

CONSERVATION STATUS OF SOME PEATBOGS IN MARAMUREȘ COUNTY

Oana Danci *

* "Lucian Blaga" University of Sibiu, Faculty of Sciences, Applied Ecology Research Center, Dr. Ioan Rațiu Street, 5-7, Sibiu, Romania, RO-550012, oanadanci@gmail.com

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ABSTRACT

Peat bogs and specially raised bogs are vulnerable ecosystems all over the world and they create refuges for some rare plant species. The aim of this paper is to provide information regarding the conservation status of five oligotrophic peat bogs situated in the volcanic mountains in the Oriental Chain of Carpathians, in Maramureș County. The studied peat bogs are: Tăul lui Dumitru (Dumitru Pond), Mlaștina Vlășinescu (Vlășinescu Peat bog), Iezeru Mare (Big Tarn), Tăul Chendroaiei (Chendroaiei Pond) and Tăul Negru (Black Pond), all of them have the status of nature reserve and under the IUCN categories they are included in category IV Habitat/Species Management Area (www.iucn.org, 2016). The analysis of the selected peat bogs reveals that all five of them have the vegetation included in the Natura 2000 priority habitat 7110* Active raised bogs. The conservation status of these peat bogs was evaluated and it is variable from moderate to very good conservation status.

ZUSAMMENFASSUNG: Der Erhaltungszustand einiger Torfmoore im Kreis Maramuresch.

Die Torfmoore vor allem die lebenden Hochmoore, sind weltweit gefährdete Ökosysteme, die Rückzugsgebiete für einige seltene Pflanzenarten darstellen. Ziel der vorliegenden Arbeit ist es, Informationen über den Erhaltungszustand von fünf in den vulkanischen Gebirgen der Ostkarpaten im Kreis Maramuresch gelegenen oligotrophen Torfmooren zu liefern. Die untersuchten Moore sind der Tăul lui Dumitru, das Vlășinescu-Moor, der Große Iezer/Iezeru Mare, das Chendroaiei-Moor/Tăul Chendroaiei und das Schwarze Moor/Tăul Negru, die alle den Status eines durch das Gesetz 5/2000 ausgewiesenen Naturschutzgebietes haben. Auch gehören sie laut IUCN Kriterien in die vierte Kategorie der Habitat und Arten Management-Gebiete (***, 2016). Die Analyse der ausgewählten Torfmoore führt zu dem Schluss, dass die Vegetation aller fünf Moore dem prioritären Habitattyp 7110* Naturnahe lebende Hochmoore angehört. Der Erhaltungszustand dieser Torfmoore wurde naturschutzfachlich mit einer Schwankung zwischen mäßig bis sehr gut bewertet.

REZUMAT: Starea de conservare a unor mlaștini de turbă din județul Maramureș.

Mlaștinile de turbă, și în special tinoavele bombate active, sunt ecosisteme vulnerabile la nivel global și constituie refugii pentru specii rare de plante. Scopul acestei lucrări este de a oferi informații referitoare la starea de conservare a cinci mlaștini oligotrofe de turbă, situate în munții vulcanici din lanțul Carpaților Orientali, pe teritoriul Județului Maramureș. Mlaștinile care fac obiectul acestui studiu sunt: Tăul lui Dumitru, Mlaștina Vlășinescu, Iezeru Mare, Tăul Chendroaiei și Tăul Negru, toate încadrate ca rezervații naturale și în categoria IV IUCN. Analiza mlaștinilor de turbă selectate relevă apartenența vegetației lor la habitatul prioritar European 7110* Tinoave bombate active. Starea de conservare a mlaștinilor studiate variază de la medie până la foarte bună, în funcție de impactul antropic manifestat asupra lor.

INTRODUCTION

Peat bogs and especially active raised bogs are both very robust and vulnerable systems (Casparie, 1993). In Europe there are a very low number of active raised bogs unaffected by human impact, except in Finland and Sweden, where active raised bogs are the main bog complex in hemiboreal and south-boreal areas (Gafta, 2008).

The paper presents the conservation status of five peat bogs situated in Maramureş County, in the volcanic mountains of Igriş, Gutâi and Țibleş. The studied peat bogs are: Tăul lui Dumitru (Dumitru Pond), Mlaştina Vlăşinescu (Vlăşinescu Peat bog), Iezeru Mare (Big Tarn), Tăul Chendroaiei (Chendroaiei Pond) and Tăul Negru (Black Pond), all of them have the status of nature reserve declared by Law 5/2000 and under the IUCN categories they are included in the 4th category IV Habitat/Species Management Area (www.iucn.org, 2016).

Due to the great conservation value of these peat bogs, Tăul lui Dumitru and Iezeru Mare are included in Natura 2000 site ROSCI0092 Igriş and Tăul Chendroaiei is included in Natura 2000 site of community importance ROSCI0089 Gutâi – Creasta Cicoşului, by the Order of the Ministry of Environment and Sustainable Development 1.964/2007.

The pillars of nature conservation policy in Europe are Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive, and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, known as the Birds Directive (European Commission 1992, 1995, 2007; European Parliament and Council of Europe, 2009). The implementation of these directives leads to the establishment of the Natura 2000 Network.

In Romanian legislation, the Habitats Directive and Birds Directive are enforced by Governmental Emergency Ordinance no. 57/2007 regarding the protected areas regime, conservation of natural habitats and wild flora and fauna, completed and modified by Law 49/2011 and by Governmental Emergency Ordinance no. 31/2014.

Those peat bogs that have the status of nature reserve were studied and the results were published in the 1960's by Pop and in 2005 by Drăgulescu. The aim of this paper is to provide more data regarding these peat bogs and their conservation status.

MATERIAL AND METHODS

Five of the oligotrophic *Sphagnum* peat bogs situated in the Oriental Chain of Carpathian Mountains in Maramureş County were selected for this study. The selection was made in order to analyze peat bogs with similar conditions of altitude and flora structure.

The data field collecting was conducted in August 2016. For each of the peat bogs data collecting sheets were created for the habitat structures. The plant species were identified in the field using the field guide elaborated by Sârbu et al. (2012) and the other species that were not identified in the field were identified in the office using the Flora Republicii Populare Române. (*, 1952-1976, Flora R.P.R.-R.S.R.). The scientific names of the plants were updated using Flora Europaea (**)(<http://ww2.bgbm.org/EuroPlusMed/query.asp>).

Because no specific data regarding the surface of the peat bog was collected before, it was also necessary to collect GIS data. The centre of each peat bog and the whole area were registered using GPS receptor Garmin Dakota 10. The GIS data were analysed in the laboratory using Arc Map 10.3. Only the surface of the peat bog was mapped, not all the surface of the protected area.

Also, in order to establish the conservation status of the peat bogs, any marks of anthropic impact were registered. Invasive alien species were also registered for each of the peat bogs.

Where necessary, some minimum conservation measures were recommended.

RESULTS AND DISCUSSION

The location of the studied peat bogs in Maramureş County is presented in figure 2. The peat bogs are situated in the volcanic mountains of Igriş, Gutâi and Tibleş, in the mountain layer of vegetation, at altitudes between 881 and 1,153 m (Tab. 1).

Table 1: Geographic information related to the studied peat bogs.

Peat Bog	Altitude and GPS coordinates of the centre	Surface (hectares)	Peat volume (Pop, 1960) (m ³)	Thickness of peat layer (Pop, 1960) (m)
Vlăşinescu	Altitude 881 m N 47°44.817' E 023°43.378'	3.403	50,000	3.5-5.5
Iezerul Mare	Altitude 1,005 m N 47°48.500' E 023°49.526'	10.120	300,000	7
Tăul lui Dumitru	Altitude 71,142m N 47°49.458' E 023°41.894'	2.267	180,000	5.5
Tăul Chendroaiei	Altitude 1,053 m N 47°42.589' E 023°50.159'	2.269	Not evaluated	Maximum 8
Tăul Negru	Altitude 1,137 m N 47°39.649' E 023°55.971'	0.566	Not evaluated	Not evaluated

Vlăşinescu Peat Bog

Vlăşinescu Peat Bog (Fig. 1) is situated on Izvoare volcanic plateau, close to the tourist complex of Izvoare, at an altitude of 881 m, and the bog has a surface of about 3.403 hectares. The bog is included in the Nature reserve which has similar name. A detailed map of the bog is presented in figure 2. The peat bog was formed in an ancient volcano crater (Pop, 1960) and it has natural borders that consist of the Vlăşinescu Stream and Alders Stream and it is part of the administrative territory of Deseşti municipality.

The main Natura 2000 habitat is the 7110* Active raised bog, characterised by the plant associations *Sphagnetum magellanicum* and *Eriophoro vaginato-Sphagnetum*. Also in the area are the associations *Empetro-Vaccinietum*, *Carici rostratae-Sphagnetum*, *Carici echinatae-Sphagnetum* and *Carici flavae-Eriophoretum*.

The plant list includes the following: *Sphagnum magellanicum*, *Sphagnum recurvum*, *Drosera rotundifolia*, *Andromeda polifolia*, *Empetrum nigrum*, *Carex echinata*, *Carex rostrata*, *Eriophorum vaginatum*, *Vaccinium uliginosum*, *Vaccinium vitis idaea*, *Vaccinium oxycoccus*, *Calluna vulgaris*, *Potentilla erecta*, and *Lycopodium inundatum*, etc.

Vlăşinescu peat bog is surrounded by mesophilous meadows used as pastures and occasionally the sheep use also the area of the peat bog as a pasture, affecting its conservation status. The impact of the pasturing on the vegetation structure is low. Even though the area is situated close to the tourist complex of Izvoare, the anthropic impact generated by tourism is also low, and we can conclude that the conservation status of Vlăşinescu peat bog is favourable.

No invasive alien plant species were identified in the study area. Vlășinescu peat bog Nature Reserve has a custodian and also management plan.



Figure 1: Vlășinescu peat bog map.

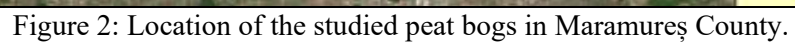
Iezerul Mare

Iezerul Mare peat bog is situated in the administrative territory of Desești municipality, the village of Hărnicești and is also known by the local inhabitants as Hărniceștilor Pond. Iezerul Mare is a protected area declared by Law 5/2000 and it is included in Natura 2000 site ROSCI0092 Igriș. A detailed map of Iezerul Mare is presented in figure 3.

It is a typical raised bog, with a convex shape; the central area is about six-seven metres higher than the periphery of the raised bog. In the centre of the raised bog is a pond that has a surface area of about 250 m². Two streams issue from the raised bog – the Iezerului Stream and the Sărita Iezerului Stream.

The main Natura 2000 habitat is the 7110* Active raised bog, characterised by the plant associations *Eriophoro vaginato-Sphagnetum*, *Vaccinietum uliginosi* and *Empetretum-Vaccinietum*.

The main species in the area are: *Sphagnum* sp., *Andromeda polifolia*, *Drosera rotundifolia*, *Empetrum nigrum*, *Vaccinium uliginosum*, *Vaccinium oxycoccus*, *Vaccinium vitis-idaea*, *Molinia coerulea*, and *Scheuchzeria palustris*.



From our observations in this area, made in 2012, the central part of the peat bog is being invaded by young saplings of birch (*Betula pendula*) and buckthorn (*Frangula alnus*) that may in time affect the structure of this bog by afforestation. The peat bog is surrounded by mountain pastures, but no impact related to agricultural practices was noticed on the peat bog surface. Also no anthropic drainage affects the peat bog.

The bog and also the protected area are well preserved, and the conservation status of the peat bog is favourable. The custodian of the Iezerul Mare peat bog is Maramureş Mountains Nature Park Administration that also administrates the Natura 2000 site Igriş.

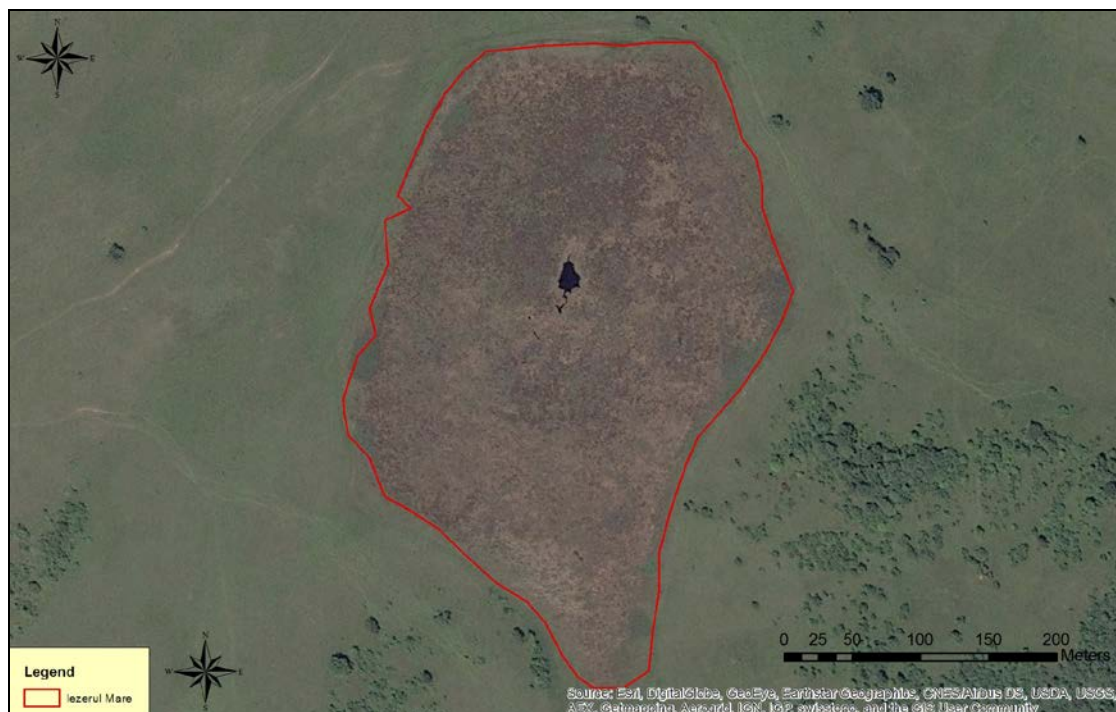


Figure 3: Detailed map of Iezerul Mare peat bog.

In order to maintain the favourable conservation status, ecological rehabilitation measures are needed. One of our recommendations is related to the cutting of the birch and buckthorn saplings on the area.

Restoration of raised bogs in Central Europe influenced by drainage, agricultural use, forest use, afforestation and peat extraction is a common practice. In Switzerland, between 2% and 5% of the former surface of area is still covered by bogs. Starting in the 1980's, efforts have been made to apply restoration measures (Pfadenhauer and Klotzli, 1996).

Tăul lui Dumitru

Tăul lui Dumitru raised bog is situated in Igriş Mountains, at an altitude of 1,142 m, between Brazilor Valley and Sturului Valley in an ancient volcano crater (Pop, 1960). It is located in the administrative territory of Baia Mare and Giuleşti municipalities.

The raised bog is surrounded by spruce forest and at the margins of the raised bog small spruces are growing. In the centre of the raised bog there is a pond 900 m². A detailed map of Tăul lui Dumitru raised bog is presented in figure 4.

Tăul lui Dumitru raised bog is a nature reserve declared by Law 5/2000 and it is included in Natura 2000 site ROSCI0092 Igriș.

The main Natura 2000 habitat is the 7110* Active raised bog, characterised by the plant associations *Carici rostratae-Sphagnetum*, *Scheuchzerietum palustris*, *Empetro-Vaccinietum*, *Eriophoro vaginato-Sphagnetum* and *Vaccinietum uliginosi*.



Figure 4: Detailed map of Tăul lui Dumitru raised bog.

The main species in the area are: *Sphagnum* sp., *Andromeda polifolia*, *Drosera rotundifolia*, *Empetrum nigrum*, *Vaccinium uliginosum*, *Vaccinium oxycoccus*, *Vaccinium vitis-idaea*, *Scheuchzeria palustris*, *Carex rostrata*, *C. limosa*, *Eriophorum vaginatum*, and *Picea abies*.

The raised bog is well preserved due to limited access and the conservation status is very good. No management measures are needed supplementary to the applied ones, mentioned in the management plan of the Natura 2000 site ROSCI0092 Igriș.

Tăul Chendroaiei

Tăul Chendroaiei is located on the northern slope of the volcanic Gutâi Mountains, under the Creasta Cocoșului (Cock's Ridge) geographical formation. It is situated at an altitude of 1,153 m and occupies a surface of 2.26 hectares. It is located in the administrative territory of Ocna Șugatag municipality. The raised bog has a typical convex shape, with the centre about six m higher than the margins of the raised bog. In the centre of the raised bog there are two water ponds, as marks of a former lake. A detailed map of Tăul Chendroaiei raised bog is presented in figure 5.

The raised bog is surrounded by mountain pastures in the south and east part and by forest in the northern and west parts. In the eastern part of the raised bog there is an access road. The area has had a status of nature reserve since 2000 and it has been included in the Natura 2000 site ROSCI0092 since 2007. The main Natura 2000 habitat is the 7110* Active raised bog, characterised by the plant associations *Empetro-Vaccinietum* and *Eriophoro vaginato-Sphagnetum*. A secondary habitat is 7120 Degraded raised bogs still capable of natural regeneration.

The main species in the are: *Sphagnum recurvum*, *Sph. magellanicum*, *Sph. fuscum*, *Polytrichum strictum*, *Vaccinium uliginosum*, *Vaccinium vitis-idaea*, *Vaccinium oxycoccos*, *Vaccinium myrtillus*, *Empetrum nigrum*, *Eriophorum vaginatum*, *Drosera rotundifolia*, *Molinia coerulea*, *Carex pauciflora*, *Carex limosa*, *Lycopodium inundatum*, *Scheuchzeria palustris*, and *Andromeda polifolia*. Some of the rare species are presented in figures 6 to 9.



Figure 5: Detailed map of Tăul Chendroaiei raised bog.

Tăul Chendroaiei is one of the most visited raised bogs in Maramureş, due to the fact that it is close to the well-known and spectacular volcano formation Creasta Cocoşului. The main anthropic impact in the raised bog area is due to tourism and to pasturing activities. At the time of our visit in the field in August 2016, we observed trails of all-terrain vehicles on the peat surface, close to the two water ponds in the centre. The margins of the water ponds were collapsed into the water. Also in some points, about 5% of the surface of the peat bog was bare, not covered by vegetation.

Considering these aspects, we evaluated the conservation status of Tăul Chendroaiei raised bog at medium to good. Some management measures are necessary. The main one is related to access in the protected area. In order to stop the degradation of this valuable and rare ecosystem some physical measures are needed that will stop access with vehicles in the protected area. Tăul Chendroaiei raised bog has a custodian and a management plan.



Figure 6: *Empetrum nigrum*.



Figure 7: *Drosera rotundifolia*.



Figure 8: *Scheuchzeria palustris*.



Figure 9: *Andromeda polifolia*.

Tăul Negru

Tăul Negru raised bog is situated on the southern slope of Țibleș Mountains, in the administrative territory of Strâmbu Băiuf municipality, at an altitude of 1,137 m. It is surrounded by beech forest on the west, south and east sides and by a mesophilous meadow on the north side. A detailed map of the raised bog Tăul Negru is presented in figure 10.

In the centre of the raised bog there is a small water pond and the water in the raised bog is naturally drained in the Pleșca Stream.

The main Natura 2000 habitat is the 7110* Active raised bog area, is characterised by the specific plant associations *Empetro-Vaccinietum* and *Eriophoro vaginato-Sphagnetum*.

The main plant species in the raised bog are: *Sphagnum* sp., *Polytrichum* sp., *Empetrum nigrum*, *Eriophorum vaginatum*, *Eriophorum angustifolium*, *Carex pauciflora*, *Carex rostrata*, *Carex canescens*, *Carex biharica*, *Nardus stricta*, *Vaccinium uliginosum*, *Vaccinium oxycoccus*, *Vaccinium vitis-idaea*, and *Drosera rotundifolia*.



Figure 10: Detailed map of the Tăul Negru raised bog.

Tăul Negru raised bog has the status of nature reserve and it is declared by Law 5/2000. It has a custodian and a management plan. Due to the difficult access to the raised bog, the area is not affected by any human impact and the conservation status of the area is very good. No supplementary management measures are needed.

CONCLUSIONS

The five studied raised bogs situated in the mountain layer of vegetation of Igriş, Gutâi and Tibleş mountains in the Oriental Carpathians chain have the status of nature reserve; Iezerul Mare and Tăul lui Dumitru are also included in Natura 2000 site ROSCI0092 Igriş and Tăul Chendroaiei is included in Natura 2000 site ROSCI0089 Gutâi.

All five studied areas are characterised by the main priority Natura 2000 habitat 7110* Active raised bog, and occasionally, where anthropic impact is present, there are areas of the habitat 7120 Degraded raised bogs still capable of natural regeneration.

Iezerul Mare is the only raised bog affected by invasive alien plant species, the central area of the peat bog is invaded by young saplings of birch (*Betula pendula*) and buckthorn (*Frangula alnus*) that may in time affect the structure of this bog by afforestation.

Tourist activities and agriculture are the main threats to the conservation status of the studied area. The impact of these threats on the raised bogs determined the conservation status, which varies from medium on Tăul Chendroaiei raised bog to very good in Tăul lui Dumitru and Tăul Negru.

In order to maintain and improve the conservation status, some management measures are needed, especially related to restoration of Iezerul Mare raised bog and tourist access in Tăul Chendroaiei. Public awareness measures are also welcome.

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