

## Red list of vascular plants of the Western Suwałki Lakeland, north-eastern Poland

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**Abstract:** The paper presents a regional red list of vascular plant species native to the Western Suwałki Lakeland, north-eastern Poland, based on the IUCN red list categories and criteria. The distribution and abundance data were obtained from the field floristic inventories carried out in 2008-2016 using the ATPOL cartogram method. The historical occurrences of vascular plant species were revised in the field. The list comprises 203 species, including seven regionally extinct species, 43 critically endangered species, 49 endangered species, 25 vulnerable species, 48 near threatened species, and 31 data deficient species. The results are compared to the Polish national red list of pteridophytes and flowering plants and briefly discussed.

**Key words:** extinction, IUCN red list categories and criteria, threatened species, Poland.

### Introduction

Species extinction is a common phenomenon caused by various natural and anthropogenic factors. The risk of species extinction can be evaluated at global, continental, national or regional level using the uniform categories and criteria recommended by the International Union for Conservation of Nature (IUCN Standards and Petitions Subcommittee 2016). These categories and criteria are widely applied as a standard method for preparing red lists and books of threatened species. In Poland, the first national red list of vascular plants was published in 1986 (Zarzycki 1986) and it has been updated three times (Zarzycki & Szelağ 1992, 2006, Kaźmierczakowa *et al.* 2016). At the same time, many regional red lists of plants have been published emphasizing the concerns about nature (e.g. Jakubowska-Gabara & Kucharski 1999, Głowacki *et al.* 2003, Kački *et al.* 2003, Markowski & Buliński 2004, Jackowiak *et al.* 2007).

The Western Suwałki Lakeland (in Polish “Pojezierze Zachodniosuwalskie”) is a region in the Polish part of the Lithuanian Lakeland, north-eastern Poland. It covers 830 km<sup>2</sup> and is bounded by Błędzianka and Czarna Hańcza rivers on the northern east and by Jarka river on the west (Kondracki 1994). It lies in a transitory temperature climate zone with an influence of continental climate where the mean annual air temperature is about 6.5°C and the average annual precipitation is about 550-600 mm (Lorenc 2005). With the main valley of the Rospuda river, the region is characterized by its topographic relief, which is a result of the Vistula Glaciation, showing many early post-glacial landscape forms such as morain hills, sandurs, tunnel valleys and ribbon lakes (Ber 1981). In this rural region, the vegetation is represented mostly by synanthropic and semi-natural plant communities (*Stellarietea mediae*, *Artemisietea vulgaris*, *Molinio-Arrhenatheretea*, and *Festuco-Brometea*), with the lower share of nemoral forest communities of boreal and subboreal influences (*Tilio-Carpinetum*, *Quercopinetum*, *Fraxino-Alnetum*, *Peucedano-Pinetum*, *Vaccinio uliginosi-Pinetum*, *Sphagno girgensohnii-Piceetum*, *Carici elongatae-Alnetum*, *Ficario-Ulmetum chrysosplenietosum*, and *Potentillo albae-Quercetum typicum*) (Pliszko 2014 and the literature cited therein). A tentative red list of vascular plants of this region was proposed by Pliszko (2012), however, it was not strictly based on the IUCN red list categories and criteria. The aim of this study is to

indicate the current risk of extinction for the native vascular plant species occurring in the Western Suwałki Lakeland.

## Material and methods

Field inventories were conducted in 2008-2016, using the ATPOL cartogram method (Zajac 1978, Fig. 1). Due to difficulties in the delimitation of the southern boundary of the Western Suwałki Lakeland, the study area was included between North latitude 53°58' to 54°18' and East longitude 22°24' to 22°53', covering about 740 km<sup>2</sup>. The distribution and abundance of vascular plant species were studied within 142 square cartogram units of 2.5 km side (Fig. 2). Moreover, floristic data provided before the 21<sup>st</sup> century (Abromeit *et al.* 1898-1940, Zajac & Zajac 2001) were revised in the field. The list was arranged in alphabetical order by the scientific names of the taxa following the nomenclature concept by Mirek *et al.* (2002). The native status of vascular plants in the region followed Zajac & Zajac (2001, 2009), Rutkowski (2004) and own observations. The red list was prepared based on the IUCN categories and criteria (IUCN Standards and Petitions Subcommittee 2016), involving regionally extinct (RE), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT) and data deficient (DD) native taxa. The category of least concern (LC) has not been considered in this study due to its lower importance.

## Results and discussion

The red list of vascular plants of the Western Suwałki Lakeland comprises 203 native species (Table 1) which is about 25% of the indigenous species found in the region (Pliszko 2014a, b, 2015, 2016). Among the listed taxa, there are seven regionally extinct (RE) species, 43 critically endangered (CR) species, 49 endangered (EN) species, 25 vulnerable (VU) species, 48 near threatened (NT) species, and 31 data deficient (DD) species. The list contains 77 species which have been included in *Polish red list of pteridophytes and flowering plants* (Każmierczakowa *et al.* 2016), however, only seven species have been placed into the same category as in the national list (i.e. *Androsace septentrionalis*, *Eriophorum gracile*, *Oxytropis pilosa*, *Potamogeton filiformis*, *Potentilla rupestris*, *Utricularia australis*, and *U. minor*). The group of threatened species (CR, EN and VU categories) is 57% of the listed species. Four species placed into the regionally extinct category, namely *Carex brunnescens*, *C. loliacea*, *Pedicularis sceptrum-carolinum*, and *Trifolium spadiceum*, have been known only from historical occurrences (Abromeit *et al.* 1898-1940). Other three species, namely *Allium scorodoprasum*, *Arabis planisiliqua*, and *Myosurus minimus*, became extinct in the past few years. It should be pointed out that the majority of listed species has a higher risk of extinction on the regional scale than on the national scale (e.g. *Antennaria dioica*, *Carex pauciflora*, *Dactylorhiza majalis*, *Lathyrus laevigatus*, *Pulmonaria angustifolia*, *Senecio congestus*, and *Trollius europaeus*). Some of these species are losing their compact geographic range in north-eastern Poland and the other are threatened due to negative human activities such as deforestation, drainage, chemicalization of agriculture, tourism and recreation. Moreover, there are only 10 species with a lower risk of extinction on the regional scale than on the national scale (e.g. *Baeothryon alpinum*, *Dactylorhiza baltica*, *Polemonium coeruleum*, *Potamogeton rutilus*, and *Viola epipsila*). This statement indicates how important for saving some native vascular plants the Western Suwałki Lakeland is. Finally, it is worth to mention that the additional field inventories are needed to establish the extinction risk for the species currently categorized as data deficient.

**Tab 1:** Red list of vascular plant species of the Western Suwałki Lakeland.

No	Taxon	Status in the Western Suwałki Lakeland		Status in Poland*
		Category	Criterion	
1	<i>Agrimonia pilosa</i>	VU	B2a+C2a(i)	NT
2	<i>Ajuga reptans</i>	NT	-	-
3	<i>Alchemilla crinita</i>	DD	-	-
4	<i>A. glabra</i>	DD	-	-
5	<i>A. plicata</i>	DD	-	-
6	<i>A. sarmatica</i>	DD	-	-
7	<i>Alisma gramineum</i>	EN	B2a+C2a(i)	VU
8	<i>A. lanceolatum</i>	EN	B2a+C2a(i)	VU
9	<i>Alliaria petiolata</i>	NT	-	-
10	<i>Allium scorodoprasum</i>	RE	-	VU
11	<i>A. vineale</i>	VU	B2a+C2a(i)	-
12	<i>Androsace septentrionalis</i>	VU	C2a(i)	VU
13	<i>Anemone sylvestris</i>	NT	-	-
14	<i>Antennaria dioica</i>	EN	B2a+C2a(i)	NT
15	<i>Anthericum ramosum</i>	NT	-	-
16	<i>Aquilegia vulgaris</i>	NT	-	-
17	<i>Arabis planisiliqua</i>	RE	-	DD
18	<i>Asperula tinctoria</i>	EN	B2a+C2a(i)	VU
19	<i>Asplenium trichomanes</i>	CR	D	-
20	<i>Astragalus arenarius</i>	VU	C2a(i)	NT
21	<i>Astragalus danicus</i>	EN	B2a+C2a(i)	VU
22	<i>Baeothryon alpinum</i>	NT	-	VU
23	<i>Barbarea stricta</i>	CR	D	-
24	<i>Batrachium aquatile</i>	EN	B2a+C2a(i)	-
25	<i>Betonica officinalis</i>	VU	B2a+C2a(i)	-
26	<i>Betula humilis</i>	DD	-	EN
27	<i>Botrychium lunaria</i>	CR	D	VU
28	<i>Brachypodium pinnatum</i>	CR	D	-
29	<i>Bromus benekenii</i>	CR	D	-
30	<i>Butomus umbellatus</i>	DD	-	-
31	<i>Calamagrostis stricta</i>	VU	B2a+C2a(i)	NT
32	<i>Callitriche autumnalis</i>	DD	-	DD
33	<i>Calystegia sepium</i>	DD	-	-
34	<i>Campanula latifolia</i>	CR	D	NT
35	<i>C. rotundifolia</i>	EN	B2a+C2a(i)	-
36	<i>Cardamine dentata</i>	DD	-	-
37	<i>Carex atherodes</i>	NT	-	VU
38	<i>C. brunnescens</i>	RE	-	-
39	<i>C. demissa</i>	CR	D	NT
40	<i>C. dioica</i>	EN	B2a+C2a(i)	VU
41	<i>C. disticha</i>	NT	-	-
42	<i>C. limosa</i>	VU	B2a+C2a(i)	NT
43	<i>C. loliacea</i>	RE	-	NT
44	<i>C. montana</i>	EN	B2a+C2a(i)	-
45	<i>C. pauciflora</i>	CR	D	EN

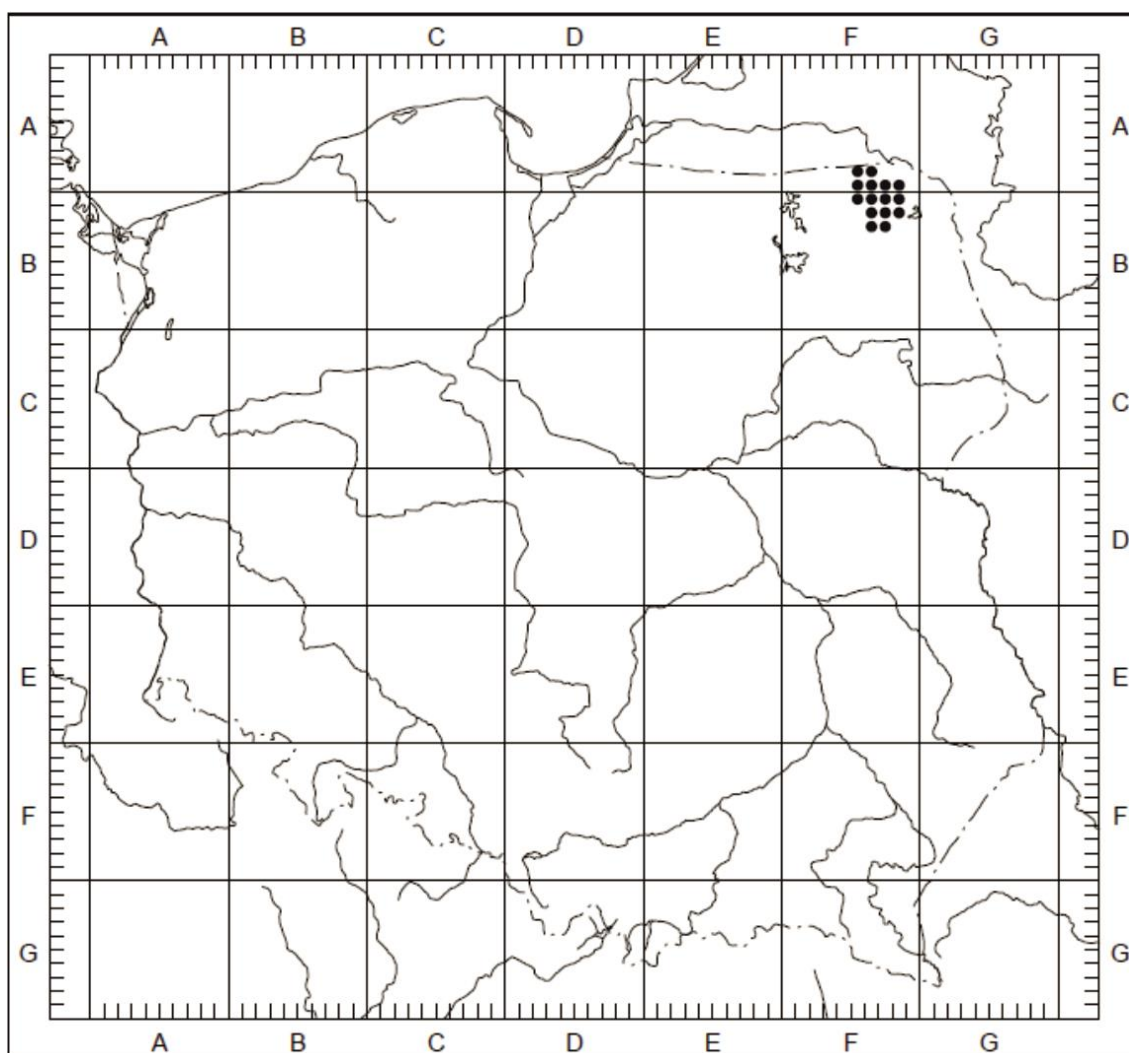
46	<i>C. pilosa</i>	EN	D	-
47	<i>C. praecox</i>	VU	B2a+C2a(i)	-
48	<i>C. riparia</i>	DD	-	-
49	<i>Catabrosa aquatica</i>	DD	-	VU
50	<i>Centaurium erythraea</i> subsp. <i>erythraea</i>	NT	-	-
51	<i>Cerastium macrocarpum</i>	CR	D	DD
52	<i>Ceratophyllum submersum</i>	NT	-	-
53	<i>Cirsium acaule</i>	EN	B2a+C2a(i)	-
54	<i>Corallorhiza trifida</i>	CR	D	VU
55	<i>Cornus sanguinea</i> subsp. <i>sanguinea</i>	DD	-	-
56	<i>Coronilla varia</i>	VU	C2a(i)	-
57	<i>Corynephorus canescens</i>	NT	-	-
58	<i>Crepis succisifolia</i>	NT	-	DD
59	<i>Cruciata laevipes</i>	EN	B2a+C2a(i)	-
60	<i>Cuscuta epithymum</i>	VU	B2a+C2a(i)	-
61	<i>C. europaea</i> subsp. <i>europaea</i>	DD	-	-
62	<i>Cyperus fuscus</i>	CR	D	-
63	<i>Cystopteris fragilis</i>	NT	-	-
64	<i>Dactylis polygama</i>	DD	-	-
65	<i>Dactylorhiza baltica</i>	NT	-	VU
66	<i>D. fuchsii</i>	EN	B2a+C2a(i)	-
67	<i>D. maculata</i>	DD	-	-
68	<i>D. majalis</i>	EN	B2a+C2a(i)	NT
69	<i>D. ruthei</i>	DD	-	EN
70	<i>Dentaria bulbifera</i>	CR	D	-
71	<i>Deschampsia flexuosa</i>	DD	-	-
72	<i>Dianthus carthusianorum</i>	EN	B2a+C2a(i)	-
73	<i>Digitalis grandiflora</i>	EN	B2a+C2a(i)	-
74	<i>Draba nemorosa</i>	NT	-	VU
75	<i>Drosera anglica</i>	CR	D	EN
76	<i>Eleocharis acicularis</i>	DD	-	-
77	<i>E. quinqueflora</i>	EN	B2a+C2a(i)	VU
78	<i>Empetrum nigrum</i>	NT	-	-
79	<i>Epipactis helleborine</i>	CR	D	-
80	<i>E. palustris</i>	NT	-	NT
81	<i>Equisetum variegatum</i>	DD	-	-
82	<i>Eriophorum gracile</i>	EN	B2a+C2a(i)	EN
83	<i>E. latifolium</i>	NT	-	-
84	<i>Euphrasia nemorosa</i>	EN	B2a+C2a(i)	-
85	<i>Filago minima</i>	EN	B2a+C2a(i)	-
86	<i>Filipendula vulgaris</i>	NT	-	-
87	<i>Fragaria viridis</i>	NT	-	-
88	<i>Gagea minima</i>	VU	B2a+C2a(i)	-
89	<i>Galeopsis pubescens</i>	EN	B2a+C2a(i)	-
90	<i>Galium boreale</i>	NT	-	-
91	<i>Geranium sanguineum</i>	NT	-	-
92	<i>G. sylvaticum</i>	EN	B2a+C2a(i)	NT
93	<i>Geum aleppicum</i>	VU	B2a+C2a(i)	-
94	<i>Glyceria nemoralis</i>	EN	B2a+C2a(i)	-

95	<i>Goodyera repens</i>	EN	B2a+C2a(i)	NT
96	<i>Gypsophila muralis</i>	VU	B2a+C2a(i)	-
97	<i>Helianthemum nummularium</i> subsp. <i>obscurum</i>	NT	-	-
98	<i>Hieracium caespitosum</i>	EN	B2a+C2a(i)	-
99	<i>H. cymosum</i>	CR	D	-
100	<i>H. sabaudum</i>	CR	D	-
101	<i>Hippuris vulgaris</i>	NT	-	-
102	<i>Holosteum umbellatum</i>	CR	D	-
103	<i>Hypericum montanum</i>	CR	D	-
104	<i>Inula salicina</i>	EN	B2a+C2a(i)	-
105	<i>Juncus alpino-articulatus</i>	VU	B2a+C2a(i)	NT
106	<i>J. filiformis</i>	VU	B2a+C2a(i)	NT
107	<i>Koeleria macrantha</i>	CR	D	-
108	<i>Lamium maculatum</i>	NT	-	-
109	<i>Laserpitium latifolium</i>	VU	B2a+C2a(i)	-
110	<i>Lathraea squamaria</i> subsp. <i>squamaria</i>	NT	-	-
111	<i>Lathyrus laevigatus</i>	EN	B2a+C2a(i)	NT
112	<i>L. niger</i>	VU	C2a(i)	-
113	<i>L. palustris</i>	CR	D	-
114	<i>Leersia oryzoides</i>	DD	-	NT
115	<i>Lilium martagon</i>	EN	B2a+C2a(i)	-
116	<i>Liparis loeselii</i>	EN	B2a+C2a(i)	VU
117	<i>Listera ovata</i>	EN	B2a+C2a(i)	-
118	<i>Lithospermum officinale</i>	EN	D	-
119	<i>Luzula pallescens</i>	EN	B2a+C2a(i)	-
120	<i>Lycopodium clavatum</i>	NT	-	-
121	<i>Malaxis monophyllos</i>	CR	D	VU
122	<i>Malus sylvestris</i>	CR	D	-
123	<i>Melandrium rubrum</i>	NT	-	-
124	<i>Mentha longifolia</i>	EN	B2a+C2a(i)	-
125	<i>Mercurialis perennis</i>	NT	-	-
126	<i>Monotropa hypophegea</i>	CR	D	DD
127	<i>Myosurus minimus</i>	RE	-	-
128	<i>Myriophyllum verticillatum</i>	DD	-	-
129	<i>Neottia nidus-avis</i>	NT	-	-
130	<i>Nuphar pumila</i>	DD	-	VU
131	<i>Ophioglossum vulgatum</i>	CR	D	VU
132	<i>Orchis mascula</i> subsp. <i>signifera</i>	CR	D	NT
133	<i>Oxytropis pilosa</i>	VU	B2a+C2a(i)	VU
134	<i>Parnassia palustris</i>	NT	-	VU
135	<i>Pedicularis palustris</i>	EN	B2a+C2a(i)	VU
136	<i>P. sceptrum-carolinum</i>	RE	-	-
137	<i>Petasites spurius</i>	CR	D	-
138	<i>Phegopteris connectilis</i>	CR	D	-
139	<i>Pimpinella major</i>	CR	D	-
140	<i>Platanthera chlorantha</i>	VU	B2a+C2a(i)	NT
141	<i>Polemonium coeruleum</i>	NT	-	VU
142	<i>Polygala amarella</i>	CR	D	-

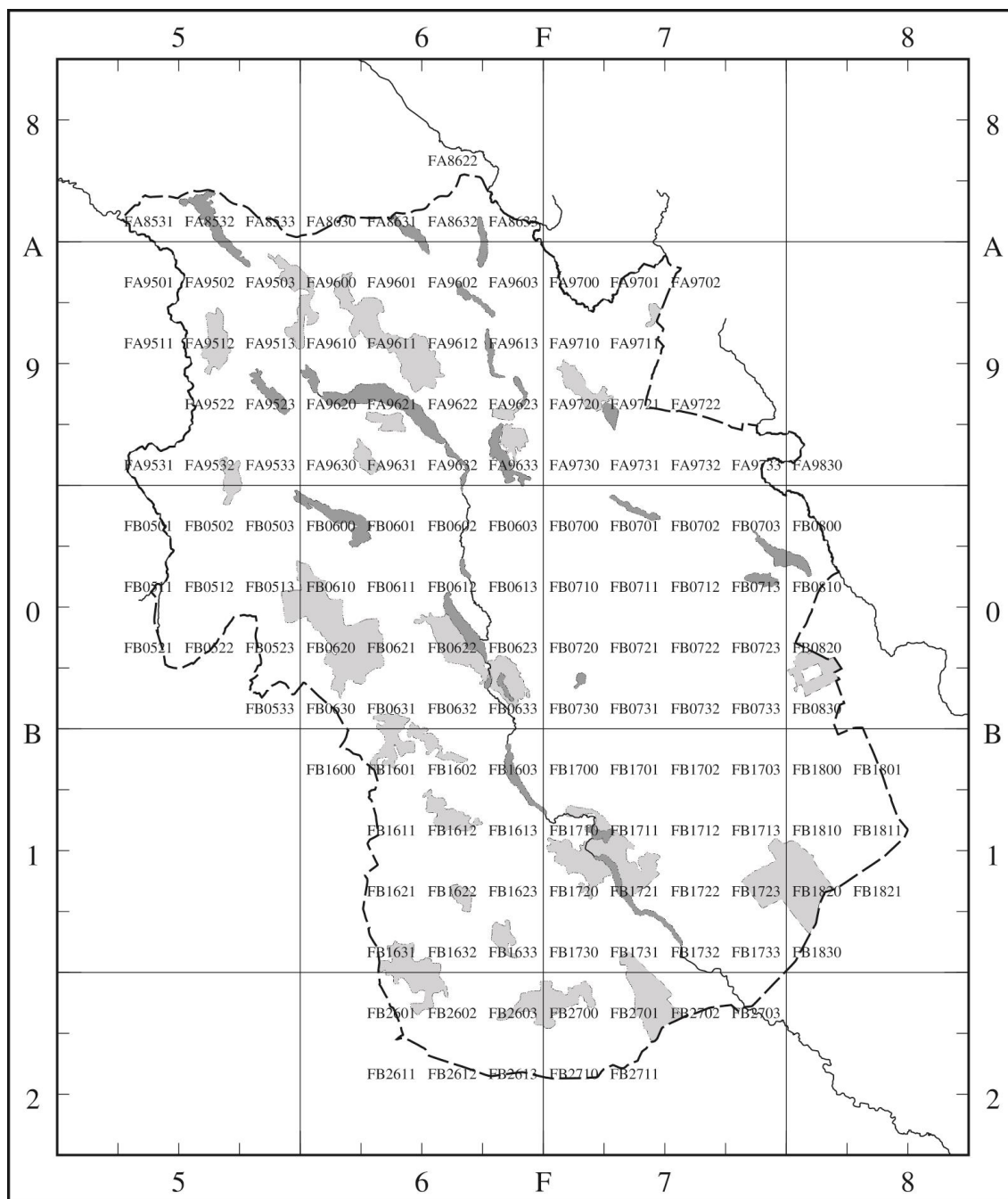
143	<i>Polygonatum odoratum</i>	EN	B2a+C2a(i)	-
144	<i>P. verticillatum</i>	VU	B2a+C2a(i)	-
145	<i>Polygonum mite</i>	DD	-	-
146	<i>Polypodium vulgare</i>	NT	-	-
147	<i>Potamogeton acutifolius</i>	VU	B2a+C2a(i)	NT
148	<i>P. alpinus</i>	NT	-	VU
149	<i>P. filiformis</i>	CR	D	CR
150	<i>P. gramineus</i>	EN	B2a+C2a(i)	VU
151	<i>P. obtusifolius</i>	CR	D	NT
152	<i>P. pusillus</i>	DD	-	NT
153	<i>P. rutilus</i>	NT	-	CR
154	<i>P. trichoides</i>	EN	D	NT
155	<i>Potentilla anglica</i>	DD	-	-
156	<i>P. collina</i>	DD	-	-
157	<i>P. neumanniana</i>	CR	D	-
158	<i>P. norvegica</i>	EN	B2a+C2a(i)	-
159	<i>P. reptans</i>	EN	B2a+C2a(i)	-
160	<i>P. rupestris</i>	EN	B2a+D	EN
161	<i>Prunus spinosa</i>	DD	-	-
162	<i>Pulmonaria angustifolia</i>	CR	D	VU
163	<i>Ranunculus cassubicus</i>	NT	-	-
164	<i>R. polyanthemos</i>	VU	B2a+C2a(i)	-
165	<i>Rumex aquaticus</i>	DD	-	-
166	<i>R. maritimus</i>	EN	B2a+C2a(i)	-
167	<i>Sagina nodosa</i>	VU	B2a+C2a(i)	-
168	<i>Salix starkeana</i>	CR	D	VU
169	<i>Sanguisorba muricata</i>	EN	B2a+C2a(i)	DD
170	<i>S. officinalis</i>	CR	D	-
171	<i>Sanicula europaea</i>	NT	-	-
172	<i>Saxifraga tridactylites</i>	NT	-	-
173	<i>Scheuchzeria palustris</i>	EN	B2a+C2a(i)	VU
174	<i>Scleranthus perennis</i>	NT	-	-
175	<i>Scorzonera humilis</i>	NT	-	-
176	<i>Selinum carvifolia</i>	VU	B2a+C2a(i)	-
177	<i>Senecio congestus</i>	EN	B2a+C2a(i)	NT
178	<i>S. paludosus</i>	NT	-	-
179	<i>S. sylvaticus</i>	CR	D	-
180	<i>Serratula tinctoria</i>	EN	B2a+C2a(i)	-
181	<i>Spergularia rubra</i>	NT	-	-
182	<i>Stellaria crassifolia</i>	CR	D	VU
183	<i>S. longifolia</i>	CR	D	-
184	<i>S. uliginosa</i>	DD	-	-
185	<i>Thalictrum minus</i> subsp. <i>minus</i>	CR	D	-
186	<i>T. simplex</i>	NT	-	VU
187	<i>Thesium ebracteatum</i>	EN	D	VU
188	<i>Tragopogon orientalis</i>	DD	-	-
189	<i>Trifolium rubens</i>	EN	B2a+C2a(i)	VU
190	<i>T. spadiceum</i>	RE	-	DD
191	<i>Trisetum sibiricum</i>	CR	D	NT
192	<i>Trollius europaeus</i>	CR	D	VU

193	<i>Utricularia australis</i>	NT	-	NT
194	<i>Utricularia intermedia</i>	EN	B2a+C2a(i)	VU
195	<i>U. minor</i>	NT	-	NT
196	<i>V. spicata</i> subsp. <i>spicata</i>	CR	D	-
197	<i>Vicia tenuifolia</i>	NT	-	-
198	<i>Vincetoxicum hirundinaria</i>	NT	-	-
199	<i>Viola epipsila</i>	VU	B2a+C2a(i)	EN
200	<i>V. hirta</i>	CR	D	-
201	<i>V. stagnina</i>	EN	B2a+C2a(i)	VU
202	<i>V. tricolor</i>	DD	-	-
203	<i>Viscaria vulgaris</i>	NT	-	-

\* – according to Kaźmierczakowa *et al.* (2016).



**Fig 1:** Localization of the study area within the ATPOL cartogram grid.



**Fig 2:** The codes of the ATPOL cartogram units for the study area. Explanations: the capital letters indicate the square of 100 km side, two numbers in the middle indicate the square of 10-km side, and the last two numbers indicate the square of 2.5 km side. The boundaries of the study area (dashed line), main rivers, lakes, and forests in the background.

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