Steciana

2014, Vol. 18(4): 233–244
doi:10.12657/steciana.018.025

www.up.poznan.pl/steciana

ISSN 1689-653X

CHANGES IN SHARE OF *TRISETUM SIBIRICUM* IN GUTOWO MEADOWS (URSZULEWO PLAIN) IN 2000–2013

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(Received: January 9, 2014. Accepted: November 13, 2014)

Abstract. This paper presents results of abundance field research, distribution and habitat and phytocoenotic preferences of *Trisetum sibiricum* on the Gutowo Meadows (Urszulewo Plain, NE Poland), in a locality outside the continuous range of distribution. The species grown in wet, not used meadows, in places overflooded by beavers, partially afforested. The research was carried out in 2013 and the results were compared with analogical data from 2000–2002. Currently a higher abundance of species (circa 1600 tufts), a larger area of the locality (circa 2.5 ha), larger phytosociological spectrum and a larger share of hygrophilous species in species composition of the examined phytocoenoses was revealed. In 2013 a share of *Trisetum sibiricum* was noted in 12 plant communities from seven classes (*Phragmitetea australis, Scheuchzerio-Caricetea nigrae, Bidentetea tripartiti, Molinio-Arrhenatheretea, Artemisietea vulgaris, Alnetea glutinosae* and *Querco-Fagetea*), and in 2000–2002 – only in seven plant communities from three classes (*Scheuchzerio-Caricetea nigrae, Molinio-Arrhenatheretea* and *Artemisietea vulgaris*). Formerly the species was listed mainly in phytocoenoses of *Angelico-Cirsietum oleracei* and currently most often in phytocoenoses of *Junco-Molinietum*.

Key words: population resources, dynamic tendencies, meadow vegetation, phytocoenotic preferences, moisture changes, Ellenberg's indicator values, afforestation of meadows, Górzno-Lidzbark Landscape Park

INTRODUCTION

Siberian oat grass *Trisetum sibiricum* Rupr. (*Poaceae* family) is a hardly known taxon, not listed in Poland until the second half of 20th century (Chrtek 1968, Sokołowski 1981, 1988, Ceynowa-Giełdon 1988, Frey 1992).

Trisetum sibiricum is a loosely tufted grass with culms up to 100 cm. The panicle reaches 20 cm and its branches are slightly ascending. Spikelets are 5.2–8.5 cm long with 2–3(4) florets. *Trisetum sibiricum* may be a species mistakenly taken for a golden oat grass *T. flavescens*. Both species differs in width and color of blades, pubescence of sheaths, length and bending of lower glume's awn, color of spikelets and occupied habitats. The blade of *T. sibiricum* is 3–8 mm wide, its lower sheaths are lanate and upper are glabrous. The blade of *T. flavescens*, in turn, is narrower (2–5 mm) and its lower sheaths are glabrous or very shortly, retrorse-pilose. The observations of the authors point out the difference in blade colour during fruiting; in case of *T. sibiricum* it is brownish and of *T. flavescens* – golden. Lower glume's awn of *T. sibiricum* is longer (5–10 mm), with whitish hairs basally, it is not nodally bent. Whereas glume's awn of *T. flavescens* is shorter (4.5–6.5 mm), nodally bent without basal hairs. Spikelets of *T. sibiricum* are golden brown and shiny and of *T. flavescens* golden yellow, green, rarely with purple shine (Frey 1992, Rutkowski 1998, Finot et al. 2005). Species prefer different habitats. *Trisetum sibiricum* occur mainly on fen mires (including spring fens), in sedges and rushes, on wet meadows, in tall herbs and less often in bog forests and in bushes. Whereas *T. flavescens* grows on fresh meadows where it may be sown (Sokołowski 1981, 1988, Ceynowa-Giełdon 1988, Frey 1992, Frey et al. 2001, Gawenda & Załuski 2001).

Area of distribution of *T. sibiricum* encompasses mainly Asia and eastern part of Europe (Hultén & Fries 1986, Frey 1992). Along north-eastern Poland runs the western range limit of this species. Locality in the Gutowo Meadows (Urszulewo Plain mesoregion) is situated outside the area of species' contig-

Fig. 1. Location of *Trisetum sibiricum* locality
1 – forests, 2 – surface waters, 3 – towns and main roads, 4 – railways, 5 – boundary of Górzno-Lidzbark Landscape Park, 6 – locality of *Trisetum sibiricum*

uous range. It is located within the Górzno-Lidzbark Landscape Park. It lies in the Gutowo Meadows complex – meliorated fen mires by the Brynica river, on the south of Gutowo (Fig. 1). Yet in the middle of the last century an occurrence of relict species was noted, such as: *Betula humilis*, *Empetrum nigrum*, *Pedicularis sceptrum-carolinum*, *Sweertia perennis* and *Tofieldia calyculata* (Czubiński 1948).

Trisetum sibiricum is a rare species of lower risk category (LR), described in Polish red data book of plants (Frey et al. 2001). As a rare species (R) it is mentioned in the red list of plants in Poland but only in the 1992 edition (Zarzycki & Szeląg 1992). The species in the Kujawy-Pomorze voivodeship (Rutkowski 1997) has a vulnerable category (V) and in Western Pomerania (Żukowski & Jackowiak 1995) – it has an indeterminate category (I). The species is placed on lists of threatened species in Estonia, Lithuania, Latvia, Ukraine, Belarus and Russia (Ingelög et al. 1993, Tret'âkov 2006, Gudžinskas 2007).

The aim of the study is to compare the abundance, distribution and habitat preferences of *Trisetum sibiricum* in two research periods: in 2000–2002 and in 2013. The comparison of the results from both periods allowed to determine dynamic tendencies of the species.

MATERIAL AND METHODS

Locality of *T. sibiricum* in the Gutowo Meadows was found in 2000 (Gawenda & Załuski 2001). In 2000–2002 an approximate area of occurrence was defined, its abundance was estimated and phytosociological documentation was collected (Gawenda & Załuski 2001, Załuski & Gawenda 2003). In 2013 the research was repeated. A detailed documentation of the locality was performed including pointing out places of its occurrence by using GPS receiver. A phytosociological documentation of plant communities with share of *T. sibiricum* was made anew.

For each period of the research maps of distribution of *T. sibiricum* were drawn (ArcGIS application), where abundance of the species was marked. Using TURBOVEG application a phytosociological table was generated for data collected in 2013. Phytosociological belongingness of the examined phytocoenoses was determined and diagnostic value of the species was adopted mainly after Matuszkiewicz (2001), and partially after Ratyńska et al. (2010). Nomenclature of vascular plant species is given according to Mirek et al. (2002) and nomenclature of mosses according to Ochyra et al. (2003).

Data collected in 2013 were compared with the results from 2000–2002. On a basis of phytosociological relevés' analysis the share of socio-ecological groups in flora accompanying *T. sibiricum* was defined and compared. Moreover, for selected species a setout was made for mean cover values calculated from the sum of their mean degree of cover in the respective period of time.

In order to characterise the habitat conditions of the examined species, mean values (arithmetic mean) of Ellenberg's indicators were calculated (comp. Dzwonko 2008). They were worked out from phytosociological relevés for both periods of observation. These calculations were based on numbers of Ellenberg's indicator values for vascular plants (Jäger 2011).

RESULTS

The abundance of *T. sibiricum* in 2000 amounted to circa 130 individuals (tufts) dispersed in an area of circa 2 ha. In 2013 the area of the locality was estimated at 2.5 ha and species resources at 1600 tufts, concentrated mainly in one area of a diversified density of individuals (Fig. 2). The geographic coordinates of the centre of the locality are: N 53°13'32.7'', E 19°40'43.3''.

The basic documentation includes 21 phytosociological relevés performed in 2013 with a presence of *T. sibiricum*. They represent 12 phytosociological units (Table 1).

Trisetum sibiricum occurs quite often in rush plant communities of *Phragmitetea australis* class – in a plant community with *Phragmites australis*, in phytocoenoses of *Caricetum acutiformis* association and in a plant community with *Equisetum fluviatile* (Table 1, relevés 1–4). The first plant community has a transitional character (in dynamic and floristic sense) between meadow communities of *Molinietalia* order and reeds and therefore it was not assigned as *Phragmitetum australis*. It is characterised by a abundant share of meadow species with dominance of tall individuals of *Phragmites australis*. It occupies habitats wet only in area not used, usually near ditches. Also phytocoenosis of *Caricetum acutiformis* has a transitional character, an association revealed in moderately wet area by a ditch. Its species composition comprises also quite a large share of tall herb species of *Artemisietea vulgaris* class. While plant community with quite *Equisetum fluviatile*, also with numerous meadow species occupies wet places. Quantitative share of *T. sibiricum* in plant communities of *Phragmitetea australis* is small.

Subsequent group of plant communities where *T. sibiricum* occurs, comprises associations of *Scheuchzerio-Caricetea nigrae* class (Table 1, relevés 5–8). The first is the *Caricetum appropinquatae* association, characterised by a distinct hummock-hollow structure. The second association is *Calamagrostieum neglectae* with dominance of stoloniferous grass *Calamagrostis stricta*. Phytocoenoses of both associations occur in wet areas not used for a long time. Quantitative share of *T. sibiricum* is larger here rather than in the previous group.

The examined species grows also in a specific, complex plant community developed near beaver dam constructions where substrate is wet and boggy. Mosaic system is comprised of small phytocoenoses of *Bidentetum cernui* (*Bidentetea tripartiti* class) with phytocoenoses of plant community with dominance of *Epilobium roseum* (Table 1, relevé 9). The layer of herbs is low and relatively dense. The share of *T. sibiricum* is small.

Trisetum sibiricum most frequently grows in phytocoenoses of plant associations of *Molinio-Arrhenatheretea* class (Table 1, relevés 10–18), that is *Junco-Moli-*

Fig. 2. Distribution and population resources of *Trisetum sibiricum* in Gutowo Meadows in 2000–2002 and in 2013
1 – approx. 130 individuals, 2 – approx. 20 individuals, 3 – approx. 60 individuals, 4 – approx. 80–100 individuals, 5 – approx. 180 individuals, 6 – approx. 1100 individuals

Table 1. Phytosociological documentation of plant communities with share of *Trisetum sibiricum* – state of art in 2013
1–2 – *Phragmites australis* community, 3 – *Caricetum acutiformis*, 4 – *Equisetum fluviatile* community, 5–6 – *Caricetum appropinquatae*, 7–8 – *Calamagrostietum neglectae*, 9 – complex system of *Bidentetum cernui/Epilobium roseum* community, 10–13 – *Junco-Molinietum*, 14–15 – *Junco-Molinietum*/developmental stadia of *Fraxino-Alnetum*, 16–18 – *Angelico-Cirsietum oleracei*, 19 – *Urtica dioica* community, 20 – *Salix repens* community, 21 – *Fraxino-Alnetum*

Successive number of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Number of relevé in the field	4	16	21	13	6	7	10	12	11	5	9	14	15	17	18	1	2	3	20	8	19
	05	06	06	05	05	05	05	05	05	05	05	05	06	06	06	10	05	05	06	05	06
Date	08	08	08	08	08	08	08	08	08	08	08	08	08	08	08	07	08	08	08	08	08
	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013
Area of relevé [m²]	24	24	30	25	20	21	25	25	25	25	28	25	24	48	50	25	25	24	20	20	80
Tree layer cover [%]	–	–	–	–	–	–	–	–	–	–	–	–	–	55	–	–	–	–	–	–	80
Shrub layer cover [%]	–	5	–	–	–	–	–	–	–	–	–	–	<5	10	30	–	5	<5	–	80	30
Herb layer cover [%]	100	100	90	95	100	100	100	100	100	100	100	100	100	90	100	100	100	100	95	30	95
Moss layer cover [%]	–	5	<5	<5	<5	<5	<5	–	5	–	<5	<5	10	5	<5	5	–	<5	<5	25	5
Number of species	23	26	18	22	25	30	22	17	24	16	30	25	38	33	23	33	25	33	11	22	38
I. ChCl. *Phragmitetea australis*																					
Equisetum fluviatile	1	1	1	4	1	1	1	2	.	1	1	.	1	1	.	.	.	.	.	1	.
Carex acutiformis	.	.	4	.	.	1	.	.	.	.	1	.	.	.	1	3	3	3	.	.	1
Phragmites australis	4	5	1	.	.	.	.	.	.	.	.	.	.	3	2	.	.	.	.	.	1
Galium palustre	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	+	.
Carex rostrata	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	+	.
Rumex aquaticus	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Typha latifolia	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
II. ChCl. *Scheuchzerio-Caricetea nigrae*																					
Epilobium palustre	+	+	.	1	1	+	+	+	1	+	+	.	1	+	.	+	.	.	.	.	+
Carex appropinquata	2	.	.	.	5	5	.	.	1	1	1	.	.	1	.	.	.	.	.	1	.
Valeriana dioica	1	.	+	.	1	1	.	.	.	1	+	.	.	.	.	1	.	.	+	.	.
Calamagrostis stricta	.	.	.	.	.	.	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola × rupechtiana	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	1	.
III. ChCl. *Bidentetea tripartiti*																					
Bidens cernua	.	.	.	1	.	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.
Bidens tripartita	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.
IV. ChCl. *Molinion caeruleae*																					
Molinia caerulea	2	1	.	1	1	2	.	1	.	5	2	2	4	2	3	.	.	1	1	2	1
Succisa pratensis	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.

Ophioglossum vulgatum	1	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
V. ChCl., DAll. *Calthion palustris*																					
Cirsium oleraceum	2	1	.	2	2	2	2	2	1	2	1	2	2	2	2	2	1	2	.	+	1
Geum rivale	1	2	2	3	.	2	2	3	2	2	2	3	.	3	3	1	1	3	.	1	2
Polygonum bistorta	+	1	+	.	+	1	+	1	+	+	1	1	+	1	1	2	.	1	.	1	1
Carex cespitosa	.	2	.	.	.	.	1	.	.	.	.	2	.	2	1	.	.	.	.	.	1
Crepis paludosa	+	.	+	.	.	.	.	.	.	.	1	.	.	.	+	1	.	1	.	.	.
VI. ChCl. *Molinietalia caeruleae*																					
Lotus uliginosus	+	1	.	2	1	.	1	.	+	.	1	+	1	1	1	1	1	1	.	1	.
Valeriana officinalis	.	.	.	2	.	.	2	2	1	.	.	1	1	+	1	.	1	+	.	+	1
Angelica sylvestris	2	1	.	.	1	1	1	.	.	1	1	2	+	1	.	2	.	.	.	1	1
Galium uliginosum	.	.	.	.	+	.	.	.	.	+	.	.	1	1	1	1	.	.	.	+	.
Lychnis flos-cuculi	.	+	+	.	.	+	.	+	.	.	+	.	.	+	+	+	.	.	.	.	.
Cirsium palustre	.	.	.	+	+	+	.	1	.	1	+	.	.	.	.	.	.	+	.	+	.
Veronica longifolia	1	.	.	1	+	.	.	.	.	+	.	2	.	.	.	.	.	.	.	.	.
Lythrum salicaria	.	.	.	+	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.	.	.
Filipendula ulmaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	2	.	.	.
Lysimachia vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.
Hypericum tetrapterum	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
VII. ChCl. *Molinio-Arrhenatheretea*																					
Festuca rubra	.	1	.	.	.	.	.	.	.	.	.	.	1	+	1	.	1	+	.	.	.
Holcus lanatus	+	1	.	1	+	.	1	1	2	.	.	1	1	1	.	2	2	1	1	.	2
Veronica chamaedrys	+	+	.	.	+	+	.	+	.	.	+	.	.	.	.	1	1	+	.	.	+
Poa trivialis	.	2	2	+	1	1	.	+	2	1	1	1	2	2	2	1	2	1	3	.	3
Campanula patula	.	+	.	.	+	.	.	.	.	.	+	.	+	.	.	+	.	+	.	.	+
Poa pratensis	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	+	.	.	+
Ranunculus acris	.	.	.	.	.	.	.	.	.	.	+	+	1	+	.	+	.	.	.	+	.
Rumex acetosa	+	.	.	.	.	.	.	.	.	.	+	.	+	+	+	+	+	.	.	.	.
Avenula pubescens	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	1	1	1	.	.	.
Heracleum sibiricum	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.
Vicia cracca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	1	.	.	.
Ranunculus repens	.	.	.	.	.	+	+	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Agrostis stolonifera	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.
Cerastium holosteoides	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+

VIII. ChCl. *Artemisietea vulgaris*																					
Urtica dioica	1	1	2	.	+	+	1	+	.	+	.	1	1	2	+	+	1	.	5	.	2
Anthriscus sylvestris	.	1	.	.	+	+	1	1	1	1	+	1	1	.	.	1	2	1	1	.	1
Galeopsis speciosa	.	.	2	1	.	.	1	.	2	.	.	.	.	1	1	.	+	+	2	.	2
Epilobium parviflorum	.	.	.	2	+	.	.	.	.	.	.	1	+	+	1	.	.	.	.	.	+
Galium aparine	.	.	2	.	.	.	1	.	1	.	.	.	.	+	.	.	+	.	3	.	1
Carduus crispus	.	.	.	1	.	+	.	.	+	.	.	1	.	.	.	.	1	.	.	.	.
Galeopsis bifida	+	+	.	+	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Epilobium roseum	+	.	.	.	.	+	.	.	3	.	.	.	.	.	.	.	.	.	.	.	+
Epilobium hirsutum	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Eupatorium cannabinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	.	.
Sonchus arvensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.
IX. ChCl., DCl. *Alnetea glutinosae*																					
Alnus glutinosa a	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	4
Alnus glutinosa b	.	1	.	.	.	.	.	.	.	.	.	.	1	2	3	.	.	.	.	.	1
Alnus glutinosa c	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	+
Salix repens c	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	5	.
Solanum dulcamara	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Lycopus europaeus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.
Salix cinerea b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Salix cinerea c	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
X. ChCl. *Querco-Fagetea*																					
Alnus incana a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Alnus incana b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Alnus incana c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Impatiens noli-tangere	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
Plagiomnium undulatum	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	+	.	1
XI. ChCl. *Rhamno-Prunetea*																					
Populus tremula b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
Populus tremula c	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
XII. Others																					
Trisetum sibiricum	+	+	1	1	1	1	2	1	1	2	2	2	1	1	+	1	1	1	+	1	+
Anthoxanthum odoratum	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	+
Potentilla erecta	.	.	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.	+	.	.	.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Galium verum	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.
Chrysosplenium alternifolium	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Poa angustifolia	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.
Rubus idaeus c	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Galium album	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	+	.	.	.
Cardamine amara	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brachythecium rutabulum	.	1	.	1	+	+	.	.	1	.	+	+	+	1	.	.	.	1	.	2	1
Amblystegium serpens	.	.	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
Plagiomnium ellipticum	.	1	.	.	.	+	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.
Plagiomnium cuspidatum	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	2	+
Plagiomnium elatum	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	.	.	.	.	.
Leptobryum pyriforme	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Leptodictyum humile	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.

Sporadic species: I. *Scrophularia umbrosa* 3(+); *Scutellaria galericulata* 9(1); **III.** *Polygonum hydropiper* 7(+); **V.** *Caltha palustris* 11(1); *Myosotis palustris* 16(1); *Scirpus sylvaticus* 16(1); **VI.** *Equisetum palustre* 11(1); **VII.** *Achillea millefolium* 12(+); *Dactylis glomerata* 18(+); *Festuca pratensis* 12(+); *Knautia arvensis* 7(+); *Plantago lanceolata*13(+); *Potentilla anserina* 21(+); **VIII.** *Geranium robertianum* 3(+); *Humulus lupulus* 6(+); *Lapsana communis* 21(+); *Linaria vulgaris* 6(1); *Moehringia trinervia* 21(1); *Myosoton aquaticum* 21(+); **X.** *Acer pseudoplatanus* c 21(+); **XI.** *Rhamnus catharticus* b 14(1); *Sambucus nigra* b 21(1); **XII.** *Athyrium filix-femina* 3(1); *Betula pendula* c 18(+); *Brachythecium mildeanum* 13(+); *Calamagrostis epigeios* 7(+); *Oxyrrhynchium hians* 14(+); *Plagiothecium ruthei* 20(+); *Thalictrum aquilegifolium* 17(1).

nietum and *Angelico-Cirsietum oleracei*. Phytocoenoses of the first of the associations mentioned above occur on meadows not used and of different moisture level: from wet habitats to moderately wet. They are characterised by a large share of *Molinia caerulea* and a highly variable species richness. Some of the phytocoenoses, with a smaller share of higrophilous species refer to *Selino-Molinietum* association. Quantitative share of *T. sibiricum* in phytocoenoses of *Junco-Molinietum* is usually large. In 2000–2002 phytocoenoses of the discussed association occupied a greater area than they do currently but have been partially afforested. In places with planted black alder at that time a plant community of *Junco-Molinietum*, form with *Alnus glutinosa* characterised by a large share of *Phragmites australis* and a small share of *T. sibiricum* was distinguished. In contrast, phytocoenoses of *Angelico-Cirsietum oleracei* associations develop on rarely used meadows. They have a relatively large share of *Cirsium oleraceum, Polygonum bistorta, Filipendula ulmaria* and *Carex acutiformis* and a small of *T. sibiricum*.

In 2013 the examined species was sporadically noted in floristically poor non-forest plant communities of other classes (Table 1, relevés 19–20). It is

Table 2. Plant communities with share of *Trisetum sibiricum* in 2000–2002 and in 2013

Plant communities	Number of relevés	
	2000–2002	2013
Cl. ***Phragmitetea australis***		
1. *Phragmites australis* community	–	2
2. *Caricetum acutiformis*	–	1
3. *Equisetum fluviatile* community	–	1
Cl. ***Scheuchzerio-Caricetea nigrae***		
4. *Caricetum appropinquatae*	1	2
5. *Calamagrostietum neglectae*	–	2
Cl. ***Bidentetea tripartitae***		
6. complex system of *Bidentetum cernui/ Epilobium roseum* community	–	1
Cl. ***Molinio-Arrhenatheretea***		
7. *Junco-Molinietum*	1	4
8. *Junco-Molinietum*/developmental stadia of *Fraxino-Alnetum*	–	2
9. *Angelico-Cirsietum oleracei*	4	3
10. *Angelico-Cirsietum oleracei*, form with *Alnus glutinosa*	3	–
11. *Geum rivale* community	1	–
Cl. ***Artemisietea vulgaris***		
12. *Anthriscetum sylvestris*	1	–
13. *Urtica dioica* community	1	1
Cl. ***Alnetea glutinosae***		
14. *Salix repens* community	–	1
Cl. ***Querco-Fagetea***		
15. *Fraxino-Alnetum*	–	1
Total	12	21

the *Urtica dioica* plant community of *Artemisietea vulgaris* class, occurring in mucky peat on the edge of the ash-alder forest as well as in *Salix repens* plant community of *Alnetea glutinosae* class, forming phytocoenoses on not used, overgrowing, marshy meadows.

Trisetum sibiricum is also present not abundantly in forest phytocoenoses of *Querco-Fagetea* class, representing ash-alder forest *Fraxino-Alnetum* (Table 1, relevé 21). Phytocoenoses with share of oat grass are characterised by domination of *Alnus glutinosa*, they occur on a moderately wet organic substrate.

Documentation comparison of two research periods indicates an enlargement of phytosociological spectrum of *T. sibiricum* (Table 2). In 2000–2002 the examined taxon in seven plant communities from three classes were reported: *Phragmitetea australis*, *Molinio-Arrhenatheretea* and *Artemisietea vulgaris* (Załuski & Gawenda 2003). In 2013 it was revealed in 12 plant communities from seven classes: *Phragmitetea australis, Scheuchzerio-Caricetea nigrae, Bidentetea tripartiti, Molinio-Arrhenatheretea, Artemisietea vulgaris, Alnetea glutinosae* and *Querco-Fagetea*. In both research periods *T. sibiricum* was noted in plant communities from *Molinio-Arrhenatheretea* class. In 2000–2002 the species was related mainly with *Angelico-Cirsietum oleracei* association, including form with *Alnus glutinosa* (young, planted black alder). In 2013 the species was focused mainly in phytocoenoses of *Junco-Molinietum* and *Angelico-Cirsietum oleracei* and in phytocoenoses with transitional character between *Junco-Molinietum* and developmental stadia of *Fraxino-Alnetum*.

A comparison of species from respective socio-ecological groups in both periods of the research (Fig. 3) reveals fairly distinct differences. A decrease of characteristic species number from *Scheuchzerio-Caricetea nigrae* and *Molinio-Arrhenatheretea* classes was noted. A distinct increase of tall herb species from *Artemisietea vulgaris* was reported and a less distinct – of species of moist and wet habitats from *Phragmitetea australis*, *Alnetea glutinosae* and *Querco-Fagetea* classes as well as from *Molinion caeruleae* and *Calthion palustris* alliances. Moreover, in 2013 a presence of species from groups previously not observed – from *Bidentetea tripartiti* and *Rhamno-Prunetea* classes was noted.

Transformations in occurrence conditions of *T. sibiricum* in 2000–2002 and in 2013 is shown in Table 3, where mean cover values of selected species were compared. Therein mainly species of which quantitative share (mean percentual cover) has significantly decreased or increased in phytosociological material, which indirectly suggests changes of habitat conditions of *T. sibiricum* in both periods of time. In 2013 a distinctly larger share in examined phytocoenoses had some of the species from *Phragmitetea* class (especially *Phragmites australis*), *Molinion* alliance (*Molinia caerulea*), *Molinietalia* order (e.g. *Valeriana officinalis* and *Angelica sylvestris*), *Molinio-Arrhenatheretea* class (especially *Poa trivialis*), *Artemisietea vulgaris* class (i.a. *Galeopsis speciosa*), *Scheuchzerio-Caricetea nigrae* class (especially *Calamagrostis stricta*) and *Alnetea glutinosae* class (*Alnus glutinosa* in layer a, *Salix repens*). Whereas a smaller share in phytocoenoses with *T. sibiricum* revealed species from *Calthion* alliance (especially *Cirsium oleraceum*), *Molinietalia* order (*Lotus uliginosus*), *Molinio-Arrhen-*

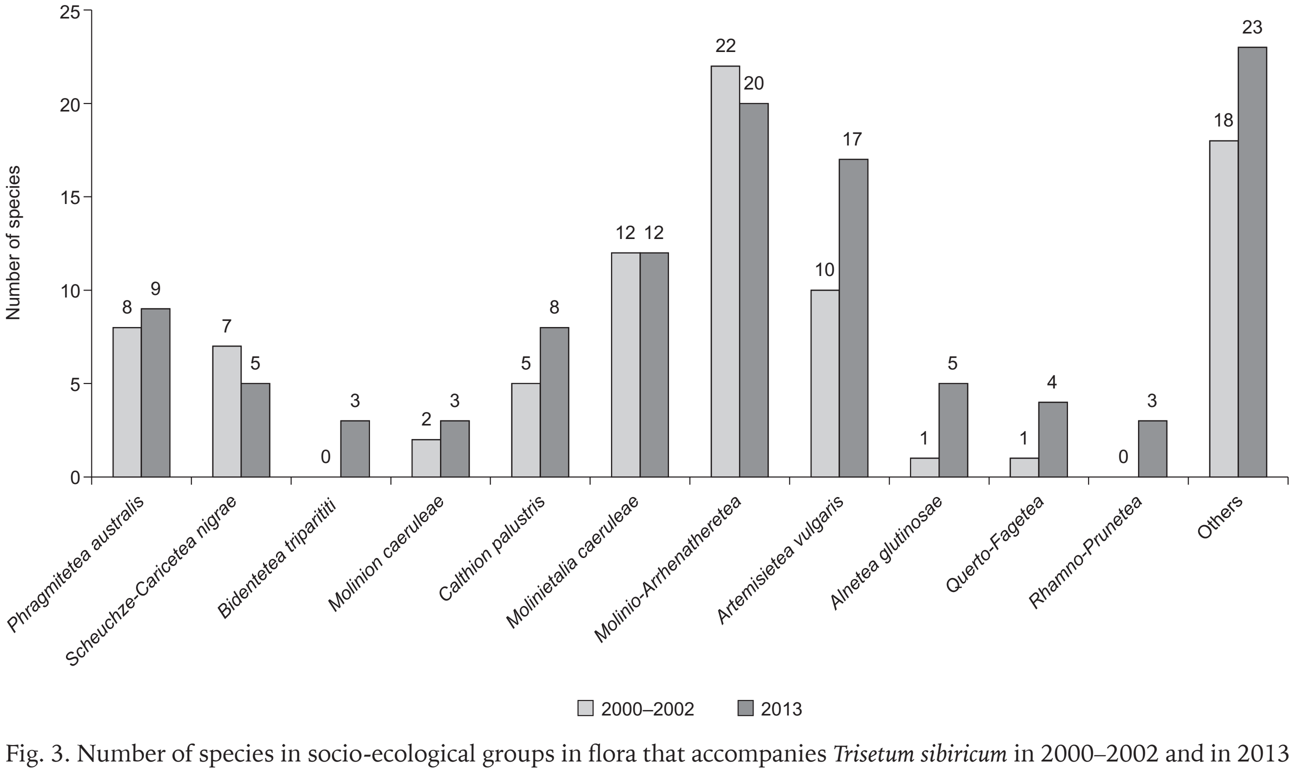

Fig. 3. Number of species in socio-ecological groups in flora that accompanies *Trisetum sibiricum* in 2000–2002 and in 2013

Table 3. Medium cover values of selected species in socio–ecological groups in *Trisetum sibiricum* flora that accompanies *Trisetum sibiricum* in 2000–2002 and in 2013

Period	2000–2002	2013
Number of relevés	12	21
Phragmitetea australis		
Carex acutiformis	5.00	8.81
Equisetum fluviatile	0.85	5.00
Phragmites australis	0.21	9.88
Scheuchzerio–Caricetea nigrae		
Viola palustris	0.43	0.01
Carex appropinquata	6.47	9.64
Calamagrostis stricta	–	5.95
Epilobium palustre	0.25	0.52
Valeriana dioica	–	0.61
Bidentetea tripartiti		
Bidens cernua	–	0.95
Molinion caeruleae		
Molinia caerulea	10.64	14.05
Calthion palustris		
Cirsium oleraceum	21.46	9.89
Geum rivale	17.29	16.90
Polygonum bistorta	4.18	1.94
Carex cespitosa	1.25	2.50
Molinietalia caeruleae		
Lotus uliginosus	7.29	2.04
Valeriana officinalis	1.08	2.87
Angelica sylvestris	0.87	3.22
Veronica longifolia	0.21	0.96
Filipendula ulmaria	0.01	1.43
Lythrum salicaria	–	0.36
Molinio–Arrhenatheretea		
Holcus lanatus	10.83	3.94
Festuca rubra	7.93	0.49
Plantago lanceolata	1.48	0.01
Veronica chamaedrys	1.07	0.28
Ranunculus acris	0.65	0.14
Rumex acetosa	0.65	0.03
Avenula pubescens	0.86	0.37
Festuca arundinacea	0.43	0.01
Poa pratensis	0.25	0.13
Poa trivialis	0.84	9.41
Vicia cracca	0.43	2.02
Galium mollugo	0.43	–
Briza media	0.42	–
Euphrasia rostkoviana	0.22	–
Artemisietea vulgaris		
Urtica dioica	14.39	7.05
Anthriscus sylvestris	9.79	2.04
Galium aparine	3.15	2.87
Galeopsis speciosa	1.47	3.34
Epilobium parviflorum	0.23	0.97
Eupatorium cannabinum	–	0.83
Alnetea glutinosae		
Alnus glutinosa b	7.71	1.07
Alnus glutinosa c	0.43	0.13
Alnus glutinosa a	–	5.95
Salix repens c	–	4.17
Salix cinerea c	–	1.79
Others		
Trisetum sibiricum	10.22	4.31
Plagiomnium ellipticum	7.94	0.36
Galium verum	0.64	0.01
Anthoxanthum odoratum	0.64	0.02
Galium album	1.67	0.12
Leptodictyum humile	0.03	0.01
Brachythecium rutabulum	0.88	1.45
Plagiomnium cuspidatum	0.26	0.73
Chrysosplenium alternifolium	0.01	0.24

Grey color – higher mean cover value.

atheretea class (especially *Holcus lanatus* and *Festuca rubra*), *Artemisietea vulgaris* class (i.a. *Urtica dioica* and *Anthriscus sylvestris*) and *Alnetea glutinosae* class (*Alnus glutinosa* in layer b). The result of a set out is a decrease of share of *T. sibiricum*, which should be interpreted as an effect of species records with lower qualitative values in 2013.

The differences in habitat conditions of *T. sibiricum* in both research periods are displayed through a comparison of mean Ellenberg indicators' values (Fig. 4). A higher humidity of the habitats in 2013 (F – 7.91) in relation to years 200–2002 (F – 7.19) has been revealed. The following indicators obtained slightly higher values: continentality (K), light (L) and reaction (R). Only the indicator of nitrogen (N) in 2000–2002 had a higher value (N – 5.27) and lower in 2013 (N – 4.89).

DISCUSSION AND CONCLUSIONS

Research carried out revealed a distinct increase of population resources of *T. sibiricum* on the Gutowo Meadows from approx. 130 tufts in 2000–2002 up to 1600 tufts in 2013. The majority of the localities known in Poland of the examined species are not so abundant. Usually few to several dozen tufts are noted (Ceynowa-Giełdon 1988, Sokołowski 1988). Less often the population abundance is estimated to sev-

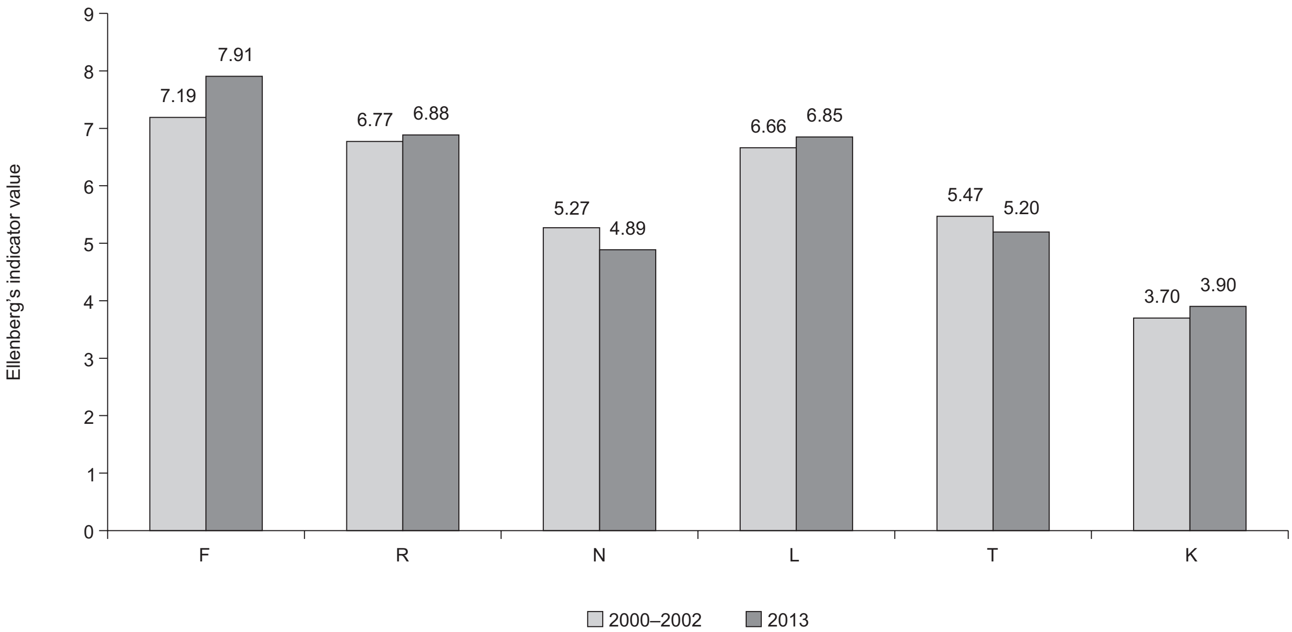

Fig. 4. Medium values of Ellenberg's indicators for relevés in 2000–2002 and in 2013
F – moisture indicator, R – reaction indicator, N – fertility indicator, L – light indicator, T – temperature indicator, K – continentality indicator

eral hundred tufts which occur in localities from the Białowieża National Park (Sokołowski 1995).

Trisetum sibiricum is a species preferring wet habitats (Frey et al. 2001, Zarzycki et al. 2002). Hence, the observed increase of abundance of *T. sibiricum* is due to moisture increase of the habitats comparing with the previous research period, confirmed by an increase of moisture indicator value (Fig. 4). The moisture growth occurred mainly due to an activity of Eurasian beaver *Castor fiber,* as well as an effect of gradual overgrowing of ditches confirmed by the authors' own observation. Another confirmation of moisture increase is a different species share spectrum in plant communities in 2013, showing a larger number of higrophilous phytocoenoses from *Phragmitetea australis* and *Scheuchzerio-Caricetea nigrae* classes (Table 2).

The increase of abundance of the examined species may be also related to the lack of use of meadows. A large area of meadows has not been not mown for at least 20 years and a part of meadows previously used was afforested by alder a dozen or so years ago. A distinct increase of species abundance was revealed in places not mown for a long time. Lack of use of meadows is found as a factor favouring spreading of *Trisetum sibiricum* (Ceynowa-Giełdon 1988, Sokołowski 1988, Frey et al. 2001), which indicates the dynamic tendency specifics of the species.

Moreover, an impoverishment of the resources of *T. sibiricum* was observed in places where a dozen or so years ago black alder *Alnus glutinosa* had been planted. It is due to i.a. a fact that in 2000–2002 a community of *Angelico-Cirsietum oleracei* form with *Alnus glutinosa* was noted and in 2013 this syntaxon was not listed (Table 2). A disappearance of *T. sibiricum* in these areas may be indirectly presumed through a current listing in young alder forests with a small number of tufts of the examined species, significantly less than in adjacent meadows. There is no cartographic documentation from 2000–2002 for aggregations of *T. sibiricum*. It should be underlined that the examined species was listed until the coverage of alder's young individuals was not exceeding 50% (Załuski & Gawenda 2003).

The publications revealing phytocoenotic preferences of *T. sibiricum* in Poland are scarce. Therefore, phytosociological documentation from the Gutowo Meadows (Załuski & Gawenda 2003, current authors' materials) in a significant way contributes to expansion of the knowledge in this subject. Against the current data from publications (Sokołowski 1981, 1988, Ceynowa-Giełdon 1988) on Gutowo Meadows a presence of *T. sibiricum* in nine, new plant communities were shown: community with *Phragmites australis*, *Caricetum acutiformis*, community with *Equisetum fluviatile*, *Calamagrostietum neglectae*, *Bidentetum cernui*/community with *Epilobium roseum*, *Anthriscetum sylvestris,* community with *Urtica dioica,* community with *Salix repens* and *Fraxino-Alnetum*.

In both research periods the discussed species was noted mainly in meadow plant communities of *Molinio-Arrhenatheretea* class (Table 2). Nevertheless in 2000–2002 the species occurred more often in phytocoenoses of *Angelico-Cirsietum oleracei*, whereas currently – in phytocoenoses of *Junco-Molinietum* association. In 2013 a share of *T. sibiricum* was also noted in transitional meadow-forest plant communities (*Junco-Molinietum*/developmental stadia of *Fraxino-Alnetum*), where *Molinia caerulea* reveals a tendency to spread similarly as in the Tuchola surrounding area (Ceynowa-Giełdon 1988). Intensive spreading of *M. caerulea* occurs mainly on not mown meadows (Michalska-Hejduk 2007) and it is often a result of a ecrease of habitats' trophy, previously occupied by wet thistle meadows (Kącki 2007). In the examined area it is confirmed by a decrease of the trophic indicator, noted in 2013 in comparison with the anterior period of time (Fig. 4).

Obvious increase of abundance of *T. sibiricum* in Gutowo Meadows as well as habitat and phytocoenotic changes observed in this area, indicate that the examined species has currently favourable conditions for persistency and further growth. Cease of use and substrate moisture growth favour the existence of the examined species (comp. Ceynowa-Giełdon 1988, Sokołowski 1988, Frey et al. 2001). Nevertheless, in order to preserve the population resources of *T. sibiricum* in conditions of lowering of water table and initiation of brushwood and forest vegetation growth a periodical mowing will certainly be necessary.

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