

Red list of vascular flora of Wielkopolska (Poland)

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Abstract. The article presents the second, substantially changed edition of the red list of vascular plants of Wielkopolska. The region under study covers the area of 50 000 km² and constitutes a significant part of the Central European Lowlands. The east and central part of Wielkopolska includes an important historical territory which, from the 8th-10th century, was the center of Polish statehood creation. The flora of this region has been the subject of systematic investigations since the first half of the 19th century. Thanks to that, it is possible to evaluate the longterm changes resulting from human activities. Currently, the red list consists of 601 taxons, which accounts for 30% of the vascular flora of Wielkopolska. Apart from the dominant native plants, the list includes also archaeophytes (42 species). In comparison to the first edition of the list, further increase in the flora endangerment has been observed. At present, 52 species should be considered extinct. Moreover, the number of taxons critically endangered (87 species) has also significantly increased. A detailed analysis of the data presented in the publication emphasizes taxonomical, chorological and ecological aspects of species extinction. The separate part of the red list has been dedicated to the 13 species which conservation requires designation of Special Areas of Conservation (SACs) within the Natura 2000 network.

Key words: regional biodiversity assessment, red list, vascular plants, categories of threat, IUCN, Habitats Directive, Natura 2000

1. Introduction

The subject of this publication is the extinction of vascular plants under human influence on natural environment. For the last several dozens of years, the problem has been evoking a deep interest which increases proportionally to the growing speed and range of this phenomenon and results both from scientific and practical reasons. Scientific interest is caused by insufficient recognition of the mechanisms of species retreat and a small effectiveness of methods for counteracting this process. Practical reasons are mainly connected with the decreasing level of biodiversity and, at the same time, diminishing possibilities of utilization of genetic resources stored in populations of irreversibly disappearing species.

An important role in this current of research play regional red lists of threatened species. They give the basis for an estimation of the level of endangerment of biodiversity and indicate the species which in the first place should be the subject of the detailed chorological and ecological studies and the target of conservation measures.

The red list of vascular flora of Wielkopolska follows this direction of research, alluding to several dozens of similar lists prepared for other regions of Poland (among others, Zając A. & Zając M. 1998; Jakubowska-Gabara & Kucharski 1999; Bernacki *et al.* 2000; Krukowski *et al.* 2000; Jakubowska-Gabara 2001; Towpasz & Kotańska 2001; Nowak *et al.* 2003; Głowacki *et al.* 2003; Kącki *et al.* 2003; Kucharczyk & Szukałowicz 2003; Markowski & Buliński 2004) and other areas of Central Europe (among others, Fukarek 1992; Maglocký & Feraková 1993; Čefovský *et al.* 1999; Schulz 1999; Prasse *et al.* 2001; Scheuerer & Ahlmer 2003; Schnitter 2004; Ristow *et al.* 2006). The present version is the result of a critical analysis of the earlier edition of the red list of vascular flora of Wielkopolska (Żukowski & Jackowiak 1995a). The need for its updating stems from several reasons: (i) change of threat categories introduced by the IUCN 2001; (ii) considerable progress in the recognition of the region's flora resources; (iii) suggestions of many specialists which, in the meantime, were directed to the authors of the 1995 edition; (iv) intensification of works related to the conservation of

the region's nature, including introduction of the European Ecological Network Natura 2000.

2. The area of study

An analysis of vascular flora endangerment has been conducted in the area of Wielkopolska, i.e., in the region's broad limits designated by Krygowski (1961). Wielkopolska stretches from the Odra river valley in the west up to the Łódź Upland and Kłodawa Upland in the east. From the north it is limited by the edges of the Noteć and Warta river valleys and from the south by the Trzebnica Hills and Dalkowskie Hills (Fig. 1). The area of Wielkopolska delimited in this way covers almost 50 thousand km² and constitutes a significant part of the Polish Lowlands. To a large extent, it is also representative for the Central European Lowlands.

The area of study almost entirely coincides with the geobotanical region named the Wielkopolska-Kujawy Lowland (Szafer 1972).

Proglacial Valley and in the central region it is partially divided by the Warszawa-Berlin Proglacial Valley. Proglacial depressions are connected by the latitudinal sections of river valleys.

The present landscape of Wielkopolska has been shaped mainly by Pleistocene glaciations, particularly, by the Central-Polish and Baltic (Northern-Polish) ones. The evident remains of the Central Polish Glaciation are, already mentioned, the Trzebnica Hills, while the Baltic Glaciation marked the landscape with smaller but noticeable moraine hills (Krygowski 1961; Bartkowski 1970; Kondracki 1980).

In Wielkopolska, like in other parts of the Polish Lowlands, dominate soils developed from glacial deposits, mainly clays and sands. The distribution of soils is strictly related to the variation in the bedrock. The most frequent are brown soils and podsoles, which cover about 90% of the area. A special feature of Wielkopolska are black soils, which are most strongly represented in Kujawy, and to a lesser extent, in the Gniezno Lake

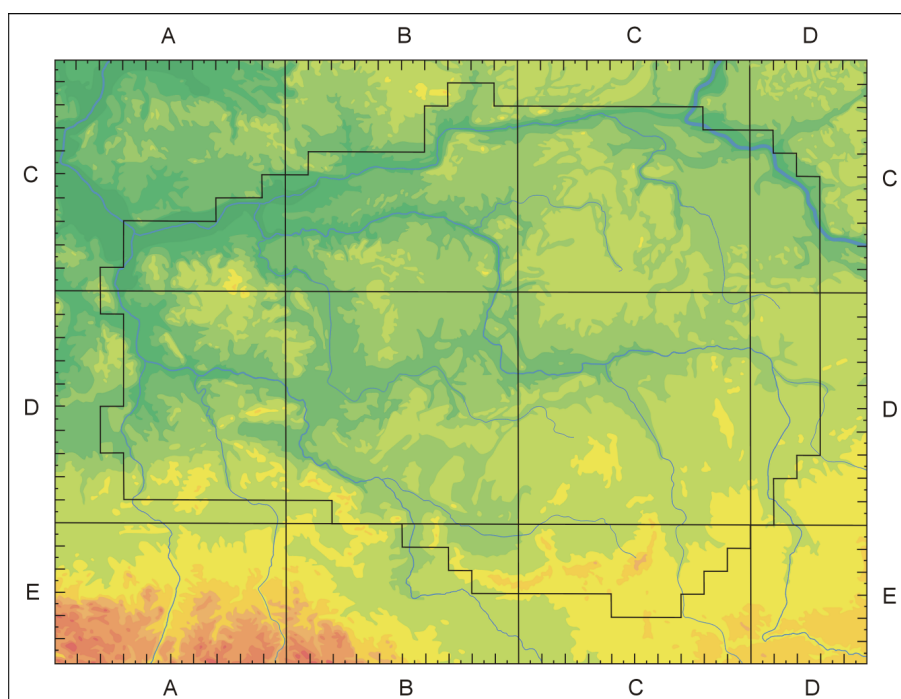


Fig. 1. Location and borders of the Wielkopolska Region

Although Wielkopolska is a lowland region, it is showing a distinctly varied relief. Its lowland character is emphasized by the predominance of areas (about 70%) lying from 10 to 100 m above the sea level. In contrast with the neighboring Mazowsze, the region has a number of geomorphological forms which make the landscape considerably diversified. A characteristic feature of the relief are broad and fairly deep valley depressions, which divide Wielkopolska into smaller sections. In the north, the territory is divided by the Toruń-Eberswald Proglacial Valley, in the south by the Barycko-Głogowska

District and Kalisz Plateau (Bednarek, Prusinkiewicz 1997). No less interesting are relatively frequent remains of older geological periods – in the form of salt outcrops found in the vicinity of Ciechocinek, Inowrocław, Szubin, Wapno and Kłodawa. The remaining types of soils (peat, peat earth and alluvial soil) account only for a small percentage and are related to valleys and proglacial valleys depressions. They are also found in topographically low and watershed areas, like, e.g., raised and transitional bogs in the Notecka Forest.

The main river of Wielkopolska is Warta, which forms region's hydrographic axis. Its main tributaries are: Ner, Wełna, Noteć, Prosna and Obra.

Wielkopolska is abounding in postglacial lakes, although they are distributed irregularly. The line dividing the area under discussion into the lake-rich northern part and almost devoid of them southern part became the base for its division into two physical-geographical units: Wielkopolska Lake District and Southern Wielkopolska Lowland (Kondracki 1980). Overall, in the whole region there are nearly 1000 lakes, of which the largest are: Gopło, Powidzkie, Zbąszyńskie and Przemęckie.

Apart from the natural waterway network, there are also some artificial water bodies, including storage reservoirs (e.g. Jeziorsko on the Warta river), systems of

The most significant feature of the climate of Wielkopolska is its transitional character with alternating oceanic and continental influences. This results in constant changes of the weather connected with the movement of atmospheric fronts, facilitated by lack of natural barriers. The western parts of Wielkopolska are warmest (Fig. 2), with the mean annual temperature exceeding 8°C (Słubice – 8.4°C, Zielona Góra – 8.2°C). Further eastward, the temperature gradually falls (Poznań – 8°C, Koło – 7.9°C, Kalisz – 7.8°C) (Fig. 3). The mean total annual precipitation in excess of 600 mm is recorded only in southern Wielkopolska (in higher elevation areas) and in the Lubuskie Lake District (Woś 1994), while the lowest one (below 500 mm) is observed in the central and eastern parts of the

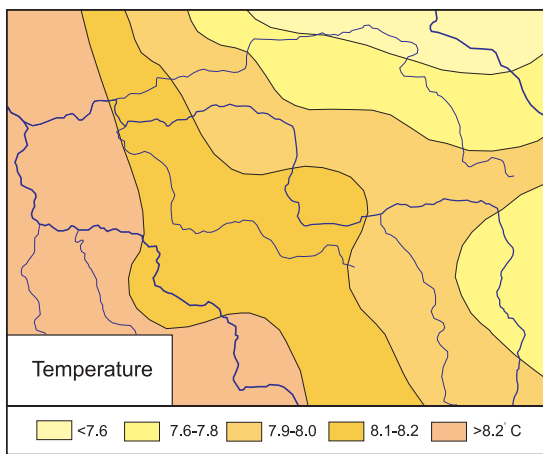


Fig. 2. Mean values of average annual air temperature in Wielkopolska in the years 1951-1980 (according to Woś 1994)

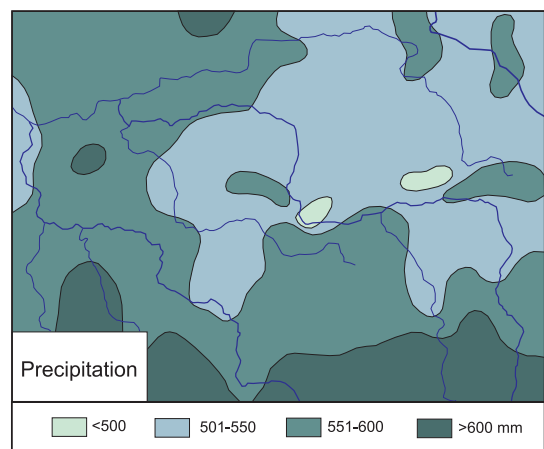


Fig. 4. Mean annual precipitation in Wielkopolska in the years 1951-1980 (according to Woś 1994)

channels (e.g. Bydgoski, Ślesięński and three Obrzańskie channels) and complexes of fish-farming ponds (e.g. Milicz Ponds).

region (Fig. 4). The level of precipitation and its distribution during the vegetation season confirms a well established in scientific literature opinion about the

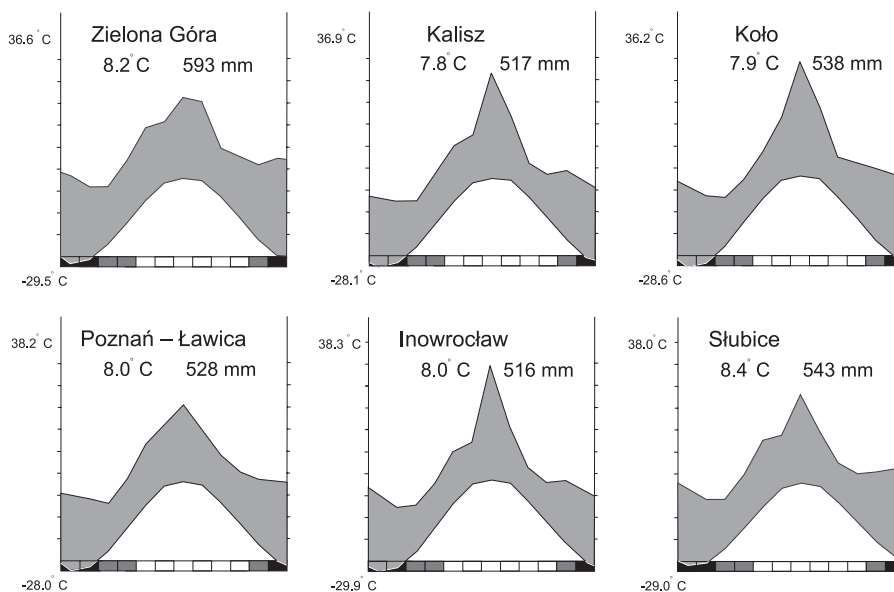


Fig. 3. Climatic diagrams of Gausson-Walter for the six measuring stations in Wielkopolska in the years 1951-1985

increasing processes of continentalization of anthropogenic origin, described also as the conversion of Wielkopolska into steppe (among others, Wodziczko 1947; Czubiński 1947; Szulczewski 1947; cf. Latowski 2001, 2004; Jackowiak 2003). The changes of natural features of the climate of Wielkopolska along the east-west axis are generally expressed as a loss of oceanic character, accompanied by the increase of continental characteristics. This direction is reflected in the plant cover and expressed as a disappearance of single localities of species connected with the broadly understood Atlantic zone.

3. Material and methods

3.1. The sources of floristic data

The red list of threatened vascular plants of Wielkopolska has been created on the basis of the source data (literature and herbarium) analysis and several dozen years of the authors' own studies, both published and unpublished. While preparing the second edition of the red list of flora of Wielkopolska, numerous localities of the target species were checked and herbarium collections verified to ensure their correctness and validity. In the new version of the list, the authors attempted to take into consideration numerous comments of other botanists, which were submitted after the first

marked by important synthetic publications which sum up the state of knowledge of vascular plants of this region over longer period of time: Ritschl (1850), Pfuhl (1896), Szulczewski (1951) and Jackowiak *et al.* (2008).

3.2. Taxonomy, nomenclature and other principles of species classification

The red list of flora of Wielkopolska is arranged in the alphabetical order (Table 3 in the chapter 4.1.) and takes into account the following information: name of a species along with authors abbreviations and, in some instances, also its synonyms with authors abbreviations, category of threat in the region, conservation status in Poland and family affiliation. Species of alien origin, in this case archaeophytes, are designated with an asterisk. Moreover, the statistical analysis involved also the phytogeographical status of native species and their synecological preferences.

Taxonomy and nomenclature of species follow, in principle, the checklist by Mirek *et al.* (2002). A fairly broad approach to taxons corresponds to the above mentioned list and to the position of the editors of the "Distribution Atlas of Vascular Plants in Poland" (Zajac A. & Zajac M. 2001). In some particularly justified cases, the decision was made to estimate the imperilment of subspecies, in certain works considered at the species level. Such situation illustrates well an example of *Pinguicula vulgaris* L., divided into two

Table 1. The stages of floristic studies in Wielkopolska

Stage	Period	Selected works
I	1815-1850	Władimirski (1815), Adamski (1828, por. Erzepki 1896), Motty (1836), Pampuch (1840), Ritschl (1850)
II	1851-1896	Szafarkiewicz (1861, por. Stecki & Pietkiewicz 1931), Bänitz (1865), Huth (1882), Spribille (1883, 1898), Nowicki (1885), Strähler (1893), Drymmer (1895), Struve (1895), Pfuhl (1896)
III	1897-1951	Hellwig (1897), Miller (1899, 1900), Spribille (1900), Schube (1903), Matuszewski (1904), Bock (1908), Decker (1912, 1924), Nowicki (1912), Kulesza (1920), Wodziczko (1925), Frase (1930, 1935), Krawiec & Urbański (1930), Urbański (1930), Rafalski & Urbański (1932), Ożminówna (1933), Papiewska (1933), Krawiec (1935, 1936), Papiewska-Urbańska (1935), Wodziczko <i>et al.</i> (1938), Krawiecowa (1951), Szulczewski (1951)
IV	1952-2008	Wojterscy H. & T. (1953), Wojterski (1960), Żukowski (1961, 1976), Grynia (1962), Wilkoń-Michalska (1963), Denisiuk (1964, 1980), Krotoska (1966), Filipek (1974), Latowski (1977/1978, 1998, 2007), Latowski <i>et al.</i> (1979, 1985), Jackowiak (1983, 1990a, 1990b, 1993, 1998), Ratyńska (2000, 2003), Chmiel (1993, 1997, 1998, 2001, 2004, 2006a, 2006b), Jackowiak <i>et al.</i> (1990, 1994), Jackowiak & Żukowski (1991), Borysiak <i>et al.</i> (1992), Borysiak (1994), Borysiak & Brzeg (1994), Celka (1995, 1997, 1998, 1999, 2004), Żukowski & Jackowiak (1995a, 1995b), Żukowski <i>et al.</i> (1995, 2001, 2002), Jackowiak & Celka (1997), Celka & Szkudlarz (1999), Chmiel <i>et al.</i> (2000), Pawłowski (2001, 2004), Wojterska (2003), Czarna (2004, 2006), Brzeg (2005), Jackowiak <i>et al.</i> (2008)

edition in 1995. The complete floristic database, along with the list of literature resources is held in the Department of Plant Taxonomy of the Adam Mickiewicz University of Poznań.

The history of studies on the flora of Wielkopolska can be divided into four stages (Table 1). They are

subspecies: *P. vulgaris* and *P. vulgaris* subsp. *bicolor* (Wof.) Á. Löve & D. Löve. An analysis took also into account the established species of hybrid origin, e.g. *Potamogeton xnitens* Weber (*Potamogeton perfoliatus* × *P. gramineus*). The names of families follow Rothmaler (1994).

Table 2. Categories of extinct, endangered and vulnerable species of plants in Wielkopolska

IUCN category	Definition
EX – Extinct, presumed to be extinct	Category comprising species which, according to the present state of knowledge, do not grow in the wild in Wielkopolska, i.e. all earlier known populations of species become destroyed (extinct) or there has been no confirmation of species presence since the beginning of the 20 th century (presumably extinct). For the sake of the publication, no distinction between the Extinct and Extinct in the Wild categories is made.
CR – Critically Endangered	Survival of the populations of such species in Wielkopolska is very unlikely if the threatening factors continue to operate, protection measures are not promptly implemented or are abandoned or inappropriate. Involve species occurring at single locations as small, isolated populations.
EN – Endangered	Survival of the populations of such species in Wielkopolska is very unlikely if the threatening factors continue to operate and future protection measures are not implemented. Involves species found at relatively more numerous localities and not necessarily only in small populations.
VU – Vulnerable	Species which resources are clearly decreasing in the area of Wielkopolska as a result of direct and indirect activities. In the nearest future, if the threatening factors continue to operate, they are at risk of moving to the EN category. Involves rare species, species occurring in small populations and rare species occupying threatened habitats.
LC – Least Concern	Species which are naturally rare, even though their resources have remained fairly stable over the last period, including some archaeophytes occurring in synanthropic plant communities influenced by human activities.
DD – Data Deficient	Species which can not be ranked among the above categories due to the insufficient information. The reasons of such inadequate state of knowledge could be of taxonomical, biological or ecological nature.

In conformity with the classification system of threatened species introduced by the International Union for Conservation of Nature (IUCN 2001) and principles recommended by this organisation, the categories presented in the Table 2 have been employed.

In the column ‘protection status’ (Table 3 in the chapter 4.1.), the species mentioned in the Annex II of the Habitats Directive (EC Habitats Directive 1992) (HD) as well as those under the law’s protection in the area of Poland were singled out. In compliance with the Regulation of the Minister of Environment on wild species of plants under protection (Regulation 2004), two groups of species were distinguished: strictly protected (SP) and partially protected (PP).

The affiliation to the group of archaeophytes, i.e. species of alien origin naturalized in Poland before the end of the 15th century, was assigned mainly on the basis of works by Zajac (1979, 1983, 1987a, 1987b, 1988).

The phytogeographical diagnostics of native species is based on the conception of geographical elements and, accordingly, the following three groups of species were distinguished:

- western (Atlantic sensu lato), classified according to Zajac M. and Zajac A. (2006)
- northern (boreal), classified according to Zajac A. and Zajac M. (2001)
- south-eastern and eastern, classified on the basis of analysis of their general distribution range and distribution in Poland.

An important feature of the studied flora of lowlands is the presence of species which have their

optimum in the mountains. Their classification was based on the work by Zajac (1996).

The basis of the synecological diagnostics is the classification of plant communities of Poland according to Matuszkiewicz (2001) as well as regional phytosociological documentation and the authors’ own field observations.

4. Results

4.1. Red list of the vascular plants threatened in Wielkopolska

In the present edition of the red list, in comparison to the first edition from 1995 (Żukowski & Jackowiak 1995a), several dozen of species have been excluded (Table 3). Some of them were removed from the list on account of a different taxonomic approach (e.g. *Seseli sibirica*) or better recognition of composition and condition of the flora of Wielkopolska. The species excluded from the list are mainly those previously considered as rare (e.g. *Acer campestre*, *Conium maculatum*, *Eryngium planum* or *Lathyrus palustris*) or threatened (among others, *Carex disticha*, *Ceratophyllum submersum* or *Cucubalus baccifer*). Clearly designated borders of Wielkopolska (cf. Żukowski *et al.* 2001) as well as publishing of the “*Distribution Atlas of Vascular Flora in Poland*” (Zajac A. & Zajac M. 2001), allowed to adjust the range limits of some very rare species, which have never occurred in Wielkopolska, e.g. *Deschampsia setacea* or *Orobancha arenaria*.

Table 3. List of endangered and vulnerable species of Wielkopolska

Name of species	Categories of threat	Protection status	Name of family
<i>Abies alba</i> Mill.	VU	-	Pinaceae
<i>Aconitum variegatum</i> L.	EN	SP	Ranunculaceae
<i>Actaea spicata</i> L.	LC	-	Ranunculaceae
<i>Adenophora liliifolia</i> (L.) Besser	CR	SP, HD	Campanulaceae
* <i>Adonis aestivalis</i> L.	EN	-	Ranunculaceae
<i>Adonis vernalis</i> L.	CR	SP	Ranunculaceae
<i>Aira caryophyllea</i> L.	LC	-	Poaceae
<i>Aira praecox</i> L.	LC	-	Poaceae
<i>Alchemilla acutiloba</i> Opiz	EN	-	Rosaceae
<i>Alchemilla cymatophylla</i> Juz.	EN	-	Rosaceae
<i>Alchemilla glabra</i> Neygenf.	EN	-	Rosaceae
<i>Alchemilla glaucescens</i> Wallr.	EN	-	Rosaceae
<i>Alchemilla gracilis</i> Opiz	VU	-	Rosaceae
<i>Alchemilla monticola</i> Opiz	VU	-	Rosaceae
<i>Alchemilla plicata</i> Buser	EN	-	Rosaceae
<i>Alchemilla propinqua</i> H. Lindb.	EN	-	Rosaceae
<i>Alchemilla subcrenata</i> Buser	EN	-	Rosaceae
<i>Alchemilla walasii</i> Pawł.	CR	-	Rosaceae
<i>Alchemilla xanthochlora</i> Rothm.	CR	-	Rosaceae
<i>Aldrovanda vesiculosa</i> L.	CR	SP, HD	Droseraceae
<i>Alisma gramineum</i> Lej.	EN	-	Alismataceae
<i>Alisma lanceolatum</i> With.	VU	-	Alismataceae
<i>Allium angulosum</i> L.	EN	-	Liliaceae
<i>Allium montanum</i> F. W. Schmidt	EN	-	Liliaceae
* <i>Allium rotundum</i> L. ¹	EN	-	Liliaceae
<i>Allium ursinum</i> L. ²	EN	PP	Liliaceae
<i>Anacamptis pyramidalis</i> (L.) Rich.	EX	-	Orchidaceae
* <i>Anagallis foemina</i> Mill. [= <i>Anagallis coerulea</i> Schreb.]	EN	-	Primulaceae
<i>Andromeda polifolia</i> L.	VU	-	Ericaceae
<i>Androsace septentrionalis</i> L.	VU	-	Primulaceae
<i>Anemone sylvestris</i> L.	EN	SP	Ranunculaceae
<i>Antennaria dioica</i> (L.) Gaertn.	EN	-	Asteraceae
* <i>Anthemis cotula</i> L.	VU	-	Asteraceae
<i>Anthericum liliago</i> L.	EN	SP	Liliaceae
* <i>Aphanes inexpectata</i> W. Lippert [= <i>Aphanes microcarpa</i> (Boiss. & Reuter) Rothm.]	LC	-	Rosaceae
<i>Apium nodiflorum</i> (L.) Lag.	CR	SP	Apiaceae
<i>Apium repens</i> (Jacq.) Lag.	CR	SP, HD	Apiaceae
<i>Aquilegia vulgaris</i> L. ³	VU	SP	Ranunculaceae
<i>Arabis planisiliqua</i> (Pers.) Rchb. [= <i>Arabis gerardii</i> (Besser) Besser]	EN	-	Brassicaceae
<i>Arabis sagittata</i> (Bertol.) DC.	DD	-	Brassicaceae
<i>Arctium nemorosum</i> Lej.	LC	-	Asteraceae
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	LC	SP	Ericaceae
<i>Arnica montana</i> L.	VU	SP	Asteraceae
<i>Asperula cynanchica</i> L.	EN	-	Rubiaceae
<i>Asperula tinctoria</i> L.	VU	-	Rubiaceae
<i>Asplenium septentrionale</i> (L.) Hoffm.	EX	-	Aspleniaceae

¹ Quoted from several localities in Wielkopolska – POZ (Czarna 2005).^{2,3} Aside from native populations, found also spreading from cultivation and running wild.

Name of species	Categories of threat	Protection status	Name of family
<i>Asplenium trichomanes</i> L. ⁴	EN	-	Aspleniaceae
<i>Aster amellus</i> L.	EN	SP	Asteraceae
<i>Aster tripolium</i> L.	EN	SP	Asteraceae
<i>Astragalus danicus</i> Retz.	EN	-	Fabaceae
<i>Astrantia major</i> L.	VU	-	Apiaceae
* <i>Atriplex rosea</i> L.	EN	-	Chenopodiaceae
* <i>Avena strigosa</i> Schreb.	LC	-	Poaceae
<i>Avenula pratensis</i> (L.) Dumort.	LC	-	Poaceae
<i>Baeothryon alpinum</i> (L.) T. V. Egorova [= <i>Trichophorum alpinum</i> (L.) Pers.]	EX	SP	Cyperaceae
<i>Batrachium hederaceum</i> (L.) Gray	EX	SP	Ranunculaceae
<i>Betonica officinalis</i> L.	VU	-	Lamiaceae
<i>Betula humilis</i> Schrank	CR	SP	Betulaceae
<i>Betula obscura</i> Kotula	DD	-	Betulaceae
<i>Bidens radiata</i> Thuill.	LC	-	Asteraceae
<i>Blechnum spicant</i> (L.) Roth	EN	SP	Blechnaceae
<i>Blysmus rufus</i> (Huds.) Link	EX	-	Cyperaceae
<i>Botrychium lunaria</i> (L.) Sw.	EN	SP	Ophioglossaceae
<i>Botrychium matricariifolium</i> (Retz.) A. Braun ex W. D. J. Koch [= <i>Botrychium ramosum</i> (Roth) Aschers.]	EN	SP	Ophioglossaceae
<i>Botrychium multifidum</i> (S. G. Gmel.) Rupr.	CR	SP	Ophioglossaceae
<i>Botrychium simplex</i> E. Hitchc.	EX	SP, HD	Ophioglossaceae
* <i>Bromus arvensis</i> L.	LC	-	Poaceae
<i>Bromus racemosus</i> L.	VU	-	Poaceae
<i>Bromus ramosus</i> Huds.	EN	-	Poaceae
* <i>Bromus secalinus</i> L.	VU	-	Poaceae
* <i>Bupleurum rotundifolium</i> L.	EX	-	Apiaceae
<i>Bupleurum tenuissimum</i> L.	EX	-	Apiaceae
<i>Calamagrostis stricta</i> (Timm) Koeler	VU	-	Poaceae
<i>Caldesia parnassifolia</i> (L.) Parl.	CR	SP, HD	Alismataceae
<i>Callitriche autumnalis</i> L. emend. Wahlenb.	EN	-	Callitrichaceae
<i>Callitriche hamulata</i> Kütz. ex W. D. J. Koch	EN	-	Callitrichaceae
<i>Callitriche stagnalis</i> Scop.	EN	-	Callitrichaceae
* <i>Camelina alyssum</i> (Mill.) Thell. ⁵	EX	-	Brassicaceae
* <i>Camelina sativa</i> (L.) Crantz	VU	-	Brassicaceae
<i>Campanula bononiensis</i> L.	VU	SP	Campanulaceae
<i>Campanula cervicaria</i> L.	VU	-	Campanulaceae
<i>Campanula latifolia</i> L. ⁶	LC	SP	Campanulaceae
<i>Campanula sibirica</i> L.	VU	SP	Campanulaceae
<i>Cardamine flexuosa</i> With.	LC	-	Brassicaceae
<i>Cardamine impatiens</i> L.	VU	-	Brassicaceae
<i>Cardamine parviflora</i> L.	EN	-	Brassicaceae
<i>Carex atherodes</i> Spreng. [= <i>Carex aristata</i> R. Br.]	EN	-	Cyperaceae
<i>Carex bohémica</i> Schreb.	EN	-	Cyperaceae
<i>Carex buekii</i> Wimm.	EX	-	Cyperaceae
<i>Carex buxbaumii</i> Wahlenb.	CR	-	Cyperaceae
<i>Carex chordorrhiza</i> L. f.	CR	SP	Cyperaceae
<i>Carex davalliana</i> Sm.	CR	SP	Cyperaceae

⁴ Native in Poland, in lowlands also secondarily (i.e. shadowed walls).

⁵ According to Mirek (1981), in Poland the taxon is differentiated into 2 subspecies: subsp. *alyssum* and subsp. *integerrima* Čelak, both formerly observed also in Wielkopolska but for a long time not confirmed.

⁶ Apart from localities in natural communities, where it is threatened, more frequently found in country parks.

Name of species	Categories of threat	Protection status	Name of family
Carex demissa Hornem.	VU	-	Cyperaceae
Carex diandra Schrank	LC	-	Cyperaceae
Carex dioica L.	EN	-	Cyperaceae
Carex divulsa Stokes	EN	SP	Cyperaceae
Carex hartmanii Cajander	VU	-	Cyperaceae
Carex heleonastes Ehrh. in L. f.	EX	-	Cyperaceae
Carex hostiana DC.	VU	-	Cyperaceae
Carex humilis Leyss.	CR	-	Cyperaceae
Carex lepidocarpa Tausch	LC	-	Cyperaceae
Carex ligerica J. Gay	VU	-	Cyperaceae
Carex limosa L.	VU	SP	Cyperaceae
Carex ornithopoda Willd.	EX	-	Cyperaceae
Carex pilosa Scop.	VU	-	Cyperaceae
Carex pseudo-brizoides Clavaud [= <i>Carex reichenbachii</i> Kük.]	CR	-	Cyperaceae
Carex pulicaris L.	CR	SP	Cyperaceae
Carex repens Bellardi	EN	-	Cyperaceae
Carex secalina Wahlenb.	CR	SP	Cyperaceae
Carex supina Wahlenb.	CR	SP	Cyperaceae
Carex tomentosa L.	VU	-	Cyperaceae
Carex umbrosa Host	CR	-	Cyperaceae
Carlina acaulis L.	EN	SP	Asteraceae
Catabrosa aquatica (L.) P. Beauv.	VU	-	Poaceae
* Caucalis platycarpus L. [= <i>Caucalis daucoides</i> L.]	CR	-	Apiaceae
Centaurea oxylepis (Wimm. & Grab.) Hayek	EN	-	Asteraceae
Centaurea phrygia L.	DD	-	Asteraceae
Centunculus minimus L.	EN	-	Primulaceae
Cephalanthera damasonium (Mill.) Druce [= <i>Cephalanthera alba</i> (Crantz) Simk.]	CR	SP	Orchidaceae
Cephalanthera longifolia (L.) Fritsch [= <i>Cephalanthera ensifolia</i> (Sw.) L. C. Richard]	CR	SP	Orchidaceae
Cephalanthera rubra (L.) Rich.	EN	SP	Orchidaceae
Cerastium brachypetalum Pers.	EX	-	Caryophyllaceae
Cerastium dubium (Bastard) Guépin [= <i>Cerastium anomalum</i> Waldst. & Kit.]	DD	-	Caryophyllaceae
Cerastium glutinosum F. W. Schultz [= <i>Cerastium pallens</i> F. W. Schultz]	EN	-	Caryophyllaceae
Cerastium macrocarpum Schur emend. Gaertner	DD	-	Caryophyllaceae
Cerastium pumilum Curtis s. str.	EN	-	Caryophyllaceae
Cerasus fruticosa Pall.	VU	SP	Rosaceae
Chaerophyllum hirsutum L.	VU	-	Apiaceae
Chamaecytisus ratisbonensis (Schaeff.) Rothm. [= <i>Cytisus ratisbonensis</i> Schaeff.]	EN	-	Fabaceae
Chamaecytisus supinus (L.) Link [= <i>Cytisus capitatus</i> Scop.]	EN	-	Fabaceae
* Chenopodium bonus-henricus L.	LC	-	Chenopodiaceae
* Chenopodium murale L.	LC	-	Chenopodiaceae
* Chenopodium opulifolium Schrad. ex W. D. J. Koch & Ziz	LC	-	Chenopodiaceae
* Chenopodium urbicum L.	LC	-	Chenopodiaceae
* Chenopodium vulvaria L.	LC	-	Chenopodiaceae
Chimaphila umbellata (L.) W. P. C. Barton	LC	SP	Pyrolaceae
* Chrysanthemum segetum L.	LC	-	Asteraceae
Chrysosplenium oppositifolium L.	CR	-	Saxifragaceae
Cimicifuga europaea Schipcz.	EN	SP	Ranunculaceae
Circaea intermedia Ehrh.	VU	-	Onagraceae

Name of species	Categories of threat	Protection status	Name of family
<i>Cirsium canum</i> (L.) All.	VU	-	Asteraceae
<i>Cirsium rivulare</i> (Jacq.) All.	EN	-	Asteraceae
<i>Cladium mariscus</i> (L.) Pohl	LC	SP	Cyperaceae
<i>Cnidium dubium</i> (Schkuhr) Thell.	LC	-	Apiaceae
<i>Coeloglossum viride</i> (L.) Hartm.	EX	SP	Orchidaceae
<i>Colchicum autumnale</i> L.	EN	SP	Liliaceae
* <i>Conringia orientalis</i> (L.) Dumort.	EX	-	Brassicaceae
<i>Corallorhiza trifida</i> Châtel.	CR	SP	Orchidaceae
* <i>Coronopus squamatus</i> (Forssk.) Asch. [= <i>Coronopus procumbens</i> Gilib.]	LC	-	Brassicaceae
<i>Corrigiola litoralis</i> L.	CR	SP	Caryophyllaceae
<i>Corydalis intermedia</i> (L.) Mérat	LC	-	Fumariaceae
<i>Corydalis pumila</i> (Host) Rchb.	EN	SP	Fumariaceae
<i>Corydalis solida</i> (L.) Clairv.	EN	-	Fumariaceae
<i>Crassula aquatica</i> (L.) Schönland ⁷ [= <i>Bulliardia aquatica</i> (L.) DC.]	CR	-	Crassulaceae
<i>Crataegus rhipidophylla</i> Gand. var. rhipidophylla	LC	-	Rosaceae
<i>Crepis mollis</i> (Jacq.) Asch. s. str. [= <i>Crepis mollis</i> (Jacq.) Aschers. subsp. <i>mollis</i>]	EN	-	Asteraceae
<i>Crepis praemorsa</i> (L.) Tausch	EN	-	Asteraceae
<i>Cruciata glabra</i> (L.) Ehrend. [= <i>Galium verum</i> Scop.]	LC	-	Rubiaceae
<i>Cruciata laevipes</i> Opiz [= <i>Galium cruciata</i> (L.) Scop.]	LC	-	Rubiaceae
* <i>Cuscuta epilinum</i> Weihe ex Boenn.	EX	-	Cuscutaceae
<i>Cuscuta epithymum</i> (L.) L. s. str.	LC	-	Cuscutaceae
<i>Cyperus flavescens</i> L.	CR	-	Cyperaceae
<i>Cypripedium calceolus</i> L.	CR	SP, HD	Orchidaceae
<i>Cystopteris fragilis</i> (L.) Bernh.	LC	-	Athyriaceae
<i>Dactylorhiza baltica</i> (Klinge) N. I. Orlova	EX	SP	Orchidaceae
<i>Dactylorhiza fuchsii</i> (Druce) Soó	EN	SP	Orchidaceae
<i>Dactylorhiza incarnata</i> (L.) Soó subsp. incarnata ⁸	LC	SP	Orchidaceae
<i>Dactylorhiza incarnata</i> (L.) Soó subsp. ochroleuca (Boll) P. F. Hunt & Summerh. ⁸	CR	SP	Orchidaceae
<i>Dactylorhiza maculata</i> (L.) Soó	VU	SP	Orchidaceae
<i>Dactylorhiza majalis</i> (Rchb.) P. F. Hunt & Summerh.	LC	SP	Orchidaceae
<i>Dactylorhiza sambucina</i> (L.) Soó	EX	SP	Orchidaceae
<i>Daphne mezereum</i> L.	LC	SP	Thymelaeaceae
<i>Dentaria bulbifera</i> L.	EN	-	Brassicaceae
<i>Dentaria enneaphyllos</i> L.	EN	-	Brassicaceae
<i>Dianthus arenarius</i> L.	LC	SP	Caryophyllaceae
<i>Dianthus armeria</i> L.	LC	SP	Caryophyllaceae
<i>Dianthus gratianopolitanus</i> Vill. [= <i>Dianthus caesius</i> Sm.]	CR	SP	Caryophyllaceae
<i>Dianthus superbis</i> L. s. str.	LC	SP	Caryophyllaceae
<i>Dichostylis micheliana</i> (L.) Nees	EX	-	Cyperaceae
<i>Diphasiastrum complanatum</i> (L.) Holub [= <i>Diphasium complanatum</i> (L.) Rothm., <i>Lycopodium complanatum</i> L.]	VU	SP	Lycopodiaceae
<i>Diphasiastrum tristachyum</i> (Pursh) Holub [= <i>Lycopodium tristachyum</i> Pursh, <i>Lycopodium chamaecyparissus</i> A. Br., <i>Diphasium tristachyum</i> (Pursh) Rothm.]	CR	SP	Lycopodiaceae

⁷ Not observed in Poland for the last several dozen of years (Żukowski 2001). Recently found in the Barycz river valley by Kaćki (2005).

⁸ A species consisting of two taxons at the rank of subspecies, with differentiated degree of endangerment.

Name of species	Categories of threat	Protection status	Name of family
Diphasiastrum zeilleri (Rouy) Holub [= <i>Diphasium zeilleri</i> (Rouy) Damboldt]	DD	SP	Lycopodiaceae
Dipsacus laciniatus L.	DD	-	Dipsacaceae
Draba nemorosa L.	VU	-	Brassicaceae
Dracocephalum ruyschiana L.	CR	SP	Lamiaceae
Drosera anglica Huds.	VU	SP	Droseraceae
Drosera intermedia Hayne	VU	SP	Droseraceae
Drosera xobovata Mert. & W. D. J. Koch	DD	SP	Droseraceae
Drosera rotundifolia L.	LC	SP	Droseraceae
Dryopteris affinis (Lowe) Fraser-Jenk.	DD	-	Aspidiaceae
Dryopteris cristata (L.) A. Gray	VU	-	Aspidiaceae
Dryopteris expansa (C. Presl) Fraser-Jenk. & Jermy [= <i>Dryopteris assimilis</i> S. Walker]	DD	-	Aspidiaceae
Elatine alsinastrum L.	EN	SP	Elatinaceae
Elatine hexandra (Lapierre) DC.	EN	SP	Elatinaceae
Elatine hydropiper L. emend. Oeder	EN	SP	Elatinaceae
Elatine triandra Schkuhr	EN	SP	Elatinaceae
Eleocharis mamillata (H. Lindb.) H. Lindb. ex Dörfl. s. str.	CR	-	Cyperaceae
Eleocharis multicaulis Sm.	CR	SP	Cyperaceae
Eleocharis ovata (Roth) Roem. & Schult.	VU	-	Cyperaceae
Eleocharis quinqueflora (Hartmann) O. Schwarz	VU	-	Cyperaceae
Eleogiton fluitans (L.) Link ⁹	EX	-	Cyperaceae
Empetrum nigrum L. s. str.	CR	-	Empetraceae
Epilobium obscurum Schreb.	LC	-	Onagraceae
Epipactis albensis Nováková & Rydlo	CR	SP	Orchidaceae
Epipactis atrorubens (Hoffm.) Besser	CR	SP	Orchidaceae
Epipactis palustris (L.) Crantz	LC	SP	Orchidaceae
Epipactis purpurata Sm. [= <i>Epipactis viridiflora</i> (Hoffm.) Rchb.]	CR	SP	Orchidaceae
Epipogium aphyllum Sw.	EX	SP	Orchidaceae
Equisetum ramosissimum Desf.	DD	-	Equisetaceae
Equisetum telmateia Ehrh.	LC	SP	Equisetaceae
Equisetum variegatum Schleich.	EN	SP	Equisetaceae
Erica tetralix L.	CR	SP	Ericaceae
Eriophorum gracile W. D. J. Koch	EX	SP	Cyperaceae
Eriophorum latifolium Hoppe	VU	-	Cyperaceae
Eriophorum vaginatum L.	VU	-	Cyperaceae
Eryngium campestre L.	VU	-	Apiaceae
Euonymus verrucosa Scop.	LC	-	Celastraceae
Euphorbia dulcis L.	LC	-	Euphorbiaceae
Euphorbia lucida Waldst. & Kit.	VU	-	Euphorbiaceae
Euphorbia palustris L.	LC	-	Euphorbiaceae
Euphrasia micrantha Rchb.	DD	-	Scrophulariaceae
Euphrasia nemorosa (Pers.) Wallr.	VU	-	Scrophulariaceae
Festuca altissima All.	EN	-	Poaceae
Festuca amethystina L. subsp. ritschlii (Hack.) Lemke ex Markgr.-Dann.	VU	SP	Poaceae
Festuca duvalii (St.-Yves) Stohr	DD	-	Poaceae
Festuca nigrescens Lam.	DD	-	Poaceae
Festuca polesica Zapał.	DD	-	Poaceae
Festuca psammophila (Hack. ex Čelak.) Fritsch	VU	-	Poaceae
Festuca questhalica Boenn. ex Rchb.	DD	-	Poaceae

⁹ A western species quoted from a single, isolated locality in Poland; POZ – Schönke 1845 (Żukowski 1969).

Name of species	Categories of threat	Protection status	Name of family
Festuca rupicola Heuff.	LC	-	Poaceae
Festuca tenuifolia Sibth. [= <i>Festuca capillata</i> Lam.]	DD	-	Poaceae
Festuca vaginata Waldst. & Kit. ex Willd.	DD	-	Poaceae
Festuca valesiaca Schleich. ex Gaudin	DD	-	Poaceae
Ficaria nudicaulis A. Kern. [= <i>Ficaria calthifolia</i> Rchb.]	DD	-	Ranunculaceae
Filago lutescens Jord. [= <i>Filago germanica</i> L. non Huds.]	DD	-	Asteraceae
Filago vulgaris Lam.	EN	-	Asteraceae
Fragaria moschata Duchesne	VU	-	Rosaceae
Fritillaria meleagris L. ¹⁰	EX	SP	Liliaceae
* Fumaria schleicheri Soy.-Will.	LC	-	Fumariaceae
* Fumaria vaillantii Loisel.	LC	-	Fumariaceae
* Gagea arvensis (Pers.) Dumort.	LC	-	Liliaceae
Gagea spathacea (Hayne) Salisb.	DD	-	Liliaceae
Galanthus nivalis L. ¹¹	DD	SP	Liliaceae
Galium pumilum Murray	LC	-	Rubiaceae
Galium rivale (Sibth. & Sm.) Griseb.	LC	-	Rosaceae
Galium rotundifolium L.	VU	-	Rubiaceae
Galium sylvaticum L.	LC	-	Rubiaceae
Galium schultesii Vest	LC	-	Rubiaceae
Genista germanica L.	VU	-	Fabaceae
Genista pilosa L.	EN	-	Fabaceae
Gentiana cruciata L.	CR	SP	Gentianaceae
Gentiana pneumonanthe L.	VU	SP	Gentianaceae
Gentianella amarella (L.) Börner	DD	SP	Gentianaceae
Gentianella baltica (Murb.) Börner	EX	SP	Gentianaceae
Gentianella uliginosa (Willd.) Börner [= <i>Gentiana uliginosa</i> (Willd.) Börner]	CR	SP	Gentianaceae
Geranium sylvaticum L.	VU		Geraniaceae
Gladiolus imbricatus L.	EN	SP	Iridaceae
Gladiolus paluster Gaudin	EX	SP, HD	Iridaceae
Glaux maritima L.	VU	SP	Primulaceae
Glyceria declinata Bréb.	EN	-	Poaceae
Glyceria nemoralis (R. Uechtr.) R. Uechtr. & Körn.	EN	-	Poaceae
Gnaphalium luteo-album L.	LC	-	Asteraceae
Goodyera repens (L.) R. Br.	EN	SP	Orchidaceae
Gratiola officinalis L.	VU	SP	Scrophulariaceae
Groenlandia densa (L.) Fourr. [= <i>Potamogeton densus</i> L.]	EX	SP	Potamogetonaceae
Gymnadenia conopsea (L.) R. Br.	EN	SP	Orchidaceae
Hammarbya paludosa (L.) Kuntze	CR	SP	Orchidaceae
Helianthemum nummularium (L.) Mill. subsp. obscurum (Čelak.) Holub [= <i>Helianthemum ovatum</i> (Viv.) Dunal]	VU	-	Cistaceae
Herminium monorchis (L.) R. Br.	EX	SP	Orchidaceae
* Herniaria hirsuta L.	LC	-	Caryophyllaceae
Hieracium bauhini Schult.	DD	-	Asteraceae
Hieracium bifurcum M. Bieb. (<i>pilosella</i> > <i>echioides</i>)	DD	-	Asteraceae

¹⁰ The species extinct in natural localities (cf. Szulczewski 1951), recently quoted from the vicinity of Gubin – from the locality implying its anthropogenic origin (Kujawa-Pawlaczyk 2005).

¹¹ A species spreading from cultivation and running wild. The presence of native populations in the south of Wielkopolska cannot be excluded.

Name of species	Categories of threat	Protection status	Name of family
Hieracium brachiatum Bertol. ex DC. (pilosella > piloselloides)	DD	-	Asteraceae
Hieracium cymosum L.	DD	-	Asteraceae
Hieracium echioides Lumn.	VU	-	Asteraceae
Hieracium fallax Willd. (echioides – cymosum)	DD	-	Asteraceae
Hieracium flagellare Willd. (pilosella – caespitosum)	DD	-	Asteraceae
Hieracium floribundum Wimm. & Grab. (caespitosum > lactucella)	DD	-	Asteraceae
Hieracium lactucella Wallr.	LC	-	Asteraceae
Hieracium longiscapum Boiss. & Kotschy (caespitosum – lactucella)	DD	-	Asteraceae
Hieracium prussicum Nägeli & A. Peter (caespitosum > pilosella)	DD	-	Asteraceae
Hierochloë australis (Schrad.) Roem. & Schult.	CR	PP	Poaceae
Hierochloë odorata (L.) P. Beauv.	CR	PP	Poaceae
Hordelymus europaeus (L.) Jess ex Harz	CR	-	Poaceae
Huperzia selago (L.) Bernh. ex Schrank & Mart. [= <i>Lycopodium selago</i> L.]	EN	SP	Huperziaceae
Hypericum hirsutum L.	LC	-	Hypericaceae
Hypericum pulchrum L.	CR	SP	Hypericaceae
Hypochoeris maculata L.	VU	-	Asteraceae
Illecebrum verticillatum L.	VU	-	Caryophyllaceae
Inula hirta L.	CR	-	Asteraceae
Inula salicina L.	LC	-	Asteraceae
Iris sibirica L.	VU	SP	Iridaceae
Isolepis setacea (L.) R. Br.	VU	-	Cyperaceae
Isolepis supina (L.) R. Br.	EX	-	Cyperaceae
Isopyrum thalictroides L.	VU	-	Ranunculaceae
Jovibarba sobolifera (Sims) Opiz [= <i>Sempervivum soboliferum</i> Sims subsp. <i>soboliferum</i>]	VU	SP	Crassulaceae
Juncus acutiflorus Ehrh. ex Hoffm.	EN	-	Juncaceae
Juncus alpino-articulatus Chaix [= <i>Juncus alpinus</i> Vill.]	VU	-	Juncaceae
Juncus atratus Krock.	DD	-	Juncaceae
Juncus capitatus Weigel	LC	-	Juncaceae
Juncus filiformis L.	EN	-	Juncaceae
Juncus gerardi Loisel.	CR	-	Juncaceae
Juncus squarrosus L.	VU	-	Juncaceae
Juncus subnodulosus Schrank	VU	-	Juncaceae
Juncus tenageia Ehrh.	CR	-	Juncaceae
* Kickxia elatine (L.) Dumort. [= <i>Linaria elatine</i> (L.) Mill.]	LC	-	Scrophulariaceae
* Kickxia spuria (L.) Dumort. [= <i>Linaria spuria</i> (L.) Mill.]	EX	-	Scrophulariaceae
Koeleria grandis Besser ex Gorski	EN	-	Poaceae
Koeleria pyramidata (Lam.) P. Beauv. ¹²	EN	-	Poaceae
* Lamium incisum Willd. ¹³ [= <i>Lamium dissectum</i> With., <i>Lamium hybridum</i> auct.]	DD	-	Lamiaceae
* Lamium moluccellifolium Fr. ¹³ [= <i>Lamium intermedium</i> Fr.]	DD	-	Lamiaceae

¹² Quoted from several localities by Klimko and Czarna (2001a, 2001b).

¹³ Both historical and geographical and taxonomical statuses have not been definitely determined so far. Some researchers acknowledge that parents of both hybrids are *Lamium purpureum* and *L. amplexicaule* (Sychowa 1967; Gladokova 1978; Adler 1994). Rothmaler (1994) and Dvořáková (2002) share this opinion only in relation to *L. moluccellifolium* (*L. intermedium*). In turn, as parental species of *L. hybridum*, Dvořáková (2002) considers *L. bifidum* and *L. purpureum*, while Rothmaler (1994) designates *L. moschatum* and *L. purpureum*.

Name of species	Categories of threat	Protection status	Name of family
<i>Laserpitium latifolium</i> L.	EN	-	Apiaceae
<i>Laserpitium prutenicum</i> L.	VU	-	Apiaceae
<i>Lathyrus heterophyllus</i> L.	EX	-	Fabaceae
<i>Lathyrus montanus</i> Bernh.	LC	-	Fabaceae
<i>Ledum palustre</i> L.	VU	SP	Ericaceae
<i>Leersia oryzoides</i> (L.) Sw.	VU	-	Poaceae
<i>Lembotropis nigricans</i> (L.) Griseb. [= <i>Cytisus nigricans</i> L.]	VU	-	Fabaceae
<i>Leucoium vernum</i> L. ¹⁴	DD	SP	Liliaceae
<i>Libanotis pyrenaica</i> (L.) Bourg. [= <i>Libanotis montana</i> Crantz]	LC	-	Apiaceae
<i>Lilium martagon</i> L.	LC	SP	Liliaceae
* <i>Linaria arvensis</i> (L.) Desf.	EX	-	Scrophulariaceae
<i>Lindernia procumbens</i> (Krock.) Borbás [= <i>Lindernia pyxidaria</i> L.]	CR	-	Scrophulariaceae
<i>Linnaea borealis</i> L.	CR	SP	Caprifoliaceae
<i>Linomyris vulgaris</i> Cass. [= <i>Aster linomyris</i> (L.) Bernh.]	CR	SP	Asteraceae
<i>Liparis loeselii</i> (L.) Rich.	EN	SP, HD	Orchidaceae
<i>Listera ovata</i> (L.) R. Br.	LC	SP	Orchidaceae
<i>Lithospermum officinale</i> L.	VU	-	Boraginaceae
<i>Littorella uniflora</i> (L.) Asch.	EX	-	Plantaginaceae
* <i>Lolium remotum</i> Schrank	EX	-	Poaceae
* <i>Lolium temulentum</i> L.	LC	-	Poaceae
<i>Lonicera periclymenum</i> L. ¹⁵	VU	SP	Caprifoliaceae
<i>Lotus tenuis</i> Waldst. & Kit. ex Willd.	VU	-	Fabaceae
<i>Ludwigia palustris</i> (L.) Elliott	EX	-	Onagraceae
<i>Luronium natans</i> (L.) Raf. [= <i>Elisma natans</i> (L.) Buchenau] ¹⁶	EX	SP, HD	Alismataceae
<i>Luzula luzuloides</i> (Lam.) Dandy & Wilmott ¹⁷	VU	-	Juncaceae
<i>Lycopodiella inundata</i> (L.) Holub [= <i>Lycopodium inundatum</i> L.]	CR	SP	Lycopodiaceae
<i>Lycopodium annotinum</i> L.	VU	SP	Lycopodiaceae
<i>Lycopodium clavatum</i> L.	LC	SP	Lycopodiaceae
<i>Lythrum hyssopifolia</i> L.	VU	-	Lythraceae
<i>Malaxis monophyllos</i> (L.) Sw.	EX	SP	Orchidaceae
<i>Matteucia struthiopteris</i> (L.) Tod. ¹⁸	EN	SP	Athyriaceae
<i>Medicago minima</i> (L.) L.	VU	-	Fabaceae
<i>Melampyrum arvense</i> L.	VU	-	Scrophulariaceae
<i>Melampyrum cristatum</i> L.	EN	-	Scrophulariaceae
<i>Melampyrum sylvaticum</i> L.	EN	-	Scrophulariaceae
<i>Melandrium rubrum</i> (Weigel) Garcke	LC	-	Caryophyllaceae
<i>Melilotus altissima</i> Thuill.	DD	-	Fabaceae
<i>Melilotus dentata</i> (Waldst. & Kit.) Pers.	EN	-	Fabaceae
<i>Melittis melissophyllum</i> L.	VU	SP	Lamiaceae
<i>Mentha pulegium</i> L.	VU	-	Lamiaceae
<i>Minuartia viscosa</i> (Schreb.) Schinz & Thell.	VU	-	Caryophyllaceae
* <i>Misopates orontium</i> (L.) Raf. [= <i>Antirrhinum orontium</i> L.]	EN	-	Scrophulariaceae

¹⁴ A species spreading from cultivation and running wild.

¹⁵ A species occurs in natural localities in the south and south-west parts of Wielkopolska, apart from this also secondarily, i.e. in the Wielkopolski National Park.

¹⁶ Localities recently quoted (Kujawa-Pawlaczyk 2005) are not documented with herbarium specimens.

¹⁷ A species occurs in natural localities in south Wielkopolska, apart from this, also secondarily.

¹⁸ All localities outside the Lubuska Land are secondary.

Name of species	Categories of threat	Protection status	Name of family
Moneses uniflora (L.) A. Gray [= <i>Pyrola uniflora</i> L.]	VU	-	Pyrolaceae
Montia fontana L. subsp. montana	CR	SP	Portulacaceae
Myrica gale L.	CR	SP	Myricaceae
Najas minor All.	CR	SP	Najadaceae
Nasturtium officinale R. Br.	VU	SP	Brassicaceae
Neottia nidus-avis (L.) Rich.	EN	SP	Orchidaceae
Nuphar pumila (Timm) DC.	CR	SP	Nymphaeaceae
Nymphaea candida C. Presl ¹⁹	DD	SP	Nymphaeaceae
Nymphoides peltata (S. G. Gmel.) Kuntze	VU	SP	Menyanthaceae
Oenanthe fistulosa L.	VU	-	Apiaceae
Ononis repens L.	VU	PP	Fabaceae
Ophioglossum vulgatum L.	VU	SP	Ophioglossaceae
Orchis coriophora L. ²⁰	CR	SP	Orchidaceae
Orchis militaris L.	VU	SP	Orchidaceae
Orchis morio L.	CR	SP	Orchidaceae
Orchis palustris Jacq.	CR	SP	Orchidaceae
Orchis tridentata Scop.	EX	SP	Orchidaceae
Orchis ustulata L.	EX	SP	Orchidaceae
Oreopteris limbosperma (Bellardi ex All.) Holub [= <i>Dryopteris oreopteris</i> (Ehrh.) Maxon]	EN	-	Thelypteridaceae
Ornithopus perpusillus L.	VU	-	Fabaceae
Orobanche caryophyllacea Sm.	CR	SP	Orobanchaceae
Orobanche elatior Sutton	CR	SP	Orobanchaceae
Orobanche lutea Baumg.	CR	SP	Orobanchaceae
Orobanche purpurea Jacq.	CR	SP	Orobanchaceae
Osmunda regalis L.	VU	SP	Osmundaceae
Ostericum palustre Besser [= <i>Angelica palustris</i> (Besser) Hoffm.]	VU	SP, HD	Apiaceae
Oxycoccus microcarpus Turcz. ex Rupr.	DD	-	Ericaceae
Oxycoccus palustris Pers. [= <i>Oxycoccus quadripetalus</i> Gilib.]	VU	-	Ericaceae
Oxytropis pilosa (L.) DC.	VU	SP	Fabaceae
Parnassia palustris L.	VU	-	Parnassiaceae
Pedicularis palustris L.	EN	SP	Scrophulariaceae
Pedicularis sceptrum-carolinum L.	EX	SP	Scrophulariaceae
Pedicularis sylvatica L.	EN	SP	Scrophulariaceae
Petasites spurius (Retz.) Rchb.	VU	-	Asteraceae
Peucedanum cervaria (L.) Lapeyr.	VU	-	Apiaceae
Phegopteris connectilis (Michx.) Watt [= <i>Phegopteris polypodioides</i> Fée]	EN	-	Thelypteridaceae
Phyteuma orbiculare L.	EX	SP	Campanulaceae
Pilularia globulifera L.	CR	SP	Marsileaceae
Pinguicula vulgaris L. subsp. bicolor (Wol.) Á. Löve & D. Löve ²¹	CR	SP	Lentibulariaceae
Pinguicula vulgaris L. subsp. vulgaris ²¹	CR	SP	Lentibulariaceae
Platanthera bifolia (L.) Rich.	VU	SP	Orchidaceae
Platanthera chlorantha (Custer) Rchb.	EN	SP	Orchidaceae
Pleurospermum austriacum (L.) Hoffm.	EX	-	Apiaceae
Poa remota Forselles	VU	-	Poaceae
Polemonium coeruleum L.	EX	-	Polemoniaceae
Polycnemum arvense L.)	CR	-	Chenopodiaceae

¹⁹ In the light of recent publications, the occurrence of this species in the Lubuska Land (Wayda 2000; Pelechaty & Pukacz 2005) requires further studies.

²⁰ Lately noted, among others, in the vicinity of Poznań (Stachnowicz 1997).

²¹ In Poland, *Pinguicula vulgaris* L. is distinctly differentiated into two taxa at the rank of subspecies.

Name of species	Categories of threat	Protection status	Name of family
Polygonatum verticillatum (L.) All.	EN	-	Liliaceae
Polystichum aculeatum (L.) Roth	EN	SP	Aspidiaceae
Populus nigra L.	LC	-	Salicaceae
Potamogeton acutifolius Link	VU	-	Potamogetonaceae
Potamogeton alpinus Balb.	VU	-	Potamogetonaceae
Potamogeton xangustifolius Bercht. & J. Presl [= Potamogeton xzizii Koch ex Roth, Potamogeton lucens x P. gramineus]	DD	-	Potamogetonaceae
Potamogeton berchtoldii Fieber	VU	-	Potamogetonaceae
Potamogeton compressus L.	VU	-	Potamogetonaceae
Potamogeton filiformis Pers.	CR	-	Potamogetonaceae
Potamogeton friesii Rupr. [= Potamogeton mucronatus Schrad.]	VU	-	Potamogetonaceae
Potamogeton gramineus L.	VU	-	Potamogetonaceae
Potamogeton xnitens Weber [= Potamogeton perfoliatus x P. gramineus]	DD	-	Potamogetonaceae
Potamogeton obtusifolius Mert. & W. D. J. Koch	VU	-	Potamogetonaceae
Potamogeton polygonifolius Pourr.	CR	-	Potamogetonaceae
Potamogeton praelongus Wulfen	CR	-	Potamogetonaceae
Potamogeton pusillus L.	VU	-	Potamogetonaceae
Potamogeton rutilus Wolfg.	DD	-	Potamogetonaceae
Potamogeton trichoides Cham. & Schltld.	VU	-	Potamogetonaceae
Potentilla norvegica L.	LC	-	Rosaceae
Potentilla rupestris L.	EN	-	Rosaceae
Potentilla silesiaca R. Uechtr.	DD	SP	Rosaceae
Potentilla sterilis (L.) Garcke	EX	-	Rosaceae
Prenanthes purpurea L.	EN	-	Rosaceae
Primula elatior (L.) Hill ²²	EN	PP	Primulaceae
Prunella grandiflora (L.) Scholler	EN	-	Lamiaceae
Prunella laciniata (L.) L.	EN	-	Lamiaceae
Pulmonaria angustifolia L.	VU	-	Boraginaceae
Pulsatilla patens (L.) Mill. subsp. patens	CR	SP, HD	Ranunculaceae
Pulsatilla pratensis (L.) Mill.	EN	SP	Ranunculaceae
Pulsatilla vernalis (L.) Mill.	CR	SP	Ranunculaceae
Pulsatilla vulgaris Mill.	EX	SP	Ranunculaceae
Pyrola chlorantha Sw.	VU	-	Pyrolaceae
Pyrola media Sw.	EN	-	Pyrolaceae
Pyrola rotundifolia L.	VU	-	Pyrolaceae
Radiola linoides Roth	VU	-	Linaceae
* Ranunculus arvensis L.	VU	-	Ranunculaceae
Ranunculus cassubicus L. s. l.	VU	-	Ranunculaceae
Ranunculus serpens Schrank subsp. nemosus (DC.) G. López	DD	-	Ranunculaceae
Rhinanthus alectorolophus (Scop.) Pollich [= Rhinanthus hirsutus All., Rhinanthus major L.]	DD	-	Scrophulariaceae
Rhynchospora alba (L.) Vahl	VU	-	Cyperaceae
Rhynchospora fusca (L.) W. T. Aiton	CR	SP	Cyperaceae
Rosa agrestis Savi	VU	-	Rosaceae
Rosa gallica L.	VU	SP	Rosaceae
Rosa jundzillii Besser	VU	-	Rosaceae
Rosa micrantha Borrer ex Sm.	VU	-	Rosaceae
Rosa tomentosa Sm.	LC	-	Rosaceae
Rosa zalana Wiesb.	VU	-	Rosaceae

²² Aside from native populations, found also spreading from cultivation and running wild.

Name of species	Categories of threat	Protection status	Name of family
Rubus acanthodes (H. Hofm. ex Focke) E. Barber	LC	-	Rosaceae
Rubus angustipaniculatus Holub	LC	-	Rosaceae
Rubus apricus Wimm.	LC	-	Rosaceae
Rubus bavaricus (Focke) Hruby	LC	-	Rosaceae
Rubus bifrons Vest	LC	-	Rosaceae
Rubus camptostachys G. Braun	LC	-	Rosaceae
Rubus capitulatus Utsch	LC	-	Rosaceae
Rubus chaerophylloides Sprib.	LC	-	Rosaceae
Rubus chaerophyllus Sagorski & Wilh. Schulze	LC	-	Rosaceae
Rubus constrictus P. J. Müll. & Lefèvre	LC	-	Rosaceae
Rubus crispomarginatus Holub	LC	-	Rosaceae
Rubus curvaciculatus Walsemann ex H. E. Weber	LC	-	Rosaceae
Rubus czarnunensis (Sprib.) Sprib.	LC	-	Rosaceae
Rubus divaricatus P. J. Müll.	LC	-	Rosaceae
Rubus dollnensis Sprib.	LC	-	Rosaceae
Rubus fasciculatus P. J. Müll.	LC	-	Rosaceae
Rubus franconicus H. E. Weber	LC	-	Rosaceae
Rubus glivicensis (Sprib. ex Sudre) Sprib.	LC	-	Rosaceae
Rubus guentheri Weihe	LC	-	Rosaceae
Rubus hevellicus (E. H. L. Krause) E. H. L. Krause	LC	-	Rosaceae
Rubus hirtus Waldst. & Kit. Agg.	LC	-	Rosaceae
Rubus koehleri Weihe	LC	-	Rosaceae
Rubus kuleszae Ziel.	LC	-	Rosaceae
Rubus lidforsii (Gelert) Lange	LC	-	Rosaceae
Rubus lusaticus Rostock	LC	-	Rosaceae
Rubus macrophyllus Weihe & Nees	LC	-	Rosaceae
Rubus nemoralis P. J. Müll.	LC	-	Rosaceae
Rubus opacus Focke	LC	-	Rosaceae
Rubus ostroviensis Sprib.	LC	-	Rosaceae
Rubus pedemontanus Pinkw.	LC	-	Rosaceae
Rubus pfuhlianus Sprib.	LC	-	Rosaceae
Rubus posnaniensis Sprib.	LC	-	Rosaceae
Rubus pyramidalis Kaltenb.	LC	-	Rosaceae
Rubus rudis Weihe	LC	-	Rosaceae
Rubus salisburgensis Focke ex Caflisch	LC	-	Rosaceae
Rubus schleicheri Weihe ex Tratt.	LC	-	Rosaceae
Rubus schnedleri H. E. Weber	LC	-	Rosaceae
Rubus scissus W. C. R. Watson	LC	-	Rosaceae
Rubus seebergensis Pfuhl ex Sprib.	LC	-	Rosaceae
Rubus senticosus Köhler ex Weihe	LC	-	Rosaceae
Rubus silesiacus Weihe	LC	-	Rosaceae
Rubus spribillei (Pfuhl ex Sprib.) Kulesza	LC	-	Rosaceae
Rubus sulcatus Vest	LC	-	Rosaceae
Rubus tabanimontanus Figert	LC	-	Rosaceae
Rubus wahlbergii Arrh.	LC	-	Rosaceae
Rumex aquaticus L.	VU	-	Polygonaceae
Rumex palustris Sm.	VU	-	Polygonaceae
Rumex sanguineus L.	VU	-	Polygonaceae
Rumex ucrainicus Besser ex Spreng.	EN	-	Polygonaceae
Sagina ciliata Fr.	VU	-	Caryophyllaceae
Salicornia europaea L.	VU	SP	Chenopodiaceae
Salix myrsinifolia Salisb. [= <i>Salix nigricans</i> Sm.]	VU	-	Salicaceae
Salix myrtilloides L.	CR	SP	Salicaceae
Salix starkeana Willd.	CR	-	Salicaceae

Name of species	Categories of threat	Protection status	Name of family
<i>Salvinia natans</i> (L.) All.	VU	SP	Salviniaceae
<i>Samolus valerandi</i> L.	CR	-	Primulaceae
<i>Saxifraga hirculus</i> L.	EX	SP, HD	Saxifragaceae
<i>Scabiosa canescens</i> Waldst. & Kit.	VU	-	Dipsacaceae
<i>Scabiosa columbaria</i> L. s. str.	VU	-	Dipsacaceae
* <i>Scandix pecten-veneris</i> L.	EX	-	Apiaceae
<i>Scheuchzeria palustris</i> L.	EN	SP	Scheuchzeriaceae
<i>Schoenoplectus mucronatus</i> (L.) Palla [= <i>Scirpus mucronatus</i> L.]	EX	-	Cyperaceae
<i>Schoenus ferrugineus</i> L.	CR	SP	Cyperaceae
<i>Schoenus nigricans</i> L.	CR	SP	Cyperaceae
<i>Scirpoides holoschoenus</i> (L.) Soják [= <i>Holoschoenus vulgaris</i> Link]	CR	-	Cyperaceae
<i>Scirpus radicans</i> Schkuhr	VU	-	Cyperaceae
<i>Scolochloa festucacea</i> (Willd.) Link	VU	-	Poaceae
<i>Scorzonera purpurea</i> L. s. str.	EN	SP	Asteraceae
<i>Scutellaria minor</i> Huds. ²³	DD	-	Scrophulariaceae
<i>Sedum villosum</i> L.	EX	-	Crassulaceae
<i>Senecio aquaticus</i> Hill	VU	-	Asteraceae
<i>Senecio barbaraeifolius</i> (Krock.) Wimm. & Grab.	VU	-	Asteraceae
<i>Senecio erucifolius</i> L.	DD	-	Asteraceae
<i>Senecio fluviatilis</i> Wallr.	VU	-	Asteraceae
<i>Senecio nemorensis</i> L. subsp. <i>nemorensis</i>	EN	-	Asteraceae
<i>Senecio ovatus</i> (P. Gaertn., B. Mey. & Scherb.) Willd.	EN	-	Asteraceae
<i>Senecio paludosus</i> L.	VU	-	Asteraceae
<i>Senecio rivularis</i> (Waldst. & Kit.) DC.	VU	-	Asteraceae
* <i>Sherardia arvensis</i> L.	LC	-	Rubiaceae
<i>Silaum silaus</i> (L.) Schinz & Thell.	LC	-	Apiaceae
<i>Silene chlorantha</i> (Willd.) Ehrh.	VU	-	Caryophyllaceae
* <i>Silene gallica</i> L.	LC	-	Caryophyllaceae
<i>Silene nutans</i> L. subsp. <i>glabra</i> (DC.) Rothm.	VU	-	Caryophyllaceae
<i>Sonchus palustris</i> L.	EN	-	Asteraceae
<i>Sorbus torminalis</i> (L.) Crantz	LC	SP	Rosaceae
<i>Sparganium angustifolium</i> F. Michx.	EN	-	Sparganiaceae
<i>Sparganium minimum</i> Wallr.	VU	-	Sparganiaceae
<i>Sparganium neglectum</i> Beeby [= <i>Sparganium ramosum</i> Huds., <i>Sparganium erectum</i> subsp. <i>neglectum</i> (Beeby) Schinz & Thell.]	DD	-	Sparganiaceae
<i>Spergula pentandra</i> L.	CR	-	Caryophyllaceae
<i>Spergularia media</i> (L.) C. Presl [= <i>Spergularia marginata</i> (DC.) Kittel]	EX	-	Caryophyllaceae
<i>Spergularia salina</i> J. Presl & C. Presl	VU	-	Caryophyllaceae
<i>Spergularia segetalis</i> (L.) G. Don [= <i>Delia segetalis</i> (L.) Dum.]	DD	-	Caryophyllaceae
<i>Spiranthes spiralis</i> (L.) Chevall.	EX	SP	Orchidaceae
* <i>Stachys arvensis</i> (L.) L.	EX	-	Lamiaceae
<i>Stachys germanica</i> L.	LC	-	Lamiaceae
<i>Stachys recta</i> L.	LC	-	Lamiaceae
<i>Stellaria crassifolia</i> Ehrh.	DD	-	Caryophyllaceae
<i>Stellaria longifolia</i> H. L. Mühl. ex Willd.	DD	-	Caryophyllaceae
<i>Stellaria uliginosa</i> Murray	VU	-	Caryophyllaceae
<i>Stipa capillata</i> L.	EN	SP	Poaceae

²³ According to Czubiński (1961), a western, native species, occurring at the edge of its geographical range (cf. Hultén & Fries 1986).

Name of species	Categories of threat	Protection status	Name of family
<i>Stipa joannis</i> Čelak. s. str.	EN	SP	Poaceae
<i>Succisella inflexa</i> (Kluk) Beck	CR	SP	Dipsacaceae
<i>Swertia perennis</i> L. subsp. perennis	CR	SP	Gentianaceae
<i>Symphytum tuberosum</i> L.	EN		Boraginaceae
<i>Taxus baccata</i> L. ²⁴	LC	SP	Taxaceae
<i>Tetragonolobus maritimus</i> (L.) Roth subsp. siliquosus (L.) Murb. [= <i>Lotus siliquosus</i> L.]	LC	-	Fabaceae
<i>Teucrium scordium</i> L.	LC	-	Lamiaceae
<i>Teucrium scorodonia</i> L.	LC	-	Lamiaceae
<i>Thalictrum simplex</i> L.	EN	-	Ranunculaceae
<i>Thesium ebracteatum</i> Hayne	CR	SP, HD	Santalaceae
<i>Thesium linophyllum</i> L.	EN	-	Santalaceae
* <i>Thymelaea passerina</i> (L.) Coss. & Germ. [= <i>Lygia passerina</i> (L.) Fassano]	DD	-	Thymelaeaceae
<i>Tofieldia calyculata</i> (L.) Wahlenb.	CR	SP	Liliaceae
<i>Trapa natans</i> L. s. l.	EN	SP	Trapaceae
<i>Traunsteinera globosa</i> (L.) Rchb.	EX	SP	Orchidaceae
<i>Trifolium lupinaster</i> L.	EN	-	Fabaceae
<i>Trifolium ochroleucon</i> Huds.	EN	-	Fabaceae
<i>Trifolium rubens</i> L.	EN	-	Fabaceae
<i>Trifolium striatum</i> L.	EN	-	Fabaceae
<i>Triglochin maritimum</i> L.	VU	-	Juncaginaceae
<i>Trisetum flavescens</i> (L.) P. Beauv. ²⁵	VU	-	Poaceae
<i>Trollius europaeus</i> L. s. str.	VU	SP	Ranunculaceae
<i>Utricularia australis</i> R. Br.	VU	SP	Scrophulariaceae
<i>Utricularia intermedia</i> Hayne	EN	SP	Lentibulariaceae
<i>Utricularia minor</i> L.	VU	SP	Lentibulariaceae
<i>Utricularia ochroleuca</i> R. W. Hartm.	CR	SP	Lentibulariaceae
* <i>Vaccaria hispanica</i> (Mill.) Rauschert	LC	-	Caryophyllaceae
<i>Vaccinium uliginosum</i> L.	VU	-	Ericaceae
<i>Valeriana angustifolia</i> Tausch	DD	-	Valerianaceae
<i>Valeriana dioica</i> L. s. str.	LC	-	Valerianaceae
<i>Valeriana sambucifolia</i> J. C. Mikan	VU	-	Valerianaceae
<i>Valeriana simplicifolia</i> Kabath	EN	-	Valerianaceae
* <i>Valerianella rimosa</i> Bastard	LC	-	Valerianaceae
<i>Verbascum phoeniceum</i> L.	VU	-	Scrophulariaceae
<i>Veronica austriaca</i> L. s. str.	VU	-	Scrophulariaceae
<i>Veronica catenata</i> Pennell	VU	-	Scrophulariaceae
<i>Veronica montana</i> L.	VU	-	Scrophulariaceae
<i>Veronica praecox</i> All.	LC	-	Scrophulariaceae
<i>Veronica teucrium</i> L.	VU	-	Scrophulariaceae
<i>Veronica vindobonensis</i> (M. A. Fisch.) M. A. Fisch. [= <i>Veronica chamaedrys</i> L. subsp. <i>vindobonensis</i> M. A. Fisch.]	DD	-	Scrophulariaceae
<i>Vicia dumetorum</i> L.	LC	-	Fabaceae
<i>Vicia pisiformis</i> L.	EN	-	Fabaceae
<i>Vicia sylvatica</i> L.	LC	-	Fabaceae
<i>Vicia tenuifolia</i> Roth	LC	-	Fabaceae
<i>Viola collina</i> Besser	VU	-	Violaceae
<i>Viola elatior</i> Fr.	EN	-	Violaceae
<i>Viola mirabilis</i> L.	LC	-	Violaceae

²⁴ Aside from native populations, found also spreading from cultivation and running wild.²⁵ A species native only in the south of Wielkopolska, in north part, probably, only in secondary localities.

Name of species	Categories of threat	Protection status	Name of family
<i>Viola pumila</i> Chaix	CR	-	Violaceae
<i>Viola stagnina</i> Kit.	VU	SP	Violaceae
<i>Viscum album</i> L. subsp. <i>abietis</i> (Wiesb.) Abrom.	VU	-	Loranthaceae
<i>Vulpia bromoides</i> (L.) S. F. Gray	DD	-	Poaceae
<i>Vulpia myuros</i> (L.) C. C. Gmel.	VU	-	Poaceae
<i>Wolffia arrhiza</i> (L.) Horkel ex Wimm.	VU	-	Lemnaceae
<i>Zannichellia palustris</i> L. subsp. <i>palustris</i> ²⁶	VU	-	Zannichelliaceae
<i>Zannichellia palustris</i> L. subsp. <i>pedicellata</i> (Wahlenb. & Rosén) Hegi ²⁶	DD	-	Zannichelliaceae

²⁶ A species consisting of two taxons at the rank of subspecies, with differentiated degree of endangerment.

4.2. Statistical data

At present, floristic database of Wielkopolska (FDBW) comprises 1950 species of vascular plants, including those brought into the area or running wild from cultivation (Jackowiak *et al.* 2007 – FDBW). The body of the region's flora is composed of native species and naturalized foreign species. Altogether, from the beginning of the 19th century up to the modern times, 1630 species belonging to both groups have been registered.

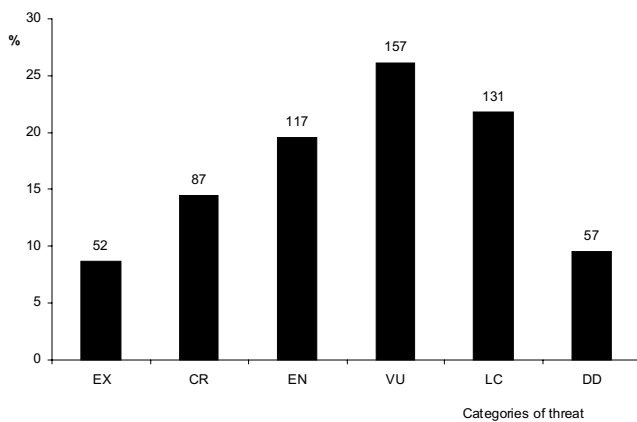


Fig. 5. The number and percentage participation of species in the particular threat categories of the IUCN

The red list of the vascular flora of Wielkopolska includes 601 taxons (598 species including 3 species differentiated into subspecies), i.e. 31% of the body of the region's flora. All the basic categories of threat, as defined by the IUCN 2001, are represented in the list (Fig. 5). Since 1951, which is accepted as the critical date, 52 species have not been recorded anymore, while 87 others classified as critically endangered (CR), 117 endangered (EN) and 157 vulnerable (VU). The red list is complemented with 131 least concern species (LC) and, in the light of the present state of knowledge, 57 species of unknown risk of extinction (DD).

Threats to flora affect different systematic, geographic and historical and biotopic groups with various intensity. Adequately to the taxonomic structure of the total flora of the region, the red list is dominated by angiosperm plants (570 species) composed of 392 species of dicotyledons and 178 of monocotyledons. The other groups of high taxonomic rank are represented as follows: gymnosperms – 2 species, ferns – 19, horsetails – 3 and lycopods – 7. Amongst 81 families, most numerous in threatened species are: Rosaceae, Cyperaceae, Asteraceae, Poaceae, Orchidaceae, Caryophyllaceae, Fabaceae and Scrophulariaceae. A special attention deserve the Orchidaceae and Cyperaceae families which include many species recognized as extinct (EX) and critically endangered (CR) (Table 4).

Out of 559 native species of threatened vascular plants of the region, 189 (33.8%) constitute taxons representing 3 main geographic elements (western, south-east and boreal) characteristic for the area under scrutiny as well as the montane element, rarely met in the Wielkopolska-Kujawy Lowlands. The most numerous is the western element comprising 70 species. The south-east element (continental) includes 43 species, while the boreal one 32 species. 42 species representing the montane element, mostly from the lower forest zone, are classified as endangered in Wielkopolska.

Besides the native species, the red list comprises also a large, composed of 42 species, group of archaeophytes. Although, almost half of them belong to the LC category (20 species), still, 9 from the group of early adventives have to be considered as extinct, one of them critically endangered (*Caucalis platycarpus*) and some missing (*Bupleurum rotundifolium*, *Camelina alyssum*, *Conringia orientalis*, *Cuscuta epilinum*, *Kickxia spuria*, *Linaria arvensis*, *Lolium remotum*, *Scandix pecten-veneris* and *Stachys arvensis*). Additionally, the list of threatened archaeophytes is complemented with the species from other categories: EN – 5, VU – 4 and DD – 3.

Table 4. Plant families participation in the threat categories of vascular plants of Wielkopolska

Name of family	EX	CR	EN	VU	LC	DD	Total
Alismataceae	1	1	1	1	0	0	4
Apiaceae	4	3	1	7	3	0	18
Aspidiaceae	0	0	1	1	0	2	4
Aspleniaceae	1	0	1	0	0	0	2
Asteraceae	0	2	13	11	6	12	44
Athyriaceae	0	0	1	0	1	0	2
Betulaceae	0	1	0	0	0	1	2
Blechnaceae	0	0	1	0	0	0	1
Boraginaceae	0	0	1	2	0	0	3
Brassicaceae	2	0	4	4	2	1	13
Callitrichaceae	0	0	3	0	0	0	3
Campanulaceae	1	1	0	3	1	0	6
Caprifoliaceae	0	1	0	1	0	0	2
Caryophyllaceae	2	3	2	7	7	5	26
Celastraceae	0	0	0	0	1	0	1
Chenopodiaceae	0	1	1	1	5	0	8
Cistaceae	0	0	0	1	0	0	1
Crassulaceae	1	1	0	1	0	0	3
Cuscutaceae	1	0	0	0	1	0	2
Cyperaceae	10	16	5	14	3	0	48
Dipsacaceae	0	1	0	2	0	1	4
Droseraceae	0	1	0	2	1	1	5
Elatinaceae	0	0	4	0	0	0	4
Empetraceae	0	1	0	0	0	0	1
Equisetaceae	0	0	1	0	1	1	3
Ericaceae	0	1	0	4	1	1	7
Euphorbiaceae	0	0	0	1	2	0	3
Fabaceae	1	0	10	7	5	1	24
Fumariaceae	0	0	2	0	3	0	5
Gentianaceae	1	3	0	1	0	1	6
Geraniaceae	0	0	0	1	0	0	1
Huperziaceae	0	0	1	0	0	0	1
Hypericaceae	0	1	0	0	1	0	2
Iridaceae	1	0	1	1	0	0	3
Juncaceae	0	2	2	4	1	1	10
Juncaginaceae	0	0	0	1	0	0	1
Lamiaceae	1	1	2	3	4	2	13
Lemnaceae	0	0	0	1	0	0	1
Lentibulariaceae	0	3	1	1	0	0	5
Liliaceae	1	1	7	0	2	3	14
Linaceae	0	0	0	1	0	0	1
Loranthaceae	0	0	0	1	0	0	1
Lycopodiaceae	0	2	0	2	1	1	6
Lythraceae	0	0	0	1	0	0	1
Marsileaceae	0	1	0	0	0	0	1
Menyanthaceae	0	0	0	1	0	0	1
Myricaceae	0	1	0	0	0	0	1
Najadaceae	0	1	0	0	0	0	1
Nymphaeaceae	0	1	0	0	0	1	2
Onagraceae	1	0	0	1	1	0	3
Ophioglossaceae	1	1	2	1	0	0	5
Orchidaceae	11	12	7	3	4	0	37
Orobanchaceae	0	4	0	0	0	0	4
Osmundaceae	0	0	0	1	0	0	1
Parnassiaceae	0	0	0	1	0	0	1
Pinaceae	0	0	0	1	0	0	1
Plantaginaceae	1	0	0	0	0	0	1
Poaceae	1	3	8	11	7	8	38
Polemoniaceae	1	0	0	0	0	0	1
Polygonaceae	0	0	1	3	0	0	4
Portulacaceae	0	1	0	0	0	0	1
Potamogetonaceae	1	3	0	9	0	3	16
Primulaceae	0	1	3	2	0	0	6
Pyrolaceae	0	0	1	3	1	0	5
Ranunculaceae	2	3	6	5	1	2	19
Rosaceae	1	2	9	9	51	1	73
Rubiaceae	0	0	1	2	6	0	9

Salicaceae	0	2	0	1	1	0	4
Salviniaceae	0	0	0	1	0	0	1
Santalaceae	0	1	1	0	0	0	2
Saxifragaceae	1	1	0	0	0	0	2
Scheuchzeriaceae	0	0	1	0	0	0	1
Scrophulariaceae	3	1	5	9	2	4	24
Sparganiaceae	0	0	1	1	0	1	3
Taxaceae	0	0	0	0	1	0	1
Thelypteridaceae	0	0	2	0	0	0	2
Thymelaeaceae	0	0	0	0	1	1	2
Trapaceae	0	0	1	0	0	0	1
Valerianaceae	0	0	1	1	2	1	5
Violaceae	0	1	1	2	1	0	5
Zannichelliaceae	0	0	0	1	0	1	2
	52	87	117	157	131	57	601

Threatened species are components of various plant communities and represent, in total, as many as 27 syntaxonomical classes (Table 5, Plate I). These units group not only natural communities but also seminatural and synanthropic ones. The most numerous group constitute sward species – especially from the *Festuco-Brometea*

class, meadow species from the *Molinio-Arrhenatheretea* class as well as forest species – mainly representing the floristically richest *Quercu-Fagetea* and *Vaccinio-Piceetea* classes. A particularly high level of risk is noted among species of fens (*Scheuchzerio-Caricetea fuscae*), aquatic (*Potametea*), littoral (*Isoëto-Nanojuncetea*) and,

Table 5. Participation of the threatened species of Wielkopolska in the main syntaxonomical groups

Syntaxonomical groups	No. spp.	EX	CR	EN	VU	LC	DD
Forest and shrub communities	132	4	20	27	37	35	9
Rhamno-Prunetea	11	0	1	0	5	5	0
Salicetea purpureae	4	0	0	0	2	1	1
Alnetea glutinosae	3	0	1	0	2	0	0
Vaccinio-Piceetea	25	1	6	6	7	2	3
Quercetea robori-petraeae	9	0	2	0	4	3	0
Quercu-Fagetea	80	3	10	21	17	24	5
Skirt, clearing and heath communities	46	5	2	13	8	12	6
Trifolio-Geranietea sanguinei	17	2	1	6	4	3	1
Artemisietea vulgaris	6	0	0	1	0	4	1
Epilobietea angustifolii	3	0	0	1	0	2	0
Nardo-Callunetea	20	3	1	5	4	3	4
Sward and meadow communities (permanent grasslands)	147	12	17	37	47	18	15
Koelerio glaucae-Corynephoretea canescentis	23	1	2	2	9	4	5
Festuco-Brometea	75	6	11	24	21	8	5
Molinio-Arrhenatheretea	48	5	4	11	17	6	5
Bog, fen and poor fen communities	63	6	21	9	19	6	3
Oxycocco-Sphagnetea	10	0	2	0	5	1	2
Scheuchzerio-Caricetea fuscae	54	6	19	9	14	5	1
Rushes and halophytes communities	29	4	5	6	10	3	1
Phragmitetea	16	2	2	4	5	2	1
Asteretea tripolium	12	2	3	2	4	1	0
Thero-Salicornietea	1	0	0	0	1	0	0
Short-lived communities of muddy banks and shores and periodically flooded depressions	33	3	7	6	12	3	2
Isoëto-Nanojuncetea	27	3	7	6	7	2	2
Bidentetea tripartiti	6	0	0	0	5	1	0
Aquatic and spring seepage areas communities	44	5	10	6	17	1	5
Lemnetea minoris	2	0	0	0	2	0	0
Potametea	28	2	5	4	12	0	5
Utricularietea intermedio-minoris	5	0	2	1	2	0	0
Littorelletea uniflorae	5	2	2	1	0	0	0
Montio-Cardaminetea	4	1	1	0	1	1	0
Ruderal and segetal communities	41	9	2	5	4	18	3
Polygono arenastri-Poetea annuae	1	0	0	0	0	1	0
Stellarietea mediae	40	9	2	5	4	17	3
Others (of wider or unspecified synecological scale)	66	4	3	8	3	35	13
Total	601	52	87	117	157	131	57

Explanation: No. spp. – number of species

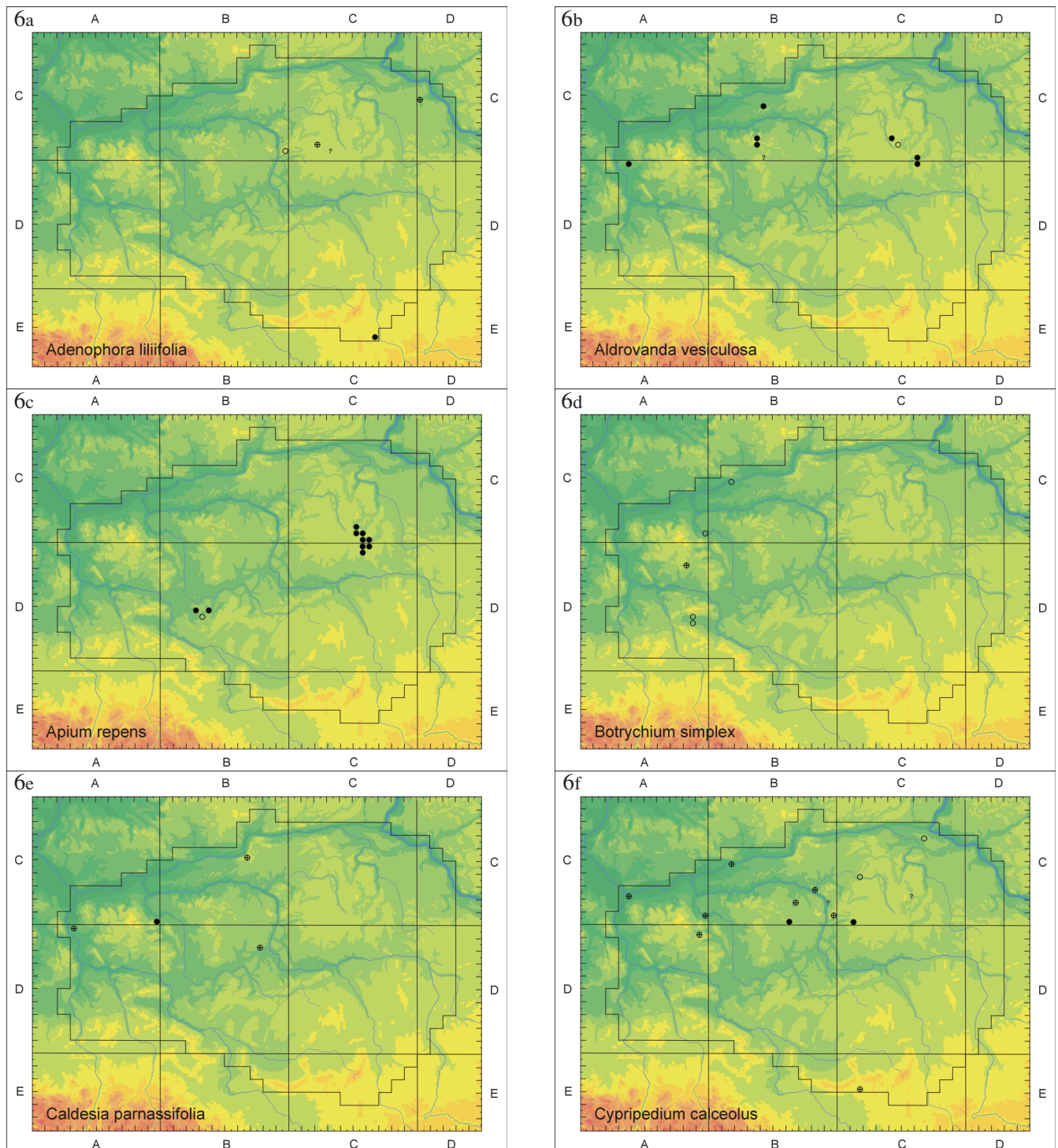
in the first place, among segetal ones (*Stellarietea mediae*). It is worth noting that a smaller number of species from other classes is often the result of their natural, smaller representation in the flora of the studied area. A good example is here the *Asteretea tripolium* class, with almost all its species classified as threatened in Wielkopolska.

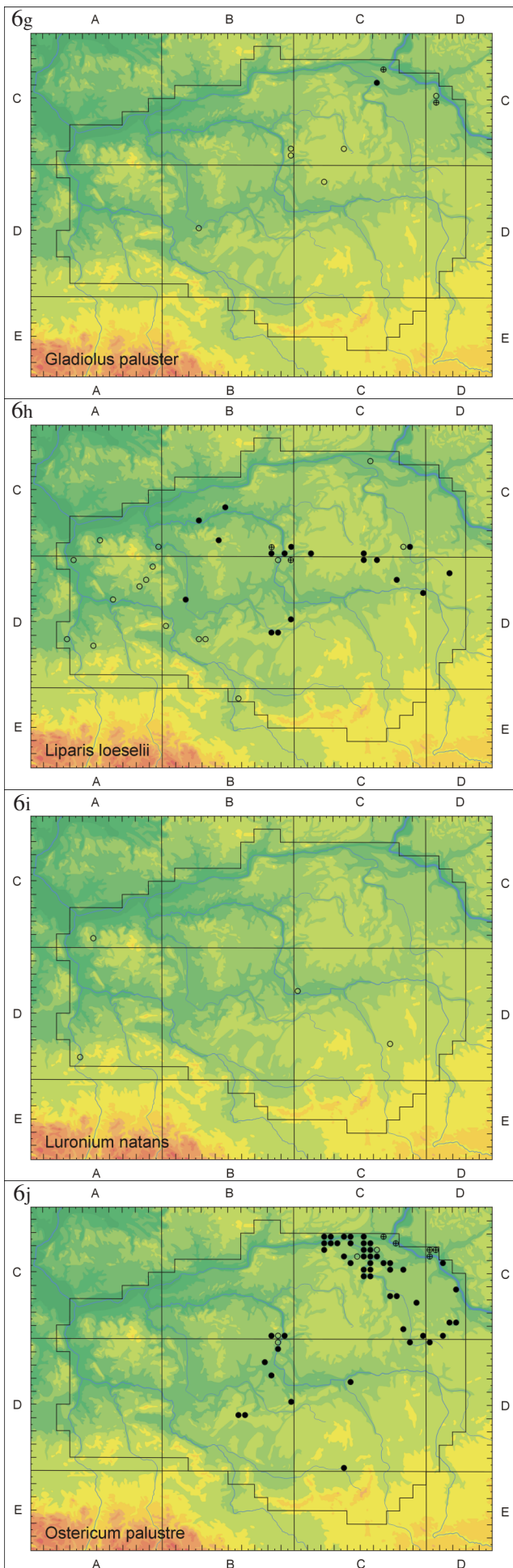
An analysis of the species frequency distribution in particular categories of risk reveals that in the group of extinct species (EX) most numerous are meadow-sward and segetal species. In the Critically Endangered category (CR) the highest share have bog and fen species and once more, sward ones. The representatives of

the latter group prevail also in the EN and VU categories, which are marked by high participation of forest species (Plate II).

4.3. The occurrence of species of the Habitats Directive and species protected in Poland

In Wielkopolska, there are 13 species of vascular plants listed in the Annex II of the Habitats Directive (EC Habitats Directive 1992). Most of them (8) belong to naturally very rare species and the rest – to rare ones (Fig. 6 – caption see page 118). Currently, all of them are included in the red list of the region's flora with





4 of them considered extinct, 7 critically endangered, 1 endangered and 1 vulnerable.

Adenophora liliifolia (L.) Besser – a critically endangered species (CR). Known from 5 localities, with one locality of uncertain location (Fig. 6a). The last observation comes from Tobolski (1961).

Aldrovanda vesiculosa L. – a critically endangered species (CR). Quoted from 8 localities, including 7 recorded after 1951 (Fig. 6b). Recently observed in 1983 (Kamiński 2006). Reintroduction attempts were unsuccessful.

Apium repens (Jacq.) Lag. – a critically endangered species (CR), despite the fact that in recent years it has been observed in 11 localities (Fig. 6c). However, the localities are concentrated in 2 remote parts of the region and the size of the populations monitored for about 30 years, excluding one locality in the Leszno Lake District, is clearly decreasing (Chmiel, Jackowiak 2001; Jackowiak 2004).

Botrychium simplex E. Hitchc. – extinct in the wild (EX). It was noted in 5 localities situated in the western part of the region (Fig. 6d). The latest data come from the beginning of the 20th century (Schube 1903; Decker 1912).

Caldesia parnassifolia (L.) Parl. – a critically endangered species (CR). It was known from 4 localities situated in western Wielkopolska (Fig. 6e). Currently, the presence of the species in the lake Nietopersko, in the locality discovered by Dąbska (1964) and confirmed by Żukowski in 1986 (Żukowski 2001), cannot be ruled out.

Cypripedium calceolus L. – a species critically endangered in the region (CR). Quoted, in total, from 14 localities (Fig. 6f). It was observed in 2 localities as early as in the second half of the 20th century. At present, it is monitored by the authors only in one of them.

Gladiolus paluster Gaudin – extinct in the wild (EX). It was quoted from 9 localities (Fig. 6g). The most recent report from Dziki Ostrów, in the vicinity of Bydgoszcz (Szymańska & Szymański 1959), was not confirmed later, despite the special search carried out by Chmiel and Celka in 1998.

Liparis loeselii (L.) Rich. – an endangered species (EN). Overall, quoted from over 30 localities scattered in western, central and eastern Wielkopolska (Fig. 6h). Currently confirmed in 18 localities (ca. 50% of those known from the literature). *Liparis loeselii* occupies habitats very sensitive to anthropopression, and particularly, to changes in water conditions and eutrophication.

Luronium natans (L.) Raf. – a species which should be recognized as extinct in Wielkopolska (EX). Quoted in the literature as early as in the first half of the 20th century from 4 localities (Fig. 6i) but, presumably, only on the basis of earlier works (Schube 1903; Decker 1912). The subsequent information is not sufficiently documented.

Ostericum palustre Besser – a vulnerable species (VU). Known from almost 60 localities, with most of them managed to be found or confirmed in recent years (Fig. 6j). This concerns mostly the north-east part of

the region. It cannot be ruled out, that the species occurs more frequently than it has been thought so far. It requires further studies.

Pulsatilla patens (L.) Mill. subsp. *patens* – a critically endangered species (CR). Formerly, it occurred quite frequently in almost whole Wielkopolska (Fig. 6k). Overall, noted in over 70 localities. In the recent period, the species resources have been rapidly decreasing.

Saxifraga hirculus L. – an extinct species (EX). According to the literature sources it occurred in over 20 localities situated in the north, west and south-west part of the region (Fig. 6l). The latest data come from the interwar period.

Thesium ebracteatum Hayne – a critically endangered species (CR). Known from over 30 localities (Fig. 6m), although only a few of them were confirmed in the second part of the 20th century.

The species listed in the Annex II of the Habitats Directive (EC Habitats Directive 1992) which are currently occurring in Wielkopolska provide the basis for creation of special areas of conservation (SACs). Hence, there is hope that their resources remain stable in the nearest future. Moreover, considerably larger group of the red list plants is subject to species protection, which, according to the Polish law, is differentiated into the strict and partial protection. The former involves 180 species and the latter 5 species. Although effectiveness of these forms of protection has not been satisfactory so far, it seems that in the recent years they have been preserving localities of threatened plants more efficiently, first of all, against investment activities. In the course of procedure for estimation of the planned enterprises impact on natural environment, it becomes the rule that investors are obliged to protect threatened habitats, including the necessity of implementation of active protection measures, such as metaplantations.

5. Conclusions

Wielkopolska has been an area of geobotanical studies since the beginning of the 19th century. During this period, the region has been subject to the dynamic social and economic transformations, which caused essential changes in the structure of plant landscape and natural habitats. This, in turn, exerted an enormous influence on the species resources of flora and on vegetation. As early as in the first half of the 20th century, the attention was drawn to the natural effects of the intensification of land usage. It was Wodziczko (1947), who described this process in particularly straightforward way as ‘the conversion of Wielkopolska into steppe’. Most important manifestations of so named, at that time, phenomenon involved: extinction of native species and spreading of geographically alien ones (Jackowiak 2003). Since the mid-1960s, this idea has been devel-

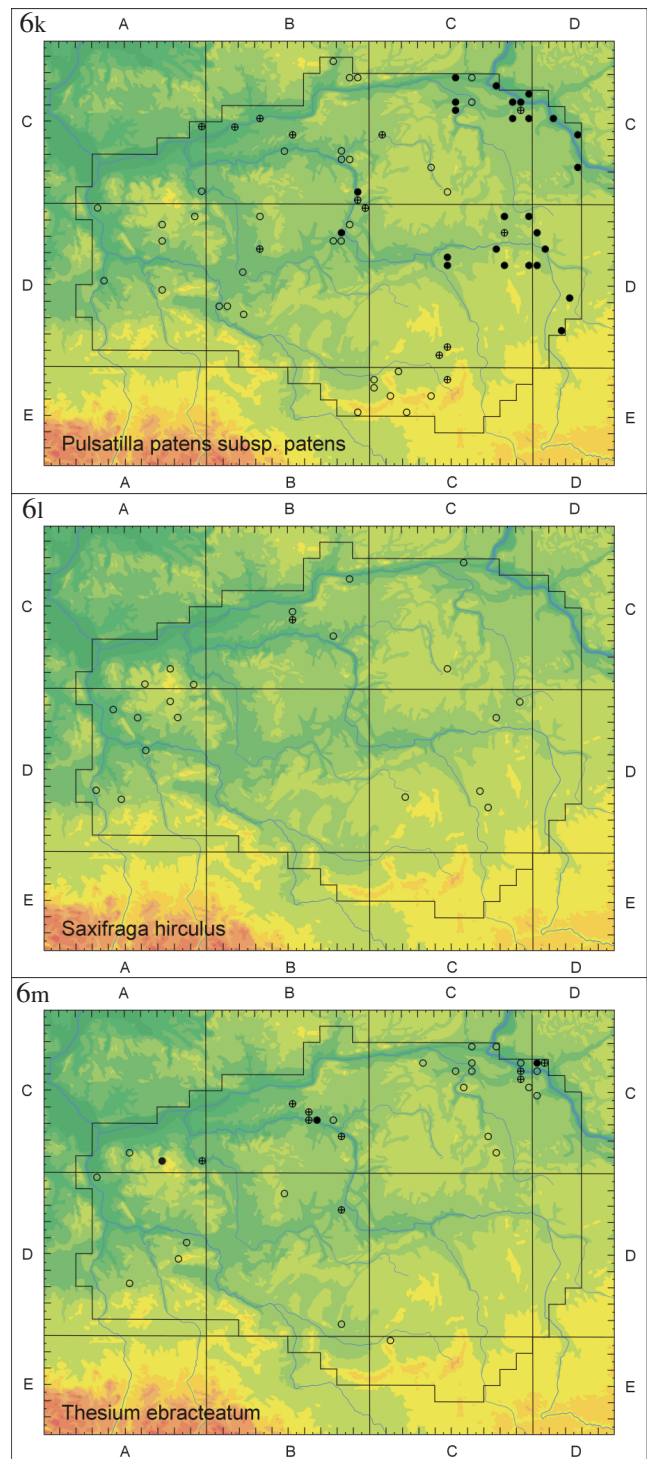


Fig. 6. Distribution of vascular plant species from the Annex II of the Habitats Directive in Wielkopolska

Explanations: ⊕ – localities last observed in the 19th century (1900 included); ○ – localities last observed in the years 1901-1951; ● – localities observed after 1951; ? – location of the site uncertain

oped by Faliński (1966, 2000), the author of the theory of plant cover synanthropisation based on the following definition: synanthropisation of plant cover is the entirety of historic and modern transformations of flora and vegetation, consisting in withdrawal of specific

stenotopic elements and their replacement with cosmopolitan, eurytopic ones.

The red list of vascular flora of Wielkopolska confirms that the process of synanthropisation is very advanced in the Central European Lowlands and keeps increasing its rate. At present, every third species is at risk of extinction. This index is significantly higher than the degree of threat to the flora of the whole country, which comes to about 20% (Zarzycki & Szeląg 1992, 2006) and, in turn, corresponds to the level of threat observed in other countries of central and western Europe, such as Germany, Switzerland or Austria (Niklfeld 1986). It is worth emphasizing that in the last dozen or so years, the number of plants listed as extinct and endangered increased

from 527 to 601 species (cf. Żukowski & Jackowiak 1995a). It happens, despite the efforts connected with the expansion and modernization of the biodiversity conservation system in Wielkopolska. Some hope for stopping this process maybe associated with the introduction of the European Ecological Network Natura 2000, based on the conception of conservation of natural habitats particularly sensitive to anthropopression as well as the most threatened species. The experience to date in the organization of this network points out that the effectiveness of this form of biodiversity protection would be certainly higher if the set of species used as the basis for creation of special conservation areas to a larger extent considers the local red lists.

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Plate I. Selected habitats of threatened species of Wielkopolska

1. Fragment of willow carr – *Salicetum albo-fragilis* (Warta river valley in the vicinity of Oborniki, central Wielkopolska); 2. Alder carr – *Ribeso nigri-Alnetum* (Kąty Forest District in Central Wielkopolska); 3. Fresh scots pine forest – *Leucobryo-Pinetum* (Wolsztyn Forest District – western Wielkopolska); 4. Lichen scots pine forest – *Cladonio-Pinetum* (Notecka Forest – north-west Wielkopolska); 5. Xerothermic oak forest – *Potentillo albae-Quercetum* (Miradz Forest District – eastern Wielkopolska); 6. Oak-hornbeam forest – *Galio sylvatici-Carpinetum betuli* („Dębina” Reserve in the vicinity of Wągrowiec – central Wielkopolska); 7. Inland psammophilous grassland – *Spergulo vernalis-Corynephorum* (in the vicinity of Lubstów – eastern Wielkopolska); 8. Extensively used meadow with *Lychnis flos-cuculi* (Barycz river valley in the vicinity of Odolanów – southern Wielkopolska); 9. Poor fen – a community of the class *Scheuchzerio-Caricetea fuscae* („Bagno Chorzemińskie” Reserve in the vicinity of Wolsztyn – western Wielkopolska); 10. Raised peat bog – the community of the class *Oxycocco-Sphagnetea* (Notecka Forest – north-west Wielkopolska); 11. Chara lake with a belt of vegetation with floating leaves – *Nupharo-Nymphaetum albae* (Lake Zamorze in the vicinity of Pniewy – central Wielkopolska); 12. Cultivated field with segetal vegetation (Lednica Landscape Park – central Wielkopolska)

Authors of photographs: Zbigniew Celka (2, 3, 9, 11, 12), Julian Chmiel (5, 7), Radosław Sajkiewicz (1, 4, 10), Piotr Szkudlarz (6, 8)





Plate II. Selected species of threatened plants of Wielkopolska

1. *Linnaea borealis* in the scots pine urban forest of Poznań (central Wielkopolska); 2. *Dianthus gratianopolitanus* on the hillside in scots pine woodland (in the vicinity of Pszczew – western Wielkopolska); 3. *Epipactis atrorubens* at the edge of scots pine forest (Wronki Forest District in the Notecka Forest – north-west Wielkopolska); 4. *Orchis palustris* on wet meadow (in the vicinity of Pyzdry – central Wielkopolska); 5. *Cephalanthera rubra* at the edge of acidophilous beech forest (Karwin Forest District in the Notecka Forest – north-west Wielkopolska); 6. *Botrychium lunaria* in ash carr (Dziewicza Góra hill – central Wielkopolska); 7. *Trollius europaeus* on wet meadow (Różany Potok valley in the Morasko district of Poznań – central Wielkopolska); 8. *Vaccinium uliginosum* at the edge of marshy pine forest (in the vicinity of Chlebowo in the Notecka Forest – central Wielkopolska); 9. *Dianthus arenarius* at the edge of scots pine forest (in the vicinity of Nowy Tomysł – western Wielkopolska); 10. *Leucoium vernum* in low oak-hornbeam forest (“Śnieżycowy Jar” Reserve in the vicinity of Murowana Goślina – central Wielkopolska); 11. *Gagea arvensis* on a slope of an historic earthenwork (Kicin in the vicinity of Poznań – central Wielkopolska); 12. *Bromus secalinus* in the field of rye (in the vicinity of Zielona Góra – the Lubuska Province)

Authors of photographs: Zbigniew Celka (2, 8, 9, 11, 12), Elżbieta Obarska (1), Radosław Sajkiewicz (3-7, 10)