

# Invasive vascular plant species of oxbow lakes in south-western Poland

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**Abstract:** Natural water reservoirs are very valuable floristic sites in south-western Poland. Among them, the most important for the preservation of biodiversity of flora are oxbow lakes. The long-term process of human pressure on habitats of this type caused disturbances of their biological balance. Changes in the water regime, industrial development and chemisation of agriculture, especially in the period of the last two hundred years, led to systematic disappearances of localities of many plant species connected with rare habitats and also to the appearance of numerous invasive plant species. They are: *Azolla filiculoides*, *Echinocystis lobata*, *Erechtites hieraciifolia*, *Impatiens glandulifera*, *I. parviflora*, *Reynoutria japonica*, *Solidago canadensis*, *S. gigantea* and *S. graminifolia*. Field works were conducted in years 2005-2012.

**Key words:** invasive plant species, phytocoenoses, oxbow lakes, distribution, south-western Poland

## 1. Introduction

A breakthrough in river valley transformations took place in the 18<sup>th</sup> century and it was connected with the industrial revolution. Not only did it accelerate regulatory works on majority of Europe's bigger rivers, but it also led to a mass transformation of natural watercourses into canals. Riverbeds were being shortened, deepened and regulated on a large scale. Recreation of the potential of once transformed river valleys is currently very difficult and, in most cases, even impossible. However, in order to accomplish this goal, it is necessary to know the conditions prevalent in the whole valley and limit degradation factors (Olaczek 2000; Horska-Schwarz 2006). Many plant species are strictly dependant on river valleys; they form a group of so-called „river corridor species”. For the lowland part of Central Europe, 129 taxa have been identified, including numerous invasive species (Burkart 2001). Permanently established species of alien origin, including invasive species are common also in the south-west of Poland (e.g. Anioł-Kwiatkowska *et al.* 1992; Dajdok *et al.* 1998, 2003; Dajdok & Kaćki 2003; Spalek 2003; Tokarska-Guzik & Dajdok 2004). In the course of the present research, plant species of this type were found; however, rarely in the oxbow lakes, mainly of the Oder.

## 2. Material and methods

The field work was conducted during the growth seasons in years 2005-2012. *Lemno-Azoletum filiculoides* community was studied with the methods of the Zurich-Montpellier School of Phytosociology (Braun-Blanquet 1964). The phytosociological nomenclature and the syntaxonomical appendix are based on Oberdorfer (1994) and Matuszkiewicz (2005). The species names of vascular plants are given according to Mirek *et al.* (2002). The assessment of the physical and chemical properties of the habitat was determined in the field work, when the pH of water was measured in the spring at depths of 0-20 cm and 20-40 cm with the assistance of Elmetron multipurpose measuring device.

## 3. Results and discussion

*Azolla filiculoides* Lam. (Lamarck in Lamarck *et al.* 1783)

First information from the area within the borders of the present-day Poland came from Lower Silesia. *Azolla filiculoides* was identified in the palace pond in Wawrzyszów near Strzelin, where it overwintered several times (Schube 1928). After 1945, this species was reported in Bielsk Podlaski (Wołkowycki 1999),

**Table 1.** *Lemno-Azolletum filiculoides* Br.-Bl. 1952 in oxbow lakes near Kobierzyce

Relevé number	1	2	3	4	5	6	7	8	9	10	C
Date	11.08. 2011	11.08. 2011	11.08. 2011	11.08. 2011	11.08. 2011	11.08. 2011	02.09. 2011	02.09. 2011	17.07. 2011	17.07. 2011	
Cover of herb layer [%]	80	65	70	60	50	80	60	70	50	45	
Area of relevé [m <sup>2</sup> ]	50	50	50	50	50	50	100	50	50	50	
Number of species in relevé	4	3	4	4	3	3	4	4	3	4	
Ch. <i>Lemno-Azolletum filiculoides</i>											
<i>Azolla filiculoides</i>	3	3	3	3	3	3	3	3	3	3	V
Ch. <i>Lemnetalia minoris</i> , <i>Lemnetea minoris</i>											
<i>Lemna minor</i>	3	3	3	3	3	3	2	3	+	1	V
<i>Spirodela polyrhiza</i>	1	1	1	2	1	2	1	1	2	2	V
<i>Salvinia natans</i>	.	.	.	.	.	.	.	.	.	+	I
Ch. <i>Potametea</i>											
<i>Nuphar lutea</i>	+	.	+	+	.	.	+	1	.	.	III

Explanations: Ch. – characteristic species, C – constancy of *Wolffia arrhiza*

Siedlisko near Nowa Sól (Rosadziński 2008) and sites located in the south-west of Poland: Wrocław, Wilkszyn, Koźlice (Szczeńiak 2009; Szczeńiak *et al.* 2009). In the course of the present research, *Azolla filiculoides* was recognised in significant numbers in Kościerzycy near Brzeg in two oxbow lakes of the Oder (N 50°87.721', E 17°53.052' and N 50°86.626', E 17°54.749') in *Lemno-Azolletum filiculoides* phytocoenoses. This community was growing in 10 to 160 cm deep waters with pH 7.2-7.8 on silty as well as silty-sandy subsoil. Its lobes were dominated by *Azolla filiculoides* and *Lemna minor* as well as *Spirodela polyrhiza* (Table 1). From 3 to 4 (with 4 on average) species were identified. In its phytocoenoses, a total number of 5 plant species were reported. The floristic composition of *Lemno-Azolletum filiculoides* patches in Kobierzyce was usually very similar to phytocoenoses of this community from other areas of Poland (Szczeńiak *et al.* 2009) and neighbouring countries (Ot'ahel'ová 1995; Passarge 1996; Šumberová 2011).

#### *Echinocystis lobata* (F. Michx.) Torr. & A. Gray

In the course of the current research, several dozens of this species were reported in the Oder oxbow lake in Ścinawa near Oława in Lower Silesia (N 50°92.889', E 17°34.154') within *Phragmitetum australis* and in the Oder oxbow in Boguszyce near Opole (N 50°60.067', E 17°95.452') within *Glycerietum maximae* and *Typhetum latifoliae*. So far, this species was not reported in the south-west of Poland in this type of habitat.

#### *Erechtites hieraciifolia* (L.) Raf. ex DC.

A few specimens of this species were found in the Oder oxbow lake in Ścinawa near Oława (N 50°92.889', E 17°34.154') in *Phragmitetum australis*. It is very

rarely reported in this type of habitat (Górski *et al.* 2003).

#### *Impatiens glandulifera* Royle

Several dozens of the species were reported in the oxbow lake of the Nysa Kłodzka River near Bielice in Opole Silesia (N 50°55.799', E 17°48.184') within *Phragmitetum australis*. So far, this species was not reported in the south-west of Poland in this type of habitat.

#### *Impatiens parviflora* DC.

Several dozens of the species were reported in the oxbow lake of the Oder in Boguszyce (N 50°60.067', E 17°95.452') within *Phragmitetum australis* and *Typhetum latifoliae*. So far, this species was not reported in oxbow lakes of the south-west of Poland.

#### *Reynoutria japonica* Houtt.

Several specimens of this species were reported in the oxbow lake of the Nysa Kłodzka River near Bielice (N 50°55.799', E 17°48.184') within *Phragmitetum australis*. So far, this species was not reported in this type of habitats.

#### *Solidago canadensis* L.

Several dozen specimens of this species were reported in the oxbow lake of the Oder in Boguszyce (N 50°60.067', E 17°95.452') within *Glycerietum maximae*, *Phragmitetum australis* and *Typhetum latifoliae*. So far, this species was not reported in oxbow lakes of the south-west Poland.

#### *Solidago gigantea* Aiton

Several dozen specimens of this species were reported in the oxbow lake of the Oder near Malczyce (N

51°22.757', E 16°48.413') and Głogów (N 51°66.813', E 16°09.660') and in the oxbow lake of the Barycz River near Bełcz Mały in Lower Silesia (N 51°57.363', E 16°65.318') within *Phragmitetum australis*. So far, this species was not reported in oxbow lakes of the south-west of Poland.

#### *Solidago graminifolia* (L.) Elliott

Several hundred specimens of this species were reported in the oxbow lake of the Oder in Boguszyce (N 50°60.067', E 17°95.452') within *Glycerietum maximae*, *Phragmitetum australis* and *Typhetum latifoliae*. So far, this species was not reported in plant oxbow lakes in Poland.

### 4. Conclusion

The current research proved the occurrence of 9 invasive species in the oxbow lakes of south-west

Poland. Most of them appeared, usually not numerous, in rush communities of *Phragmitetea* class, most often in *Phragmitetum australis* phytocoenoses. Only *Azolla filiculoides* created lobes of its community *Lemno-Azoletum filiculoides*. The invasive species were identified only in the oxbow lakes in the vicinity of illegal waste dumps or, less commonly, in oxbow lakes adjacent to agricultural land. As far as remedial actions are concerned, using chemicals in aquatic communities is unacceptable. As the populations of invasive species are usually small in this type of habitat, the only and the best way to eliminate them is to remove them manually, including *Azolla filiculoides*. Due to numerous plant migrations in the river valleys, it is supposed that invasive species will appear more often in oxbow lakes. The potential and biggest danger to the flora and community of plant oxbow lakes of south-west Poland may be *Azolla filiculoides*.

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