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REWILDING IN NALIBOKSKAYA PUSHCHA

Process of a rewilding, as the latest nature protection ideologies which is based on restoration of highly productive ecosystems, characteristic for a certain region, by stage-by-stage return of the remained large animals, or so-called types engineers in places of a primordial area where earlier they were completely exterminated by the person is considered. The analysis of a revaylding in the conditions of Belarus is made for the first time for the territory of one of the largest forest complexes of Eastern Europe – the Naliboksky dense forest. The specific structure of megafauna of the Naliboksky dense forest, and also process of restoration of populations of such large phytophages as a red deer and a bison is studied. For a local site population density of representatives of megafauna is studied: bison, elk, red deer, roe, boar, bear, wolf and lynx. Calculation of impact of phytophages on forest ecosystems by calculation of the consumed phytoweight is made. The main forms of influence of views engineers of forest ecosystems – zoogene glades and reservoirs, and their value for increase of heterogeneity of habitat and preservation of a biodiversity are considered. For further restoration of ecosystems of the woods, characteristic for the doagrikulturnykh, the list of the types which are of interest to the subsequent installation is offered: fallow deer European, Przhevalsky's horse, tur cattle.

Key words: rewilding, megafauna, ecosystem, types engineers, peragriculture woods.

Introduction. Currently, humanity may have witnesses the beginning of the final stage of the collapse of ecosystems occurring on the background of the next climate adjustment, progressive population growth and increasing the negative human impact on the environment. The decline of population of top predators and large grazing animals caused by human activities, starts a "domino effect" in the complex food chains and is one of the main causes of the destruction of natural ecosystems and mass extinction of species [1].

Rewilding – the newest environmental ideology based on the recovery of highly productive ecosystems specific for this region through a phased return of the surviving large animals to the native places of the area.

The doctrine of environmental rewilding was first formulated by the Russian ecologists at the turn of the twentieth and twenty-first centuries, and developed by foreign ecologists, who gave it an English name "rewilding" from the English word *wild*.

The so-called Pleistocene parks – the specific areas in which experiments are carried out to restore the megafauna become strongholds of rewilding [1]. In the analysis of the various options and opportunities to create Pleistocene Park in Belarus one area in particular stands out – the Nalibokskaya Pushcha. It is in this woodland the representatives of megafauna have been recovered typical of our latitudes. Moreover, it should be noted that the representatives of megafauna are not only marked on the territory of the Nalibokskaya Pushcha but formed a quite stable territorial population. What, for example, can not be said of the Berezinsky Biosphere Reserve, where due to a variety of reasons the populations of such species as red deer and bison, can not be called stable.

Main part. For a long period of time the Nalibokskaya Pushcha, as well as the whole territory of

Belarus was characterized by a poor composition of megafauna, which was limited to the following species: moose (*Alces alces*), boar (*Sus scrofa*), roe deer (*Capreolus capreolus*), beaver (*Castor fiber*) and wolf (*Canus lupus*). And only in the 80s of the XX century the work on its restoration began.

The recovery of the red deer (*Cervus elaphus*) population was made in the period from 1973 to 1978. In total, 162 deer were all brought from the Belovezhskaya Pushcha. After a 2–4-month overexposure the deer were released into the wild. Within a few months, they were kept close to the aviary, and only after that they diverged. The observations showed that at the density of the population of 9 individuals per 1,000 ha and above, the development of the surrounding forests occurred at the site of habitat. By the 90-ies the deer had been constantly me in the forests of the Belarusian Society of Hunters and Fishermen – Volozhin, Lida, Dubrovsky and Stolbt-sy forest-hunting farms. Due to the achievement of a significant size and density of deer hunting has become the object of the mentioned hunting grounds. In the western part of the territory of the Nalibokskaya Pushcha of the Ivie forestry in 1981, 16 deer were also brought and released, including 11 individuals from the Belovezhskaya Pushcha and 5 individuals (4♀ and 1♂) from the Osipovichy forestry, which had mixed Belovezhsky-Voronezh origin. The role of this group in the formation of the Nalibokskaya populations remains unclear, since it practically ceased to exist by the mid 90-ies of the XX century. Some of these animals preserved in the territory of Vishnevsky forest of the Volozhin forestry, which is the northern edge of the Nalibokskaya Pushcha. It is here that the local group of deer, which is separated from the main one by the distance of 10–15 km, dwells.

The role of resided deer in the Novogrudok district is clearer. In the early 90-ies of the XX century

deer from the Belovezhskaya Pushcha were released on the territory of the Shchors forestry. Here, the animals settled down and gave rise to the so-called southern hearth settlement of deer in the Nalibokskaya Pushcha. Gradually increasing the number of populations of deer in Volozhinsky and Novogrudsky settlement centers by the beginning of 2000, closed in one Naliboki population, numbering at present 1,250–1,300 individuals.

The recovery of the bison population (*Bos bison*) began in 1994, when 15 individuals from the Belovezhskaya Pushcha were brought to the Volozhin forestry. By now, the bisons have mastered the entire territory of the reserve, except for the portion that is in the area between the Berezina and Western Isloch. The total number of the bisons in the Nalibokskaya Pushcha is 90.

In 2012, after more than 50-year absence, the brown bear (*Ursus arctos*) has newly settled in the territory of the Nalibokskaya Pushcha. Settling of the territory by this predator is happening at the moment. The number of bears estimated is 4 (1 adult male, 1 adult female with 1 little bear, 1 young bear at the age of 3 years old).

For the last 3 years on the territory of the Nalibokskaya Pushcha there has been (for a number of reasons) a sharp reduction in the number of species such as the roe deer and wild boar. Their number is estimated to be 200–300 individuals, and 30–50 respectively.

Thus, the maximum possible recovery of megafauna has been made on the territory of the Nalibokskaya Pushcha under the current conditions.

The main essence of rewilding is the recovery of ecological roles of species in ecosystems. In this regard, we have analyzed the recovery of cenotic relations characteristic of pre-agricultural forest ecosystems on the local area (the tract "Tyakovo") of the Nalibokskaya Puscha.

To do this, we assessed the density of the population of the representatives of large mammals. This evaluation results show that the saturation of the ecosystems by the representatives of megafauna is high. Thus, on the territory of the tract the bison population density is estimated to be 10–15 ind./thousand ha, moose – 12–17 ind./thousand ha, red deer – 45–55 ind./thousand ha, the European roe deer – 1.7 ind./thousand ha, wild boar – 2 ind./thousand ha, river beaver – 2–4 ind./km of shoreline. At the same time, the tract is a part of the territory of habitat of wolves the total number of which is 6 individuals as well as 2 lynx and 1 adult male bear.

The high abundance of herbivores naturally can not but influence the phytocenoses. We calculated the consumption of vegetable feed from 1 thous. ha (Table) on the basis of published data on the volume of consumption of feed [2] and our own research of the population density of the species.

On the average the estimated number of grazing animals consumes about 388 kg of phytomass per 1 hectare per 1 year. Considering that forest stocks of phytomass (without trees) range from 400 to 9,200 kg/ha [3, 4] we can conclude that the impact of grazing animals on forest ecosystems is quite high. As a result of this impact the local destruction of woody plants and forest canopy thinning occurs that gives rise to zoogenic fields, which play an important role in forest ecosystems. Zoogenic reservoirs are formed in the fields of life of river beavers which also lead to the disruption of the local forest canopy. As a result, the heterogeneity of the environment is created in the forests, which is close to the environment typical of pre-agricultural, climax forests. Such a heterogeneous medium in the forest plays an important role to increase the biodiversity and improve the sustainability of forest ecosystems. So, in this tract the occurrence of protected species of animals are significantly higher than in tracts with poor composition of megafauna. On the territory of the tract there are animal species included in the Red Book of Belarus (greater spotted eagle, white-tailed eagle, owl, gray crane, black stork, bison, lynx, badger) and having an unfavorable conservation status in Europe (black grouse, capercaillie, garganey, whooper swan and otter). It should be noted that these species belong to different environmental groups. This is made possible as a result of a variety of habitats on relatively small areas, which increases their ecotone.

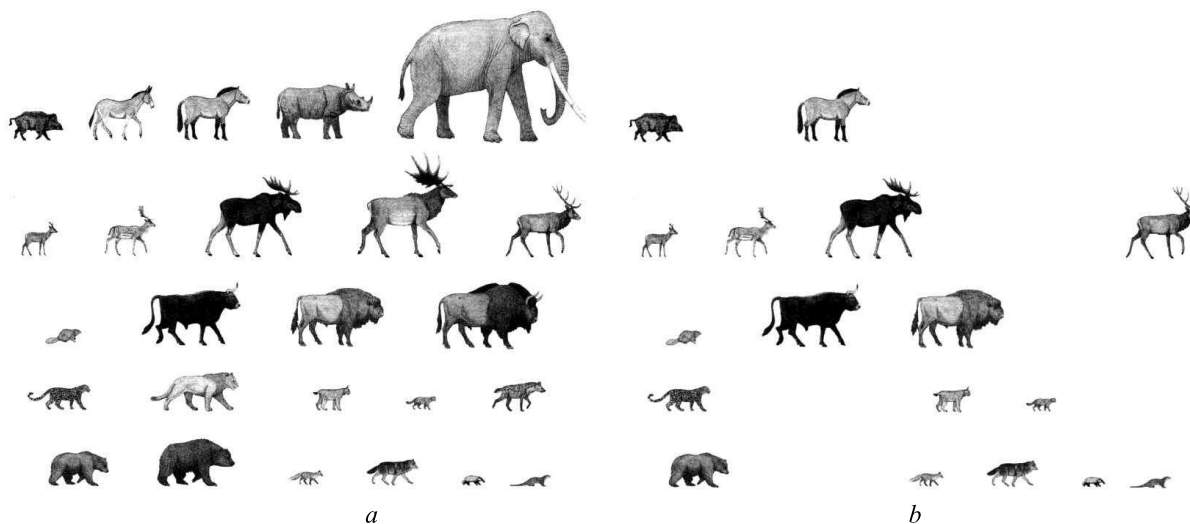
The main increase in ecotone of the area is the result of activity of animals. Mosaic nature caused largely by life activity of animals, herbivores is a characteristic feature of forest landscape, as well as phylogenetic mosaic.

But it should be emphasized that at present the distinct heterogeneity of the environment has not been reached yet. This is due to incomplete recovery of key species and, as a consequence, insufficient recovery of cenotic links in the ecosystem. Thus, recovered representatives of large herbivores (deer, bison) belong, in fact, to the detrital food chain and are unable to maintain zoogenic glade in a highly productive state. This in turn can lead to the degradation of created pastures due to the accumulation of phytomass of grassy plants.

An important step to achieve the components of pre-agricultural forests [5] should be a check-in of missing species detrital (European fallow deer) and pasture (Przewalski's horse and Taurus-like cattle) food chains. Settlement of these species is necessary for the formation and maintenance of semi-open and open landscapes with mesoscale herbaceous ecosystems in a highly productive state. Prospects for recovery of key species for forest ecosystems of the Nalibokskaya Pushcha are presented below.

The calculations of biomass consumption by large phytophages of Nalibokskaya Pushcha

Kind of animal	Habitat density, ind./ha	Daily need, kg		Consumption per 1 day, kg		Total consumption, kg	
		vegetation period	winter	vegetation period	winter	vegetation period	winter
Bison/aurochs	12	30	15	360	180	73,800	28,800
Elk	15	25	17	375	255	76,875	40,800
Deer	40	12	10	480	400	98,400	64,000
Roe	3	4.5	2.5	13.5	7.5	2,768	1,200
Boar	1	5	2.5	5	2.5	1,025	400
Total	–	–	–	–	–	252,868	135,200



Prospects for recovery of megafauna in Nalibokskaya Puscha:
 a – pleistocene fauna of Central Europe during the interglacial period;
 b – perspective fauna of Nalibokskaya Pushcha

Conclusion. The experiment to maximize the full restoration of forest ecosystems, characteristic of the forests of Belarus before the man’s destruction of one of the main components – large herbivores is in the process of carrying out on the territory of the Nalibokskaya Pushcha. Restoration of the maximum possible number of key spe-

cies of large herbivores typical of forest ecosystems in Eastern Europe of the beginning of the holocene will enable us to achieve the landscape and population mosaic, which in turn will lead to the formation of a large number of ecotone communities that have the highest biodiversity and environmental sustainability.

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