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Assessment of conservation of European bison in Ukraine in view of future conservation actions for the species



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Report WWF Poland / WWF Ukraine, 2019

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1. PREFACE

Work on this report was initiated by WWF Ukraine and WWF Poland in order to summarize the dispersed available knowledge on the state of populations of European bison in the territory of Ukraine. In addition to looking at the most important actual and potential threats, areas where information is missing, and research needs, the report also identifies potential sites where conservation measures can be taken (including reintroduction programmes). Although further research is needed, this report is intended to contribute to the ongoing process of preparing a new Conservation Action Plan for the species that is being undertaken by the IUCN Species Survival Commission Bison Specialist Group. Moreover, the process of gathering information and devising follow-up conservation actions shall lead to measures taken on the ground to support the species' recovery after the recent decades of population breakdown.

This assessment concerns a crucial issue – the preservation of European bison (or wisent) in Ukraine and their restoration in an anthropogenically altered environment. This species has been assigned the highest conservation status – it is listed in the Red Book of Ukraine, is on the International Union for Conservation of Nature's Red List, and is on Annex II to the Bern Convention ratified by Ukraine. The most vulnerable species serve as “indicators” of habitat degradation and human economic interest. Wisent hold a special place among them, as the largest representative of the fauna of Europe.

In the past, wisent were a typical dweller of deciduous and mixed forests, and covered a significant portion of Ukraine's territory. The species has steadily declined in number over the past centuries due to unregulated hunting and overall habitat degradation. The eventual disappearance of the European bison from its natural domain prompted scientific research and the development of a set of measures to restore the species. In Ukraine, the successful efforts in this area commenced in the mid-1960s. The high rates of successful restoration of this species and well-organized conservation measures enabled wisent to increase in number, and by the 1980s territory of Ukraine contained one third of the world's population of wisent. Unfortunately, the political and economic challenges of the 1990s resulted in the loss of all the past achievements, and now the majority of domestic subpopulations are in a state of decline. Hence, the current adverse situation demands the immediate development of a set of effective measures under the auspices of the highest government bodies in order to preserve wisent as a national treasure.

Notably, the challenge of saving the species is pivotal in this work, and the suggested ways of overcoming the existing crisis are designed to optimize both the total number and the qualitative characteristics of the Ukrainian metapopulation of wisent. Studies on the ecology of the species were exemplary for development of a deep retrospective study on the formation of the species; the distribution history was simulated in detail (including the territory of Ukraine). Differential analysis of the establishment and current state of each domestic subpopulation allowed detection of influential factors – both climatic and nutritional (factoring in the various landscape and climatic conditions of Ukraine), and those stemming directly from anthropogenic pressure (poaching, forest exploitation, conservation measures, etc.). A genealogical study of individual groups exposed the issue of the gene pool depletion. The contribution made by regional wisent conservation projects and assessment of philanthropic support of private environmental funds are among the major aspects in the study, amid a rather indifferent attitude on the part of the specialized state executive offices.

2. ACKNOWLEDGEMENTS

We would like to express our deep appreciation to N. L. Klestov, Director of the Private Environmental Enterprise “Kyiv Zoological Center”, Prof. P. B. Hoetsky of the Department of Forestry of the National Forestry and Wood-Technology University of Ukraine, V. A. Kostyushin, Head of the Department of Animal Monitoring and Conservation of the I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine, V. F. Cherevatov, Head of the Department of Zoology of the Yuri Fedkovych Chernivtsi National University, and O. G. Mariskevich, Senior Researcher of the Institute of Ecology of the Carpathians of the National Academy of Sciences of Ukraine for the consultations, sound advice, and invaluable assistance in conducting the research.

In addition, we would like to express our gratitude to R. V. Lyushchuk, Chief Forester of the State Enterprise “Kolkovskoye forestry”, I. S. Kvach, Director of the Kivertsi NNP “Tsumanska Pushcha”, V. R. Burmas, Head of the Hunting Department of the Lviv Regional Division of Forestry and Hunting, D. A. Pasternak, Game Warden of the “Zalissia” Residence, T. V. Yushchinsky, Director of the State Enterprise “Khmilnytske forest range”, V. V. Tkach, Game Warden of the State Enterprise “Khmilnytske forest range”, S. I. Chistov, Game Warden of the State Enterprise “Storozhynetske forest range”, V. Ya. Banderich, Director of the National Nature Park “Skole Beskids”, and N.A. Bondar, Chief Forester of the State Enterprise “Konotopske forestry” for the fruitful collaboration and practical guidance.

We cherish the memory of the research mastermind – V. I. Kryzhanovsky, former Head of the Department of Fauna and Systematics of Vertebrates of the I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine.

3. EXECUTIVE SUMMARY

In comparison with the early 1990s, the population of wisent in Ukraine has decreased more than threefold. Moreover, three foci of acclimatization of the species disappeared in the Ivano-Frankivsk, Rivne and Chernihiv regions. The species decline is due to the permanent socio-economic crisis, which incited habitat degradation, poorly-planned organization of breeding and conservation efforts, and above all – the poaching on an unprecedented scale. Nowadays, the Uladovska subpopulation is the only one that shows consistently high figures, and the Lopatynska subpopulation demonstrates substantial growth rates. Conversely, the majority of domestic groups are in a state of decline (not least due to the mating of closely related individuals) and, unless pertinent measures are taken, are doomed to extinction.

4. INTRODUCTION

Habitat alteration is attributable to the decrease of populations of animals. The most vulnerable species face extinction. Scientific achievements of recent years have allowed the development of measures to revive the populations of animal species ruined by human activity. A vivid example is the restoration of wisent, whose population was on the brink of extinction in the early twentieth century. At the same time, the wisent population growth revealed a number of issues. In particular, the following remain rather unclear: the extent of ecological plasticity and adaptation capabilities of the restored groups in light of the anthropogenically altered environment, the role of individual behavioral mechanisms, the aftermath of inbreeding for productivity and biological resilience of animals, as well as a wide range of genetic and breeding aspects. These matters are of special relevance amidst the prospects of economic use of the species, which until recently was a traditional game species.

In view of the above, analysis of biological characteristics of Ukrainian wisent subpopulations, their inventory, and habitats play a prominent role in the research into the world population of the species and are an indispensable component of species recovery in their natural habitat.

As a result of extensive conservation measures in the former USSR, Ukraine inherited 10 subpopulations of wisent. By the mid-1990s, the Ukrainian population of wisent constituted a third of the world population of the species, and according to various sources amounted to between 664 (Форма № 2-тп-охота) and 685 (Герус, Крыжановский, 2005; Крыжановский, 2006) individuals. Over the following two decades, the population decreased more than threefold, and the presumable annual loss was 50-70 individuals (Межжерин, 2008). The reasons for this decline were conditioned by the prolonged economic crisis that evoked the burgeoning poaching, habitat degradation, and incompetent planning of culling measures, which emphasizes the absolute necessity for development and implementation of urgent measures to optimize the wisent population in Ukraine.



5. CONSERVATION STATUS OF EUROPEAN BISON IN UKRAINE (A BRIEF HISTORY OF THE SPECIES IN THE TERRITORY OF UKRAINE, PAST AND CURRENT CONSERVATION MEASURES)

THE SPECIES DECLINE IS DUE TO THE PERMANENT SOCIOECONOMIC CRISIS, WHICH INCITED HABITAT DEGRADATION, POORLY-PLANNED ORGANIZATION OF BREEDING AND CONSERVATION EFFORTS, AND ABOVE ALL - THE POACHING ON AN UNPRECEDENTED SCALE

Wisent breeding in Ukraine effectively commenced in 1965 as part of an Soviet-Union-Wide species restoration programme led by M. A. Zablotsky. Resettlement of wisent in Ukraine occurred in territories with ranging landscape and climate conditions.

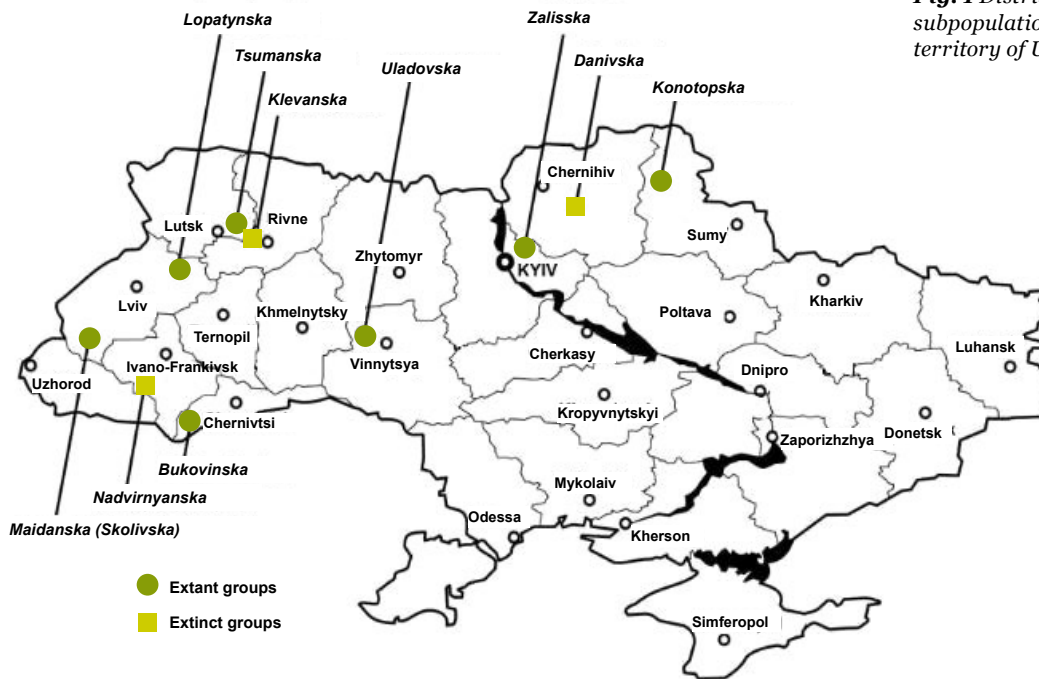
Efforts on species acclimatization began in the mountainous Crimea. Between 1972 and 1973, thirteen wisent from the Okskiy and Prioksko-Terrasny nature reserves were released into the Bakhchisaray state hunting grounds (SHG). Wisent lived there for eight years, but elimination has steadily halted the herd growth. By 1980, the group had increased by merely two individuals. Animals caused damage to crops and provoked conflicts with the local communities. In 1979, wisent were captured and relocated to the Chernihiv region, namely to the SHG “Danivske”. Concurrently, the subpopulation was replenished with two individuals from the Prioksko-Terrasny Reserve. The group experienced a fast and stable increase in number: with 110 individuals as of 2002. Nonetheless, by 2006, the Danivska subpopulation was entirely extirpated.

In 1965, 15 wisent from the Białowieża Forest were brought to the Volyn region. The animals were released into the territory of SHG “Tsumanske” (Смаголь, Шарапа, 2009; Смаголь и др., 2009). Mosaic habitats of the area and a rich fodder supply determined the prerequisites for the successful expansion of the Tsumanska subpopulation (Татаринов, Дякун, 1969).

The SHG “Klevanskoe” of the Rivne region were chosen as the location for wisent acclimatization, with eight animals released in 1967 (Герус, Крыжановский, 2005). The herd subsisted until the early 1990s. A portion of the herd might have migrated to the neighboring Volyn region and joined the Tsumanska group. However, the Klevanska subpopulation initially exhibited insignificant reproduction rates (Перепова и др., 1991).

The Zalissia state forest and game reserve (SFGR) in the Kyiv region obtained wisent in 1967 from the Białowieża Forest. Eight animals established the Zalisska subpopulation that lived in semi-free ranging conditions. In 1984, following an increase in the size of the group, fourteen animals were transferred to the Sumy region (SHG “Konotopske”) (Герус, Крыжановский, 2005; Камінецький та ін., 2011), where the independent Konotopska subpopulation was soon established.

Fig. 1 Distribution of wisent subpopulations in the territory of Ukraine



In 1970, the Chernivtsi region welcomed a total of 19 wisent from the SFGR “Beloviezhskaya Pushcha” and Berezhinsky, Okskiy and Prioksko-Terrasny reserves. The animals were released into the grounds of the Beregometsky Woodworking Plant. In 1976, some of the wisent moved to the neighboring SHG “Zubrovitsa”, where another four individuals were transferred from the Prioksko-Terrasny Reserve. Soon, the Bukovinska subpopulation, with the largest increase in herd among the domestic groups, emerged on the grounds of the facilities mentioned above (Крыжановский, Самчук, 2004).

In 1976, Nadvirna Zakaznyk (nature reserve) in the Ivano-Frankivsk region obtained eight wisent from the Okskiy Reserve. In 1979, the group was replenished with two animals from the Prioksko-Terrasny Reserve, and in 1982 with eight more individuals (Хоєцький, 2010). According to V.I. Kryzhanovsky (Крыжановский, 2006), the Nadvirnyanska subpopulation was initially poorly established. Being located in an area with a dense population and a developed road network, several wisent were killed shortly after that. Moreover, all the male individuals were affected by necrotic balanoposthitis. In 1991, the herd consisted of 24 individuals, while in 2002 only two wisent remained. Having existed briefly, the last animals vanished without a trace.

In 1965, ten animals were transferred from the Białowieża Forest to the Lviv region (SHG “Maidan”) (Бондаренко, 2000). Wisent bred and explored the surrounding territories, but in the mid-2000s the Maidanska subpopulation was completely annihilated. These days a new (Skolivska) group is being formed in this area, and it is unrelated to the preceding one (Шапаря та ін., 2010).

Between 1980 and 1981, twelve wisent of the lowland line, obtained from the “Naujamiestis” nursery (Lithuania), were introduced in the north of the Lviv region (SHG “Lopatynske”). The group was in decline,

which prompted replenishment with animals from the Białowieża-Caucasian (or Lowland-Caucasian) line in 2007-2009.

The Uladovska subpopulation of wisent was established in the Vinnytsia region; currently, it is the only progressive domestic group. In 1979, six individuals of wisent, previously captured in the SHG “Tsumanske”, were released into the grounds of the Uladovske forestry of the Khmilnytske forest range.

6. GENETIC STRUCTURE OF THE SPECIES IN UKRAINE – STATUS OF THE TWO BREEDING LINES

At the moment, the metapopulation of European bison in Ukraine is undergoing restoration of the species' biological characteristics; this determines the need to control the origin of the animals. Studies of this sort will mean the state of the gene pool can be assessed for each subpopulation, as well as allow breeding efforts to preserve the overall genetic variability of wisent. Nevertheless, currently there is only information about animals imported to Ukraine, i.e. the founders of subpopulations.

It is important to remember that the modern-day wisent population went through at least two so-called *bottlenecks*, which in terms of genetics means a reduction in the gene pool of a population to a critical minimum (Кайданов, 1996). The first bottleneck occurred in 1924, when 17 animals were selected to restore the species. In 1946, only 67 animals took part in the breeding as a result of the population reduction during World War II (the second bottleneck). Such genetic cataclysms led to the depletion of the overall heterogeneous pool of the world's wisent population.

Until recently, only the Lopatynska group (Lviv region) belonged to the Białowieża breeding line (Lowland line). In the early 2000s, the size of this group was merely eight individuals, which indicated its precarious state. To optimize further progress, 14 animals of the Lowland-Caucasian breeding line were imported between 2007 and 2009 from the Vinnytsia region (Uladovska subpopulation). This measure optimized further development of the subpopulation, and yet it negated the groundwork to preserve the Lowland line in Ukraine. Hence, every single wisent group in Ukraine belongs to the Lowland-Caucasian breeding line.

Nonetheless, studies on genealogy of Ukrainian wisent subpopulations confirm that they can be split into *polyphyletic* (originating from different breeding foci) and *monophyletic* (originating from one focus).

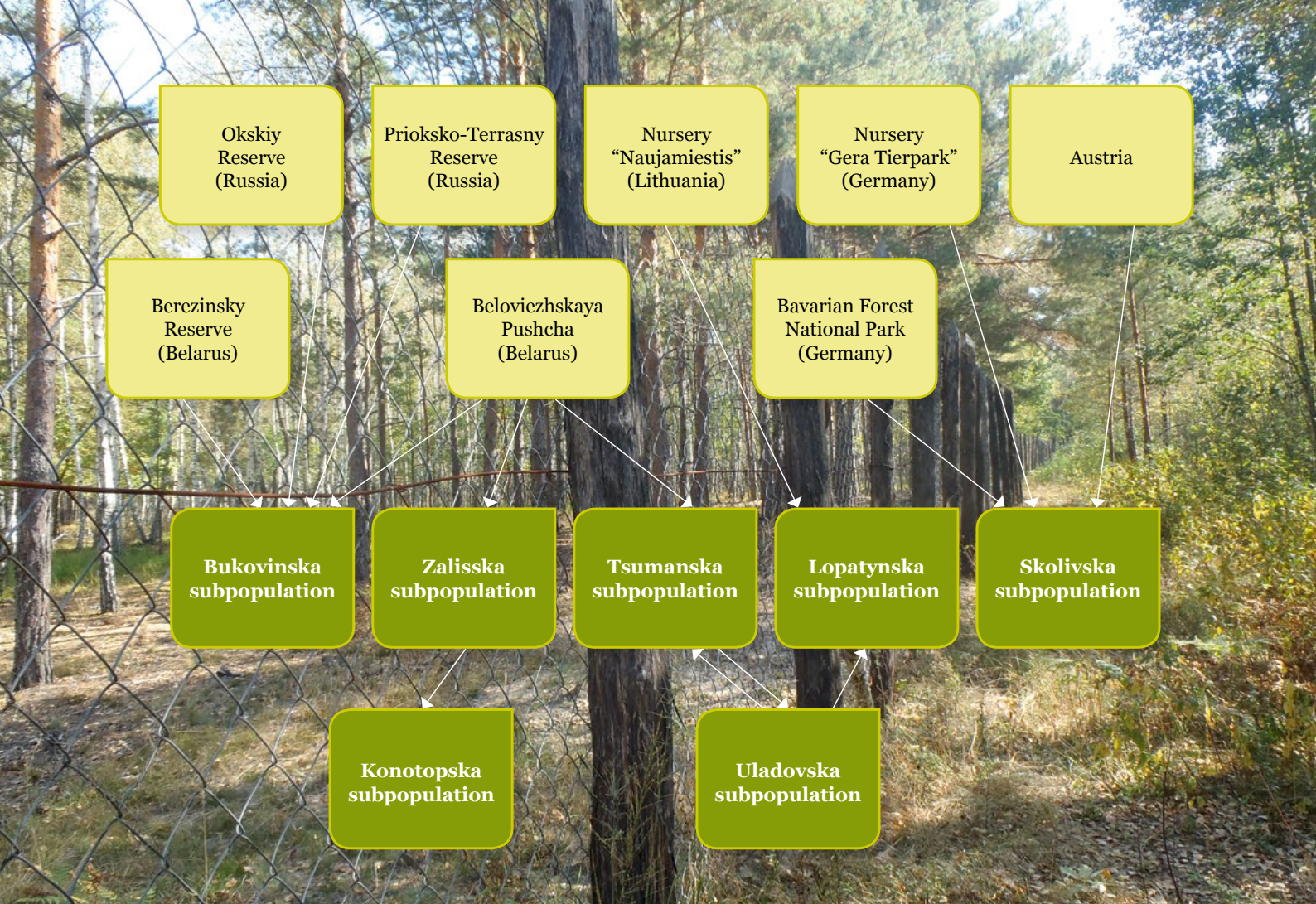


Fig. 2 Origin of Ukrainian wisent subpopulations

The first group consists of:

- the Bukovinska subpopulation: founder individuals originate from the Białowieża Forest (Belarus), the Berezinsky Reserve (Belarus), and the Prioksko-Terrasny and Okskiy reserves (Russia);
- the Lopatynska subpopulation: formed on the basis of wisent from the specialized nursery “Naujamiestis” (Lithuania), and the recently transferred group from the Uladovska subpopulation (originally from the Białowieża Forest);
- the Skolivska subpopulation was imported primarily from Germany, though from different breeding centers.

The heterozygosity of the first two groups is unquestionable, which determines their optimization through additional conservation measures.

The founder individuals of the Skolivska subpopulation are initially distinguished by a high degree of inbreeding; however, the prospects of having several males participating in breeding create a sufficient prerequisite for improving the group’s heterogeneity.

The second group includes:

- the Tsumanska subpopulation;
- the Uladovska subpopulation;
- the Zalisska subpopulation;
- the Konotopska subpopulation.

All the discussed groups originate from the Belarusian State Nature Protection Institution “National Park “Belovezhskaya Pushcha”. The Uladovska subpopulation is “filial” (i.e. closely related) to the Tsumanska group. The Konotopska subpopulation is of similar descent to the Zalisska one. At the same time, wisent were brought to Zalissia and Volyn from the very same Białowieża Forest and, moreover, around the same time (in 1965 and 1967). It is therefore likely that all four groups are closely related. Hence, animal exchange between them optimizes the overall heterozygosity only marginally.

Exchange of animals (i.e. genetic material exchange) of Białowieża and German origin may avert the inbreeding depression. In particular, it is reasonable to transfer a portion of the population from the “Skole Beskids” National Nature Park to the State Organization “Residence Zalissia”, considering the availability of a fenced territory and, consequently, the potential for high-quality monitoring.

For the “Skole Beskids” National Nature Park, it seems more promising to transfer animals from the Uladovska subpopulation, which (in light of the accumulated herd number) is now the only one in Ukraine that can serve as a “donor” for other domestic groups.

7. DISTRIBUTION OF THE SPECIES IN UKRAINE

7.1. Distribution of the species in the past

IN THE XVI AND XVII CENTURIES, EUROPEAN BISON WERE DISTRIBUTED FROM THE DNIESTER TO THE DON, THROUGHOUT ALMOST THE ENTIRE FOREST-STEPPE ZONE

Wisent were disappearing in Ukraine at slower rates as compared to the Europe-wide trend (Тимченко, 1972). Evidence of the number and distribution of the species during the Mongol and Tatar invasion is fragmented; however, in 1431, sixty animals were supplied daily to princely banquets in Lutsk (Кириков, 1979).

In the XVI and XVII centuries, European bison were distributed from the Dniester to the Don, throughout almost the entire Forest-Steppe zone. There is anecdotal evidence of the presence of wisent even in the Ochakov steppe (Кириков, 1979). A letter from Ivan the Terrible sent in 1552 to the Novhorod-Siverskyi Monastery mentions the “plavlya (floats) of oxen”. At that time, *plavlya* was the name used for hunting for ungulates during their seasonal migrations across the rivers. However, in contemporaneous literature, the terms “wild ox”, “tur”, “bison”, and “forest bull” were often used interchangeably.

By the mid-XVI century, when Podolia was sparsely populated, huge herds of wisent grazed there. In the Kyiv Voivodeship, the population of wisent was also substantial – their meat was regularly exported to Lithuania (Кириков, 1979). The last encounters with wisent in the Forest-Steppe zone refer to the late XVII and early XVIII centuries. According to Guillaume Levasseur de Beauplan (Боплан 1998), before the Khmelnytsky Uprising, wisent could be found throughout this territory right up to the border with the Tsardom of Muscovy. However, by 1696

wisent were extirpated from the Left-Bank Forest Steppe. In the meantime, the species remained common on the Right Bank, where it was hunted by the Zaporozhian Cossacks (Крман, 1999). According to S. V. Kirikov (Кириков, 1979), in the late XVII century numerous herds of wisent grazed in the deserted corners of Podolia.

In the XVI century, this species even inhabited the Black Sea steppe. The Polish envoy Martin Bronevsky, who described the Crimean Khanate fauna in 1578, mentioned “bisontes”. Some argue that in the past, the wisent was a steppe animal, whereas its relocation to forests was driven by anthropogenic pressure (Козло, 2008). However, K. K. Flerov (Флеров, 1972) deems such conclusions implausible, since the evolution of the genus *Bison* proceeded along the path of species differentiation, with regard to the adaptation of bison (*Bison bison*) to the steppe lands, and wisent to the forest. Thus, the likelihood of wisent occurrence in the steppe region should be considered only in the local context – in the floodplain forests.

No written evidence remained of the existence of wisent in the Forest-Steppe and Steppe territories during the XVIII century, which likely indicates its eradication by this time. In the Carpathians, they survived until 1790, and in Bukovina until the early XIX century (Млекопитающие Советского Союза, 1961). The eventual disappearance of free-ranging wisent on Ukraine’s territory presumably took place at the end of the XVIII and the beginning of the XIX centuries.

However, a small group of wisent (22 animals) lasted until the end of World War I in Count Potocki’s hunting grounds of “Pilyavin” (currently the Novohrad-Volynskyi district in the Zhytomyr region). Despite the efforts of the German occupation authorities to preserve wisent, they had been wiped out by poachers by 1919 (Герус, Крыжановский, 2005).

Analyzed data demonstrate a pattern of gradual displacement of the animals northwards, which substantiates the pivotal role of anthropogenic pressure (Pucek, 1991). K. K. Flerov (Флеров, 1972) makes a distinction between indirect human influence (displacement of wisent from the natural habitat due to deforestation) and direct human influence (loss of animals through unrestricted hunting).

The first attempts to reintroduce wisent in Ukraine took place in 1902, when a couple of animals from the Białowieża Forest were transferred to the zoo of “Askania-Nova” (Заблоцкий, 1939). However, the breeding of pureblood wisent was unsuccessful and ended in 1913. Nonetheless, the groundwork on wisent hybridization with bison and cattle was established in Askania-Nova. In 1941, the number of Askanian hybrids exceeded 50 animals, which were later killed during the war. In 1953, Askania-Nova resumed efforts regarding the wisent (seven animals were brought in), but quite soon they stopped again due to the adverse climatic conditions (Салганский и др., 1963).

In 1913, the Białowieża specimens were transferred to the “Tsarskaya Ohta” manor (modern-day Crimean Nature Reserve). In 1917, nine wisent lived here; they were killed during the Civil War (Млекопитающие Советского союза, 1961). In 1937, several “hybrid wisent” were brought to Crimea from Askania-Nova (Заблоцкий, 1939); these also died during World War II.

7.2. Recent distribution

7.2.1. Captive breeding

Some Ukrainian zoos and one farm work with wisent in captivity. These animals have no effect on the domestic free range subpopulations; however, they represent a safety-net gene pool of the species. Captive conditions allow use of zootechnical and veterinary methods, previously tested on domesticated animals: artificial insemination, cultivation and cryopreservation of germ cells, embryo transfers, etc. Animals currently kept in captivity are listed in the table below:

No	Facility	Name	Year of birth	Pedigree Book No.	Sex
1		Muron	2005	10568	M
2	Kyiv zoo	Mura	2007	11142	F
3		Muskat	2018	14241	M
4		Murko	2009	11444	M
5	Mykolaiv zoo	Mygaia	2009	11524	F
6		Muza VI	2016	13623	F
7		Mustang II	2018	14015	M
6	Vinnitsa zoo	Murazh	2012	12437	M
8	Odessa zoo	Musultan	2008	11360	M
9	Medvyn Farm "Eco-House"	Murtin	2013	12508	M
10		Murmont	2015	13031	M

THE FIRST ATTEMPTS TO REINTRODUCE WISENT IN UKRAINE TOOK PLACE IN 1902, WHEN A COUPLE OF ANIMALS FROM THE BIAŁOWIEŻA FOREST WERE TRANSFERRED TO THE ZOO OF "ASKANIA-NOVA"

7.2.2. Free-ranging and semi-free herds

The Lopatynska, Tsumanska, Konotopska and the majority of the Bukovinska subpopulations inhabit the hunting grounds with minimal human care. This is the least favorable method of keeping them, considering the poor protection and substantial levels of disturbance induced by active forestry and logging activities.

The Uladovska subpopulation resides in the hunting grounds too, though in conditions of constant observation and actively implemented security measures. This is an efficient method of keeping them, but often provokes conflicts with forest and farmland owners. The challenge lies in the lack of compensation schemes for forest and agricultural crops, as well as in the inconsistency in handling of land and animal resources.

The Skolivska subpopulation occupies the territory belonging to the nature reserve fund (NRF), which reduces the challenges related to anthropogenic pressure and the conflicting interests of the land users. These are the most favorable conditions for keeping them, and the most promising conditions for the settlement of wisent; however, they do not contribute to saving the existing groups.

The Zalisska subpopulation lives in semi-free ranging conditions. The fenced land area is large – 14.8 thousand hectares, which requires fixed costs to repair and maintain the fence. Moreover, the high density of various ungulate species requires feeding in significant volumes.

A minority of the Bukovinska subpopulation (9 individuals) occupies a specially equipped enclosure (80.2 hectares), where the population is expected to be built up to 15-16 animals, followed by the release of the surplus (mostly youngsters) into the surrounding lands. Animals in the enclosure will serve as a sort of “magnet” for the free-ranging wisent and prevent them from roaming into undesirable terrain. In such cases, it is feasible to construct several enclosures in the areas with the highest level of security and optimal nutrition and protection.

In addition, two males of the Tsumanska subpopulation of wisent are kept in the enclosure (208 hectares) along with other ungulate species.





8. POPULATION NUMBERS, STRUCTURE AND ORGANIZATION

The number of free-living wisent groups and those living in semi-free conditions at the end of 2018 is provided in the table below.

Subpopulation name	Facility name	Number of animals
Tsumanska	“Kivertsivske” Forest Range (Volyn region)	14+2*
Zalisska	“Zalissia” State Residency (Kyiv region)	26*
Lopatynska	“Brodivske” Forest Range (Lviv region)	67
Uladvovska	“Khmilnytske” Forest Range (Vinnytsia region)	93
Konotopska	“Konotopske” Forest Range (Sumy region)	49
Bukovinska	“Beregometske” Forest and Hunting Range, “Storozhynetske” Forest Range (Chernivtsi region)	30+9*
Skolivska	“Skole Beskids” National Nature Park (Lviv region)	34
Total		324

Records of the Tsumanska group made in February 2019 indicate the presence of 12 animals (3 males, 5 females, and 4 individuals of 2-4 years of age), staying as one herd near the feeding station. As mentioned before, two more males are kept in semi-free conditions. The area occupied by the Tsumanska group is around 7 thousand hectares within the “Kivertsivske” Forest Range and the nearby farmland (Fig. 3). With the arrival of snow cover, wisent settle in close range of the feeders with hay.

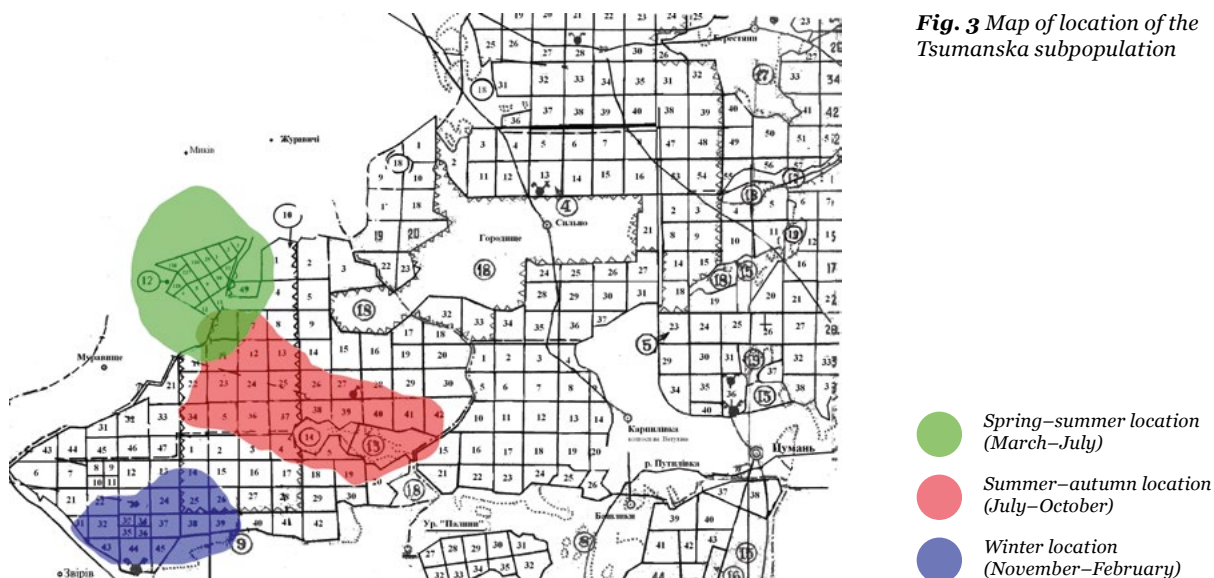
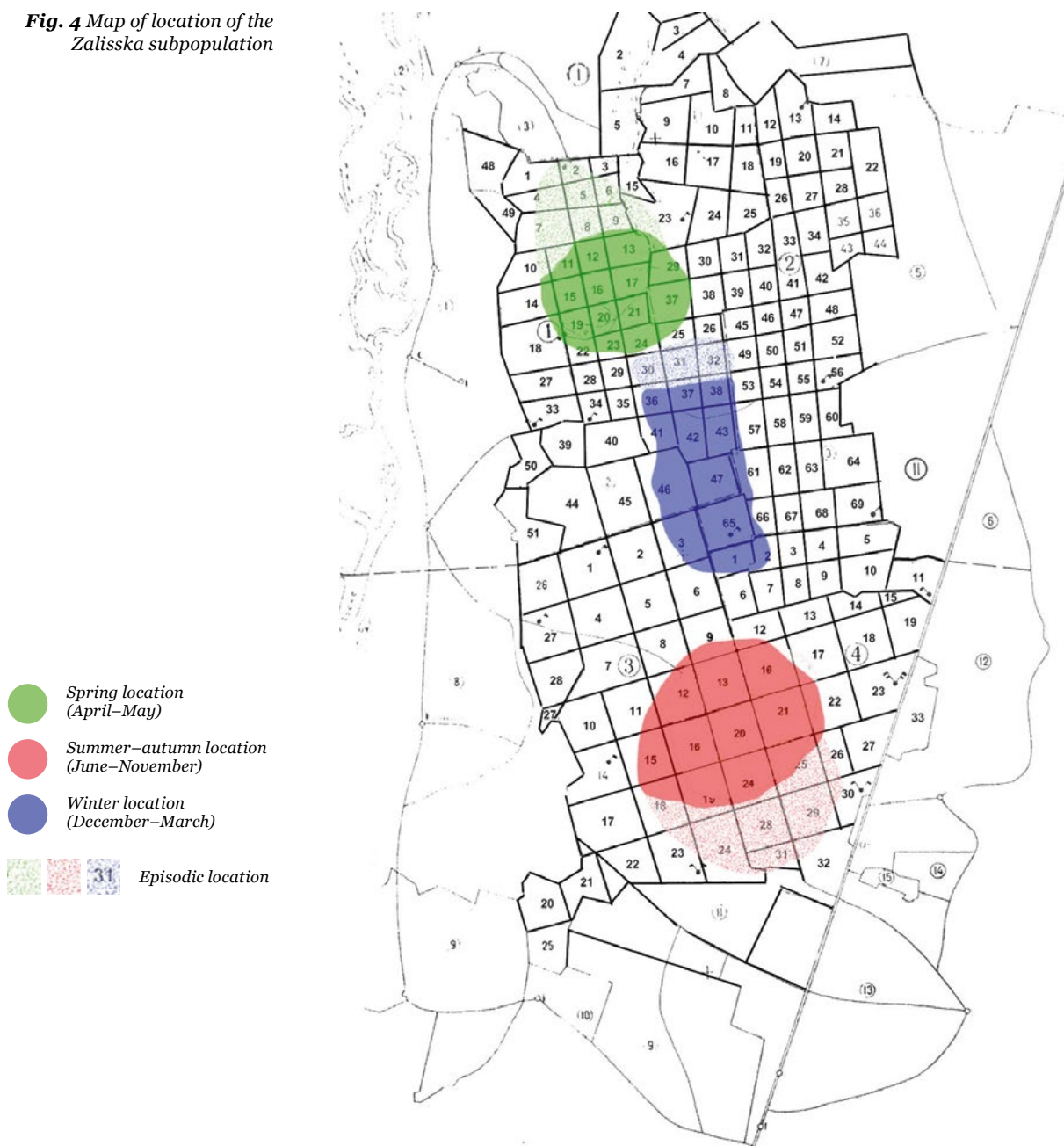


Fig. 3 Map of location of the Tsumanska subpopulation

Semi-free living of the animals in the Zalisska subpopulation is determined by the 14.8 thousand hectares of the fenced territory of the “Zalissia” State Residency. Wisent are distributed over nearly 20% of the

territory (Fig. 4). In the wintertime, the animals tend to stay close to the feeders in two aggregations (more than 10 individuals each) of a balanced age-sex composition. Two old males stay away. The group also includes 13 adult females, 4 adult males, 5 specimens aged between 2-4 years, and two calves born the year before.

Fig. 4 Map of location of the Zalisska subpopulation



The Lopatynska subpopulation of wisent occupies an area of 18 thousand hectares of the “Brodivske” Forest Range (Fig. 5). Approximately 50 animals stay as one herd in the winter period, of which females and youngsters form the basis. Fifteen males of different age groups form unstable (in number) clusters. In the summer, certain males join the breeding stock. The “fresh blood” influx ten years ago had a positive effect on the well-being of the group, which demonstrates the highest growth rates among the domestic subpopulations. Notably, there have been repeated instances of twin births in recent years.

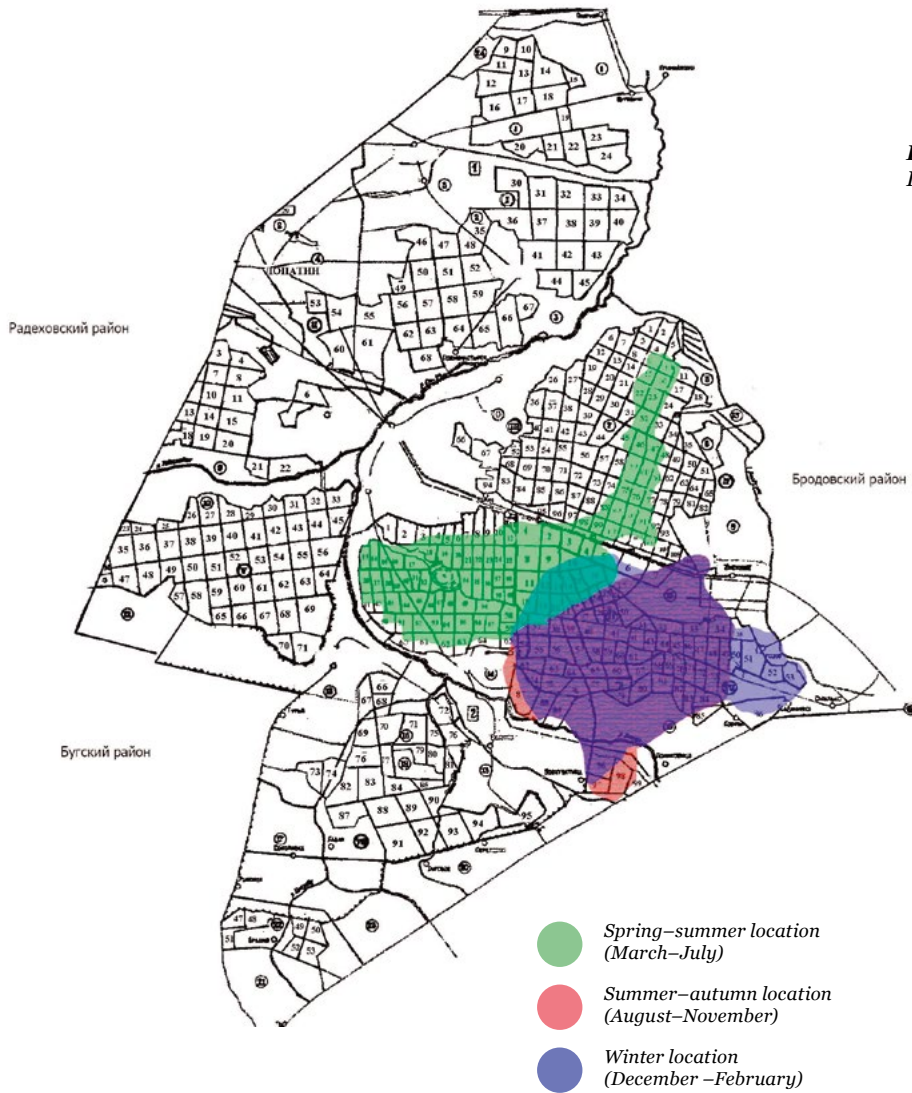


Fig. 5 Map of location of the Lopatynska subpopulation

Uladovska is the most numerous of the domestic subpopulations. However, the growth rates of the group are rather low. While there are more than 80 adult animals, the number of youngsters was less than 10 individuals. In winter, the breeding stock (about 75 animals) stays within the farmlands as one herd. Other groups (about 15 animals) are single males and small groups of youngsters. In the springtime, the main herd splits into three patchy groups of nearly the same size (25–30 animals). Here, the area occupied by European bison is ~40 thousand hectares, of which only half is within the forest-covered area of the “Khmilnytske” Forest Range. The remaining territory of the group covers agricultural landscape (Fig. 6).

Throughout the winter period, animals of the Konotopska group form a single herd (about 40 animals) adjacent to the local feeding stations. Seven to eight males keep away from the main group, although at a negligible distance. Locations inhabited by wisent cover a total of 17 thousand hectares, clustered both in forested lands and in the floodplain of the Seym River (Fig. 7).

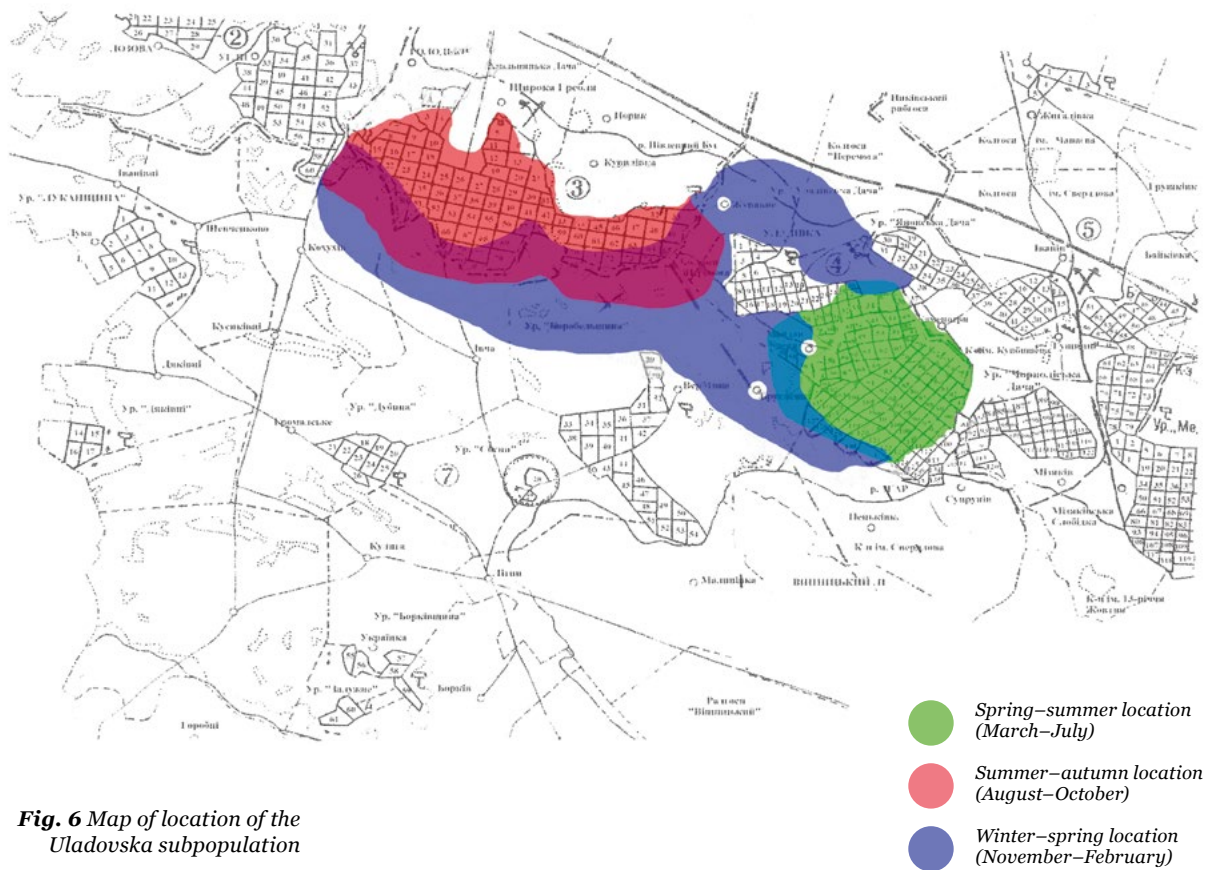


Fig. 6 Map of location of the Uladovska subpopulation

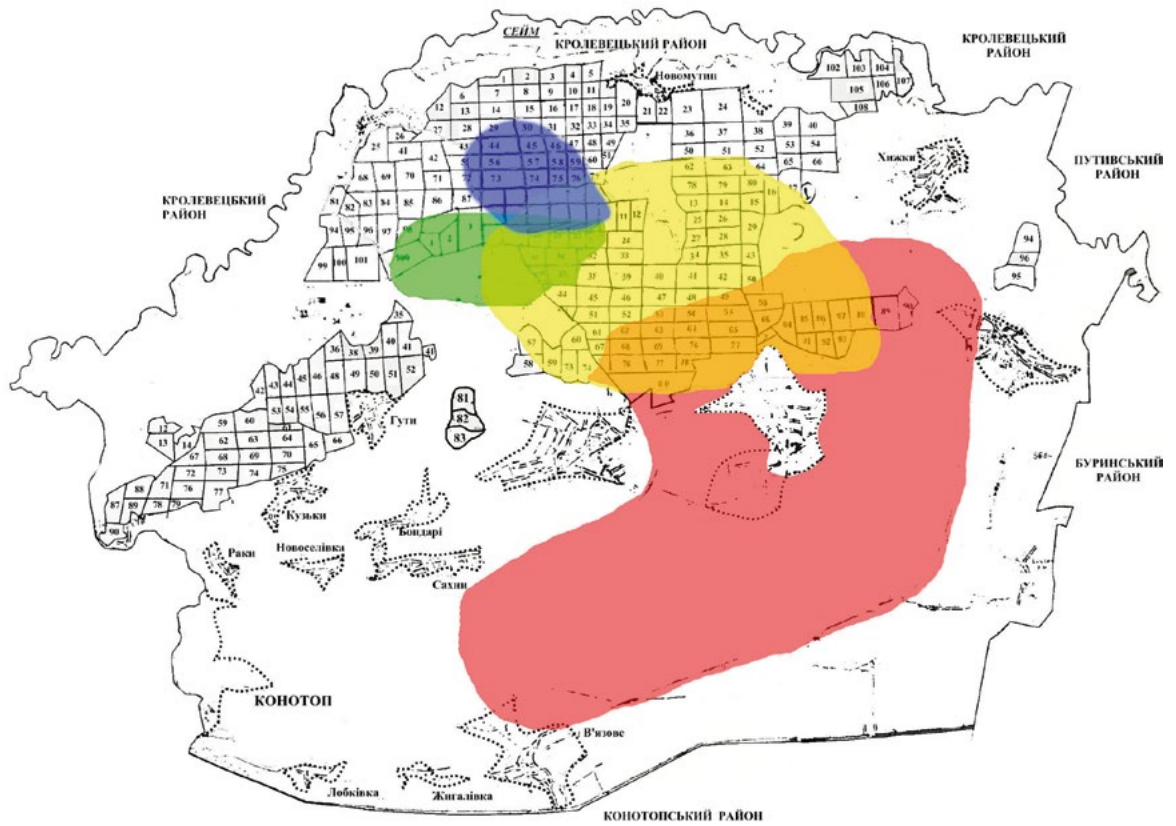


Fig. 7 Map of location of the Konotopska subpopulation

Altitudes of up to 700 m define the range of the Bukovinska subpopulation. They are distributed over an area of about 32 thousand hectares (Fig. 8). In autumn, wisent move from the upper mountain belt down to the lower belt, and in spring, they return to the upper boundary of the forest zone. In winter, the group splits into three herds of around the same size (7–8 animals each). Single males form a separate group (5 animals). The breeding rates of the subpopulation are extremely low (only one calf in 2018). The group kept in an enclosure contains two adult males, five adult females, and two calves born in the preceding year.

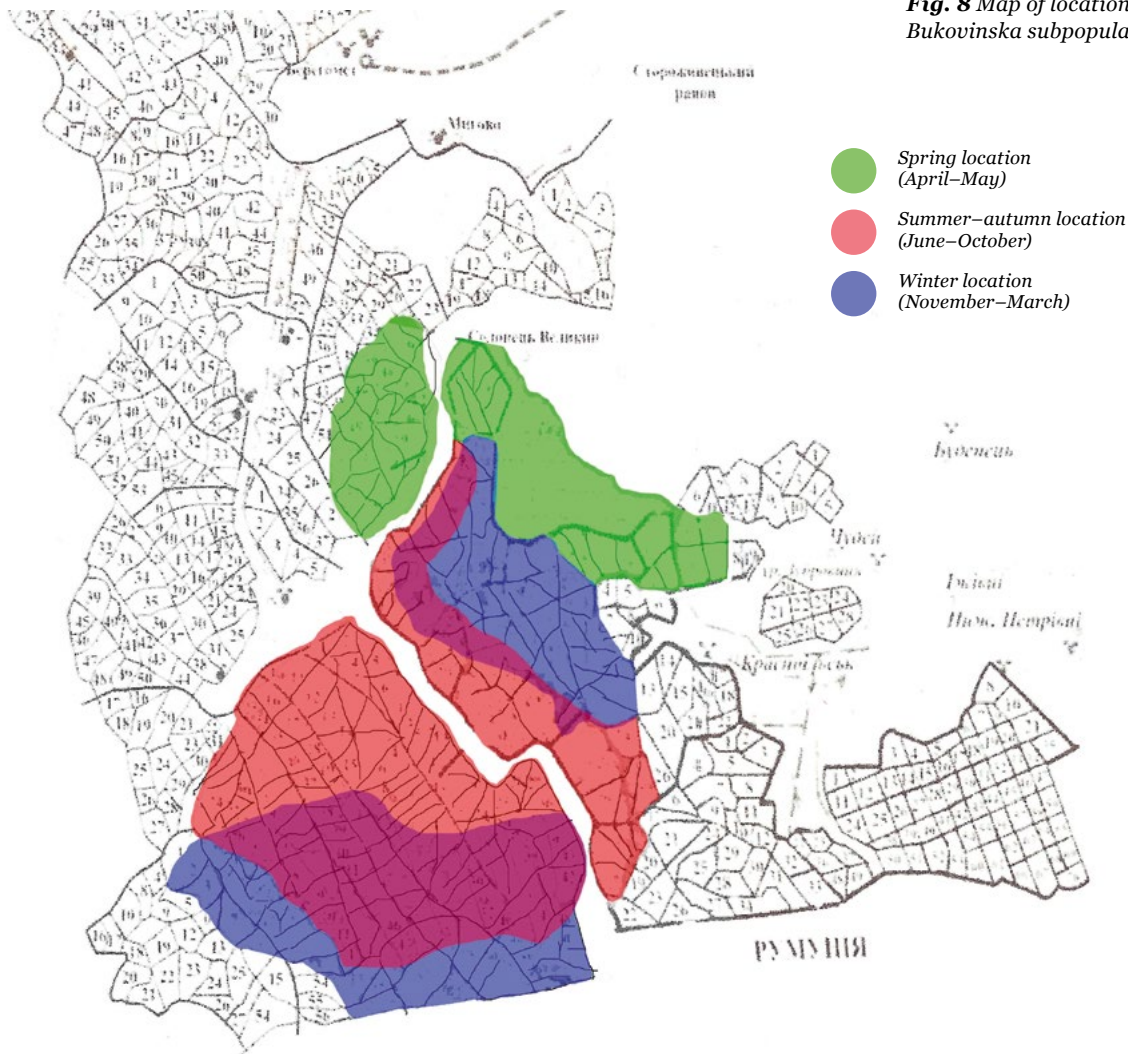


Fig. 8 Map of location of the Bukovinska subpopulation

The Skolivska subpopulation is also characterized by the vertical dynamics of its habitat. The majority of animals (about 30 wisent) occupy a small area (about 5 thousand hectares) surrounding the enclosure (Fig. 9). Three adult males are much more mobile, showing no fear for humans and often entering human settlements. The breeding rate of the group is quite high: 2-3 calves are born annually.

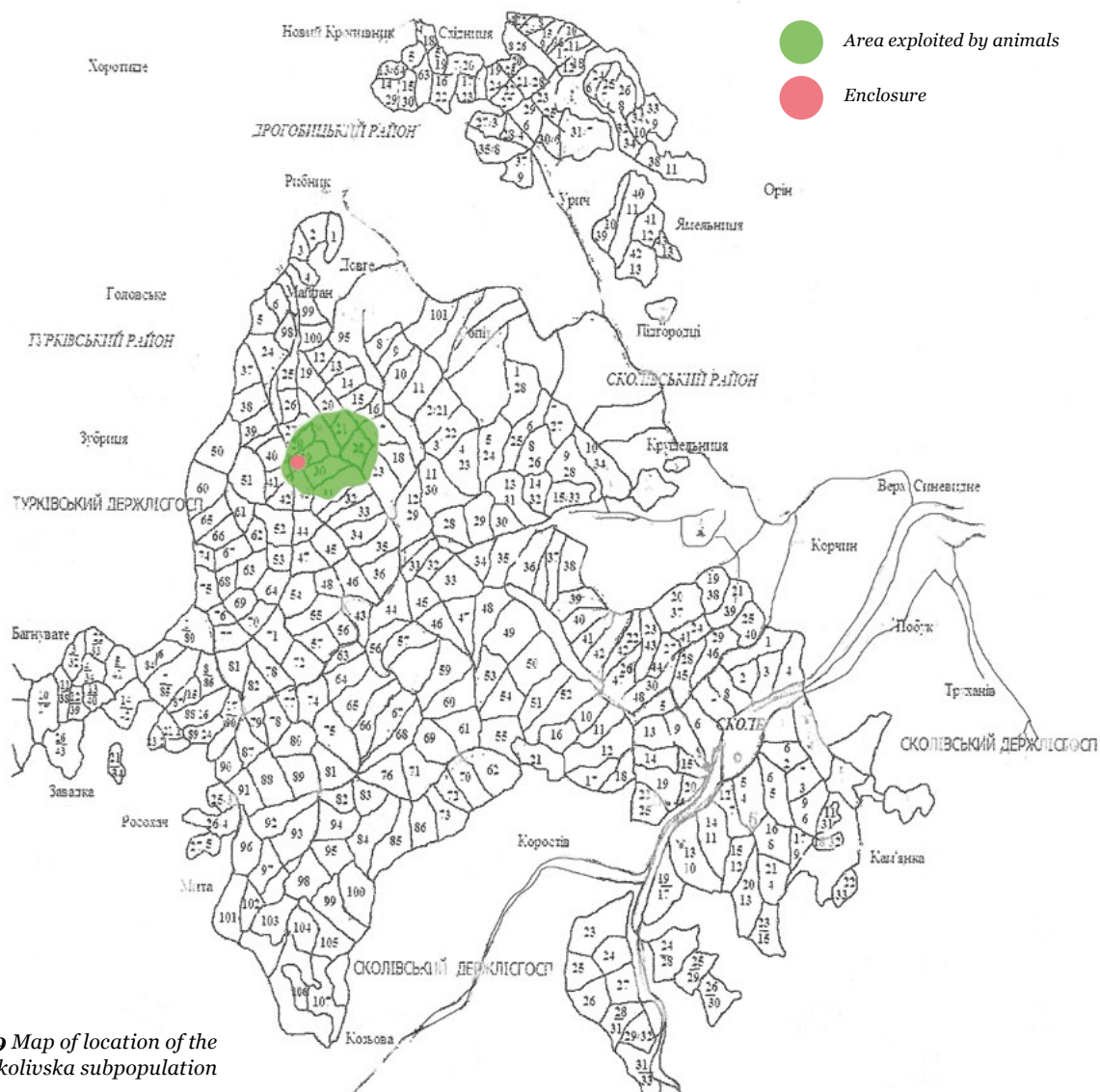
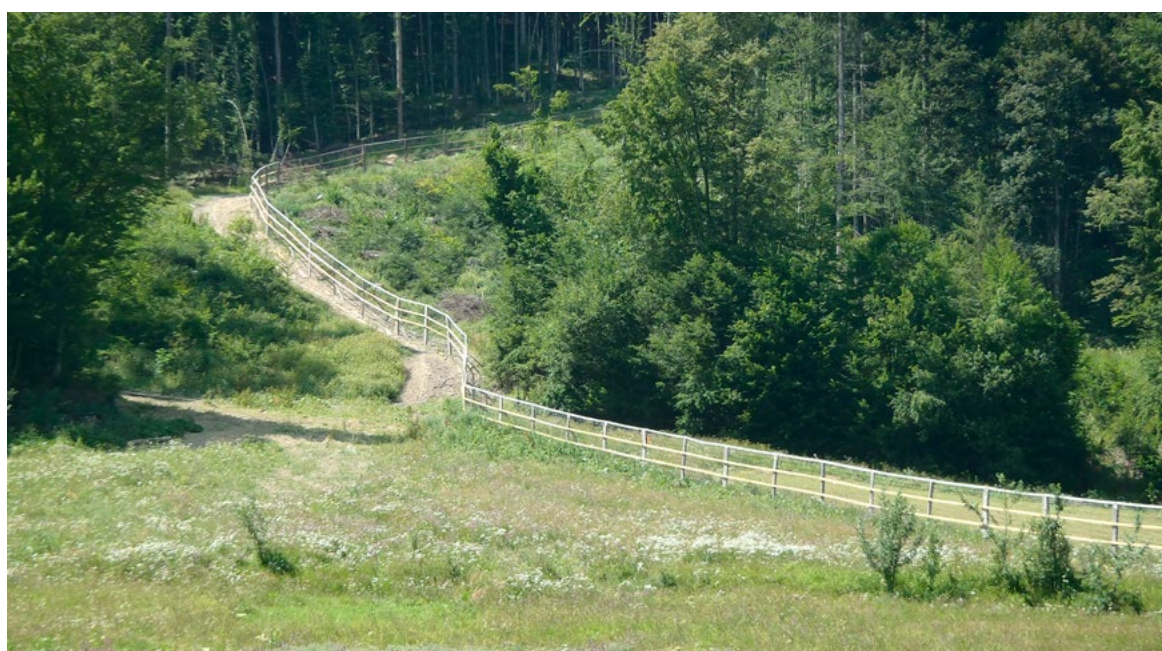


Fig. 9 Map of location of the Skolivska subpopulation



EUROPEAN BISON

This species has been assigned the highest conservation status – it is listed in the Red Book of Ukraine, is on the International Union for Conservation of Nature's Red List, and is on Annex II to the Bern Convention ratified by Ukraine.





9. POPULATION MANAGEMENT INCLUDING ARTIFICIAL FEEDING AND POPULATION REGULATION (MORTALITY, CULLING, DISEASES)

For most of the calendar year, all the free and semi-free living groups of wisent are fully provided with natural fodder through grass and wood- and leaf-based food sources. During the winter, regular feeding is established in the distribution foci of the lowland subpopulations, and the volume and variety of feed depends on the capabilities of a particular farm. The feeders are always supplied with hay, which serves as the basis of animal diet. The quantity of feedstuff is limited. However, some years are marked by addition of silage and fodder beet in the wisent diet. Winter feeding is especially relevant for subpopulations residing in the territory of Polesia, where heavy snowfall restricts both animal movement and obtaining of natural fodder. Hence, the supplementary feeding provides not only a nutrition component, but also contains wisent within a limited space and restrains their movement towards unguarded territory. The groups residing in the Forest-Steppe are dependent on artificial feeding to a lesser degree, due to the snow cover being less thick. In particular, wisent feeders with hay are neglected. At this time of year, they are concentrated in agricultural landscape, feeding on winter crops (mainly rapeseed). Willow and aspen bark on the forest edges and in patches of forest amidst the fields becomes a source of supplementary nutrition for animals. Winter feeding of animals in the Ukrainian Carpathians is also limited, above all by the apparent challenge of delivering the feed to the highlands in deep snow. Hence, green shoots of blackberry (which wisent dig up from under the snow), along with bark and young shoots of spruce, constitute the basis of the winter diet of mountain groups.

Virtually all domestic subpopulations of wisent (except for Uladovska) show gradual restoration of the group size in the context of preceding depression caused by unpunished poaching and unwarranted levels of selective culling. The majority of measures related to wisent management are compartmentalized, addressed at the level of individual enterprises (considering the interests of a given user), and poorly coordinated.

The current state of the Lopatynska subpopulation is a good example of how the group has been restored. In the early 2000s, the condition of the group was critical – the eight remaining individuals did not spur any confidence for prospective development. Two possible solutions to the problem lay ahead; the first one implied importing wisent of the Lowland line from abroad. The second option of replenishing the subpopulation with animals from the Lowland-Caucasian line, which would instantly resolve the problem of inbreeding. Acknowledging the absence of other domestic groups of the Lowland breeding line, the latter option was deemed more promising and affordable. The project

commenced in 2007, when the subpopulation was replenished with wisent captured in the “Khmilnytske” Forest Range.

The first batch (2 males and 2 females) was released in January 2008 after a 10-month period in an enclosure. From 2008 until 2009, the second group was formed (with 4 males and 6 females), which replenished the herd in June 2009. After some time, the introduced individuals merged with the remnants of the “old” Lopatynska subpopulation. The assimilation of animals has predetermined the setting for establishment of a subpopulation with an optimal age-sex structure, with mature animals of high reproduction capacity at the core.

The Uladovska subpopulation is currently the largest in Ukraine and often serves as a “donor” for other domestic groups of the species. Besides the previously mentioned “export” measures related to the optimization of the Lopatynska group, a portion of the herd was secured for captive breeding in the “Storozhynetske” Forest Range. In 2017, 1 adult male and 5 females were placed in an equipped enclosure; by that time, the male Murza III (No. 13185) from the Mykolaiv Zoo was already kept there. In 2017, two calves were born (a male and a female).

The mass demise of wisent of the Uladovska group in the winter of 2016 deserves special consideration; due to illegal actions of a group of people, 17 animals wound up on fragile ice of a small pond and fell through, and none survived (Смаголь, 2016).

Restoration of the wisent population in the “Skole Beskids” National Nature Park is a prominent achievement of recent years. In the winter season of 2009, not a single animal could be observed in the park. Unofficial sources stated that wisent disappeared from the location in the mid-2000s. This situation conditioned the undertaking of a second attempt to reintroduce wisent. The first transfer took place in 2009, when six individuals (as listed in the table below) were received from the Gera Tierpark (Thuringia, Germany). List of individuals from the first tranche received in “Skole Beskids” in 2009 is presented in the table below:

№	Parents		Name	Pedigree Book No.	Year of birth	Sex
	M	F				
1	Orion	Thyra	Thasidos	11182	2008	M
2	Orion	Lina	Thunderbird	10983	2007	M
3	Orion	Zwetschke	Theo	10711	2006	M
4	Orion	Thyra	Thalia	10710	2006	F
5	Orion	Lina	Thyra	9773	2002	F
6	Orion	Zwetschke	Thoska	9774	2002	F

Compared to males, the eldest of which turned three, all females reached reproductive age. The animals come from the same breeding bull – Orion. Two calves were born as a result of mating with its own daughter Thyra. Hence, even at the initial stage, considerable inbreeding characterized the herd. In October 2009, the youngest male, Thasidos, died. Shortly after that two older females produced progeny, but in a few days one of the newborns also died. Orion was the father of these animals as well. Therefore, upon their release from the enclosure in May 2010, the herd consisted of three females, two young males, and a calf born the same year.

In 2010, the second transfer of wisent from Austria (1 animal) and Bavaria (4 animals) was carried out:

№	Parents		Name	Pedigree Book No.	Year of birth	Sex
	M	F				
1	Scharan	Pomroka	Schah	11426	2009	M
2	Abkes	Aboka	Aboko	11334	2008	M
3	Abkes	Abtei	Abtebo	11518	2009	M
4	Abkes	Abalu	Aballa	11519	2009	F
5	Abkes	Aboka	Aboker	11520	2009	F

All the wisent were in the same age category (youngsters of up to 2 years old). The origin of the German animals was also marked by inbreeding. Only the Austrian Schah is affiliated with a different pedigree. In February 2011, the second group of wisent was released from the enclosure. Almost immediately, both herds merged, and even seven years later they remain adjacent to the release location, regularly visiting the feeding stations. In winter, wisent are bound to the slopes of the southern aspect, where there is much less snow cover.

As previously mentioned, three adult males (who should be at least 10 years old now) regularly visit the periphery of human settlements, leading to conflicts with the local inhabitants. Capturing these individuals and exporting them to the enclosure in the “Beregometske” Forest and Hunting Range (1 animal) and also to the “Zalissia” State Residency (2 animals) are now being discussed, with the aim of “replenishing the blood” of the two groups.



10. REINTRODUCTION PROGRAMMES

IN 2006, V.I. KRYZHANOVSKY PRESENTED THE “ACTION PLAN FOR THE CONSERVATION OF THE WISENT (BISON BONASUS L.) IN THE FAUNA OF UKRAINE”. THE PROJECT SUGGESTED CREATING NEW SUBPOPULATIONS, IN PARTICULAR IN THE CHERNOBYL NUCLEAR POWER PLANT ZONE OF ALIENATION, THE SHATSKY AND DESNIANSKO-STAROHUTSKYI NATIONAL NATURE PARKS, AND THE KINBURNSKA KOSA REGIONAL LANDSCAPE PARK

In 2006, V.I. Kryzhanovsky presented the “*Action Plan for the Conservation of the Wisent (Bison bonasus L.) in the Fauna of Ukraine*”. The project suggested creating new subpopulations, in particular in the Chernobyl Nuclear Power Plant Zone of Alienation, the Shatsky and Desniansko-Starohutskyi national nature parks, and the Kinburnska Kosa Regional Landscape Park (Акімов та ін., 1999; Архипов, 1999; Крыжановский, 1999; Мизин, 1999). Moreover, they developed scenarios to optimize the coexistence of wisent and economic activity of humans, provided reasons supporting the creation of a domestic wisent nursery, and raised the question of feasibility of breeding a “pure” inbred Lowland line. Unfortunately, the project was not given the status of a national programme or associated funding; hence the only objective fulfilled was rescuing the Lopatynska group by enriching its gene pool.

Due to a lack of funding, the national programme “*Certification of subpopulations and development of a plan for wisent resettlement in Ukraine based on assessment of the current state, forage base, and the optimal subpopulation size; development and implementation of measures for species preservation, including outreach and awareness-raising activities*”, which was carried out by the I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine and commissioned by the Ministry of Ecology and Natural Resources of Ukraine, was terminated.

The regional level situation is slightly better. Specialists at the Institute of Ecology of the Carpathians of NAS of Ukraine implemented the “*European bison (wisent) reintroduction programme in the Skole Beskids (Ukrainian Carpathians) for the period up to 2015*”. The project was implemented in cooperation with the European Bison Friends Society (Poland). Aside from that, the Lviv Regional Division of Forestry and Hunting developed a “*Programme for the conservation, protection, and restoration of wisent in the Lviv region*”, which supported the restoration of the Lopatynska subpopulation.

Nowadays, wisent restoration in Ukraine is often achievable only with the aid of foreign philanthropists and international foundations. The Private Environmental Enterprise “Kyiv Sozological Center”, supported by the Frankfurt Zoological Society (Germany), developed a regional programme “*Preservation and Restoration of Wisent (Bison bonasus L.) in the Volyn Region*”.

11. ACTUAL AND POTENTIAL THREATS

Among the fundamental reasons for the reduction in the wisent population in Ukraine is the prevailing inconsistency between the existing environmental legislation and its actual implementation. Corruption within the judicial system in Ukraine makes it impossible for any single case of illegal hunting of wisent to reach a logical conclusion.

A significant challenge for the successful survival and prospective resettlement of wisent is the conflict of interest between users of the animal resources and landowners whose grounds are occupied by the animals in question. As mentioned in paragraph 7.2.2., the owners of agricultural holdings often present well-founded claims to the forest range authorities that manage the wisent population, due to substantial losses caused by animals' foraging activities. At the moment, this challenge is significant only for the Uladovska and Konotopska subpopulations (because of the large group size and wide distribution), but considering the prospective increase in the area occupied by other groups, absence of compensation mechanisms for damaged crops will certainly increase the risks.

The subject of inbreeding is relevant for virtually all wisent groups (except for Lopatynska), since they either originate from a limited number of founder individuals, or were reduced to several individuals in the early 2000s.

Another powerful factor limiting survival of the wisent without regular supplementary feeding and the relevant preventative measures is the harsh winters of the Ukrainian Carpathians.

In modern conditions of a market-based economy, profitability is an essential characteristic for any industry. Intensive game management implies having highly productive fauna, wide adaptation capabilities of particular species, and certain economic indicators, etc. (Кудрявцев, Белоусова 2000). At the same time, most of the species listed in the Red Book of Ukraine (including wisent) are a "burden" for the hunting grounds due to the cost of protection and feeding, along with no possibility for their economic use. Hence, the optimization of wisent populations requires formulation of special programmes designed to draw land users' attention to the maintenance of "unprofitable" species, including state financial support systems.

IN COMPARISON WITH THE EARLY 1990S, THE POPULATION OF WISENT IN UKRAINE HAS DECREASED MORE THAN THREEFOLD. MOREOVER, THREE FOCI OF ACCLIMATIZATION OF THE SPECIES DISAPPEARED IN THE IVANO-FRANKIVSK, RIVNE AND CHERNIHIV REGIONS. THE SPECIES DECLINE IS DUE TO THE PERMANENT SOCIOECONOMIC CRISIS, WHICH INCITED HABITAT DEGRADATION, POORLY-PLANNED ORGANIZATION OF BREEDING AND CONSERVATION EFFORTS, AND ABOVE ALL - THE POACHING ON AN UNPRECEDENTED SCALE

12. RESEARCH NEEDS

Nowadays, the wisent metapopulation in Ukraine is in the process of restoration of the biological characteristics of the species, which means that oversight of the origin of animals is required. Such studies will support the gene pool estimation for each subpopulation, along with implementing breeding measures aimed at preserving the overall genetic variability of European bison. Wisent reproduction occurs randomly – based on arbitrary mating and a wide selection of partners. Considering the high density of animals, the breeding bulls may change every year or even several times a season. At present, the only available data concern the imported individuals, meaning the founders of subpopulations, which makes the identification of genealogical kinship and representation of the individual founders' gene pool in separate groups rather difficult.

Nevertheless, animal identification requires constant monitoring of the main species groups. The experience of Polish colleagues (Białowiecki National Park) is illustrated with studies on location of wild wisent at any stage of the annual cycle. Animals are immobilized prior to being tagged with radio collars, which periodically transmit signals that are captured by the receiver. Next, the signals are recorded with a satellite navigation device and processed using software that allows the movement of an individual animal to be tracked, both in the seasonal perspective and for several years. This research is well funded, including dedicated funding from the European Union, which, however, makes these sources unavailable for Ukraine.



13. EXISTING CONSERVATION STRATEGIES

13.1. Legal set up in relation to European bison conservation

Conservation of wisent in Ukraine is regulated by:

- The Law of Ukraine “On the Red Book of Ukraine” of February 07, 2002 No. 3055-III;
- The Law of Ukraine “On Fauna” of December 13, 2001 No. 2894-III;
- The Law of Ukraine “On Environmental Protection” of June 25, 1991 No. 1264-XII.

In the case of the wisent found within a protected area, their protection and survival is assured by the Law of Ukraine “ On the Nature Reserve Fund of Ukraine” of June 16, 1992 No. 2456-XII. Wisent residing in hunting grounds are the responsibility of the land users in accordance with the Law of Ukraine “On Hunting Economy and Shooting” of February 22, 2000 No. 1478-III.

In certain cases, the settlement of disputes may be regulated by the following:

- The Law of Ukraine “On Ukraine’s Accession to the Convention on the Conservation of Migratory Species of Wild Animals” of March 19, 1999 No. 535-XIV;
- The Law of Ukraine “On Ukraine’s Accession to the Convention on International Trade in Endangered Species of Wild Fauna and Flora” of May 14, 1999 No. 662-XIV.

Hence, violation of any of these laws would be prosecuted under the Criminal Code of Ukraine (of April 05, 2001 No. 2341-III) or the Code of Administrative Offences of Ukraine (of December 7, 1984 No. 8073-X).

13.2. Institutions and organizations involved in species conservation

The highest-ranking state executive body in the field of rational use, restoration, and protection of the animal world is the Ministry of Ecology and Natural Resources of Ukraine. At the regional level, the territorial (region-wide) bodies of the State Environmental Inspectorate of Ukraine supervise conservation of endangered and vulnerable species (including wisent).

As the majority of the domestic wisent population is retained in the hunting grounds (including forest fund), animals receive additional protection from the State Forest Guard of the State Forest Resources Agency of Ukraine and from the wildlife services of the respective hunting grounds.

13.3. Transboundary cooperation (Poland, Belarus, Romania, Russia)

Cooperation regarding wisent conservation and restoration was most extensive with the Polish colleagues. In particular, the group of wisent in the “Skole Beskids” NNP was restored with direct support from the European Bison Friends Society (Poland). Personal acquaintance with Prof. Wanda Olech-Piasecka (Department of Genetics and Animal Breeding, Warsaw University of Life Sciences), Krzysztof Schmidt and Rafał Kowalczyk (Mammal Research Institute, Polish Academy of Sciences, Białowieża) paves the way for scientific collaboration, including in the form of conference participation and article publication in specialized journals. Regular communication is also established with Małgorzata Bolbot (European Bison Pedigree Book), who is the contact person for annual transfer of data on the state of wisent population in Ukraine.

Among Belarusian colleagues, we cooperate most closely with Vasili Shakun (SSPA “Scientific and Practical Center for Bioresources of the National Academy of Sciences of Belarus”).

Russian researchers Dr. Taras Sipko (A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences) and Natalia Treboganova (Kh. G. Shaposhnikov Caucasus State Natural Biosphere Reserve) are also in regular contact, and they advise on conducting research and conservation measures.



14. INITIAL ASSESSMENT OF AREAS SUITABLE FOR CREATION OF NEW FREE-RANGING POPULATIONS

Analysis of the distribution of domestic wisent subpopulations leads to the following conclusions:

- 1.** Seasonal differentiation of habitat is innate for all domestic wisent subpopulations. Where there is minimal anthropogenic pressure, the wisent location is determined chiefly by the supply of food resources; where disturbance factors have a major impact, the role of protective characteristics of the biotope increases.
- 2.** Occurrence of wisent in any landscape and climate conditions involves the availability of open land. The role of meadow formations is particularly large in spring, due to the rapid growth of grassy vegetation, as a result of strong insolation. During this period, forest stands essentially play a protective role.
- 3.** Lack of meadow formations forces animals to adjust to the anthropogenically altered environment. In the Forest-Steppe zone, wisent may enter agricultural landscapes, and in Polesia they wander into sparse tree plantations with ample glades and clearings. In the Carpathian Mountains (where biotopes are better preserved in their natural state), meadows are prevalent in the foothills, where wisent groups descend from the forested mountain slopes.
- 4.** In the summertime, wisent movements are minimal. Animals gather in the most inaccessible forested areas. Normally, these are closed canopy forests with mixed and deciduous stands of middle-aged and young trees. Wood- and leaf-based feed is the basis of nutrition in this period.
- 5.** In Polesia and in the Carpathian Mountains, the autumn habitats of wisent are essentially the same as the summer ones. However, the animals' activity changes, as they explore a much larger area of land. In the Forest-Steppe, the autumn distribution of wisent is determined by crop rotation: animals start consuming succulent feeds (beets, cabbage), then they shift to winter crops and rapeseed. Nonetheless, they still occasionally visit the forest in this period.
- 6.** Winter distribution of wisent is entirely conditioned by feed-related priorities. In Polesia, animals depend on the active conservation measures, which means that they remain close to the regular feeding locations. In the Forest-Steppe, winter distribution of animals is the same as in the autumn; however, their connection with forested lands is completely disrupted. In the Carpathians, the location of wisent groups is defined by the presence of natural feed, in particular blackberries. For all the subpopulations, wood- and branch-based feed plays a secondary role in winter.

**CHERNOBYL RADIATION
AND ECOLOGICAL
BIOSPHERE RESERVE
(REBR) HAS ALL
OF THE REQUIRED
CHARACTERISTICS FOR
CREATION OF NEW FREE-
RANGING POPULATIONS**

As mentioned before, the harsh climatic conditions of the Carpathian winters often lead to the loss of animals and create inherent complications for carrying out effective active conservation measures, such as artificial feeding. At the same time, experience in breeding wisent in Polesia and the Forest-Steppe areas suggests that the anthropogenic factors alone may limit the species' distribution and survival in the lowland part of Ukraine. Being quite a populous country, Ukraine is characterized by a high density of human settlements, a well-developed road network, and altered natural landscapes, which ultimately complicates the successful survival of a species prone to seasonal movements with migrations of certain age and gender patterns.

Thus, wisent reintroduction sites should possess the following key characteristics:

- vast area,
- species-appropriate nutrition and protection characteristics,
- minimal population density and urbanization level,
- sufficient level of security,
- opportunities for high-quality monitoring and research.

In our opinion, the territory of the Chernobyl Radiation and Ecological Biosphere Reserve (REBR) has all of the mentioned characteristics, as evident from the experience in successful acclimatization of the Przewalski horse in this territory. Adjacent to the Zone of Alienation of the Chernobyl, in the territory of Belarus, the Polesia State Radioecological Reserve operates with similar characteristics and tasks. A herd of free-living wisent has already formed in this territory, which determines the preconditions for establishment of a transboundary wisent group with optimal genetic characteristics.

As mentioned in paragraph 7.2.2., protected areas have the most favorable conditions for creation of new wisent groups. Compared to the Chernobyl REBR, the other sites are much more limited in terms of area. However, the security level, as well as the nutrition and protection characteristics of the Cheremosh National Nature Park (Chernivtsi region) fully meet the requirements of the species. The park is adjacent to the grounds of the "Storozhynetske" Forest Range, which allows the prospective expansion of the already existing Bukovinska subpopulation. The territory of the Desniansko-Starohutskyi National Nature Park (Sumy region) also has the necessary characteristics; this NNP has potential to become a transboundary reserve bordering the Bryansk Forest Nature Reserve, where successful releases of wisent have already been carried out. The Shatsky NNP (Volyn region) is another promising focus for creating a new subpopulation of wisent.



15. CONCLUSIONS

Given the situation in modern Ukraine, preservation and resettlement of wisent should concentrate, on the one hand, on ensuring a stable increase in the population size and expansion of the species' habitat, and on the other hand, on resolving conflicts with humans, which will certainly arise as a result of the former. To solve this problem, the following measures are required:

- identification of new (potential) areas for the species;
- forging relations between the species and humans, along with expansion of a compensation mechanism for damage to forestry and agriculture;
- relentless combating of poaching, introduction of mandatory criminal liability for hunting wisent;
- minimizing in-breeding (establishing the exchange of animals and genetic material);
- creation of a domestic central wisent nursery (or establishment of several regional ones) for accumulation of a safety-net population of the species;
- development of a portfolio of effective conservation measures designed for specific users of land inhabited by wisent;
- continued monitoring of the group status and studying the animals' adaptation processes (including those aimed at eradicating manifestations of domestication);
- regular outreach and awareness-raising activities pertaining to conservation of wisent;
- raising financial aid from the state budget, philanthropists, and international foundations for the protection of the environment.

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