infrastructure, recreation and tourism, using of the habitat for grazing, as well as reforestation with exotic and non-native species were not observed.

The parameters that have unfavourable valuation are: low average age of tree species, lack of old age forests, insufficient quantity of dead wood, as well as lack of old trees. This reflects to the assessment of conservation status as unfavourable-unsatisfactory.



Fig. 2. Nature habitat "9150 Thermophilous beech forests (*Cephalanthero-Fagion*)".

Nature habitat "9130 Beech forests *Asperulo-Fagetum*" (Fig.3)

The habitat occupies around 9% in the zone and can be observed at 1100 m a. s. l. on 20° slopes with northern exposures. The stand age is 90 years. The tree layer cover is 80%. Shrub and herbaceous layers are not well formed. The species of herbaceous layer are with cover 10- 20%. The plant community is formed from 1 tree and 6 herbaceous species which are presented below. The tree species is *Fagus sylvatica* L. (5). The established herbaceous species are as follows: *Galium odoratum* (L.) Scop. (2), *Dryopteris filix-mas* (L.) Schott (1), *Aegopodium podagraria* L. (+), *Salvia glutinosa* L. (+), *Lamium galeobdolon* L. (+) and *Brachypodium sylvaticum* (Huds.) Beauv (+).

Most of the parameters such as cover of the first tree layer, composition of the first tree layer and others have favourable assessment.

The parameters which assessment is unfavourable are: lack of old age forests, insufficient quantity of dead wood, as well as absence of old trees. Although, that habitat occupies one of the highest parts of the zone because of a well-developed road system it has been a subject of cuttings during the last 100 years. As a result the old forests have been demolished and the tree layer is with coppice origin. The natural conservation status is assessed as unfavourable-unsatisfactory.



Fig. 3. Nature habitat "9130 Beech forests *Asperulo-Fagetum*".

Nature habitat "9110 *Luzulo-Fagetum* beech forests" (Fig. 4)

The habitat occupies only 0.01% of the zone area and it is located at 1500 m a. s. l. on 11-15° slopes at northern expositions. The stand age is between 60 and 70 years. The tree layer cover is 90%. Shrub layer is not well formed but species are with 10% cover. The herbaceous layer is with cover 30%. The plant community is formed from 2 tree, 1 shrub and 3 herbaceous species which are presented below. Tree species are *Fagus sylvatica* L. (5) and *Sorbus aucuparia* L. (+). *Rubus hirtus* W. et K. (2) is the only shrub species. The established herbaceous species are as follows: *Luzula luzuloides* (Lam.) Dandy (2), *Dryopteris filix-mas* (L.) Schott (2) and *Geranium macrorrhizum* L. (2).

Most of the parameters of habitat 9110 have favourable assessment. The floristic composition is characteristic for the habitat.

Nature disturbances and threats include incorrectly planned and carried out cuttings, non-regulated gathering of non-wood forest resources, threat by construction and infrastructure, recreation and tourism, fires, using of the habitat for grazing, as well as by reforestation with exotic and non-native species.

The parameters which classify the assessment as unfavourable are: low average age of tree species, lack of old age forests, insufficient quantity of dead wood as well as old trees. All these negative assessments of habitat status are a result by the anthropogenic impact in the past and inappropriate management. This is the reason this habitat status to be finally assessed with unfavourable-unsatisfactory assessment.



Fig. 4. Nature habitat “9110 *Luzulo-Fagetum* beech forests”.

Nature habitat “91M0 Pannonian-Balkan turkey oak-sessile oak forests” (Fig. 5)

The habitat occupies 4.4% of the zone area. It is located from 489.57 to 626.07 m a.s.l. on 6-20° slopes at east and west expositions. The stand age is between 30 and 50 years. The tree canopy cover is 50%-70%. Shrub layer is not well formed and the species are with cover between 10-20%. The herbaceous layer cover is between 40 and 20%. The plant community is formed from 7 tree, 6 shrub and 15 herbaceous species which are presented below. The tree species

are: *Quercus frainetto* (3-4), *Quercus petraea* (Matt.) Liebl. (1), *Quercus cerris* L. (2), *Fagus sylvatica* L. (+), *Sorbus torminalis* (L.) Crantz (+), *Acer campestre* L. (1) and *Fraxinus ornus* L. (+). The shrub species are: *Crataegus monogyna* Jacq. (2), *Carpinus orientalis* Miller (1-3), *Chamaecytisus supinus* (L.) Link (+; 1), *Genista tinctoria* L. (+), *Rubus caesius* L. (+), and *Genista carinalis* Griseb. (+). The established herbaceous species are as follows: *Prenanthes purpurea* L. (+), *Festuca heterophylla* Lam. (1-2), *Luzula sylvatica* (Huds.) Gaud. (1), *Galium pseudoaristatum* Schur (+; 1), *Hieracium hoppeanum* Schleicher (+), *Euphorbia amygdaloides* L. (1), *Dactylis glomerata* L. (2), *Poa nemoralis* L. (2), *Lychnis coronaria* (L.) Desr. in Lam. (+), *Mycelis muralis* (L.) Dumort (+), *Anthoxanthum odoratum* L. (+;1), *Silene viridiflora* L. (+), *Fragaria vesca* L. (+), *Cruciata glabra* (L.) Ehrend. (+) and *Hieracium racemosus* W. et K. (+).

Most of the parameters are at favorable conservation status. The study shows that the habitat has characteristic species at all layers. The cover of the first tree layer, average age of the first tree layer and ground cover are also appropriate. Incorrectly planned and carried out cuttings, gathering of non-wood forest resources, threat by construction and infrastructure, recreation and tourism, fires, using of the habitat for grazing, as well as by reforestation with exotic and non-native species were not observed.

The parameters which assessment is unfavourable are: lack of old age forests, insufficient quantity of dead wood, and old trees. Some indications for succession processes because of *Carpinus orientalis* Miller high abundance at some parts of the habitat and nature disturbances as windfalls were observed. That is why the natural conservation status is assessed as unfavourable-unsatisfactory.

Nature habitat “91AA East pubescent oak forest” (Fig. 6)

The habitat occupies insignificant area of the zone (0.02%). It can be observed on 450 m a.s.l. at 6-10° slopes on east exposures. The stand age is between 30 and 40 years. The tree layer is with cover 70%.



Fig. 5. Nature habitat "91M0 Pannonian-Balkan turkey oak-sessile oak forests".

Shrub layer is not well formed - species are with cover 20%. The herbaceous layer is with cover 30%. The plant community is formed from 2 tree, 3 shrub and 5 herbaceous species which are presented below. The tree species are *Quercus pubescens* Willd. (4) and *Fraxinus ornus* L. (1). The shrub species are: *Syringa vulgaris* L. (1), *Cornus mas* L. (1), *Carpinus orientalis* Miller (2). The established herbaceous species are as follows: *Poa nemoralis* L. (1), *Festuca heterophylla* Lam. (2), *Fragaria vesca* L. (+), *Dactylis glomerata* L. (1) and *Brachypodium pinnatum* (L.) Beauv (1).

The habitat has characteristic trees, shrub and herbaceous species. Unfavorable are the parameters related to the age and the presence of dead wood in the stands, most probably due to incorrect management in the past expressed with cuttings and subsequent difficult regeneration of the *Quercus pubescens* Willd. There were not dead wood observed, which can be due to the fact that the stands are near to the settlements and the fallen branches are gathered for firewood. It can be pointed using the habitats territory for grazing and high abundance of *Carpinus orientalis* Miller which is indication for succession processes from the treats for good nature conservation status for this habitat. This leads to unfavourable-unsatisfactory assessment of the habitat status.



Fig. 6. Nature habitat "91AA East pubescent oak forest".

Nature habitat "91G0 Pannonic woods with *Quercus petraea* and *Carpinus betulus*" (Fig. 7)

The habitat occupies 5.4% of the zone and is distributed at 400 m a.s.l. at 6-10° slopes on northwest expositions. The stands age is 60 years. The tree layer is with cover 70%. Shrub layer is not well formed - species are with coverage 10%. The herbaceous layer is with coverage of 40%. The plant community is formed from 8 tree, 2 shrub and 11 herbaceous species. The tree species are: *Prunus avium* L. (1), *Carpinus betulus* L. (2), *Quercus frainetto* Ten. (2), *Quercus cerris* L. (3), *Quercus petraea* (Matt.) Liebl. (3), *Acer campestre* L. (1), *Tilia cordata* Miller (1) and *Sorbus torminalis* (L.) Crantz (+). The shrub species are *Crataegus monogyna* Jacq. (1) and *Cornus mas* L. (2). The established herbaceous species are as follows: *Euphorbia amygdaloides* L. (+), *Clinopodium vulgare* L. (+), *Potentilla micrantha* Ramond ex DC (+), *Dactylis glomerata* L. (2), *Prenanthes purpurea* L. (+), *Physospermum cornubiense* (L.) DC (2), *Poa nemoralis* L. (1), *Fragaria vesca* L. (1), *Digitalis viridiflora* Lindley (+), *Cruciata glabra* (L.) Ehrend. (+) and *Galium pseudoaristatum* Schur (+).

The conservation status of most parameters of habitat 91G0 is assessed as favorable. The investigation shows that the habitat has characteristic species in tree, shrub and herbaceous layers. Indications for succession processes, threats by nature

disturbances, incorrectly planned and carried out cuttings, gathering of non-wood forest resources, treat by construction and infrastructure, recreation and tourism, fires, using of the habitat for grazing, as well as by reforestation with exotic and non-native species were not observed.

The parameters which assessment is unfavourable are: low average age of tree species, lack of old age forests, insufficient quantity of dead wood, as well as lack of old trees. This is the reason for unfavorable conservation status.



Fig. 7. Nature habitat “91G0 Pannonic woods with *Quercus petraea* and *Carpinus betulus*”.

Nature habitat “91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Pandion, Alnion incanae, Salicion albae)” (Fig. 8)

The habitat occupies insignificant part of the zone (0.005%). It can be observed on 400-500 m a.s.l. at 1-5° near rivers. The stand age is 40 years. The tree layer is with 60% cover. Shrub layer is not formed. The herbaceous layer is with cover 80%. The plant community is formed from 2 tree and 6 herbaceous species. The tree species are *Salix alba* L. (3) and *Alnus glutinosa* (L.) Gaertner (3). The established herbaceous

species are as follows: *Mentha longifolia* (L.) Hudson (1), *Heracleum verticillatum* Panči (2), *Sambucus ebulus* L. (1), *Valeriana officinalis* L. (3), *Equisetum arvense* L. (3) and *Circaea lutecliana* L. (1).

The conservation status of most parameters of habitat 91E0 is assessed as favorable. The study shows that the habitat has characteristic species at all layers. Penetrating of invasive species, changes in hydrological regime, cleaning of river beds, using of the habitat for grazing, threats by construction and infrastructure, recreation and tourism, as well as by reforestation with exotic and non-native species were not observed.

The parameters which classify the assessment as unfavourable are: low average age of tree species, lack of old age forests, old trees and insufficient quantity of dead wood. All these negative parameters are a result of anthropogenic impact in the past but nowadays they lead to unfavorable-unsatisfactory assessment of the habitat.



Fig. 8. Nature habitat “91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Pandion, Alnion incanae, Salicion albae”.

Nature habitat “9180 Tilio-Acerion forests of slopes, screes and ravines” (Fig. 9)

The habitat occupies 7.2% of the zone “Tvardishka planina”. It is located about 500 m a.s.l. at 11-15° slopes at north expositions. The stand age is between 50 and 60 years. The tree layer is with cover 80%. Shrub layer is not well formed - species are with cover 10%. The herbaceous layer is with cover 30%. The plant community is formed from 5 tree, 1 shrub and 16 herbaceous species. The

tree species are *Tilia platyphyllos* Scop (2), *Acer pseudoplatanus* L. (2), *Carpinus betulus* L. (3), *Fraxinus excelsior* L. (2) and *Prunus avium* L. (2). *Cornus mas* L. (2) is the only shrub species. The established herbaceous species are as follows: *Athyrium filix-femina* (L.) Roth (2), *Galium odoratum* (L.) Scop. (2), *Lamiastrum galeobdolon* L. (2), *Geranium robertianum* L. (+), *Euphorbia amygdaloides* L. (+), *Dryopteris filix-mas* (L.) Scott. (2), *Polygonatum latifolium* (Jacq.) Desf. (+), *Campanula rapunculoides* L. (+), *Viola riviniana* Reich. (+), *Aremonia agrimonoides* (L.) DC (+), *Circaea luteciana* L. (+), *Poa nemoralis* L. (1), *Carex pilosa* Scop. (+), *Salvia glutinosa* L. (1), *Sanicula europaea* L. (2) and *Lathyrus vernus* (L.) Bernh. (+).

The conservation status of most parameters of habitat 9180 is assessed as favorable. The investigation shows that the habitat has characteristic species in tree, shrub and herbaceous layers. Incorrectly planned and carried out cuttings, removal of dead wood, using the habitat for grazing, threats by construction and infrastructure, recreation and tourism, as well as by reforestation with exotic and non-native species were not observed.

The parameters which classify the assessment as unfavourable are: low average age of tree species, lack of old age forests and insufficient quantity of dead wood. This is the reason for unfavorable-unsatisfactory conservation status of the habitat.

Nature habitat "9170 *Galio-Carpinetum* oak-hornbeam forests" (Fig. 10)

The habitat occupies 11% of the zone. It is located between 600 and 850 m a.s.l. at 6-30° slopes on south, east and west expositions. The stand age is between 50 and 80 years. The tree layer is with cover 60-80%. Shrub layer is not well formed - the species are with cover 10%. The herbaceous layer is with cover 40 - 70%. The plant community is formed from 7 tree, 4 shrub and 17 herbaceous species. The tree species are: *Quercus dalechampii* Ten. (3-5), *Carpinus betulus* L. (1-2), *Acer platanoides* L. (1), *Fagus sylvatica* L. (1-3), *Fraxinus excelsior* L. (+), *Sorbus torminalis* (L.) Crantz (+) and *Acer*

campestre L. (1). The shrub species are: *Crataegus monogyna* Jacq. (1), *Corylus avellana* L. (1), *Cornus mas* L. (2) and *Rubus hirtus* W. et K. (1). The established herbaceous species are as follows: *Luzula luzuloides* (Huds.) Gaud. (+; 3), *Lathyrus niger* (L.) Bernh. (2), *Festuca drymeja* Mert et Koch. (2-3), *Vicia sativa* L. (1), *Fragaria vesca* L. (+), *Galium pseudoaristatum* Schur (+; 1), *Festuca valesiaca* Schleich. ex Gaud. (1-3), *Lathyrus laxiflorus* (Desf.) Kuntze (1), *Euphorbia amygdaloides* L. (+), *Platanthera bifolia* (L.) Rich (+), *Poa nemoralis* L. (2-4), *Helleborus odoratus* W. et K. (+), *Stellaria holostea* L. (3), *Melica uniflora* Retz (1), *Dactylis glomerata* L. (+), *Vincetoxicum hirundinaria* Medik. (+) and *Festuca heterophylla* Lam. (1).



Fig. 9. Nature habitat "9180 *Tilio-Acerion* forests of slopes, screes and ravines".

Most of the parameters of habitat 9170 are at favorable conservation status. The observations show that the habitat has characteristic species at tree, shrub and herbaceous layers. Incorrectly planned and carried out cuttings, removal of dead wood, gathering of non-wood forest resources, threat by construction and infrastructure, recreation and tourism, using the habitat for grazing, as well as by reforestation with exotic and non-native species was not observed.

The parameters which are unfavourable for the habitat are: threat by fires, insufficient quantity of dead wood, lack of old age forests, old trees and low average age of first tree layer. The assessment of conservation status is unfavorable-unsatisfactory.



Fig. 10. Nature habitat “9170 *Galio-Carpinetum* oak-hornbeam forests”.

Nature habitat “9530 SubMediterranean pine forests with endemic black pines” (Fig. 11)

The habitat occupies insignificant part of the zone (0.08%) or several compartments southwest from the Tvarditca town near to the main ridge of Balkan Range. It can be observed at 700 m above sea level on stony 40° slopes at southwest expositions. The soils are shallow, poor and dry. The stand age is around 30 years. The tree layer cover is 40%. There is no shrub and herbaceous layer while species are with cover 10 and 20% respectively. The plant community is formed from 1 tree, 3 shrubs and 2 herbaceous species. The tree species is *Pinus nigra* Arn. subsp. *pallasiana* (3). The shrub species are *Cotinus coggygria* Scop. (2), *Carpinus orientalis* Miller (1) and *Clematis vitalba* L. (1). The established herbaceous species are *Poa nemoralis* L. (2) and *Trifolium alpestre* L. (1).

Most parameters of habitat 9530 in protected zone „Tvardishka planina“ testify to a favourable conservation status.

The observations show that it has characteristic species in the tree layer composition and also in the ground layer. Incorrectly planned and carried out cuttings, dead wood removal, and threat by fires, construction and infrastructure, recreation and tourism, using of the habitat for grazing, as well as by reforestation with exotic and non-native species have not been observed. Lots of seeding and undergrowth presence which appears very often in cracks and almost soil devoid terrains were observed. It is necessary to be set up total prohibition for all types of cuttings in the habitat because the steep terrains which the habitat occupies and its negligible participation in the total area of the protected zone. It is also desirable to be planned additional protection measures as creation of mineralization strips around passing asphalt road near the stands.

The parameters which are unfavourable for the habitat are: low density, low average age of first tree layer; lack of old age forests and old trees, insufficient quantity of dead wood and because of this the assessment is unfavourable-unsatisfactory status.



Fig. 11. Nature habitat “9530 SubMediterranean pine forests with endemic black pines”.

Conclusions

In sum, it was established that the habitats have a typical floristic composition. The most of natural conservation status parameters have favorable assessment. The parameters with unfavorable valuation almost for all habitats are: lack of old forests, old trees and insufficient quantity of dead

wood trees. So the final status assessment of all habitats in the site is unfavourable-unsatisfactory. The habitat management has to be directed not only to the wood utilization but also to the biodiversity maintaining. These will lead to the natural status improving of habitats: 9110, 9130, 9150, 9170, 9180, 91AA, 91G0, 91M0. The forests management has to be oriented to maintaining the composition and mixed age stand structure through leaving of old trees in quantity 10 numbers.ha⁻¹ and dry and fallen trees in amount of 8% from the stand stock.

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