SHORT COMMUNICATIONS

FLORISTIC DIVERSITY OF WATERCOURSES AND TEMPORARY RESERVOIRS OF THE OSTROVTSOVSKY CLUSTER OF THE VOLGA REGIONAL FOREST-STEPPE STATE NATURAL BIOSPHERIC RESERVE IMPACTED BY THE EUROPEAN BEAVER'S EXPANSION

Elena A. Katsman

A. N. Severtsov Institute of Ecology and Evolution, *Russian Academy of Sciences*
33 Leninsky Prosp., *Moscow 119071*, *Russia*
E-mail: *elenkz05@gmail.com*

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The paper is devoted to an important problem of modern ecology, namely, the reaction of native ecosystems to the activity of invader species, with the European beaver (*Castor fiber* L) as an example. This species transforms the environment as a result of its foraging and constructive activities. Higher vascular plants (macrophytes) in water bodies and streams are one of the basic components of biotopes. They serve as a limiting factor for the spread of such invasive species as *C. fiber*, because macrophytes determine the basis of this animal's diet. On the other hand, under the influence of the constructive and foraging activities of *C. fiber*, the macrophyte communities undergo significant changes. As a result of this process, such indicators as trophicity and saprobity of natural waters change, whose quality is formed at the level of small reservoirs and watercourses. It is especially important for the forest-steppe zone characterized by relative poverty of water resources. The data collected during three field seasons (2015–2017) allow describing the current status of the highest aquatic vegetation in several small water bodies and watercourses located in the Volga regional forest-steppe State Nature Reserve. Other factors of environment transformation, such as the economic use of reservoirs and watercourses and their adjacent territories, and the recreational load, are practically excluded there. The presented data reflect the influence of *C. fiber* upon the biocenoses of small water bodies and watercourses.

Key words: macrophytes, *Castor fiber*, small water bodies and watercourses, forest-steppe.

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Widely spreaded on the territory of the Russian Federation after the successful introduction in 1930–1950 the invasive species of the River (European) beaver (*Castor fiber* L.) (Dyakov, 1975) has an unprecedented effect on the ecosystems it inhabits. Changes are noted in the tree layer of vegetation, which is primarily affected by this spe-

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cies, removing the trunks of certain tree species for construction activities and foraging (Goryaynov et al., 2014). The construction of dams causes the occurrence of temporary and permanent water bodies of a special type – beaver ponds, as well as a general swamping of the areas used. Obvious changes are noted in the composition of the fauna of these habitats; on the one hand, there is a simplification of the structure of hydrobiont communities, on the other hand, insects are attracted to fallen tree trunks, followed by insectivorous birds, as well as mammals that feed on tree-shrub vegetation.

The flora of higher aquatic herbaceous plants also undergoes significant changes, due to the decrease in water transparency in beaver ponds the level of submerged vegetation is impoverished, and due to the constant enrichment of water with biogenic elements and their removal to the coastal zone, dense thickets of ruderal plants are formed around soils enriched with phosphorus and nitrogen. Since macrophytes experience a double press in the habitats of the River Beaver, being a food object seized in the spring-summer period and undergoing changes in the microclimate and microrelief, a variety of them can be reduced and the floristic composition changes (Antipov, Martynov, 2012; Katsman, 2012).

Transformations that occur under the influence of the activities of the River beaver with the flora of watercourses and water bodies are studied in various natural zones and have both common features and significant differences. The presented research is devoted to the peculiarities of macrophyte communities of small watercourses and temporary reservoirs of the forest-steppe zone.

Material and Methods. Studies of higher aquatic vegetation were carried out on watercourses and temporary reservoirs, which are habitats of the river beaver in the Volga Rigion Forest-Steppe State Natural Biosphere Reserve during 2014 (May, July) and since 2015 to 2017 (August). Research included the study of floristic composition and sampling to determine the productivity of communities of higher aquatic vegetation. The data on the floristic composition of the higher aquatic vegetation of the streams and sites of the small Yuzhnaya and Selimutka rivers and the Khoper river of the Ostrovtsovskaya forest-steppe claster are summarized.

The study of the phytocenosises of the watercourses of reserves was carried out by the method of route population censuses and the construction of test plots. Twelve stations with the most common phytocenosises were identified, where 36 sample plots of 4 m^2 were used to study the floristic composition, abundance, and projection cover estimates in accordance with V. G. Papchenkov method (Papchenkov, 2006).

Figure show the description and sampling stations.

The following below Table summarizes the data on the floristic composition of higher aquatic vegetation of streams and small rivers sections of the Yuzhnaya river and the Selimutka and Khoper rivers in cluster Ostrovosky forest-steppe of the reserve. The systematic position of plants was determined in accordance with the plant identifier by P. F. Mayevsky (Mayevsky, 2006). Latin names of plants are given regardless of systematic affiliation, in alphabetical order. √ sign marks representation of the species in the area of route accounting adjacent to the station. The total number of species is 55, the most represented are hygrophytes and helophytes, to a lesser extent pleistophytes (plants with floating leaves), the group of hydrophytes is well represented only in the areas of

the Khoper river. The most common plants are a nettle and a meadowsweet, as well as duckweeds.

Most species belong to the ecological group of hygrophytes and hygromesophytes uniting the plants of wetlands and moist habitats.

The watercourse is very poorly represented hydrophytes: none of the small number of species, with the exception of *Lemna minor* is not characterized by high abundance and occurrence. A small number of types of helophytes, but *Typha latipholia* and *Phragmites australis* are characterized by high abundance, creating pure thickets in fairly extensive areas. Most number of species of higher aquatic plants belongs to the group of hygrophytes and hygromesophytes. Most abundant species: *Urtica dioica* – hygromezofhyte and *Filipendula ulmaria* – hygrophyt. In addition, it should be noted the presence in the described phytocenosises of a certain number of mesophytes with low occurence and abundance.

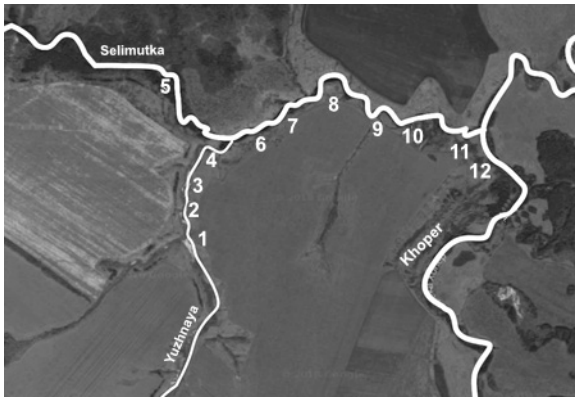

Figure. The hydrophilic vegetation study stations: *1* – the beaver pond on the Yuzhnaya river, *2* – the beaver pond on the Yuzhnaya river, *3* – the beaver pond on the Yuzhnaya river, *4* – the beaver pond on the Yuzhnaya river, *5* – the channel of the Selimutka river (deflated beaver pond), *6* – the channel of the Selimutka river, *7* – the channel of the Selimutka river, *8* – the pit on the Selimutka river, *9* – Selimutka river, *10* – the channel of the Selimutka river, *11* – the beaver pond on the Selimutka river, *12* – Khoper river

Table. The hydrophilic vegetation species

No.	Species	The hydrophilic vegetation study stations											
		1	2	3	4	5	6	7	8	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	*Alisma plantago-aquatica*	√				√					√		
2	*Bidens cernua*				√		√					√	
3	*Bidens tripartita*	√		√	√					√			√
4	*Butomus umbellatus*			√		√			√	√			
5	*Calla palustris*							√					
6	*Callitriche cophocarpa*			√									
7	*Caltha palustris*		√				√	√			√		√
8	*Cardamine amara*												
9	*Carex acuta*	√	√	√	√	√	√		√	√	√		√
10	*Carex pseudocyperus*		√		√	√	√			√	√	√	√
11	*Carex riparia*			√	√	√		√	√		√		√
12	*Carex rostrata*												
13	*Carex vesicaria*	√		√	√		√		√		√		√
14	*Carex vulpina*					√				√			

Table. Continuation

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	*Ceratophyllum demersum*			√					√			√	
16	*Elodea canadensis*	√				√				√			√
17	*Epilobium palustre*				√				√				
18	*Equisetum fluviatile*	√		√			√				√		
19	*Filipendula ulmaria*	√	√	√	√	√	√	√		√	√	√	√
20	*Galium palustre*		√	√				√			√		√
21	*Glyceria fluitans*			√	√		√			√	√		√
22	*Hydrocharis morsus-ranae*		√		√	√	√	√		√	√		√
23	*Iris pseudacorus*						√						
24	*Juncus ambiguus*			√									√
25	*Lemna minor*	√	√	√	√	√	√	√	√	√	√	√	√
26	*Lemna trisulca*	√	√	√	√	√	√	√	√	√	√	√	√
27	*Lycopus europaeus*		√										√
28	*Lysimachia nummularia*						√			√		√	
29	*Lysimachia vulgaris*	√			√			√			√		
30	*Lythrum salicaria*		√	√	√	√	√		√	√	√		√
31	*Mentha arvensis*	√					√					√	
32	*Myosotis palustris*			√			√						√
33	*Oenanthe aquatica*												
34	*Persicaria amphibia*	√	√	√	√	√	√	√			√		√
35	*Phragmites australis*	√	√	√	√	√			√	√	√	√	√
36	*Potamogeton crispus*												√
37	*Potamogeton lucens*												√
38	*Potamogeton natans*												√
39	*Potamogeton pectinatus*												√
40	*Potamogeton perfoliatus*												√
41	*Potentilla anserina*			√			√			√			
42	*Rorippa amphibia*	√	√						√			√	
43	*Rumex aquaticus*		√			√				√		√	
44	*Rumex hydrolapathum*			√			√				√		
45	*Sagittaria sagittifolia*		√		√	√	√		√	√		√	√
46	*Scirpus lacustris*	√	√	√		√				√	√		
47	*Scirpus sylvaticus*						√						
48	*Scutellaria galericulata*			√									
49	*Solanum dulcamara*												
50	*Sparganium emersum*		√										√
51	*Sparganium erectum*					√							√
52	*Stachys palustris*							√					
53	*Symphytum officinale*												
54	*Typha angustifolia*	√	√	√			√		√			√	√
55	*Urtica dioica*	√	√	√	√	√	√	√	√	√	√	√	√

In General, the studied floodplain and channel areas of watercourses are characterized by mosaic vegetation, a variety of phytocenosises concentrated in a relatively small space. In the upper reaches of the Selimutka river, under the cover of black alder, projective grass cover is low, a narrow strip along the water's edge are sedimentary, quite often there are mezophytes. On the banks of beaver ponds, also under the cover of black alder, there are quite extensive areas where sedges grow in abundance. In several places along the banks of the ponds outside the forest canopy there are large areas occupied by clean thickets *Phragmites australis*. In the middle reaches there are areas of the floodplain

occupied by almost pure thickets *Sparganium erectum* and *Scirpus sylvaticus*, interspersed with areas of floodplain, overgrown with *Urtica dioica* and *Filipendula ulmaria*, covering large areas from the water's edge to the slope of the shore. The heterogeneity and diversity of phytocenosises formed by herbaceous vascular plants in the floodplain of the Selimutka river are associated with the long-term impact of the construction and feeding activities of the river beaver (Bashinskiy, Osipov, 2018), which affects the course of succession in plant communities.

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Elena A. Katsman

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ФЛОРИСТИЧЕСКОЕ РАЗНООБРАЗИЕ ВОДОТОКОВ И ВРЕМЕННЫХ ВОДОЁМОВ ОСТРОВЦОВСКОГО УЧАСТКА ЗАПОВЕДНИКА «ПРИВОЛЖСКАЯ ЛЕСОСТЕПЬ» ПОД ВЛИЯНИЕМ РАССЕЛЕНИЯ ЕВРОПЕЙСКОГО БОБРА

Е. А. Кацман

Институт проблем экологии и эволюции им. А. Н. Северцова РАН
Россия, *119071*, *Москва*, *Ленинский просп.*, *33*
E-mail: *elenkz05@gmail.com*

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Статья посвящена важной проблеме современной экологии – реакции природных экосистем на жизнедеятельность видов-вселенцев на примере европейского бобра (*Castor fiber* L.). Этот вид трансформирует среду обитания в результате кормодобывающей и строительной деятельности. Высшие сосудистые растения (макрофиты) водоёмов и водотоков являются одним из основных компонентов биотопов. Они служат ограничивающим фактором в распространении видов-вселенцев как европейский бобр, так как макрофиты определяют основу рациона этого вида. С другой стороны, под влиянием строительно-кормодобывающей деятельности бобров сообщества макрофитов претерпевают значительные изменения. В результате этого процесса меняются также такие показатели, как трофность и сапробность природных вод, качество которых формируется на уровне небольших водоёмов и водотоков. Это особенно важно для лесостепной зоны, характеризующейся относительной бедностью водными ресурсами. Данные, собранные в течение трех полевых сезонов (2015 – 2017 гг.), позволили описать текущее состояние высшей водной растительности небольших водоёмов и водотоков, расположенных в Государственном природном заповеднике «Приволжская лесостепь». Другие факторы трансформации природной среды, такие как промышленное использование водоёмов и водотоков и их прилегающих территорий, а также рекреационная нагрузка, здесь практически исключены. Представленные данные отражают воздействие на биоценозы мелких водоёмов и водотоков европейского бобра.

Ключевые слова: макрофиты, *Castor fiber*, малые водоёмы и водотоки, лесостепь.

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