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Department of Animal Ethology and Wildlife Management,
Faculty of Animal Sciences and Bioeconomy, University of Life Sciences in Lublin,
Akademicka 13, 20-950 Lublin, Poland
* e-mail: katarzyna.tajchman@up.lublin.pl

MONIKA MAŃKOWSKA, KATARZYNA DZIKI-MICHALSKA, KATARZYNA TAJCHMAN*

The impact of the European beaver on the environment of selected water reservoirs in the Ciechanów Forest District – a case study

Abstract. The European beaver (*Castor fiber*) has long been considered an ecosystem engineer, exerting a profound influence on the habitats it occupies. Its activities significantly shape water conditions, terrain, and biodiversity. Research conducted in the Ciechanów Forest District aimed to assess the impact of beavers on the local environment. Observations took place from August 2024 to March 2025 and involved documenting beaver activities such as browsing trees, creating burrows, and building lodges. It was found that the tree species most frequently selected by beavers in the study area was gray alder (*Alnus incana*). Beavers most frequently browsed trees with a diameter of 1–20 cm and a hardness of 2.1 on the Brinell scale. Their most intense impact occurred at the end of the growing season, from August to November. The most preferred species were young trees with soft wood, which may indicate that less effort and energy are required to cut them down, or that they are more palatable, juicy, and tender than older plants.

Keywords: *Castor fiber*, environmental impact, food preferences

INTRODUCTION

The European beaver (*Castor fiber*) is currently a common species in Poland, with an estimated population of over 149,900 individuals [GUS 2024]. Its population has fluctuated significantly over recent centuries, a result of hunting, changes in conservation status,

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and habitat availability [Rakowska and Stachurska-Swakoń 2021]. This species exerts a significant influence on the environment. Beavers' ability to transform their environment has led to their classification as ecosystem engineers [Jones et al. 1994]. While European beavers are viewed positively by some, they may be considered pests in areas of high population density or where their activities negatively affect human interests. Negative perception of this species stems from the damage they cause to agricultural crops, flood embankments, and orchard trees and shrubs, as well as from the flooding of forest areas and the potential transmission of parasites and diseases to livestock [Giżejewski and Goździewski 2016].

Despite their impact on human activity, beavers play a significant role in restoring the natural balance of forest ecosystems. By constructing dams, they retain water during summer droughts while also contributing to its purification. Above all, their environmental influence enhances the attractiveness of landscapes not only for their aesthetic quality but also for their educational and recreational value. In areas transformed by these rodents, numerous species of waterfowl, fish, amphibians, and invertebrates can be observed, and the areas surrounding floodplains become havens for various species of birds of prey and mammals [Konopka and Erenc 2002, Janiszewski and Misiukiewicz 2012, Janiszewski and Hanzal 2015].

Beavers feed primarily at night, but can occasionally be observed active during the day, especially at noon [Czech 2001]. As semi-aquatic animals, they inhabit areas close to water bodies [Tranda and Jaroniewski 1999]. Their foraging is usually limited to a 20-meter zone along the shoreline, which strongly influences the diversity of food they consume [Czech 2007].

Areas where beavers create floodplains can extend over several dozen hectares. They act as a natural sponge, storing water in spring and gradually releasing it in summer. By building dams, beavers increase the water retention capacity of the catchment area. Its level depends on the shape of the catchment area, the density of beaver habitats, and soil conditions. Beaver reservoirs can also mitigate peak flood waves. In their vicinity, groundwater levels stabilize and rise, erosion is reduced, and the deposition of mineral and organic particles increases significantly. As a result, natural marsh-forming processes are initiated. Following heavy rainfall or spring snowmelt, floodwaters spread over a larger area, thereby losing their force [Naiman 1988].

Due to beavers' high adaptability, they can occupy areas modified or degraded by humans, which is frequently a source of conflict. In some countries – including Lithuania, Sweden, and Finland – beaver populations have recovered to such an extent that hunting has been reinstated. In other countries, the species remains endangered and strictly protected, for example, in France, Hungary, Slovakia, and Germany [Czech 2000].

Beavers are herbivores that feed on a wide range of aquatic and riparian plant species. Their diet includes 100 species of woody plants and over 200 species of herbaceous plants. The composition of a beaver's diet depends on food availability and habitat conditions, and changes depending on the season [Dzięciołowski and Goździewski 1996]. The species' population growth and expanding range prompt an analysis of the animal's impact on its environment and the surrounding area. Therefore, this study aimed to assess the impact of the European beaver (*Castor fiber*) on the environment of reservoirs located within the Ciechanów Forest District.

MATERIAL AND METHODS

Observations were carried out in the vicinity of water reservoirs located within the Ciechanów Forest District: the Dziady reservoir, the Krubin water complex, and a reservoir located in the village of Nużewko. The Ciechanów Forest District lies in the northern part of the Mazovian Voivodeship and covers a total area of 11,300.37 ha, of which 11,116.93 ha is forested. The study areas are located within the Bardonki and Gołoty Forest. The predominant forest habitat types in this region are fresh mixed coniferous forest and fresh mixed deciduous forest. The pine is the dominant species, accounting for over 70% of the tree stand composition [https://ciechanow.olsztyn.lasy.gov.pl/]. In terms of area, the most abundant species in the Ciechanów Forest District are Scots pine (7789.23 ha), oak (1166.53 ha), alder (1154.10 ha), birch (739.06 ha), and others (171.77 ha) [Plan urządzania lasu Nadleśnictwo Ciechanów 2024].

Observations were conducted once per month from August 2024 to March 2025, along with a damage inventory. Tree species were identified, and the trunk diameter of all trees at felling height was measured to the nearest 1 cm using a caliper. Additionally, photographic documentation of animal habitats and environmental changes was collected.

The hardness of browsed trees was determined using the Brinell scale [PN-EN ISO 6506-1: 2008, PN-EN ISO 6506-1: 2002].

Statistical analysis of the results was performed using the Statistica 13.1 statistical package. The analysis included the frequency of felled tree species, the distribution of felled trees by diameter at the measurement point, wood hardness, and the month of observations across the three study sites. To determine the correlation between the analyzed number of trees and wood hardness, as well as between tree diameter and wood hardness, Pearson correlation coefficients were calculated, and linear regression equations were presented.

RESULTS

It was shown that the most frequently selected tree species by beavers was grey alder (*Alnus incana*), with selection rates of 50%, 28% and 18% in the vicinity of the water reservoir in the village of Nużewko, the Dziady reservoir and the Krubin water complex, respectively. Less frequently beavers selected aspen (*Populus tremula* L.) and sycamore maple (*Acer pseudoplatanus* L.) near the Nużewko reservoir, at 27% and 18%, respectively (Fig. 1).

Beavers showed the highest preference forbrowsing trees with a diameter of 1–20 cm, notably, 63% of trees felled near the Nużewko water reservoir had a diameter of less than 10 cm (Fig. 2).

The observed rodents most often chose tree species with hardness of 2.1, especially in the Dziady reservoir and in the village of Nużewko (56%), and 1.3 and 1.5, 14% each (Fig. 3).

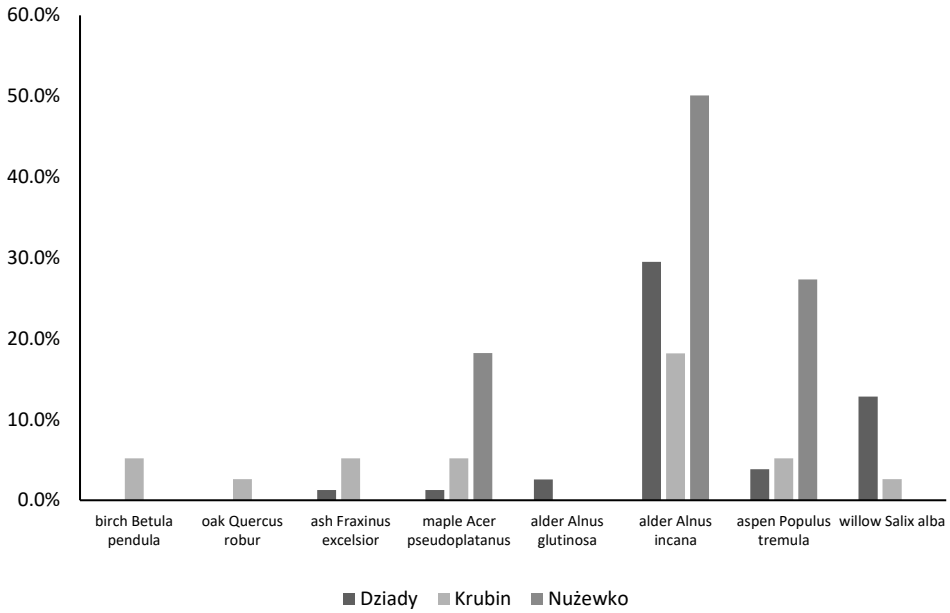

Fig. 1. Percentage of tree species cut down in the vicinity of water reservoirs: Dziady, Krubin and in the village of Nużewko

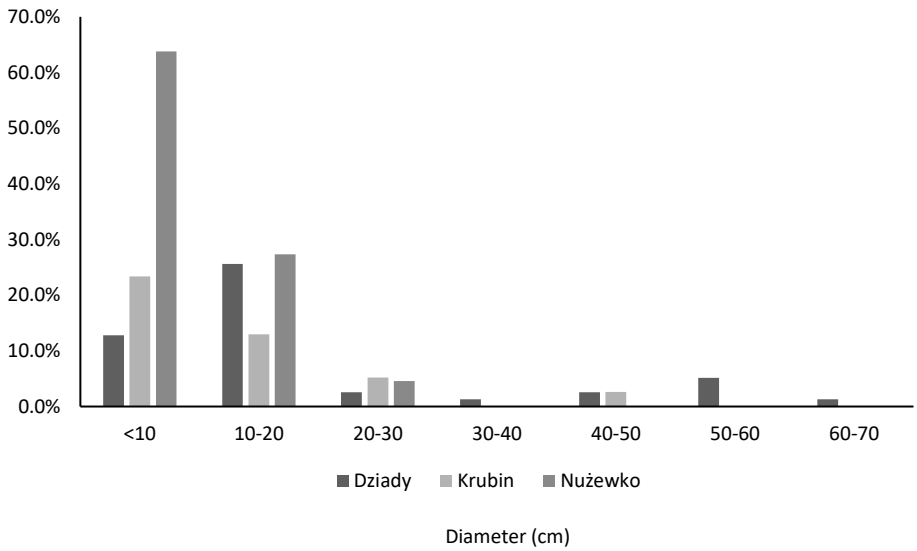

Fig. 2. Percentage distribution of felled trees depending on diameter at the site of logging in the area of water reservoirs: Dziady, Krubin and in the area of the village of Nużewko

The period of most intensive tree browsing by the observed animals was from August to November (17–20%). Beaver activity decreased in December and January (5%) – as in Figure 4.

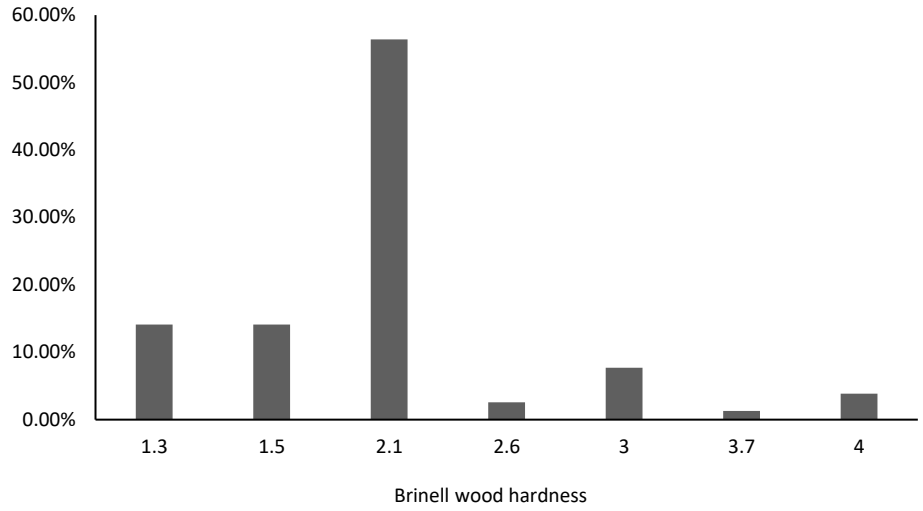

Fig. 3. Percentage distribution of felled trees depending on hardness in the studied water bodies

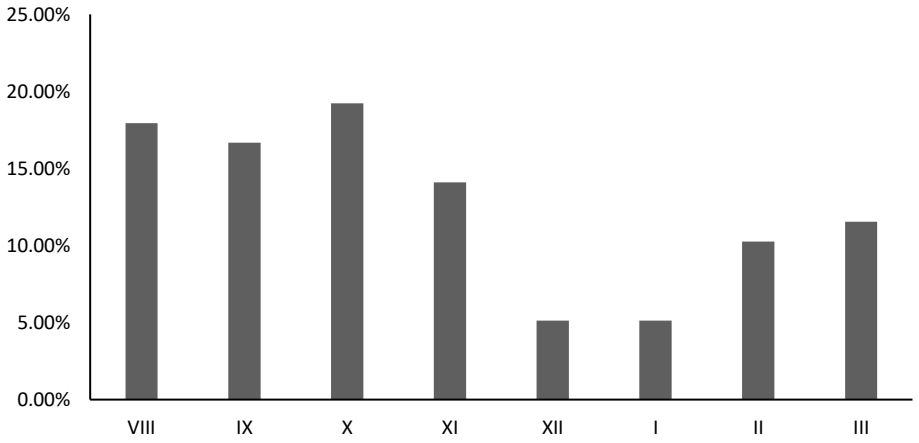

Fig. 4. Percentage distribution of cut trees depending on the month of observations

The correlation between the number of damaged trees and wood hardness was analyzed and found to be inversely proportional to the wood hardness of the analyzed tree

species. The calculated correlation between the number of browsed trees and wood hardness was negative and statistically insignificant (Pr = 0.33) – as in Figure 5. In general, the number of damaged trees decreased with increasing wood hardness.

The correlation between the diameter and hardness of the wood of the browsed trees was positive and also insignificant (Pr = 0.43) – as in Figure 6.

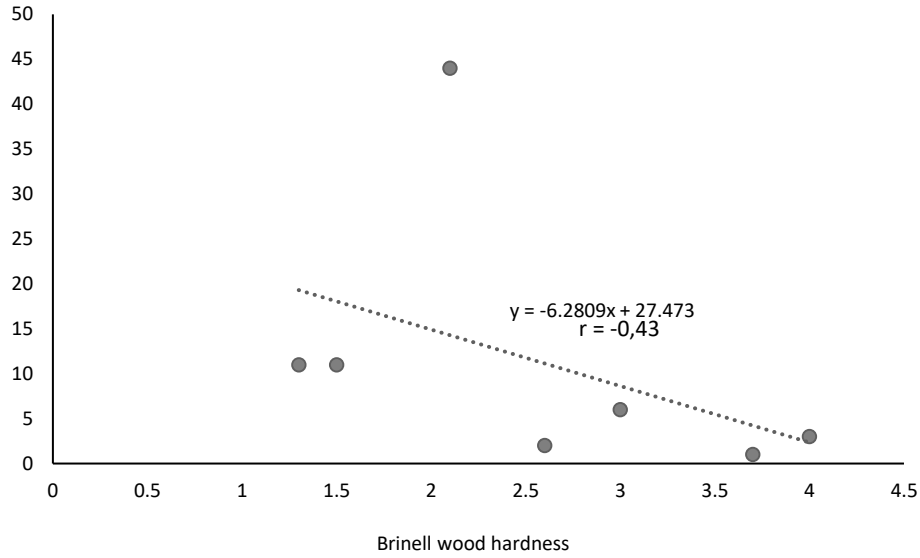

Fig. 5. The correlation between the number of felled trees and the hardness of wood of the analyzed species

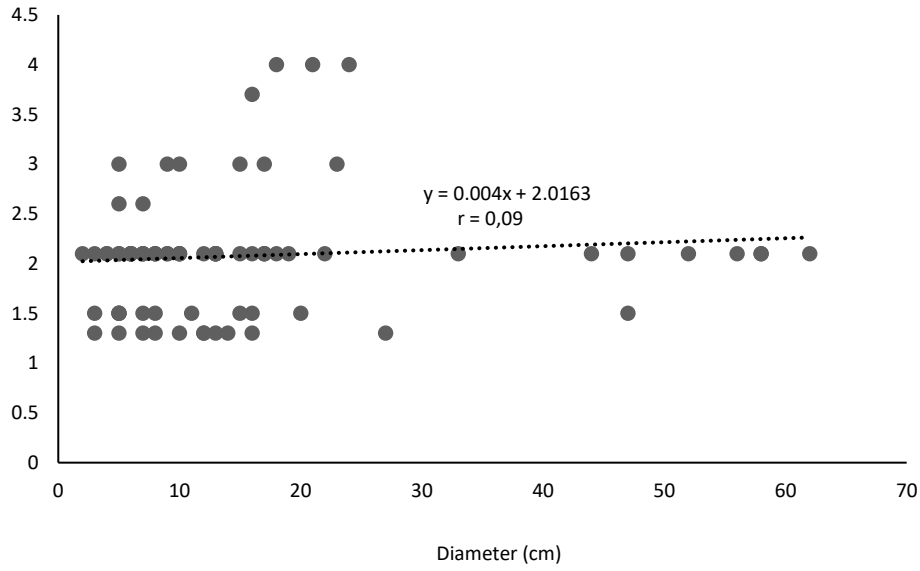

Fig. 6. Correlation between diameter and hardness of wood of browsed trees

DISCUSSION

Beavers feed on marsh and aquatic vegetation, buds, fresh twigs, and leaves from spring to autumn. From late autumn to early spring, their diet consists primarily of bark and twigs of trees and shrubs [Dzięciołowski 1996]. They most frequently choose species of trees from the genera *Salix* sp., *Populus* sp., *Betula* sp., and other deciduous trees [Czech 2007, Tajchman et al. 2018].

As the current observations show, the selection of plant species that constitute potential food or building material for beavers depended primarily on the abundance of vegetation growing in their habitat, which is also confirmed by previous studies [Tajchman et al. 2018]. They most often chose pioneer, fast-growing tree species, i.e., gray alder and first-age aspen, and less frequently, sycamore maple or white willow. This is confirmed by studies conducted in the Czech Republic, where a strong preference for poplar was also demonstrated [Brenner 1962, Belovski 1984, Derwich 2001, Fustec et al. 2001, John 2001, Ficek 2003]. Beavers digest aspen more efficiently than other tree species, and their daily consumption of other plants was inversely proportional to their digestibility. A strong preference for alder or poplar may slow the succession of these species in wet floodplains. However, because beavers eagerly feed on these species, they contribute to the transformation of tree stands and promote the development of other vegetation species, thereby creating favorable living conditions for the aquatic fauna [Valachovič and Gímeš 2003, Janiszewski et al. 2017].

Some researchers argue that the interest in willow is due to its low resin and essential oil content, which beavers tend to avoid [Nolet et al. 1994, Dzięciołowski 2004]. The number of tree species in the diet increases at the end of the growing season, when beavers store up for winter, a pattern also confirmed by our results. During this period, beavers typically browse species of the genera *Populus* spp. and *Salix* spp. [Danilov and Kanshiev 1983, Nolet et al. 1994, Kostkan 2000, Ficek 2003]. However, when their numbers are limited, beavers may feed on *Betula* spp., *Acer* spp., as well as *Tillia cordata*, *Corylus avellana*, and *Quercus robur* [Doucet and Ball 1994, Doucet et al. 1996]. Similar patterns were recorded in Polesie National Park, where a notable consumption of alder buckthorn (26%) and common oak (17%) was described [Janiszewski et al. 2017]. In addition, studies conducted in three reservoirs in the Ciechanów Forest District showed that sycamore maple and common ash may also be components of beaver diets. As reported by Nolet et al. [1994], beavers may select plant species to supplement specific nutrients that are deficient in their preferred species.

This study showed that beavers select tree species with a trunk diameter ranging from 1 to 20 cm, consistent with findings from the Czech Republic, where 78% of trees had diameters below 20 cm (78%). The diameter of the most frequently damaged tree species was in the range of 2.6–6 cm and 6.1–12 cm, and the third most frequently selected group were trees with a diameter below 2.5 cm [Dvořák 2013]. Observations in the Ciechanów Forest District confirm this tendency: beavers were most interested in young trees with a diameter of up to 10 cm (63%).Similar results were reported by Janiszewski et al. [2017], who showed a preference for trees with a diameter of up to 15 cm, with an average percentage share of such trees at the level of 88%.

In studies conducted within the Ciechanów Forest District, a negative but statistically insignificant correlation ($r = –0.43$) was found between the number of browsed trees and wood hardness, consistent with results obtained in the Lubaczów and Chotyłów Forest

Districts [Tajchman et al. 2018]. Similar results were reported by Czyżowski et al. [2009] in studies conducted in the Lublin and Nadwieprzański Landscape Parks ($r = –0.321$). Overall, the number of damaged trees decreased with increasing wood hardness.

Beavers most often inhabit areas around lakes and rivers, gravel and peat pits, marshes, mountain streams, and small brooks. Key factors influencing their habitat selection include the depth of the water body and the availability and quantity of woody food resources [Gałek and Woch 2011]. Beavers avoid areas with strong currents due to the risk of burrow erosion and the potential drowning of their young [Czech 2000]. They are highly territorial and family-oriented animals that can occupy a given area for several generations [Wąs and Gorczyca 2022].

It is worth noting that in the Krubin water complex, where the municipal swimming pool is located, beavers did not build lodges but inhabited burrows dug in the shores. This is a natural phenomenon, as in bodies of water where water levels do not fluctuate significantly, beavers usually dig residential burrows [Dzięciołowski 2004]. On the other hand, in flowing waters, they build tree dams, which cause the water to accumulate above the structure and create better living conditions for the species. By doing so, they contribute to increasing the water depth and reducing its flow, and as a result, they gain better access to vegetation, i.e., building material and food [Wąs and Gorczyca 2022]. Again, on elevated areas surrounded by water, they build dome-shaped lodges, which serve both as a protective and breeding function. The lodges are constructed of tree branches and soft vegetation, covered with mud and clay. These structures can reach up to 3 meters in height [Panfil 1984].

Observations conducted in the Ciechanów Forest District also showed that beavers primarily inhabited small reservoirs located in close proximity to farmland and buildings. Their impact on the environment was significant, as they improved water retention, created floodplains, and raised groundwater levels. Despite these benefits, many people in the study area viewed them as pests, since they flood farmland, fell trees, and undermine banks. In the Krubin reservoir and Dziady reservoir, at the request of residents, the municipality protects trees by wrapping them in netting, enhancing safety and minimizing potential infrastructure damage.

Due to the observed increase in the number of species studied, this type of analysis may have an applied nature, e.g. in planning the planting of suitable tree species near streams and water reservoirs.

REFERENCES

Belovski G.E., 1984. Summer diet optimalization by beaver. Am. Midl. Nat. 111(2), 209–223.

Brenner F.J., 1962. Foods consumed by beavers in Crowford country, Pennsylvania. J. Wildl. Manage. 26 (1), 104–107.

Czech A., 2000. Bóbr – gryzący problem? Sposoby rozwiązywania konfliktów pomiędzy ludźmi, a bobrami. Towarzystwo na rzecz Ziemi, Kroków–Oświęcim.

Czech A., 2001. Bóbr. Monografie przyrodnicze. Lubuski Klub Przyrodników, Świebodzin.

Czech A., 2007. Krajowy plan ochrony gatunku: bóbr europejski (*Castor fiber*). Opracowanie planów renaturalizacji siedlisk przyrodniczych i siedlisk gatunków na obszarach Natura 2000 oraz planów zarządzania dla wybranych gatunków objętych Dyrektywą Ptasią i Dyrektywą Siedliskową. Kraków.

Czech A., Starzecka A., Bednarz T., 2000. Influence of beaver dams on metabolic activity of water microorganisms. The European beaver in a New Millennium. Proceedings of the 2nd European Beaver Symposium, Białowieża, Polska, 144–146.

Czyżowski P., Karpiński M., Drozd L., 2009. Forage preferences of the European Beaver (*Castor fiber* L.) on urban and protected areas. Sylwan 153(6), 425–432.

Danilov P.I., Kanshiev V.Y., 1983. The state of populations and ecological characteristics of European (*Castor fiber* L.) and Canadian (*Castor canadensis* Kuhl.) beavers in the Nortwestern USSR. Acta Zool. Fennica 174(18), 95–97.

Derwich A., 2001. European beaver (*Castor fiber* L.) in the Internationl Biosphere Reserve „Eastern Carpatian Mts". Folia Venat. 30–31, 255–266.

Doucet C.M., Ball J.P., 1994. Analysis of digestion data. Apparent and true digestibilites of foods eaten by beavers. Am. Midl. Nat. 132, 239–247.

Doucet C.M., Walton R.A., Fryxell J.M., 1996. Perceptual cues used by beavers foraging on woody plants. Behaviour 47, 1482–1484.

Dvořák J., 2013. Diet preference of Euroasian beaver (*Casor fiber* L., 1758) in the environmental of Oderské Vrchy and its influence on the tree species composition of river bank stands. Acta Univ. Agric. Silvic. Mendel. Brun. 6, 1637–1643.

Dzięciołowski R., 2004. *Castor fiber*, Bóbr europejski – ssaki, gryzonie, bobrowate. W: Z. Witkowski (red.), Gatunki zwierząt (z wyjątkiem ptaków). Poradnik ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Tom 6. Ministerstwo Środowiska, Warszawa, 457–462.

Dzięciołowski R., 1996. Bóbr. Wydawnictwo Łowiec Polski, Wydawnictwo SGGW, Warszawa.

Ficek A., 2003. Životní prostředí, potravní a stavební činnost bobra evropského (*Castor fiber* L. 1758) na území České republiky. Folia Venat. 33, 7–105.

Fustec J., Lode T., le Jacques D. et al., 2001. Colonization, riparian habitat selection and home range size in a reintroduced population of European beavers in the Loire. Freswater Biol. 46, 1361–1371.

Gałek D., Woch F., 2011. Analiza zmian populacji bobra europejskiego (*Castor fiber*) na terenie Świętokrzyskiego Parku Narodowego. Rocz. Świętokrzyski 32, 9–26.

Giżejewski Z., Goździewski J., 2016. Zarządzanie populacją bobra europejskiego *Castor fiber*. W: Zarządzanie populacjami zwierząt. Łowiec Polski, Polski Związek Łowiecki, Warszawa, 61–69.

GUS, 2024. Rocznik Statystyczny Leśnictwa. Główny Urząd Statystyczny. Available: https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-lesnictwa-2024,13,7.html [date of access: 2.10.2025]

Janiszewski P., Gugołek A., Lobanowska A., 2006. Use of shoreline vegetation by the European beaver (*Castor fiber* L.). Acta Sci. Pol. Silv. Colendar. Rat. Ind. Lignar. 5(2,) 63–70.

Janiszewski P., Misiukiewicz W., 2012. Bóbr europejski *Castor fiber*. BTL Works, Warszawa.

Janiszewski P., Hanzal V., 2015. Bóbr europejski *Castor fiber* – biologia i ekologia gatunku. Wydawnictwo UWM w Olsztynie.

Janiszewski P., Kolasa S., Strychalski J., 2017. The preferences of the European beaver *Castor fiber* for trees and shrubs in riparian zones. Appl. Ecol. Env. Res. 15(4), 313–327.

John F., 2001. Využití a ovlivnění dřevinné skladby bobrem evropským (*Castor fiber*). Diplomová práce. UP Olomouc, PřF UP.

Jones C.G., Lawton J.H., Shachak M., 1994. Organisms as ecosystem engineers. Oikos 69, 373–386.

Konopka J., Erenc I., 2002. Bóbr a środowisko. Poznaj. Las 1, 24–25.

Kostkan V., 2000. Ekologická nika bobra evropského (*Castor fiber* L. 1758) v CHKO Litoveské Pomoraví. Disertační práce. UP Olomouc.

https://ciechanow.olsztyn.lasy.gov.pl/ [date of access: 25.03.2024]

Naiman R.J., Johanston C.A., Kelley J.C., 1988. Alteration of North American Streams by Beaver. BioScience 38(11), 755–762.

Nolet B.A., Hoekstra A., Ottenheim M.M., 1994. Selective foraging on wood species by the be aver *Castor fiber*, and its impact on a riparian forest. Biol. Conserv. 70, 117–128.

Panfil J., 1984. Ssaki Pojezierza Mazurskiego. Wydawnictwo Pojezierze, Olsztyn.

Plan urządzania lasu Nadleśnictwo Ciechanów sporządzony na okres od 1 stycznia 2024 roku do 31 grudnia 2033 roku na podstawie stanu lasu w dniu 1 stycznia 2024 roku. Opis ogólny lasów nadleśnictwa (elaborat), 2024. Regionalna Dyrekcja Lasów Państwowych w Olsztynie, Olsztyn.

Rakowska R., Stachurska-Swakoń A., 2021. Historia bobra europejskiego w Polsce i obecny stan populacji. Wszechświat 122, 48–53.

Tajchman K., Czyżowski P., Drozd L., 2018. Food selectivity of European beaver (*Castor fiber* L.) occurring in the area Lubaczow and Chotylow Forest Districts. Pol. J. Nat. Sci. 33(4), 533–543.

Tranda E., Jaroniewski W., 1999. Zwierzęta chronione w Polsce. Multico Oficyna Wydawnicza, Warszawa.

Wąs J., Gorczyca E., 2022. Wpływ bobrów na funkcjonowanie rzek i potoków górskich. W: E. Gorczyca, A. Radecki-Pawlik, K. Krzemień, Procesy fluwialne a utrzymanie rzek i potoków górskich. IGiGP Uniwersytet Jagiellonski, Kraków, 349–392.

Valachovič D., Gímeš R., 2003. Manuál prestarostlivosť o populáciu bobra vodného. Bánska Bystrica: Štátna ochrana prírody Slovenskej republiky.

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K.D.-M. https://orcid.org/0000-0003-0611-903X
K.T. https://orcid.org/0000-0003-4725-9020

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