THE EUROPEAN BEAVER (*CASTOR FIBER* L.) IN CONDITIONS OF RELICT SWAMPS OF THE NATIONAL NATURAL PARK SLOBOZHANSKYI

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Abstract: In the years 2012-2014 the relict forest swamps on the upland terrace of the National Natural Park Slobozhanskyi (Krasnokutsk district, Kharkov region, Ukraine) were examined. The canals, lodges, dens, trails of beavers and food caches were mapped using hand-handled GPS. The number of beaver sites was determined by food caches. 44 beaver lodges were founded in the relict forest swamps. 13 lodges were used by beavers in the winter of 2013-2014. As the results of the counting indicate it, about 50 individuals of beavers have been living in the relict swamps. Regarding beaver feeding in winter, birch (*Betula pendula, Betula pubescens*) dominated up to 71.72%, then Aspen (*Populus tremula*) - 9.74% and willow (*Salix aurita, Salix cinerea, Salix alba*) - 14.75%. Beavers actively affect the relict swamps in the National Natural Park Slobozhanskyi. Canals help to keep water, eating of trees and shrubs prevents swamps from overgrowing; beaver constructions give refuge to many species of animals.

Keywords: European Beaver, National Natural Park Slobozhanskyi, relict swamp

Introduction:

The European beaver (*Castor fiber*) is gradually becoming a fairly common mammal throughout Europe. These animals are classified as ecosystem engineers, because their building activities can change, maintain or create habitats by modulating the availability of resources of both biotic and abiotic materials for themselves and for other species (Jones et al. 1994; Gurney and Lawton 1996; Rosell et al. 2005; Danilov et al. 2007). Beavers can greatly affect their environment by constructing dams, canals and other structures. Beavers play a key role in small rivers and wetlands ecosystem processes, because their foraging has a considerable impact on the course of succession, species composition and structure of plant communities (Gurnell 1998; Zav`yalov 2008; Dgebuadze et al. 2012). These animals increase heterogeneity, the habitat and species' diversity at the landscape scale.

The beaver`s population was declining until the 19th century in most regions in Europe. Thanks to protection, reintroductions and natural spread beavers are returning to areas from which they had been eradicated. In the 70s of the 20th century, the first beavers in the Kharkiv

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region (Ukraine) moved to river Merla from Poltava region (Tokarskiy et al. 2002). First of all, the animals had colonized river Merla and river Merchyk, including land-reclamation canals (Skorobogatov and Atemasova 2001a; Skorobogatov and Atemasova 2001b; Skorobogatov et al. 2004). After that, beavers settled in the relict swamps of the National Natural Park Slobozhanskyi (Brusentsova 2014).

This paper discusses some features of ecology of the beaver in the relict swamps of National Natural Park Slobozhanskyi. The aim of this study was to identify the main types of the beaver`s impact on wetland ecosistems.

Materials and methods:

The National Natural Park (NNP) Slobozhanskyi was created in 2009 (Krasnokutsk district, Kharkov region, Ukraine) to preserve valuable natural, historical and cultural complexes and objects of forest-steppe zone.

Most of the park`s territory consists of forests. On the right bank of river Merla the maple-lime-oak forest dominates, on the left bank prevail natural and planted pine forests. The unique ecosystem of Kharkiv region – comprising sphagnum and sedge-sphagnum bogs, birch and alder swamps, forest lakes – is located among the pine forest. As regards the relict swamps in the forest-steppe zone, it has been observed the age-old tendency to dry out and reduce their area due to climate change. Shallow open water wetlands provide critically important habitat for numerous species, yet they have become increasingly vulnerable to drought and are often reduced in size and depth or disappear during drought.

Furthermore, the floodplain of river Merla and river Merchyk was subjected to radical hydromelioration within Krasnokutsk district during the 70s-80s of the previous century. This has led to radical changes in the hydrological regime of the floodplain. After changing the climate and the hydrological regime it has been observed a drying of the wetlands on the upland terrace and a reduction of the forest lakes' water mirror. The system of wetlands and lakes of National Natural Park Slobozhanskyi is not only crucial in saving many flora and fauna species listed in the Red Book of Ukraine and other security lists, but it also plays an important role in the ecology of water birds, such as herons, ducks, sandpipers and the like.

In the years 2012-2014 the relict forest swamps on the upland terrace of the National Natural Park Slobozhanskyi were examined. The canals, lodges, dens, trails of beavers and food caches were mapped using hand-handle GPS (Fig. 1). The number of beaver sites was determined by food caches. It was by counting the felled trees and shrubs that feeding composition was determined. Each tree and shrub species was determined and the stem diameters were measured. The processing of field data was performed with the software package Quantum GIS 2.0.1. The family composition and the number of individuals in each family was grasped by method described in Poyarkov (1953), D`yakov (1975) and Solov`ev (1971).

Results and discussion:

Swamps are not the most popular habitat for beavers. Most studies of European beaver populations point out that rivers and streams are its typical habitats (Gurnell 1998; Rosell et al. 2005; Danilov et al. 2007; Dgebuadze et al. 2012; Tokarskiy et al. 2002). The beaver sites in the swamps of the forest-steppe zone have been almost unexplored. Data on population of this animal are available for the forest zone. In Lithuania, the beaver sites in the natural rivers comprise about 18% of all sites, in brooks - 12%, in lakes - 17%, in swamps and peat bogs - 15%. The greatest part of the beaver sites (up to 36%) has been situated in the canals of land reclamation. However, in some regions with plentiful swamps, the beaver uses them very

actively, as in the example of the hilly moraine uplands (Ulevičius et al. 2011).

In Finland most of the beavers inhabit relatively small lakes (Lahti and Helminen 1974). Each family of animals usually occupies one whole lake or several small ones, such as in the National Natural Park Slobozhanskyi.

Figure no. 1 Registry of beavers in the National Natural Park Slobozhanskiy (Foto by Prylutskyi O.)

44 beaver lodges have been found in the relict forest swamps of the National Natural Park Slobozhanskyi. In 2012 we mapped 6 wintering lodges, but some swamps remained unexamined. In 2013 a detailed mapping of the wetlands was organised with the participation of volunteers and 13 wintering lodges were found (Fig. 2). At one beaver site the animals wintered in dens.

On average, each beaver family built more than one lodge. Additional lodges were used in different ways according to the local topography. Secondary lodges were occupied when the water level was low near the main lodge, or when the human recreation activity disturbed the beavers. In the Masurian and Brodnica Lakeland of Poland, Żurowski (1992) also found that *C. fiber* built many lodges. A similar situation is found in Finland (Lahti and Helminen 1974).

An important condition for beavers' accommodation in any area is a sufficient water level. It should be such that it has become possible to create enough reserves for the winter and dive for them in the food caches (Gurnell 1998). In 2013, the number of wintering lodges in the National Natural Park Slobozhanskyi increased. This fact is connected to the favorable conditions for the settling of beavers in that year (high water level in swamps).

The basic social unit – family group – consists of a monogamous adult pair with juveniles of one year, yearlings, and sometimes two-year-olds (subadults). Normally, subadults stay with parents for two winters and disperse at the age of two (Wilsson 1971). As the results of count have illustrated, about 50 beaver individuals live in relict swamps of National Natural Park Slobozhanskyi (Tab. 1).

Figure no. 2 Beaver lodges in the National Natural Park Slobozhanskyi in winter 2013-2014

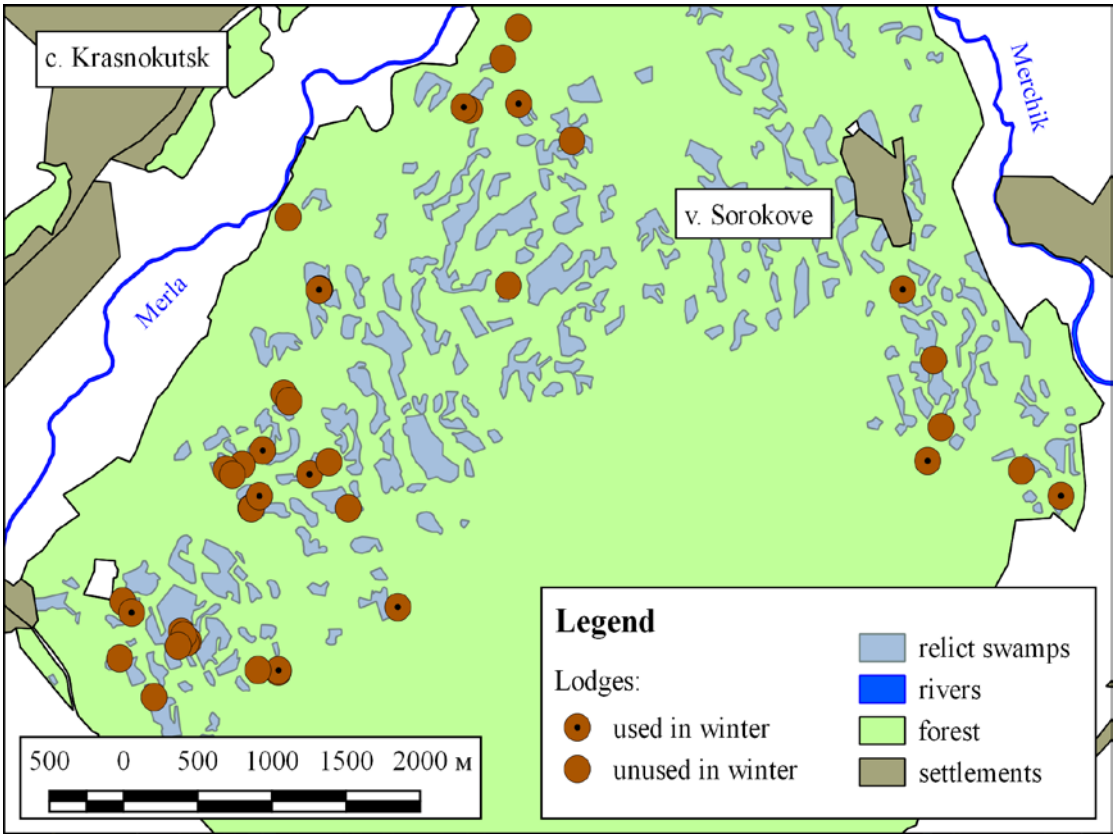

Table no. 1 The results of beavers accounting for the year 2013

Site no.	Structure of family (juv. : subad. : ad.)	No. of individuals
1	0:2:0	2-3
2	2:2:2	5-7 (6)
3	0:2:2	3-5 (4)
4	3:0:2	5
5	0:2:2	4
6	2:0:2	3-5 (4)
7	2:2:?	3-5 (4)
8	0:2:0	2
9	2:2:2	5-7 (6)
10	0:3:2	5-7 (6)
11	0:1:0	1
12	0:0:1	1
13	0:2:0	2
14	0:1:2	3

A lot of researches devoted to the influence of beavers on ecosystems (Gurnell 1998; Rosell et al. 2005; Danilov et al. 2007; Dgebuadze et al. 2012). Studying the beaver population in the National Natural Park Slobozhanskyi we have identified three aspects:

- the impact on the water regime of wetlands - the creation of canals;
- impact on plant communities;
- impact on fauna.

A family territory of beavers in the National Natural Park Slobozhanskyi consists of several lakes and wetlands, which are connected by paths and canals. Herewith, animals do not usually build dams.

The most prominent activity for the local beavers is creating canals that retain water during summer droughts (Fig. 3).

Canals allow animals to get safely to the rear section through thickets of higher aquatic vegetation and provide help when the

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water mirror area of wetlands and lakes decreases. There are marshes that are fully strewn with canals (Figs. 4 and 5). Canals are also used as route ways for transporting timber to the beaver pond (Gurnell 1998).

In mixed-wood boreal region of Canada the temperature, precipitation and climatic variables were less important than the beaver`s activity in maintaining open water areas. In addition, during the wet and dry years, the beaver`s presence was associated with a 9-fold increment of open water area when compared to a period when beavers were absent from the same sites (Hood and Bayley 2008).

In summer beavers use multiple forest swamps and lakes for providing stability fodder. They can spend up to 90% of their feeding time consuming grass, forbs and aquatic vegetation in summer and depend largely on woody plants as food sources in winter (Gurnell 1998; Lahti and Helminen 1974). Overall, 2.793 trimmed trees were recorded in this study. It was showed that in beaver winter feeding there prevail birch (*Betula pendula*, *Betula pubescens*) - 71.72%, Aspen (*Populus tremula*) - 9.74% and willow (*Salix aurita*, *Salix cinerea*, *Salix alba*) - 14.75% (Tab. 2; Fig. 6).

Table no. 2 Beavers feeding composition in National Natural Park Slobozhanskyi

Species	No.
Betula pendula; *B. pubescens*	2003
Populus tremula	272
Alnus glutinosa	42
Salix aurita; *S. cinerea*; *S. alba*	412
Pinus sylvestris	43
Quercus robur	20
Amelanchier spicata	1
Total	2793

Figure no. 3 Beaver lodge in the National Natural Park Slobozhanskiy (Foto by Brusentsova N.)

Figure no. 4 Beaver canals in the National Natural Park Slobozhanskiy (Foto by Prylutskyi O.)

Figure no. 5 Location beaver canals in the swamp. A. Display on the satellite image (source ArcGIS World Imagery); B. Scheme of canals

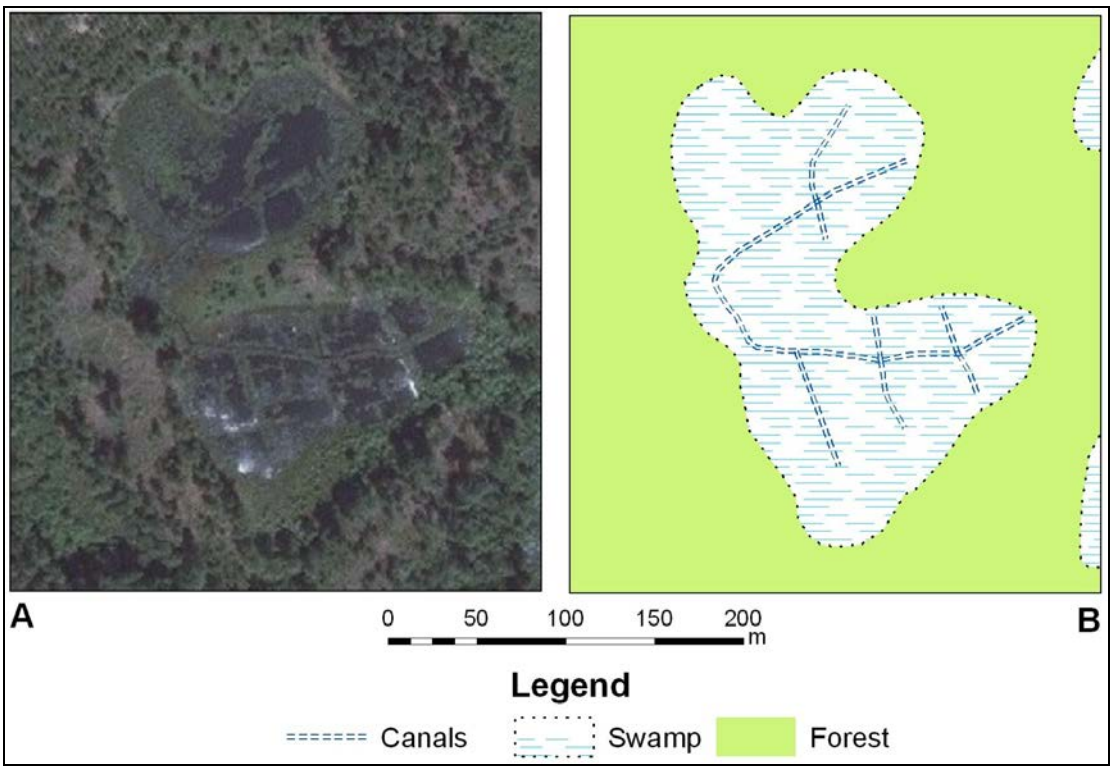

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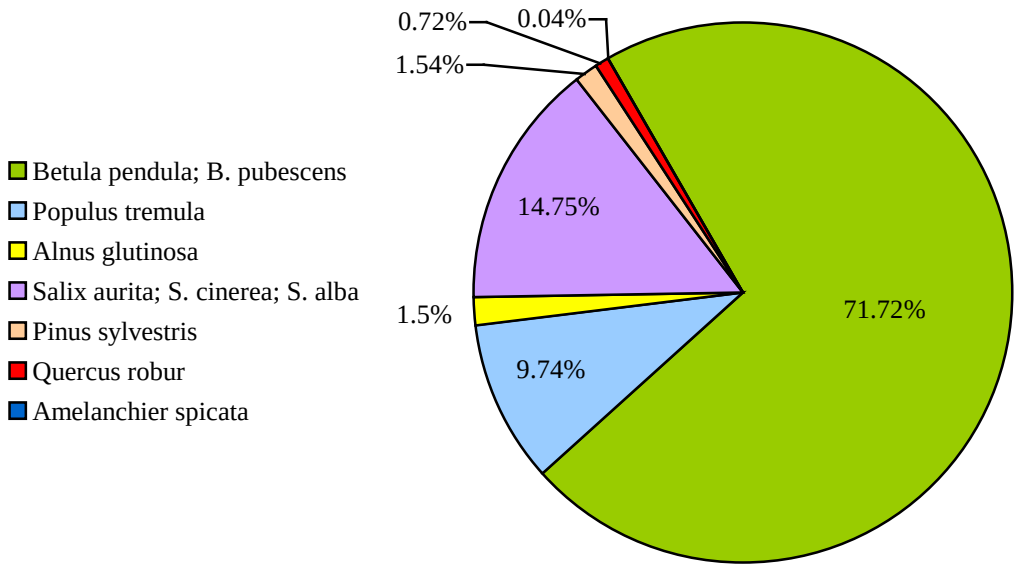
Figure no. 6 The percentual composition of beavers feeding in National Natural Park Slobozhanskyi



These trees encircle the periphery of swamps and lakes and separate them from the surrounding pine forest. These tree species dominate in the diet of the beaver in the European North of Russia (Danilov et al. 2007). In Finland aspen and birch are preferred, especially in autumn (Lahti and Helminen 1974). In Poland willows alone constituted 62.5% of the total number of twigs and branches of beaver food caches (Dzięciołowski and Misiukiewicz 2002). In Croatia young pedunculate oak (*Quercus robur* L.) are the most abundant species in beaver's feeding; *Corylus avellana* (44%) and *Cornus sanguinea* represent about 30% of their alimentation (Margaletić et al. 2006).

Birch, aspen and willow start to be overgrown within the swamps of National Natural Park Slobozhanskyi that dry out and further extract all water from swamps. Therefore, the actively eating of these trees by beavers helps to preserve water in wetlands.

Many studies have shown that the establishment of beaver dams on rivers and streams increases the biodiversity and these dams retain many species of animals (Gurnell 1998; Rosell et al. 2005; Danilov et al. 2007; Dgebuadze et al. 2012). In the Natural Park Slobozhanskyi beavers live in swamps and therefore they have no place to create new ponds. Their main aim is to maintain wetland complexes and the water level. Maintaining the water regime of wetlands, beavers help to keep their unique flora and fauna. In addition, the lodges provide shelter to other types of vertebrate animals, which may occur on the territory of the National Natural Park Slobozhanskyi. It these have also been observed by other researchers (Tab. 3).

Conclusions:

Beavers actively affect the relict swamps in the National Natural Park Slobozhanskyi. Their canals help to keep water; their eating plants prevents swamps from overgrowing, beaver constructions giving refuge to many species of animals. Beaver activity, aimed at maintaining the level of water in the wetlands of the park, contributes to the conservation of relict swamps as a whole with their unique flora and fauna.

Nevertheless, this issue requires further long-term monitoring studies.

Table no. 3 The beaver lodge occupants

No.	Species	Author
1	*Martes martes*	Rosell and Hovde 1998
2	*Mustela vison*	Żurowski and Kammler 1987; Rosell et al. 2005
3	*Lutra lutra*	Danilov et al. 2007; Rosell et al. 2005
4	*Arvicola terrestris*	Danilov et al. 2007; Rosell et al. 2005
5	*Ondatra zibethicus*	Danilov et al. 2007; Rosell et al. 2005
6	*Sorex araneus*	Ulevičius and Janulaitis 2007
7	*Sorex minutus*	Ulevičius and Janulaitis 2007
8	*Neomys fodiens*	Ulevičius and Janulaitis 2007
9	*Mus musculus*	Ulevičius and Janulaitis 2007
10	*Apodemus agrarius*	Ulevičius and Janulaitis 2007
11	*Apodemus flavicollis*	Ulevičius and Janulaitis 2007
12	*Myoides glareolus*	Ulevičius and Janulaitis 2007
13	*Microtus arvalis*	Ulevičius and Janulaitis 2007
14	*Microtus agrestis*	Ulevičius and Janulaitis 2007
15	*Emys orbicularis*	this study
16	*Natrix natrix*	this study

Rezumat:

CASTORUL (*CASTOR FIBER* L.) ÎN CONDIȚIILE MLAȘTINILOR SECULARE DIN PARCUL NATURAL NAȚIONAL SLOBOZHANSKYI

Între anii 2012-2014 au fost studiate pădurile mlaștinilor seculare de pe terasa înaltă a Parcului Natural Național Slobozhanskyi (Districtul Krasnokutsk, regiunea Kharkov, Ucraina). Canalele, adăposturile, vizuinele, traseele castorilor și depozitele de hrană au fost cartografiate cu ajutorul unui GPS portabil. Locurile de staționare ale castorilor au fost recunoscute după depozitele de hrană. 44 de adăposturi ale castorilor au fost descoperite în pădurile din mlaștinile seculare. 13 adăposturi au fost folosite de castori în timpul iernii din 2013-2014. În urma numărătorii a rezultat că aproximativ 50 de exemplare de castor trăiesc în mlaștinile seculare. În ceea ce privește hrana pe timpul iernii, mesteacănul (*Betula pendula*, *Betula pubescens*) este dominant cu 71.72%, în timp ce plopul (*Populus tremula*) reprezintă 9.74%, iar salcia (*Salix aurita*, *Salix cinerea*, *Salix alba*) 14.75%. Castorii influențează în mod evident mlaștinile seculare din Parcul Natural Național Slobozhanskyi. Canalele ajută la păstrarea apei, iar consumul arborilor și arbuștilor previne suprapopularea mlaștinilor; construcțiile realizate de castori oferă adăpost pentru multe specii de animale.

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