

Activity of European beavers (*Castor fiber* L.) in young pedunculate oak (*Quercus robur* L.) forests

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ABSTRACT

Beavers were reintroduced to Croatia (Posavina region) in the period from 1996 to 1998. Research into their influence on the specific conditions of lowland forests was carried out in March 2003, using young pedunculate oak forests (*Quercus robur* L.). The number of damaged trees and bushes was analysed, as well as the presence of certain plant species in the field. We further measured the distance of the damaged sites from the ground and tree diameter immediately below the damaged sites. The percentage of damaged trees and bushes was evaluated on the basis of a sample of 1648 plants from seven transects. Seventy-five percent of plants were undamaged. The most frequently damaged species was *Corylus avellana*. Two-hundred plants were used to measure the height of damage and the tree diameter just below the damaged site. Most plants were damaged at a height between 30 and 40 cm above ground, and the diameter at the site of the damage ranged from two to four cm.

Key words: beaver, *Castor fiber*, lowland forests, damage

Introduction

In recent history, the European beaver (*Castor fiber* L.) inhabited almost all European countries (FREYE, 1978; LAVROV, 1983; KITCHENER and CONROY, 1997; HALLEY and ROSELL, 2002, 2003). Following a series of negative impacts, beavers were almost

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eradicated from most of their natural habitats. Thanks to various protective measures, especially reintroduction into their original habitats, the negative population trend was stopped and survival of the species became possible (RICHARD, 1965; BURRI, 1973; LAVSUD, 1983; ZUROWSKI and KASPERCZYK, 1988; HARTMAN, 1994; HARTMAN, 1995; MACDONALD et al., 1995; NOLET and ROSELL, 1998; ELMEROS et al., 2003; SLUITER, 2003). Croatia joined the beaver protection projects by reintroducing beavers to carefully selected areas. From April 1996 to February 1998 a total of 85 individuals from Germany (Bavaria) were released at three separate localities in Croatia (GRUBEŠIĆ and KRAPINEC, 1998). Prior to reintroduction, it was established that 17 of 29 species of woody plants usually eaten by beavers existed, in their possible Croatian habitats (NUMMI, 1989; SCHWAB et al., 1992; GRUBEŠIĆ, 1993, 1995).

Beavers are largely dependent on their dwelling places and the year-round availability of a sufficient quantity of food close to these places (GRUBEŠIĆ, 1995). During the vegetation period, beavers mostly feed upon herbaceous plants, while during the winter-time they eat live bark of most soft deciduous trees that grow near the water areas where they reside (JENKINS, 1979; NOLET et al. 1994; GANZHORN and HARTHUN, 2000; DZIECIOŁOWSKI and MISIUKIEWICZ, 2002). Beavers fell trees of various dimensions (JENKINS, 1975; BUSHER, 2003), bite off parts of runners and branches and take them to their underwater food storage. Food stored in this way can be used during cold days, when the animals are unable to leave the water due to the ice coverage (JENKINS, 1980; GRUBEŠIĆ, 1994).

The aim of this paper was to analyze, for the first time, the distribution of tree damage caused by beavers in lowland forests of the Republic of Croatia.

Materials and methods

The research was carried out in March 2003 in the department/section 48a of the Forest Management unit "Žutica" (Croatian Forests), located 40 km from Zagreb, between 16°21' and 16°31' E and 45°34' and 45°41' N. Elevation is between 93 and 99 m above sea level (BARIČEVIĆ, 1999). Of the total surface of 6116 ha, 5107 ha are covered by forests, 75% of which are pedunculate oak communities (*Quercus robur* L.). The department/section 48a is covered by young pedunculate oak forest. GRUBEŠIĆ and KRAPINEC (1998) estimated the number of beavers in this area at 47.

In the field part of the research, we analyzed the number of damaged trees and bushes, as well as the presence of woody plant species. For that purpose, seven parallel transects were performed at a distance of 50 m, oriented perpendicular to the course of the River Lonjica, which is inhabited by beavers. All transects were two meters wide and 40 meters

long (ROSELL and NOLET, 1997; ROSELL et al., 1998). All woody plants were listed on each transect linear meter and, according to the damage caused by beavers, assigned to one of the following five categories: 1) undamaged, 2) freshly damaged but not pulled down, 3) freshly pulled down, 4) old damaged but not pulled down, and 5) old pulled down. In 200 trees, the height at which they were damaged as well as the diameter just below the place of damage were measured. At the same time we determined the area of beaver activity. Intensity of beaver activity was analysed along the transect of 250 m length, 15 m from the river bank and parallel with the water course inhabited by beavers. A stand was placed every five meters (total of 49) of the surface area of 10 m² where the beaver activity was estimated according to five categories: 1) no activities, 2) very low level, 3) medium activity, 4) intense activity and 5) very intense activity. The criterion for these categories was intense damage by plant from beavers.

Results

The presence of certain tree and bush species and the percentage of damaged plants were determined on the basis of a sample of 1648 plants. The number of analyzed plants in transects ranged from 110 to 399. The following tree and bush species were found: *Corylus avellana* L., *Cornus sanguinea* L., *Fraxinus angustifolia* Vahl., *Ulmus campestris* L., *Alnus glutinosa* L. Gaerth., *Carpinus betulus* L., *Rhamnus catharticus* L., *Crataegus nigra* Waldst. et Kit., *Euonymus europaeus* L., *Quercus robur* L. and *Pyrus pyraster* Burgsd. The most abundant species were *C. avellana* (44%) and *Cornus sanguinea* (30%). The majority of plants (77%) were recorded at a distance of 25 meters from the river bank (Fig. 1).

Of the total number of checked plants, 75% were undamaged, 1% were newly damaged but not pulled down, 8% were newly pulled down, 1% was old damaged but not pulled down and 15% were old pulled down (Fig. 2).

The plant species damaged by beavers were: *C. avellana*, *C. sanguinea*, *F. angustifolia*, *U. campestris*, *A. glutinosa* and *C. betulus*. The most frequently damaged species was *C. avellana*. The average height of the damage was 36 cm, and the average plant diameter below the site of the damage was 3 cm. The results of our research showed that 64% of damaged specimens exhibited ‘‘a below-damage diameter’’ of two to four centimetres (Fig. 3).

On 49 sites, 6.1% of the beaver activity was graded category 1, 36.7% category 2, 28.6% category 3, 22.4% category 4 (intense), and 6.1% category 5 (very intense) (Fig. 4).

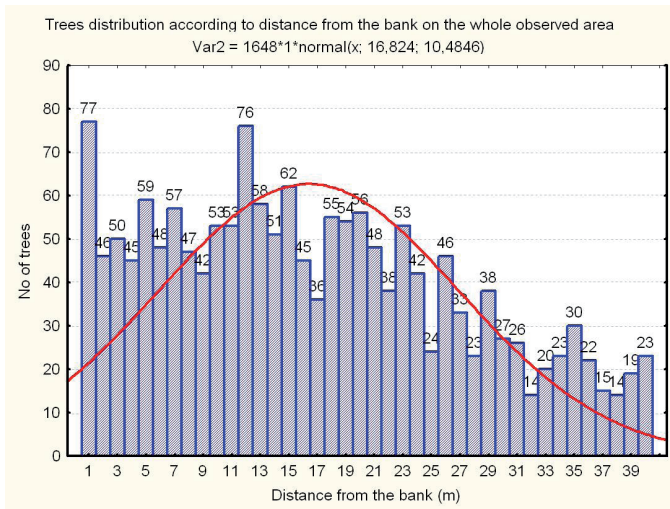


Fig. 1 The distribution of the spatial presence of the woody plants

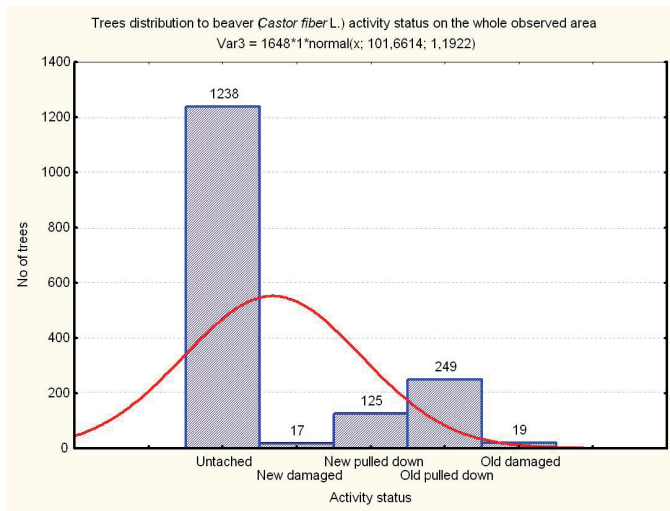


Fig. 2. The number of checked plants according to categories of damages

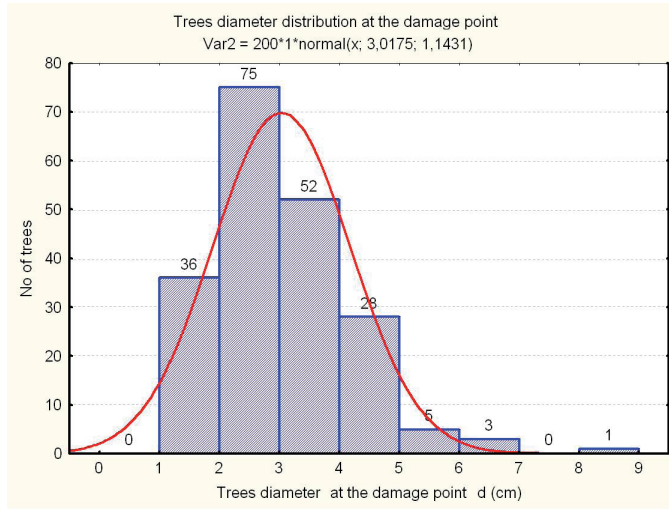


Fig. 3. The distribution of the damaged plant diameter

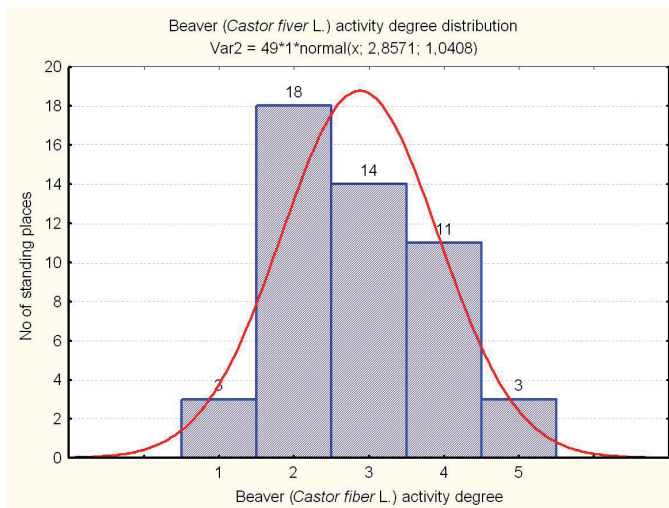


Fig. 4. The distribution of number of stands according to the activity category

Discussion

Twenty-five percent of the total number of 1648 examined plants exhibited traces of beaver activity. The most frequently damaged was *C. avellana*. These results differ from the results of other authors who reported that the major source of beaver food during winter-time is bark from the genus *Salix* and *Populus* (JACOBS, 1974; JENKINS, 1975; SLOUGH, 1978; OSMUNDSON and BUSKIRK, 1993; GRUBEŠIĆ, 1995). The distribution of plant species analysed according to transect lengths clearly indicates the fact that the density of examined materials depends on the distance from the River Lonjica, inhabited by beavers. It has previously been proven that beaver on-land activity is concentrated in a zone 15 m from the bank, while the furthest distance and therefore the maximum extension of the activity area is 40 m from the water (GRUBEŠIĆ, 1995). Our results suggest that the longest linear distance travelled by beavers as part of their regular activity was 47 m from the bank (according to the damage and movement traces). Most of the trees previously pulled down were recorded at a distance of up to 20 m from the River Lonjica. Newly felled trees were mostly noticed at a distance of more than 20 m, suggesting that during the winter 2002/03 beavers were feeding further from the bank. The number of old felled trees was much higher than the number of newly felled, since the first group included all plants in which the damage was at least one year old and beaver activities have been recorded in this micro-locality for five years. The height distribution of damage depends largely on the body size of individuals (and therefore also on the population structure) whose activities were recorded in the area. The maximum measured height of damage was 90 cm. Beaver activity was most intense at a distance of 30 to 40 m from the site. The two largest oak trees damaged by beavers had a circumference of 187 cm and 162 cm, respectively. The highest damage was located 85 cm above the ground. However, the most intensive damage was recorded at heights of 15 to 60 cm from the ground.

The results of distribution of different plant species indicate that the analysed area contains enough food sources for beavers. This statement is further confirmed by the presence of plant species preferred by beavers. The bark of *Corylus avellana* and *Cornus sanguinea* constitutes the bulk of the beaver's nutrition. Given that *C. avellana* is abundant in the bush layer of pedunculate oak forests (BARIČEVIĆ, 1999); beavers indirectly stimulate the natural renovation of the pedunculates by removing the species that are competitive to young pedunculate plants.

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SAŽETAK

U posavski dio Hrvatske dabrovi su uneseni u razdoblju od 1996. do 1998. godine. Istraživanja njihove aktivnosti u specifičnim stanišnim uvjetima obavljena su u ožujku 2003. godine u mladoj šumi hrasta lužnjaka (*Quercus robur* L.), a sastojala su se od analize broja oštećenog drveća i grmlja, zastupljenosti pojedinih biljnih vrsta na terenu, te mjerenja visine oštećenja i promjera ispod mjesta oštećenja. Postotak oštećenoga drveća i grmlja utvrđen je na uzorku od 1648 biljaka analiziranih na sedam transekata. Ukupno 75% biljaka bilo je

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neoštećeno. Lijeska (*Corylus avellana* L.) bila je najčešće oštećena vrsta. Mjerenje visine oštećenja i promjera ispod mjesta oštećenja obavljeno je na uzorku od 200 biljaka. Najviše je biljaka oštećeno na visini između 30 i 40 cm, a promjer na mjestu oštećenja iznosio je od dva do četiri cm.

Ključne riječi: dabar, *Castor fiber*, nizinske šume, oštećenja
