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# THE DYNAMICS OF THE POPULATION OF BEAVERS AND THE FLORA CHEWED BY THEM IN THE LEŻAJSK FOREST INSPECTORATE

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**Summary.** The research covered the area of the Leżajsk Forest Inspectorate, where in the years 1991-1992 11 and 9 beavers (3 positions) coming from Wizajny were settled down. The dynamics of the quantity of the population in the years 1993-2004 was estimated as far as the flora on the positions occupied by beavers. During this period of time there was an increase of the population up to 371 individuals this year and the species spread throughout 9 inspectorates, and in the years 2001-2004 stabilization of the increase of population reached 14%. Beavers occupy, in general, habitats close to alder-ash marshy meadows and, additionally, find tree food and timber in fresh mixed woods. The species chewed by beavers are: alder, birch, oak, hornbeam, beech, spruce and pine.

**Key words:** beaver, *Castor fiber*, introduction, dynamics of the population, habitat

## INTRODUCTION

The history of beavers *(Castor fiber* L.) in Poland is interesting. Initially, the species was numerous and intensively used. In the XX c. it was small and since 1923 the species has been legally protected [Czech 2000]. It was treated as being in danger of extinction and put in the Polish Red Book of Animals [Głowaciński 1992]. The restitution of the species meant the species protection and reintroduction, generally in the years 1975-1986. These actions and natural migrations helped a lot and today the beaver is common in Poland. Its population is about 28 thousand individuals, and in many places beavers' activities result in conflicts with human economy. It changed the statute of the species; now it is partially protected.

## STUDY AREA, MATERIAL AND METHODS

The evaluation of the population of the beaver was carried out annually by workers of the Leżajsk Forest Inspectorate since 1993 until 2004. The evaluation of the popula-

tion was carried out according to the observation of the territories occupied by beaver families. It was assumed that an average family consists of 8 individuals: parents and young individuals of the first and second generations. The beaver is a territorial species, so one beaver pond is occupied by only one family [Żurowski 1989, Dzięciołowski 1996].

The evaluation of habitats occupied by beavers and transferred due to their activities was done assuming the areas on which phytosociological records were made [Matuszkiewicz 2001]. Four records in two positions were taken where the first introductions took place (the Zerwanka and Jelna Forest Inspectorates). In each of the positions, a florist schedule was made. Two phytosociological records of composition communities were taken in a habitat with a high level of humidity caused by beavers' activities and two records of the surrounding forest areas which are a reservoir of the tree flora chewed as food and construction resource.

Flora species on which chewing traces were noticed in each positions. Flora was marked according to a key for marking plants [Szafer *et al.* 1988], and the kind of a community according to a guide for marking a community [Matuszkiewicz 2001].

Other traces of beavers' activities such as dikes, burrows, paths, traces of branch pulling were also noticed.

## RESULTS

### Introduction and the dynamics of the population of beavers

On the territory of the Leżajsk Forest Inspectorate the first introduction took place in 1991. 11 individuals coming from Wizajny were settled down in agencies 322 and 323 in Zerwanka (Tab. 1, Fig. 1). In 1992 the settling was done on the area of two inspectorates. In Jelna 5 individuals were set at liberty into the territory of agencies 118, 119 and 120 and in Brzyska Wola 4 individuals around agency 100. The first evaluations of the population were carried out in the year 1993 – an increase in population and migration

Table 1. Settlement and population of beavers in the Leżajsk Forest Inspectorate

Tabela 1. Wsiedlenia i liczebność bobrów w Nadleśnictwie Leżajsk

| Forest district Leśnictwo | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brzyska Wola | | 4 * | 2 | | 4 | 12 | 21 | 36 | 36 | 34 | 38 | 42 | 50 | 63 |
| Zerwanka | 11 * | | 32 | 30 | 32 | 35 | 15 | 27 | 29 | 35 | 46 | 50 | 40 | 50 |
| Kulno | | | 2 | 2 | 4 | 6 | 13 | 10 | 6 | 6 | 21 | 12 | 16 | 18 |
| Jelna | | 5 * | 9 | 15 | 10 | 11 | 30 | 33 | 30 | 26 | 35 | 55 | 52 | 52 |
| Zmysłówka +Korniaktów | | | | | | 14 | 20 | 16 | 20 | 26 | 29 | 30 | 38 | 43 |
| Wydrze | | | | | | 8 | 17 | 18 | 23 | 37 | 53 | 61 | 85 | 90 |
| Czarna | | | | | | 2 | 2 | | 4 | 14 | 16 | 24 | 32 | 41 |
| Sarzyna | | | | | | | | 5 | 6 | 6 | 10 | 10 | 12 | 14 |
| Total – Razem | 11* | 9 * | 45 | 47 | 50 | 88 | 118 | 145 | 154 | 184 | 248 | 284 | 325 | 371 |

*introduced individuals – osobniki introdukowane

Table 2. List of flora on surfaces in the places of the introduction of beavers
Tabela 2. Wykaz roślinności na powierzchniach w miejscach introdukcji bobrów

| Location Stanowisko | Trees Drzewa | Shrubs Krzewy | Herbs Zioła | Mosses Mchy |
|---|---|---|---|---|
| Zerwanka Za1 | | 1 | 5, 16, 25, 30, 31, 33, 36, 37, 44, 46, 49, 50, 51, 52, 56, 58, 60, 63, | |
| Zerwanka Za2 | | 1,5 | 3, 5, 6, 8, 13, 16, 18, 19, 20, 22, 23, 24, 27, 28, 29, 31, 36, 38, 39, 40, 45, 46, 49, 52, 54, 55, 56, 58, 62 | 4 |
| Jelna Ja1 | 1, | 1,9 | 4, 5, 6, 7, 8, 14, 15, 21, 25, 37, 46, 47, 49, 55, 56, 57, 58, 62, 63 | |
| Jelna Ja2 | 1, 4, | 3, 4, 5, 6, 7, 11, 12, 16, | 1, 4, 8, 9, 10, 12, 14, 15, 17, 26, 27, 32, 37, 51, 55, 56, 57, 63, | |
| Zerwanka Zb1 | 1, 2, 3, 5, 6, 7 | 5, 8, 11, 13, 14, 15 | 11, 23, 28, 34, 41, 42, 53 | 1,3 |
| Zerwanka Zb2 | 1, 4, | 3, 5, 7, 10, 12, 13 | 1, 2, 5, 6, 10, 27, 56, 59, 63 | |
| Jelna Jb1 | 1, 2, 6, 7 | 1, 3, 4, 5, 11, 13, 14, 16 | 2, 28, 32, 35, 40, 41, 43, 48, 61 | 2,3 |
| Jelna Jb2 | 6, 7 | 2, 3, 5, 8, 11, 13, 14 | 2, 23, 41, 42, 53, 61 | 2,3 |

**Trees:** 1 – *Alnus glutinosa*, 2 – *Betula verrucosa*, 3 – *Carpinus betulus*, 4 – *Fraxinus excelsior*, 5 – *Picea abies*, 6 – *Pinus sylvestris*, 7 – *Quercus robur*.
**Shrubs:** 1 – *Alnus glutinosa*, 2 – *Carpinus betulus*, 3 – *Corylus avellana*, 4 – *Euonymus verrucosus*, 5 – *Frangula alnus*, 6 – *Fraxinus excelsior*, 7 – *Padus avium*, 8 – *Quercus robur*, 9 – *Ribes nigra*, 10 – *Rubus idaeus*, 11 – *R. sp.*, 12 – *Sambucus nigra*, 13 – *Sorbus aucuparia*, 14 – *Vaccinium myrtillus*, 15 – *V. vitis-idaea*, 16 – *Viburnum opulus*.
**Herbs:** 1 – *Aegopodium podagraria*, 2 – *Anemone nemorosa*, 3 – *Arrhenatherum elatius*, 4 – *Athyrium filix-femina*, 5 – *Calla palustris*, 6 – *Caltha palustris*, 7 – *Carex acutiformis*, 8 – *C. appropinquata*, 9 – *C. diandra*, 10 – *C. elongata*, 11 – *C. lepidocarpa*, 12 – *C. leporina*, 13 – *C. nigra*, 14 – *C. pseudocyperus*, 15 – *C. remota*, 16 – *C. rostrata*, 17 – *Cirsium palustre*, 18 – *C. rivulare*, 19 – *Dactylorhiza majalis*, 20 – *Eleocharis palustris*, 21 – *Equisetum limosum*, 22 – *Eriophorum angustifolium*, 23 – *Festuca rubra*, 24 – *Filipendula ulmaria*, 25 – *Galium aparine*, 26 – *Geranium palustre*, 27 – *Geum rivale*, 28 – *Hieracium sylvaticum*, 29 – *Holcus lanatus*, 30 – *Humulus lupulus*, 31 – *Iris pseudoacorus*, 32 – *Juncus effusus*, 33 – *Lathyrus paluster*, 34 – *Luzula multiflora*, 35 – *Luzula pilosa*, 36 – *Lychnis flos-cuculi*, 37 – *Lycopus europaeus*, 38 – *Lysimachia nummularia*, 39 – *L. thyrsiflora*, 40 – *L. vulgaris*, 41 – *Majanthemum bifolium*, 42 – *Melampyrum pratense*, 43 – *Melica nutans*, 44 – *Mentha aquatica*, 45 – *Menyanthes trifoliata*, 46 – *Myosotis palustris*, 47 – *Oenanthe aquatica*, 48 – *Oxalis acetosella*, 49 – *Peucedanum palustris*, 50 – *Phalaris arundinacea*, 51 – *Poa palustris*, 52 – *P. pratensis*, 53 – *Pteridium aquilinum*, 54 – *Ranunculus acer*, 55 – *R. repens*, 56 – *Scirpus silvaticus*, 57 – *Scutellaria galericulata*, 58 – *Solanum dulcamara*, 59 – *Stellaria nemorum*, 60 – *S. palustris*, 61 – *Trientalis europaea*, 62 – *Typha angustifolia*, 63 – *Urtica dioica*,
**Mosses:** 1 – *Leucobryum glaucum*, 2 – *Pleurozium schreberi*, 3 – *Polytrichum formosum*, 4 – *Sphagnum sp.*

were noticed. 2 individuals appeared in the neighbourhood of Kulno inspectorate. Altogether there were 45 beavers. The next two years resulted in a small increase of the population of beavers by 2 individuals (4.4%) in 1994 and 3 individuals (6.4%) in 1995 and migrations of the animals (Tab. 1 Fig. 1, Fig. 2). In that year there were no beavers observed in one of the settling places – Brzyska Wola. 1996 was the year of the highest increase in population (by 76%) in the period analysed. It was caused by various migrations and occupying new territories in four inspectorates. Since 1999 up to now, the beaver has lived in 9 inspectorates. In the following years, stabilization in the increase of the population of the species can be seen and in the last three years it was about 14%. Today, in 2004, the population of beavers in the inspectorate is 371.

Table 3. List of tree plant species chewed by beavers

Tabela 3. Wykaz gatunków roślin drzewiastych zgryzanych przez bobry

| Location – Stanowisko | Zerwanka | | Jelna | | Zerwanka | | Jelna | | Zerwanka | Jelna |
|---|---|---|---|---|---|---|---|---|---|---|
| Species – Gatunek | Za1 | Za2 | Ja1 | Ja2 | Zb1 | Zb2 | Jb1 | Jb2 | | |
| *Alnus glutinosa* | | | + | – | | | + | | | + |
| *Betula verrucosa* | + | | + | | + | | + | | + | + |
| *Carpinus betulus* | | | | | + | | | + | + | + |
| *Fraxinus excelsior* | | | | + | | | | | | + |
| *Picea abies* | | | | | + | + | | | + | |
| *Pinus sylvestris* | + | + | | | | | | | + | |
| *Quercus robur* | | | + | | | | + | + | | + |
| *Fagus sylvatica** | | + | | | + | | | | + | |
| *Salix sp.** | + | | | | | | | | + | |
| *Frangula alnus** | | + | | | | | | | + | |
| *Quercus rubra** | | + | | | | | | | + | |
| *Corylus avellana** | | | + | | | | | | | + |

* Species eaten near location – Gatunki zgryzane w pobliżu stanowisk

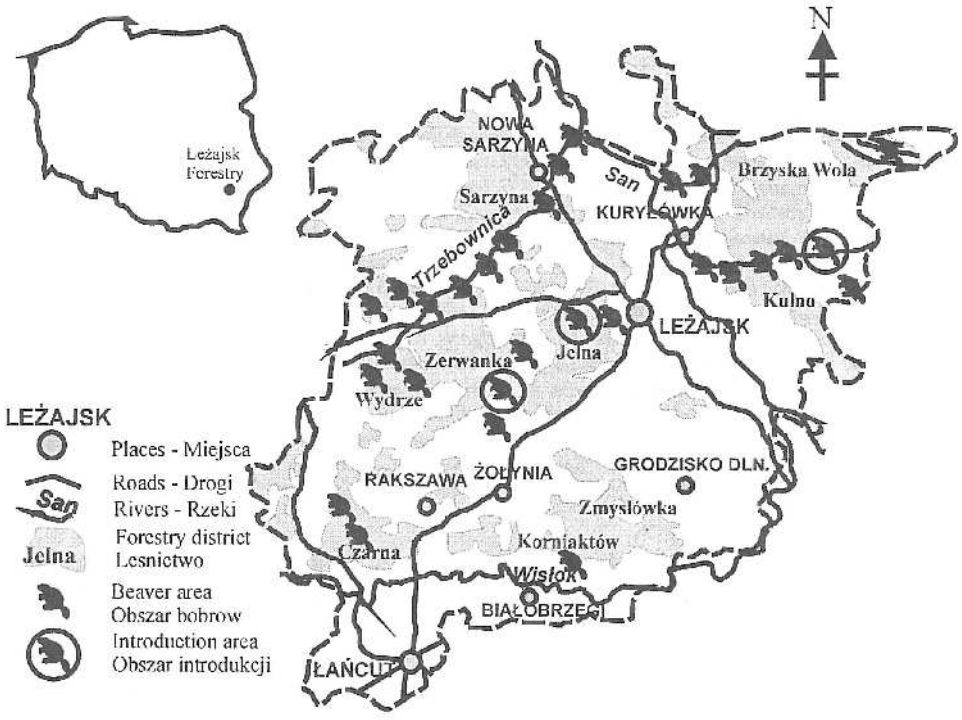


Fig. 1. Places of introduction and the positions of beavers in the Lezajsk Forest Inspectorate

Rys. 1. Miejsca introdukcji oraz stanowiska bobrów na terenie Nadleśnictwa Leżajsk

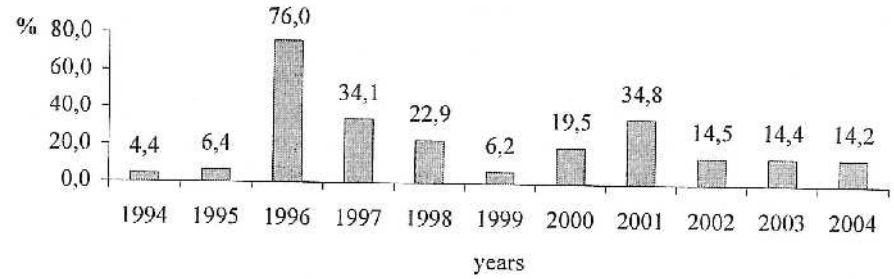


Fig. 2. An increase of the population of beavers in the Leżajsk Forest Inspectorate in the years 1993-2004

Rys. 2. Przyrost liczebności bobrów w Nadleśnictwie Leżajsk w latach 1993-2004

Flora in beavers' habitats

Due to the character and role of flora, the habitats occupied by beavers are divided into two categories:

- hydro-marshy or flooded areas due to beavers' activities (a);
- forest areas as a place for finding tree food and resources for constructions of dikes (b) – in the direct neighbourhood of the areas (a) .

The first group included surfaces of mezophylic humid meadows *Calthion palustris* (Za1) and rushes *Magnocaricion* (Za2) in Zerwanka and surfaces close to alder woods *Alno-Ulmion,* ash-tree and alder marshy meadow *Fraxino-Alnetum* (Zb2, Tab. 2).

There was big diversity between two positions in the species structure of plants chewed by beavers. In the Zerwanka Inspectorate numerous bites on birches, hornbeams, pines and spruces were observed. Moreover, next to the surfaces on which phytosociological rebords were made, there were occasional traces on beech, willows and red oak. In the Jelna Inspectorate, birches, hombeams as well as black alders, ash-trees, pin oaks and hazel were also chewed (Tab. 3).

## DISCUSSION

The effects of beavers' introduction are positive. The population increased up to 371 individuals in the year 2004 out of 20 individuals set at liberty in the years 1991 and 1992. Beavers quite easily adapted to the conditions. What is more, they changed the environment accommodating it to their needs. Meadows mowed by farmers have changed into rushes and humid meadows due to numerous dikes, sometimes a hundred meters long. In forest habitats the dikes were built on water-courses, which resulted in drying out of older trees and changing into marshy meadows. Generally, beavers' activities led to fertilization of habitats. In these fertile habitats, beavers chewed deciduous trees but in the areas close to poorer meadows also coniferous ones. Adaptation of the environment let beavers increase in number very fast in the previous years and caused territorial expansion. Recently, beavers have inhabited almost all the water-courses and wet areas of the territory. It seems that the further increase of the population will be hindered due to the limitation of the environment and the lack of the migration possi-

bilities within an inspectorate. There has been a noticeable decrease and stabilization of the growth of the species during the last few years. Moreover, there is a constant conflict between the beaver and human activities. It is estimated that within the territory of the inspectorate beavers have cut down or drowned trees on the area of 6-8 hectares. Conflicts with local people have been occasional, despite many cases of a house or meadow flooding as far as cutting down fruit trees and eating up beetroots. On post-arable fields oaks and ash-trees have been cut down. On this area, digging burrows in the dikes of fishing ponds and digging communication roads and railway embankments may cause serious problems.

## CONCLUSIONS

A high increase of the population as far as the migrations and inhabiting the whole territory of the inspectorate proves that the introduction of beavers has doubled. Stabilization in the increase of the population of beavers shows the exhaustion of the environmental limits.

The composition of the food taken depends on habitat conditions and flora. In spite of a similar species composition of tree plants (about 65%), on each positions only two species were chewed. In the poorer habitat (Zerwanka), the species estimated as less attractive for beavers (pines, spruces) were chewed as well. But in the more fertile habitat (Jelna), coniferous trees were not chewed.

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## DYNAMIKA LICZEBNOŚCI BOBRÓW I ROŚLINNOŚĆ PRZEZ NIE ZGRYZANA W NADLEŚNICTWIE LEŻAJSK

**Streszczenie.** Badaniami objęto tereny Nadleśnictwa Leżajsk, gdzie w latach 1991-1992 wsiedlono odpowiednio 11 i 9 bobrów (w 3 stanowiskach) pochodzących z Wiżajn. Określono dynamikę liczebności populacji w latach 1993-2004 oraz szatę roślinną na zajmowanych przez bobry stanowiskach.

W badanym okresie nastąpił wzrost liczebności do 371 osobników w 2004 r. i rozprzestrzenienie występowania gatunku do obszaru 9 leśnictw, a w okresie 2001-2004 r. nastąpiło ustabilizowanie przyrostu na poziomie 14%. Bobry zajmują głównie siedliska zbliżone do łęgu jesionowo-olszowego, natomiast dodatkowo zdobywają pokarm drzewiasty i budulec w borach mieszanych świeżych. Zgryzane gatunki drzewiaste to: olsza, brzoza, dąb, grab, buk, świerk, sosna.

**Słowa kluczowe**: bóbr, *Castor fiber*, introdukcja, dynamika populacji, siedlisko