

INCOMES OF ROE DEER MANAGEMENT IN THE HUNTING GROUNDS OF CENTRAL SERBIA

PROFITI GOSPODARENJA SRNEĆOM DIVLJAČI U LOVIŠTIMA SREDIŠNJE SRBIJE

Marija POPOVIĆ¹, Hristo MIHAYLOV², Nikola MIHAJLOVIĆ³, Zoran POPOVIĆ⁴

SUMMARY

The aim of this paper is to analyze the total breeding stock market in 2021/2022, an estimate of the value of the stock of this type of game, the culling value and income per 100 ha of total hunting areas of all hunting grounds in Central Serbia. This research covered the roe deer breeding stock in the hunting grounds of central Serbia. Based on the analysis, the directions and possibilities for increasing the income in all hunting areas of Serbia has been considered. The assessment of the value of the roe deer breeding stock was determined according to the Rulebook (Official Gazette, No. 18/19), while the income from roe deer culling was calculated using the market price list given by the Hunting Association of Serbia for 2021/2022. It was determined that the value of the male roe deer stock is 6.506.000 €, while the value of the female and offspring stock is approximately 3.615.000€. Total income of culled game in 2017/2018 was 480.626 €, while the income per 100 ha of the total area of all hunting areas is 9€. The highest total income is generated by the Central Hunting ground and it amounts to 191.785 €. In order to achieve a higher profit from the management of roe deer at the hunting grounds of central Serbia, it is necessary to completely fulfill the planned culling with an increased inclusion of roebucks that have higher trophy mass.

KEY WORDS: roe deer, culling, economic aspects, income, Serbia.

INTRODUCTION

UVOD

According to the Serbian Game and Hunting Act (Anon., 2010), roe deer (*Capreolus capreolus* L.) is classified as a big game protected by Close Season. Roe deer is a highly adaptable mammalian species, widespread in Europe, as well as in parts of the Asian continent (Stubbe, 2008).

Game populations in Serbia are managed through various hunting ground users, where the largest number of hunting grounds and the largest areas (almost 90 %) are managed by hunting associations. In Serbia, roe deer live in a large number of different habitats ranging from the Pannonian

lowlands to mountain massifs, but their population numbers differ in some areas and vary depending on habitat conditions (Gajić and Popović, 2010). On 1000 ha of hunting-productive hunting area, the average density of roe deer varies from 48.67 to 74 individuals (Popović et al., 2021). From the aspect of the hunting tourism development roe deer is also very important, moreover, roe deer is attractive to the hunters not only because of the trophy (Popović et al., 2020) but also because of the tasty and nutritious meat (Ivanović et al., 2020).

The goal of managing the roe deer population is raising and maintaining their populations as well as trophy values in

¹ Marija Popović, Ph.D., candidate, Faculty of Agriculture, University of Belgrade, Nemanjina no. 6, 11080 Zemun, Serbia, e-mail: marija.popovic11@gmail.com

² Hristo Mihaylov, Ph.D., Associate Professor, University of Forestry, 10 Bul. Kliment Ohridski, 1797 Sofia, Bulgaria, e-mail: h_mihajlov@abv.bg

³ Nikola Mihajlović, Master engineer of Agriculture, Faculty of Agriculture, University of Belgrade, Nemanjina no. 6, 11080 Zemun, Serbia, e-mail: nikola.mihajlovic@agrif.bg.ac.rs

⁴ Zoran Popović, Ph.D., Full Professor, Faculty of Agriculture, University of Belgrade, Nemanjina no. 6, 11080, zpopovic@agrif.bg.ac.rs

*Glavni autor – Corresponding author

accordance with the ecological possibilities of the habitat, by culling the certain number of trophy-mature individuals. The goal is to achieve an ideal relationship between age categories. In a population of roe deer with an optimal sex ratio of 1:1, the optimal structure of roe deer is 48% young, 26% middle age, 26% mature (Gajić and Popović, 2010). Moreover, one of the goals of hunting ground management in the Republic of Serbia is to preserve the stability of ecosystems, to have progressive and sustainable hunting management in a way that it maintains biological diversity, reproductive capacity, production, vitality, to fulfill ecological, managerial and social functions without harming other ecosystems (Keča et al., 2018).

The roe deer participates with 63.40% of the total production value at the hunting ground “Brajevska reka” size of 21.312 ha, out of which 52.22% of the value is the roebuck trophy, venison sale and hunting services, whereas 11.18% is the value of does and fawns (Popović et al. 2014). Roe deer is of special economic importance for Serbia, whose economic benefit derives from all three determinants of the hunting values (trophies, culls and weights).

Roe deer (*Capreolus capreolus* L.) is an autochthonous representative of wild ungulates and inhabits over 90% of the total hunting area of Serbia (Popović and Gačić, 2006). One of the basic goals of roe deer hunting management is to maintain high quality and vital populations with all the elements of the structure, that ensure successful breeding and valuable trophies (Gačić, 2006).

The aim of the research is to estimate the value of the breeding stock of roe deer in 2021/2022 and to conduct the analysis of the total income from roe deer culling and income per 100 ha of total hunting area in hunting year 2017/2018 in all hunting areas of Central Serbia. Based on this analysis, the directions and possibilities for increasing the income in all hunting areas of Serbia will be perceived.

MATERIAL AND METHODS

MATERIJAL I METODE

The research of economic aspects of management includes the roe deer game stock in the hunting grounds of central Serbia. With the Decree on the Establishment of Hunting Areas on the territory of the Republic of Serbia (Anon., 2020), sixteen hunting areas were formed, of which five hunting areas are located in central Serbia: Belgrade hunting district, Western hunting district, Central hunting district, Eastern hunting district and Southern hunting district (Figure 1). Within the hunting district, the boundaries of individual hunting district are determined on the total area (<https://upravazasume.gov.rs/lovstvo/dokumenti-i-propisi-lovstvo/>). Considering these data issued by the Ministry of Agriculture, Forestry and Water Management, the analysis of income will be expressed on the total area of the hunting district.



Figure 1: Established hunting areas in central Serbia
Slika 1: Utvrđena lovna područja u središnjoj Srbiji

The assessment of the value of the roe deer game stock was determined on the basis of data from the Ministry of Agriculture, Forestry and Water Management. Forest Administration for 2021, according to the form of the Rule for calculating the fee for the use of Closed season protected game species for the next hunting year (Anon., 2019), determines the fee, 200 € for males, 66.67 € for females and offspring. Revenue from roe deer culling is calculated for hunting year 2017/2018, according to the market price list given by the Hunting Association of Serbia for hunting year 2021/2022 (<http://www.lss.rs/wp-content/uploads/2021/04/LSS-cenovnik-2021-2022.pdf> Table 1) Moreover, the income per 100 ha of the total hunting area was determined, as well as the percentage of realized roe deer culling in 2017/2018.

Roe deer culling data for 2017/2018 were taken from the central database of the Ministry of Agriculture, Forestry and Water Economy, Forest Administration, wherein 41.33% roebucks, 41.33% does and 17.33% fawns were culled. Based on previous research, the average trophy value shown in Table 2 was calculated on the basis of nine hunting grounds (Brajevska river, Jadar, Takovo, Dubrava, Klisura, Kamenica, Majsinjska mountains, Resava, Krilas). According to CIC trophy scoring system, 1184 roe deer trophies were scored (Beuković and Popović, 2014; Ristić and Todorović, 2009; Trense et al., 1981; Frković, 1989).

The average body weight of roebucks without internal organs, head and legs below the knees is 20.08 kg (Popović et

Table 1: Market prices of roe deer for 2021/22. Source: <http://www.lss.rs/wp-content/uploads/2021/04/LSS-cenovnik-2021-2022.pdf>**Tablica 1:** Tržišne cijene srneće divljači za 2021/22. godinu. Izvor: <http://www.lss.rs/wp-content/uploads/2021/04/LSS-cenovnik-2021-2022.pdf>

Weight of antlers (grams) / Masa rogovanja (grama)	Price / Cijena	
	Culling (€ per animal) / odstrel (€ po grlu) Roebucks with the trophy / srnjaci sa trofejem	meat (€ per kg) / meso (€ po kg)
up to/do 200	50,00	2,00
from/od 200 to/do 249	100,00	2,00
from/od 250 to/do 299	150,00	2,00
from/od 300 to/do 349	200,00	2,00
from/od 350 to/do 399	250,00	2,00
from/od 400 to/do 449	500,00	2,00
from/od 450 to/do 499	800,00	2,00
from/od 500 to/do 549	1.200,00	2,00
Does / srne	30,00	2,00
Fawns / lanad	15,00	2,00

Table 2: Average roe deer weight of antlers structure based on the basis of nine hunting grounds**Tablica 2:** Struktura prosječnih masa rogovlja srnjaka dobivena na temelju devet lovišta

Weight of antlers (grams) / Masa rogovlja (grama)	Up to/do 200,0	From/od 200,0 to/do 249,0	From/od 250,0 to/do 299,0	From/od 300,0 to/do 349,0	From/od 350,0 to/do 399,0	From/od 400,0 to/do 449,0	From/od 450,0 to/do 499,0	From/od 500,0 to/do 549,0
Average (%) / Prosek (%)	17,30	15,42	23,56	20,22	13,67	6,83	1,67	1,33

al., 2017), while for does and fawns average weights are 17.25 kg respectable 12.60 kg (Popović, 1998; Popović et al., 2003). The calculation of average roebuck prices starts from the fact that the total catch is made by hunters (70 % members of the hunting association, and 30 % hunting tourists) and that the market price of individual animal is the composite value of the meat and the price of trophies, which is different depending on the trophy scale (Tomić et al., 2005). Culled does price is calculated with a discount of 30 % of the market price list for the members of the association.

RESULTS AND DISCUSSION REZULTATI I RASPRAVA

Based on roe deer data for hunting year 2021/2022 the total value of the roebuck breeding stock is 6,506,000€, while the

value of the does and fawns stock is 3,615,000€. The highest value of the breeding stock is in the Central Hunting district, which includes about 28% of the total stock of males, females and offspring. Considering that the Central Hunting district does not have the largest hunting area, but has a large number of roe deer (24,532 in total), thus, the largest value of the breeding stock is justified (Table 3).

In the structure of the value of culled individuals in 2017/2018, the largest share belongs to roebucks 84.47%, followed by does 12.83% and fawns 2.69% (Table 4). Improving the economic results of managing game populations can be done by improving the age structure of the roe deer population, by increasing the share of roebucks that have trophy weight over 450 g, which is achieved by a greater participation of mature roe deer, considering that the weight of the trophy depends on the age of the individual

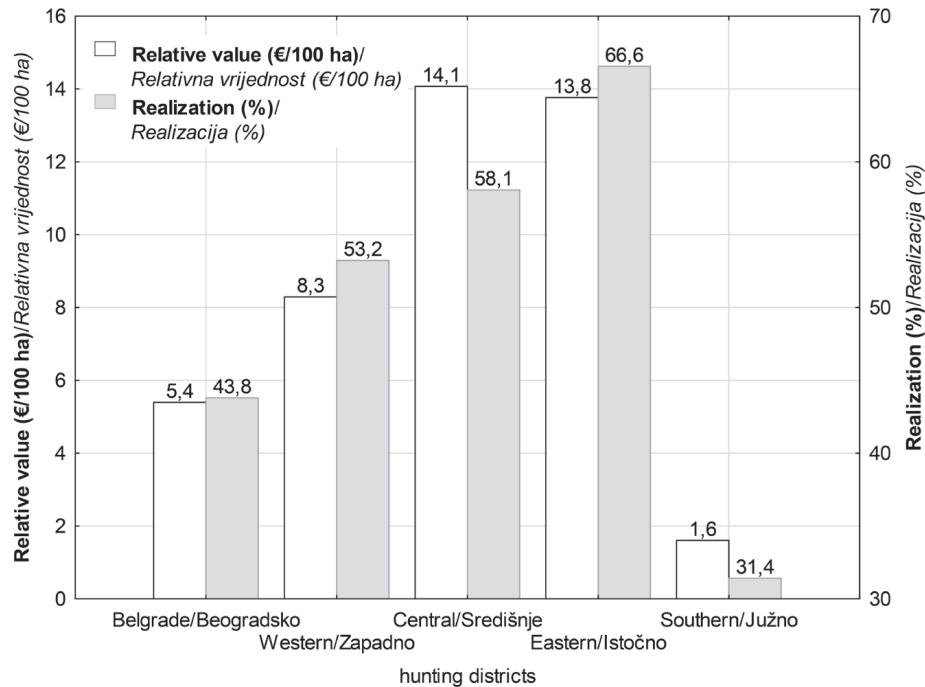
Table 3: Area, abundance and values of roe deer 2021 according to the hunting districts**Tablica 3:** Ploština, brojnost i vrijednost srneće divljači u 2021. godini

Nº / red. br	Hunting districts / lovna područja	area (ha) / ploština (ha)	Does OPT number / srna OPT brojnost	Abundance (animals) / brojnost	Bucks (animals) / srnjaci (grla)	Does and fawns (animals) / srne i lanad (grla)	Stock value – bucks (€) / vrijednost fonda – srnjaka (€)	Stock value – does and fawns (€) / vrijednost fonda – ženke i lanad
1.	Belgrade / Beogradsko	442.220,93	9.550	8.912	3.388	5.524	677.600	368.267
2.	Western / Zapadno	1.188.869,39	17.870	15.926	5.923	10.003	1.184.600	666.867
3.	Central / Središnje	1.362.951,99	22.208	24.532	9.258	15.274	1.851.600	1.018.267
4.	Eastern / Istočno	1.046.462,97	21.440	21.554	8.121	13.433	1.624.200	895.533
5.	Southern / Južno	1.551.366,01	17.872	15.831	5.840	9.991	1.168.000	666.067
	Total / Ukupno	5.591.871	88.940	86.755	32.530	54.225	6.506.000	3.615.000

Table 4: Number and value of culled roe deer in hunting year 2017/2018

Tablica 4: Brojnost i vrijednost odstreljene srneće divljači u 2017/2018.

N° / red. br.	Hunting districts / Lovna područja	Fawns/Lanad		Does/Srne		Bucks/Srnjaci		Total/Ukupno	
		Animals / Grla	Value (€) / Vrijednost (€)	Animals / Grla	Value (€) / Vrijednost (€)	Animals / Grla	Value (€) / Vrijednost (€)	Animals / Grla	Value (€) / Vrijednost (€)
1	Belgrade / Beogradsko	43	645	102	3.060	102	20.161	247	23.866
2	Western / Zapadno	177	2.655	422	12.660	422	83.257	1.020	98.572
3	Central / Središnje	344	5.160	820	24.600	820	162.025	1.985	191.785
4	Eastern / Istočno	258	3.870	616	18.480	616	121.702	1.491	144.052
5	Southern / Južno	45	675	107	3.210	107	21.059	258	24.944

**Graph 1:** Percentage of realized roe deer culling and relative income in hunting year 2017/2018 according to hunting districts

Grafikon 1: Postotak ostvarenog odstrela srneće divljači i relativnog prihoda u lovnog godini 2017/2018. po lovnim područjima

(Popović and Popović, 2021; Popović et al., 2020; Popović and Bogdanović, 2004). It can be made a correlation between the value of the trophy and the age that the animal had from which it was harvested (Lazăr et al., 2014). The Central Hunting districts has the greatest value because of the participation of roebucks with a trophy weight over 450 and 500 g.

Culling realization expressed in percentage terms can be seen in Graph 1 and it shows that the culling target was not met in hunting year 2017/2018 and that there is a huge space for meeting the planned culling target. The highest percentage of utilization is in the Eastern hunting district about 67%, followed by the Central 58%, Western 53%, Belgrade 44% and the Southern hunting districts 31%.

It was determined that the highest total income from roe deer culling in 2017/2018 was at the Central Hunting district 191.785 €, while the Belgrade Hunting district had the lowest income of 23.866 € (Table 4). The major difference

in income between hunting district is explained by the lower culling plan realization.

In order to get a more realistic picture of the income from culling in the observed hunting grounds, the income per 100 ha of total hunting area was observed (Chart 1). The total income per 100 ha on the entire hunting area of 5.595.090 ha is 9 euros. It should be noticed, the very small income of only 2 euros per 100ha from the Southern Hunting ground, considering that it has one of the largest hunting areas around 1.361.250 ha, this can only be explained by the low percentage of realized culling which shown in Graph 1.

Members of the hunting association perform 70 % of game culling, while tourist hunters perform 30 %. When calculating the value of the culling, the price of the individual was determined according to the market price list, where a discount of 30% is provided for the members of the hunting association. Since the roe deer trophy value is calcula-

Table 5: Number and value of roe deer and venison culled in hunting year 2017/2018, from members of the hunting association and tourist hunters according to the market price list

Tablica 5: Brojnost i vrijednost odstrela srneće divljači i mesa u lovnoj godini 2017/2018. od članova lovačkih udruga i lovaca turista po tržišnom cjeniku

Parameter / Parametar	Members of the hunting association / članovi lovačkih udruga		Tourist hunters / Lovci turisti		Total / Ukupno
	Number of culled individuals / br.odstreljenih grla	Value (€) / Vrijednost (€)	Number of culled individuals / br.odstrijeljenih grla	Value (€) / Vrijednost (€)	
trophy/do 200	250	3.755	107	5.363	9.118
200,0–249,0 g.	223	6.694	96	9.560	16.254
250,0–299,0 g.	341	15.341	146	21.911	37.252
300,0–349,0 g.	293	17.555	125	25.073	42.628
350,0–399,0 g.	198	14.835	85	21.789	36.624
400,0–449,0 g.	99	14.825	42	21.173	35.998
450,0–499,0 g.	24	5.800	10	8.283	14.083
500,0–549,0 g.	19	6.928	8	9.895	16.823
Total trophy/ukupno:	1.447	85.733	620	122.447	208.180
Venison value roebucks / vrednost mesa srnjaci	2.067	83.011	–	–	83.011
Venison value does / Vrednost mesa srne	2.067	71.312	–	–	71.312
Venison value fawns / Vrednost mesa lanad	867	21.848	–	–	21.848

ted according to its weight, the highest income is generated from the highest weight trophies.

The weight of the trophy increases with the age of the individual and reaches its culmination in the seventh year. Individuals aged six and seven have the highest quality antlers, and that is when they are deemed to be culled (Popović et al., 2020; Urošević et al. 2018). Trophy hunting is thought to be the reason for the reduction in length and thickness of trophies as well as body size in several Bovidae species. This is indicated by the analyzes of the shooting of trophy bucks, which were followed in three categories of hunters: local, regional, or national, depending on the origin and access to the hunting permits (Garcia-Ferrer et al., 2019). It is showed that foreign trophy stalkers select for larger antlers when hunting roe deer (*Capreolus capreolus*) than local hunters, but that close to half of the difference in selectivity was due to foreigners hunting earlier in the season and in locations with larger males. The relationship between antler size and age was nevertheless fairly similar based on whether deer was shot by foreign or local hunters (Mysterud et al., 2006). Looking at Table 5, it can be noticed that the largest number of culled roebuck trophy weigh between 200 – 349 g. The value of roe deer culled by association member hunters and tourist hunters is 85.733 € and 122.447 €, respectively. While the total value is 208.180 €. Also, the value of venison was calculated for members of the hunting association, amounting to 83.011 € from roebucks, 71.312 € from does and 867 € from fawns.

In order to increase the economical basis of hunting associations, it is necessary to increase hunting tourism especially in district with relative low realization of hunting bag. Hunting tourism, as a very specific branch of tourism, is a very significant source of income (Beuković et al. 2004),

according to the data in our research it is obviously hunting tourism is still underutilized.

Some small localities in the interior of the larger roe deer breeding habitat yield higher quality trophies compared to other localities. The habitat factors of these smaller localities have a more important role than age when it comes to the increase in trophy value (Degmečić et al., 2010). However, it is stated that the correlation between the age of the bucks and the mass of the trophy is 0,67. The coefficient of determination that explains the proportional share of the total variability of the trophy mass caused by the age of the bucks is 45.09% (Popović and Bogdanović, 2003).

According to the research the value of the roe deer breeding stock in Serbia is around 8 million euros, and the value of the annual culling is over 400.000 €. Significant improvement of economic results can be done by improving the way of game population management, from one side and raise hunting tourism. This is indicated by the research of the roe deer's breeding stock in Serbia during the 2003/2004 hunting business year (Tomić et al. 2005).

CONCLUSION ZAKLJUČAK

Roe deer is the most important and most widespread large game in all hunting grounds of the territory of the Republic of Serbia. Estimated value of the roe deer breeding stock in 2021/2022 is 10.121.100 €, while the return of roe deer culling in 2017/2018 amounts to 480.626 €. In the structure of culled individuals, the largest share is occupied by roebucks 84.47%, followed by does 12.83 % and fawns 2.69 %. The Central Hunting ground has the highest total income from roe deer culling 191.785€. The determined income

per 100ha of hunting ground for the area of Central Serbia is 9 €. The Southern hunting district has one of the largest hunting areas of about 1,361,250ha, however, it has the lowest culling value of 2 €, which hinders the progress at the level of Central Serbia due to low percentage realized culling of 31 %. The value of roe deer culled by hunters, members of the association is 85.733 € and tourist hunters 122.447 €.

In order to achieve higher returns from roe deer management in all areas, it is necessary that the planned culling is fully realized. In addition to fulfilling the culling plan, a significant improvement in economic results can be achieved by reaching the optimal number of game at the hunting grounds, reducing losses and realizing a higher percentage of roe deer culling in hunting tourism.

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SAŽETAK

Istraživanjem je obuhvaćen fond srneće divljači, u lovištima središnje Srbije. Cilj rada je analiziranje ukupnog matičnog fonda u 2021/2022. godini, procijena vrijedosti fonda ove vrste divljači, vrijednost odstrela i prihoda na 100 hektara ukupne površine lovišta u svim lovnim područjima središnje Srbije. Na osnovi analize razmotrit će se smjernice i mogućnosti za uvećanje prihoda u svim lovnim područjima Srbije. Procjena vrijednosti matičnog fonda srneće divljači utvrđena je prema Pravilniku (Službeni glasnik, br. 18/19), dok je prihod od odstrela srna izračunat je po tržišnom cjeniku koji propisuje Lovački savez Srbije za lovnu 2021/2022. godinu. Utvrđeno je da vrijednost fonda mužjaka koji iznosi 6.506.000 eura, te vrijednosti fonda ženki i podmladka oko 3.615.000 eura. Ukupan prihod odstrijeljene divljači u 2017/2018. iznosi 480.626 eura, dok je prihod na 100 hektara ukupne površine svih lovnih područja 9 eura. Najveći ukupan prihod ostvaruje Središnje lovno područje i iznosi 191.785 eura. Prihodi po jedinici površine se razlikuju između različitih lovnih područja Srbije i dosta ovisi od intenziteta gospodarenje populacijama srneće divljači. Kako bi se ostvario veći profit od gospodarenja srnom običnom u lovištima središnje Srbije, potrebno je u potpunosti ostvariti planirani odstrel s povećanim učešćem srndaća veće trofejne mase.

KLJUČNE REČI: srna, odstrel, ekonomski aspekti, prihod, Srbija.