THE STRUCTURE AND DYNAMICS OF THE PHYTOPLANKTON FROM DRAGOMIRNA AND SOLCA LAKES (MOLDAVIA, ROMANIA)

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KEYWORDS: Romania, Moldavia, Dragomirna Lake, Solca Lake, phytoplankton, dynamics, numerical density, biomass.

ABSTRACT

In this paper was realised a comparative study regarding the phytoplankton density and biomass of two artificial lakes: Dragomirna and Solca in the period 2001 - 2005. The water of both these lakes was destinated for the local human population needs, Dragomirna Lake water being used also for the Suceava locality industry. From the geographical point of view both lakes are localised in the Suceava Plateau, the Solca Lake being situated in a forest area and Dragomirna Lake in a hillocks lawn area.

The samplings were done with a frequency of 3 - 4 on year, starting in the month of April and finished in the first part of November. It was highlighted that the development degree of the phytoplankton has variations regarding its numerical density and biomass from one year to another, without the presences of the algae blooming phenomena appearance which can show a hipertrophy level which modify the organoleptical proprieties of the water.

The predominance in the phytopankton of the diatoms, both like density and biomass, confirm the relatively low level of trophicity of these lakes, a good sign for the two ecosystems, indicating a good quality of the water.

Based on the obtained results from the phytoplankton density and biomass analisis, the Solca Lake can be considered as oligotrophic and Dragomirna Lake as mezotrophic.

REZUMAT: Structura şi dinamica fitoplanctonului lacurilor Dragomirna şi Solca (Moldova, România).

În această lucrare s-a realizat un studiu comparativ privind densitatea şi biomasa fitoplanctonului a două lacuri de acumulare: Dragomirna şi Solca în perioada 2001 - 2005. Ambele lacuri au fost destinate alimentării cu apă a populației umane, iar lacul Dragomirna este utilizat şi ca sursă de apă pentru zona industrială a oraşului Suceava. Din punct de vedere geografic, ambele lacuri sunt localizate în Podişul Sucevei, lacul Solca fiind situat într-o zonă împădurită, iar lacul Dragomirna într-o pajişte colinară.

Prelevările au fost făcute cu o frecvență de 3 - 4 ori pe an, începând cu luna aprilie şi terminând cu prima parte a lunii noiembrie. S-a constatat că, gradul de dezvoltare al fitoplanctonului a înregistrat variații prinvind densitatea numerică şi biomasa de la un an la altul, fără a se semnala fenomenul de înflorire a apei care să indice un stadiu hipertrof şi să modifice proprietățile organoleptice ale apei.

Predominanța în fitoplancton a diatomeelor, atât ca densitate cât şi ca biomasă, confirmă nivelul relativ scăzut de troficitate al lacurilor, benefic pentru cele două ecosisteme, indicând o apă de bună calitate.

Pe baza rezultatelor obținute din calcularea densității şi a biomasei fitoplanctonice, lacul Solca se încadrează în categoria lacurilor oligotrofe, iar lacul Dragomirna în categoria celor mezotrofe.

ZUSSAMENFASSUNG: Struktur und Dynamik des Phytoplanktons in den Seen Dragomirna und Solca (Moldau, Rumänien).

Die vorliegende Arbeit stellt die Ergebnisse einer zwischen 2001 - 2005 durchgeführten vergleichenden Untersuchung betreffend Biomasse und Dichte des Phytoplanktons der beiden Stauseen Dragomirna und Solca vor. Beide Seen waren zur Trinkwasserversorgung der Bevölkerung bestimmt, wobei der Dragomirna See auch zur Wasserversorgung des Industriegebietes der Stadt Suceava dient. Geografisch gesehen, liegen beide Seen im Hochland von Suceava, der Solca-See in einem bewaldeten und der Dragomirna-See in einem bergigen Grünland Gebiet.

Die Probenahmen fanden 3 - 4 mal/Jahr, von April bis zur ersten Novemberhälfte statt. Es wurde festgestellt, dass die Entwicklung des Phytoplanktons bezüglich der numerischen Dichte und der Biomasse jährlichen Schwankungen unterworfen ist, wobei jedoch keine Algenblüte festgestellt wurde, die ein hypertrophes Stadium angezeigt und die organoleptischen Eigenschaften des Wassers verändert hätte.

Die Dominanz der Diatomeen, sowohl was ihre Dichte als auch die Biomasse betrifft, bestätigt das relativ niedrige, für die beiden Ökosysteme sehr gute trophische Niveau der Seen, das eine gute Wasserqualität anzeigt.

Auf Grund der Ergebnisse die sich aus der Errechnung der Phytoplankton Dichte und Biomasse entnehmen lassen, ist der Solca-See in die Gruppe der oligotrophen Seen einzustufen, während der Dragomirna-See in die Kategorie mesotropher Seen gehört.

INTRODUCTION

The Dragomirna lake has a length of 32 km, a total volume of 19.22 millions m^3 and function as a reservoir of flows coming from Suceava River and Dragomirna Stream.

The Solca Lake is located at the border between the mountain area and the piemont. The initial total volume of Solca lake was 3620 m^3, but now it is found in an advanced mudding status.

Taking into account the importance of these lakes in providing water to Suceava and Solca cities, we followed the biological and chemical evolution of these two lakes over a period of five years (2001 - 2005). The most important criterion for this study was the trophicity of ecosystems based on the quantitative analysis of phytoplankton and the level of nitrogen and phosphor.

MATERIALS AND METHODS

To be able to point out the qualitative and quantitative structure of phytoplankton, the samples were sampled quaterly from the following sections of Dragomirna Lake: feeding source; barrage 0 m, 3 m, 6 m; middle section 0 m, 3 m; rear end and from the following sections of Solca Lake: feeding source; barrage 0 m, 3 m; rear end.

All the samples were preserved on the field in Lugol solution, prepared following the methodology and then they were concentrated in sedimentation cones over the next 10 days.

The biological and chemical characterization of these two lakes took into consideration the recommendations enclosed in "Methodologic guide for following the biological evolution of the lakes", I.C.I.M, 1995, and in 1142/2002-Revised Order.

Density and biomass parameters were calculated according to Pantle-Buck method. It was also taken into consideration the book "Volumetrical measurements of algae" by Cărăuș and Olteanu (2000, revised). The results were represented as mean values and the units were exemplary/liter (ex./l) and milligrams per liter (mg/l).

RESULTS AND DISCUSSIONS

From physico - chemical and biological point of view, the analysis of the samples of water under investigation intended the determination of certain parameters indicating the level of eutrophication and the quality of aquatic environment. The most important parameter to evaluate the trophic evolution of a lake are the nutrients and the phytoplanktonic biomass.

Solca Lake, over the five years period of interest, had the mean values of mineral nitrogen concentration comprised between 0.38 - 0.478 mg/l and 0.012 - 0.033mg/l for mineral phosphor concentration. These values confined Solca lake to oligo-mesotrophic lakes category (Tab. 1). Dragomirna lake had the mean values of mineral nitrogen concentration between 0.290 - 0.440 mg/l and the mineral phosphor concentration between 0.019 - 0.041 mg/l, reflecting the fact that Dragomirna Lake belongs to mesotrophic category (Tab. 1).

Table 1: The yearly medium values of nutrients in the studyed lakes.

		2001	2002	2003	2004	2005
Solca Lake	N mineral total mg N/l	0.467	0.487	0.38	0.449	0.464
	P mineral total mg P/l	0.019	0.0298	0.024	0.012	0.033
Dragomirna Lake	N mineral total mg N/l	0.321	0.29	0.235	0.401	0.454
	P mineral total mg P/l	0.041	0.037	0.019	0.023	0.029

In the same time, we performed the biological analysis of these two lakes, studying the quality parameter - the phytoplankton, in terms of density and biomass and also in terms of taxonomic groups of algae.

In the Solca Lake, the predominant taxonomic group of the phytoplankton is Bacillariophyta, which represents 50.24% in 2001, 86.5% in 2002, 61.1% in 2003, 72.8% in 2004 and 83% in 2005.

As shown in the figure 1, the other taxonomic groups are less well represented compared to main group with percentages between 1 - 25%.

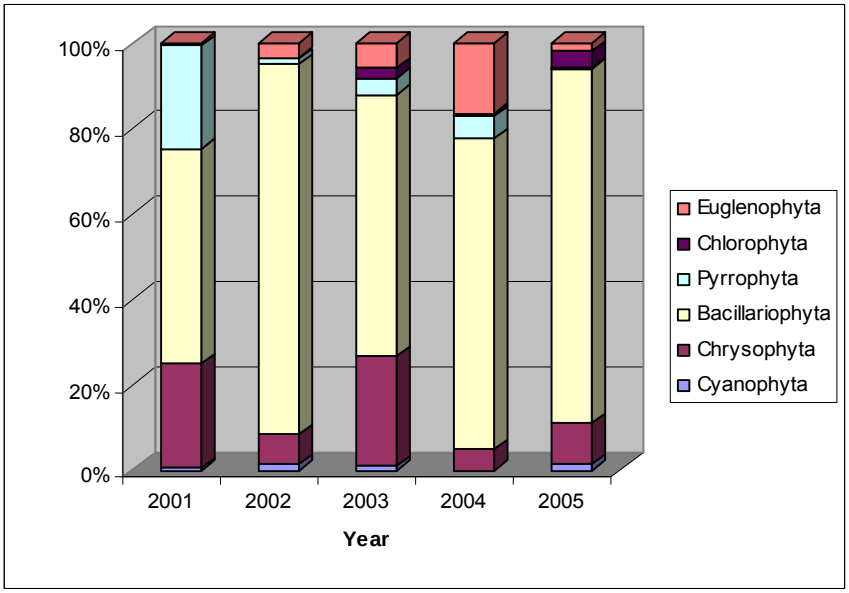

Figure 1: Distribution of algae groups (%) in Solca Lake during 2001 - 2005 period.

The figure 2 shows the predominance of Baccilariophyta group in Dragomirna Lake with a good representation of 35.7% in 2001, 33.3% in 2002, 35.3% in 2003, 67.8% in 2004 and 39.5% in 2005. Also well represented is the Chlorophyta group with the percentage of 9.6 - 30.6% over the five year period.

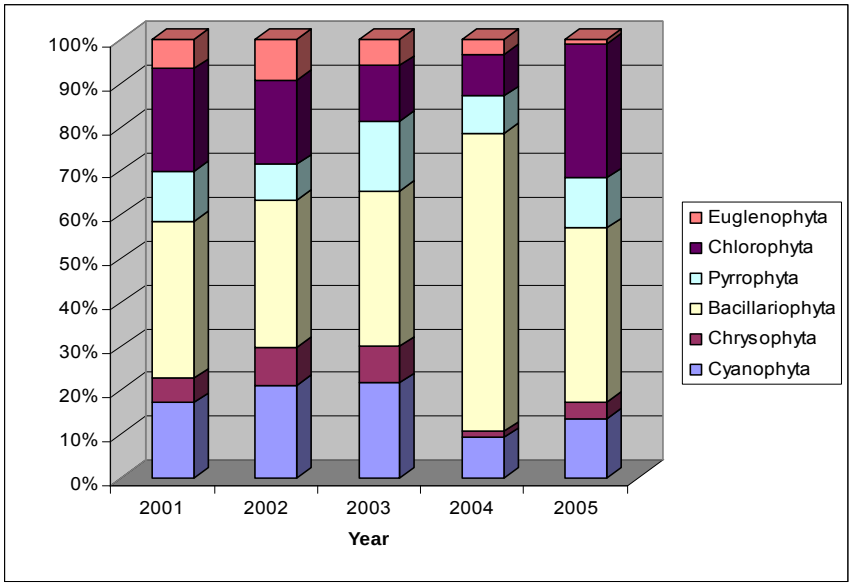

Figure 2: Distribution of algae groups (%) in Dragomirna Lake during 2001 - 2005 period.

Among the representative species of Bacillariophyta group found in Solca Lake, it is worth mentioning the following: *Synedra ulna, Achnanthes minutissima, Gomphonema olivaceum, Cymbella ventricosa, Navicula* sp.

Among the representative species found in Dragomirna Lake are: *Asterionella formosa, Cyclotella* sp., *Navicula cryptocephala* (Bacillariophyta), *Oocystis* sp., *Coelastrum cambricum* (Chlorophyta), *Ceratium hirudinella* (Pyrrophyta).

As shown in the figure 3, the mean annual values of phytoplanktonic numerical density and biomass in Solca Lake recorded a reduced level between 2001 - 2004 with the most significant increase in 2005 (560270 ex/l and 3.86 mg/l respectively). The lowest value was observed in 2003 (343332 ex/l and 0.94mg/l respectively). The phytoplanktonic biomass is usually direct proportional with the cellular density, which means that high cellular density corresponds to high phytoplanktonic biomass as a result of the presence of large forms of algae.

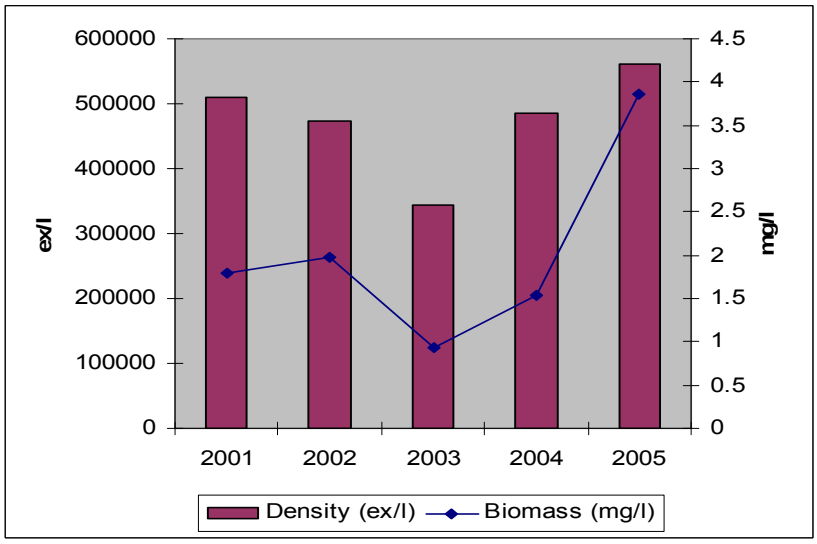

Figure 3: Mean annual values of numerical density and phytoplanktonic biomass in Solca Lake.

Regarding Dragomirna Lake, the same study of mean annual values of numerical density and phytoplanktonic biomass was performed, but in this case the highest value was observed in 2002 (as is shown in the figure 4) with a value of 118943 ex/l and 8.77 mg/l respectively. These high values of density and phytoplanktonic biomass were due to favorable conditions for algae growth like high temperatures and high values of mineral phosphor - (0.032mg/l in September 2002). The lowest value was observed in 2004 (442093 ex/l and 3.12mg/l respectively).

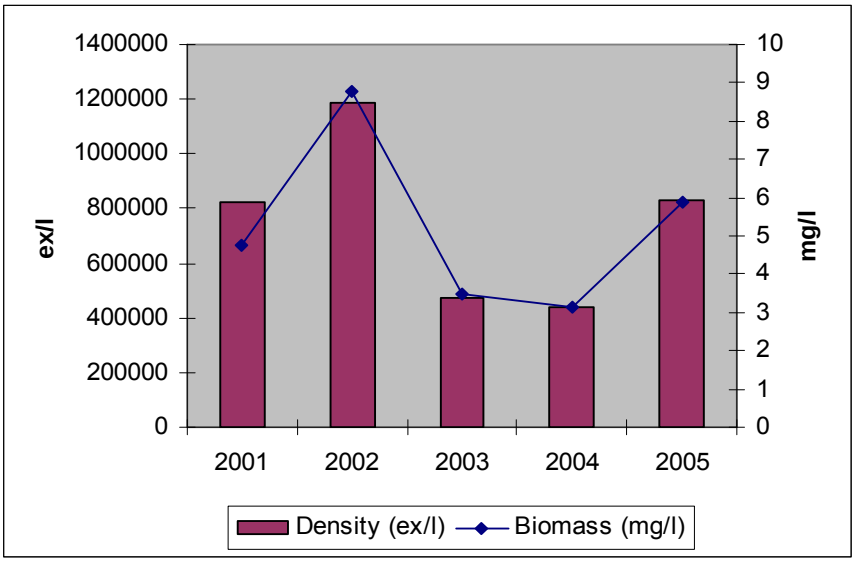

Figure 4: The dynamics of mean annual values of numerical density and phytoplanktonic biomass in Dragomirna Lake (2001 - 2005).

CONCLUSIONS

The level of phytoplankton displayed significant variations regarding the numerical density and biomass comparing the two lakes, one year with another, because of the interaction between physico-chemical conditions and different populations of algae.

The predominance of diatoms (Bacillariophyta) in terms of density and biomass confirms a relative low level of trophicity of both lakes, beneficial for both ecosystems. This also confirms that the quality of water coming from these two lakes is good.

Generally, during this five years study, Solca Lake had an oligotrophic level in terms of medium phytoplankton biomass and an oligo-mesotrophic level in terms of mean concentrations of nutrients. The exploitation period of Solca Lake is coming to an end because of the mudding phenomenon.

Also, during this extensive study, Dragomirna Lake displayed a mesotrophic level in terms of medium phytoplankton biomass and in terms of mean concentrations of nutrients.

According to results there was a difference between the algae biomass in these two lakes, and the qualitative structure of phytoplankton because of the altitude and place of each lake.

The results of this study showed that it is imperative to have a continuous observation and analysis of these lakes for gathering significant information regarding the biological evolution of lakes and how and when these two ecosystems can be used as a valuable source of water.

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DIVERSITY OF MACROMYCETES FROM THE NATURAL PARK COMANA (GIURGIU DISTRICT, MUNTENIA, ROMANIA)

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KEYWORDS: Romania, Muntenia, Natural Park Comana, Macromycetes, Ascomycetes, Basidiomycetes.

ABSTRACT

The Natural Park Comana from Giurgiu District is at present a protected area by the Decision of the Government no. 2151/24th November 2004, published in the Official Monitor no. 38/12.01.2005. It is the largest protected area from the South of Romania Plain, placed between $44^0$10'11"N - $44^0$09'25"N and $26^0$00'42"E - $26^0$02'28"E.

From botanical point of view, this area is very interesting: (i) there are many thermophilous plants, at the Northeast limit of their area (*Ruscus aculeatus* L.); (ii) there are different types, xerophilous hillsides with subthermophilous vegetation, salty soils with specific vegetation, also, in the Northern part, with the second reed-grass area from Romania, with aquatic and marshy vegetation. Marsh Comana has a surface of 1200 ha, that is means a large area for a field zone; (iii) among the internationally protected species, it could be mentioned: *Ruscus aculeatus* L., *Paeonia peregrina* Mill., *Convallaria majalis* L., all of them belonging to the forest; (iv) many species from sozological national lists exist in the Comana Complex, like: *Prospero paratethicum* Speta; (v) all autochthonous species of *Fraxinus* and seven species of *Quercus* recorded from Romania are present in the composition of forests from the Park Comana. Unfortunately, during the last years, forests have been dramatically cut for obtaining new agricultural fields.

It has been identified in Comana Natural Park, 160 macromycetes taxons, among them 23 belonging to Ascomycota and 137 to Basidiomycota phyla, this number representing a large mycodiversity in the investigated area.

The identified Ascomycetes belong to 4 orders (Helotiales, Hypocreales, Pezizales and Xylariales); the largest one is Pezizales Order, containing 17 taxons, among them the amplest one with 7 species belonging to the Pezizaceae family.

The 137 recorded Basidiomycetes taxons belong to 10 orders. The largest order was Agaricales, with 75 taxons, belonging to 19 families. The richest family from our material was Tricholomataceae (12 taxons), followed by Agaricaceae (10 taxons), Lycoperdaceae (9 spp.), Psathyrellaceae and Marasmiaceae, each with 6 taxons.

Among 160 Mycobiota taxons, 55 have been previously recorded and cited from that area (Popovici, 1910; Alexandri, 1932; Brândză and Solacolu, 1932; Săvulescu, 1938; Georgescu, 1940; Gaşmet, 1940; Eliade, 1965), but 105 represent taxons new cited for the Comana Park.

The 160 Mycobiota taxons identified from the investigated area have a different alimentary value: 99 are non- edible, 30 have a reduced alimentary value, 5 with a medium alimentary value, 16 with a high alimentary value, 7 species are toxic (*Amanita vaginata, Coprinopsis atramentaria, Hypholoma fasciculare, Lactarius torminosus, Scleroderma bovista, S. cepa, S. verrucosum*), 2 are very toxic (*Amanita pantherina*, *Entoloma sinuatum*), one is lethal (*Omphalotus olearius*).

The value of the studied area, in addition with the scientifical, bio-ecological, in general, and mycological ones, is also landscape, touristic, agricultural, social and educational, so for these reasons this area has to be known, respected and preserved in its whole variety and splendour.

REZUMAT: Diversitatea macromicetelor din Parcul Natural Comana (Județul Giurgiu, Muntenia, România).

Parcul Natural Comana din județul Giurgiu este la ora actuală o zonă protejată în temeiul Hotărârii Guvernului României nr. 2151 din 24 noiembrie 2004, publicată în Monitorul Oficial nr. 38 din 12 ianuarie 2005. Este cea mai mare rezervație din partea sudică a țării, din Câmpia Română, situată între coordonatele: $44^0$10'11"N - $44^0$09'25"N şi $26^0$00'42"E - $26^0$02'28"E.

Din punct de vedere botanic, zona studiată este deosebit de interesantă: (i) se află aici mai multe plante termofile, spre limita de nord a arealului lor mondial (*Ruscus aculeatus* L.); (ii) există în cuprinsul Parcului Comana păduri de mai multe tipuri, coaste xerofile cu vegetație subtermofilă interesantă, sărături de vegetație specifică, de asemenea, în partea de nord a complexului studiat, se află a doua suprafață stuficolă de pe teritoriul României, cu vegetație acvatică şi palustră - Balta Comana are o suprafață de 1200 ha, ceea ce reprezintă o întindere foarte mare pentru zona de câmpie; (iii) dintre speciile ocrotite pe plan internațional menționăm aici: *Ruscus aculeatus* L. (ghimpele), *Paeonia peregrina* Mill. (bujorul românesc), *Convallaria majalis* L. (lăcrămioarele, mărgaritarul), toate încadrate în pădure/ ecosistemul forestier; (iv) numeroase specii din listele naționale sozologice există în Complexul Comana, ca de exemplu: *Prospero paratheticum* Speta; (v) toate speciile autohtone de *Fraxinus* şi şapte dintre speciile de *Quercus* semnalate în România sunt prezente în componența pădurilor Parcului.

Din păcate, în ultimii ani pădurea a fost defrişată în mod dramatic, doar pentru motivul de a se oferi noi terenuri pentru agricultură.

Au fost identificate pe teritoriul Parcului Natural Comana, județul Giurgiu, România, un număr de 160 taxoni de macromicete, dintre care 23 aparținând încrengăturii Ascomycota şi 131 aparținând la Basidiomycota.

Ciupercile ascomicete identificate aparțin la 4 ordine (Helotiales, Pezizales, Hypocreales, Xylariales); cel mai mare a fost ordinul Pezizales, cu 17 taxoni, dintre care 7 aparțin familiei Pezizaceae.

Cei 137 taxoni identificați din încrengătura Basidiomycota aparțin la 10 ordine. Cel mai cuprinzător a fost ordinul Agaricales, cu 75 taxoni, aparținând la 19 familii. Cea mai bogată familie din materialul nostru a fost Tricholomataceae (12 taxoni), urmată de Agaricaceae (10 taxoni) şi Lycoperdaceae (9 taxoni), apoi Marasmiaceae şi Psathyrellaceae, fiecare cu câte 6 taxoni.

Din cei 160 de taxoni, numai 55 au fost citați anterior din zonă (Popovici, 1910; Alexandri, 1932; Brândză şi Solacolu, 1932; Săvulescu, 1938; Georgescu, 1940; Gaşmet, 1940; Eliade, 1965), iar 105 reprezintă taxoni nou citați pentru Parcul Natural Comana.

Cei 160 de taxoni de Mycobiota identificați din zona cercetată au o valoare alimentară diferită: 99 specii necomestibile, 30 cu valoare alimentară redusă, 5 cu valoare alimentară medie, 16 cu o valoare alimentară foarte ridicată, 7 specii toxice (*Amanita vaginata, Coprinus atramentarius, Hypholoma fasciculare, Lactarius torminosus, Scleroderma bovista, S. cepa, S. verrucosum*), 2 specii foarte toxice (*Amanita pantherina*, *Entoloma sinuatum*) şi o specie letală (*Omphalotus olearius*).

Valoarea zonei cercetate, în afara celei ştiințifice, bio-ecologice, în general, botanice şi micologice în special, este şi peisagistică, turistică, agricolă, socială şi educativă, de aceea trebuie cunoscută, respectată şi conservată în toată varietatea şi splendoarea ei.

RÉSUMÉ: La diversité des micromycètes du Parc Naturel de Comana (Département de Giurgiu, Muntenia, Roumanie).

Le parc naturel de Comana de l'arrondissement de Giurgiu est a présent une zone protégée par le loi no. 2151/24 novembre 2004, publiée dans le Journal officiel no 38/12.01.2005. C'est une grande surface protégée depuis le sud de la plaine de la Roumanie, située entre $44^{O}10'11''N$ - $44^{O}09'25''N$ et $26^{O}00'42''E$ - $26^{O}02'28''E$. Du point de vue botanique, c'est une très importante zone: (i) il y a plusieurs plantes thermophiles, a l'extrême Nord de la zone (*Ruscus aculeatus* L.); (ii) dans ce parc, il y a différentes types de côtes xerophiles avec une végétation subthermophile, des sols salés avec une végétation spécifique, également, à la partie nord du complexe, avec la seconde zone de cannaie de la Roumanie avec la végétation aquatique et marécageuse. Le marécage de Comana a une surface de 1200 ha, ce qui indique une grande surface pour un champ; (iii) parmi les espèces protégées sur le plan international, il pourrait être mentionné: *Ruscus aculeatus* L., *Paeonia peregrina Mill*., *Convallaria majalis* L., elles appartiennent toutes à la forêt; (iv) plusieurs espèces appartenant à la liste sozologique du complexe de Comana, telle que: *Prospero paratethicum* Speta; (v) toutes les espèces autochtones de *Fraxinus* et 7 espèces de *Quercus* enregistrées en Roumania sont présentes dans la composition de la forêt depuis le parc de Comana.

Malheureusement, au courant de l'année dernière, la forêt a été dramatiquement coupée pour obtenir des champs de culture.

Il a été identifié depuis le parc naturel de Comana, à l'arrondissement de Giurgiu et à Romania, un nombre de 160 espèces de macromycètes, parmi elles 23 appartiennent au Ascomycota et 131 au Basidiomycota phylla.

Les Ascomycètes identifiées appartiennent à 4 ordres (Helotiales, Pezizales, Hypocreales et Xylariales); la plus nombreuse est l'ordre des Pezizales, comprenant 17 taxons, parmi elles 7 appartiennent à la famille des Pezizaceae.

Les 137 Basidiomycètes enregistrées appartiennent à 10 ordres. Le plus important des ordres était celui des Agaricales, avec 75 taxons, appartenant à 19 familles. La plus riche famille de notre matériel mycologique était celle de Tricholomataceae (12 taxons), suivie par Agaricaceae (10 taxons) et Lycoperdaceae (9 taxons), ensuite Psatyrellaceae et Marasmiaceae, chacune avec 6 taxons.

Parmi les 160 taxons de Mycobiota, 55 ont été déjà enregistrée et citée dans cette zone (Propovici, 1910; Alexandri, 1932; Brândză et Solacolu, 1932 ; Savulescu, 1938; Georgescu, 1940; Gasmet, 1940; Eliade, 1965), mais 105 taxons représentés sont nouvellement citées pour le parc naturel de Comana.

Les 160 taxons de Mycobiota identifiés dans notre zone d'investigation ont une valeur d'alimentation différente: 99 sont non comestibles, 30 ont une valeur d'alimentation réduite, 5 avec une valeur d'alimentation moyenne, 16 avec une valeur d'alimentation élevée, 7 espèces sont toxiques (*Amanita vaginata*, *Coprinus atramentarius*, *Hypholoma fasciculare*, *Lactarius torminosus*, *Scleroderma bovista*, *S. cepa*, *S. verrucosum*), deux sont très toxique (*Amanita pantherina*, *Entoloma sinuatum*) et une est létale (*Omphalotus olearius*).

Les valeurs de cette zone d'étude, en plus sur le plan scientifique, bio-ecologique, en général, et mycologique, est aussi un paysage, touristique, agricole, social et éducatif, et pour cette raison, cette zone doit être connue, respectée et préservée dans sa grande variété et splendeur.

INTRODUCTION

The Comana Natural Park is the Southeast natural park in Romania, with the largest area in the Romanian Plain.

The large diversity of vegetal species has been recorded even since 1974 (Tarnavschi et al., 1974), who make references of the presence of over 1250 species and subspecies of vascular plants from wetlands, forest habitats or salty grasslands from the Neajlov's meadow.

As far as the Mycobiota is concerned, only few published data exist and there are no comprehensive lists of fungi from the park, although the area of the park is situated very close to the capital, Bucharest. Mentions of some Macromycetes taxons are available in some general ecological researches performed in the specific area, but these data require field checking (Falcă et al., 2004, 2005).

The botanical research and especially the ones regarding fungi have not been systematically, and the existence of a small number of articles regarding this area led us to draw up this paper.

This report purpose is to promote mycodiversity, to offer a macromycetes list of the Comana Natural Park, published until now, and to initiate a monitoring plan of this specific group of organisms in the context of local biocoenosis in order to develop conservation measures. The investigated area has a major bio-ecological scientific value, but also a landscape, touristic, agricultural, social, educational (Picu, 2001) and economical value.

History of botanical research in the *Convallaria majalis* Reserve from the Neajlov meadow

The first data regarding dendrological flora of the Neajlov meadow are provided by Rusescu (1899 a, b; 1906; 1907), results mentioned by Lupe in the biography of this sylviculturist, ex-chief of the Comana Forest Office (Lupe, 1950).

The first data regarding flora of the Neajlov meadow are provided by Zaharia Panțu, who published a list of plant taxons in that area starting with the year 1908 (Panțu, 1908, 1910, 1912).

Later, Şerbănescu, in his study regarding grasslands of the Romanian Plain, indicates some taxons from this area (Şerbănescu, 1961). The same author published data regarding *Hordeum secalinum* Schreber, for the first time in Romania, with the indication "Călugăreni, Neajlov's meadow, for about 1 ha", a unique recording for this plant in Romania (Şerbănescu, 1957).

In the Romanian Flora publication there are some recordings of the plants from the meadow, most of them provided by Panțu (Săvulescu, 1952 - 1976). Also, A. Borza has mentioned some interesting taxons in the area of Călugăreni meadow (Borza, 1967, 1968).

During 1961 - 2001, Negrean has developed researches on the Neajlov meadow flora (16 V 1965, VI 1965, 10 IX 1965, 11 IX 1966, 11 X 1966, 18 IX 1977, VI 1998, 31 V 2000, 28 VII 2000, 8 VIII 2000). During his botanical and mycological excursions G. Negrean some critical taxons (*Fraxinus*, *Ulmus* etc.) in the investigated area have been analyzed together with other important botanists like: PhD Biologist Mihaela Paucă, PhD Forestry Eng. N. Doniță, PhD Forestry Eng. C. Bândiu and others.

History of the botanical research in the *Paeonia peregrina* Reserve to the East of the Vlad - Țepeş

This it's very limited. Besides Negrean's researches, out of which was publicated very little, are unknown dedicated writings for this zone. The indications from Romanian Flora (Săvulescu, 1952 - 1976) are too vague ("Vlad - Țepeş") and we do not know exactly the investigated forest plots.

The great diversity of vegetal species has been recorded in 1974 by the Tarnavschi et al. (1974), who mentioned the presence of more than 1250 species and subspecies of plants described from wetlands area, forest or salty grasslands from the Neajlov's River meadow. Only in the area of the lake more than 20 vegetal associations were described.

The large diversity is the result of a specific microrelief conditions and of the wet microclimate, of the lake's microdelta characteristics, with areas that are changing continuously, and of the development of salty fields in the main meadow of the Neajlov River. The flora is a specific one, containing mainly plants characteristic for plain areas, the majority of them being the herbaceous ones.

The history of mycological research

No systematic researches were implemented. Some mycological data are presented in the cited literature (Popovici, 1910; Alexandri, 1932; Brândză and Solacolu, 1932; Săvulescu, 1938; Georgescu, 1940; Gaşmet, 1940; Eliade, 1965). During the field work through forests belonging to the Natural Park Comana, G. Negrean (21 III 1972, 30 V 1976, 13 IV 1980, 20 IV 1980, 1 VI 1980, 24 XI 1980, 29 III 1981, 16 VII 1981, 30 V 1982, 11 V 1983, 25 V 1984, 5 VII 1986, 29 IX 1989, 10 V 1991, 23 V 1993, 3 VIII 2000, VI 2000, 26 III 2005, 26 V 2006) collected numerous taxons, especially micromycetes, stored in the Herbarium of the Institute of Biology in Bucharest [BUCM] and [BUC].

Some mycological data in the frame of ecological investigations of the Neajlov Holm have been obtained by Falcă et al. (2004, 2005), only as a short list of macromycetes from the flooding forests in the investigated area, and without complete citation of the locations, synonymies and other ecological aspects.

Physico-geographycal conditions of the Natural Park Comana

The Natural Park Comana was founded by the Decision of the Romanian Government no. 2151/ 30 November 2004, published in Official Monitor no. 38/12 January 2005, with a declared surface of 25000 ha, the largest protected area from the Romanian Plain. This park is composed of forest with a high conservation value of high european importance (http://www. Greenpeace.ro /images_var/soia_rr.pdf).

The boundaries of the Comana Natural Park

The Northern and North-Eastern boundary of the Comana Natural Park is situated on the existing road by the right lakeside of the Argeş river, starting with the bridge over Argeş river, next to the Goştinari village, continuing through North-West to the railway bridge from the Grădiştea village and then on the railway to Grădiştea village. From this point the limit continues through the county road no. 411, Grădiştea-Comana, to the crossroad situated at East of Budeni, from were it follows the same county road to the West, North of Budeni, Brăniştari, to the crossroad with DN (E) 70 - 85, in the Călugăreni village, and then the border follows the direction N-W to Singureni, crossing Crânguri village.

The Western boundary of the Comana Natural Park starts from Singureni village, at the crossroad of county road 411 with the stone road to Iepureşti, to the bridge over the Neajlov river, branches out on the left side to the agricultural farm residence on the farm road going to Hulubeşti, passing the farm and going to the forest belt of the upper terrace of Neajlov, that belong to the Park. The boundary continues with the outline next to the corner (100 m West of landmark no. 6, u.a. 2A, U.P. 1 Călugăreni - Strâmbeasca Forest), separating the agricultural fields and shifting the orientation towards South-West for 1.2 km, refollows the South-Eastern direction to the fountain on the hill, then goes down through the agricultural fields to the entrance in Hulubeşti, next to the old cemetery. After that the boundary follows Hulubeşti village on the N-S direction and on the another agricultural road, with the same direction, crossing with the county road 603, one kilometer before Ianculeşti village, crossing the Câlnişte River.

The Southern boundary of the park starts from the East of Ianculeşti village, at one kilometer before it, on the county road 603, passing through Uzunu village crossing with the European Road E 70 - 85, it maintains the direction until it reaches the Mihai Bravu village, next to the bridge over the Dadilovăț brook, drawing a North line to the Dadilov forest. From this point forward it continues to the South following the Dadilovăț brook's flow, to the crossroad with the railway station, which it follows in a parallel direction with the railway (Bucureşti-Giurgiu) on the Western part, crossing the railway to the agricultural farm, continuing one the same road to the pomping station at West of the Pietrele village. From here the boundary heads East, following the Southern lakeside of the Comasca Valley, South of Pietrele and Puieni villages, to the bridge from the Prundu village.

The Eastern boundary of the park starts from the bridge over the Comasca River from Prundu village and follows to the North the county road 412, to the river bed of Neajlov river, downstream of the mouth in Argeş.

The Zboiu-Măgura complex of the Comana Natural Park starts from it's Eastern boundary to the main river bed of Zboiu brook (15 m wide on the left part and 15 m long on the right part of the water flow) from the stream to the Măgura forest, then the boundary is set after the exterior limit of the Măgura forest, including it in the protected area.

Natural features

The investigated area has the following geographic coordinates: 44°10'11"N - 44°09'25"N, 26°00'42"E - 26°02'28"E.

The altitude is between 41 m on the Neajlov lakeside and aproximately 87 m, under the riverside (Fig. 1).

From the floristic point of view this specific area is important for the following reasons:

- the presence here of several termophylous plant species at the Northern limit of their global habitat (*Ruscus aculeatus* L.);
- the physico - geographical conditions allowed the development of some types of very interesting vegetation. There are in the park different types like: xerophilous hillsides with subthermophilous vegetation, salty soils with specific vegetation, also, in the Northern part of the complex, with the second reed-grass area from Romania with aquatic and marshy vegetation. The marsh Comana has a surface of 1200 ha, being a large area for a field zone;
- among the internationally protected species, it could be mentioned: *Ruscus aculeatus* L., *Paeonia peregrina* Mill., *Convallaria majalis* L., all of them belonging to the forest vegetation;
- numerous species present in the national habitat lists exist in the Comana Complex area, like *Prospero paratethicum* Speta;
- all autochthonous species of *Fraxinus* and seven species of *Quercus* recorded from the Romanian territory are present in the composition of the forests from the Park Comana. Unfortunately, during the last years, forests have been dramatically cut for obtaining new agricultural fields.

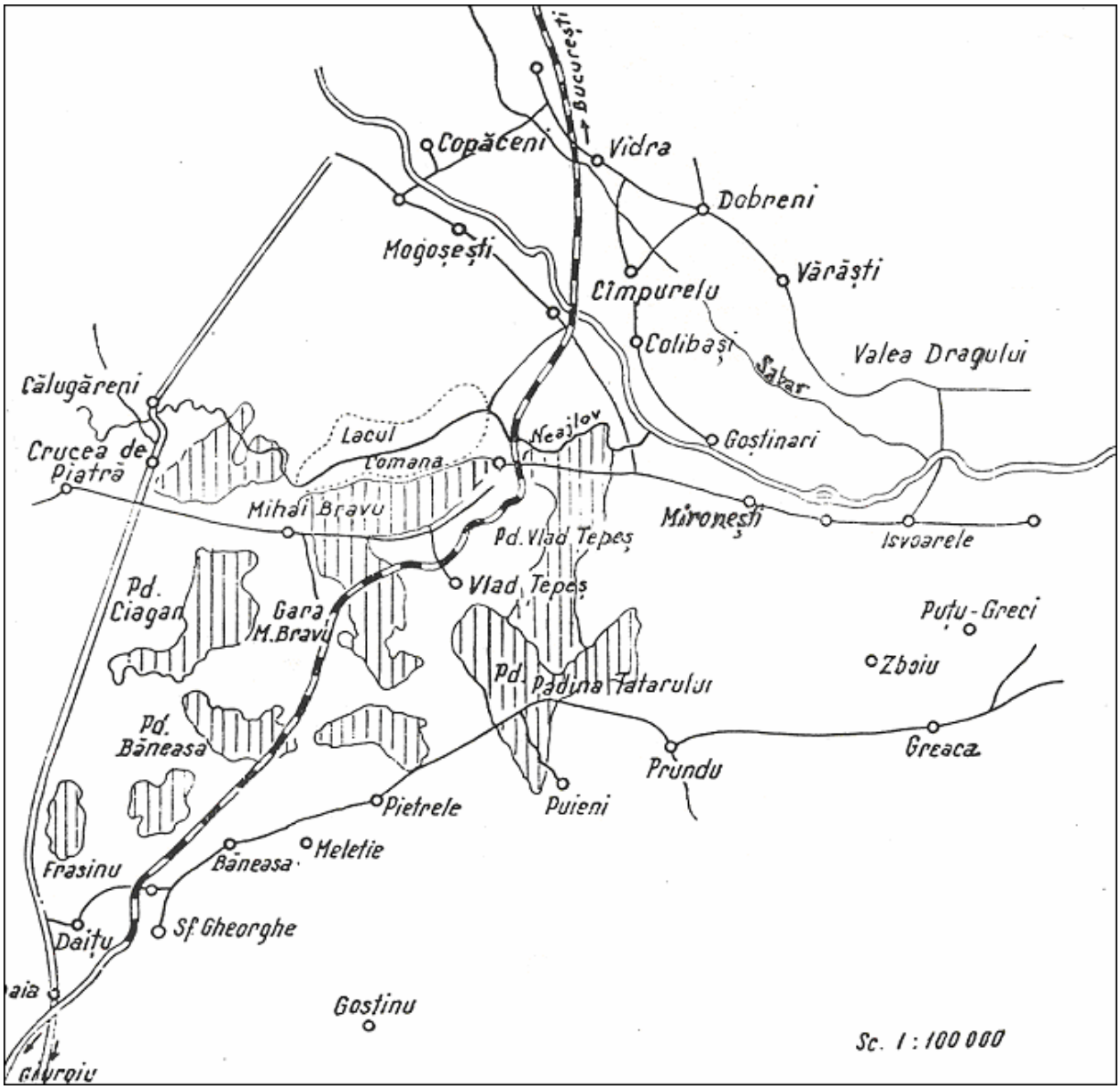

Figure 1: Map of the investigated area (based on Tarnavschi et al., 1974).

Habitat data

A part of the complex containing *Paeonia peregrina* (Padina Tătarului) and *Ruscus aculeatus* (zone Oloaga-Grădinari) has been declared natural protected area for the rare species found here, both of these species being considered threatened because of the trade on the Bucharest market.

Also, a protected area has been created at Călugăreni, Călugăreni-Fântânele part, for the protection of several interesting types of forest in the Neajlov's Meadow containing the specific riverside (*Convallaria majalis* Protection Area) and a forest protection unit containing natural mixtures of *Quercus pedunculiflora* (stejar brumăriu) and *Q. frainetto* (gârniţă), Manafu forest, at 36 km South-West of Bucharest.

Comana lake, a particular ecosystem with a surface of 1200 ha, represent the second red surface (*Phragmites communis*) in Romania, with aquatic and paludous very interesting vegetation, and numerous groups of animals with scientific importance like: *Pentroleuciscus celesti* (cleanul de Comana - in Romanian), *Umbra krameri* (ţigănuşul - in Romanian), the last one having been declared - long time ago - disappeared from the Romanian waters; amphibians, reptiles, over 140 species of birds, among them 70 protected by the Bern Convention, specific mammals and others.

MATERIALS AND METHODS

Botanical research. Observations about plants have been done and the known plants were identified in the field and were listed. The ones with critical problems were collected and identified in the laboratory. It has been built a list containing all the species found in the nature. For each taxon a list of parameters were added, based on the existing literature and personal observations.

It has been used the international abbreviation for herbaria after Holmgren et al. (1990). The critical plants have been stored in the herbaria BUCM, BUC.

The systematic used follows, with small corrections, the Romanian Flora (Săvulescu, 1952 - 1976) and Flora Europaea (Tutin et al., 1964 - 1970, 1993). Also, a 'standard' list was produced (Negrean, 1960 - 2000). We realized that the number of plant species is large in comparison with the relatively small area studied, having a uniform landscape.

Mycological research. The herbarium pieces BUCM, BUC (abbreviations of Holmgren et al., 1990) and the literature referring to the Mycobiota study developed in the area were consulted.

Various fieldwork activities were made by G. Negrean (21 III 1972, 30 V 1976, 13 IV 1980, 20 IV 1980, 1 VI 1980, 24 XI 1980, 29 III 1981, 16 VII 1981, 30 V 1982, 11 V 1983, 25 V 1984, 5 VII 1986, 29 IX 1989, 10 V 1991, 23 V 1993, 3 VIII 2000, VI 2000, 26 III 2005, 26 V 2006) and by the Mycological and Phytopathopatological Working Student Group, guided by Prof. Dr. T.E. Şesan (4 XII 2004, 10 IV 2005), activities that concluded with the collection of mycological materials. The taxons identification was executed at the site, in the case of less problematic taxons and in laboratory, taking in consideration both the collected material and the field observations. The mycologial material is stored in the collection of the Mycological Laboratory - Faculty of Biology, University of Bucharest.

Some mycological data in the frame of ecological investigations of the Neajlov Holm have been obtained by Falcă et al. (2004, 2005), only as short list of macromycetes from the flooding forests in the area, and without complete citation of the locations, synonymies, etc.

The systematic rules from the Fungi Dictionary IXth Edition (Kirk et al., 2001) has been used for Mycobiota; this edition is available on the internet at www.IndexFungorum.org

For the identifications, few handbooks, guides, monographs have been used: Phillips (1981), Breitenbach and Kränzlin (1984, 1986), Hansen and Knudsen (1992, 1997, 2000), Borgarino and Hurtado (2005), Sălăgeanu and Sălăgeanu (1985), Şesan and Tănase (2004) a.o.

The habitat data are gathered from Sălăgeanu and Sălăgeanu (1985), and completed with field observations.

It has been built a list of Macromycetes, belonging to the filla: Ascomycota and Basidiomycota, list presented in an alphabetical order. The biology, ecology, chorology data are present in the list, next to the vernacular name of the species.

The photographs are executed by: T. E. Şesan, L. Burlacu and D. Bostănel.

The Conventional signs used were gathered from Sălăgeanu and Sălăgeanu (1985): CCC = edible with a very important value; CC = edible with a large alimental value; C = edible with a small alimental value; N = not-edible mushroom; ✝✝✝ = TTT = fungi inducing lethal intoxications; ✝✝ = TT = fungi inducing intoxications of the nervous central systems; ✝ = T = fungi inducing gastro-intestinal intoxications.

Abbreviations (after Sălăgeanu and Sălăgeanu, 1985): EPx = mycetoepixilophyta (fungal life cycle development on dead wood); Ex = mycetoendoxilophyta (fungal life cycle development in the woodden plants); Gm = mycetogeophyta (mycorrhizal fungi); Gs = mycetogeophyta saprophytica (saprophytic fungi developing their mycelium in soil or in decomposing substrate); Th = mycetotherophyta (fungi with very short life, sometimes just of few hours).

RESULTS

Through the study of the Comana Natural Park a data list of the macromycota was concluded (Tab. 1), list containing 154 taxons from the Ascomycota (23 taxons) and Basidiomycota (131 taxons) filla.

Ascomycota

Aleuria albida Gill. = *Tarzetta catinus* (Holmsk.) Korf and J. K. Rogers.

Dasyscyphella crystallina (Fuckel) Raitv. = *Lachnum crystallinum* (Fuckel) Rehm.

Dasyscyphus bicolor (Bull.) Fuckel = *Lachnum bicolor* (Bull.) P. Karst.

Dumontinia tuberosa (Bull.) l. M. Kohn [*Sclerotinia tuberosa* (Hedw.) Fuckel, *Onziza tuberosa* Bull.] - Matrix: *Anemone ranunculoides* L., Comana S, Coasta lui Tudorache, 26 III 2005, G. Negrean (5433) [BUC]. In spring forms apothecium; between rhizomes of *Anemone* spp. (Hansen and Knudsen, 2000: 169). In deciduous forests, next to the *Anemone nemorosa* L., in groups among the blooming plants, frequent in spring (Breitenbach and Kränzlin, 1984: 140 - 141). Non-edible.

?*Encoelia furfuracea* (Roth) P. Karst. - on *Carpinus betulus* L., Comana SW, Comana Forest, Padina lui Vasile, in *Tilio-Carpino-Quercetum*, 44°09'33"N, 26°07'05"E, alt. 51 m, 5 VII 1986, G. Negrean [BUCM 99.177]. Saprophytic fungus on fallen branches of alder and hazel tree. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 40).

Helvella acetabulum (L.) Quél. [*Paxina acetabulum* (L.) Kunze] - on soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.171]. On calcareus soils, in deciduous forests. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 65).

Hyalinia rubella (Pers.) Nannf. (*Onziza rubella* Pers.) - on decorticated wood, Călugăreni, 21 III 1972, leg. G. Negrean, det. Adriana Pop [BUCM 117.167]. Saprophyte on bark and wood of deciduous trees, especially on *Salix* and *Populus*, summer-autumn. (Hansen and Knudsen, 2000: 211). Non-edible.

Humaria hemisphaerica (F. H. Wigg.) Fuckel - on soil, Vlad Ţepeş Forest, 1 VI 1980, leg. G. Negrean, det. Adriana Pop [BUCM 67.236]. On rich soils, through forests. VII-X. Gs, N (Sălăgeanu, 1985: 57).

Lachnum bicolor (Bull.) P. Karst. [*Dasyscyphus bicolor* (Bull.) Fuckel] - on wood, Mihai Bravu Forest, 13 IV 1980, leg. G. Negrean, det. Adriana Pop [BUCM 67.239]. On oak wood. VII-IX. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 37).

Lachnum crystallinum (Fuckel) Rehm [*Dasyscyphella crystallina* (Fuckel) Raitv.] - Mihai Bravu Forest, 13 IV 1980, leg. G. Negrean, det. Adriana Pop [BUCM 67.242]. On soil with dejections, in gardens, hotbads, substratum for mushrooms growing; since spring until autumn (Hansen and Knudsen, 2000: 65). On horse excrements, burned soil, in substratum for mushrooms growing; it's present all the year, frequent (Breitenbach and Kränzlin, 1984: 78). Non-edible.

Mitrophora semilibera (DC.) Lév. - on soil, Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.184]. On wetsoil, under poplar tree. IV-V. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 67).

Morchella esculenta (L.) Pers. - Comana Forest (Popovici, 1910; Eliade, 1965: 195). In wetsides, through gardens, parks, grasslands. IV-V. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 66).

Morchella crassipes (Vent.) Pers. [*Morchella esculenta* L.: Fr. *var. crassions* (Vent.) M.M. Moser: Pers.] - on soil, Comana W, Comana Forest, in *Quercetum*, 44°09'12"N, 26°05'52"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.188]. In wetsides, gardens, parks, grasslands. IV-V. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 66).

Nectria cinnabarina (Tode) Fr. - Comana, Comana Forest W, on *Tilia* sp., 29 III 1981, leg. R. Vallfisch, det. G. Negrean [BUCM 70.810]. On dry branches of deciduous trees and on shrubs, it's present all the year, frequent. (Breitenbach and Kränzlin, 1984: 258-259). Non-edible.

Nectria peziza Berk. [*Neuronectria peziza* (Tode) Munk] - Comana Forest V, on *Tilia tomentosa* Moench, 24 XI 1980, leg. G. Negrean, det. O. Constantinescu [BUCM 58.348]. On soft rotten wood, on old mushrooms, mosses, especially *Sphagnum*, since summer until autumn (Hansen and Knudsen, 2000: 224). Non-edible.

Neuronectria peziza (Tode: Fr.) Munk = *Nectria peziza* (Tode: Fr.) Fr.

Paxina acetabulum (L.) Kunze = *Helvella acetabulum* (L.) Quél.

Peziza cerea Sowerby - on soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.174]. On plant residues and on heaps of wastes, sometimes on rich soils. V-IX. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 52).

Peziza limnaea Maas Geesteranus [*Peziza limosa* (Grelet) Nannf.] - on rotten wood, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, 80 m, 10 V 1991, G. Negrean [BUCM 120.166]. On road margin'ss or on waste land, acid, sandy, or on argillaceous soils, under stinging nettle (*Urtica dioica*) or *Petasites*, apears in the middle of the summer, it is difficult to observed, it is possible to be more spread (Breitenbach and Kränzlin, 1984: 72). Non-edible.

Peziza limosa (Grelet) Nannf. = *Peziza limnaea* Maas Geesteranus.

Peziza rubella Pers. = *Hyalinia rubella* (Pers.) Nannf.

Peziza trachycarpa Curr. [*Plicaria pustulata* Rehm = *Plicaria trachycarpa* (Curr.) Boud.] - Comana Forest (Popovici, 1910; Eliade, 1965: 194). In burned sites, at 10-130 weeks; it is present during the hole year (Hansen and Knudsen, 2000: 66). Rare, in places with burned substratum, IX-V (Breitenbach and Kränzlin, 1984: 64). Non-edible.

Peziza tuberosa Bull. = *Dumontinia tuberosa* (Bull.) l. M. Kohn = *Sclerotinia tuberosa* (Hedw.) Fuckel

Peziza vesiculosa Bull. - on soil, Comana SW, Comana Forest, in *Quercetum*, 44°08'54"N, 26°06'33"E, alt. 85 m, 23 V 1993, G. Negrean [BUCM 126.830]. On heaps of garbage or on croped land and manured. IV-IX. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 52). On dejections, rotten straw and rich soils, during the whole year, usual, poisonous if it is not well prepared (Phillips, 1984: 269).

Plicaria pustulata Rehm = *Peziza trachycarpa* Curr.

Plicaria trachycarpa (Curr.) Boud. = *Peziza trachycarpa* Curr.

Sarcoscypha coccinea (Jacq.) Sacc. (Plate I) - frequent in early spring, on fallen branchs, matrix: *Quercus cerris* L. - on branches, Comana S, Coasta lui Tudorache, 26 III 2005, G. Negrean (5418) [BUC].

Tilia tomentosa Moench – Comana Forest W, 24 XI 1980, G. Negrean [BUCM 58.360]. On buried wood. XII-IV. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 59).

Sclerotinia tuberosa (Hedw.) Fuckel = *Dumontinia tuberosa* (Bull.) l. M. Kohn.

Scutellinia scutellata (L.) Lambotte - on soil, Comana, Gurbanului Valley, 24 XI 1980, G. Negrean [BUCM 75.670]. On rotten wood. VIII-X. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 56).

Scutellinia umbrorum (Fr.) Lambotte - On soil, Comana, at Fântana cu Nuc, 44°09'35"N, 26°06'15"E, alt. 49 m, 11 V 1983, G. Negrean [BUCM 76.352]. On wet soil, throughout forests. VII-X. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 56).

Tarzetta catinus (Holmsk.) Korf and J. K. Rogers [*Aleuria albida* Gill.*, *Pustularia catinus* (Holmsk. : Fr.) Fuckel**] - Comana Forest (Popovici 1910: *; Eliade 1965: 191*). In coniferous and deciduous forests, gardens, road margins, on waste land, acid and sandy, VI-IX, spread (Breitenbach and Kränzlin, 1984: 84**). Non-edible.

Tarzetta cupularis (L.) Svrček [*Pustularia cupularis* (L. : Fr.) Fuckel*] - on soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.170]. On argillaceous road margins, under trees, shrubs and through the grass, the most frequent on waste land, IV-X, rare (Breitenbach and Kränzlin, 1984: 86*). Non-edible.

Xylaria hypoxylon (L.) Grev. - on *Tilia tomentosa* Moench, Comana Forest, Padina lui Vasile, 24 XI 1980, G. Negrean [BUCM 58.362; BUCM 58.295]. On stumps in putrefaction. XI-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 31).

Xylaria polymorpha (Pers.) Grev. - on rotten wood, Comana Forest W, Padina cu Nuc, 24 XI 1980, G. Negrean [BUCM 58.361]. Mihai Bravu, Ciompul Forest, 44°06'03"N, 26°05'40"E, alt. 82 m, 30 V 1982, G. Negrean [72.168]. On wood, Comana, 12 IX 1989, Ecaterina Fodor [BUCM 119.607]. In *Alnus glutinosa* forest, Călugăreni-Clinceanca area (Falcă et al., 2005). On rotten wood of deciduous trees. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 31).

Basidiomycota
(**Hymenomycetes** and **Gasteromycetes**)

Acia uda subsp. *denticulata* (Pers.) Bourdot and Galzin = *Steccherinum ochraceum* (Pers.: Fr.) Gray.

Agaricus arvensis Schaeff. [*Psalliota arvensis* (Schaeff.) Fr.] - Comana Forest (Popovici, 1910, Eliade, 1965: 254). On soil, through grasslands, shrubs in the gardens. V-X. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 211).

Agaricus bisporus (J. E. Lange) Pilát [?*Agaricus hortensis* (Cooke) Pilát] - on soil, Vlad Țepeș NW, in *Robinietum*, 44°08'18"N, 26°07'03"E, alt. 85 m, 5 VII 1986, G. Negrean [BUCM 99.109]. In the grassland, in the flooding ash (*Fraxinus*) forest from the Neajlov Holm (Falcă et al., 2004). Through gardens and parks, next to roads. VI-X. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 210).

Agaricus haemorrhoidarius sensu auct.= *A. langei* (F. H. Møller and Jul. Schäff.) Maire.

Agaricus hortensis (Cooke) Pilát = *Agaricus bisporus* (J. E. Lange) Pilát.

Agaricus langei (F. H. Møller and Jul. Schäff.) Maire, syn. *Agaricus haemorrhoidarius* sensu auct., citated by the synonimy *A. haemorrhoidarius* sensu auct., without the current name by Falcă et al. (2004), from the flooding ash (*Fraxinus*) forest in the Naejlov Holm (Falcă et al., 2004). In the decidous or mixted forests, on wood, from late summer to autumn (Phillips, 1981: 160; Bielli, 1999: 180), under leaves, with good alimentary value, after Phillips, 1981: 160, but with moderation (Borgarino and Hurtado, 2005: 332). In small groups on rich soil, especially under *Picea*, more rarely under decidous trees (Hansen and Knudsen, 1992, vol. 2: 207-208). VIII-X, Gs (Sălăgeanu and Sălăgeanu, 1986: 210).

Agaricus silvicola (Vittad.) Peck - Vlad Țepeș NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.108]. On soil, through forest. V-XI. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 211).

Amanita pantherina (D. C.) Krombh. (Plate I) - in the flooding ash (*Fraxinus*) forest from Neajlov Holm (Falcă et al., 2004), recollected by Bostănel (2006). Frequently in the decidous and coniferous forests (Bielli, 1999: 52; Hansen and Knudsen, 1992: 196), from the plain to the montainous area, very toxic (Hansen and Knudsen, 1992: 196; Sălăgeanu and Sălăgeanu, 1986: 203), by the hight content of the toxin muscarine (Bielli, 1999: 52); under oaks and chest-nut trees, sometimes under conifers, autumn (Borgarino and Hurtado, 2005: 304); VII-IX, Gm (Sălăgeanu and Sălăgeanu, 1986: 203).

Amanita rubescens Pers. - Comana Forest (Popovici, 1910, Eliade, 1965: 228). on soil, through deciduous forest and pinewood. VI-X. Gm, CC (Sălăgeanu and Sălăgeanu, 1985: 205).

Amanita vaginata (Bull.) Lam. - Comana Forest (Popovici, 1910, Eliade, 1965: 228). on soil, through deciduous forest and coniferous. VI-X. Gm, ✝ (Sălăgeanu and Sălăgeanu, 1985: 202).

Aleurodiscus acerinus (Pers.) Höhnel and Litsch. = *Dendrothele acerina* (Pers.) P. A. Lemke.

Auricularia mesenterica (Dicks.) Pers. - Cross to the Stone Forest, 21 III 1972, K. Wells [BUCM 41.188, 41. 190]. On *Quercus* sp., - Comana W, Fântana cu Nuc W, in *Quercetum roboris*, 44°11'00"N, 26°07'00"E, alt. about 44 m, 3 VIII 2000, G. Negrean [BUCM]. Comana S, Coasta lui Tudorache, in *Quercetum cerris*, 26 III 2005, G. Negrean [BUCM]. On leaf - bearing wood. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 78 - 79).

Bjerkandera adusta (Willd.) P. Karst. - on trunks, Călugăreni NW, in *Quercetum*, 20 IV 1980, G. Negrean [BUCM 75.562]. On *Carpinus betulus* L., Comana Forest W, 24 XI 1980, G. Negrean [BUCM 75.847]. On wood, Comana Forest, Padina lui Vasile, 24 V 1981, G. Negrean [BUCM 75.587]. On *Quercus frainetto* Ten., Vlad Ţepeş NW, Comana Forest, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.127]. Călugăreni SE, Pădurea Fântânele, in *Querceto-Tilietum*, 44°09'48"N, 26°00'43"E, alt. 65 m, 29 IV 1989, G. Negrean [BUCM 112.092]. On wood of deciduous trees and pinewood. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 123).

Bolbitius boltonii (Pers. : Fr.) Fr. = *Bolbitius titubans* (Bull.) Fr.

Bolbitius titubans (Bull.) Fr. [*Bolbitius boltonii* (Pers.: Fr.) Fr.] - Comana Forest (Popovici, 1910, Eliade, 1965: 229). On excrements, soil with dejections, especially in grass, usualy in human habitates (Hansen and Knudsen, 1992: 271). Non-edible.

Bolbitius vitellinus (Pers.) Fr. - Mihai Bravu W, Ceagău Forest, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.817]. On manure, V-IX. Th, N (Sălăgeanu and Sălăgeanu, 1985: 225).

Boletus appendiculatus Schaeff. - in the flooding ash (*Fraxinus*) forest from Neajlov Holm (Falcă et al., 2004). Habitat with broad-leaved trees, in the decidous or mixed forests, from late summer to early autumn (Phillips, 1981: 194; Sălăgeanu and Sălăgeanu, 1986: 2709, associated with *Fagus* and *Quercus* (Hansen and Knudsen, 1992, vol. 2: 123). After Borgarino and Hurtado, 2005: 123, under *Abies* trees, on the acid soil, ebible, but not so common. VI-X, Gm, with an excellent alimentary value (Phillips, 1981: 194; Sălăgeanu and Sălăgeanu, 1986: 270).

Boletus chrysenteron Bull. [*Xerocomus chrysenteron* (Bull.) Quél.] - on soil, Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.120]. Vlad Ţepeş NV, in *Quercetum-frainetto*, 44°08'43"N, 26°06'39"E, alt. 85 m, 23 V 1993, G. Negrean [BUCM 126.833]. Frequent in all the forest in summer; in many times is parasitated by the *Hypomyces aurantius* (Pers. ex Gray) Tul. Exemple: Vlad-Ţepeş ESE, parcela 59, 7 VIII 2000, G. Negrean [BUC]. Through pinewood and deciduous forests. VII-XI. Gm, C (Sălăgeanu and Sălăgeanu, 1985: 272).

Boletus ?*queletii* Schulzer - on soil, Comana SW, Comana Forest, in *Quercetum* with *Ruscus aculeatus* L., 44°07'06"N, 26°09'34"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.171]. In grassy fields, through glades and forest's margin. VII-X. Gm, C (Sălăgeanu and Sălăgeanu, 1985: 269).

Boletus tuberaster Jacq. = *Polyporus tuberaster* (Jacq.) Fr.

Bovista aestivalis (Bonord.) Demoulin = *Lycoperdon furfuraceum* Schaeff.

Bovista dermoxantha (Vittad.) De Toni, *Bovista pusilla* (Batsch: Pers.) Pers. *Lycoperdon pusillum* Batsch, *Lycoperdon ericetorum* Pers. - in forests, Comana, VI-X (Brândză and Solacolu 1932: 21). In grassy fields, sometimes through forests. VII-X. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 298). In sandy soils, on dune, on riversides, dry meanders, stones, field, grasslands, since summer until autumn, almost cosmopolitical (Hansen and Knudsen, 1997: 333).

Bovista plumbea Pers. - in grasslands of steppe, especially in rich soils with nitrogenous substances, VIII-X, Comana Forest (Brândză and Solacolu 1932: 25-26). Commons, fields, pastures, V-X - Grădiştea (Alexandri, 1932: 83). Mihai-Bravul (Alexandri, 1932: 83). Comana, salty soils marshes, on soil, 24 XI 1980, leg. G. Negrean, det. M. Toma, G. Negrean [BUCM 58.346]. On soil, in grass, Călugăreni, Crucea de Piatră, 20 IV 1980, G. Negrean [BUCM 75.736]. On soil, between Comana and Grădiştea, in salty soils, 26 V 2006, G. Negrean [BUC]. Through pastures and hayfields. VII-X. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 294).

Bovista pusilla (Batsch : Pers.) Pers. = *Bovista dermoxantha* (Vittad.) De Toni.

Calocera cornea (Batsch) - on *Tilia tomentosa* Moench, Comana Forest (Popovici, 1910, Eliade, 1965: 199). Comana Forest W, 24 XI 1980, G. Negrean [BUCM 58.366]. On wood of deciduous trees. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 80).

Calocybe gambosa (Fr.) Singer [*Tricholoma georgii* (L.) Quél.] - Comana Forest (Popovici, 1910, Eliade, 1965: 261). On soil, Comana SE, Pădurea Dumitraşcului, Padina cu Iapa, 44°07'39"N, 26°10'52"E, alt. 87 m, 25 V 1984, G. Negrean [BUCM 82.692]. on soil, Mihai Bravu V, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 82 m, 23 V 1993, G. Negrean [BUCM 126.819]. On soil, in grassy fields, often in goups with circular forms. IV-VI. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 189).

Calvatia candida (Rostk.) Hollós - stubbles, agricultural fields, vineyards - Mihai-Bravul (Alexandri 1932: 69). On grasslandsand agricultural fields. VII-X. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 296).

Calvatia maxima (Schaeff.) Morgan = *Langermannia gigantea* (Batsch: Pers.) Rostaf.

Cantharellus aurantiacus Fr. = *Hygrophoropsis aurantiaca* (Vulfen) Maire.

Cantharellus cibarius Fr. - on soil, Comana SW, Comana Forest, Valea Adâncă, in *Tilio-Quercetum*, 44°09'28"N, 26°05'45"E, alt. 60 m, 5 VII 1986, G. Negrean [BUCM 99.141]. In groups, pinewood forests, altitudinal mountain belt. Gm, CCC (Sălăgeanu and Sălăgeanu, 1985: 142).

Chlorophyllum rhacodes (Vittad.) Vellinga [*Macrolepiota rhacodes* (Vittad.) Singer] - on sandy soil, Crânguri, Lunca Neajlovului, 16 VII 1981, G. Negrean [BUCM 73.612]. On soil, through forests, parks and bushes. VII-X. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 214). Under coniferous trees, especially spruce, often in skirts of forests, edible (Borgarino and Hurtado, 2005: 318).

Chlorophyllum rhacodes (Vittad.) Vellinga var. *hortensis* (Pilát) Wasser [*Macrolepiota rhacodes* var. *hortensis* (Pilát) Wasser] - on soil, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.820]. Under coniferous tree, especially spruce, often in skirts of forests, very indigestible, non-edible (Borgarino and Hurtado, 2005: 318).

Clavariadelphus fistulosus (Holmsk) Corner = *Macrotyphula fistulosa* (Holmsk.) R. H. Ontersen.

Clavulina cinerea (Bull.) J. Schröt. - on soil, Comana SW, Comana Forest, in *Carpino-Quercetum*, 44°08'45"N, 26°06'25"E, alt. 84 m, 5 VII 1986, G. Negrean [BUCM 99.133]. On soil, Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.137]. On soil, through wet forests. IX-XI. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 97).

Clavulina coralloides (L.) J. Schröt. [*Clavulina cristata* (Holmsk.) J. Schröt.] - on soil, Comana SW, Comana Forest, Padina lui Vasile, 44°09'33"N, 26°07'05"E, alt. 51 m, 5 VII 1986, G. Negrean [BUCM 99.166]. On soil, through deciduous forest and pinewood. VII-X. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 97-98).

Clitocybe gibba (Pers.) P. Kumm. [*Clitocybe infundibuliformis* (Schaeff.) Fr.] - Comana Forest (Popovici, 1910, Eliade, 1965: 230). On soil, through deciduous forest and pinewood. VI-IX. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 181).

Clitocybe infundibuliformis (Schaeff.) Fr. = *Clitocybe gibba* (Pers.) P. Kumm.

Clitocybe inversa (Scop.) Fr. = *Lepista inversa* (Scop.) Pat.

Collybia confluens (Pers.) P. Kumm. = *Gymnopus confluens* (Pers.) Antonín, Halling and Noordel.

Collybia dryophila (Pers. : Fr.) Quél. = *Gymnopus dryophilus* (Bull.) Murrill.

Collybia ocellata (Fr.) P. Kumm. - Comana Forest (Popovici, 1910, Eliade, 1965: 232). Gs, N (Sălăgeanu and Sălăgeanu, 1985: 183).

Collybia radicata Fr. = *Xerula radicata* (Relhan).

Coprinellus disseminatus Pers. (*Coprinus disseminatus* (Pers.) Gray) - on trunks, Comana Forest (Popovici, 1910, Eliade, 1965: 255). Mihai Bravu W, Pădurea Ceagău, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.816]. Comana Forest, VI 2000, G. Negrean. In many exemplars, disseminate of plant residues in rotting and on the lower part of trees trunks. V-X. Th, N (Sălăgeanu and Sălăgeanu, 1985: 218).

Coprinellus truncorum (Scop.) Redhead, Vilgalys and Moncalvo (syn. *Coprinus micaceus* sensu Lange, auct.) (Plate II) - on soil, Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.183]. Greaca NE, Valea Zboiul, G. Negrean [BUCM]. Comana Forest, 4 XII 2004, Team [BUC]. In groups, on soil, wood in putrefaction and on the lower part of trees trunks. V-XI. Th, N (Sălăgeanu and Sălăgeanu, 1985: 220).

Coprinopsis atramentaria (Bull.) Readhead, Vilgalys and Moncalvo (*Coprinus atramentarius* (Bull.) Fr.) - on soil, Comana SW, Comana Forest, Padina lui Vasile, in *Tilio-Quercetum*, 44°09'33"N, 26°07'05"E, alt. 51 m, 5 VII 1986, G. Negrean [BUCM 99.175]. In groups, on soil, through forests, parks and gardens. V-XI. Th, ✝ (Sălăgeanu and Sălăgeanu, 1985: 219).

Coprinopsis picacea (Bull.) Redhead, Vilgalys and Moncalvo (syn. *Coprinus picaceus* (Bull.) Gray) - on soil, Comana S, Valea Gurbanului, in *Quercetum roboris*, 26 III 2005, G. Negrean [BUCM]. Comana Forest, 4 XII 2004, Team [BUC]. On rich soils in humus, through deciduous forest. VII-X. Th, N (Sălăgeanu and Sălăgeanu, 1985: 220).

Coprinus atramentarius (Bull.) Fr. = *Coprinopsis atramentaria* (Bull.) Readhead, Vilgalys and Moncalvo.

Coprinus comatus (O. F. Müll.) Pers. - on soil, Comana, Comana Forest, 20 IX 1980, G. Negrean [BUCM 58.634]. Finding in groups on road margin's, through wreckages or ruins, parks, in spring, very common; edible (CC) only in the early stage and avoiding to consume alcohol concomitant. (Borgarino and Hurtado, 2005: 338).

Coprinus disseminatus (Pers.) Gray = *Coprinellus disseminatus* Pers.

Coprinus micaceus sensu Lange, auct. = *Coprinellus truncorum* (Scop.) Redhead, Vilgalys and Moncalvo.

Coprinus picaceus (Bull.) Gray = *Coprinopsis picacea* (Bull.) Redhead, Vilgalys and Moncalvo.

Coriolus versicolor (L.) Quél. = *Trametes versicolor* (L.) Lloyd.

Crepidotus mollis (Schaeff.) Staude - Comana Forest (Popovici, 1910, Eliade, 1965: 236). On deciduous branches, Comana SW, Comana Forest, in *Quercetum*, 44°08'54"N, 26°06'33"E, alt. 85 m, 23 V 1993, G. Negrean [BUCM 126.829]. In groups, imbricated, on wood of deciduous trees. VI-XI. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 256).

Crepidotus variabilis (Pers.) P. Kumm. - On deciduous branches, Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.124]. On wood of deciduous trees. VI-XI. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 256).

Cyathus olla (Batsch) Pers. - On organics matters in decomposition, Comana (Brândză and Solacolu 1932: 30). On soil, through agricultural fields and bushes. VII-XI. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 305).

Cyathus striatus (Huds.) Villd. - On *Tilia tomentosa* Moench, Comana Forest V, 24 XI 1980, G. Negrean [BUCM 58.359]. Vlad Ţepeş NW, Comana Forest, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.121]. On soil in Călugăreni-Clinceanca area (Falcă et al., 2005). On soil, rotten wood, fallen leaves, through deciduous forest and pinewood. VIII-XI. Ex-Gs, N (Sălăgeanu and Sălăgeanu, 1985: 305).

Cytidia salicina (Fr.) Burt - On *Salix fragilis* L., Comana Forest W, Padina cu Nuc, 24 XI 1980, G. Negrean [BUCM 58.336]. On willow tree branches and trunks, VII-X. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 110).

Dacrymyces stillatus Nees - On rotten wood, Călugăreni V, 20 IV 1980, G. Negrean [BUCM 75.638]. On coniferous wood, in altitudinal mountain belt. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 80-81).

Daedalea quercina (L.) Pers. (Plate II) - in oak forests, Comana (Gaşmet, 1954), Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.180]. On *Quercus robur* L. - Călugăreni SE, Lunca Neajlovului, *Convallaria majalis* L. Reservation, 44°10'11"N, 26°00'42"E, alt. about 45 m, 28 VII 2000, G. Negrean [BUCM]. On *Quercus robur* in flooding ash (*Fraxinus*) forest, Neajlov Holm (Falcă et. al., 2004), in *Alnus glutinosa* forest, Călugăreni-Clinceanca (Falcă et al., 2005).

In groups, imbricated, on oak wood, is an exception on another deciduous trees species. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 139).

Daedaleopsis confragosa (Bolton) J. Schröt. - On *Salix fragilis* L., Comana Forest, Padina cu Nuc, 24 XI 1980, G. Negrean [BUCM 58.357]. On wood of deciduous trees. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 139).

Dendrothele acerina (Pers.) P. A. Lemke [*Aleurodiscus acerinus* (Pers.) Höhnel and Litsch.] - on *Acer campestre* L., 26 III 2005, G. Negrean [BUCM]. On maple trees trunks. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 86).

Disciseda candida (Schwein.) Lloyd - Mihai-Bravu (Alexandri A. V. 1934: 69). Through grasslands and agricultural fields. VII-X. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 296).

Entoloma erophilus Fr. = *Entoloma plebeium* (Kalchbr.) Noordel.

Entoloma eulividum Noordel. = *Entoloma sinuatum* (Bull.) P. Kumm.

Entoloma plebeium (Kalchbr.) Noordel. (*Entoloma erophilus* Fr.) - on soil, Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'45"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.182]. Neglected by from Hansen and Knudsen (1992: 342). Non-edible.

Entoloma sinuatum (Fr.) Kumm. ss. auct. = *Entoloma sinuatum* (Bull.) P. Kumm. *Entoloma sinuatum* (Bull.) P. Kumm. [*Entoloma sinuatum* (Fr.) Kumm. ss. auct., *Entoloma eulividum* Noordel.] - Comana Forest (Popovici, 1910, Eliade, 1965: 237). In forests under *Quercus* and *Fagus*, ✝✝ (Hansen and Knudsen, 1992: 354).

Exidia plana (F. H. Wiggers) Donk [*Exidia glandulosa* (Bull.) Fr.] - Comana Forest (Popovici, 1010, Eliade, 1965: 273). On deciduous branches, Vlad Ţepeş SE, Pădurea Dumitraşcului, in *Robinietum*, 44°07'48"N, 26°08'48"E, alt. 86 m, 27 V 1984, G. Negrean [BUCM 82.670]. On *Salix fragilis* L., Comana Forest W, Padina cu Nuc, 24 XI 1980, G. Negrean [BUCM 58.365]. On *Quercus* sp., Vlad Ţepeş Forest, 1 VI 1980, G. Negrean [BUCM 57.568]. On wood of deciduous trees. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 77).

Fistulina hepatica (Schaeff.) Vith. - Comana Forest (Georgescu, 1940, Eliade, 1965: 209-210). Comana SW, Comana Forest, in *Quercetum ceris-frainetto*, 47°08'40"N, 25°06'55"E, alt. 85 m, 25 VII 1988, G. Nergrean [BUCM 109.645]. On oak wood, basal part of living trunks or on stump, producing red rot. VIII-X. Ex-EPx, C (Sălăgeanu and Sălăgeanu, 1985: 111).

Flammulina velutipes (Curtis) Singer (Plate II) - pe *Morus alba* L. cultivated, Comana, 24 XI 1980, G. Negrean [BUCM 70.836]. On *Tilia tomentosa* Moench, Comana Forest W, 24 XI 1980, leg. G. Negrean, det. M. Toma [BUCM 58.454]. On subterranean wood - Greaca NE, Valea Zboiul, 21 XI 2000, G. Negrean [BUCM]. Comana Forest, 4 XII 2004, Team [BUC]. On wood or roots, sometimes on living trunks, in groups of many exemplars in the same place. X-IV. Ex-EPx, C (Sălăgeanu and Sălăgeanu, 1985: 186).

Fomes fomentarius (L.) J. J. Kickx - On *Quercus* sp., Comana W, Fântâna cu Nuc V, in *Quercetum roboris*, 44°11'00"N, 26°07'00"E, alt. about 44 m, 28 VII 2000, G. Negrean [BUCM]. On living trunks or dries beech tree (*Fagus*) trunks. I-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 126).

Ganoderma applanatum (Pers.) Pat. (Plate II) - On rotten wood, Călugăreni, 20 IV 1980, G. Negrean [BUCM 57.518]. On *Tilia tomentosa* Moench, Comana Forest W, Padina lui Vasile, 24 XI 1980, G. Negrean [BUCM 58.351]. On *Tilia tomentosa* Moench, Călugăreni SE, Pădurea Fântânele, in *Tilio-Quercetum*, 44°09'48"N, 26°00'43"E, alt. 65 m, 28 IV 1989, G. Negrean [BUCM 112.090]. On *Tilia* sp., on wood, Comana V, Comana Forest, Padina lui Vasile, 44°09'35"N, 26°06'34"E, alt. 35 m, 10 V 1991, G. Negrean [BUCM 120.211]. On *Quercus robur* L. - Călugăreni SE, Lunca Neajlovului, *Convallaria majalis* L. Reserve, 44°10'11"N, 26°00'42"E, alt. about 45 m, 28 VII 2000, G. Negrean [BUCM]. Comana W, Fântâna cu Nuc W, in *Quercetum roboris*, 44°11'00"N, 26°07'00"E, alt. about 46 m, 3 VIII 2000, G. Negrean [BUCM]. On oak trunks, beech (*Fagus*), willows (*Salix* spp.) and plane tree (*Platanus acerifolia*). I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 132).

Ganoderma lucidum (Curtis) P. Karsten (Plate II) - Comana Forest (Eliade, 1965: 212 [BUC]). On *Tilia tomentosa* Moench, Comana Forest W, next by Padina lui Vasile, 24 XI 1980, G. Negrean [BUCM 58.363]. On wood, Comana Forest, Valea Adâncă, in *Tilio-Quercetum*, 44"09'28"N, 26"05'45"E, alt. 60 m, 5 VII 1986, G. Negrean [BUCM 99.170]. On *Tilia tomentosa* Moench, in *Querceto-Tilietum*, 44 09 48 N, 26 00 43 E, alt. 65 m, 28 IV 1989, G. Negrean [BUCM 112.094]. On *Quercus* sp. - Călugăreni SE, Lunca Neajlovului, *Convallaria majalis* L. Reserve, 44°10'11"N, 26°00'42"E, alt. about 45 m, 28 VII 2000 , G. Negrean [BUCM]. Comana Forest, 4 XII 2004, Team [BUC] (foto). In *Alnus glutinosa* forest, Călugăreni-Clinceanca area (Falcă et al., 2005). On roots and at the lower part of oak trunks, is an exception on ather essences. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 132), medicinal.

Geaster Michelius = *Geastrum.*

Geastrum ?*fimbriatum* Fr. Comana Forest, 4 XII 2004, Team [BUC] (Plate I). Through deciduous and pinewood forest. VII-X. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 299-300).

Grandinia crustosa (Pers.) Fr. = *Hyphodontia crustosa* (Onrd.) J. Erikss.

Gymnopilus junonius (Fr.) P. D. Orton - On *Quercus cerris* L., Comana SE, Pădurea Izlaz, 44°09'10"N, 26°10'32"E, alt. 85 m, 10 VIII 1993, G. Negrean [BUCM 129.930]. In large groups at the lower part of the deciduous trees or on stumps, since lately summer until early winter, common, non-edible (Phillips, 1981: 144). Non-edible.

Gymnopus confluens (Pers.) Antonin, Halling and Noordel. [*Collybia confluens* (Pers.) P. Kumm.] - on soil, Comana S, Valea Gurbanului, in *Carpino-Quercetum*, 44°09'16"N, 26°08'56"E, alt. 68 m, 10 V 1991, G. Negrean [BUCM 120.160]. Through pinewood and deciduous forests. VII-XI. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 185).

Gymnopus dryophilus (Bull.) Murril [*Collybia dryophila* (Pers.: Fr.) Quél.] - Comana Forest (Popovici, 1910, Eliade, 1965: 231). On soil, Vlad Ţepeş NW, in *Robinietum*, 44°08'18"N, 26°07'03"E, alt. 85 m, 5 VII 1986, G. Negrean [BUCM 99.111]. On soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.175]. On soil, Mihai Bravu W., Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.809]. On soil, through forests. V-XI. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 184).

Hapalopilus nidulans (Fr.) P. Karst. - On *Quercus frainetto* Ten., Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.115].

Hapalopilus rutilans (Pers.) P. Karst. [*Phaeolus rutilans* (Pers.) Pat.] - Comana Forest (Popovici, 1910, Eliade, 1965: 215). On dead wood of deciduous trees, present all the year, especially since summer until autumn, non-edible (Phillips, 1981: 224). Non-edible.

Hydnum crustosum (Pers.) Pers. = *Hyphodontia crustosa* (Pers.) J. Erikss.

Hygrophoropsis aurantiaca (Vulfen) Maire (*Cantharellus aurantiacus* Fr.) - Comana Forest (Popovici, 1910, Eliade, 1965: 225). Comana Forest, 1933 leg. V. Mocanu, det. G. Negrean [BUCM 97.114]. On wood, through pinewood forests, in mountain region. IX-XI. EPx, C (Sălăgeanu and Sălăgeanu, 1985: 182).

Hymenochaete rubiginosa (Dicks.) Lév. - on *Quercus robur* L., Comana, Comana Forest, 24 XII 1980, G. Negrean [BUCM 58.431]. On wood of deciduous trees. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 89).

Hyphodontia crustosa (Onrd.) J. Erikss. [*Grandinia crustosa* (Pers.) Fr., *Hydnum crustosum* (Pers.) Pers.] - on wood, Comana S, Valea Gurbanului, 44°09'16"N, 26°08'56"E, alt. 68 m, 10 V 1991, G. Negrean [BUCM 120.286]. On wood of deciduous and coniferous trees (Hansen and Knudsen, 1997: 212). Non-edible.

Hypholoma fasciculare (Huds.) Quél. [*Nematoloma fasciculare* (Huds. : Fr.) Karst.] - On rotten wood, Pădurea Vlad Ţepeş, 1 VI 1980, G. Negrean [BUCM 74.844]. Comana Forest W, 24 XI 1980, G. Negrean [BUCM 58.349]. On trunks, Comana, Comana Forest W, Padina lui Vasile, 24 VI 1981, G. Negrean [BUCM 75.588]. On *Quercus cerris* L., Vlad Ţepeş SE, Pădurea Dumitraşcului, in *Quercetum cerris*, 44°07'48"N, 26°08'50"E, alt. 86 m, 27 V 1984, G. Negrean [BUCM 82.688]. On wood, Călugăreni, Pădurea Fântânele, in *Querco-Tilietum tomentosae*, 44°09'51"N, 26°00'42"E, alt. 75 m, 28 IV 1989, G. Negrean [BUCM 112.088]. On *Quercus frainetto* Ten., Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'31"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.117]. Comana Forest, 4 XII 2004, Team [BUC] (Plate II). On *Fraxinus* in the flooding ash forest from Neajlov Holm (Falcă et al., 2004). On wood of deciduous trees and pinewood. IV-XII. EPx, ✝ (Sălăgeanu and Sălăgeanu, 1985: 233).

Hypsizygus ulmarius (Bull.) Redhead [?*Lyophyllum ulmarium* (Bull.) Kühner] - on living cut down timber, Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.181]. On wood of deciduous trees, especially on elm alive trunks, hornbeam tree, poplar tree and tile tree. IX-XI. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 188).

Inonotus hispidus (Bull.) P. Karst. - On *Quercus* sp., Greaca NE, Valea Zboiul, 21 XI 2000, G. Negrean [BUCM]. Solitaire or in groups on fruit tree trunks. VII-X. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 129).

Inonotus obliquus (Arch. : Pers.) Pilát - Comana Forest (Popovici, 1910, Eliade, 1965: 214). On deciduous trunks. I-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 128).

Laccaria laccata (Scop.) Fr. - Comana Forest (Popovici, 1910, Eliade, 1965: 241). Gs, C (Sălăgeanu and Sălăgeanu, 1985: 177).

Lactarius pergamenus sensu auct. = *Lactarius piperatus* (L.) Pers.

Lactarius piperatus (L.) Pers. (*Lactarius pergamenus* sensu auct.) - Comana, Comana Forest, Valea Adâncă, in *Tilio-Quercetum*, 44°09'28"N, 26°05'45"E, alt. 60 m, 5 VII 1986, G. Negrean [BUCM 99.142]. On soil, Vlad Ţepeş; NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.129]. Through deciduous and mixed forests. VII-X, Gm, C (Sălăgeanu and Sălăgeanu, 1985: 274).

Lactarius pyrogalus (Bull.) Fr. - Comana Forest (Popovici, 1910, Eliade, 1965: 242-243). Through forests and bushes, only under hazel tree. VIII-X. Gm, N (Sălăgeanu and Sălăgeanu, 1985: 278).

Lactarius torminosus (Schaeff.) Gray - Comana SW, Comana Forest, in *Carpino-Quercetum*, 44°08'45"N, 26°06'25"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.135]. Gm, ✝ (Sălăgeanu and Sălăgeanu, 1985: 276).

Lactarius vellereus (Fr.) Fr. - On soil, Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.114]. Through deciduous and mixed forests, especially in oak forest (*Quercus robur*) - durmast oak forest (*Q. petraea*) VIII-XI. Gm, N (Sălăgeanu and Sălăgeanu, 1985: 274).

Lactarius volemus (Fr.) Fr. - On soil, Comana SW, Comana Forest, in *Tilio-Quercetum*, 44°08'54"N, 26°06'25"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.136]. Through forests, especially under birch trees (*Betula*). VII-XI. Gm, C (Sălăgeanu and Sălăgeanu, 1985: 279).

Laetiporus sulphureus (Bull.: Fr.) Murrill - On *Salix* sp., Călugăreni SE, Lunca Neajlovului, *Convallaria majalis* L. Reserve, 44°10'11"N, 26°00'42"E, alt. about 45 m, 28 VII 2000, G. Negrean [BUCM]. Comana Forest, 4 XII 2004, Team [BUC]. On *Salix*, in flooding ash (*Fraxinus*) forest of the Neajlov Holm (Falcă et al., 2004). On deciduous trees wood in many superposed exemplars, united of the lower part. IV-X. Ex, C (Sălăgeanu and Sălăgeanu, 1985: 121-122).

Langermannia gigantea (Batsch) Rostk. [*Calvatia maxima* (Batsch) Lloyd] - Comana Forest, VIII-X (Brândză and Solacolu 1932: 14, Eliade, 1965: 264). On soil, Greaca E, Pădurea Măgura, in *Quercetum*, X 1985, G. Negrean [BUCM]. On *Salix* sp., Călugăreni SE, Lunca Neajlovului, 28 VII 2000, G. Negrean [BUCM]. Common in grassy rich soils, through grasslands, parks; edible in the early stage (Borgarino and Hurtado, 2005: 114).

Leccinum griseum (Quél.) Singer - On soil, Comana SW, Comana Forest, in *Carpino-Quercetum*, 44°07'06"N, 26°09'34"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.176]. Next by the *Corylus* and *Carpinus* and less by the *Quercus* or *Fagus* (Hansen and Knudsen, 1992: 65). Non-edible.

Lentinus tigrinus (Bull.) Fr. [*Panus tigrinus* (Bull.) Singer] - On *Fraxinus* sp., Pădurea Călugăreni NW, Lunca Neajlovului, 8 V 1982, G. Negrean [BUCM 70.736]. On ?*Carpinus betulus* L., Comana SSV, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.172]. On wood, Comana E, Valea Hoţilor, 44°10'20"N, 26°11'19"E, alt. 60 m, 10 VIII 1993, G. Negrean [BUCM 129.936]. Cited on *Salix*, only with the synonimy *Panus tigrinus*, without the current name after Kirk et al. (2001), in the flooding ash (*Fraxinus*) forest from Neajlov Holm (Falcă et al., 2004). It is growing in groups of ± exemplars, on stumps and wooden fragments of decidous trees, especially on *Salix* and *Populus*, from the plain to the mountain zones, from spring to autumn (Bielli, 1999: 148; Borgarino and Hurtado, 2005: 208). On wood of deciduous trees, especially willow tree and poplar tree. V-IX. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 147). It could be edible only in very early stage (Borgarino and Hurtado, 2005: 208).

Lenzites betulina (L.) Fr. [*Trametes betulina* (L.) Pil.] - Comana Forest (Gaşmet, 1954, Eliade, 1965: 220). In groups, imbricated, on wood of deciduous trees, especially on beech tree, oak tree and birch tree. IV-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 140).

Lepiota procera Scop.: Fr. = *Macrolepiota procera* (Scop.: Fr.) Singer.

Lepista inversa (Scop.) Pat. [*Clitocybe inversa* (Scop.) Fr.] - Comana Forest (Popovici, 1910, Eliade, 1965: 230). On soil, through pinewood forests. VIII-X. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 178).

Lepiota mastoidea (Fries) Kummer = *Macrolepiota mastoidea* (Fr.) Sing.

Lepista nuda (Bull.) Cooke [*Rhodopaxillus nudus* (Fr. ex Bull.) Maire] - Comana Forest (Popovici, 1910, Eliade, 1965: 256). On soil, Comana W, Comana Forest, Padina lui Vasile, 44°09'35"N, 26°06'34"E, alt. 35 m, 10 V 1991, G. Negrean [BUCM 120.187]. Through forests. IX-XI. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 199).

Lycoperdon asterospermum Durieu and Mont. - on soil, in forests, VIII-IX - Comana (Alexandri 1932: 71, Eliade, 1965: 266 [BUC]). Non-edible.

Lycoperdon atropurpureum Vittad. (*Lycoperdon molle* Pers.) - Comana (Brândză and Solacolu, 1932: 17-18, Eliade, 1965: 266). On soil, in spruce forests, is an exception through beech forests. VII-X. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 297).

Lycoperdon atropurpureum Vittad. var. *hirtellum* Peck - in leaf-mould, Comana, VI-IX (Brândză and Solacolu 1932: 17-18). Non-edible.

Lycoperdon ericetorum Pers. = *Bovista dermoxantha* (Vittad.) De Toni = *Bovista pussila* (Batsch : Pers.) Pers. *Lycoperdon pusillum* Batsch.

Lycoperdon furfuraceum Schaeff. [*Bovista aestivalis* (Bonord.) Demoulin] - Mihai-Bravul (Alexandri A. V. 1934: 67). On dune, sandylands, rocks, since summer until autumn (Hansen and Knudsen, 1997: 333). Non-edible.

Lycoperdon gemmatum Batsch = *Lycoperdon perlatum* Pers.

Lycoperdon molle Pers. = *Lycoperdon atropurpureum* Vittad.

Lycoperdon perlatum Pers. (*Lycoperdon gemmatum* Batsch) - Comana (Popovici, 1910). On soil, VIII-X - Comana (Alexandri 1932: 73). On soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.168]. In the grassland, in the flooding ash (*Fraxinus*) forest, from the Neajlov Holm (Falcă et al., 2004). Through deciduous and pinewood forest. VI-XI. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 297).

Lycoperdon pusillum Batsch = *Bovista dermoxantha* (Vittad.) De Toni.

?*Lyophyllum ulmarium* (Bull.) Kühner = *Hypsizygus ulmarius* (Bull.) Redhead.

Macrolepiota excoriata (Schaeff.) M. M. Moser - Vlad Ţepeş SE, Pădurea Dumitraşcului, in *Quercetum cerris*, 44°07'48"N, 26°08'50"E, alt. 86 m, 27 V 1984, G. Negrean [BUCM 82.694]. On soil, on agricultural fields. VIII-X. Gs, CC (Sălăgeanu and Sălăgeanu, 1985: 214).

Macrolepiota mastoidea (Fr.) Sing. (*Lepiota mastoidea* (Fries) Kummer) - Comana Forest, 4 XII 2004, Team [BUC] (Plate I). On soil, through grasslands, at forest margins. IX-X. Gs, CC (Sălăgeanu and Sălăgeanu, 1985: 214). Near frondose trees in clearings, margins of forests and parks (Hansen and Knudsen, 1992, vol. 2: 226); in open woodland, autumn, uncommon, good edibility (Phillips, 1981: 27).

Macrolepiota procera (Scop.: Fr.) Singer - on soil, Comana S, Valea Gurbanului, in *Robinietum*, VII 1988, G. Negrean [BUCM]. On soil, through forests. VII-X. Gs, CCC (Sălăgeanu and Sălăgeanu, 1985: 212).

Macrolepiota rhacodes (Vittad.) Singer = *Chlorophyllum rhacodes* (Vittad.) Vellinga.

Macrolepiota rhacodes var. *hortensis* (Pilát) Wasser = *Chlorophyllum rhacodes* (Vittad.) Vellinga var. *hortensis* (Pilát) Wasser.

Macrotyphula fistulosa (Holmsk.) R. H. Ontersen [*Clavariadelphus fistulosus* (Holmsk) Corner] - on *Tilia tomentosa* Moench, Comana Forest, 24 XI 1980, G. Negrean [BUCM 58.364]. On leafs, through deciduous forest. IX-X. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 96).

Marasmius argyropus Oudem. = *Marasimus wynnei* Berk. and Broome.

Marasmius globularis (Weinm.) Fr. = *Marasimus wynnei* Berk. and Broome.

Marasmius oreades (Bolton: Fr.) Fr. - in glades, Comana S, Coasta lui Tudorache, 1 V 1986, G. Negrean [BUCM]. On soil, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.818]. On soil, Vlad Ţepeş NV, in *Robinietum*, 44°08'18"N, 26°07'03"E, alt. 85 m, 5 VII 1986, G. Negrean [BUCM 99.110]. On soil, Comana, Comana Forest, Padina lui Vasile, in *Tilio-Quercetum*, 44°09'33"N, 26°07'05"E, alt. 51 m, 5 VII 1986, G. Negrean [BUCM 99.174]. On soil, Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.179]. On soil, Comana, 12 IX 1989, Ecaterina Fodor [BUCM 119.585]. In grassy fields, through pastures, glades, hay-fields and at forest margins. V-XI. Gp, CCC (Sălăgeanu and Sălăgeanu, 1985: 166).

Marasmius rotula (Scop.) Fr. - Comana Forest (Popovici, 1910, Eliade, 1965: 247). Vlad Ţepeş, Comana Forest, in *Querceto-frainetti*, 46°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.123]. In *Alnus glutinosa* forest, Călugăreni-Clinceanca area (Falcă et al., 2005). Through forests, on branches in putrefaction, often on leaf-moulded, too. V-X. EPx-Gs, N (Sălăgeanu and Sălăgeanu, 1985: 165).

Marasmius wynnei Berk. and Broome [*Marasmius globularis* (Weinm.) Fr.; *Marasmius argyropus* Oudem.] - Comana Forest (Popovici, 1910, Eliade, 1965: 246). In forests, grows on dead leafs, especially *Fagus* leafs (Hansen and Knudsen, 1992: 147). In groups on leafage birch, unusualy; Non-edible (Phillips, 1981: 66).

Melanoleuca langei (Boekhout) Bon (*Melanoleuca brevions* sensu NCL) - on soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.169]. Through grasslands, sometimes through forests, on heap of leaves in decomposition. IV-XI. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 196).

Mycena acicula (Schaeff.) P. Kumm. - Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.185]. On branches and fallen twings, through forests. IV-XI. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 171).

Mycena galericulata (Scop.) Gray - on soil, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 1206.813]. In groups, caespitous, on wood in putrefaction, through deciduous and pinewood forest. IV-VII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 173-174).

Mycena gypsea (Fr.) Quél. = *Mycena olida* Bres.

Mycena hiemalis sensu Cooke = *Mycena olida* Bres.

Mycena olida Bres. [*Mycena gypsea* (Fr.) Quél., *Mycena hiemalis* sensu Cooke] - Comana Forest (Popovici, 1910, Eliade, 1965: 248). On bark of trees, through oak forests, X-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 171).

Mycena rosea (Schumach.) Gramberg [*Mycena rosella* (Fr.) Kumm.] - Comana Forest, 4 XII 2004, Team [BUC] (Plate I). On fallen leaves, through coniferous forests. VIII-XI. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 170).

Mycena vitilis (Fr.) Quél. - on rotten wood, Comana SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.178]. In places with plenty leafage decompositions and on others plants rubbishes bottomed in the soil, through forests. VI-XI. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 173).

Mycenastrum corium (Gauers.) Desv. - steppe grasslands, Comana, VIII-X (Brândză and Solacolu 1932: 26). On soil, in arid fields, common, VIII-X - Mihai-Bravul (Alexandri 1932: 86). On sandy soils. VI-X. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 293).

Mycoacia denticulata (Pers.) Parmasto = *Steccherinum ochraceum* (Pers.: Fr.) Gray.

Naucoria furpuracea (Pers.) Quél. = *Tubaria furfuracea* (Pers.) Gillet

Nematoloma fasciculare (Huds. : Fr.) Karst. = *Hypholoma fasciculare* (Huds.) Quél.

Omphalotus olearius (DC.) Singer (*Pleurotus olearius* (DC.) Gillet) - on rotten wood, Comana, 28 V 1967, M. Toma, G. Negrean [BUCM 80.179]. On soil, Pădurea Vlad Ţepeş, 1 VI 1980, G. Negrean [BUCM 57.582]. On soil, Valea Gurbanului, 245 XI 1980, G. Negrean [BUCM 58.352]. On rotten trunks, Pădurea Mihai Bravu SE, 21 V 1982, G. Negrean [BUCM 70.756]. On stumps, Comana SE, Pădurea Dumitraşcului, Padina cu Iapa, 44°07'39"N, 26°10'52"E, alt. 87 m, 27 V 1984, G. Negrean [BUCM 82.693]. On *Quercus cerris* L., Vlad Ţepeş SE, Pădurea Dumitraşcului, in *Quercetum cerris*, 44°07'48"N, 26°08'50"E, alt. 86 m, 27 V 1984, G. Negrean [BUCM 82.690]. Through oak forests, on wood in putrefaction or on trees. VIII-IX. Ex-EPx, ✝✝✝ (Sălăgeanu and Sălăgeanu, 1985: 182).

Oudemansiella badia (Lucard) M. M. Moser = *Xerula pudens* (Pers.) Singer *Oudemansiella longipes* (P. Kumm.) M. M. Moser = *Xerula pudens* (Pers.) Singer.

Oudemansiella pudens (Pers.) Pegler and T.W.K. Young = *Xerula pudens* (Pers.) Singer

Oudemansiella radicata (Relhan) Singer = *Xerula radicata* (Relhan) Dörfelt.

Panaeolus papilionaceus var. *parvisporus* Ew. Gerhardt (*Panaeolus retirugis* Fr.) - Comana Forest (Popovici, 1910, Eliade, 1965: 251). In manured fields, through grasslands and at road margins. VI-X. Th, N (Sălăgeanu and Sălăgeanu, 1985: 221).

Panaeolus retirugis Fr. = *Panaeolus papilionaceus* var. *parvisporus* EV. Gerhardt.

Panus tigrinus (Bull.) Singer = *Lentinus tigrinus* (Bull.) Fr.

Paxillus filamentosus sensu auct. = *Paxillus rubicundulus* P. D. Orton.

Paxillus involutus (Batsch) Fr. - Comana Forest (Popovici, 191, Eliade, 1965: 225). On soil, through forests. VI-XI. Gm, N (Sălăgeanu and Sălăgeanu, 1985: 262).

Paxillus rubicundulus P.D. Orton (syn. *P. filamentosus* sensu auct.) - on soil in the area Călugăreni-Clinceanca, cited as *P. filamentosus* (Falcă et al., 2005). On soil, under *Alnus* (Sălăgeanu and Sălăgeanu, 1986: 262; Hansen and Knudsen, 1992, vol. 2: 54), VII-IX. Gm (Sălăgeanu and Sălăgeanu, 1986: 262). Non-edible, it is better to be avoided (Borganrino and Hurtado, 2005: 151).

Peniophora cinerea (Fr.) Cooke - on *Quercus* sp. - Comana S, Coasta lui Tudorache, 1 V 1986, G. Negrean [BUCM]. On the wood of deciduous trees. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 88).

Peniophora quercina (Pers.: Fr.) Cooke - on *Quercus pedunculiflora* Ehrh., Pădurea Mihai Bravu, 15 VII 1952, M. Ontrescu, G. Negrean [BUCM, 107.853]. On dead branches of wood of deciduous trees, especially oak tree, present in all the year, common, non-edible (Phillips, 1981: 241).

Phaeolus rutilans (Pers.) Pat. = *Hapalopilus rutilans* (Pers.) P. Karst.

Phellinus igniarius (L.: Fr.) Quél. (Plate II) - on: *Salix alba* L., rotten - Comana Forest W, 20 IV 1980, G. Negrean [BUCM 75.592]. Călugăreni, Lunca Neajlovului, 20 IV 1980, G. Negrean [BUCM 76.079]. Comana, Valea Gurbanului, 44°09'52"N, 26°09'22"E, alt. 48 m, 11 V 1983, G. Negrean [BUCM 76.356]. Comana S, Valea Gurbanului, 44°09'40"N, 26°08'58"E, alt. 49 m, 10 V 1991, G. Negrean [BUCM 120.141]. Crucea de Piatră E, Pădurea Călugăreni, lot 76, lakeside's marsh, 44°10'11"N, 26°00'42"E, alt. about 41 m, 8 VIII 2000, G. Negrean [BUCM]. On willow trunks, osier willow (*Salix fragilis*) and ash trees, attacking the heart of wood. I-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 131).

Phellinus pomaceus (Pers. ex Gray) Maire (Plate II) - on: *Prunus cerasifera* Ehrh. - Pădurea Călugăreni, 20 IV 1980, G. Negrean [BUCM 57.521]. Comana Forest W, Padina cu Nuc, 24 XI 1980, G. Negrean [BUCM 58.355]. Călugăreni SE, Lunca Neajlovului, *Convallaria majalis* L. Reserve, 44°10'11"N, 26°00'42"E, alt. about 45 m, 28 VII 2000, G. Negrean [BUCM]. Comana V, Fântâna cu Nuc V, in *Quercetum roboris*, 44°11'00"N, 26°07'00"E, alt. about 44 m, 3 VIII 2000, G. Negrean [BUCM]. Comana (W), cultivated, 26 III 2005, G. Negrean [BUC]. On plum tree trunks, rare on apple and pear trees. I-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 130).

Phellinus ribis (Schum.: Fr.) P. Karst. = *Phyllophoria ribis* (Schumach.) Ryvarden.

Phellinus robustus (Karst.) Bond. - on *Salix fragilis* L., Comana Forest, Tableland with Walnut, 24 XI 1980, leg. G. Negrean, det. M. Toma [BUCM 53.342]. On oak trunks. I-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 131).

Phyllophoria ribis (Schumach.) Ryvarden [*Phellinus ribis* (Schum.: Fr.) P. Karst.], on: *Prunus mahaleb* L. - Greaca E, Pădurea Măgura, in *Quercetum*, 21 XI 2000, G. Negrean [BUCM], on *Euonymus europaeus* L. - Pădurea Călugăreni, 16 III 1981, G. Negrean [BUCM 70.812], on *Crataegus monogyna* Jacq. - Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 46°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.131], on rotten bushes - Comana Forest, 4 XII 2004, Team [BUC]. At the lower part of deciduous trunks. I-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 130).

Pleurotus ostreatus (Jacq.) Quél. var. *pulmonarius* (Fr.) Pilát = *Pleurotus pulmonarius* (Fr.) Quél.

Pleurotus pulmonarius (Fr.) Quél. [*Pleurotus ostreatus* (Jacq.) Quél. var. *pulmonarius* (Fr.) Pilát] - Comana Forest (Georgescu, 1940, Eliade, 1965: 253). On deciduous trees species. IX-XII. Ex-EPx, CCC (Sălăgeanu and Sălăgeanu, 1985: 148).

Pleurotus spodoleucus (Fr.) Quél. - Comana Forest (Popovici, 1910, Eliade, 1965: 253). On living and dead deciduous trees, unusual on conifers; since autumn until late autumn and spring (Hansen and Knudsen, 1992: 49). Non-edible.

Pleurotus olearius (DC.) Gillet = *Omphalotus olearius* (DC.) Singer.

Pluteus cervinus P. Kumm. - on rotten wood, Vlad-Ţepeş ESE, parcela 59, 7 VIII 2000, G. Negrean [BUCM]. Through deciduous forest and pinewood, on wood in putrefaction. V-XI. EPx, C (Sălăgeanu and Sălăgeanu, 1985: 207).

Pluteus onllitus (Pers.) P. Kumm. - Comana Forest (Popovici, 1910, Eliade, 1965: 254). On beech wood in putrefaction, through beech forests. V-VIII. EPx, C (Sălăgeanu and Sălăgeanu, 1985: 207).

Polyporellus arcularius (Batsch) Fr. = *Polyporus arcularius* (Batsch) Fr.

Polyporus alveolarius (DC.) Bondartsev and Singer = *Polyporus arcularius* (Batsch) Fr.

Polyporus arcularius (Batsch) Fr. [*Polyporus alveolarius* (DC.) Bondartsev and Singer, *Polyporellus arcularius* (Batsch) Fr.] - Comana Forest (Popovici, 1910, Eliade, 1965: 217). On *Quercus frainetto* Ten., Vlad Ţepeş, Comana Forest, in *Quercetum-frainetto*, 44 08 31 N, 26 06 51^{E}, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.116]. On deciduous branches, Comana SSV, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07' 46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.177]. On deciduous branches, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.821].]. On Fraxinus in flooding ash forest from Neajlov Holm (Falcă et al., 2004). On wood of deciduous trees, especially hazel tree and ash tree. V-XII. Ex, N (Sălăgeanu and Sălăgeanu, 1985: 133).

Polyporus alveolarius (DC.) Bondartsev and Singer = *Polyporus arcularius* (Batsch) Fr.

Polyporus brumalis (Pers.) Fr. - on wood, Comana, SSW, Coasta lui Tudorache, in *Carpino-Quercetum*, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.176]. On wood of deciduous trees, especially on branches and twings. VI-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 133).

Polyporus floccopus Rostaf. - on dried trunks of forest trees, Mihai-Bravul (Săvulescu, 1938: 288). Non-edible.

Polyporus tuberaster (Jacq.) Fr. (*Boletus tuberaster* Jacq.) - on deciduous branches, Vlad Ţepeş NW, in *Quercetum-frainetto*, 44°08'43"N, 26°06'39"E, alt. 85 m, 23 V 1993, G. Negrean [BUCM 126.831]. On soil or fallen deciduous branches, sometimes connected with an pseudosclerote of 5-25 cm, deep buried in soil (Hansen and Knudsen, 1992: 53). Non-edible.

Psalliota arvensis (Schaeff.) Fr. = *Agaricus arvensis* Schaeff.

Psathyrella candolleana (Fr.) Maire - on soil, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.832]. On soil, in groups, fasciculate. VI-X. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 222).

Psathyrella piluliformis (Bull.) P.D. Orton [*Hypholoma hydrophyllum* (Bull.) Quél.] - Comana Forest (Popovici, 1910, Eliade, 1965: 240). In coniferous forests, on rich stratum of fallen leafs, since late spring until late autumn, common, edible, without alimentary value (bitter) (Phillips, 1981: 174).

Russula cyanoxantha (Schaeff.) Fr. [*Russula furcata* (Pers.) Fr.] - Comana Forest (Popovici, 1910, Eliade, 1965: 258). On soil, through deciduous and pinewood forest. VII-X. Gm, CC (Sălăgeanu and Sălăgeanu, 1985: 287).

Russula foetens (Pers.) Pers. - on soil, Vlad Ţepeş NW, Comana Forest, in *Quercetum frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 102.377]. In the flooding ash (*Fraxinus*) forest from Neajlov Holm (Falcă et al., 2004). On soil, through deciduous and pinewood forest. VI-X. Gm, N (Sălăgeanu and Sălăgeanu, 1985: 282).

Russula furcata (Pers.) Fr. = *Russula cyanoxantha* (Schaeff.) Fr.

Russula ochroleuca (Pers.) Fr. - Comana, V 1933 V. Mocanu., det. leg. G. Negrean [BUCM 97.285]. On soil, through deciduous and pinewood forest. VIII-XI. Gm, C (Sălăgeanu and Sălăgeanu, 1985: 282).

Russula rosea Pers. (*Russula* ?*lepida* Fr.) - on soil, Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.122]. On soil, through forests. VIII-IX. Gm, C (Sălăgeanu and Sălăgeanu, 1985: 286).

Russula virescens (Schaeff.) Fr. - on soil, Comana SW, Comana Forest, in *Carpino-Quercetum*, 44°08'54"N, 26°06'25"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.134]. On more or less acid soils, through deciduous and mixed forests. VII-IX. Gm, CCC (Sălăgeanu and Sălăgeanu, 1985: 286).

Schizophyllum commune Fr. - frequent in all area's Park; ex. On decidous branches, Comana S, Coasta lui Tudorache, 26 III 2005, G. Negrean [BUCM]. On cultivated *Gleditsia tricanthos* L., Călugăreni centre, 16 VII 1981, G. Negrean [BUCM 59.784]. On *Salix*, in flooding ash (Fraxinus) forest from Neajlov Holm (Falcă et al., 2004). In *Alnus glutinosa* forest, Călugăreni-Clinceni area (Falcă et al., 2005). On wood of deciduous trees and pinewood, in groups, imbricated. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 146).

Scleroderma bovista Fr. - on soil, in oak forests, VII-IX, Comana (Alexandri 1932: 102, Eliade, 1965: 270). Through deciduous forest. VII-X. Gm, ✝ (Sălăgeanu and Sălăgeanu, 1985: 310).

Scleroderma cepa Pers. - in field forests, Comana Forest (Brândză and Solacolu 1932: 27, Eliade, 1965: 270). On argillaceous soils, especially on sunny slopes, in altitudinal mountain belt. VII-XI. Gm, ✝ (Sălăgeanu and Sălăgeanu, 1985: 310). In deciduous forest, autumn (Hansen and Knudsen, 1992: 297).

Scleroderma citrina Pers. - On soil, in *Tilio - Quercetum*, 44°09'33"N, 26°07'05"E, alt. 51 m, 5 VII 1986, G. Negrean [BUCM 99.167]. Rare, through forests, grasslands, especially in acid soils; non-edible (Borgarino and Hurtado, 2005: 115).

Scleroderma verrucosum (Vaill.) Pers. - In forests, Comana (Brândză and Solacolu 1932: 27, Eliade, 1965: 270). Through deciduous forest. VII-X. Gm, ✝ (Sălăgeanu and Sălăgeanu, 1985: 310).

Secotium agaricoides (Czern.) Hollós - On soil, pastures, IV-IX, Grădiştea (Alexandri 1932: 48). In sandy fields, sunny, through grasslands steppe. VII-IX. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 292).

Sphaerobolus stellatus Tode - on wood etc., Comana, VI-IX (Brândză and Solacolu 1932: 31, Eliade, 1965: 270). On dota, through forests. VII-XI. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 306).

Steccherinum ochraceum (Pers.: Fr.) Gray [*Mycoacia denticulata* (Pers.) Parmasto = *Acia uda* subsp. *denticulata* (Pers.) Bourdot and Galzin] - on trunks, in forests, Comana S, Coasta lui Tudorache, 26 III 2005, G. Negrean (5430) [BUC]. On fallen branches to leafy trees; common, present all the year (Phillips, 1981: 241). Non-edible.

Stereum hirsutum (Villd.: Fr.) Fr., on:

Quercus sp. - frequent, ex. Comana S, Coasta lui Tudorache, in forest, 26 III 2005, G. Negrean [BUC]. Greaca E, Pădurea Măgura, 21 XI 2000, G. Negrean [BUCM].

Quercus frainetto Ten. - Vlad Ţepeş NW, Comana Forest, in *Quercetum-frainetto*, 45°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.118].

Crataegus curvisepala Lindman - Comana Forest W, 24 XI 1980, G. Negrean [BUCM 58.353]. Comana Forest (Eliade, 1965: 201-202). Pădurea Vlad Ţepeş, 24 XI 1980, G. Negrean [BUCM 57.570]. On trunks, Pădurea Mihai Bravu, 21 V 1982, G. Negrean [BUCM 70.722]. On wood, Vlad Ţepeş SE, Pădurea Dumitraşcului, in *Quercetum cerris*, 44°07'48"N, 26°08'50"E, alt. 86 m, 27 V 1984, G. Negrean [BUCM 82.698]. Comana Forest, 2 XII 2004, Team [BUC]. In *Alnus glutinosa* forest, in the area Călugăreni-Clinceanca (Falcă et al., 2005). On wood of deciduous trees. I-XII. Ex-EPx, N (Sălăgeanu and Sălăgeanu, 1985: 91).

Stropharia coronilla (Bull.) Fr. - On soil, Călugăreni SE, Pădurea Fântânele, in *Querco-Tilietum*, 44°09'48"N, 26°00'43"E, alt. 65 m, 28 IV 1989, G. Negrean [BUCM 112.093]. Comana S, Coasta lui Tudorache, 44°09'22"N, 26°08'45"E, alt. 65 m, 10 V 1991, G. Negrean [BUCM 120.165]. On soil, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126.822]. In agricultural fields and through grasslands. VII-XI. Gs, C (Sălăgeanu and Sălăgeanu, 1985: 231).

Stropharia semiglobata (Batsch) Quél. (*Stropharia stercoraria* Fr.) - Comana Forest (Popovici, 1910, Eliade, 1965: 260). On manures through grasslands. V-XI. Gs, N (Sălăgeanu and Sălăgeanu, 1985: 231).

Stropharia stercoraria Fr. = *Stropharia semiglobata* (Batsch) Quél.

Trametes betulina (L.) Pil. = *Lenzites betulina* (L.) Fr.

Trametes gibbosa (Pers.) Fr., on:

Quercus sp. - Comana Forest, 4 XII 2004, Team [BUC]. Călugăreni, VII 1999, G. Negrean [BUCM]. On dead oak wood, common, non-edible (Borgarino and Hurtado, 2005: 72).

Trametes hirsuta (Vulfen) Pilát - on trunks, Pădurea Călugăreni NW, Lunca Neajlovului, 16 VII 1981, G. Negrean [BUCM 70.731]. *Ulmus* sp., Pădurea Mihai Bravu SE, 21 V 1982, G. Negrean [BUCM 70.723]. In groups, on wood of deciduous trees. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 135).

Trametes suaveolens (L.) Fr. - on *Salix*, in the flooding ash (*Fraxinus*) forest, from Neajlov Hom (Falcă et al., 2004). It causes white rot on wood of decidous trees, rarely conifers, usually on *Salix fragilis* (Bielli, 1999: 250; Hansen and Knudsen, 1997, vol. 3: 229). In groups, imbricated, on decidous tree trunks, especially on *Salix*, I-XII, Ex-Epx, non-edible (Sălăgenau and Sălăgeanu, 1986: 136).

Trametes versicolor (L.) Lloyd [*Coriolus versicolor* (L.) Quél.] on:

Quercus sp. - frequent, ex. Comana S, Coasta lui Tudorache, in forest, 26 III 2005, G. Negrean [BUC]. Greaca NE, Valea Zboiul, 21 XI 2000, G. Negrean [BUCM]. Comana Forest, 4 XII 2004, Team [BUC] (Plate II). On wood, Comana Forest, in *Quercetum*, 26 VI 1989, Ecaterina Fodor G. Negrean [BUCM 114.395].

Quercus frainetto Ten. - Vlad Ţepeş NW, Comana Forest, 44°08'31"N, 26°06'51"E, alt. 86 m, 5 VII 1986, G. Negrean [BUCM 99.126].

Tilia tomentosa Moench - Comana Forest, 24 XI 1980, G. Negrean [BUCM 58.347].

Ulmus sp. - Pădurea Mihai Bravu SE, 21 V 1982, G. Negrean [BUCM 70.721].

Comana Forest (Eliade, 1965: 208 [BUC]). Comana Forest, 4 XII 2004, Team [BUC]. In *Alnus glutinosa* forest, Călugăreni -Clinceanca area (Falcă et al., 2005). On wood in putrefaction. I-XII. EPx, N (Sălăgeanu and Sălăgeanu, 1985: 135). Medicinal.

Tricholoma georgii (L.) Quél. = *Calocybe gambosa* (Fr.) Singer.

Tubaria furfuracea (Pers.) Gillet [*Naucoria furfuracea* (Pers.) Quél.] - Comana Forest (Popovici, 1910, Eliade, 1965: 249). On wooden branches and rubbish; present all the year, especially since autumn until early winter, common, Non-edible (Phillips, 1981: 159).

Tulostoma brumale Bertero (*Tulostoma mammosum* Vittad.) - on soil, through grass, through commons or arid fields, VIII-X - Grădiştea (Alexandri, 1932: 93). Present in sandy calcareous soils, on dune among moss, on old stones built with mortar instead of cement, autumn, rare, non-edible (Phillips, 1981: 251).

Tulostoma mammosum Vittad. (*Tulostoma brumale* Bertero).

Xerocomus chrysenteron (Bull.) Quél. = *Boletus chrysenteron* Bull.

Xerula longipes (P. Kumm.) Maire = *Xerula pudens* (Pers.) Singer.

Xerula pudens (Pers.) Singer (*Oudemansiella pudens* (Pers.) Pegler and T. W. K. Young, *Oudemansiella badia* (Lucard) M. M. Moser, *Oudemansiella longipes* (P. Kumm.) M. M. Moser / *O. longipes* (P. Kumm.) Boursier, *Xerula longipes* (P. Kumm.) Maire) - On soil at Călugăreni-Clinceanca area (Falcă et al., 2005). In parks and open forests on fertile soil, in connection with burried roots of decidous trees (*Fagus*, *Quercus*, *Corylus*), in autumn (Hansen and Knudsen, 1992, vol.2: 193); under leaves, summer-autumn, common, non-edible, it is better to be avoided (Borgarino and Hurtado, 2005: 285). After Sălăgeanu and Sălăgeanu (1986: 186), on the soil, in the decidous forests and under shubs, VIII-X, Ex-Epx.

Xerula radicata (Relhan) Dörfelt (*Collybia radicata* Fr.; *Oudemansiella radicata* (Relhan) Singer) - Comana Forest (Popovici, 1910, Eliade, 1965: 232). On soil, Comana SE, Pădurea Dumitraşcului, Padina cu Iapa, 44°07'39"N, 26°10'52"E, alt. 87 m, 27 V 1984, G. Negrean [BUCM 82.695]. On soil, Comana SSW, Coasta lui Tudorache, 44°09'11"N, 26°07'46"E, alt. 80 m, 10 V 1991, G. Negrean [BUCM 120.173]. On soil, Mihai Bravu W, Pădurea Ceagău, in *Robinietum*, 44°08'24"N, 26°01'40"E, alt. 83 m, 23 V 1993, G. Negrean [BUCM 126. 814]. On soil in the area of Călugăreni-Clinbceanca (Falcă et al., 2005). Present under or next by the deciduous trees, especially birch trees, especially on roots and buryed wood in soil; since early summer until late autumn, very common, edible, without alimentary value (Phillips, 1981: 33).

A number of 23 taxons were identified from the Ascomycota fillum (Tab. 1), belonging to 4 orders, and the order that is best represented was Pezizales, with 17 identified taxons, the largest family being the Pezizaceae family (7 taxons).

From Basidiomycota fillum have been identified 137 taxons, belonging to 10 orders. The largest one was Agaricales, with 75 taxons, belonging to 19 families. The most encountered family was Tricholomataceae (12 taxons), followed by Agaricaceae (10 spp.) and Lycoperdaceae (9 spp.), Marasmiaceae and Psatyrellaceae (6 spp.).

Table 1: Number of Macromycetes taxons belonging to different orders and families.

Fillum Class Subclass	Order	Family	Species	No. spp.	No. total
Ascomycota Ascomycetes Leomycetidae	Helotiales	Sclerotiniaceae	*Dumontinia tuberosa* *? Encoelia furfuracea*	2	2
Pezizomycetidae	Pezizales	Helvellaceae	*Helvella acetabulum*	1	17
		Morchellaceae	*Mitrophora semilibera* *Morchella crassipes* *Morchella esculenta*	3	
		Pezizaceae	*Hyalinia rubella* *Lachnum bicolor* *Lachnum crystallinum* *Peziza cerea* *Peziza limnaea* *Peziza tracheycarpa* *Peziza vesiculosa*	7	
		Pyronemataceae	*Humaria haemisphaerica* *Scutellinia scutellata* *Scutellinia umbrorum* *Tarzetta catinus* *Tarzetta cupulis*	5	
		Sarcoscyphaceae	*Sarcoscypha coccinea*	1	
Sordario-mycetidae	Hypocreales	Nectriaceae	*Nectria cinnabarina* *Nectria peziza*	2	4
	Xylariales	Xylariaceae	*Xylaria hypoxylon* *Xylaria polymorpha*	2	
Basidiomycota Basidiomycetes Agaricomycetidae	Agaricales	Agaricaceae	*Agaricus arvensis* *Agaricus bisporus* *Agaricus langei* *Agaricus silvicola* *Chlorophyllum rhacodes* *Chlorophyllum rhacodes* var. *hortensis* *Coprinus comatus* *Macrolepiota excoriata* *Macrolepiota mastoidea* *Macrolepiota procera* *Secotium agaricoides*	11	75
		Bolbitiaceae	*Bolbitius titubans* *Bolbitius vetellinus* *Panaeolus papilionaceus* var. *parvisporus*	3	
		Clavariaceae	*Macrotyphula fistulosa*	1	
		Cortinariaceae	*Crepidotus mollis* *Crepidotus variabilis* *Dendrothele acerina* *Gymnopilus confluens* *Gymnopilus dryophilus* *Gymnopilus junonius* *Tubaria furfuracea*	7	
		Entolomataceae	*Entoloma plebeianum* *Entoloma sinuatum*	2	
		Fistulinaceae	*Fistulina hepatica*	1	
		Hydnangiaceae	*Laccaria laccata*	1	

Basidiomycota Basidiomycetes Agaricomycetidae	Agaricales	Lycoperdaceae	*Bovista dermoxantha* *Bovista plumbea* *Disciseda candida* *Langermannia gigantea* *Lycoperdon asterospermum* *Lycoperdon atropurpureum* *L. atropurpureum* var. *hirtellum* *Lycoperdon furouraceum* *Lycoperdon perlatum*	9	75
		Marasmiaceae	*Flammulina velutipes* *Marasmius oreades* *Marasmius rotula* *Marasmius wynnei* *Xerula pudens* *Xerula radicata*	6	
		Mycenastraceae	*Mycenastrum corium*	1	
		Nidulariaceae	*Cyathus olla* *Cyathus striatus*	2	
		Omphalotaceae	*Omphalotus olearius*	1	
		Pleurotaceae	*Pleurotus pulmonarius* *Pleurotus spodoleucus*	2	
		Pluteaceae	*Amanita pantherina* *Amanita rubescens* *Amanita vaginata* *Pluteus cervinus* *Pluteus pellitus*	5	
		Psathyrellaceae	*Coprinopsis atramentaria* *Coprinopsis picacea* *Coprinellus disseminatus* *Coprinellus truncorum* *Psathyrella candoleana* *Psathyrella piluliformis*	6	
		Schizophyllaceae	*Schizophyllum commune*	1	
		Strophariaceae	*Hypholoma fasciculare* *Stropharia coronilla* *Stropharia semiglobata*	3	
		Tricholomataceae	*Callocybe gambosa* *Clitocybe bibba* *Collybia ocellata* *Hypsizygus ulmarius* *Lepista inversa* *Lepista nuda* *Melanoleuca langei* *Mycena acicula* *Mycena ?galericulata* *Mycena olida* *Mycena rosea* *Mycena vitilis*	12	
		Tulostomataceae	*Tulostoma brumale*	1	
	Auriculariales	Auriculariaceae	*Auricularia mesenterica*	1	1
	Boletales	Boletaceae	*Boletus appendiculatus* *Boletus chrysenteron* *Boletus ? queletii* *Leccinum griseum*	4	11
		Hygrophoropsidaceae	*Hygrophoropsis aurantiaca*	1	
		Paxillaceae	*Paxillus involutus* *Paxillus rubicundulus*	2	
		Sclerodermataceae	*Scleroderma bovista* *Scleroderma cepa* *Scleroderma citrina* *Scleroderma verrucosum*	4	

Basidiomycota Basidiomycetes Agaricomycetidae	Cantharellales	Cantharellaceae	*Cantharellus cibarius*	1	3
		Clavulinaceae	*Clavulina cinerea* *Clavulina coralloides*	2	
	Dacrymycetales	Dacrymycetaceae	*Calocera cornea* *Calvatia candida* *Dacrymyces stillatus*	3	3
	Hymenochaetale	Hymenochaetaceae	*Hymenochaete rubiginosa* *Inonotus hispidus* *Inonotus obliquus* *Phellinus igniarius* *Phellinus pomaceus* *Phellinus robustus* *Phylloporia ribis*	7	8
		Schizoporaceae	*Hyphodontia crustosa*	1	
	Phallales	Geastraceae	*Geastrum ?fimbriatum* *Sphaerobolus stellatus*	2	2
	Polyporales	Corticiaceae	*Cytidia salicina*	1	20
		Fomitopsidaceae	*Daedalea quercina*	1	
		Ganodermataceae	*Ganoderma applanatum* *Ganoderma lucidum*	2	
		Hapalopilaceae	*Bjerkandera adusta* *Hapalopilus nidulans* *Hapalopilus rutilans*	3	
		Polyporaceae	*Daedaleopsis confragosa* *Fomes fomentarius* *Laetiporus sulphureus* *Lentinus tigrinus* *Lenzites betukina* *Polyporus arcularius* *Polyporus brumalis* *Polyporus floccopus* *Polyporus tuberaster* *Trametes gibbosa* *Trametes hirsuta* *Trametes suaveolens* *Trametes versicolor*	13	
		Steccherinaceae	*Stecherrinum ochraceum*	1	
	Russulales	Peniophoraceae	*Peniophora cinerea* *Peniophora quercina*	2	13
		Russulaceae	*Lactarius piperatus* *Lactarius pyrogalus* *Lactarius torminosus* *Lactarius vellereus* *Lactarius volemus* *Russula cyanoxantha* *Russula foetens* *Russula ochroleuca* *Russula rosea* *Russula virescens*	10	
		Stereaceae	*Stereum hirsutum*	1	
Tremellomycetidae	Tremellales	Exidiaceae	*Exidia plana*	1	1

The Order Agaricales is followed by the Order Polyporales, with 20 taxons, distributed in 6 families, the most common being Polyporaceae family, with 13 taxons.

The third order is Russulales, with 13 taxons, belonging to 3 families, and the most common family was Russulaceae family, containing 10 taxons.

Ord. Boletales contains 11 spp., including the largest families Boletaceae and Sclerodermataceae, each with 4 species.

The alimentary value of mycotaxons. The 160 taxons of Mycobiota identified in the studied area have a different alimentary value: 99 taxons are not-edible, 30 have a small alimentary value; 5 of them have a medium value, 16 have a very high food value, 7 species are toxic (*Amanita vaginata*, *Coprinopsis atramentaria*, *Hypholoma fasciculare*, *Lactarius torminosus*, *Scleroderma bovista*, *S. cepa*, *S. verrucosum*), 2 is very toxic (*Amanita pantherina*, *Entoloma sinuatum*) and 1 is lethal (*Omphalotus olearius*).

Plate I: Macromycetes from the Natural Park Comana: 1a-c. *Polyporus tuberaster* (photo: L. Burlacu, 2006); 2a-b. *Amanita pantherina* (photo: D. Bostănel, 2006); 3. *Geastrum fimbriatum* (photo: T. E. Şesan, 04.12.2004); 4. *Macrolepiota mastoidea* (photo: T. E. Şesan, 04.12.2004); 5. *Mycena rosea* (photo: T. E. Şesan, 04.12.2004) G.

1a

2a

2b

1b

4

3

1c

5

Plate II: Macromycetes from the Natural Park Comana: *Sarcoscypha coccinea*, *Coprinus micaceus*, *Flammulina velutipes*, *Phellinus igniarius*, *P. pomaceus*, *Ganoderma applanatum*, *G. lucidum*, *Trametes versicolor*, *Daedalea quercina.*

Sarcoscypha coccinea
(photo: Daniela Bostănel, 24.02.2008)

Coprinopsis truncorum = *Coprinus micaceus*
(photo: L. Burlacu, 2005)

Flammulina velutipes
(photo: T. E. Şesan, 04.12.2004)

Phellinus igniarius
(photo: M. I.Radu, 2006)

Phellinus pomaceus
(photo: M. I.Radu, 2006)

Ganoderma applanatum
(photo: D. Bostănel, 2005)

Hypholoma fasciculare
(photo: T. E. Şesan, 04.12.2004)

Ganoderma lucidum
(photo: T. E. Şesan, 04.12.2004)

Trametes versicolor
(photo: T. E. Şesan, 04.12.2004)

Daedalea quercina
(photo: T. E. Şesan, 04.12.2004)

Plate III: Macromycetes from the Natural Park Comana: *Coprinopsis picacea*, *Lycoperdon perlatum*, *Marasmius oreades*, *Pluteus cervinus*, *Scleroderma verrucosum*.

Coprinopsis picacea
(photo: T. E. Şesan, 04.12.2004)

Lycoperdon perlatum
(photo: T. E. Şesan, 23.08.2002)

Marasmius oreades (photo: T.E. Şesan, 13.07.2005)

Pluteus cervinus (photo: T. E. Şesan, 13.08.2005)

Scleroderma verrucosum (photo: T. E. Şesan, 13.07.2005; Daniela Bostănel, 2006)

CONCLUSIONS

The Comana Natural Park situated in the Giurgiu District is presently a protected area according to the Government Decision no. 2151 from November 24th, 2004, published in the Official Monitor no. 38 from January 2nd, 2005.

It represents the largest protected area of the Southern part of the country, from the Romanian Plain, with the following coordinates: 44°10'11"N - 44°09'25"N and 26°00'42"E - 26°02'28"E.

From the **botanical** point of view, this studied area presents some very interesting features:

- Presence of several thermophilous plants, at the Northern limit of their global habitat (*Ruscus aculeatus* L.).
- Presence of several types of forests, xerophilous hills with subthermophilous vegetation, salty lands with specific vegetation, and also, in the Northern part of the area, the existence of the second large reed field in Romania, with interesting aquatic and swamp vegetation. The Comana Lake has a surface of 1200 ha, considered to be much extended for the plain area.
- The species with an international protection status are: *Ruscus aculeatus* L. (Butcher's broom), *Paeonia peregrina* Mill. (Romanian peony), *Convallaria majalis* L. (lily of the valley), all of them found in the forest.
- Several species from the habitat national lists exist in the Comana Complex, as for example: *Prospero paratethicum* Speta.
- All the endemic species of *Fraxinus* and seven of the *Quercus* species cited in Romania are present in the Comana forests. Unfortunately, during the last years the forest has suffered drastical cuttings, in order to obtain new agricultural fields.

From the **mycological** point of view, in the area of the Comana Natural Park, a number of 160 macromycetes taxons were identified, 23 of them beloging to Ascomycota and 137 to Basidiomycota filla, this number represent a large mycodiversity in the investigated area.

The identified Ascomycetes belong to 4 orders (Helotiales, Pezizales, Hypocreales and Xylariales); the largest one is Pezizales Order, containing 17 taxons, among them the largest one with 7 species belonging to the Pezizaceae family.

The 137 recorded Basidiomycetes taxons belong to 10 orders. The largest order was Agaricales, with 75 taxons, belonging to the 19 families. The richest family from our mycological material was Tricholomataceae (12 taxons), followed by Agaricaceae (10 taxons) and Lycoperdaceae (9 spp.), and then Psatyrellaceae and Marasmiaceae, each with 6 taxons.

Among 160 Mycobiota taxons, 55 have been previously recorded and cited from that area (Popovici, 1910; Alexandri, 1932; Brândză and Solacolu, 1932; Săvulescu, 1938; Georgescu, 1940; Gaşmet, 1940; Eliade, 1965), but 105 represent taxons new cited for the Natural Park Comana.

The 160 Mycobiota taxons identified from the investigated area have a different alimentary value: 99 are non-edible, 30 have a reduced alimentary value, 5 with a medium alimentary value, 16 with a high alimentary value, 7 species are toxic (*Amanita vaginata, Coprinopsis atramentaria, Hypholoma fasciculare, Lactarius torminosus, Scleroderma bovista, S. cepa, S. verrucosum*), 2 are very toxic (*Amanita pantherina*, *Entoloma sinuatum*) and one is lethal (*Omphalotus olearius*).

The value of the investigated area, the Natural Park Comana, is not only scientific, bio-ecological, botanical in general and mycological in particular, but also is important for the landscape, tourism, agriculture, social and educational life, and that is why it must be known, charished and protected in all its variety and beauty.

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SOME REFLECTIONS ON THE PHYTODIVERSITY OF THE FORMER DAFFODIL (*NARCISSUS RADIIFLORUS*) FIELD OF DUMBRAVA SIBIULUI (TRANSYLVANIA, ROMANIA)

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KEYWORDS: Romania, Transylvania, Dumbrava Sibiului, daffodil field, phytodiversity, restoration.

ABSTRACT

A series of testimonies show the fact that in Dumbrava Sibiului existed a huge grasland with daffodils (*Narcissus radiiflorus*) which disapeared one century ago.

Starting from the bibliographical informations and old herbariums (XVIII and XIX centuries), the author recreate an important part of the floristc inventory of this grassland, together with the daffodils were present here minimum 60 cormophites (among with *Carex flava, Carex nigra, Carex stelullata, Crocus banaticus, Fritillaria meleagris*, *Galium boreale, Gladiolus imbricatus, Molinia coerulea, Orchis incarnata, Polygonum bistorta, Salix rosmarinifolia* and *Trollius europaeus)*.

Based on the floristical structure the author belive that the forest in which the grassland with daffodils appeared, belong to the Molinio-Quercetum roboris association, and the most extensive herbal coenosis, there were in the Junco-Molinietum association, what was meen that there were very similar with those of the Dumbrava Vadului (Braşov County).

REZUMAT: Unele reflecţii asupra fitodiversităţii fostului câmp cu narcise (*Narcissus radiiflorus*) din Dumbrava Sibiului (Transilvania, România).

O serie de mărturii atestă faptul că în Dumbrava Sibiului a existat o imensă pajişte cu narcise (*Narcissus radiiflorus*) care a dispărut în urmă cu un secol.

Pornind de la informaţiile bibliografice şi de la materialele de ierbar existente în colecţii vechi (din secolele XVIII şi XIX), autorul reconstituie o bună parte din inventarul floristic al acestei pajişti în care, pe lângă narcise, creşteau alte cel puţin 60 de cormofite (între care *Carex flava, Carex nigra, Carex stelullata, Crocus banaticus, Fritillaria meleagris*, *Galium boreale, Gladiolus imbricatus, Molinia coerulea, Orchis incarnata, Polygonum bistorta, Salix rosmarinifolia, Trollius europaeus)*.

Pe baza structurii floristice autorul presupune că pădurea în care s-a dezvoltat pajiştea cu narcise aparţinea asociaţiei Molinio-Quercetum roboris, iar cenozele ierboase cele mai întinse, se încadrau la asociaţia Junco-Molinietum, ceea ce înseamnă că erau foarte asemănătoare cu cele din Dumbrava Vadului (Judeţul Braşov).

ZUSSAMENFASSUNG: Einige Betrachtungen über die Phytodiversität der ehemaligen Narzissenwiesen (*Narcissus radiiflorus*) im Jungen Wald von Sibiu/Hermannstadt (Transylvanien, Rumänien).

Eine Reihe von Zeugen bestätigen, dass im Jungen Wald bei Hermannstadt eine ausgedehnte Narzissenwiese vorkam, die vor einem Jahrhundert verschwunden ist.

Ausgehend von bibliographischen Quellen und Herbarmaterial der alten botanischen Sammlungen (XVIII. und XIX. Jahrhundert) stellt der Verfasser einen Großteil des Floreninventars dieser Wiesen wieder zusammen, in denen neben Narzissen mindestens 60 verschiedene höhere Pflanzen vorkamen. Unter ihnen finden sich *Carex flava, Carex nigra, Carex stelullata, Crocus banaticus, Fritillaria meleagris*, *Galium boreale, Gladiolus imbricatus, Molinia coerulea, Orchis incarnata, Polygonum bistorta, Salix rosmarinifolia, Trollius europaeus*.

Auf Grund der florsitischen Struktur geht der Verfasser davon aus, dass der Wald, in dem sich die Narzissenwiese befand, zur Gesellschaft Molinio-Quercetum roboris gehörte, während die größten Flächen des Grünlandes dem Junco-Molinietum zugeordnet werden konnten, was darauf hinweist, dass sie jenen von Dumbrava Vadului (Kreis Braşov) sehr ähnlich waren.

INTRODUCTION

Older botanical works, as well as herbarium collections, certify the existence of quite a large daffodil (*Narcissus radiiflorus*) field in Dumbrava Sibiului, from the 18th century onwards until the beginning of the 20th century. It used to be at the south of Sibiu and would stretch, at the middle of the 19th century, on almost 200 hectares along Valea Aurie (Goldtal) and furthermost in the Dumbrava Forest (Jungenwald), up to the village Răşinari and the Cisnădioara Forest. The perimeter measures aproximatively 6 - 7 km in length and a few hundred meters in width.

The Dumbrava Forest is a terrace oak wood that covers 1.009 hectares of land. From the old forest of 150 - 200 years ago, when daffodils would grow all over it, about forty pieces of *Quercus robur* have survived, now aged 250 - 700. The last 700 - 710 year-old oak tree, growing next to the Dumbrava Inn and measuring 1.020 cm in circumference, dried up back in 1979; yet, not far from there, near the Zoo's Boat Lake, an oak about 600 years of age still vegetates.

FINDINGS AND DISCUSSIONS

We try, with the help of older bibliography and herbariums, to restore the picture of that large and interesting field, particularly in what its phytodiversity is concerned. We can get a first glimpse of what the field looked like in the 18th century by perusing J. Lerchenfeld's herbarium (with plants that were collected - for the most part - in 1780 - 1795). Lerchenfeld collected from the daffodil field of Dumbrava Sibiului: *Cirsium rivulare, Euphorbia villosa, Oenanthe silaifolia, Polygonum bistorta, Ranunculus x silvicolus, Sagina procumbens, Salix rosmarinifolia, Sedum annum, Stellaria graminea*.

The first botanist to mention the field and cite the species *Narcissus poeticus* (s.l.) and *Fritillaria meleagris* is J. C. G. Baumgarten (in 1816). Half a century later, M. Fuss will collect (see the Fuss Herbarium of the Museum of Natural History in Sibiu) from the daffodil field the following species: *Allium angulosum, Carex elongata, Carex flava, Carex leporina, Carex nigra, Carex stelullata, Carex vesicaria, Gladiolus imbricatus, Gymnadenia conopsea, Juncus atratus, Lychnis viscaria, Orchis coriophora, Orchis laxiflora, Orchis ustulata, Ranunculus acris, Salix rosmarinifolia* and *Trollius europaeus.*

A contemporary of M. Fuss, F. Schur published in 1866 an exquisite *Transylvanian Flora*, from which we cite the following thirty-seven species from the daffodil field of Dumbrava Sibiului: *Aconitum moldavicum* (at edges), *Adenophora liliifolia, Agrostis tenuis f. hispida, Asyneuma canescens, Carex appropinquata, Carex buxbaumii, Carex flava f. patula, Carex hostiana ? (*under *C. fulva), Carex lepidocarpa, Carex remota f. subloliacea, Cerastium glomaratum f. eglandulosum, Epilobium palustre (*at edges*), Epilobium x weissenburgense, Equisetum pratense* cu *f. ramulosum, Galium boreale f. hyssopifolium, Galium palustre, Gladiolus imbricatus, Juncus atratus, Leersia oryzoides, Luzula multiflora var. pallens, Molinia coerulea ssp. littoralis, Myosotis scorpioides f. latiflora, Narcissus angustifolius* ("towards Răşinari"), *Oenanthe silaifolia, Orchis incarnata* with var. *straminea, Orobanche elatior (*under *O. scabiosae* with the mention on *Scabiosa tenuifolia* Bmg., at edges Cisnădioarei Forest, in "Daffodils Field")*, Petasites hybridus, Rhinanthus minor f. minimus, Salix rosmarinifolia* with *f. angustifolia, Taraxacum palustre, Thalictrum lucidum f. peucedanifolium, Trollius europaeus f. serotinus, Typha angustifolia f. media, Valeriana officinalis f. altissima, Veratrum album f. velutinum, Veronica serpyllifolia f. wolffiana, Viola stagnina f. microstipulata.*

Towards the end of the 19th century, in 1882 - 1883, Ormay collected from the same field (see the Herbarium of the Museum of Natural History in Sibiu): *Anemone ranunculoides, Crocus banaticus, Luzula campestris* and *Luzula pilosa*.

The last one to collect daffodils here is K. Ungar in 1905 (see the Ungar Herbarium of the Museum of Natural History in Sibiu).

It follows therefore that, in 1780 - 1905, at least 60 species of herbaceous cormophytes were studied and collected from the daffodil field of Dumbrava Sibiului. Here they are, in alphabetical order: *Aconitum moldavicum, Adenophora liliifolia, Agrostis tenuis, Allium angulosum, Anemone ranunculoides, Asyneuma canescens, Carex appropinquata, Carex buxbaumii, Carex elongata, Carex flava, Carex hostiana, Carex lepidocarpa, Carex ovalis (C. leporina), Carex nigra, Carex remota, Carex stelullata, Carex vesicaria, Cerastium glomeratum, Cirsium rivulare, Crocus banaticus, Epilobium palustre, Epilobium weissenburgense, Equisetum pratense, Euphorbia villosa, Fritillaria meleagris, Galium boreale, Galium palustre, Gladiolus imbricatus, Gymnadenia conopsea, Juncus atratus, Leersia oryzoides, Luzula campestris, Luzula multiflora, Luzula pilosa, Lychnis viscaria, Molinia coerulea, Myosotis scorpioides, Narcissus radiiflorus, Oenanthe silaifolia, Orchis coriophora, Orchis incarnata, Orchis laxiflora, Orchis ustulata, Petasites hybridus, Polygonum bistorta, Ranunculus acris, Ranunculus silvicolus, Rhinanthus minor, Sagina procumbens, Salix rosmarinifolia, Sedum annuum, Stellaria graminea, Taraxacum palustre, Thalictrum lucidum, Trollius europaeus, Typha angustifolia, Valeriana officinalis, Veratrum album, Veronica serpyllifolia* and *Viola stagnina*.

CONCLUSIONS

If we analyze the coenosis of the species mentioned in the list just above, we notice that a great majority belong to the Molinio-Arrhenatheretea Class, especially to the *Molinion* and *Agrostion stoloniferae* associations. Based on such findings, we can conclude that the daffodils of Dumbrava Sibiului used to grow in the presence of a Molinietum most likely the *Junco-Molinietum Prsg.* 1951, much like the one of Dumbrava Vadului of Braşov County (Şerbănescu, 1960; Ciobanu, 2002).

By using this plant inventory as a starting point, we can arrive at certain conclusions concerning phytocoenosis. Due to the deforestation that was done in the 18th century, the level of phreatic waters went up, and that favored the spreading of a vigorous population of daffodils (*Narcissus radiiflorus*). Exactly the same thing occurred in Dumbrava Vadului of Braşov County, where the daffodils spread until they covered a 400 - hectare area, as a result of massive deforestation that took place between the two World Wars. We possess no evidence of the presence here of wild daffodils prior to the deforestations mentioned above, despite Transylvanian botanists' having searched the area. Initially, the forest near Sibiu where the daffodils would grow was, in terms of phytocoenosis, *Molinio-Quercetum roboris*, (R. Tx. 1937; Scamoni and Passarge, 1959) - as is the case with Dumbrava Vadului of Braşov County, but later on the hornbeam (*Carpinus betulus*) proliferated, so that now the tree coenosis that dominates Dumbrava Sibiului is Querco robori - Carpinetum. In the 1970s, just a few *Molinia coerulea* were preserved of the old forest (Schneider-Binder, 1973), at the Răşinari end of Dumbrava Sibiului, facing the 'Dealul Obrejii' (i.e. the Obreja Hill).

We assume that, if one or two ten-hectare lots were deforested, the daffodils would reappear, given the favorable environmental conditions for their development. In our days, of the sixty species listed above, only nineteen are identified: *Agrostis tenuis, Anemone ranunculoides, Carex ovalis, Carex remota, Cirsium rivulare, Crocus banaticus, Galium palustre, Gymnadenia conopsea, Juncus atratus, Leersia oryzoides, Luzula campestris, Myosotis scorpioides, Petasites hybridus, Ranunculus acris, Rhinanthus minor, Stellaria graminea, Valeriana officinalis* and *Veronica serpyllifolia.*

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THE USE OF THE VEGETAL BIOFORMS IN THE BIOTOPES CHARACTERIZATION

Constantin DRĂGULESCU [1]

KEYWORDS: therophytes, hemicryptophytes and chamaephytes, vegetal bioforms, altitude coefficient, botanic indexes.

ABSTRACT

The author proposes some formulas, respectively ratioes between the therophytes and the hemicryptophytes (and the chamaephytes) for the estimation of the altitude, the degree of aridity and the intensity of the anthropic impact of the area which has been researched from floristic point of view.

The author makes a comparison between these formulas and Em. de Martone's, Hesselman's and Seleaninov's aridity or hydrothermic indexes.

REZUMAT: Utilizarea bioformelor vegetale în caracterizarea biotopurilor.

Autorul propune termeni noi, precum coeficient altitudinal, indice botanic de ariditate, cu ajutorul cărora pot fi caracterizate biotopurile. Este vorba de mai multe formule bazate pe raportul dintre terofite şi hemicriptofite sau terofite + camefite şi hemicriptofite + camefite. Valorile acestor rapoarte reflectă nivelul altitudinal la care se află aria cercetată floristic, gradul ei de ariditate şi intensitatea impactului antropic asupra fitocenozelor (biocenozelor).

Sunt prezentate corelaţiile dintre aceste formule şi indicele de ariditate şi hidrotermic ai lui Em. de Martone, Hesselman şi Seleaninov, precum şi relaţia dintre coeficientul altitudinal şi indicele botanic de ariditate.

ZUSSAMMENFASUNG: Verwendung der Lebensformen der Pflanzen für die Charakterisierung der Lebensräume.

Der Verfasser schlägt neue Begriffe wie Höhenstufenkoeffizient und botanischer Aridităţsindex vor, mit Hilfe deren die Lebensräume gekennzeichnet und beschrieben werden können. Dabei handelt es sich um mehrere Formeln, die auf dem Verhältnis zwischen Therophyten und Hemikryptophyten oder Therophyrten und Chamaephyten sowie Hemikryptophyten und Chamaephyten beruhen. Die Werte dieser Verhältnisse widerspiegeln die Höhe, in der sich das floristisch untersuchte Gebiet befindet, seinen Aridităţsgrad und die Intensität des menschlichen Einflusses auf die Phytozönosen (Biozönosen).

Es werden die Beziehungen zwischen diesen Formeln und dem Aridităţs- und hydrothermischen Index von Em. de Martonne, Hesselmann und Seleaninov vorgestellt sowie das Verhältnis zwischen dem Höhenkoeffizienten und dem botanischen Aridităţsindex.

By analyzing the cormoflora in the Sadu Valley (Meridional Carpathians) on altitudinal levels, it became clear that together with the rising of the altitude, the percentage of the hemicryptophytes diminishes, while that of the therophytes increases. This process was known to the geobotanists, but little attention was paid to it. By calculating the ratio between the therophytes and hemicryptophytes for different areas situated at different altitudes we noticed that it is approximately the same at equal altitudes and we expressed it by the altitude coefficient, respectively proposing the formula:

$$K_{alt} = \frac{T}{H}100$$

(I. Pop, C. Drăgulescu, 1983)

Afterwards (C. Drăgulescu, 1994), in the altitude coefficient formula we included also the chamaephytes, which also increase by percentage, together with the altitude, by temperatures:

$$K_{alt} = \frac{T}{H + Ch}100$$

At very high altitudes, its values are almost at zero (0), and at the lowest altitudes they exceed 100. Of course, these values are valid for the territory of Romania, respectively for the latitude of this country. Otherwise, this latitude coefficient may be used also for latitudes in the Holarctic region, due to the fact that as the latitude rises more and more, the percentage of chamaephytes and hemicryptophytes increases, while that of therophytes diminishes.

By pointing out the altitude at which the vegetal bioforms grow, this altitude coefficient shows, of course, indirectly, the climate of the region/area and also the intensity (power) of the anthropic pressure (the superior levels being more protected against the impact of the human civilization). That is why we named this ratio - at the same time - altitude, aridity and anthropisation coefficient.

In the present study we try to show the relationship between the aridity degree of different regions/areas and the vegetal bioforms spectrum. For the illustration of the aridity or humidity of the globe zones there were proposed different calculating formulas. Thus, for the calculation of a region's aridity (or humidity) R. Lang (1915) proposed the ratio value between the annual precipitation and the annual temperature average (T). He named this ratio rain factor. But, because in the case of the annual average temperatures equal with zero or negative this ratio tends towards infinite or has negative values, Em. de Martonne (1926) rectified the formula under the aspect P/T+10 and named the ratio aridity index. A similar formula was proposed by T. G. Seleaninov (1976) for the hydrothermic index. This represents the amount of the precipitation from the vegetation period multiplied by 10 and divided by the sum of the same period.

$$ITH = \frac{\sum P + 10}{\sum T}$$

The majority of specialists used to calculate the aridity Em. de Martonne's aridity index. But, because the aridity depends directly by the rising of the temperature and it is indirectly proportional with the precipitation quantity H. Hesselman, rightly, names this index, humidity index and for the aridity calculation, he uses the opposite ratio of the French geographer, although

$$I_a = \frac{T + 10}{P}$$

To these modes to evaluate the aridity degree of a region, we add another one by which we wish to show that the vegetal bioforms may indicate very well the aridity degree of the area on which they grow. This fact was firstly pointed out by A. Grisebach (1872), who defined the climatic content of vegetal bioform notion. C. Raunkiaer (1905, 1918) carried out a classification system of the bioforms and

even a division of the Terra into four great phytoclimates: the phanerophytical climate (specific to wet equatorial and tropical regions), the hemicryptophytical climate (specific to non-arid temperate regions), the therophyitical climate (specific to arid tropical and temperate regions) and the chamaephytical climate (specific to polar regions and upper mountains levels). By taking over this C. Raunkiaer's idea and by analyzing it through the point of view of the personal observations and results (calculations), we reached the conclusion that it may be possible to speak about an aridity botanical index which is nothing but the ratio between the therophytes and chamaephytes, on one side, and between the hemicryptophytes and chamaephytes on the other side:

$$I_{ba} = \frac{T(T+Ch)}{H(H+Ch)}100$$

We inserted the chamaephytes into the formula both at the denominator and at the numerator because their percentage is great, both in humid regions (around the poles and on the top of the mountains), and in arid regions (deserts) in both cases being able to exceed 20% from the whole cormoflora. This botanic aridity index has values between zero (0) (at the poles and in the nival/snowy/level) and 2000 (in the warm deserts). On the Romanian territory it varies together with the altitude between zero (in the Carpathians' alpine) and 180 (in the steppe). It is apparent that between the botanic aridity index and the aridity climatic index and also the altitude coefficient there is a concordance, a directly proportional ratio, all three decreasing together with the altitude increasing. This happens when/if/ the aridity climatic index is calculated using H. Hesselman's formula or using a new formula proposed by us:

$$I_a = \frac{T+10}{P}100$$

We use this formula for the uniformity with the aridity botanic index and the altitude coefficient which, they too, have the numerator multiplied with 100 and get supraunitary values (the most of them) of the aridity index. For Romania the climatic index - using our formula - have values between about 0.5 (mountain nival/ snowy/levels) and 6 (Dobrogea). If this index cannot be calculated due to the lack of meteorological information, it may be found out (appreciated) with the help of the altitude coefficient (the ratio between the therophytes and hemicryptophytes). For this purpose we propose the formula:

$$I_a = \frac{K_{alt}}{Alt_{\max} - Alt_{loc}}100$$

where Alt-max represents the maximum altitude of the Romanian Carpathians (in our case), and Alt-loc is the altitude of the area for which we want to calculate the altitude index. For Romania the precise formula is:

$$I_a = \frac{K_{alt}}{2544 - Alt_{loc}}100$$

Therefore, we can - indirectly, too - establish the aridity index of a place/an area/ by relying on the ratio between the vegetal bioforms (respectively, the altitude coefficient). More, we can even find out the aridity botanic index and the relationship between it and the aridity climatic index and the altitude coefficient by using the formula:

$$I_{ba} = \frac{I_a K_{alt}}{5}$$

The formulas proposed by us have an important practical value, not only for the aridity estimation of some zones/areas/ with the help of the vegetal bioforms, but also, to find out the ratio (K-alt) between therophytes and hemicryptophytes, if we know the aridity climatic index value:

$$K_{alt} = \frac{T}{H}100 = I_a\left(\frac{2544 - Alt_{loc}}{100}\right)$$

Therefore, knowing the aridity index and the altitude of a place/an area/ we can appreciate (by soundings or calculations) even the therophytes and hemicryptophytes percentage of that place/area.

Finally, we mention that the indexes and coefficients were calculated to a great extent by using the meteorological values of some stations situated at different altitudes and the botanic information from the specialty studies. For the altitudes for which the data missed either the aridity indexes or the altitude coefficients were established with the help of the above mentioned formulas. Of course, calculating errors may occur by the meteorological measurements inexactitude or by the insufficient botanic research of the involved zone/area.

We must take into account that when we study the flora and climate of some localities (anthropic or anthropised ecosystems) the values of the altitude coefficient (Kalt) and aridity botanical index (Iba) are greater due to the percentage of therophytes, respectively ruderal and segetal species. These values will indicate smaller altitudes than in reality. As a matter of fact, the bioforms indicate the real aridity degree of the artificial ecosystems, which is larger than in the case of natural ecosystems, lied at some altitude.

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ASPECTS REGARDING THE ROLE OF TERRESTRIAL GASTROPODS (*HELIX POMATIA* LINNAEUS, 1758) IN DISSEMINATION OF THE PARASITE *TOXOPLASMA GONDII* NICOLLE AND MANCEAUX, 1908

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KEYWORDS: *Toxoplasma gondii*, zoonosis, *Helix pomatia,* parathenic host.

ABSTRACT

Parasitary zoonosis, toxoplasmosis affects all bird and mammal species, including humans. The major contamination ways are the ingestion of cysts and pseudo cysts from infected meat and ingestion of food and water contaminated with oocysts released by the definitive hosts (mostly cats). Some invertebrates as earthworms, cockroaches and flies are known as parathenic hosts. This paper investigates the presence of *Toxoplasma gondii* cysts and pseudo cysts in a terrestrial gastropod species, *Helix pomatia*. Toxoplasma and Toxoplasma like cysts were found in foot and digestive gland, and pseudo cysts in mantle. There was a considerably higher contamination in individuals from anthropic environments. Considering the snail's position in the terrestrial food chains, toxoplasmosis can be passed though them in bird and mammal species, including humans. We also consider that terrestrial gastropods can be used as bioindicator of the parasite's environmental presence.

REZUMAT: Aspecte referitoare la rolul gastropodelor terestre (*Helix pomatia* Linnaeus, 1758) în diseminarea parazitului *Toxoplasma gondii*.

Zoonoză parazitară, toxoplasmoza afectează toate speciile de păsări şi mamifere, inclusiv omul. Principalele căi de contaminare sunt reprezentate de ingestia de chişti şi pseudochişti din carnea infestată, precum şi consumul de alimente şi apă infestate cu oochişti eliminați de gazdele definitive (pisici). Unele nevertebrate, cum este cazul lumbricidelor, blatodeelor şi a dipterelor brahicere, sunt cunoscute ca şi gazde paratenice. Lucrarea investighează prezența chiştilor şi pseudochiştilor de *Toxoplasma gondii* la o specie de gastropod terestru, *Helix pomatia*. Au fost identificați chişti de Toxoplasma şi Toxoplasma like în picior şi glanda digestivă, şi pseudochişti în manta. S-a înregistrat o contaminare semnificativ mai mare la indivizii proveniți din medii antropizate. Având în vedere poziția gastropodelor în lanțurile trofice terestre, aceştia pot reprezenta o sursă de infecție cu Toxoplasma pentru păsări şi mamifere, inclusiv om. Considerăm de asemenea că gastropodele terestre pot fi utilizate ca bioindicatori ai prezenței parazitului în mediu.

RESUME: Aspects concernant le rôle des gastropodes terrestres (*Helix pomatia* Linnaeus, 1758) dans la dissémination du parasite *Toxoplasma gondii.*

Zoonose parasitaire, la toxoplasmose affecte toutes les espèces d'oiseaux et mammifères, y compris l'homme. Les principales voies de transmission sont représentes par l'ingestion de cysts et pseudo cysts avec l'eau infestée mai aussi la consommation des aliments et de l'eau infeste par les oocystes releases par les chats - la hôte définitif. Quelques invertébrées comme les vers de terre et les mouches sont porteurs. La recherche a comme sujet la présence des cysts et pseudo cysts de *Toxoplasma gondii* dans les tissues d'une espèce de gastropode terrestre *Helix pomatia*. Ont été identifies Toxoplasma et Toxoplasma like cysts dans le pied et la glande digestive, et des pseudo cysts dans le manteau. La contamination est beaucoup plus importante dans les individus provenant des endroits anthropiques. A cause de leur position dans les réseaux trophiques terrestres, les gastropodes peuvent représentes des source d'infection pour des oiseaux et mammifères, homme y compris, et aussi peuvent être utilises comme des indicateurs pour la présence du parasite dans le milieux.

INTRODUCTION

Toxoplasmosis, a parasitary zoonosis with severe social and medical effects, affect all species of mammals and birds. Produced by *Toxopalasma gondii* Nicolle and Manceaux, 1908, this disease is encountered on the entire globe, with variable frequency, conditioned by numerous socio-economical, ecological, etc. factors (Şuteu and Cozma, 1998, Tenter et al., 2000).

The human population is 15-85% seropositive to *T. gondii* - depending on the area (Jackson and Hutchinson, 1989). The ingestion of cysts and pseudo cysts from infected meat coming from intermediary hosts, which is insufficiently heated, and ingestion of food and water contaminated with oocysts released in the feces of definitive hosts are the two main ways of contamination (Dubey et al., 1997). Experimental transmission of the parasite from some Felidae species and the large quantity of antitoxoplasma antibodies in these species (Choi et al. 1987), demonstrate that felids are definitive hosts for *T. gondii*.

The main role in the environmental pollution with oocysts is played by Felidae, especially by cats. In the patent period over 10^6 oocysts per gram of feces are released (Fayer, 1981 ap. Şuteu et Cosma 1998).

Oocysts released in the Felidae feces are disseminated in the environment by wind, water, lumbricides and other invertebrates. In this way they can contaminate superficial waters, soil, fruits and vegetables that are in contact with the soil (Dubey, 1970 a; Frenkel, 1975; Smith, 1978; Ruiz, 1980; Dubey, 1988; Dumètre, 2003). The presence of oocysts in these environments (substrata) is suspected based on indirect evidence (grouped cases or epidemics having as source water, soil, contamination of herbivore animals, birds, etc.). There are few studies aiming the identification of oocysts in these substrata, except for the soil.

Despite that *Toxoplasma gondii* is not known as a parasite in invertebrates or ectothermic vertebrates there are a series of experimental evidence, especially from invertebrates, of their oocysts concentration capacity. For example, in marine environment filtrating animals can play this role (David et al., 2004). Marine bivalves are considered responsible for contamination with *Toxoplasma* of the hydras (*Enhydra lutris nereis),* the parasite being susceptible of 17% of the mortality recorded in this species (Miller et al. 2002, Conrad et al., 2005).

This study aimed the identification of Toxoplasma-like parasites in different tissues from *Helix pomatia*, considering that terrestrial gastropods are organisms of first contact with infested material from soil and from the plants they feed on. Thus, this species can be used as an indicator of the parasite's presence in the environment. Besides, considering that *H. pomatia* is one of the most commonly used snail species in human diet, it may also represent a direct contamination source for humans.

MATERIALS AND METHODS

Tissue samples (leg, mantle, digestive gland and ovotestis) were collected from *Helix pomatia* individuals from different locations. Some of the gastropods came from a very anthropic area in the centre of Copşa Mică locality, while the rest came from an area outside localities (from a forest between Cristian and Săcel in Sibiu County). The samples were histologically processed and coloured using HE method, being examined with Zeiss Axioscop 40 microscope.

RESULTS AND DISCUSSIONS

In the individuals collected from the forest skirt cysts and pseudocysts were identified only in the leg and the mantle (Figs. 1, 3). In the individuals from Copşa Mică *Toxoplasma*-like cysts were identified in a high number in the leg and the mantle and in a lower proportion in the digestive gland (Figs. 2, 4, 5). In the hermaphrodite gland (ovotestis) no parasite forms were identified.

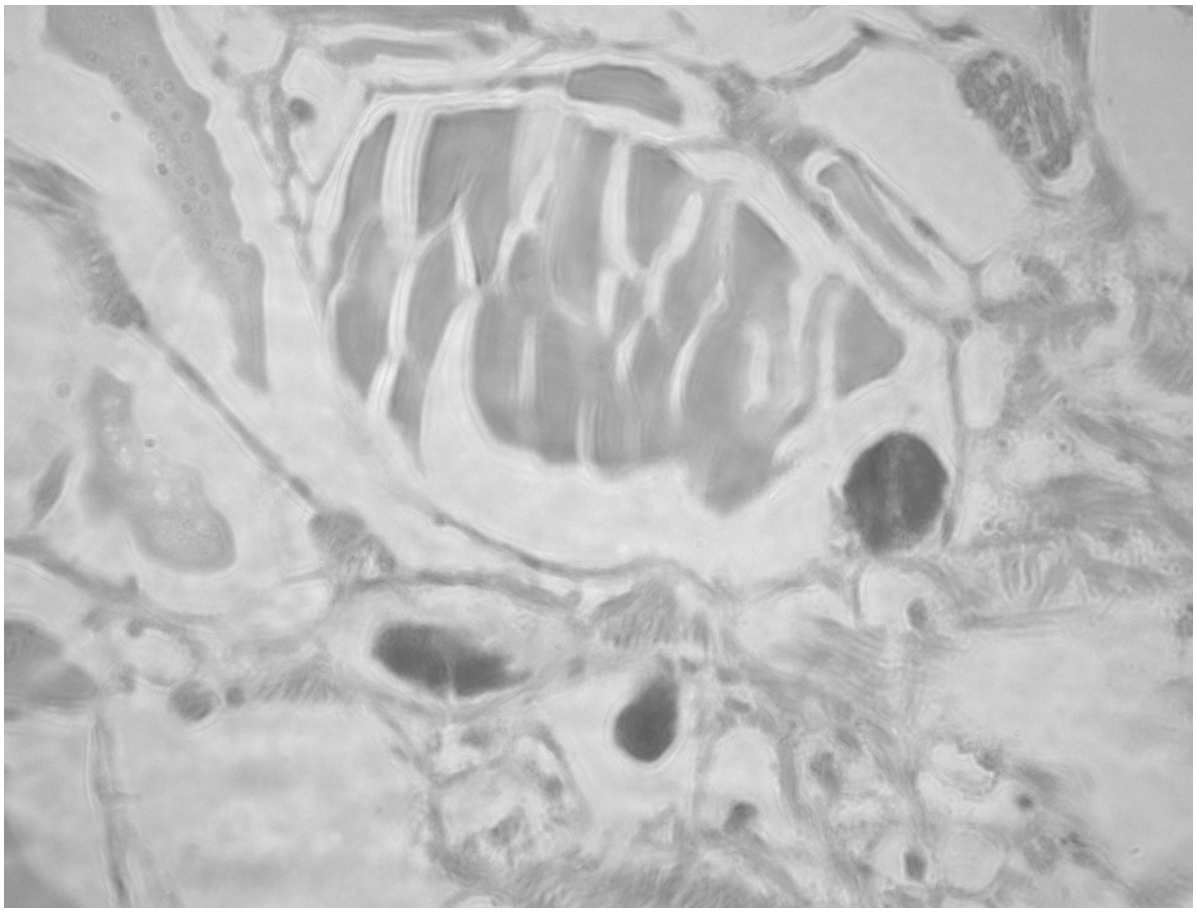

Figure 1: *Toxoplasma*-like pseudocysts in the mantle (200X).

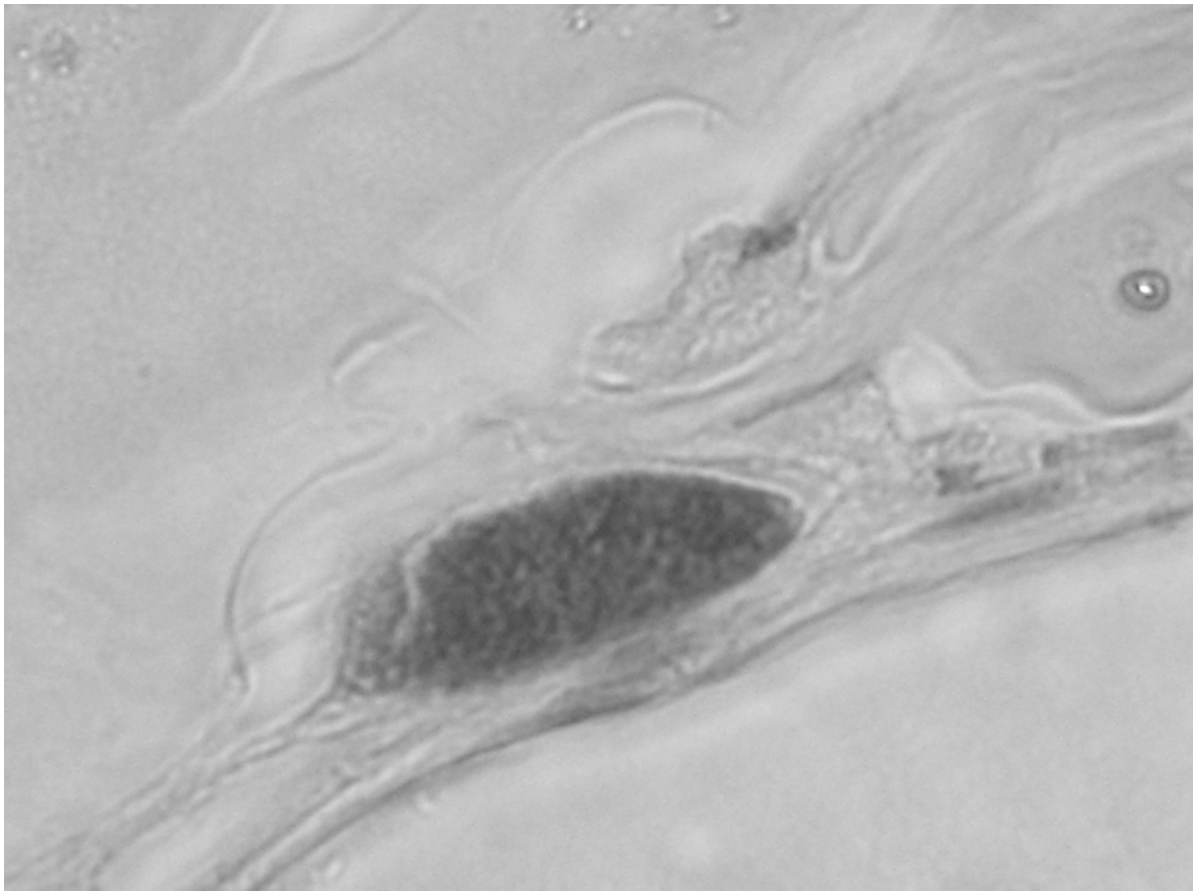

Figure 2: *Toxoplasma*-like pseudocysts in the mantle (400X).

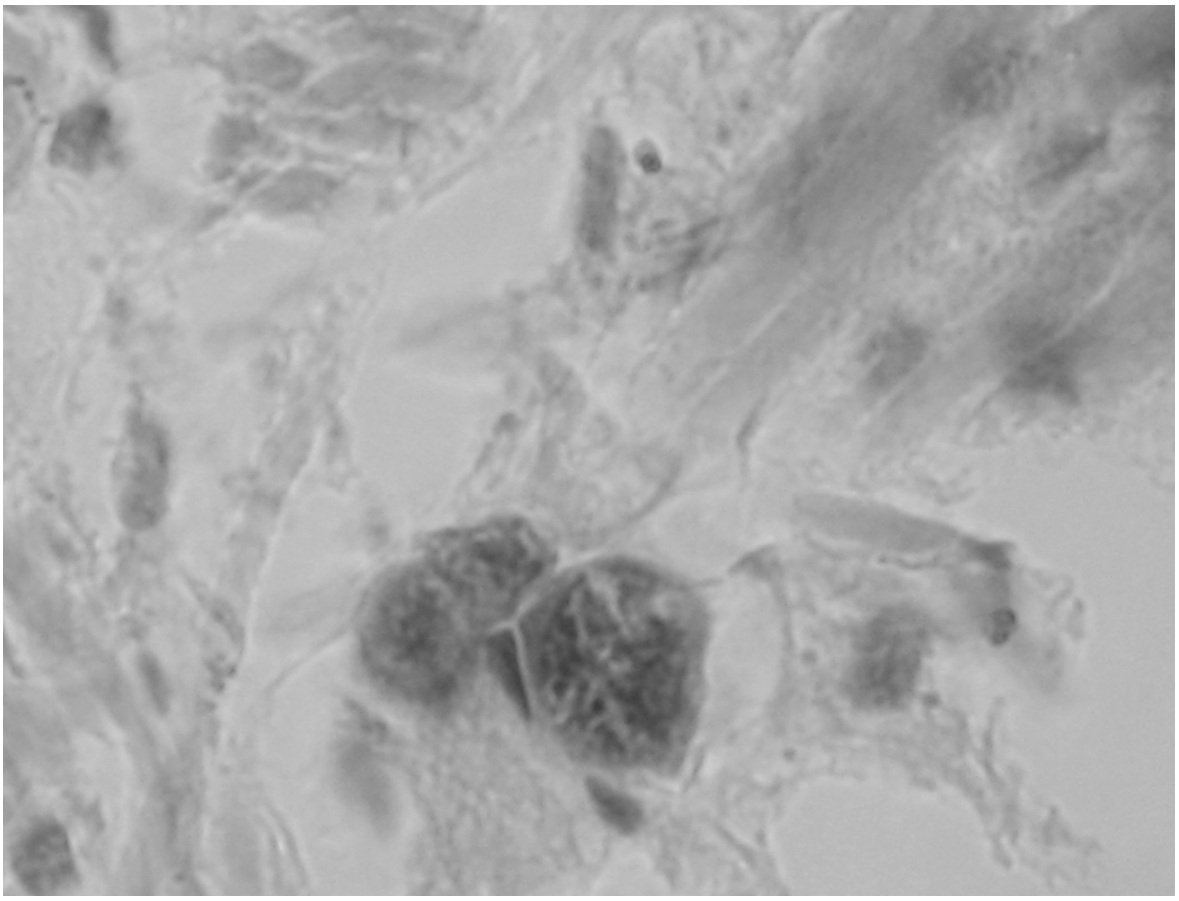

Figure 3: *Toxoplasma*-like cysts in the leg (400X).

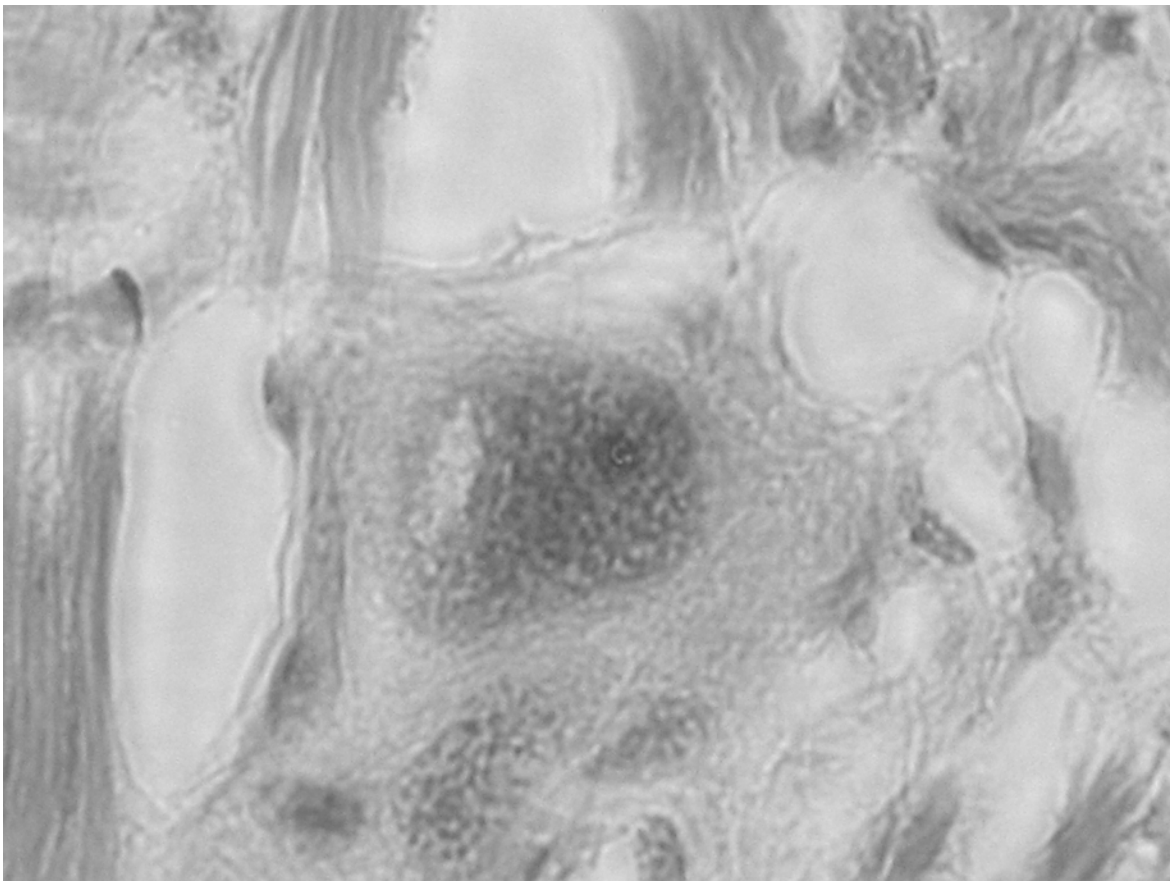

Figure 4: *Toxoplasma*-like cysts in the leg (1000X).

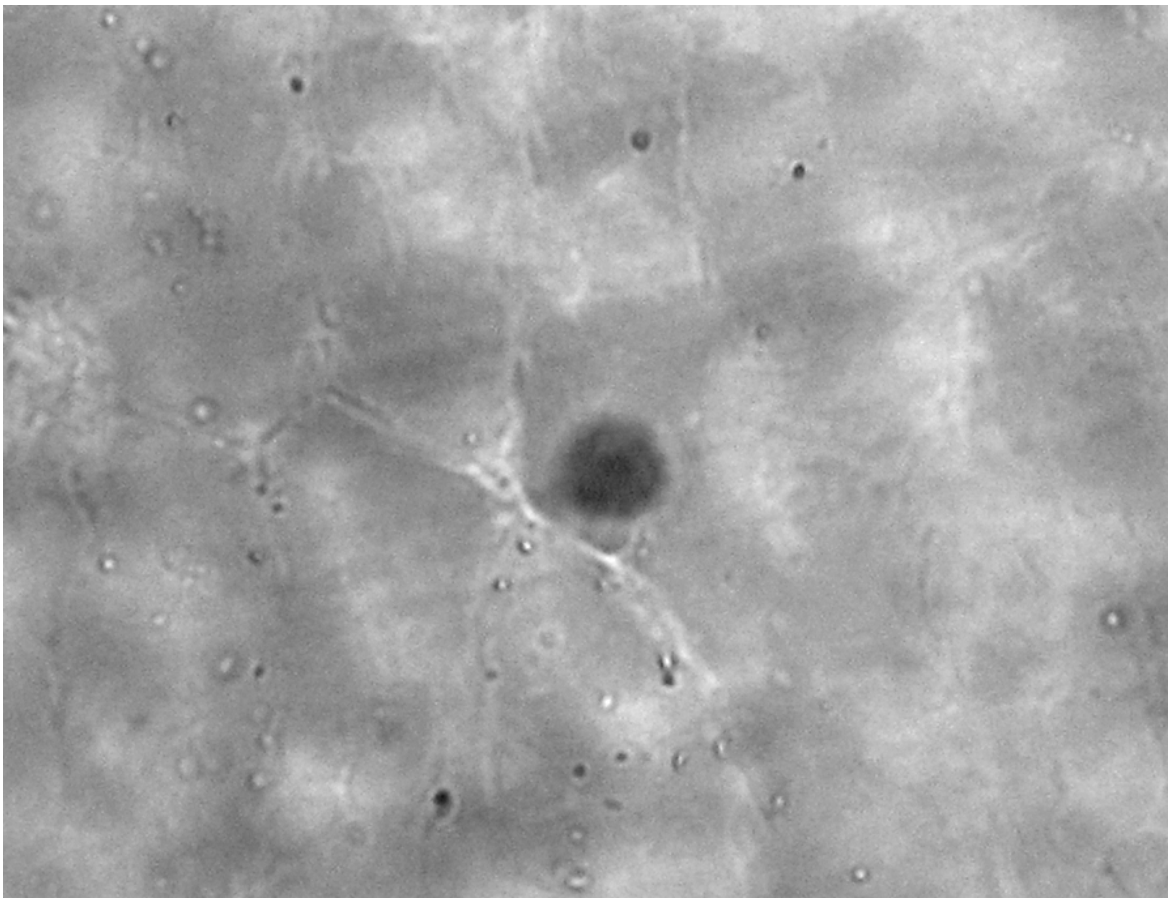

Figure 5: *Toxoplasma*-like cysts in the hepatopancreas (400X);
post mortem autolysis of the tissue.

There are studies, which demonstrate the role of lumbricides in the contamination with *Toxoplasma* of some Tasmanian marsupials (Bettiol et al., 2000), as well as the concentration of oocysts in bivalves due to their way of feeding. By filtering the water these species may encounter oocysts, resulting in their accumulation in the shells' body. Some field researches underline the role of bivalves in contamination of sea otters (Miller et al., 2008).

All these facts demonstrate that the invertebrates can serve as parathenic hosts for *Toxoplasma gondii*, playing an important role in the dissemination of this parasite in the environment.

In general, the data on the survival capacity of the oocysts come from different experimental studies that reproduce more or less the different environmental conditions.

In the absence of a microscopic technique that would enable the differentiation of the viable oocysts from those nonviable, the parasite's survival is usually evaluated by bio tests (inoculations in mice). No studies were published on the presence of *Toxoplasma* in marine and terrestrial molluscs that are used as human food, neither collected from their environment, nor from the market.

Our study results show the fact that regarding the risk of human contamination with *Toxoplasma gondii* by food, besides the ingestion of infected meat and milk, the consumption of products from invertebrates may represent a source of contamination. Molluscs have an important role.

CONCLUSIONS

A stronger infestation was observed in the specimens collected from the anthropic area, the number of cysts and pseudocysts in the leg and mantle being higher. Also, only in the snails from this area were identified cysts in hepatopancreas.

The presence of *Toxoplasma*-like cysts and pseudocysts in *Helix pomatia* - one of the most appreciated gastropod species for its gastronomic qualities, demonstrate that these species represent one of the potential contamination sources for humans.

The results show that terrestrial gastropods may represent an indicator for the presence of these parasites in the environment, by their capacity of concentrating parasitic forms.

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FAUNISTIC AND ECOLOGICAL STUDY CONCERNING THE TERRESTRIAL ISOPODS IN THE RIVERSIDES OF THE BAIA MARE BASIN AREA AND THE NEIGHBOURING AREAS (MARAMUREŞ, ROMANIA)

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KEYWORDS: Romania, Maramureş, Baia Mare area, riversides, species, ecological indexes.

ABSTRACT

Faunistic and ecological research on terrestrial isopods found in riversides of Baia Mare basin area and the surrounding areas.

The study presents the results of the research done in the eight riversides in Baia Mare basin area and the surrounding areas, where 15 isopods species have been identified from which 815 individuals have been collected.

Analizing the spread of the 15 identified species we conclude that no species is present in all the riversides.

The widest spread belongs to *Trachelipus wächtleri* which can be found in 5 riversides and then *Portracheoniscus politus politus* and *Trachelipus arcuatus,* all present in 4 riversides. A number of 8 species are found in one single riverside.

These results indicate a relatively large diversity of the ecological conditions of the 8 riversides and big differences regarding the ecological valency of isopod species. The species with narrow ecological valency limits are present only in those riversides where the environment factors (especially: temperature and humidity), do not have big variations in the biological activity period. Other ecological values (such as: relative abundancy, frequency, the ecological significance indicator) have been calculated only for the isopod communities in 4 riversides, where more individuals have been found. We considered that only for these riversides the ecological indeces are relevant.

REZUMAT: Cercetări faunistice şi ecologice asupra izopodelor terestre din zăvoaiele din Depresiunea Baia Mare şi zonele limitrofe cercetate (Maramureş, România).

Lucrarea prezintă rezultatele cercetărilor făcute în cele 8 zăvoaie din Depresiunea Baia Mare şi zonele limitrofe acesteia, în care am identificat 15 specii de izopode din care am colectat 815 indivizi.

Analizând răspândirea celor 15 specii identificate constatăm că nici o specie nu este prezentă în toate zăvoaiele.

Cea mai largă răspândire o are *Trachelipus wächtleri* prezentă în 5 zăvoaie şi *Portracheoniscus politus politus* şi *Trachelipus arcuatus,* prezente în câte 4 zăvoaie. Un număr de 8 specii sunt prezente în câte un singur zăvoi.

Aceste rezultate indică o diversitate relativ mare a condiţiilor ecologice din cele 8 zăvoaie şi diferenţe mari privind valenţa ecologică a speciilor de izopode. Speciile cu limite înguste ale valenţei ecologice populează numai acele zăvoaie în care factorii de mediu, în special temperatura şi umiditatea, nu înregistrează variaţii mari în perioada de activitate biologică. Alţi indici ecologici (abundenţa relativă, frecvenţa, indicele de semnificaţie ecologică) au fost calculaţi numai pentru comunităţile de izopode din 4 zăvoaie, unde au fost capturaţi mai mulţi indivizi. Am considerat că numai pentru aceste zăvoaie valorile indicilor ecologici sunt relevante.

ZUSSAMMENFASUNG: Faunistische und ökologische Untersuchungen über die terrestrischen Isopoden der Auwälder der Senke von Baia Mare und ihrer Randgebiete (Maramureş, Rumänien).

Die Arbeit stellt die Ergebnisse der in acht Auenwälder der Senke von Baia Mare und ihren Randgebieten durchgeführten Untersuchungen vor, wobei 15 Arten von Isopoden mit 815 Individuen erfasst wurden.

Bei der Analyse der 15 festgestellten Arten und ihrer Verbreitung zeigt sich, dass keine in allen acht untersuchten Auenwäldern vorkommt.

Die größte Verbreitung hat die Art *Trachelipus wächtleri,* die in fünf der untersuchten Auwälder vorkommt sowie *Portracheoniscus politus politus* und *Trachelipus arcuatus,* die jeweils in vier Gebieten verzeichnet wurden. Acht Arten kommen jeweils nur in einem der Auenwälder vor.

Diese Ergebnisse weisen auf eine relativ hohe Diversität der ökologischen Bedingungen der acht untersuchten Auenwälder hin, sowie auf eine große ökologische Valenz der Isopodenarten. Die Arten mit einer engen ökologischen Valenz besiedeln nur die Auenwälder, in denen die Standortfaktoren, vor allem Temperatur und Feuchtigkeit, in der biologisch aktiven Zeit der Arten keine hohen Schwankungen aufweisen. Andere ökologische Kennwerte wie realtive Abundanz, Frequenz, ökologischer Index wurden nur für die Isopodengemeinschaften jener vier Auenwäldern berechnet, bei denen eine entsprechend hohe Zahl von Individuen gesammelt werden konnte. Nur für diese Auenwälder sind die ökologischen Kennwerte als relevant anzusehen.

INTRODUCTION

The Isopoda order is the most diversed group of crustaceans from a biological, as well as ecological point of view. The isopods live both in water (sea water and fresh water) and on land where they have adapted to various types of ecosystems, with hygrophyll, mesophyll and xerycal habitats. The aquatic species have a diverse eating system, some of them are phytophagous (they eat algae), others are zoophagous, the great majority feed on degraded vegetal detritus.

These species have an important role in the degradation of the organic material resulted from plants (Hassal, 1977, 1983; Hassal and Ruston, 1982; Radu, 1964). Through the galeries that the isopod species dig in the superficial layers of the soil, they contributed to the loosening of the soil, especially in the forests (Radu, 1964).

MATERIALS AND METHODS

In our research on communities of terrestrial isopods we took samples from 8 riversides located both in Baia Mare basin area and in the sorrounding areas.

The searched riversides have as dominant tree species: the alder (*Alnus glutinosa*) and the poplar tree (*Populus nigra*) and as bushes the osier willow species (*Salix* sp.), the hazel- tree (*Corylus avellana*), the elder (*Sambucus nigra*) etc., and in the herbal layer the hygrophyla plants represent the dominant species.

The riversides are different because they have different altitude, temperature, humidity, vegetation structure. These differences influence the terrestrial isopod communities in these ecosystems.

Te riverside situated at the bottom of the southern slope of Gutâi Mountain between 47° 40′ 24.6′′ northern latitude, 23° 44′ 00.8′′ eastern longitude, and 451 m altitudine, going out of Baia Sprie. In this riverside we placed 5 Barber traps, and in the samples we took there were 231 individuals which belong to the following species: paludicolous*Ligidium germanicum* 40 individuals, *Hyloniscus transsylvanicus* 164 individuals, *Hyloniscus mariae* 1 individual, sylvan *Protracheoniscus politus politus* 24 individuals, *Trachelipus wächtleri* 1 individual and praticolous *Trachelipus difficilis angulatus* 1 individual.

The riverside situated near the decantation pond Bozânta Mare, between 47°38′38,4′′ northern latitude, 23°28′59.3′′ easterrn longitude and 163 m altitude, at aproximately 500 m away from the riverside. Here we placed 3 Barber traps, and from the samples taken we collected 15 individuals of isopods which belong to the following species: sylvan *Protracheoniscus politus politus* 1 individual, *Trachelipus arcuatus* 9 individuals and praticolous *Trachelipus nodulosus* 2 individuals and *Armadillidium vulgare* 3 individuals.

The riverside situated on the banks of Lăpuş river upstream the Butesii bridge, between 47°27′51.835′′ northern latitude, 23°33′49.305′′ eastern longitude and 217 m altitude. In this riverside we placed 4 Barber traps we collected 4 individual of isopods, from which 3 individuals belonging to sylvan species *Trachelipus wächtleri* and 1 individual sylvan species *Protracheoniscus politus politus.* The very small number of isopod individuals is explained by the presence of the sandy soil and by the banks being washed away by the Lăpuş river during the rainy seasons, and during the spring time when the snow melts.

The riverside situated on the banks of Săsar river, near Bozânta Mare village between 47°38′38.4′′ northern latitude, 23°28′59.3′′ eastern longitude and 162 m altitude aproximately 600 m away from the decantation pond in Bozânta Mare. Here we placed 3 Barber traps and collected 214 isopods which belong to: paludicolous *Hyloniscus transsylvanicus* 1 individual, praticolous *Cylisticus convexus* 15 individuals, *Trachelipus nodulosus* 80 individuals and *Armadillidium vulgare* 4 individuals, sylvan *Protracheoniscus politus politus* 1 individual, *Trachelipus arcuatus* 21 individuals and eurytopic *Porcellio scaber* 92 individuals.

The riverside situated on the banks of Someş river, upstream the Ardusat bridge, between 47°37′48.520′′ northern latitude, 23°22′40.610′′ eastern longitude and 144 m altitude, situated on an isle made by the Someş river with a dried stream. In this riverside we placed 3 traps, and from the taken samples we collected 52 individuals, which belong to the sylvan species *Trachelipus arcuatus* 50 individuals, *Trachelipus wächtleri* 2 individuals.

The riverside situated on the banks of the Lăpuşel rivulet, Lăpuşel forest, between 47°36′04.210′′ northern latitude, 23°27′07.226′′ eastern longitutude and 167 m altitude. The rivulet dries during the hot, dry summertime. In this riverside we placed 5 Barber traps and from the samples we took we collected 275 individuals which belong to the following species: paludicolous *Hyloniscus transsylvanicus* 50 individuals, *Trichoniscus pusillus pusillus* 109 individuals and sylvan *Protracheoniscus politus politus* 95 individuals and *Trachelipus wächtleri* 21 individuals.

The riverside situated on the banks of Porcului Valley, in Cărbunari village, between 47°34′19.053′ northern latitude, 23°40′17.785′′ eastern longitude and 255 m altitude. From all the 4 Barber traps placed, we collected 10 individuals which belong to the following species: paludicolous *Ligidium germanicum* 5 individuals and sylvan *Porcellium collicolum* 5 individuals.

The riverside situated on the bank of Chechişel rivulet near Rus village, between 47°36′30.310′′ northern latitude, 23°39′47.620′′ eastern longitude and 215 m altitude, where we placed 5 Barber traps, and from the samples we took we collected 14 individuals which belong to the following species: paludicolous *Ligidium hypnorum* 1 individual, praticolous *Metoponorthus pruinosus* 1 individual, *Trachelipus nodulosus* 9 individuals and sylvan *Trachelipus arcuatus* 1 individual and *Trachelipus wächtleri* 2 individuals.

The collecting of the isopods has been made using ground traps (Barber traps). In these traps saltinous water from Ocna Şugatag has been placed. After at least one month the samples have been take away (removed). The collected materialul was put into separated tubes, in alcohol of 70^0 and analised in laboratory. The species have been determined (recognised) and the ecological parameters (index) have been calculated.

RESULTS

From all the 8 searched riversides we collected a number of 815 individuals, which belong to 15 species of terrestrial isopods (Tab. 1).

The numeric abundances ($\overline{X}$) differs from one riverside to another and from one species to another (Tab. 1). In the searched riversides the highest value of the numeric abundance appeared at the *Hyloniscus transsylvanicus* populations in the riverside located at the bottom of the southern slope of Gutâi Mountains ($\overline{X}$ = 32.8), *Trichoniscus pusillus pusillus* in the riverside on the banks of the Lăpuşel rivulet ($\overline{X}$ = 21.8), *Protracheniscus politus politus* in the same riverside ($\overline{X}$ = 19), *Trachelipus arcuatus* in the riverside situated on the banks of Someş river ($\overline{X}$ = 16.6), *Porcellio scaber* in the riverside of the Săsar banks ($\overline{X}$ = 15.3), *Trachelipus nodulosus* in the same riverside ($\overline{X}$ = 13.3), *Hyloniscus transsylvanicus* in the riverside from the banks of the Lăpuşel rivulet ($\overline{X}$ = 10). The numeric abundance, having the value below 10, was registered at the following species: *Ligidium germanicum* ($\overline{X}$ = 8), *Protracheoniscus politus politus* ($\overline{X}$ = 4.8) in the riverside situated at the bottom of the southern slope of Gutâi Mountains, *Trachelipus wächtleri* ($\overline{X}$ = 4.2) in the riversite located on the banks of the Lăpuşel rivulet, *Trachelipus arcuatus* ($\overline{X}$ = 3.5), *Cylisticus convexus* ($\overline{X}$ = 2.5) in the riverside of the banks of Săsar river, *Trachelipus arcuatus* ($\overline{X}$ = 1.5) in the riverside near the decantantation pond in Bozânta Mare, *Porcellium collicolum* ($\overline{X}$ = 1.25) in the riverside situated on the banks of Porcului Valley.

There are very low level of numeric abundance because of the small number of individuals in the populations of some riversides which have the following species: *Trachelipus difficilis angulatus, Trachelipus arcuatus, Metoponorthus pruinosus, Ligidium hypnorum, Trachelipus wächtleri, Protracheoniscus politus politus* ($\overline{X}$ = 0.2), *Hyloniscus transsylvanicus* ($\overline{X}$ = 0.16), *Armadillidium vulgare* ($\overline{X}$ = 0.5).

The values of the numeric abundance separately calculated for each riverside and for all the species identified in each riverside, show that the best ecological conditions for the isopods are in the riverside which is situated on the banks of the Lăpuşel rivulet ($\overline{X}$ = 55), followed by the riverside situated at the bottom of the southern slope of the Gutâi Mountains ($\overline{X}$ = 46.2), the riverside on the banks of the Săsar river ($\overline{X}$ = 35.6) and the riverside on the banks of the Someş river ($\overline{X}$ = 17.3). In these riversides the isopod populations consist of a great number of individuals, comparated to those from the riversides where the value of numeric abundancy is lower, for example: the riverside on the banks of Lăpuş river ($\overline{X}$ = 1), the riverside situated on the banks of Porcului Valley ($\overline{X}$ = 2.5).

Comparing the species communities and the size of the populations in all the 8 searched riversides, big differences can be seen regarding the specific structure and the affiliation to different ecological groups and the number of populations as well.

In some riversides there live a large number of species. For example in the riverside situated on the banks of Săsar river 7 species, the riverside at the bottom of southern slope of Gutâi Mountains, 6 species, the riverside on the Chechişel rivulet 5 species. These riversides also have another characteristic: the existance of some different microhabitats, because some of them are paludicolous, others are sylvan, and others are praticolous. In some riversides the paludicolous and sylvan species represent the dominant number as in the riverside situated at the southern bottom of Gutâi Mountains, the riverside situated on Lăpuşel banks.

Table 1: The communities of terrestrial isopods from the riverside coppices in the basin area of Baia Mare and the neighbouring areas under study: ZG = riverside coppice at the bottom of the southern slope of Gutâi Mountains; ZB = riverside coppice near Bozânta Mare; ZL = riverside coppice along Lăpuş river; ZS = riverside coppice Săsar river; ZSO = riverside coppice Someş river; ZPL = riverside coppice Lăpuşel rivulet; ZVP = riverside coppice Văii Porcului; ZC = riverside coppice Chechişel rivulet; n = number of individuals; X = the (absolute) numerical abundance; I = ecological categories of terrestrial isopods: pa = paludicolous; s = sylvan; pr = praticolous, eu = eurytopic.

Nr. crt.	Species	I		ZG	ZB	ZL	ZS	ZSO	ZPL	ZVP	ZC	Total
1.	*Ligidium hypnorum*	pa	n								1	1
			$\overline{X}$								0.2	
2.	*Ligidium germanicum*	pa	n	40						5		45
			$\overline{X}$	8						1.25		
3.	*Hyloniscus transsylvanicus*	pa	n	164			1		50			213
			$\overline{X}$	328			0.16		10			
4.	*Hyloniscus mariae*	pa	n	1								1
			$\overline{X}$	0.2								
5.	*Trichoniscus pusillus pusillus*	pa	n						109			109
			$\overline{X}$						21.8			
6.	*Cylisticus convexus*	pr	n				15					15
			$\overline{X}$				2.5					
7.	*Protracheoniscus politus politus*	s	n	24	1	1	1		95			122
			$\overline{X}$	4.8	0.16	0.25	0.25		19			
8.	*Porcellium collicolum*	s	n							5		5
			$\overline{X}$							1.25		
9.	*Trachelipus arcuatus*	s	n		9		21	50			1	81
			$\overline{X}$		15		3.5	16.6			0.2	
10.	*Trachelipus wachtleri*	s	n	1		3		2	21		2	29
			$\overline{X}$	02		0.75		0.66	4.2		0.4	
11.	*Trachelipus nodulosus*	pr	n		2		80				9	91
			$\overline{X}$		0.33		13.3				1.8	
12.	*Trachelipus difficilis angulatus*	pr	n	1								1
			$\overline{X}$	0.2								
13.	*Metoponorthus pruinosus*	pr	n								1	1
			$\overline{X}$								0.2	
14.	*Porcellio scaber*	eu	n				92					92
			$\overline{X}$				15.3					
15.	*Armadillidium vulgare*	pr	n		3		4					7
			$\overline{X}$		0.5		0.66					
	Total individuals			231	15	4	214	52	275	10	14	815
	Total species			6	4	2	7	2	4	2	5	15
	Numeric abundancy / Total number of individuals		$\overline{X}$	46.2	2.5	1	35.6	17.3	55	2.5	2.8	

Analising the spread of the 15 species in all the 8 studied riversides, the conclusion is that not a single species can be found in all these 8 riversides (Tab. 1). The largest spread belongs to *Trachelipus wächtleri* which can be found in 5 riversides and then *Portracheoniscus politus politus* and *Trachelipus arcuatus,* all present in 4 riversides. 8 species are found in one single riverside. These results indicate that a relatively large diversity of the ecological conditions of the 8 riversides and big differences regarding the ecological valency of isopod species. The species with narrow ecological valency limits are present only in those riversides where the environment factors (temperature and humidity), do not have big variations in the biological activity period. Other ecological values (relative abundancy, frequency, the ecological significance indicator) have been calculated only for the isopod communities found in 4 riversides, where more individuals have been captured. We considered that only for these riversides the ecological values are relevant. Data are presented in the table 2.

Table 2: The ecological indices of the populations of terrestrial isopods species from the riverside coppices in the Baia Mare basin area and the neighbouring areas under study: ZG = riverside coppice at the bottom of the southern slope of Gutâi Mountains; ZS = riverside coppice Săsar river; ZSO = riverside coppice Someş river; ZPL = riverside coppice Lăpuşel rivulet; A = relative abundance (%); F = frequency (%); W = index of ecological significance (%).

Nr. crt.	Species	Ecological Indexes %	ZG	ZS	ZSO	ZPL
1.	*Ligidium germanicum*	A	17.3			
		F	20			
		W	3.46			
2.	*Hyloniscus transsylvanicus*	A	70.9	0.46		18.1
		F	100	16.6		80
		W	70.9	0.07		14.48
3.	*Hyloniscus mariae*	A	0.43			
		F	20			
		W	0.086			
4.	*Trichoniscus pusillus pusillus*	A				39.6
		F				80
		W				31.6
5.	*Cylisticus convexus*	A		7		
		F		16.6		
		W		1.16		
6.	*Protracheoniscus politus politus*	A	10.3	0.46		34.5
		F	60	16.6		80
		W	6.18	0.07		27.6
7.	*Trachelipus arcuatus*	A		9.8	96.1	
		F		50	100	
		W		4.9	96.1	
8.	*Trachelipus wachtleri*	A	0.43		3.8	7.6
		F	20		33.3	100
		W	0.086		1.26	7.6
9.	*Trachelipus nodulosus*	A		37.3		
		F		16.6		
		W		6.19		
10.	*Trachelipus difficilis angulatus*	A	0.43			
		F	20			
		W	0086			
11.	*Porcellio scaber*	A		42.9		
		F		83.3		
		W		35.7		
12.	*Armadillidium vulgare*	A		1.8		
		F		16.6		
		W		0.29		
	Total individuals		231	214	52	275
	Total species		6	7	2	4

The values of the relative abundance (A) are calculated for the 4 riversides and are different, in relation to the size of population belonging to each species.

It can be seen that the values of the relative abundancy differ from one specie to another and from one riverside to another as well (Fig. 1).

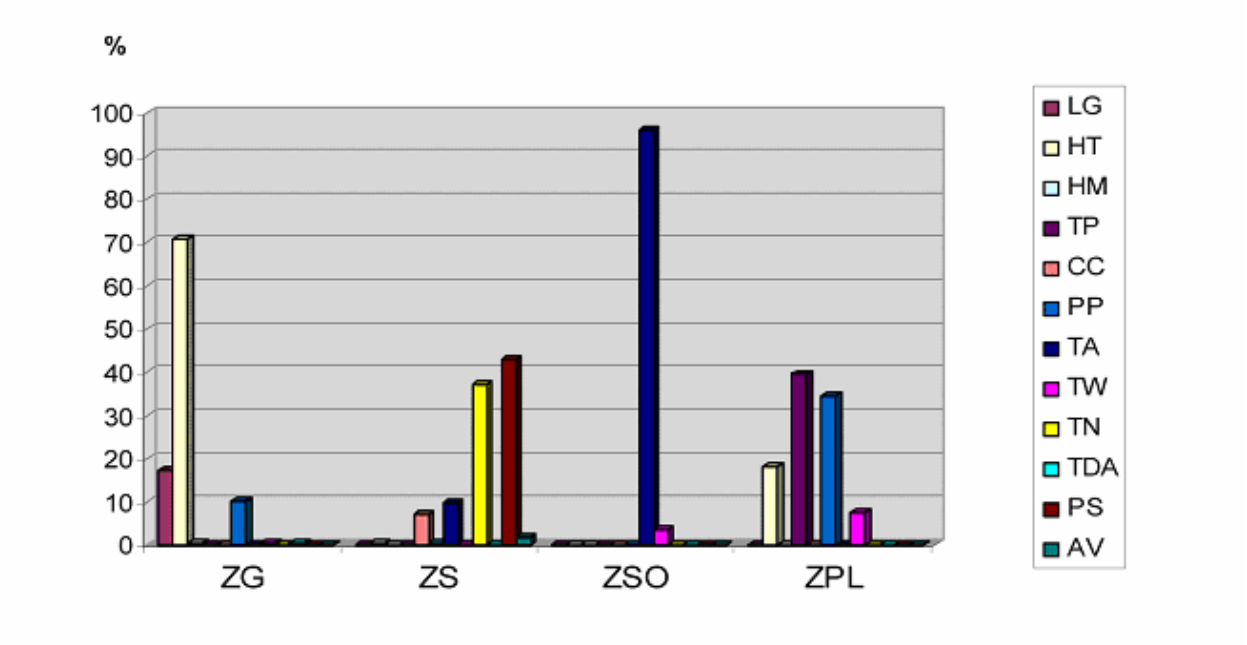

Figure 1: The relative abundance (A%), of the populations of terrestrial isopods from the riverside coppice in the Baia Mare area and the neighbouring areas; ZG = riverside coppice at the bottom of the southern slope of Gutâi Mountains; ZS = riverside coppice Săsar river; ZSO = riverside coppice Someş river; ZPL = riverside coppice Lăpuşel rivulet; LG = *Ligidium germanicum*; HT = *Hyloniscus transsylvanicus*; HM = *Hyloniscus mariae*; TP = *Trichoniscus pusillus pusillus*; CC = *Cylisticus convexus*; PP = *Protracheoniscus politus politus*; TA = *Trachelipus arcuatus*; TW = *Trachelipus wächtleri*; TN = *Trachelipus nodulosus*;TDA = *Trachelipus difficilis angulatus*; PS = *Porcellio scaber*; AV = *Armadillidium vulgare.*

In the riverside located at the southern bottom slope of the Gutâi Mountains the greatest value of the relative abundancy belongs to paludicolous species *Hyloniscus transsylvanicus* (A = 70.9%), followed by another paludicolous species, *Ligidium germanicum* (A = 17.3%) and the sylvan species *Protracheoniscus politus politus* (A = 10.3%), these species are eudominant. Very low values, under 1%, have been registered for other 3 species (Tab. 2), which have very reduced populations and are subrecedent.

In the riverside located on Săsar river banks, the highest relative abundance value has been registered at *Porcellio scaber* (A = 42.9%), which is an eurytopic with a very synantropic behaviour and at *Trachelipus nodulosus* (A = 37.3%), praticolous species, both species eudominant. The only paludicolous species, *Hyloniscus transsylvanicus,* has here a very reduced population (A = 0.46%) and it is subrecedent. The dominant isopods indicate a high drop of soil humidity during the summer and higher temperature values when compared to the riverside at the bottom of the southern slope of Gutâi Mountains.

In the riverside situated on the banks of the Someş river have been identified only 2 sylvan (52 individuals). *Trachelipus arcuatus* is a numeric dominat (A = 96.1%). Here the conditions do not correspond neither to paludicolous species nor to praticolous species.

In the riverside on Lăpuşel rivulet the paludicolous populations have the highest number: *Trichoniscus pusillus pusillus* (A = 39.6%) and *Hyloniscus transsylvanicus* (A = 18.1%). From these 2 sylvan species, *Protracheoniscus politus politus* has a numerous population (A = 34.5%). A reduced number belongs *Trachelipus wächtleri* population, (A = 7.6%). Praticolous species are absent.

From the isopods species frequency (F) values (Tab. 2, Fig. 2), the following have a high frequency: euconstant *Hyloniscus transsylvanicus* (F = 100%) in the riverside at the bottom of southern slope of Gutâi, (F = 80%) in the riverside located on the Lăpuşel rivulet banks, *Trichoniscus pusillus pusillus*, *Protracheoniscus politus politus* (F = 80%) and *Trachelipus wächtleri* (F = 100%) in the riverside of Lăpuşel rivulet banks. *Trachelipus arcuatus* (F = 100%) in the riverside of the Someş river banks, *Porcellio scaber* (F = 83.3%) in the riverside of Săsar river banks.

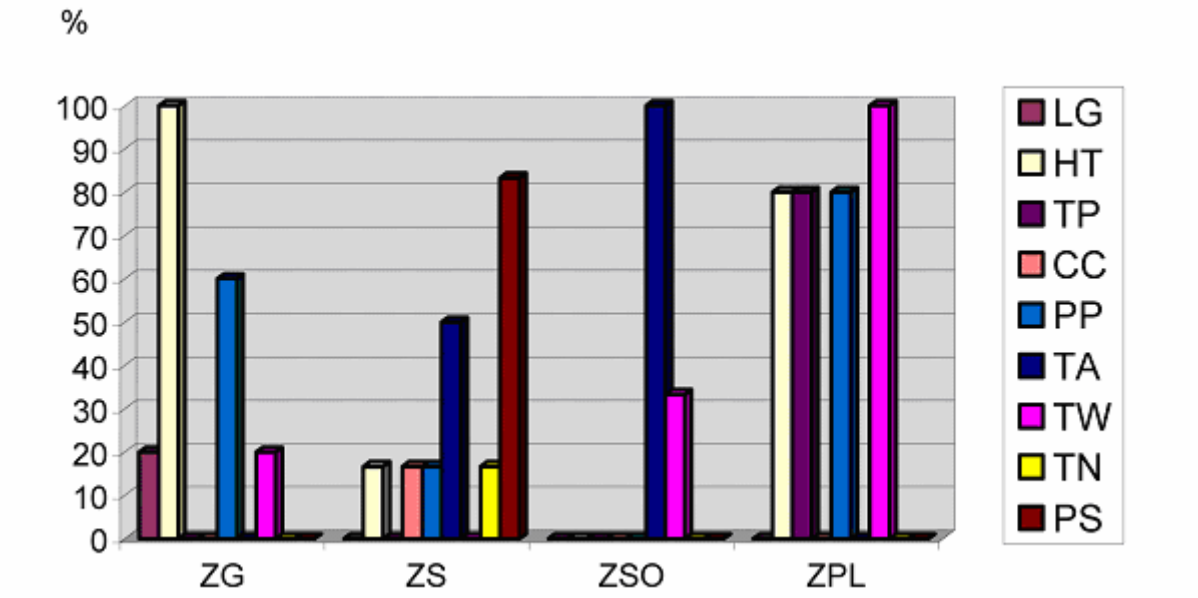

Figure 2: The frequency (F%), of the populations of terrestrial isopods from theriverside coppice in the basin area of Baia Mare and the neighbouring areas: ZG = riverside coppice at the botton of the southern slope of Gutâi Mountains; ZS = riverside coppice Săsar river; ZSO = riverside coppice Someş river; ZPL = riverside coppice Lăpuşel rivulet; LG = *Ligidium germanicum*; HT = *Hyloniscus transsylvanicus*; TP = *Trichoniscus pusillus pusillus*; CC = *Cylisticus convexus*; PP = *Protracheoniscus politus politus*; TA = *Trachelipus arcuatus*; TW = *Trachelipus wächtleri*; TN = *Trachelipus nodulosus,* PS = *Porcellio scaber.*

The *Protracheoniscus politus politus* species (F=60%) is constant for the riverside situated at the southern bottom of Gutâi Mountains. The accessorial species here: *Trachelipus arcuatus* (F = 50%) in the riverside on Săsar river banks, *Trachelipus wächtleri* (F = 33.3%) in the riverside on Someş river banks. The accidental species are: *Hyloniscus transsylvanicus, Cylisticus convexus, Trachelipus nodulosus, Armadillidium vulgare* (F = 16.6%), in the riverside situated on the banks of Săsar river, *Ligidium germanicum, Hyloniscus mariae, Trachelipus wächtleri, Trachelipus difficilis angulatus* (F = 20%) in the riverside at the bottom of the Gutâi Mountains southern slopes.

The values of ecological significance index (W) (Tab. 2) show that the followings *Hyloniscus transsylvanicus* (W = 70.9%), *Protracheoniscus politus politus* (W = 6.18%), are self-evident for the riverside located at the bottom of the southern slope of Gutâi, *Ligidium germanicum* (W = 3.46%) is accessorial, and *Hyloniscus mariae, Trachelipus wächtleri, Trachelipus difficilis angulatus* (W = 0.086%) are accidental here.

In the riverside on Săsar banks, self-evident species are: *Porcellio scaber* (W = 35.7%), *Trachelipus nodulosus* (W = 6.19%). *Trachelipus arcuatus* (W = 4.9%), *Cylisticus convexus* (W = 1.16%), *Armadillidium vulgare* (W = 0.29%) are accesorial, and *Hyloniscus transsylvanicus, Protracheoniscus politus politus* (W = 0.07), accidental.

In the riverside on the Someş banks, the species *Trachelipus arcuatus* (W = 96.1%) is characteristic, and the species *Trachelipus wächtleri* (W = 1.26%) is accesorial.

In the Lăpuşel river banks riverside, all the identified species are characteristic and self-evident, the values of the ecological significance index are: W = 14.48% for *Hylonsicus transsylvanicus,* W = 31.6% for *Trichoniscus pusillus pusillus,* W = 27.6% for *Protracheoniscus politus politus,* W = 7.6% for *Trachelipus wächtleri*.

The values of the similarity index (Tab. 3), show that the biggest similarity of the terrestrial isopod fauna exists between: the riverside at the bottom of the southern slope of Gutâi Mountains and that on the Săsar river banks, the similarity index between these is 1. Between the riverside on Someş river banks and the riverside on Lăpuşel rivulet banks the index is close to 1.

Table 3: The similarity index values calculated for riversides in the basin area of Baia Mare and the neighbouring areas: 1 = riverside at the bottom southern slopes of Gutâi Mountains; 2 = riverside on the banks of Săsar river; 3 = riverside on the banks of Someş river; 4 = riverside on the banks of Lăpuşel rivulet.

Types of ecosystem	1	2	3	4
1	*			
2	1	*		
3	0.4761	0.2096	*	
4	0.1322	0.0056	0.9474	*

The other values of the similarity index are low and they indicate a slite resemblence of the terrestrial isopod fauna in the searched riversides.

The coenotic affinity was calculated for species identified in the following riversides: at the southern bottom of Gutâi Mountains, on Săsar river banks and on Lăpuşel river banks. In these riversides a larger number of species and individuals has been captured.

In the riverside placed at the southern bottom of Gutâi slope (Fig. 3) 231 individual have been captured, belonging to 6 species, 3 paludicolous and 3 sylvan. The coenotic affinity values show that the spread of the populations on the surface of the soil is mosaic-like, the individuals strictly occupying certain microhabitats. A very striking cohabitation tendency can be seen at different congeneric paludicolous species, *Hyloniscus transsylvanicus* and *Hyloniscus mariae* as well as different other species, *Hylonsicus mariae* and *Trachelipus difficilis angulatus,* where the affinity coenotic coefficient is over 60%. We also add that the *Hyloniscus transsylvanicus* individuals live together in a percentage of 20% of microhabitation with the other species. Some species are totally isolated, living in different microhabitats in this riverside. *Ligidium germanicum* does not cohabitates with *Trachelipus wächtleri* and *Trachelipus difficilis angulatus, Hyloniscus mariae* do not cohabitate with *Portracheoniscus politus politus* and *Trachelipus wächtleri, Protracheoniscus politus politus* do not cohabitate with *Trachelipus difficilis angulatus,* and *Trachelipus wächtleri* does not cohabitates with *Trachelipus difficilis angulatus*. It is interesting to underline that the cohabitation of the 2 congeneric species of *Hyloniscus* and the total isolation of the congeneric species of *Trachelipus*. Other scientists too admited that *Hyloniscus* species can cohabitate in certain ecosystem and microhabitat, when the *Trachelipus* species, which are evolved species, do not cohabitate (Tomescu et al., 2002).

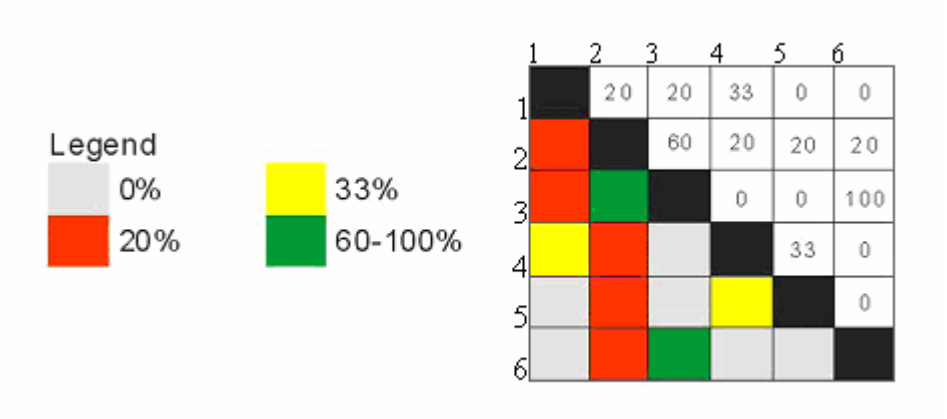

Figure 3: The coenotic affinity of the terrestrial isopods species from the riverside coppice at the bottom of the southern slope of Gutâi Mountains: 1 = *Ligidium germanicum*; 2 = *Hyloniscus transsylvanicus*; 3 = *Hyloniscus mariae*; 4 = *Protracheoniscus politus politus*; 5 = *Trachelipus wächtleri*; 6 = *Trachelipus difficilis angulatus.*

In the riverside on the Săsar river bank, where 214 individuals belonging to 7 species and 3 ecological categories (paludicolous, sylvan and praticolous), ecological conditions in the microhabitates allow cohabitation of the great majority of the species, as an exception we found *Trachelipus arcuatus* (Fig. 4). Here too, *Hyloniscus transsylvanicus* and *Armadillidium vulgare* have cohabitation tendencies with most of the species, followed by *Cylisticus convexus* and *Trachelipus nodulosus*. It is possible to exist microhabitates with extreme ecological conditions (very humid and very dry), and individuals of the seven species easily migrate from one microhabitat to another during 24 hours, especially during the night, when the air humidity is higher even in the dry micrihabitats. This is how we can explain why the paludicolous and praticolous species have been captured in the same traps. From the specialised literature it is known that nocturnal terrestrial isopods move at about 10 - 20 m.

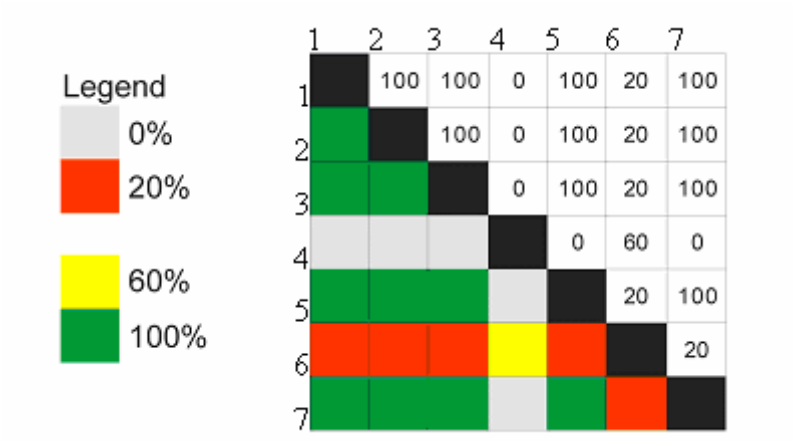

Figure 4: The coenotic affinity of the terrestrial isopods species from the riverside coppice along Săsar river: 1 = *Hyloniscus transsylvanicus*; 2 = *Cylisticus convexus*; 3 = *Protracheoniscus politus politus*; 4 = *Trachelipus arcuatus*; 5 = *Trachelipus nodulosus*; 6 = *Porcellio scaber*; 7 = *Armadillidium vulgare.*

In the riverside situated on Lăpuşel rivulet banks 275 individuals have been captured which belong to 4 species (2 paludicolous and 2 sylvan).

Here the ecological conditions in the microhabitates are not so different. Individuals of the 4 species cohabitate in most of the microhabitates, the values of the coenotic affinity index vary between 60 - 80 % (Fig. 5).

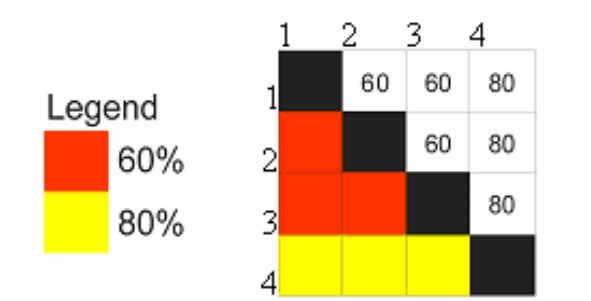

Figure 5: The coenotic affinity of the terrestrial isopods from the riverside coppice along Lăpuşel rivulet: 1 = *Hyloniscus transsylvanicus*; 2 = *Trichoniscus pusillus pusillus*; 3 = *Protracheoniscus politus politus*; 4 = *Trachelipus wächtleri*.

The sex ratio (Fig. 6), was calculated for the populations of the species from which more individuals have been collected. Thus, from all the 15 species of identified isopods, the sex rate was calculated for 8 species, and the values show that the paludicolous species *Ligidium germanicum* from which 45 individuals have been collected (m/f = 98/2%), inside the populations males dominate; from *Hyloniscus transsylvanicus* 213 individuals have been collected (m/f = 48/52%), the female are the dominants but in small difference in omparison with the males; from *Trichoniscus pusillus pusillus* 109 individuals have been collected (m/f = 0/100%), the population of the species is entirely made up of females. Sylvan species: *Protracheoniscus politus politus* - 122 individuals have been collected (m/f = 20/80%), in this species population the female are the dominants with a big difference on males; from *Trachelipus arcuatus* 81 individuals collected (m/f=51/49%), in the population of this species the males have the dominant number, but only with 2% difference from the females. From *Trachelipus wächtleri* - 29 individuals collected (m/f = 38/62%), the female are the dominant in the population. From the praticolous species *Trachelipus nodulosus* 1 individuals have been collected (m/f = 16/84%), and the females are the dominant, and from the eurytopic species *Porcellio scaber* 92 individuals have been collected (m/f = 57/43%), the males predominate.

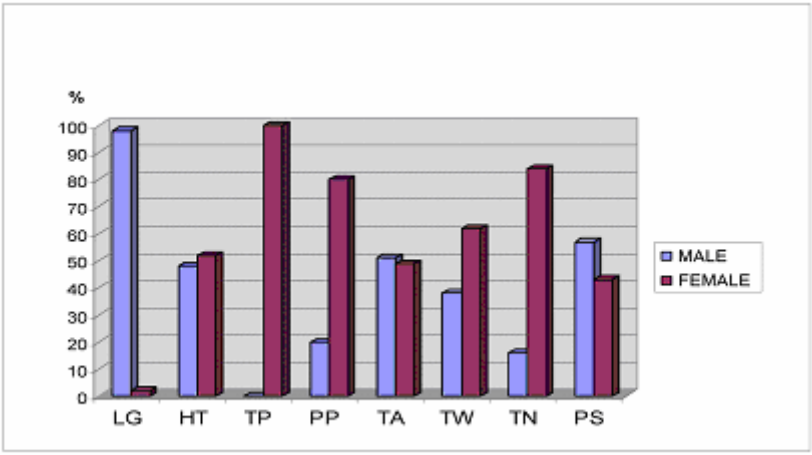

Figure 6: Sex rate at the terrestrial isopods found in the basin area of Baia Mare and the sorrounding areas: LG = *Ligidium germanicum*; HT = *Hyloniscus transsylvanicus*; TP = *Trichoniscus pusillus pusillus*; PP = *Protracheoniscus politus politus*; TA = *Trachelipus arcuatus*; TW = *Trachelipus wächtleri*; TN = *Trachelipus nodulosus*; PS = *Porcellio scaber*.

CONCLUSIONS

In the riverside coppices under study, we have identified 15 isopods species. *Hyloniscus transsylvanicus* (W = 70.9%), *Protracheoniscus politus politus* (W = 6.18%), are illustrating for the riverside coppice at the bottom of the southern slope of Gutâi Mountains, the species *Ligidium germanicum* (W = 3.46%) is an accessory, and *Hyloniscus mariae, Trachelipus wächtleri, Trachelipus difficilis angulatus* (W = 0.086%) are accidental for this riverside coppice.

In the riverside coppice on the Săsar River, the illustrative species are: *Porcellio scaber* (W = 35.7%), *Trachelipus nodulosus* (W = 6.19%). *Trachelipus arcuatus* (W = 4.9%), *Cylisticus convexus* (W = 1.16%), *Armadillidium vulgare* (W = 0.29%) are accessories, and *Hyloniscus transsylvanicus, Protracheoniscus politus politus* (W = 0.07) are accidental.

In the riverside coppice on Someş river side, *Trachelipus arcuatus* (W = 96.1%) is characteristic, and *Trachelipus wächtleri* (W = 1.26%) is an accessory.

In the riverside coppice on Lăpuşel rivulet side, all the identified species are characteristic and illustrative, the index values of ecological significance are: W = 14.48% for *Hyloniscus transsylvanicus,* W = 31.6% for *Trichoniscus pusillus pusillus,* W = 27.6% for *Protracheoniscus politus politus,* W = 7.6% for *Trachelipus wächtleri*.

The values of the coenotic affinity show that in the riverside coppice of the bottom of the southern slope of Gutâi Mountains, the spreading of the populations at the surface of the soul is mosaic-like, the individuals strictly occupying only certain microhabitats. The congenerical paludicolous species *Hyloniscus transsylvanicus* and *Hyloniscus mariae* cohabit, as well as species of different genera: *Hyloniscus mariae* and *Trachelipus difficilis angulatus*. In the riverside coppice on Săsar river side, the ecological conditions from the microhabitats allow the cohabiting of the great majority of the species. In the riverside coppice on Lăpuşel rivulet side, the ecological conditions from the microhabitats are less different. The individuals of the species in this riverside coppice cohabit in the majority of the microhabitats. No species is present in all the riverside coppices.

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SEASONAL AND LONGITUDINAL CHANGES IN THE MACROINVERTEBRATE COMMUNITY OF THE RIVER MOLDOVA (MOLDAVIA, ROMANIA)

Gabriela SASU[1]

KEYWORDS: Romania, Moldavia, relative abundance, frequency, biodiversity.

ABSTRACT

The seasonal and spatial variations in the invertebrate community from the Moldova River have been studied in 6 sections of the Moldova River from May to October 2007.

40 taxa have been identified. The most abundant species and taxa were *Rhitrogena semicolorata* (S1, S2), *Baetis rhodani* (S1, S2, S3), *Caenis rivulorum* (S6) and *Subfamily Orthocladiinae* (S2, S3, S4) and *Subfamily Chironominae* (S5, S6). The calculated saprobic index showed I and II quality classes for all sections except section S6, class III.

The changes observed in the composition of the functional groups of the invertebrate communities are similar to those proposed by the Continuous River concept. In the upstream sections the shredders are not dominant since these sections lack the shadow usually existing in the sources area.

The cluster analysis shows that the samples from the S2, S3 sections are similar to those from S4, S5 in terms of diversity. The sections S1 and S6 are different in terms of the populations' diversity from those of the other sections due to the physical and chemical parameters, the river's morphometry as well as a possible pollution.

REZUMAT: Schimbari sezoniere si longitudinale in comunitatea de macronevertebrate a Râului Moldova (Moldova, România).

Variațiile sezonale şi spațiale ale comunității de nevertebrate din râul Moldova au fost studiate în 6 secțiuni de-a lungul râului Moldova în mai - octombrie 2007.

Au fost identificați 40 de taxoni. Cele mai abundente specii şi taxoni au fost *Rhitrogena semicolorata* (S1, S2), *Baetis rhodani* (S1, S2, S3), *Caenis rivulorum* (S6) şi Subfam. *Orthocladiinae* (S2, S3, S4) şi Subfam. *Chironominae* (S5, S6). Indicele saprob calculat arată clase de calitate I - II pentru toate secțiunile cu excepția secțiunii S6 clasa a III a.

Schimbările observate în compoziția grupurilor funcționale a comunității de nevertebrate sunt similare cu cele propuse în conceptul de continuum lotic. În secțiunile din amonte nu sunt dominanți mărunțitorii deoarece secțiunile nu sunt foarte umbrite ca cele din zona izvoarelor.

Analiza cluster arată că probele din secțiunile S2, S3 şi cele din S4, S5 sunt similare ca diversitate. Secțiunile S1 şi S6 sunt diferite din punct de vedere al diversității populațiilor față de celelalte secțiuni datorită parametrilor fizico-chimici, morfometriei râului şi a unei posibile poluari.

RESUME: Modifications saisonnières et longitudinales dans la communauté des macroinvertebrés de la rivière Moldova (Moldavie, Roumanie).

Les variations saisonnières et spatiales dans la communauté d'invertébrés de la rivière Moldova ont été étudiées sur 6 sections de la rivière entre les mois de mai et d'octobre 2007.

40 taxons ont été identifiés. Les espèces et les taxons les plus abondants ont été *Rhitrogena semicolorata* (S1, S2), *Baetis rhodani* (S1, S2, S3), *Caenis rivulorum* (S6) et la Sous-fam. *Orthocladiinae* (S2, S3, S4) et la Sous-fam. *Chironominae* (S5, S6). L'indice saprobie calculé a montré des classes de qualité I et II pour toutes les sections à l'exception de la section 6, classe de qualité III.

Les changements observés dans la composition des groups fonctionnels des communautés d'invertébrés sont similaires à ceux proposés par le concept de la Rivière Continue. Dans les sections situées en amont les déchiqueteurs ne sont pas dominants car les sections ne sont pas très ombragées, tel celles de la zone des sources.

L'analyse par partitionnement des données montre le fait que les échantillons des sections S2, S3 et celles des sections S4, S5 sont similaires en termes de diversité. Les sections S1 et S6 sont différentes des autres sections en ce qui concerne la diversité des populations à cause des paramètres physico-chimiques, la morphométrie de la rivière ainsi qu'à cause d'une possible pollution.

INTRODUCTION

Longitudinal and seasonal shifts in benthic community structure, either in species composition or functional feeding group composition, due to changes in physical, chemical and geomorphological characteristics, have been documented by many authors (Allan, 1975; Vannote et al., 1980; Winter-Bourn et al., 1981; Dudgeon 1984; Brussock et al., 1985; Minshall et al., 1985; Statzner and Higler 1986; Huryn and Wallace 1987; King et al., 1988; Grubaugh et al. 1996).

The benthic communities in the streams in the north part of Romania have not been all characterized from an ecological and functioning of ecosystems point of view. The macroinvertebrate part of this community is important for water quality evaluations used in European biomonitoring programs. Therefore, it is important that more studies focus on the structure and function of lotic invertebrate communities in the north of Romania to increase our knowledge and allow comparisons of information between regions.

This paper presents results from a study on the dynamics of the benthic invertebrate community in a mountain river.

MATERIALS AND METHODS

A first-order river, the Moldova river is located in NE Romania. The river Moldova arises from springs in a mixed forest area, runs through forest, hills, villages and cities, and about 213 km downstream from its origin, flows into Siret river near city Roman. The Moldova river is a fast flowing, up to 15 m - 20 m wide and 0.3- 0.7 m deep depending on season and precipitations. It has three main tributaries: Moldovița, Suha Mare and Ozana.

For the ecological investigation of benthic fauna, six sampling sites in the Moldova river were investigated from the upper part Fundu Moldovei - S1, Amonte Câmpulung Moldovenesc - S2, middle part Aval Gura Humorului - S3, Baia - S4, Timişeşti - S5 and Roman - S6 in lower part of the river.

The headwaters and middle sections of the Moldova river were partly shaded by riparian vegetation (*Alnus incana, Myricaria gemenica, Salix alba, Salix pupurea*). The dominant substrate was cobbles (S1, S2) and gravel with cobbles (S2, S3, S4). The channel become wider downstream, less intensively shaded by riparian vegetation (*Salix* sp*., Populus* sp.) and the dominant substrates was gravel (S5, S6).

Macroinvertebrate samples were taken by standard Surber net (mouth opening 30 x 30 cm, mesh size 0.3 mm) using transect sampling methodology, three month per year in three sampling sites, and another 3 sampling sites for 2 month per year in the interval between May 2007 and October 2007. Samples were preserved in 4% formaldehyde and organisms were sorted and identified to species level where possible.

Selected physical and chemical parameters were measured: temperature ºC, oxygen saturation % and oxygen content mg/l (Oxygenometers InoLab Oxi 730), pH (pH-meteters SevenEasy), Conductivity µS/cm (InoLab Cond 730), CaO Hardness ºGerman was determined by titration.

Species diversity was assessed using the Simpson diversity index. Water quality was evaluated with the saprobic index (Pantle-Buck modificated - Romanian Monitoring Programme) and expressed as quality class.

Spatial and temporal changes in the structure of macroinvertebrates communities were performed with cluster analyses on the basis of Bray-Curtis dissimilarity using the MVPS software. Functional feeding groups were determined after Merrit and Cummins (1978) and expressed as a percentage of density.

RESULTS AND DISCUSSIONS

The physical and chemical conditions at selected sampling sites are presented in the table 1.

Temperature, pH, conductivity showed seasonal variations and variation among sampling sites. The Moldova river headwaters had quite constant temperature in the summer (14 - 16ºC) whereas temperatures and its amplitude increased downstream 20ºC. Similar patterns were observed for conductivity, and CaO hardness. Oxygen saturation and oxygen content at all sites were typicall for fast flowing river and reached 86%, 96.7% or exceed 96.7%.

A total of 40 taxa of macroinvertebrates were identified during two season. Mean number of individuals per sample, number of taxa, mean of Simpson Diversity index and saprobic quality class are presented in the table 2.

Table 1: Physical and chemical parameters at sampling sites in the Moldova river.

Sites	Elevation (m)	Catchment area (km2)	Temp. (°C)	Oxygen saturation %	Dissolved O2 (mg/l)	pH	Conductivity (µS/cm)	Hardness (°german)
S1	726	327	5...16	78 - 89.2	8 - 9.1	8.2	203.2	7.8
S2	633	660	6...17	79.8 - 90.2	7.9 - 11.5	8.2	214.7	7.2
S3	468	1757	5...18	83.7 - 90.4	8.8 - 11.2	8.3	302.4	9.7
S4	412	2558	8...20	72 - 93.2	6.6 - 11.7	7.8	443	12.4
S5	320	3468	8...15	108 - 126	10.9 - 11.5	8.2	411.6	12.5
S6	204	4299	9...20	88.8 - 96.7	8.8 - 10.2	8.1	440.5	10.5

Table 2: Biological characteristics at sampling sites S1 - S6 in the Moldova river; no. ind - mean number of individuals per sample; no. taxa - number of taxa; S - Simpson diversity index; QC - quality class.

Sites	S1	S2	S3	S4	S5	S6
No. ind.	178	267	119	119	164	104
No. taxa	13	10	9	9	7	6
S	0.89	0.83	0.75	0.82	0.75	0.66
QC	I	I	I	I-II	I-II	III

Species diversity were lowest at the lower parts (S6), highest in the upper parts and middle (S1, S2, S4), declined in the middle parts (S3, S5).

The most abundant species in the macroinvertebrates community were *Rhitrogena semicolorata* (S2, S1), *Baetis rhodani* (S1, S2, S3), *Caenis rivulorum* (S6) and the chironomid subfamily *Orthocladiinae* (S2, S3, S4), subfamily *Chironominae* (S5, S6). Saprobic values indicated quality class I - II for all sampling sites except S6 - III. Organic pollution may be one of the possible reason for low taxa diversity in S6. The most diverse group were mayflies (11 taxa), dipterans (10 taxa), stoneflies (7 taxa), trichopterans (5 taxa), oligochaeta (3 taxa) and with 1 taxa: crustaceans, Odonata, and Hirudinea.

The observed changes in functional feeding groups composition (Fig. 1) of macroinvertebrates community were similar in some respects to those proposed in the river continuum concept (Vannote et al., 1980). In the upper part the shredders are not dominant (9.14 %), because the sections there are not very shaded. The sections from upper part is not in the spring area.

In the upper part of the Moldova river (S1, S2) collectors/scrapers dominated (43.4% and 47.9% respectively) filterers (23.2%) in S2, whereas in the S3, S4 dominated filterers (29.1%), collectors/scrapers (28.3 %), and in S4 predators are importants (21.1%). In the middle parts in S5 dominated collectors (66.3 %) then collectors/scrapers (16.3%) and generalist like *Gammarus* (13.04%) and in S6 dominated collectors (48.1%), predators (33.01%).

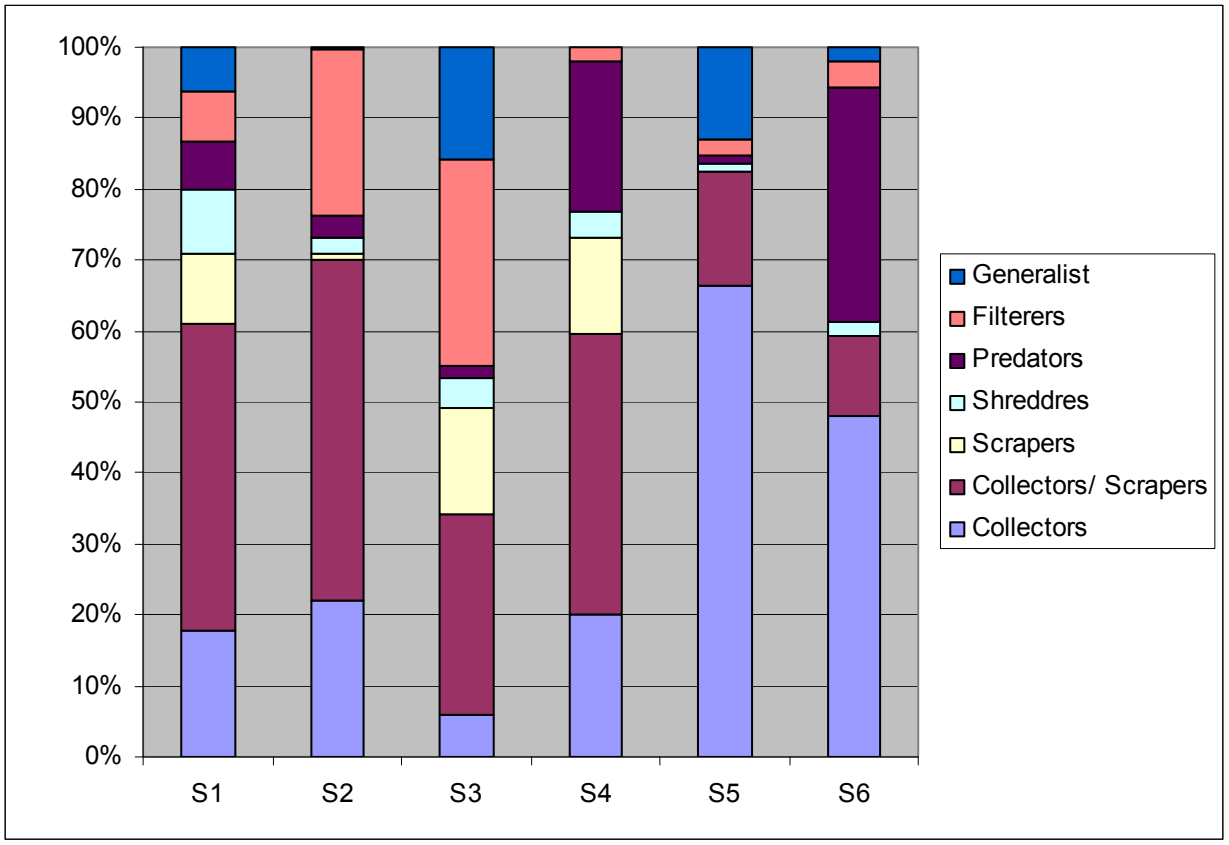

Figure 1: Composition of functional feeding groups in the Moldova river; data are shown as percentage of density (%); S1 - S6 - sampling sites.

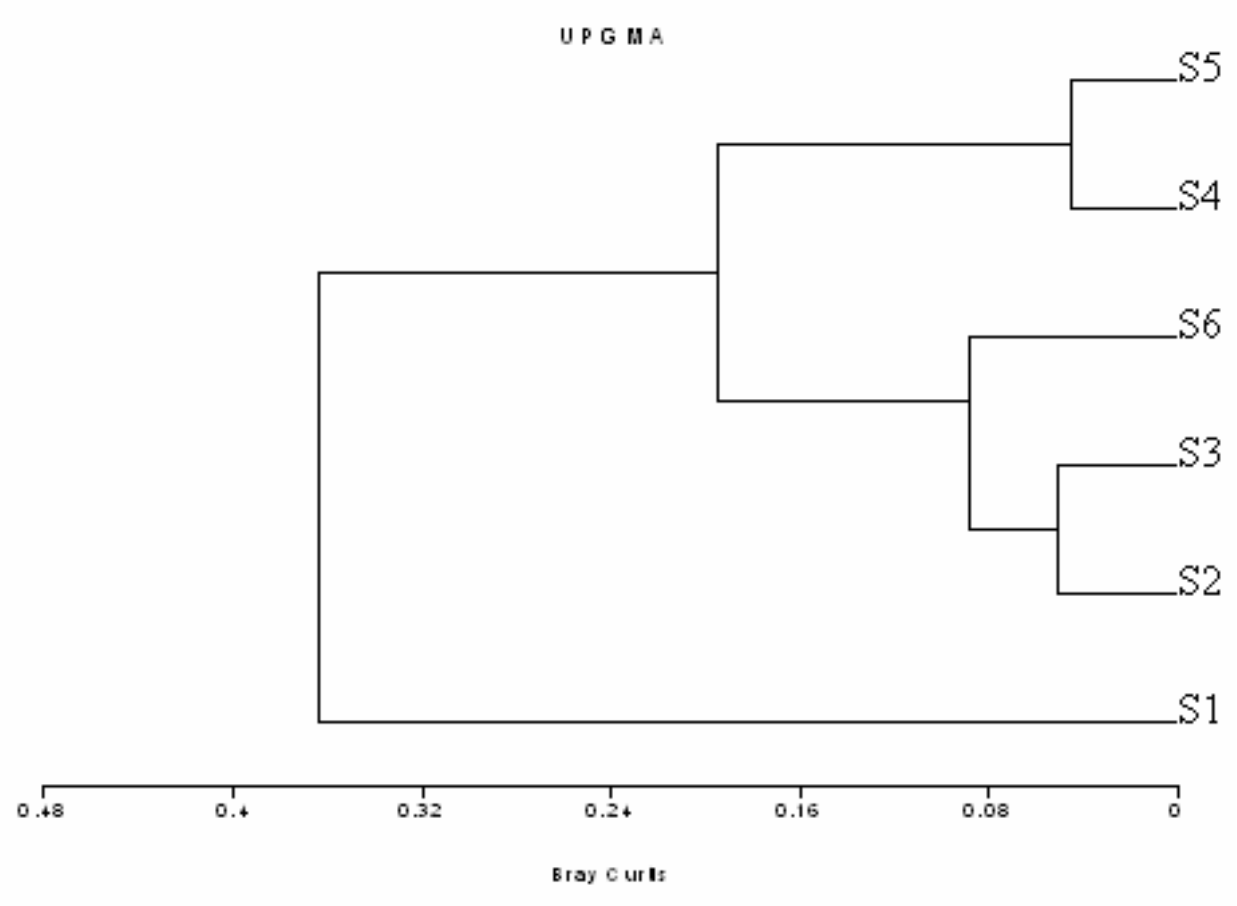

Figure 2: Cluster analysis of macroinvertebrate samples collected in the Moldova river; S1 - S6 sampling sites.

Cluster analysis have shown in the figure 2 that the samples from the sampling sites (S2, S3) and (S4, S5) are similar from the point of view of diversity. In contrast S1 and S6 are different in the macroinvertebrate community diversity in comparison with other sampling sites because of physico-chemical parameters, morphometry features (S1) and possible organic pollution (S6).

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NATURA 2000 SITES PROPOSALS FOR THE EUROPEAN COMMUNITY INTEREST CYCLOSTOMATA FISH SPECIES CONSERVATION (ROMANIA)

Doru BĂNĂDUC [1]

KEYWORDS: Romanian Carpathians, *Eudontomyzon danfordi*, *Eudontomyzon mariae*, and *Eudontomyzon vladykovi*, sites of Community importance, Biogeographic seminars.

ABSTRACT

This paper data were obtained for the Biogeographic Seminars for Romania and Bulgaria which was in Sibiu/Romania 2007, arguments for the proposal of some Natura 2000 sites (SCI), for the conservation of the species belonging to the Cyclotomata Class, Petromyzonidae Family, in the Romanian Carpathians, based on personal knowledge of the author no older than five years.

For each of these three fish species of European conservative interest (*Eudontomyzon danfordi*, *Eudontomyzon mariae* and *Eudontomyzon vladykovi*) were offered data regarding their: general information, sites/lotic sectors proposed for the Natura 2000 net, status of conservation, conservative objectives and future necessary studies.

REZUMAT: Propuneri de situri Natura 2000 pentru conservarea unor specii de peşti Cyclostomata de interes comunitar (România).

Datele din această lucrare au fost obținute pentru Seminariile Biogeografice pentru România şi Bulgaria care au avut loc la Sibiu/România 2007, argumente în favoarea desemnării unor situri Natura 2000 (SCI), pentru conservarea speciilor din Carpații Românești aparținând clasei Cyclotomata, familia Petromyzonidae, bazate pe cunoştințe ale autorului din ultimii cinci ani.

Pentru fiecare dintre aceste specii de inres conservativ europen (*Eudontomyzon danfordi*, *Eudontomyzon mariae* şi *Eudontomyzon vladykovi*) sunt prezentate informații de ordin general, situri/sectoare lotice propuse pentru rețeaua Natura 2000, stare de conservare, obiective de conservare, necesitatea unor studii vitoare.

ZUSAMMENFASSUNG: Vorschläge betreffend Natura 2000 Gebiete für Fische Cyclostomata von gemeinschaftlichem Interesse (Rumänien).

Die vorliegende Arbeit hat zum Ziel für die Biogeographischen Seminare für Rumänien und Bulgarien, die 2007 in Sibiu/Rumänien stattfinden werden, Argumente zu Gunsten von Vorschlägen zur Ausweisung von Natura 2000 Gebieten zu bringen, die sich insbesondere auf die in Rumänien vorkommenden Arten der Klasse Cyclostomata (Rundmäuler), Familie Petromyzonidae beziehen und sich auf Daten stützen, die nicht älter als fünf Jahre sind.

Für jede dieser Arten (*Eudontomyzon danfordi*, *Eudontomyzon mariae* und *Eudontomyzon vladykovi*) werden allgemeine Informationen geliefert sowie Daten zu den für das Netzwerk Natura 2000 vorgeschlagenen Gebieten /lotischen Abschnitten, über Zustand, Schutzziele und die Notwendigkeit weiterer Untersuchungen.

INTRODUCTION

The main objectives of the European Community in the environmental field are the conservation, the protection and the improvement of the environment quality, in the condition of the rationale use of the existing natural resources. The biodiversity conservation constituted an important task of the European Union in the last 25 years.

To elaborate its environmental policies the European Community takes in consideration the scientifically and technical available information, the environmental conditions characteristic for different regions of the Community and the need for an equilibrated development of all regions, the benefits involved and the costs involved.

The EC action frame, to preserve the biodiversity was established through the Council Directives (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora. This European Directive have as objective to protect and sustain biodiversity in the EU through a network of protected areas (Nature 2000), in which to conserve habitats and species characteristic for the European biogeographic regions.

Romania contributes to the European Natural heritage with around: 47% of the territory covered by natural and semi natural ecosystems; 780 types of habitats; 3700 superior plant, 33085 invertebrate and 717 vertebrates species (Bănăduc, 2001).

Romania is the country with the highest biogeographic diversity of the European Union countries and the country which will join the European Union in 2007, with five biogeographic regions: continental, alpine, pannonic, pontic and stepic (Bănăduc and Florescu, 2007).

There are few ways through which the Nature 2000 initiative in Romania can improve the nature protection: extension of the natural areas; the correct management plans; institutional capacity building; involvement of only proper educated and trained personel; raising awareness.

One important aspect of the implementation of the Directives is the establishment of a network of protected sites called Natura 2000 in Romania.

The author have done already some scientifical works regarding other fish species of European conservative interest for the potential Natura 2000 sites frame designation and/or management (Bănăduc, 2001; Bănăduc, 2006; Bănăduc, 2007a, b, c; Curtean-Bănăduc and Florescu, 2007). This work being regarding the Cyclosomata taxonomical group on the Romanian territory.

This paper can be considered as a part of the proposal for Natura 2000 sites of community importance (SCIs) for fish (Cyclostomata/Petromyzonidae) species based on the author original data and meeting the scientific as well as the European Union criteria for Natura 2000 site selection. This work shouldn't be considered complete, new future inputs being wellcome.

The author hope that these data will consist a part of the Romanian proposals at the Biogeographical seminars, as a part of the dynamic adaptation of the Natura 2000 network across Europe, trying to avoid that Romania do not propose sufficient sites to meet the Directive 92/43/EEC requirements for this taxonomic group species.

MATERIALS AND METHODS

This report is based on original data, no older than five years. Different samplings methods were used for fish capture: angling, diffent types of nets and electric fishing.

This group include threatened and in regres species, that's why the sampled fish were released imediately after their identificaton in the same place where they were captured due to obviously conservative reasons.

Few site selection criteria were used: well preserved fish (of Community interest - oCi) populations; stable fish (oCi) populations; healthy fish (oCi) populations; typical natural habitats (oCi); low human impact; favorable geographical position for the species spreading in more than one hydrographic watersheds; best option for species/habitat (oCi) in relation with the future Nature 2000 areas management.

RESULTS

Eudontomyzon mariae (Berg, 1931) - Nature 2000 code 2484 (Cicar, Ukrainian brook lamprey, Ukrainische lamprete, Lamproie d'Ucraine)

General fact sheet. The body is cylindrical in its anterior part. The body height represents 5.3 - 7.0% of the total length. The two dorsal fins have a space between them and are not tall. In June, immediately before the reproduction period the two dorsal fins grow and touch one to another. The adult's individuals are dark brown on their back with light brown sides and the ventral face silver coloured. There are some individuals which are almost black. This species is living in mountainous rivers. The reproduction period is between June - July period. The larvae are living long periods of time in mud. The metamorphosis happened in autumn. (Bănărescu, 1969; Oţel, 2007). In Romania has a relatively low spreading area and can be considered as a species with a high vulnerability. The species is protected by: Bern Convention, European Habiats Directive 92/43, IUCN Red List, OUG 57/2007.

Proposed sites. The relatively short lotic sectors with proper ecologic conditions for this noncomercial species, and the posibility to be wrongly identified make it a species characterised in general by old and sometimes triky information, reason for which new samppling campagnes were necessary. As a result of such field campaigns in the last five years, in this paper some Natura 2000 sites or part of sites/sectors can be proposed: Gilort River (Jiu River watershead); main stream and its tributaries between 550 and 800 m altitude; Cisnădiei River main stream between 600 - 800 m altitude; Lotrioara River main stream between 600 and 900 m altitude; Argeş River main stream and its tributaries (Vâlsan, Râul Doamnei, Râuşor, Brătia, Râul Târgului), between 600 and 1100 m altitude, one or two of these rivers being sufficient to be protect for this species in this watershed; Buzău River main stream between 600 and 700 m altitude; Moldova River main stream and its tributaries between 700 and 1000 m altitude; Suceava River main stream and its tributaries between 500 and 900 m altitude.

Eudontomyzon mariae can be considered a criticaly endangered species, of which conservation (Tab. 1) is of high importance in the present.

Table 1: Generic conservation objectives for the *Eudontomyzon mariae* species.

Attribute	Acceptable limits
Adult population density	No decline in density under the value of one individual at $50m^2$.
Age structure	At least three year-classes should be present at significant densities.
	At least 75% of the population should consist of 3+ fish individuals
Habitat quality - water	River ecological state good. Oligo-ß-mesosaprobic. Strict phisico-chemical pollution control.
	Carpathian Fish - Index of Biotic Integrity scoring minimum 36.
River morphology	No artificial barriers constraining essential fish movements.
	No artificial river bed and river banks. No riverbed sand, rocks and boulders exploitation.
Hydrology	Maintain natural liquid and solid water flow regime and depth.
Substrate	No artificial river bed. Natural river bed.

Including the above mentioned lotic sectors in the Natura 2000 network can be asured the best posible (based on actual data) coverage and conectivity for this fish species. One important missing steping stone/s should be possible to be find by future ichtiological studies in the middle part of the Eastern Romanian Carpathians.

Eudontomyzon vladykovi (Oliva and Zanandrea, 1959) - Nature 2000 code 2485 (Cicar, River lamprey, Lamproie de riviere, Donau-Bachneunauge).

Fact sheet. The maximum body height represent 6.5 - 7.5% of its total lenght. The two dorsal fins are tall and one near another. The body is slightly narrowed in its anterior part. The adults colour is dark grey with a whitish ventral face. The adults reach 156 - 201 mm. (Bănărescu, 1969) This species living in the mountainous zone, in a very restricted area in Romania. The metamorphosis is happen in autumn. The adults are no feeding. The reproduction period is June - July, period after which the adults die. (Bănărescu, 1969) In Romania it can be considered as a species with a high degree of vulnerability. The species is protected by: Low 13/1993, Bern Convention, European Directive 92/43, and Low 462/2001.

Proposed sites. The relatively short lotic sectors and extremely few areas with proper ecologic conditions for this noncomercial species, and the posibility to be wrongly identified make it a species characterised in general by old and sometimes triky information (in fact, till now, the lack of recent studies make a lot of the specialists to belive that this species exist no more in Romania) reasons for which new samppling campagnes were highly necessary. As a result of such field campaigns in the last five years, in this paper some Natura 2000 sites or part of sites/sectors can be proposed: Bistra Bouţarului River main stream and tributaries between 500 and 750 m altitude; Upper Timiş River main stream and tributaries between 450 and 900 m altitude.

Eudontomyzon vladykovi is the most critically endangered species of the Cyclostomata Class on the Romanian territory, of which conservation (Tab. 2) is extremely urgent and serious in the present.

Table 2: Generic conservation objectives for the *Eudontomyzon vladykovi* species in the proposed areas.

Atribute	Acceptable limits
Adult population density	No decline in density under the value of one individual at $50m^2$.
Age structure	At least three year-classes should be present at significant densities.
	At least 75% of the population should consist of 3+ fish individuals.
Habitat quality - water	River ecological state good. Oligo-ß-mesosaprobic. Strict phisico-chemical pollution control..
	Carpathian Fish - Index of Biotic Integrity scoring minimum 43.
River morphology	No artificial barriers constraining essential fish movements.
	No artificial river bed and river banks. No riverbed sand, rocks and boulders exploitation..
Hydrology	Maintain natural liquid and solid water flow regime and depth.
Substrate character	No artificial river bed. Natural river bed.
Riverine habitat character	Natural vegetation (including trees) associations presence.
Monitoring	Seasonly integrated monitoring.

Important missing stepping stones for an optimum connectivity should exist to the southern Romanian and Serbian areas of interest.

More research in these areas should be done in this respect in the near future!

Eudontomyzon danfordi (Regan, 1911) - Nature 2000 code 4123.

Fact sheet. The body is relatively compressed laterally in the anterior region. The body height represents 5.0 - 7.7% of the total length. The two dorsal fins have a space between them, space which represent 2.3 - 6.8% of the body length. The first dorsal fin is not tall and rounded, the second one is taller. The adults are dark grey; the ventral side is yellow-white. This species is living in mountainous rivers. The larvae eat invertebrates and the adult fish. (Bănărescu, 1969) In Romania has a relatively large spreading area. There were registered reductions in its area of spreading due to the human impact. The presence of this fish in rivers/rivers sectors is unequal due to its relation with slow moving muddy areas in which the larvae stay. In Romania it can be considered as a species with a medium vulnerability. The species is protected by: Low 13/1993, Bern Convention, European Directive 92/43, and OUG 57/2007.

Eudontomyzon danfordy can be considered an endangered species, of which conservation (Tab. 3) is important in the present.

Proposed sites. The relatively short lotic sectors with good ecologic conditions for this noncomercial species, and the posibility to be wrongly identified make it a species characterised in general by old and triky information, reasons for which new samppling campagnes were necessary. As a result of such field campaigns in the last five years, in this paper some Natura 2000 sites or part of sites/sectors can be proposed: Vişeu River main stream between 700 and 1000 m altitudes; Someşul Mare River main stream 600 - 1000 m altitude, Sălăuţa River (Someşul Mare River watershed) main stream between 650 and 900 m altitude; Mureş main stream and the tributaries 700 - 1000 m altitude; Târnava Mare River main stream 500 - 700 m altitude; Sebeş River main stream (Mureş river watershed) 500 - 800 m altitudes; Râul Orăştiei main stream and the tributaries (Mureş river watershed) 600 - 900 m altitude, Cerna hunedoreană main stream (Mureş river watershed) 650 - 1000 m altitude; Crişul Repede 700 - 900 m altitude, Crişul Negru 700 - 900 m altitude; Upper Timiş River main stream and tributaries between 450 and 900 m altitude; Caraş 450 - 700.

Table 3: Generic conservation objectives for the *Eudontomyzon danfordy* species in the proposed areas.

Atribute	Acceptable limits
Adult population density	No decline in density under the value of one individual at $50m^2$.
Age structure	At least three year-classes should be present at significant densities.
	At least 75% of the population should consist of 3+ fish individuals.
Habitat quality - water	River ecological state good. Oligo-ß-mesosaprobic. Strict phisico-chemical pollution control.
	Carpathian Fish - Index of Biotic Integrity scoring minimum 36.
River morphology	No artificial barriers constraining essential fish movements.
	No artificial river bed and river banks. No riverbed sand, rocks and boulders exploitation.
Hydrology	Maintain natural liquid and solid water flow regime and depth.
Substrate character	No artificial river bed. Natural river bed.
Riverine habitat	Natural vegetation (including trees) associations.
Monitoring	Seasonly integrated monitoring.

Including the above mentioned lotic sectors in the Natura 2000 network can be asured its improvement.

More research can also improve this proposals.

CONCLUSIONS

The presented data should be used in the Biogeographical Semiars process of designation the Natura 2000 net in Romania due to their importance in terms of valuable populations, coverage and conectivity.

Of course a national wide task like this can not be fulfilled by one or some of the Romanian ichtiologists, all of them being necesary to be bring together, action which unfortunately was not happened at least till this moment, a lack of coordination or understanding of the situation which can induce a lack of data in the construction of a proper Natura 2000 net in Romania.

All the studied species present important problems in terms of their conservation in the last decades and urgent protection actions should be proceed in the field by proper specialists, at the national level now!

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*** Bern Convention on the Conservation of Wildlife and Natural Habitats http://conventions.coe.int/Treaty/FR/Treaties/Html/104-3.htm

*** OUG 57/2007 pivind regimul ariilor naturale protejate, conservarea habitatelor naturale, a florei şi faunei.

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IMPORTANT AREA FOR FISH - NATURA 2000 (SCI) FOR *GOBIO ALBIPINNATUS* LUKASCH, 1933 SPECIES IN THE LOWER CARAŞ RIVER (BANAT, ROMANIA)

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KEYWORDS: Romania, Banat, *Gobio albipinnatus* Lukasch, 1933, ichtiocenosis, site of Community importance proposal, lower Caraş River, biogeographic seminars.

ABSTRACT

The main objectives of the European Community in the environment issue are the conservation, protection and the improovement of the environment quality, in the conditions of the rational use of the existent natural resources. In the last few decades the biodiversity conservation was one of the main objectives in this rspect.

This paper data goal is to bring arguments in the favour of the proposal of a Natura 2000 site (Lower Caraş River), based on the original data of the author, specific criteria (well preserved fish populations; stable fish populations; healthy fish populations; typical natural habitats; low human impact; favorable geographical position) in relation with the *Gobio albipinnatus* species and the other species present in the local fish comunities of the interest area.

REZUMAT: Sit Natura 2000 (SCI) important pentru specia *Gobio albipinnatus* Lukasch, 1933 în Caraşul inferior (Banat, România).

În general obiectivele Comunității Europene în domeniul mediului, sunt conservarea, protecția şi îmbunătățirea calității acestuia, în condițiile utilizării raționale a resurselor naturale existente.

În ultimul sfert de secol conservarea biodiversității a fost unul dintre cele mai importante obiective în acest sens.

Prezenta lucrare îşi propune să aducă argumente în favoarea desemnării unui sit Natura 2000 (Caraşul inferior), bazată pe date originale actuale ale autorului, criterii specifice (populații de peşti bine conservate; populații de peşti stabile; populații de peşti sănătoase; habitate naturale tipice; impact antropic scăzut; poziție geografică favorabilă) legate de specia *Gobio albipinnatus* şi celelalte specii prezente în comunitățile de peşti din zona de interes.

ZUSSAMENFASUNG: Ein für Fische, insbesondere für *Gobio albipinnatus* Lukasch 1933 wichtiges Natura 2000 (SCI)-Gebiet am Unterlauf des Caraşul inferior (Banat, Rumänien).

Die Hauptziele der Europäischen Gemeinschaft im Bereich Umwelt sind Sicherung, Schutz und Verbesserung der Umweltqualität unter den Bedingungen einer nachhaltigen Nutzung der vorhandenen, natürlichen Ressourcen. Ab dem letzten Viertel des vergangenen Jahrhunderts war das Hauptaugenmerk des Naturschutzes auf die Bewahrung der Biodiversität ausgerichtet.

Die vorliegende Arbeit setzt sich zum Ziel Argumente zugunsten eines Vorschlags bzw. der Unterstützung der Ausweisung eines Natura 2000-Gebietes am unteren Caraş zu finden, die auf den Kenntnissen des Verfassers beruhen und sich auf artspezifische Kriterien (gut geschützte, stabile, gesunde Fischpopulationen, typische natürliche Habitate mit geringem menschlichem Einfluss, günstige geografische Bedingungen) für die Art *Gobio albipinnatus* und die anderen, in den Fischgemeinschaften des betreffenden Gebietes vorkommenden Arten stützen.

INTRODUCTION

The main objectives of the EC in the environmental field are the conservation, the protection and the improvement of the environment quality, in the condition of the rationale use of the existing natural resources. The biodiversity conservation constituted one important objective of the EU in the last quarter of century.

To elaborate its environmental policies the EC structures takes in consideration the scientific and technical available information, the environmental conditions characteristic for different regions of the Community and the need for an equilibrated development of all its component regions, the result benefits and the involved costs.

The action frame at the European Community level, to preserve the biodiversity was established based on the Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC).

These both European Directives have as objective to protect and sustain the biodiversity in the European Union through the creation of a protected areas network (Nature 2000 net), in which to conserve habitats and species characteristic for the European biogeographic regions.

In this moment Romania contributes to the European Natural heritage with around: 47% of the territory covered by natural and semi natural ecosystems; 780 types of habitats; 3700 superior plant species; 33085 invertebrate species and 717 vertebrate species. (Bănăduc, 2001)

RESULTS AND DISCUSSIONS

Site selection criteria

According to the European Natura 2000 initiative the following site selection criteria were used: well preserved fish (of Community interest - oCi) populations; stable fish (oCi) populations; healthy fish (oCi) populations; typical natural habitats (oCi); lowest (as possible) human impact presence; favorable geographical position (possibility of species spreading in more than one hydrographic watersheds); best option for species/habitat (oCi) in relation with the needed future Nature 2000 areas management.

Romania is the country with the highest biogeographic diversity of all the European Union countries and the country which joined the European Union in 2007, with five biogeographic regions: continental, alpine, pannonic, pontic and stepic.

There are few ways through which the Nature 2000 initiative in our country can improve its nature protection: extension of the natural areas surface; the creation and implementation of correct management plans for these protected areas; institutional capacity building; raising awareness.

One important element of the implementation of these two Directives is the establishment of a Natura 2000 sites network in Romania too.

The author have done already some scientifical works regarding this fish species of European conservative interest for the potential Natura 2000 sites frame designation and/or management (Bănăduc, 2001; Bănăduc, 2006; Bănăduc, 2007a, b, c; Curtean-Bănăduc and Florescu, 2007).

This paper data goal was to sustain, for Biogeographic Seminars for Romania, arguments for the proposal for a Natura 2000 site based on *Gobio albipinnatus* Lukasch, 1933 fish species. The paper is based on the author present original data and meets the scientific as well as the European Union criteria for Natura 2000 site selection.

It can be regarded as an example for the selection of Natura 2000 sites for other fish vspecies groups.

This report is based on the original scientific data, no older than five years. It has to be stated that no complete data are available to definitely and comprehensively statute and border the local populations. Further populational field studies are needed.

This paper focused mainly on the *Gobio albipinatus*, an Annex II fish species. This species can be regarded as 'umbrella species'. Secondary the other fish species of the local ichthiocenosis are considered.

Species fact sheet

Scientific name: *Romanogobio vladykovi* (Fang, 1943) / *Gobio albipinatus* (Lukasch) 1933. Order: Cypriniformes / Suborder: Cyprinoidei / Family: Cyprinidae.

Vernacular name: whitefin gudgeon (English) / porcuşor de şes/porcuşor de nisip (Romanian).

Tera typica: Kahul Lake (actual teritory of Moldavia Republic).

Ecology: living in rivers with sandy and/or muddy riverbeds. It prefers deep water with slow velocity (lower than 50 cm/s). (Bănărescu, 1969) In general is solitary, sometimes is find in small fish schools. Its food consists mainly in benthic macroinvertebrates. (Bănăduc, 2003).

Conservation status: In Romania the whitefin gudgeon has a relatively wide range but its range evolution is in regress. Its position is considered as being with low vulnerability. *Gobio albipinatus* species is protected by the Law 13 of 1993 (through which Romania became a part to the Bern Convention), European Directive 92/43/EEC, through the Law no. 462/2001 (and the last amendments) regarding the protected natural areas and the habitats and wild flora and fauna conservation.

The studied area and also the proposed Natura 2000 site are on the lower Caraş River in the Caraş-Severin County, belonging to the Continental biogeographic region (Fig. 1).

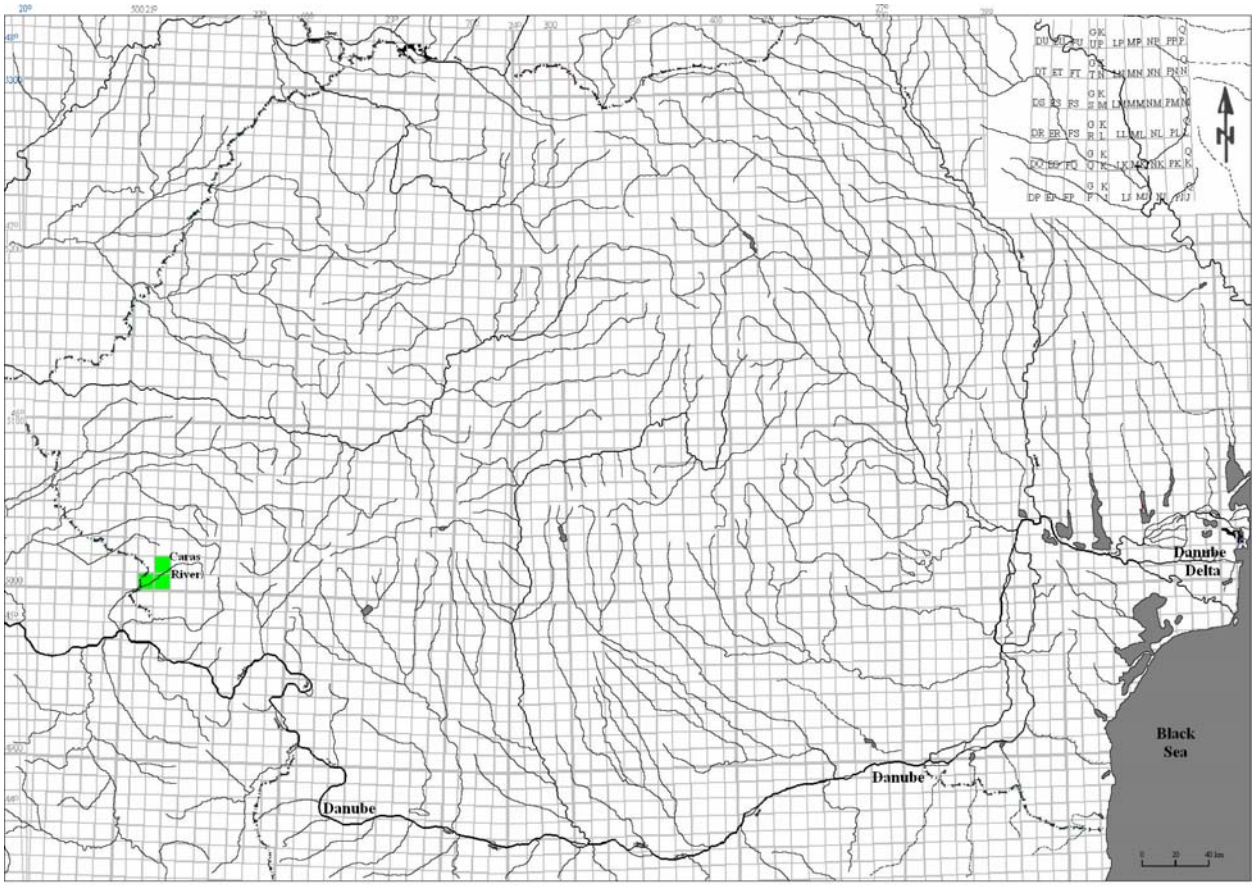

Figure 1: Nature 2000 (SCI) proposed site (■) for *Gobio albipinnatus* on the Lower Caraş River.

Lower Caraş River proposed site

Arguments for the proposal of the (Lower Caraş River) site: healthy fish *Gobio albipinatus* individuals; typical natural habitats/good habitats under quantitative and qualitative aspects; enough space and diverse microhabitats in mosaic (longitudinal and transversal) shape; the anthropogenic impact presence is actually in the limits of this species tolerance; the possibility of this site extension over the national border (in Serbia) can bring the possibility of a future triple management control (European, Romanian, Serbian) on the proposed Natura 2000 site; important population in the Romanian territory context.

Gobio albipinatus can act here as an umbrella species for the high local ichtyofauna diversity (over 25 fish species).

Based on the present known data, there are here, around three more fish species under diverse status of protection: *Gobio kessleri* - vulnerable species (Law 13/1993 through which Romania became a part of Bern Convention; European Directive 92/43/EEC, Nature 2000; Law 462/2001 regarding the protected Natural areas and the Natural habitats and wild flora and fauna conservation); *Gymnocephalus baloni* - vulnerable species (Law 13/1993 through which Romania became a part of Bern Convention; European Directive 92/43/EEC, Nature 2000; Law 462/2001 regarding the protected Natural areas and the Natural habitats and wild flora and fauna conservation); *Gymnocephalus schraetser* - vulnerable species (Law 13/1993 through which Romania became a part of Bern Convention; European Directive 92/43/EEC, Nature 2000; Law 462/2001 regarding the protected Natural areas and Natural habitats and wild flora and fauna conservation).

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ORNITHOLOGICAL RESEARCHES IN THE AREA OF THE RÂUŞOR BASIN FROM THE UPPER BASIN OF THE TÂRGULUI RIVER (IEZER-PĂPUŞA MASSIF, MUNTENIA, ROMANIA)

Adrian MESTECĂNEANU [1]

KEYWORDS: Iezer-Păpuşa Mountains, biodiversity conservation, birds.

ABSTRACT

In this paper work are presented the results of the researches effectuated between October 2005 and July 2007 in the area of the Râuşor Basin from the upper hydrographical basin of the Târgului River. The lake has a surface of 190 ha and is situated at aproximately 850 m alitude. Its palustral vegetation is not rich and the sorounding mountainous slopes are covered with mixt forests. In this conditions, the observed ornitofauna is relatively not rich, in the mentioned time interval being still identified 69 bird species, which belong to 9 orders. 11 species are aquatic or depending of wetlands: *Podiceps cristatus, Tachybaptus ruficollis, Phalacrocorax carbo, Ardea cinerea, Anas platyrhynchos, Anas querquedula, Bucephala clangula, Mergus merganser, Motacilla cinerea, Motacilla alba* and *Cinclus cinclus*. The number of species varied between 17, in January, and 35, in Octomber, and the number of individuals between 74, in May, and 326, in September. The majority of the species are sedentary, remercable in this respect being the big duck (*Anas platyrhynchos*), which also breed here, a female being observed here with its ducklings, important is also the presence of the migratory species. Notable is the certain breeding on basin of the Goosander (*Mergus merganser*), a species ich breed very rare in our country.

REZUMAT: Cercetări ornitologice la lacul de acumulare Râuşor din bazinul superior al râului Târgului (Iezer-Păpuşa, Muntenia, România).

În lucrare sunt prezentate rezultatele cercetărilor efectuate între octombrie 2005 şi iulie 2007 în zona lacului de acumulare Râuşor din bazinul superior al Râului Târgului.

Lacul are o suprafaţă de 190 ha şi este situat la aprox. 850 m altitudine. Vegetaţia sa palustră este săracă iar versanţii montani înconjurători sunt acoperiţi îndeosebi cu păduri mixte de fag şi molid. În aceste condiţii, ornitofauna observată a fost relativ săracă, în intervalul de timp mai sus menţionat aici fiind totuşi identificate 69 de specii care aparţin la 9 ordine. 11 dintre acestea sunt acvatice sau dependente de zonele umede: *Podiceps cristatus*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Ardea cinerea*, *Anas platyrhynchos*, *Anas querquedula*, *Bucephala clangula*, *Mergus merganser*, *Motacilla cinerea*, *Motacilla alba* şi *Cinclus cinclus*. Numărul speciilor a variat între 17, în ianuarie, şi 35, în octombrie, iar cel al exemplarelor între 74, în mai, şi 326, în septembrie. Majoritatea speciilor sunt sedentare, de remarcat fiind în acest sens rața mare (Anas platyrhynchos), care a şi cuibărit aici, o femelă fiind observată alături de bobocii săi, însă importantă este şi prezența speciilor de pasaj sau a oaspeților de iarnă. De asemenea, de notat este şi cuibăritul sigur în zonă al ferăstraşului mare (*Mergus merganser*), specie care se reproduce foarte rar în țara noastră.

ZUSAMMENFASSUNG: Ornithologische Untersuchungen um den Râuşor-Stausee im oberen Einzugsgebiet des Târgul-Flusses (Iezer Păpuşa, Muntenia, Rumänien).

In vorliegender Arbeit werden die Ergebnisse der zwischen Oktober 2005 und Juli 2007 im Gebiet des Râuşor-Stausees, oberes Einzugsgebiet des Târgul-Flusses, durchgeführten Untersuchungen vorgestellt. Der See hat eine Fläche von 190 ha und liegt in einer Höhe von etwa 850 m. Die ihn umgebende Sumpfvegetation ist spärlich entwickelt und artenarm, die umliegenden Berghänge sind vorwiegend von Buchen- und Fichten-Mischwäldern bedeckt. Unter diesen Bedingungen ist die beobachtete Vogelfauna relativ arm. Dennoch wurden im betrachteten Zeitraum hier 69 Arten festgestellt, die zu 9 Ordnungen gehören. 11 der festgestellten Arten sind Wasservögel oder von Feuchtgebieten abhängige Arten, es sind: Haubentaucher (*Podiceps cristatus*), Zwergtaucher (*Tachybaptus ruficollis*), Kormoran (*Phalacrocorax carbo*), Graureiher (*Ardea cinerea*), Stockente (*Anas platyrhynchos*), Knäkente (*Anas querquedula*), Schellente (*Bucephala clangula*), Gänsesäger (*Mergus merganser*), Gebirgstelze (*Motacilla cinerea*), Bachstelze (*Motacilla alba*) und Wasseramsel (*Cinclus cinclus*). Die Zahl der Arten schwankte zwischen 17 im Januar und 35 im Oktober und jene der Individuen zwischen 74 im Mai und 326 im September. Die Mehrheit der Vögel sind sesshaft und ständig im Gebiet, wobei vor allen die Stockente(*Anas platyrhynchos*) hervorzuheben ist, die auch hier brütete und ein Weibchen neben seinen Küken beobachtet werden konnte. Wichtig ist jedoch auch das Vorkommen von Durchzüglern oder Wintergästen. Bemerkenswert ist der im Gebiet gesicherte Brutnachweis des Gänsesägers (*Mergus merganser*), der sich auf dem Gebiete Rumäniens nur selten fortpflanzt.

INTRODUCTION

Despite the basin Râuşor was opened in 1987, its avifauna was not studied until now. Thus, in this paper, the ornithofauna of the lake is for the first time presented. In the same time, new data about the birds' fauna of the Iezer - Păpuşa Massif and of the basins made after 1960 in the mountain hydrographically basin of the Argeş River is presented.

MATERIALS AND METHODS

The basin Râuşor (Fig. 1)is situated in the superior hydrographical basin of the Târgului River, at its confluence with the Râuşor stream. It is placed at about 16 km upstream of Câmpulung, approximately 850 m altitude, between Zănoaga, Baratu and Plaiul Păpuşii summit. It is a 4.4 km long and 115 km^2 hydrological basin. In the backside of its rock-fill dam (120 m height and 380 m coronament) is collected a water volume of 60 mil. m^3 for a surface of 190 ha.

The objective of the structure is the production of electricity, the supply of potable and industrial water of Câmpulung and the attenuation of high flood.

The basin water is oligotrophic. The dissolved oxygen is high and the pH is little acid. The maximum temperature in the superficial level of the basin is about 20 ºC, between spring and autumn there is an accentuated thermic stratification. The basin is affected by frost, the ice level reaching 20 - 30 cm at the entrance section and 10 - 12 cm at the dam section; the frost and the thaw are produced up to dam (Ţârlea, 2007b). After the first half of winter, the surface of the basin could be all frozen.

The fish fauna is dominated by trout (*Salmo trutta fario*).

The shores of the basin are rocky and abrupt. Due to that, the typical vegetation of marsh is not present. Regarding the phytoplankton, the little concentration of nutrients of the basin determines a high range of systematic groups, with a low number of individuals. The cryophilic Diatomea, dominate all the year, in associations with the Dinophytae algae (Ţârlea, 2007a).

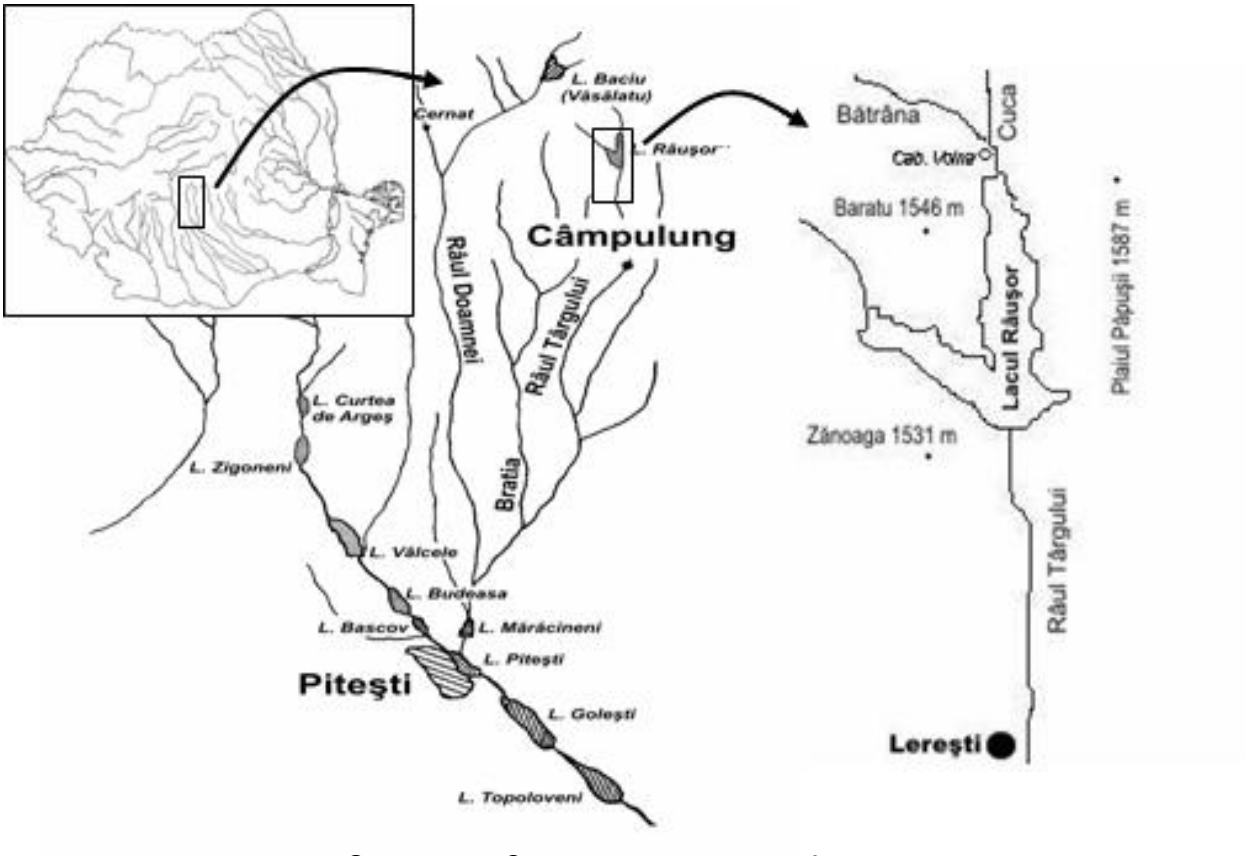

Figure 1: The map of the Râuşor Basin area.

The vegetation of the neighborhood versants is constituted mainly of mixed forests with beech (*Fagus sylvatica*) and spruce (*Picea abies*). The shrub level is represented by: *Sambucus racemosa*, *Lonicera nigra, Spiraea chamaedryfolia* etc. (Alexiu, 1998).

The climate of the zone is montane tempered continental. The annual average temperature is 7.9 ºC and the rainfall is high, with an average of 780 l/m^2/year. The hydrologic regime presents big variations, rainy periods alternated with dry periods at 3 - 4 years (Ţârlea, 2007b).

The anthropic pressure on the basin Râuşor is moderate. The sportive fishing is frequently practiced and voyages with the motorized boats are organized in the middle of the summer tourist's season. Plastic recipients carried by the water from the upper side of the river (where a lot of tourists prefer to spend their holidays and weekends) float on the water surface. Noticeable is the pollution created by the engines of the cars (which go on the road that border the basin on its left side and unite the village Lereşti with Voina and Cuca chalets) and the lack of civilized tourists, too. The trucks that transport wood from the forestall exploitations pollute as well.

The itinerary method was used. The transect was covered on foot, on the road that bordered the basin on the Eastern part, in general between 10 and 12 o'clock. The birds found on the water surface and shores were registered as well as the ones observed or heard in the tampon area. Binocular 50 x 80 was used. The researches were effectuated during October 2005 - July 2007. 17 collections of data were made - two in each of the following months: October, December, January and February and one in every other month.

RESULTS AND DISCUSSION

During the study, 69 species were observed in the area of the basin Râuşor. They belong to 9 orders: Podicipediformes (2 species), Pelecaniformes (1 species), Ciconiiformes (1 species), Anseriformes (4 species), Falconiformes (3 species), Columbiformes (1 species), Cuculiformes (1 species), Piciformes (3 species) and Passeriformes (53 species). Among these species, 11 are aquatic or depending of wetlands: *Podiceps cristatus*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Ardea cinerea*, *Anas platyrhynchos*, *Anas querquedula*, *Bucephala clangula*, *Mergus merganser*, *Motacilla cinerea*, *Motacilla alba* and *Cinclus cinclus* (Tab. 1).

Table 1: The bird species found in the area of the basin Râuşor.

No	Species	Biogeographic origin	Presence on lake and in the tampon zone												Phenology in area of the Râuşoru Bassin	Breeding in area	Observations
			January	February	March	April	Mai	June	July	August	September	October	November	December			
Order Podicipediformes																	
1.	*Podiceps cristatus**	Tp		■											P	Nc	1 ex., 22.II.2007
2.	*Tachybaptus ruficollis**	E		■								■			P	Nc	1 ex., 13.X.2006, 1 ex., 22.II.2007
Order Pelecaniformes																	
3.	*Phalacrocorax carbo**	Tp											■		P	Nc	1 ex. immature, 8.XI. 2006
Order Ciconiiformes																	
4.	*Ardea cinerea**	Tp					■								P	Nc	1 ex., 22.X.2006
Order Anseriformes																	
5.	*Anas platyrhynchos**	Tp	■	■	■	■	■	■	■	■	■	■	■	■	S, P, Oi	Sc	
6.	*Anas querquedula**	Tp				■									P	Nc	3 ex., 26.IV.2006
7.	*Bucephala clangula**	S												■	Oi	Nc	5 ex., 22.X.2005
8.	*Mergus merganser**	Tp			■	■	■	■	■	■	■			■	Ov, Oi	Sc	1 fem.+ 7 juv. 6.VI.2007
Order Falconiformes																	
9.	*Buteo buteo*	Tp		■	■	■	■	■	■	■		■			Ov	Sc	
10.	*Accipiter gentilis*	Tp		■											S	Pc	2 ex., 23.II.2006
11.	*Accipiter nisus*	Tp		■			■								S	Pc	3 ex., 6.VI.2007
Order Columbiformes																	
12.	*Columba palumbus*	E						■							Ov	Pc	
Order Cuculiformes																	
13.	*Cuculus canorus*	Tp				■									Ov	Sc	
Order Piciformes																	
14.	*Dendrocopos major*	Tp			■			■		■					S	Sc	
15.	*Dendrocopos minor*	Tp								■					S	Pc	
16.	*Dryocopus martius*	S		■			■	■				■		■	S	Pc	
Order Passeriformes																	
17.	*Delichon urbica*	Tp					■	■	■						Ov	Sc	
18.	*Anthus spinoletta*	Ti										■			P	Nc	
19.	*Motacilla cinerea**	E				■	■	■	■		■	■	■		Ov	Sc	
20.	*Motacilla alba**	E			■	■	■	■	■			■			Ov	Sc	
21.	*Lanius collurio*	E					■								P	Nc	1 ex., 22.V.2006
22.	*Lanius excubitor*	Tp											■		P	Nc	1 ex., 8.XI.2006
23.	*Garrulus glandarius*	E	■	■	■	■		■		■		■	■	■	S	Sc	

No	Species	Biogeographic origin	Presence on lake and in the tampon zone												Phenology in area of the Râuşoru Bassin	Breeding in area	Observations
			January	February	March	April	Mai	June	July	August	September	October	November	December			
24.	*Pica pica*	E										■			E	Nc	1 ex., 13.X.2006
25.	*Nucifraga caryocatactes*	S		■	■	■	■		■	■	■	■	■		S	Sc	
26.	*Corvus corone cornix*	E		■											E	Nc	2 ex., 23.II.2006
27.	*Corvus corax*	Tp	■	■					■		■	■	■	■	S	Pc	
28.	*Cinclus cinclus**	E										■	■	■	S	Sc	
29.	*Troglodytes troglodytes*	E		■	■	■	■	■	■	■	■	■	■	■	S	Sc	
30.	*Prunella modularis*	E		■	■	■	■	■	■	■	■	■			Ov	Sc	
31.	*Prunella collaris*	Ti										■		■	Oi	Nc	1 ex., 13.X.2006, 1ex., 22.XII.2005
32.	*Sylvia borin*	E					■	■							Ov	Sc	
33.	*Sylvia atricapilla*	E				■	■	■	■	■	■				Ov	Sc	
34.	*Sylvia curruca*	E						■	■	■					Ov	Sc	
35.	*Phylloscopus collybita*	Tp			■	■	■	■	■	■	■	■			Ov	Sc	
36.	*Regulus regulus*	E	■	■	■	■	■	■	■			■	■	■	S	Sc	
37.	*Regulus ignicapillus*	E						■		■					Ov	Pc	
38.	*Ficedula albicollis*	E				■									Ov	Pc	
39.	*Ficedula parva*	S					■								Ov	Pc	1 ex., 22.V.2006
40.	*Saxicola rubetra*	E				■				■					P	Nc	3 ex., 26.IV.2006
41.	*Phoenicurus phoenicurus*	E				■									P	Nc	1 ex., 26.IV.2006
42.	*Phoenicurus ochruros*	Mo				■		■	■		■	■			Ov	Sc	
43.	*Erithacus rubecula*	E			■	■	■	■	■	■	■	■			Ov	Sc	
44.	*Turdus torquatus*	E			■										P	Nc	1 ex., 27.III.2007
45.	*Turdus merula*	E		■	■	■	■	■	■		■	■			Ov	Sc	
46.	*Turdus philomelos*	E			■	■		■			■	■			Ov	Sc	
47.	*Turdus viscivorus*	E			■	■									S	Pc	
48.	*Turdus pilaris*	S	■											■	Oi	Nc	
49.	*Parus palustris*	E	■	■	■			■		■		■	■	■	S	Sc	
50.	*Parus montanus*	S	■	■				■	■		■	■	■	■	S	Sc	
51.	*Parus cristatus*	E	■	■							■	■			S	Pc	
52.	*Parus caeruleus*	E									■	■	■	■	S	Pc	
53.	*Parus ater*	E	■	■	■	■	■	■	■	■	■	■	■	■	S	Sc	
54.	*Parus major*	E	■	■	■	■		■	■	■	■	■	■	■	S	Sc	
55.	*Aegithalos caudatus*	Tp	■		■	■		■		■	■	■			S	Sc	
56.	*Sitta europaea*	Tp										■			S	Pc	
57.	*Certhia familiaris*	E	■	■						■	■		■		S	Pc	
58.	*Tichodroma muraria*	Ti	■										■		Oi	Nc	1 ex., 27.I.2006, 1 ex., 8.XI.2006
59.	*Passer domesticus*	Tp										■			E	Nc	13 ex., 13.X.2006
60.	*Fringilla coelebs*	E			■	■	■	■	■	■	■	■			Ov	Sc	
61.	*Fringilla montifringilla*	S										■		■	Oi	Nc	

No	Species	Biogeographic origin	Presence on lake and in the tampon zone												Phenology in area of the Râușoru Bassin	Breeding in area	Observations
			January	February	March	April	Mai	June	July	August	September	October	November	December			
62.	*Pyrrhula pyrrhula*	S													S	Pc	
63.	*Coccothraustes coccothraustes*	E													S	Pc	
64.	*Carduelis chloris*	E													E	Nc	1 ex., 6.VI.2007
65.	*Carduelis spinus*	E													S	Pc	
66.	*Carduelis carduelis*	E													E	Nc	
67.	*Loxia curvirostra*	S													S	Sc	
68.	*Emberiza cia*	M													E	Nc	1 ex., 27.III.2007
69.	*Emberiza citrinella*	E													P	Nc	2 ex., 8.XI.2006

Legend: * - aquatic species or depending of wetlands; Tp - Transpalearctic species, Mo - Mongolian species, A - Arctic species, M - Mediterranean species, E - European species, Ti - Tibetan species, S - Siberian species; S - resident species, Ov - summer visitor, Oi - winter visitor, P - migratory species, E - vagrant species; Nc - non breeding species, Pc - probable breeding species, Sc - certainly breeding species; ex. - exemplar, fem. - female, juv. - juvenile.

In accordance with the biogeographic origins (Tab. 1, Fig. 2), the observed species belong to seven groups: Transpalearctic, Mongolian, Arctic, Mediterranean, European, Tibetan and Siberian. The most numerous are the European species (36 species - *Columba palumbus*, *Ficedula albicollis*, *Phoenicurus phoenicurus* etc.; 57.17%). The other species are Transpalearctic (19 species - *Phalacrocorax carbo*, *Lanius excubitor*, *Corvus corax* etc.; 27.54%), Siberian (19 species - *Bucephala clangula*, *Dryocopus martius*, *Ficedula parva* etc.; 13.04%), Tibetan (3 species - *Anthus spinoletta*, *Prunella collaris* and *Tichodroma muraria*; 4.35%), Mongolian and Mediterranean (each with 1 species - *Phoenicurus ochruros* and *Emberiza cia*, 1.45%).

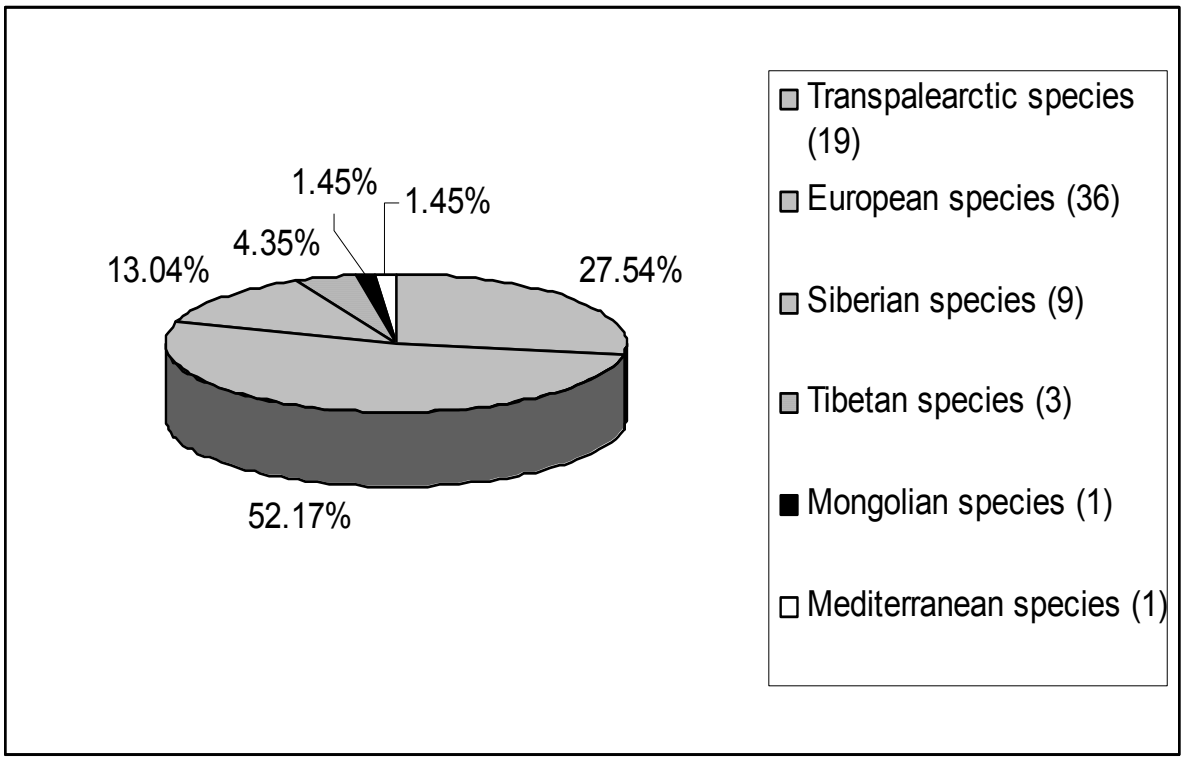

Figure 2: The birds' distribution in accordance with their biogeographic origin.

The number of the observed species in the area of the basin Râuşor varied between 17, in January, and 35, in October (Tab. 1, Fig. 3), and that of the exemplars varied between 74, in May, and 326, in September (Fig. 4). Ascertainable is the little number of species (*Anas platyrhynchos*, *Parus ater*, *Carduelis spinus*) that are present in big number of exemplars in the winter months (December and January), when the trophic resources are available only for them.

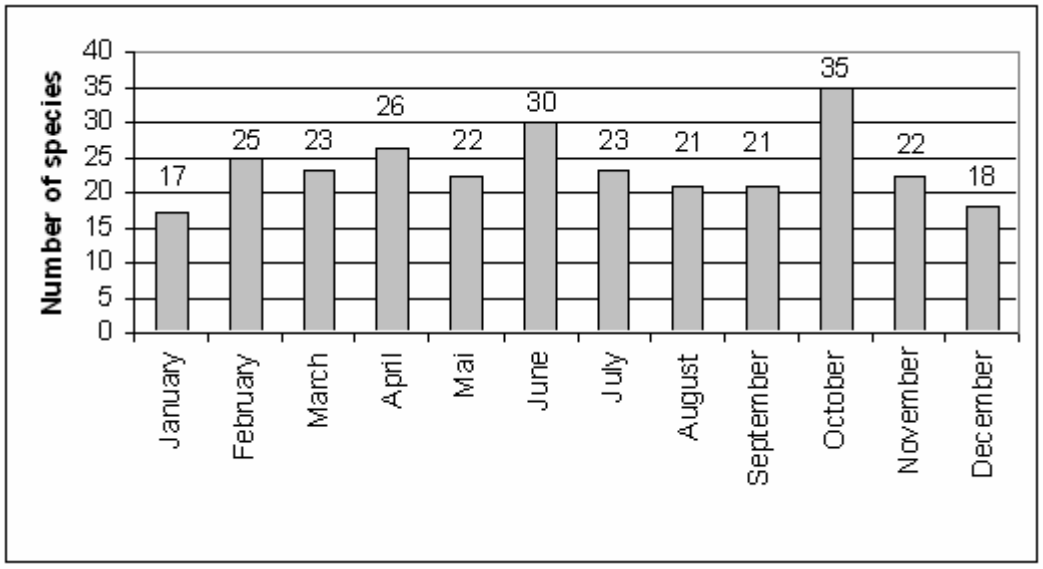

Figure 3: The monthly variation of the number of species observed in the Râuşor basin area.

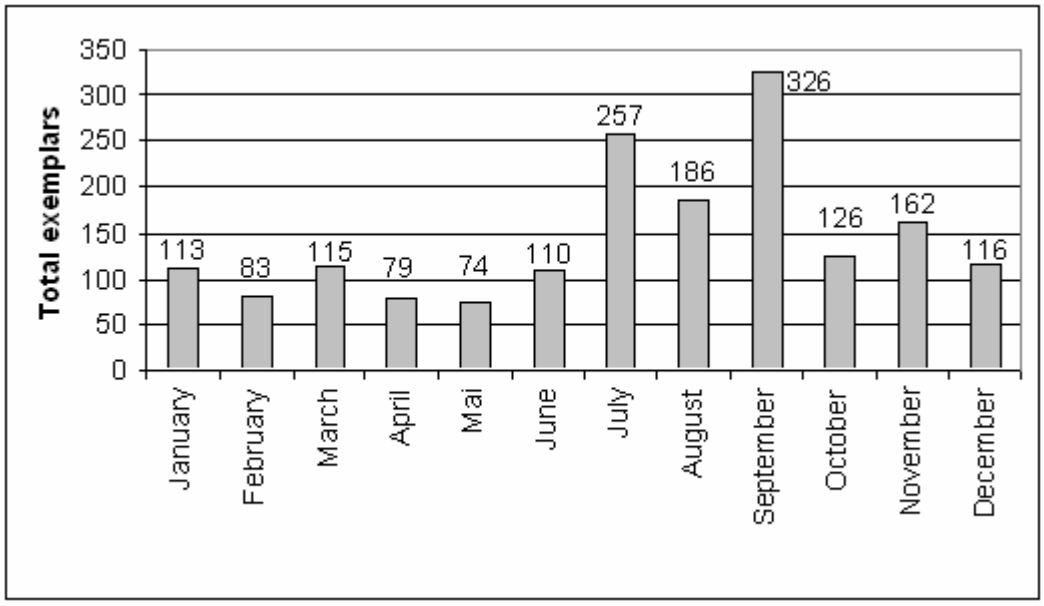

Figure 4: The monthly average variation of the number of exemplars observed in area of the Râuşor basin.

The maximum number of the species from October is due to the presence of the passage species (*Tachybaptus ruficollis*, *Anthus spinoletta*) and vagrant species in the area (*Pica pica*, *Passer domesticus*), and, also of the summer species which did not leave in complete effectives, and the winter species (*Prunella collaris*, *Fringilla montifringilla*) which started to arrive. The other maximum number of species from June is smaller than the maximum number of species from October explicable because of the intense activity of the birds mating, when their presence is more evident. Regarding the variation of the effectives, it is noticeable that, despite the big number of species from April and May, the number of exemplars is the least of the year. The reason is that the sedentary species, like many summer species, are already found in the reproduction territory. The species presented in winter went to the north wards. In the next months, the effectives increase substantially, as a result of the appearance of flying juveniles. The top of this curve in July is due to the House Martin (*Delichon urbica*), species that breed on the building near the dam. Starting with August, the autumn migration begins. The maximum of September is a result of the increasing number of the chaffinches (*Fringilla coelebs*) and Mallards (*Anas platyrhynchos*). The spring migration is less in amplitude. It starts in March and ends in May. In the beginning of winter, in November, the effectives increase again. The Mallards (*Anas platyrhynchos*) came here for wintering and the Tits (*Parus* sp.) move down from the versants for the foraging. In the following month, the number of exemplars decreases constantly until February, when a new minimum appears. Now, especially for the Passeriformes, the resources of food are poor. The frozen water surface, could lead to the departure of the aquatic or water dependent species, too.

In accordance with the phenology (Tab. 1, Fig. 5) - the basin with its shores and the area which includes the base of the neighborhood versants - 26 species (37.68%) are sedentary (*Anas platyrhynchos*, *Accipiter nisus*, *Dryocopus martius* etc.), 20 species (28.99%) are summer visitors (*Anas platyrhynchos*, *Accipiter nisus*, *Dryocopus martius* etc.), 12 species (17.39%) are passage visitors (*Podiceps cristatus*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Ardea cinerea*, *Anas querquedula* etc.), 6 species (8.70%) are vagrant species (*Passer domesticus*, *Carduelis chloris*, *Emberiza cia* etc.) and 5 species (7.25%) are winter visitors (*Bucephala clangula*, *Prunella collaris*, *Turdus pilaris* etc.).

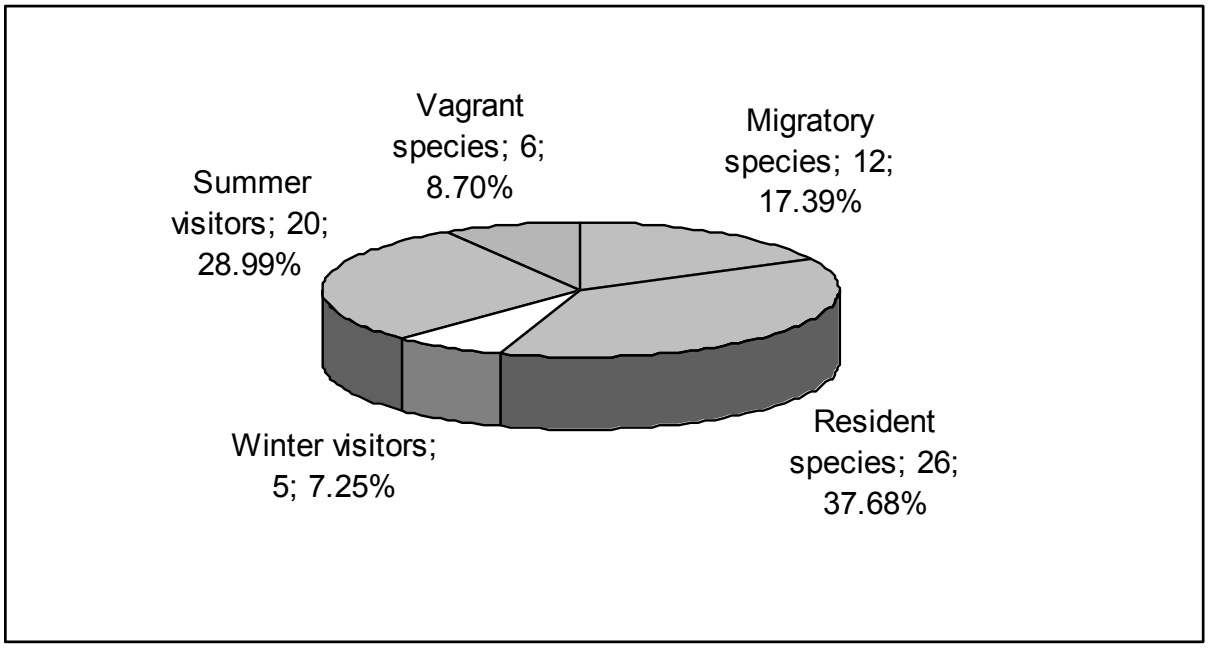

Figure 5: The birds species observed in the basin Râuşor in accordance with their phenology.

Among the passage species, some species effectuated long flights from winter wards to breeding ones and then return (*Podiceps cristatus*, *Lanius collurio*, *Saxicola rubetra* etc.) and other ones effectuated short flights - kilometers or dozens of kilometers - (*Anthus spinoletta*, *Tachybaptus ruficollis*). Among the winter species, some remain in area of the basin after they covered big distances from the breeding wards (*Bucephala clangula*, *Fringilla montifringilla*); the other ones cross small distances (*Prunella collaris*, *Tichodroma muraria*). Same species could belong to more phenologic categories.

Regarding the breeding we can say that (Tab. 1, Fig. 6) 23 species (33.33%) are nonbreeding (*Phalacrocorax carbo*, *Anas querquedula*, *Lanius excubitor* etc.), 17 species (24.64%) are probable breeding (*Accipiter gentilis*, *Dendrocopos minor*, *Corvus corax* etc.) and 29 species are certainly breeding (*Buteo buteo*, *Motacilla cinerea*, *Sylvia borin* etc.). It is remarkable the breeding on basin of the Goosander (*Mergus merganser*), (a Nordic species that is mainly a winter visitor in Romania, where he breed very rare) and of the Mallard (*Anas platyrhynchos*), that breed sporadic in the mountain water.

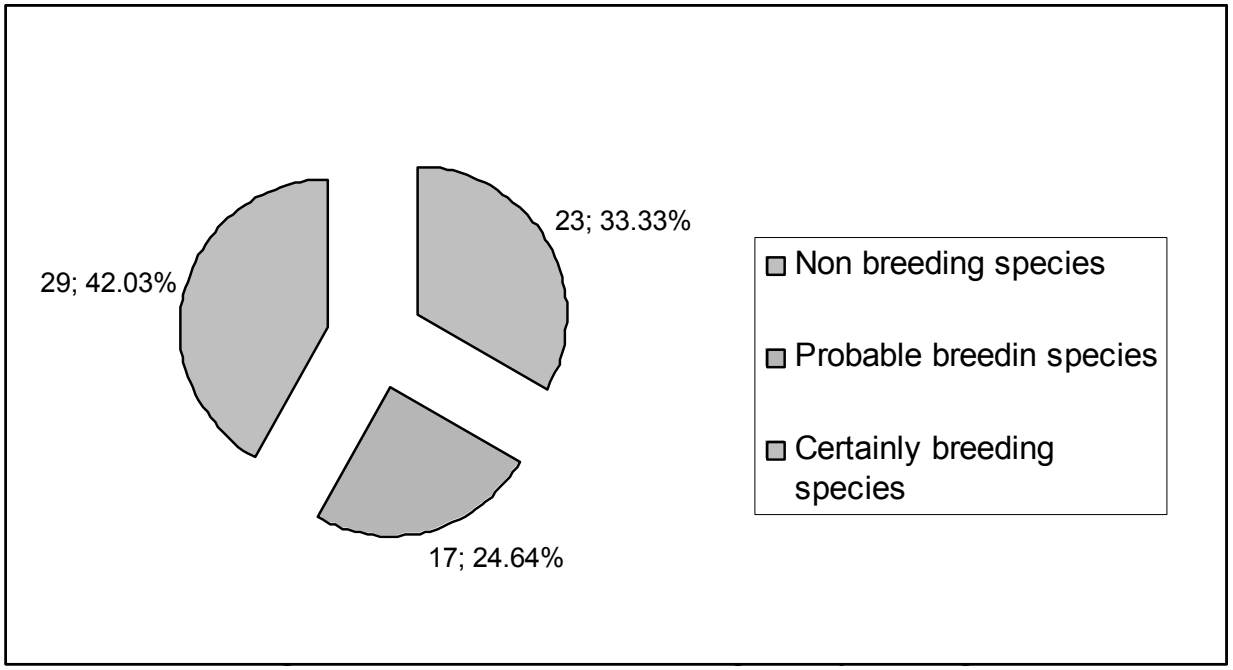

Figure 6: The distribution of the birds species in accordance to breeding.

The quantitative data were processed using (I_R): $I_R = NA/N \times 100$ relation index; N_A - number of the individuals of the order A; N - the total number of individuals counted.

The static axis is $A_S = 100/N = 11{,}11$ and the dominance axis is $A_D = 2 \times A_S = 22{,}22$; N - the counted orders number.
During entire studied interval, the Passeriformes and Anseriformes are over-dominant and other orders are complementary (Tab. 2, Fig. 7).

Table 2: The I_R values of the presented orders in the avifauna of the researched period.

No	Orders	Period
1	Anseriformes	30.01
2	Accipitriformes	1.20
3	Passeriformes	68.04
4	Other orders	0.74

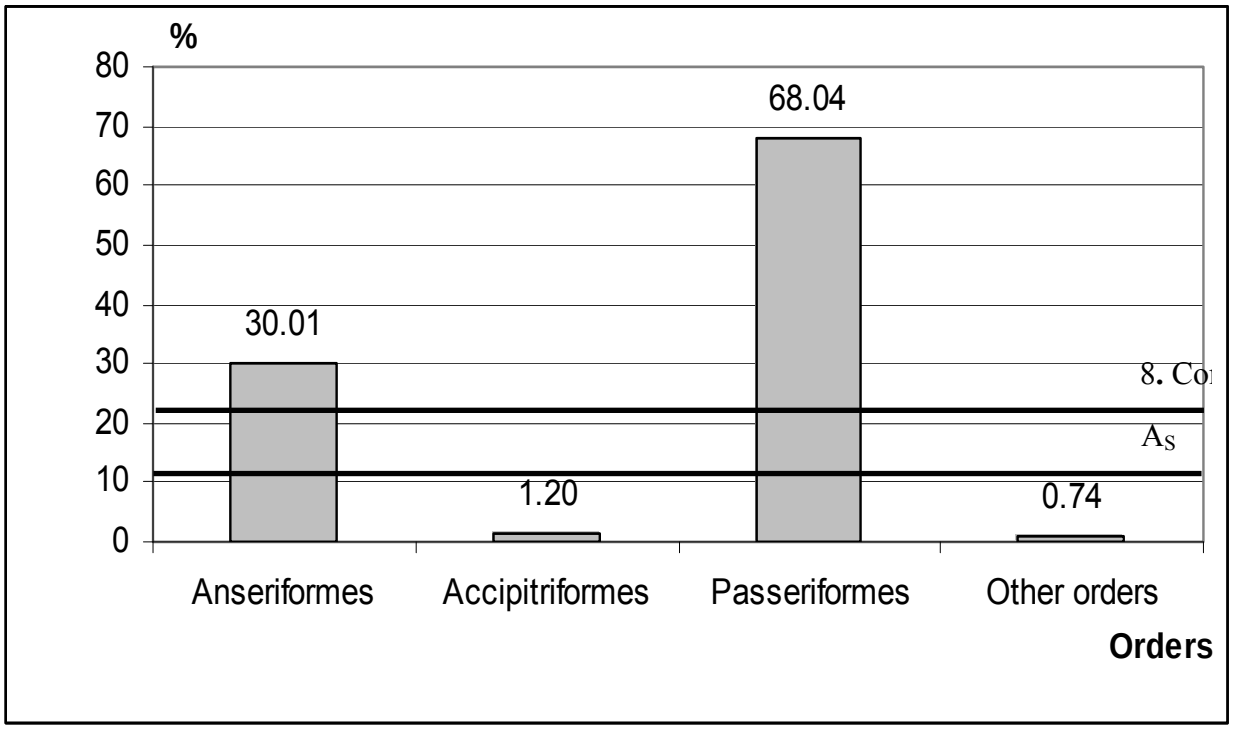

Figure 7: The birds orders of the population of the avifauna from the Râuşor River basin.

CONCLUSIONS

During the October 2005 - July 2007, in the area of the Râuşor Basin, 69 species belonging to 9 orders were observed. Among these species, 11 are aquatic or depending of wetlands: *Podiceps cristatus*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Ardea cinerea*, *Anas platyrhynchos*, *Anas querquedula*, *Bucephala clangula*, *Mergus merganser*, *Motacilla cinerea*, *Motacilla alba* and *Cinclus cinclus*.

In accordance with the biogeographic origins, the observed species belonging to seven groups: Transpalearctic, Mongolian, Arctic, Mediterranean, European, Tibetan and Siberian. The most numerous are the European species.

The number of the observed species in the area of the basin Râuşor varied between 17, in January, and 35, in October, and that of the exemplars varied between 74, in May, and 326, in September. The qualitative and quantitative presence is influenced of phenology and the availability of the trophic resources.

The majority of the species are sedentary, this category including the Mallard (*Anas platyrhynchos*), which has exemplars presented all year on the basin surface. Among the passage species, we remark: *Podiceps cristatus*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Ardea cinerea*, *Anas querquedula* and among winter visitors: *Bucephala clangula*, *Prunella collaris* and *Tichodroma muraria*.

It is noticeable the breeding on basin of the Goosander (*Mergus merganser*), (a Nordic species that is mainly a winter visitor in Romania, where he breed very rare) and of the Mallard (*Anas platyrhynchos*), that breed sporadic in the mountain water.

During the whole period, the Passeriformes and Anseriformes are over-dominant and the other orders are complementary.

In the future, for the biodiversity conservation it is necessary to stop or reduce the anthropic impact over the basin.

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THE INFLUENCE OF THE CLIMATICAL MODIFICATIONS ON THE DYNAMIC OF THE POPULATIONS OF BIRDS FROM BISTREŢ-CÂRNA WETLAND (DOLJ COUNTY, OLTENIA, ROMANIA)

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KEYWORDS: dynamics, aquatic birds, climatic factors, habitats, Bistreţ-Cârna wetland.

ABSTRACT

The paper present some aspects regarding the dynamic of the populations of some aquatic bird species (Ord. Podicipediformes, Pelecaniformes, Anseriformes, Ciconiiformes and Charadriiformes), of the Bistreţ - Cârna (Dolj County) wetland, situated in the Danube wetland and modified for intensive fish farming.

Beside the economic function, this area present a conservative importance for birds (it is on the way of intense aquatic migratory bird species, which stay in these basins or near them, temporarily or seasonally, for feeding, rest and/or reproduction), what determine the creation here of a special protected area for birds and a Community interest site.

The research on birds realised in this area were started in 1997, but in this study the subject was the dynamic of the species which are dependent by the aquatic habitats, observed in the last three years (2005 - 2007); this periods it was characterised by extreme climatic phenomenon, which determined the instability of many ecosystems of the Danube wetlands and implicitly of their bird communities.

REZUMAT: Influenţa modificărilor climatice asupra dinamicii populaţiilor de păsări din zona umedă Bistreţ-Cârna (judeţul Dolj, Oltenia, România).

Lucrarea prezintă câteva aspecte privitoare la dinamica populaţiilor unor specii de păsări acvatice (Ord. Podicipediformes, Pelecaniformes, Anseriformes, Ciconiiformes, Charadriiformes), din zona umedă Bistreţ - Cârna (judeţul Dolj), situată în Lunca Dunării şi amenajată pentru exploatare piscicolă intensivă.

Pe lângă funcţia economică, această arie prezintă o mare importanţă avifaunistică (se află pe un traseu intens tranzitat de speciile acvatice migratoare, care staţionează în perimetrul bazinelor sau în imediata vecinătate a acestora, temporar sau sezonier, pentru hrană, odihnă şi/sau reproducere), ceea ce a dus la acordarea statutului de arie de protecţie specială avifaunistică şi sit de interes comunitar.

Cercetările ornitologice efectuate în această zonă au demarat în 1997, dar în studiul de faţă s-a avut în vedere dinamica speciilor dependente de habitatele acvatice, observate în ultimii trei ani (2005 - 2007); această perioadă a fost caracterizată de fenomene climatice extreme, care au determinat instabilitatea mai multor ecosisteme din Lunca Dunării şi implicit a avicenozelor constituite aici.

RESUMÉ: L'influence des modifications climatiques sur la dynamique des populations d'oiseaux de la zone humide Bistreț-Cârna (département de Dolj, Oltenia, Roumanie).

L'article présente quelques aspects de la dynamique de certaines espèces d'oiseaux aquatiques (Ord. Podicipediformes, Pélécaniformes, Ansériformes, Ciconiiformes, Charadriiformes) de la zone humide Bistreț - Cârna (département de Dolj), située dans la Pleine de Daube et aménagée pour une exploitation piscicole intensive.

À part sa fonction économique, cette zone a une grande importance ornithologique (elle se situe sur un trajet intensément transité par les espèces aquatiques migratoires qui s'arrêtent dans le périmètre des bassins ou dans leur proximité, de manière temporaire ou saisonnière, pour se nourrir, se reposer et/ou se reproduire), ce qui a apporté le statut de zone de protection spéciale avifaunistique et zone d'intérêt communautaire.

Les recherches ornithologiques effectuées dans cette zone ont démarré en 1997, mais l'étude présente s'est concentré sur la dynamique des espèces dépendants des habitats aquatiques observées dans les trois derniers années (2005 - 2007); cette période a été caractérisée par des phénomènes climatiques extrêmes qui ont déterminé l'instabilité de plusieurs écosystèmes de la Plaine de Danube et implicitement des avicenoses y-constituées.

INTRODUCTION

Bistreț - Cârna lake is situated at about 5 km North of the Danube and the water supply comes from the Desnățui river, which flows into the lake in the North; it represents the largest wetland from the Oltenian sector of the dammed alluvial plain of the Danube and it covers a surface of about 2,000 ha; the lake is an important economic objective as it is fitted out for intensive piscicultural exploitation;

Its statute is that of important avifaunal areas with IBA code: RO 036 (Munteanu, 2006) and eurpean site (H. G. no. 1284/2007), attractive especially for migratory (winter guests, transitory species, summer guests) or partially migratory birds.

By the end of April 2006, the western basins (with a nursery role) were surrounded by paludous vegetation (*Salix* sp., *Typha* sp., *Carex* sp., *Cyperus* sp.), which was used for shelter and reproduction by certain aquatic species (*Podiceps cristatus, Aythya nyroca, Ixobrychus minutus, Ardeola ralloides, Circus aeruginosus, Chlidonias hybridus, Sterna hirundo, Porzana parva, Rallus aquaticus* etc.); the species *Anser anser, Ardea purpurea* found favourable conditions for nesting within the aquatic macrophytes that covered two small islands located in basin I and II.

MATERIAL AND METHOD

The dynamics of the aquatic species was monitored through systematic observations during each ecological season, as it follows: the prevernal season (the 1st of March - the 1st of May) - 2 field trips; the vernal season (the 1st of May - the 15th of June) - 4 field trips; the estival season (the 15th of June - the 15th of August) - 6 field trips; the serotinal season (the 15th of August - the 15th of September) - 2 field trips; the autumnal season (the 15th of September - the 1st of November) - 2field trips; the hiemal season (the 1st of November - the 1st of March) - 4 field trips.

We used the binoculars 10 x for observations, while for the identification process we consulted the guide for determining bird species (Bruun et al, 1999).

RESULTS AND DEBATES

The ornithological research within this important avifaunal area started in 1997 (Ridiche; Ridiche et al., 2000 - 2007) but the present study is focused on the dynamics of those species, which depend on the aquatic habitats and were noticed during the last three years (2005 - 2007); this period was characterized by visible climatic oscillations, induced by global warming, which generated the instability of many ecosystems from the Danube Alluvial Plain.

The qualitative and quantitative results of my own research are rendered in the table 1.

Table 1: The systematic list of the species noticed within Bistreţ-Cârna wetland and the numerical values registered between 2005 and 2007; in. - individual, pres. - presence, freq. - frequency, juv. - juvenile.

Species	2005 9 field trips: I-VIII	2006 6 field trips: I, IV, V, VI, VIII, X	2007 5 field trips: I, IV, V, VII, X	Observations
Tachybaptus ruficollis (Pall)	VII: 70 - 80 in.; X: 60/70 in.			Summer guest, uncertain nestling until 2005
Podiceps cristatus (L.)	VII:12 in.; VIII: + 50 in.; IX: 8 in.	X: 7 in.		Frequent summer guest; it nestled until 2005
Phalacrocorax carbo-sinensis (Blum.)	I: 5 in.; II: +350 in.; III: +20 in.; V: +16 in; VI: 6 in.; VII,VIII: +220 in; IX: 90 in	I: 15 in.; IV: tens in.	I: 30 in.; IV: +80 in.; V: +7in.; VII: + 300 in.; X: + 670 in.	Frequent all year long, numerous in passage
Phalacrocorax pygmaeus (Pall.)	II: + 80 in.; III: 7 in; V: 6 in., VI: 5 in; VIII: 6 in.	I: 9 in., IV: + 22 in.	I: 8 in., IV: +50 in. VII: + 100 in.; X: + 230 in.	Frequent, more numerous in passage
Pelecanus onocrotalus (L.)	VI: 4 in; IX: 42		VII: +250 in.; X: + 220 in.	Summer guest and transitory species with an oscillating number
Pelecanus crispus (Bruch)	IX: 8 in.; II: 7 in; VIII: 3 in.		VII: Pres.?; X: + 27 in.	Oscillating number in search for food
Ixobrychus minutus (L.)	VII: 3 in.; VI: 4 in.			Summer guest; it constantly nestled until 2005
Nycticorax nycticorax (L.)	VII: 30 in.; VIII: 6 in. juv.		V: 3 in., VII : 1 in.	Summer guest; constant presence until 2005
Ardeola ralloides (Scop.)	VII: 2 in. VI: 3 in.		VII: 1 in.	Frequent summer guest; it hatched until 2005
Egretta garzetta (L.)	VII:3 in; IX: 30 in., III: 3 in; V: 2 in; VI: 5 in; VIII: 60 in	IV: 20 in.; VI: few in.; X: 14 in.	I: 1 in., IV: 1 in. VII: + 70 in.	Summer guest and transitory species; the number increases during the summer-autumn passage

Species	2005 9 field trips: I-VIII	2006 6 field trips: I, IV, V, VI, VIII, X	2007 5 field trips: I, IV, V, VII, X	Observations
Egretta alba (L.)	I: 3 in., VII: 4 in., IX:55 in; II:+38 in; III: 3 in.	I: 2 in.; X: 1 in.	I:1 in.	Numerous in passage; isolated individuals in winter
Ardea cinerea (L.)	I: 2 in., VII: 6 in.; IX:15 in. III: 8 in; VI: 3 in.	IV: 14 in.; X: 3 in.	I: 27in., IV: 1 in; V: 2 in., VII: +150 in.; X: 52 in.	Summer guest; its number increases during passage; isolated individuals in winter
Ardea purpurea (L.)	VII: 3 in.; V: 2 in; VI: 1 in; VIII: 5 in			Summer guest; about 40 pairs hatched until 2005
Ciconia nigra (L.)	III: 2 in; V: 2 in.; VIII: 3 in.			Transitory species
Ciconia ciconia (L.)	III: 3 in, V: 14 in.; VIII: 3 in.		V: 4 in., VII: 20 in.	Frequent; it hatches in the village
Plegadis falcinellus (L.)	VIII: 7 in.		IV: 11 in., VII: 2 in.	Rare
Platalea leucorodia (L.)	VIII: 1 in.		VII: + 150 in.; X: 68 in.	Rare until 2005; numerous in the summer
Anser erythropus (L.)			I: 5 in.	Winter guest or transitory species; it rests here
Anser albifrons (Scop.)	I: 11 in. II: +100 in.			Numerous transitory flocks; it sometimes appears as a winter guest
Anser anser (L.)	III: 5 in		X: +118 in.	At least one pair nested until 2005
Tadorn tadorna (L.)	I: 1 in.; III: 3 in.	I: 10 in.		Winter guest and transitory species
Anas penelope (L.)	III: + 35 in.			Transitory species
Anas strepera (L.)	V, VIII: 6 in.			Summer guest
Anas crecca (L.)	I: +200 in., III: +80	IV: pres, X: 100 in.	I: +800 in.; X: +350 in.	Numerous as winter guest and transitory species

Species	2005 9 field trips: I-VIII	2006 6 field trips: I, IV, V, VI, VIII, X	2007 5 field trips: I, IV, V, VII, X	Observations
Anas platyrhynchos (L.)	I: 150 in.; III: 4 in.; VI: 1 in.;	IV: pres., X: 40 in.	I: +250 in., IV: 1 in., V: 5 in., VII: 22 in.	Numerous as winter guest and transitory species, possibly nesting.
Anas querquedula (L.)	III: + 45 in.		IV: 3 in., V: 2 in. VII: pres.	Transitory species and summer guest, possibly nesting
Anas clypeata (L.)	III: 130 in.		X: + 120 in.	Transitory species
Aythya ferina (L.)	VII: 2 in.			
Aythya nyroca (Guld.)	VII: 2 in.			Summer guest, it nested until 2005
Mergus albellus (L.)	II: 7 ex			Rare winter guest
Mergus merganser (L.)	I: 80 in.			Winter guest
Circus aeruginosus (L.)	III: 2 in.		X: 1 in.	Hatching species until 2005
Rallus aquaticus (L.)	II: 1 in.			Hatching species until 2005, partially migratory
Porzana parva (Scop.)	VII: 1 in. juv.			Hatching species until 2005
Gallinula chloropus (L.)	VI, VII: pres.			Hatching species until 2005
Fulica atra (L.)	VI: + 75 in.; VIII: + 100 in.; IX: 90 in.	I: 5 in., IV: tenth in.	IV: + 80 in.; X: + 75 in.	Hatching species until 2005
Himantopus himantopus (L.)	V: 5 in; VIII: 8 in.	IV: 6 in.	IV, V: 30 in., VII: +50 in.; X: 2 in.	Constant presence in summer, more numerous in 2007; possibly nesting
Recurvirostra avosetta (L.)	III: + 90 in.; V: 22 in; VIII: 2 in.	IV: 2 in.	IV: 25 in, V: 15-20 in, VII: 5 in.	More numerous in transition and in the summer of 2007
Charadrius dubius (Scop)	I: 3 in.		V: 1 in., VII: +30 in.	Less numerous Transitory species, probable nesting

Species	2005 9 field trips: I-VIII	2006 6 field trips: I, IV, V, VI, VIII, X	2007 5 field trips: I, IV, V, VII, X	Observations
Haematopus ostralegus L.			VII:1 in.	Transitory species
Vanellus vanellus (L.)	III: tens in.; VI : 2 in.; VIII: 30 in.	IV: tens in., X : 40 in.	IV, V: 30-40 in.; X: + 420 in.	Summer guest, hatching species
Calidris sp.	I: 8 in.	IV, X: tens in.	V: +20 in.	Frequent in transition
Philomachus pugnax (L.)	VIII: +12 in.	IV: tens in.	IV, V, VII : 6 – 35 in.	Transitory species, probably nesting
Limosa limosa (L.)	III: +220 in.; V: 8 in.; VIII: + 90 in ; VII: 20 in.; X: pres.	IV: + 250 in.	I: +80 in., IV: 20 in., VII: tens in.; X: + 12 in.	Numerous in transition
Numenius arquata (L.)	I. 100 in., IX: pres.	I:12 in.; X: 60 in.	VII: 60 in.; X: 2 in.	Frequent in transition, oscillating number
Tringa erythropus (Pall.)		IV: 3 in.	V: 2 in.	Transitory species
Tringa totanus (L.)	III: 23 in; VI: 2 in.; VIII: 5 in.	IV: tens-hundreds in.	IV: 3 in., VII: 15 in.	Transitory species and summer guest; probably nesting
Tringa stagnatilis (Bechst.)	VIII: 10 in.	X: pres.?	IV, VII: ?	Transitory species
Tringa sp.		X: pres.?	IV,VII: ? pres., V:+ 10 in.	
Larus ridibundus (L.)	I: + 50 in; II: tenth in.; III: +30; VI:18 in.; VII, IX: freq.	X: pres.	I: +70 in. VII: numerous; X: tens in.	Partially migratory
Larus canus (L.)	I: 12 in.; II: 9 ex.			Winter guest, small number
Larus argentatus (L.)	I: 8 in; II: 3 juv.; III: +12 in; VII, VIII: 3-5 in.		VII: pres.; X: 4 in.	
Sterna hirundo (L.)	V: 5 in; VI: few in.; VIII: + 6			Summer guest
Chlidonias hybridus (Pall.)	V: 2 in; VIII: tens-hundreds in.; VII: +50 in.	VI : little in.	VII : pres.	Summer guest, nesting species
Chlidonias niger (L.)			V: +12 in.	Summer guest, probable nesting

Species	2005 9 field trips: I-VIII	2006 6 field trips: I, IV, V, VI, VIII, X	2007 5 field trips: I, IV, V, VII, X	Observations
Alcedo atthis (L.)	VIII: 1 in.			Rare, partially migratory
Riparia riparia	VI, VII: tens in.; VII: tens-hundreds in.		VII: numerous	Summer guest, numerous colonies, hatching species
Motacilla flava feldegg (Mich.)	V, VI: freq.; VII: pres.		IV: +3 in VII: numerous	Frequent and numerous as a summer guest
Motacilla Alba (L.)	III: 1 in; VI: freq. VII: freq.	IV: 1 in.	VII: pres.	Frequent summer guest
Acrocephalus sp.	VI, VIII: pres.			Absent species in the last two years
Emberiza schoeniclus (L.)	I: 2 in; II: 1 in.			Rare winter guest

By analyzing the quantitative and qualitative values of the populations of identified aquatic birds, in correlation with the state of habitats, respectively with the climatic conditions from the area in question, we conclude:

- during the prevernal season (the 1st of March - the 1st of May), the analysed biotopes maintained in relatively constant conditions, which were also favourable for the stationing of the transitory birds (Ardeidae: *Egretta garzetta*, *E. alba*; Anatidae: *Anser* sp., *Anas* sp.; Charadriidae: *Limosa limosa L., Numenius arquata* L., *Tringa* sp. etc.).

- the vernal (the 1st of May - the 15th of June) and the estival (the 15th of June - the 15th of August) seasons were deeply marked by the extreme climatic changes in 2006 and 2007:

1. because of the abundant precipitation and of the sudden snow thawing, there occurred a flood on the Danube, in April - May 2006, which led to the inundation of the terrains located within the alluvial plain of the river, including the riparian settlements; consequently, the aquatic and terrestrial ecosystems developed within Rast-Bistreț (Dolj) sector were extremely affected: the nesting places, respectively the laying of eggs of the hatching species were covered by water, while the trophic resources were inaccessible for most of the species for a certain period of time (about 6 - 8 months); the herpetofauna (especially the batrachians) from the analysed wetland registered a great numerical increase after the overflow of the Danube and, thus, it represented an abundant trophic support for *Ciconia ciconia* L., which registered a positive numerical evolution; then, although the hydric level of the basins and of the neighbouring fields came to normal parameters, characteristic to the area in question, the aquatic vegetation did not regenerated itself; thus, only a few limicole species can be included in the category of hatching birds for the vernal and estival seasons of 2007 (*Himantopus himantopus*, *Recurvirostra avosetta* (not sure), *Vanellus vanellus*, *Philomachus pugnax*); the oozy beeches ensured numerous trophic resources for transitory species (*Limosa limosa, Haematopus ostralegus, Charadrius dubius*, *Tringa* sp. etc.);

2. the climatic conditions from the spring and summer of the 2007, namely the lack of precipitation and the extremely high temperatures, contributed to the decrease of the discharge of the Desnățui river and of the water volume of the basins, which determined the reserve of the trophic resources for ichthyophagous and/or mixed zoophagous species (*Phalacrocorax carbo* and *P. pygmaeus, Pelecanus crispus* and *P. onocrotalus, Ardea cinerea, Platalea leucorodia, Plegadis falcinellus* etc.) that registered a significant number in the beginning of the autumn transition;

- the serotinal (the 15th of August - the 15th of September) and the autumnal (the 15th of September - the 1st of November) seasons imposes a specific dynamics to the aquatic ecosystems from Bistreț-Cârna wetland, similar to the spring landscape;

- the hiemal season (the 1st of November - the 1st of March), from the climatic point of view, oscillated between a warm climate (temperatures above the normal of the period and a low volume of precipitation (2005, 2007) and a hostile climate, which is normal for the hiemal aspect in the South of the country; consequently, the presence of the aquatic birds (predominantly Anatidae) was conditioned by the state of the aquatic basins and of the neighbouring fields.

CONCLUSIONS

The evaluation of the quantitative and qualitative data gathered during the research leads us to the following conclusions:

- the passage of the migratory birds, the beginning of which corresponds with the departure or with the transition of the hivernant species in spring and with their arrival in autumn, imposes a specific dynamics to the aquatic ecosystems from Bistreț-Cârna wetland;

- the climatic factors (abundant precipitation, sudden warming followed by snow thawing and, consequently, the great flood of the Danube in the spring of 2006) stood at the basis of the reversible and/or irreversible modifications of the habitats within the studied area and, thus, determined the chasing/the changing of place of certain species that nested in the perimeter of the piscicultural basins;

- the prolonged drought and the extremely high temperatures registered in the summer of 2007 year brought to a drastic decrease of the hydric level of Bistreț-Cârna lake; consequently, the extended beeches became very attractive for limicole species (Charadriiformes Ord.); of course, in the area of the piscicultural basins the ichthyophagous species (*Phalacrocorax carbo* and *P. pygmaeus, Pelecanus crispus* and *P. onocrotalus*) or the ones with a mixed zoophagous regime (*Ardea cinerea, Platalea leucorodia, Plegadis falcinellus* etc.) came back.

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NITRATES POLLUTION ASSESMENT IN NIRAJ RIVER BASIN (TRANSYLVANIA, ROMANIA)

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KEYWORDS: Romania, Transylvania, nitrate, pollution, Nitrate Directive, wells.

ABSTRACT

The nitrate pollution in the water table represents an important problem for the rural areas considering the possible degradation of the aquatic ecological system as well as for the matter of the drinkable water supply for the local population. In this paper we present the results of a survey performed in the Niraj river catchment area. This is a medium size drainage basin, representative for the Carpathian area. During our research, we have surveyed 17 inhabited sites situated in the upper part as well as in the middle and in the lower part of the catchment area. Form a total number of 355 wells investigated, the nitrate concentration was higher than the treshold limit value of 50 mg/l in 152 of them (43%). We noticed the irregular distribution of the polluted wells in the catchment area. In the upper part of the area, in sites situated over 350 m of altitude, the percentage of wells in which the nitrate concentration was surpassing the threshold limit value was of 26 while under 350 m of altitude, 66% of the examined wells registered a nitrate concentration over the threshold limit value. There are sites in the lower part of the catchment area in which over 90% of the wells presented a nitrate concentration over 50 mg/l while in the upstream area there are sites in which only 12% of the examined wells presented a nitrate concentration higher than the threshold limit value. We noticed that the nitrate pollution is originated both from diffuse sources as well as from point sources (especially unprotected animal manure deposits). We noticed an accumulation of the nitrates in the water table of the river terraces and a higher nitrate load of the surface water within the inhabited areas. The nitrate pollution depends greatly on the topography and on the soil properties.

REZUMAT: Evaluarea poluării cu nitraţi în bazinul râului Niraj (Translvania, România).

Poluarea cu nitraţi al pânzei freatice reprezintă o problemă importantă în zone rurale atât din punctul de vedere al posibilei degradări al sistemului ecologic aquatic cât şi din punctul de vedere al alimentării populaţiei locale cu apă potabilă. În cadrul acestei lucrări prezentăm cercetările efectuate în bazinul hidrografic a râului Niraj. Acest bazin hidrografic este un bazin de dimensiuni medii, reprezentativ pentru bazinul Carpatic. În cadrul cercetărilor am evaluat 17 localităţi situate atât în partea superioară cât şi în partea inferioară şi mijlocie al bazinului hidrografic. Din totalul de 355 fântâni examinate în 152 (43%) concentraţia de nitraţi a depăşit limita permisă de 50 mg/l. Am constatat o distribuţie neuniformă a fântânilor poluate în bazinul hidrografic. În partea superioară al bazinului hidrografic în localităţile situate peste 350 m procentul de fântâni în care concentraţia de nitraţi a depăşit limita permisă era de 26% iar în partea inferioară sub 350 m în 66% din fântânile examinate concentraţia de nitraţi depăşeşte limita permisă. Există localităţi în partea inferioară al bazinului hidrografic în care peste 90% din fântâni, concentraţia de nitraţi depăşeşte 50 mg/l, iar în zona amonte există localităţi unde numai 12% din fântânile examinate concentraţia de nitraţi depăşeşte limita admisă. Am constatat că poluarea cu nitraţi provine atât din surse difuze cât şi din surse punctiforme (mai ales gunoiul de grajd neizolat). Am constatat o acumulare de nitraţi în pânza freatică pe terase, şi o încărcare cu nitraţi al apelor de suprafaţă de către localităţi. Poluarea cu nitraţi depinde în mare măsură de topgrafia terenului şi de proprietăţile solului.

ZUSSAMENFASSUNG: Evaluierung der Nitratbelastung im Einzugsgebiet des Niraj-Flusses (Transylvanien, Rumänien).

Die Belastung des Grundwassers durch Nitrate ist in dörflichen Gegenden sowohl aus Sicht eines möglichen Qualitätsverfalls des aquatischen Ökosystems als auch der Trinkwasserversorgung der örtlichern Bevölkerung ein schwerwiegendes Proble m. Im Rahmen der vorliegenden Studie werden die Untersuchungen vorgestellt, die im Einzugsgebiet des Niraj-Flusses durchgeführt wurden. Dieses Einzugsgebiet ist mittlerer Größe und gilt als repräsentativ für das Karpatenbecken. Im Rahmen der Untersuchungen wurden 17, sowohl im oberen, als auch im mittleren und unteren Bereich liegende Ortschaften bewertet. Von den 355 untersuchten Brunnen wurden in 152 (43%) Brunnen Konzentrationen von Nitraten festgestellt, die die zulässigen Grenzwerte von 50 mg/l überschritten. Dabei wurde eine uneinheitliche Verteilung der verschmutzten Brunnen im Einzugsgebiet registriert. Im oberen Teil des Einzugsgebietes, in den über einer Höhe von 350m liegenden Ortschaften lag der Prozentsatz der Brunnen, die die zulässigen Nitratgrenzwerte überschritten bei 26%, während in Ortschaften unterhalb der Höhenlage von 350 m in 66 % der Brunnen Nitratkonzentrationen über der zulässigen Grenze verzeichnet wurden. Es gibt aber auch Ortschaften im unteren Bereich des Einzugsgebiets, in denen 90% der Brunnen Nitratkonzentrationen von über 50mg/l aufwiesen, während im oberen Bereich Orte sind, in denen nur 12% der Brunnen die zulässigen Grenzwerte überschritten. Auch wurde festgestellt, dass die Belastung mit Nitraten sowohl aus diffusen als auch aus punktuellen Verschmutzungsquellen (vor allem nicht abgedichtet gelagerter Stallmist) stammt. Im Grundwassernetz der Terrasse wurde eine Anreicherung an Nitraten festgestellt und eine Belastung der Oberflächengewässer durch Einleitung von Nitraten aus den Ortschaften. Die Nitratverschmutzung ist größtenteils von der Geländetopographie und den Eigenschaften des Bodens abhängig.

INTRODUCTION

The Niraj Basin is a middle sized catchment of the Carpathian basin, densely populated, where the drinking water come from shallow wells. The research goal was to study the nitrate pollution of water in wells in function of the topography, farm management and agricultural practices, rainfall regime, and situation of the buffer zones in the Niraj River catchment area.

The groundwater nitrate pollution is widely studied, especially from agricultural sources. Nitrate leaching downward into the soil profile, out of the crops rooting zone, and eventually into the groundwater is a complex process. In some soils it may take only a few years (or less) for nitrate to leach into the groundwater, whereas with other soils the chance of nitrate leaching is remote. Prominent factors that affect the nitrate-leaching process are soil properties, topography, climate, kind of crops grown, and farm management practices used (Smith and Cassel, 1991). Classification of soils by their susceptibility to leaching represents a management aid. Four aids in estimating nitrate-leaching potentials are: (1) permeability (Cassel and Vasey, 1974), (2) available water holding capacity (Cassel and Nilsen, 1986), (3) hydrologic group, and leaching class (Kissel et al., 1982). It was demonstrated in a pilot area (Füleky, 2004) that in the increasing artificial fertiliser use, nitrate leaching is significant. This study show, that nitrate can be found at 3 m, the plants using the nitrate from the artificial fertiliser above this depth. The nitrate 3 m and below is from the leached into the soil organic material mineralization. Research in different catchments field systems (Pierre, 1983) demonstrated that (1) the increase of nitrate concentration in water is related to the rainfall regime and to the degree of intensification of agriculture, (2) there is a relation between the agricultural practices and the quality of water (average nitrate concentration over the period for forestry,

mix agriculture and intensive agriculture is 9, 22 and 53 mg/l respectively), the geographic structure of land influences nitrogen dynamics, as well as buffer zones efficient at absorbing/mitigating nitrate. According to other research (Dugast, 1999) in Aurade basin (France) the measurement of soil nitrogen solution confirmed the efficiency of a grass-strip along the river, an 8-10 m width was considered sufficient.

Many experiments have been conducted to see the correlation between $NO3^-$ leaching and the environmental or management factors. However, with limited time and funding for field experiments, estimation of $NO3^-$ leaching, especially at the regional scale, has had to rely on mathematical models. Some models, such as MIKE SHE (Dhi, 1999) and MODFLOW (Harbaugh et al., 2000) are hydrology-oriented with less details about N biogeochemical processes; and some, such as CENTURY and SOILN (Liu et al., 2000; Johnsson et al., 1987), have N turnover functions with marginal hydrological features.

Recent research was conducted to merge the two kinds of models to improve the modeling reliability. As a result of this research, a biogeochemical model was adopted with limited modifications to serve as a $NO3^-$ leaching prediction tool that can be used for farm management planning (Li et. al, 2006). In comparison with several existing biogeochemical models, such as CASA, CENTURY or Roth-C (Potter et al., 1993; Johnsson et al., 1987; Jenkinson, 1990), DNDC possesses a relatively complete suite of N transformation processes under both aerobic and anaerobic conditions. In addition, a one-dimension water flow module has been developed in DNDC (Li et al., 1992; Zhang et al., 2002 a, b). The existing methods provided a basis for further developing the model with new features such as N leaching. Nitrate leaching and runoff into rivers and estuarine ecosystems are responsible for algal blooms and eutrophication and is a public health risk (Beman et al., 2005) , (Wolfe and Patz, 2002). For example, 9% of U.S. domestic wells sampled during 1993-2000 had nitrate concentrations exceeding the U.S. Environmental Protection Agency's (EPA) maximum contaminant level of 10 mg_liter_1 as N (Nolan et al., 2002). In the Yakima River Basin of Washington State, 13% of the samples taken from small-watershed sites exceeded the EPA's maximum contaminant level, indicating a potential health risk to nearby residents with shallow wells (Fuhrer et al., 2004).

MATERIALS AND MEHODS

In the selected area it was realised the evaluation of individual water sources from localities from the river basin. Other criterion of selection of the studied localities was the situation of the localities in relation to the Niraj River and tributaries. Localities along the Niraj River and along the tributaries were selected.

The individual water sources for monitoring were selected according to their distribution in the locality and according to their distance from potential pollution sources. During our research we intended to identify the relation between the potential pollution sources and the nitrate pollution of the groundwater. The sampled wells were daily used domestic wells and all of wells were shallow wells. The samples from surface water were obtained from the tributaries, where it was possible at two sampling points: before and after locality.

In order to evaluate the tendencies of distribution of the nitrate in the groundwater, which was very important in obtaining our research data, the piezometric level was measured with a GPS (Garmin E-trex).

The nitrate concentration of the water samples were analyzed in the laboratory of the SzIE University from Gödöllő, using a distillation method. During the pre-evaluation of the nitrate concentration in the studied area other methods were also used (Merck nitrate and spectrofotometric methods, using 2, 4 dimetilfenol).

The nitrate distribution maps of the groundwater of the different localities were realized with Surfer 8 software.

RESULTS AND DISCUSSIONS

During our research in the period 2003 - 2006 in the Niraj River catchment area 17 localities were evaluated, from the upper, the middle, and from the lower part of the catchment area.

Out of 355 wells sampled, 152 wells (43%) exceeded the nitrate concentration standards of the EU (50 mg/l), (Tabs. 1, 2) which is much higher than in the Yakima River Basin of Washington State, where 13% of the samples taken from small-watershed sites exceeded the EPA's maximum contaminant level in shallow wells (Fuhrer, Morace, Johnson, Rinella, Ebbert, Embrey, Waite, Carpenter, Wise, and Hughes, 2004).

The different nitrate levels throughout the valley are important considering agricultural practices are similar in the different villages. The varying nitrate levels are caused by the soil properties and the topography of the landscape (Smith and Cassel, 1991). There are significant differences between the sampling points in the higher part of the catchment area, over 350 m, and those sampling points situated in the lower part of the catchment area, under 350 m. In the lower part of the catchment area the nitrate concentration exceeds in 66% the 50 mg/l (Tab. 1) and in the upper part, the nitrate concentration exceeds the 50 mg/l in 26% of the sampled wells (Tab. 2). However, in the upper part of the catchment area in the case of the villages situated on the terraces of hillsides, the percent of heavily contaminated wells is much higher. For example, in the case of the village Mărculeni, (Tab. 2) 64% of the sampled wells had nitrate concentrations exceeding 50 mg/l. In the case of other villages situated on steep slopes, the percent of sampled wells where the nitrate concentration exceeded 50 mg/l is much lower, as in the case of Adrianu Mare (Tab. 2) where 12% of wells exceeded 50 mg/l.

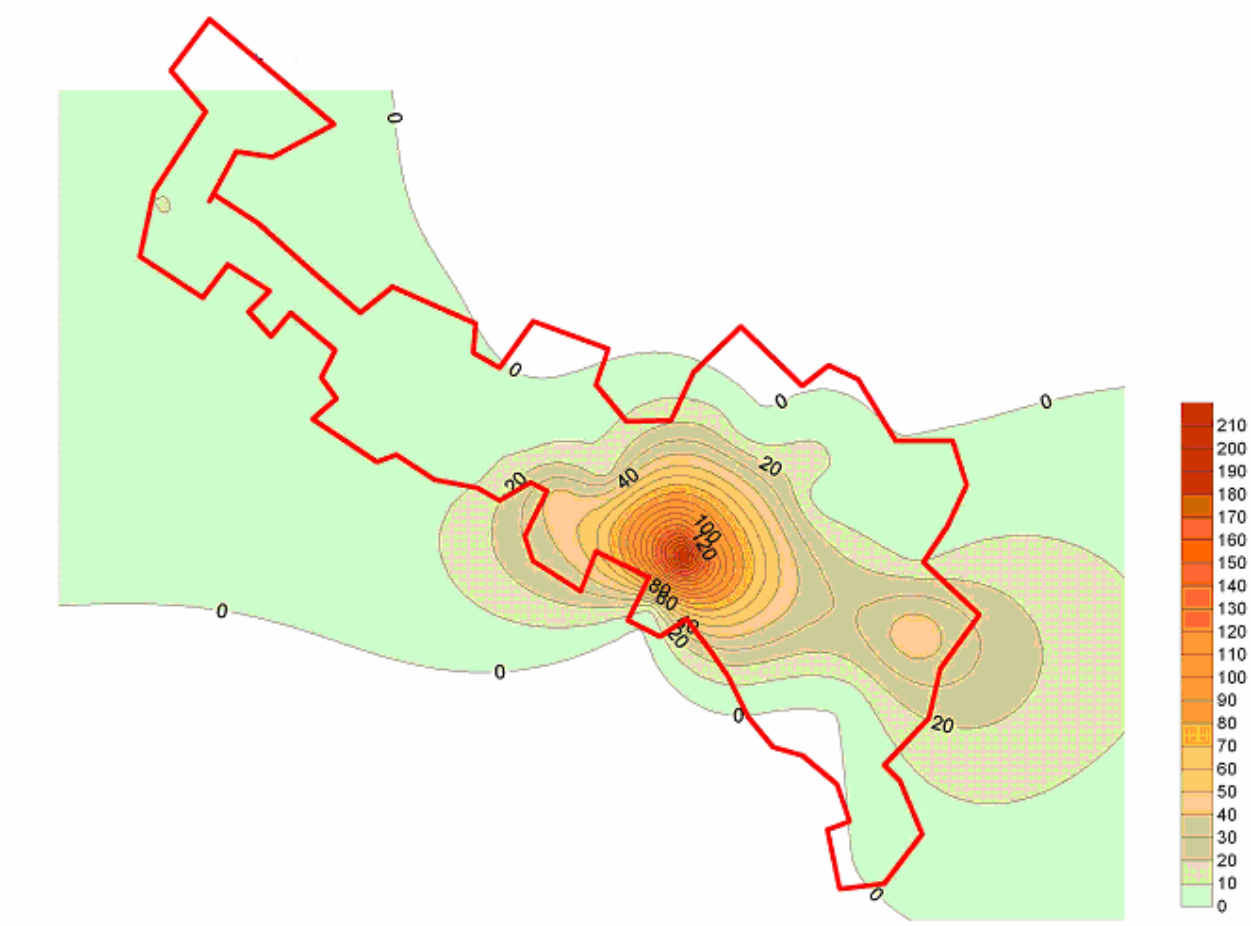

Figure 1: Spatial nitrate distribution in Adrianu Mare; distribution levels in mg/l.

For the villages situated on upper part of the catchment area the percent of wells exceeding 50 mg/l of nitrate was similar to that of Adrianu Mare (about 12%).

In this village we can see the nitrate distribution on the figure 1.

Table 1: Nitrate concentration in localities situated under 350 m.

Localities	NO_3^- mg/l									
Well Nr.	1	2	3	4	5	6	7	8	9	10
Sântana	139.0	16.0	74.7	198.4	11.6	2.4	93.4	118.0	36.9	195.0
Găleşti	139.0	76.7	159.0	106.0	141.8	4.4	139.0	141.0	375.0	107.0
Păsăreni	18.8	4.9	58.3	3.2	44.5	53.4	25.7	2.3	56.5	45.0
Satul Nou	59.2	68.0	103.0	59.8	71.5	280.0	271.0	189.0	62.5	215.0
Leordeni	54.6	31.1	114.0	18.4	101.5	73.1	79.6	74.3	221.0	98.0

Localities	NO_3^- mg/l									
Well Nr.	11	12	13	14	15	16	17	18	19	20
Sântana	25.8	110.3	150.4	195.0	6.9	1.9	0.6	nd	nd	nd
Găleşti	93.5	20.4	31.4	60.7	68.4	67.3	45.2	15.2	120.0	19.0
Păsăreni	46.3	4.7	60.9	28.9	19.3	18.5	43.7	16.6	23.3	204.0
Satul Nou	207.0	99.2	26.2	340.0	120.0	63.8	214.0	297.0	257.0	173.0
Leordeni	71.4	462.0	406.0	133.0	233.0	311.0	347.0	75.3	354.0	254.0

Localities	NO_3^- mg/l									
Well Nr.	21	22	23	24	25	26	27	28	29	30
Găleşti	nd	nd	nd	nd	nd	nd	26.3	89.4	66.9	93.5
Păsăreni	82.8	104.0	113.0	114.0	68.1	52.5	96.4	68.6	174.0	nd
Leordeni	5.3	22.5	222.0	195.0	280.0	14.2	120.0	112.0	70.4	449.0
Satul Nou	156.0	nd	nd	nd	nd	nd	nd	nd	nd	nd
Leordeni	170.0	96.8	121.0	24.9	86.1	309.0	nd	nd	nd	nd

Localities	NO_3^- mg/l								
Well Nr.	31	32	33	34	35	36	37	38	39
Găleşti	62.0	51.7	8.0	41.6	60.5	40.7	70.4	233.0	140.0
Leordeni	440.0	nd	nd	nd	nd	nd	nd	nd	nd

In this case the nitrate pollution is concentrated under the central part of the village, as it is in other research sites (Kerényi, 1995).

Table 2: Nitrate concentration in localities situated over 350 m terraces, where we have higher nitrate concentration.

Localities	NO_3^- mg/l										
Well Nr.	1	2	3	4	5	6	7	8	9	10	11
Măgherani	4.3	66.4	90.7	41.1	45.9	24.0	15.3	34.7	12.7	27.0	145.0
Mărculeni	13.7	64.4	116.0	36.3	49.5	148.0	87.1	53.0	53.9	82.0	94.2
Adrianu Mare	2.7	4.5	1.3	1.7	4.3	3.5	1.9	5.8	51.2	2.7	1.9
Adrianu Mic	9.4	23.1	2.7	10.1	4.7	1.6	110.0	45.8	113.0	5.6	3.6
Beu	4.4	3.1	29.6	0.7	32.7	1.3	3.2	1.0	1.3	0.7	12.3
Măiad	3.9	46.1	120.0	59.4	51.7	76.4	12.7	26.5	92.8	47.0	58.4
Isla	7.2	2.7	46.0	34.0	17.9	34.2	50.7	13.3	154.0	112.0	17.7
Sâmbriaş	20.2	14.2	83.7	37.4	50.6	20.0	49.5	34.0	17.8	5.0	10.6
Hodoşa	2.3	31.6	3.5	nd	nd	nd	nd	nd	nd	nd	nd
Gruişor	6.0	74.1	16.4	5.2	17.9	41.4	36.7	17.8	153.0	nd	nd
Drojdie	7.4	34.1	10.2	42.0	10.7	10.9	nd	nd	nd	nd	nd
Eremieni	6.1	40.1	17.0	143.0	8.0	0.2	nd	nd	nd	nd	nd

Localities	NO_3^- mg/l										
Well Nr.	12	13	14	15	16	17	18	19	20	21	22
Măgherani	27.7	13.1	45.3	91.5	102.9	13.2	59.8	8.6	144.0	19.0	14.1
Mărculeni	138.0	76.0	41.0	102.0	88.7	1.0	60.1	23.6	63.5	114.0	50.3
Adrianu Mare	4.0	119.0	220.0	3.1	52.8	1.4	46.8	1.4	1.7	9.7	2.3
Adrianu Mic	9.7	14.3	20.6	3.1	5.3	13.4	4.0	63.0	46.7	2.7	3.4
Beu	45.9	28.5	1.3	77.1	79.1	129.0	35.4	17.9	10.0	nd	nd
Măiad	39.3	4.8	172.0	5.7	119.7	10.4	nd	nd	nd	nd	nd
Isla	84.3	84.3	12.5	nd	nd	nd	nd	nd	nd	nd	nd
Sâmbriaş	103.0	9.4	21.1	74.6	4.8	nd	nd	nd	nd	nd	nd

Localities	NO_3^- mg/l										
Well Nr.	23	24	25	26	27	28	29	30	31	32	33
Măgherani	4.9	10.6	5.2	118.9	9.6	10.2	nd	nd	nd	nd	nd
Mărculeni	29.3	24.0	nd	nd	nd	nd	nd	nd	nd	nd	nd
Adrianu Mare	1.7	1.3	3.1	3.5	2.7	10.3	4.4	5.1	13.4	4.0	5.0
Beu	46.7	38.9	16.7	2.6	3.1	11.2	3.9	nd	nd	nd	nd

As we can see in the figure 2, the village of Adrianu Mare is situated in the bottom of a valley of a tributary (Dorman creek). The distribution of the sampled wells covers the whole territory of the village. The nitrate concentration is low in areas of the village where there is a steep slope and is higher on the terraces. In this case we have two terraces, where we have higher nitrate concentration.

The centre of the village is situated on the main terrace, thus having the highest concentration of nitrate in the groundwater. The nitrate is concentrating at this point from pollution of diffuse and punctual sources from the village. On the lower part of the village where the slope again becomes steep, the nitrate concentration is reduced.

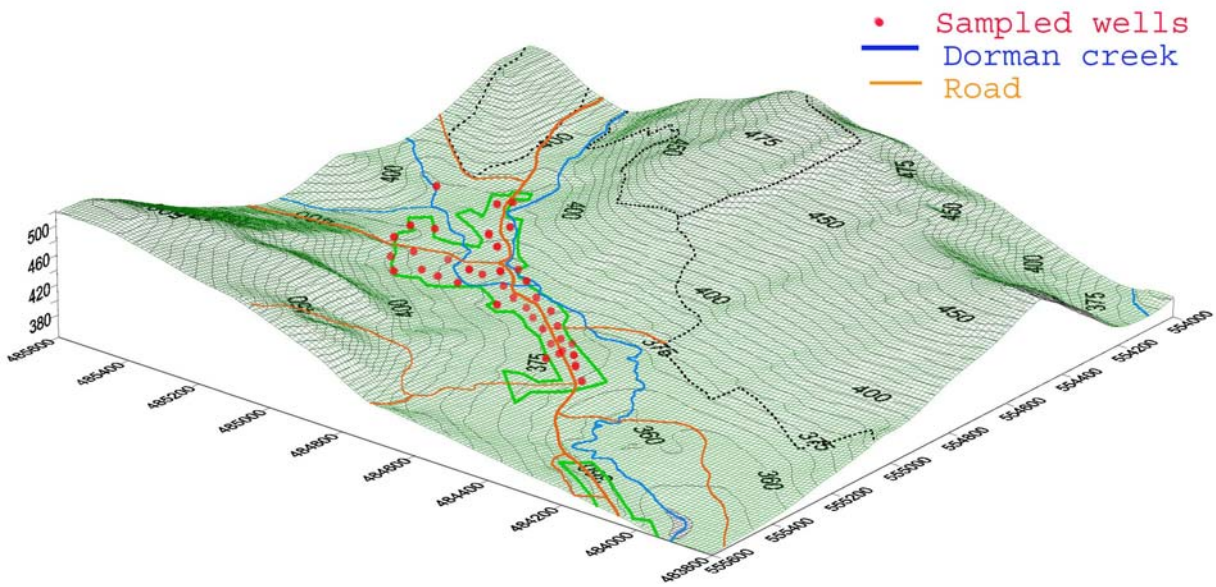

Figure 2: Sampled wells in Adrianu Mare.

For the villages situated in lower part of the catchment area, under 350 m a typical village is Leordeni. In this village 31 wells were sampled (Fig. 3).

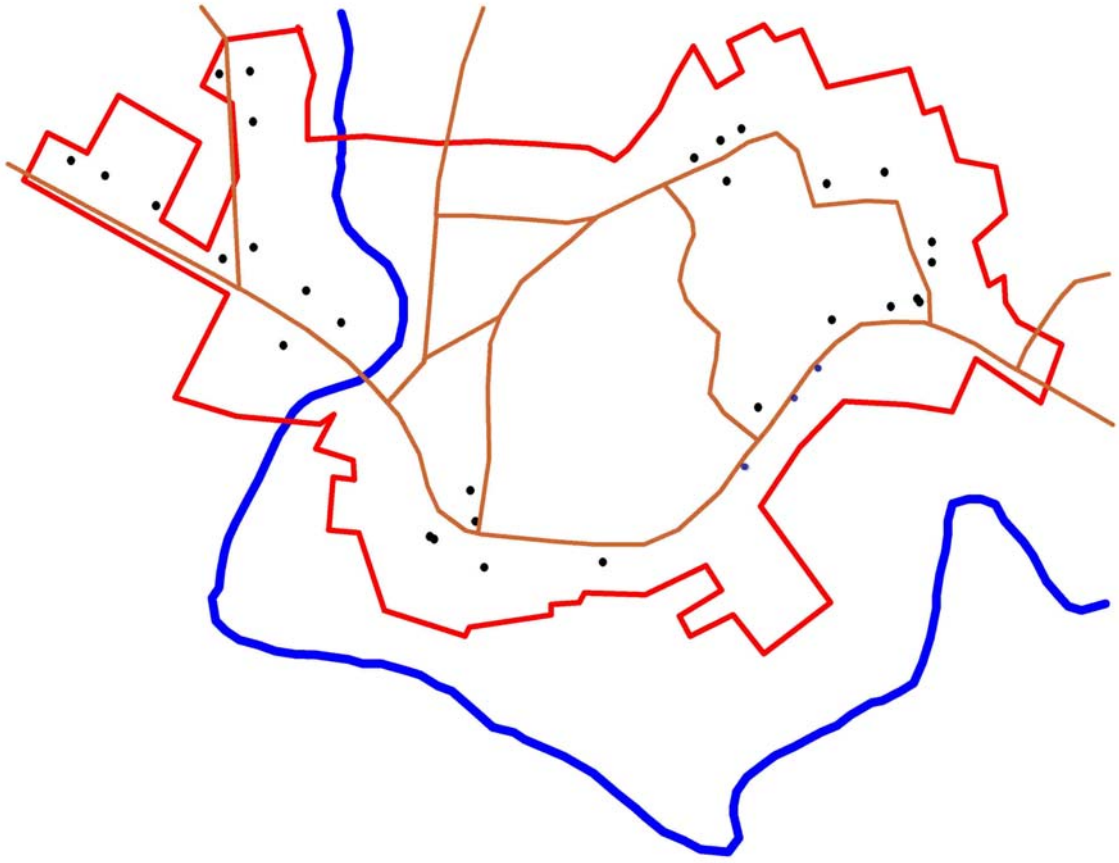

Figure 3: Sampled wells in Leordeni.

In this case there are high values of the nitrate concentration of the sampled wells (90% exceeding 50 mg/l), so it can be said that the groundwater is severely polluted with nitrate. There are lower values only on higher parts of the village and near the river where the groundwater is in direct contact with water from the river.

The spatial distribution of the nitrate is presented in the figure 4.

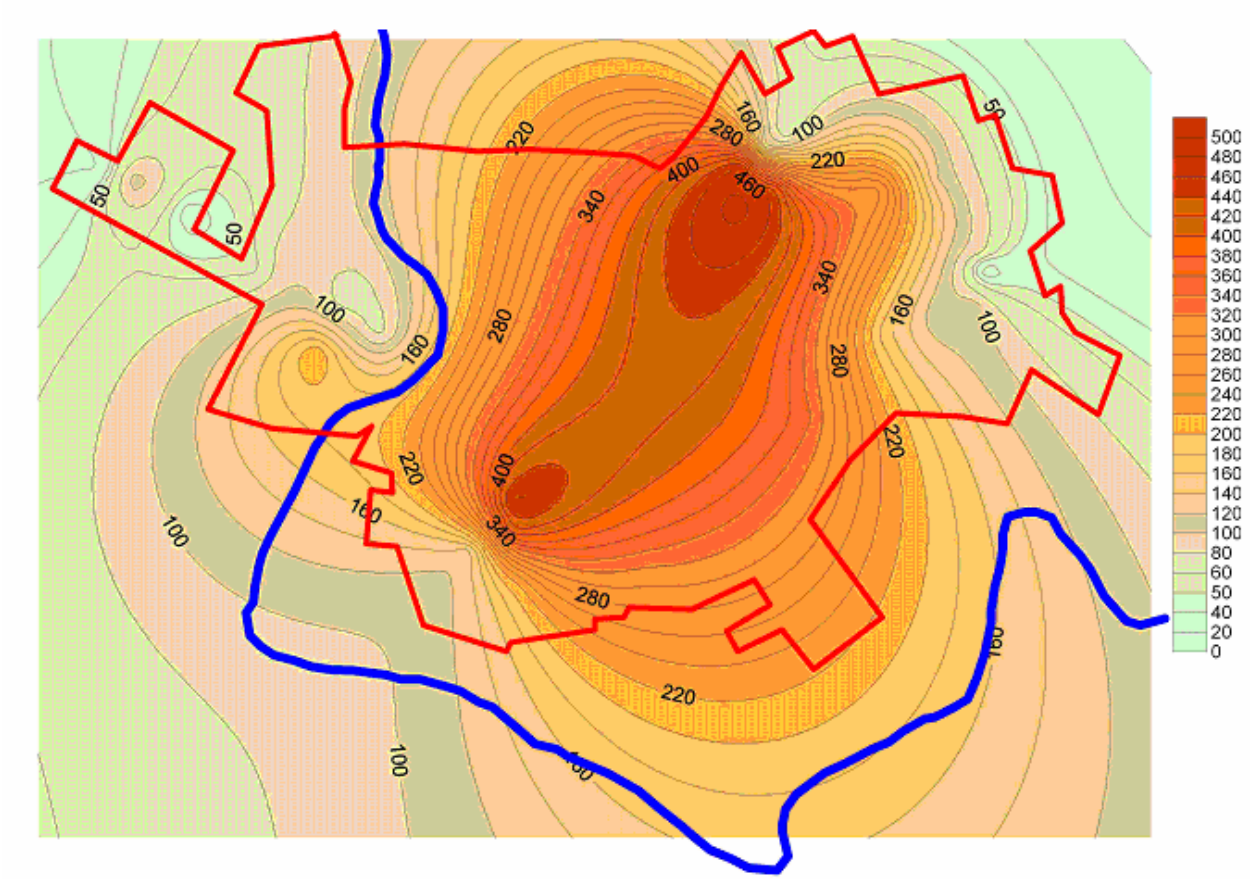

Figure 4: Distribution of the nitrate in Leordeni
- distribution levels in mg/l.

The village of Leordeni is situated partly on the floodplain of the Niraj River and partly on the terrace. In the village 31 wells were sampled, the difference between the highest water table (314 m) and the lowest water table (293 m) being 21 m. In this case we have two concentrations of nitrate pollution. We have a concentration point on the terrace situated on the higher part of the village (314 m) and another concentration point on the terrace situated on the lower part of the village (293). In both cases the groundwater pollution is caused by diffuse pollution sources and punctual diffusion sources.

The results from a village from the middle part of the river basin (Galeşti) confirm the tendencies concerning the pollution with nitrate of the groundwater and the spatial distribution of the nitrate concentration in Galeşti show the similar characteristics as in the case of the villages analysed beforehand (Fig. 6).

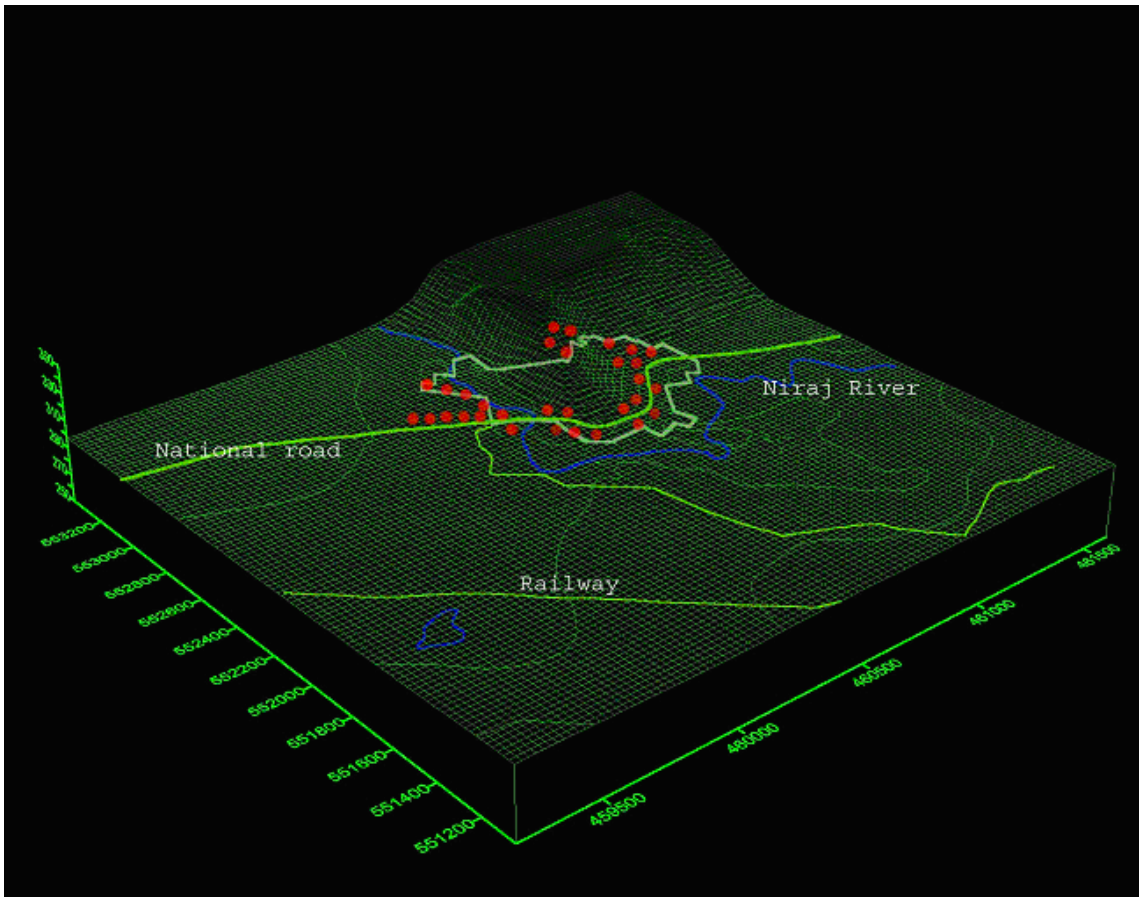

Figure 5: Sampled wells in Leordeni, 3D presentation of the village; • wells.

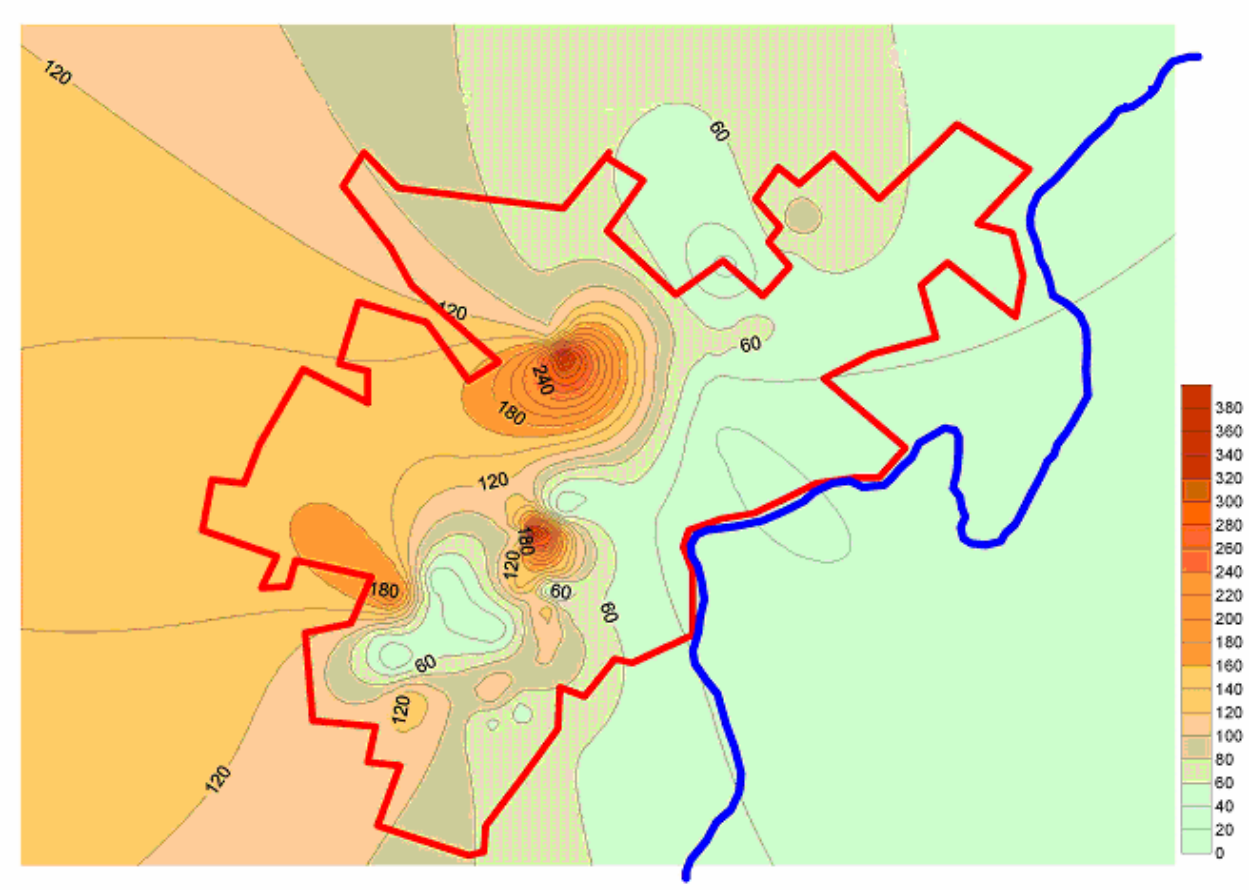

Figure 6: Distribution of the nitrate in Galeşti - distribution levels in mg/l.

A nitrate concentration on the terrace is situated on the upper part of the village and three smaller concentration points on the floodplain. On the terrace the nitrate concentration is more prominent due to the influence of pollution from diffuse and punctual sources. On the floodplain the groundwater is influenced by the water from the river and the groundwater pollution with nitrate is concentrated near punctual sources. We can also observe the average of sampled wells which exceed nitrate concentrations of 50 mg/l (74%) is lower than those in Leordeni but higher than those in Adrianu Mare. From 35 sampled wells, 26 (74%) exceeded nitrate concentrations of 50 mg/l.

We created the nitrate spatial distribution maps and the groundwater flow maps for all 17 researched villages similarly to the presented cases. According to our research, the nitrate pollution of the groundwater is linked to the agricultural practices so we can confirm that there is a relation between agricultural practices and the quality of water (Pierre, 1983). Most of the inhabitants, having small farms and a small number of animals (2 - 15 cattle, 2 - 5 pigs, poultry), are not managing the animal waste properly. Dunghills are not insulated causing the nitrate to leach into the groundwater. These dunghills are individual pollution sources.

We have examined how the influence of pollution sources (diffuse and punctual) from the localities effects the pollution of surface waters with nitrates (Fig. 7). This examination was possible where a creek was flowing over the locality. In each case a significant increase of nitrate concentration in the creek after running through the village was observed: Drojdie from 7.44 mg/l to 10.88 mg/l, Maiad from 3.92 mg/l to 10.94 mg/l and Isla 7.55 mg/l to 12.48 mg/l. In the mentioned cases before, the first sampling point punctual pollution source doesn't exist and the pollution of the water with nitrate is from diffuse pollutions sources. In the localities the pollution of the water with nitrate is from diffuse and punctual pollutions sources.

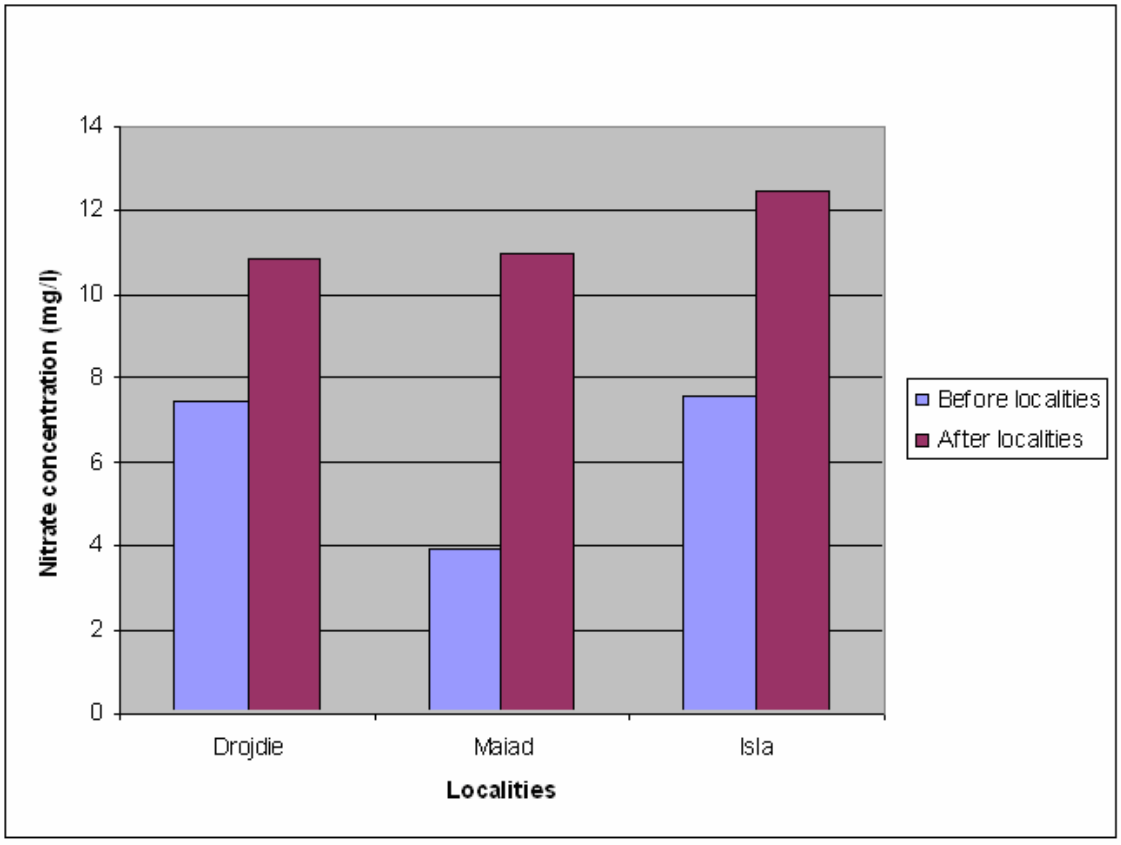

Figure 7: Pollution of the surface waters with nitrate by the diffuse and punctual pollution sources before and after localities.

CONCLUSIONS

Nitrate pollution of the groundwater in the Niraj River Basin is a major concern and important issue, in 43% of the sampled wells nitrate concentrations exceeded EU standards (50 mg/l). In our study, the main cause of groundwater pollution with nitrate was due to agricultural practices and untreated household water. High nitrate concentrations exist under the localities because of the large number of small scale farms where animal waste is not managed properly and the household waste water is not treated. The nitrate leaching depends on topography, and soil proprieties. On the different parts of the catchment there are different nitrate concentrations of the groundwater even though the agricultural practices and the small farms management are not different. On the upper part (over 350 m) 26% of the sampled wells have an average concentration of nitrate higher than 50 mg/l, and in the lower part (under 350 m) 64% of the sampled wells have concentrations of nitrate higher than 50 mg/l. The concentration of nitrate is significant on the terraces and on the floodplain of the river. On the steep slopes the nitrate concentration is lower. The nitrate concentration in the groundwater depends also on the amount of rainfall.

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USING THE IMPACT MATRIX AND THE SORENSEN NETWORK FOR THE EVALUATION OF LAND-USE IMPACT UPON VERSANTS. CASE STUDY: SEBEŞ RIVER BASIN (MUREŞ BASIN, TRANSYLVANIA, ROMANIA)

Marioara COSTEA [1]

KEYWORDS: Romania, Transylvania, Sebeş River basin, impact matrix, Sorensen network, geomorphologic processes, land use, slopes.

ABSTRACT

This paper presents the relations which are established between the present geomorphologic processes (due to the gravity or associated to rainfall denudation) and the land use. Assessment and analysis of land use impact on the manifestation, evolution and intensity of the geomorphologic modelling processes is achieved through the impact matrix and Sorensen network, two methods of assessing specific ecology and adapted to the geomorphologic applied research. Following in the case study of Sebeş basin, we conclude that the mixed use of land, agricultural practices, forest exploitation, the exploitation of hydro potential rivers etc., constitutes active factors for differential expression and the diverse processes of slope. The historical and actual tendency of deforestation, over-grazing, the present dividing of the territory into smaller parcels, the creation of roads and access paths for early agricultural areas or tree plantations of vine-like and the use of inappropriate techniques, which are incompatible with the substrate type, soil characteristics and tilting of slopes have had and they still have a negative impact on planning and on maintaining balance dynamic of the slopes.

REZUMAT: Utilizarea matricii de impact şi a reţelei Sorensen în evaluarea impactului utilizării terenurilor asupra modelării versanţilor. Studiu de caz: bazinul Sebeşului (Bazinul Râului Mureş, Transilvania, România).

În această lucrare sunt prezentate relaţiile care se stabilesc între procesele geomorfologice actuale (gravitaţionale sau cele asociate pluviodenudării) şi modul de folosinţă al terenurilor. Evaluarea şi analiza impactului utilizării terenurilor în evoluţia şi intensitatea de manifestare a proceselor de modelare a reliefului este realizată prin intermediul matricii de impact şi a reţelei Sorensen, două metode de evaluare specifice ecologiei şi adaptate în cercetarea geomorfologică aplicată. În urma studiului de caz pe Bazinul Sebeşului am ajns la concluzia că: caracterul mozaicat al utilizării terenurilor din bazinul Sebeşului, practicile agricole, exploatarea forestieră, exploatarea potenţialului hidroenergetic al râurilor etc., constituie factori activi pentru manifestarea diferenţiată şi acţiunea diversificată a proceselor de versant. Un impact negativ asupra teritoriului şi asupra menţinerii echilibrului diamic al versanţilor l-au avut şi îl au defrişările, suprapăşunatul, divizarea teritoriului în parcele de dimensiuni reduse, crearea de drumuri şi poteci pentru acces, abandonul suprafeţelor agricole sau al plantaţiilor pomi-viticole, precum şi practicarea unor tehnici inadecvate, incompatibile cu tipul substratului, caracteristicile solului şi înclinarea versanţilor.

RESUME: Utilisant impact matrix et réseau du Sorensen dans l'évaluation de l'impact de l'utilisation des terres sur la modélisation versants. Etude de cas: bassin Sebeş (Bassin Mureş, Transilvanie, Roumanie).

Cet article présente les relations établies entre les processus géomorphologiques en cours (associée a la gravité ou a la denudation) et comment utiliser la terre. L'évaluation et l'analyse de l'impact de l'utilisation des terres sur l'évolution et l'intensité de la manifestation de la modélisation du relief est assurée par l'impact matrix et réseau Sorensen, deux méthodes d'évaluation spécifique a l'iécologie et adaptée a le recherche du géomorphologie appliquée. Après l'étude de cas du bassin Sebeş nous concluons que l'utilisation complémentaire des terres du bassin Sebeş, les pratiques agricoles, l'exploitation forestière, l'exploitation du potentiel hydroélectrique des rivières, etc., constitue les actives facteurs de différence d'expression et la diversité des processus de pente. Un impact négatif sur le territoire et sur l'équilibre dynamique du relief qu'ils ont eu et avons la déforestation, le pâturage excessif, la division du territoire en petites parcelles, la création de routes et de chemins d'accès, les zones agricoles ou l'abandon de la vigne, la plantation d'arbres, et l'utilisation de techniques inappropriées, qui sont incompatibles avec le type de substrat, les caractéristiques du sol et d'incliner du versants.

INTRODUCTION

The pressure of human activity on the geographic landscape becomes manifest in different actions such as: meeting the food supply requirements, natural resources exploitation and use, the industrialization process and demographic concentration in urban and rural areas etc. This problem has attracted specialist attention and international decision makers who have come together to maintain the productivity of land, to fight environmental aggression and degrading factors and to regain land capability to provide food at the required quantitative and qualitative levels.

Starting from the idea that all human activities require a certain geographic space for their development characterized by a certain appearance, structure and an usable natural and anthropic potential, research in the field should focus on the relation between environmental factors, on the organization and optimization of geographical space and rebalancing and calibration of geo-ecological possibilities and consumption requirements. Thus, the development and implementation of sustainable land-management strategies, irrespective of the scale of assessment (global, regional or local), the effectiveness of environmental policies and their correlation to economical policies in agriculture, industry, transportation and tourism are based upon real knowledge and objective evaluation of land use categories, concrete data related to land typology and flora, and information on recent developments in land utilization. This may be the result of certain joint natural anthropic processes and which may lead in time to changes in geomorphologic balance through the amplification and/or re-activation of certain geomorphologic processes having negative effects upon the pedologic cover through the loss of land fertility.

METHODOLOGY

The relief, through its morphometric characteristics and particularities induced by its petrographic nature and climate, is the defining element of the appearance of the Sebeş Basin landscape, while land use, which is directly dependent on natural conditions and social-economic development, is one of the most important economic territorial indicators and the most apparent result of the use of environmental conditions.

The relation between the characteristics of morphological surface, land use and current relief modeling through elementary or complex processes and the impact of different anthropic actions on the activation of modeling processes in the Sebeş Basin are determined by the following modalities:

- quantitative statistical-mathematical analysis through the correlatives between land-use types distribution and repartition of morphometric indicators: altitude, relief fragmentation, slopes, mountain exposition (Costea, 2003, 2005);

- the impact matrix (Leopold et. al. 1970 qtd. in Glasson et. al. 1999) the most common forecast and evaluation method of the primary impact - as a direct result of the anthropic action and of the secondary impact - as an effect of this action upon the environment through the modification of natural and anthropic conditions. The matrix is two-dimensional, horizontally along the first line are types of use on land-use categories, and vertically it displays the geomorphologic modeling elementary and complex processes. The interaction between the type of anthropic action and the type of the process is described depending on the magnitude (amplitude and importance). The amplitude of the interaction is set to values from 1 (low impact) to 10 (high impact), but not 0 (zero impact). For both impact parameters considered (amplitude and importance) the values attributed to the relations may be negative or positive, denoting a negative or positive impact (Canter, 1977; Vădineanu, 1998). There where the determined relations between land use and geomorphologic processes were not set a question mark was inserted, sign which reveals an ambiguous relation.

- the complex systemic-quantitative analysis, by means of the Sorensen impact network (Vladineanu, 1998), through which the potential anthropic causes of morpho-dynamics are identified, revealing the negative or positive effects of anthropic actions on the intensity of modeling processes in the areas being analyzed.

RESULTS

Morphogenetic and evolutionary aspects of the Sebeş Basin

The Sebeş hydrographic basin overlaps distinct physical and geographical areas, which are complementary from an economical and geographical point of view and implicitly from one related to land utilization and the anthropic impact upon landscape. The genesis and evolution of the basin have determined a morphology differentiated on two distinct sectors: the superior (Carpathian) sector and the inferior (depression and plateau) sector, characterized by specific geological, geomorphologic and bio-pedo-climatic conditions.

The Carpathian basin is characterized by petrographic homogeneity (epi-metamorphic and mezzo-metamorphic crystalline schist belonging to the Getae bed). This lithology along with the lack of significant tectonic accidents despite fragmentation depth (which in certain defile sectors is more than 700 m). These are in contrast with the relief generated by the clay marl and clay complexes on the bed of the depression and on the plateau. The adaptation of the valleys to the monoclinal structure of the Secaş Plateau is pointed out by the symmetrical profile of the consequent valleys (the tributaries of Secaşul Mare), through the slope relief, through the asymmetry of the subsequent valleys.

The higher stability of the versants depends on two important elements: their shape and angle of slope. The slightly convex shapes present at the level of mountain inter-rivers and in the plateau interrupted by concave segments at the level of the saddles are specific to the main watersheds of the basin where there are leveling surfaces. The step versants correspond to the marginal piedmont sector and to the Sebeş and Secaşul Mare terraces which have a rather balanced dynamics. The straight versants are specific to the valley Carpathian chutes, both for Sebeş and its tributaries due to depositions on the valleys where gravitational processes are frequent. Complex versants are more frequent in the Secaş Plateau and in the hills region, their shape being the result of versant processes that may be reactivated. The configuration of the versants may be easily modified, and they become actively dynamic as a result of inappropriate economic processes: excessive grazing, uncontrolled forestry, influent conduits buried in the versant, access roads and the lack of communication trenches, intense traffic and uncontrolled dispersion of certain settlements.

The high density of the permanent network of valleys in the Carpathians and of the mainly temporary one in the lower sector of the basin, as well as the 15- 20° slopes of the mixed or convex versants cause them to be rather unstable under seasonal or permanent impact of current modeling processes and economic activity (grazing, agriculture); there is also a high risk of subsidence and landslide. The dispersion of torrential basins and high density of ravines in the sub-basins of Bistra, Dobra, Purcariul, Martinie, Dumbrava, Valea Caselor and the ravine springs in the hills (Câlnic, Gârbova, Reciu) and in the plateau (Daia, Boz, Sângătin, Guşu) induce a torrential drainage regime which is the main cause of imbalance. Torrentiality in the Carpathian basin is stimulated by melting snow and spring rain, but especially by the aggressive torrential summer rain which undertake a geomorphologic background processed by anthropic activity through grazing, deforestaton, building of sewerage, road systems on the steepest side of versants, unconsolidated pipeline systems.

There is also imbalance in the hills and plateau area at the level of the versants. Current modeling processes which contribute to the damaging of land become manifest through torrential erosion, streaming, creep, old reactivated subsidence and landslide on the versants, and in minor and major beds, during water inrushes, banks are eroded, there are accumulations and debris cones. This time, these processes are facilitated by the clay substrate, torrentiality, the position of the versant, and especially the low rate of afforestation. Forests occupy only 14% of the inferior basin surface, being located on the inter-river bridges which are not part of the imbalance in the superior basins of the Gârbova, Reciu, Dobârca and Rod valleys and the steep versant of the chute towards Sălişte Depression. In the plateau the woody areas are restricted to the following hills: Gruiului (520 m), Mare (492 m), Vingardului, Gorguleanului - Fundătura - Zăpodea Mare (in the Sângătin Basin), Carpen and Rebeşu Mare, west of the Cut village. The dynamics is however apparent in the higher parts of the versants, where gullies, springs alignments or marshland areas are easier to identify and in the inferior part of the versants near hydrographic arteries. The median part of the versants is usually occupied by landslide waves. This leads us to the conclusion that the moisture produced by the neighboring forest or water flows activates imbalance, along with the nature of the geological substrate.

Land use in the Sebeş Basin

The development of the geomorphological processes and the intensity of them depending on morphology of the region, on the way land is used and on the settlements and their typology and structure.

The geographic position and the pedo-climatic conditions in the Carpathian sector of the Sebeş influence primarily the vegetation. Conifer and mixed forests occupy almost the entire sector (71% of the region is covered by forests). They are not uniformly spread on altitudinal steps and vegetation storeys, the largest surface being between 1000 and 1700 m, of which 37,000 ha is covered with pine spruce forests. In the sub-storey of the beech and white oak forests human interference has resulted in secondary pastures for stock raising (pastures near the villages in Marginimea Sibiului).

The anthropic pressure of the Şugag, the concentration of a high number of population on small areas of land and the large number of animals (which reached the maximum value in the '40s) have led to massive deforestation in the north of Şureanu and Cindrel Mountains. Grazing is widely spread at the level of the Gornovița area (800 - 1250 m), where there are numerous settlements reaching heights of 1000 m (Jina, Poiana), in the valleys 800 m (Tău Bistra, even 1200 m in Oașa). Temporary or seasonal settlements (shelters, sheep yards) are denser at the level of the other areas, their higher limit being of about 1800 m altitude. This limit is so high due to mountain economy based on the exploitation of forests, on grazing and hydroenergetic utilization of the Sebeş River and its tributaries (Figs. 1, 2).

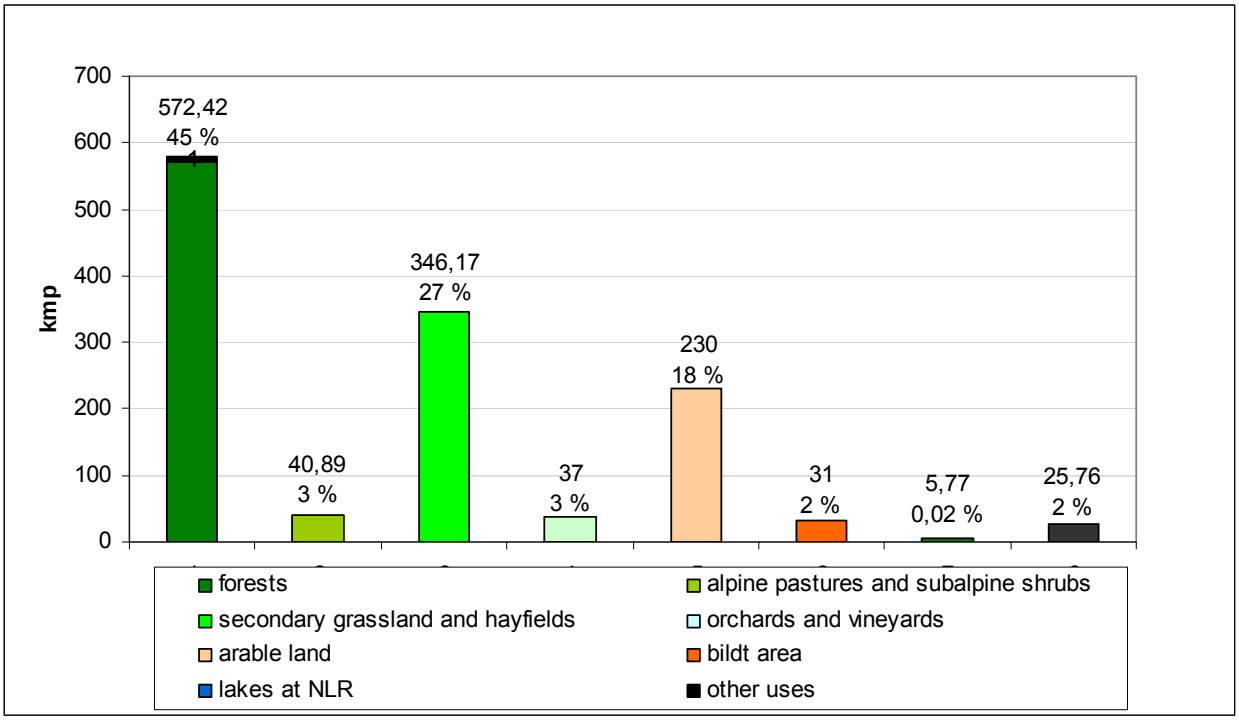

Figure 1: Land use in Sebeş Basin (surfaces and weights).

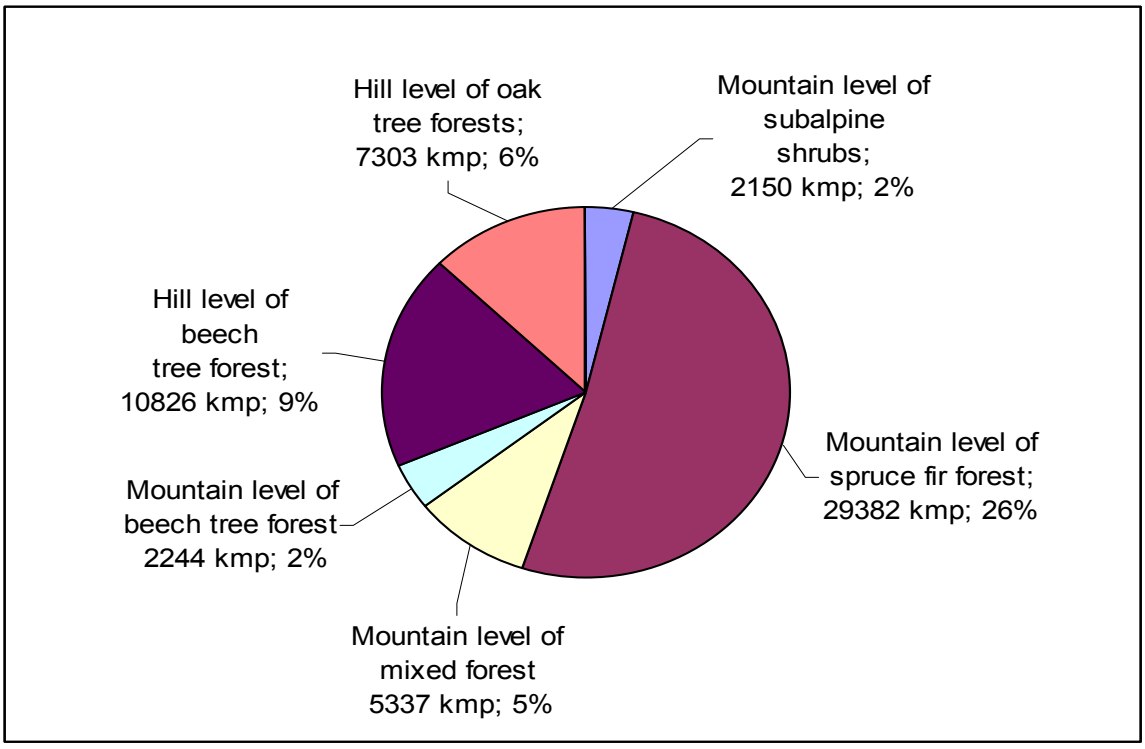

Figure 2: The forest fund on the vegetation level distribution in Sebeş basin (surfaces and weight)

Nevertheless, the Sebeş Valley and its tributary valleys represent true axes of mountain penetration. The access to Cindrel and Şureanu Mountains, but also to other mountains beyond the origins of eastern Jiu and Lotru rivers is facilitated by the county road DN67C, the old "Queen's road", which used to connect the historic provinces through the mountains. The access to the mountain is alleviated by the dense network of forestry roads and paths. These access ways are undertaken, overused and degraded by people involved in forestry activities.

The depression and plateau sector occupies 47% of the entire area of the basin and within its altitudinal limits (213 - 800 m) predominant is a mild relief adapted to the monoclinal structure, with asymmetrical versants, shallow and wide valleys where people have settled. The altitudinal limit of permanent settlements is of 400 m in the plateau and 600 m in the hills area, i.e. 30 rural settlements and 2 urban settlements (Sebeş and Miercurea Sibiului) which occupy 4% of the inferior basin. Under 400 m altitude, this sector contains the alluvial plain and the terraces of Sebeş river, of the Secaşul Mare river, the slope of the Secaş Plateau and the terrace glacises, with a predominantly agricultural use. The cultivable land occupies 32% of the total area of the inferior basin, pastures and grasslands 41%. Spontaneous vegetation on the hills on the right of Secaşul Mare river or on the hills between Petreşti and Pianu de Jos, forest-steppe elements, has undergone significant changes through deforestation and reclamation. This area is the most suitable for habitation and agriculture in the entire basin, which generated a high anthropic pressure. The high anthropization of the inferior basin of Sebeş was possible due to the rich water network, high accessibility, and fertile soil.

Hydroenergetic power plants on the Sebeş Valley and its tributaries, or fish-farming facilities in the inferior basin have led to certain changes in the natural landscape and in the structure of human settlements. The most obvious transformations are those on the valleys and versants in the developed sectors. The development activities had a great impact upon human settlements and environmental conditions. They are currently well integrated with the landscape, the areas that used to be marshlands or grasslands are now covered by the water of lakes.

The Impact Matrix and Sorensen Impact Network

The preliminary analysis was centralized within the framework of an impact matrix according to the methodology presented above (Tab. 1). The impact was quantified gradually, from 1 to 10, but with high subjectivity. The values assigned to the impact cumulated both parameters of the impact which were considered (amplitude and importance).

The values assigned to the relations between the land use and current geomorphologic processes may be positive or negative, which denotes a positive impact (the process decreases) or negative (the process accelerates) of the use in the commencement or development of current processes (Canter, 1977, Vădineanu, 1998).

Where the relation between determined land use and geomorphologic processes could not be established the question mark was used, which indicates an ambiguous relation (Costea, 2005). The impact was evaluated through the Sorensen Network too, in the figure 3, completing with the table 2.

This network is a starting point towards the identification and classification of these effects depending on their frequency in each of the fields of study and presents the qualitative significance of the impact of these actions upon the relief; the impact may be direct, caused by short-term anthropic actions, or indirect through the modifications induced in the medium and long term under modeling conditions.

Table 1: The impact matrix.

Land use Geomorphologic processes	Forests	Secondary grasslands	Natural grassland and hayfields	Shrubs	Arable land	Bildt area	Lakes	Abandoned land
Stable surfaces	+10	-9	+2	+5	+6	+4	-2	-8
Splash erosion	-3	-5	-2	-1	+1	+6	-1	-10
Rill erosion	+4	-6	-4	+7	-8	-1	-6	-9
Ravening	-4	-6	-3	+2	-5	-1	-2	-7
Torrential erosion	-5	-7	-4	-1	-1	-1	-5	-7
Collapses	+8	-9	-6	+3	?	+1	-4	-7
Landslides	+8	-10	-7	-2	-1	+5	-7	-9
Solifluxion	+9	-8	-8	+6	+7	?	-3	-9
River accumulation	?	-2	-2	+1	+1	+1	-9	-5
Lake accumulation	+8	-6	-6	+4	-7	?	-10	-7
Wave erosion	+7	-10	?	+5	-9	?	-10	-10
Total score	+42	-78	-40	+29	-16	+14	-59	-88

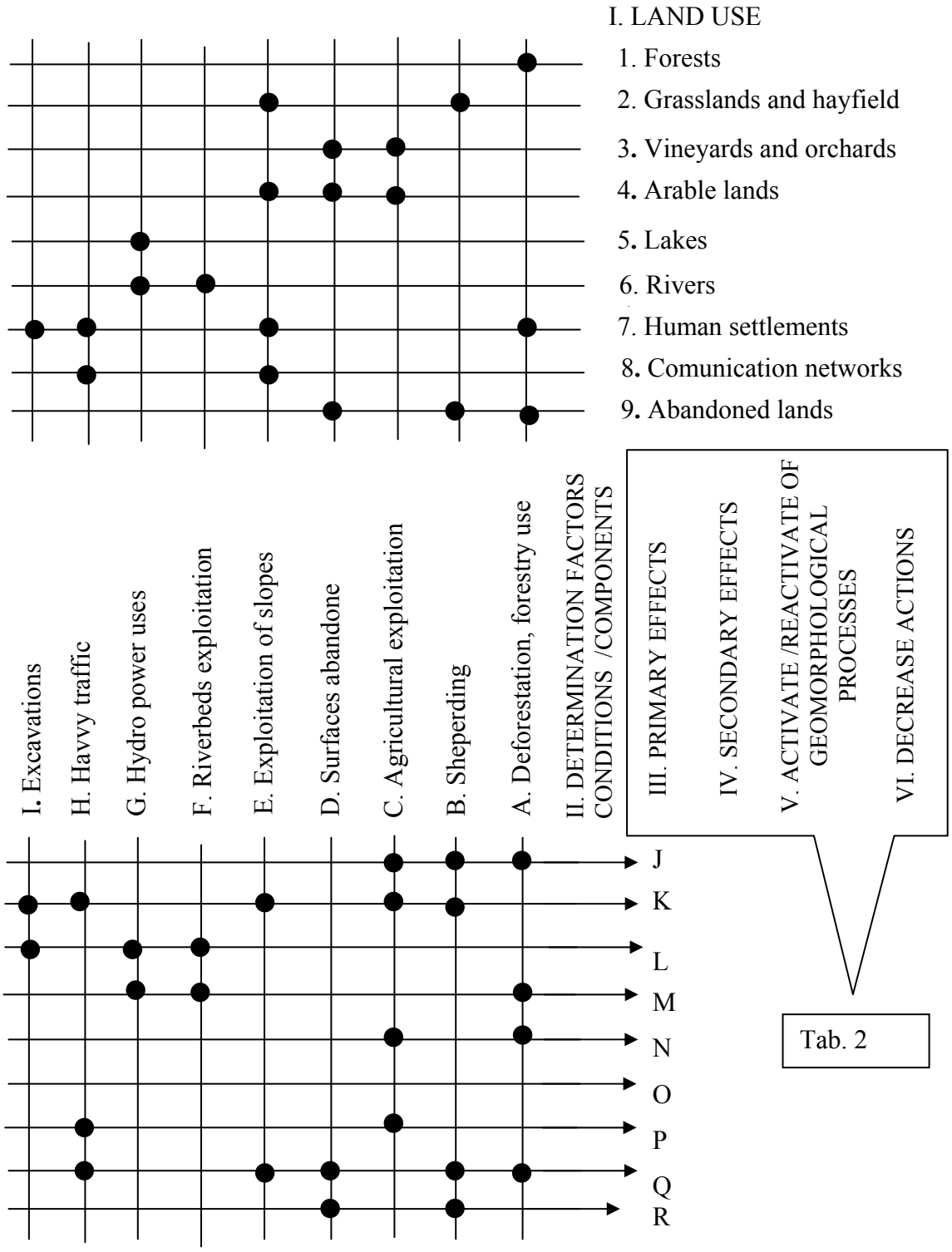

Figure 3: Sorensen network.

Table 2: Effects, collateral processes, decrease actions.

II. Primary effects		IV. Secondary effects	V. Geomorphologic processes/forms Activate/Reactivate	VI. Decrease actions
J	Animals paths	Flows increase	Spalsh, rill, gully erosion	Afforestation, torrential basin arrangements
K	Slopes changes	Slpes undermining	Landslides	Tree planting, substratum drainage, springs collecting
L	Riverbeds changes	Talveg migration	River banck erosion/ accumulation	Bancks consolidation
M	Flow fluctuations	Alternating gmf. Processes Er./Acc.	Depth fluvial erosion	Riverbeds arrangements
N	Upturning	Sufaces erosion	Gully, ravine, torrents	Tree and grass planting, torrential arrangements
O	Compacting	Subsidence	Settling and suffosion	Decrease of mechanic stress
P	Cracks along slopes	Head scarpes of landslides	Mass movements	Afforestation, embankment, walls support, injections of concrete
Q.R	Fallows slopes	Stability of slopes	Rainsplash erosion, sheet erosion	Moderat exploatation of pastures

INTERPRETATIONS

The centralization of the data in the Impact Matrix and Sorensen Network (the impact evaluation diagram) indicates several significant aspects.

The extension of the forest areas and land stability against different current geomorphologic processes are indirectly correlated, a strong and positive correlation, the impact of forestry on the development of geomorphologic process being a negative one, both in the short and in the long run. However, pluvial-denudation processes (torrentiality, ravines, streaming) are possible in forest areas as well. Thus, the anthropic modification of the basic level which erosion is strictly dependent on, in the Carpathian basin of the Sebeş through the construction of dams has stimulated erosion upstream (phenomenon manifest in the influence areas of the 4 storage lakes on the Sebeş river or the tributaries of Secaşul Mare). The position of the degraded surfaces upstream Oaşa in the pine spruce storey is related to the features of the trees and litter which facilitate concentrated flow. Under the same bio-climatic conditions of the pine spruce forest in the basins of Bistra and Dobra, massive deforestation on the superior part of the versants generated runways and channels which were later on deepened by torrential flows. Terminal sectors of the ravines and torrents are in the forest, sectors which contain the deepest shapes and slopes; these conditions facilitate concentrated flow and erosion. Forestry restricts gravitational processes such as landslide and subsidence, which do not take place in forest areas. The effect is ambiguous in the accumulation processes, even negative in areas covered by deciduous trees, i.e. there is no such process on areas covered with thick litter.

Pluvial-denudation processes, surface erosion, torrentiality, streaming and ravines are facilitated and even amplified by the utilization of land for grazing and grassland. This direct and positive connection indicates the fact that the anthropic pressure on this land-use category leads to an exacerbation of the processes on animal paths, paths and access roads which follow the slope lines with the highest degree of inclination. The scores assigned are above medium values and indicate the negative impact of this binomial upon mountainsides.

It is a direct and positive connection between grazing and grassland utilization of land, which is indicated by the maximum scores assigned. Gravitational processes of deep, shallow, or surface (solifluction) subsidence, are present and amplified on versants with slopes of 15 - 25° inclination, especially on upper half or third. They are maintained and amplified by the geological background, i.e. clay deposits and phreatic springs appeared on the strata extremities or structural plateau surfaces, or in contact areas of the crystalline and the sediments cover (Jina, Poiana). These areas are dynamic as a result of the joint action of gravitational and pluvial-denudation processes, which causes exportation of solid materials (soil, eluvium, or adobe material) and glacises.

Agricultural utilization stimulates pluvial-denudation (surface erosion, streaming) when ploughing is made on the slope line or when cultivated areas are abandoned; these actions cause re-activation of landslides on the pseudo-terrace fronts. The most degraded surfaces are today those situated on abandoned agricultural areas. Another negative effect is that of parceling and changing the land-use category.

The exploitation of the energetic potential of rivers through turbines, bed drainage, surface drainage accelerate abrasion, streaming, ablation processes in the banks of storage lakes such as Oaşa, Tău Bistra, Nedeiu, and Petreşti. When a large volume of water is caused to flow from the lake, the shoreline and bed erosion process is activated upstream of the lake, and affects the balance of versants. Moreover, the silting of the river mouths of the tributaries of Sebeş in their own alluvium is another negative effect of this process. These effects appear in fish-farming facilities on Slatina and Bozului valleys in the plateau area.

Traffic is one of the most active factors which cause bulk earth moving. The road sector east of Apold Depression (DN1-DN7) overlaps with the landslide glacis at the origins of Apold and Aciliu rivers. This area is very unstable due to frequent landslides reactivation, torrentially, and ravines which remodel old and deep landslides. There is a high risk of degradation and blocking with versant materials, through the destruction of asphalt carpet due to the persistence of snow for almost 5 months a year, streaming and frost on DN67C in the mountain areas upstream of Şugag.

CONCLUSIONS

The hypotheses analyzed above are representative of the entire Sebeş basin. Even if our analysis of the relation between land-use categories and modeling processes mostly excluded the favorable geological substrate as passive factor and climatic stress as active factor of modeling, we are bound to admit their importance. On the entire surface of the Sebeş basin, the three essential factors for the activation and development of geomorphologic processes combine and support one another causing processes of different intensity on different areas and a direct and immediate impact or an indirect but long-term impact upon all environmental elements in the basin.

The mixed character of land-use in the Sebeş basin, agricultural activities, forestry, the exploitation of hydro energetic potential of rivers, and traffic are active factors for the activation and diversification of versant processes. Moreover, deforestation, over-grazing, parceling, deserted land, the building of access roads and paths, the inadequate methods employed have had a negative impact upon land and dynamic balance of the versants.

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CONSIDERATIONS ON THE HUMAN IMPACT ON SOME AQUATIC ECOSYSTEMS (MOLDAVIA)

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KEYWORDS: Moldavia, lake vegetation, biodiversity conservation, human impact, natural areas.

ABSTRACT

The object of our study was a like, situated between the Plopi and Maramanovca villages (in the northern region of the Republic of Moldavia) and the surrounding region of about 10 hectares, represented by a flooded meadow with an abundant paludinous vegetation, dominated by Cyperaceae, Thyphaceae, Poaceae.

Besides the registered fauna and flora species in this ecosystem, water and mud composition was researched. The results showed a high accumulation of stable chemical compounds and intensive consumption of nitrogen and phosphorus compounds. The results obtained reveal the impact of the human factor on the researched lake that persisted throughout the last years.

In order to preserve its value, this ecosystem is proposed to be included on the list of Protected Natural Areas, within the Hydrological Monument of the Nature category. This will contribute to the ecological balance, the preservation of the biodiversity and the ecological education of the population.

REZUMAT: Consideraţii referitoare la impactul antropic asupra unor ecosistme acvatice.

Obiectul studiului nostru este localizat între satele Plopi şi Maramanovca (în partea de nord a Republicii Moldova) şi într-o zonă limitrofă de aproximativ 10 hectare, reprezentată de o zonă inundată, cu vegetaţie paludicolă abundentă, dominată de Cyperaceae, Thyphaceae, Poaceae.

Pe lângă fauna şi flora înregistrată în acest ecosistem, au fost studiate apa şi compoziţia nămolului. Rezultatele arată o acumulare ridicată de compuşi chimici stabili şi un consum intensiv de compuşi de azot şi fosfor. Rezultatele obţinute relevă impactul antropic asupra lacului cercetat, care a persistat în ultimii ani.

Pentru conservarea valorii ecosistemului, acesta este propus să fie incus în lista de arii naturale protejate, în categoria monumentelor naturii hidrologice. Acesta va contribui la echilibrul ecologic, coservarea biodiversităţii şi educaţia ecologică.

RESUMÉ: Des considérations au regard de l'impacte anthropique sur certains écosystèmes aquatiques (Moldavie).

L'objet de notre étude a été un lac, situé entre les villages de Plopi et de Maramanovca, (dans le nord de la République de Moldavie) ainsi que la zone autour, d'environ 10 hectares, représentée par un pré inondé avec une végétation palustre abondante, dominée par des Cypéracées, Typhacées, Poacées.

A part les espèces de faune et de flore répertoriées pour cet écosystème, la composition de l'eau et de la boue a été également investiguée. Les résultats montrent une importante accumulation de composants chimiques stables et la consommation intense des composés azotés et phosphorés. Les résultats obtenus mettent en évidence l'impacte anthropique sur les indicateurs du lac investigué, impacte qui a persisté le long des dernières années.

Afin de conserver sa valeur, cet écosystème a été proposé pour faire parti de la liste des Zones Naturelles Protégées, dans la catégorie des Monuments Hydrologiques de la Nature. Ceci contribuera à préserver l'équilibre écologique, la biodiversité ainsi qu'à l'éducation écologique de la population.

INTRODUCTION

The anthropic impact and the atmospheric processes persist on the environment, continuing to endanger the ecological equilibrium of natural ecosystems, simultaneously influencing the human life conditions. Among the three main natural factors of the environment: atmosphere, soil, water, the last one is the most exposed to human action. Water passes through different usage places (technological processes, agricultural activities, domestic use) and captures much substances that worsen it qualities. Aquatic ecosystems with all their components (biotic and non-biotic), directly or indirectly, are under human influence. This is why corrective measures are necessary in order to improve their state and to ensure the preservation of biodiversity and natural habitats.

EXPERIMENTAL

The experimental research was conducted on the lake and the surrounding grounds situated between the Plopi and Maramonovca villages, (in the northern region of the Republic of Moldavia) during 2005. The lake is artificial, situated at an altitude of around 150 m next to the river Cubolta. Initially, some observations regarding the ecological state of the ecosystem were conducted, the next step being a phytocenotic description in different phenological stages (spring, summer, autumn), creating an inventory of the plants and animals living there, collecting algae, molluscs, water and mud samples for lab investigations. Classifying and systemizing the biotic species present there was an operation conducted using the MBS-10 and MBS-5 microscopes while their identification was realized using the identifiers approves for superior plants, algae and molluscs. The algae samples were taken from the aquatic basin, from those places that have the highest density of aquatic plants, filamentous algae - from the bottom of the aquatic basin, from the stones, mud and aquatic plants.

The material collected was conserved using formalin solution 4% and kept in the dark. The terrestrial gastropods were collected from the plants and soil near the pond, together with these. The bivalve molluscs were collected directly from the shore of the lake. Establishing the value and the level of endangerment for the recorded species was conducted according to the categories UICN, Moldavian Red Book, Romanian Red Book, Ukraine Red Book, Bern Convention, Bonn Convention, and Washington Convention. The water collecting and analysis was conducted according to standards conforming to the standard dishes, conservation conditions and the carrying-out of the analysis.

In order to determine the heavy metals content, the atomic absorption method was used - AAS and spectroscopy (XRS) using a Spectroscan Max G device. The passport of the protected area was filled according to the methodological recommendations regarding the filling of the passport of a protected area.

RESULTS AND DISCUSSIONS

The observations regarding the ecological state of the lake and the nearing zone that were taken into consideration for this study are testimony to the influence of the anthropic factor on the researched lake. In the last few years, the ecosystem is subject to the impact of the irrational use of intensive agriculture, intensive use of the water in irrigations. In the nearing zone, the aquatic basin protection zone is missing. The lake is in very bad shape, with a very low water level, much mud (Fig. 1) and on its shores, gastropod shells were discovered, bivalve molluscs, remains of the river lobster, traces from a while back.

Figure 1: Mud on the lake bottom.

The nearing sector, with a surface of around 10 hectares, presents a flooded meadow zone with abundant palustral, mesophytic vegetation well developed, dominated by *Cyperaceae, Thyphaceae, Poaceae.*

Amongst the superior palustral plant species have been recorded as follws: *Calamagrostis epigeois, C. earundinacea, Carex brevicollis, Phragmites australis, Plantago maritima, Thypha latifolia, T. Angustifolia* and so on, and amongst the aquatic: red algae: *Batrachospermum moniliforme,* cyanophytes *Gomontiella subtubulosa, Chamaesiphon polymorphum, C. stagnalis, Nodularia spumigena;* diatoms: *Coconeis shumanniana, Eunotia pectinalis, E. lunaris, Frustulia rhomboides;* green algae: *Scenedesmus acumunatus, S. bijugatus, Oocystis submarina, Spirogyra* sp., *Gongrosira debaryana, Sphaerocystis schroeteri,* euglenophytes: *Trachelomonas granulosa, T. hispida* var. *hispida, T. hispida* var. *volicensis.* Amongst the fauna species recorded, we mention: *Helix pomatia, Anodonta cygnaea, Astacus fluviatilis., Ardea cinerea, Ondatra zibetica* and so on.

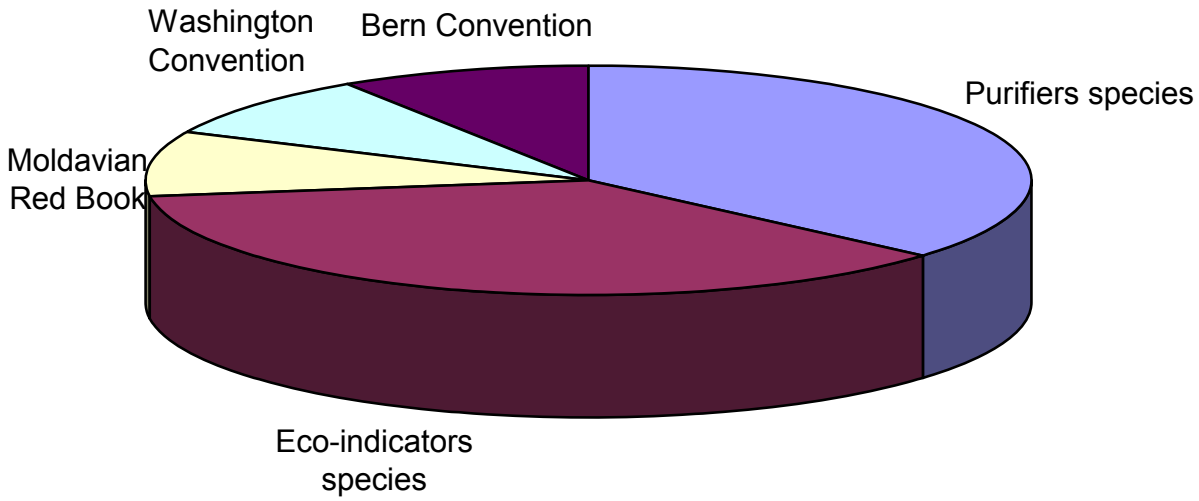

Figure 2: Categories of valuable species of flora and fauna.

The value of the ecosystem comes from the importance of the species that purify water (*Phragmites*, *Thypha*, *Carex*), eco-indicators of the degree of pollution with organic and inorganic chemical compounds (*Scenedesmus, Trachelomonas, Anodonta, Astacus*) and the possibility of serving as habitat for the migrating and remaining birds, as well as for some species with a national and international level of protection (*Ondatra zibehtica* - 8th category of protection in the UICN clasifier; *Ciconia ciconia* - endangered species, included in the appendix of the Bern convention, 1979, 8th category of protection in the UICN clasifier; *Helix pomatia* - included in the appendix of the Washington convention, 1973) (Fig. 2).

Some species, as *Trachelomonas hispida*, *Scenedesmus acumunatus*, beside the fact that they take part in the biological water cleaning process, they also have the capacity to assimilate organic substances and are used as nutrition for invertebrate animals.

In the aquatic biocenoses, the molluscs represent the dominant group. Bivalve molluscs have their contribution in maintaining the quality of the water, having the capacity of accumulating intensively a lot of metals. In the water of the lake situated between the Plopi and Maramonovca villages, shells of the lake mollusc - *Anodonta cygnaea* (sometimes it has 160 - 180 mm in length), were found in abundance, this mollusc being considered as an indicator of good water quality. Thus we can conclude that pollution in this basin is minimum, fact confirmed also by the presence of the river lobster. The capacity of accumulating Cd, Pb, Zn, the vast spreading and the reduced migration make the *Anodonta* molluscs very good bio-indicators for the level of pollution with these metals. Within this context, the analysis of heavy metals contents in the shells of the lake mollusc was conducted. The molluscs were of course collected from the researched lake. The results indicate an insignificant accumulation of heavy metals, especially of the most aggressive ones, Cd and Pb, of which content proved to be of 0.312 and respectively 0.76 mg/kg. Thus, the weight of metal content raises as follows: Cd(II) < Pb(II) < Zn(II) < Cu(II) < Ni(II) (Fig. 3).

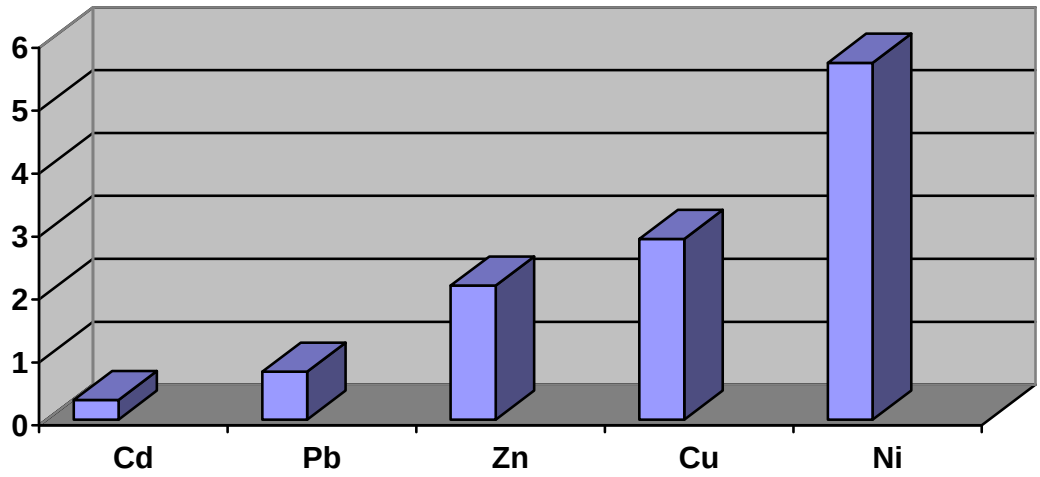

Figure 3: Heavy metals content (mg/kg) in the shells collected.

Along with the heavy metal content of the shells, the composition of the water and mud were also analysed, the results indicating a high accumulation of stable chemical compounds, as well as an intense use of compounds that contain nitrogen and phosphorus. According to the ecological state index, the water quality in the lake researched falls within the quality classes II and III.

In order to maintain its value, a proposal has been made to include this zone into the Protected Natural Areas, within the category of Hydrological Natural Monuments, fact that will contribute to the re-establishment of the ecological equilibrium, the preservation of bio-diversity and to the ecological education of the population.

CONCLUSIONS

The zone proposed for protection is characterised by an ecological state influenced by the action of the anthropic factor. The heavy metals content from the elements investigated, that fall within the CMA limits, as well as the parameters of the water in the lake, confirm a satisfying quality of this ecosystem.

The results of the study conducted will serve as scientific argument for the lake situated between the villages of Plopi and Maramonovca to get the status of state Protected Area within the category Hydrological Monument of Nature, fact that will contribute to the expansion of the areas protected by the state within Moldavia.

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SEBEŞ RIVER MONTAINOUS SECTOR (OLT RIVER WATERSHED) ECOLOGICAL ASSESSMENT (TRANSYLVANIA, ROMANIA)

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KEYWORDS: Romania, Transylvania, lotic system, assessment, biotope, macroinvertebrates, fish, management.

ABSTRACT

The paper presents the ecological evaluation, based on the structure of the benthonic macroinvertebrates communities, fish fauna and biotope elements of the mountain sector of the Sebeş River, situated in the area of the Natura 2000 site Făgăraş Mountains.

The study emphasizes the good ecological state of this river sector, close to the natural one and proposes measures for the sustainable management of the surveyed area, related to the aquatic fauna, the substrata structural type, the riverbed and shore morphology, the connectivity, the water quality, the riparian vegetation.

REZUMAT: Evaluarea ecologică a sectorului montan al râului Sebeş (bazinul hidrografic Olt) (Transilvania, România).

Lucrarea prezintă evaluarea ecologică, bazată pe structura comunităţilor de macronevertebrate bentonice, ihtiofaună şi elemente de biotop a sectorului montan al râului Sebeş, localizat în aria sitului Natura 2000 Munţii Făgăraş.

Studiul reliefează starea ecologică bună a acestui sector de râu, apropiată de cea naturală şi propune măsuri pentru managementul sustenabil al zonei de interes, legate de: faună acvatică, structura substratului, morfologia albiei şi a malurilor, conectivitate, calitatea apei, vegetaţia ripariană.

RESUME: L'évaluation écologique du secteur de montagne de la river Sebeş (le bassin de la rivière Olt) (Transylvanie, Roumanie).

L'article présente l'évaluation écologique, basée sur la structure des communautés de macroinvertebrés benthoniques, ihtiofaune et sur les éléments de biotope du secteur montagneux de la rivière de Sebeş, localisé dans la région du site Natura 2000 des Montagnes de Făgăraş.

L'étude met en évidence le bon état écologique de ce secteur de la rivière, proche de l'état naturel et propose des mesures pour la gestion durable de la zone d'intérêt, liées à la faune aquatique, à la structure du substrat, à la morphologie du lit et des berges de la rivière, à la connectivité, à la qualité de l'eau, à la végétation riparienne.

INTRODUCTION

The studied Sebeş River is a left side tributary of the Olt River in the Făgăraşului Depresion. From the spring to its confluence with Olt the river has a length of 34.5 km and pass two geomophological units: Făgăraşului Mountains and Făgăraşului Depresion (***, 1987). This hydrographic basin is a small one, with a surface of 115 km^2 (Ujvari, 1972) of which the largest part was developed in the mountainous region.

For the montanous course of this river the ecological state assessment and the identification of some main sustainable management measures, there were analised the benthic macroinvertebrates and fish communities structure (key components for this type of river bioeconomy), in correlation with some biotope characteristics.

Based on the obtained results can be concluded the stability degree of the analysed lotic system, can be identified the anhtropogenicaly sensyble components and can be established some measurements for a sustainable management of this river mountainous sector, which belong to the Făgăraş Mountains Natura 2000 site.

MATERIALS AND METHODS

The presented results are based on the 2008 field observations and sampled biological material analysis.

For the description of the considered aquatic communities were sampled benthic macroinvertebrates and fish quantitative samples from four sampling stations situated along the Sebeş River and one station situated on the Cuciulaţi Valley, a tributary (Fig. 1; Tab. 1). These sampling stations were established in corelation with the biotope specificity, the main confluences and the posible presence of the human activities with a potential impact on the river.

The quantitative benthic samples were sampled with a Surber sampler with a surface of 887 cm^2 and a net with meshes of 250 µ. In each station were sampled samples from five points, to can be highlighted the micro-habitas specific diversity.

The macroinvertebrates identification was done till the species level for ephemeropterans, plecopterans, gastropods.

To identify the presence of the rare species were sampled qualiative samples too.

There were sampled fish quantitative samples, with a hand net in the time (one hour) on effort unit; after the sampled individuals identification and counting they all were released back in the river.

For the quantitative structure description of the benthic macroinvertebrates communities we have used the statistical density (Ds - the average number of individuals on the sampling surfaces) and the relative abundance (A%) of the present taxons; for these parameters determination were considered only quantitatively samples.

As synthetic indexes used for the river ecological state assessment the Belgian Biotic Index (BBI) (De Pauw and Hawkes, 1992) and Ephemeroptera Plecoptera Trichoptera / Chironomidae Index (EPT/C) (Plafkin et al., 1989) were determined.

The Belgian Biotic Index values can be grouped in five classes corresponding to the water quality classes (Tab. 2).

The used taxonomical groups indicators for the lotic system integrality analise were: Plecoptera and Ephemeroptera orders and Osteichthyes Class representatives.

The used methods for the river ecological assessment and the indicator values of the determined species were based on: Beck (1977); Hellawell (1986); Chapman (1992); Rosenberg, Resh (1993); Pauw and Hawkes (1992); Knoben et al. (1995), Resh et al. (1996).

For the biotope conditions description the folowing morphometric and hidrologic caracteristics of the riverbed were considered: slope, water width, maximum depth, average depth, minimum depth, watered perimeter, section surface, hydraulic radius, average speed, the speed near the banks, the water flow in the observation moment, the multianual average water flow, the specific liquid flow, the substratum type, the shadowing of the riverbed (Ştef and Costea, 2006).

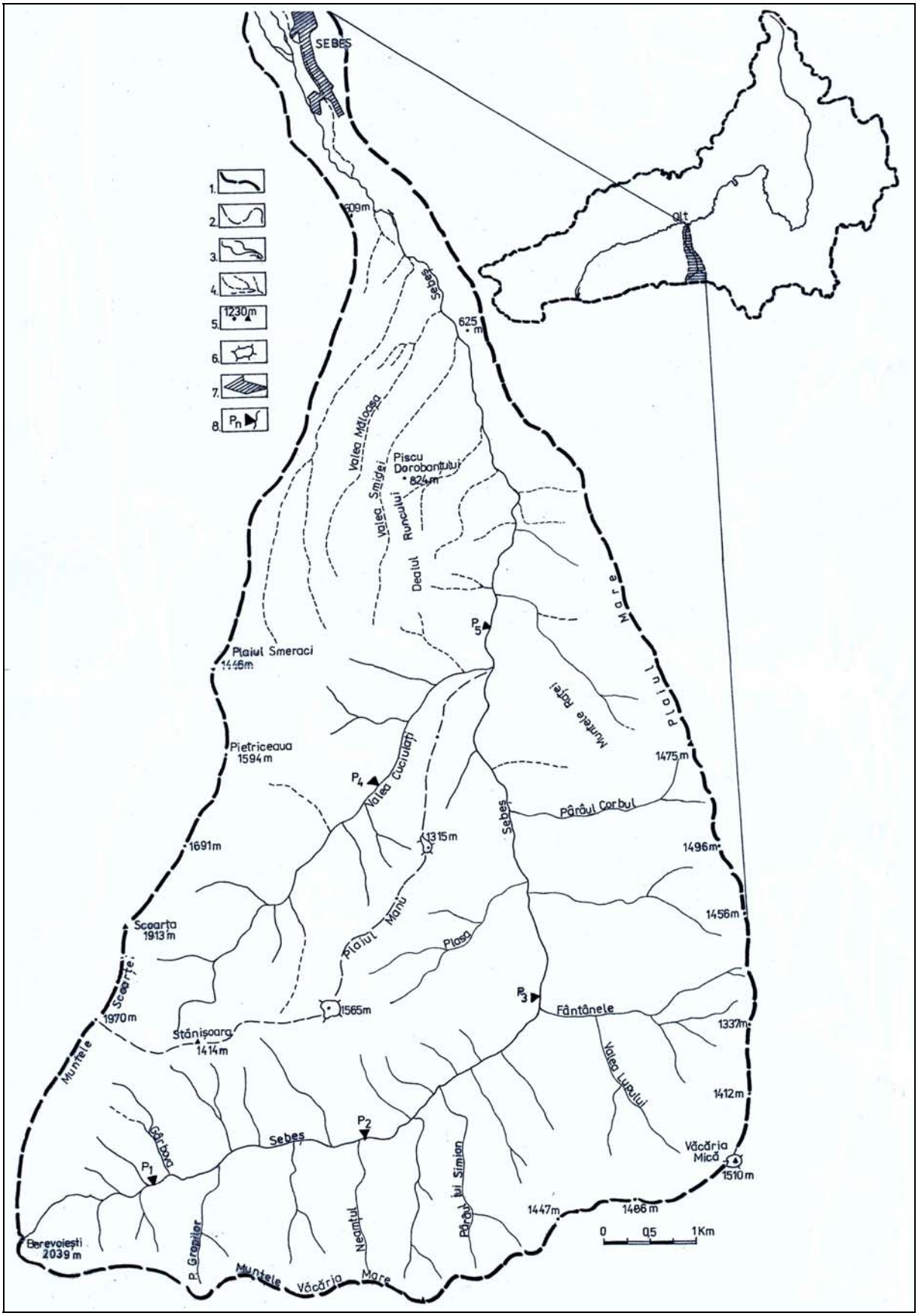

Figure 1: Sebeş River catchment and his position in the Olt River basin; 1 principal watershed, 2 secondary watershed, 3 permanent hydrographical network, 4 temporary network; 5 peaks; 6 erosion outliers, 7 settlement, 8 analyzed river cross-profile and points of sampling.

Table 1: The location of the sampling stations and some physico-geographic characteristics, along the Sebeş River.

Sampling stations	Geographical position	Altitude (m)	Basin surface F (km^2)
P1 (Sebeş)	45°36′47″ latitude N 25°00′25″ longitude E	1123	6.89
P2 (Sebeş confluence with Neamţu)	45°37′00″ latitude N 25°02′12″ longitude E	945	17.6
P3 (Sebeş)	45°37′48″ latitude N 25°03′40″ longitude E	830	29.3
P4 (Cuciulaţi Valley)	45°39′04″ latitude N 25°02′22″ longitude E	830	7.22
P5 (Sebeş)	45°40′02″ latitude N 25°03′20″ longitude E	705	53.52

Table 2: The water quality classes in relation with the Belgian Biotic Index values.

Class	Belgian Biotic Index value	Quality category
I	10 - 9	Unpolluted water
II	8 - 7	Low polluted water
III	6 - 5	Polluted water, critical situation
IV	4 - 3	Very polluted water
V	2 - 1	Excessive pollution

RESULTS

P1 sampling station

This valley sector is relatively narrow (about 40 m width), the valley has a high relief energy, of over 400 m. The sieds of the mountain are steep with slopes which reach values of 70 - 90° at their lower part, with fir trees mixed with beech trees and with abruptions of hard rocks. The Sebeş minor riverbed has a slope of around 7 m / 100 m, being deepened with 2 - 3 m up against the banks. The riverbed is covered with big dimensions boulders (the big diameter 1 - 1.2 - 1.5 m, the small diameter 0.5 - 0.8 m) not very rolled which demonstrate their gravitational provenience from the slopes and the edges round off through fluviatile erosion and polishing with solid material (sand, pebles). The rivebed is asymetric, being agglomerate with material in the central section of the sector, where is the smallest depth (0.13 m), and deeper near the banks. In the right bank vicinity at a distance of 1 m against the bank is the main talweg at 0.4 m depth. The morphometric and hidrometric particuarities of the riverbed are presented in the table 8.

In this sector the riverbed is anthropogenicaly modified due to some construction materials left near an old dam yard in the rea.

The structure of the macroinvrrtebrate communities (Tab. 3) and the values of the Belgian Biotic Index (IBB = 7) and of the index EPT/C (EPT/C = 5.28) reveal the fact at this sector present a good ecological state fom this perspective.

Tab. 3: The structure of the benthic macroinvertebrates of the Sebeş River (P1) (Ds - statistcal density, A% - relative abundance).

Taxon	Ds nr. ind/ 887 cm^2	A%	Species list - EP
Subcls. Oligochaeta	3	5.77	
Ord. Hydracarina	1	1.92	
Ord. Collembola	1	1.92	
Ord. Ephemeroptera	28	53.85	*Baetis vernus* Curtis, 1834 *Baetis rhodani* (Pictet, 1843-45) *Rhithrogena semicolorata* (Curtis, 1834) *Rhithrogena alpestris* Eaton, 1885
Ord. Plecoptera	5	9.62	*Perla marginata* (Panzer, 1799) *Nemoura cinerea* (Retzius, 1783) *Protonemura intricata* (Ris, 1902) *Protonemura brevistyla* (Ris, 1902)
Ord. Trichoptera	4	7.69	
Ord. Coleoptera	1	1.92	
Ord. Diptera Fam. Chironomidae Other dipterans	 7 2	 13.46 3.85	

In tis sector were not found fish.

From the general natural frame point of view, the relative nearness of this sector by the river springs area from the East extremity of the Făgaraş Mountains ridge (in the Scoarța glacial caldron - 2000 m), its localization at an altitude of 1123 m, the torrenticoll character, high relief energy, high slope, relativly sinuous course, low water temperature, high water oxigenation, high water speed, waterfalls presence, water clearness, the prevalence substratum is formed of rocks and boulders, the high degree of shade of the water, represent specific conditions for the ichtiological zonation of the trout (*Salmo fario* Linnaeus, 1758). The missing of fish here can be explained by the upstrem antropogenicaly influence (the old dam yard), the habitat being significantly deteriorated in the very near proximity (10-15 m upstream) of the studied section. The habitat geomorphologic and hidrologc characteristics are deteriorated due to the upstream dam construction and to a retention area for water and sediments.

P2 sampling sation

The valley is relatively large, the studied section is situated in a small confluence basin (the confluence between Neamțu Brook with Sebeş River). The major riverbed is well developed, especialy in the confluence area. The minor riverbed has a maximum width of 10 - 12 m and a minimum width of around 3.5 m at the confluence. This width at the confluence can be explan due to the fact that the colector was loaded on and near the banks with detritus from its trbutary the Neamțul Brook. Sebeş River confluence with the Neamțu stream is done in almost right angle (about 80 - 85 degrees), with a great discharge of alluvial fan composed of gravel embedded in a mass of sand, where may identify generations of deposits.

The cone has a length of 15 - 20 m and a width at its base of 16,5 m, and the Neamțu Brook cuted a lateral course against the the cone, deepened with 0.5 m in its own sediments. The acumulation in this sector is favoured by the decreasig of angle of the riverbed slope, which has an inclination of maximum 3 m/100 m. The alluvial fan pressure to the collector river and the

reduced riverbed slope of Sebeş makes upstream the confluence, even under the bridge, to accumulate the alluvia as two points bar, one of them fixed by grass vegetation, and other set of alder trees. In this section the riverbed is nearly symmetrical with the talweg located cvasicentral (at 2.3 m from the right bank). The morphometrics peculiarities of the river in this section are presented in the table 8.

The benthic macroinetebrates structure (Tab. 4) and the values of he Belgian Biotic Index (IBB = 8) and EPT/C (EPT/C = 4.60) reveal the fact that this river sector present a good ecological status, the anthropogenic impact being insignificant.

Here the indigen trout (*Salmo fario*) is present, but missing in the Neamțu Brook. Like in the upstresam studied section the general natural frame is a propicious habitat for this fish species: the localisation at an altitude of 935 m, the torrential character, high slope, a relativly sinuous course, thelow water temperature, the high oxigenation of the water, highwater speed, the waterfalls presence, water clearness, the substrata formed in majorty of bg boulders, high degree of shade above the water.

Table 4: The benthic macroinverebrates structure of the Sebeş River at the confluence with the Neamțu Brook (P2) (Ds - statistic density, A% - relative abundance, xc - taxonomic groups present only in qualitative samples).

Taxon	Ds nr. ind /887cm^2	A%	Species list - GEP
Ord. Tricladida Subcls. Planariidae	xc	xc	
Subcls. Oligochaeta	13	29.55	
Cls. Gastropoda	2	4.55	*Ancylus fluviatilis* O.F. Müller 1774
Ord. Ephemeroptera	17	38.64	*Baetis vernus* Curtis, 1834 *Baetis rhodani* (Pictet, 1843-45) *Ecdyonurus venosus* (Fabricius, 1775) *Rhithrogena semicolorata* (Curtis, 1834) *Rhithrogena alpestris* Eaton, 1885
Ord. Plecoptera	2	4.55	*Perla marginata* (Panzer, 1799) *Nemoura cinerea* (Retzius, 1783) *Nemoura cambrica* Stephens, 1835 *Protonemura intricata* (Ris, 1902) *Protonemura brevistyla* (Ris, 1902) *Protonemura auberti* Illies,1954
Ord. Trichoptera	4	9.09	
Ord. Coleoptera	1	2.27	
Ord. Diptera Fam. Chironomidae	5	11.35	

P3 sampling sation

In this area Sebeş River Valley is asymmetrical. The left versant has an eastern exhibition, and corresponds to a nearly vertical slope made by crystalline schists, with very inclined slopes above 70 degrees and covered by a pine forest. In this area minor riverbed is tangent to the versant. Valley asymmetry is accompanied by a major riverbed asymmetrical development, well represented on the right side of Sebes, with a width of about 10 m. The contact with the right versant is marked by a glacis covered about 100 m^2 of a young forest of Abies alba. At the superior level of the glacis, on the right and lower slopes with 45 - 50 degrees and western exhibition is good developed the *Fagus sylvatica* associations forest.

This river sector it is an almost linear one in which on both banks were identified the river evolution phases at variable flows. The minor riverbed has a width of 5 - 6 m, is relatively symetrical, the talwegul has a depth of 0.36 m and is situated aproximately central (the morphometrical data can be found in table 8). In the thalweg predominates helicoidal erosion because of grossly material on the riverbed bottom and that links current and generates a helicoidal flow. On bank, the contact between bank and river bottom is made by alluvial deposits (gravels with a diameter of 5-12 cm and fine sand). Banks are steep and their micromorphology shows the existence of periodic oscillations of the leakage. The right bank is digging in sedimentary deposits transported and downloaded by the river, with a depth of 1.3 m to gloss water , being verry eroded. At present the top small concavity and cracks indicating the direction of development by withdrawing and crumbling of the bank, exercised from the river downstream.

In this river sector the indigen trout is present. Like in the upstresam studied section the general natural frame is a propicious habitat for this fish species: the localisation at an altitude of 830 m, high relief energy, high slope, a relativly sinuous course, thelow water temperature, the high oxigenation of the water, high water speed, the waterfalls presence, water clearness, the substrata formed in majorty of bg boulders, high degree of shade above the water.

The structure of the benthic macroinvertebrates commity (Tab. 5) and the values of the indexes Belgian Biotic (IBB = 7) and EPT/C (EPT/C = 9) show the fact that the ecological state of this river sector is a good one.

Table 5. The benthic macroinverebrates structure of the Sebeş River (P3) (Ds - statistic density, A% - relative abundance).

Taxon	Ds nr. ind /887cm^2	A%	Species list - EP
Subls. Oligochaeta	1	3.33	
Ord. Amphipoda Fam. Gamaridae	4	13.33	
Ord. Ephemeroptera	13	43.34	*Baetis vernus* Curtis, 1834 *Baetis rhodani* (Pictet, 1843-45) *Rhithrogena semicolorata* (Curtis, 1834)
Ord. Plecoptera	2	6.67	*Perla marginata* (Panzer, 1799) *Nemoura cinerea* (Retzius 1783) *Nemoura cambrica* Stephens, 1835 *Protonemura intricata* (Ris, 1902) *Protonemura auberti* Illies, 1954
Ord. Trichoptera	3	10.0	
Ord. Coleoptera	4	13.33	
Ord. Diptera Fam. Chironomidae Fam. Tipulidae	2 1	6.67 3.33	

P4 sampling sation

The P4 section is situated on the Cuciulați Valley, a left side Sebeş River tributary, at an altitudine of 830 m, at the same altitude with P3 station on Sebeş River. In this sector the valley has an opening of around 20 - 22 m and a relief energy f over 350 m, being a sector deep duged in the cristaline schists (***, 1987). Major riverbed is 14 -16 m width and the contact with the mountainside is marked by a unstable glacis about 15 - 30 degrees of slopes. The minor riverbed has a width of 8 m and the slope is accentuated. Bottom of the riverbed is crowded by material with metric size (the large diameter than 1.2 - 1 - 0.80 m, the small diameter than 0.50 - 0.80 m) and timber material buried in the alluvium. The presence of the hard rokcs in the middle of the riverbed favoured in spite of a high slope there (7 m/100 m) the accumulation of the fine deposits of sand and pebles and the aparition of an islet of big dimensions in comparison with the riverbed (9 m length, 3.5 m width), with a central position and covered with *Petasites hybridis*. This iet forced the Cuciulați Valley course to have here two secondary rivebeds, relatively equal from the morphometr point of view (Tab. 8).

Here is present the indigen trout.

The general natural frame is a propicious habitat for this fish species: the localisation at an altitude of 830 m, the high relief energy, the torrential character, high slope, a relativly sinuous course, thelow water temperature, the high oxigenation of the water, highwater speed, the waterfalls presence, water clearness, the substrata formed in majorty of bg boulders, high degree of shade above the water.

The structure of the benthic macroinvertebrates commity (Tab. 6) and the values of the indexes Belgian Biotic (IBB = 7) and EPT/C (EPT/C = 12.33) show the fact that the ecological state of this river sector is a good one.

Table 6: The benthic macroinverebrates structure of the Valea Cucilați (P4) (Ds - statistic density, A% - relative abundance, xc - taxonomic groups present only in qualitative samples).

Taxon	Ds nr. ind /887cm^2	A%	Species list - EP
Ord. Tricladida Fam. Planariidae	xc	xc	
Subcls. Oligochaeta	11	21.57	
Ord. Ephemeroptera	16	31.37	*Baetis vernus* Curtis, 1834 *Baetis rhodani* (Pictet, 1843-45) *Ecdyonurus venosus* (Fabricius, 1775) *Ecdyonurus dispar* (Curtis 1834) *Rhithrogena semicolorata* (Curtis, 1834)
Ord. Plecoptera	18	35.29	*Perla marginata* (Panzer, 1799) *Nemoura cinerea* (Retzius, 1783) *Protonemura intricata* (Ris, 1902) *Protonemura auberti* Illies, 1954
Ord. Trichoptera	3	5.88	
Ord. Diptera Fam. Chironomidae	3	588	

P5 sampling sation

In this sector the valley is relatively large in comparison with the upstream studied sectors, with a width of around 50 m and a relief energy of 200 - 250 m, the minor iverged has a width of 8 m. The river slope is 2 - 3 m/100 m which favoured the acumulation on the bottom of the riverbed of a course material (the big diameter of 0.80 m, the small diameter of 0.40 - 0.50 m) in a relative reduced mass f pebbles (the diamater of 1 - 2 cm to 20 cm) and sands. Presence in small quantities of fine material and gravels is due to two reasons: the first is high speed flow of water through lead jaunty, crawl and suspension the fine and small alluvia downstream, the second reason is the presence of a discharge alluvia threshold at 58 m upstream, made by concrete. This threshold has a height of 1.5 m, and behind it were accumulated fine and medium-sized alluvia (sand and gravels). Threshold generates a cascade of the same size and the water drop generate a helicoidal erosion at the threshold base. To mitigate this effect, the threshold is based on a concrete platform of 0.5 m high. If the alluvia passing, however, this discharger, they are stoped downstream in the form of point bar deposition or bank accumulation set of vegetation or foot bridge over Sebeş, blocked by wooden material, chaotic discarged in the minor riverbed.

In this sector are present the species *Salmo fario* and *Cottus gobio* Linnaeus 1758, the last one being included in the Annex II of the Habitats Directive.

The structure of the benthic macroinvertebrates commity (Tab. 7) and the values of the indexes Belgian Biotic (IBB = 7) and EPT/C (EPT/C = 3.87) show the fact that the ecological state of this river sector is a good one.

Table 7: The benthic macroinverebrates structure of the Sebeş River (P5) (Ds - statistic density, A% - relative abundance, xc - taxonomic groups present only in qualitative samples).

Taxon	Ds nr. ind /887cm^2	A%	Species list - GEP
Ord. Tricladida Fam. Planariidae	xc	xc	
Subcls. Oligochaeta	9	18.75	
Cls. Gastropoda	xc	xc	*Ancylus fluviatilis* O. F. Müller 1774
Ord. Ephemeroptera	21	43.75	*Baetis vernus* Curtis, 1834 *Baetis rhodani* (Pictet, 1843-45) *Ecdyonurus venosus* (Fabricius, 1775) *Ecdyonurus dispar* (Curtis 1834) *Rhithrogena semicolorata* (Curtis, 1834)
Ord. Plecoptera	6	12.5	*Perla marginata* (Panzer, 1799) *Protonemura intricata* (Ris, 1902) *Nemoura cinerea* (Retzius, 1783)
Ord. Trichoptera	4	8.33	
Ord. Diptera Fam. Chironomidae	8	16.67	

Table 8: Morphometrical elements of the minor riverbed and hydrological data on the Sebeş River in 31.07.2008 (measured data and analysis based on elementary hydrological calculus).

Measured/ calcuated elements	Sampling stations				
	Sebeş River				Cuciulaţi Valley
	P1	P2	P3	P5	P4
River slope I %	7	3	7	2.5-3	9
Riverbed width - B (m)	3.5	5	6	8	8
Maximum depth $_{max}$ (m)	0.40	0.40	0.36	0.30	h_{max1} = 0.26 h_{max2} = 0.30
Average depth h_{med} (m)	0.20	0.21	0.19	0.20	h_{med1} = 0.16 h_{med2} = 0.19
Minimum depth h_{min} (m)	0.13	0.19	0.10	0.14	0.19
Watered perimeter P (m)	3.41	5.076	6.046	8.02	2.279
Section Surface Ω (m^2)	0.715	1.065	1.14	1.639	Ω 1 = 0.315 Ω 2 = 0.370
Hydraulic radius R (m)	0.21	0.21	0.19	0.20	R_1 = 0,138 R_2 = 0,159
Average speed (m/s)	1.2	0.96	1.64	1.5	0.8
Speed near the bank (m/s)	0.9	0.64	1.09	0.73	-
The flow in the moment of observation (m^3/s)	0.858	1.022	1.87	2.45	0.544
Multiannual average flow (m^3/s)	0.286	0.660	0.850	1.088	0.238
Specific liquid flow q (l/sec.∗ km^2)	41.51	37.5	29.01	32.96	20.33

CONCLUSIONS

The montaneous course of the Sebeş River is charactersied through a good ecological state, excepting its superior part (P1) due to some abandoned hydrotechnical works lefft on the habitat.

The benthic macroinvertebrates communities present a characteristic structure for the Romanian Carpathian mountainous rivers, the reophilic and oxyphilic species are present and the insect's larvae are numerically dominant.

The distribution patterns of the fish assemblages reflect the good ecolgical status of this mountaneous river sector.

There are some management measurements which should be respected in the area for the local and regional aquatic fauna and ecosytem conservation: to not be changed the substrata structure (dimensions, form, density) preponderently from boulders; to not be changed the riverbed and banks morphology; the exclusion of some obstacles even temporary in the riverbed; the exclusion of some polution bariers even temporary in the riverbed; keeping the vegetal coridor along the water course which assure the needed shading degree and temperature regime.

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CONTRIBUTION TO THE INTEGRATED APPROACH OF THE ENVIRONMENT ASPECTS

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KEYWORDS: integrated approach, environment quality indicators, total correlation, partial correlation, environmental protection management.

ABSTRACT

The proposed method is an emission analysis method that study the relations between at least three main parameters, interconnected in the production process: the emission level in the environment, the production volume and the volume of the investments in environment protection. We consider that such an analysis may be called Integrated Environment Analysis. The study of the reciprocal influences is relatively simple, with the help of the known statistical methods, using the correlation coefficients. The total and partial correlation coefficients can be calculated and analyzed. For exemplification, we present a set of data simulated on an integrated environment analysis. This method can assist the environment authority and the organizations in basing the environment protection decisions and appreciating the degree of consideration organizations pay to the environment aspects.

REZUMAT: Contribuţie la abordarea integrată a aspectelor mediului.

Lucrarea prezintă o metodă de analiză a performanţei de mediu la care să concure mai mulţi parametri principali din cadrul agentului economic. Metoda se numeşte analiză integrată de mediu. Analiza exclusivă a evoluţiei indicatorilor de calitate a mediului, fără a se ţine cont şi de alţi parametri principali poate genera rezultate şi concluzii incomplete, sau uneori, greşite referitoare la performanţele de mediu ale organizaţiei. Metoda propusă are la bază studierea corelaţiilor parţiale şi totale între următorii parametri de bază: nivelul emisiilor în mediu, volumul producţiei şi volumul investiţiilor/cheltuielilor în protecţia mediului. Prezentarea generală este urmată de exemple şi interpretări pentru diverse tipuri de corelaţii. Metoda prezentată poate fi aplicată în analiza performanţelor de mediu ale organizaţiilor.

RESUMÉ: Contribution à l'approche intégrée des aspects environnementaux.

L'œuvre présente une méthode d'analyse de la performance environnementale à la quelle contribuent plusieurs paramètres principaux du même agent économique. Il s'agit de l'analyse intégrée de l'environnement. L'analyse exclusive de l'évolution des indices de qualité de l'environnement, sans tenir compte d'autres paramètres principaux, peut générer des résultats et des conclusions incomplètes ou, parfois, erronée au regard des performances environnementales de l'organisation. La méthode proposée est basée sur l'étude des corrélations partielles et totales établies entre les paramètres basiques suivants: le niveau des émissions dans l'environnement, le volume de la production et le volume des investissements/coûts concernant la protection de l'environnement. La présentation générale de la méthode est suivie par des exemples et des interprétations pour les différentes catégories de corrélations. La méthode présentée peut être appliquée dans l'analyse des performances environnementales des organisations.

INTRODUCTION

In recent years, an integrated approach of the envirinmental aspects and phenomena, including those regarding pollution is more and more obvious (the IPPC Directive and its transposing in the Romanian legislation by the Emergency Government Ordinance 152/2005 regarding the prevention and integrated pollution control). We think these analysis methods should be extended on a larger scale and specifically in the area of the organization and installation environment performance. In this direction, we propose a method for performance environment analysis to which many main parameters within the economic operator should concur. We called the method as integrated environment analysis.

DISCUSSIONS

In our opinion, the integrated approach is not sufficiently developed, both at a legislative level as well as practically. At a legislative level there are some general mentions regarding an integrated approach, but without requiring concrete data and procedures or providing developments with specific methodologies which should include more information about how an integrated control should be pursued. Practically, the majority of those who use and apply the environment legislation regarding the prevention and integrated pollution control don't follow it by proposals to improve that legislation, but merely apply it as it is ruled by its transposal in the national legislation. We sustain the above by the following arguments.

There aren't any provisions in the environment legislation on the integrated pollution control that should limit or monitor the emissions based on production volumes, or on the product units (for example, specific emissions/production unit). There are some exceptions of mentions published in the specific BAT for distinct sectors.

There aren't in the environment legislation provisions that analyze the correlations between the emission volumes, the quality of environment factors, their proportionality to the maximum admissible values and to the volume of the environment protection investments within a specific installation. Example: there is no instrument or method that delineates, within an organization, that which has been concretely done for environment protection and that which could have been done based on the economic performance. The more reliable establishment of the limits for the BATNEC (the best available techniques without excessive costs) that is.

In this context, we propose the following to be introduced in the specific European legislation in order to improve the prevention and integrated control methods of pollution. The introduction of a prevention and integrated pollution control method which would not only monitor the emissions in absolute values, but also based on the production values (example: specific emissions on product unit) for all the installations under the IPPC Directive, and for all the relevant quality environment indicators of the respective production process. In our opinion, this would be a significant quality advance in the integrated approach to the environment aspects.

The introduction of an emission analysis method that must study the relations between at least three main parameters, interconnected in the production process:

- the emission level in the environment;
- the production volume;
- the volume of the investments in environment protection.

We consider that such analysis can be called Integrated Environment Analysis (IEA).

Given the three basic parameters, each of their interdependencies is significant in the integrated approach on the pollution prevention and control. The study of the reciprocal influences is relatively simple, with the help of the known statistical methods, using the correlation coefficients. Thus, for the three proposed main parameters we can consider three features (variables) I, P and C, for the same time period:

I - an indicator for the environment quality that should be considered, or the volume of the evacuated polluters;

P - the production volume;

C - the environment investment volume within the organization/installation.

We can then have the following partial correlation coefficients:

$r_{IP(C)}$ - the partial correlation coefficient between the environment quality indicator I, and the production volume P, without the influence exerted by the environment costs C;

$r_{IC(P)}$ - the partial correlation coefficient between the environment quality indicator I and the environment costs C, without the influence exerted by the production volume P;

$r_{PC(I)}$ -the partial correlation coefficient between the production volume P and the environment costs C, without the influence exerted by the quality indicator I. In these cases we have level I partial correlation coefficients.

In order to complete the analysis, we consider that the total correlation coefficients should also be analyzed, considering as well the influence of the third variable, $\bar{r}_{IP,}\bar{r}_{IC}$ and $\bar{r}_{PC}$ that is.

The formulas linking the partial correlation coefficients to the total correlation coefficients are:

$$r_{IP\,(C)} = \frac{\bar{r}_{IP} - \bar{r}_{IC}\bar{r}_{PC}}{\sqrt{1-\bar{r}_{IC}^2}\sqrt{1-\bar{r}_{PC}^2}} \qquad (1)$$

$$r_{IC(P)} = \frac{\bar{r}_{IC} - \bar{r}_{IP}\bar{r}_{CP}}{\sqrt{1-\bar{r}_{IP}^2}\sqrt{1-\bar{r}_{CP}^2}} \qquad (2)$$

$$r_{PC(I)} = \frac{\bar{r}_{PC} - \bar{r}_{PI}\bar{r}_{CI}}{\sqrt{1-\bar{r}_{PI}^2}\sqrt{1-\bar{r}_{CI}^2}} \qquad (3)$$

More than three parameters can be used for more detailed analyses, if requested by the situation. The partial correlation coefficients can be calculated and analyzed, but, in our opinion, in the majority of cases, an analysis of the three main variables, I, P and C is sufficient.

The environment quality indicator "I" may be any of the indicators established by the environment authorization, or, for a more suggestive analysis, we propose to consider the variable of the evacuated polluter quantity. The quality indicators that are to be analyzed are the **S**ignificant **E**nvironment **Q**uality **I**ndicators (SEQI).

For the production indicator "P" finding a suggestive measurement unit is necessary, that should express the actual realized production volume, and not its value expression (example: the number of hours of turning within a month, and not the average conversion cost, or the value expressed in currency of the products realized within a time interval).

In order to establish the environment cost indicator "C" we have to consider that:

- From the total volume of the environment protection investment it is to be considered only the part that contributes to the control of the indicators under study;
- It is necessary that in the process of identifying the volume of investments, there should be a person specialized in environment protection that should identify correctly the investments with a direct and/or indirect contribution to the improvement of a certain environment quality indicator. We consider that the accounting department of the analyzed company should also be involved;

- The consistency of the selection may compensate for the errors generated by non observance of some environment expenses.

For exemplification, we hereby present a set of data simulated on an integrated environment analysis.

An economic operator self-monitored, within a specific time interval, the environment quality indicator "I". Within the same time interval, the existing machines in the company functioned for a number of hours "P", representing the production volume. Within the same period the company had environment costs "C".

The simulation data are presented in the table 1.

Table 1: Weekly values for I, P and C.

Week	Environment quality indicator "I" (pH)	Production volume "P" [hours]	Environment cost value "C" [lei]
1	6.5	320	585
2	6.7	335	602
...	...	...	...
29	75	380	673
30	7.1	350	640

From the analysis of the total correlation coefficients one may observe that the value series are strongly correlated. The coefficients $\bar{r}_{IP,}\bar{r}_{IC}$ and $\bar{r}_{PC}$ have values of over 0.95. The following conclusions can be drawn:

✓ The correlation I1, P1 is not acceptable. On increasing the production, the quality indicators and implicitly the evacuated damaging factors should be kept under control. The variations of the environment quality indicator I1 are relatively large, but them do not exceed the maximum admissible values.

✓ The correlation P1 and C1 evolves normally and acceptably from an environment protection point of view. The funds allocated for the environment management of the installation shall normally rise directly proportional to the increase in production.

✓ The correlation C1 and I1 is not acceptable. An increase in the environment cost should produce a relative stability in the amount of damaging factors evacuated, or their diminishing. In this context we may assert that:

- the allocated funds for the environment were insufficient, or
- the allocated funds for the environment were improperly managed.

Both aspects indicate a defective environment protection management.

By introducing the partial correlation factors into our analyzis, new aspects are noticed, such as:

✓ The partial correlation coefficient $r_{IP(C)}$ has a value of 0.71. The increase in production was greater than that in the evacuated polluter. This indicates the fact that the operator invested in environment protection, the analyzed environment indicator was kept under control, although not at an optimal level, and the level of the environment expenses was not the one that should have been.

✓ The partial correlation coefficient $r_{IC(P)}$ has a value of 0.84. This confirms the above mentioned hypothesis that the environment expenses were not at the optimum level.

✓ The partial correlation coefficient $r_{PC(I)}$ has a value of -0.23. The negative correlation points to the fact that the two series of values evolve in opposite senses. The value of the environment indicator and, implicitly, the value of the polluters decrease with the increase in the environment expenses. This is a positive fact in the environment management of the economic operator. The absolute value 0.23 indicates a weak correlation.

✓ Regarding the negative correlation, the evolution of the values in the two studied parameters should also be monitored. The negative correlation (meaning inversed correlation), may be interpreted both in the sense of the increase in the environment performance, as well as in the sense of its decrease. The concrete situation of inversed correlation that can be met are centralized in the table 2.

Table 2: Interpretation of the negative correlations (inversed correlations).

Environment expenses-quality indicator analysis		
The sense of environment expense variation	The sense of environment indicator variation	Environment protection management
increasing	decreasing	good
constant	decreasing	very good
constant	increasing	bad
decreasing	increasing	very bad
Production volume-quality indicator analysis		
The sense of production volume variation	The sense of environment indicator variation	Environment protection management
increasing	constant	good
increasing	decreasing	very good
decreasing	constant	bad
decreasing	increasing	very bad

There similarly may exist series of values between which there are direct correlations average or strongly correlated, that may represent, in certain contexts, a performant environment management, or a defective one. The examples are presented in the table 3.

Table 3: Example of inacceptable direct correlations.

Parameters for which the correlation is analyzed	Value of correlation coefficient	Interpretation of Management Atitude
Production-environment quality indicator	0.30 - 0,95	Inacceptble
Environment-expenses quality indicator	0.30 - 0.95	Inacceptble

CONCLUSIONS

In our opinion, we consider that the three proposed parameters for the integrated environment analysis (IEA) are, in most of the cases, sufficient for:

✓ identifying the significant evolution in the environment aspects (positive or negative) within organizations;

✓ revealing the causes that generated the respective evolutions during environment protection analyses/audits;

✓ basing the future environment protection decisions;

✓ appreciating the degree of consideration the organizations pay to the environment aspects.

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THE MONITORING OF WATER QUALITY THROUGH BIOINDICATION (MOLDAVIA)

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KEYWORDS: Moldavia, middle Prut River tributaries, bioindication, saprobity, chemical pollution, algae diversity, algae sensibility.

ABSTRACT

Biomonitoring is one of the components of environmental monitoring. The presence of plant and animal indicator species permits to evaluate the researched water quality. The determination of the pollution degree on the base of the aquatic basins living organisms composition permits a rapid assessment of the sanitary state, the degree and the character of the pollution, the ways of pollution dissemination, as well as the qualitative characteristics of the natural self purification process. The application of ecobioindication in the aquatic sources monitoring is an express method, more efficient in comparison to the classical analytical methods, because the indicating organisms are subjected to the impact of all the environmental factors (abiotic, biotic and manmade), while the equipment, even the most sophisticate, determines the effects of only several chemical compounds and of the other nature.

There were researched 7 streams situated on the Prut left river bank, through the study of algae diversity in different seasons and the water and mud chemical particularities, between 2004 and 2007. The algae samples were collected and fixated with formalin (4%) and then studied at the microscope (Micmed - 5).

The results showed a high algal diversity in the streams Camenca (137 species) and Ciuhur (133 species), with the predomination of the phyllum Chlorophyta (72 and 74 species, respectively), followed by the streams Lopătinca (100 species) and Racovăț (97 species) and finishing with the poorest streams in algal diversity - Larga (61 species), Vilia (61 species) and Drăghişte (71 species).

The presence of several indicator species in different streams suppose that the stream Ciuhur has a limofil character, Larga, Vilia and Racovăț - reofil, and Lopătinca - reolimnofil.

The particularity of water pollution with organic substances was established according to the Pantle-Buck (1960) criterion, and the water chemistry according to the indicators species analyzed in laboratory. For the most of the streams from the middle part of the river Prut is specific the summer mineralization, higher than the admissible concentration for drinking water (Larga, Vilia, Lopătinca 800 - 1100 mg/l; Drăghişte, Racovăț and Ciuhur 900 - 1200 mg/l), the result being confirmed by the chemical analyses of water.

The utilization of ecoindicator organisms in water quality monitoring proved to be more efficient and accessible.

REZUMAT: Monitorizarea calităţii apei prin metoda bioindicatorilor (Moldova).

Biomonitorizarea este una dintre componentele monitorizării calităţii mediului. Prezenţa speciilor de plante şi animale indicatoare permite evaluarea calităţii apei studiate. Determinarea gradului de poluare pe baza comunităţilor de organisme vii din bazinele acvatice permite o apreciere rapidă a situaţiei sanitare, a gradului şi a caracterului poluării, maniera de dispersie a poluanţilor, precum şi caracterizarea calitativă a proceselor naturale de autopurificare. Aplicarea

metodei ecobioindicatorilor în monitorizarea surselor acvatice este una rapidă, mai eficientă în comparaţie cu metodele analitice clasice, datorită faptului că organismele indicatoare sunt supuse impactului tuturor factorilor de mediu (abiotici, biotici şi antropici), pe când aparatura de monitorizare, chiar şi cea mai sofisticată, nu oferă date decât asupra câtorva compuşi chimici şi de altă natură.

Şapte tributari de pe malul stâng al Prutului au fost studiaţi prin prisma cercetării diversităţii algale în diferite perioade ale anului, a caracteristicilor chimice ale apei şi mâlului, între anii 2004 şi 2007. Eşantioanele de alge colectate au fost fixate cu formalină (4%) şi apoi studiate la microscop (Micmed-5).

Rezultatele au pus în evidenţă o mare diversitate algală în pâraiele Camenca (137 specii) şi Ciuhur (133 specii), cu predominarea încrengăturii Chlorophyta (72 şi respectiv 74 de specii), urmate de pâraiele Lopătinca (100 specii) şi Racovăţ (97 specii), pâraiele cu diversitatea algală cea mai scăzută fiind Larga (61 specii), Vilia (61 specii) şi Drăghişte (71 specii).

Prezenţa unor specii indicatoare în diferitele cursuri de apă duc la concluzia că pârâul Ciuhur are un caracter limnofil, Larga, Vilia şi Racovăţ au caracter reofil iar Lopătinca are caracter reolimnofil.

Gradul de poluare a apei cu substanţe organice a fost determinată conform criteriilor Pantle-Buck (1960), iar parametrii chimici ai apei în funcţie de speciile indicatoare analizate în laborator. Pentru cea mai mare parte a tributarilor din sectorul mijlociu al râului Prut este specifică o mineralizare estivală care depăşeşte concentraţia maximă admisă pentru apa potabilă (Larga, Vilia, Lopătinca 800 - 1100 mg/l; Drăghişte, Racovăţ şi Ciuhur 900 - 1200 mg/l), rezultatul fiind confirmat de analiza chimică a apei.

Utilizarea organismelor ecoindicatoare în monitorizarea calităţii apei s-a dovedit a fi o metodă mai eficientă şi mai accesibilă.

RESUME: La surveillance de la qualité de l'eau par la méthode des bioindicateurs (Moldavie).

La biosurveillance est une des composantes de la surveillance de la qualité de l'environnement. La présence des especes de plantes et d'animaux indicatrices permet l'évaluation de la qualité de l'eau étudiée. La détermination du degré de pollution basée sur les communautés d'organismes vivant dans les bassins aquatiques permet une évaluation rapide de la situation sanitaire, du degré et du caractere de la pollution, la maniere de dissémination des polluants, ainsi que la caractérisation qualitative des processus naturels d'autopurification. L'application de la méthode des ecobioindicateurs dans la surveillance des sources d'eau est une méthode rapide, plus efficace par comparaison aux méthodes analytiques classiques, car les organismes indicateurs sont soumis a l'impacte de tous les facteurs de l'environnement (abiotiques, biotiques et anthropiques) pendant que les équipements, meme les plus sophistiques, n'offrent des données que sur quelques uns des composants chimiques ou d'autre nature.

Sept ruisseaux de la rive gauche du Prut ont été étudies par le biais de la diversité algale dans des différentes périodes de l'année, des caractéristiques chimiques de l'eau et de la boue, dans la période 2004 - 2007. Les échantillons d'algues collectés ont été fixés a la formaline (4%) et ensuite étudiés au microscope (Micmed-5).

Les résultats ont mis en évidence une grande diversité algale dans les ruisseaux Camenca (137 especes) et Ciuhur (133 especes), l'embranchement Chlorophyta étant dominant (72 et respectivement 74 especes), suivies par les ruisseaux Lopătinca (100 especes) et Racovăţ (97 especes), les ruisseaux a la diversité algale la plus basse étant Larga (61 especes), Vilia (61 especes) et Drăghişte (71 especes).

La présence des especes indicatrices dans les différents cours d'eau ont amené a la conclusion que le ruisseau Ciuhur a un caractere limnophile, Larga, Vilia et Racovăţ ont un caractere rhéophile pendant que Lopătinca a un caractere rhéolimnophile

Le degré de pollution de l'eau avec des substances organiques a été déterminé selon les criteres Pantle-Buck (1960), et les parametres chimiques de l'eau en fonction des especes indicatrices analysées en laboratoire. Pour la plus grande partie des affluents du secteur moyen de la riviere Prut il y a une minéralisation estivale spécifique, dépassant la concentration maximale admise pour l'eau potable (Larga, Vilia, Lopătinca 800 - 1100 mg/l; Drăghişte, Racovăţ et Ciuhur 900 - 1200 mg/l), le résultat étant confirmé par l'analyse chimique de l'eau.

L'utilisation des organismes ecoindicatrices dans la surveillance de la qualité de l'eau a été prouvée en tant que méthode plus efficace et plus accessible.

INTRODUCTION

Biomonitoring represents one of the environment monitoring components. The presence of plant and animal indicator species in water permits to assess quickly the quality of it, the level and the character of pollution, the way the pollution spreads and the natural flow of water purification. The biomonitoring method is considered to be express and efficient in comparison with other classical methods because the indicator organisms are exposed to all environmental factors simultaneously (abiotic, biotic and anthrop), while the equipment, even the most sophisticated; can determine only the effect of some chemical components or of the other nature.

For instance, the influence of different pollution substances (such as: heavy metals, radionuclids, pesticides and hydrocarburs) on the biota of an aquatic basin can be analyzed with the help of monitoring organisms and the efficiency of the method mostly depend on the chosen monitoring organisms. Depending on the ecosystem pollution level, indicator organisms can be classified in: sensible, moderate sensible and tolerant, and the system of appreciating the water quality is based on the quantitative and qualitative relation between the sensible and tolerant organisms to pollution.

Algae and invertebrate are important aquatic biomonitoring organisms. The quality of the aquatic environment can by evaluated quite efficient by studying the diversity of the sensible species and their reaction to specific factors, as algae are ubiquitous in different habitats. Therefore the presence or the absence of specific ecobioindication species, it association with bacteria or it extend can already signify a character. Among invertebrates usually are recommended mollusks most of which are macroscopic and easy to collect.

MATERIALS AND METHODS

Seven Prut River tributaries from the left part including their alga diversity, invertebrates (mollusks) water and soil chemical particularities in different seasons were researched during the 2004 - 2007 years. The alga samples were fixed by formalin (4%) and then studied at the microscope (Micmed - 5). The mollusks were collected manually from the river bank, mud and aquatic plants and then analyzed in the laboratory. The particularities of water pollution with organic substances were established according to Pantle-Buck, and water chemistry through indication species and laboratory analysis.

RESULTS AND DISCUSSIONS

According to the researches done in 2004 - 2006 period in all rivers predominated green algae, followed by the cyanophytes and euglenophytes. There was registered a small number of dinophyts, xantophyts, crizophyts and harophytes. Periodically there was registered algae species from *Rhodophyta* and *Criptophyta.*

The presence of indicator species in different tributaries supposes that the tributary Larga, Vilia, Ciuhur and Camenca have a limnoreofil character, and Lopătinca and Racovăț - reolimnofil.

For the majority of tributaries located in the Prut middle zone is specific the process of high mineralization indicate a halobitatii: *Achnanthes hungarica, Navicula salinarum, N. peregrina, Nitzschia apiculata, N. hungarica, Cocconeis scutellum, Aphanothece stagnina, Anabaena spiroides, Stigeoclonium tenue, Gymnodinium aeruginosum, Strombomonas acuminata, Lepocinclis ovum, Euglena proxima, E. oxyuris E. spirogyra, Phacus curvicauda*; what was demonstrated as well as through chemical analyses according to which after the summary mineralization the water corresponds to II - IV quality classes, varying from 250 - 764 in Larga, Vilia, Lopătinca and 503 - 914 mg/dm^3 in Drăghişte, Racovăț, Ciuhur and Camenca.

The algae species: *Astasia parva, Euglena caudata, E. proxima, Trachelomonas granulata, T. granulosa, Pseudanabaena catenata, Oscillatoria tenuis, O. planctonica* etc.; are indicators of waters reduced in oxygen. The presence of rich invertebrate's population, particularly *Lymnaea stagnalis* and *Dreissena polymorpha,* confirms the same fact. A higher effectiveness was registered in Drăghişte and Racovăț, characterizing the sectors by a slow flow with tendency to limnification.

Besides other invertebrates, accumulators of microelements, were registered *Helix pomatia* and *Cepaea vindobonensis*, which can suggest the water pollution with heavy metals (particularly with Cd and Cu) and with pesticides, as well as *Anodonta* sp. and *Astacus fluviatilis*, considered as indicators of clean and low polluted waters.

It is to mention that the water quality was evaluated not only on the base of saprobity, but on the content of chemical pollutants as well: compounds of N, Cl, F, hidrocarburs, heavy metals, radionuclides, surfactant, colorings, etc. Therefore the utilization of ecobioindicator organisms in water monitoring is an efficient and accessible method.

Larga River. The length of the river is 30 km. The declivity is under 4 m/km, what defines the intensity of water auto purification with the help of algae.

The algae of this river are developing relatively intense. There was registered *Cladophoretum* and *Spirogyretum* rich in green algae and diatoms in the upstream of the river. In the downstream was established an increase in diversity of cianophyts and euglenophyts, conditioned by the water pollution with sludge and solid waste.

The pollution indicator species with organic substances are: *Anabaena spioides* (αβ), *Oscillatoria amphybia* (βα), *Oscillatoria chalybea* (α), *Oscillatoria limosa* (βα), *Oscillatoria tenuis* (α), *Lepocynclis ovum* (αβ), *Phacus longicauda* (αβ), *Vacuolaria virescens* (α), *Cymbella aequalis* (β), *C. lanceolata* (β), *Gyrosigma acuminatum* (β), *Hantzschia amphyoxis* (α), *Navicula cuspidata* (αβ), *N. pupula* (αβ), *N. viridula* (α), *Nitzscia acuta* (β), *N. closterium* (αβ), *N. lorenziana* (αβ), *Surirella ovata* (α), *Chlamydomonas reinhardtii* (pα), *Crucigeniella rectangularis* (αβ), *Enteromorpha intestinalis* (α), *Stigeoclonium tenue (*α - mezosaprob*),* etc.

The saprobity index (Tab. 1) in spring, summer and autumn time increased from 1.70 to 2.10 - 2.05 accompanied with an increased demand in chemical oxygen consumption (COD) up to 13 -18 mg/l O_2.

Table 1: Water saprobity of the Prut River left side tributaries.

Nr.	Prut River tributaries	The saprobity index			
		Spring	Summer	Autumn	Average
1.	Larga	1.70	2.10	2.05	2.0
2.	Vilia	1.72	2.05	2.00	1.9
3.	Lopătinca	1.71	2.15	2.10	2.1
4.	Racovăț	1.80	2.40	2.20	2.0
5.	Drăghişte	1.80	2.30	2.10	1.95
6.	Ciuhur	2.10	2.55	2.30	2.2
7.	Camenca	2.20	2.70	2.40	2.2

Vilia River. The length of the river is 50 km and the surface is 300 km^2. The river flora is less divers. There are predominating green algae and diatoms, followed by cyanophytes and euglenophytes. The saprobity specter is determined by the species with a value of β - mezosoprob and oligosaprob. Among cyanophytes there are: *Coelosphaerium kuetzingianum* (oβ), *Merismopedia glauca* (β), *Oscillatoria limnetica* (oβ-), among euglenophytes - *Euglena hemichromata* (βo), *Phacus pleuronectes* (β), *Trachelomonas armata* (β), *T. volvocina* (βo), among crysophytes - *Chromulina ovalis* (o), and among xantophytes - *Ophiocytium cohleare* (oβ), *Tetraedriella impressa* (o), *Trilonema vulgare* (xo). The diatoms, indicators of saprobity, were rather diverse and presented through *Amphiprora ornata* (β), *Amphora ovalis* (βo), *Cocconeis disculus* (βo), *Cymbella helvetica* (xo), *C. lanceolata* (β), *Epithemia turgida* (oβ), *E. sorex* (oβ), *Eunotia arcus* (oβ), *Fragilaria capucina* (oβ), *Navicula bacillum* (oβ), *N. mutica* (oβ), *N. radiosa* (oβ), *Nitzschia apiculata* (β), *N. hantzciana* (oβ), *N. linearis* (oβ), *Pinnularia microstauron* (β), *Rhoppalodia gibberula* (oβ), *Stephanodiscus astraea* (oβ), *Synedra acus* (βo). The green algae indicators are - *Pandorina morum* (βo), *Tetraspora gelatinosa* (oβ), *Ankyra ancora* (βo), *Scenedesmus arcuatus* (βo), *Desmodesmus communis* (βo), *D. denticulatus* (β), *D. opoliensis* (β), *etc.*

Totally, in Vilia River was identified approximately 60 algae indicator species, specific for clean waters (oligo - and oligobeta, beta-oligo and beta-mezasaprobe), what was confirmed as well by the saprobity index 1.9 (Tab. 1).

Lopătinca River. The length of the river is 57 km and the area is 257 m^2. The river forms lakes in some places, what serve as a good source for algae flora enrichment. The most spread communities are the *Cladophoretum* with a high number of periphytonic and planctonic diatoms. Among green algae is worth to mention the presence of zygnematales (*Spirogyra* and *Mougeotia*). A high effectiveness have *Chlorococcophyceae*, most of them are typical limnic organisms (*Scenedesmus, Oocystis, Dictyophaerium,* etc.). The saprobity index was middle 2.1 what indicates a tendency of slight water pollution.

Racovăț River. The river area is 1100 km^2. The Racovăț River tributary is Drăgişte. The algae flora of this river includes many riolimnic and limnoreofile species and with several reofile. A high diversity is characteristic for C*hlorophyta*, specifically *Clorococcophyceae* and *Bacillariophyta*. The river saprobity increased essentially from 1.80 in the spring time to 2.40 in summer and decreased down to 2.20 in autumn, what confirms a higher pollution with organic substance in summer.

The algae vegetation structure of this river is determined by the β–and o-β-mezosaprobe groups. Regarding to the biological diversity an interest represents the Racovăț tributary - Bogda, where several alga specific for clean waters still remained. For instance: the blue green algae *Gomontiella subtubulosa*, for which was established the second station in Europe. The first is in Danube delta.

Ciuhur River. The length of the river is 90 m and the area is 724 km^2. The river passes through the North Moldavian plain and the sylvostep zone. The algae flora of this river includes cosmopolit algae, forming *Cladophoretum, Spirogyretum, Vaucheriaetum, Entomophtoretum,* etc., with a small number of eurobiont species with relative low epuration activity. Regarding to the saprobity species dominated were the α +$\alpha\beta$ - mezasaprobe species. Among blue-green algae are: *Oscillatoria tenuissima* ($\beta\alpha$), *Ochalybea* (β), *O. chlorine* ($\alpha\beta$), *O. limosa* ($\beta\acute{\alpha}$), *O. subtilissima* ($\beta\alpha$), *O. tenuis* ($\alpha\beta$), *Phormidium molle* (α); among euglenophytes - *Euglena polymorpha* ($\alpha\beta$), *Phacus curvicauda* ($\alpha\beta$); among diatoms - *Achnanthes brevipes* (euribiont), *Anomoeonees sphaerophora* ($\alpha\beta$), *Gomphonema angustatum* (βo), *G. parvulum* ($\alpha\beta$), *Hantzsţhiasia amphioxix* (α), *Navicula cryptocephala* (α), *N. cincta* ($\alpha\beta$), *N. cuspidata* ($\alpha\beta$), *N. minuscula* ($\alpha\beta$), *Nitzsthia apiculata* (α), *N. closterium* (α), *N. palea* (α), *N. tryblionella* ($\alpha\beta$), *Surirella ovata* (α) among green algae - *Chlamydomonas ehrenbergii* (α), *Chlorella ellipsoidea* ($\beta\alpha$), *Crucigenia rectangularis* ($\alpha\beta$).

The saprobity index in the river Ciuhur exceeded 2.0 influenced by the water high content in organic substances.

For the sector located in the upstream from the Ocniţa locality, the Ciuhur river waters were characteristic in indicator green species: *Spirogyra, Oedogonium, Gongrosira, Stigeoclonium, Draparnaldia* and diatoms: *Gomphonema, Cocconeis, Achnanthes, Navicula, Cymbella* etc. In the plain sector among the green algae and diatoms as well vegetated the euglenophytes and cianophytes species. In the vicinity of the Pociumbeni-Duruitoarea locality were specific epiphytonic and epistonic communities (on the rocks), specific for quick flowing waters. There was a rather high diversity of green algae from the *Chlamydomonadales*, class *Chlorococcophyceae* which together represents the limnofil and limnoreofil algae vegetation elements. This vegetation becomes more predominant with the approach to the Costeşti-Stânca accumulation basin.

The Pantle-Buck saprobity index of the Ciuhur varied seasonally from 2.10 in the spring to 2.55 in the summer and 2.30 in the autumn, reaching high values, what demonstrated an increased pollution with organic substance during all year round.

Camenca River. The length of the river is 100 km and the hydrographic area is 1230 km^2. The river is reach in biotopes and has high algae diversity. The dominant algae species were the green algae followed by the diatoms, then cianophytes and euglenophyte. In the superior flow predominated the oligosaprobe+oligo-beta-mezosaprobe species and in the middle and inferior flow the saprobity was increasing.

The algae flora is changing on the river flow. In the upstream there were predominating oligosaprobe+oligo-beta-mezosaprobe species, in the down and middle stream - the saprobity increased. Higher vegetation diversity is characteristic for the portion of the river near the Bălăţina and Pruteni village, a fact proved by rich habitats and an increased water mineralization. In some places in the communities of this river were evidenced planctonic, bentic and periphytonic formations. In addition there were detected blue algae *Calothrix braunii*, *Hydrocoleus homoeotrichoides*, *Aphanothece saxicola*. In the area of the villages Bălăţina-Pruteni the river forms swamps, in which are developing zignematophyceae communities: *Mougeotia scalaris*, *Spirogyra maxima*, *S. crassa* etc.) and Charophyts, which are rather rare for the Moldavian waters.

The most spread communities in the lower part of the river Camenca were *Cladophoretum* sp., *C. glomeratae, C. fractae, Chaetomorphetum liniae, Spirogyretum parvulae, S. setiformis*, *Oedogonietum, Draparnaldietum glomerateae, Rhizoclonietum hieroglyphycum*, *Stigeoclonietum tenue, S. amoenum*. On the oozy bottom of the river vegetated the following communities

Zygnematales, Oedogoniales, and blue green algae (*Phormidietum, Lyngbyietum, Chamaesiphonietum, Oscillatorietum*). Were detected some relative rare species *Aphanochaete repens, Coleochaete scutata, Gongrosira debaryana, Cylindrocapsa geminella, Leptosira mediciana.* Indicator of water mineralization is *Caloneis silicula*, and of cold and clean waters are *Diatoma hiemale, Ceratoneis arcus, Eucocconeis flexellum, Rhoppalodia gibba.*

The obtained chemical analyses denoted that the quantity of organic substances that biochemical degraded slowly were prevailing on those that degraded easily, what explains the water low capacity of auto purification. Those, measurements should be taken to reduce the water pollution caused by rural solid waste.

Table 2: Chemical composition of the Prut River left side tributaries.

Nr.	River	Upstream/ Down.	Locality	Indexes			
				pH	Hardness, mg.ech/ dm^3	Mineralization, mg/ dm^3	No_3^-, mg/ dm^3
1.	Larga	Upstream	Larga	8.3	8.1	565	8.9
		Downstream	Şireuţi	8.1	6.9	625	13.5
2.	Vilia	Upstream	Cotiujeni	8.1	6.2	410	7.5
		Downstream	Teţcani	8.0	5.3	425	4.5
3.	Lopătinca	Downstream	Lopatnic	8.0	6.6	764	1.9
4.	Racovăţ	Upstream	Hădărăuţi	7.85	6.2	503	0.8
		Downstream	Brânzeni	8.1	6.2	770	3.7
5.	Drăghişte	Upstream	Trebisăuţi	8.1	5.4	542	1.1
		Downstream	Brânzeni	8.1	5.7	820	5.6
6.	Ciuhur	Upstream	Ocniţa	8.6	11.2	510	6.3
		Downstream	Chiurt	8.0	7.7	860	11.5
7.	Camenca	Upstream	Pârjota	7.4-8.05	4.7-5.2	788	2.1
		Downstream	Drujineni	7.2-8.8	9.3-9.6	914	2.3
8.	Prut	Upstream	Pererâta	8.4	4.3	249	3.7
		Downstream	Valeni	7.6	4.9	457	11.9

The pH index values are comprised between the limits 7.8 - 8.8 those demonstrating a high water alkalization, particularly of those located in the south part - Ciuhur and Camenca, what confirms the pollution of these rivers with organic substance. The same, the Hardness index is higher in above mentioned rives, in which the halophyts species rate is higher. Regarding to NO3 content in Lopătinca, Drăghişte, Racovăţ and Camenca they are attributed to the class I of quality. Rather high nitrates quantities were registered in Ciuhur River (6.3 - 11.5), Larga (8.9 - 13.5) and Vilia (4.5 - 7.5 mg/ dm^3), attributing them to the II class regarding to the NO3 pollution. These suppose that there is a pollution source with N compounds: manure and solid waste somewhere nearby. The Drăghişte, Vilia (Teţcani village), Larga (Şireuţi village) and Racovăţ (Hădărauţi village) waters have a hardness that exceed those of Prut River by up to 1.6 - 2.0 times, and the Ciuhur and Lopătinca by up to 2.0 - 3.0 times.

Those, application of ecobioindication method permits to monitor the water quality through the reaction response of the bioindicators during a specific time, while the chemical methods characterize the situation at the researched time.

CONCLUSIONS

The algae diversity of the Prut River has changed essentially over the last 40 years, particularly under the influence of the anthrop factor, what induce the development of some indicator species according to the habitat particularities.

The presence of organic pollution indicator species in water permit to monitor the quality of water, and the presence of the indicator species for the limnification process permits to assess the current situation and to undertake amelioration measurements.

The water quality evaluated through ecobioindication method, confirmed as well by the chemical analysis, permits to recommend some of the tributaries and the areas around them to be declared as protected areas, particularly because they contain valuable species.

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WHAT CONTRIBUTIONS CAN REMOTE SENSING MAKE TO HABITAT MONITORING OF THE E.U. HABITATS DIRECTIVE ARTICLE 11? - RESULTS OF RESEARCH IN BULGARIA, TURKEY AND ROMANIA

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KEYWORDS: monitoring, remote sensing, Natura 2000, habitat classification, mountainous habitats, coastal habitats, beech forest, Central Balkan, Çukurova Delta.

ABSTRACT

The implementation of article 11 of the EU Habitats Directive (92/43/EWG) requires among others a long term monitoring of annex 1 habitats inside and outside Natura 2000 areas. Every 6 years the Member States have to present a national report including information about distribution, conservation status and trends (Article 17). An exhaustive biotope mapping provides a basis for these standards. Sometimes there are no suitable methods and data basis or the intensive mapping can not be achieved in a short or medium term. Two case studies in a high mountainous region (Central Balkan in Bulgaria) and a coastal region (Çukurova Delta in Turkey) set an example for the use of several remote sensing methods for habitat classification and evaluation. The research results will be transferred to the Romanian mountainous and coastal regions. Possibilities and limits of LANDSAT satellite data and aerial photographs will be presented. Therefore, conclusions of their applicability to meet the requirements of habitats and Natura 2000 areas are drawn.

Own researches show that air photographs are more suitable for habitat monitoring than satellite data. Also the quantitative assessment of habitats requires a relatively large scale for interpretations of at least 1:5000. Is the detection of habitat types impossible in spite of high resolution (e.g. alpine meadows), at least a searching area for potential annex 1 habitats can be localised. The habitat classification is for high mountainous regions more expensive than for plane coastal regions. The reasons are special geographical and climatic conditions. But for all that the exertion of remote sensing data is particularly suitable for areas that are difficult to access as well as wide areas with the occurrences of large area connected annex 1 habitats. The increasing impact because of land use to the Romanian mountainous and coastal regions requires an inexpensive, quick and area wide inventory and observation. In terms of quantitative monitoring an extensive control of preservation of Natura 2000 areas is required. By the use of a combined interpretation of satellite images and aerial photographs these make just a limited but important contribution to the evaluation of conservation status (qualitative monitoring). The large area surveillances of detecting impacts (e.g. deforestation, scrub encroachment, drainage, cultivation, damage) by remote sensing is there of particular importance.

REZUMAT: Ce contribuţii aduce monitorizarea la distanţă în cazul monitorizării habitatelor din articolul 11 al Directivei Habitate U.E.? - Rezultate ale cercetării în Bulgaria, Turcia şi România.

Implementarea articolului 11 a Directivei Habitate a UE (92/43/ EWG) necesită şi un monitoring pe termen lung a habitatelor anexei 1 în interiorul şi în exteriorul ariilor Natura 2000. La fiecare 6 ani Statele Membre trebuie să prezinte un raport incluzând informaţii referitoare la distribuţie, starea conservării şi tedinţe (Articolul 17). O cartare exhaustivă a biotopilor oferă baza pentru aceste standarde. Uneori nu există metode potrivite şi baze de date sau cartarea intensivă nu poate fi realizată în termen mediu sau scurt. Studii de caz în zone montane înalte (Balcanii Centrali în Bulgaria) şi o regiune de coastă - Delta Çukurova în Turcia) reprezintă exmple pentru utilizarea câtorva metode de urmărire la distanţă pentru clasificarea şi evaluarea habitatelor. Rezultatele cercetării vor fi transferate în zone similare din România. Posibilităţile şi limitele datelor satelitului LANDSAT şi fotografiile aeriene vor fi prezentate. De aceea, sunt reliefate concluzii referitoare la aplicabilitatea acestora în condiţiile habitatelor şi ariilor Natura 2000.

Cercetările noastre arată faptul că fotografiile aeriene sunt mult mai potrivite pentru monitorizarea habitatelor decât datele satelitare. De asemenea evaluarea cantitativă a habitatelor necesită o scară relativ largă pentru interpretări, de cel puţin 1:5000. Dacă detectarea tipurilor de habitate este imposibilă în pofida rezoluţiei înalte (ex. păşunile alpine), cel puţin o arie pentru habitate potenţiale din anexa 1 pot fi localizate. Clasificarea habitatelor este mult mai scumpă pentru regiuni montane decât pentru regiuni de coastă. Motivele sunt reprezentate de condiţiile geografice şi climatice speciale. Dar extragerea de date de la distanţă în special pentru arii unde accesul este dificil sau necesită o analiză a unor spaţii întinse şi cu habitate din anexa 1, metoda este propice. Creşterea impactului datorat folosinţei terenurilor în regiunile montane şi de coastă din România necesită o inventariere şi o observare rapidă, ieftină şi extinsă. În termeni de monitoring cantitativ este necesar un control extensiv a conservării ariilor Naura 2000. Utilizarea interpretării imaginilor satelitare şi a fotografiilor aeriene oferă o contribuţie limitată dar importantă pentru evaluarea stării de conservare (monitoring calitativ). Supravegherea impactelor asupra unor arii extinse (ex. despăduriri, drenări, culturi agricole) prin monitorizare la distanţă are o importanţă particură.

ZUSSAMENFASSUNG: Welchen Beitrag leistet die Fernerkundung beim Monitoring der Habitate aus Artikel 11 der Habitatrichtlinie der EU? – Ergebnisse von Forschungsprojekten in Bulgarien, Türkei und Rumänien.

Die Umsetzung des Artikels 11 der EU-Habitatrichtlinie (92/43/EWG) erfordert auch ein Langzeitmonitoring der in Anhang I aufgelisteten Habitate innerhalb und außerhalb der Natura 2000 Gebiete. Alle sechs Jahre müssen die Mitgliedstaaten einen Bericht mit Informationen über Verteilung, Erhaltungszustand und Entwicklungstendenzen vorlegen (Artikel 17). Eine umfassende Kartierung der Biotope liefert die Grundlage für diese Standards. Manchmal gibt es jedoch keine entsprechenden Methoden und Datengrundlagen oder kann die Kartierung mittel- oder kurzfristig nicht durchgeführt werden. Fallstudien in hochmontanen Gebieten (Zentral-Balkan in Bulgarien) und in einem Küstengebiet (Çukurova Delta in der Türkei) liefern Beispiele für die Anwendung einiger Methoden von Fernerkundung für die Klassifizierung und Bewertung von Habitaten. Die Ergebnisse der Untersuchungen werden in ähnliche Gebiete Rumäniens übertragen. Die Möglichkeiten und Grenzen von LANDSAT Satellitendaten und Luftbildaufnahmen werden vorgestellt. Daher sind Schlussfolgerungen betreffend ihre

Anwendbarkeit unter den Bedingungen der Habitate und Natura 2000 Gebiete hervorgehoben.

Die vorliegenden Untersuchungen belegen, dass sich Luftbilder viel besser für das Monitoring von Habitaten eignen als Satellitendaten. Auch erfordert die quantitative und qualitative Evaluierung und Interpretation der Habitate einen relativ großen Maßstab, von mindestens 1:5000. Wenn die Herausarbeitung der Habitattypen trotz hoher Auflösung nicht möglich ist (z. B. bei den alpinen Weiden), kann zumindest ein Gebiet mit einem potentiellen Habitat der Anhangliste I geortet werden. Auch ist die Klassifizierung der Habitate viel teurer für montane Gebiete als für Küstenbereiche. Die Gründe dafür liegen in den geographischen und den besonderen klimatischen Gegebenheiten. Vor allem für Gebiete mit schwieriger Zugänglichkeit oder solche deren Analyse große Flächen erfordert und in denen Habitate der Anhangliste I vorkommen, ist die Methode der Datenerfassung durch Fernerkundung geeignet. Der wachsende, durch Landnutzung bedingte Einfluss in montanen und auch in Küstengebieten Rumäniens erfordert eine Erfassung sowie rasche, preisgünstige und großflächige Beobachtung, bzw. Überwachung der Flächen. Was das quantitative Monitoring betrifft, ist eine extensive Kontrolle des Erhaltungszustandes der Natura 2000 Gebiete erforderlich. Die Verwendung der Interpretation von Satellitenbildern und Luftbildern liefert einen begrenzten, aber wichtigen Beitrag für die Auswertung des Erhaltungszustandes (qualitatives Monitoring). Die Überwachung von Eingriffen in ausgedehnten Gebieten (z. B. Waldrodungen, Entwässerungen, Ackerflächen) mittels Flächenmonitoring durch Fernerkundung hat eine besondere Bedeutung.

INTRODUCTION

The European Union is seeking to ensure biodiversity by conserving natural habitats and wild fauna and flora in Member States. Therefore, the Habitats Directive 92/43/EEC is one of the most important instruments of nature conservation at European level. The Directive establishes an European ecological network known as "Natura 2000". The network comprises "special areas of conservation" designated by Member States in accordance with the provisions of the Directive. Article 6 of the Habitats Directive obligates Member States to preserve and establish the favourable conservation status of species and habitats (Management). General surveillance of species and habitats of Community interest is covered by Article 11 (Monitoring). These must be observed inside and outside Natura 2000 areas. Every six years, Member States must report on the measures they have taken pursuant to the Directive (Article 17, Reporting).

The Habitats Directive implementation often poses difficulties for the Member States. The preliminary work necessary is time-consuming. Comprehensive scientific data of species and habitats distribution have to be recorded according to the Habitats Directive outlined requirements (Homeyer and Klaphake, 2001). The development of management concepts and monitoring schemes requires a rough but comprehensive inventory of potential conservation objects. The habitat mapping and evaluation method to be used is therefore of great importance. The Central European standards in place can not be simply adopted; they must be adapted and further developed in a methodical way and adjusted to the specific situations in the new and future Member States. The development and application of efficient data acquisition methods is required because of the large areas to be covered, insufficient records and limited financial resources. The necessary inventory, particularly for the Carpathians and the large coastal ecosystems of the Black Sea, cannot be made through terrestrial mapping only. As for the monitoring of habitats of Community interest in Romania, cheap remote sensing methods are highly relevant. The large area

of the Romanian Carpathians and the Romanian Black Sea Coast along 245 km, are rich in habitats of Community interest and include a huge number of Natura 2000 areas. Romania possesses 91 of 218 habitat types of Community interest. 48 thereof are located in the alpine zone (Carpathians) and 29 in the pontic zone (Black Sea Coast) (Ordinance 52/2003).

In this article we present two research projects using remote sensing data (LANDSAT satellite photos, aerial photographs) to classify and evaluate habitat types. One case study is located in a mountainous region (Central Balkan, Bulgaria) and one in a coastal region (Çukurova Delta, Turkey). In this article, the opportunities and limitations of LANDSAT satellite data and aerial photographs will be presented and conclusions will be presented concerning their relevance in meeting the monitoring requirements of natural habitats and Natura 2000 areas. The results will then be applied to the Romanian mountainous and coastal regions. Furthermore, we will illustrate some results of a current research project in the Southern Carpathians and argue for the necessity of integration field-based methods using beech forests as an example.

Research in Bulgaria and Turkey

The research projects in the Central Balkan region in Bulgaria (Tischew et al., 2005) and in the Çukurova Delta coastal region in Turkey (Tischew et al., 2004) deal with the goal of applying remote sensing data to yield cost-efficient processing of large areas which have been little-researched for nature conservation and landscape planning purposes. The central issues of the studies are the classification, survey and evaluation of habitats. Before analysing the remote sensing data of both research projects a habitat type classification scheme was developed. This was based on a survey of the literature available and field-based vegetation data sampling.

In order to pursue our research goals, we analysed satellite image data of the Çukurova Delta. Objects and details down to a scale of 1:50,000 could be detected. In the Central Balkan project we analysed satellite images as well as our own aerial photographs. These aerial photographs were used to develop a low-cost remote sensing system. Objects and details down to a scale of 1:5,000 could be detected here. For the data analyses, we used the free software GRASS GIS, which would cut costs in offices and institutions as well as NGOs.

Both projects were carried out by Anhalt University of Applied Sciences (Germany) in cooperation with Çukurova University and the administration of the Biosphere Reserve Çukurova Delta and National Park Central Balkan.

Mountainous ecosystem: Central Balkan (Bulgaria)

Pilot area, goals and methods

The goal of the project was to draft and test a procedure for mapping, classification and evaluation of potential Natura 2000 habitats in large areas and areas that are difficult to access. We combined traditional field methods of vegetation mapping and remote sensing methods using satellite data and airplane-mounted digital camera data (Tab. 1). The aerial surveys we did took place in the Tsarichina reserve. The area studied is 34 km^2 and has an altitude of 700 m - 2198 m above sea level. Its terrain ranges from mountainous to alpine.

Table 1: Remote sensing data.

Project Central Balkan, Bulgaria		
Satellite photos	Sensor: LANDSAT 7 ETM+ Recording date: 21.06.2000, WRS path: 183, WRS pow: 30 *Digital aerial photographs* TetraCam (RGB + NIR) Recording date: spring and late summer 2004, summer 2005 Resolution: 1000 m; flight strip width = 1.70 m Picture size: 1000 m; above ground = 800 m x 600 m *Flight route and technical date of the flight* areal cover: min. 600 m x 500 m; coverage of one flight strip (7 aerial photographs): 3500 m x 600 m; time per flight strip: aprox. 5 min *Topographic map:* 1987; 1:50,000	
Project Çukurova Delta, Turkey		
Satellite photos	Sensor: LANDSAT 5 TM Recording date: 25.04.1985 WRS path: 175 WRS row: 35	Sensor: LANDSAT 7 ETM+ Recording date: 05.05.2003 WRS path: 175 WRS row: 35
Used in both projects: *Digital elevation model*: SRTM3 Sensor: Shuttle Imaging Radar C (SIR-C); Recording date: 11.02. - 22.02.2000; Spatial ground resolution: 90 m; Spatial height resolution: 10 m		

Because the new Member States of the EU only have limited financial resources for environmental protection, we aimed at developing and testing a low-cost remote sensing system. Low-cost remote sensing means aerial recording techniques with inexpensive recording devices such as medium format and 35 mm cameras (Frazier et al., 1994), digital cameras (King, 1994) and video cameras (Redd et al., 1994; Nowling and Tueller, 1994). The uses of low-cost systems are similar to those of conventional aerial photography. However, they have been seldom employed (Traxler, 1997).

After drafting a classification scheme of habitats and vegetation structures, we then detected habitat types via satellite data and digital aerial photographs made from our own aerial survey. We checked what level of classification was feasible. This depended on to what extent different habitat types, which were spectrally difficult to distinguish, had to be combined in order to enable their detection using remote sensing data. We also checked whether the system was suitable for monitoring the conservation status. Special structural parameters important to habitat management were taken into account (e.g. scrub encroachment of sub-alpine grasslands and heaths, detection of current or former clear-cutting areas or illegal felling).

The remote sensing data used included satellite photos of LANDSAT 7 ETM+ as well as aerial photographs from our own aerial survey. We made three surveys in 2004 and 2005 in two areas of the reserve. A TetraCam MCA was used. At the same time with the aerial surveys, we also conducted fieldwork. This included recording ground control points and training areas, mapping wooded areas and revising and developing the habitat type classification scheme. All dominant and representative plant species which roughly enable vegetation mapping (association level at the most) in a total of 60 training areas were included. An analysis phase preceded each round of field study. This included georeferencing and visually classifying the aerial photographs as well as evaluating vegetation mapping of the training areas. Finally, we classified the entire area under investigation (using semi-automatic means) and in the third field study, evaluated it by random sample.

RESULTS

Using satellite photos, we were able to classify the following habitat complexes: deciduous forests [beech (fir) forests], evergreen forests [Norway spruce forests (pine forests)], heaths (grassland heaths, tall herb grounds, different phases of scrub encroachment), and grass grounds (sub-alpine - mountain) and areas which are almost devoid of vegetation as well as vegetation-free areas like crags, screed or gravel. There were difficulties in classifying mixed forests, e.g. beech-fir forests, which were mostly classified as being deciduous forests because they were spectrally dominant at those sites. Also, there is a fine line between sub-alpine heaths and sub-alpine grasslands. This manifested itself in mixed pixel images which were difficult to differentiate. An invasion by grasses in several heaths in the area investigated also magnified this effect.

In the figure 1, it can be seen that the classification of aerial photographs is much more detailed and on a much smaller scale. On the photos, the rough zoning is accurate, but smaller areas are lost, blending in with the larger, differently classified surrounding areas. The higher spatial resolution of the aerial photographs helped in recording heath habitats, for example, since different vegetation classes could be determined more easily than on the satellite photos. Juniper heaths can be clearly distinguished from the more species-diverse vaccinion/bruckentahalion heaths. Further differentiation of the sub-alpine grass grounds was not possible even using the data from the aerial surveys. Table 2 also shows a comparative overview of the detectability of habitat types using the data from the satellite photos, the aerial photographs and from our habitat type classification scheme.

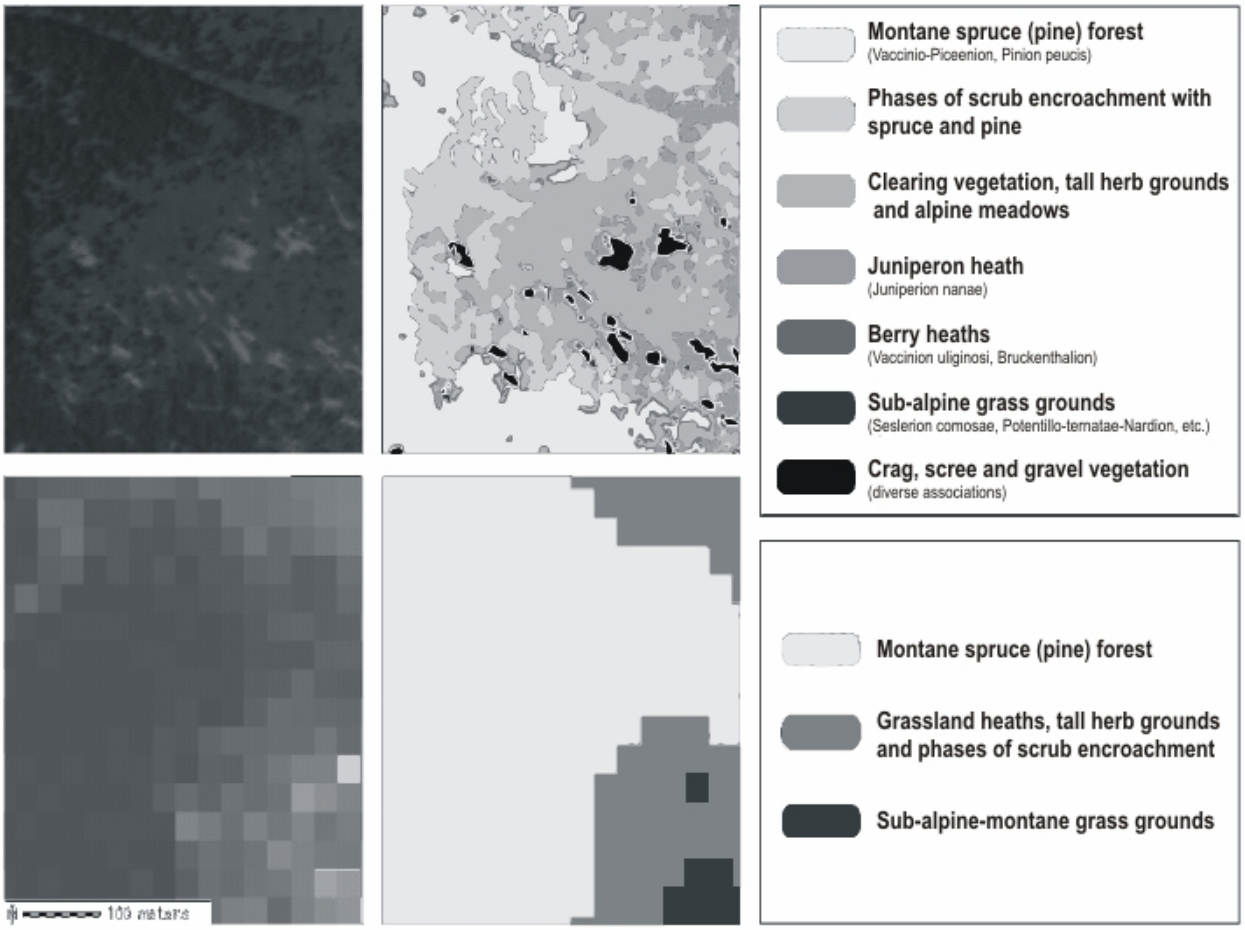

Figure 1: Aerial survey area 1, above: area detail of aerial photo from the TetraCam (left: original aerial photo, right: classified area detail), below: image of the same area using a LANDSAT satellite photo (left: unclassified photo, right: classified photo).

Table 2: Determination of habitat types at different survey levels in the Central Balkan (In parantheses: Natura 2000 code).

Satellite image	Aerial photographs	Terrestrial classification
Coniferous forest	Coniferous forest	Vaccinio-Junipero-Piceetum subalpinum (9410)
		Pinetum peucis typicum
Mixed deciduous forest	Beech-fir-forest	Abieti-Fagetum moesiacum
	Beech forest	Luzulo-Fagetum (9110)
		Galio-Fagetum
		Asperulo-Fagetum (9130)
		etc.
Grassland heaths, tall herb grounds and phases of scrub encroachment	Different phases of scrub encroachment with spruce and pine	Different phases of scrub encroachment with spruce and pine
	Clearing vegetation, tall herb grounds, alpine meadows (over-manured)	Diverse associations and communities (e.g. Cirsion appendiculati, Rubetum idaei)
	Juniper heaths (4060)	Juniperion nanae
	Berry heaths (4060)	Bruckenthalion
		Vaccinion uliginosi
		etc.
Montane - sub-alpine grass grounds	Montane - sub-alpine grass grounds	Nardion (6230*)
		Seslerion
		etc.
Crag, scree and gravel vegetation	Crag, scree and gravel vegetation	Diverse associations and communities

DISCUSSION

Problems with the aerial surveys and data

Because of highly variable weather conditions in Central Balkan National Park, there were problems in completing the aerial surveys. Because of the unpredictable weather conditions in the mountains and sudden fluctuations in weather patterns, aerial surveys under optimal conditions were very difficult to plan. Because of this, less-than-optimal aerial surveys and the data resulting from them could not be ruled out. During the aerial survey conducted in the spring, low-lying clouds forced the airplane to fly at a lower altitude, so complete coverage of the area was not possible using the TetraCam. The aerial survey in the summer could not be conducted midday, which caused longer and harder shadows.

In summer, the mostly heavy cloud formations over the Balkan Mountains are also seen on the LANDSAT satellite photos. Because of this, we had to resort to satellite pictures from 2000, since all later images were unusable due to overcast skies.

The TetraCam used was only suitable to a limited extent. This was due to the fact that the individual objectives were extremely sensitive to changes in light conditions, which greatly affects picture results in high mountain regions (frequent alternation of lighted areas and shaded areas). Because of this sensitivity, the brightness fluctuates greatly on several of the aerial photographs. This made (semi-) automatic classification more difficult and increased the amount of corrections which had to be made after the fact. There was also a problem with the (semi-)automatic classification of the aerial photo mosaic because of these differences in brightness (Hörsch, 2001).

Also, the camera was prone to malfunction during the summer aerial survey, since the NIR function sometimes did not work. The georeferencing of the aerial photographs proved to be very difficult and time intensive due to image distortions caused by the constantly changing relief.

Opportunities, limits and suitability of the method

Our project in Central Balkan National Park shows that a blanket inventory of habitats of Community interest and their exact determination and designation could not be produced with the techniques used in the project. For an exact designation of habitat types of Community interest, a differentiation of the vegetation is necessary at least on the association level and in some cases on the plant community level. Habitat types of Community interest could only be detected on the class level (association level at the most) using the satellite data and the aerial photo data. The method is suitable for forest habitat types, which are often present in mountainous regions, if the composite of tree species is clearly demarcated (e.g. beech-fir forests and beech forests). The different forest types (beech, beech-fir and spruce forests) could be distinguished very well via aerial photo classification in spite of the different valley exposures caused by large differences in brightness. Forest habitat types, which only differ from each other because of the species composite of the herb layer (e.g. beech forests), were more problematic. These can only be described as a unit. Using aerial photographs, heaths could be classified very well. There were problems differentiating sub-alpine grass grounds. Ecotone and border areas, such as chamaephytes on the edge of woodlands or the invasion by grasses of chamaephyte heaths changing over to sub-alpine short grass communities, were very difficult to differentiate because of extreme mixed pixel effects. It was especially difficult to suitably differentiate the classes of the complex patterns of the smallest habitat areas of different vegetation types above the timber line. Because of this, this method is not yet suited to distinguish fine vegetation structures, like for example differentiating vegetation types from alpine grasslands or sub-alpine heaths, which differ from each other very little spectrally.

In order for the methods used in the project to be suited for practical use, the technology used needs to be optimised. In the high mountains, a camera not as prone to be disturbed by differences in brightness needs to be used. Moreover, ways need to be found to reduce the current amount of work involved in georeferencing the aerial photographs and in visual classification using (semi-)automatic classification methods. Though the continual development and improvement of technology, these problems will probably be overcome in the medium-term.

Coastal ecosystem: Çucurova Delta (Turkey)

Pilot area, project goals and methods

The coastal ecosystem Çukurova Delta is located on the south-eastern Turkish Mediterranean coast. The Çukurova is a typical delta basin and one of the largest river drainage basins flowing into the Mediterranean Sea. In spite of extensive and dramatic man-made alterations, it is one of the most important Mediterranean wetlands and continuous coastal ecosystems on the Turkish Mediterranean coast. The area is characterised by high ecological diversity rich in fauna, flora (Altan and Yucel, 1987). With a 110 km long coast, Çukurova Delta encompasses an area of about 5000 km² (Kuleli, 2005).

The project goal was to develop an operations manual for the classification of habitats, land coverage and land use by using inexpensive and practicable LANDSAT data (Tab. 3). In combination with GRASS GIS software, we intended to research the opportunities and limits of this low-cost method. At 80 training sites we recorded vegetation, land use intensity, degradation and other relevant abiotic parameters.

RESULTS

The following terrestrial and aquatic habitat types could be classified with the methods used: dune, dune slack, dune forest, salt meadows and salt mud (salt areas), river, lagoon and sea. In addition to classifying these habitat types, we analysed land use change. Using this analysis, degradation data and results may be attained, taking into account the vegetation cover, hydrological balance and building facilities. Change could be detected on a minimum area of one hectare.

Data on vegetation cover degradation could be ascertained by detecting the elimination of plant cover, clearing, afforestation, transition in arable farm land and fragmentation of former adjacent habitats. But gathering detailed information on vegetation composition and structure was impossible. Disturbances in the hydrological balance could be shown by the change in river courses and superficial changes in the water balance (moisture content). Furthermore, settlement expansion and dune excavation following agricultural use are visible signs of negative changes in land use. Land use change analyses between 1985 and 2003 show massive negative impact on natural features of the coastal ecosystem.

The figures 2 and 3 illustrate the massive loss of natural areas. In the year 1983, approximately 64.3 ha dunes and 36.2 ha dune slacks still existed. Over twenty years, approx. 50 % of these were lost. Dune excavation (approx. 65 %) and afforestation (approx. 35 %) were responsible for this. Dune loss was higher in the vicinity of built-up areas and other areas of greater land use impact. The dune sand is used to enable agricultural use in areas with higher salt content. In such areas, sand is used to form the top layer and thus lowers the salt content. Flattened dunes are then used agriculturally.

An alarmingly similar balance can be seen in standing waters and salt areas. Between 1985 and 2003, standing waters almost completely disappeared. Just like salt areas, where more than half were damaged, standing waters were drained and transfered to agricultural use.

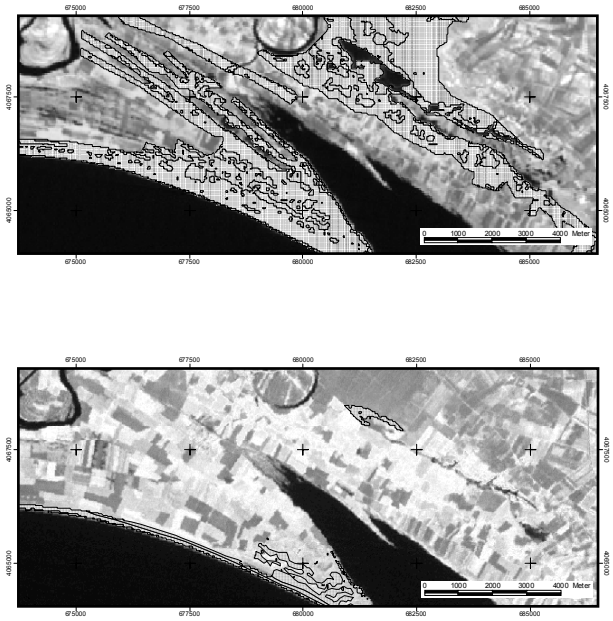

Figure: 2. Dunes in the Çukurova Delta 1985 (above) and 2003 (below) in the area of the Tuzla Lagoon.

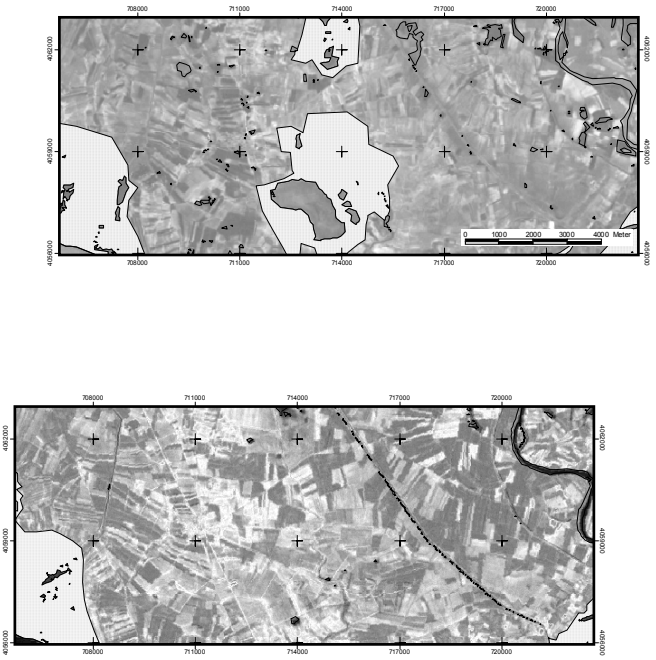

Figure 3: Salt areas and standing waters in the Çukurova Delta 1985 (above) and 2003 (below) to the west of the Seyhan River.

In addition to quantitative data, we are able to give rough qualitative statements regarding the state of degradation. The figure 4 shows the situation in the Delta in 2003. To achieve a precise determination of the state of degradation, area assessment based on the state of impairment or damage is necessary. Therefore, we sought indicators, which allowed us to objectively ascertain its condition. We used the concentration of linear structures, proximity to built-up areas and the proportion of natural habitats within a superimposed grid. The result yields a map of degradation (Fig. 4). Using this, we were able to clearly distinguish between the high, medium and low states of degradation.

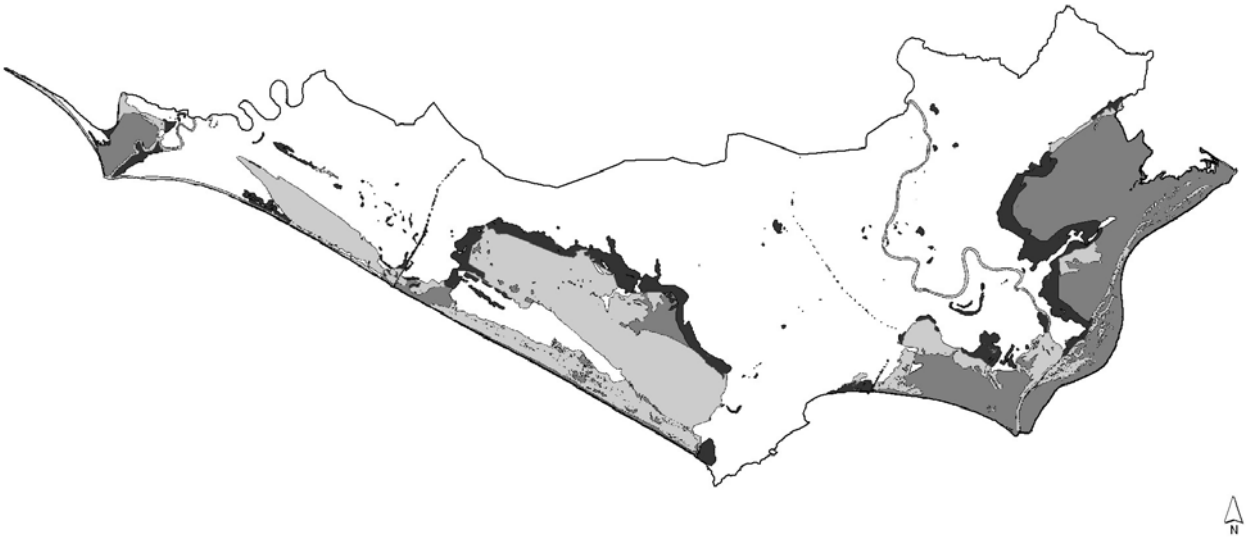

Figure 4: Map of degradation in the Çukurova Delta 2003 (line = biosphere reserve, white = agricultural land, black = high, dark grey = medium, light grey = low).

Table 3: Determination of habitat types at different survey levels in the Çukurova Delta (In parantheses: Natura 2000 code).

Satellite image	Terrestrial classification
Dune	Fordune (embryonic dune, salt dune, white dune) (2110, 2210)
	Fixed dune (grey dune, maquis dune) (2130*, 2260)
	Shifting dune
Dune slack	Dune slack with species of embryonic dune
	Humid dune slack (2190)
	Dune slack with maquis species (2250*)
	Wet dune slack
Dune forest	Dune forest with main tree species *Pinus halepensis* or *Pinus brutia* (2270*)
	Dune forest with maquis (2270*)
	Humid dune forest (2270*)
	Open dry dune forest (2270*)
	Open dry dune forest with halophytic species (2270*)
	Afforestation with diverse species
Salt areas	Salt meadow with *Tamarix smyrnensis*, with maquis (1410, 1420)
	Salt mud annual, perennial, grazed, with *Tamarix smyrnensis* (1410)
River	River with riparian vegetation, reed, gallery forest, riparian shrub (3280)
	Shingle bank and Sand bank (1110)
	Cut off meander
	Estuaries (1130)
Lagoon	Temporary lagoon with or without reed (1140, 1150*)
	Permanent lagoon with or without reed (1150*)
Sea	Sea

DISCUSSION

LANDSAT data fulfil the project's requirements: good spectral and spatial resolution, easy handling and high operability, coverage over a large area, cost-effective interpretation, availability of historical data and classification of habitat and land use types at a scale of 1:100,000 to maximal 1:50,000 with good delineation of structural elements. Important information on aerial distribution of habitat types and land use change can be given. For more detailed requirements, LANDSAT data are unsuitable. States of degradation just can be shown only very roughly and on a low-detailed habitat classification level (e.g. only for dunes as a whole).

In the Delta, natural habitats of Community interest cannot be detected separately. They cannot be distinguished from similar habitat types which are not of Community interest. In order to classify them, these types must be grouped on a higher hierarchy level, such as salt meadow (1410) and salt mud as salt areas. Furthermore, the degradation state cannot be shown for each individual habitat type. Therefore, information on vegetation cover, species abundance and species composition, among other things, is essential.

Advantages of remote sensing of habitat monitoring, particularly in the case of mountain and coastal regions in Romania

In order to comply with statutory regulations which are in force because of new national laws, bringing them into line with the Habitats Directive, (ordinance 462/2001), a monitoring scheme must be designed and established. This monitoring scheme must meet all European Union monitoring and reporting requirements. The results must be reported by 2013, covering the reporting period 2007 - 2012. The European Union has determined the content of the compulsory reporting (European Commission, 2005), but the method of evaluation and reporting are up to the Member States, so there is some leeway here. In order to fulfil the reporting requirements, however, distribution data and conservation status data are essential.

Habitat mapping must be used for monitoring. If only field- based sampling methods are used, then comprehensive habitat mapping cannot be completed in the short-term or medium-term because of the lack of proper methods and resources. Moreover, the monitoring of natural habitat types of Community interest are not possible only using field-based methods. In mountain and coastal regions, the difficulty of access, large areas representing large connected natural habitats of Community interest and land use impact all play a determining role. The strong and increasing impact of land use caused by tourism and the exploitation of resources (e.g. forestry, agriculture) necessitates acting fast to inventory and to effectively monitor of the Carpathians and Black Sea Coastal regions.

The research projects presented show that remote sensing provides an effective instrument to gather basis data quickly and inexpensively. The overall findings of the projects can easily be applied to other regions. The Central Balkan National Park and the Carpathians share a lot in common traits. Both mountainous regions are characterised by high mountain areas which are difficult to access large-scale distribution of the same forest habitat types (beech forests, mixed beech forests and coniferous forests).

Numerous habitat types of sufficient size can be distinguished very well using high-resolution aerial photographs. In order to achieve almost complete coverage of habitat types of Community interest, the scale should be at least 1:5,000 to ensure depth of interpretation. Remote sensing methods can effectively support the reporting requirements with regard to habitat distribution. The habitat mosaic and land cover accounts can be reported. Furthermore, individual areas can be pinpointed if the habitat types there are not detectable, so that these areas can be searched using terrestrial mapping. Another important factor for monitoring is to measure, record and evaluate impacts. Therefore, aerial photographs offer an adequate optical medium. Currently, the large-scale survey of impacts (such as illegal timber harvest, dune destruction, building up beach sectors), fragmentation (e.g. road building) and degradation (e.g. scrub encroachment of montane meadows and heaths, drainage of coastal habitats) is of high interest.

For especially endangered coastal sectors and Natura 2000 coastal areas, an annual analysis of satellite data is recommended. LANDSAT data are already sufficient to detect acute hazards. After these analyses, terrestrial inspections can take place. In general, the survey of the long and narrow coast should be carried out in a three-year cycle using aerial photographs, preferably with as complete coverage as possible, since the monitoring of habitats of Community interest has to proceed inside as well as outside of Natura 2000 areas. Because it is narrow and flat, the Romanian Black Sea coast provides ideal flying conditions. Often one flight strip is sufficient to get an overview with very good spatial resolution. Also, as opposed to the mountains, there are no georeferencing problems.

In the Carpathians, remote sensing-supported monitoring can only be used for smaller areas due to the enormous size of the mountain range. The Natura 2000 areas have top priority here. Next in line to be surveyed, which also are high priority, are high mountain areas above the tree line. Large area surveys in relatively short cycles (2 - 3 years) can be carried out using satellite data. Aerial surveys for more detailed inventories should be carried out for small selected sub-areas at less frequent intervals. Every 6 years a report shall be given to the European Commission. A detailed inventory should be done once during each reporting period. This suggestion seems to make sense because of the greater expenditure in making aerial surveys and georeferencing as well as anthropogeneous disturbances which have a lesser impact in the Carpathians.

For monitoring of habitats of Community interest and Natura 2000 areas using remote sensing, aerial photographs are generally better suited than satellite data. In spite of the fact that satellites offer increasingly better resolution, satellite data also has a lot of disadvantages. Satellite data are often not available at the required recording date. However, they can easily monitor anthropogeneous disturbances over longer intervals between arduous aerial surveys. In contrast, low-cost systems using aircraft-mounted digital cameras are flexible and provide higher spatial resolution. The camera should have an RGB channel as well as an infrared channel (4-Channel-Aerial Camera) as features.

Limits of remote sensing and the necessity of integrating field-based sampling methods using beech forests as an example

The limits of remote sensing methods for habitat detection and survey have already been discussed. Also, high spectral resolution data cannot comply with all requirements of Natura 2000 monitoring. The results of both case studies discussed here, as well as other research dealing with detection of forest habitat types using remote sensing, show that habitat types with similar tree layers, like in case of beech forests, lead to satisfactory results when the site conditions data is viewed more closely. Kleinschmit et al. (2006) show the difficulty in detecting different beech forest types by remote sensing. For example, the habitat types of Community interest 9110 (Luzulo-Fagetum beech forests) and 9130 (Asperulo-Fagetum beech forests) are not distinguishable using SPOT5 and ASTER data. Our own terrestrial research in the large and pristine beech forests of Domogled-Valea-Cernei National Park and Natura 2000 areas (Southern Carpathians) reveals the necessity of a field-based permanent plot network. The beech forests there are characterised by different closely interconnected beech forest communities resulting from changing site conditions (bedrock, exposure) on a small scale. As such, they could be classified as being either to habitat types 9110 Luzulo-Fagetum beech forests (Luzulo-Fagetum), 91KO Illyrian *Fagus sylvatica* forests (Aremonio agrimonioidi-Fagetum) or to 91V0 Dacian Beech forests (Symphyto-Fagetum) (Dullau and Schecher, 2007). All these types are difficult to determine on the ground. They differ only in their field layers, which can vary greatly in their cover and species composition even within a habitat type. To test appropriate methods for the long-term monitoring of the conservation status of beech forests will be the main focus of further research in the Southern Carpathians.

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LOWER PRUT WETLAND - UNDER ECOLOGICAL PROTECTION (MOLDAVIA, ROMANIA)

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KEYWORDS: Romania, Moldavia, Lower Prut Wetland, protection frame, Natural Park, Natura 2000, SPA, SCI, LIFE-Natura project.

ABSTRACT

The Lower Prut River meadow, include a surface of over 8200 ha, localized in Galați County, along the Prut River is a protected area of which importance is sustained by a series of normatives elaborated on the national level.

The protection of this area had few steps, the first one was the legislative acts for the nominalisation of 4 natural reservations (Low 5/2000) in the Prut River meadow: Prut Islet (62 ha), Vlăşcuța Wetland (42 ha), Pochina Wetland (75 ha), the lower Prut River meadow (81 ha). The next step which unified all the aquatic and wetland surces along the 122 km of the Lower Prut River was the HG 1251/2004 which decla as natural park a surface of 8247 ha.

The integration of important surfaces of the Lower Prut River meadow in the Natura 2000 net, enlarged the level of protection from a national one to an European one. In the present the park is the beneficiary of a Life Natura project which aim the improovement of the conservation status of the species and habitats of the „Prut River Lower Meadow Natural Park".

REZUMAT: Zona umedă a Prutului inferior - sub protecție ecologică (Moldova, România).

Lunca Joasă a Prutului, ce include o suprafață de peste 8200 ha, localizată în județul Galați, de-a lungul râului Prut constituie o arie naturală a cărei importanță este susținută de o serie de acte normative elaborate pe plan național.

Protecția acestei zone a parcurs câteva etape, unul din primii paşi din demersurile legislative a fost nominalizarea a 4 rezervații naturale (Legea 5/2000) din lunca Prutului şi anume: ostrovul Prut (62 ha), balta Vlăşcuța (42 ha), balta Pochina (75 ha), Lunca joasă a Prutului inferior (81 ha). Următorul pas care a unit toate suprafețele acvatice şi de luncă desfăşurate de-a lungul celor 122 de km ai Prutului inferior prin declararea suprafeței de 8247 ha, ca Parc natural a fost HG 1251/2004.

Integrarea unor suprafețe importante din Parcul Natural Lunca Joasă a Prutului Inferior, în cadrul Rețelei Natura 2000 a lărgit nivelul de protecție de la nivel național la nivel european. În prezent, Parcul este beneficiarul unui proiect Life Natura care urmăreşte îmbunătățirea stării de conservare a speciilor şi habitatelor din Parcul Natural „Lunca Joasă a Prutului Inferior".

RESUME: La zone humide du bas-Prut - sous protection écologique (Moldavie, Roumanie).

Le pré inondable du bas-Prut, incluant une surface de plus de 8200 ha, située dans le département de Galați, le long de la rivière Prut, constitue une zone naturelle l'importance de la quelle est soutenue par une série d'actes normatifs élaborées au niveau national.

La protection de cette zone a parcouru quelques étapes, un des premiers pas des démarches législatives étant la nominalisation des 4 réservations naturelles (Loi 5/2000) dans le pré de Prut, plus précisément: l'Ostrov de Prut (62 ha), l'étang de Vlăşcuța (42 ha), l'étang de

Pochina (75 ha), le pré inondable du bas-Prut (81 ha). L'étape suivante a été l'unification de toutes les surfaces aquatiques et de la zone riparienne s'étendant sur les 122 km du Prut inferieur par la déclaration de la surface de 8247 ha comme Parc Naturel dans l'Arrêté Gouvernemental 1251/2004.

L'intégration des surfaces importantes dans le Parc Naturel le Pré inondable du bas-Prut dans le cadre du réseau Natura 2000 a élargit le niveau de protection au niveau européen. Au présent, le Parc est le bénéficiaire d'un projet Life Natura qui poursuit l'amélioration de l'état de conservation des espèces et des habitats du Parc Naturel „Pré Inondable du bas-Prut".

INTRODUCTION

Situated in the central-eastern part of Romania, the county of Galați is biogeographically included in the steppe region, characterised by a dry and warm climate, with reduced biodiversity, having common elements with the eastern steppes.

The county of Galați has never excelled in a high number of protected natural areas, as in the county there were in 2000 (Law 5/2000 on approving the improvement plan of the national territory - Section III protected areas) 16 protected natural areas, of the natural reservation type (corresponding to the category IV IUCN - Area of habitat/species administration: protected area administered especially for conservation by improvement interventions). These 16 natural reservations had a total area of 925 ha, which represet 0.2% of the area of 4466 km^2 of the Galați County.

The county of Galați has a monotonous relief, with heights varying from over 300 m on the Fălciu Hills to less than 10 m on the Danube valley. The main relief units belong to the Moldova Plateau - the Covurlui Plateau, the Tutova Hills - and the Romanian Plain - the Tecuci Plain, the Siret Plain.

DISCUSSIONS

The hydrographic network of the county is not rich, but 3 of the most important rivers of the country border the county, the Danube to the South, the Siret to the West and the Prut to the East. Along the areas covered by these rivers the habitats are diverse, the ecosystems formed around these waters contribute to habitat diversification, by means of the resources and services provided to suporting the local social and economic systems and to maintaining the local and regional balance.

Out of these three rivers it was considered that Prut and its wetland gathers the most qualities to become a nationally protected area. Thus, starting in 2002, the Regional Agency for Environment Protection Galati have started taking measures to declare the Lower Prut wetland a natural park.

Based on "the Study of Scientific Foundation", drawn up by the specialists of the Environment Agency of Galați and favourably evaluated by the Romanian Academy, with the support of local authorities and the Ministry of the Environment and Water Administration, in 2004 (Government Resolution 2151/ 2004 on instituting the regime of protected natural area for new areas) the Lower Prut Wetland with a surface of 8247 ha obtained the statute of Natural Park, corresponding to the category V IUCN "Protected scenery: protected area mainly administered for scenery preservation and relaxation".

RESULTS AND DISCUSSIONS

The arguments at the basis of proposing this area for inclusion in the category of the protected areas at a national and international level were the following:

- The works effected along the lower course of the Prut (dams, improvements etc.) have partly modified the state of the original site, but not to the extent of causing major and irreversible efects;
- The lower Prut course is part of the migration corridors of the avifauna to and from the Danube Delta;
- The Prut, albeit dark to the sight, is the cleanest river in the county;
- The existence on the right bank of the Prut, in the Republic of Moldavia, of the natural Reservation "the Lower Prut" created in 1991 to the purpose of protecting the flora and fauna in the Beleu lake and the floodlands around it;
- The existence on the right bank of the Prut, of the natural Reservation "the Lower Prut" created in 1991 to the purpose of protecting the flora and fauna in the Beleu lake and the floodlands around it;
- The existence of the dam-free Prut wetland for about 60 km in lenght and a number of 7 natural lakes out of which the most important are Pochina and Vlăşcuţa;
- On the territory of the park there are habitats of natural eutrophysed (code 3150) and galleries of *Salix alba* and *Populus alba* (code 92 AO), permanent lakes and ponds (code 22.1), free-flowing vegetation (code 22.41), plains with tall grass (code 37.1), swamps with eutrophysed grass (code 37.2) and wet tree and shrub formations (code 44.1);
- Biodiversity is represented by protected animal and plant species, endemic and subendemic, rare and very rare, vulnerable and verging on extinction (241 species of birds, 90 species of mammals, 13 species of reptiles, 14 species of amphibians, 50 species of fish).

The Natural Park the Lower Prut Wetland - general characteristics

- It as an area of 8247 ha and a lenght of about 145 km, the borderline elements being mainly the border with the Vaslui County in the north, the Danube river in the south, the state border with the Republic of Moldavia in the east and the Covurlui Hills and in the west the defence dam against floods from Vlădeşti lake and the Giurgiuleşti customs point.
- It includes more types of natural or improved aquatic ecosystems contributing to maintaining a rich biological diversity in the respective areas: 4925 ha lakes, swamps, (wet areas); 2627 ha forests and wet pastures; other small areas.
- Out of the aquatic ecosystems in the Lower Prut Wetland, the most important are: the Maţa-Rădeanu fish farm, the Cacia lake, the Teleajen lake, the Broscarului lake, the Leahului lake, the Pochina lake, the Şovârca fish farm, the Vlădeşti fish farm (Măicaş -Vlădeşti), the Brăneşti lake, the Vlăşcuţa lake, the Cotu Chiului geno-type base, the Brateş lake.

The Lower Prut Wetland represents a natural area of recreational, economic and scientific value, acting as a tampon and controller of floods, supply of the subterraneous water layer, retaining the nutrients and sediments and atenuating the climate change of the area and mainly preserving biodiversity.

The Natural Park the Lower Prut Wetland and the Natura 2000 Network

By order of the Ministry of the Environment and Durable Development 776/2007 the community relevant sites were designated in our country; the territory of the Natural Park of the Lower Prut Wetland except the Brateş lake was designated as Site of Community Importance (SCI) ROSCI0105.

By the Government Resolution 1284/2007 on declaring the areas of special avifaunistic protection as an itegral part of the European ecological network Natura 2000 in Romania, on the territory of the county of Galaţi the Prut Wetland - Vlădeşti - Frumuşiţa area was validated, encompassing the territory from Murgeni (the area of the Maţa Rădeanu complex) to Vlădeşti and Tulucești as Special Area of Avifaunistic Protection (SPA).

The Natural Park The Lower Prut Wetland and the Ramsar Convent

Romania, as a part of the Convention on preserving the wet areas of international importance especially as habitat for aquatic birds - the Ramsar Convent (ratified by the Law no. 5/1991) has proposed that the Natural Park the Lower Prut Wetland be declared Wet Area of International Importance.

In 2005, the Regional Agency for Environment Protection submitted to the Ministry of Environment and Water Administration all the necessary documentation for the Lower Prut Wetland to be declared a Ramsar Site. This documentation included:

- Information Sheet on Ramsar Wetlands - RIS, mentioning the characteristics of the wet area and the reasons for its declaration as a Ramsar Site;
- The map of the Natural Park the Lower Prut Wetland, extracted from the Government Resolution 2151/2005;
- Relevant images from the Natural Park.

The Natural Park the Lower Prut Wetland and the LIFE Nature Programme

Since 2005, the Regional Agency for Environment Protection Galaţi has benefited from the project LIFE05NAT/RO/000155 ”Ecological Restoration of the Lower Prut Floodplain Natural Park”, whithin the framework of the LIFE Nature Programme.

The project has as its main objective the improvement of the preservation state of species and habitats in the Natural Park the Lower Prut Wetland, by means of the following activities:

- Scientific inventoring;
- Monitoring the environment factors;
- Ecological reconstruction;
- Creating a viable administration structure for the park;
- Elaborating the management plan;
- Informing, and raising the awareness of the public;
- Designating protection areas within the framework of Natura 2000 Network.

In the area of the Vlăşcuţa, Pochina and Maţa-Rădeanu lakes, reconstruction activities will take place in order to prevent the destruction of the habitats of aquatic birds. The total cost of the project will reach 879,710 EURO, out of which 658,782 EURO will come from the European Commission, 69,428 EURO from the Regional Agency for Environmental Protection Galaţi, 31,500 EURO from the partners, and 120,000 EURO from the co-financing granted by the Council of the county of Galaţi.

CONCLUSIONS

The area called the Lower Prut Wetland is salient by its natural characteristics for the steppe areal of the county of Galați as a wet area with multiple resources and functions.

The first step in protecting this area at a national level was to declare 4 areas in this area as natural reservations, with a total surface of 260 ha (Law 5/2000).

An important step in protectin this area was to include certain natural and anthropysed ecosystems covering the whole of the 122 km of the Prut in the protected area called the Natural Park the Lower Prut Wetland, with a total surface of terrain of 8247 ha (HG 21 51/2004).

2006 and 2007 constituted a landmark in implementing the Natura 2000 Network on the territory of the Natural Park the Lower Prut Wetland, so that the national protection is reinforced at an European level by: declaring the territory of the Natural Park of the Lower Prut Wetland as SCI (O. M. 776/2007); and declaring the Lunca Prutului - Vlădeşti - Frumuşița area (from Murgeni to Vlădeşti and Tuluceşti) as SPA (1284/2007).

The presence in the region of RAMSAR sites, i.e. the Danube Delta Biosphere Reservation with 647,000 ha (Moldavia, Romania) and the Natural Park ”Lakes of the Lower Prut” with 19,152 ha (Republic of Moldavia) constituted an important argument for the reinforcement of cooperation across borders in the Prut area and the proposal that on the Romanian bank as well the Natural Park the Lower Prut Wetland be given the status of Ramsar site (proposal to the Secretary of Ramsar, 2005).

So far the only actual benefit to the Natural Park the Lower Prut Wetland has been the LIFE Nature Project - ”Ecological Restoration of the Lower Prut Floodplain Natural Park”, by means of which certain facilities have been obtained, aiming at improving the state of the species and habitats in the area. Thus, at the level of Vlăşcuța lake, deplugging works have been carried out for the supply and evacuation channels of the Prut. For the Pochina lake, the same type of works of channel unplugging will take place in 2008.

Although to date the Natural Park the Lower Prut Wetland was supposed to beefit from its own administration, no request has been registered to this purpose.

The human settlements in the Lower Prut Wetland have an occupational profile that is mostly concerned with agriculture and fish farming, which reinforces the pressure on the wet areas by the organic pollutants resulting from the improper use of chemicals in agriculture, fish farming or the improper use of terrains for stock farming.

Once the status of national and European protection has been obtained, the activities taking place in this protected area will have to be adapted and carried out according to a suitable Management Plan, which should fit in with the objectives of nature preservation and sustainable development in this area.

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PRELIMINARY TESTS CONCERNING SOME AQUIFER POLLUTED MICROBIOTA FOR PROSPECTIVE APPLICATION OF DECONTAMINATION BIOTECHNOLOGIES

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KEYWORDS: aquifer, microbiota, microbial decontamination, organic pollutants, hydrocarbon-oxidizing microorganisms.

ABSTRACT

The paper is an approach of the preliminary stages of the physical, chemical and microbiological analysis of some groundwater samples from sites which registered a hydrocarbons pollution, crude oil or refined fuels like.

Two case studies are presented, in two different areas: Ovidiu Pod, Constanța County and C.F.R. Basarab, in the city of Bucharest. At the first location an accidental contamination with crude oil has been set forth. The second location implied a chronic (historical) pollution, resulting from over 40 years of fuel manipulation and storage.

Since microbial decontaminations techniques are to be applied in the future, a series of aquifer samples have been analyzed, at the same time with the implementation of the location's survey and the establishment of an area management measure plan.

The physical and chemical analysis were made by the Microbiology Center of the Biology Institute of Bucharest and consisted in the testing with test kits and test apparatus of about 15 different parameters.

The microbiological analysis implied pointing out the presence of more than 10 groups of microorganisms, through culture on specific selective media, their characterization and identification as well as the determination of the hydrocarbon-oxidizing capacity of the microorganisms present in the analyzed samples.

The addressed research are some of the mandatory stages included in the decontaminating biotechnologies approach protocol for sites under the influence of pollutants, with negative consequences in the maintenance of the ecological equilibrium and environment biodiversity.

REZUMAT: Teste preliminare referitoare la microbiota unor acvifere poluate pentru biotehnologii aplicative prospective de decontaminre.

Lucrarea abordează etapele preliminare, de analiză fizico-chimică şi microbiologică, a unor probe de apă freatică prelevate din locații unde s-a constatat o poluare cu hidrocarburi de tipul țițeiului brut sau a unor combustibili prelucrați.

Sunt prezentate două cazuri de studiu, situate în zone diferite: Ovidiu Pod, jud. Constanța şi C.F.R. Basarab, în Bucureşti. La prima locație se invoca o contaminare accidentală, cu țiței brut. Cea de a doua locație implica o poluare cronică (istorică), produsă ca urmare a manipulării şi stocării unor combustibili petrolieri, pe durata a peste 40 de ani.

În perspectiva aplicării unor tehnologii microbiene de decontaminare s-au analizat o serie de probe de acvifer, procedându-se totodată la monitorizarea locației şi stabilirea unui plan de măsuri de management al zonei.

Determinările fizico-chimice realizate în cadrul Centrului de Microbiologie al Institutului de Biologie Bucureşti, au implicat circa 15 caracteristici testate cu aparatură sau chituri test.

Analiza microbiologică a constat în evidențierea prezenței a peste 10 grupe de microorganisme, prin cultivarea pe medii selective specifice, caracterizarea şi identificarea acestora, cât şi stabilirea capacității hidrocarbon-oxidante a microorganismelor prezente în probele analizate.

Cercetările întreprinse constituie etape obligatorii ce se includ în protocolul de abordare a biotehnologiilor de decontaminare a unor situri afectate de prezența unor poluanți, cu implicații negative în menținerea echilibrului ecologic şi al biodiversității mediului.

RESUME: Quelques testes préliminaires concernant des microbes des eaux polluées pour l'application prospective des technologies de décontamination.

Ce travail est une approche des étape préliminaires d'analyse physico-chimique et microbiologique des échantillons d'eau phréatique prélevés dans des locations ou une pollution aux hydrocarbures du type du pétrole brut ou des combustibles raffinés a été constatée.

Deux cas d'étude sont présentés, situes dans des zones différentes: Ovidiu Pod, département de Constanța et CFR Basarab, a Bucarest. Dans le premier cas, une contamination accidentelle, au pétrole brut, a été invoquée. La deuxième situation impliquait une pollution chronique (historique), survenue à la suite de la manipulation et du stockage des combustibles pétroliers pendant plus de 40 ans.

Dans la perspective de l'application des technologies microbiennes de décontamination, une série d'échantillons de l'aquifère a été analysée, en même temps procédant à la surveillance du site et à la mise au point d'un plan de mesures de gestion du site.

Les déterminations physico-chimiques réalisées dans le cadre du Centre de Microbiologie de l'Institut de Biologie de Bucarest, ont implique l'analyse d'environ 15 paramètres a l'aide des appareils ou des kits de tests.

L'analyse microbiologique a mis en évidence la présence de plus de 10 groupes de microorganismes, par culture sur des milieux sélectifs spécifiques, leur caractérisation et identification, en permettant aussi la détermination de la capacité hydrocarbure-oxydante des microorganismes présentes dans les échantillons analysés.

INTRODUCTION

The biotechnological researches and physico-chemical analyses performed over a period exceeding 2 years at two locations chosen during a national research contract CEEX-MENER, ERPISA aimed at characterization of the aquifer from the areas intended to be submitted to field applications meant to reduce the contamination level with oil-derived hydrophobic products.

The first study case, located in the Pod Ovidiu area, Constanța county, next to the Poarta Albă - Năvodari channel, refers to the microbiological research performed on the low depth phreatic water samples, presumed to be contaminated with oil residues, following some damage to the underground pipes designed for oil transportation. These pipes, maintained under pressure, pass under the Poarta Albă Năvodari channel (Fig. 1).

On both sides of the channel, in the area where the pipe passes, 8 drilling filters (wells) are present. From two of them, as well as from the collecting barrier running all along the channel (Fig. 2), water samples were drawn, which were physico-chemically characterized and microbiologically analyzed.

Figure 1: Poarta Albă - Năvodari channel.

Figure 2: Drilling filter.

The second case study was performed in Bucharest, at the C.F.R. Triaj - Basarab area (railway), measuring about 500 m length and 80 m across.

Following the every day loading-unloading of oil fuels, imminent losses occur around the slide valve of the tanks, a chronic (historic) pollution of the soil being recorded, down to the phreatic water layer. In the area, there are 8 monitoring wells, with depth ranging between 7 to 15 m, out of which 4 samples of phreatic water were drawn and analyzed.

The performed analyses represent a precursory stage in the potential application of some biotechnologies for remediation of certain oil contaminated areas.

The paper shows the analyses performed by the team of the Microbiology Center from the Institute of Biology, Bucharest.

During the same period, the other contract partners performed physico-chemical analyses and characterization of the polluting agents. Corroboration of all results, together with the identification of the microbial strains with degradation potential, allows the proposal of the most adequate biotechnology for the decontamination of the area.

Concomitantly, when it comes to chronic contamination, measures for prevention and removal of the pollution source become imminent. Thus, the effects of the decontamination technology can be thoroughly monitored over a time period after the treatment.

MATERIALS AND METHODS

Sampling of the phreatic water was performed with a sensor fitted device, which allows both the estimation of the sampling depth and the collection of surface or deep samples.

All phreatic water samples were characterized physico-chemically and microbiologically, using various selective culture media to identify the main physiological groups of microorganisms: bacteria - heterotrophic aerobic, facultative anaerobic, heterotrophic anaerobic, hydrocarbon oxidizing, coliforms, denitrificant, sulfate-reducing, ferrobacteria, as well as yeasts and filamentous microscopic fungi and microscopic fungi.

Concomitantly, studies were undertaken as to the capacity of hydrocarbon oxidizing enriched cultures to degrade the hydrophobic substrate represented by crude oil and various refined oil derivatives, such as diesel oil or and mineral oil, calculating also the degradation percent.

The hydrophobic substrate used for the degradation tests of the contaminants consisted in oil-derived hydrocarbons such as diesel oil, mineral oil and light oil, collected from the C.F.R. Triaj - Basarab area. These hydrocarbons represent products that are actually manipulated at the site and represent the main contamination source of the area.

RESULTS AND DISCUSSIONS

Physico-chemical analyses of the phreatic water samples collected from both the two ponds (T4 and T5) and the surface waters of Poarata Alba-Năvodari channel from Pod Ovidiu location are shown in detail in the table 1.

It can be noticed that the water pH ranges between 7.24 and 8.0, more elevated in the surface water samples.

Table 1: Physico-chemical characteristics of water samples collected from the Pod-Ovidiu area: * - assessed with a pH-meter (1); Merck kits: Aquamerck 11151, Compact Laboratory for water testing (2 - 9), Aquamerck Calcium 11110 (10), Aquamerck Zinc Test 1.14412.0001 (11), Merckoquant Sulfate Test 1.10019 (12), Merckoquant Iron Test 1.10004 (13), Merckoquant Cooper Test 1.10003.0001 (14), Merckoquant Lead Test 1.10077 (15), Merckoquant Aluminium Test 1.10015 (16).

No.	Physico-chemical* characteristics	Measuring unit	Analyzed samples:					
			4^{th} Filter		5^{th} Filter		Poarta Alba-Navodari channel	
			(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
1.	pH	-	7.30	7.24	7.33	7.44	7.91	8.00
2.	Ammonia	mg/l	0.3	0.2	0.4	0.4	0.4	0.4
3.	Nitrites	mg/l	0.025	0.025	0.05	0.05	0.4	0.4
4.	Nitrates	mg/l	0	0	0	0	25	15
5.	Phosphates	mg/l	0	0	0	0	0	0
6.	Total hardness	mmol/l	10.5	11.5	7.0	7.0	5.5	7.0
		^{0}dH	60	65	40	40	30	40
7.	Residual hardness	^{0}d	>0.5	>0.5	>0.5	>0.5	0.5	0.5
8.	Carbonates	mmol/l	14	28	14	14	7	14
		^{0}d	40	80	40	40	20	40
9.	Oxygen	mg/l	18.0	18.5	14.0	9.0	13.5	11.0
10.	Calcium	mg/l	100	70	68	62	65	60
11.	Zn	mg/l	0.45	0.45	0.30	0.40	0.40	0.50
12.	Sulfate (SO_4^{2-})	mg/l	300	300	300	300	300	300
13.	Fe^{2+}	mg/l	3.0	3.0	2.0	2.0	3.0	3.0
14.	Cu	mg/l	0	0	0	0	0	0
15.	Pb^{2+}	mg/l	0	0	0	0	0	0
16.	Al^{3+}	mg/l	10.0	10.0	15.0	25.0	15.0	15.0

Concomitantly, the absence of certain chemical elements such as Cu, Pb as well as phosphates can be seen. Nitrites are present only in the two surface water samples, but not in the phreatic water. Sulfates are present in all 6 analyzed samples, at a stable concentration of 300 mg/l, while oxygen varies between 9.0 and 18.5 mg/l.

As concerns the C.F.R. Triaj-Basarab location, the physico-chemical characterization of the 7 phreatic water samples (Tab. 2) showed a relatively constant pH, varying between 6.3 and 7.05, the absence of Cu and Pb ions, and higher levels of O_2, ranging between 11.0 and 20.0 mg/l.

In addition, the presence of a layer of oil hydrophobic contaminants in some samples, caused a smell of sulfur in sample A2 and of oil hydrocarbons in the other ones.

Table 2: Physico-chemical characteristics of water samples collected from CFR Triaj – Basarab area.

Physico-chemical* characteristics	Measuring unit	Analyzed samples						
		A_2	A_3	A_4	A_6	A_7	A_9	A_{10}
pH		6.52	6.52	6.44	6.49	7.05	6.30	6.82
SO_4^{2-}	mg/l	400	400	300	400	300	400	300
PO_4^{3-}	mg/l	2.0	1.5	1.0	3.5	0.25	0.25	0.25
NO_2^-	mg/l	0	0	0.075	0.050	0	0.050	0
NO_3^-	mg/l	10.0	10.0	0	25.0	10.0	15.0	0
NH_4^+	mg/l	0.2	0.2	0	0	0.2	0	0.2
O_2	mg/l	18.0	20.0	19.2	11.0	20.0	17.2	18.7
Carbonates	mmol/l	8.5	5.6	12.0	9.0	5.7	9.9	11.6
Calcium	mg/l	92.0	80.0	122.0	0	0	160.0	170.0
Smell/sediment		Sulf	Oil hydrocarbons					
Total hardness	mmol/l	5.0	4.5	5.5	10.5	4.25	12.5	3.5
Residual hardness	^{0}d	7.0	5.7	10.5	9.0	5.0	7.0	9.4
Total iron (Fe^{2+} şi Fe^{3+})	mg/l	15.0	15.0	15.0	15.0	3.0	15.0	7.5
Fe^{2+}	mg/l	3.0	3.0	3.0	3.0	2.0	10.0	2.0
Cu	mg/l	0	0	0	0	0	0	0
Pb^{2+}	mg/l	0	0	0	0	0	0	0
Al^{3+}	mg/l	0	0	5.0	0	10.0	5.0	5.0
Zn	mg/l	0.3	1.0	1.0	0.1	5.0	0.5	1.0

The microbiologic analyses of the 6 water samples collected at Pod-Ovidiu location aimed at determining the presence and the density of cells/ml for 13 groups of microorganisms represented by bacteria, yeasts, microscopic filamentous fungi and unicellular green algae, appointed to 5 metabolic cycles (Tab. 3 a, b).

Cultivation was performed on specific selective media.

Aerobic heterotrophic facultative anaerobic bacteria were best represented, ranging between 3.0 x 10^7 and 1.1 x 10^{12} cells/ml.

High cellular concentrations were recorded in the group of anaerobic heterotrophic bacteria (1.1 x 10^5 - 1.1 x 10^{10}). In addition, for these microorganisms, a quite increased production of gases was recorded (++ – +++).

No presence of actynomycetes, cianobacteria and green unicellular algae was demonstrated.

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Sulfate-reducing bacteria, cultivated on Postgate B selective medium, showed a moderate presence (4.5 x 10 - 9.5 x 10^2) and a fermentative character of medium value. As concerns the sulfur-oxidant bacteria, their concentration was higher, up to 4.5 x 10^4 cells/ml, the following species being identified: *Thiobacillus thioparus* and *Thiobacillus denitrificans*. For filamentous microscopic fungi, concentrations up to 3.0 x 104 cells/ml and the presence of *Penicillium*, *Aspergillus*, *Fusarium* and *Trichoderma* were recorded. Evaluation of hydrocarbon-oxidizing bacteria on mineral medium supplemented with 5% crude oil as substrate showed a density of 9.5 x 10^4 cells/ml. At the same time, for the screening of hydrocarbon-oxidizing microorganisms, the discoloration test was performed, using 2.6 diclorfenol-indofenol, under static and stirring conditions (Tab. 5).

Table 3a: Microbiological analysis of water samples collected from Pod-Ovidiu area.

Metabolic cycles	Microorganisms	Culture medium		Analyzed samples (cells/ml)		
				4th Filter		
				1a	1b	2a
Carbon cycle	Aerobic heterotrophic aerobe, facultative anaerobic bacteria	LB		1.1×10^{8}	1.5×10^{8}	1.5×10^{9}
	Anaerobic heterotrophic bacteria	VL		1.1×10^{10} (gas ++)	6.5×10^{8} (gas +++)	3.5×10^{5} (gas ++)
	Coliform bacteria	Levine	*E. coli*	6.0×10	1.4×10^{3}	1.5×10^{2}
			Klebsiella	1.0×10	1.0×10^{3}	1.3×10^{2}
	Hydrocarbon-oxidizing	M + 5% oil		2.5×10	9.5×10	4.5×10
		MM + 5% oil		4.5×10^{2}	4.0×10^{3}	4.0×10^{2}
	Yeasts	YPG		3.0×10^{2} (*Rodotorula*)	2.8×10^{2}	1.3×10^{2}
	Microscopic filamentous fungi	Sabouraud		6.0×10 (*Penicillum, Aspergillus*)	1.5×10^{2} (*Penicillum, Aspergillus*, *Fusarium)*	2.0×10^{2} (*Penicillum, Aspergillus*, *Fusarium)*
	Actinomycets	Gause		0	0	0
Nitrogen cycle	Denitrificant bacteria	Giltay		2.0×10^{3}	1.5×10^{3}	4.0×10^{2}
Sulfur cycle	Sulfate-reducing bacteria	Postgate B		2.5×10^{2} (fermentation +)	9.5×10^{2} (ferment. ++)	4.5×10 (ferment. ++)
	Sulfur-oxidizing bacteria	Waksman with S (pH 6,6)		2.5×10^{3} (*Thiobacillus thioparus; Thiobacillus denitrificans*)	2.0×10^{4} (*Thiobacillus thioparus; Thiobacillus denitrificans*)	2.5×10^{4} (*Thiobacillus thioparus Thiobacillus denitrificans*)
Iron cycle	Ferobacteria	Vinogradski		2.5×10^{4}	4.5×10^{3}	4.5×10^{3}
Phototrophic	Cyanobacteria	BG11		0	0	0
	Unicellular green algae	Knop-Pringhaim		0	0	0

Table 3b: Microbiological analysis of water samples collected from Pod-Ovidiu area.

Metabolic cycles	Microorganisms	Culture medium		Analyzed samples (cells/ml)		
				5th Filter	Poarta Alba-Navodari channel	
				2b	3a	3b
Carbon cycle	Aerobic heterotrophic aerobe, facultative anaerobic bacteria	LB		3.0×10^{9}	3.0×10^{7}	1.1×10^{12}
	Anaerobic heterotrophic bacteria	VL		3.0×10^{5} (gas +++)	1.1×10^{5} (gas +++)	3.0×10^{5} (gas +++)
	Coliform bacteria	Levine	*E. coli*	4.0×10^{3}	5.0×10^{3}	1.0×10^{3}
			Klebsiella	1.2×10^{4}	1.0×10^{2}	2.0×10
	Hydrocarbon-oxidizing	M + 5% oil		1.5×10^{3}	9.5×10^{4}	9.0×10^{2}
		MM + 5% oil		4.0×10^{4}	7.5×10^{2}	2.0×10^{2}
	Yeasts	YPG		0	6.0×10^{2}	9.0×10^{3}
	Microscopic filamentous fungi	Sabouraud		3.0×10^{4} (*Penicillum, Aspergillus*, *Trichoderma*)	2.6×10^{2} (*Penicillum, Aspergillus*, *Fusarium)*	2.0×10^{2} (*Penicillum, Aspergillus*, *Fusarium)*
	Actinomycets	Gause		0	0	0
Nitrogen cycle	Denitrificant bacteria	Giltay		2.5×10^{4}	1.5×10^{4}	2.5×10^{4}
Sulfur cycle	Sulfate-reducing bacteria	Postgate B		2.5×10^{2} (ferment. +++)	4.5×10^{2} (ferment. +++)	2.5×10^{2} (ferment. ++)
	Sulfur-oxidizing bacteria	Waksman with S (pH 6,6)		2.5×10 (*Thiobacillus thioparus; Thiobacillus denitrificans*)	0.9×10 (*Thiobacillus thioparus; Thiobacillus denitrificans*)	4.5×10^{4} (*Thiobacillus thioparus; Thiobacillus denitrificans*)
Iron cycle	Ferobacteria	Vinogradski		2.5×10^{6}	7.5×10^{4}	1.1×10^{5}
Phototrophic	Cyanobacteria	BG11		0	0	0
	Unicellular green algae	Knop-Pringhaim		0	0	0

Table 5: Rapid screening test for hydrocarbon-oxidizing microorganisms; legend * = 50% moderate discoloration; 100% total discoloration of the medium.

Water samples		Incubation conditions	
		Static	Continuous shaking
4th Filter	Surface water (1a)	50%	100%
	Deep water (1b)*	50%	100%
5th Filter	Surface water (2a)*	50%	100%
	Deep water (2b)*	50%	100%
Poarta Albă-Năvodari channel	Collecting barrier (3a)*	100%	100%
	Streaming water (3b)	100%	100%

The capacity of hydrocarbon-oxidizing microorganisms to degrade hydrophobic contaminants of paraffinic oil type was assessed by using enriched bacterial cultures, obtained from isolates from the Pod-Ovidiu location water samples. Thus, the paraffinic oil was degraded to amplitude of 76 - 98% by the selected hydrocarbon-oxidizing microorganisms, cultivated under continuous shaking conditions.

The microbiologic analyses of the five phreatic water samples collected at C.F.R. Triaj - Basarab location proved the higher prevalence of aerobic heterotrophic facultative anaerobic bacteria, ranging from 1.4 x 10^5 to 2.5 x 10^8 cells/ml (Tab. 4).

The presence of denitrificant bacteria, sulfur-reducing, ferrobacteria and heterotrophic anaerobic was recorded as well, but at lower concentrations.

No yeasts and filamentous microscopic fungi were present in any sample.

Coliform bacteria present in low amounts, were represented by populations of *Klebsiella* and *Escherichia* genera.

It is worth mentioning that hydrocarbon-oxidizing bacteria underwent scanty development on selective medium supplemented with mineral oil and light oil as compared to the substrate represented by Diesel oil, where the density of bacterial cells reached, in 2 out of 5 analyzed cases, values of 1.1 x 10^3 and 2.5 x 10^3 cells/ml.

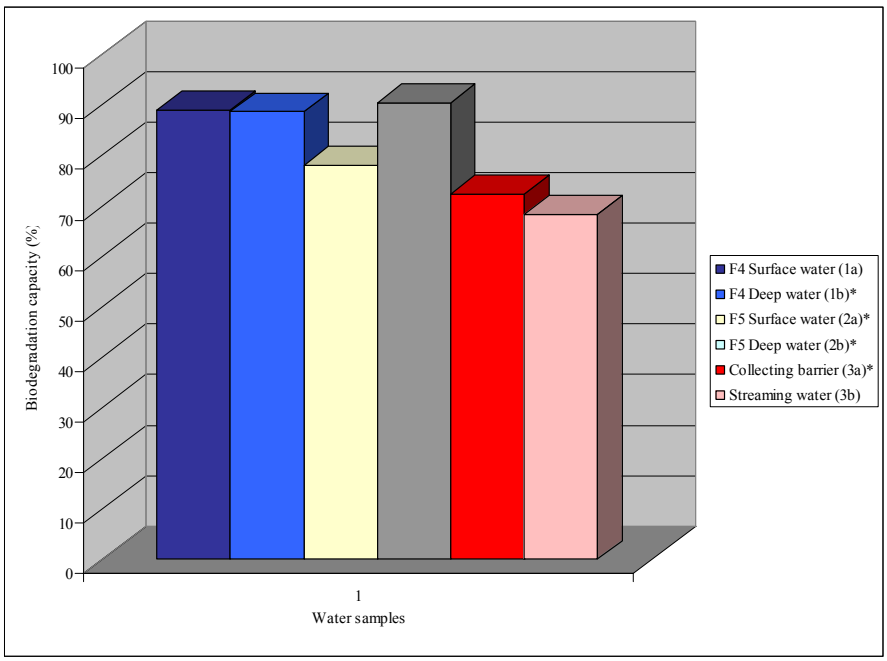

Figure 3: The capacity of hydrocarbon-oxidizing microorganisms from enriched cultures, originating from the Pod - Ovidiu area, to degrade a paraffinic oil.

All 3 hydrophobic substrates used as carbon source originated from the C.F.R. Triaj - Basarab site, representing the main source of pollution of the area.

The biodegradative capacity of the 3 types of substrates mentioned above was assessed by means of hydrocarbon-oxidizing bacterial cultures, isolated from the analyzed phreatic water samples; based in these cultures, enriched cultures were prepared, containing 70% mineral medium (MM), 20% phreatic water and 10% polluting hydrophobic substrate (diesel oil, light oil, mineral oil).

No presence of actynomycetes, cianobacteria and green unicellular algae was demonstrated.

As it can be seen in the diagram in the figure 3, the degradation of the pollutant, as concerns the diesel oil, ranged between over 70% and over 90% for all 5 analyzed samples of phreatic water.

Sulfate-reducing bacteria, cultivated on Postgate B selective medium, showed a moderate presence (4.5 x 10 - 9.5 x 10^2) and a fermentative character of medium value. As concerns the sulfur-oxidant bacteria, their concentration was higher, up to 4.5 x 10^4 cells/ml, the following species being identified: *Thiobacillus thioparus* and *Thiobacillus denitrificans*. For filamentous microscopic fungi, concentrations up to 3.0 x 104 cells/ml and the presence of *Penicillium*, *Aspergillus*, *Fusarium* and *Trichoderma* were recorded.

Evaluation of hydrocarbon-oxidizing bacteria on mineral medium supplemented with 5% crude oil as substrate showed a density of 9.5 x 10^4 cells/ml. At the same time, for the screening of hydrocarbon-oxidizing microorganisms, the discoloration test was performed, using 2.6 diclorfenol-indofenol, under static and stirring conditions (Tab. 5).

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Poarta Albă-Năvodari channel	Collecting barrier (3a)*	100%	100%
	Streaming water (3b)	100%	100%

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The microbiologic analyses of the five phreatic water samples collected at CF.R. Triaj - Basarab location proved the higher prevalence of aerobic heterotrophic facultative anaerobic bacteria, ranging from 1.4 x 10^5 to 2.5 x 10^8 cells/ml (Tab. 4).

The presence of denitrificant bacteria, sulfur-reducing, ferrobacteria and heterotrophic anaerobic was recorded as well, but at lower concentrations.

No yeasts and filamentous microscopic fungi were present in any sample.

Coliform bacteria present in low amounts, were represented by populations belonging to *Klebsiella* and *Escherichia* genera.

It is worth mentioning that hydrocarbon-oxidizing bacteria underwent scanty development on selective medium supplemented with mineral oil and light oil as compared to the substrate represented by Diesel oil, fwhere the density of bacterial cells reached, in 2 out of 5 analyzed cases, values of 1.1 x 10^3 and 2.5 x 10^3 cells/ml, respectively.

Table 4: Microbiological analysis of the phreatic water samples collected from the C.F.R. Triaj - Basarab location.

Metabolic cycles	Microorganisms	Culture medium	Analyzed samples (cells/ml):				
			A_2	A_3	A_6	A_7	A_9
Carbon cycle	Aerobic heterotrophic aerobe, facultative anaerobic bacteria	LB	$2.5x10^8$	$1.4x10^8$	$0.4x10^8$	$1.4x10^5$	$0.4x10^8$
	Anaerobic heterotrophic bacteria	VL	$2.5x10^2$	$2.5x10^4$	$2.5x10^2$	$2.5x10^2$	$2.5x10^2$
	Hydrocarbon-oxidizing	MM+diesel oil MM+mineral oil MM+light oil	4.5x10 0 0	$1.1x10^3$ $4.5x10^2$ 2.0x10	$2.5x10^3$ 2.5x10 $1.5x10^3$	2.5x10 0.4x10 3.0x10	2.5x10 0 1.0x10
	Coliform bacteria	Levine	$1.0x10^2$ *Klebsiella*	$5.0x10^2$ *Klebsiella*	1.0x10 *Klebsiella*	1.4x10 *Klebsiella, Escherichia*	1.0x10 *Klebsiella*
	Yeasts	YGP	0	$2.0x10^2$	2.0x10	0	0
	Fungi	Czapec	0	$4.0x10^4$	$1.0x10^2$	$1.0x10^2$	$1.0x10^4$
Nitrogen cycle	Denitrificant bacteria	Giltay	$9.5x10^2$	$1.5x10^5$	$4.5x10^2$	$9.5x10^2$	0
Sulfur cycle	Sulfate-reducing bacteria	Postgate	9.5x10	$4.5x10^2$	$9.5x10^6$	$4.5x10^2$	$1.5x10^3$
Iron cycle	Ferobacteria	Vinogradski	$1.5x10^3$	$9.5x10^4$	$1.5x10^3$	$9.5x10^2$	$9.5x10^2$

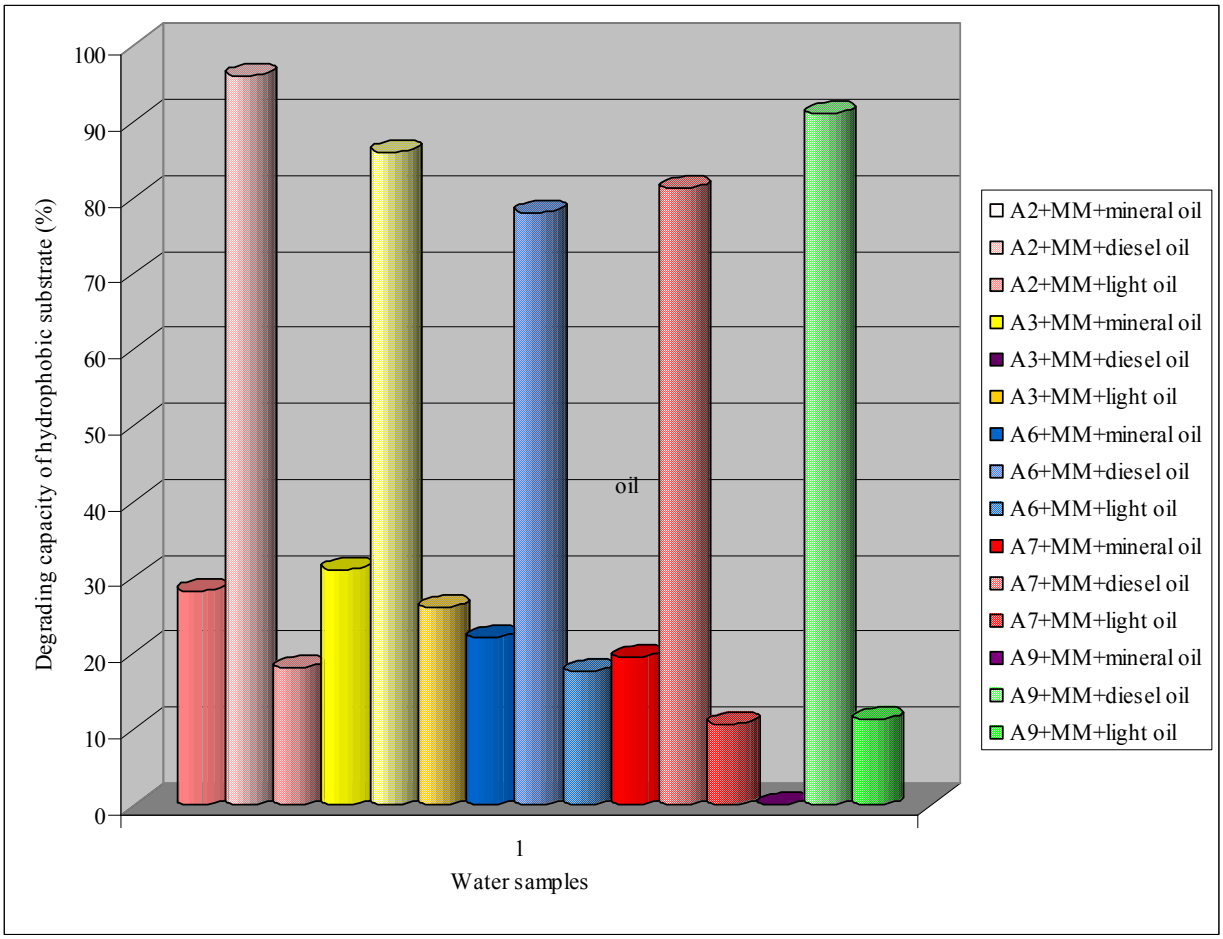

Figure 4: The capacity of the enriched microorganism's cultures present in the phreatic water samples from the C.F.R. Triaj - Basarab area to degrade polluting oil hydrocarbons. The enriched cultures contained mineral medium (MM) 70%; phreatic water 20%; pollutant 10%.

All these analyses and tests, to which the water samples collected at both the study sites were submitted, enable the microbiological characterization of the fluids with contaminating potential. Mastering the microbiota of the polluted areas as well as its biodiversity allows the drawing up of a management strategy, in order to reduce the contamination level by means of biotechnological methods of bio-remediation, which do not perturb the biological equilibrium of the area, by non-vernacular chemical compounds or disturbing physical factors, the possibility of natural attenuation of the contaminants being an acceptable alternative to depollution.

CONCLUSIONS

The two study cases represented potentially contaminated sites or chronically polluted sites with oil hydrocarbons.

The presence of contaminants was assessed, in both cases, in the lower depths phreatic water layer.

The physico-chemical analyses, performed with test kits offered some indication as to the environmental conditions from the chosen sites.

The microbiological analyses consisted in cultivation on selective media, allowing the identification of the presence of the main groups of microorganisms.

In order to assess the presence of hydrocarbon-oxidizing bacteria, a rapid screening test, containing 2.6 diclorofenol-indofenol was used.

Observations on both growth intensity and degradation capacity of the hydrophobic substrate were performed, by using enriched cultures of microorganisms present in the phreatic water samples.

The undertaken studies represent a precursory stage in the potential application of some biotechnologies for remediation of certain oil contaminated areas.

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ATLASUL PEŞTILOR DIN REZERVAȚIA BIOSFEREI DELTA DUNĂRII/ (THE FISH ATLAS OF THE DANUBE DELTA BIOSPHERE RESERVE)

- REVIEW -

Doru BĂNĂDUC [1]

Vasile Oțel, 2007, Atlasul peştilor din Rezervația Biosferei Delta Dunării (The Fish Atlas of the Danube Delta Biosphere Reserve), 481 pages, Editura Centrul de Informare Tehnologică Delta Dunării, Tulcea, ISBN 978-973-88117-0-6.

Under the care of the Danube Delta National Institute of Research-Development Tulcea was published in Romanian a volume regarding the ichtyophauna of one of the most important protected area in Romania for the fish conservation, the Danube Delta Biosphere Reserve.

This volume is structured in two parts: the general and systematic ones.

The general section include: Territorial-administrative divisions of the Danube Delta Biosphere Reserve as a necessary element of spatial and administrative integration; Aquatic habitats of the Danube Delta Biosphere Reserve with elements of fish inventory, general ecology and distribution; Fish morphology; Fish anatomy; General notions of fish cell genetic; Fish general ecology elements; Fish general evolutionary elements; General elements regarding the industrial fishing; General elements regarding the sport fishing; Fish as food.

The systematic section represent in fact the most important one of the volume, both qualitatively and quantitatively and include: Danube Delta Biosphere Reserve fish classification, where all the certain present fish species in the area were enumerated; Module of species presentation, where is revealed the model how all the fish species are presented (scientifical name, vernacular name, foreign languages names, colour photos, distribution, specific characters, caryotype, biology, industrial fishing, sportive fishing, nutritional value and protection).

The high number of fish species included in this volume are the following: *Eudontomyzon mariae* (Berg, 1931); *Squalus acanthias* Linnaeus, 1758; *Raja clavata* L., 1758; *Dasyatis pastinaca* (L., 1758), *Acipenser gueldenstaedtii* Brandt and Ratzenburg, 1833; *Acipenser nudiventris* Lovetzsky, 1828; *Acipenser ruthenus* L., 1758; *Acipenser stellatus* L., 1758; *Acipenser sturio* L., 1758; *Huso huso* (L., 1758); *Alosa immaculata* (Bennett, 1835); *Alosa tanaica* (Grimm, 1901); *Clupeonella cultiventris* (Nordmann, 1840); *Sprattus sprattus* (L., 1758); *Sardina pilchardus* (Walbaum, 1792); *Engraulis encrasicolus* (L., 1758), *Salmo labrax* Pallas, 1814; *Esox lucius* L., 1758; *Umbra krameri* Walbaum, 1792; *Abramis ballerus* (L., 1758); *Abramis sapa* (Pallas, 1814); *Abramis brama* (L., 1758); *Blicca bjoerkna* (L., 1758); *Vimba vimba* (L., 1758); *Alburnus alburnus* (L., 1758); *Chalcalburnus chalcoides* (Gueldenstaedt, 1772); *Aspius aspius* (L., 1758); *Barbus barbus* (L., 1758); *Carassius gibelio* (Bloch, 1782); *Carassius carassiu* (L., 1758); *Cyprinus carpio* L., 1758; *Chondrostoma nasus* (L., 1758); *Hypophthalmichthys molitrix* (Valenciennes, 1844); *Aristichthys nobilis* (Richardson, 1845); *Ctenopharingodon idlla* (Valenciennes, 1844); *Pseodorasbora parva* (Temmink and Schlegel, 1842); *Gobio albipinnatus* Lukasch, 1933; *Gobio kesslerii* Dybowsky, 1862; *Leucaspius delineatus* (Heckel, 1843); *Leucaspius cephalus* (Linnaeus, 1758); *Leuciscus idus* (L., 1758); *Petroleuciscus borysthenicus* (Kessler, 1859); *Rutilus rutilus* (L., 1758); *Rutilus frisii* (Nordmann, 1840); *Scardinius erythrophthalmus* (L., 1758); *Pelecus cultratus* (L., 1758); *Rhodeus amarus* (Bloch, 1782); *Tinca tinca* (L., 1758); *Cobitis danubialis* Băcescu, 1993; *Cobitis tanaitica* Băcescu and Mayer, 1969; *Cobitis megaspila* Nalbant, 1993; *Sabanejewia bulgarica* (Drensky, 1928); *Misgurnus fossilis* (L., 1758); cyprinids hybrids (*Rutilus rutilus x Blicca bjoerkna*, *Rutilus rutilus x Abramis brama*, *Carassius gibelio x Cyprinus carpio, Alburnus alburnus x Rutilus*

rutilus, *Carassius carassius x Carassius gibelio*); *Silurus glanis* L., 1758; *Anguila anguilla* (L., 1758); *Belone belone euxini* Gunther, 1866; *Merlagus merlangus euxinus* (Nordmann, 1840); *Lota lota* (L.,); *Gaidropsarus mediterraneus* (L., 1758); *Gasterosteus aculeatus aculeatus* L., 1758; *Pungitius platygaster* (Kessler, 1859); *Hippocampus guttulatus* Cuvier, 1829; *Syngnathus abaster* Risso, 1826; *Syngnathus schmidti* Popov, 1927; *Syngnathus tenuirostris* Rathe, 1837; *Syngnathus variegatus* Pallas, 1814; *Syngnathus typhle* L., 1758; *Nerophis ophidion* (L., 1758); *Perca fluviatilis* L., 1758; *Sander lucioperca* (L., 1758); *Sander volgensis* (Gmelin, 1788); *Gymnocephalus baloni* Holčic and Hensel, 1974; *Gymnoephalus cernuus* (L., 1758); *Gymnoephalus schraetser* (L., 1758); *Percarina demidoffi* Nordmann, 1840; *Zingel streber* (Siebold, 1863); *Zigel zingle* (L., 1766); *Aphia minuta* (Risso, 1810); *Bethophiloides brauneri* Beling and Iljin, 1927; *Benthophilus stellatus* (Sauvage, 1874); *Gobius niger* L., 1758; *Knipowitschia cameliae* Nalbant and Oţel, 1995; *Knipowitschia caucasica* (Berg, 1916); *Mesogobius batrachocephalus* (Pallas, 1814); *Neogobius eurycepalus* (Kessler, 1874); *Neogobius flviatilis* (Pallas, 1814); *Neogobius gymnotrachelus* (Kessler, 1857); *Neogobius kessleri* (Günther, 1861); *Neogobius melanostomus* (Pallas, 1814); *Neogobius ratan* Nordmann, 1840); *Neogobius syrman* (Nordmann, 1840); *Pomatoschistus marmoratus* (Risso, 1810); *Proterorhinus marmoratus* (Pallas, 1814); *Zosterisessor ophiocephalus* (Pallas, 1814); *Gymnammodytes cicerellus* (Rafinesque, 1810); *Aidablennius sphynx* (Valenciennes, 1836); *Parablennius sanguinolentus* (Pallas, 1814); *Parablennius tentaculais* (Brünnich, 1768); *Callionymus risso* (Lesuerus, 1814); *Trachurus meditrraneus ponticus* Aleev, 1956; *Trachurus trachurus* (L., 1758); *Lepomis gibbosus* (L., 1758); *Cetnolabrus rupestris* (L., 1758); *Symphodus cinereus* (Bonnaterre, 1788); *Symphodus roissali* (Riso, 1810); *Symphodus tinca* (L., 1758); *Symphodus ocellatus* (Forssal, 1775); *Spicara smaris* (L., 1758); *Spicara maena* (L., 1758); *Liza aurata* (Risso, 1810); *Liza saliens* (Risso 1810); *Liza haematocheila* (Temminck and Schlegel, 1845); *Mugil cephalus* L., 1758; *Mullus barbatus ponticus* Essipov, 1927; *Poatomus saltatrix* (L., 1758); *Sciaena umbra* L., 1758; *Umbrina cirrosa* (L., 1758); *Sarda sarda* (Bloch, 1793); *Scomber scombrus* L., 1758; *Xiphias gladius* L., 1758; *Boops boops* (L., 1758); *Diplodus annularis* (L., 1758); *Diplodus puntazzo* (Cetti, 1777); *Trainus draco* L., 1758; *Uranoscopus scaber* L., 1758; *Dicentrarchus labrax* (L., 1758); *Atherina boyeri* Risso, 1810; *Atherina hepsetus* L., 1758; *Ophidion rochei* Müller, 1845; *Scorpaena porcus* L., 1758; *Chelidonichthys lucernus* (L., 1758); *Diplecogaster bimaculata euxinica* Murgoci, 1964; *Platichthys flesus luscus* (Pallas, 1814); *Psetta maeottica* (Pallas, 1814); *Pegusa lascaris* (Risso, 1810) and *Pegusa lascaris* (Risso, 1810).

This atlas is valuable in the actual scientific publicistic context with immediate resonance for the readers with interest in ichtiology. The activities related with teaching and research connected with the environment, fish exploitation and trade, can easily use the presented information.

In the context of a relatively rich ichtyological literature in Romania, the essential quality of this work is that an important part of this was integrated in an accessible and unitary form, actualised in content, the publication relaying too on an important personal scientific contribution of the author. The illustration in majority in colour is very reach and original.

The over 40 year of experience of the author in the Danube Delta, its profesional value and hard work necesary for the realisation of such publication like this, raise in the Romanian scientific community new more expectations regarding new such publications, from this a long time ago acknowledged ichtyologist.

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GUIDELINES FOR APPLYING IUCN PROTECTED AREAS MANAGEMENT CATEGORIES

- REVIEW -

Angela CURTEAN-BĂNĂDUC[1]

Dudley Nigel editor, 2007, Guidlines for applying protected area management categories, 86 pages, published by International Union for Conservation of Nature, Gland, Switzerland, ISNB 978-8317-1086-0.

This publication work was structured in eight chapters and foreword, acknowledgements, introduction, appendix - typology and glossary (the definition of key terms used in the guidelines) and references, present a revision of the International Union for Conservation of Nature Protected Area Management Categories system, the interpretation of the protected area definition and management categories.

This publication is the result of an extensive consultative process within International Union for Conservation of Nature and within its members, which started with a consultative research project reported at the World Conservation Congress in Bangkok in 2004, resulting in a resolution calling for the production of such guidelines.

This guidelines is more detailed in comparison with the 1994 version, offer more details about each category of protected area, explains how they can be used to plan, implement and assess conservation strategies, being an important suport for the application of the International Union for Conservation of Nature protected area management categories, wich classify protected area according to their management objectives.

The first section of this publication - Background - include the International Union for Conservation of Nature "protected area" concept definition, the IUCN protected area categories history and explain the purposes of the categories as understood by IUCN.

The second section - Definiton and categories - explains the International Union for Conservation of Nature definition of a protected area, principles, definition of a protected area system and the ecosystem approach, definition and describe of the six protected area categories (their main objectives, other objectives, distinguishing features, role in landscape/seascape, unique points and actions that are compatible or incompatible) and the relationship between the categories.

The third section - Governance - outlines the importance of governance types for protected area management and explains how the governance link to the categories and "looks at how the governance by indigenous peoples, communities and private bodies can contribute to protected area system".

The section - Applying the categories - presents the processes for applying categories choosing the most suitable category for a given situation, assigning the category according with national and international legal requirements, standards and norms, also present reporting issues.

Using the International Union for Conservation of Nature protected area categories as a tool for conservation planning and policy are the subject of five sections, here is also aproached the planning for climate change subject.

In the section number six are present in detail, the specialized applicatons: forest, marine and inland water protected areas, sacred natural sites, geodiversity and the role of restoration in protection.

In the section number seven are present some international conservation initiatives to protect key habitats under the United Nations or regional agreements, with accent on the World Heritage Convetion, Convention on Biological Diversity and Ramsar Convention, also here are revealed links how World Heritige sites and Ramsar sites relate to the International Union for Conservation of Nature categories.

Finaly, the section - Efectiveness of the International Union for Conservation of Nature categories - outlines the assessment of management aspects in relation with the IUCN categories and the relationship between assessment and category assignment.

This publication has a remarkable clearnes and aplicativity, being a very useful instrument for specialists in the field of biodiversity conservation, students but also to the administrative and politic decision makers.

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TRANSYLVANIAN REVIEW OF SYSTEMATICAL AN ECOLOGICAL RESEARCH 4 - THE SAXON VILLAGES REGION OF SOUTHEAST TRANSYLVANIA

- REVIEW -

Nathaniel PAGE [1] and *John AKEROYD* [2]

Angela Curtean-Bănăduc, Doru Bănăduc and Ioan Sîrbu, 2007. Transylvanian Review of Systematical and Ecological Research, 4 - The Saxon Villages Region of southeast Transylvania, 216 pages, Editura Universității „Lucian Blaga" din Sibiu, ISSN 1841-7051.

The historic landscape of the Saxon Villages, or Târnava Mare Plateau region of southern Transylvania, is one of the most important areas of Europe for the conservation of biodiversity. Here species-rich plant and animal communities thrive in intimate association with traditional agriculture, and this is one of the most significant areas of Europe for the survival of biodiversity within a farmed landscape. It is a remarkable fragment of an older Europe, yet one that had been largely ignored until recent years. In contrast to some other important conservation areas in Romania, where natural vegetation predominates, the future of the flora and fauna of the Saxon Villages is very much in the hands of the human population, who have to contend with their own problems of survival and economic development.

From a Romanian perspective, many of the plants, animals and habitats of the Saxon Villages region are not particularly rare or threatened, but the region has spectacular biodiversity partly because of its proximity to several biogeographic regions. At a European level, the survival of these species and habitats in significant numbers and extent considerably alleviates their loss in other regions. The area includes some of Romania's best High Nature Value farm grassland. The traditionally managed wildflower meadows and pastures, probably the best to survive in lowland Europe, are both a living link with medieval Europe, and also a genetic resource of forage crops, especially legumes. Since biodiversity thrives in close harmony with human activity, conservation of this relatively intact, non-intensively farmed landscape, with substantial surviving wetlands and old-growth woodland, must be linked directly to sustainable rural development. Conservation measures need to be applied in the wider countryside, for the benefit of local people and the sustainable development of farming communities, rather than within a conventional protected area.

The 17 papers in volume 4 of ***Transylvanian Review of Systematical and Ecological Research*** explore aspects of an astonishingly rich biological landscape, following on from a series of papers on the Târnava Mare basin in volume 2 (2005). The papers explore the geology and physical environment, including hydrology, vegetation and flora, fungal flora, aquatic macroinvertebrates, amphibian, reptile, fish, bird and small mammal fauna, and human land use and its impact on biodiversity.

The research carried out by many of the contributors has played the major part in the designation of the area as the largest Natura 2000 site - both a Special [Avifaunistic] Protection Area (SPA) and a Site of [European] Community Interest (SCI) - in Romania's continental biogeographic region, a significant achievement for which the contributors are to be congratulated.

This contribution to knowledge of the Saxon Villages region will be essential for those drawing up future management plans, although the authors and editors would be the first to admit that a huge amount of additional work needs to be carried out.

A brief abstract of the papers in this volume indicates the breadth of coverage.

The first three contributions look into the physical environment, bringing together a wealth of information and literature that comprise essential background material for biological studies of the area. They emphasize the dynamic character of the landscape, with variable river flow and unstable slumping slopes. "Aspects concern the superficial liquid flow in the Târnava Mare River middle hydrographic basin (Transylvania, Romania)" by Valer Dobros presents data for water flow in the rivers, emphasizing the variation between torrential flows and periods of low flow that characterize the area.

The next contribution, "Characteristics of the relief from the central-eastern part of the Târnavelor Plateau, with reference to present modeling and the associate geomorphologic risk (Transylvania, Romania)" by Marioara Costa, explains the geological structure, deformation, instability and erosion of the Târnava Mare plateau. The tendency to landslips is of significance not only to land management but also to the biodiversity of the area. This theme of instability continues in "Stratigraphic considerations on the southern sector of the Târnava Mare Plateau (Transylvania, Romania)" by Rodica Ciobanu, which looks at the complex stratigraphy of the area, including salt and gas deposits. Petrographic factors underlie the present geological instability, which is a major factor in the evolution of this special landscape and its biota.

"Macromycetes of the Breite Nature Reserve of ancient oaks (Transylvania, Romania)" by Livia Bucşa presents preliminary research on 121 species of macro-fungi collected on the Breite plateau in 2006. The author notes that there is at present a low level of interest in fungi, which are a potential economic resource, but suggests a programme of public education, especially with regard to edible and poisonous species.

"The riverside thickets of the Saxon Villages area of south-east Transylvania (Romania)" by Constantin Drăgulescu provides a summary of published botanical information on the area, together with results of the author's study of pools, ditches, tall herb, arborescent communities. Of most concern for conservation are some 500 ha of willow and poplar communities of the *Salicion albae* alliance, which are in need of protection.

Another paper in the volume (15th in the sequence), "The importance of the riparian forest habitat for bird species richness in the Târnava Mare Valley (Transylvania, Romania)" by Cosmin Moga and Kinga Ollerer, looks at riparian communities, showing that 58 bird species occur in riparian forests (27 exclusively in this habitat), whereas 49 occur in other deciduous forests (18 exclusively in this habitat) in the area.

A group of four botanical papers concentrate on grasslands, reflecting that some of the most extensive and best-preserved anthropogenic grasslands in Romania occur in the Târnava Mare Plateau. "Xerophilous and Xero-Mesophilous grasslands on slumping hills around the Saxon villages Apold and Saschiz (Transylvania, Romania)" by Erika Schneider is a summary of the author's important long-term studies of unstable, species-rich hillocks that are a landscape feature of the Saxon Villages. The complex mosaic of xerophilic, mesophilic and even montane species, with local small-scale variation in plant communities, on steep, often unstable slopes is of great ecological importance and requires careful conservation measures.

In his paper "The challenge of High Nature Value grasslands conservation in Transylvania (Romania)", Andrew Jones examines the grassland communities mosaic in the Târnava Mare Plateau with reference to the conserving farm grassland in the face of the profound economic changes resulting from Romania's EU accession. A key aspect of grassland conservation will be to protect and manage large contiguous areas, ensuring that farmers receive benefit from biodiversity conservation measures taken.

"The xero-mezophilic and xerophilic grasslands of *Festuco-Brometea* class in the Sighisoara-Târnava Mare potential Natura 2000 site (Transylvania, Romania)", by Silvia Oroian, Mariana Hiritiu and Manuela Curticapean, identifies the principal habitats and communities in the floristically rich dry grassland that is such a feature of the area. The authors provide extensive phyto-sociological tables and note the presence of 25 species of considerable rarity, either threatened at a European level or on national Red Lists. Conversely, the paper "Ruderal flora of the Saxon Villages (Transylvania, Romania): a neglected conservation community" by John Akeroyd looks at a group of plants that are not rare but are often ignored by conservationists but are of major cultural significance. Several of these species have disappeared in other parts of Europe.

Another group of papers looks at the fauna of the Saxon Villages. "Aspects regarding the terrestrial malacofauna of the Saxon Villages area of Southern Transylvania (Romania)", by Voichita Gheoca, presents a preliminary survey and systematic list of 50 molluscs in different habitats, especially riverside thickets, which were richest in species, including the edible *Helix pomatia*, which might be the basis of judicious economic exploitation.

"Benthic macro-invertebrate and fish communities of some southern Târnava Mare river tributaries (Transylvania, Romania)" by Angela Curtean-Bănăduc and Doru Bănăduc is an extensive analysis of macro-invertebrate and fish communities in 15 sections of the rivers feeding the Târnave Mare from the south. The authors show that these rivers are ecologically sensitive, with good populations of protected species, and that the Stejăreni and Criş valleys still remain substantially biologically intact. Other rivers are more impacted by human activity and all will require management and monitoring.

The herpetofauna of the area is an important element, considered in "Regional distribution, dynamic and determinants of breeding pond use in *Pelobates fuscus* (Amphibia) in the middle section of the Târnava Mare Basin (Transylvania, Romania)" by Tibor Hartel, Kinga Ollerer and Cosmin-Ioan Moga. This species to a great extent depends upon the presence of established, vegetated permanent ponds in open areas, without predatory fish. In a more general account, "The herpetofauna of the Sighisoara area (Transylvania, Romania)", Ioan Ghira gives an account of the 13 amphibians and eight reptiles recorded in the area (of a national total herpetofauna of 42) in 2005-7. Notes on ecology, distribution and threats (14 species are threatened, including *Pelobates fuscus*) effectively make this a provisional Red Data book for the area.

There are two papers on birds, that of Cosmin Ioan Moga and Kinga Ollerer (see above), and "Distribution, population size and dynamics of the white stork (*Ciconia ciconia* L.) in the Hârtibaciu River basin (Transylvania, Romania)" by Ferenc Kosa and Tamas Papp. Based on data on breeding pairs collected in 2004, this shows that stork numbers in the Hârtibaciu River basin have decreased by some 30% since 1974, although the population appears to be potentially stable. It is worth noting that Milvus Group (including Tamas Papp), have identified the area as the most important Natura 2000 SPA in Transylvania, notably for its populations of Lesser Spotted Eagle (*Aquila pomarina*). Such high populations of raptors, as of large carnivore mammals, in the area are a good indication of pristine habitats.

The study of "Small mammals (Insectivora and Rodentia) from the Agnita-Sighisoara area (Transylvania, Romania)" by Ana Maria Benedek shows that this group too is richly represented in the area. The variety of habitats, especially the margins of mixed broadleaf forest and cultivated fields, plays an important role, and 13 species (of 19 known) were captured in the present survey.

The last paper looks at this landscape heterogeneity and habitat diversity in relation to human activity past and present and the factors that are driving change. "Future land use change in a traditionally farmed landscape in eastern Europe (Transylvania, Romania)" by Martha Cowell emphasizes the importance of traditional farming practices in maintaining the biodiversity-rich landscape of the Saxon Villages. This High Nature Value farmed landscape is a mosaic landscape, richer in biodiversity than many more homogeneous wilderness areas. It is the result of hundreds of years of traditional, extensive land management. It can only be conserved if the farmers continue this traditional management.

This diversity of papers reflects the need for a holistic approach to conserve the Saxon Villages region as a geographical, cultural and biological entirety. Like many traditional Romanian farming communities, the villages urgently require restructuring of a damaged, out-of-date rural economy to improve incomes and prospects, especially for younger people. Farming communities and wetlands, grasslands and other habitats face an uncertain future. Continuation of traditional land management must be actively encouraged as part of the future management plan for the region, much of which is now a Protected Area under Romanian law as a result of Natura 2000 designation. The challenge is to create a stable rural society and improve farming incomes whilst protecting the unique ecological and cultural landscape of the Saxon Villages. Conservation must not inhibit economic prospects of local people. Agriculture must drive biodiversity conservation as well as community regeneration.

In 2008, the European Union completed the designation of approximately 85,000 ha, including 35 villages with some 21,000 inhabitants, as a Natura 2000 SCI (Site of [European] Community Interest), overlapping with an approximately 250,000 ha SPA (Special [Avifaunistic] Protection Area). The Saxon Villages now comprise the single largest Natura 2000 site in continental Romania, exceptional for its size, high level of agriculture and sizeable human population. Natura 2000 makes local people eligible for special grants and funding, offering a way forward for conservation. Hopefully future volumes of ***Transylvanian Review of Systematical and Ecological Research*** will record progress in addressing this important task.

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