SUPPLEMENTARY MATERIAL

Endangered *Ostericum palustre* – ecological spectrum in the Natura 2000 site Bagno Bubnów and protection methods

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Table S1. The frequency and relative average cover of species building the phytocoenoses with *Ostericum palustre* (number of examined phytocoenoses = 19).

Species	Frequency (%)	Relative average cover (%)
Molinia caerulea (L.) Moench	100.00	32.15
Ostericum palustre Besser	100.00	0.64
Galium verum L.	89.47	1.01
Selinum carvifolia (L.) L.	84.21	6.51
Potentilla erecta (L.) Raeusch.	84.21	2.17
Centaurea jacea L.	84.21	1.58
Briza media L.	84.21	1.53
Carex flacca Schreb.	78.95	5.49
Succisa pratensis Moench	78.95	1.99
Deschampsia caespitosa (L.) P. Beauv.	73.68	1.90
Vicia cracca L.	68.42	1.08
Equisetum arvense L.	68.42	0.74
Ononis arvensis L.	68.42	0.62
Holcus lanatus L.	63.16	1.87
Luzula campestris (L.) DC.	63.16	0.67
Epipactis palustris Crantz	57.89	1.18
Lathyrus pratensis L.	57.89	0.43
Galium boreale L.	52.63	2.94
Lychnis flos-cuculi L.	52.63	0.42
Pimpinella saxifraga L.	52.63	0.29
Leucanthemum vulgare Lam.	52.63	0.17
Cirsium arvense (L.) Scop.	52.63	0.11
Cirsium rivulare (Jacq.) Link	47.37	2.29
Anthoxanthum odoratum L.	47.37	1.67
Festuca arundinacea Schreb.	47.37	0.86
Ranunculus acris L.	47.37	0.39
Leontodon hispidus L.	47.37	0.24

Species	Frequency (%)	Relative average cover (%)
Prunella vulgaris L.	47.37	0.24
Salix aurita L.	42.11	1.60
Festuca rubra L. s. s.	42.11	0.50
Galium uliginosum L.	42.11	0.39
Dactylis glomerata L.	42.11	0.33
Polygonum bistorta L.	42.11	0.22
Campanula glomerata L.	42.11	0.14
Veratrum lobelianum Bernh.	36.84	3.60
Carex panicea L.	36.84	1.82
Poa angustifolia L.	36.84	0.78
Arrhenatherum elatius (L.) P. Beauv.	36.84	0.37
Filipendula ulmaria (L.) Maxim.	36.84	0.20
Viburnum opulus L.	36.84	0.17
Avenula pubescens (Huds.) Dumort.	31.58	0.28
Juncus inflexus L.	31.58	0.25
Phleum pratense L.	31.58	0.25
Lythrum salicaria L.	31.58	0.17
Frangula alnus Mill.	31.58	0.08
Crepis paludosa (L.) Moench	31.58	0.07
Hypericum maculatum Crantz	31.58	0.07
Calamagrostis epigejos (L.) Roth	26.32	1.33
Geum rivale L.	26.32	0.69
Carex flava L.	26.32	0.64
Trifolium medium L.	26.32	0.53
Carex acutiformis Ehrh.	26.32	0.24
Rumex acetosa L.	26.32	0.18
Betula pendula Roth	26.32	0.07
Platanthera bifolia (L.) Rich.	26.32	0.07
Betonica officinalis L.	21.05	2.53
Carex hostiana DC.	21.05	0.51
Sanguisorba officinalis L.	21.05	0.51
Carex buxbaumii Wahlenb.	21.05	0.17
Festuca pratensis Huds.	21.05	0.17
Lysimachia vulgaris L.	21.05	0.17
Salix repens ssp. rosmarinifolia	21.05	0.17
Lathyrus palustris L.	21.05	0.11
Lotus corniculatus L.	21.05	0.10
Thymus pulegioides L.	21.05	0.06
Salix cinerea L.	15.79	0.85
Inula salicina L.	15.79	0.56
Carex hirta L.	15.79	0.50
Phragmites australis (Cav.) Trin. ex Steud.	15.79	0.50
Salix pentandra L.	15.79	0.50

Species	Frequency (%)	Relative average cover (%)
Mentha arvensis L.	15.79	0.21
Achillea millefolium L.	15.79	0.15
Equisetum palustre L.	15.79	0.15
Carex pallescens L.	15.79	0.10
Cynosurus cristatus L.	15.79	0.10
Serratula tinctoria L.	15.79	0.10
Plantago media L.	15.79	0.09
Coronilla varia L.	15.79	0.04
Heracleum sphondylium L.	15.79	0.04
Knautia arvensis (L.) J. M. Coult.	15.79	0.04
Valeriana officinalis L.	15.79	0.04
Plantago lanceolata L.	15.79	0.03
Trollius europaeus L. s. s.	10.53	1.06
Luzula multiflora (Retz.) Lej.	10.53	0.49
Carex nigra Reichard	10.53	0.14
Poa pratensis L.	10.53	0.14
Alnus glutinosa (L.) Gaertn.	10.53	0.08
Campanula cervicaria L.	10.53	0.08
Carex distans L.	10.53	0.08
Carex pairae F. W. Schultz	10.53	0.08
Gentiana pneumonanthe L.	10.53	0.08
Juncus articulatus L.	10.53	0.08
Juncus conglomeratus Ehrh. ex Hoffm.	10.53	0.08
Poa compressa L.	10.53	0.08
Cornus sanguinea L.	10.53	0.07
Carex lepidocarpa Tausch	10.53	0.03
Cerastium holosteoides Fr. em. Hyl.	10.53	0.03
Dactylorhiza incarnata (L.) Soó	10.53	0.03
Dactylorhiza majalis (Rchb.) P. F. Hunt & Summerh.	10.53	0.03
Euphorbia palustris L.	10.53	0.03
Filipendula vulgaris Moench	10.53	0.03
Phleum hubbardii D. Kováts	10.53	0.03
Potentilla reptans L.	10.53	0.03
Rubus idaeus L.	10.53	0.03
Scrophularia nodosa L.	10.53	0.03
Trifolium montanum L.	10.53	0.03
Veronica chamaedrys L.	10.53	0.03
Agrimonia eupatoria L.	10.53	0.02
Cirsium oleraceum (L.) Scop.	10.53	0.02
Listera ovata (L.) R. Br.	10.53	0.02
Potentilla anserina L.	10.53	0.02
Trifolium repens L.	10.53	0.02
Viola hirta L.	10.53	0.02

Species	Frequency (%)	Relative average cover (%)
Iris sibirica L.	5.26	1.04
Carex davalliana Sm.	5.26	0.42
Agrostis canina L.	5.26	0.07
Carex tomentosa L.	5.26	0.07
Laserpitium prutenicum L.	5.26	0.07
Lotus uliginosus Schkuhr	5.26	0.07
Melampyrum sylvaticum L.	5.26	0.07
Mentha aquatica L.	5.26	0.07
Poa trivialis L.	5.26	0.07
Agrostis gigantea Roth	5.26	0.01
Campanula patula L.	5.26	0.01
Carex diandra Schrank	5.26	0.01
Centaurium erythraea Rafn, subsp. *erythraea*	5.26	0.01
Cirsium palustre (L.) Scop.	5.26	0.01
Cnidium dubium (Schkuhr) Thell.	5.26	0.01
Crataegus laevigata (Poir.) DC.	5.26	0.01
Crataegus monogyna Jacq.	5.26	0.01
Daucus carota L.	5.26	0.01
Epilobium hirsutum L.	5.26	0.01
Equisetum fluviatile L.	5.26	0.01
Eupatorium cannabinum L.	5.26	0.01
Festuca ovina L.	5.26	0.01
Genista tinctora L.	5.26	0.01
Hypericum perforatum L.	5.26	0.01
Juncus tenuis Willd.	5.26	0.01
Linum catharticum L.	5.26	0.01
Lycopus europaeus L.	5.26	0.01
Melilotus alba Medik.	5.26	0.01
Pedicularis sceptrum-carolinum L.	5.26	0.01
Pimpinella major (L.) Huds.	5.26	0.01
Populus tremula L.	5.26	0.01
Rumex acetosella L.	5.26	0.01
Verbascum nigrum L.	5.26	0.01
Veronica longifolia L.	5.26	0.01
Solidago canadensis L.	5.26	0.00

Source: own study.

Table S2. Features of phytocoenoses and habitats where *Ostericum palustre* was found – synthesis from the literature and own research

Feature of phytocoenosis	Information from the literature	PLB 060001 Bagno Bubnów
Type of phytocoenosis	• wet meadows of the *Molinietalia* order [a, b, c, l] of which it is a characteristic species [d]; *Filipendulo-Menthetum longifoliae* [e], *Molinion* [f], *Molinietum caerulae* [g]; • some phytoconoses from *Calthion* alliance [c, h], including: *Angelico-Cirsietum oleracei* [g,i], *Cirsietum rivularis* [e]; • the herb phytoconoses of *Filipendulion* [b, e]; • fresh meadows and pastures of *Arrhenatheretalia* order [b, j], *Arrhenetheretum elatioris* [g]; • phytocoenoses of *Phragmitetea* class [g, c, l]: *Phragmites australis* Ass. [h], *Caricetum acutifromis* [g, j], *Caricetum paniculatae* [g], *Caricetum appropinquatae* [g]; • in southern Poland, on carbonate peat bogs, in *Caricetum davallianae* and *Schoenetum ferruginei* phytocoenoses [c]	mainly in the *Molinia* meadows of the *Molinion* alliance; in relative cover, species from the *Molinio-Arrhenatheretea* class predominate, including species from the *Molinetalia* order of the *Molinion* alliance (48.6%)
Most frequent co-components	Most frequent co-components (>70% frequency in phytosociological relevés): – *Carex acutiformis*, *Cirsium oleraceum*, *Achillea millefolium*, *Gallium mollugo*, *Festuca rubra*, *Holcus lanatus*, *Plantago lanceolata* [j]; – *Carex acutiformis*, *Cirsium rivulare*, *Polygonum bistorta*, *Deschampsia caepitosa*, *Lychnis flos-cuculi*, *Equisetum palustre*, *Arrhenatherum elatius*, *Gallium mollugo*, *Centaurea jacea*, *Festuca rubra*, *Lathyrus pratensis*, *Phleum pratense*, *Poa pratensis*, *Festuca pratensis*, *Holcus lanatus*, *Lysimachia nummularia*, *Ranunculus acris*, *Ranunculus repens*, *Galium verum* [c]; – *Lythrum salicaria*, *Deschampsia caespitosa*, *Cirsium palustre*, *Lychnis flos-cuculi*, *Festuca rubra*, *Festuca pratensis*, *Poa pratensis*, *Ranunculus acris*, *Achillea millefolium*, *Galium verumi* [f]	most frequent co-components (>70% frequency in phytosociological relevés): *Molinia caerulea*, *Galium verum*, *Briza media*, *Centaurea jacea*, *Potentilla erecta*, *Selinum carvifolia*, *Carex flacca*, *Succisa pratensis*, *Deschampsia caespitosa*
Habitat	• usually silt-peat and mineral-peat soils, with a pH ranging from acidic to alkaline [f, k]; • moderately drained, oligo- to mesotrophic peat bogs, including calcareous peat bogs [g]; • on humus-rich, alkaline, wet water banks and flood reservoirs that are temporarily dry on the surface [g]; • fresh, rich in nutrients and clayey [g]	eutrophic, mineral soil, neutral pH, with significant saturation of the sorption complex with alkaline cations, especially Ca^{2+}
Land use	• usually used for mowing [c, g, h, j]; • one cut per year [g, h]; • two cuts per year [j]; • sometimes in abandoned hay meadows [c, h]	annual late summer mowing, excluding other fragments of meadow each year, one cut per year

Feature of phytocoenosis	Information from the literature	PLB 060001 Bagno Bubnów
Abundance	frequency in phytosociological relevés on the Braun-Blanquet scale from "+" to "2" [e, j]	frequency in phytosociological relevés on the Braun-Blanquet scale from "r" to "1"
Spatial distribution	• single or loose clusters (the most often) of *Ostericum palustre* plants, or large patches (even 1000–10 000 individuals per 1 ha [a]; • sward height, 24 cm – *Calthion* phytocoenosis, 74 cm – *Calthion*, 111 cm – *Phragmites australis* Ass. [h]	single or loose clusters of *Ostericum palustre* plants, high sward

Explanations: [a] Czarna *et al.* (2014), [b] Załuski (2004), [c] Nobis *et al.* (2008), [d] Matuszkiewicz (2008), [e] Bróż and Podgórska (2006), [f] Michalska-Hejduk and Kopeć 2010, [g] Dittbrenner, Partzsch and Hensen (2005), [h] Kostrakiewicz-Gierałt, Stachurska-Swakoń, A. and Towpasz (2018), [i] Grynia (1962), [j] Krasicka-Korczyńska, Stosik and Korczyński (2014), [k] Fijałkowski (1994), [l] Wójcik *et al.* (2021).

Source: synthesis from the literature and own study.