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THE ROLE OF THE BIOSPHERE RESERVE «ASKANIA-NOVA» IN PRESERVING THE RARE FAUNA OF NATIONAL AND INTERNATIONAL IMPORTANCE

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The ecosystems of the modern biosphere reserve «Askania-Nova» have been significantly transformed in the course of almost 120 years of its existence and have in their natural-anthropogenic line all the variants of nature management inherent in the Dnieper-Molochnianske interfluvium. The largest protected steppe ecosystem of Europe and the oldest one on the planet has become a steppe oasis among the agrolandscape. **Aim.** The aim of the study was to determine the species diversity of rare fauna in the territory of the biosphere reserve, protected by the Red Book of Endangered Species of Ukraine, the Red Book of the International Union for Conservation of Nature, and according to international conventions for biodiversity preservation. **Methods.** The studies were conducted via the analysis of literature and archive data, electronic databases of the authors, visual observations over animals within the boundaries of the biosphere reserve and insects from light traps, application of ultrasound Pettersson D 240x and Pettersson D 500x detectors with further processing using BatSound and Excel 2016 software. **Results.** 130 species of animals listed in the Red Book of Ukraine, 324 protected ones according to the Bern (1979) and Bonn (1979) conventions, as well as 66 species included in the list of the International Union for Nature Conservation were found in the biosphere reserve «Askania-Nova». A gradual decrease of the special steppe rare fauna with a simultaneous increase in ecological niches for rare animals of other climatic zones is traced. The character of the stay of the protected species changes and the quantitative indices of steppe taxa are reduced with the simultaneous increase in wetland and polyecotopic ones. **Conclusions.** The relevance of the correction of the existing edition of the Red Book of Ukraine has been proven, which concerns additional listing of 87 animal species as well as their current status for the territory of the biosphere reserve.

Keywords: rare species of the Red Book of Ukraine, of Europe, IUCN.

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INTRODUCTION

The biosphere of the planet has been losing its species diversity rapidly. A considerable loss has been noted both in the equatorial zone and in the latitudes of moderate climate – the zones of intensive land use, which has become rather extensive in the southern steppe region of Ukraine as well.

The increasing human impact on natural ecosystems has been traced here for the last 200 years. The general cattle grazing pattern, notable for the XIX – early XX

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century, has been replaced with bogharic (dry-land) agriculture, which was considerably changed for cultivation of agricultural crops in irrigated conditions in the second half of the XX century. This was made possible due to the construction of one of the largest irrigation networks in the world, including Northern Crimean, Kakhovka and Inhulets irrigation systems with the area of over 1,200 thousand hectares. By the end of the XX century the ploughness level of virgin ecosystems in Zaporizhzhia, Mykolayiv, Kherson regions reached as high as 80–90 per cent. The same indicator for the Autonomous Republic of Crimea is somewhat lower – 69 % [1]. Due to this transformation

of the southern Ukrainian steppe, most steppe species of animals have become of disjunctive character, and their locality has been the remains of ecosystems in the places, inadequate for agriculture – draws, depressions, shore-land of the Sea of Azov and the Black Sea, riversides, and reserve territory. One of these – the biosphere reserve «Askania-Nova» – is located in the center of the Dnieper-Molochnianske interfluvium; this is the largest European steppe reserve (330.3 sq. km.) and the oldest steppe reserve territory of the planet. The current natural-territorial complex of the biosphere reserve has acquired the whole set of ecosystems, inherent to the southern steppe region of Ukraine, for 120 years of its existence. They are situated in different modes of land use: from proximal to absolute reserve in the central zone right down to intensive use, involving modern agrotechnical irrigation methods in the zone of anthropogenic landscapes. The diversity of natural and artificial ecosystems is of scientific and practical interest in the context of determining the role of this territory in preserving rare fauna of both national and international importance.

MATERIALS AND METHODS

The material for summarization of this study was found in scientific publications about the nature of the territory of the reserve-to-be, starting from the first scientific description, made by Franz Teetzmann in 1842 [2], the ornithological list of birds, presented by Friedrich Naumann in the manuscript of 1835 [3], the archives of the biosphere reserve, scientific papers in the publications of the First State Steppe Reserve “Chapli” (Askania-Nova), the Nature records for the biosphere reserve «Askania-Nova» for 1981–2016, the databases of the authors of this article, who have been working at this institution for over a decade. The work also involved the use of collection funds of entomological and craniological fauna collections of the laboratory of biological monitoring and reserved steppe of the biosphere reserve as well as the scientific museum of the latter, private collections of scientists, the Red Book of Ukraine (2009) [4], lists of animals, protected according to the Bern (1979) [5] and Bonn (1979) [6] conventions and included into the Red Book of IUCN (1996) [7] and the European List of Endangered Species. The collection of field material was conducted via visual observations over animals in biotopes, the analysis of animals remains in the rangle, sampling of insects using light traps and the net. In addition to the contact method [8], the identification of species of chiropterans (*Chiroptera*) involved the distant method –

listening to and recording of their sounds using ultrasound Pettersson D 240x and Pettersson D 500x detectors (Netherlands) with further processing in BatSound 414 program [9].

The names of rare species of mammals in Ukrainian, Latin and English are presented according to Zagorodniuk I. V., Emelianov I. G. [10], those of birds – according to Fesenko H. V., Bokotei A. A. [11]. The scientific names of amphibians and reptiles are presented according to “Scientific names of Amphibians and Reptiles of Ukraine” approved by the Commission on zoological terminology of the I.I. Shmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine http://www.izan.kiev.ua/term_com/herpet.htm [12]. The Ukrainian and Latin names of insects are presented according to the Red Book of Ukraine [4]. The general computer-aided processing was conducted in Excel 2016.

RESULTS AND DISCUSSION

Since late XVIII century, the Dnieper-Molochnianske interfluvium (Fig. 1) witnessed centuries-long seasonal use of its territory, followed by permanent settlements of people, whose main occupation was animal breeding.

Sheep farming was the most common kind of breeding, demanding extensive virgin territories which were present in the mentioned region at the time. In addition to excessive grazing, it involved the extermination of some species of animals. The literature and archive documents of the XIX century contain the information only about the vertebrates, which were first and foremost of hunting interest, or could be of some threat for the settlements. For instance, the founder of the zoo, dendropark, and the first steppe reserve, Friedrich Falz-Fein indicated that in 1879, near «Askania-Nova», in Ahaimany field, the last wild horse *Equus caballus* Boddaert, 1785 ferus was killed [13]. The extinction of the most northern saiga antelope *Saiga tatarica* Linnaeus, 1766 in the southern Ukrainian Steppe occurred at the same time. As for birds of those times, the first valuable information can be found in the manuscript of Friedrich Naumann, a German ornithologist, who examined the stuffed birds, sent from «Askania-Nova» to the Duchy of Anhalt in 1835 (preserved in the museum of Ketten, Germany), and noted a number of steppe species, which became very rare since then, or even ceased to nest in the current territory of the reserve. These include: first and foremost, the steppe eagle *Aquila rapax* Temminck, 1828,

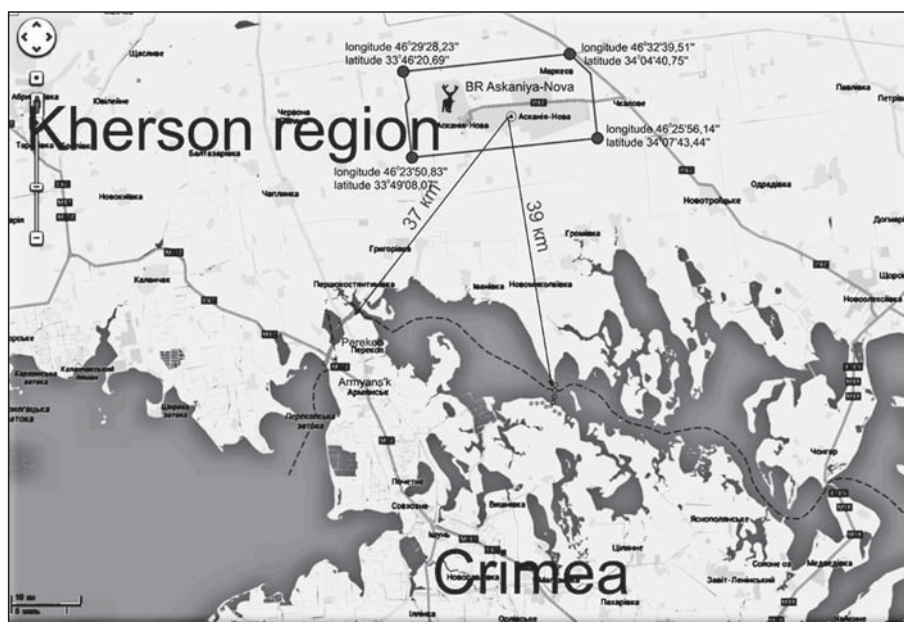


Fig. 1. Region of the biosphere reserve «Askania Nova»

lesser kestrel *Falco naumanni* Fleischer, 1818, little bustard *Tetrax tetrax* Linnaeus, 1758, great bustard *Otis tarda* Linnaeus, 1758, black-winged pratincole *Glareola nordmanni* Nordmann, 1842 [3]. The analysis of factors, which had their impact on the extinction of these species, reveals that the establishment of human settlements and the use of territory for grazing was not fatal for most steppe species. The number of small settlements among steppe and temporary or permanent sheep sheds was much higher in late XIX – early XX century compared to early XXI century. Here the impact of such negative factors as disturbance, physical elimination, stamping, and scything was extensive. At the same time, steppe eagles nested near cattle sheds and even at the outskirts of «Askania-Nova» settlement as far as in the 1920s [14] and great bustard was a commonly present species [15]. The situation suffered critical changes with the start of intensive ploughing of steppe at the end of 1950s – the beginning of 1960, and the development of irrigation.

The perishing of real steppe was accompanied with some measures in creating the reserve territories and even expanding their area. In particular, the reserve area of the biosphere reserve «Askania-Nova» was about 600 hectares from 1898 till 1927, 1,800 hectares from 1927 till 1966, and 11,054 hectares up till now (Fig. 2).

However, as of the beginning of the XX century, the steppe occupied over 90 % of all the zones of the current biosphere reserve, with only 33 % as of the

end of the same century. Since late 1970s, the whole reserve was surrounded by irrigation canals (Fig. 3).

At the same time, the core of the reserve (the reserve area according to the categories of Ukrainian legislation), the area of 8,000 hectares which have never been ploughed, has been preserved in the mode, approximate to that of absolute reserve, for 25 years. At present, the territory, relieved from domestic cattle grazing, is not under any natural impact of wild hoofed animals. The study of species diversity of animals and its quantitative indices revealed that the introduction of absolute reserve mode at a limited territory is not a guarantee of species preservation, as a strong dead underlayer is formed in the course of two or three years after the grazing of hoofed animals has been stopped in weather conditions, favorable for grasses, which is not remarkable for natural dynamics of the steppe ecosystem. When natural destroyers of grass stand, which hoofed animals have always been in the steppe, are absent, the underlayer and high dry grass stand initiate the process of mesophytization, which pushes back the very steppe species, for whose sake the reserve has been created [16, 17, 18]. One of three reserve areas of the biosphere reserve – the Great Chapelsky depression – is a natural lowland, the bottom of which is periodically filled with meltwater. Since the time of founding the reserve and up until now, this is the territory where hoofed animals of the zoo are traditionally kept in semi-free and additionally created conditions. For instance, 23.4 sq.km of the

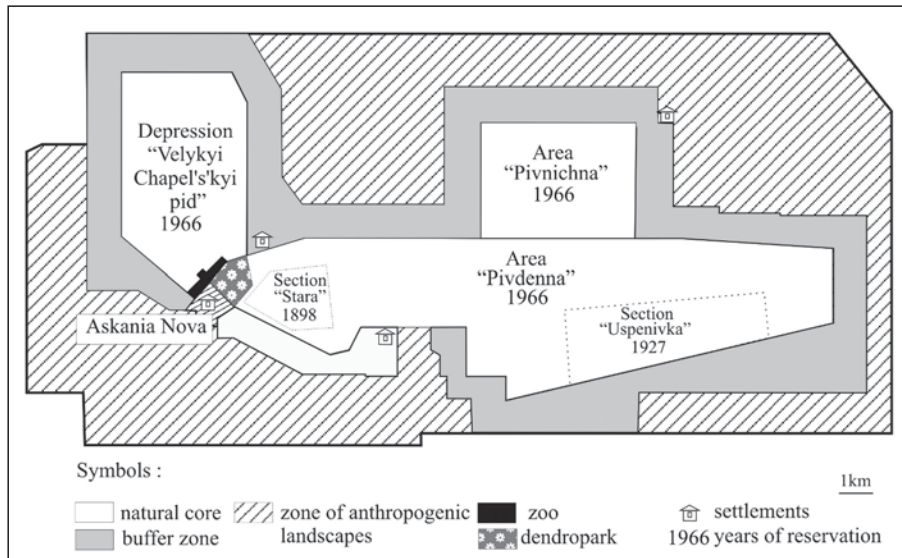


Fig. 2. The functional zoning of the territory and the years of reserving the steppe areas

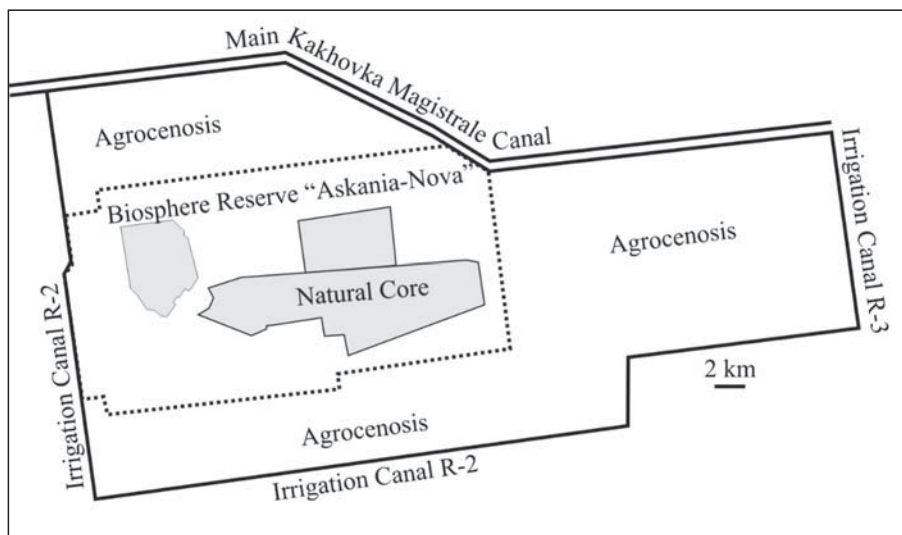


Fig. 3. Askanian steppe, surrounded by canals

depression territory are fenced and divided into 12 plots of different size to keep the hoofed animals of the zoo both for different seasons and throughout the year. As the catch water basin of the depression territory has mostly been broken in the recent 50 years, the regularity and the capacity of filling the accumulative basin have decreased. In the dry season and in winter, the water is supplied hereto via irrigation channels from artesian wells for hoofed animals of the zoo. This ensures the preservation of a permanent water basin which, in its turn, creates favorable conditions for near-water biota. In some years there is considerable impact of hoofed mammals and migrating flocks of birds both on flora and fauna complexes [19]. The

territory of the dendrological park – an insular source of woody vegetation among dry steppe – and the forest belt, created in the second half of the XX century are of great relevance as the environment of existence for rare species, including the ones, the habitat of which was of invasive character. The whole complex of natural biocenoses and the ones, created by humans in the territory of the biosphere reserve along with the natural flow of processes, ensures the conditions for the settlement of species, including the rare ones, not notable for the steppe ecosystem.

Following the strategy of preserving biodiversity, every human nation should take care of it in their own

area of residence, first and foremost. Therefore, first of all we shall consider the role of the reserve in preserving the species, introduced to the Red Book of Ukraine, as this document determines the degree of rarity and danger for species, which should be protected on legal grounds in the territory of the state.

The list of animals in the Red Book of Ukraine covers 542 species [3], including 143 hydrobionts. The analysis demonstrates that 130 rare species of the national relevance have been registered in the biosphere reserve in the last 100 years. When the hydrobionts are not taken into consideration, one may state that 32.6 % of rare terrestrial fauna, listed in the latest edition of the Red Book of Ukraine, were registered in the reserve. Fig. 4 demonstrates that regardless of consecutive reduction of steppe ecosystem biodiversity both in the region and in the current territory of the biosphere reserve, a share of rare steppe species (54) prevails among other ecological groups, with polyecotopic (32) and wetland species (29) to follow.

At the same time, the polyvariant use of the territory of the biosphere reserve, the presence of wetland, park biotopes, forest belts with woody vegetation, as well as the zoo with semi-free enclosure of animals, make the area extremely attractive for the migrating birds, promoting their nesting, stops and preservation. That is why among the other animals the class of Birds (Aves) is represented by the highest number of rare species (63) (Fig. 5).

The next position is taken by invertebrates, only one species among which – house centipede *Scutigera coleoptrata* Linnaeus, 1758 – does not belong to the class of Insects (Insecta). Among rare insects, the order of hymenopterans (Hymenoptera) is represented the most – 21 species, which are mostly steppe species: *Criptocheilus rubellus* Eversmann, 1846, *Stizus bipunctatus* F. Smith, 1856, *Stizoides tridentatus* Fabricius, 1775, *Sphex flavipennis* Fabricius, 1793, *Anthophora robusta* Klug, 1845, *Bombus fragrans* Pallas, 1771 and others.

The distribution of animals, registered in the territory of the reserve, according to the rarity categories of the Red Book of Ukraine, is as follows: rare species are the best represented group (RS) – 50, followed by vulnerable species (VS) – 40. The group of endangered species (ES) has 30 representatives (Fig. 6).

It should be noted that according to the materials of the latest edition of the Red Book of Ukraine, the rare fauna in the biosphere reserve «Askania-Nova»

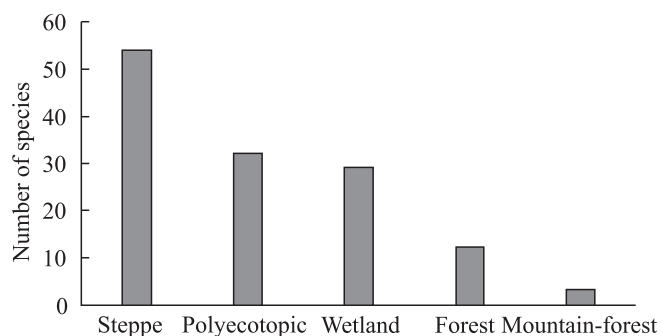


Fig. 4. The representation of ecological groups of animals, listed in the Red Book of Ukraine, in the biosphere reserve «Askania-Nova»

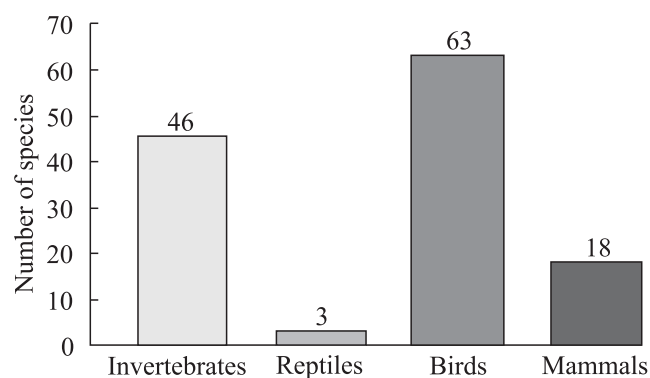


Fig. 5. The taxonomic representation of species, listed in the Red Book of Ukraine, in the biosphere reserve

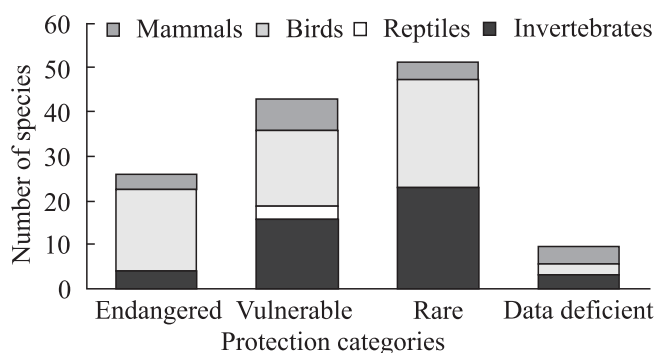


Fig. 6. The distribution of rare fauna of the biosphere reserve according to the rarity categories in the Red Book of Ukraine

is represented only with 43 species of invertebrates, mammals, birds and amphibians. According to our studies, this list should be added 87 species and relevant corrections should be introduced into the next edition.

When the Council of Europe was adopting the Convention on the Conservation of European Wildlife and Natural Habitats – Bern Convention, 1979 and the Convention on the Conservation of Migratory Species of Wild Animals, CMS – Bonn Convention, 1979, they were based on the situation with animal



Przewalski's wild horse
Equus caballus Boddaert 1785



Gray dwarf hamster
Cricetulus migratorius Pallas, 1773



Steppe Eagle
Aquila rapax Temminck, 1828



Short-eared Owl
Asio flammeus Pontoppidan, 1763



Long-legged Buzzard
Buteo rufinus Cretzschmar, 1827



Montagu's Harrier
Circus pygargus Linnaeus, 1758



Great Bustard
Otis tarda Linnaeus, 1758



Little Bustard
Tetrax tetrax Linnaeus, 1758



Demoiselle Crane
Anthropoides virgo Linnaeus, 1758



Curlew
Numenius arquata Linnaeus, 1758



Roller
Coracias garrulus Linnaeus, 1758



Rose-coloured Starling
Sturnus roseus Linnaeus, 1758

THE ROLE OF THE BIOSPHERE RESERVE «ASKANIA-NOVA» IN PRESERVING THE RARE FAUNA



Steppe Viper
Vipera renardi Cristoph, 1861



East-Four-lined Ratsnake
Elaphe sauromates Pallas, 1811



Smooth Snake
Coronella austriaca Laurenti, 1768



Andrena ornata
Morawitz, 1878



Anthophora (Lophanthophora)
robusta Klug, 1845



Eucera (Synhalonia) armeniaca
Morawitz, 1878



Bombus (Megabombus)
argillaceus Smith, 1854



Bombus muscorum
Linnaeus, 1758



Bombus fragrans
Pallas, 1771



Xylocopa valga
Gerstaecker, 1872



Libelloides macaronius
Scopoli, 1763



Stizoides tridentatus
Fabricius 1775

species, common for Western Europe. The Western European scientists had scarce information about the preservation of species diversity in the Eastern Europe, thus many species, common for the latter, were included into the protection lists of animals. While analyzing the species diversity, listed in the addenda of the abovementioned conventions and the species diversity of the animals in the biosphere reserve, we established that currently 324 species of animals, protected according to Bern and Bonn conventions, are present in all its zones. There is an analogous situation with the species, listed in the European Red List, which is close to Addenda 2 and 3 of Bern convention; most species, listed in them, belong to category LC, that is the one with the least risks.

Rare fauna of the Red List of IUCN is presented in the biosphere reserve «Askania-Nova» with 66 species, 34 of which belong to the category of minimal risks (LC), and the representative of one species, considered to be the subspecies of the extinct wild horse – Przewalski's horse (*Equus caballus* Boddaert, 1785 – *Equus ferus przewalskii* Poljakov, 1881) – has a status of extinct in the wild (EW). At the same time, this status may be changed in the near future, as in 1992–1993 Przewalski's horse was returned from «Askania-Nova» to Mongolia, Khustain Nuruu and Takhin Tal national parks. These were the first projects of returning this species into Mongolian nature, which were carried out in cooperation with the Foundation for the Preservation and Protection of the Przewalski's horse, the Netherlands, and the Christian Oswald Foundation for Preservation of Wild Animals, Germany. The repatriation was found to be more successful in the first reserve, the animals have already been transferred from enclosures into free habitat. As for «Askania-Nova», the species is still kept semi-free in the enclosures of the Great Chapelski depression. In order to ensure the preservation of the free population of Przewalski's horse in the Chernobyl Nuclear Power Plant Zone of obligatory resettlement, formed since 1999 using animals from the Askanian population, the species was included into the Red Book of Ukraine.

CONCLUSIONS

As of the beginning of the XXI century, the biosphere reserve «Askania-Nova», the largest in Europe and the oldest on the planet steppe ecosystem, acquired the features of an oasis among agricultural landscape of southern Ukraine.

The species diversity of animals of different rarity categories includes aborigine species as well as representatives of other climatic zones, which have settled in new ecological niches, formed in the process of transforming steppe ecosystems. There is traceable loss of steppe diversity, which is going on in the complex of rare species, protected by the state and international conventions.

130 species of animals, listed in the Red Book of Ukraine, are present in all the zones of the biosphere reserve, which is 32.6 % from the number of rare terrestrial fauna of national relevance.

The territory is important in terms of being the collection place for migrating, volant and nesting species of birds, 63 of which are listed in the Red Book of Ukraine.

The study proves the need of correcting the areas of 87 species of animals, listed in the Red Book of Ukraine, with the indication of their status in the biosphere reserve «Askania-Nova».

There are 324 species, protected according to Bern (1979) and Bonn (1979) conventions as well as 66 species of different rarity degree, listed in the International List of IUCN.

The experiment of returning Przewalski horse from «Askania-Nova» into the wild areas of Mongolia was successfully conducted twenty-five years ago with subsequent renaturalization.

Роль біосферного заповідника «Асканія-Нова» у збереженні рідкісної фауни національного і міжнародного значення

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Екосистеми сучасного Біосферного заповідника «Асканія-Нова» за майже 120 років його існування зазнали суттєвої трансформації і мають у своєму природно-антропогенному ряді всі варіанти природокористування, притаманні межиріччю Дніпро-Молочна. Найбільша заповідна степова екосистема Європи і найдавніша на планеті стала степовою оазою серед агроландшафту. **Мета.** Метою дослідження було виявлення видового різноманіття рідкісної фауни на території біосферного заповідника, що охороняється за Червоною книгою України, Червоною книгою міжнародного союзу охорони природи та згідно міжнародних конвенції зі збе-

реження біорізноманіття. **Методи.** Дослідження проведені в межах біосферного заповідника шляхом аналізу літературних та архівних даних, електронних баз даних авторів, візуальних спостережень тварин у природі, привабленням комах на світло, застосуванням ультразвукових детекторів “Pettersson D 240x” і “Pettersson D 500x” з подальшою обробкою у комп’ютерній програмі BatSound та Excel 2016. **Результати.** Встановлено, що в біосферному заповіднику зустрічається 130 видів тварин, занесених до Червоної книги України, 324 охоронюваних за Боннською (1979 р.) та Бернською (1979 р.) конвенціями та 66 видів, віднесених до Червоного списку Міжнародного союзу охорони природи. Простежується поступове скорочення суто степової рідкісної фауни з одночасним збільшенням екологічних ніш для рідкісних тварин інших природних зон. Змінюється характер перебування охоронюваних видів, а також зменшуються кількісні показники степових таксонів, при збільшенні водно-болотних та полієкотопних. **Висновки.** Результатом дослідження є висновок щодо актуальності коригування існуючого видання Червоної книги України в частині внесення змін до ареалів 87 видів тварин з визначенням їх статусу для території біосферного заповідника.

Ключові слова: рідкісні тварини Червоної книги України, Європи, Міжнародний союз охорони природи.

Роль біосферного заповідника «Асканія-Нова» в сохрании редкой фауны национального и международного значения

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Экосистемы современного Биосферного заповедника «Аскания-Нова» за почти 120 лет его существования существенно трансформировались и имеют в своем природно-антропогенном ряду все варианты природопользования, присущие междуречью Днепр – Молочная. Самая большая заповедная степная экосистема Европы и старейшая на планете стала степным оазисом среди агроландшафта. **Цель.** Целью исследования было выявление видового состава разнообразия редкостной фауны на территории биосферного заповедника, которая охраняется Красной книгой Украина, Красной книгой международного союза охраны природы, а также в соответствии с международными конвенциями по сохранению биоразнообразия. **Методы.** Исследования проведены в пределах биосферного заповедника путем анализа литературных и архивных данных, электронных баз данных авторов, визуальными наблюдениями за жи-

вотными в природе, привлечением насекомых на свет, применением ультразвуковых детекторов “Pettersson D 240x” и “Pettersson D 500x” с дальнейшей обработкой в компьютерной программе BatSound и Excel 2016. **Результаты.** Установлено, что здесь встречается 130 видов животных, занесенных в Красную книгу Украины, 324 охраняемых по Бернской (1979 г.) и Боннской (1979 г.) конвенциям, а также 66 видов, включенных в список Международного союза охраны природы. Прослеживается постепенное сокращение сугубо степной редкостной фауны с одновременным увеличением экологических ниш для редких животных других климатических зон. Изменяется характер пребывания охраняемых видов, а также уменьшаются количественные показатели степных таксонов при увеличении водно-болотных и полиэкотопных. **Выводы.** Результатом исследования является вывод об актуальности корректировки существующего издания Красной книги Украины в части внесения изменений к ареалам 87 видов животных с определением их статуса для территории биосферного заповедника.

Ключевые слова: редкие животные Красной книги Украины, Европы, Международный союз охраны природы.

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GLOSSARY

English

Taxon
 Polycotopic
 Disjunctive area
 Volitant species
 Locality
 Rangle
 Entomology
 Herpetology
 Ornithology
 Theriology
 Chiropterans
 Depression
 Mesophytization
 Wild horse
 Saiga antelope
 Steppe Eagle
 Lesser Kestrel
 Little Bustard
 Great Bustard
 Black-winged Pratincole
 Hydrobionts
 House Centipede
 Hymenopterans
 Endangered species
 Vulnerable species
 Rare species
 Data deficient

Interpretation of notions

A group of organisms, united on the bases of common classification methods
 An organism, capable of existing in different conditions
 A space of existence, divided into several separate territories
 A species, existing but not nesting in the territory in summer
 Location
 The mass of undigested bird’s food
 The science of insects
 The science of amphibians and reptiles
 The science of birds
 The science of mammals
 A group of flying mammals
 Lowland
 The replacement of rooted firm-bunch plant formations for rhizome plants
 Wild horse
 Saiga antelope
 Steppe Eagle
 Lesser Kestrel
 Little Bustard
 Great Bustard
 Black-winged Pratincole
 Organisms, existing in water environment
 A rare centipede species
 A line of insects
 A species in danger of extinction
 A vulnerable species
 A rare species
 The data about the species is deficient (the current information is insufficient to evaluate the risk of its extinction based on the data about its spreading and/or number)