

## PHYTOCENOTIC CHARACTERISTIC OF THE NORTHERN PART OF THE GREEN SHELTER BELT OF STARA ZAGORA, BULGARIA

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### ABSTRACT:

As a result of investigation , conducted in the northern part of the green shelter belt of Stara Zagora, 5 formations and 15 associations have been established. The areas occupied by *Pinus nigra* Formation with totally secondary origin prevail (65,8%). *Carpinus orientalis* Formation (composed of 3 associations), *Fraxinus Ornus* Formation (1 association), *Fraxinus excelsior* (1 association) and *Robinia pseudo acacia* (2 associations ) are with aboriginal origin.

**KEY WORDS:** green shelter belt, formations, xero-phytization .

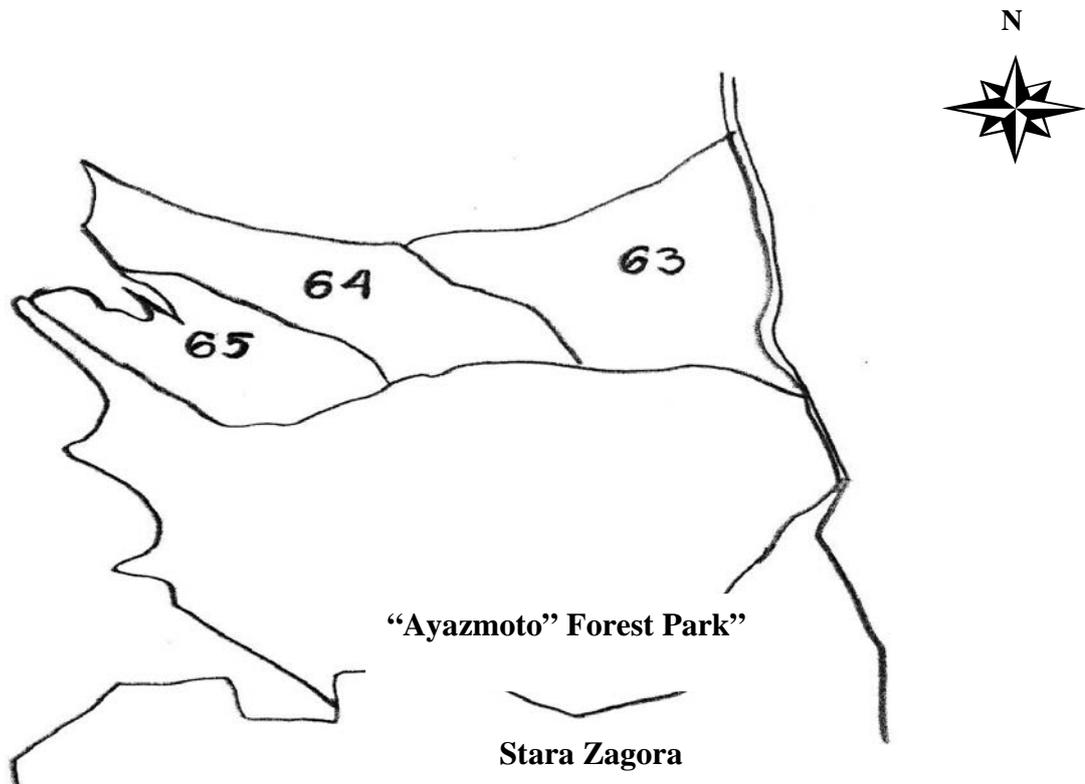
### INTRODUCTION :

At degradation of forests under the influence of anthropogenic factor, successional changes take place, leading to setting up of permanent anthropogenic formations. The aboriginal vegetation invariably presents as an element in their composition. The active afforestation activity in the lower altitude oak belt alters their composition in direction to coniferous cenoses with artificial origin.

Continuous change of the round the town landscape appearance necessitates analysis and updating of the phytocenotic structure of the plant communities in the close proximity to built – up areas.

### MATERIALS AND METHODS:

Subject to the present investigation is the plant cover in part of the Stara Zagora green shelter belt in sections № 63 to 65 according to the Forest Management Plan, situated to the north of the town with aggregate area of 249,3 hectares. **(Fig. 1).**



**Fig.1.** Geographical location of the sections №63, №64 and №65 with respect to Stara Zagora (A scale 1:25 000)

Altitude varies in the scope of 300 ÷ 550 m, tilts is in the range of 6°-27°. Sections with eastern, southern and south-eastern aspects prevail.

There are two types of soils: humus – carbonized, sandy-clayey, heavily stony, shallow and maroon-leached, sandy-clayey, medium stony, average depth. The basic rock is lime-stone. Considerable part of the territory (58%) remains unaffected by erosion. In the sections № 63 and № 64 erosion processes of the second degree are observed

With respect to the climate the region belongs to an area with transitional-continental climate and Mediterranean influence (Gantchev, 1965; Bondev, 1991).

The following data can be used as a basis for a comparative analysis of the phytocenotic structure of sections № 63, № 64 and № 65 according to the Forest Management Plan of the green shelter belt of Stara Zagora:

For the hills and the foothill slopes, situated in the periphery of the Stara Zagora field, Ganchev (1962) defines as typical the residual forests of *Quercus pubescens* Willd. and the frutices of *Carpinus orientalis* Hill. On the place of the cleared as a result of the human influence sections, two relatively lasting formations take shape: *Chrysopogon gryllus* and *Festuca pseudovina* formations.

Analyzing vegetation of meadows and pastures, Ganchev & al. (eds)(1964) point the *Agropyrum repens* formations as typical for the region.

Ganchev (1965) distributes the residual forests in the Stara Zagora field and its peripheral hills into 8 formations: Form. *Fraxinus oxycarpa*; Form. *Ulmus foliacea*; Form. *Quercus pedunculiflora*; Form. *Q. cerris*; Form. *Q. cerris*+ *Q. conferta*; Form. *Q. conferta*; Form. *Q. pubescens*; Form. *Carpinus orientalis*.

Proofs for the replacement of the primary vegetation with secondary one could be found in the investigations of Bondev (1991).

In the vicinity of the North of Stara Zagora the author distinguishes two types of vegetation – root and derivative vegetation. The root vegetation is presented by mixed – up forests of *Quercus pubescens* Willd., *Q. virgiliana* (Ten.) Ten. and *Carpinus orientalis* Mill., arisen as secondary at some places, and the derivative is presented by forests and frutices from *Carpinus orientalis* Mill. with Mediterranean elements and prevailing xero-thermic grass formations with *Dichantium ischaemum* (L.) Roberty, *Chrysopogon gryllus* (L.) Trin., *Poa bulbosa* L. and ephemerae.

The transect method is used for the determination of the species diversity.

The works of Yordanov(ed.)(1963-1989); Kozhuharov(ed.)(1992); Petrova et all. are adopted as a taxonomic base for the determination of species.

Projective cover is defined by the ten point marking system and expressed in % .

For the grass species with cover under 10% the indices of abundance are defined by the five point marking system of Hult - Sernander and the frequency indices by the five point marking system of Raunkjar.

The current study aims to update the composition and structure of the ligneous formations , building the plant cover to the north of Stara Zagora .

Investigations are conducted in the 2002-2004 time span.

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## RESULTS:

Analysis of plant cover established two types of formations:

**The first type** – plant communities with coniferous species as a dominant (**Fig.2**).

### ***Pinus nigra* formation.**

The associations of the formation locate on areas with various aspects – South–Eastern; Southern and South–Western in the range of 300 – 500 m in altitude. It is formed by 8 associations:

**The first association:** *Pinus nigra – subnudum* (map.unit **1**). Its cenoses take 71,1 hectares from the area of the three sectors (28,7%). Evolves equally well in the two types of soils – humus–carbonized, sandy–clayey, shallow, and maroon-leached with medium richness, shallow, both types on a limestone rock foundation. The ligneous floor is mono- dominant, built-up of *Pinus nigra* (10) and isolated specimen of *Carpinus orientalis*, *Pinus sylvestris*, *Robinia pseudoacacia*, *Cedrus atlantica*, *Cupressus sempervirens*, *Fraxinus ornus*, *Betula pendula*, *Fraxinus excelsior*, *Ailanthus althissima*. Tree stand is with high projective cover (0,8 - 0,9) and doesn't allow development of any vegetation in the lower floors. The grass cover is rare (5%) and is built – up of forest sciophytics - *Brachypodium sylvaticum* (1,I), *Geranium sanguineum* (1,I), *Lepidium campestre* (1,I), *Turritis glabra* (1,I).

Forest grow-up of *Carpinus orientalis* and *Fraxinus ornus* evolves in five sections, which presumes a process of natural renovation of the coniferous plantations of the aboriginal

vegetation in the immediate future. In the periphery of the coniferous cenoses *Dactylis glomerata* (1,I) , *Euphorbia helioscopia* (1,I), lians of *Clematis vitalba* (1,I) and frutices of *Rosa canina* can be found.

**The second association:** *P. nigra* + *Quercus pubescens* + *Fraxinus ornus* (map.unit 2). It takes an area of 32,8 hectares and locates on the slopes with eastern and southern aspects.

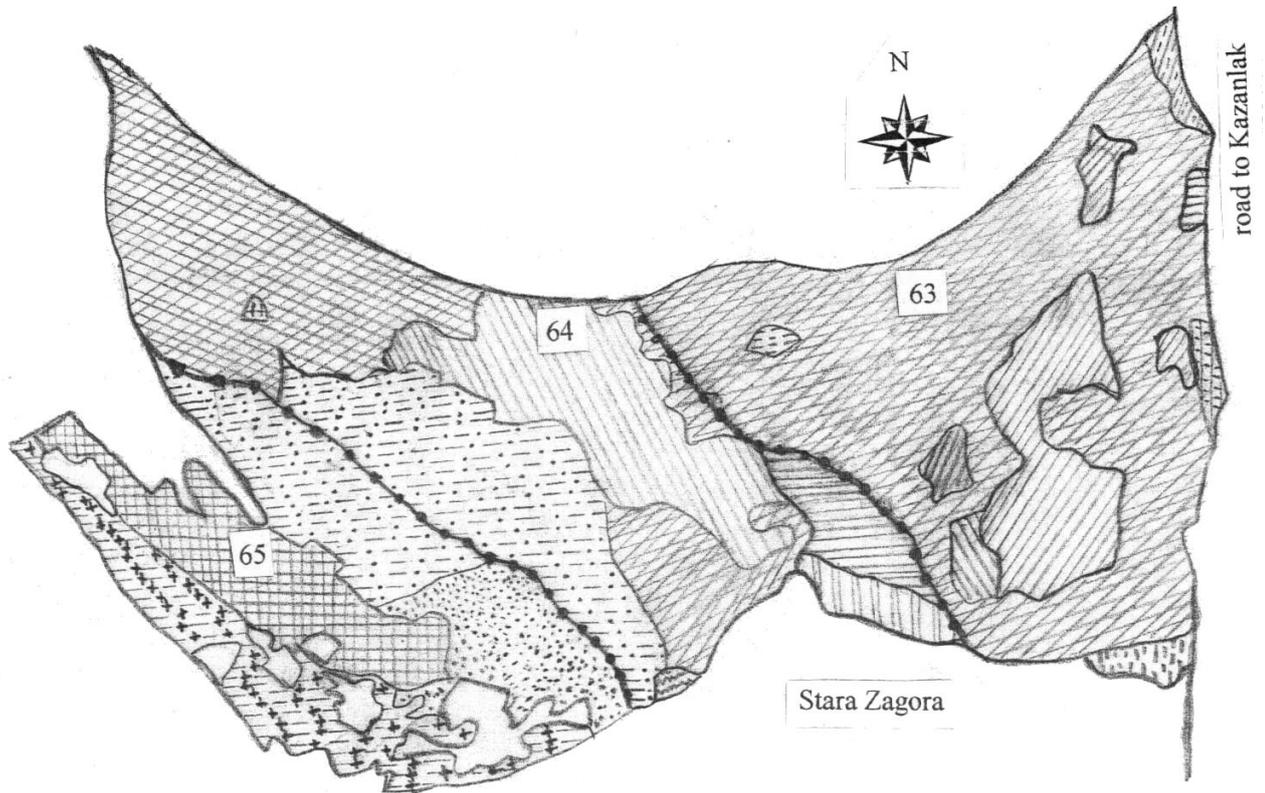
The association includes 3 types of cenoses with different share holding of the dominants . The ligneous cover in the first type is built – up of *Pinus nigra* (7), *Quercus pubescens* (2),

*Fraxinus ornus* (1) and individual specimen of *Carpinus orientalis* ; in the second type – of *Pinus nigra* (7), *Quercus pubescens* (1), *Fraxinus ornus* (2); in the third type of *Pinus nigra* (8), *Quercus pubescens* (1), *Fraxinus ornus* (1). and isolated specimen of *Carpinus orientalis* . The frutescent floor is composed of *Jasminum fruticans* (1,I), *Rubus caesius* (1,I) , *Crataegus monogyna* (1,I). The grass cover is with little projective cover (10%) and is similar in structure to that of the previous association.

**The third association:** *P. nigra* + *Carpinus orientalis* + *Quercus pubescens* (map.unit 3).

Situated on the slopes with eastern and southern aspects and takes limited area – 8,3 hectares. The cenoses are two types, depending on the share holding of the dominants. The ligneous floor in the first case is built up by *Pinus nigra* (5), *Carpinus orientalis* (3), *Quercus pubescens* (2) and *Pinus nigra* (8), *Carpinus orientalis* (1), *Quercus pubescens* (1) in the second case. The grass floor is with low cover (10 – 15%) and is composed of *Turritis glabra* (1,I), *Geum urbanum* (1,I), *Fragaria vesca* (1,I), *Agrimonia eupatoria* (1,I) and climbing lianas *Clematis vitalba* (1,I), *Hedera helix* (1,I).

**The fourth association:** *P. nigra* + *Cedrus deodara* (map.unit 4). It takes an area of 12,6 hectares over the upper part of a slope with western aspect in № 65 section. *Cedrus*



**Legend:**

- |     |   |   |
|-----|---|---|
| 1.  |  | asoc. <i>Pinus nigra</i> -subnudum  |
| 2.  |  | asoc. <i>P. nigra</i> + <i>Quercus pubescens</i> + <i>Fraxinus ornus</i>                              |
| 3.  |  | asoc. <i>P. nigra</i> + <i>Carpinus orientalis</i> + <i>Quercus pubescens</i>                         |
| 4.  |  | asoc. <i>P. nigra</i> + <i>Cedrus deodara</i>   |
| 5.  |  | asoc. <i>P. nigra</i> + <i>Carpinus orientalis</i> + <i>Quercus pubescens</i> + <i>Fraxinus ornus</i> |
| 6.  |  | asoc. <i>P. nigra</i> + <i>Carpinus orientalis</i>  |
| 7.  |  | asoc. <i>P. nigra</i> + <i>Carpinus orientalis</i> + <i>Fraxinus ornus</i>                            |
| 8.  |  | asoc. <i>P. nigra</i> + <i>Salix alba</i>   |
| 9.  |  | asoc. <i>Carpinus orientalis</i> + <i>Pinus nigra</i>   |
| 10. |  | asoc. <i>Carpinus orientalis</i> + <i>Fraxinus ornus</i>  |
| 11. |  | asoc. <i>Carpinus orientalis</i> + <i>Fraxinus ornus</i> + <i>Quercus pubescens</i>                   |
| 12. |  | asoc. <i>Fraxinus ornus</i> + <i>Quercus pubescens</i> + <i>Carpinus orientalis</i>                   |
| 13. |  | asoc. <i>Fraxinus excelsior</i> + <i>Robinia pseudoacacia</i>   |
| 14. |  | asoc. <i>Robinia pseudoacacia</i> -subnudum   |
| 15. |  | asoc. <i>Robinia pseudoacacia</i> + <i>Fraxinus ornus</i>   |

**Fig.2.** Plant associations in sections № 63, 64, 65 (A scale 1:25 000).

*deodara* specimen are young, 5 to 6 meters high and in excellent state of health. Single specimen of *Sorbus torminalis* are found. Tree stand forms dense cover, that is why grass species are situated in the periphery of the plantation. Species such as *Ferulago sylvatica* (1,I), *Jurinea mollis* (1,I), *Potentilla argentea* (1,I), *Ornithogalum umbellatum* (1,I), *Teucrium chamaedrys* (2,II), *Hypericum rumeliacum* (2,II), *Teucrium polium* (2,II) , *Ajuga laxmanii* (1,I), *Sanguisorba officinalis* (1,I), *Stachys recta* (2,I), *Dactylis glomerata* (1,I), *Thymus striatus* (1,II) and frutices of *Rosa canina* (2,II) are typical for the marginal parts of the association.

**The fifth association:** *P. nigra* + *Carpinus orientalis* + *Quercus pubescens* + *Fraxinus ornus* (map.unit 5). The association is with limited area (1,2 hectares) over the lower part of a slope with eastern aspect, 300 m altitude and 22° tilt. Ligneous floor is formed by *Pinus nigra* (6), *Carpinus orientalis* (2), *Quercus pubescens* (1), *Fraxinus ornus* (1). Tree stand is rare (0,7). Grass cover is sparse (5 – 10 %) and is represented by *Lathyrus laxiflorus* (1,I), *Paeonia peregrina* (1,I), *Sisymbrium orientale* (1,I), *Erodium cicutarium* (1,I), *Ferulago sylvatica* (1,I).

**The sixth association:** *P. nigra* + *Carpinus orientalis* + *Fraxinus ornus* (map. unit 6).

The cenoses of the association take an area of 28 hectares and are situated on sections with southern and south–eastern aspects. Dominants are included in various degrees in the tree stand and form two types of cenoses: *Pinus nigra* (6), *Carpinus orientalis* (2) *Fraxinus ornus* (1); *Pinus nigra* (3), *Carpinus orientalis* (3), *Fraxinus ornus* (3). *Quercus pubescens* is added with 10% participation in the second version. In the under tree forest cover *Cornus mas*, *Cotinus coggigria*, *Rosa canina* (1,I), *Jasminum fruticans* (1,I), *Crataegus monogyna* (1,I) are frequently found .

**The seventh association:** *P. nigra* + *Carpinus orientalis* (map.unit 7).

It is located over the upper part of a slope with eastern aspect and altitude of 400 m on an area of 7 hectares. Tree stand is formed by *Pinus nigra* (6) and *Carpinus orientalis* (4). Sciophytics species, typical for the first and the third associations dominate in the grass cover.

**The eighth association:** *P. nigra* + *Salix alba* (map.unit 8). The cenoses of the association are located over the lower part of a slope with south–eastern aspect and 300 m altitude on an area of 3,1 hectares . The shares that the edificators hold are as follows : *Pinus nigra* (7), *Salix alba* (2). In the ligneous floor *Betula pendula* (1) and single specimen of *Populus nigra* and *Juglans regia* are added. In the grass floor with projective cover of 10 – 20%, *Medicago minima* (2,II), *Potentilla argentea* (2,I), *Dactylis glomerata* (1,I), *Sanguisorba officinalis* (1,I), *Geum urbanum* (1,I), *Fragaria vesca* (1,I), *Mercurialis ovata* (1,I) *Stellaria media* (1,I), *Luzula sylvatica* (1,I), *Epilobium parviflorum* (1,I), *Brachypodium sylvaticum* (1,I), *Verbena officinalis* (1,I) take part.

For the time being the *Pinus nigra* cenoses status is good; the relatively little altitude and the lime – stone rock foundation favour this good condition. At some places specimen with broken branches can be seen.

**The second type** – plant communities with deciduous species as a dominant.

Such types of communities are formed by *Carpinus orientalis*, *Fraxinus ornus*, *Fraxinus excelsior* and *Robinia pseudoacacia*.

The ***Carpinus orientalis* formation** takes an area from 60,8 hectares (24,4%). Its associations are with natural origin and are situated on the lower parts of the slopes with southern, south–eastern and western aspects; 300 – 450 m altitude. The formation is built-up by 3 associations:

**The first association:** *Carpinus orientalis* + *Pinus nigra* (map.unit 9). It takes an area of 39,4 hectares. Tree stand is formed by *Carpinus orientalis* (6) and *Pinus Nigra* (2) and has high canopy (0,8). *Fraxinus ornus* (1) and *Quercus pubescence* (1), as well as single specimen of *Tilia tomentosa*, *Sorbus torminalis*, *Ailanthus altissima* participate in the ligneous floor. The origin of *Carpinus orientalis* Mill. is offshoot, that is why the vertical structure is poorly expressed. The under tree forest cover is built – up by *Crataegus monogyna*, *Ligustrum vulgare*, *Cornus mas*, *Prunus spinosa*, *Cotinus coggygrya*. In the grass floor with projective cover of 10–20% *Oryzopsis virescens* (1,I), *Brachypodium distachyon*

(1,I) ,*Dactylis glomerata* (1,I), *Agrimonia eupatoria* (1,I), *Lepidium campestre* (1,I), *Conium maculatum* (1,I), *Tanacetum vulgare* (1,I) participate.

**The second association:** *Carpinus orientalis* + *Fraxinus ornus* (map.unit 10). The cenoses of the association are located on the upper part of a slope on an area of 3,7 hectares with 300 m altitude and southern aspect. The tree stand is with offshoot origin of the edificators, canopy 0,6 – 0,8 and is built – up by *Carpinus orientalis* (6), *Fraxinus ornus* (2), *Quercus pubescens* (1) and *Pinus nigra* (1). The grass cover is with projective cover of 10 – 20% and is composed by *Helleborus odorus* (2,II), *Geranium brutium* (2,II), *Fragaria vesca* (1,I), *Erodium cicutarium* (1,I), *Sanguisorba officinalis* (1,I), *Brachypodium sylvaticum* (1,I).

**The third association:** *Carpinus orientalis* + *Quercus pubescens* (map.unit 11). The association is located on an area of 17,7 hectares on the lower part of a slope with western aspect and 400 m altitude. *Carpinus orientalis* (6), *Fraxinus ornus* (2), *Quercus pubescens* (2) and single specimen of *Q. cerris* build up the ligneous floor. In the grass floor the species , mentioned in the previous association prevail.

The ***Fraxinus ornus* formation** is distributed on a limited area of 1,5 hectares and includes *Fraxinus ornus* + *Quercus pubescens* + *Carpinus orientalis* (map. unit 12) associations. It takes the lower part of a slope with eastern aspect and 300 m altitude. The origin of the dominants in the ligneous floor is offshoot and the interrelation is as follows: *Fraxinus ornus* (4), *Quercus pubescens* (4), *Carpinus orientalis* (2). The grass cover is with 10 – 15% projective cover and in the sparsely located sections groups of *Cornus mas*, *Prunus spinosa* with cereals and various grass species are found.

The ***Fraxinus excelsior* formation** includes *Fraxinus excelsior* + *Robinia pseudoacacia* associations (map.unit 13). It is situated on the upper part of a slope with southern aspect and 450 m altitude. The dominant, *Fraxinus excelsior* (6), is with natural origin and the co–dominant *Robinia pseudoacacia* (4) – with artificial one. Single specimen of *Quercus pubescens* are present in the tree stand. Groups of *Cotinus coggygria* (1,I), *Rubus caesius* (1,I), *Crataegus monogyna* (1,I) and *Cornus mas* (1,I) are located in the sparsely located sections. On the peripheral sections groups of *Coronilla varia* (2,II) and *Polygala*

*major* (2,II), and single specimen of *Stachys recta* (1,I), *Acinos rotundifolius* (1,I), *Dictamnus albus* (1,I), *Verbascum xanthophoeniceum* (1,I), *Campanula persicifolia* (1,I) are formed.

The **formation** of *Robinia pseudoacacia* takes an area of 0,3 hectares and includes 2 associations:

The cenoses of **Robinia pseudoacacia – subnudum** association (map.unit 14) are located on an area of 0,1 hectares, in the lower part of a slope with 500 m altitude and southern aspect. The tree stand is with offshoot origin and with 0,8 – 0,9 projective cover. The grass cover is rare and is represented by *Ferulago sylvatica* (1,I), *Orlaya grandiflora* (1,I), *Arum maculatum* L. (2,I), *Buglossoides arvensis* (1,I), *Pulmonaria officinalis* (1,I)

**Robinia pseudoacacia + Fraxinus ornus** association (map.unit 15) takes an area of 0,2 hectares and is located on a section with 350 m altitude. *Robinia pseudoacacia* is with offshoot origin; with single specimen *Pinus nigra* and *Ailanthus altissima* are presented. Tree stand is with 0,6 – 0,8 canopy. In the frutescent floor *Jasminum fruticans* (1,I), *Rubus caesius* (1,I), *Crataegus monogyna* (1,I) develop.

Grass cenoses on the hills crests are of a real interest for the present study. Grass stand is dense – 70 - 80% projective cover and is built – up mainly of various biennial and perennial grass species: *Achillea millefolium* (2,II), *Centaurea napulifera* (2,I), *Salvia pratensis* L.(1,II), *Scorzonera hispanica* (1,I), *Marrubium peregrinum* (1,II), *Euphorbia salicifolia* (1,I), *Achillea clypeolata* (2,II), *Erysimum diffusum* (1,I), *Ajuga chamaeptytis* (1,I), *Agrimonia eupatoria* (2,I), *Siderites Montana* (1,I). Frequently found are *Onobrychis alba* (2,I), *Medicago minima* (2,II), *Aegilops triuncialis* (2,I), *Thymus striatus* (2,II), *Festuca pseudovina* (2,II), *Bituminaria bituminosa* (2,II), *Dorycnium herbaceum* (2,II).

## DISCUSSION

The associations of *Pinus nigra* formation have a paramount significance in building up the plant cover, and according to their location the places deforested in the recent past can clearly be defined. The coniferous species that compose these associations are entirely of a secondary origin. The forestation undertakings set the pattern of demutation processes, connected with restoration of the aboriginal vegetation cenoses. Preserving and further

developing the soil layer, they create favourable conditions for multiplication of the bio – diversity in the region.

Analysis of the aboriginal formations in the region shows a trend towards impoverishment of the species list, disappearance of the more mesophilic species at the expense of the xerophytic ones. They prove to be a natural continuation of the xerothermic forest vegetation of the Sarnena Sredna Gora Mountain slopes (Bondev 1991). The point is the presence of *Quercus pubescens* Willd., *Carpinus orientalis* Mill. and *Fraxinus ornus* L. in the composition of deciduous communities. According to the author it is possible that the little *Quercus pubescens* Willd. populations, which are among the deciduous cenoses, could be residuals from the relict polydominant forests, having existed during the Tertiary on these places. The three species indicate the xerophytic line in the development of the plant cover in the low – altitude oak belt, connected with the degradation of the vegetation as a result of the anthropogenic factor influence.

## **CONCLUSION**

The phytocenotic characteristic of the Northern part of the Stara Zagora green shelter belt can be used as a reliable indicator for establishment of the progressive and regressive processes, connected with the activity of the anthropogenic factor. The natural replacement of the mesophytic dominants and edificators in the aboriginal communities with xerophytic ones reflects the general trend of xerophytization of the climate in a world scale.

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