

Processes of the oak forests degradation in the Middle Danube Plain

Georgi Hinkov, Tzvetan Zlatanov, Denitsa Pandeva

Forest Research Institute, Sofia, Bulgaria

georgihi@abv.bg

Abstract:

Georgi Hinkov, Tzvetan Zlatanov, Denitsa Pandeva: Processes of the oak forests degradation in the Middle Danube Plain. Proceeding of the 8th Symposium of flora of Southeastern Serbia and Neighbouring Regions, Nis, 2005.

The main reasons for degradation of oak forests in the Middle Danube Plain are:

- The a restriction of oak forests area by uprooting the trees for extending the agricultural lands;
- The a reconstruction of oak forests with hybrid black poplars, *Robinia pseudoacacia* and *Pinus nigra*;
- The a regressive succession trends. As result of improper management the oak forests are replaced by other tree and shrub species.

Parallel with the regressive successions trends of returning of oaks on deserted agricultural lands are observed. Pioneer species such as *Rosa canina*, *Crataegus monogyna*, *Pyrus communis* create conditions for indigenous oak species (*Quercus cerris*, *Q. frainetto*, *Q. robur*, *Q. pubescens*, *Q. petraea*) to turn back.

Key words: oak forests degradation, succession processes, *Quercus* sp.

Introduction

The Danube plain is situated in Northern Bulgaria and includes the forest-steppe zone, reaching to the big forest complexes of the Foremountain and Loudogorie regions, which surround it from west, south and east.

Small part of the plain has been preserved as typical steppe, while in the past the steppe was widely spread especially on north, near the Danube river (Yordanov, 1936). At that time, as in the present, the forest-steppe zone prevailed, but in the southern parts vast, compact forest complexes were distributed. The question about the boundaries of the steppe, forest-steppe and typical forest zones is still under discussion (Yordanov, 1936; Stefanov, 1938; Tsonev, 2002).

In the past big forest massifs spread as wedges along the river sides of Danube tributaries - Iskar,

Vit, Osam and Yantra (Stefanov 1938, 1944). Small, scattered forests still can be found in the lowlands along the above mentioned rivers, on the hills at the right bank of Danube river and in the southern part of the plain. Most of the oak forests were cut down and the fertile lands under them were transformed to arable areas (Chernyavski, 1957; Velkov et al., 1991). During the last century the forest cover of the Danube plain decreased several times (Kostov, 1986). Nowadays, the deforestation of the plain is, to a great extent, a serious prerequisite for ecological disasters.

Material and methods

Object of investigation in the present study are the oak forests with participation of *Quercus cerris* L.,

Q. frainetto Ten., *Q. robur* L., *Q. pubescens* Willd. и *Q. petraea* Liebl. in the Middle Danube Plain.

Methods. Information from the inventory projects of the State Forestries was used. On the base of reference data, field trip investigations and established temporary sample plots an estimation was made on the degradation processes and on the ongoing in the oak forests of the Middle Danube Plain succession processes.

The aim of this work is to present adequate characteristics of the degradation processes in the oak forests, as well as of their natural reforestation on open areas.

Results and discussion

1. Anthropogenic limitation of the oak forests area

The last uprootings of oak forests in the Danube Plain for transformation in arable lands ended about 30 years ago. Recently in many places near forest massifs the opposite process of returning of tree and shrub species on deserved agricultural areas can be observed.

Large scale forest activities for transformation of coppice to high-stem stands were carried out in the investigated region till the end of the last century (Stiptsov et al., 1995). This was valid especially for the 60^s and 70^s years when great part of the oak forests near river banks were replaced by different hybrids of the black poplar. Smaller in area were the transformation activities in the oak dendrocoses on the hilly part of the Danube plain and their replacement by *Robinia pseudoacacia* L. and *Pinus nigra* Arn. (Iliev et al., 1995)

Insignificant part of the oak forests was destroyed as result of roads construction, digging of channels, building of electric transmission networks, gas-mains and other technical facilities, as well as due to expanding of settlements and industrial areas.

2. Decrease of the oak participation in the mixed forest stands

The low-stem management, which was applied for centuries in the Danube plain let to limited participation in the oak associations of such species as *Quercus petraea*, *Q. frainetto* and *Q. robur*. They were naturally replaced by biologically more aggressive but nowadays considered as economically less valuable species as *Q. cerris*, *Fraxinus ornus*, *Acer campestre*, etc. This is result first of all of the weaker stump and root sucker productive ability of the oaks and their gradual decline from the tree species composition after 2-3 rotation periods (Marinov et al., 1995).

Another reason for the decreasing participation of the oaks in the plain forest ecosystems is the absence of selective thinning or the incorrect forest management. There are different forest management practices giving opportunities for regulation of the tree species composition of the forests, i.e. tolerating of the oaks and establishing of desired composition in the forests (Popov, 1994).

The destruction of the oak dendrocoses in the investigated region is also result of the intensive pasture of domestic animals. This is the main factor for the stamping of the soil, the lack of natural regeneration, the withering and gradual decreasing of the stands density (Marinov et al., 1995).

To degradation of the oak stands lead also the spontaneous or deliberately set on fires. This factor is characteristic for the last decade. The fires cause destruction of the oak saplings, burning down of the trees bark and injuring of the wood.

Recently a tendency for total decay of the oak forests health status is observed – pest attacks, distribution of fungi diseases, etc. The main reason for the changes in the health condition of the oaks is again the anthropogenic pressure (Rosnev, 1994).

3. Regressive succession processes resulting limited distribution of the oaks

The successions or the change of one type of vegetation with another, in this case of the oaks with other tree or shrub species, are often resulted of the anthropogenic activity. These processes are complicated, extended in time and are invisible in the limits of one human life but affect great part of the forest ecosystems. In this investigation only clearly expressed successions, observed in the last 2-3 decades, are presented.

Typical for Bulgaria, and especially for the Middle Danube Plain, is the process of invasion of more plastic species, which occupy the areas where the oaks were cut down (Stefanov, 1994; Penev et al., 1969; Bondev, 1991). Such species are the indigenous trees and shrubs as *Tilia tomentosa*, *Carpinus orientalis*, *Cotinus coggygria*, *Cornus sanguinea*, *Rubus caesius* and the introduced species *Ailanthus altissima*, *Fraxinus americana*, *Acer negundo*, *Amorpha fruticosa*, etc. (**Tab. 1**). Another obvious process of regressive succession is the so called “steppe formation” - on the place of the destroyed oak forests herbaceous vegetation, mainly of representatives of *Poaceae* family settles down (Yordanov, 1936; Stefanov, 1938).

Table 1. Tendency in oaks replacement in the Middle Danube Plain

| Main tree species | species change | CHANGE WITH TREE AND SHRUB SPECIES |
|---------------------------------|----------------|---|
| <i>Quercus pubescens</i> Willd. | → | <i>Carpinus orientalis</i> , <i>Paliurus spina-christi</i> ; → <i>Cotinus coggygria</i> , <i>Rubus caesius</i> , <i>Cornus sanguinea</i> ; → Poaceae sp. |
| <i>Q. frainetto</i> Ten. | → | <i>Quercus cerris</i> ; → <i>Carpinus orientalis</i> , <i>Acer tataricum</i> ; → <i>Cornus mas</i> , <i>Cornus sanguinea</i> , <i>Corylus avellana</i> ; → <i>Cotinus coggygria</i> , <i>Euonymus europaea</i> . |
| <i>Q. cerris</i> L. | ↔ | <i>Rosa canina</i> , <i>Crataegus monogyna</i> , <i>Prunus spinosa</i> ; → <i>Carpinus orientalis</i> ; → <i>Tilia tomentosa</i> → <i>Carpinus orientalis</i> , <i>Fraxinus ornus</i> ; → <i>Cotinus coggygria</i> , <i>Rubus caesius</i> . |
| <i>Q. robur</i> L. | ↔ | <i>Rosa canina</i> , <i>Acer tataricum</i> , <i>Crataegus monogyna</i> , <i>Prunus spinosa</i> , <i>Staphylea pinnata</i> , <i>Sambucus nigra</i> ; ↔ <i>Populus alba</i> , <i>P. nigra</i> , <i>Salix alba</i> ; ↔ <i>Ulmus minor</i> , <i>U. laevis</i> , <i>Morus alba</i> , <i>Pyrus communis</i> ; → <i>Tilia tomentosa</i> , <i>Quercus cerris</i> , <i>Acer campestre</i> ; → <i>Fraxinus americana</i> , <i>Acer negundo</i> , <i>Robinia pseuacacia</i> ; → <i>Amorpha fruticosa</i> , <i>Rubus caesius</i> , <i>Corylus avellana</i> , <i>Cornus sanguinea</i> ; |
| <i>Q. petraea</i> Liebl. | → | <i>Acer pseudoptanus</i> , <i>A. platanoides</i> , <i>A. campestre</i> , <i>Sorbus torminalis</i> ; → <i>Tilia tomentosa</i> , <i>Quercus cerris</i> , <i>Carpinus betulus</i> , <i>Fraxinus excelsior</i> ; → <i>Corylus avellana</i> , <i>Cornus sanguinea</i> . |

Legend:

→ one-way changes,

↔ two-way changes.

4. Progressive successions and retrieval of the oaks

The retrieval of the oaks is most often observed on deserved pastures and fields, situated at the edge of oaks groups or forests. The main reasons for this reverse process are that in the last 10-15 years some arable lands are no more cultivated and the pasture in some regions of the plain was strongly reduced.

In the beginning the seeds of some shrub species dispersed by birds, wind or gravity, form small regeneration "nests", unevenly distributed on the deserved territories. Rarely the shrub association, after a 1-2 decades growing period, reach up to 30-50% coverage of the occupied area. It includes such species as *Rosa canina*, *Crataegus monogyna*, *Prunus spinosa*, *Cornus mas*, *Corylus avellana*, etc., which play the role of pioneer vegetation and created suitable conditions for appearance of oaks and some other deciduous tree species – *Juglans regia*, *Prunus cerasifera*, *Morus*

alba, *Pyrus communis*, etc. Many authors (Hanon et al., 1987; Kollman, Schil, 1996; Hermann, 1997) consider that birds disperse the edible seeds and fruits of the most tree and shrub species. The acorns as heavy fruits are high quality food for such birds as *Garrulus glandarius*, *Corvus frugilegus*, *C. monedula*, *C. cornix*, *Coccothraustes coccothraustes*, *Columba palumbus*, *Dendrocopus medius*, etc., which are of prior significance for their distribution. Less important for the dispersal of the oak acorns are the animal species *Sciurus vulgaris* (Mellanby, 1968), *Apodemis sylvaticus* and *Clethrionomys glaeolus* (Shaw, 1968).

The shrubs play the role of pioneer vegetation till the full stabilization of the oak saplings. At age of 10-15 years the young oak trees are higher than the "host" shrub associations and start to cast a shadow on them. If the number of the oak saplings is about 2000-3000 per ha formation of good quality oak stand after a period of 20-30 years is possible.

Quercus frainetto and *Quercus robur* are the two species that most often can be found outside the boundaries of the oak stands. Never-the-less that in the Middle Danube Plain they meet rarely than *Q. cerris* their saplings are more frequently found in the spontaneously afforested areas. May be this is result of the better nutrition quality of the *Q. frainetto* and *Q. robur* acorns, making them preferable for the birds, which respectively disperse them. *Quercus petraea* meets comparatively rare in the Middle Danube Plain and this determines its weak local regeneration. The participation of *Q. pubescens* saplings is also low as this species meets at aggravated site conditions and characterizes with rare and weak fruit bearing. Although the forests with *Q. cerris* are more widely distributed in the investigated region, the common impression is that this species regenerates better under the canopy of *Q. cerris* forests and disperse weaker by the birds on deserved agricultural lands.

Conclusions

The main reasons for the degradation of the oak forests in the Middle Danube Plain are the anthropogenic limitation of their areas and the regressive succession processes taking place in them.

The anthropogenic limitation of the oak forests area is due to:

- their uprooting till the beginning of 70s of the last century in order to establish agricultural fields;

- the big scale transformations of the oak forests that continued till the beginning of the 90s of the last century: along the river banks they were replaced with plantations of black poplar hybrids and in the hilly parts of the plain – with *Robinia pseudoacacia* and *Pinus nigra*;

- the regressive succession processes in the oak forests express in change of the species composition, mainly as result of inappropriate management in them. The oaks were replaced as by the indigenous species *Tilia tomentosa*, *Acer campestre*, *Fraxinus ornus*, *Carpinus orientalis*, *Cotinus coggygria*, *Cornus sanguinea*, *Rubus caesius*, so by the introduced *Ailanthus altissima*, *Fraxinus americana*, *Acer negundo*, *Amorpha fruticosa* и др.

Parallel with the regressive successions, tendency of reverse natural regeneration of the oak forests, mainly on deserved agricultural lands, is observed. In this case such species as *Rosa canina*, *Crataegus monogyna*, *Prunus spinosa*, *Cornus mas*, *Pyrus communis*, etc. play pioneer role, creating suitable conditions for the re-settlement of the

typical for this region oak species - *Quercus cerris*, *Q. frainetto*, *Q. robur*, *Q. pubescens* and *Q. petraea*.

Literatura

- Bondev, I. (1991): The Vegetation in Bulgaria. University Publishing House "St. Kliment Ohridski", Sofia, 184 p. (In Bulg.)
- Chernyavski, P. (1957). Establishment of Fast-growing and Drought Resistant Ecotypes of the Robur group oaks. Scientific Works of SRIFFM (FRI) 4: 7–62. (In Bulg.)
- Delkov, N. (1988): Dendrology. Zemizdat, Sofia, 334 p. (In Bulg.)
- Hanon S., R. Mumme, W. Koenig, S. Spon, F. Pitelka. (1987): Poor acorn crop, dominance, and decline in numbers of acorn woodpeckers. Journal of Animal Ecology, 56: 197–207.
- Hermann, B. (1997): Mehr Eichen dank dem Eichelhaeher. Wald Holz 9: 20–22.
- Iliev, S., M. Milev, K. Petkova. (1995): Some Problems of the Afforestations for Transformation. In: Reports at the National Conference on the Problems of Transformation of Forest Stands. Sofia: 72–82. (In Bulg.)
- Kollman, J., H. Schill. (1996): Spatial patterns of dispersal, seed predation and germination during colonization of abandoned grassland by *Quercus robur* and *Corylus avellana*. Vegetatio, 125: 193–205
- Kostov, K. (1986): The Forests in the Plains. Forest Management and Forest Industry, №3: 19–21. (In Bulg.)
- Marinov, M., K. Kostadinov, G. Popov, V. Stiptsov, H. Bojinov, D. Dinev, D. Denev, S. Horozov. (1995): The Oak Forests in Bulgaria. Zemizdat, Sofia, 254 p. (In Bulg.)
- Mellanby, K. (1968): The effects of some mammals and birds on regeneration of Oak, J. appl. Ecol., Oxford, 2: 359–366.
- Penev, N., D. Garetkov, M. Marinov, Z. Naumov (1969): Forest Types in Bulgaria. Publ. House of BAS, Sofia, 354 p. (In Bulg.)
- Popov, G. (1994): Transformation of the Coppice Oak Forests into High-stem Ones: National Conference on the Problems of Transformation of Coppice to High-stem Forests, Sofia: 33–37. (In Bulg.)
- Rosnev, B. (1994): Health Condition of the Oak Forests in Bulgaria in the Period of 1980–1992. In: National Conference on the Problems of Transformation of Coppice to High-stem Forests, Sofia: 71–77.
- Shaw, M. (1968): Factors affecting the natural regeneration of Sessile Oak (*Quercus petraea*)

- in North Wales. A preliminary study of acorn production, viability and losses. *J. Ecol.*, 2: 565–583.
- Stefanov, B. (1938): The Loess and the Distribution of the Forest Vegetation in the Near-Danube Lowland. *News of the Bulgarian Geographic Society*, vol. VI, Sofia, Publ. House “Culture”: 141–168. (in Bulg.)
- Stefanov, B. (1944): Contribution to the Study and Classification of the Oak Forests in Bulgaria. III. Sofia University, Faculty of agriculture and forestry, XXII, 2: 65–103. (In Bulg.)
- Stiptsov, V., R. Efremov, Ts. Tsenov. (1995): On the Essence and the Context of the Term and Activity “Transformation of a Stand”. In: Reports at the National Conference on the Problems of Transformation of Forest stands. Sofia: 38–61. (In Bulg.)
- Tsonev, R. (2002): Notes on the Phyto-geography of the Central Danube Plain. In: Works of the Sixth National Botanic Conference, Sofia, 18–20 June 2001. University Publ. House “St. Kliment Ohridski”: 319–324. (In Bulg.)
- Velkov, D., A. Alexandrov, K. Kostov. (1991): Restoration of the Common Oak (*Quercus robur* L.) in its Natural Distribution Area. *Nature*, №2: 10–14. (In Bulg.)
- Yordanov, D. (1936): On the Distribution of the Steppe Vegetation in Bulgaria. *Proceedings of BAS*, volume XXXII, Department nature-and-mathematics, Royal Publishing House, Sofia, 105 p. (In Bulg.).