



ESTABLISHMENT OF THE NATIONAL BANK OF THE GENEROFUND OF BIODIVERSITY OF UKRAINE – AN IMPORTANT ELEMENT OF THE SYSTEM OF BIOLOGICAL SAFETY AND BIOLOGICAL PROTECTION OF THE STATE: ASPECTS OF MANAGEMENT AND ECONOMY

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ABSTRACT. Aim of the Research. To investigate the feasibility of a national bank gene pool of the state biodiversity establishing as a separate element of the system of biosafety and biosecurity in the context of countering threats to the biological nature of Ukraine's national security.

Materials and Methods. International and domestic legislation, scientific publications, materials of scientific and practical conferences on the conservation of the biodiversity gene pool – the development of these documents and articles became the basis of the study.

The following methods were used: hermeneutic for the analysis of cited scientific works, the given legislative acts, explanation of concepts and terms concerning genetic resources of biodiversity; systematic analysis of funding sources in the creation of a bank for the conservation of the biodiversity gene pool as an element of biosafety and biosecurity in the national security system of Ukraine and the system of public management methods for biodiversity conservation, as well as logical and formal economic methods.

Results and Discussion. The article examines the expediency of creating a national bank of the gene pool of biodiversity of the state as a separate element of the biosafety system and biosecurity in the context of counteracting biological threats to the national security of Ukraine.

It is noted that the establishment of the National Bank of the Biodiversity Gene Fund of Ukraine will allow effective safe and economic management of genetic resources of biodiversity both domestically and internationally in accordance with the Nagoya Protocol to regulate access to genetic resources and share benefits, including financial.

The main innovative tools for preserving the biodiversity of the state are considered. Possibilities of introduction of innovative tools of biodiversity conservation and implementation of the best foreign experience in Ukraine are investigated.

Conclusions. It is advisable to create National Bank of the State Biodiversity Gene Fund as a separate element of the biosafety and biosecurity system in the context of counteracting biological threats to the national security of Ukraine. It is proposed to legislate its creation by including it in the draft Law of Ukraine "On biosafety and biosecurity".

Key Words: national biota gene pool bank, biodiversity, biological threats, bio-risks, biological security, biological protection, public administration, financing.

Introduction. Ukraine is a party to numerous multilateral agreements concerning the conservation and balanced use of biodiversity. Among them is the "Convention on the Protection of Biological Diversity" (hereinafter – the Convention), which was ratified by the Law of Ukraine of November 29, 1994 No 257/94-VR [1].

On October 18 – 20, 2010 in the Japanese city of Nagoya in accordance with the implementa-

tion program of the Convention adopted the Nagoya Protocol to regulate access to genetic resources and benefit-sharing (hereinafter – the Nagoya Protocol) [2].

On the issue of biosafety and biosecurity of the state, the Nagoya Protocol is an extremely important international treaty that has established and supported the implementation of the Convention on Biological Diversity, especially

one of its three objectives, especially one of its three objectives, namely the sharing on a fair and equitable basis of the benefits of the use of genetic resources in the national economy. The Nagoya Protocol is relevant to international bioresource management and access to them, especially in the commercial and non-commercial sectors involved in the use and exchange of genetic resources. The agreement reached includes as one of the preconditions for access to the genetic resource and its use the need to share with the supplier the benefits of using the resource. On the other hand, genetic resource customers are also required to ensure fair and non-discriminatory rules and procedures for access to their genetic resources.

The Nagoya Protocol provides clearer legal certainty and increases transparency for both suppliers and users of genetic resources. It helps ensure benefit-sharing, especially when genetic resources are exported from the host country. By enhancing legal certainty and encouraging inter-governmental benefit-sharing, the Protocol stimulates the advancement of research in the field of genetic resources, which can lead to new discoveries and create incentives for the conservation and sustainable use of the planet's biodiversity.

Under the anthropogenic influence as a result of human economic activity in Ukraine there is an active destructive transformation of the natural environment, including biota: the steppes were plowed, forests were uprooted in large areas and replaced with agricultural lands, and many swamps were drained. Thus, the problem of conservation of domestic genetic resources of biodiversity has become extremely relevant and important in the context of national security.

Undoubtedly, there is a need to create a biosafety system (hereinafter – biosafety) and biological protection (hereinafter – biosecurity) of Ukraine – one of the important elements in the implementation of the adopted Strategy for Biosafety and Biosecurity on the principle of “Single Health” for the period up to 2025 (hereinafter – the Strategy) – a specialized structure such as the National Bank for Biodiversity Gene Fund.

Aim of the Research. To investigate the feasibility of a national bank gene pool of the state biodiversity establishing as a separate element of the system of biosafety and biosecurity in the context of countering threats to the biological nature of Ukraine's national security.

Research on the prospects of creating a DNA collection as an important resource in global

efforts to overcome the crisis of dynamic reduction of the species composition of biodiversity on Earth, managing the world's genetic resources and maximizing their potential – a problem studied by a large group of foreign scientists. In particular, Adams, R.P. DNA Bank-Net – An overview (1994) examines the conservation of plant genetic resources, both natural and anthropogenic in the form of DNA banks [3]; Graner A., Anersson M. S. & de Vicente M. C. A model for DNA banking to enhance the management, distribution and use of ex situ stored PGR (2006) describes some innovative approaches, focusing on monomolecular polymorphism (SNPs) in the genotyping (creation of genetic passports) of plants. Highlight the achievements and accomplishments in this area of research, analyze and outline the prospects for the use of SNPs, as well as consider other approaches to plant genotyping [4] – Savolainen V., Powel M.P., Davis K., Reves G. & Corthals A. [et al.] DNA and tissue banking for biodiversity and conservation: theory, practice and uses (2006) are leading biologists, economists and lawyers - experts in international environmental law to promote global economic development, while preserving local biodiversity [5]. Hodgkinson T. R., Waldren S., Parnell J. A., Kelleher C. T., Salamin K., & Salamin N. DNA banking for plant breeding, biotechnology and biodiversity evaluation (2007) in the review analyze existing international DNA banks and outline the directions of their work. This includes the collection, preservation, isolation, storage, management of databases and exchange DNA of plants [6]. Bonnet J., Colotte M., Coudy D., Couallier V., Portiver J., Morin B., Chain S. and conformation stability of solid-state: implications for room temperature storage (2010) experimentally show that atmospheric water and oxygen adversely affect the preservation of DNA at room temperature.

For long-term storage at room temperature, it is recommended to dehydrate DNA [7]. Gemeinholzer B., Rey I., Weising K., Grundmann M., Vbtlner A. N., Zetsche H., Weigt L. Organizing specimen and tissue preservation in the field for subsequent molecular analyzes (2010) investigated and proposed procedures for sampling plant tissue in the field and the technology of their preservation for further molecular analyzes [8]. Applequist W. I. & Campbell I. M. [et al.] DNA Banking for the 21st Century: Proceedings of the U. S. Workshop on DNA Banking. (2014) investigated the practice of collecting and storing infor-

mation on genetic resource banks through an online survey that included 57 questions to those responsible for preserving 45 international independent collections in 39 different institutions and nine countries [9]. Stierschneider M. & Sehr E. M. A DNA repository platform for germplasm collection (2016) analyzed the current state of conservation of plant genetic resources in the world in the context of the threat of "genetic erosion". They noted the importance of DNA banks in the storage of DNA samples and proposed legal mechanisms for their transfer for scientific purposes [10]. Relado Antonio "UK Biobank supercharges medicine with gene data on 500,000 Brits" in the study examines the activities of the Biobank of Genetic Resources (DNA) for 500,000 citizens of the United Kingdom. Reveals the mechanism of management of these resources, their replenishment and use in the interests of customers [11].

Many scientific works of domestic scientists are also devoted to the preservation of genetic resources of biodiversity of Ukraine. Thus, these issues concerning the gene pool of farm animals were studied by Zubets M. V., Melnyk Yu. F.; Burkat V. P., Huziev I. V., Mykytiuk D. M., Bilous O. V., Kudriavska N. V. and others [12].

Problems of preservation of cultural plant genetic resources are reflected in the publications of Riabchun V. K., Bohuslavskyi R. L., Herasymova M. V., Kuzmyshyna N. V., Bondarenko V. M., Muzafarova V. A., Kholod S. M., Kholod S. G., Kurdin O. O. [13].

Introduction of rare natural plant species by transfer to the botanical garden was investigated by Melnyk V.I., Sobko V.G., Sikura J.J., Kharchyshyn V.T. and others [14].

Scientific publications Holovko A. M., Oliinyk V. O., Krasnobaiev E. O., Skrypyuk V. G. and others relate to technologies for the preservation of microorganisms to meet the needs of the national economy [15].

At the same time the need to create National Bank of the Biodiversity Gene Fund of Ukraine, in which the genetic resource of the state's biota would be accumulated as an important element of the system of biosafety and biosecurity of the state was not studied.

Materials and Methods. The source base of the study is international (Declaration on the Conservation of Flora, Fauna and Habitat, 1988: Decision of the European Economic Commission E (43); Declaration on Environmental Issues:

United Nations Conference on the Environment (Stockholm, June 16, 1972); Rio Declaration on Environment and Development (June 14, 1992) Rio Declaration on Environment and Development (June 14, 1992); Declaration and Plan of Implementation of the World Summit on Sustainable Development (August 26 – September 4, 2002, Johannesburg, South Africa). – 2nd typ. – K.: UNDP / MGSDP, 2007; United Nations Convention on Biological Diversity of June 5, 1992; Convention on Wetlands of International Importance, Mainly as Habitats for Waterfowl, Ramsar, February 2, 1971, as amended by the Paris Protocol of December 3, 1982 and the Ridge Amendments of May 28, 1987; Declaration and Plan of Implementation of the World Summit on Sustainable Development (August 26 – September 4, 2002, Johannesburg, South Africa). – 2nd typ. – K.: UNDP / MGSDP, 2007; Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Matters Concerning the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention) of June 25, 1998; Convention on International Trade in Endangered Species of Wild Fauna and Flora of March 3, 1973, amended on June 22, 1979; Convention on the Protection of Biological Diversity of June 5, 1992; Convention on the Conservation of European Wildlife and Natural Habitats of September 19, 1979; Nagoya Protocol on Access to Genetic Resources and Fair and Equitable Sharing of Benefits Arising from their Application to the Convention on Biological Diversity (Nagoya, Japan, October 18 – 29, 2010); Agreement on cooperation in the field of conservation and use of genetic resources of cultivated plants of the CIS member states: Law of Ukraine of February 10, 2000 No 1452-III; Directive of the European Parliament and of the Council (EU) 2015/412 of March 11, 2015 amending Directive 2001/18/EC concerning the possibility for Member States to restrict or prohibit the cultivation of genetically modified organisms (GMOs) on their territory; Directive 2009/147/EC of the European Parliament and of the Council of November 30, 2009 "On the conservation of wild birds"; Directive 2008/99/EC of the European Parliament and of the Council "On criminal and legal protection of the environment"; Directive 2008/27/EC of the European Parliament and of

the Council of March 11, 2008 amending Directive 2001/18/EC “On the deliberate release into the environment of genetically modified organisms” relating to the executive powers conferred on the Commission; Commission Directive 2004/102/EC “Amendments II, III, IV and V to Council Directive 2000/29/EC on protection measures to prevent the introduction into the Union of organisms harmful to plants and plant products and to prevent their spread in Union countries”; Directive 2004/35/EC of the European Parliament and of the Council of April 21, 2004 “On environmental liability for prevention and elimination of the consequences of damage to the environment and domestics” (Constitution of Ukraine of June 28, 1996 No 254k/96-VR) (as amended); “On environmental protection”: Law of Ukraine of June 25, 1991 No 1264-XII (as amended); “On the nature reserve fund of Ukraine”: Law of Ukraine of June 16, 1992 No 2456-XII (as amended); “On plant quarantine”: The Law of Ukraine of June 30, 1993 No 3348-XII (as amended); “On ratification of the Convention for the Protection of Biological Diversity”: Law of Ukraine of November 29, 1994 No 257/54-VR; “On Ukraine’s participation in the Convention on Wetlands of International Importance, Mainly as a Habitat for Waterfowl”: Law of Ukraine of October 29, 1996 No 437/96-VR (as amended); “On Ukraine’s accession to the 1979 Convention on the Conservation of European Wildlife and Natural Habitats”: Law of Ukraine of October 29, 1996 No 436/96-VR; “On Ukraine’s accession to the Convention on International Trade in Endangered Species of Wild Fauna and Flora”: Law of Ukraine of May 14, 1999 No662-XIV; “On the National Program for the Formation of the National Ecological Network of Ukraine for 2000 – 2015”: Law of Ukraine of September 21, 2000 No 1989-III (as amended); “On the Red Book of Ukraine”: Law of Ukraine of February 7, 2002 No 3055-III (as amended); “On wildlife”: Law of Ukraine of December 13, 2001 No 2894-III (as amended); “On Ukraine’s accession to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity”: Law of Ukraine of September 12, 2002 No 152-IV (as amended); “On the ecological network of Ukraine”: Law of Ukraine of June 24, 2004 No 1864-IV (as amended); “On the state system of biosafety in the creation, testing, transportation and use of genetically modified organisms”: Law of Ukraine of May 31, 2007 No 1103-V (as

amended); “On the basic principles (Strategy) of the state environmental policy of Ukraine for the period up to 2020”: Law of Ukraine of December 21, 2010 No 2818-VI (as amended); “On environmental impact assessment”: Law of Ukraine of May 23, 2017 No 2059-VIII. Legislation, other regulations, scientific publications, materials of scientific and practical conferences regarding the conservation of the biodiversity gene pool.

The following methods were used in the research: hermeneutic for the analysis of cited scientific works, the given legislative acts, explanation of concepts and terms concerning genetic resources of biodiversity and legal relations in this sphere. That is, the definition of content in the establishment and implementation of the rule of law, based on knowledge of ontological technology, concepts such as content, ambiguity or polysemy, symbol, sign, etc. The method of system analysis was used to find real sources of financial investment in the Bank creation for the preservation of the Biodiversity Gene Fund as an element of biosafety and biosecurity in the National Security System of Ukraine. Systems analysis as a scientific method of cognition is a sequence of actions to establish structural relationships between variables or elements of the studied system. This method is based on a set of general scientific, experimental, natural, statistical, mathematical methods. System of methods of public management of biodiversity conservation, as well as logical and formal-economic methods.

Results and Discussion. Biological resources, as the national wealth of Ukraine, need to be preserved, protected and constantly monitored for their use. Among the Kingdoms of Animals, Plants and Fungi alone, Ukraine owns about 35% of Europe’s biodiversity, occupying only 6% of its area. Ukraine’s biodiversity includes more than 72,000 species of flora, mycobiota and fauna. Flora and mycobiota – more than 27 thousand species, including: fungi and mucous membranes – 15 thousand, algae – 5 thousand, lichens – 1.2 thousand, mosses – 800 and vascular plants – 5.1 thousand species, including the most important cultural species. The fauna includes more than 45 thousand species, including: insects – 35 thousand, arthropods without insects – 3.4 thousand, worms – 3.2 thousand; vertebrates are represented by fish and round-mouthed (170 species and subspecies), amphibians (17 species), reptiles (21 species),

birds (about 400 species), mammals (108 species) [16]. According to experts, in Ukraine, a third of species, mostly fungi and arthropods, have not yet been described. In addition, there are collections of both beneficial to humans and dangerous microorganisms.

The first level of protection of biodiversity in Ukraine is the level *in situ* – i.e. in natural conditions. Optimally, all plants, fungi and animals should be in natural conditions (*in situ*), as part of intact full-fledged populations, but in practice this is not always possible. To do this, each country creates a nature reserve fund (NRF): national nature parks, protected tracts, reserves, natural monuments, monument parks of garden and park art. Leading in the national nature reserve fund are national nature parks (NNP) – centers of the state gene pool of Ukraine [17]. Due to the regime's environmental measures, the anthropogenic load on the NNP is limited as much as possible (human intervention in natural processes), scientific monitoring, scientific researches are conducted.

The second level of biodiversity gene pool conservation in Ukraine is *ex situ*. *Ex situ* conservation involves the support of rare or most "vulnerable" biodiversity beyond their natural range. These are botanical gardens and zoos, seed cans, etc. Today, science knows examples of species of plants or animals that disappeared in nature, but preserved in the collections of botanical gardens or zoos around the world.

For example, in the collection funds of the National Botanical Garden named after M. M. Hryshko National Academy of Sciences of Ukraine has about 200 species of rare, endemic and relict plants. Most of them, since 1970, are grown on a specially created for many years site "Rare plants of the flora of Ukraine", which takes into account specific soil conditions (chernozem, forest soils, peat, sand, granite, chalk and limestone), moisture and lighting regime required by different types of plants) [18].

Zoological parks are for the animal world. Zoological parks are artificially created nature protection, research and cultural-educational institutions, which belong to the objects of nature reserve fund of national importance. Their functions: formation and maintenance of animal collections, preservation and reproduction of animals in artificial conditions, first of all, rare species listed in the Red Book of Ukraine and international Red Lists, study, generalization and

implementation of domestic and foreign experience of keeping and breeding animals in captivity; conducting research, educational and cultural-educational activities in the field of ecology, nature protection, ethology, zoology, hunting and animal husbandry, providing various forms of cultural leisure for visitors, creating appropriate conditions for recreation, while maintaining favorable conditions for keeping animals [19].

There are many other branch collection funds available in Ukraine for the storage of genetic resources of both wild and cultivated plants and wild and domestic animals. This is the National Centre for Plant Genetic Resources of Ukraine, which operates at the Institute of Plant Breeding NAAS, founded in 1993 in Kharkiv on the basis of 35 leading breeding and research institutions. There are about 126.6 thousand varieties and forms of 320 species of cultivated plants, in addition, 345 species of medicinal and 687 useful wild species of plants [20].

The third level is the preservation in the form of a culture of cells or tissues (plants, animals or humans) – *in vitro* (in glass), although now more often the culture is grown in plastic containers. The cells are incubated at a temperature of +38° C to +39° C (for cells of animal and human organisms) and at +22° C to +28° C (for plant cells) in a nutrient medium of appropriate composition.

Currently, this level of preservation of the gene pool and further increase in the number of species by microclonal reproduction is actively developing and the most developed for the plant world. Today, this is a separate biotechnological industry in the world.

Since 1992, a collection of cell lines in a cell culture bank has been created on the basis of the Institute of Cell Biology and Genetic Engineering of the National Academy of Sciences of Ukraine on the basis of research conducted both in classical botany (plant taxonomy) and biotechnology methods (*in vitro* culture). At present, the collection has about 5,000 specimens in the seed bank and more than 2,000 cell lines in the *in vitro* cell culture bank. In 1999, by the Resolution of the Cabinet of Ministers of Ukraine, the collection was included in the list of objects that constitute the national scientific heritage [21].

In vitro banks have a number of significant advantages over *ex situ* collections of live plants, first of all – it is independent of climatic and weather conditions, no risk of disease and pest attack due to storage in aseptic conditions, high

reproduction rates and reduced spatial needs, the possibility of using any suitable explant to start aseptic culture and plant regeneration [22].

An example of preserving genetic resources at the *in vitro* level for animal organisms is the Bank of Animal Genetic Resources of the Institute of Animal Breeding and Genetics. Zubets M. V. of NAAS of Ukraine. By Resolution of the Cabinet of Ministers of Ukraine of August 19, 2002, T 472-r, this Bank was included in the State Register of Scientific Objects Constituting National Heritage. The main task is to purposefully acquire the necessary amount of genetic material (sperm, oocytes, embryos, somatic cells, etc.) of certain gene pool objects and ensure reliable long-term preservation [23].

The fourth level of biodiversity conservation is the genetic certification of biota, including humans as one of its representatives. This level began at the beginning of the 21st century after Craig Venter, president of the Celera Genomics biotechnology company, announced a revolutionary breakthrough in genetics at a press conference at the White House on May 15, 2000: he and his team first deciphered the human genome, which is 20,000 – 25,000 genes.

The bioinformation method of genome mapping makes it possible not only to identify the biota by genome, but also to reproduce it in case of species loss at the three previous levels. Therefore, in the world, along with the three previous levels of conservation of genetic resources, biota is developing rapidly and the fourth level in the form of DNA banks. These are the DNA Bank of the Royal Botanic Gardens Kew, England, the DNA Bank of the New York Botanic Gardens, the United States, the Australian Plant DNA Bank, the DNA Bank of Brazilian Flora, the DNA Bank in Kirstenbosch, South Africa, the DNA Bank of the Institute of Genetics and Cytology of the National Academy of Sciences of Belarus and others.

Today there are no materials on scientific research on bioinformation mapping of genomes of the population of Ukraine. There are separate works in the field of fauna and flora and microorganisms. This is due to the shortcomings of government approaches to the need for such scientific and practical work, as well as the lack of funding. At the same time, scientists from such countries as Singapore, the United States, England, Japan, France, Germany, Russia, China, and India are engaged in these studies.

The results of their scientific activity are accumulated in the banks of genetic resources of these states and access to them is limited. By the way, Singapore is currently considered the world capital of biotechnology. Having set itself the goal of becoming a world leader in biotechnology by 2010, Singapore has done everything to achieve its goal. According to this unique project in the north-western part of the island, the research center was built and equipped with the latest technology, which was called "Biopolis". In other words, Singapore has created a "paradise" for scientists in the field of biomedical research. Despite strict rules on biosafety and biosecurity, on animal experiments, archiving of genetic information, handling of embryonic stem cells, etc., yet biosafety rules are more liberal, than, for example, in Germany. This has enabled many leading biotechnologists to move to Singapore to implement their scientific ideas [24].

Today, Singapore is one of the few countries in the world that has no foreign debt. During the XXI century, the annual economic growth in different years ranged from 7.7 to 8.7%. The highest growth rates were in mechanical engineering and biomedical production, especially in biotechnology.

Thus, Ukraine, on the one hand, after France has the second biotic genetic resource of biodiversity in Europe in terms of species composition, on the other hand, it practically does not control it. There is also no national inventory accounting. Only on January 22, 2020. The Cabinet of Ministers of Ukraine has adopted the Strategy for Ensuring Biosafety and Biosecurity on the principle of "Single Health" for the period up to 2025 (hereinafter – the Strategy) and approved the Action Plan for its implementation (hereinafter – the Plan). This plan envisages the development and submission of the draft Law of Ukraine to the Cabinet of Ministers of Ukraine in accordance with the established procedure "On biosafety and biosecurity".

Ukraine has the scientific resources to be included in the list of highly developed biotechnological countries. Therefore, as part of the implementation of the Strategy the authors consider it expedient to create the National Bank of Genetic Environmental Resources of Ukraine – an important element of the system of biosafety and biosecurity of the state.

The main purpose of the National Bank of Genetic Resources of Biodiversity of Ukraine is to

manage the circulation of available genetic resources of biodiversity of the state in order to rationally use it in the interests of the state. After the creation and replenishment of the assets of this bank, the state will receive a new strategic security level to counter biological threats.

For example, by conducting a “genetic certification” of the population of Ukraine, it is possible to develop a scientifically sound effective health care program with optimal economic costs, which will be an effective component of biosafety and biosecurity of the state. Depending on the spectrum of genetic resistance or vulnerability to the disease of the population of Ukraine, the state will be able to really plan the directions and volumes of its own pharmacological production and its import. This, in turn, will give projected profits and budget savings. The creation of the National Bank of the Biodiversity Gene Fund of

Ukraine – an important element of the state's biosafety and biosecurity system – is proposed to be laid down and recorded in the draft Law of Ukraine “On biosafety and biosecurity”.

In case of creation of the National Bank of Genetic Environmental Resources in Ukraine, it is important to study the possibilities of both domestic and international financial opportunities to support this project and effectively manage it.

Biodiversity conservation is also managed at the interstate level. At the present stage, such management is implemented by intergovernmental and non-governmental organizations involved in nature protection. They develop programs on topical issues of sustainable development, nature protection requirements, disseminate information related to nature protection issues, provide consultations, financial and technical assistance (Fig. 1).

State methods of influencing enterprises to stimulate the production of environmental goods	Administrative	Product standardization	
		Normalization	
		Ecological examination	
		Licensing	
		Limiting	
		Administrative responsibility	
		Obligations towards the consumer	
		Prohibitions	
		Antitrust laws	
		Control	
	Economic	Compulsory	Payments and fees for environmental pollution and use of resources
			Penalties
			*Pollution rights sales
			Price regulation
		Incentives	Government order
			Programming
			Financing of environmental projects and programs
			*Tax benefits
			Preferential loans
			*Subsidizing prices for environmental goods
	Organizational	Provision of legal, business and other services, assistance in finding partners, concluding agreements under state guarantees	
		Information infrastructure	
		*Initiation of demonstration projects by the state	
*Environmental audit			
*Establishment of specialized state research institutes, laboratories, centers for the assessment of production development options			
*Opening of faculties in universities, creation of courses for training in the theory of STP, innovation, ecology			
*Environmental education, advertising, etc.			

Fig. 1. The system of methods of public management of biodiversity conservation [26].

Ukraine is a party to 18 global and regional environmental conventions and 4 protocols to them. The Ministry of Energy and Environmental Protection of Ukraine coordinates environmental cooperation within the framework of 54 long-term international agreements and treaties, which include the Nagoya Protocol [25].

In general, the innovative way of developing a biodiversity conservation system is associated with many problems, among the most important – a very high level of risk for investment, which makes it difficult to find sources of funding for environmental innovation, especially with a general shortage of financial resources. Thus, external investors are reluctant to agree to finance innovative projects, and financing at the expense of own means for many domestic enterprises is practically impossible. Given the budget deficit, it also becomes impossible to rely on public funding [26].

The use of resources for the implementation of environmental innovations, such as loans and credits of commercial banks and financial leasing, is limited due to too high bank rates. In addition, commercial banks provide only short-term loans in times of financial instability, while long-term loans are required to finance innovation. That is, the provision of loans for innovation for banks is not attractive. Thus, to finance environmental innovations, the use of venture financing is promising, which is just emerging in Ukraine with the support of international financial organizations.

It is also possible to use multi-channel investment, attracting portfolio investors who include risky projects in their diversified packages, hoping to get a high return if successful. According to Art. 17 of the Law of Ukraine “On innovation”, the subjects of innovation to implement innovative projects may be provided financial support by [27]:

a) full interest-free lending (on the terms of inflation indexation) of priority innovation projects at the expense of the State Budget of Ukraine, the budget of the Autonomous Republic of Crimea and local budgets;

b) partial (up to 50%) interest-free lending (under inflation indexation) of innovative projects at the expense of the State Budget of Ukraine, the budget of the Autonomous Republic of Crimea and local budgets provided that other necessary project executor and (or) other funds are involved in project financing subjects of innovative activity;

c) full or partial compensation (at the expense of the State Budget of Ukraine, the budget of the Autonomous Republic of Crimea and local budgets) of interest paid by innovation entities to commercial banks and other financial institutions for lending to innovation projects;

d) provision of state guarantees to commercial banks that provide loans for priority innovation projects;

e) property insurance for the implementation of innovative projects by insurers, in accordance with the Law of Ukraine “On insurance”.

Financial support for innovation activities at the expense of the State Budget of Ukraine, the budget of the Autonomous Republic of Crimea, local budgets is provided within the funds provided by relevant budgets.

Sources of financial support for innovation are [28]:

a) funds from the State Budget of Ukraine;

b) funds of local budgets and the budget of the Autonomous Republic of Crimea;

c) own funds of specialized state and municipal innovative financial and credit institutions;

d) own or borrowed funds of subjects of innovation activity;

e) funds (investments) of any individuals and legal entities;

f) other sources not prohibited by the legislation of Ukraine.

To provide financial support for environmental innovation activities of economic entities of various forms of ownership, the Cabinet of Ministers of Ukraine at the request of the specially authorized central executive body in the field of innovation creates specialized state non-bank innovative financial institutions. Each such institution is subordinated to a specially authorized central executive body in the field of innovation and operates on the basis of a provision (statute) approved by the Cabinet of Ministers of Ukraine.

According to Art. 33 of the Law of Ukraine “On scientific and scientific-technical activity” the state uses financial-credit and tax levers to create economically favorable conditions for effective scientific and scientific-technical activity, in accordance with the legislation of Ukraine.

One of the main levers of state policy in the field of scientific and scientific-technical activities is budget funding. The state provides budget funding for scientific and scientific-technical activities (except for defense expenditures) in the amount of not less than 1.7% of the gross domestic product of Ukraine. Expenditures on

scientific and scientific-technical activities are protected items of expenditures of the State Budget of Ukraine.

Budget funding for research is provided through basic and program-targeted funding. Basic funding is provided to ensure:

- basic research;
- the most important areas of research for the state, in particular in the interests of national security and defense;
- development of infrastructure of scientific and scientific-technical activity;
- preservation of scientific objects that constitute the national heritage;
- training of scientific personnel.

The list of scientific institutions and higher educational institutions, which are provided with basic funding for scientific and scientific-technical activities, is approved by the Cabinet of Ministers of Ukraine.

Program-targeted funding is usually provided on a competitive basis for:

- scientific and technical programs and individual developments aimed at implementing the priority areas of science and technology;
- ensuring the implementation of the most important applied scientific and technical developments, which are performed by state order;
- projects implemented within the framework of international scientific and technical cooperation.

The State Fund for Basic Research has been established to support basic scientific research in the field of natural, technical and human sciences conducted by scientific institutions, higher educational institutions, and scientists. The activity of this fund is regulated by the Regulations approved by the Cabinet of Ministers of Ukraine. In the State Budget of Ukraine, funds for this fund are determined on a separate line. The funds of this fund are formed at the expense of both budget funds and voluntary contributions of legal entities and individuals (including foreign ones) and are distributed on a competitive basis.

State targeted scientific and scientific-technical programs are the main means of implementing the priority areas of science and technology development by concentrating the scientific and technical potential of the state to solve the most important natural, technical and humanitarian problems. Such programs are formulated by the central executive body in the field of scientific, scientific-technical and innovative activities on

the basis of targeted projects selected on a competitive basis.

In Art. 38 of the Law of Ukraine “On innovation” it is stated, that in order to financially support the state policy in scientific and scientific-technical activities and measures aimed at the development and use of scientific achievements in Ukraine, the State Innovation Fund is created, the regulations of which are approved by the Cabinet of Ministers of Ukraine. The Fund is subordinated to the central executive body in the field of scientific, scientific-technical and innovative activities [29].

Conclusions

1. Establishment of the National Bank of the Biodiversity Gene Fund of Ukraine is an important element of the system of biosafety and biosecurity of the state in accordance with the Implementation Plan of the Strategy for Biosafety and Biosecurity on the principle of “Single Health” until 2025.
2. It is important to create the National Bank of the Biodiversity Gene Fund of Ukraine as an element of the system of biosafety and biosecurity of the state, which should be laid down in the draft Law of Ukraine “On biosafety and biosecurity”.
3. The establishment of the National Bank of the Biodiversity Gene Fund of Ukraine will provide an opportunity for effective safe and economic management of genetic resources of biodiversity both at the domestic level, and international in accordance with the Nagoya Protocol regulating access to genetic resources and benefit-sharing, including financial benefits.
4. Innovative tools for biodiversity conservation, which on the basis of the best experience of developed countries should be adapted when creating the National Bank of the Biodiversity Gene Fund in Ukraine are: grants, soft loans, environmental subsidies, assistance (restrictions) in the market, environmental competitions with a cash prize and others.
5. Incentive methods, as evidenced by international experience, have proven to be the best in terms of biodiversity conservation and are effective. Involvement of innovative tools will allow through the creation of the National Bank of the Biodiversity Gene Fund to increase the efficiency of biodiversity conservation in Ukraine for present and future generations.

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**СТВОРЕННЯ НАЦІОНАЛЬНОГО БАНКУ ГЕНОФОНДУ БІОРИЗНОМАНІТТЯ УКРАЇНИ —
ВАЖЛИВОГО ЕЛЕМЕНТУ СИСТЕМИ БІОЛОГІЧНОЇ БЕЗПЕКИ ТА БІОЛОГІЧНОГО ЗАХИСТУ
ДЕРЖАВИ: АСПЕКТИ УПРАВЛІННЯ ТА ЕКОНОМІКИ**

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РЕЗЮМЕ. Мета. Дослідити доцільність створення національного банку генофонду біорізноманіття держави як окремого елемента системи біобезпеки та біозахисту у контексті протидії загрозам біологічного характеру національній безпеці України.

Матеріали і методи. Міжнародне та вітчизняне законодавство, наукові публікації, матеріали науково-практичних конференцій стосовно збереження генофонду біорізноманіття – опрацювання цих документів і дописів стали підґрунтям дослідження.

Були використані наступні методи: герменевтичний для аналізу цитованих наукових праць, наведених законодавчих актів, пояснення понять і термінів стосовно генетичних ресурсів біорізноманіття; системного аналізу джерел фінансування при створенні банку збереження генофонду біорізноманіття як елемента біобезпеки та біозахисту в системі національної безпеки України та системи методів державного управління збереження біорізноманіття, а також логічний та формально-економічний методи.

Результати та обговорення. У статті досліджено питання про доцільність створення національного банку генофонду біорізноманіття держави як окремого елемента системи біобезпеки та біозахисту у контексті протидії загрозам біологічного характеру національній безпеці України.

Зазначено, що створення Національного банку генофонду біорізноманіття України надасть можливість ефективно, безпечно та економічно грамотно управляти генетичними ресурсами біорізноманіття як на внутрішньодержавному рівні, так і міжнародному відповідно до Нагойського протоколу регулювання доступу до генетичних ресурсів та спільного використання переваг, зокрема фінансових.

Розглянуто основні інноваційні інструменти збереження біорізноманіття держави. Досліджено можливості запровадження інноваційних інструментів збереження біорізноманіття та імплементації кращого закордонного досвіду в Україні.

Висновки. Доцільно створити Національний банк генофонду біорізноманіття держави як окремого елемента системи біобезпеки та біозахисту у контексті протидії загрозам біологічного характеру національній безпеці України. Запропоновано законодавчо закріпити його створення шляхом включення до проекту Закону України "Про біологічну безпеку та біологічний захист".

Ключові слова: національний банк генофонду біоти, біорізноманіття, біологічні загрози, біоризики, біологічна безпека, біологічний захист, державне управління, фінансування.

**СОЗДАНИЕ НАЦИОНАЛЬНОГО БАНКА ГЕНОФОНДА БИОРАЗНООБРАЗИЯ УКРАИНЫ –
ВАЖНОГО ЭЛЕМЕНТА СИСТЕМЫ БИОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ И БИОЛОГИЧЕСКОЙ
ЗАЩИТЫ ГОСУДАРСТВА: АСПЕКТЫ УПРАВЛЕНИЯ И ЭКОНОМИКИ**

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РЕЗЮМЕ. Цель. Исследовать целесообразность создания национального банка генофонда биоразнообразия государства как отдельного элемента системы биобезопасности и биозащиты в контексте противодействия угрозам биологического характера национальной безопасности Украины.

Материалы и методы. Изучение международного и отечественного законодательства, публикаций научно-практических конференций. Применялись методы герменевтический, системного анализа, а также логический и формально-экологический.

Результаты и обсуждение. Предложено законодательно закрепить создание банка путем включения в проект Закона Украины "О биологической безопасности и биологической защите".

Отмечено, что создание Национального банка генофонда биоразнообразия Украины даст возможность эффективно, безопасно и экономически грамотно управлять генетическими ресурсами биоразнообразия как на внутреннем государственном уровне, так и международном согласно Нагойского протокола регулирования доступа к генетическим ресурсам и совместного использования преимуществ, в том числе и финансовых.

Рассмотрены основные инновационные инструменты сохранения биоразнообразия государства. Исследованы возможности внедрения инновационных инструментов сохранения биоразнообразия и имплементации передового зарубежного опыта в Украине.

Выводы. Необходимо создание Национального банка генофонда биоразнообразия государства как элемента системы в контексте противодействия угрозам биологического характера национальной безопасности Украины.

Ключевые слова: национальный банк генофонда биоты, биоразнообразие, биологические угрозы, биориск, биологическая безопасность, биологическая защита, государственное управление, финансирование.

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