# STRUCTURE, ECOLOGY AND PHYTHOGEOGRAPHICAL CHARACTERISTICS OF RIPARIAN VEGETATION ALONG THE BÂRZAVA AND CARAȘ RIVERS (BANAT, ROMANIA)

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**KEYWORDS**: environment quality indicator, thermophile riparian species, calcareous rocky thermophile species.

**ABSTRACT**

The riparian vegetation in the studied area have its particularties, due to the geographic position in the South-Western part of Romania with mountains and plains. These come together to give a most interesting and unique mosaic of habitats of riparian vegetation with a remarkable biodiversity. The climatic conditions and the relief with plains and mountains elements give the specific character to the studied riparian vegetation.

**ZUSAMMENFASSUNG**: Struktur, Ökologie und pflanzengeographische Kennzeichen der Ufervegetation entlang der Flüsse Bârzava und Caraș. (Banat, Rumänien).

Die untersuchte Auenvegetation der genannten Flüsse hat ihre Besonderheiten, die bedingt sind durch die geographische Lage im Südwesten Rumäniens, wobei das Klima, aber auch das Relief mit Bergen und Ebenen eine große Rolle spielt. Diese Elemente ergeben zusammen ein besonderes Mosaik an Auenhabitaten mit einer beachtlichen Biodiversität der Bergregion und der Ebene.

**REZUMAT**: Structura, ecologia și caracteristicile fitogeografice ale vegetației ripariene dea lungul râurilor Bârzava și Caraș (Banat, România).

Vegetația ripariană studiată are un caracter deosebit datorită poziției geografice în sud/ vestul României, unde atât climatul, dar și poziția geografică cu segmente muntoase și de câmpie prin care trec râurile joacă un rol deosebit fiind și baza pentru o biodiversitate remarcabilă.

## INTRODUCTION

The Bârzava River has its source in the Cracul Lung hills, the western side of Semenic Mountains at an altitude of 1,023 m above sea level. Breaking through the Dognecea Mountains, the river crosses the towns of Reșița and Bocșa and than turns in a north-western direction through the large Bârzava Plain near to the localities of Gătaia and Deta. South of the town of Deta the Bârzava River is canalized on a long stretch, flowing in an Eastern direction to the canal system of Timiș (Danube Basin). The Bârzava has on its course three storage lakes, in north-eastern direction the Văliug Lake, followed by the smaller Breazova and after the turn of the river to a westerly direction – to the town of Reșița – the Secu Lake. North-east from Reșița the stream of Bîrzavița flows into the main river (Fig. 1). (Dragomir et al., 1981)

The Caraș River has its source on the eastern side of the Anina Mountains near to the watershed of the Nera River. Crossing the calcareous mountain chain, the river turns in a south-western direction, flowing as a meandering river in the plain of Caraș (Caraș Depresion) and then further in the direction of the Danube River, having the mouth at Banatska Palanka (Serbia), not far off the mouth of Nera River. Due to the varied rocky relief in the upper part and a harsh climate, followed in the plain by warmer temperatures and with mild climatic conditions, numerous thermophile species occur in the area. The Caraș has eroded out on its course in a northern direction the deep gorge of Caraș (Cheile Carașului), which ends in a semicircle bed near the locality of Carașova (Fig. 1). (Dragomir et al., 1981)

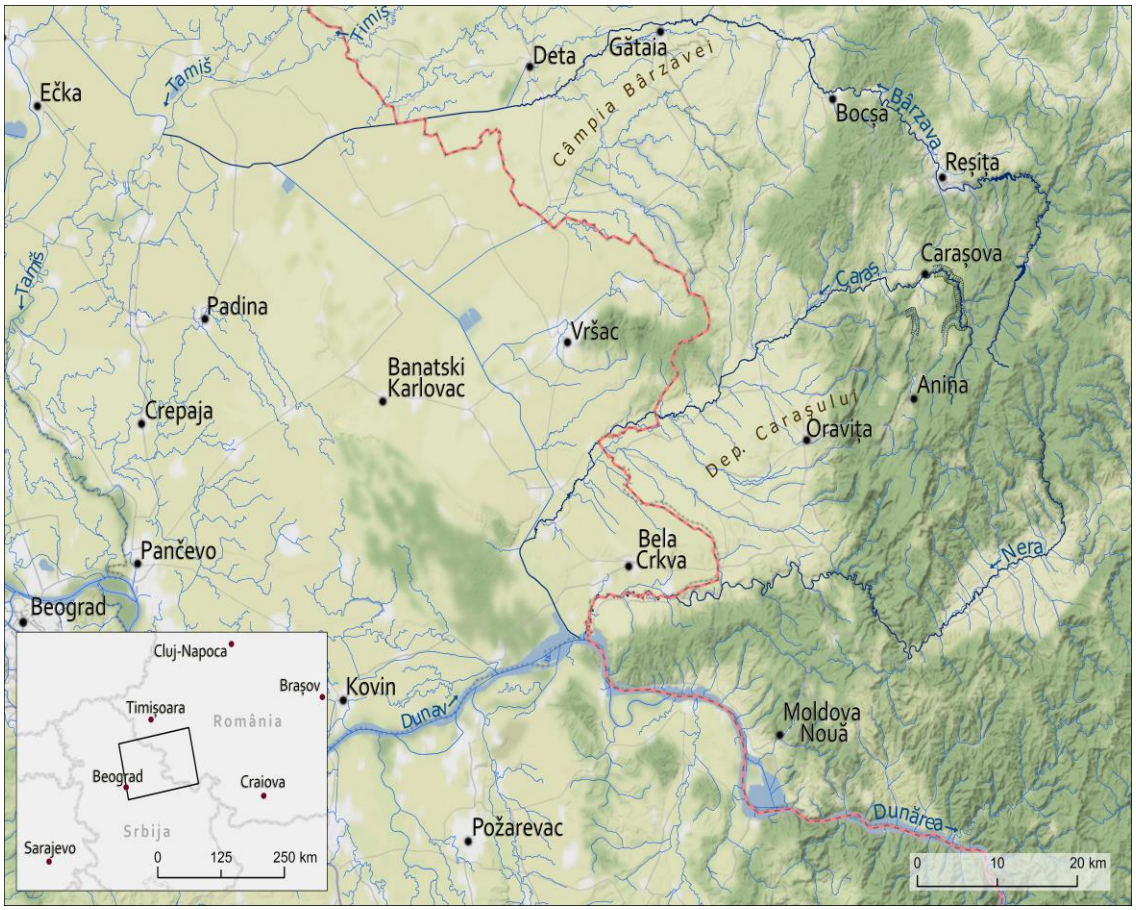


Figure 1: Map of the study area realized on the base of maps of the area by Lars Gerstner KIT Institute for Geography and Geoecology, Department for Wetlands Ecology – Aueninstitut.

The Nera River collects its waters from a seeping water slope with the sources streams Coșava, Nergănița, and Nergana (Schneider-Binder 2017). Parallel to the Caraș River in a western direction flows in the Buhui Stream, near to the northern opening of the gorge. The river embrace in its northern gorge stretch the mountain of Socolova (783 m altitude). Turning in western and south-western directions, the meandering river crosses the large plain of Caraș (Caraș Gorge) and flows into the Danube River at Banatska Palanka (Serbia), not far of the mouth of Caraș River. (Dragomir et al., 1981)

The cliffy area of upper Bârzava and Caraș rivers shelter a mosaic of interlocking riparian phytocoenoses of different plant communities, identified by species of diverse phyto-geographical regions such are those of the daco-illyrian province (Borza and Boșcaiu, 1965) in the south/western part of Romania with numerous thermophile species, giving this riparian zone a particular aspect.

In general view the riparian vegetation is mostly reduced to small strips along the water course, the dominant, edifying species of the riparian forest being mostly the Common Ash (*Fraxinus excelsior*) and Black Alder (*Alnus glutinosa*) (Tab. 1).

## MATERIAL AND METHODS

During the growing season of the years 2015 and 2016 in the frame of Natura 2000 sites inventory and their importance for biodiversity, field researches concerning the riparian habitats were realized on the rivers Bârzava, Caraș, and Nera, and for completion information was collected concerning the transboundary Danubian tributaries in the Banat area.

Samples were taken according to the method of Braun-Blanquet with the seven degree abundance-dominance scale (Braun-Blanquet, 1964; Borza and Boşcaiu 1965). Considered were as well aspects concerning the structure of the habitats in strong relation to the water dynamics of the tributaries, the grain size of sediments and the succession of the vegetation along ecological gradients from the river banks to the higher elevations of the river valleys. From upstream to downstream the following valleys have been studied: the Caraș River on the confluence with Buhui River, the area around the old terrace of the railway, the Comarnic Stream near the forestry residence, the Toplița Stream area and the Carașova area downstream the gorge of Caraș River (August 2015).

The samples taken are included in a phyto-coenological table and grouped according to characteristic species of the different phytocoenological units and to their layers, such as the tree, shrub, tall, and smaller herbaceous layers, the regeneration and lianas.

Species occurring only in one sample are mentioned at the end of the table.

The nomenclature of species is given according to Oberdorfer (2001), Ciocârlan (2009), and Sârbu et al. (2013).

The samples were used as well for detailed studies concerning the species composition and structure of the phytocoenoses and their ecological requirements (Schneider, 2003) All the phytocoenoses were considered in strong relation to the hydro-morphological dynamics, the grain size of sediments, the water quality and the succession of the vegetation along ecological gradients

## RESULTS AND DISCUSSION

The riparian vegetation is represented mostly as a small green ribbon with softwood and hardwood species, bordered frequently by tall herbaceous species characteristics for riparian area such are *Telekia speciosa* and *Petasites hybridus*. The tree layer is characterized by the dominant Common Ash (*Fraxinus excelsior*) and Black Alder (*Alnus glutinosa*). The softwood species, characteristic also for the riparian area, are represented by White Willow (*Salix alba*), Crack Willow (*Salix fragilis*) and Almond Willow (*Salix triandra*) (Tab. 1). From the near slope of the deep valley area enter also trees, not typical for riparian areas such as Beech (*Fagus sylvatica*), Sycamore (*Acer pseudoplatanus*), Field Maple (*Acer campestre*), Hornbeam (*Carpinus betulus*), and Wild Pear (*Pyrus pyraster*).

Table 1: Place of sampling: 1. Comarnic Valley; 2. Caraș River downstream of the confluence with Buhui Stream; 3. confluence of Buhui Stream with Caraș River; 4. valley on the terrace of the former forest train; 5. old terrace of the forestry railway; 6. forester house on the Comarnic Stream; 7. on the Toplița Stream; 8. Toplița Stream; 9. Carașova, downstream of the Caraș Gorge; Carașova, 10-11 Carașova Gorge downstream part; (August 2015).

| Layers | Number of sample<br>Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trees | *Fraxinus excelsior* | 1 | 3 | 2 | 1 | . | 1 | 1 | , | + | 1 | . |
| Trees | *Alnus glutinosa* | 1 | 1 | . | . | . | 3 | . | 3 | 4 | 3 | 3 |
| Trees | *Ulmus procera* | + | . | . | . | . | . | . | . | . | . | 1 |
| Trees | *Fagus sylvatica* | 4 | 2 | . | + | . | 2 | 1 | 4 | . | . | . |
| Trees | *Acer pseudoplatanus* | 1 | . | . | 1 | 1 | + | 1 | 1 | . | . | . |
| Trees | *Tilia platyphyllos* | 1 | . | . | . | . | . | . | . | . | . | . |
| Trees | *Acer campestre* | + | . | . | . | + | 1 | . | 1 | . | . | . |
| Trees | *Abies alba* | . | . | . | 1 | . | . | . | . | . | . | . |
| Trees | *Sorbus torminalis* | . | . | . | . | 2 | . | . | . | . | . | . |
| Trees | *Fraxinus ornus* | . | . | . | . | 3 | . | . | . | . | 3 | + |
| Trees | *Populus tremula* | . | . | . | . | . | + | . | . | . | + | . |
| Trees | *Acer campestre* | . | . | . | . | . | . | . | . | . | 1 | . |
| Trees | *Aesculus hippocastanum* | . | . | . | . | . | . | 1 | 1 | . | . | . |
| Trees | *Carpinus betulus* | . | . | . | . | . | . | 1 | 1 | . | . | . |
| Trees | *Pyrus pyraster* | . | . | . | . | . | . | . | . | . | 1 | 1 |

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shrubs | *Salix fragilis* | . | . | . | . | . | . | . | 2 | 2 | . | + |
| Shrubs | *Salix alba* | . | . | . | . | . | . | . | 1 | 2 | . | 3 |
| Shrubs | *Staphylea pinnata* | + | . | . | 2 | . | . | . | . | . | . | . |
| Shrubs | *Corylus avellana* | + | 1 | . | . | . | . | . | . | . | . | . |
| Shrubs | *Rubus caesius* | 1 | . | . | . | . | . | 3 | 4 | . | 2 | + |
| Shrubs | *Cornus mas* | . | 1 | . | . | + | . | . | . | . | . | . |
| Shrubs | *Sambucus racemosa* | . | . | + | . | . | . | . | . | . | . | . |
| Shrubs | *Cotinus coggygria* | . | . | . | . | 2 | . | . | . | . | . | . |
| Shrubs | *Syringa vulgaris* | . | . | . | . | + | . | . | . | . | . | . |
| Shrubs | *Rosa pimpinellifolia* | . | . | . | . | + | . | . | . | . | . | . |
| Shrubs | *Rosa canina* | . | . | . | . | . | . | . | . | . | + | . |
| Shrubs | *Sambucus nigra* | . | . | . | . | + | . | + | . | . | . | . |
| Shrubs | *Cornus sanguinea* | . | . | . | . | . | . | . | . | 1 | 1 | . |
| Shrubs | *Ligustrum vulgare* | . | . | . | . | . | . | . | . | . | + | 2 |
| Lianas | *Hedera helix* | 3 | + | . | 2 | . | 2 | . | + | . | 2 | 2 |
| Lianas | *Clematis vitalba* | . | . | . | . | . | . | . | + | . | . | + |
| Lianas | *Parthenocyssus quinquefolia* | . | . | . | . | . | . | . | . | . | 2 | . |
| Lianas | *Solanum dulcamara* | . | . | . | . | . | . | . | . | . | + | + |
| Lianas | *Humulus lupulus* | . | . | . | . | . | . | . | . | . | 1 | . |

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| reg. forest | *Ulmus procera* | + | . | . | . | . | . | . | + | . | . | + |
| reg. forest | *Acer campestre* | + | . | . | . | + | + | . | + | . | . | . |
| tall herb. | *Petasites hybridus* | 4 | . | 5 | . | . | 4 | . | . | . | . | . |
| tall herb. | *Telekia speciosa* | . | . | 1 | . | . | 3 | 2 | + | . | . | . |
| tall herb. | *Cirsium oleraceum* | + | . | + | . | . | . | . | . | . | . | . |
| tall herb. | *Cirsium waldsteinii* | + | + | . | . | . | + | . | . | . | . | . |
| tall herb. | *Eupatorium cannabinum* | . | . | . | . | . | . | . | + | . | + | . |
| tall herb. | *Salvia glutinosa* | + | + | . | + | . | . | . | . | . | . | . |
| herb. | *Phyllitis scolopendrium* | 2 | + | . | + | . | + | . | . | . | . | . |
| herb. | *Athyrium filix-femina* | + | + | . | . | . | + | . | + | . | . | . |
| herb. | *Aegopodium podagraria* | . | + | + | . | . | . | . | . | . | . | . |
| herb. | *Urtica dioica* | . | + | . | . | . | 2 | + | 3 | . | . | . |
| herb. | *Lotus corniculatus* | + | . | . | . | 3 | . | . | . | . | . | . |
| herb. | *Mercurialis perennis* | + | . | . | 2 | . | + | . | . | . | . | . |
| herb. | *Knautia sylvatica* | + | 2 | + | . | . | . | . | . | . | . | . |
| herb. | *Brachypodium sylvaticum* | + | + | . | . | . | . | . | . | + | + | . |
| herb. | *Asarum europaeum* | + | + | . | + | + | . | . | . | . | . | . |
| herb. | *Lathyrus sylvestris* | + | . | . | + | . | . | . | . | . | . | . |
| herb. | *Lunaria rediviva* | . | 3 | . | 3 | . | 3 | . | . | . | . | . |
| herb. | *Stellaria holostea* | . | + | + | . | . | . | . | . | . | . | . |
| herb. | *Pulmonaria maculata* | . | + | . | + | . | + | . | . | . | . | . |

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| herb. | *Galium sylvaticum* | . | . | + | + | . | . | . | . | . | . | . |
| herb. | *Arum maculatum* | . | . | + | + | . | + | . | . | . | . | . |
| herb. | *Parietaria officinalis* | . | . | . | . | 2 | + | . | . | . | . | . |
| herb. | *Angelica sylvestris* | . | . | . | . | . | + | . | + | . | . | . |
| herb. | *Lycopus europaeus* | . | . | . | . | . | + | . | . | . | + | + |
| herb. | *Ranunculus repens* | . | . | . | . | . | + | . | + | . | + | . |
| herb. | *Impatiens parviflora* | . | . | . | . | . | . | . | + | . | + | . |
| herb. | *Rumex obtusifolius* | . | . | . | . | . | . | . | + | . | + | . |

Species occurring only in one sampling place. rel 1: *Athyrium filix femina, Polypodium vulgare, Festuca sylvatica, Lotus corniculatus, Mercurialis perennis, Sanicula europaea, Melica nutans, Sambucus ebulus,* and *Equisetum maximum*; rel. 2: *Cornus mas, Oxalis acetosella* and *Polygonatum multiflorum*; rel. 3: *Galium sylvaticum, Euphorbia amygdaloides, Geranium phaeum,* and *Sambucus racemosa*; rel. 4: *Galium schultesii, Lilium martagon,* and *Geranium sylvaticum*; rel. 5: *Glechoma hederacea, Daphne laureola, Rosa canina, Burnet rose (Rosa pimpinellifolia), Tussilago farfara, Syringa vulgaris,* and *Ceterach officinarum*; rel. 6: *Salix triandra, Trifolium repens, Polygonatum latifolium,* and *Anthriscus sylvestris*; rel. 7: *Aconitum vulparia; Verbena officinalis, Bromus inermis, Physocaulis nodosus, Knautia drymeia, Impatiens parviflora,* and *Ajuga reptans*; rel. 11: *Oriental hornbeam (Carpinus orientalis), Crataegus pentagyna, Lythrum salicaria, Deschampsia caespitosa,* and *Galinsoga parviflora.*

Due to the geographical position and the prevailing climate characteristics a number of thermophilous balcanic, balcano-anatolian, pontic-mediteranean, and mediteranean species are present in the area. They can be found almost all in the shrub layer. These species are: Cornelian cherry (*Cornus mas*), Mountain ash (*Sorbus torminalis*), European bladdernut (*Stapylea pinnata*), Common lilac (*Syringa vulgaris*), Smoke tree (*Cotinus coggygria*), Flowering ash (*Fraxinus ornus*). Downstream of the Carașova Gorge silver lime tree (*Tilia tomentosa*) can be observed. In the herbaceous layer near to the water occur Carpatian – Balcanic hydrophilous species, for example *Veronica bachofenii, Parietaria officinalis, Lunaria rediviva,* and *Cirsium waldsteinii*. Around the gorge of Caraova, many xero-thermophilous species occurring on the rock slope, for example *Centaurea atropurpurea*, are adjacent to the riparian species.

## CONCLUSIONS

The riparian vegetation of the Caraș and Bârzava rivers is special, due to the geographical position brought about by the climate and the typical relief of the area, with both plain and mountain conditions. Due to this situation, we can observe in the area large scale biodiversity.

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