

**DYNAMICS OF UNGULATES ANIMALS UNDER MODERN
ANTOPOGENIC LOAD IN FORESTRY FACILITIES OF SUMY REGION**

Melnyk Andrii, Doctor of Agricultural Sciences, Professor

Tovstukha Alexander, Candidate of Agricultural Sciences, Associate Professor

Melnyk Tetyana, Candidate of Biological Sciences, Professor

Kremenetska Yevhenia, Candidate of Agricultural Sciences, Associate Professor

Trotskaya Svetlana, Candidate of Biological Sciences, teacher

Sumy National Agricultural University, Ukraine

Introduction. Hunting has long been considered the main form of human activity and the main source of its existence. With the development of civilization, the biological significance of hunting for man has been lost. Today, hunting is a traditional type of activity of the population and economic entities, hunting is a type of active recreation and sport, which in general forms an important component of forest use.

Analysis of official statistics on the dynamics of the number of major species of hunting fauna over the past decades shows the spontaneous and inefficient management of hunting in almost all regions of Ukraine. Despite the minimal volumes of extraction of the main hunting animals, the number of their populations remains almost at the same level, and some species even decrease (Muraviov, 2019).

Wild animals in their habitat are constantly under the influence of various factors - abiotic, biotic and anthropogenic, which determine the state of species populations. Such effects directly or indirectly change the number, fertility and mortality, seasonal movements, migration and immigration, morbidity, physical and physiological condition of hunting animals (Sobol, 2021 Panek, 2004).

Anthropogenic pressure on the environment can be traced in the transformation of the main abiotic factors, especially climatic (temperature, light, humidity, radiation regime, pressure), which are the most variable. Increasing the temperature regime and reducing the amount of precipitation contribute to an increase in the frequency of dry winds, heat and sudden changes in temperature during the day (Adamenko, 2006). Temperature in general affects the distribution of some species through the forage base.

Anthropogenic impact is manifested through the intensification of agricultural production (the use of highly toxic chemicals to control unwanted organisms), high plowing of land, reclamation measures, which ultimately led to a decrease in the forage base of ungulates and habitats of other hunting animals. Currently, plowed land in Ukraine is the largest in the world, reaching 56% of the total area, and 80% of agricultural land (Apostol, 2020; FAO).

A. V. Domnich, I. O. Smirnova, D. O. Buglo, V. V. Petrichenko (Domnich, 2010; Smirnova et al., 2011) studied the features of the transformation of natural habitats of hunting fauna. In the forest-steppe zone, similar studies were conducted by Korzh (Korzh & et al., 2006), Katysh (Katysh, 2016).

Human actions in the natural environment, conscious or unconscious, often cause stress in wild animals, which can lead to significant physiological changes in

**Modern Challenges of Agrarian Transformations In Ukraine:
Agriculture, Forestry And Horticulture**

animals. The so-called disturbance factor in hunting grounds arises mainly due to the presence of a significant number of people in them: conducting various forestry and forestry operations, picking berries and mushrooms, tourism and more.

Materials and methods of research. *The purpose of the research* is statistical analysis of the dynamics of the number of ungulates hunting animals depending on the anthropogenic load in the conditions of the north-eastern Forest-Steppe of Ukraine (Sumy region).

The object of research - the number of ungulates, in particular, European bison (*Bison bonasus* L.), European elk (*Alces alces* L.), red deer (noble) (*Cervus elaphus* L.), spotted deer (*Cervus nippon n.* Temminsk), roe deer (European deer) (*Capreolus capreolus* L.), wild boar (*Sus scrofa* L.).

Research methods - comparative analysis and mathematical statistics. The materials of statistical reporting and accounting of the State Statistics Committee, the State Agency of Forest Resources of Ukraine, the Sumy Regional Department of Forestry and Hunting, literature sources, the results of own research were used for the analysis. Statistical analysis of research results was performed using analysis of variance using computer programs Statistica-8.0.

Results. According to statistics for the analyzed period, the total area of hunting grounds in Ukraine is 38,779.9 thousand hectares (table 1).

Table 1 - Area of hunting grounds and number of ungulates by regions of Ukraine (2019)

Region	Area of hunting grounds, thousand hectares		Total number of ungulates in hunting farms, thousand individuals	Density of ungulates hunting animals / thousand ha
	provided for use	covered by hunting regulation		
Ukraine	38779.9	38060.9	221.0	5.8
Poltava	2092,0	2086,0	9.0	4.3
Sumy	2026.4	2021.4	7.7	3.8
Kharkiv	1494,0	1494,0	10.5	7.0
Chernihiv	2768.2	2731.8	13.6	5.0

In Sumy region it is 2053.6 thousand hectares (5.3%) and is divided between 40 users. State enterprises of the Sumy Regional Department of Forestry and Hunting occupy 12% (237.8 thousand hectares), the rest of the area (1571.4 thousand hectares) is divided between 17 branches of district organizations of the Ukrainian Society of Hunters and Fishermen (UHFA) and 10 other users, which transferred 228, 7 thousand hectares of hunting grounds. In total, almost 1,150 legal entities are

**Modern Challenges of Agrarian Transformations In Ukraine:
Agriculture, Forestry And Horticulture**

engaged in hunting. More than 800,000 hunters are registered in Ukraine. The analysis of the density of ungulates in the allotted hunting areas, in Sumy region, is the lowest, both in terms of density of individuals per 1 thousand hectares and the total number in hunting farms.

The dynamics of the number of ungulates in Ukraine during the analyzed period (2010-2022) is shown in Table 2.

Table 2 - Dynamics of the number of hunting animals, the number and percentage of caught in hunting farms of Ukraine

Year	Number of ungulates animals, thousands of individuals	Number of extracted (removed) ungulates, thousand individuals	Percentage of animal removal,%
2010	239.0	12.3	5.1
2011	244.4	13.3	5.4
2012	239.6	12.8	5.3
2013	238.3	12.8	5.4
2014	233.6	13.9	6.0
2015	231.3	18.6	8.0
2016	220.2	14.7	6.7
2017	221.0	13.3	6.0
2018	217.1	13.0	6.0
2019	217.4	13.1	6.0
2020	222.9	13.2	5.9
Duncan test ₀₅	22.5	1.7	

Therefore, we can observe variations in the total number of major species of ungulates over the past ten years from 217.1 (2018) to 244, 4 thousand individuals (2011). The average number of ungulates during this period in Ukraine was 252.48 thousand individuals, and the number of captured - 15.1 thousand individuals. The withdrawal rate was 6.58% and varied over the years from the lowest 5.1% in 2010 to 8.0% in 2015. Withdrawal of animals had significant differences in species and years. Thus, the mass death and increased percentage of wild boar seizures in 2015-2018 led to a significant decrease in the total population in subsequent years compared to 2011. In 2020, began to show an increasing trend of ungulate fauna in hunting farms in Ukraine and Sumy region (Table 3).

**Modern Challenges of Agrarian Transformations In Ukraine:
Agriculture, Forestry And Horticulture**

Table 3 - Number of ungulates and their products (2020), thousand individuals, thousands of individuals in Ukraine

The name of the species of ungulates	Number ungulate hunting animals	Number of ungulates caught
European bison	0.3	0
European moose	6.2	0
European deer	13.7	0.4
Spotted deer	4.3	0.2
European fallow deer	1.3	0.1
European roe deer	167.7	10.4
European mouflon	0.9	0
Wild boar	28.5	2.1
Total	222.9	13.2

In terms of species, among ungulates of Ukraine, the dominant place is occupied by European roe deer (167.7 thousand individuals), which is - 75.2%. The second place in terms of distribution is classically occupied by wild boar (28.5 thousand individuals). The number of red deer and spotted deer is 13.7 and 4.3 thousand individuals. The number of European fallow deer (1.3 thousand individuals) and European mouflon (0.9 thousand individuals) is gradually increasing.

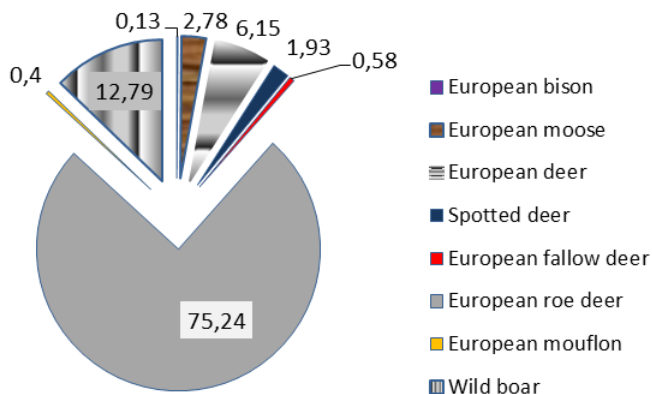
The particular note are the growth rates of the European moose population, which in 2020 numbered 6.2 thousand individuals, and the European bison. This unique species feels good under the protection of the Red Book and the number of livestock is currently over 300 individuals.

The above trends in the number of animals in Ukraine are reflected in the statistics of animal production in 2020. European roe deer (10.4 thousand individuals) were harvested the most, at the level of 78.8% (Fig. 1) and wild boar (2.1 thousand individuals) at the level of 15.9%. The percentage of harvested spotted deer and red deer is 1.5 and 3.0 of the total number of ungulates removed. No European bison, European moose or European mouflon were fished in Ukraine in the period 2020–2021.

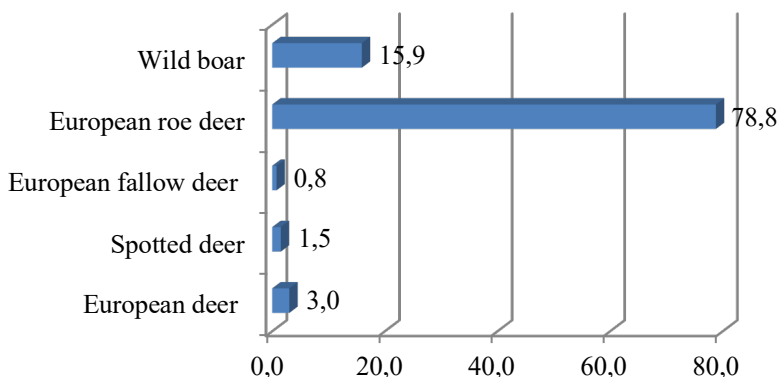
According to the results of the analysis of the dynamics of population density of ungulates in the lands of Sumy region, a positive trend towards increasing the number over the past two years (2020-2021). It should be noted that the total number of ungulate theriofauna in 2021 was 8839 individuals, which corresponds to the level of "depopulation" in 2010 and 2011. In general, the most numerous was in 2013 - 2986 individuals of *Sus scrofa* L. Within the species, the dynamics of population size for the period 2010-2021 fluctuated significantly.

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

As can be seen from the table. 4, in 2021, 228 individuals of the European moose were found on the hunting grounds of Sumy forestry management. The largest number (35 individuals) was observed in the lands of Konotop L H. This farm is also a leader in the number of red deer (94 individuals).



A



B

*Fig. 1. Percentage of species (A) and harvested (B) ungulates, %
(for Ukraine, 2020)*

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

Spotted deer are most common in the hunting grounds of Krasnopilske LH (49 individuals), Konotop LH (5 individuals) and Lebedynske LH. In total, 204 individuals of this species were found in the region, taking into account other users of hunting grounds.

In terms of the number of European roe deer populations, the first place is occupied by the Sumy hunting farm (540 individuals), the second by the Konotop forestry (335 individuals) and the third by the Krolevets forestry (273 individuals). A total of 2,267 European roe deer have been registered in the hunting grounds of the Sumy forestry management.

Positive changes in the recovery of wild boar populations are observed. According to the results of the tax assessment in 2021, the number of species has increased to 1233 individuals in the region, which is 298 individuals higher than in 2020. At the same time, before the mass "depopulation" in 2013, the wild boar population in the hunting grounds of the region was 2986 individuals.

The European bison is a unique representative of the forest natural fauna of Sumy region. This "Red Book" animal is found in the hunting grounds of Konotop forestry. Its population in 2021 was 64 individuals and over the past 10 years has grown by 24 individuals. The average growth was +2.4 individuals with a peak in 2019.

In forestry farms of other forms of subordination and ownership, there is also a steady increase in the population of ungulates. The largest number of ungulates is characterized by the hunting fauna of SMG "Swan" (1158 individuals), LLC CBA "Forests of Sumy" (350 individuals) and LLC "Trostyanets SMG" (313 individuals). Appropriate biotechnical measures, regulated hunting and game breeding are the key to such positive dynamics.

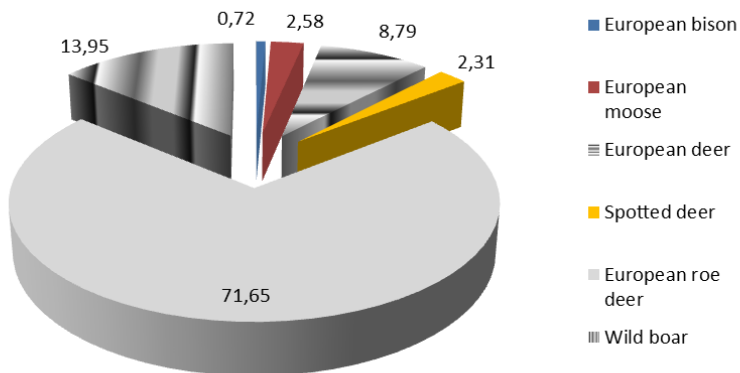


Fig. 2.- Representation of ungulate species in the hunting fauna of Sumy forestry management (2021)

Species structure of the number of ungulates hunting animals of Sumy region is presented in Figure 2. The leader in this group is the European roe deer (71.6%), wild boar

Modern Challenges of Agrarian Transformations In Ukraine: Agriculture, Forestry And Horticulture

is 13.9%, red deer - 8.8%; spotted deer - 2.3%. European moose and European bison, which are banned from hunting, account for 2.6% and 0.7%, respectively.

Discussion. Climate change on the planet, especially rising temperatures, has already affected a number of meteorological characteristics in almost all regions of the globe (Adamenko, 2006). These changes also affected the conditions of the north-eastern part of the Forest-Steppe of Ukraine (Sumy region).

Thus, in comparison with the long-term averages, for the period 1994–2020 there was an increase in the sum of temperatures during the growing season by 198 ° C, a decrease in the amount of precipitation by 26.8 mm. As a result, the SCC changed from 1.18 to 0.95, which indicates the formation of conditions typical of the central and southern regions of the country (southern Kharkiv, Dnipropetrovsk, Zaporizhia and Mykolaiv regions) (Melnyk & et al., 2020).

A number of modern scientists emphasize the need for introduction and adaptation of hunting fauna in these realities of climatic conditions and growing anthropogenic pressure (Volokh, 2015; Katysh, 2016; Kratiuk, 2018). In particular, the problem can be solved by increasing the number of hunting animals.

Conclusions. Given the analysis, current threats to the biodiversity of ungulates have become significant. One of the key factors of influence is anthropogenic impact, which is manifested through significant climate change. According to the results of research it is established that in the conditions of the north-eastern Forest-Steppe of Ukraine (Sumy region) there is a tendency to increase the anthropogenic load on natural lands and as a consequence on the number of ungulates. At the same time, it should be noted the positive dynamics of reproduction of populations of individual members of the hunting fauna, including roe deer and wild boar. The rational organization of Sumy forestry management in hunting and the growing role of enterprises of other forms of ownership play an important role in this. At the same time, the existing indicators remain lower than the European ones, which should be taken into account in the priority tasks of forestry management in the region.

REFERENCES

1. Adamenko, T. (2006). Changes of agro-climatic conditions and their impact on grain farming. *Agronom* , 3, 12–15 (in Ukrainian).
2. Apollonio M., Belkin V., Borkowski J. et al. (2017) Challenges and science-based implications for modern management and conservation of European ungulate populations. *Mammal Research* . Vol. 62, 209–217. (in English).
3. Apostol M. Plowed land in Ukraine is the largest in the world and reached 56% of the state] [Electronic resource]. - Access mode: Agravery.com <https://agravery.com/uk/posts/show/rozoranist-zemel-v-ukraini-e-najbilsou-v-sviti-ta-dosagla-56-teritorii-derzavi-apostol>. (in Ukrainian).
4. Domnich VI (2010) [Population change and anthropogenic pressure on deer and dog animals in Ukraine // zb. scientific-technical. prats: Naukovyi visnyk NLTU Ukrainy. Lviv. Issue 20.5, 8–19. (in Ukrainian).

5. Dziedzic R., Dzieciolowski R. (2010) Dziedzic Roman. Status of game species in Poland and neighboring countries. The status of game species in Poland and neighboring countries] // Międzynarodowa konferencja. The population of wild animals in the border areas (2-3 September 2010, Chelm). - Chelm, 7–23. (in Polish).
6. Katysh SV (2016) // Breeding on the territory of the Forest-Steppe and Steppe zones of Ukraine (on the example of Poltava and Zaporizhia regions) // Biological systems. T. 8. Issue. 1. 2016. S. 219–227. ovoi i Stepovoi zon ukrainy (na prykladi Poltavskoi i Zaporizkoi oblasti) // Bioloichni systemy , T. 8. Vyp. 1, 219–227. (in Ukrainian).
7. Melnyk AV, Romanko Yu.O., Brunov MI, Sorokolit Je.M. Kubrak TM (2020) Growth and development of chickpeas in the northern forest-steppe of Ukraine // Visnyk Sums'kogo NAU . № 2 (40), 38–46. (in Ukrainian).
8. Muraviov, Yu. V. (2019). Game animals resources as a prerequisite for the establishment of ecological and economic development of hunting economy. Scientific Bulletin of UNFU, 29 (4), 86–88. DOI <https://doi.org/10.15421/40290418> (in English).
9. Wyniki monitoringingu zwierzyny drobnej v latach 2002/2003 [Small game monitoring results in the years] // Łowiec Polski. № 4, 11–12. (in Polish).
10. Radisak, J. (2016). A test of traditional diversity measure and taxonomic distinctness indices on benthic diatoms of soda pans in the Carpathian basin. Ecological Indicators. 64, 1–8 [Electronic resource]. - Access mode: <http://dx.doi.org/10.1016/j.ekolind.2015.12.018>. (in English).
11. Smahol VN, Havrys H. H. (2013) Zubr, Bison bonasus (Mammalia Artiodactyla), v Ukrainy: dynamyka chyslennosti, rasprostraneny, statsyy y lymytyruishchye faktory: monohrafiya [Bison bonasus (Mammalia Artiodactyla), stat distribution and limitation), in distribution factors: monograph] Kiev: "Veles", 128 p. (in Ukrainian).
12. Smirnova IO, Buhlo DO, Domnich AV, Petrychenko VV (2011) Population dynamics and analysis of factors influencing the number of predators and ungulates in eastern Ukraine // Visnyk Zaporizhzhya National University . № 1, 61–68. (in Ukrainian).
13. Sobol O. M. (2021) Dynamics of species composition of hunting fauna of Kherson region // Tavrijs'kij visnik. Issue 118, 368–376. (in Ukrainian). DOI <https://doi.org/10.32851/2226-0099.2021.118.47>.
14. Volokh, AM (2015) Mammals Hunted in Steppe Ukraine. Part 2. Green DC, Kherson, 1–401. (In Russian).
15. Jessica Bateman. Jak u Evropu povertajut'sja veliki ssavci [How big scoops return to Europe] BBC Future. [Electronic resource]. - Access mode: <https://www.bbc.com/ukrainian/vert-fut-55847029> .