

O. Slyvka^{1,2}, S. Bublei^{1,3}, I. Delehan^{1,4}, P. Khoyetsky^{1,5}¹ National Forestry University of Ukraine, Lviv, Ukraine;² <https://orcid.org/0009-0007-2106-2322>, postgraduate student;³ <https://orcid.org/0009-0009-9403-1740>, bachelor's degree student;⁴ <https://orcid.org/0000-0003-4730-0193>, associate professor, candidate of agricultural sciences;⁵ <https://orcid.org/0000-0001-9726-953X>, professor, doctor of agricultural sciences.

EUROPEAN BISON - A REVIEW OF THE REPRODUCTION PROBLEM OF THE HUNTING SPECIES

Habitat transformation is associated with the degradation of faunal complexes, with the most vulnerable species facing extinction. The analysis of biological indicators of Ukrainian bison subpopulations, their inventory, and habitat studies play an important role in the study of the global population of the species. The ecosystems of the European continent have already been significantly transformed. The possibility of biological self-regulation and natural processes is very limited and likely only within a small part of Europe. It is unlikely that the preservation of a species with such significant habitat requirements, and at the same time so dependent on humans, will be achieved solely through the protection of its habitats, especially given the threats related to the preservation of its genetic diversity.

Keywords: *Bison bonasus* L., subpopulation, "Skole Beskids" National Nature Park

The European bison (*Bison bonasus* L., 1758) is the only species from the *Bovidae* family (Gray, 1821) that inhabited Europe since the Pliocene and survived into the historical period. At the beginning of the 20th century, its population was on the verge of extinction. Through the significant efforts of scientists and hunting management specialists, it was restored and reintroduced to its former habitats. However, the increase in bison numbers revealed several practical issues. Key concerns include the potential for managing a species that was a traditional hunting target in the recent past. By the mid-1990s, Ukraine's bison population accounted for one-third of the world's total, numbering up to 685 individuals. Despite the successes in restoring the bison population in Ukraine and globally, it remains listed in the national Red Book (with the status of "extinct in the wild") and is protected under several international agreements at both European and global levels.

In the mid-2000s, a program was developed to restore the bison in the former Maidan herd area, which included plans to bring animals from breeding centers in Western Europe. The formation of a new bison subpopulation began after the reorganization of the "Maidan" State Hunting Ground into the "Skole Beskids" National Nature Park. The first transfer took place in 2009, when 3 adult females and 3 young males, all offspring of the same father, were received from the Gera wildlife park (Germany). Thus, from the very beginning, the herd was characterized by significant inbreeding. A second transfer occurred in 2010, when 2 males and 2 females were brought from the Altschönauberg breeding center (Germany), and 1 male from the Schlosshof breeding center (Austria), which created favorable conditions for the formation of a subpopulation with the possibility of outbreeding. Over the next ten years, the total herd size more than tripled: by early 2022, it had grown to 39 individuals, and by 2024, it is expected to reach 45 individuals.

In the Skole subpopulation, the male-to-female ratio of bison is 1:1.6 (12 adult males and 19 adult females). The optimal ratio in natural conditions is considered to be 1:1 or 1:2, while in enclosures, it is typically 1:3 or 1:4. At birth, the sex ratio among calves is 1:1. As the animals grow, the percentage of males gradually decreases, with adults comprising 40-45% males, and the proportion of females rising to 55-60%. Typically, 50% to 70% of females participate in reproduction, though under unfavorable conditions, this figure can drop to 30-50%. The average

annual herd growth in natural conditions is around 15%, but under optimal conditions, it can increase to 20% or more. Puberty in males occurs at the age of 2-3 years, but they do not participate in reproduction until they are 5-6 years old, after reaching physiological maturity, which allows them to compete with other males. Typically, bulls aged 7-12 years participate in reproduction. Females begin mating at 3 years old (occasionally at 4) and retain their reproductive potential until they are around 10 years old. The bison mating season lasts from early August to mid-September. During this time, an adult male joins the herd, which consists of females and calves, driving off younger and weaker bulls. Females give birth every two to three years, and in poor climate and food conditions, the interval between estrous cycles increases. The average lifespan of males is 22 years, while females can live up to 27 years.

It is believed that for demographic stability, a bison population should consist of at least 50 individuals. Therefore, 50 bison is the critical minimum below which no removal should occur. The only exception might be exchanges between populations, where captured animals are replaced by an equivalent number of individuals. Currently, the Skole subpopulation is showing a stable growth trend. However, there is a reverse side to this issue, which is currently relevant only to the Lopatin subpopulation, but in the future, it could affect all subpopulations with established protection and a stable trend of population growth. The bison's habitat in the Brody forestry area was recently confined to a relatively small forest area, where the animals were properly protected. However, in recent years, due to population growth, the bison have begun to expand into surrounding forested and agricultural areas. This has raised concerns about potential poaching in areas beyond the control of the forest protection service. In addition, the high density of bison within the forestry area places pressure on other ungulate species – at feeding sites and near troughs, bison tend to gather, displacing deer and roe deer. There have been cases in Poland where bison caused severe injuries to deer during the winter months, when natural food supplies are scarce. As a result, these "economically viable" species, which emerge weakened from winter due to food shortages, reproduce less effectively, suffer more illnesses, and ultimately cause financial losses to the forestry enterprise.

A pressing issue in bison breeding in Ukraine is the profitability of such an endeavor. In a market economy, a crucial characteristic of any sector is its self-sustainability. This issue does not apply to areas of the nature reserve fund, as the preservation and reproduction of species with the highest conservation status are a priority for them. However, intensive hunting management requires high fauna productivity, broad adaptive capacities of specific species, and their economic indicators. Species listed in the Red Book of Ukraine (including the bison) are considered a "burden" for hunting grounds due to the costs associated with their protection and feeding, while at the same time, they cannot be economically utilized. Therefore, optimizing bison populations requires the creation and implementation of special programs designed to incentivize forest and hunting land users to maintain this "non-profitable" species.

Another significant issue is the lack of a clearly defined mechanism for compensating for damage caused by wild animals to forestry and agriculture. The impact of the bison's foraging on the agricultural sector is particularly evident in the forest-steppe region. Bison feed exclusively on plant matter, with their diet including about 350 species of herbaceous plants and 50 species of trees and shrubs. In summer, bison primarily consume grass, but the lack of natural meadow complexes forces them to visit agricultural fields, feeding on winter crops, corn, soybeans, and rapeseed. They feed much less on tree bark, but in winter, they eat a lot of branches and bark, and occasionally consume conifer needles. An adult bison consumes up to 50 kg of plant material daily. Like any living being, they prioritize the most nutritious and accessible food sources.

The genus *Bison* consists of two modern species: the American bison (buffalo) and the European bison (wisent). Both species were on the brink of extinction at the beginning of the 20th century. However, the North American conservation model has worked better for the American bison, and both the forest and plains subspecies are now not at risk. Hunting is allowed in several states, such as Alaska, Missouri, and South Dakota, as well as in the Canadian provinces of Saskatchewan and Alberta. Hunting bison in North America costs approximately between \$4,000

and \$7,000, depending on the territory and the size of the trophy. Hunting in Europe has always been an exclusive affair, with costs usually around \$14,000 to \$15,000. In the U.S. and Canada, over 500,000 bison are raised for their environmentally friendly meat, which contains lower amounts of fat and cholesterol and higher amounts of protein compared to beef.

According to the Regulation on the Accounting, Passportization, and Issuance of Permits for the Relocation and Extraction (Catching, Shooting) for the Purpose of Selective Culling of Wisents, which was approved by the Ministry of Ecology in 1991, it was stipulated that "...culling of sick, old, injured, and abnormally developed individuals from the populations of hunted animals" was to be carried out. This Regulation was repealed by the Ministry of Ecology's Order No. 584 on November 20, 2007. According to the Law of Ukraine "On the Red Book of Ukraine," decisions regarding selective culling of wisents must be agreed upon with the National Commission on the Red Book of Ukraine. For the last 17 years, no permits for such removals have been issued. The International Union for Conservation of Nature (IUCN) has long recognized that wise use of wildlife can not only be compatible with conservation principles but also contribute to their implementation, as the socio-economic benefits derived from such use of wild animals can create incentives for the conservation of target species and their habitats. The IUCN statement notes that trophy hunting typically serves as a source of significant funds that can be directed toward conservation measures, such as environmental protection, population monitoring, enforcement of legal norms, scientific research, and the implementation of management programs in the field of nature conservation. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides for the trade of trophies obtained through the removal of individual rare species of animals. The "European Charter on Hunting and Biodiversity," adopted under the "Bern Convention on the Conservation of European Wildlife and Natural Habitats," contains specific operational and methodological guidelines for hunting and conservation activities. Key principles enshrined in the "European Charter on Hunting and Biodiversity" include, in particular: ensuring ecological sustainability of extraction volumes (Principle No. 3), supporting wild populations of native species with adaptive gene pools (Principle No. 4), maintaining environments that ensure healthy and strong populations of species hunted (Principle No. 5), encouraging use that provides economic incentives for conservation (Principle No. 6), and empowering local stakeholders with the necessary authority and competencies, placing responsibility on them (Principle No. 9).

Trophy hunting is a form of wildlife resource use that, when effectively organized and administered, can contribute to solving conservation tasks by creating financial and economic incentives for managing the conservation process of target species and their habitats, as well as supporting the livelihoods of local populations. Trophy hunting occurs in both North American and European countries, as well as in developing countries where the infrastructure for managing wildlife is not as well developed. Typically, trophy hunting is undertaken by individuals who are willing and able to pay significant sums of money for such opportunities. Generally, this involves the removal of a small number of individuals, with relatively modest infrastructure in place. In certain cases, trophy hunting becomes an important component of conservation activities and the practice of "sustainable resource management at the local level," which involves transferring responsibility for the sustainable use and management of wildlife resources from distant government structures to local community representatives. It is believed that trophy hunting can serve conservation interests and promote fair and equitable distribution of the benefits derived from the use of natural resources if the relevant programs include the following five elements: biological sustainability (balance); net benefits for conservation; socio-economic and cultural-historical benefits; an adaptive management approach (adaptive management): planning, monitoring, and reporting; and an effective management system based on the principles of delegation of authority, responsibility, and accountability.

Thus, it is worth considering carefully how to approach the issue of the wisent in Ukraine. It may be possible to act in such a way that the forest remains intact, the wisent is well-fed, and funds are available for its protection. At the same time, it should be remembered that wisents thrive only where people live well.

References:

1. Brodie J.F. *A review of American bison (Bison bison) demography and population dynamics*. Wildlife Conservation Society & Pennsylvania State University. 2008. 51 p.
2. Bublei S., Delehan I. *Hunting ground as an instrument of nature protection*. // *International Young Researchers' Conference Industrial Engineering 2023 – Circular Economy: Production and Consumption*. 2023. P. 145-146.
3. Krasińska M., Krasiński Z.A. *Zubr. Monografia przyrodnicza*. Warszawa, Białowieża. 2004. 312 p.
4. Krasińska M., Krasiński Z.A., Olech W., & Perzanowski K. *European bison. The Nature Monograph*. Mammal Research Institute PAS, Białowieża. 2007. 318 p.
5. Делеган І.В., Делеган І.І., Делеган І.І. *Біологія лісових птахів і звірів*. Львів. Поллі. 2005. 600 с.
6. Делеган І., Мазепа В., Хоєцький П. *Мисливські трофеї*. Львів : ТзОВ "Галицька видавнича спілка". 2018. 192 с.
7. Крижанівський В.І. *План дій по збереженню зубра (Bison bonasus L.) у фауні України. Мисливство та рибальство в Україні. Ін-т біограф. досліджень, Громад. орг. «Українське наукове товариство геральдики та вексилології»*. 2006. 176 с.
8. Хоєцький П.Б. *Стан популяції зубра (Bison bonasus L.) в Сколівських Бескидах* // *Вісник Львівського національного університету ім. Івана Франка. Сер.: Біологічна*. Львів : Вид. центр ЛНУ ім. Івана Франка. Вип. 32. 2003. С. 128-133.
9. Шарапа О.С., Хоєцький П.Б., Смаголь В.М. *Динаміка стану Майданської субпопуляції зубра (Bison bonasus L.)* // *Наукові основи збереження біотичної різноманітності*. Львів. 2010. С. 98–101.
10. Шарапа О.С., Хоєцький П.Б., Смаголь В.М. *Перспективи відновлення зубра (Bison bonasus L.) в національному природному парку "Сколівські Бескиди"* // *Науковий вісник НУБіП України : зб. наук. праць. Сер.: Лісівництво та декоративне садівництво*. К. : Вид-во НУБіП України. Вип. 147. 2010. С. 353-361.