

**Marija POPOVIĆ*¹, Zoran POPOVIĆ¹,
Bojan DIMITRIJEVIĆ¹, Vukan LAVADINOVIĆ^{1,2}**

MANAGEMENT AND INCOME OF THE ECONOMICALLY MOST IMPORTANT GAME SPECIES OF SERBIA

SUMMARY

The most important hunting game species found in majority of established hunting grounds in the Republic of Serbia are roe deer, wild boar and hare. The objective of this paper is to determine abundance, shooting rate and income generated by managing mentioned game populations in Serbia. On the basis of data of the Republican Bureau of Statistics of Serbia the records on abundance and shooting rate in game species in the 2011-2021 period were collected. The value of shot animals has been determined both on the basis of market pricelist of the Hunting Association of Serbia for the 2021/22 hunting year and according to the structure of animals shot per certain game categories obtained in previous research.

Shooting rate realized in relation to overall roe deer abundance in 2021 was 7.90% with the shooting value reaching 1,106,724 euros. Wild boar abundance index recorded population growth of even 33.53% in 2021 and percentage of population utilization accounted for 63.83% while value of shooting reached 834,509 euros being three times higher than the income of shooting established in 2011. Hare population abundance has recorded a drastic fall and this decreasing trend has been reflected also in a reduced shooting rate thus in 2021 the value of shooting rate of hare was 676,625 euros. The results of the analysis of abundance, shooting rate and trends regarding their values make a basis for indicating a direction of improvement and the measures to enhance the management of these game species populations.

Keywords: roe deer, wild boar, hare, abundance, shooting rate, income

INTRODUCTION

Establishing the abundance of game population is very important for successful management of game population. Determining the number of wild

¹Marija Popović (corresponding author: marija.popovic11@gmail.com), Zoran Popović, Bojan Dimitrijević, University of Belgrade, Faculty of Agriculture, Nemanjina 6, Belgrade, Serbia

²Vukan Lavadinović, University of Belgrade, Faculty of Forestry, Kneza Višeslava 1, Belgrade, SERBIA

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game can be either complete if a whole hunting ground is included or partial if it is conducted on a representative sample of hunting ground (Beuković and Popović, 2014). Diversity of habitats and their good quality is essential for the sustainable and effective management of big and small game animals in the hunting grounds (Ozimec *et al.*, 2016). Game population abundance in hunting ground is being determined at the beginning of a hunting year and the counting methods depend on a type of hunting ground and of game species (large or small game). The most significant income from non-wood forest products is fauna of hunting importance (Enescu and Hălălișan, 2017). The most representative game species in hunting grounds of Serbia are roe deer, wild boar and hare. (Enescu and Hălălișan, 2017).

Roe deer (*Capreolus capreolus* L.), which inhabits almost all of Europe, has an increasing ecological and economic importance and is subject to intensive management, and inhabits over 90% of the total hunting area of Serbia (Kopij, 2023, Popović and Gačić, 2006).

One of the four indigenous species of ruminants distinguished by a wide area of distribution on terrains with different habitat conditions on an overall European continent and in Serbia as well is a wild boar (*Sus scrofa* L.), a very adaptable game species (Novković, 2003; Gačić and Danilović, 2009). In several previous years this species recorded a wide territorial and abundance expansion what resulted in an increased volume of damages on field crops. The shooting of wild boar has been used as one of the ways to reduce the volume of these damages and to alleviate the economic consequences thereof but due to the trophy it is nevertheless very attractive to hunters as well (Scillitani *et al.*, 2010; Quirós-Fernández *et al.*, 2017).

The hare (*Lepus europaeus* Pall.) is economically one of the most important species of small game in hunting grounds managed by the Hunting Association of Serbia (Popović *et al.*, 2012) and the most spread and hunted game in Europe.

The objective of this paper is an economic analysis of a hunting management of the most important game species in Serbia (roe deer, wild boar and hare) through studying both the abundance and shooting rate trends in this game species and a total income generated by shooting.

MATERIAL AND METHODS

The research included hunting activity and economically most representative game species managed by a majority of established hunting grounds according to the Law on Game and Hunting (2010) and the Rule Book on the way of establishing hunting grounds and areas (2018) and the Solution on establishing hunting grounds in hunting areas (2020) in Serbia. Out of a large game a roe deer and wild boar were taken for this analysis while of a small game a native hare species was studied. The records on game abundance and shooting rate in the Republic of Serbia are issued every second year and are taken from the Statistical Bulletin – the Forestry of the Republic of Serbia published by the

Republican Bureau of Statistics of Serbia. A period of observation lasted from 2011 to 2021. The values of shot game were estimated according to a market pricelist of the Hunting Association of Serbia for 2021/22 hunting year <https://lss.rs/wp-content/uploads/2022/02/LSS-cenovnik-2021-2022.pdf> and are shown in Table 1.

Table 1: Market prices in euros for 2021/22

Game species	Price (Euro)
	Shot animals
Trophy roebucks – trophy mass (grams)	
Up to 200,0	50,00
from 200,0 to 249,0	100,00
from 250,0 to 299,0	150,00
from 300,0 to 349,0	200,00
from 350,0 to 399,0	250,00
from 400,0 to 449,0	500,00
from 450,0 to 499,0	800,00
from 500,0 to 549,0	1,200,00
Does	30,00
Fawns	15,00
Trophy wild boar – length of trophy (cm)	
Up to 12,9	50,00
From 13 to 14,9	100,00
from 15 to 17,9	150,00
From 18 to 19,9	200,00
from 20 to 21,9	400,00
from 22 to 23,9	700,00
over 24	1,100,00
Sows	30,00
Piglets and gilts	15,00
Hare	25,00

The shooting structure roebucks and does accounted for 41.33% and in fawns for 17.33%. On the basis of a previous research an average trophy value shown in Table 2 was calculated on the basis of the nine hunting grounds in the territory of Serbia (Barajevska river, Jadar, Takovo, Dubrava, Klisura, Kamenica, Majsinske mountains, Resava, Krilaš) where 1,184 roe deer trophies were evaluated (Popović *et al.*, 2023) according to the formula of the International Council for Game and Wildlife Conservation CIC (Beuković and Popović, 2014; Ristić and Todorović, 2009; Trense *et al.*, 1981; Frković, 1989). An average body mass of roebucks was 20.08 kg (Popović *et al.*, 2017) while of does and fawns it was 17.25 kg and 12.60 kg – respectively (Popović, 1998; Popović *et al.*, 2003).

Table 2: Share of trophies of different mass in total shooting rate of roebucks

Trophy mass (grams)	Up to 200,0	from 200,0 to 249,0	from 250,0 to 299,0	from 300,0 to 349,0	from 350,0 to 399,0	from 400,0 to 449,0	from 450,0 to 499,0	from 500,0 to 549,0
Average (%)	17.30	15.42	23.56	20.22	13.67	6.83	1.67	1.33

In total shooting rate the structure of individual categories in wild boar was 20.00% for sows and boars and 60.00% for piglets (Novković, 2003). An average body mass of boars and sows was 73 kg (Gajić, 1976) and of piglets and gilts 30 kg (Novaković, 1994) while the share of trophy is displayed in Table 3.

Table 3: Share of individual categories of wild boar trophies in total shooting rate (%)

Trophy length (cm)	Up to 12,9	from 13,0 to 14,9	from 14,0 to 17,9	from 18,0 to 19,9	from 20,0 to 21,9	from 22,0 to 23,9	over 24,00
Average (%)	30.00	20.00	16.00	14.00	12.00	6.0	2.0

RESULTS AND DISCUSSION

The basis for hunting management is both an accurate estimation of the number of animals and insight into the real conditions that exist in individual game populations (Ćosić *et al.*, 2022). The fluctuations in game number depend on a studied game species. On the basis of the Republican Bureau of Statistics the estimations on population number of the most important game in Serbia (2011-2021) indicate an increasing trend roe deer with the difference in 2021 being 27,489 roe deer and a growing rate of 4.29% compared with 2011. An average shooting rate realized in relation to total number of roe deer ranged between 6.84% and 7.95% (Table 4).

The abundance of wild boar in Serbia shows that the wild boar population is increasing along with the volume of shooting. Number of wild boar in Serbia in 2021 was 23,856 individuals the rate of increase in number of population being 5.95% compared with 2011. The shooting rate in 2021 increased by 25.14% compared to 2011. A utilization percentage of wild boar population in relation to number of wild boar was 63.83% in 2021. The abundance index of wild boar in the last year of research compared to basic 2011 shows the increase in the population by even 33.53%. The results of the other authors also indicate the increasing abundance in wild boar for which one of the reasons could be a discrepancy between a planned and realized shooting (Djan *et al.*, 2013; Lavadinović *et al.*, 2020). The research in the 1980-2000 period showed that the trend of shooting rate in wild boar is parabolic with shooting rate decreasing by 1% annually (Ranković and Popović, 2002).

The number of hare varied in the interval of 430 thousand to 501 thousand in the period from 2011 to 2021 and the abundance index of hare population in the last year of observation, i.e. 2021, recorded the fall in population by about 5% compared with the basic 2011. In addition, there occurred the change in hare shooting rate where a falling trend was noticed along with a negative growth rate of 14.61%. Hare population is decreasing not only in our region but also throughout whole Europe. Many authors suggest that the decrease in hare number is caused by human activities (use of arable land, traffic, hunting), climate (precipitations and temperature) and/or diseases (Popović *et al.*, 2014; Beuković *et al.*, 2013). According to the Law on Game and Hunting (2010) the wild game

can be introduced into a hunting ground only if by their introducing the balance between biological equilibrium and biological diversity has not been disturbed. Introduction of hares into the hunting grounds of Serbia were mostly conducted by catching the hare in Vojvodina hunting grounds and discharging them in the hunting grounds of Central Serbia. However, as their number decreased in the last several years there is no user of hunting ground who will catch and sell hare while hare breeding on farms in Serbia is practically non-existent.

Table 4: Abundance and shooting rate of roe deer, wild boar and hare in the Republic of Serbia

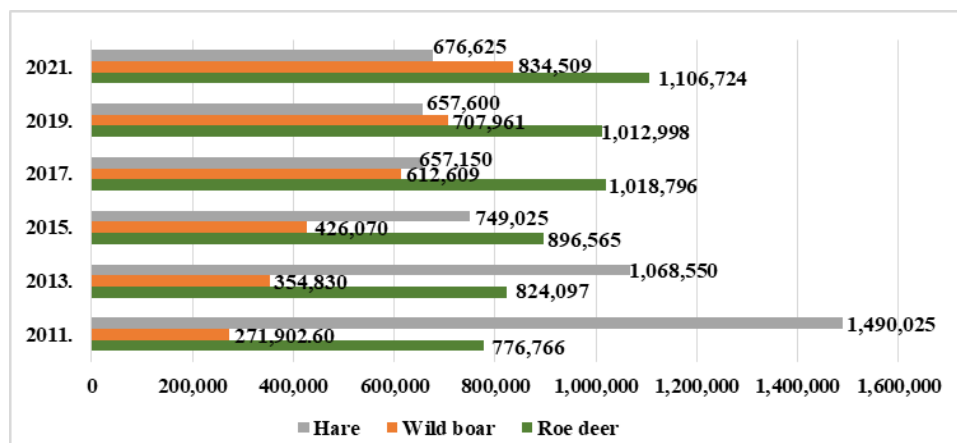
Year	Roe deer				Wild boar				Hare			
	Number state	Shooting rate	% utilisation	Number index	Number state	Shooting rate	% utilisation	Number index	Number state	Shooting rate	% utilisation	Number index
2011.	117.502	8.039	6,84	100,00	17.865	4.962	27,77	100,00	501.456	59.601	11,89	100,00
2013.	120.095	8.529	7,10	102,21	23.163	6.475	27,95	129,66	486.105	42.742	8,79	96,94
2015.	127.853	9.279	7,26	108,81	21.288	7.775	36,52	119,16	454.887	29.961	6,59	90,71
2017.	132.642	10.544	7,95	112,88	23.701	11.179	47,17	132,67	430.690	26.286	6,10	85,89
2019.	141.602	10.484	7,40	120,51	25.309	12.919	51,05	141,67	447.303	26.304	5,88	89,20
2021.	144.991	11.454	7,90	123,39	23.856	15.228	63,83	133,53	478.111	27.065	5,66	95,34

Source: *Statistical Bulletin – the Forestry in the Republic of Serbia, RBS and the author's calculation*

Analyzing the income obtained by shooting roe deer, wild boar and hare in the period from 2011 to 2021 great differences can be noticed (graph 1). The roe deer generated income shows an increasing trend being 1,106,724 euros in 2021 what resulted in higher shooting rate and share of male deer trophies in shooting rate quotas. An early shooting of male deer is forbidden (Urošević *et al.*, 2017) and a research conducted in our country (Urošević *et al.*, 2013) confirmed that male deer were shot before they finished their body development and therefore trophies could not attain their maximum value. Trophy mass increases with the age of an individual and the highest quality antlers were found in the individuals aged six and seven when shooting should actually take place (Popović *et al.*, 2020).

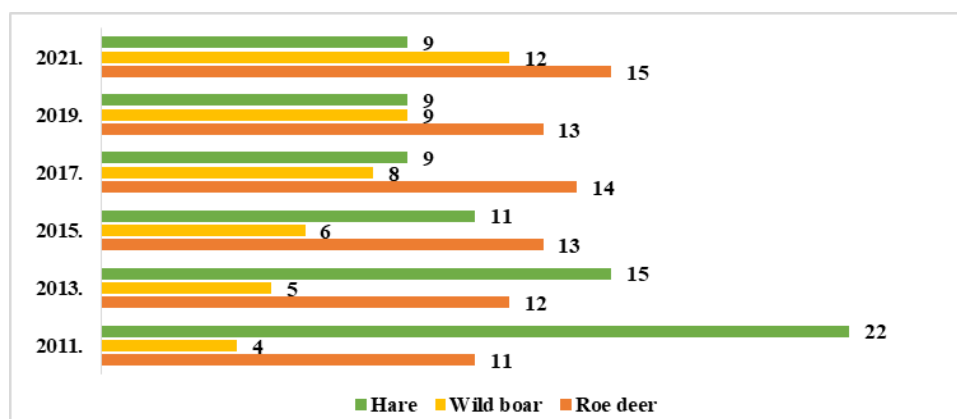
In addition, the income generated by shooting wild boar registered the increase in each studied year and in 2021 the value of shooting was 834,509 euros what was three times higher compared with the profit of shooting determined in 2011.

When it comes to total hare shooting income as an economically the most important species of small game its number in the last years in Serbia decreased considerably what resulted in decreased shooting incomes as well. The shooting value in the observed period decreased from 1,490,025 euros to 676,625 euros what is a decrease of 45.41 %.



Graph 1. Total income of shooting the roe deer, wild boar and hare in the Republic of Serbia in euros in the 2011-2021 period

The income generated on total 100 ha of hunting ground in the Republic of Serbia was observed (graph 2) and in 2021 the realized income for roe deer was 15 euros, for wild boar 12 euros and for hare 9 euros.



Graph 2. The income on 100 ha generated by shooting the roe deer, wild boar and hare in the Republic of Serbia in euros in the 2011-2021 period

The improvement of the economic results of managing the large and small game populations can be accomplished by improving the age

structure of roe deer population, by increasing the share of male deer with trophy mass of over 450 grams, decreasing the losses and increasing the real weight growth in some game species in acceptable biological limits (Popović and Popović, 2021).

CONCLUSIONS

By the analysis of abundance, shooting rate and income in hunting grounds of Serbia in the three most important hunting species (roe deer, wild boar and hare) it was determined that the roe deer is the most distributed species of large game and the most important game of high hunting from the economic aspect followed by wild boar while in hare the trend of decrease of abundance and shooting has been observed entailing a decrease in the shooting value as well. The results of abundance, shooting rate and fluctuations in their values make the basis for indicating the directions of improving the management of populations of these game species. In roe deer and wild boar it seems necessary to increase the percentage of utilization (shooting) of population, to make improvements in age structure, reduce losses and increase a real growth in acceptable biological limits. In hare it is necessary to work on stopping a negative rate of population growth by all the management measures and in the first place to determine a possibility of utilizing the population in a given year on the basis of spring abundance and a population real growth.

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