

Preliminary Data Concerning the Conservation Value of the Natural Habitats and Their Correspondent Threats within Tulcea County – Romania

Date preliminare privind valoarea conservativă a habitatelor naturale și amenințările corespunzătoare din județul Tulcea – România

Mihai PETRESCU

Abstract

Within the last eight years the studies undertaken on the territory of each administrative unit of Tulcea County (towns, communes), besides the flora species and habitat inventory, led to a preliminary general assessment of the conservation value and main threats induced by human activities upon this natural heritage. One of these preliminary criteria for the conservation status was considered the dominance of primary plant communities versus secondary ones. Wherever data allowed there was assessed also the intensity of these activities, using a simple scale that estimates a high, medium, low or null level of disturbance, taking into account the dominance indices and the number of ruderal and/ or non – native species identified in the plant communities, within the studied habitats. Other general criteria for the conservation value of a territory were considered: the dominance within the natural habitats of community interest habitats; the preponderant threat category correspondent to the frequency of the plant community within the territory; the prevalence of plant communities that contain threatened species at the national or European level. The main threats that induce plant communities` disturbance for each territory were also inventoried.

Keywords: Balkan, conservation, Danube Delta, Dobrogea, flora, habitat, Natura 2000, Steppic, sub-Mediterranean, threat, threatened, Tulcea, vegetation

Introduction

Tulcea County is the most important territorial unit within Romania, from the nature conservation point of view, taking into account that it concentrates the largest surface of protected areas of national/ global importance and Natura 2000 sites. Within the last eight years the studies undertaken within the territory of each administrative unit of Tulcea County (towns, communes), besides the flora species and habitat inventory, led to an overall preliminary and general assessment of the conservation value and main threats induced by human activities upon this natural heritage.

Material and Methods

The toponym Dobrogea usually refers to the Dobrogea Plateau, situated between the Danube and the Black Sea, framed in the Steppic bioregion. The Danube Delta toponym, refers to the area of the Danube Delta Biosphere Reserve, included in the Steppic and Pontic bioregions. The present studies were concentrated in the northern part of Dobrogea region, Tulcea County.

In Dobrogea and the Danube Delta eight major vegetation/ landscape units occur, as follows: Steppes (M), Wooded steppes (L), Xerothermal deciduous and deciduous – resinaceous forests (G), Mesophyllous deciduous and deciduous-resinaceous forests (F), Coastal and halophyllous vegetation (P), Flood plain vegetation (U), Reed-beds and marshes with *Bolboschoenus* spp. (R), Sand vegetation. All these are framed into different habitat types according to the Palaearctic classification, many of them being also considered habitats of community importance, listed in the *Interpretation Manual of the European Union Habitats - EUR 27*. The main threats that induce plant communities' disturbance for each territory were also inventoried. Threat assessment is separately done, on groups of habitats for their specific aspects, and also globally, when the threat is common for all of them. Wherever data allowed there was assessed also the intensity of the impact due to different threats, using a simple scale that estimates a high, medium, low or null level of disturbance.

Preliminary criteria for the assessment of the habitat conservation status and conservation value of the natural heritage of a territory represent general estimations of:

- the dominance of artificial versus natural/ semi-natural habitats;
- the dominance of primary plant communities versus secondary ones;
- the dominance within the natural habitats of community interest habitats;
- the habitat diversity, respectively the maximum number of plant communities and correspondent habitats;
- the preponderant threat category correspondent to the frequency of the plant community within the territory;
- the prevalence of plant communities that contain threatened species at the national or European level.

The field research consisted in observations on itineraries where there were located plots of 10 x 10 m, according to the Braun-Blanquet methodology. The identification and framing of the plant species, coenotaxa and habitats are based on PHYSIS database and other papers or field guides (CIOCÂRLAN, 2009; DEVILLIERS, DEVILLIERS-TERSCHUREN, LINDEN, 1996; DIHORU, DONIȚĂ, 1970; OLTEAN *et alii*, 1994; PETRESCU, 2007; PRODAN, 1934; SANDA, 1998; SANDA, 2002; SANDA, ARCUȘ, 1999; SANDA, VICOL, ȘTEFĂNUȚ, 2008; SĂVULESCU *et alii*, 1976). The

correspondence with the community interest habitats follows the descriptions mentioned in the EUR 27 version of the *Interpretation Manual of the European Union Habitats* (EUROPEAN COMMISSION-DG ENVIRONMENT, 2007).

The preliminary assessment of the importance and conservation status of threatened species or habitats/ coenotaxa, as a basis for the evaluation of the conservation priorities, was based upon their framing into several local threat categories, within the analyzed coenotaxa (for the species), by using a scale, as follows (PETRESCU, 2007). For the species the first three gradations correspond to the IUCN threat categories (endangered, vulnerable, rare), to which the "critically endangered" category was added. For the next three gradations, that correspond to the "not threatened" IUCN category the following frequency categories were used: sporadic, frequent and very frequent. A correspondence was also set between these categories and the Braun-Blanquet scale for the assessment of the dominance within the plots. For the preliminary evaluation of the habitat threat categories an adapted form of the previous scale was used, based on the estimation of the percentage limits in the research route within which the habitat/ coenotaxa was noticed. If a species or habitat is framed into a high threat category (endangered, vulnerable) its local conservation status can be considered low, closer to an unfavorable status and vice versa. In the case of habitats/ plant communities, the higher is their threatened species number, the better can be considered their conservation value and status, taking into account that these taxa, sensitive to human activities, are in general considered as environment indicators.

The correspondence between the abundance – dominance indices, the plant community frequency and the threat categories for species and coenotaxa

Abundance-dominance indices (species)	Threat category	Frequency of the habitat in the studied area (% of the itinerary)
r – <5 individuals/ plot, negligible dominance	critically endangered	-
+ – ≤ 1 % dominance	endangered	+ – ≤ 1 %
1 – 1-10 % dominance	vulnerable	I – 1-10 %
2 – 10-25 % dominance	rare	II – 10-25 %
3 – 25-50 % dominance	sporadic	III – 25-50 %
4 – 50-75 % dominance	frequent	IV – 50-75 %
5 – 75-100 % dominance	very frequent	V – 75-100 %

Wherever data allowed there was assessed also the conservation status of the plant communities/ habitats induced by the intensity of human activities. There was used a simple scale that estimates a high, medium, low or null level of disturbance, taking into account the dominance indices and the number of ruderal and/ or non-native species identified in the plant communities, within the studied habitats.

Within each shrub or herbaceous plant community the presence of at least one ruderal/ non-native species with a certain dominance index corresponds to a level of disturbance, respectively: r – very low; + – low, 1 – medium; 2-5 – high. If the number of recorded ruderal or non-native species is equal or exceeds 50% of the total number of species, even if these kind of taxa have low dominance indices, (like for example +-low), there can be considered that the respective plant community has a level of disturbance that corresponds to the next higher level (such as in this case 1-medium).

For the oak forests, if the oak species proportion is: higher or equal to 2 (20%) – low disturbance; between (or equal to) 1 (10%) and 2 (20%) – medium disturbance; no oaks – high disturbance. The highest disturbance level in the canopy or shrub/grasses layer is considered representative for the overall plant community.

Results and Discussion

GENERAL THREATS

In this category were included the factors that generally threaten the habitats and species of the studied sites.

Abandoned and active quarries in the studied sites and their neighbourhood can be considered a medium impact. Thus, even if locally the impact due to the quarries is high and irreversible, and the total area is relatively important, the area of unspoiled natural habitats is still much larger. The most disturbed areas are within the communes/ towns of Turcoaia, Măcin, Greci and to a lower extent Isaccea and Niculițel.

Fires represent a low impact factor as they are rare, usually affecting reduced areas, mainly in the grassland meadows used as pastures or in the reedbeds. The most affected zones are within the reedbeds of the Danube Delta and the pastures of the mainland communes Somova and Cerna.

Tourism represents generally a low impact threat in most of the studied sites, where it occurs especially in weekend, in springtime or at the beginning of summer in the mainland, while in the Delta from springtime to autumn. Still the most important impact, reaching a medium level, can be considered within the central part of the Delta from Tulcea to Sulina, extending southwards to the Sfântu Gheorghe arm. In the the mainland tourism still has a low impact, mainly within Măcin, Greci, Babadag and less Cerna, Niculițel, Somova, Frecăței areas.

This impact is mainly linked with transportation, threatened species occasional harvesting, and the threat of tourism developments even outside localities.

Harvesting of endangered species is a medium intensity factor, the quantities being important in some reduced areas, generally in the spring or at the beginning of summer, when these illegal activities threaten only a few species from the much numerous protected taxa. This was observed mainly in the case of *Galanthus plicatus*, *Galanthus elwesii*, *Nectaroscordum siculum*, *Paeonia peregrina*, especially within the Babadag, Slava Cercheză, Greci, Niculițel areas.

Harvesting of medicinal plants represents a factor with a medium intensity. Except the silver lime tree, medicinal plant species are harvested in low quantities. The impact is considered medium, not because of the quantities that are collected, considering the very large resources, but because of the way of harvesting, often not ecological, as lime tree branches are frequently cut, like mainly within the Greci and Niculițel communes.

Harvesting of edible plants can be considered a low intensity factor because their quantities, even if they are sometimes important, do not endanger the large populations of these common species. Thus, *Allium ursinum* and less *Urtica dioica*, *Nectaroscordum siculum* are collected in important quantities for marketing, mainly from Babadag and Luncavița areas.

Harvesting of reed, including with specialized machinery, throughout the Danube Delta and the western part of the lagoons, have a low-medium impact, as the areas are reduced in comparison with the much larger reed bed surface.

SPECIFIC THREATS FOR DIFFERENT HABITAT GROUPS

Within the studied sites some threats are more or less specific for each group of habitats, as presented below.

I. Mesophyllous Balkan and xerotherm deciduous forests (sub-Mediterranean and wooded steppe), floodplain forests

In this category are framed the habitats: 41.1F, 41.2C22, 41.7, 44 (except subtypes 44.814112, 44.921) and their subtypes.

Biodiversity loss, is due to the fact that within the forest management, so far, biodiversity conservation was not taken into account, fact that led to the total or partial loss of oak species from the tree layer, under the conditions of difficult regeneration of *Quercus* species in Dobrogea's dry climate and the competition of other tree species. The impact of this factor has a medium value, as even the areas with this type of forests have a conservation value as they preserve most of the species typical for the prime forests. The largest areas with such derived forests are found within the Luncavița, Niculițel, Valea Teilor and less Ciucurova, Slava Cercheză, Babadag areas.

Within the floodplain forests this impact is low, as usually they are mono-dominant willow, poplar, elm or alder forests, with active regeneration, so biodiversity loss is less obvious. Still these forests are more affected by a higher level of non-native species invasion than the mainland ones, through the seeds brought by floodings, the main level of disturbance being low. Such examples are *Amorpha fruticosa*, that spreads on large areas within the Danube Delta or along the Danube, or American ash species, mainly concentrated on higher levees in the western part of the Delta.

Decreasing of mature and old growth or prime forests areas leads also to diversity loss. The impact is considered medium, due to the existence in the mainland of many forests with protection functions, that include larger unfragmented surfaces of mature or old forests than in many other areas hilly areas of Romania, mainly within Greci, Cerna, Luncavița, Niculițel, Isaccea, Hamcearca, Valea Teilor, Ciucurova, Slava Cercheză, Babadag. The largest areas with young forests are mainly concentrated on the easy accessible forests within Luncavița commune, Ciucurova or Babadag areas.

Within the floodplain forests or the Danube Delta sandy levees forests this factor has a medium impact. Despite the large areas afforested with poplar and willow, in the Danube floodplain (Dăeni, Ostrov, Peceneaga, Turcoaia, Măcin) or in the Delta (Mahmudia, Beștepe, Nufăru, Maliuc), there are still natural forest with no (or low) human intervention, and even old-growth forests or prime forests, such as Letea and Caraorman.

Afforestation with non-native, native species or mono-dominant forestry plantations may be considered as having a low impact, because the respective surfaces are reduced in comparison with the forests resulted from natural regeneration, in the case of the Balkan and sub-Mediterranean forests, the largest such areas being found in the Babadag and Ciucurova areas. In the the wooded steppe area the impact can be considered as medium, as important areas were planted, especially in the former steppe clearings, mostly in the Casimcea and Babadag areas.

The impact is medium for the floodplain forests, as on large areas they were replaced by poplar or willow plantations, both in the Danube floodplain between Dăeni and I.C. Brătianu, as well as in the Danube Delta, mainly in its western part (Ceatalchioi, Tulcea, Nufăru, Beștepe, Mahmudia, Murighiol) and less in the east (C.A. Rosetti, Sfântu Gheorghe).

Modification of the forests spatial structure has mainly the following causes:

1. *Creation of structures close to the primeval forests* was not, so far, a management goal. The impact of this factor may be considered high, as most of the forests have an even-aged structure, throughout most of the communes/towns, both in the mainland and in the Danube Delta. Few exceptions are

represented first of all by the prime forests Letea and Caraorman, as well as by reduced patches of forests in the Greci, Luncavița areas, or by fragments of wooded pastures from Hamcearca or Somova communes.

2. *Afforestation in rows or in terraces* creates an artificial spatial structure/ landscape, and leads to the modification of the relief. The impact of these factors on the studied sites is medium, as all the afforestations are made in this manner. This also led to the destruction of valuable natural forest, shrub or grassland habitats on thousands of hectares. Still, these areas are reduced in comparison with the natural habitats area. The largest such areas are located within the Babadag and Ciucurova areas, along the Danube floodplain and in many areas of the Danube Delta, where willows and hybrid poplars were planted.

3. *Illegal cutting of wood material*, especially of the oak species, leads to a decrease of the coverage percentage and/ or to changes in the species inventory. The impact is estimated as medium, these areas are situated especially near human settlements or in easy accessible areas, mainly in the wooded pastures. The largest affected areas are within the Beidaud area, where the sparse trees were cut on hundreds of hectares of the Beidaud nature reserve, and less within Casimcea, Dorobanțu, Somova communes, as well as throughout the Danube Delta, to a lower extent.

II. Xerophyllous, higrophyllous and hidrophyllous shrubs

This category corresponds to the habitats: 31.8B7, 31.8B125, 37.26412, 44.6622, 44.81411, 44.921 and their subtypes.

Biodiversity loss is mainly a consequence of these habitat areas decreasing, or the invasion of allochthonous (alien) shrub species (*Ailanthus altissima*, *Morus* sp., *Amorpha fruticosa* etc.), including through afforestations. The impact is considered low, such areas being reduced in comparison with the natural habitats. Some significant examples are within the Frecățtei, Niculițel, Topolog, Dorobanțu communes and Sulina town.

III. Grasslands (xerophile, mesophile, halophile)

These grasslands include the habitats 15.115, 15.A21, 16.12, 16.21, 16.22B, 24.32, 34.92, 34.A2 and their subtypes.

Modification of the flora inventory consists in the replacement of primary plant communities with secondary ones, or in the invasion of the phytocoenosis by ruderal species characteristic for habitats degraded by human activities. Modification of the flora inventory through grazing has a low impact in the case of the reduced areas that are under forestry administration, where grazing is not allowed; still it accidentally occurs close to pastures, like in the communes Greci, Hamcearca, Niculițel, Stejaru, Casimcea, Beidaud, Babadag, Cerna, Maliuc, C.A.Rosetti, Sulina, Sfântu Gheorghe etc. For the other

grasslands from the studied sites, mostly used as pastures, the impact is considered, in general from low to medium, with the exception of some areas situated close to human settlements or within some communes/ towns with insufficient pasture areas where this factor has locally a high intensity (Mihail Kogălniceanu, Topolog, Stejaru, Sulina, Sfântu Gheorghe etc.). The field observations revealed that usually many threatened plant species, or at least their reproduction organs are not grazed, due to their difficult accessibility, low size, thorns, or probably unsuitable chemical composition.

Reduction of the area of grassland habitats has a medium impact on the saxicolous grasslands, mainly degraded by quarries, such as in the Turcoaia, Măcin, Greci, Isaccea, Niculițel, Baia, and a medium one for dry grasslands on deeper soils, more favourable for afforestations, undertaken so far on thousands of hectares, mostly within the Beidaud, Casimcea, Dorobanțu, Cerna, Sfântu Gheorghe communes. The areas with natural grasslands are yet considerably larger than the degraded ones. The reduction of the grassland habitats and their fragmentation is also a result of waste material storing and different constructions that include roads, wind farms/ solar panel parks and their associated infrastructure etc. The most affected zones include even protected areas/ Natura 2000 sites or their vicinity, like within Casimcea, Cerna, Baia, Valea Nucarilor, Nalbant, Somova, Sulina communes/ towns etc.

IV. Higrophile and hidrophile herbaceous vegetation

This vegetation type includes habitats like 22.41, 22.43, 53.1 and their subtypes.

The impact of waterworks (dykes, draining etc.) on wetland vegetation can be considered as high in the mainland (e.g. Traian Lake) and its adjacent Danube floodplain that was drained on its major part from Dăeni to Isaccea. A medium level can be estimated for the Danube Delta, where the native vegetation was eliminated on thousands of hectares, but still the undisturbed areas are much larger. These habitats areas were also modified by water level control works, induced by human interventions, which have changed the natural flooding regime, like westwards of Isaccea and in the former fish farms of the Delta. Still large areas of these habitats are already recovered within the ecological restored former polders like Babina and Cernovca.

GENERAL OBSERVATIONS CONCERNING CONSERVATION STATUS AND CONSERVATION VALUE OF THE STUDIED AREAS

The preliminary assessment of the habitat conservation status and conservation value of the studied habitats within the administrative territories of Tulcea County led to several general remarks, presented below.

Most of the communes/ towns of the mainland are dominated by artificial habitats, the natural habitats occurring on larger areas within the communes from the central hilly area of the county, being more restricted in the peripheral more or less flat zones, favourable for agriculture. Community interest habitats represent the highest proportion within the natural vegetation of the mainland, where nearly all the grassland, shrub and forest plant communities belong to this category.

In the Danube Delta Biosphere Reserve, within the territories of the communes/ towns natural habitats prevail in most cases, but the surface proportion of community interest habitats areas is reduced in comparison with the mainland, due to the dominance of large areas of reed beds that are not Natura 2000 habitats. Regardless of their area, still the number of plant communities included in Natura 2000 habitats is higher in comparison with the unprotected vegetation types. The highest concentration of community interest habitats is associated with the psamphilous or halophile grasslands, shrubs or forests of the Letea, Caraorman, Sărăturile levees and the seashore (C.A. Rosetti, Crișan, Sulina, Sfântu Gheorghe, Murighiol, Jurilovca localities).

Within most of the communes/ towns of the mainland the number of primary plant communities (mainly representative for the steppe grasslands, thickets as well as sub-Mediterranean and wooded steppe forests) is higher than for the secondary ones. Still, some steppe grasslands plant communities (*Botriochloetum ischaemi*), whose secondary or primary status is not clarified, as well as totally derived forests (mainly Balkan forests), represent an important proportion within the natural habitats. In the Danube Delta the natural habitats are dominated by primary plant communities that prevail in area and in number (aquatic/ wetland vegetation, psamophile and halophile grasslands, thickets, riparian and psamophile forests).

Within each commune/ town the major part of the plant communities can be considered endangered, followed by vulnerable ones, which indicate an unfavourable status of conservation from their occurrence area point of view, at the level of each territorial unit. This underlines the necessity to avoid the reduction of their area if it is not possible to increase it.

The highest habitat diversity, respectively the maximum number of plant communities (32) was recorded within the Murighiol commune, most of them being framed into 17 subtypes of community interest habitats that include a wide variety of vegetation types: halophilous, psamphilous and xerophilous (steppe) grasslands, steppe thickets, riparian forests etc.

Within the mainland many plant communities have at least one threatened species at the national or European levels, the richest being the rocky steppe coenotaxa, on siliceous substrata (Măcin, Greci, Cerna, Hamcearca, Niculițel, Valea Teilor, Casimcea, Beidaud etc.) but especially on

limestone (Babadag, Sarichioi, Slava Cercheză, Ciucurova, Jurilovca, Baia, Cerna). In the Danube Delta there is a lower number of plant communities that shelter threatened species, these being mainly located on the sand dunes of the Letea, Caraorman, Sărăturile and on the seashore (Sulina, Sfântu Gheorghe, Murighiol, Jurilovca) and less in the wetlands.

MANAGEMENT RECOMENDATIONS

Allowed activities compatible with habitat conservation

The allowed activities are detailed in the Romanian environment legislation, so there will be emphasized only the aspects regarding grazing in areas where it is allowed or recommended. In general in such areas the grazing pressure should not exceed one animal/ year/ hectare, in order to avoid biodiversity loss within the grasslands. In areas where strict conservation is required, grazing should occur out of the vegetation season, preferably between 1st October and 1st March, after the reproduction period of the plant species, especially of the threatened ones.

Necessary interdictions for habitat conservation

As general recommendations it is mainly necessary to avoid the following activities that are likely to have a negative impact on natural habitats and protected areas:

- changing of the land use categories of the natural habitats, including the land cultivation;
- building activities, that also increase habitat fragmentation, including the crossing of the protected area by pipes, electric networks and any other types of such construction, water capture, roads, windfarms, solar pannels etc.;
- fencing, except in the situations when conservation objectives require this; the fence should be only used in the sectors where it is absolutely necessary, in order to reduce the landscape impact and to ensure unfenced areas for the fauna migration;
- quarrying or any other geological prospection within or in the neighbourhood of the protected area;
- logging in the nature reserves and in the core areas (special conservation areas) of the national / natural parks;
- logging of the following forest plant communities: endemic for certain regions and / or at the national level; rare and/ or close to extinction, protected or not by national or international legislation; habitats of threatened species; fragile forests in extreme biotopes, with difficult natural regeneration; relict forests; old-growth forests (including the oak stands of over 100 years old); forests that shelter threatened species. In the case

of the forests that cannot be excluded from logging, it is necessary to allow their cutting only if the seedlings composition can ensure their recovery exclusively through natural regeneration, the covering percentages of the tree species, especially oak ones, being about the same with the former ones;

- afforestation, being necessary to allow natural succession and to avoid the replacement of native vegetation by artificial habitats, even if native species are used;
- forms of tourism that could infringe the conservation objectives;
- destruction or degradation of habitats and landscape by any human intervention.

Conclusions

Even though further more detailed and quantitative research is necessary, it can be considered that most of the natural/ semi-natural habitats of Tulcea County are in general low disturbed by different threats and the overall conservation value of the native vegetation in this area is outstanding, as most of the vegetation types are included into community interest habitats, with an important proportion of priority ones. These vegetation types are dominated by primary plant communities, in number and area. Even though the area of natural habitats is larger in the Danube Delta Biosphere Reserve, the proportion of Natura 2000 habitats is higher within the mainland native habitats.

Still this natural heritage is threatened at a low-medium extent by more or less irreversible factors (quarries, constructions-wind farms, solar panels, roads), long term recovery factors (logging, non-native species invasion) or short term recovery activities (overgrazing). At least for protected areas –m including Natura 2000 sites, urgent management measures should be taken in order to avoid or minimize the negative effects on species and habitats.

Despite all these threats, by the close cooperation between the European Union and the national institutions it will be possible to identify adequate and sustainable alternatives and locations for threatening activities. Thus, there will be a ray of hope that the Danube Delta and Dobrogea will still remain a natural paradise, for the benefit of actual and future generations.

References

- CIOCÂRLAN, V., 2009, *Flora ilustrată a României*, Ed. Ceres, București.
- DEVILLIERS, P., DEVILLIERS-TERSCHUREN, J., LINDEN, C.V., 1996, *Paelearctic Habitats. PHYSIS Data Base*, Royal Belgian Institute of Natural Sciences.
- DIHORU, Gh., DONIȚĂ, N., 1970, *Flora și vegetația Podișului Babadag*, Ed. Academiei R.S.R., București.
- OLTEAN, M., NEGREAN, G., POPESCU, A., ROMAN, N., DIHORU, GH., SANDA, V., MIHĂILESCU, Simona, 1994, *Lista roșie a plantelor superioare din România*, Studii, sinteze, documentații de ecologie, partea I, București.
- PETRESCU, M., 2007, *Dobrogea și Delta Dunării. Conservarea florei și habitatelor*, Biblioteca Istro-Pontica, ICEM Tulcea, Tulcea.
- PRODAN, I., 1934, *Conspectul florei Dobrogei*, Buletinul Academiei de Înalte Studii Agronomice, vol. V, No 1, Cluj.
- SANDA, V., 1998, *Conspectul cormofitelor spontane din România*, Acta Botanica Horti Bucurestiensis, Ed. Universității București.
- SANDA, V., 2002, *Vademecum ceno-structural privind covorul vegetal din România*, Ed. Vergiliu, București.
- SANDA, V., ARCUȘ, Mariana, 1999, *Sintaxonomia grupărilor vegetale din Dobrogea și Delta Dunării*, Ed. Cultura, Pitești.
- SANDA, V., VICOL, I., ȘTEFĂNUȚ, S., 2008, *Biodiversitatea ceno-structurală a învelișului vegetal din România*, Ed. Ars Docendi, București.
- SĂVULESCU, T. (coordonator), 1976, *Flora R.S.R.*, I-XIII, Ed. Academiei R.S.R., București.
- *** 2007, *Interpretation Manual of the European Union Habitats*, European Comission-DG Environment - EUR27.

Mihai PETRESCU

*“Gavrilă Simion” Eco-Museum Research Institute,
Danube Delta Ecotourism Museum Center
E-mail: mihaipetrescu2@gmail.com*