



Floristic study of a protected wetland from Borsaros-Sancraieni, Harghita County, Romania

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Abstract. In this paper we intend to present a brief floristic survey and the old literature data over an interesting area in the Harghita County, Romania, Borsaros-Sancraieni swamp reserve, area protected since the beginning of 1939. Important personal scientific observations are highlighted. This paper was written specially to reveal the diversity of vascular flora from this area and the surroundings, and the risks which treat this bog. We confirm the presence of main characteristic species of this swamp type and complete the vascular flora species list. This area was mentioned as an important refuge of some rare glacial relict plant species of main conservation importance as: *Betula humilis* Schrank, *Drosera anglica* Hudson, *Ligularia sibirica* L. and *Saxifraga hirculus* L. Also, we would like to signal a significant change of the initial habitat, for which the area was designated a protected area, due in particular to the anthropic activity but also the lack of involvement in the conservation of nature at local and regional level.

Key Words: vascular flora, swamp reserve, *Betula humilis* Schrank, *Drosera anglica* Hudson, *Ligularia sibirica* L., *Saxifraga hirculus* L., species list, habitat loss, adventive species.

Introduction. Today, many natural reservations wide world are affected in terms of biodiversity loss due to inadequate and un-sustainable use of natural resources. Therefore, studies that contribute to knowledge of the natural heritage are welcome in all fields related to environment (Vintila 2010; Yahya et al 2012; Yang et al 2012; Yuan et al 2012). Our present study is such a case. The studied area (this eutrophic swamp Figure 1, 2 and 3) is located in Olt river basin, in the central part of Romania, Harghita County (Figure 1a, c), south from Miercurea-Ciuc city (Figures 1b, d, f, aerial photo and e). The reserve belongs to the inner Carpathian area with peat soils, GPS: 46°18' N – 25°50' E; Elevation: 649 m; Surface: 2.6 ha (Figure 1); Climate: it is continental with low temperatures during winter.

Borsaros-Sancraieni wetland reserve, used to present an oligotrophic state, with a reduced biomass production. In the swamp area grow some rare plants, considered to be glacial relicts. The swamp is fed by mild acidic (ferrous) springs, with T°C=16-20 and pH 6-6.5, the peat pH around the values of 7-8. This marsh area was established in 1939 as a reserve.

In the wetland reserve from lower Ciucului Basin – Natura 2000 Sites, the following threatened habitats have been identified: EUNIS G1, broadleaf deciduous forests; Habitats Directive DH 91E0* Alluvial Woodlands with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno padion*, *Alnion incanae*, *Salicion albae*); Bern Convention 44.1 willow formations (OUG 57/2007 - Ordonanta de Urgenta nr. 57 din 20 iunie 2007, Romanian legislation, Convention of the Conservation of European Wildlife and Natural Habitats Bern, 1979; habitat R5412 South Eastern mesotrophic Carpathian marshes, with *Carex diandra* (Donita et al 2005); Correspondence: NATURA 2000 7140 Transition mires and quaking bogs. CORINE 54.5 transition mires. EUNIS: D2.32 *Carex diandra* quaking mires.

Land use: The area has a mixed system of property, public and private. It is designed for nature conservation and scientific research. It is mown towards the end of the vegetation period (august) which is not necessarily favorable for the plant species but is also cultivated with various crops (except the central protected area – Figure 1).

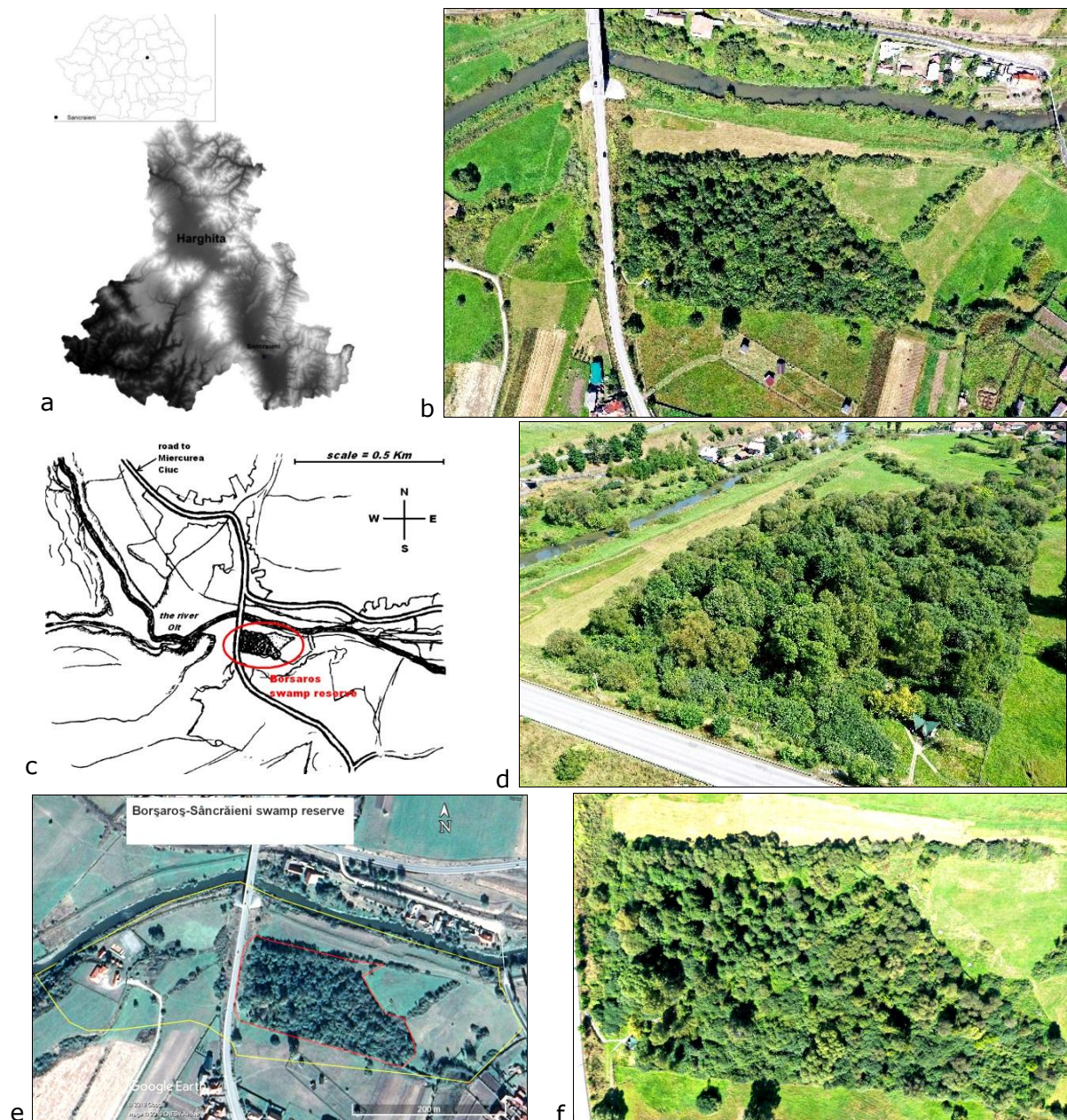


Figure 1. Borșaroș-Sâncrăieni area (Harghita): a – Harghita county and Borșaroș area; b – Sâncrăieni area (aerial photo) and Borsaros swamp reserve; c - Borșaroș-Sâncrăieni general area (original drawn map); d – aerial photo of the reservation (2019); e - map based on aerial photo (Google Earth), on yellow margin polygon the estimated original wetland area (more than 100 000 m²), on red the actual protected area (2019); f - original aerial photo of Borșaroș wetland reserve, actual surface, measured by us 26,352 m² (2019).

Brief historical surveys. The first researcher who studied the Borșaroș-Sâncrăieni area and the surrounding areas was Erasmus I. Nyarady. He discovered, in 1925, this wetland near Sâncrăieni, the swamp was fed by the mineral springs called by locals "Borșaroș" (Nyarady 1924, 1926, 1929a, b).

In 1929, E. I. Nyarady published a small geographical description of the swamp, mentioning also a part of the flora that grows in that area. At that time, he also declared: "I do not know a similar swamp in the entire Ciucului river basin". The plant species collected by E. I. Nyarady were introduced by Al. Borza in the collection "Flora Romaniae Exsiccata" (Nyarady 1929, b).

On 15-16th of June 1927, the botanist E. Pop visited the "Harmasliget" from Borsec swamp and he discovered the glacial relict *Betula humilis*. In 1928, he published an article in which noted that the "Borșaroș" swamp was the southernmost known point at the time being for *B. humilis* (Pop 1928). Starting with the year 1927, E. Pop performed a series of field investigations in Ciucului river basin, year that he visited the "Borsaros" swamp, and suggested immediately after a form of protection for this area (Pop 1938, 1954, 1956, 1960).

On the 17th of July 1941, A. Boros, after a field investigation, indicated for the first time the existence of a single specimen of *Betula zimpelii* Junge (*Betula X zimpelii*) and of the species *Ligularia sibirica* (Boros 1941). In 1942, Boros returned to Borșaroș and discovered the moos species *Meesea hexasticha*, indicating this swamp from Sâncrăieni the southernmost location of this glacial relict (Boros 1943).

R. Soo performed many field investigations to see and examine the flora of this region (Soo 1944). He later cited several species from "Borșaroș", but many of them were indicated before by E. I. Nyarady, and some of them by A. Boros. In 1944, R. Soo published a paper on land vegetation, which revealed three phytocoenological surveys conducted in "molinietele" from "Borșaroș" and where we can find *Drosera anglica*, *Saxifraga hirculus* and *Betula humilis* (Soo 1944). In addition, in 1944, J. Keller mentioned several plant species from this swamp (Keller 1944).

In a campaign to research the peat bogs and deposits of Romania, between 1950 and 1960, E. Pop visited again the swamp where he rediscovered the species *Ligularia sibirica f. araneosa* (Pop 1960). E. Pop searched in vain for *Drosera anglica* but did not find it, and considered this species extinct from this reservation (Pop 1954). In 1957, he returned and counted 28 specimens of *Betula humilis* from this swamp (Pop 1960). In the monograph of peat bogs from Romania, E. Pop described the flora of this area and mentioned that the reserve was in worse state. He mentioned that in this swamp were present at the time being only a few debilitated specimens of *Saxifraga hirculus*, *Drosera anglica* being extinct. In the west portion of the swamp, an unprotected area at that time, Pop E. founds few, small specimens of *Saxifraga hirculus* and *Drosera anglica*, specimens threatened and endangered by drainage and mowing (Pop 1960).

A geologist, named A. Kristo, born in Sâncrăieni, studied the "Borșaroș" swamp, studying aspects of hydrology and protection of this area (Kristo 1958); A. Kristo also cited the drilling works from the year 1964 made in this reserve and their consequences (Kristo 1991).

In 1977, F. Ratiu rediscovered *Drosera anglica* in "Borșaroș" swamp, probably in the western side of the area and published the coenotical state of this species (Ratiu 1977). In 1980, F. Ratiu raised the alarm regarding the conservation status of *Saxifraga hirculus* from Ciucului basin. Urgent protection measures were required, designed to save the species from extinction (Ratiu 1980). After 1990, Vass, Kolumbanand Kerekes, critically analyzed the state of conservation of all the reservations from Ciuc basin, including the "Borșaroș-Sâncrăieni" reserve (Jakab et al 2007). Beside this, there are other new studies available in literature concerning the flora and vegetation of this area and they were also included in this survey (Borza & Ratiu 1974; Boscaiu 1989; Dragulescu 1999; Sarbu 2007).

Material and Method. All the studies have been made on the basis of field surveys between 2006 and 2019 and the old literature over this area. Visual inspections have been carried out in the area in order to identify the species habitat and the human activity. The habitat and all plant species have been identified with the help of the scientific literature (Ciocarlan 2009; Donita et al 2005; Dragulescu 1999; Savulescu 1952-1976; Speta & Rakosy 2010). Aerial surveys were carried out in the summer of 2019 and are presented in Figure 1b, d, f. All the investigated species are mentioned as from the reservation area and close surroundings (small buffer zone). All plant species are mentioned in alphabetical order. The aerial photos are original and are taken with a DJI Mavic 2 Pro pilotless flying device with 20MP Hasselblad camera and a hand camera. We also used Google corporation products (Earth) and ArcView GIS for area mapping.

Our goal was to study the general wetland plant diversity (Negrea & Pricop 2009). The main data is presented in Figure 1, 2, 3 and 4.

Results and Discussion. Floristic composition list – floristic conspectus, (*Pteridophyta* and *Magnoliophyta*) on the basis of the old literature survey and the new data is presented below. These are all the species that are occurring in the reservation and in some areas near the reservation. Some species from below, mentioned in older studies, are extinct from Borșaroș–Sâncrăieni reserve.

***Pteridophyta*:**

Dryopteris carthusiana (Will) H. P. Fuchs (syn. *D. spinosa* Watt), *Dryopteris cristata* (L.) A. Gray, *Dryopteris dilatata* (Hoffm.) A. Gray (syn. *D. austriaca* auct.), *Dryopteris expansa* (C. B. Presl.) Fros-Jenkf Jermy, *Equisetum arvense* L., *Equisetum fluviatile* L., *Equisetum palustre* L., *Equisetum pratense* Ehrh., *Equisetum sylvaticum* L., *Equisetum telmateia* Ehrh. (syn. *Equisetum maxima* L.).

***Magnoliophyta*:**

Acer campestre L., *Acer negundo* L., *Achillea distans* L., *Achillea millefolium* L., *Aconitum moldavicum* Hacq (incl. *A. hosteanum* Schur), *Aegopodium podagraria* L., *Agrostis capillaris* L., *Agrostis stolonifera* L., *Alisma plantago-aquatica* L., *Alopecurus aequalis* Sobol., *Alopecurus pratensis* L., *Alnus glutinosa* (L.) Gaertner, *Alnus incana* (L.) Moench, *Angelica palustris* (Besser) Hoffm., *Angelica sylvestris* L., *Arctium lappa* L., *Arrhenantherum elatius* (L.) Beauv ex J. et C. Presl, *Artemisia vulgaris* L., *Asarum europaeum* L., *Barbarea vulgaris* R.Br., *Bellis perennis* L., *Berula erecta* (Hudson) Coville, *Betula humilis* Schrank, *Betula pendula* Roth., *Betula pubescens* Ehrh., *Betula x zimpelli*, *Bidens tripartita* L., *Bolboschoenus maritimus* L., *Briza media* L., *Calamagrostis canescens* Weber ex FH Wigg. Roth, *Caltha palustris* L., *Calystegia sepium* (L.) R.Br., *Campanula patula* L., *Capsella bursa-pastoris* (L.) Medik, *Cardamine impatiens* L., *Cardamine pratense* L., *Carduus glaucus* Baumg., *Carex acutiformis* Ehrh., *Carex canescens* L. (syn. *C. cinerea* Poll.; *C. curta* Gooden), *Carex caespitosa* L., *Carex diandra* Schrank, *Carex distans* L., *Carex flava* L., *Carex echinata* Murray ssp. *echinata*, *Carex elongata* L., *Carex flacca* Schreb., *Carex fusca* All. (syn. *Carex nigra* (L.) Reichard), *Carex gracilis* Ehrhart, *Carex hirta* L., *Carex panicea* L., *Carex lasiocarpa* Ehrh., *Carex limosa* L., *Carex ovalis* Gooden., *Carex paniculata* L., *Carex riparia* Curtis, *Carex rostrata* Stokes, *Carex vesicaria* L., *Carex vulpina* L., *Chamaenerion angustifolium* (L.) Scop., *Carum carvi* L., *Centaurea phrygia* (C. A. Meyer), *Cicuta virosa* L., *Cirsium arvense* L., *Cirsium canum* L., *Cirsium oleraceum* L., *Cirsium palustre* L., *Cirsium rivulare* Jacq, *Cirsium serratuloides* Baumg., *Clematis vitalba* L., *Convulvus arvensis* L., *Corylus avellana* L., *Cucubalus baccifer* L., *Cynosurus cristatus* L., *Dactylis glomerata* L., *Daucus carota* L., *Deschampsia cespitosa* (L.) P. Beauv., *Dianthus superbus* L., *Doronicum austriacum* Jacq., *Drosera anglica* Hudson (syn. *Drosera longifolia* L.) possible extinct (Ex?), *Dactylorhiza incarnata* (L.) Soó, *Dactylorhiza maculata* (L.) Soó, *Echinochloa crus-galli* (L.) Beauv., *Echinocystis lobata* (Michx.) Torr. & Gray, *Elymus repens* (L.) Gould (syn. *Agropyron repens* L.), *Epilobium hirsutum* L., *Epilobium palustre* L., *Epilobium parviflorum* Schreb, *Erigeron annuus* (L.) Desf., *Erigeron canadensis* L., *Eriophorum angustifolium* Honck. (syn. *E. polystachion* L.), *Epipactis palustris* (L.) Crantz, *Eriophorum vaginatum* L., *Euonymus latifolius* (L.) Miller, *Eupatorium cannabinum* L., *Euphrasia stricta* D. Wolff ex J. F. Lehm., *Festuca pratensis* Hudson, *Festuca rubra* L., *Filipendula vulgaris* Moench, *Filipendula ulmaria* (L.) Maxim, *Frangula alnus* Miller (syn. *Rhamnus frangula* L.), *Galium aparine* L., *Galium boreale* L., *Galium palustre* L., *Galium uliginosum* L., *Geranium palustre* L., *Geranium phaeum* L., *Geranium pratense* L., *Geum rivale* L., *Gladiolus palustris* Gaudin, *Glechoma hederacea* L., *Glyceria maxima* (Hartm.) Holmb., *Glyceria notata* Chevall, *Gymnadenia conopsea* L., *Helleborus purpurascens* Waldst. et Kit., *Heracleum sphondylium* L., *Hieracium lactucella* Wallr., *Holcus lanatus* L., *Humulus lupulus* L., *Impatiens noli-tangere* L., *Juncus articulatus* L., *Juncus effusus* L., *Juncus inflexus* L., *Lathyrus palustris* L., *Lathyrus pratensis* L., *Leontodon autumnalis* L., *Leontodon hispidus* L., *Leonurus cardiaca* L., *Leuchanthemum vulgare* L., *Ligularia sibirica* (L.) Cass (syn. L.

bucovinensis Nakai), *Lilium martagon* L., *Listera ovata* (L.) R. Br., *Lolium perenne* L., *Lonicera xylosteum* L., *Lotus corniculatus* L., *Lychnis flos-cuculi* L., *Lycopus europaeus* L., *Lycopus exaltatus* L.f., *Lysimachia nummularia* L., *Lysimachia thyrsiflora* L., *Lysimachia vulgaris* L., *Lythrum thymifolium* L., *Lythrum salicaria* L., *Lythrum virgatum* L., *Matricaria discoidea* DC., *Medicago lupulina* L., *Mentha aquatica* L., *Mentha longifolia* (L.) Hudson, *Menyanthes trifoliata* L., *Molinia caerulea* (L.) Moench, *Myosotis laxa* Lehm., *Myosotis scorpioides* L. (syn. *Myosotis palustris* L.), *Oenanthe aquatica* (L.) Poir., *Orchis laxiflora* Lam., *Padus avium* Mill., *Parnassia palustris* L., *Petasites hybridus* L., *Peucedanum palustre* (L.) Moench, *Phleum pratense* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Pimpinella major* (L.) Hudson, *Plantago major* L., *Plantago media* L., *Poa annua* L., *Poa palustris* L., *Poa pratensis* L., *Poa trivialis* L., *Polygonum amphibium* L., *Polygonum aviculare* L., *Polygonum bistorta* L., *Polygonum laphatifolium* L., *Polygonum persicaria* L., *Potentilla anserina* L., *Potentilla erecta* (L.) Rausch, *Potentilla palustris* (L.) Lehm., *Potentilla reptans* L., *Prunella vulgaris* L., *Pyrola rotundifolia* L. var. *rotundifolia*, *Ranunculus acris* L., *Ranunculus polyanthemus* L., *Ranunculus repens* L., *Ranunculus sardous* Crantz, *Ranunculus scleratus* L., *Rhinantus alectorolophus* (Scop.) Pollich, *Ribes nigrum* L., *Ribes petraeum* Wulfen, *Ribes uva-crispa* L., *Robinia pseudoacacia* L., *Rorripa austriaca* (Crantz) Bess., *Rorripa sylvestris* (L.) Besser, *Rosa canina* L., *Rosa pendulina* L., *Rubus caesius* L., *Rubus idaeus* L., *Rumex acetosa* L., *Rumex crispus* L., *Rumex conglomeratus* Murray, *Rumex obtusifolius* L., *Salix alba* L., *Salix aurita* L., *Salix cinerea* L., *Salix fragilis* L., *Salvia glutinosa* L., *Salix purpurea* L., *Salix pentandra* L., *Salix rosmarinifolia* L., *Salix triandra* L., *Salvia verticillata* L., *Sanguisorba officinalis* L., *Sambucus racemosa* L., *Saxifraga hirculus* L., *Schoenoplectus lacustris* (L.) Pallas, *Scutellaria galericulata* L., *Senecio nemorensis* L., *Senecio sylvaticus* L., *Serratula tinctoria* L., *Silene latifolia* Poir., *Solanum dulcamara* L., *Spiraea chamaedryfolia* L. (syn. *S. ulmifolia* Scop.), *Spiraea salicifolia* L., *Stachys officinalis* L., *Stachys palustris* (L.) Walter, *Stellaria graminea* L., *Stellaria media* L. Vill., *Stellaria nemorum* L., *Succisa pratensis* Moench, *Symphytum officinalis* L., *Tanacetum vulgare* L., *Taraxacum officinale* Weber, *Telekia speciosa* (Schreber) Baumg., *Thalictrum lucidum* L., *Tilia cordata* Mill., *Tragopogon pratensis* L., *Trifolium hybridum* L., *Trifolium repens* L., *Trifolium pratense* L., *Triglochin palustris* L., *Typha angustifolia* L., *Typha latifolia* L., *Typhoides arundinacea* (L.) Moench, *Quercus robur* L. (syn. *Quercus pedunculata* Ehrh), *Ulmus laevis* Pall., *Urtica dioica* L., *Valeriana officinalis* L., *Veronica anagallis-aquatica* L., *Veronica beccabunga* L., *Veronica chamaedrys* L., *Veronica officinalis* L., *Veronica serpyllifolia* L., *Viburnum opulus* L., *Viburnum lantana* L..

In 1929 when the floristic rarities of the marsh were first observed and popularized by the botanist Erasmus Gyula Nyarady - he reported on this marshes with small water surfaces (stagnant water surfaces are not present, in current time, in "Borşaroş"). In 1939 the area was declared a botanical reserve, and since 2007 it is part of the European network of Natura 2000 protected areas (ROSCI0007 Ciucului de Jos Basin/Lower Ciuc Basin).

However, the legal protection failed to stop the surface decrease and degradation of the marsh, which, first of all, is due to the works of sewage and water regulation; the marsh edge was invaded by ruderal plants – some alien invasive species also, the alkaline marsh with open vegetation, with species of sedges turned into hygrophilous weeds and shrubs (Figure 1b, d, f). Among the rare species of the alkaline marsh, there was mentioned a strong population of marsh angelica (*Angelica palustris*), which can now be found only in few specimens today (2019).

Thus, since its decree as a protected area the area was transformed radically (1977, 1985, 2009 source <https://www.eco-turism.ro/>). Attempts to maintain the rare species for the long term were made during this time. In 2014 the local authorities together with the custodians of Natura 2000 Site intervened in the rehabilitation of the marsh.

Since 2014 when the reservation was "furbished" (another wrong practice in nature conservation in Romania) and a thematic trail was created the reservation underwent major changes. The appearance of invasive species caused by lack of water

and global warming (which clearly benefits some invasive species, (*Acer negundo*), have led to the disappearance of some species today and the radical transformation of habitats for which the area has been declared a reserve. An observation would be that non-involvement and ignorance made this reservation practically to lose the unique character and rare species for which it was declared. The uncontrolled spread of invasive alien plant species is among the most urgent nature conservation issues of this century (Pricop & Negrea 2018).

Because of draining and decomposing of the organic matter from the soil, the marsh has changed its chemistry, becoming now from slightly alkaline to slightly acidic meadow, to a swampy forest. The resulting nitrogen compounds lead to a strong nitrification favorable to some ruderal species (*Urtica dioica*). At the time of our investigation this year (August-September) this species had overwhelmed almost the entire vegetal carpet beneath the shaded areas of the reserve, only a few specimens of *Ligularia sibirica* managed to penetrate the compact and tall grass layer of over 1 m formed by *Urtica dioica*. Unless urgent action is taken, the marsh evolves towards the stabilization of another type of habitat, one of heavily ruderalized meadow forest.

The current situation of main protected species

Saxifraga hirculus and its habitat overlaps Harghita County (Nyarady 1924, 1926, 1929a, b). For *Saxifraga hirculus*, we mention other known locations beside "Borsaros": "Dumbrava Harghitei", "Benes" swamp, "Valea Mijlocie" mineral marsh (Pop 1960). "Valea Mijlocie" is the southernmost point of distribution for this species. In 1980, Ratiu considered this species lost (Filip 2007).

Drosera anglica is one of the most vulnerable species. We mention other known locations beside "Borșaroș": "Misentea" (Harghita County), "Ozunca-Bai" (Covasna County) and "Harman", "Stupini", "Prejmer" (Brasov County). We also considered this species lost.

D. anglica was not found in the Borșaroș-Sâncrăieni reservation and it is presumptive to be possible extinct (Ex?) from this area; this species was not seen for nearly 30 years. Also, the moss species and the specific habitat of this mineral springs have been lost.

For ***Betula humilis***, "Borșaroș" reserve is also the southernmost point of distribution. In the past, *B. humilis* population occupied an area of approximately 1,800 square meters, and it was one of the largest populations from Romania, now it is cut down most probably accidentally by the local people. The population is consisting in tens of individuals, vigorous, strong, with an average height of 1.4 meters (data from 2010), but this shrubs have now a larger height (up to 2 meters) because of the pressure (competition for light) put on them by the other growing trees. *B. humilis* population is persistent and is regenerating.

Ligularia sibirica is encountered quite frequently in the swamps of Ciuc depression. The area covered by *L. sibirica* is less than 1,000 square meters, with a maximum density of about 15 individuals per square meter (data from 2019) (Figure 2).

Ligularia sibirica, *Betula humilis* and *Saxifraga hirculus* have been traced by the authors of this paper in the reserve (Figure 3).



Figure 2. "Borșaroș-Sâncrăieni" natural reserve: a, b, d - entrance to the reserve and a mineral water spring named "borsar"; c - an opening, habitat of *Ligularia sibirica* and *Betula humilis*; e, f - habitat of some relict plant species; g - a meadow (habitat dominated by *Salix fragilis* in the northern part of this reserve); f - habitat with *Salix cinerea* and other shrub and trees (original).

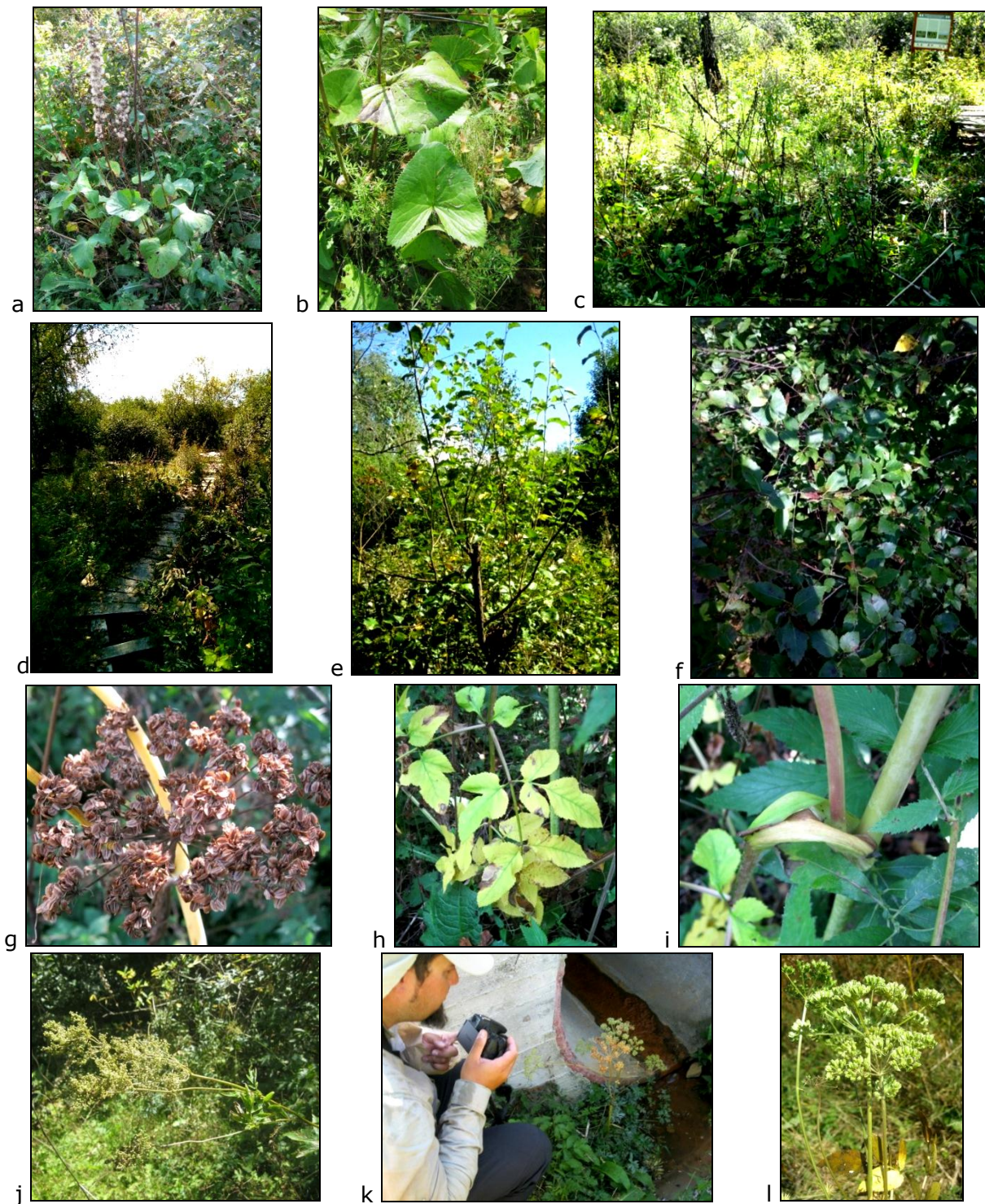


Figure 3. Rare species and habitats from "Borsaros-Sancraieni" reserve:
a, b, c - *Ligularia sibirica*; d – favorable habitat of the few rare relict species; e, f – *Betula humilis*; g, h, i - *Angelica sylvestris*; j - *Filipendula ulmaria*; k - *Angelica palustris* (original).

The major threats to "Borșaroș–Sâncrăieni" reserve are:

The area it is adversely affected by habitat loss due to nearby road and bridge. Moreover, the *Betula pubescens*, *Salix fragilis*, *Alnus glutinosa* and *Acer negundo* populations have developed uncontrolled and aggressive, occupying, stabilizing and shading much of the original habitat. These mentioned plant species are extending over the area with the protected glacial relict plant species (Figure 4).

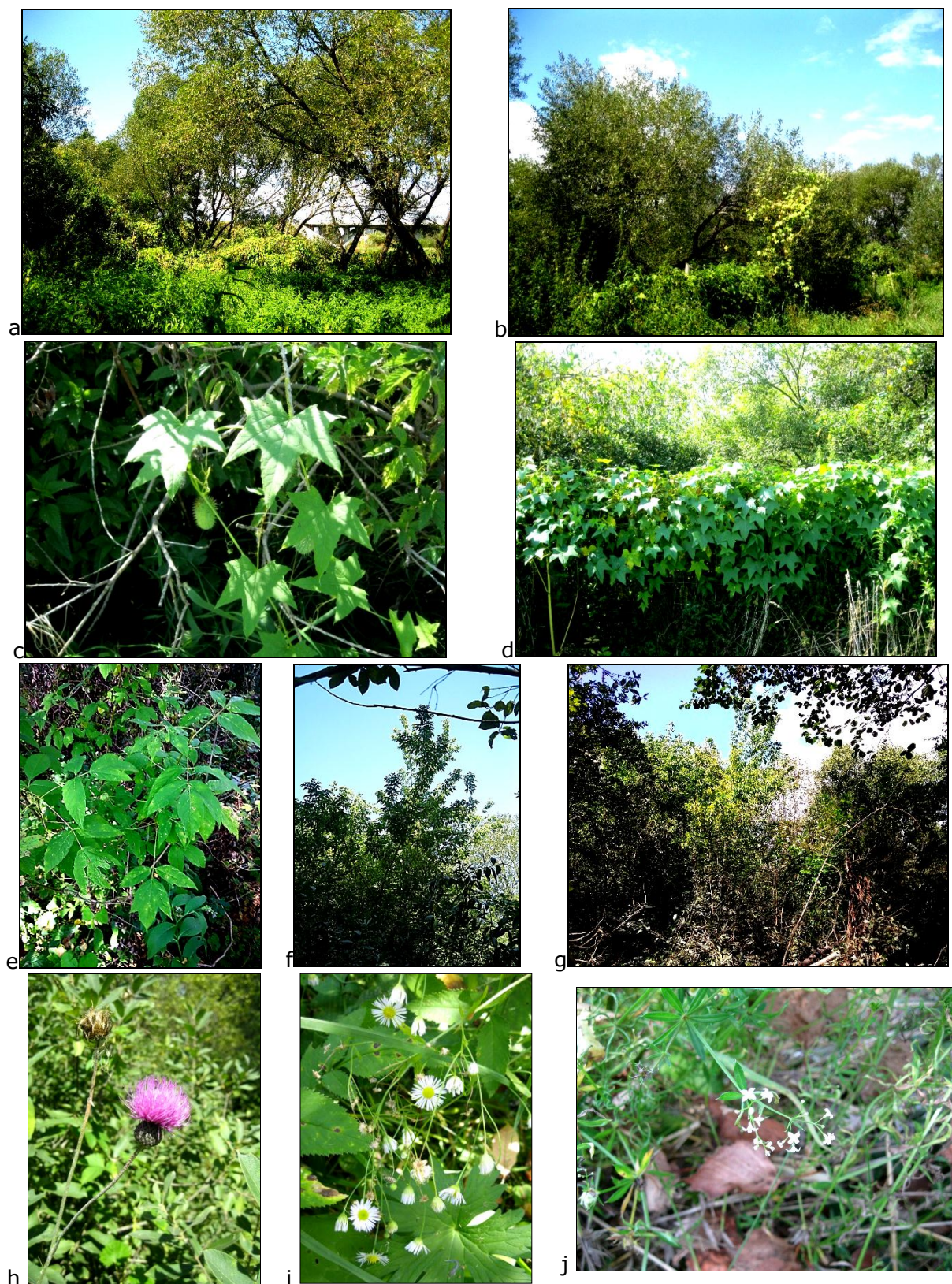


Figure 4. Problematic invasive and ruderal plant species from "Borsaros-Sancraieni" reserve: a, b, c, d – the invasion produced by *Echinocystis lobata*; e, f, g – *Acer negundo* rapidly growing in this reserve; h – *Cirsium canum*; i – *Erigeron annuus*; j – *Galium aparine* (original).

Drainage - the construction of a small canal along Oltului river plain it is causing a lowering water level specially in the summer months.

Anthropic pressure - through habitat loss and *agricultural practices* in Ciucului basin, like mowing practices advantaged the developping of grassland vegetation with reduced biodiversity. Some plant species produce mature fruits late in the summer and cannot reach maturity if mowed (the populations of *S. hirculus*, a species that is spreading its seeds in late summer). The land near the reservation is being cultivated with various crops, agricultural intensification process is occurring (plowing the earth does the most damage than other traditional methods). This protected wetland has no buffer space between the reservation and the agricultural landscape around it. The vegetation was burned many times in the past; individuals of *B. humilis* have been deliberately set on fire to obtain a better production in the former grassland.

This area, once was home to large populations of rare taxa of the Romanian Flora (Olteanu et al 1994): *Dactylorhiza incarnata*, *Betula humilis*, *Drosera anglica*, *Potentilla palustris* and *Lysimachia thyrsiflora*, *Ligularia sibirica*, *Mesia hexasticha* and *Saxifraga hirculus*, now all these species are considered threatened taxa.

Conclusions. The flora of "Borșaroș-Sâncrăieni" natural reserve is an interesting floral mix, containing from the relict species: *Ligularia sibirica*, *Betula humilis*, *Saxifraga hirculus* to the specific flora of eutrophic marshes. Total identified species: Pteridophyta - 10 species, Magnoliophyta - 252 species (a total of 162 species). From the analysis of this flora, we conclude that the majority of vascular plant species (more than 60%) have a northern origin (Eurasian and Circumpolar). The area occupied by the hydrophilic vegetation decreases due to drainage work, instead mesophilic meadows are formed; later, these meadows are covered by shrubs and trees – forming a secondary forested bog.

The site of the reserve, near Sâncrăieni locality, is threatened. The human impact may lead to total and irreversible loss of all protected species. Conservation measures are necessary and a prompt action is needed to eliminate the adventive plant species that invaded this reserve and to restore as much as possible of the previous state with the help of an ecological restoration program.

Beside the water drainage and the water spring exploitation, the most damage was done by the road constructions in the vicinity of "Borșaroș" reserve and river regularization. In these conditions this ex-wetland, in this current state, does not have the necessary wet habitats to sustain the characteristic species.

Proposed actions in support of conservation: all drainage activities should be prohibited and the natural water regime reinstalled if as much as possible.

The extending populations of *Acer negundo*, *Alnus glutinosa*, *Betula pubescens*, *Betula pendula* and *Salix fragilis* should be controlled.

The woody plant species *Betula humilis* and *Salix rosmarinifolia* should be protected, in present time (2019) many specimens belonging to this rare species have been cut down.

The initial wetland, much larger around 100,000 m² became in less than 100 years restricted to only 2.7 ha through drainage and agricultural development of pastures and hayfields. In this reserve used to grow the only Romanian population of the Nordic peat bog moss *Messia hexasticha*; also, in the swamp is still present one of the two populations known in Romania of *Saxifraga hirculus*.

Ligularia sibirica is abundant in Borsaros – Sancrieni area but is declining due to the fast-growing trees. All native herbaceous plant species populations are declining, except *Urtica dioica* and other invasive plant species populations.

Despite the conservation measures taken over time, the lack of continuity makes the current state of the protected area more serious than it was 10 years ago. In our opinion the current state of this reservation reflects the fact that once intervened in the habitats by humans, the balance is extremely difficult to restore and involves the will and coherent projects.

Caught between the anthropic pressure exerted by the village and the river Olt, drained, split by a road and a bridge, restricted to about 2.7 ha the protected area requires

extensive urgent biodiversity restoration work. Otherwise it risks disappearing forever as a landmark in the nature conservation of Romania, becoming slowly but surely simply another trivial and ruderalized wetland.

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