

## ANALYSIS OF HUNTING FAUNA IN THE LANDS OF HUNTING FARMS OF THE SUMY REGION

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Hunting is one of the forms of use of natural resources aimed at the exploitation, reproduction and preservation of wild animal populations. In Ukraine today there are problems related to the uncontrolled use of hunting resources, intensive economic activity, deterioration of game conditions, poaching and the lack of a sufficient number of qualified specialists. This situation causes a significant decrease in the population of hunting animals compared to European countries. In the developed countries of North America and Europe, hunting is effective, contributes to the creation of new jobs and brings significant income to the country's budget [41].

Hunting is a way of using the resources of the animal world, in which hunting animals are specially hunted, which are in semi-free conditions or are kept in a state of natural will within the boundaries of hunting grounds. This activity satisfies various needs of citizens, such as material and recreational, and is popular among the population of many European countries. Thus, it is important to study the number of hunters in European countries, the use of hunting resources, the peculiarities of hunting and the management of hunting economy (Table 1) [42].

Table 1. Analysis of the number of hunters in European countries (as of 01.01.2021).

Country	Area, thousand km <sup>2</sup>	Number		
		population, million people	hunters	
			persons	%
1	2	3	4	5
Albania	29	3.3	17000	0.5
Austria	84	8.3	118200	1.4
England	244	63.2	800,000	1.3
Belgium	32	10.3	20000	0.2
Belarus	93	9.5	130,000	1.4
Bosnia and Herzegovina	51	4.4	50000	1.1
Bulgaria	111	7.4	95000	1.3
Greece	132	11.3	270,000	2.4

Table 1. Continuation.

1	2	3	4	5
Denmark	43	5.5	165000	3.0
Estonia	45	1.3	15000	1,2
Ireland	70	4.6	350,000	7.6
Iceland	103	0.3	6000	2.0
Spain	505	45	980000	2,2
Italy	301	59	750000	1.3
Cyprus	9	0.8	45000	5,6
Latvia	64	2,3	25000	1.1
Lithuania	65	3,4	25000	0.7
Macedonia	34	2.4	12000	0.5
Moldova	34	3.6	12000	0.3
Netherlands	41	16.4	30500	0.2
Germany	357	81.8	350,000	0.4
Slovenia	20	2.0	22000	1.1
Turkey	783	70.0	300,000	0.4
Hungary	93	10.0	50000	0.5
Ukraine	603	45.4	560000	1,2
Finland	338	5.4	290000	5.3
France	551	65.0	1313000	2.0
Croatia	56	4.3	55000	1.3
Czech Republic	79	10.5	100000	0.9
Switzerland	41	7.6	30000	0.4
Sweden	450	9.3	290000	3.1

France is the leader in the number of registered hunters (more than 1.3 million people). In 1900, the country had 463,000 hunters, in the mid-1950s their number increased to more than 1.5 million, and in 1969 it reached approximately 2 million [8, 13].

In France, *Capreolus capreolus* and *Sus scrofa* are the main objects of hunting among wild animals. Every year in this country hunt more than 450,000 wild animals, of which approximately 50% are roe deer, 45% are wild pigs, and only 4% are *Cervus elaphus*. In one hunting season, the number of deer harvested in France is 15-20 thousand, while the total number of red deer in the forests of Ukraine is about 15 thousand. In addition to hunting for rat animals, hunting for feathered game is popular in the country. At the beginning of the 21st century, more than 6 million pheasants, more than 3 million partridges, about 2 million wild ducks, and more than 1 million grouse were harvested in the hunting grounds.

At the beginning of the 80s of the last century, the number of hunters in Italy was 1.5-2.0 million people, and now their number has decreased to 750 thousand [2, 9]. The area of hunting grounds in Italy is 27 million hectares, and they are home to 70 different species of animals and birds. The country is heavily hunted, including traditional species such as duck and hare, as well as songbirds such as sparrow, lark and finch [6]. In the 70s and 80s of the last century, during autumn and spring

migrations, hunters used traps and caught millions of sparrow-like birds. For example, more than 100 million blackbirds alone were harvested, and they are one of the most important hunting objects, along with hare and pheasant [9, 16]. With a large number of hunters comes the problem of securing hunting rights, which is why hunting tourism is popular among French, Italian and Spanish hunters. Italian, French and Spanish hunters enjoy hunting birds such as *Coturnix coturnix* and *Scolopax rusticola*.

During the ten-year period from 2010 to 2020, the hunting-tourism industry of Ukraine received an income of 3,081 thousand dollars from foreign tourists. During this period, from 2010 to 2016, the average annual profit was 152 thousand dollars. However, from 2017 to 2019, thanks to the hunting of Italian and French hunters, the amount of income increased 4.4 times. In total, over 3,000 foreign hunters were hunted in Ukraine during this ten-year period.

However, this number is much smaller compared to other countries such as Poland and Hungary. For example, at the beginning of the 70s of the 20th century, Hungary annually attracted about 8 thousand foreign hunters, and at the beginning of the 21st century, this number increased to more than 25 thousand.

The first exhibition of hunting trophies, which took place in 1871, is considered a stage in the intensive development of trophy hunting. The obtained trophies, even in the situation of high density of animals, are recognized as one of the best in the world and evidence of a high level of hunting economy based on the latest scientific achievements [3, 5].

The successful development of the trophy business was preceded by intensive game breeding. With the onset of the 21st century, this type of hunting has become increasingly popular among hunters. However, attempts to get the best and biggest trophies can negatively affect the gene pool of wild animals, disrupt the age and sex structure of populations and reduce their reproductive capabilities. Aviary maintenance is one of the solutions for optimizing the structure of natural populations and increasing the productivity of hunting grounds. In addition to ducks, partridges and pheasants, wild pigs, mouflons, deer, bison, etc. are also bred in the enclosures.

The hunting industry in Hungary is not only aimed at attracting foreign hunters for tourism purposes, but is also actively engaged in the export of game. Buyers are sent not only the meat of large and small game, but also live hares, partridges and pheasants. During the 80s of the last century, about 90% of produced game was exported [5]. Since the 1960s, Hungarian hunters have achieved the profitability of their hunting industry [18]. This group managed to ensure a rational and effective management of the hunting industry thanks to the implementation of measures that began in the 60s of the last century. Each hunter was allocated more than 7 thousand hectares of hunting grounds. Most of the hunters were over 60 years old, and several of them had no professional education. The order of the Minister of Agriculture established a requirement for the Hungarian Union of Hunters to form a hunting guard with a maximum age of 45 and the mandatory availability of special education [18].

Thanks to the effective organization and observance of ethical standards of hunting, the population of game in the hunting grounds has increased significantly. To ensure the ration of animals, with the exception of wild boar, hunters used

exclusively methods of approach or approach. Each hunter was accompanied by a hunter, who at the same time provided transportation. The hunter was allowed to shoot only with the permission of the hunter. For a missed shot or injury to an animal, the hunter was subject to a fine [3]. In general, compared to the 1960s, the number of hunters in Hungary increased 2.6 times and reached 50,000 people at the beginning of the 21st century.

In addition to Italy, a significant number of hunting enthusiasts can be found in Spain (980,000) and Great Britain (800,000). England, which is the most economically developed country in Europe, is marked by a high use of land for hunting - approximately 70% of it is agricultural, and forest land accounts for more than 10%. Despite the exploitation of the territory by economic activity, the number of hunters in this country is increasing. In the middle of the 20th century, their number was 500,000, and by 2000, more than 600,000 were registered. Of the six species of wild animals in hunting grounds, roe deer is the most common. Their number is more than 1 million heads, which is about 49% of the total number. The second place in terms of number is occupied by red deer (more than 35%), followed by *Cervus dama* with approximately 10%. The remaining species include the *Cervus nippon*, *Muntiacus reevesi*, *Hydropotes inermis* and the *Elaphurus davidianus*. Roe deer thus accounts for over 50% of the game taken by English hunters, while red deer accounts for over 30% of the total game hunted.

In the UK, approximately 12% of hunters choose to hunt red deer, but there is a significant number of those who wish to harvest this species. In addition to red deer, hunters also pay attention to three species of hare-like animals in the hunting grounds of Great Britain: wild rabbit (*Oryctolagus cuniculus*), gray hair (*Lepus europaeus*) and white hare (*Lepus timidus*). The number of gray hares in the country is twice as high as the number of white hares. In general, the number of shares is more than 1.2 million, and the population of wild rabbits exceeds them by three times. Wild rabbit hunting is allowed throughout the year. As for game birds, hunters usually hunt pigeons, partridges and wild game. Hunting for game birds is allowed only in summer and only for one species at a time. In the 1970s, English hunters hunted pigeons, and in the 1980s their annual catch was more than 10 million pigeons. Hunting for partridges (*Perdix perdix*, *Lagopus lagopus scoticus*, *Lagopus mutus*), pheasants (*Phasianus colchicus*) and hunting for foxes (*Vulpes vulpes*) is popular in the country [11].

In the countries of Northern Europe, in particular in Finland, Sweden and Norway, there are traditionally a large number of hunters. A constant number of hunters has been observed for quite a long time. Thus, in the second half of the 20th century, the number of hunters in Norway ranged from 100 to 150 thousand people, and today this number is about 190 thousand. Approximately 7% of men over the age of 16 in the country are engaged in hunting. In general, about 82% of hunters hunt white partridge, 29% - moose (*Alces alces*), 11% - red deer, 10% - roe deer, and 5% - reindeer. It is important to note that the red deer is a rare species in Norway, it is common only in the western part of the country, where the winter is mild and the vegetation provides a better forage base.

Red deer are usually hunted using the herd method, but in rough terrain such as mountains, gorges and others, hunting is not always effective. The use of licenses for hunting these animals does not exceed 40% [14]. Norwegian hunters consider red deer trophies the most valuable. According to literature data, it was established that in 1964, 7 thousand moose, 7 thousand reindeer and 1 thousand red deer were harvested within the country's hunting grounds. After 50 years, the volume of moose hunting increased 5 times, roe deer - 8 times, red deer - 20 times. Reindeer harvesting amounted to about 9,000 heads.

In the second half of the 20th century, the number of wild animals in Norway and other Scandinavian countries increased significantly. Hunters from Scandinavia believed that this increase was the result of a favorable climate, the availability of greater food resources and the absence of natural enemies. Winters in Norway have become warmer, with less snow and milder temperatures. These favorable conditions allowed deer to settle in the northern territories. Logging has led to an increase in the diversity of pastures and food supplies. One of the key factors in the increase in numbers, according to the conclusions of Swedish hunting experts, was the ban on grazing livestock in forest biotopes. Farmers were convinced that keeping large cattle on closed pastures will help increase milk and meat production.

In Sweden, similarly to Norway, moose is one of the main objects of hunting. In order to increase the number of moose in the Scandinavian countries, regulation of the population structure was introduced and various norms for hunting these animals were established. In Sweden, the increase in the moose population began at the beginning of the 20th century. In 1977, their number was half of this figure, and in 1979 it reached 116,000. The prevalence of males that were the object of hunting ranged from 51% to 69%. In 1981, 162,000 animals were sport caught, of which about 54,000 were males, 37,000 were females, and 61,000 were young. At the beginning of 1982, the total number of moose was 300,000, and by 1983 this figure had increased to approximately 450,000. The population density of moose animals in biotopes ranged from 26 to 40 individuals per 1,000 ha.

However, selective hunting has reduced the productivity of the salmon population by increasing the percentage of old females and reducing the average weight of males by 25 kg. Accordingly, a decision was made to conduct a uniform hunt for all age and sex groups of moose. For example, in autumn, they decided to hunt 20% of calves, 20% of individuals aged 1.5 years, 20% of individuals aged 2.5 years and 20% of elderly individuals, with the same number of males and females [4].

According to the mentioned statistics, the optimal number of moose in natural places in Sweden is about 250 thousand individuals. Currently, Swedish hunters conduct more than 100,000 moose hunts. In Sweden, this form of sport is popular among more than 200,000 people who practice it. In total, the number of hunters in Sweden is 290–310 thousand people. In addition, there is an increase in the number of hunters in Finland. In the 50s of the last century, 100,000 to 120,000 hunters were registered there, in the 60s, about 170,000 people, and in the 70s, more than 220,000 people [1, 12, 19, 20]. At the beginning of the 21st century, their number was 290,000.

In Finland, about 200,000 hunting enthusiasts try to take part in hunting at least once during the season. Of this number, more than 30% of hunters remain without prey. About half of hunters are successful in their hunts.

Forest areas cover more than 60% of the country's total area, while agricultural land accounts for only 8%. Moose is the most common game, approximately 38,000 moose are hunted annually. In addition, white-tailed deer and roe deer are hunted, with an annual hunting volume of more than 12,000 deer and more than 90,000 roe deer.

Deer, wild boars and mouflons also participate in hunting, but their numbers are much smaller. The introduction of white-tailed deer in Finland was important. In 1938, emigrants from the USA brought them to the country. During the years of increase in their number, the amount of hunting also increased. During the 1984–1985 season, more than 6,400 white-tailed deer were harvested, including 30% males, 24.8% females, and 45.2% young.

Unlike the Scandinavian countries, in Germany, Austria, Switzerland and other Central European countries, the main object of hunting is roe deer. During the five-year period from 1996 to 2000, about 5.2 million heads of this species were harvested in the hunting grounds of Germany, over 1.0 million heads in Austria. Roe deer hunting statistics in Switzerland at the beginning of the 21st century ranged from 40 to 45 thousand heads every year. In addition to roe deer, red deer, wild boar, and sable (*Rupicapra rupicapra*) are also hunted in these countries. In Germany and Austria, in addition to the previously mentioned species, mouflon and fallow deer are also hunted. Wild pigs are hunted in large numbers in Germany. At the end of the last century, wild boar hunting ranged from 250 to 450,000 heads, and modern hunting is in the range of 450 to 650,000 heads. In other words, such a number of wild pigs are hunted annually in Germany that corresponds to the total number of wild boars in Ukraine.

In the 1990s, the average annual deer harvest in Germany exceeded 50,000 heads; in modern times, this figure is more than 65,000 heads. In Austria, red deer is the second most common prey, with an annual harvest of 35,000 to 45,000 heads. German hunters take doe in roughly the same amount. Mouflon and skelnitsa, in turn, are common mainly in mountainous areas.

In Germany, mass hunting of wild animals is small. The annual catch, using mouflon and sable as an example, is approximately 5.5 thousand heads and 4.5 thousand heads, respectively. In comparison with the German indicator, the catch of glassfish in Austria exceeds it by 5 times, and in Switzerland by 3 times. One of the factors that explains the significant amount of hunting of wild animals in the countries of Central Europe is the absence of poaching. In addition to the mouflon and mountain goat populations, other species such as bears and birds are also actively hunted in Europe. For example, in Austria, the gray hair catch is about 200,000 heads, while in Germany this indicator is lower - 2–2.5 times less. In the case of wild rabbits in Germany, the catch fluctuates widely, but remains significant (from 200 to 450 thousand individuals).

During the 20th century, the number of hunters increased in almost all European countries. For example, in Denmark, the number of hunters in 1922 was 60,000, in 1961 - 110,000, in 1976 - 155,000, which was 8% of the country's male population.

At the beginning of the 21st century, compared to the 1970s, the population increased slightly and reached 165,000 people. Belgium (350 people per 1 km<sup>2</sup>) and Holland (400 people per 1 km<sup>2</sup>) have the highest population density in Europe. In Belgium, the area of hunting grounds is 2.8 million hectares, of which 620 thousand hectares are forest lands. In Holland, forests cover only more than 7% of the country's territory (Table 2).

Wild boar and roe deer are most commonly hunted in Poland's hunting grounds. Approximately more than 50% of hunted ungulates are wild boar, about 40% - roe deer, 10% - red deer, and less than 1% - fallow deer and mouflon [22]. The total area of hunting grounds in Poland is about 28.8 million hectares, with agricultural land covering 68% of the country's territory (28% is forest land). The lands of this country have favorable conditions for the existence of the gray hare.

Table 2. Area of forests and forest cover in European countries.

Country	Area, thousand ha			Woodland, %
	general	forests	forests per 1 person	
Finland	33814	21883	4.1	64.7
Sweden	44996	27264	3.0	60.6
Italy	30134	9857	0.2	32.7
Germany	35702	10740	0.1	30.1
Poland	31269	8942	0.2	28.6
France	55169	15156	0.2	27.5
Spain	50596	13509	0.3	26.7
Norway	38515	8710	1.9	22.6
Ukraine	60350	9400	0.2	15.6

In the 1960s, the number of hares was more than 3 million. Since the beginning of the 70s of the 20th century, a decrease in their population was recorded in the country. Annual hare hunting is 15-20 thousand heads, which is 7.8 times less than fox hunting. One of the main reasons for this decrease in the number of hares is the use of oral vaccination against predatory diseases [26]. Foxes had a significant impact not only on the population of field game, such as hares, gray partridge and pheasant, but also on the number of young roe deer [25, 27].

According to the research of Polish scientists, the decrease in the number of hares in Poland has several reasons, in addition to predators such as foxes, stray dogs and cats. One of these reasons is the use of mineral fertilizers and chemical plant protection agents, which negatively affect the environment, including the life of hares. Also, the death of hares can occur during agricultural work, such as plowing and harvesting. These actions often destroy the natural habitats of hares and lead to their death or forced migration. Another reason for the decline in the number of hares is the spread of diseases such as coccidiosis and brucellosis, which can cause great losses in the hare population.

In addition to hares, Polish hunters hunt pheasants and gray partridges. However, the number of pheasants collected (90–100 thousand) in Poland is 2–3 times

less than in neighboring Germany, while gray partridge is collected three times more than in German lands. There are significantly fewer hunters in Poland, five times less compared to Ukraine, which may explain the difference in game collection. Nevertheless, the total number of hunters in Poland, as well as in other European countries, has increased compared to the last century. At the end of the 70s of the 20th century, the number of hunters in Poland amounted to 40,000 people, and at the beginning of the 21st century, it increased by 2.7 times and reached more than 100,000 people.

A list of the main types of hunting animals and their occurrence in European countries with the highest level of hunting development is given in Table 3 and Appendix B.

Table 3. List of the main types of hunting animals and their occurrence in European countries.

Hunting animals	Country							
	Finland	Sweden	Italy	Germany	Poland	France	Spain	Norway
<i>Alces alces</i>	*	*		*	*			*
<i>Cervus elaphus</i>		*	*			*	*	*
<i>Cervus nippon</i>			*				*	
<i>Rangifer tarandus</i>	*	*						*
<i>Elaphurus davidianus</i>			*				*	
<i>Hydropotes inermis</i>			*				*	
<i>Odocoileus virginianus</i>	*	*						
<i>Capreolus capreolus</i>	*	*	*	*	*	*	*	*
<i>Dama dama mesopotamica</i>					*	*		
<i>Ovis orientalis gmelini</i>					*	*		
<i>Muntiacus reevesi</i>			*				*	
<i>Rupicapra rupicapra</i>					*	*		
<i>Sus scrofa</i>				*	*		*	
<i>Vulpes vulpes</i>	*	*	*	*	*	*	*	*
<i>Oryctolagus cuniculus</i>	*	*	*	*	*	*	*	*
<i>Lepus europaeus</i>	*	*		*	*			*
<i>Lepus timidus</i>	*	*						*

In Ukraine, only 12% of the territory is covered by forest land, while agricultural land occupies 65%. The population density is 128 people per 1 km<sup>2</sup>. Compared to other European countries, Ukraine ranks eighth in the area of forests. The total area of the forest fund in Ukraine is more than 10 million hectares, of which 9.4 million hectares are covered with forest vegetation. However, the forested area of the country is 15.6%, which is the lowest indicator among the countries of the continent. In neighboring countries, forest coverage is much higher: in Romania - 29%, Slovakia - 40.8%, Poland - 28.6%, Belarus - 42%.



About 560,000 hunters are registered in Ukraine, which is 1.2% of the total population. Approximately 280,000 people hunt every year. During the hunting season in 2021–2012, approximately 13,000 animals were taken, which is 5.3% of the total population. In the period from 2013 to 2022, 166,400 ratnik heads were harvested in the country's hunting grounds. The average annual harvest was only  $3.80 \pm 0.26\%$  of the total population, which indicates the insignificant productivity of the hunting grounds. The large number of hunters who cannot hunt ungulates forces some of them to resort to illegal hunting. Breeding of hunting animals in enclosures is one of the ways to increase the productivity of hunting grounds and the profitability of the hunting industry. This can provide an opportunity to hunt in large enclosures with a guaranteed harvest for those hunters who do not have access to game licenses or private lands.

Compared to Ukraine, in the neighboring countries of Europe, such as Poland, Slovakia and Belarus, the detection and extraction of ratites is much greater. For example, 350,000 to 400,000 ratnik heads are harvested annually in Poland.

So, in the 21st century, the number of hunters in Europe is significant. After taking into account small countries such as Liechtenstein, Luxembourg, Andorra and others, the total number reaches more than 8 million people. In European countries, the population of hunting animals significantly exceeds the population in Ukraine. In the hunting grounds of European countries, such as Germany, France, Poland, Sweden, Austria and others, the extraction of ungulates is higher than in Ukraine.

Successful hunting in European countries is due to the observance of hunting ethics, the breeding of hunting animals and birds in enclosures, the control of the number of predators and the absence of unsafe hunting for commercial game. Scientific data-driven population management of hunting animals, the development of hunting tourism and other factors also contribute to successful hunting in Europe.

### **Research materials and methods.**

*The purpose of research-* statistical analysis of the dynamics of the number of ungulate hunting animals depending on the anthropogenic load in the conditions of the North-Eastern Forest-Steppe of Ukraine (Sumy).

*Object of study* - the number of ungulate hunting animals, in particular, *Bison bonasus* L., *Alces alces* L., *Cervus elaphus* L., *Cervus nippon* n. Temminsk, *Capreolus capreolus* L., *Sus scrofa* L..

*Research methods-* comparative analysis and mathematical statistics. Materials of statistical reporting and records of the State Statistics Committee, the State Agency of Forest Resources of Ukraine, the Sumy Regional Department of Forestry and Hunting, literary sources, and the results of own research were used for the analysis. Statistical analysis of research results was carried out with the help of variance analysis using Statistica–8.0 computer programs (Ermantraut et al., 2007; Carenko et al., 2000).

### **Results. Analysis of hunting grounds of the Sumy region.**

The hunting grounds of the region are uneven, there are more productive ones, such as forest ones, and there are less productive ones - these are fields and wetlands.

According to the data of the Sumy Regional Department of Forestry and Hunting, the area of hunting grounds provided for use by state enterprises of

SOULMG is 237.8 thousand hectares, which is about 12% of the hunting grounds of the region [50].

11 state forestry enterprises and one state hunting enterprise are engaged in hunting. About 70 specialists are involved in the field of hunting management at management enterprises, of which 13 are state hunting experts. The total costs of running a hunting farm almost double the income from hunting and farming activities.

The state of protection of hunting grounds from poaching is the main restraining factor in the development of the hunting industry. The number of the main species of hunting animals in the hunting grounds of farms has been stable in recent years. In 2021, the number of the main species of hunting animals did not undergo significant changes compared to 2020. The dynamics of the number of the main species of hunting animals (individuals) is shown in the table. 4.

Table 4. Dynamics of the number of the main species of hunting animals (individuals).

Kind of animals	2019 year	2020 is the year	2021 year
Bison bonasus	52	54	64
Alces alces	239	223	228
Cervus elaphus	794	779	777
Cervus nippon	197	203	205
Capreolus capreolus	6117	6296	6333
Sus scrofa	626	965	1233

Hunting was carried out with licenses for ungulates (red deer, spotted deer, roe deer, wild boar) within the approved hunting limit and with shooting cards for fur animals. Of the 58 issued licenses for red deer, 33 were obtained, 1 licenses were not used. 6 were issued for spotted deer, 4 were obtained, 2 were not used. 158 were issued for wild boar, 99 were obtained, 5 were not used. 425 were issued for roe deer, mined - 397, not used - 12. Unfavorable weather conditions, lack of demand for catching animals became the main reasons for not using the limits. In 2021, 399 cases of poaching were detected [35].

In January-December 2021, the State Environmental Inspection in the Sumy Region conducted 39 inspections of compliance with the requirements of environmental legislation regarding hunting and hunting.

A total of 112 protocols on administrative offenses were drawn up, of which 95 were related to poaching. 126 people were brought to administrative responsibility (including one warning) for a total amount of fines of 52,568 thousand hryvnias, of which 42,198 thousand hryvnias were collected (poaching - 109 people were brought to account the amount of 44,098 thousand hryvnias, collected - 37,213 thousand hryvnias).

The total amount of calculated losses was 160 thousand hryvnias (poaching – 32 thousand hryvnias). 2 claims for the amount of UAH 160,000 have been submitted. Materials on 4 facts were handed over to law enforcement agencies, 3 of which have signs of a criminal offense.

### Analysis of hunting theriofauna in the hunting grounds of the Sumy region.

According to the results of the analysis of the dynamics of the population density of ungulate hunting animals in the lands of the Sumy region, a positive trend towards an increase in numbers was revealed over the last two years (2019–2021) (Table 5).

It should be noted that the total number of representatives of the ungulate hunting theriofauna in 2021 was 8,839 individuals, which corresponds to the level of the "depopulation" years. In general, 2021 was the most numerous in the last three years. Populations of almost all hunting ungulates increased, except for European moose and European red deer. Within species, the dynamics of the number of populations during the period 2019–2021 fluctuated.

Table 5. Dynamics of the number of ungulate hunting animals by species in the Sumy region (2019–2021).

Species name	Years		
	2019	2020	2021
<i>Bison bonasus</i>	52	54	64
<i>Alces alces</i>	239	226	228
<i>Cervus elaphus</i>	793	779	777
<i>Cervus nippon</i>	197	203	204
<i>Capreolus capreolus</i>	3117	6296	6333
<i>Sus scrofa</i>	626	965	1233

As can be seen from the data in figure 1, in 2021, 228 individuals of European moose were found on the hunting grounds of the Sumy OULMG. The largest number (35 individuals) was noted in the lands of the Konotopske LGD. This farm is also the leader in the number of red deer (94 individuals).

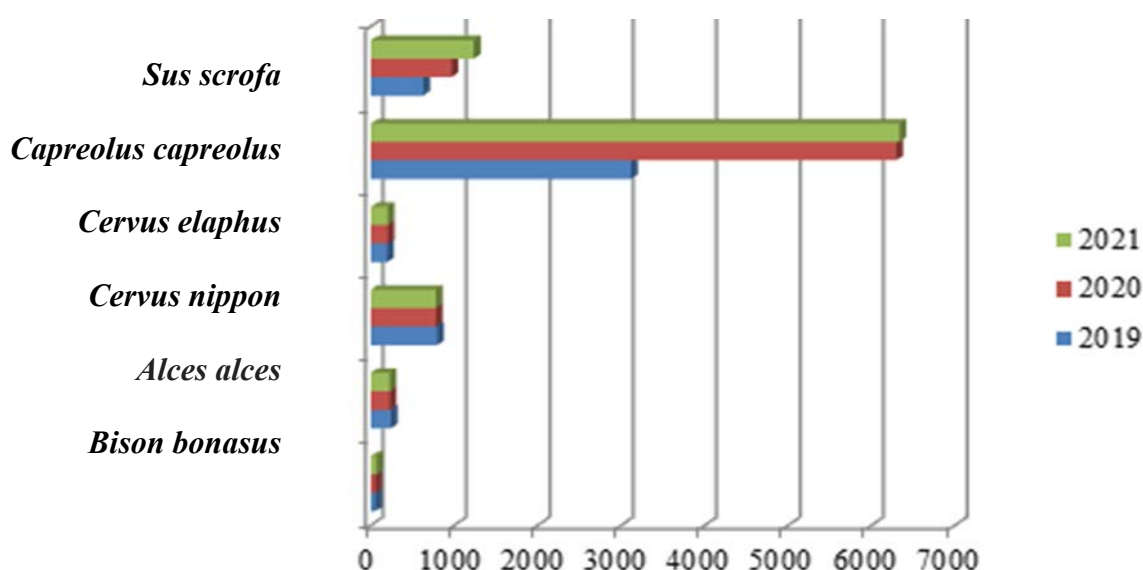


Figure 1. The dynamics of the number of populations of the main hunting species ungulates for 2019–2021.

The analysis of hunting theriofauna of ungulates of the Sumy region showed that the European roe deer population is the most numerous with a positive balance over the last three years. In second place is the wild boar population, which also has progressive dynamics to increase in numbers since 2019.

The European red deer population occupies the third position. The number of individuals has decreased slightly over the past two years, as has the case of the spotted deer.

As for the two red book species of the European moose and the European bison, there is a slight tendency to restore populations with a gradual increase in the number of individuals.

In general, it can be said that the rational organization of hunting management in the hunting grounds of the Sumy region and the growing role of enterprises of other forms of ownership have a positive effect on the development of hunting. However, this indicator is significantly lower than in European countries, which should be taken into account in the priority tasks of the region's forestry management.

#### **Analysis of hunting theriofauna of SMT 'Lebid' LLC.**

One of the tasks of this qualification work was the analysis of hunting fauna in the lands of the Sumy region, in particular, on the example of SMG 'Lebid' LLC.

For this purpose, the data of hunting fauna in the lands of the Department of Ecology, Natural Resources and the Fuel and Energy Complex of the Sumy Regional State Administration were analyzed.

The total area of hunting grounds of SMG 'Lebid' LLC is 59.5 thousand ha. The forest fund in the area of activity of the hunting industry is represented by forest massifs, where the main forest-forming species are Scots pine mixed with oak, linden, maple, birch, aspen and alder.

The accounting was carried out by the method of noise running, counting animals by tracks and from observation towers in feeding places. According to the results of the research, the paths of movement of wild animals and 20 feeding grounds located on the territory of Nyzivskyi, V. Vystoropskyi and Byshkinsky forestry were examined.

According to calculations and on the basis of observation materials, field record materials and an analysis of the number of wild animals in accordance with methodological recommendations, the number of animals for the last 5 years is summarized and shown in the table 6.

Table 6. Dynamics of the number of hunting ungulates LLC SMT Lebyd.

Kind of animals	Years			
	2020	2021	2022	2023
<i>Alces alces</i>	8	8	8	8
<i>Cervus elaphus</i>	415	415	420	430
<i>Cervus nippon</i>	128	130	135	140
<i>Capreolus capreolus</i>	512	510	512	520
<i>Sus scrofa</i>	1315	1310	1313	1325

According to the survey results, the list of ungulate hunting animals includes five species, namely: European moose, red deer, spotted deer, European roe deer, and wild boar. The wild boar population is the most numerous. In recent years, the number of pigs has increased to 1,325 from 1,315 heads. In second place is the European roe deer population. The dynamics of population development shows a positive trend. Thus, the number of livestock has remained stable at 510–520 heads for four years.

The third position belongs to the red deer. The population of this species is growing. In 2020, 415 and 430 individuals were discovered in 2023.

The population of spotted deer as a whole is characterized as progressive, as the herd has increased by 15 individuals in four years. One of the unique species of hunting theriofauna is the European moose. Its population is the smallest and is stable at 8 people.

The group of measures to increase the productivity of hunting grounds and increase the population of hunting animals includes: artificial winter feeding of deer; creation of fodder fields and protective sheds; arrangement of biotechnical equipment; control over the number of predators; fight against poaching; veterinary-sanitary measures; reducing the negative impact of care factors; protection of living conditions of red deer.

#### **Biotechnical measures on the territory of the company's hunting grounds.**

Biotechnical measures are designed to increase the number of hunting fauna, which is achieved by improving the fodder, nesting and protective properties of the land, feeding animals in difficult periods of the year, reducing the number of predators, eliminating or weakening the harmful effects of human activity, as well as releasing animals and birds for acclimatization. The basis for planning biotechnical measures was the evaluation of farm lands and the ratio of the optimal capacity of lands and the actual number of hunting animals in the farm [2].

These measures will make it possible to determine promising species of hunting animals on the territory of the farm and factors restraining the growth of livestock. To improve the fodder and protective properties of hunting grounds, we plant the following tree and shrub species valuable for game: oak, wild apple, pear, willow, hazel, rowan, blackberry, olive and others.

When creating forest crops, it is necessary to introduce nut and fruit species, olives, dogwoods, rose hips, sea buckthorn and others into their composition.

Table 7. Design of biotechnical facilities of SMG Lebid LLC.

Hunting animals	Canopies and feeders for animals	Places for feeding	Solontsi places	Places for watering hole
Deer	1 in 10 deer	-	1 in 10 deer	1 in 10 deer
Elk	-	-	2 out of 10 moose	-
Chamois	1 in 20 roe deer		1 in 20 roe deer	1 in 20 roe deer
Boar	-	1 in 10 boars	1 in 10 boars	1 in 10 boars

Feeding is a targeted improvement of fodder lands for hunting animals. It should be carried out in winter, when it is most difficult to get food for animals. Winter feeding lasts 100 days. Agricultural organizations must be required to strictly comply with established norms and rules for the use of pesticides and mineral fertilizers. All agricultural machines and units intended for work in the fields must be equipped with devices that would prevent injury and death of game [2, 30].

Harvesting of agricultural crops should be carried out in "overclocking" or in expanding strips. It is necessary to prohibit the circular method of harvesting agricultural crops, as the most harmful for game.

Animals are fed mostly with tree branches and mistletoe branches. At the feeding grounds, feed for animals, sheaves of unthreshed oats, clover, brooms from branches. Places for feeding are set up in a thinned clean forest, preferably near a thickened remze area, in order to protect from the wind and create a hiding place for animals. There should be a good entrance to the sites for the delivery of fodder. Feeders, regardless of their shape and design, should scare animals as little as possible and not stand out against the general background of the area.

There are no special facilities for feeding wild boars on the feeding grounds. Food for them is laid out in designated places. Here, wild boars easily find them and extract them even from under the snow. The best fodder is one-year shoots (together with leaves) from the following species: oak, birch, linden, poplar, ash, apple and pear, hazel, willow, rowan. It is better for animals to eat fodder brooms that have been moistened several times with a solution of 5–6% kitchen salt during drying. For winter feeding of moose and roe deer, it is necessary to cut aspen [1, 2].

On the basis of long-term observations, analysis of the activities of hunting farms, recommendations of candidate of biological sciences V.Ya. Kraynev [28], the average for all forest and hunting regions of feed procurement rates per head for a period of 100 days of feeding were calculated and accepted (Table 8).

Table 8. Table of feed procurement for an individual for the season.

Types of fodder	Unit ex.	Types of hunting fauna		
		deer	roe	boar
Forest hay, vetch, Oatmeal	kg	40	10	
Hay (silage)	kg	30	10	40
Bundles of hardwoods	piece	50	20	
Cereal sheaves	piece	50	20	
Grain fodder	kg	20	15	30
Corn on the cob	kg	40	20	80
Root crops	kg	60	30	100
Salt is a lick	kg	5	3	4

The calculation of the necessary amount of fodder is carried out depending on the forest and hunting zoning, the number of wild hunting animals in the lands and the period of the feeding period of wild animals. The timing of the fertilizing period depends on the period of freezing of the upper layer of the soil, the establishment of a significant stable level of snow cover and other factors [30]. Conventionally, the feeding season can be divided into three periods: from November 1 to November 30, the second period: from December 1 to 30, and the third period: from January 1 to February 10 (40 days).

## CONCLUSIONS

**The following conclusions can be made based on the results of the research of the qualification work:**

1. In Ukraine, 12% of the territory is covered by forest land, while agricultural land occupies 65%. The population density is 128 people per 1 km<sup>2</sup>. The total area of the forest fund in Ukraine is more than 10 million hectares, of which 9.4 million hectares are covered with forest vegetation. Forest coverage of the country is 15.6%, which is unsatisfactory.

2. About 560,000 hunters are registered in Ukraine, which is 1.2% of the total population. The average annual hunting of wild game was 3.80±0.26% of the total stock, which indicates the insignificant productivity of hunting grounds.

3. The hunting theriofauna of ungulates in European countries consists of 13 species (elk, red deer, spotted deer, reindeer, David's deer, Chinese water deer, American white-tailed deer, European roe deer, Mesopotamian fallow deer, Armenian mouflon, Chinese muntjac, goat common, wild boar); in Ukraine and the Sumy region - 6 species. The list includes two species included in the Red Book - European moose and European bison, hunting of which is prohibited.

4. The dynamics of populations of hunting ungulates in the Sumy region and their density are in a satisfactory state and have a positive trend towards growth. The number of animals available at the time of the study is insufficient for shooting in order of use, the exception is wild boar, the number of which is higher than optimal for this type of land.

5. The state of biotechnical programs and other adopted and planned measures to increase the number of the main species of hunting fauna in the lands of the SMG Lebid are being carried out at the appropriate level, as evidenced by the results of annual records and the positive dynamics of the growth of indicators.

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