

CRATAEGUS NIGRA WALDST. ET KIT. DOMINATED COMMUNITY IN THE FLOODED DANUBE RIVER AREA IN CROATIA

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Abstract

The paper deals with a community dominated by *Crataegus nigra* and developed along the Danube River branches. The community has been classified into the association *Euphorbio palustris-Crataegum nigrae* ass. nova (*Alno-Quercion roboris*, *Populetalia albae*, *Quercio-Fagetea*). The community forms the edge of the pedunculate oak community *Genisto elatae-Quercetum roboris* and poplar trees community *Populetum nigrae-albae*. These sites are temporarily flooded, however, they are elevated above the normal water level so that organic material is swept away and deposited only to a limited extent. It is there where the processes of pedogenesis already start.

Izveček

Delo obravnava združbo, v kateri dominira vrsta *Crataegus nigra* in je razširjena ob rokavih reke Donave. Združbo smo uvrstili v asociacijo *Euphorbio palustris-Crataegum nigrae* ass. nova (*Alno-Quercion roboris*, *Populetalia albae*, *Quercio-Fagetea*). Združba gradi rob gozdov doba *Genisto elatae-Quercetum roboris* in topolov *Populetum nigrae-albae*. Ta rastišča so sicer občasno poplavljeni, vendar pa so že toliko dvignjena nad srednji vodostaj, da tu poplavna voda odnaša in odlaga organski material le v omejenem obsegu in se že začno procesi pedogeneze.

Key words: flooded forests, mantle communities, *Alno-Quercion roboris*, *Populetalia albae*, vegetation, the Danube River, Croatia

Ključne besede: poplavni gozdovi, zastorne združbe, *Alno-Quercion roboris*, *Populetalia albae*, vegetacija, Donava, Hrvaška

1. INTRODUCTION

The research of forest edge vegetation began in the continental part of Croatia within the framework of the international project entitled "Vegetation of forest edges and its significance for the forest biodiversity". In eastern Slavonia, the association *Crataego-Prunetum dasyphyllae* Jurko 1964 was sampled. It can be found in warmer sites and it was classified into a thermophilic alliance *Prunion fruticosae* Tüxen 1952. Further, the association *Viburno opuli-Prunetum dasyphyllae* Čarni, Franjić et Škvorc 2002 was described anew. It develops in humid sites and was classified into the alliance *Salici-Viburnion*

de Foucault 1991, being transitional between the alliance *Berberidion* Br.-Bl. 1950 and the class *Fran-guletea* Doing ex Westhoff and Westhoff & Den Held 1969 (Čarni, Franjić & Škvorc 2002).

This research was carried out in a narrow belt of land along the Danube River where the river inundates every year and thus creates specific ecologic circumstances that facilitate the development of specific plant species and plant communities. Depending on the flood duration and quantities that represent the basic gradient in the research area, the following communities prosper in this area: *Salicetum albae* s. lat. (*Galio-Salicetum albae* Rauš 1973), *Salici-Populetum nigrae* Tüxen 1931, *Popule-*

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tum albae-nigrae Slavnić 1952, as well as the *Fraxino-Ulmetum laevis* Slav. 1952 and the *Genisto elatae-Quercetum roboris* Ht 1938. The zonation is shown in Figure 1. The flooded forests build a narrow belt along the Danube River and are probably the best preserved flooded forests in Europe.

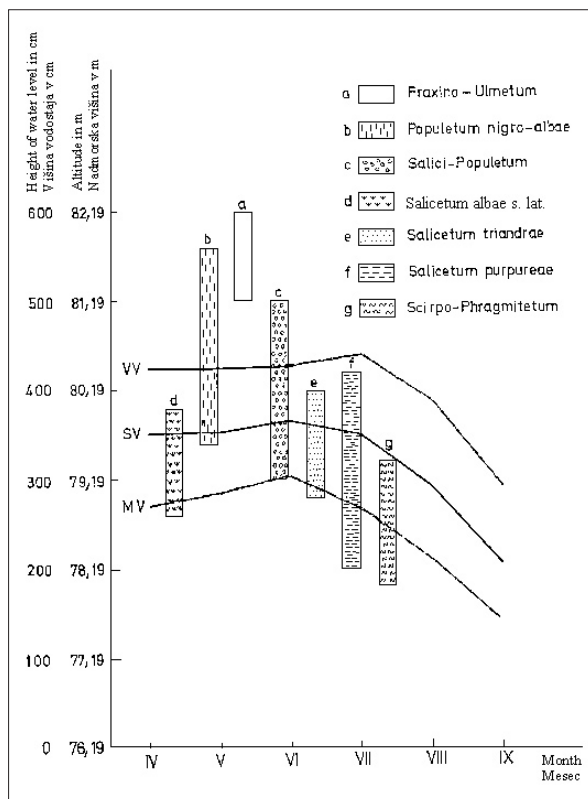


Figure 1: Zonation of forest communities on the river bank. Height of the mean water level of the river Danube at Vukovar in the vegetation season in the period 1941–1970. Legend: VV – mean height of the high water level, SV – mean height of mean water level, MV – mean height of the low water level (Rauš 1976).

Slika 1: Conacija gozdoma na rečnem bregu. Višina srednjega vodostaja Donave pri Vukovarju v času vegetacijske dobe v obdobju 1941–1970. Legenda: VV – srednja višina visokega vodostaja, SV – srednja višina srednjega vodostaja, MV – srednja višina nizkega vodostaja (Rauš 1976).

Mantle communities have not been studied along the forests where *Salix alba* dominates, and which consist of the *Salicetum triandrae* Malc. 1929 (Rauš et al. 1985), but higher on the river banks where the communities *Populetum albo-nigrae*, and particularly *Genisto-Quercetum roboris*, appear.

The term mantle communities is a phytosociological term and describes the communities appearing on forest edges and also separated from them. They

are classified into various syntaxa. Moreover, the mantle communities in drier sites are classified into the class *Rhamno-Prunetea* (e.g. Čarni, Franjić & Škvorc 2002). The mantle communities of the white willow stands (*Salicetum albae* s. lat.), built by *Salix triandra* (*Salicetum triandrae* Malc 1929) are, however, classified into the class of riverine vegetation *Salicetea purpureae* Moor 1958 (Rauš 1976, Šilc 2003). The purpose of the research was to establish the floristic composition of mantle communities and their systematic classification.

2. DESCRIPTION OF THE RESEARCH AREA

The area is located in the eastern part of Croatia along the Danube River on the border with Serbia and Montenegro (Fig. 2).

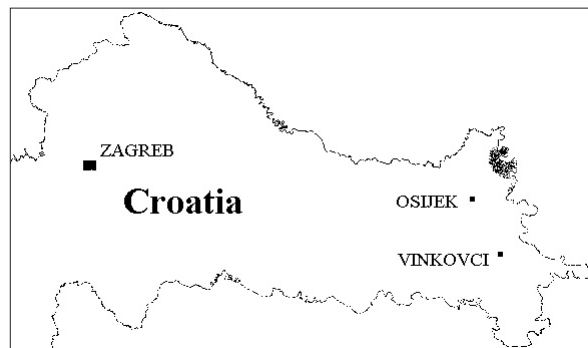


Figure 2: Geographical position of the research area. **Slika 2:** Geografska lokacija raziskovanega območja.

The climate in this part of Croatia is the most continental in all Croatia (Ilijanić 1963). The average annual temperature in Vinkovci (Fig. 3) is 10 °C, the warmest month is July with a mean temperature of 21.4 °C and the coldest month is January, where the average monthly temperature is –2.1 °C. The absolute maximum has been 39.0 °C, and the absolute minimum –30.5 °C. The average precipitation is 660 mm, with a maximum in May and December. The quantity of precipitation falls towards the east of Croatia, thus the annual precipitation in Slavonski Brod is 798 mm, in Đakovo 733 and in Vinkovci only 622 mm (Rauš & Šegulja 1983). The water level is always high when snow melts in the mountains of Austria, Slovakia and Hungary, and this is usually in May. In addition, the water level may rise twice to three times a year depending on precipitation (Fig. 4) (Rauš 1976).

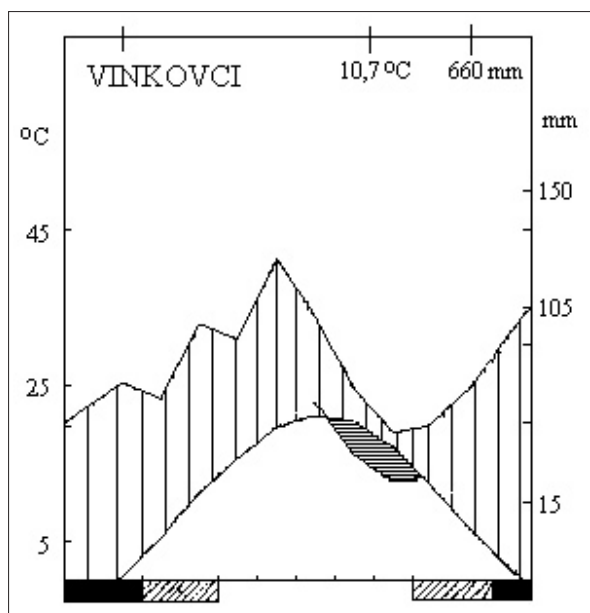


Figure 3: Climatic diagram for Vinkovci (Rauš & al. 1985).
Slika 3: Klimatski diagram za Vinkovce (Rauš & al. 1985).

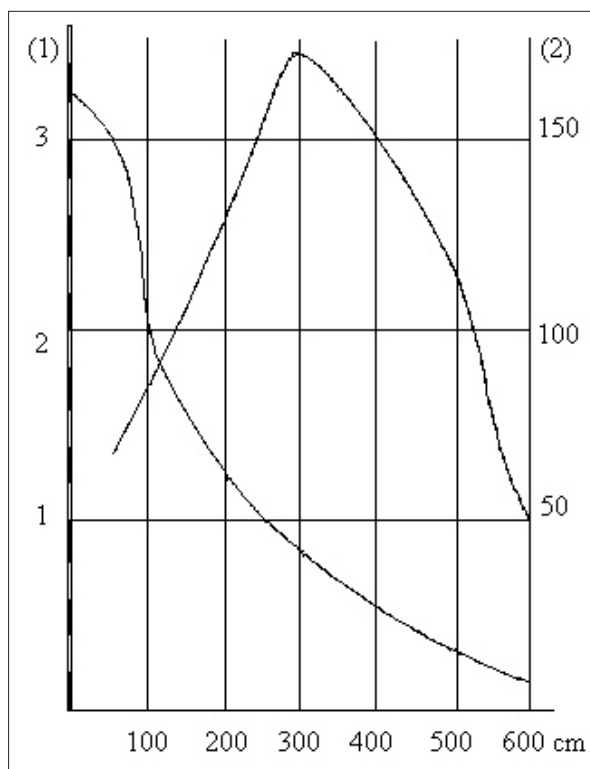


Figure 4: Duration and frequency of flooding of the river Danube at Vukovar. (1) Frequency per year, (2) Duration of individual flood in days (Rauš 1976).

Slika 4: Trajanje i pogostnost poplava reke Donave pri Vukovarju. (1) Pogostnost poplava v letu, (2) trajanje posamezne poplave v dneh (Rauš 1976).

Flooded forests that have been well preserved in the research area were often the subject of different vegetation research and have been relatively well studied (e.g. Slavnić 1952, Jovanović 1985, Rauš 1976, 1976a, Rauš & Šegulja 1983, Vukelić & Rauš 1998). Flooded forests are forests that could be found in flooded areas along rivers that are constantly periodically flooded by rivers. Therefore, these soils are developed depending on the flood duration and level. These are paraclimatic communities where the composition of the community depends heavily on the flood duration and level.

The vegetation is divided into two groups of communities: forests of softwood trees appearing in more flooded sites, and forests of hardwood trees growing in sites flooded for a shorter time.

The first group consists of the community *Salicetum triandrae*, *Salicetum albae* and *Salici-Populetum*. In addition to dominant species there are also *Acer negundo*, *Fraxinus pensilvanica* and *Morus alba* appearing in the tree layer and *Galium palustre* agg., *Rubus caesius*, *Carex elata*, *Poa trivialis*, *Solanum dulcamara*, and others appearing in the herb layer.

In higher sites where the water level is lower, poplar trees with a few willows prosper in general since the poplar trees grow quicker than willows and, consequently, the willows are suffocated by poplar trees. In lower sites, where there is a higher water level, the poplar trees are not tolerant of floods and only willow trees remain.

With regard to the syntaxonomic classification of the stands of soft deciduous trees, different points of view should be taken into consideration. A comprehensive synthetic work should be prepared, in which also the appurtenance to higher syntaxa should be established. The authors classify all stands of soft deciduous trees mostly into the alliance of *Salicion albae* Soó 1930 (class *Salicetea purpureae* Moor 1958) (Vukelić & Rauš 1998, Jovanović & al. 1985).

A somehow intermediate place between the first and second group is taken by the community *Populetum nigro-albae* which is classified into the alliance of *Salicion albae* (Rauš & Vukelić 1998), or alliance *Alno-Quercion roboris* (*Populetalia albae*) (Parabuški & al. 1986). It also facilitates the classification of the community into the alliance of *Populion albae* Br.-Bl. 1931 (*Populetalia albae*) (Jovanović & al. 1986).

The second group is composed of hardwood deciduous trees, the *Fraxino-Ulmetum laevis* Slav. 1952 and particularly the community *Genisto elatae-Quercetum roboris* Ht 1938. The well known "Slavo-

nian oak forests” that cover large continuous complexes are classified into this community. The sites of this community are located a few metres above the normal water level and are periodically flooded, however, they are flooded only for a shorter time or the sites are even not reached by floods, but in spite of that remain fresh. The tree layer is dominated by *Quercus robur* and, additionally, there are *Fraxinus angustifolia*, *Ulmus laevis*, *Populus nigra* in *P. alba*, etc. In the shrub layer, there are *Genista elata*, *Crataegus monogyna*, *Prunus spinosa*, *Viburnum opulus*, *Frangula alnus*, *Rubus caesius*, *R. fruticosus*, *Rosa* sp. div. etc. The community is ecologically similar to the community *Quercus-Ulmetum* Oberdorfer 1953 that is found in Central Europe (Rauš & Vukelić 1998).

The association is classified into the alliance *Alno-Quercion roboris* Horvat 1950 (Vukelić & Rauš 1998). The name of the alliance is first mentioned by Horvat (1937), who believes that such forests are preserved by periodic floods. In 1938, he classified the association *Genista elatae-Quercetum roboris* into the alliance *Alnion incanae* Pawł. 1928 (Horvat 1938). After that, Horvat described the alliance *Alno-Quercion roboris* in 1950 (Horvat 1950). This is accepted also in the contemporary literature (Rodwell & al. 2002).

As to the syntaxonomic classification of individual species, the classification proposed by Brullo and Stampinato (1999) was taken into consideration. They also establish that hardwood deciduous trees like *Quercus* and *Fraxinus* dominate in these stands and that they differ essentially from the forests of softwood deciduous trees where the species from the genus *Salix* and *Populus* are dominant. Since the alliance shows certain similarities with the class *Alnetea glutinosae*, from which it differs ecologically and floristically, the alliance has to be classified into a specific order of the *Populetalia albae* (Brullo & Stampinato 1999).

3. METHODS

The research was carried out using the standard central European method (Braun-Blanquet 1964). Numerical analysis of the influence of ecological factors on the vegetation was made by programme package CANOCO 4.02, applying the Canonical correspondence analysis (ter Braak & Šmilauer 1989). The ecological factors were estimated using Ellenberg values (Ellenberg 1979). The coverage values were transformed into the ordinal scale as

proposed by van der Maarel (1979). The nomenclature of plant species is according to Ehrendorfer (1973), except *Fraxinus pensilvanica* Kremer.

4. SYNTAXONOMIC SCHEME

Quercus-Fagetum Br.-Bl. et Vlieger ex Vlieger 1937
Populetalia albae Br.-Bl. ex Tschou 1948
Alno-Quercion roboris Horvat 1950
Euphorbio palustris-Crataegetum nigrae
 Čarni, Franjić et Škvorc 2004

5. COMMUNITY DESCRIPTION

The community appears as an edge community of oak and poplar forests along the Danube River branches. (Fig. 5) The species *Crataegus nigra* appears sporadically also in closed forest stands although there it does not prosper well. It can be concluded that the ecological optimum of the species is on forest edges where it builds closed narrow forest edges preventing the effects of non-forest areas deeper in forests.



Figure 5: *Euphorbio palustris-Crataegetum nigrae* on forest edge.

Slika 5: *Euphorbio palustris-Crataegetum nigrae* na gozdnem robu.

Crataegus nigra (Fig. 6) is a shrub or low tree up to 7 m high. Ecologically, this hydrophilic species differs from the other species of the genus *Crataegus* in Europe. It crops up in flooded alluvial sites along large streams, in sites of poplar forests and ash-oak forests. At times, it forms small stands in the form of secondary hydrophilic shrub commu-

nities. The species is classified into the Pannonic and Balkan element and can be found in Hungary, Croatia, Serbia and Romania. It is frequently planted as a decorative species (Jovanović 1972).



Figure 6: Dominant species *Crataegus nigra*.
Slika 6: Dominantna vrsta *Crataegus nigra*.

The stands were sampled in flooded areas, however in those areas, already distant from the river main streams, where no intensive sweeping away and depositing take place.

Similar conclusions were also drawn by Antić & al. (1969), who established that there are interesting and frequent stands of species *Crataegus nigra* in the Danube section. Generally, they build mantle shrub communities on the edge of »relict oak« forests. A provisional name of *Crataegetum nigrae* was proposed.

Jovanović & al. (1985) described the association *Crataego nigrae-Salicetum albae* within the area of Ada Huja. The stands are flooded 2 to 4 months. Parabučki (1972) described the community *Crataego nigrae-Populetum albae* Parabučki 1972 in the area of Koviljski rit. It can be ascertained that the community *Euphorbio-Crataegetum* crops up in sites flooded for a shorter time than the above stated communities.

In this community, the dominant characteristic species build dense interweaving where other species can only seldom be found. Additionally, there are also species which are considerably well represented and are classified into the alliance *Alno-Quercion roboris* and *Populetaalia albae* like *Rubus caesius*, *Fraxinus pensilvanica*, *Rumex sanguineus*, *Leucosium aestivum*, *Galium elongatum*, to enumerate only the most frequent ones.

Besides, there are other species of the class *Quercio-Fagetea*, like *Symphytum officinale*, *Stachys palus-*

tris and *Cornus sanguinea*. Among the species of high stalk and ruderal communities there are *Urtica dioica*, *Solidago serotina*, *Calystegia sepium* and *Eriogon annuus*, etc. Within the community, there are also *Euphorbia palustris* and *Lysimachia vulgaris* that are characteristic species of the alliance of forest edges in humid sites *Filipendulion*.

With regard to the floristic composition, the community was classified into the alliance *Alno-Quercion roboris*, where also contact forests are classified.

The nomenclature type of the community *Euphorbio palustris-Crataegetum nigrae* is the relevé number 7 in Table 1 (*Holotypus hoc loco*: Tab. 1/7).

6. LOWER SYNTAXA

According to the floristic composition and numerical analysis (Fig. 7) the association can be divided into three subassociations. The subassociation *phalaridetosum arundinaceae* subass. nova (Tab. 1/1–2, *holotypus hoc loco*: Tab. 1/1) can be found on the sunny, open sites. It is characterised by *Phalaris arundinacea*. The subassociation *leucojetosum aestivi* (Tab. 1/3–6, *holotypus hoc loco*: Tab. 1/3) is found in the most humid and nutrient rich sites. It is characterised by the presence of *Leucosium aestivum* and *Galium elongatum*. The third subassociation *querceto-*

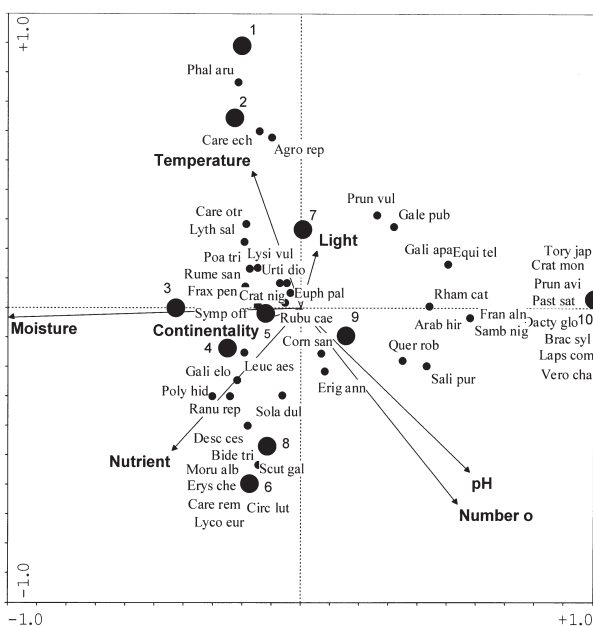


Figure 7: Results of the Canonical Correspondence Analysis. The species with minimum fit 30 are shown in the diagram.

Slika 7: Rezultati kanonične skladnostne analize. V diagramu so prikazane vrste, ki ustrezajo najmanjši prilagoditvi 30.

sum roboris (Tab. 1/7–10, *holotypus hoc loco*: Tab. 1/9) is characterised by the presence of many woody species, indicating the development of the further succession stages of the association towards the forest. It is characterised by *Quercus robur*, *Populus alba*, *Sambucus nigra* and *Frangula alnus*.

7. CONCLUSIONS

A new mantle community that builds a mantle of oak forests in the flooded area along the Danube River was described. Moreover, its optimal natural site as a mantle of flooded forests of hardwood deciduous trees was defined. The definition of its natural sites is also important, since it appears very often as a decorative species.

8. ACKNOWLEDGEMENT

For the help offered in the elaboration of this article we would like to thank Barbara Šuštar who kindly prepared the table and drew up other graphical enclosures. We also thank to employees of Forest office Batina – Hrvatske šume d. o. o. for their help and support during the field researches. The research was financed within the framework of the international project entitled "Vegetation of forest edges and its significance for the forest biodiversity", co-financed by the Ministry of Education, Science and Sport of the Republic of Slovenia and the Ministry of Science and Technology of the Republic of Croatia.

9. LOCALITIES

Croatia, Baranja, Monjoroš, branches of the river Danube: 1. lat. 45°46,516', long. 18°51,096'; 2. 45°46,637', 18°52,657'; 3. 45°46,246', 18°51,143'; 4. 45°45,892', 18°51,427'; 5. 45°46,069', 18°51,376'; 6. 45°46,634', 18°52,294'; 7. 45°46,076', 18°51,415'; 8. 45°46,729', 18°52,282'; 9. 45°46,255', 18°50,857'; 10. 45°46,269', 18°50,831'.

10. POVZETEK

Združba vrste *Crataegus nigra* Waldst. et Kit. v poplavnem območju Donave na Hrvaškem

Območje leži v vzhodnem delu Hrvaške ob reki Donavi na meji s Srbijo in Črno goro (slika 2). V

tem delu je klima najbolj kontinentalna v celotni Hrvaški (Ilijanić 1963). V Vinkovcih (slika 3) je povprečna letna temperatura 10 °C, najtoplejši mesec je julij s srednjo temperaturo 21,4 °C in najhladnejši januar, ko je povprečna mesečna temperatura –2,1 °C. Absolutni maksimum je bil 39,0 °C, absolutni minimum pa –30,5 °C. Povprečna količina padavin je 660 mm, z maksimumoma v maju in decembru (Rauš 1976).

Poplavni gozdovi so na območju, kjer reka redno in periodično poplavlja. Zato se tla intenzivno razvijajo in so odvisna od dolžine in višine poplav. To so paraklimaksne združbe. Njihov floristični inventar je odvisen od dolžine in višine poplav (slika 1, 4)

Gozdno vegetacijo na rečnih bregovih lahko razdelimo v dve skupini združb: v gozdove mehkih listavcev, ki se pojavljajo na bolj poplavljenih rastiščih, in gozdove trdih listavcev, ki uspevajo na krajši čas poplavljenih rastiščih.

V prvo skupino uvrščamo združbe *Salicetum triandrae*, *Salicetum albae* in *Salici-Populetum*. Poleg dominantnih vrst se v drevesni plasti pojavljajo *Acer negundo*, *Fraxinus pensilvanica* in *Morus alba*, v zeliščni pa *Galium palustre* agg., *Rubus caesius*, *Carex elata*, *Poa trivialis*, *Solanum dulcamara* in druge.

V višjih predelih, kjer je vodostaj najnižji, navadno uspevajo topoli z majhno primesjo vrb, ker topoli rastejo hitreje od vrb in jih zadušijo. Na nižjih rastiščih, kjer je vodostaj višji, se topoli, ki ne prenesejo poplav, posušijo in ostanejo samo vrbe.

Glede sintaksonomske uvrstitve sestojev mehkih listavcev so različni pogledi in bi bilo potrebno izdelati obsežno sintetsko delo, v katerem bi ugotovili tudi pripadnost višjim sintaksonom. Avtorji uvrščajo vse sestoje mehkih listavcev večinoma v zvezo *Salicion albae* (razred *Salicetea purpureae*) (Vukelić & Rauš 1998, Jovanović & al. 1985).

Nekakšen vmesni položaj med prvo in drugo skupino ima združba *Populetum nigro-albae*, ki jo uvrščamo ali v zvezo *Salicion albae* (Rauš & Vukelić 1998) ali v zvezo *Alno-Quercion roboris* (*Populetalia albae*) (Parabučki & al. 1986); mogoča pa je tudi uvrstitev v zvezo *Populion albae* Br.-Bl. 1931 (*Populetalia albae*) (Jovanović & al. 1986).

V drugo skupino uvrščamo gozdove trdih listavcev, združbo *Fraxino-Ulmetum* Slav. 1952 in predvsem združbo *Geniste elatae-Quercetum roboris* Ht 1938. V to združbo uvrščamo znane slavonske hrastove gozdove, ki grade velike strnjene komplekse. Rastišča te združbe so nekaj metrov nad normalnim vodostajem in so periodično poplavljeni, toda poplave trajajo le krajši čas ali pa so rastišča zunaj dosega poplav, vendar so kljub vsemu sveža. V dreves-

ni plasti prevladuje *Quercus robur*, poleg njega pa se pojavljajo *Fraxinus angustifolia*, *Ulmus laevis*, *Populus nigra* in *P. alba* itd. V grmovnem sloju pa se pojavljajo *Genista elata*, *Crataegus monogyna*, *Prunus spinosa*, *Viburnum opulus*, *Frangula alnus*, *Rubus caesius*, *R. fruticosus*, *Rosa* sp. div. itd. Združba je ekološko podobna združbi *Quercus-Ulmetum* Oberdorfer 1953 v srednji Evropi (Rauš & Vukelić 1998).

Asociacijo *Genista elatae-Quercetum roboris* uvrščamo v zvezo *Alno-Quercion* Horvat 1950 (Vukelić & Rauš 1998). Ime zveze najprej omenja Horvat (1937), ki meni, da takšne gozdove ohranjajo periodične poplave. Leta 1938 uvršča asociacijo *Genista elatae-Quercetum roboris* v zvezo *Alnion incanae* Pawl. 1928 (Horvat 1938). Horvat je zvezo veljavno opisal leta 1950, kar priznava tudi sodobna literatura (Rodwell & al. 2002).

Pri sintaksonomski uvrstitvi posameznih vrst smo upoštevali razdelitev, ki jo predlagata Brullo & Stampinato (1999). Tudi onadva ugotavljata, da v teh sestojih prevladujejo trdi listavci, kot so *Quercus* in *Fraxinus* in se bistveno razlikujejo od gozdov mehkih listavcev, kjer prevladujejo vrste iz rodov *Salix* in *Populus*. Glede na to, da zveza nakazuje nekatere podobnosti z razredom *Alnetea glutinosae*, od katere se hkrati jasno ekološko in floristično razlikuje, jo moramo uvrstiti v poseben red *Populetales albae* (Brullo & Stampinato 1999).

Sintaksonomska uvrstitve

Quercus-Fagetea Br.-Bl. et Vlieger ex Vlieger 1937

Populetales albae Br.-Bl. ex Tschou 1948

Alno-Quercion roboris Horvat 1950

Euphorbia palustris-Crataegum nigrae

Čarni, Franjić et Škvorc 2004

Opis združbe

Združba se pojavlja kot robna združba hrastovih in topolovih gozdov ob rokavih Donave (slika 5). *Crataegus nigra* se sporadično pojavlja tudi v sklenjenih gozdnih sestojih, čeprav tam ne uspeva optimalno. Tako lahko sklepamo, da je ekološki optimum vrste na gozdnih robovih, kjer gradi sklenjene ozke gozdne robove, ki preprečujejo širjenje vplivov iz negozdnih površin globlje v gozd.

Crataegus nigra (slika 6) je grm oz. nizko drevo do višine 7 m. Ekološko se ta hidrofilna vrsta razlikuje od ostalih vrst rodu *Crataegus* pri nas. Pojavlja se na naplavljenih aluvijalnih rastiščih ob velikih rekah, na rastiščih topolovih in jesenovo-dobovih gozdov. Občasno formira majhne sestoje v obliki

sekundarnih hidrofilnih šibjakov. Vrsto uvrščamo med panonsko-balkanski florni element in jo najdemo na Madžarskem, Hrvaškem, v Srbiji in Romuniji. Pogosto jo sadijo kot dekorativno vrsto (Jovanović 1972).

Sestoje smo popisovali v poplavnem območju, ki pa je že nekoliko oddaljeno od glavnega toka reke, kjer ni več tako intenzivnega odnašanja in odlaganja.

Do podobnih zaključkov so prišli Antić in sodelavci (1969), ki so ugotovili, da se na donavskem sektorju pojavljajo zanimivi in pogosti sestoji vrste *Crataegus nigra*. Običajno grade zastorne grmiščne združbe na robu »reliktnih dobovih« gozdov. Predlagali so tudi provizorično ime *Crataegum nigrae*.

V tej združbi gradi dominantna značilna vrsta goste preplete, tako da v sestojih uspevajo le redke druge vrste, ki jih uvrščamo predvsem v zvezo *Alno-Quercion* in red *Populetales albae*, kot so *Rubus caesius*, *Fraxinus pensilvanica*, *Rumex sanguineus*, *Leucosium aestivum*, *Galium elongatum*, če naštejemo le najpogostejše.

Poleg njih so zastopane še vrste razreda *Quercus-Fagetea*, kot so *Symphytum officinale*, *Stachys palustris* in *Cornus sanguinea*. Med vrstami visokih steblik in večletnih ruderalnih združb so *Urtica dioica*, *Solidago setorina*, *Calystegia sepium* in *Erigeron annuus* itd. V združbi sta tudi vrsti *Euphorbia palustris* in *Lysimachia vulgaris*, ki sta značilnici zveze gozdnih robov na vlažnih rastiščih.

Združbo smo glede na floristično sestavo uvrstili v zvezo *Alno-Quercion*, kamor uvrščamo tudi kontaktne gozdove.

Nižji sinaksoni

Povezavo med popisi, vrstami in ekološkimi dejavniki prikazuje slika 7. Ločili smo subasociacijo *phalaridetosum arundinaceae* na osončenih rastiščih, subasociacijo *leucojetosum aestivi* na vlažnih in s hranili bogatih rastiščih ter subasociacijo *quercetosum roboris*, ki pa že predstavlja razvoj asociacije k višjemu sukcesijskemu stadiju.

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Received 7. 11. 2003

Revision received 2. 2. 2004

Accepted 3. 3. 2004

Table 1 (Tabela 1): Ass. *Euphorbio palustris-Crataegetum nigrae* Čarni, Franjić et Škvrč 2004

Relevé number		1	2	3	4	5	6	7	8	9	10	Presence	Const. class
Altitude (m)		80	73	100	100	100	70	100	80	100	100		
Surface (m ²)		100	80	100	50	50	80	50	100	100	50		
Coverage of layers	B	100	100	100	100	100	100	100	100	100	100		
	C	30	20	20	30	30	20	30	20	20	20		
Inclination		0	0	0	0	0	0	0	0	0	0		
Number of species	layer	17	17	23	23	22	29	24	24	31	29		
Ass. char. species													
<i>Crataegus nigra</i>	B	5	5	4	3	4	3	3	3	4	3	10	V
<i>Crataegus nigra</i>	C	.	+	+	+	+	+	+	.	+	.	7	IV
AQ ALNO-QUERCION ROBORIS, POPULETALIA ALBAE													
<i>Rubus caesius</i>	C	+	+	1	1	+	1	2	1	1	+	10	V
<i>Rubus caesius</i>	B	.	+	+	+	+	+	1	+	+	1	9	V
<i>Fraxinus pensilvanica</i>		+	+	+	+	+	+	+	+	.	.	8	IV
<i>Rumex sanguineus</i>	C	+	+	+	+	+	+	+	+	.	.	8	IV
d2 <i>Leucojum aestivum</i>		.	.	1	1	+	+	.	.	+	.	5	III
d2 <i>Galium elongatum</i>		.	.	+	+	+	+	.	+	.	.	5	III
<i>Carex otrubae</i>		+	.	+	.	+	.	+	.	.	.	4	II
<i>Ulmus laevis</i>	B	.	+	+	.	.	+	+	.	.	.	4	II
<i>Solanum dulcamara</i>	C	.	.	.	.	+	+	.	+	+	.	4	II
<i>Salix purpurea</i>	B	.	.	.	.	.	+	.	+	+	2	4	II
d3 <i>Populus alba</i>		.	.	.	.	.	.	1	+	+	+	4	II
<i>Viburnum opulus</i>		.	.	.	2	.	.	1	+	.	.	3	II
d3 <i>Quercus robur</i>		.	.	.	.	.	.	.	+	+	+	3	II
d3 <i>Sambucus nigra</i>		.	.	.	.	.	.	.	.	+	+	2	I
d3 <i>Frangula alnus</i>		.	.	.	.	.	.	.	.	+	+	2	I
<i>Acer negundo</i>		.	+	.	.	.	.	.	.	.	.	1	I
<i>Carex remota</i>	C	.	.	.	.	.	+	.	.	.	.	1	I
<i>Amorpha fruticosa</i>		.	.	.	.	.	.	+	.	.	.	1	I
<i>Salix cinerea</i>	B	.	.	.	.	.	.	.	.	+	.	1	I
QF QUERCO-FAGETEA & RHAMNO-PRUNETEA													
<i>Symphytum officinale</i>	C	.	+	+	+	+	+	+	.	+	.	7	IV
<i>Stachys palustris</i>		.	+	+	+	+	+	.	.	+	+	7	IV
<i>Cornus sanguinea</i>	B	.	.	.	+	2	3	4	3	2	2	7	IV
<i>Rhamnus catharticus</i>	C	.	.	.	.	+	.	.	.	.	+	2	I
<i>Equisetum telmateia</i>		.	.	.	.	.	.	+	.	.	+	2	I
<i>Circaea lutetiana</i>		.	.	.	.	.	+	.	.	.	.	1	I
<i>Crataegus monogyna</i>	B	.	.	.	.	.	.	.	.	.	1	1	I
<i>Crataegus monogyna</i>	C	.	.	.	.	.	.	.	.	.	+	1	I
<i>Prunus avium</i>	B	.	.	.	.	.	.	.	.	.	+	1	I
<i>Brachypodium sylvaticum</i>	C	.	.	.	.	.	.	.	.	.	+	1	I
A ARTEMISIETEA & GALIO-URTICETEA													
<i>Urtica dioica</i>	C	1	1	1	+	1	1	1	+	+	+	10	V
<i>Solidago serotina</i>		+	1	.	+	+	+	+	+	+	+	9	V

Relevé number		1	2	3	4	5	6	7	8	9	10	
Calystegia sepium		+	.	+	+	+	+	+	.	+	+	8 IV
Erigeron annuus		.	.	.	+	+	+	.	+	+	+	6 III
Galeopsis pubescens		+	.	.	.	.	.	.	.	+	+	3 II
Glechoma hederacea		.	.	.	+	.	.	.	.	+	+	3 II
Agropyron repens		+	.	.	.	.	.	+	.	.	.	2 I
Galium aparine		.	.	.	.	.	.	+	.	.	+	2 I
Torylis japonica		.	.	.	.	.	.	.	.	.	+	1 I
Lapsana communis		.	.	.	.	.	.	.	.	.	+	1 I
Silene alba		.	.	.	.	.	.	.	.	+	.	1 I
PH PHRAGMITETEA												
Iris pseudacorus	C	+	.	+	+	+	.	.	.	+	.	5 III
Carex elata		.	.	+	+	+	.	.	.	+	.	4 II
d1 Phalaris arundinacea		+	+	.	.	.	.	.	.	.	.	2 I
Poa palustris		.	.	+	+	.	.	.	.	.	.	2 I
Scutellaria galericulata		.	.	.	.	.	+	.	+	.	.	2 I
Lycopus europaeus		.	.	.	.	.	+	.	.	.	.	1 I
F FILIPENDULION												
Euphorbia palustris	C	+	+	+	+	+	+	+	+	+	+	10 V
Lysimachia vulgaris		+	+	+	+	+	.	+	+	+	.	8 IV
Lythrum salicaria		.	+	+	.	+	.	+	.	.	.	4 II
Myosotis scorpiodes		.	.	+	.	.	.	.	.	.	.	1 I
Cirsium oleraceum		.	.	.	.	+	.	.	.	.	.	1 I
MA MOLINIO-ARRTHENATHERETEA												
Poa trivialis	C	+	+	+	.	.	+	1	+	.	.	6 III
Ranunculus repens		.	.	+	+	.	+	.	+	.	.	5 III
Lysimachia nummularia		.	.	+	+	.	.	.	+	+	.	4 II
Prunella vulgaris		.	+	.	.	.	.	+	.	.	+	3 II
Deschampsia cespitosa		.	.	.	+	.	+	.	+	.	.	3 II
Carex hirta		+	.	.	.	.	.	.	.	+	.	2 I
Dactylis glomerata		.	.	.	.	.	.	.	.	.	+	1 I
Pastinaca sativa		.	.	.	.	.	.	.	.	.	+	1 I
Other species												
Oxalis fontana		.	.	.	.	.	+	+	+	+	.	4 II
Carex echinata		+	+	.	.	.	.	+	.	.	.	3 II
Polygonum hidropiper		.	.	+	.	.	+	.	.	.	.	3 II
Morus alba	B	.	.	.	.	.	+	.	+	.	.	2 I
Bidens tripartita	C	.	.	.	.	.	+	.	+	.	.	2 I
Arabis hirsuta		.	.	.	.	.	.	.	.	+	+	2 I
Erysimum cheiranthoides		.	.	.	.	.	+	.	.	.	.	1 I
Viola hirta		.	.	.	.	.	.	.	.	+	.	1 I
Veronica chamaedrys		.	.	.	.	.	.	.	.	.	+	1 I

d1, d2,d3 - differential species of the subassociations/ razlikovalnice subasociacij