

AN OVERVIEW OF 50 YEARS OF STUDIES ON THE WET ZONES CORMOFLORA IN THE ROMANIAN BANAT

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Abstract

The paper contains our own data and observations issued from the scientific papers, published between 1970 and 2020. Although, at a first approach, the flora of wet zones in the Romanian Banat region does not seem spectacular, our analysis shows the presence of several hundreds of species. In the past 50 years, many authors have studied these wet zones habitats bringing important contributions (floristic inventories, the study of rare or invasive species, general observations on the flora). Compared to the first part of the reference period, many species, considered common in the past, have become less frequent, some of them with uncertain spontaneous presence or extinct from the Romanian Banat: *Hippuris vulgaris*, *Ludwigia palustris*, *Stratiotes aloides*, *Hottonia palustris*, *Lysimachia punctata*, *Potamogeton lucens*, *Zannichellia palustris*, *Marsilea quadrifolia*. Significant changes are also noticed in cormoflora structure in terms of life forms and geo-elements. Reducing and degrading habitats and direct human pressures, the presence of invasive species (*Amorpha fruticosa*, *Echinocystis lobata*, *Reynoutria japonica*, *Helianthus tuberosus*, *Asclepias syriaca*, *Lindernia dubia*) are serious threats to wet zones cormoflora, including that of the protected areas.

Key words: Romanian Banat, wet zones, cormoflora, historical changes, invasive species.

INTRODUCTION

Having varied geographical conditions, the historical province of Romanian Banat (its limits presented by Gaudenyi & Milošević, 2023) harbors a relatively high plant diversity (our preliminary results show that approx. 40-45% of plant species from Romania are present in the Banat, given that the area of the Romanian Banat represents less than 1/10 of Romania's area), being studied by many botanists. Among the botanists who undertook studies and collected valuable data for the flora of this region, before 1900, we can mention (according to Coste et al., 1995): Rochel - 1823, Heuffel - 1858, Borbás - 1884. In the 20th century, Banat was the subject of numerous botanical studies which had as an object of study plants from aquatic and marshy habitats (according to Coste et al., 2002): Tôkes - 1905, ZSÁK, Z. - 1916, Buia - 1942, Boșcaiu - 1942, 1944, 1965, 1966, 1971 etc., Soran - 1954, 1956, Pop - 1956, 1962, 1968, 1977, Bujorean - 1957, Bujorean et al. - 1959, 1961,

1962 etc., Gergely - 1964, Nyarady - 1966, Turenschi - 1966, Csűrös et al. - 1968, Vicol - 1974, Grigore & Coste, 1976, Arvat - 1977, Oprea et al., 1974, Schrött & Sinitean, 1999, and many others. From these researches resulted valuable works such as doctoral theses, monographic books and scientific articles.

Even if the cormoflora of humid zones is not very rich compared to the flora of other types of habitats, it preserves important species. We only recall the research of Karácsonyi & Negrean (2010), in a humid microdepression in western Romania, where they reported a series of remarkable species such as: *Polygonum bistorta*, *Iris sibirica*, *Veratrum album*, *Crocus vernus*, *Narcissus poeticus* subsp. *radiiflorus*, *Lindernia procumbens*.

Historically, it can be noted the change of wet zones cormoflora, especially since the global extent of wetlands is estimated to have declined with 70% during the 20th century (Davidson, 2016). Species losses are also reported in the cormoflora of wetlands in our country (Neacșu, 2008). Some of the wet zones resources are

being conserved in the 20 designated Romanian Ramsar sites (<https://www.ramsar.org/wetland/romania>), two of which are partially located on the territory of the Romanian Banat, Iron Gates Natural Park and Mures Floodplain Natural Park.

Based on CLC (Corine Land Cover) data, Ianăș & Ișfănescu-Ivan (2022) shows that in the hill and plain areas of Banat, the dynamics of land use and land cover occur under drivers such as agriculture, urbanization, industrialization.

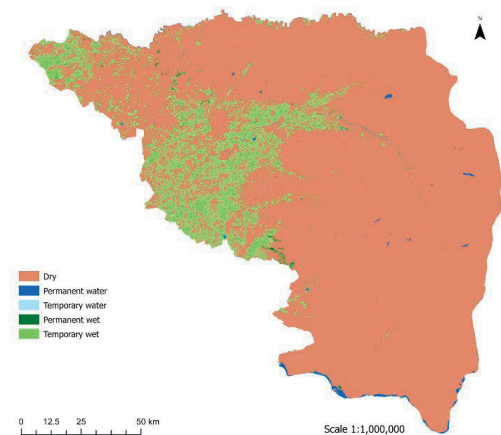


Figure 1. The wet zones distribution

The reduction of the wet zones areas in Banat (Figure 1) is expressed by the reduction of the habitats of the populations of paludicolous and aquatic species. The most recent (2022) *Romania's national communication under the United Nations Framework Convention on Climate Change* (p. 32) shows that much of the lowlands of Banat are at risk of drought. At the same time, Banat is the province where the hydro-ameliorative works (drainage) started the earliest (18th century) and continued intensively until the last years of the communist period; one of the main effects of drainages is the lowering of the underground water level in the lowland region (Nemeș & Constantinescu, 2012). The ecological effects of these works are treated among others by Buhociu (2001), Coste (2002), Coste & Oncia (2003), Coste et al. (1997), Ionescu (2001).

MATERIALS AND METHODS

In creating the general picture of the results of botanical research that had as its object the

cormophyte flora of wetlands, we brought together our own results (or the results of research projects in which we participated: Arsene et al., 2002; 2005; 2015; Biro et al., 2021; Cucu et al., 2019; Neacșu, 2008; Neacșu et al., 2008; Neacșu & Arsene, 2017a; 2017b; Neacșu et al., 2018; Turcuș & Neacșu, 2013; Otveș et al., 2014; Stănescu et al., 2005) with those contained in the main bibliographic sources. The selection of these latter bibliographic references is made giving priority to monographic research (doctoral theses, treatises, syntheses published in book form) and scientific articles. In some cases, for the same author, if he has published as articles parts of his doctoral thesis, we have chosen to cite only this.

First of all, the classic theses of flora and vegetation should be mentioned here: Arvat, 1977; Coste, 1974; Grigore, 1971; Hoborka, 1974; Lovasz, 1995; Oprea, 1976; Peia, 1978; Pop, 1977; Schrött, 1972; Vicol, 1974 etc., or the excellent syntheses published by Drăgulescu (1995, 2013). We have considered here primarily species of conservation importance, as well as invasive ones, even if not all of them are aquatic or paludicolous species, but which are found within an area considered as a whole as a wetland or (more or less) permanent humid zones.

RESULTS AND DISCUSSIONS

From our own data and from the literature consulted, we estimate that the flora of the wet zones of Banat number about 400 species, almost half of the species being aquatic and paludicolous species. Most are species characteristic for these habitats, others arrived accidentally or were introduced as a result of human activities.

It should be noted that recently, compared to references from the 1970's or even earlier, the wet zones have significantly reduced their surfaces, due to the drainage works carried out, with the aim of introducing certain areas into the agricultural circuit.

That is why, using historical Austro-Hungarian maps, general maps and satellite images, in 2018, we carried out a comparative analysis of some wet zones in Timiș County (Figure 2) and we found that the natural wet surfaces have

regressed considerably, being replaced by arable land. We noticed the deep changes and alteration in the flora and also the decreased of aquatic macrophytes populations (Neacșu et al., 2018). Artificial wet zones are more numerous now (lakes, marshes, ponds), while only few natural areas have survived and their status is not adequate (Satchinez Swamps).



Figure 2. Lake Sânandrei (Timiș) after drying up (2015)

Although the surfaces and the type of habitat are different, we can have an image of some specific biodiversity losses, numerically considered. For example, the aquatic and paludicolous species identified in the Timiș-Bega interfluvium (approx. 280 - Grigore, 1971), in the Lugoj piedmont (approx 150 - Vicol, 1974), in the perimeter of the Timiș, Pogoniș and Bârzava rivers (approx. 160 - Arvat, 1977), in the main reservoirs in Timiș (approx. 100 - Neacșu, 2008), or in the Timiș river basin (approx. 80 - Drăgulescu, 2013).

Comparing the list of aquatic and paludicolous flora near Timișoara, with the species present in the perimeter of the Satchinez Swamps (Figure 3), Arsene et al., 2005 found that a third of them are missing, compared to the initial list made by Tökes (1905).

Grigore (1971) mentions in the Timiș-Bega interfluvium, a group of well-represented hydrophilic and hygrophilic species: *Marsilea quadrifolia*, *Salvinia natans*, *Polygonum amphibium*, *Ranunculus aquatilis*, *R. sceleratus*, *Rorippa amphibia*, *Trapa natans*, *Myriophyllum spicatum*, *M. verticillatum*, *Oenanthe aquatica*, *Sagittaria sagittifolia*, *Butomus umbellatus*, *Hydrocharis morsus-ranae*, *Alisma plantago-aquatica*, *A. lanceolatum*, *Juncus inflexus*, *J. conglomeratus*, *Potamogeton natans*,

P. crispus, *Typha angustifolia*, *T. latifolia*, *Lemna minor*, *L. trisulca*, *Glyceria maxima*, *G. fluitans*, *Schoenoplectus lacustris*, *Heleocharis palustris*, *Carex sp.*

Vicol (1974) signals the remarkable presence of hydrophytes in the Lugoj piedmont and justifies it in close correlation with local conditions for the development and maintenance of wet zones. Among these species are: *Alisma plantago-aquatica*, *Lemna minor*, *L. trisulca*, *Potamogeton crispus*, *P. natans*, *Hydrocharis morsus-ranae*, *Trapa natans*, *Salvinia natans*, *Marsilea quadrifolia*, *Polygonum amphibium*, *Ranunculus aquatilis*, *Nuphar luteum*, *Typha latifolia*, *T. angustifolia*, *Heleocharis palustris*, *Oenanthe aquatica*, *O. banatica*, *Glyceria maxima*, *Elatine hexandra* (today this species is critically endangered and is included by Dihoru & Gavril, 2009 in *Red book of vascular plants of Romania*).

Arvat (1977) notes the luxuriant presence of the following species, on the edges of rivers, canals, marshes and ponds (in the space between the Timiș, Pogoniș and Bârzava rivers): *Alisma plantago-aquatica*, *Ranunculus aquatilis*, *R. sceleratus*, *Butomus umbellatus*, *Ceratophyllum submersum*, *Glyceria fluitans*, *Heleocharis palustris*, *Hydrocharis morsus-ranae*, *Lemna minor*, *L. trisulca*, *Potamogeton natans*, *P. crispus*, *Oenanthe aquatica*, *Myriophyllum spicatum*, *M. verticillatum*, *Schoenoplectus lacustris*, *Typha angustifolia*, *T. latifolia*, *Phragmites australis*, *Polygonum amphibium*, *Juncus inflexus*, *J. conglomeratus*, *Carex sp.* Neacșu (2008) notes the common species such as: *Salix alba*, *Salix cinerea*, *Ranunculus repens*, *Polygonum amphibium*, *Lythrum salicaria*, *Typha angustifolia*, *Carex riparia*, *Bidens tripartita*, *Mentha aquatica* and less common species such as: *Lindernia procumbens*, *Peplis portula*, *Eleocharis acicularis*, *Leersia oryzoides*, *Najas minor*, *Oenanthe banatica*.

As can be seen, these lists are quite similar and most of these species are still found in wet zones flora today, but their populations are less represented. We only mention the current status of the species *Marsilea quadrifolia* - Near Threatened (IUCN), which in the past grew abundantly in this area (Grigore, 1971, Vicol, 1974). Among the species of aquatic/humid

habitats listed in the annexes of the Habitats Directive, which were listed in Banat, we mention: *Marsilea quadrifolia*, *Cirsium brachycephalum*, *Eleocharis carniolica*, *Aldrovanda vesiculosa*, *Gladiolus palustris*, *Angelica palustris* (Annex IIB of the Habitat Directive), *Lindernia procumbens* (Annex IVb of the Habitat Directive).

From his study, Drăgulescu (2013) notes that among the 285 identified species in the Timiș River drainage basin, more than twenty are either rare or protected: *Thelypteris palustris*, *Marsilea quadrifolia*, *Nuphar lutea*, *Myosurus minimus*, *Ranunculus lateriflorus*, *Ranunculus lingua*, *Ranunculus ophioglossifolius*, *Montia minor*, *Rumex x gayeri*, *Ludwigia palustris*, *Apium nodiflorum*, *Peucedanum rochelianum*, *Elatine hexandra*, *Tozzia alpina* ssp. *carpatica*, *Cirsium brachycephalum*, *Taraxacum bessarabicum*, *Stratiotes aloides*, *Fritillaria meleagris*, *Gladiolus imbricatus*, *Narcissus poëticus* ssp. *radiiflorus*, *Wolffia arrhiza*. Most of these were taken from the bibliography, because they were no longer found in the field.



Figure 3. A population of *Ranunculus aquatilis* in a flooded area at Satchinez



Figure 4. The shore of the Lake Liebling (2006)

The life forms and geoelements structure has changed in recent decades due to the changes occurring within habitats, which has led to the expansion of some categories like therophytes, hemicryptophytes, mesophytes etc., in the disadvantage of hydrophytes and hygrophytes. For example, analysing the floristic structure of the reed communities (Figure 4), we noticed that compared to those described by Grigore (1971), in which helohydatophytes predominated, in those studied by us, therophytes and hemicryptophytes have a greater distribution and weight (Neacșu et al., 2008).



Figure 5. Meadow being invaded by *Amorpha fruticosa* (dark green) on the Mureș river, near Lipova

It should also be mentioned the species encountered sporadically nowadays or even with uncertain presence such as: *Hippuris vulgaris*, *Ludwigia palustris*, *Stratiotes aloides*, *Hottonia palustris*, *Lysimachia punctata*, *Potamogeton lucens*, *Zannichellia palustris* etc. Otves et al. (2014) presents a list of 82 adventive species in Banat, some of them raising problems and disrupting the stability of wetland habitats: *Amorpha fruticosa* (Figure 5), *Echinocystis lobata*, *Reynoutria japonica*, *Helianthus tuberosus*, *Asclepias syriaca*, *Lindernia dubia* (Neacșu et al., 2021).

CONCLUSIONS

The decrease of wetland areas, anthropic pressure, climate changes, are factors that negatively influence the diversity of the cormoflora of the Banat areas.

We believe that against the background of these changes, ecological restoration actions of the wetlands in Banat are required.

Most of the species of aquatic and paludicolous plants in the Romanian Banat are also found in the Serbian Banat (Ljevnaić-Mašić, 2013; Ljevnaić & Mašić, 2016; Anđelković, 2020, etc.)

We have not found recent reports of species of the genus *Elatine* in the Romanian Banat, although their presence is certain in the Serbian Banat (e.g. Perić et al., 2016; Jenačković Gocić et al., 2020).

Wetland management must include viable strategies and concrete conservation measures to reduce biodiversity loss.

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