

European bison (*Bison bonasus*) in the central Belarus: current state and prospects of conservation of the free-ranging population “Volozhinskaya”

Vasili Shakun

The Scientifically-Practical Centre of the National Academy of Sciences of Belarus for Bioresources, Minsk, Belarus

Abstract: Based on long-term data, the process of formation and the current state of free-ranging population of the E. bison “Volozhynskaya” living in the largest woodland of the central part of Belarus is described. In 18 years, the population increased from 15 to 79 individuals, with the average annual growth of 10.1%. Numbers of E. bison, despite a tendency towards the decrease in growth rate, in short time have reached an optimal level and maintain positive dynamics. Annually, on the average six calves are born, and the coefficient of birth rate is at the level typical for Belarus. The coefficient of fertility is by 50% lower comparing to the beginning of population formation. In 2012 three adult males were poached which negatively influenced the population development. General losses (including eliminations) amounted to 44 individuals, including 19 animals of low reproductive value. The prospects of development and use of resources of free-ranging population of the E. bison are described.

Key words: E. bison, quantity, growth, mortality, development prospects.

Introduction

European bison (*Bison bonasus*) – is the largest of Palearctic terrestrial mammals. It is listed in the IUCN Red List and Red Books of the countries where these animals live. For the last decade the world number of bison increased by 1.5 times and now amounts to about 4,2 thousand individuals, among them 66% free living and 34% – in captivity (EBPB 2009). However, there are still many threats to the species’ survival, among them: limited gene pool, distribution in small and isolated populations, and health problems (Pucek *et al.* 2004).

Belarus has made an important contribution to E. bison breeding, an increase of species’ numbers, and extension of its home range. The first stage of “The program for the conservation, distribution and management of European bison in Belarus” was realized in 1994–2000 (Kozlo 1999). Six new centers for free-ranging herds were created. These centers assured a stable growth of E. bison population in Belarus – from 347 in 1994 to 1080 individuals in 2011. Several years ago, Belarus took the second position (after Poland) in the world regarding E. bison numbers in the country.

In 1994, for the first time in Belarus the reintroduction of *E. bison* was carried out at area of economic use. From the Belovezhskaya Forest 15 animals were transferred to the Nalibokskaya Forest in order to create a new population of the European bison in Belarus. Initially as an optimal number for this population assumed were 70 individuals.

Main goal of research was to analyze dynamics of the population, and the use of resources of free-ranging population of the *E. bison* “Volozhynskaya”. Such data are necessary for the assessment of a current state and planning of measures for conservation and further management of this population.

Study area

Nalibokskaya Forest is situated in the basin of right confluent of river Neman – Berezina and Usa. Its area is about 2400 sq. km within eastern-most parts of Verchneniomanskaya plain (Yurkevich & Geltman 1965). The terrain is of a rolling type with dune and smoothed hills and waterlogged depressions. Forests consist mainly of coniferous species (70% of whole area), 30% of them are a young forest. Dominating are: pine (48%), spruce (22%), and birch (20%), alder forests are respectively rare. Aspen makes some 3% of stands and oak about 1%. Forests stands are intensively managed, with quite rich and diverse ground flora and undergrowth.

As a result of drainage of the forest performed in 1971–1975, former wetlands became accessible for ungulates. Peat was exploited in the 1970s at the area of 5 sq. km. At present, herbage is well developed at this territory, the process of overgrowing by lignose and bush vegetation takes place. Considerable proportion of this area is used as natural hayfields willingly visited by *E. bison*.

Materials and methods

The object of the study is free-ranging population of the *E. bison*, living within borders of the largest continuous forest in Belarus – the Nalibokskaya Forest (54°00’N, 26°30’E), representing complete natural complex.

The assessment of spatial distribution, determination of numbers, sex and age structure, reproduction and mortality of population of the *E. bison* “Volozhynskaya” were carried out on the basis of field studies which were supplemented with data collected from local inhabitants and workers of Forest Protection Service.

For more detailed characteristic of reproduction of studied population the birth rate and fertility coefficients were used.

For the determination of reproduction rate analyzed were:

- birth rate – the ratio of calves from the current year to a total number of population;
- fertility – number of calves per one female in reproductive age.

The reproductive age is the age of females in which they are capable for procreation. The reproductive age for *E. bison* is assumed for 5–18 years (Korochkina 1971; Krasinski & Raczynski 1967; Zablotsky 1947).

Results and discussion

During a reintroduction to Nalibokskaya Forest in 1994, among 15 transferred animals were: 5 males 1.5, 3, 4.5, 5 and 6 years old and 10 females 2 years old (2 ind.); 3 years old (2 ind.); 5 years old (3 ind.); 7 years old (2 ind.) and one 8 years old. After a temporary acclimatization in an enclosure of 6 hectares, animals were set free, and formed new free-ranging population of the *E. bison* in Belarus (Kozlo & Shakun 2006).

The territory of the Nalibokskaya Forest was chosen for introduction of the *E. bison* not only because of a habitat mosaic of the area (wood-field-wood-river) with presence of rich fodder biotopes, but also due to the fact that this species used to live there in the past. Archeological excavations at the city of Novogrudok (Aleksandrovich 1999) and references (Hussoviani 1522) confirm that up to 16th century the *E. bison* was widespread in large forests of a river basin Neman.

After the release, the main part of the herd remained close to reintroduction site where supplemental food was provided. Some solitary individuals or small groups (generally young males) gradually moved away from the enclosure. Division of the main herd into two isolated groups occurred in 2000 because of a decrease to a minimum of supplemental feeding. By 2004, the area penetrated by bison was about 300 sq. km. Presently, the area of winter home range is about 70 sq. km, and in vegetative season – 400 sq. km (Shakun 2011). During the winter period of 2011–2012 bison lived in groups from 9 to 35 individuals. Groups of males (9 individuals) move over the southern part of the Nalibokskaya Forest, reaching the river Neman, distant from the introduction site for more than 15 km.

The largest group (about 35 individuals) still dwell around the site of the release where for the last three years the provision of supplemental food has been reinstated. This group consists generally of females and young. At the site of supplemental feeding there are no more than two sexually mature males recorded per a year.

On the basis of long-term observations, it is possible to say that *E. bison* prefer forests, which border with hay meadows.

Throughout 18-year existence of free-ranging population of the *E. bison* “Volozhynskaya” its numbers increased by 5.3 times and in February, 2012 achieved 79 individuals (Fig. 1), that makes 2.8% of world number of free-ranging bison estimated for 2009 or 7.3% of a total number of this species in Belarus.

Small decrease in *E. bison* numbers in this area was recorded in 2006 and 2009. It was most likely connected with the general negative influence on flora and the fauna caused by transformation and reorganization of management at the territory of the Nalibokskaya Forest.

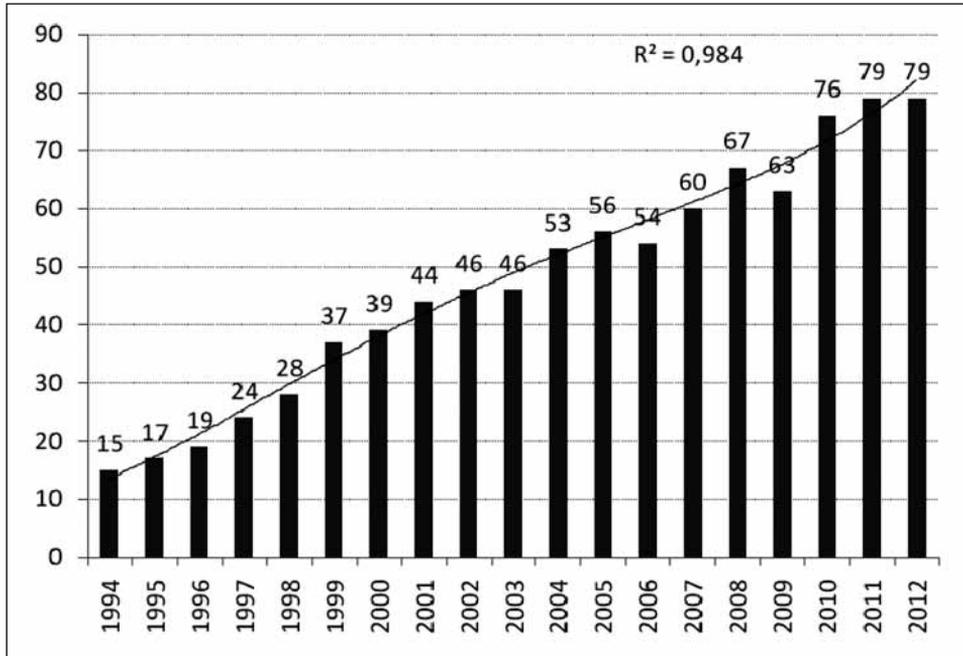


Figure 1. Population dynamics of E. bison population “Volozhynskaya”

The population generally increases but with a tendency a decrease of its rate: the value of an increment ranged between -6.0% (2009) and 32.1% (1999), 10.1% on the average (Tabl. 1).

Rutting is observed in August-September and calving generally occurs in May. In the enclosure calves were born on May 19th, 23th, 24th and 26th 1994. For the entire period of existence of population of the bison “Volozhynskaya”, 122 calves (on average 6 calves per year) were born. The maximal number of newborns (13) was observed in 2010, minimal (3) – in 1995.

In years 1994–2012 the coefficient of birth rate had a general tendency to decrease (Fig. 2). It changed from 5.1% (2011) to 31,6% (1996), being on the average 15.2% in 18 years (Tabl. 1), that is higher by 0.5% than the value for parent population “Belovezhskaya”, but lower by 0.2% comparing to a national average value in 2008 (15.4%) (Kozlo & Bunevich 2009) and the Polish population (Krasinski *et al.* 1994; Krasochko *et al.* 2004).

The sex and age structure of the population “Volozhynskaya” in last 3 years is presented in Tabl. 2. The present sex and age structure of the E. bison population “Volozhynskaya” is dominated by semi-adult animals (for the last three years their share changed from 39.1% to 51.8%), among which females (22.4–30.3%) prevail.

The coefficient of fertility for the last three years changed from 16.0% to 56.5% (33.5 on the average) and is lower by 1.9 times in comparison with

Table 1. Numbers and population parameters in the E. bison population “Volozhynskaya”

Year	Total numbers	Calves below 1 year	Increment [%]	Birth rate [%]
1994	15	6		20,0
1995	17	3	13,3	17,6
1996	19	6	11,8	31,6
1997	24	5	26,3	20,8
1998	28	7	16,7	25,0
1999	37	6	32,1	16,2
2000	39	5	5,4	12,8
2001	44	8	12,8	18,2
2002	46	6	4,5	15,2
2003	46	7	0,0	13,0
2004	53	8	15,2	15,1
2005	56	5	5,7	8,9
2006	54	7	-3,6	13,0
2007	60	7	11,1	11,7
2008	67	7	11,7	10,4
2009	63	5	-6,0	7,9
2010	76	13	20,6	17,1
2011	79	4	3,9	5,1
2012	79	7	0,0	8,9
	average	6,4	10,1	15,2

1995 (64.2%). The reason of decrease in fertility is the reduction of the proportion of adult males in relation to adult females. At introduction of E. bison to the Nalibokskaya Forest (1994) the proportion was 2 adult females per one adult male, and now this ratio is equal 1: 4.2 (Fig. 3). Additionally not all adult males participate in reproduction since they stay away from the main herd.

The ratio of males and females older than 2.5 years (1♂♂:1.5♀♀) is a proof for rejuvenating of the population. Soon it can be expected an increase of population numbers after reaching the puberty by young animals.

It should be noted the negative influence on sex and age structure of population “Volozhynskaya” caused by poaching in January 2012 three males at the age of 5–7 years and the elimination of one 15-year sick and injured male in September 2011. Because of this the share of adult males in last year decreased from 13.9% to 7.6%.

For the entire period of existence (1994–2012) general losses in the E. bison population “Volozhynskaya” reached 44 individuals. For example in December

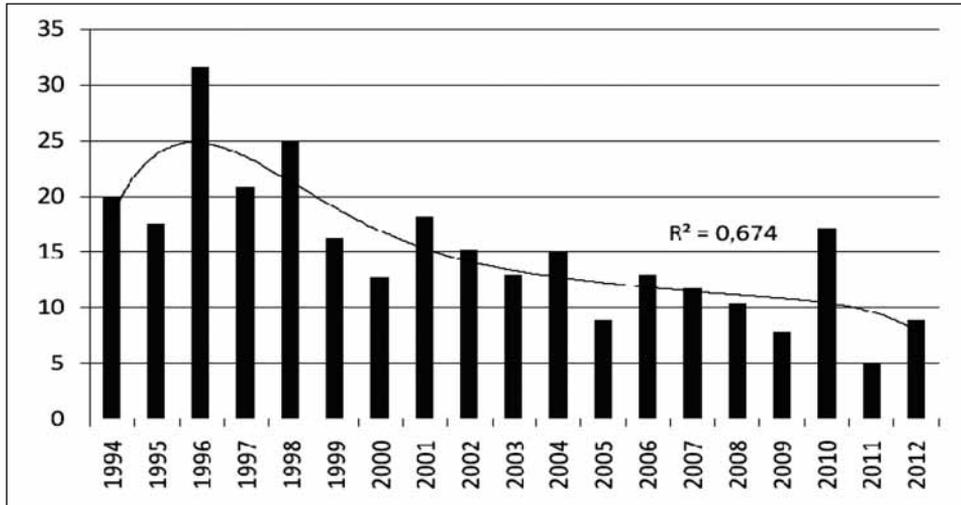


Figure 2. Dynamics of birth rate in the E. bison population "Volozhynskaya"

Table 2. Sex and age structure of the E. bison population "Volozhynskaya" in 2010–2012

Year		Adult		Juvenile				Calves up to 1 year ♀♂	All
		♂♂	♀♀	1,5 year		2,5 – 3,5 years			
				♂	♀	♂	♀		
2010	ind.	10	23	3	4	10	13	13	76
	%	13,2	30,3	3,9	5,3	13,2	17,1	17,1	100,0
2011	ind.	11	25	5	7	12	15	4	79
	%	13,9	31,6	6,3	8,9	15,2	19,0	5,1	100,0
2012	ind.	6	25	2	2	15	22	7	79
	%	7,6	31,6	2,5	2,5	19,0	27,8	8,9	100,0

1994, three-year old male was killed by poachers, and in September, 2 adult males emigrated in the direction of Lithuania. In 1996 recorded were 2 new adult males, coming from the north. However in February 1997, one of newcomers was mortally injured. In March 2000, an adult male died during fight with more powerful male because of a rupture of a bladder. In last two years, 5 cases of death E. bison were recorded. Out of the general number, 25 individuals were lost due to: poaching, disease of respiratory and digestive systems, weather conditions, emigration, etc. Remaining 19 individuals were eliminated as unsuitable for reproduction.

To a large extent, fertility in E. bison also depends on the accessibility to high quality forage (Kozlo & Bunevich 2009). Supplemental feeding for this

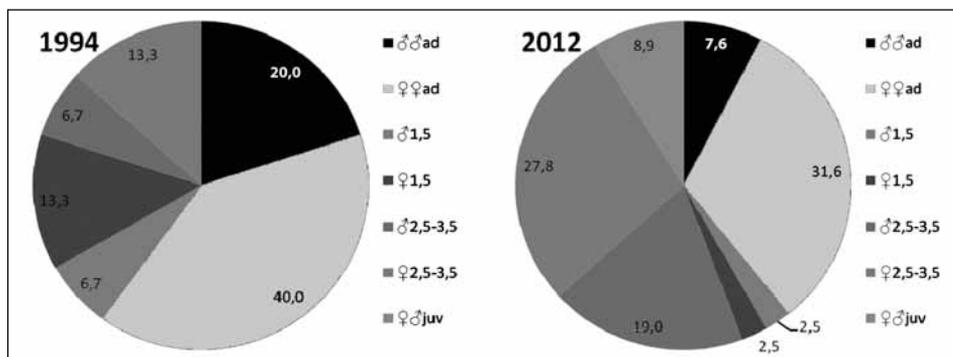


Figure 3. Sex and age structure (%) of the E. bison population “Volozhynskaya” in 1994 and 2012

population was reinstated only in 2010. During the winter period provided were grain, grain waste, potatoes and beets.

Because of a decrease of supplemental feeding in the 2000s the population has split into smaller groups (from 9 to 35 individuals), which dispersed over the whole territory of Nalibokskaya Forest. That caused lower efficiency of actions towards their protection and improvement of reproduction. Presently, the coefficient of fertility is lower by 50% comparing to the value which was observed at the beginning of population formation. Most probably, not all sexually mature females participate in reproduction. The most likely reason is that also not all available adult males take part in the reproduction. But because of the observed high proportion of young individuals, the stabilization of condition and growth of population numbers can be expected in following years. The general physical condition of animals can be estimated as good, though various diseases are observed from time to time.

The conclusions from the assessment of the formation process and current state of population “Volozhynskaya” are that the creation of free-ranging population of the European bison within Nalibokskaya Forest was successful and there is a potential for its further development. Because of the large extent of territorial distribution there is a possibility for an increase in population numbers. In the future, it will be necessary to change the approach towards the formation of the E. bison population “Volozhynskaya” from quantitative to qualitative one. Sale of trophies from eliminated defective animals should provide financing for the actions oriented on protection and increase of population numbers. Organized watching of animals during the winter period in sites of supplemental feeding, which was approved in 2010–2011, can be also a considerable source of the income. Additionally, in the Nalibokskaya Forest it is necessary to create the scientific center where there would be possible to perform studies on biological, ecological and genetic aspects of conservation and management of free-ranging population of E. bison.

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Żubr (*Bison bonasus*) w centralnej Białorusi: aktualny stan i perspektywy ochrony wolnej populacji „Volozhinskaya”

Streszczenie: Na podstawie danych wieloletnich przedstawiony jest proces tworzenia i stan aktualny wolnożyjącej populacji żubra „Volozhinskaya”, w największym kompleksie leśnym centralnej Białorusi. W ciągu 18 lat populacja zwiększyła się z 15 do 79 osobników, przy średnim rocznym przyroście równym 10,1%. Liczebność populacji, pomimo tendencji do zmniejszania się rocznego przyrostu, w krótkim czasie osiągnie poziom optymalny. Rocznie średnio rodzi się sześć cieląt, i współczynnik urodzeń ma wartość typową dla stad białoruskich. Współczynnik płodności o wartości około 50% ma mniejszą wartość niż na początku tworzenia populacji. Generalnie straty (włączając eliminacje) obejmują 44 zwierzęta, w tym 19 osobników o niskiej wartości reprodukcyjnej. Przedstawione będą perspektywy rozwoju i wykorzystania wolnej populacji żubra.
