

MAMMAL SPECIES DIVERSITY IN THE HÂRBOVĂȚ LANDSCAPE RESERVE, REPUBLIC OF MOLDOVA

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Abstract: The research was carried out in the Hârbovăț Landscape Reserve. The study was conducted based on materials collected in the area during 1985–2025. Twenty-nine mammal species were identified. Six species are included in the Red Book of the Republic of Moldova. A decrease in the mammal diversity index over the last 40 years, from 1.97 to 1.62, was established. The Hârbovăț Landscape Reserve is of particular importance for the conservation of biological diversity.

Keywords: diversity, landscape reserve, rare species, adaptation, abundance, ecotone.

INTRODUCTION

Community structure and ecological diversity represent the fundamental manifestations of species interactions. Diversity is an intrinsic feature of ecosystems and the main parameter of the evolutionary process, while simultaneously acting according to the feedback principle. The theoretical importance of biodiversity studies lies in the possibility of elucidating the mechanisms of community and ecosystem structure formation, while the practical importance consists in its role as a material resource for civilization. The theoretical maximum of diversity is recorded where the size of biotopes and the total length of their boundaries are sufficiently large. The manifestation of the ecotone effect is an additional factor confirming the concept of continuity [4, p.354-358; 6, p.74-81]. In cases of biodiversity disturbance, along with the disappearance of dominant species, some auxiliary species also disappear, while newly integrated species within the biocenosis cause a redistribution of ecological niche space within the community and reduce the opportunities for species with low competitive potential, leading to their disappearance or decline in population size. In biotopes with extreme conditions, species with narrow specialization and increased abundance dominate. These processes are strongly manifested in protected natural areas. The Hârbovăț Landscape Reserve is situated between the villages of Hârbovăț and Bulboaca, Hârbovăț forestry district, Vila Hârbovăț, including plots 8–36, and is managed by the State Forestry Enterprise Bender. It covers an area of 2218 ha [1, p.53]. It is located in the southeastern part of Moldova, approximately 50 km southeast of Chișinău and 10 km northwest of Bender, within the Lower Bîc Plain, on the

watershed and adjacent slopes of the Bîc and Dniester rivers and their small tributaries, with a moderate impact of anthropogenic and natural processes [1, p.53]. The reserve contains habitats of European importance: 9170(B), 91 HO [1, p.53]. The presence of certain mammal species is indicated in the Atlas of Vertebrate Species (mammals, reptiles, amphibians, fish) included in the Cadastre of the Animal Kingdom and the Red Book of the Republic of Moldova [3, p.55-65; 2, p. 236-265]. The aim of the study was to identify mammal species and investigate the species diversity of this class of terrestrial vertebrates within the Hârbovăț Landscape Reserve.

MATERIALS AND METHODS

Research in the Hârbovăț Landscape Reserve was conducted during 1985–2025, selecting sampling plots in different types of biotopes with varying degrees of heterogeneity. The geographic coordinates of the reserve are 46°51'55" N, 29°23'44" E. Absolute altitudes are: maximum – 165 m, minimum – 25 m, average altitude – 135 m, elevation differences – 43 (60–115) m, slope inclinations – 5–30°, with predominant exposures S, SW, E, SE, W, NW [1, p.53]. The Hârbovăț Landscape Reserve is represented by forests of downy oak, sessile oak, and smoke tree characteristic of Moldova. Within the reserve, valuable forest sectors and steppe microbiotopes have been preserved. According to previous studies, 28 mammal species were identified in the reserve, including 11 species of small rodents. Four species are included in the Red Book of Moldova, 13 species are listed in the Bern Convention lists, and 7 species are included in Annex IV of the Habitat Directive [1, p.53]. The determination of species composition and abundance of small mammals was carried out using the relative abundance assessment method — trap-nights. Absolute numerical evaluation was performed using traps on 1 ha sample plots over a period of 5 days [5, p.51]. For captured animals, the following parameters were recorded: species, sex, age, physiological and reproductive status. For the characterization of species biotopic distribution, the frequency index was used: $F=100 \cdot p/P$, where P - number of samples, p- samples in which the species was present. Species dominance was calculated as: $D=100 \cdot n/N$, where n - number of individuals of species i in the sample, N- total number of individuals. Both indices are expressed as percentages. To highlight the position of a species or taxonomic group within the biocenosis, ecological significance (WA) was calculated according to: $WA=F \cdot Da/100$, where F- group frequency and Da abundance index.

RESULTS AND DISCUSSION

The mammal fauna of the Hârbovăț Landscape Reserve is rich and includes the rodent species *Microtus arvalis*, *Microtus rossiaemeridionalis*, *Mus musculus*, *Mus spicilegus*, *Apodemus sylvaticus*, *Apodemus flavicollis*, *Apodemus agrarius*, *Apodemus uralensis*, and *Cricetulus migratorius*. In the reserve, the edge effect index value in the floodplain biotope is 0.17, while in the forest biotope it is 0.38. The proportion of rodents according to habitat preference was established as

follows: floodplain – 33.4%, ecotone – 44.4%, and forest – 22.2%. If in spring the Simpson index in the studied biotopes was respectively: floodplain – 0.072; ecotone – 0.204; forest – 0.109, later during autumn a considerable increase in this index was recorded, with diversity values of 0.478; 0.752; and 0.522 respectively.

At the ecotone of the ash nursery situated near the acacia plot, among which apple, oak, ash, and pear trees also grew, the dominant species was *A. agrarius* (46%), while at the edge of the feeding glade *A. sylvaticus* dominated (41%). In agricultural plots with 50% dominance, the most frequent species was *Mus spicilegus*, followed by *A. sylvaticus*, *M. arvalis*, and *A. uralensis* with 16.7%. The density of *Mus spicilegus* mounds on corn stubble cultivated as supplementary food for game mammals in October was 1-8 per hectare. A considerable reduction in the number and size of mounds compared to previous years was recorded due to summer drought. In some stations, micropopulations of *M. spicilegus* were recorded on abandoned arable lands without mound construction.

Within microtine populations, due to intrapopulation factors and unfavorable climatic conditions in previous years, a low population size was established. The reproductive process was partially halted, favoring increased mortality of autumn functional groups. During autumn, a density of *M. arvalis* colonies of 50–60 colonies per hectare was recorded in alfalfa fields.

A summary analysis of the abundance (%) of small mammal species in different types of biotopes was carried out. At the forest-floodplain ecotone, *A. flavicollis* dominated (42.1%), followed by *Myodes glareolus* (21%). These were followed by *A. agrarius* (10.5%) and *A. sylvaticus* (16%). *A. uralensis* was recorded in lower numbers (5.2%). In another type of ecotone — the forest-glade ecotone — the highest abundance is also exhibited by *A. flavicollis* (48%), followed by *M. glareolus* (25%), with an abundance almost half as large. These species exceed *A. agrarius* and *A. sylvaticus* (10.7%). In the forest–wheat field ecotone, *M. arvalis* dominates with 35%. For *M. arvalis*, pasture degradation proved to be quite favorable, and with the expansion of agricultural crop areas, the species found optimal biotopes. This species is also dominant during the peak phase year in the floodplain (44%), followed by *A. agrarius* (21%). The ecological indices are presented in Table 1.

Table 1.
Ecological indices (%) of small mammal species

Species	Dominance	Frequency	Ecological significance
<i>A. uralensis</i>	8	57,1	4,6
<i>A. sylvaticus</i>	13,1	71,4	7,9
<i>A. agrarius</i>	21,7	65,3	21,6
<i>A. flavicollis</i>	23,6	85,7	20,2
<i>M. musculus</i>	2,8	28,6	0,8
<i>M. spicilegus</i>	4,7	42,9	2,01

<i>M.glareolus</i>	9,3	42,9	3,9
<i>M.arvalis</i>	12,1	57,1	6,9
<i>M.rossimeridionalis</i>	2,6	42,9	1,1
<i>Cr.migratorius</i>	2,1	28,6	0,6

Among the recorded small rodent species, the highest dominance (21.6% and 23.6%) was shown by *A. sylvaticus* and *A. flavicollis*, while their frequency was maximal (71.4% and 85.7%). An analysis of species diversity indices of rodents established the highest species diversity at the forest-floodplain ecotone (1.62), followed by the forest-wheat field ecotone (1.57).

Regarding the Simpson diversity index, the biotopes are arranged in descending order as follows: fallow land (5.88), forest-wheat ecotone (5.58), forest-floodplain ecotone (4.75), alfalfa-forest edge (3.96), and forest-glade ecotone (3.26). Biological diversity is directly proportional to the diversity of environmental factors. Under optimal environmental , interspecific competitive pressure intensifies, and one species influences another as a limiting or regulatory factor. Consequently, the populations of the respective species tend to decrease. Under unfavorable and homogeneous environmental conditions, competition decreases, while species populations show a positive trend. Even if the number of species is higher in one sample compared to another, due to lower evenness in the first sample, lower diversity will be recorded in that community. Floodplain biotopes and the forest-wheat field ecotone form a distinct group in which species composition and population size are similar. Another group consists of the forest-floodplain ecotone and forest. The most distant group, separated from the first two, consists of the forest belt and glade. The carrying capacity index is maximal at the forest-agroecosystem ecotone (12.0). The anthropic adaptation index of small mammal species was determined. The highest values were recorded for *A. sylvaticus* (14.3) and *A. uralensis* (12.5). The anthropic adaptation index for the forest-wheat ecotone (50%) exceeds that calculated for fallow land (38.8%), indicating greater adaptation in the ecotone area. Community anthropic adaptation increases with the number of eusynanthropic, synanthropic, and anthropophilic species with higher anthropic adaptation indices, and with decreasing abundance of "neutral" and anthropophobic species.

The density of carnivorous mammals in the reserve per 1000 ha is: *Vulpes vulpes* – 10 individuals, *Meles meles* – 13, *Martes martes* – 3, *Martes foina* – 5, *Mustela putorius* – 8, *Mustela nivalis* – 28, and *Felis silvestris* – 6. The reserve provides favorable conditions for game species development (*Capreolus capreolus*, *Sus scrofa*). Currently, the population size of *Capreolus capreolus* is 14 individuals/1000 ha, while wild boar numbers reach 11 individuals/1000 ha.

A decrease in mammal diversity in the Hârbovăț Landscape Reserve over the last 40 years from 1.97 to 1.62 was established. A considerable negative impact on mammal species is caused by clearing forest edges of shrubs, destruction of

vegetation clusters, collecting dry or fallen trees for firewood, removal of hollow and old trees, and forest clear-cutting, especially in oak forests. Disturbance caused by local inhabitants and visitors is high, while mammal protection remains insufficient. The aesthetic landscape elements are also of inestimable value.

CONCLUSIONS

The proportion of rodents according to habitat preference is: floodplain – 33.4%, ecotone – 44.4%, and forest – 22.2%. Regarding the Simpson diversity index, the biotopes are arranged in descending order as follows: fallow land (5.88), forest-wheat ecotone (5.58), forest-floodplain ecotone (4.75), alfalfa-forest edge (3.96), and forest-glade ecotone (3.26). Mammal diversity over the last 40 years decreased from 1.97 to 1.62. The reserve has outstanding social and economic value, and its protection measures should be intensified.

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