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DISTRIBUTION AND CONSERVATIVE ISSUES OF *Lucanus cervus* (Linnaeus, 1758) AND *Cerambyx cerdo* (Linnaeus, 1758) FROM CRÂNG FOREST, BUZĂU - ROMANIA

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Abstract

According to the European legislation invertebrate species Lucanus cervus (Linnaeus, 1758) and Cerambyx cerdo Linnaeus, 1758 are two species with conservative value, being included in the European Union Habitats Directive 92/43/EEC. They are considered indicator species for mature deciduous forest ecosystems, characterized by old oak trees and dead wood. Crâng forest located near Buzău city provided favorable habitats for these invertebrates. The Crâng forest is located in the forest-steppe zone in the southeast of Romania, has an area of 189 ha. The distributions of Lucanus cervus and Cerambyx cerdo were established, in this location. If we consider the numerical abundance, 40 individuals of Cerambyx cerdo and 45 individuals of Lucanus cervus were counted, on 25 studied transects. On the other hand another two species were investigated: Oryctes nasicornis (Linnaeus, 1758) and Dorcus parallelipipedus Linnaeus 1758. In order to protect these invertebrates, the pressures, threats and conservation measures were established. The present study demonstrated that a mature, old deciduous forest dominated by Quercur robur tree species, even if it is located near an urban area, could constitute a favorable habitat for two Natura 2000 invertebrates' species.

Key words*: abundance, forest, habitat, protection, threat.*

INTRODUCTION

Romania contains five major European bioregions: Alpine, Continental, Pannonian, Steppic and Pontic (Black Sea). Our study, which wants to establish the distribution and conservative issues for *Lucanus cervus* (Linnaeus, 1758) and *Cerambyx cerdo* Linnaeus, 1758 from Crâng forest area, which is located in Buzău County. According to the above classification, the Buzău city is located in the Steppic bioregion. From the conservative point of view, *Cerambyx cerdo* is protected at European and national level through many legislative frames, as: Article 17 of the Habitats Directive (GEO no. 57/2007 -annexes 2, 3, 4 A; HD 92/43 EEC -annexes II; IV), IUCN (being considered vulnerable species) and Bern Convention (annex II). The similar conservation status could define the species *Lucanus cervus*. It is protected by national and European legislation (GEO no. 57/2007 - annexes 2, 3; HD 92/43 EEC – annexes II); IUCN (near threated species) and Bern Convention, which entered into force on June 1, 1982 (annex III).

Considering the conservative value of these two invertebrates species and the Steppic bioregion (where this studied was made), in the last monitoring report to EU (2013-2018) regarding the overall assessment of the conservation status (considering the population, habitat and future prospects) for *Cerambyx cerdo* and *Lucanus cervus* are unfavorable-inadequate (U1) (https://nature-art17.eionet.europa.eu). The national distribution of these two protected species is quite well known, being signaled in many protected areas from Romania (Serafim & Chimişliu, 2010; Prunar et al., 2014; Iorgu et al., 2015; Bărbuceanu, 2017; Manu et al., 2017; 2025; Bărbuceanu & Truță, 2021). Saproxylic species *Cerambyx cerdo* lives mainly in the deciduous forests, especially in oak forests (*Quercus* spp.), preferring older/mature or dying trees (over 100 years old with a diameter of more than 40 cm), even in the seminatural or unnatural (anthropic) forest ecosystems

(Carpaneto et al., 2010; Iorgu et al., 2015; Redolfi De Zan et al., 2017; Mannu et al., 2021). *Lucanus cervus* is another protected species which preferred Quercus spp. forests. It is considered a polyphagous species, growing in the rotten wood of many deciduous species. It can be found in deciduous forests as well as in open areas with isolated trees or hedges, in urban and suburban gardens, parks, wooded pastures, wherever there is a sufficient source of dead wood (Iorgu et al., 2015; Bardiani et al., 2017). Even if these species were recorded especially in protected areas, however we identified them in a small forest area, near to Buzău city. On the other hand the Habitats Directive 92/43/EEC contains no explicit information concerning conservation measures or management of threatened species in artificial habitats like urban/peri-urban areas. According to Carpaneto et al., 2010, this is a critical issue because parks, gardens, avenues, roadsides and other 'unnatural' places can have old and sun-exposed trees, which are important hosts for saproxylic species. The present paper wants to highlight the presence and the numerical abundance of these two protected species in such small peri-urban forest area, to indicate their distribution and their pressures and threat connected with conservation measures. In the same time the present study demonstrated that even a small size forest could provide favorable habitats for the protected invertebrate species. Any information brought from the field observations about *Cerambyx cerdo* and *Lucanus cervus* is very important in order to evaluate their habitat requirements, their distribution and conservation measures, especially in urban forest ecosystem.

MATERIALS AND METHODS

The study was accomplished in June-September 2025, in Crâng forest- Buzău Plain, located near Buzău city (N: 45°08'37.86"; E: 026°47'51.56", altitude by 95 m) (Figure 1). This study area is located in Buzău county Romania, on an area of 189 hectares. The Crâng Forest is part of the medium plain area, bordering the Municipality of Buzău, in the Buzău Plain. For the beetle species, in the filed we used visual searching for adults along transects. The length of transect was by 500 m and 20 m wide. Transects were carried out in a zigzag pattern to cover all researched areas as best as possible. The fauna observations were done directly on the substrate: soil, rocks, logs, herbaceous vegetation, shrubs and bark of trees. For saproxylic Coleoptera species, in areas with dead wood (fallen or standing trees, wood stacks), there were investigated the adequate micro-refuges, through removing the bark on the trunks of dry trees and on logs (Iorgu et al., 2015; Lotrean et al., 2015; Redolfi De Zan et al., 2017). For taxonomical identification of species, we used an actual key (Panin, 1955; Panin & Săvulescu, 1961). In total 25 transects were established (Figure 1). Maps were generated using QGIS 3.42 software (project coordinate reference system: WGS 84). Google Satellite was the base layer, with other layers of interest being sourced from the following databases: (1) Romanian borders and administrative regions (eea.europa.eu/data-and-maps); (2) regional water bodies and (3) roads (data.humdata.org/dataset). Multipoint vector layers for species distributions were generated after the gathered data was compiled into CSV files. From the vegetation point of view those 25 investigated transects were described as following: T1 – forest clearing; T8, T9, T10, T22, T25 – urban forest area with secular oaks (park); T1-T7 and T11-T21, T24 -Habitat 91I0* Euro-Siberian steppic woods with Quercus spp; T23 -ash plantation with diverse shrub layer (Doniţa et al., 1990; 2005). Analyzing the microhabitats we observed that invertebrates' species with conservative value were observed on: dry log (T1), soil (T17), dead *Quercus robur* (T16, T24) and live *Quercus robur* (T2-T15; T18-T25). The tree circumferences were quantified with a flexible tape measure at breast height (Elias, 2000).For both protected species, threats and pressures were evaluated (in degree of intensity). In order to differentiate the pressure from threat, we used "the standard lexicon for biodiversity conservation: unified classifications of threats and actions" (Salafsky et al., 2008).

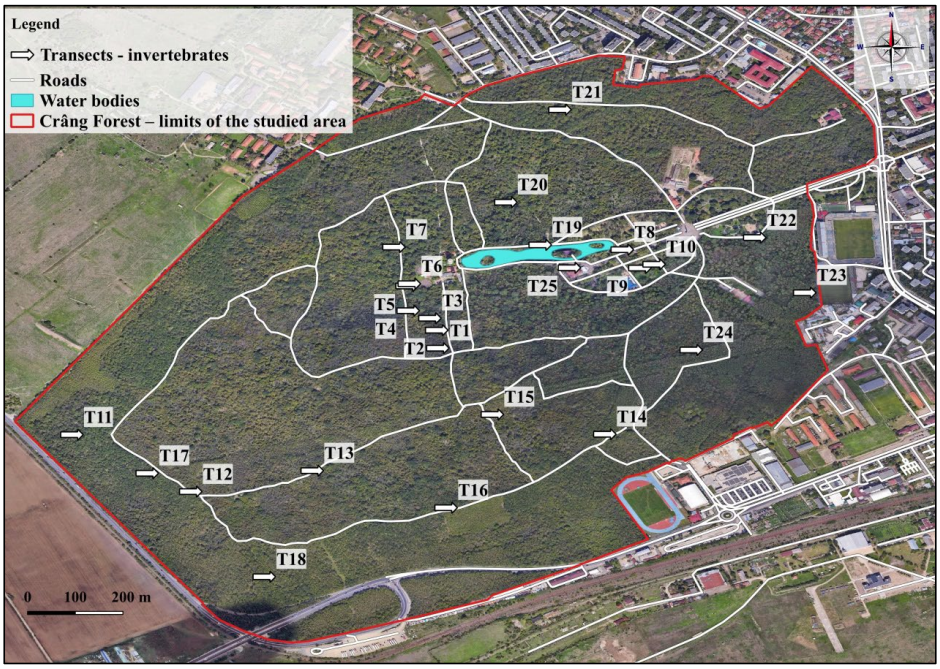


Figure 1. The geographical location of the Crâng forest and investigated transects, Buzău County, Romania, 2025 (original)

RESULTS AND DISCUSSIONS

In the Crâng forest two Natura 2000 invertebrate species were identified: *Cerambyx cerdo* and *Lucanus cervus*. In the same time, we observed another important xylophage coleopterans species: *Oryctes nasicornis* (Linnaeus, 1758) and *Dorcus parallelipipedus* Linnaeus 1758. Even if in Romania *Oryctes nasicornis* is not a legal protected species, the specialists consider that due to the decreasing of the forests with old trees we must to consider this species from the conservative point of view. It has been included in conservation efforts and recommended for the Red List of the Prut River (Popescu & Davideanu, 2009). According to the IUCN criteria, *Dorcus parallelipipedus* is listed as least concern species (IUCN, 2024).

All these xylophages species have an important role in forest ecosystem, participating in the decomposition proces, and representing a food source for other animal species (birds, micromammals, etc.). Their ecologycal role, their diverse habitat requirements, ecological niches and, in particular, their rapid responses to environmental changes, could constitue orguments to considered these invertebrates excellent bioindicators of management and, consequently, of the conservation status of forests. The strict relationship between saproxylic insects and the quantity and type of dead wood implies a very strong sensitivity to forest management practices (De Groot et al., 2016).

From 25 investigated transects, in 22 of them we identified favorable habitats and microhabitats for xylophagous coleopterans. The highest number of individuals were recorded in T7, T14, T16, T19, T24 and T25. On the opposite the lowest nmerical abundance were obtained in T, T2, T9, T12 and T17. With only tow exceptions (T9 and T25 from urban park) all those transects were integrated in Natura 2000 habitat: 91I0* Euro-Siberian steppic woods with Quercus spp. On the other hand, the transects where the high coleopterans abundaces were recorded, are characterized by the most increased average trees cicumferences (between 206 and 320 cm), despite the lowest reprezented transects (92-184 cm). According to Doniţă et al., 2005, habitat 91I0* Euro-Siberian steppic woods with Quercus spp. has a high conservative value. The type of soil is phaeozem (cambic chernozem), rich in humus, slightly acidic, eubasic, water

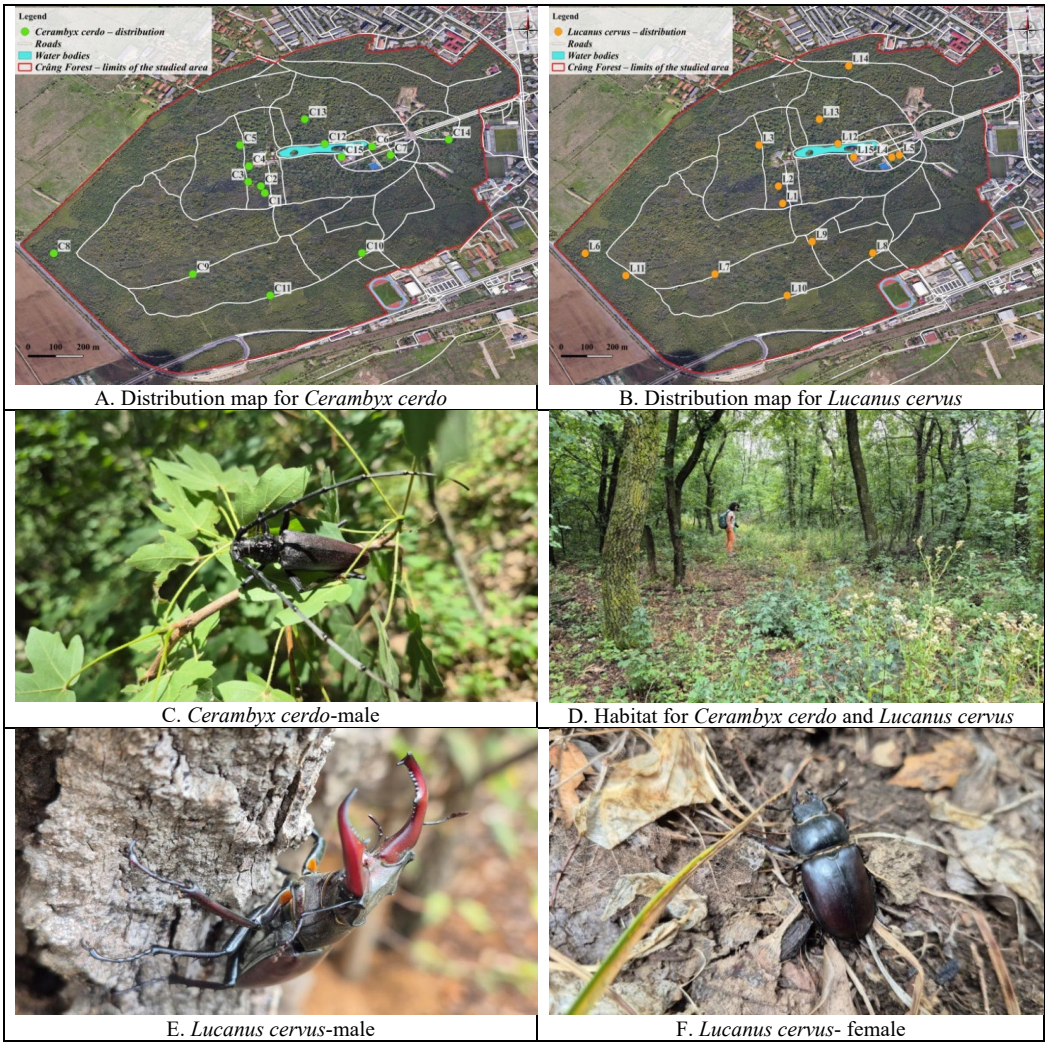
deficient during the summer, eutrophic. The tree layer is composed by: *Quercus pedunculiflora, Q. pubescens, Acer tataricum, Acer campestre, Ulmus minor, Ulmus procera, Pyrus pyraste*, etc. The shrub layer is well developed, composed by: *Crataegus monogyna, Prunus spinosa, Viburnum lantana, Rhamnus cathartica, Ligustrum vulgare, Evonymus verrucosus, E. europaeus, Rosa canina, Sambucus nigra,* etc. The herbaceous layer is dominated by the *Asperula taurina, Polygonatum latifolium, Geum urbanum* or *Glechoma hirsuta*.

Table 1: The abundance of investigated invertebrate species with conservative value in Crâng forest, Buzău county, Romania, 2025 (Cc=*Cerambyx cerdo*, Lc=*Lucanus cervus*, On=*Oryctes nasicornis*, Dp= *Dorcus parallelipipedus*).

T	Period	Altitude (m)	Cc	Lc	On	Dp	Tree circumference (cm)
T1	June 2025	98		1			289
T2	June 2025	98	1				184
T3	June 2025	97	2	3			280, 180,122
T4	June 2025	98	5				190, 233
T5	June 2025	98					172
T6	June 2025	105	3				170, 260, 186, 175
T7	June 2025	107	1	1	9		164
T8	June 2025	99	4				376
T9	June 2025	99		2			438, 378, 87, 268
T10	June 2025	100	2	1	2		229, 72, 203, 266, 255, 371
T11	June 2025	72	5	3			160, 121, 109, 98, 119, 137
T12	June 2025	97				1	92
T13	June 2025	97	2	4			183, 188
T14	July 2025	102	4	10			243, 254, 120, 208, 187, 201, 252, 215, 130
T15	July 2025	99		4			263, 183, 187
T16	July 2025	98	2	5	3		347, 248, 182, 178
T17	July 2025	99		1			
T18	July 2025	93					
T19	July 2025	89	3	1	8		265, 252, 249, 311, 347, 246, 149
T20	July 2025	92	3	2		1	411, 399, 259, 302, 254, 346
T21	July 2025	95		2	1		233, 226, 211, 127, 226
T22	August 2025	102	2				260
T23	August 2025	97					221, 231, 145
T24	August 2025	98			12		280
T25	August 2025	99	1	5	9		373, 285, 232, 238, 282

The protected species *Cerambyx cerdo* was identified in 15 transects, which represent 60% from all investigated ones (Figures 1 A, C, D). The total number of individuals was 40 individuals (13 females and 27 males), with a higher abundance in T4 and T11. The lowest numerical densities were obtained in T2, T7, T25 (Table 1). All investigated specimens were identified in 91I0* Euro-Siberian steppic woods with *Quercus* spp. If we consider the sex ratio, the highest number of females were recorded in T14 (3 specimens), on opposite being transects T2, T3, T4, T6, T7, T10 and T16 (any females). Considering the males, the highest abundances were obtained in T4 and T11 (5 specimens and respectively 4 ones). On the other hand, considering the physiological stage, we identified 20 live specimens and 20 exuvia. But, what about the *Cerambyx cerdo* population? It is viable population or not, considering the number of identified individuals? To answer at this question, we made some comparisons with other studies, from two protected areas where the conservation status of their populations is in

good condition. In ROSCI0359 Prigoria-Bengeşti, in 9 investigated transects were identified 22 individuals and in ROSCI0354 Platforma Cotmeana 41 individuals (Manu et al., 2027; Bărbuceanu & Truţă, 2021). So, having these data we can say that population of *Cerambyx cerdo* from Crâng forest is a viable one, well numerically represented.



A. Distribution map for *Cerambyx cerdo*

B. Distribution map for *Lucanus cervus*

C. *Cerambyx cerdo*-male

D. Habitat for *Cerambyx cerdo* and *Lucanus cervus*

E. *Lucanus cervus*-male

F. *Lucanus cervus*- female

Figure 1. Distribution and habitat of species *Cerambyx cerdo* and *Lucanus cervus* in Crâng forest, Buzău, 2025 (original)

Specialists observed that *Cerambyx cerdo* has often been mentioned in association with *Lucanus cervus*, a situation noted in the forest clearings or at the edges with secular trees (Panin & Săvulescu, 1961; Bărbuceanu & Truţă, 2021). This phenomen was observed in Crâng forest as well.

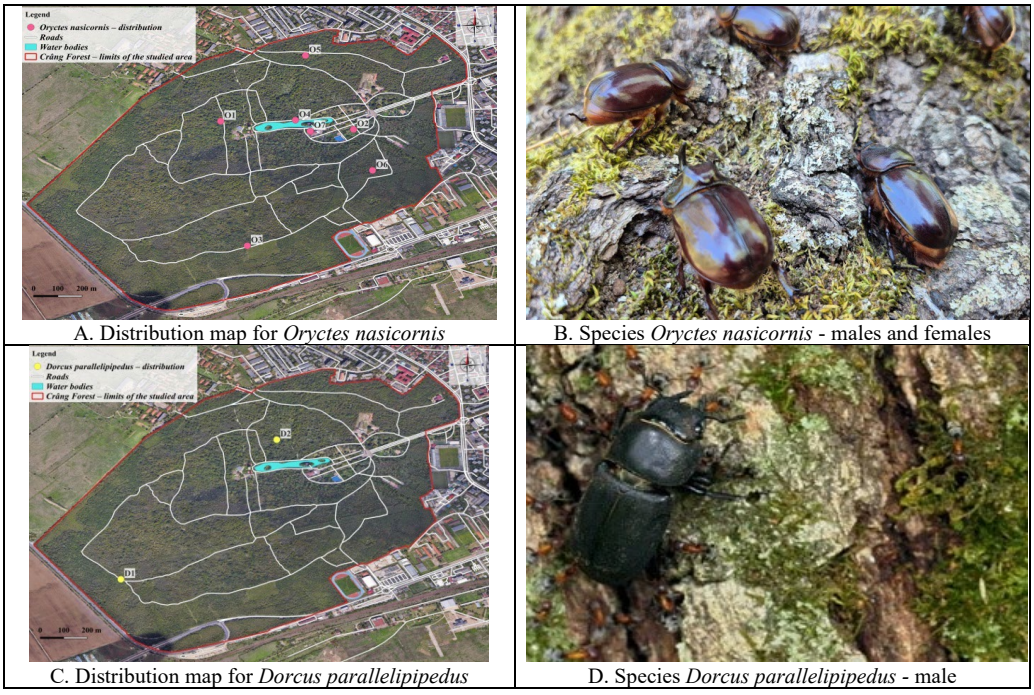
Species *Lucanus cervus* was identified in 15 transects, which represent 60% from all investigated ones (Figure 1 B, D, E, F). The total number of individuals was 45 individuals (22 females and 23 males), with a higher abundance in T14, T16 and T25. The lowest numerical densities were obtained in T1, T7, T10, T17 and T19 (Table 1). The majority of specimens were identified in 91I0* Euro-Siberian steppic woods with *Quercus* spp. If we consider the sex ratio, the highest number of females were recorded in

T14 (8 specimens) and T 25 (5 specimens), on opposite being transects T3, T7, T10, T11, T13, T15 and T19, with any females. Transects were the males were dominant were: T3, T11, and T15. On the other hand, considering the physiological stage, we identified 16 live specimens and 29 exuvia.

Comparing these data with others from two protected areas, we observed that in ROSCI0359 Prigoria-Bengești 228 individuals of *Lucanus cervus* were identified in 59 investigated transects and in ROSCI0354 Platforma Cotmeana 314 individuals (Manu et al., 2027; Bărbuceanu & Truţă, 2021). Considering the small area of Crâng forest, we consider that the population of *Lucanus cervus* is well represented in this location.

On the other hand, another two coleopterans with conservative value were identified, in Crâng forest: *Oryctes nasicornis* and *Dorcus parallelipipedus*. Species *Oryctes nasicornis* was identified in 7 transects, which represent 45% from all investigated ones (Figure 2A, B). The total number of individuals was 44 individuals (27 females and 17 males; 2 live specimens and 42 exuvia), with a higher abundance in T7, T19, T24 and T25. The lowest numerical densities were obtained in T10 and T16 (Table 1). The majority of specimens were identified in 91I0* Euro-Siberian steppic wood with *Quercus* spp., but it was also identified in urban forest ecosystem. If we consider the sex ratio, the highest number of females were recorded in T7 (5 specimens) and T24 and T25 (9 specimens each), on opposite being transects T10, T16 and T21, with any females. The transects where males were dominant were T7 and T19 (4 specimens each).

Species *Dorcus parallelipipedus* was identified in 2 transects, which represent 8% from all investigated ones (Figure 2C, D). The total number of individuals was 2 individuals (one females and one males; 2 live specimens), in T12 and T20 (with one specimen each) (Table 1). These 2 specimens were identified in 91I0* Euro-Siberian Steppic woods with *Quercus* spp.



A. Distribution map for *Oryctes nasicornis*

B. Species *Oryctes nasicornis* - males and females

C. Distribution map for *Dorcus parallelipipedus*

D. Species *Dorcus parallelipipedus* - male

Figure 2: Distribution and habitat of species *Oryctes nasicornis* and *Dorcus parallelipipedus* in Crâng forest, Buzău, 2025 (original)

Table 2: The pressures and threats (with their intensities) for Coleoptera species from Crâng forest, Buzău county (Cc = *Cerambyx cerdo*, Lc = *Lucanus cervus*, On = *Oryctes nasicornis*, Dp = *Dorcus parallelipipedus*)

PRESSURES	Code	Species	Intensity
Removal of dead or dying trees	B02.04	*Cc, L.c, Dp*	Medium
		On	Low
Forest road, tourist trail, footpaths, cycle paths	D01.01	*Cc, Lc, On, Dp*	Medium
National road	D01.02	*Cc, L.c*	Medium
Continuous urbanization	E01.01	*Cc, L.c, On*	Medium
Dispersed housing	E01.03	*Cc, L.c, On*	Medium
Household waste/recreational waste disposal	E03.01	*Cc, On*	Medium
		Lc, Dp	Low
Walking, horse riding and non-motorized vehicles	G01.02	*Cc, L.c, On, Dp*	Low
Motorized vehicles	G01.03	*Cc, L.c*	Low
Other forms of air pollution	H04.03	*Cc, L.c*	Low
Non-native invasive species	I01	*Cc, L.c, Dp*	Medium
		On	Low
Fires, bonfires	J01.01	*Cc*	Medium
		Lc, On, Dp	Low
Groundwater abstraction for public water supply	J02.07.02	*Cc, L.c*	Medium
Drought and reduced rainfall	M01.02	*Cc, L.c, On, Dp*	High
THREATS	**Code**	**Species**	**Intensity**
Removal of dead or dying trees	B02.04	*Cc*	Medium
		Lc	Low
Using chemicals to treat the insects attacks	B04	*Cc, L.c, On, Dp*	High
Forest road, tourist trail, footpaths, cycle paths	D01.01	*Cc, Dp*	Low
		Lc, On	Medium
Specimen collection	F03.02.01	*Cc, L.c, On*	Low
Dispersed housing	E01.03	*Cc, L.c, On*	Low
Household waste/recreational waste disposal	E03.01	*Cc, L.c, On, Dp*	Medium
Walking, horse riding and non-motorized vehicles	G01.02	*Cc, L.c, On, Dp*	Low
Motorized vehicles	G01.03	*Cc, L.c*	Low
Non-native invasive species	I01	*Cc, L.c, On, Dp*	Medium
Fires, bonfires	J01.01	*Cc, L., Onc*	Medium
Groundwater abstraction for public water supply	J02.07.02	*Cc, L.c*	High
Drought and reduced rainfall	M01.02	*Cc, L.c, On, Dp*	High

The code of pressures and threats are according with Order No. 304/2018 from Romania's Ministry of Environment, which approved the Guide for the development of management plans for protected natural areas.

The distribution modeling of species with conservative value represents one of the first step in their ecological knowledge (habitat requirements, conservation measures), especially in urban forests, a less study ecosystems (Onete et al., 2025; Mihai et al., 2025)

In order to protect these species, we must to identify and quantify the intensities of pressures and threats for each protected species. A complete list of them is presented in table 2, being quite similar for all 4 species, but they manifest with different intensities. In total, 13 pressures and 12 threats were identified (Table 2).

We consider that preserving characteristic habitats and applying "minimal intervention" forest management, preserving mature/old trees in their habitat are the main protection measures. We also recommend preserving existing forest trails in optimal/natural conditions, so as not to increase their number (which will lead to habitat fragmentation) or carry out major/aggressive interventions, which involve the destruction of vegetation in adjacent areas and even interventions at tree level. Tourist trails be laid

out in such a way as to protect mature/old trees. If there are old trees with rotten branches that could pose a danger to tourists on tourist routes (alleys/paths) that cannot be reconfigured, they should be selectively cut down. The ongoing urbanization process and scattered settlement must be kept under control so that the structure of the forest ecosystem is maintained at least at its current level, with the preservation of mature trees and reforestation. Proper waste management is another protection measure. The higher number of tourists at the end of the week must be taken into account, ensuring special places for waste storage. The management of invasive non-native species involves constant monitoring and surveillance of areas where they have been identified in order to identify invasive species at an early stage. Once detected, invasive species must be controlled by various methods, such as mechanical removal, biological control (such as mowing, uprooting, and cutting invasive plants), without the use of chemicals. Avoid the use of chemicals as a method of controlling forest pests. If chemical control is absolutely necessary, it should be carried out on small/targeted areas and with selective substances (Purice et al., 2025). In the context of climate change, when drought is becoming increasingly prevalent (with air temperatures reaching up to 38.7°C in Crâng forest), the existence of groundwater catchments/wells can drastically change the hydrological regime of the area, accentuating the drying process of the soil and, implicitly, of the studied forest ecosystem studied. The presence of fire pits and even burned areas in the Crâng forest indicates the presence of another factor disturbing the forest. Fires are strictly prohibited in the forest, and it is recommended that strictly monitored areas be set up for barbecuing or camping. Lighting fires and smoking will only be permitted in specially designated areas; periodic checks will be carried out on those camping within the forest perimeter to verify compliance with fire prevention regulations and to penalize violations. Species as *Cerambyx cerdo* and *Lucanus cervus* are crepuscular invertebrates, which mean that they are mainly active at dusk and dawn. Their activity increases sharply before dusk, reaching peaks at night. Therefore, we consider that public lighting in forest areas poses a threat to this species.

CONCLUSIONS

In Crâng forest from Buzău city, two Natura 2000 species were identified: *Lucanus cervus* and *Cerambyx cerdo*. In the same time, another two indicator species for mature forest were identified: *Oryctes nasicornis* and *Dorcus parallelipipedus*.

Identification of these protected species demonstrated the presence of favorable, characteristically habitats, old/mature deciduous forests and urban forest area with secular oaks, with tree circumferences between 92-411 cm.

On the other hand favorable microhabitats for these species were identified, as: dry logs and dead trees of *Quercus robur* and live trees of the same species.

In the same time the 13 pressures and 12 threats were evaluated, indicating their intensity. The main pressures were: removal of dead or dying trees; forest road, tourist trail, footpaths, cycle paths; urbanization, non-native invasive species, groundwater abstraction for public water supply; drought and reduced rainfall.

The main threats were: using chemicals to treat the insect's attacks; household waste/recreational waste disposal; walking, horse riding and non-motorized vehicles; specimen collection; drought and reduced rainfall. In order to maintain viable populations some specific conservation measures were established, in correlations with identified pressures and threats. Protecting their habitats and microhabitats we will conserve the coleopterans species. A proper forest management, waste management, invasive species management and a controlled urbanization process are few conservation measures. From conservative point of view, we consider that Crâng area represent an important forest ecosystem for Coleoptera species.

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