

NJSC AL-FARABI KAZAKH NATIONAL UNIVERSITY

FACULTY OF BIOLOGY AND BIOTECHNOLOGY

APPROVED

Member of the Board – Vice-Rector for
scientific and innovative activities
NJSC «Al-Farabi KazNU»



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**University policy for identifying, monitoring and protecting any species listed
in the IUCN Red List and species on national conservation lists**

Almaty, 2023

GLOBAL CONTEXT

The territory of Kazakhstan has a unique set of landscape complexes: from deserts to highlands and ecosystems of inland seas. Dry and sub-humid lands occupy more than 75% of the territory of the Republic of Kazakhstan. They contain more than 40% of the species composition of all biological diversity. According to a number of estimates, the flora of Kazakhstan includes more than 13 thousand species, among them more than 5,754 species of higher vascular plants, about 5,000 fungi, 485 lichens, more than 2,000 algae, about 500 bryophytes. The species of fungi and higher plants were subjected to the most complete inventory. Among plants, 14% of species are endemic. Among them are many relics. In Kazakhstan there are centers of flora endemism (Karatau Mountains, Western Tien Shan), unique natural complexes - pine forests on sands (Katon-Karagay, Naurzum); forest and steppe complexes of the low mountains of Central Kazakhstan; desert communities of Betpak-Dala, Southern Balkhash and Ile Basin original in floristic composition; a set of forest, shrub and steppe communities of the Southern Altai, Kalba Mountains and Tarbagatai, middle mountains of the Dzhungar Alatau and Tien Shan with coniferous spruce forests and fragments of apple forests; wetland ecosystems of the lower reaches of the Urals, Torgai Hollow, lakes Tengiz, Alakol; floodplain forests (tugai) of the Syrdarya, Ili, Charyn.

Unique genetic resources of plant agrobiodiversity (ABD) of global importance are concentrated in Kazakhstan. They include 194 plant species that determine the genetic potential of 24 crops. A number of them are significant for the agriculture development and for expanding export potential. Fruit ABD and, above all, wild apple and common apricot have received worldwide recognition. Kazakhstan's genetic resources of pistachio, common almond and wine grapes are also characterized by great, primarily economic, prospects. The development of natural agrobiodiversity of floral and ornamental plants has great prospects.

The fauna of Kazakhstan is represented by a variety of species, both strictly protected and widely used for commercial and economic purposes. There dwell 835 species of vertebrate animals, including 178 mammals, 489 birds (of which 396 are nesting), 49 reptiles, 12 amphibians, 104 fish and 3 cyclostome species. 34 species of mammals and 59 species of birds are the objects of hunting.

The agrobiodiversity of the fauna (wild relatives of domestic animals) in Kazakhstan has not been studied enough and is currently practically not used in breeding work. The territory of the Republic is inhabited by species of vertebrates that are considered to be the wild ancestors of domestic animals. Mammals include mouflon, mountain sheep, wild boar, ass, jackal, wolf, spotted cat and a number of others. Among birds, these are primarily ducks and chickens. It should be noted that a number of wild animals in the Republic are used without agricultural breeding, since they have the necessary consumer properties, do not require zoning and adaptation to Kazakhstani conditions, and may reproduce in captivity. One of the most successful examples is the artificial breeding of Altai wapiti in the conditions of Eastern and Central Kazakhstan. A variety of wild fur animals is actively used, some of which have been successfully bred in captivity for a long time: mink, sable, fox. It is promising to use the selection and genetic potential of other highly valuable wild fur-bearing animals living on the territory of Kazakhstan: ermine, marmot, muskrat, otter, the processes of domestication of which are quite successful.

Of the total species diversity of fish and cyclostomes (about 140 species), about 5-8 forms, including hybrids, are currently grown artificially. These are sturgeon in the Caspian Sea, whitefish in Northern and Eastern Kazakhstan, Far Eastern herbivores (grass carp and silver carp) mainly in the southern regions, almost everywhere – carp (actually a mixture of wild and domestic forms of carp), as well as a number of hybrids.

Of the amphibians and reptiles that are important as a genetic resource, first of all, species of poisonous snakes, as well as species used in traditional oriental medicine: the Semirechye ranodon, dwarf sand boa, etc.

The uniqueness of herpetofauna provides an opportunity for its breeding and export as exotic ones. Kazakhstan, due to its geographical location in the center of the Eurasian continent and the unique combination of natural complexes of steppes, deserts, mountains, large inland reservoirs with rivers flowing into them and extensive deltas, is characterized by a wide variety of ecosystems and corresponding types of vegetation.

Kazakhstan presents a full range of subzonal variants of vegetation of steppes, deserts and mountain belts, characteristic of Central Asia. The ecological situation in the Republic of Kazakhstan is characterized to a large extent by the degradation of natural systems, which leads to the destabilization of the biosphere, the loss of its ability to maintain the quality of the environment necessary for the society functioning. The problem of desertification is acute. The critical state of biodiversity is associated with economic activity, environmental pollution and natural disasters, as well as the small area of protected ecosystems. Depletion of biodiversity and degradation of ecosystems occupy 66% of the republic's area, especially in the desert and steppe zones, due to plowing and overgrazing. The situation remains difficult regarding the protection of forests from fires and illegal logging on the territory of the state forest fund.

The Red Book of Kazakhstan is the main document containing a set of information on the status of rare, declining and endangered species of plants and animals on the territory of the Republic. At the beginning of 1988 The Red Book of the Kazakh SSR, part 2. Plants was published. It included 303 rare and endangered plant species. Currently, a new edition of the Red Book of Plants of Kazakhstan is being prepared for publication. Approved by the Decree of the Government of the Republic of Kazakhstan dated October 31, 2006 No. 1034 "List of rare and endangered plant species" contains 387 plant species. Considering the global nature of the problem of biological diversity, it is very important to protect not only individual species, but also a number of unique plant communities, their diversity and sustainability are the most important condition for the optimality of the environment in biological productivity.

A small part of communities is protected to one degree or another in nature reserves or wildlife sanctuaries, but there is no general list of reference summaries of endangered and rare plant communities, the protection of which is extremely important for the future. The planned "Red Book of the Republic of Kazakhstan. Volume 2, Part 2. Plant communities. First edition." ("Green Book") will include rare plant communities of natural origin that need protection. The Red Book of Kazakhstan (Volume 1. Animals. Part 1. Vertebrates. Edition 3, 1996) lists 125 species and subspecies of vertebrates. Decree of the Government of the Republic of Kazakhstan dated 04.07. 2004 No. 622 approved the second part of the Red Book of Kazakhstan (Volume 1. Animals. Part 2. Invertebrate animals), which includes 96 species of invertebrate animals. Decree of the Government of the Republic of Kazakhstan dated October 31, 2006 No. 1034 approved the list of rare and endangered species of animals: mammals - 40, birds - 57, reptiles - 10, amphibians - 3, aquatic animals - 18, annelids - 2, mollusks - 6, crustaceans -1, arachnids -2, insects - 85.

The diversity of natural environments in Kazakhstan has determined the richness and diversity of its biological resources. A country's biological resources are vital for its economic and social development. Biological diversity is an asset of great value for present and future generations. Declines in components of biodiversity can be caused by natural or anthropogenic impacts.

MAIN GOALS

- ✓ Provide quality of biological education to students.
- ✓ Organize the effective spread of information and exchange of knowledge on the protection of rare and endangered species of living organisms.
- ✓ Create living laboratories in campus (biocenter, greenhouse, winter garden), where students and teachers will be engaged in research and educational activity.
- ✓ Promote biological and environmental literacy and responsible behavior towards nature.
- ✓ Promote biodiversity conservation and environmental restoration.
- ✓ Develop scientific researches aimed to assess the current state of rare and endangered objects of flora and fauna.
- ✓ Participate in the preparation and implementation of proposals for special measures to protect rare and endangered species of plants and animals.
- ✓ Create platforms for the development of international cooperation in the environmental sector.

UNIVERSITY ACTIVITY

The contribution of al-Farabi Kazakh National University to achieve this goal is reflected in two main directions:

1. Training of highly qualified specialists: biologists, geobotanists, zoologists at undergraduate, graduate and doctoral levels, competitive in the domestic and international labor markets, which involves the integration of research activities and training in the educational process, the implementation of the educational process using credit learning technology based on the principles of interdisciplinarity and competency-based approach.
2. Conducting research work in the field of rational use of natural resources, including combating desertification, halting and reversing land degradation and halting the loss of biological diversity.

Training of highly qualified specialists:

In world practice, the training of botanical specialists is determined by the tasks of scientific and industrial activity and the economic needs of the country. At al-Farabi Kazakh National University, in addition to the recommendations of domestic and foreign specialists based on the experience of geobotanists training, the selection of areas and the list of disciplines is compiled taking into account the applications of the main employers for specialists and priority research in the field of geobotany, determined by the National Academy of Sciences and the Ministry of Education and science of the Republic of Kazakhstan for the future and curricula of foreign countries.

The training of specialists in the field of botany in Kazakhstan has been carried out at al-Farabi Kazakh National University since 1934 on the basis of one of the oldest departments of the University, which does not lose its significance and relevance to the present day. Geobotany specialists are in demand in akimats, in organizations whose activities are related to the organization of monitoring of plant biological diversity, in the system of the Ministries of Ecology and Health; scientific workers in academic and industry scientific, environmental and environmental institutions, design organizations of biological and agricultural profiles, in nature reserves, oil producing companies, in NGOs as expert specialists in design, agricultural

reclamation systems, public utilities and services dealing with the issues of preventing and combating desertification . Among them is the RSE at the RPE "Institute of Botany and Phytointroduction" of the Committee of Forestry and Wildlife of the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan - the main customer, founder and direct active participant in the implementation of highly qualified specialists.

In addition, the following scientific organizations are interested in geobotanist graduates: the Institute of Plant Biology and Biotechnology, the Institute of Plant Protection and Quarantine, National Parks, Botanical Gardens, Akimats of all levels, etc. Over the more than 80-year period of training botanists and geobotanists, the department has established itself in as a reliable partner of the organization, making changes to the curriculum for training specialists, according to the requirements of the time and specializations recommended by employers, and has enormous authority in Kazakhstan and abroad.

The educational programs of all specialties of the faculty include the study of academic disciplines, such as “Bioresources of Kazakhstan”, “Biodiversity of Plants and Animals”, “Environmental Monitoring”, “Indication Geobotany”, etc. thus students, undergraduates and doctoral students study the status of the population of Red Book species, and their distribution on the territory of the Republic of Kazakhstan, as well as issues of their conservation.

Basic courses and educational programs aimed at studying rare species listed in the IUCN Red Book:

<i>№</i>	<i>Course</i>	<i>Specialty</i>	<i>Level of education</i>
1	Vertebrates zoology and Higher plants	6B05102 - Biology	Bachelor
2	Invertebrates zoology and lower plants	6B05102 - Biology	Bachelor
3	Bioresources of Kazakhstan	6B05102 - Biology	Bachelor
4	Ecological ethics and influence of physical fields on living organisms	6B05102 - Biology	Bachelor
5	Biology and ecology of insects	6B05102 - Biology	Bachelor
6	Biology and ecology of mammals	6B05102 - Biology	Bachelor
7	Biology of fishes	6B05102 - Biology	Bachelor
8	Plant introduction	6B05102 - Biology	Bachelor
9	Ecology of hydrobionts	6B08402 – Aquaculture and water biological resources	Bachelor
10	Fish morphology and systematics	6B08402 – Aquaculture and water biological resources	Bachelor
11	Technologies of intensive aquaculture	6B08402 – Aquaculture and water biological resources	Bachelor
12	Law of fish industry and industrial fishing	6B08402 – Aquaculture and water biological resources	Bachelor
13	Evaluation of water resources	6B08402 – Aquaculture and water biological resources	Bachelor
14	Ichthyology	6B08401 – Fish industry and industrial fishery	Bachelor
15	Hydrobiology	6B08401 – Fish industry and industrial fishery	Bachelor

16	Monitoring of water bodies	6B08401 – Fish industry and industrial fishery	Bachelor
17	Sustainable development of water bioresources	7M08402 – Aquaculture and water biological resources	Master
18	Problems of rational exploitation of water biological resources of Kazakhstan	7M08401 – Fish industry and industrial fishery	Master
19	Conservation of biodiversity and rational exploitation of plant covering	7M05112 - Geobotany	Master
20	Environmental monitoring	7M05112 - Geobotany	Master
21	Indicational geobotany	7M05112 - Geobotany	Master
22	Forest vegetation	7M05112 - Geobotany	Master
23	Modern problems of evolutionary systematics and geography of fishes	8D08401 – Fish industry and industrial fishery	Doctoral
24	Modern problems of population ecology	8D 05101 - Biology	Doctoral
25	Comparative ecomorphology of vertebrate animals	8D 05101 - Biology	Doctoral
26	Monitoring of population of vertebrate animals of Kazakhstan	8D 05101 - Biology	Doctoral
27	Protection of rare and endangered plant species	8D 05108 - Geobotany	Doctoral
28	Regional floras	8D 05108 - Geobotany	Doctoral
30	Evaluation of plant state in modern conditions of nature management	8D 05108 - Geobotany	Doctoral
31	Biogeocenology	8D 05108 - Geobotany	Doctoral

At the Al-Farabi Kazakh National University, at the Faculty of Biology and Biotechnology, there are 3 centers: “Center for Breeding Ornamental Species of Fish and Plants”, “Molecular Biology and Genetics” and “Biotechnologist”. The centers train teachers of universities and colleges, managers, specialists of enterprises and organizations under the advanced training program. There are advanced training courses in the areas of “Genetics and plant breeding”, “Molecular biology and genetic engineering”, “Biostatistics” and “Biotechnology” for breeders and farmers, as well as in the course “Methods of fishery research” for fish farmers, etc.

Centers of the Faculty of Biology and Biotechnology:

Name of the center	Duration of training	Form of training	Cost of training	Contact information
"Molecular biology and genetics"	optionally, 72 hours, 112	Online+offline	Depending on the duration of training,	+77011212812, Shynar.Yrgynbayeva@kaznu.edu.kz

	hours.		from 30 000 tenge	
"Center for breeding ornamental fish and plants"	optionally , 72 hours, 112 hours	Online+offline	Depending on the duration of training, from 30 000 tenge	+702 235 16 63, Gulnar.Kegenova@kaznu.edu.kz
"Biotechnologist"	optionally , 72 hours, 112 hours	Online+offline	Depending on the duration of training, from 30 000 tenge	+707 478 70 95, Gulzira.Yernazarova@kaznu.edu.kz

In addition, the training of highly qualified specialists includes the organization and conduct of various summer and winter schools. Thus, in the summer of 2023, a summer ecological school “Fauna and flora of the foothills of the Western Tien Shan” was held jointly with the Institute of Zoology of the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan with the financial support of DAAD (Mamilov N.Sh.) <https://www.chokpak.kz/daad-go-east-summer-schools/>. All data obtained by students during the summer school on the diversity and properties of wild animals and plants was considered from the point of view of biocentrism and ecosystem services. Therefore, this field practice is of great interest to ecologists, zoologists and botanists and to students with a wider range of interests. When conducting field exercises, the principle of “do no harm” is observed, which is important for the formation of environmental consciousness and understanding of young people. Thus, students acquire information in two stages: theoretical analysis of the natural characteristics of the territory and the formation of practical skills.

The content of the first stage is the students’ assimilation of terms and concepts that express the essence and certain patterns of interaction between man and nature. The second stage is associated with the use of the mentioned terms and concepts in practical actions in the natural environment - excursions and individual classes. The proposed approach allows not only to gain new knowledge, but also to strengthen cultural ties between different peoples. In 2023, we received 36 applications. We selected 15 participants whose specialty most closely matched the theme of our summer school. Of the 15 selected students, only 13 were able to take part in the summer school. All students arrived at the al-Farabi Kazakh National University campus on August 16, then we had a tour of the zoological museum and an introductory lecture on the diversity of landscapes and fauna of Kazakhstan. From August 17 to 29, the summer school was held at the ornithological station of the Institute of Zoology on the Chokpak pass (western Tien Shan). This pass is located between the Talas Alatau and Karatau mountain ranges, so birds are forced to make spring and autumn migrations here.

At the ornithological station, students gained knowledge about the diversity of ecosystems, flora and fauna of the Western Tien Shan, mastered the skills of setting bird traps and studying their morphological and biological features. The general direction of the summer school was to get acquainted with the flora and fauna, landscape features of the region, cultural values and mentality of the Kazakh people. In addition to lectures presented by specialists from the university and the Institute of Zoology, a large share was made up of excursion and practical

classes. However, the specifics of the hospital and its working environment provided students with ornithological information to the greatest extent. After catching, the birds were taken to the station, where, under the guidance of specialists, students banded them, determined their species, sex and age, and then measured wing length, weight, and assessed fat reserves. Separately, lectures were given in general about the ringing station, about birds of prey, bee-eaters and pigeons, and the species diversity of birds in Kazakhstan. The practical ornithological part included: identifying birds, observing, catching and ringing. Bird observations were carried out during the routes, at the pass itself, where they mainly monitored the flight of birds of prey, as well as at the Ters-Ashibulak reservoir, where waterfowl and shorebirds became the main object of observation. As a result, in two weeks, about 1000 birds were caught and 53 species from 32 genera, 22 families and 9 orders were identified. The botanical part consisted of collecting and identifying plants typical of the steppes and foothills of Southern Kazakhstan.

The main directions of scientific activity in the field of geobotany are:

- Conservation of biodiversity and rational use of vegetation
- Protection of rare and endangered plant species
- Assessment of the state of vegetation in the conditions of modern environmental management
- Plant ecology;
- Ecomorphology of plants;
- Rhizology;
- Applied botany;
- Medicinal plants.

Under the guidance of leading researchers, the following scientific projects will be carried out at the Department of Biodiversity and Bioresources: “ASSESSMENT OF THE ECOLOGICAL STATE OF THE UNIQUE SODA AND SALT ECOSYSTEMS OF KAZAKHSTAN”, scientific supervisor Ph.D., associate professor Inelova Z.A.

The goal of the project is to assess the ecological state of soda and salt lakes of the Republic of Kazakhstan. As part of biomonitoring, the state of the aquatic ecosystem of soda and salt lakes was assessed for hydrobionts and microorganisms, as well as for higher aquatic and coastal aquatic plants and waterfowl. As part of the project, employees of the Department of Biodiversity and Bioresources collaborated with the Alakol State Nature Reserve to conduct joint research work.



And also, with employees of the Yrgyz-Torgai reserve to conduct research work in the Aktoobe region.



Results:

- An assessment of the ecological state of salt and soda lakes in Almaty and Aktoobe regions was carried out.
- Samples of water, higher aquatic and coastal aquatic plants were collected for analysis;

- The species biodiversity of aquatic, coastal flora, algal flora of soda and salt lakes of Almaty and Aktobe regions was studied;
- An analysis of selected water samples, biodiversity of higher aquatic, coastal aquatic plants, and algal flora was carried out for the environmental assessment of Almaty and Aktobe regions;
- The communities of waterfowl in soda and salt lakes of Almaty and Aktobe regions were studied;
- The ecosystem functions of waterfowl on various types of soda and salt water ecosystems of Almaty and Aktobe regions were determined;
- 2 articles and (or) reviews have been published in peer-reviewed scientific publications in the scientific direction of the project, included in the 1st (first), 2nd (second) or 3rd (third) quartiles in the Web of Science database and (or) having a percentile according to CiteScore in the database Scopus no less than 50 (fifty).

Currently, scientists from the Faculty of Biology and Biotechnology are implementing the project “Innovative multi-spatial integrated approach to biomonitoring of saline ecosystems of Lake Alakol”, scientific supervisor: Candidate of Biological Sciences, Associate Professor Z.A. Inelova. The goal of the project is to develop an innovative approach to biomonitoring by combining macroecological methods with remote sensing methods and GIS databases in the most important saline ecosystems of Lake Alakol. This project at the department is carried out jointly with Professor Boros Emil, Institute of Aquatic Ecology, Center for Environmental Research, Hungary, Budapest.

As part of the project **“INTRODUCTION OF PERENNIAL WHEAT INTO AGRICULTURAL CULTURE TO PRESERVE BIODIVERSITY AND SOIL FERTILITY OF THE SOUTH AND SOUTHEAST OF KAZAKHSTAN”** (Head: Doctor of Biological Sciences, Professor Kurmanbaeva M.S.), research is being conducted to develop the agrobiological basis for the introduction of perennial wheat into culture agriculture in the south and southeast of Kazakhstan and studying its role in increasing the productivity of arable land, reducing greenhouse gas emissions, maintaining soil fertility and improving the environment.

As a result of the research, the phenology of development, the accumulation of above-ground and root biomass, and the formation of the leaf surface of perennial wheat were determined. To determine the phenology of the development of perennial wheat, the characteristics of the growth and development of perennial wheat were studied in the greenhouses of KazNU named after al-Farabi and SKSU named after M. Auezov, in various agro-ecological zones of the south in the city of Shymkent and in the Almaty region of the Karasai region of south-east Kazakhstan. The germination of seeds was determined in laboratory, greenhouse and field conditions. The date of the beginning and full onset of the main phases of development in field conditions has been determined. The morphological and anatomical features of perennial wheat have been studied. Optimal timing, methods and rates of sowing perennial wheat have been developed. During the study of the peculiarities of yield formation and grain quality of perennial wheat, the productivity of perennial wheat was determined. The protein and gluten content in the grain was determined. Based on the results obtained, a method for cultivating perennial wheat in Kazakhstan has been developed.

Results obtained:

- The ecological condition of salt and soda lakes of Almaty and Aktobe regions was assessed.
- Samples of water, higher aquatic and coastal-water plants were taken for analyzing;
- Species biodiversity of aquatic, coastal-water flora, algoflora was studied.
- Analysis of selected water samples, biodiversity of higher aquatic, coastal-water plants, algoflora for ecological assessment of Almaty and Aktobe oblasts was carried out;
- Waterfowl communities of soda and salt lakes in Almaty and Aktobe oblasts were studied;

- Ecosystem functions of waterfowl on different types of soda and salt water ecosystems of Almaty and Aktobe oblasts were determined;
- Published 2 articles and (or) review in peer-reviewed scientific publications on the scientific direction of the project, included in the 1st (first), 2nd (second) or 3rd (third) quartile in the Web of Science database and (or) having a percentile on CiteScore in the Scopus database not less than 50 (fifty).

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Within the framework of the project **"INTRODUCTION OF PERENNIAL WHEAT INTO THE CULTURE OF FARMING FOR THE PRESERVATION OF SOIL BIODIVERSITY AND FERTILITY IN THE SOUTH AND SOUTH-EAST OF KAZAKHSTAN"** (Head of Dr. B.Sc, Professor Kurmanbaeva M.S.) are conducted research on the development of agrobiological bases of introduction of perennial wheat into the culture of agriculture in the south and south-east of Kazakhstan and the study of its role in increasing the productivity of arable land, reducing greenhouse gas emissions, preserving soil fertility and improving the environment.



A B C
Perennial wheat in flowering phase, A, B - greenhouse of Al-Farabi Kazakh National University, C - greenhouse of Mukhtar Auezov South Kazakhstan University.

As a result of research was determined phenology of development, accumulation of aboveground and root biomass, leaf surface formation of perennial wheat. To determine the phenology of development of perennial wheat were studied the features of growth and development of perennial wheat in greenhouses of KazNU named after Al-Farabi and SKSU named after M.Auezov, in different agro-ecological zones of the south in the city of Shymkent and in Almaty region of Karasai district of southeastern Kazakhstan. Seed germination in laboratory, greenhouse and field conditions was determined. The date of the beginning and full onset of the main phases of development in field conditions was determined. Morphological and

anatomical features of perennial wheat were studied. The optimal terms, methods and norms of sowing perennial wheat were developed. In the course of studying the peculiarities of yield formation and grain quality of perennial wheat productivity of perennial wheat was determined. The content of protein and gluten in the grain was determined. Based on the results obtained, the method of cultivation of perennial wheat in Kazakhstan was developed.



Development of perennial wheat under field conditions.



Measurement of ears of perennial wheat, cm.



Under the project **"COMPLEX RESOURCES RESOURCES RESOURCES OF PRAGMITES AUSTRALIS, its ECOSYSTEM SIGNIFICANCE AND SUSTAINABLE USE POTENTIAL IN THE BIOECONOMY"** (Head - Doctor of Biological Sciences, Professor S.T. Nurtazin) the research is aimed at achieving SDG 12 "Responsible Consumption and Production" and SDG 15 "Conservation of Terrestrial Ecosystems". Proceeding from the negative consequences of the world economy growth on the environment, in recent decades new approaches for obtaining materials and energy sources using renewable natural biological resources are being developed especially actively. This direction, based on the use of renewable biomass as raw materials for production purposes, including feed for farm animals and poultry, biogas, etc., is called "bioeconomy", the goals of which are to maximize the conservation of the natural environment, ecosystems, biodiversity while ensuring economic growth and employment of the population. The object of research were phytocenoses of common reed (*Phragmites australis*) widespread in Kazakhstan, which has a high biomass growth potential in the warm period of the year (on average 5-10 t/ha, and sometimes up to 30 t/ha). At the same time, reed usually grows in the floodplains of rivers, on soils with high soil water level, in wetlands unsuitable or marginally suitable for agricultural crops. It should be noted that Kazakhstan is among the countries with the richest natural resources of common reed in the world. The traditionally wide range of economic use of reed has recently expanded considerably. In particular, reed stalks are used for the production of cardboard, chipboard, paper and packaging materials, in the synthetic and textile industries, as well as in the production of mats, fences, thatched roofs and building materials. The leaves of the young shoots are a useful feed for livestock as they contain 18-22% crude protein. Reed has also been successfully used for phytoremediation in aquatic ecosystems and treatment of wastewater systems, hydroponic systems and wetlands. In recent years, many applications of common reed have emerged as various innovative composite building materials, raw materials for the production of cellulose and naturally degradable bioplastics, standardized solid fuel briquettes, pharmaceuticals and food additives, livestock feed pellets, etc. In addition to the above, reed beds provide a wide range of ecosystem services such as carbon storage, water quality regulation, flood buffering, etc.

Currently, reed thickets occupy about 3 million hectares in Kazakhstan. Especially large massifs are noted on the Ile, Shu, Irtysh, Syr Darya, and Zhaiyk rivers, as well as on lakes Balkash, Tengiz, Zaisan, and Sarykopa. Reed-based ecosystems in Kazakhstan provide the greatest biodiversity. We have developed five types of fodder concentrate based on common reed (*Phragmites australis*). The main ingredients in our fodder concentrates were alfalfa, wheat, corn, sunflower cake, soybean meal, etc. The obtained fodder concentrates had different indicators of edibility by animals (cattle, cattle), nutrition and cost price. A patent for mixed

fodder pellets based on cane was obtained. The work on finalization of the technology of cane silage in combination with different root crops and different types of dry mass of cane for the production of fuel pellets and disposable tableware continues (Fig. 3).



Reed ecosystems



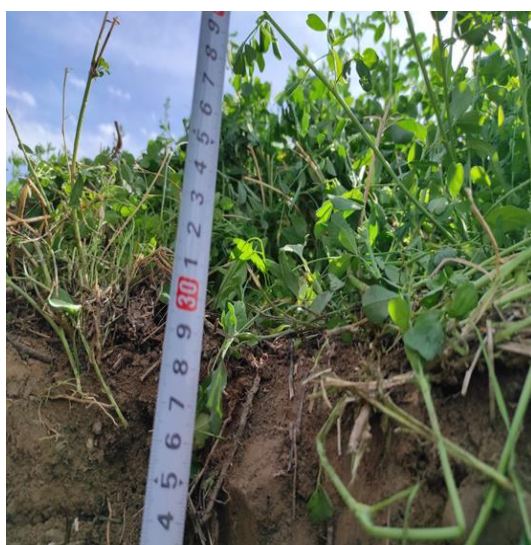
Fuel pellets and disposable cane dishes

The state and fertility of soils determine the productivity of the planet's green cover, on the resources of which the entire "food pyramid" of the biosphere is built. Their quality is of particular importance for agricultural lands that provide food for the growing population of the

planet. The problem of soil protection and rational use has two main directions: protection of fertility and preservation of productive areas for the needs of agricultural production. The Earth's population is growing rapidly, and meeting food needs can be ensured either by increasing crop yields or by expanding agricultural areas. The reserve of land suitable for agricultural development is almost exhausted. The expansion of arable land is possible mainly at the expense of land at risk, where not only biological communities but also soils are easily destroyed. The effect of involving these lands in economic turnover is not great, these lands are short-lived, they easily degrade, losing their natural fertility.

Project "EVALUATION OF THE IMPACT OF TECHNOGENIC WASTES ON SOIL PROPERTIES AND DEVELOPMENT OF REHABILITATION OF ECOLOGICALLY UNBELIEVABLE INDUSTRIAL EARTHS".

(**Head - Doctor of Biological Sciences, Professor Esimsiyitova Z.B.**) is aimed at the development of domestic fertilizer "EcoSoil" of plant origin derived from rice husk, characterized by low density and high adsorption capacity. Within the framework of the project it is planned to analyze the ecology of soil cover, assessment of current physical, chemical state, problems and ways of their solution in East-Kazakhstan, North-Kazakhstan and Zhambyl regions. Conducting research works in the field of protection of rare and endangered plant species, including medicinal plants is one of the priority tasks in the implementation of SDG 15.



As a result of regular anthropogenic impact in soils in many regions of the Republic of

Kazakhstan, negative processes are developing that affect the violation of topsoil, over-compaction, chemical and biological pollution, and the reduction of biodiversity. An increase in the technogenic load on the environment leads to the emergence of zones with a critical ecological situation. These problems require comprehensive monitoring of the state of the natural environment, conducting research that allows not only to identify and assess the danger of pollution, but also to establish trends and the speed of changes.

The importance of the problem of soil contamination with chemical elements lies in the fact that soils are a natural reservoir of heavy metals in the environment and the main source of pollution. Studying the use of biochar from rice husks for soil rehabilitation is a relevant and new direction in the field of increasing crop productivity and obtaining environmentally friendly products at significantly lower costs.

Rice husk-based biochar obtained by carbonization has a more developed structure with a larger specific surface area and porosity, which will increase its sorption properties. Due to its high porosity, in combination with other physicochemical properties, biochar contributes to the retention of moisture and beneficial nutrients in the soil.

The hypothesis of the study is that biochar produced through the optimized method is a new bio-sourced porous material for effective removal of heavy metals from topsoil, which helps to achieve sustainable development goals and improve circular economy policies.

The project Zhas Galym on the topic **“STUDYING THE STATE OF POPULATIONS AND INTRA-SPECIFIC PHENOTYPIC VARIATION OF RARE SPECIES OF MEDICINAL PLANTS FROM THE GENUS ADONIS L. IN NORTH KAZAKHSTAN”** (Project leader PhD, Zhumagul M.Zh.) is aimed at studying the current state of the population and intraspecific anatomical and morphological variability of rare species of medicinal plants from the genus *Adonis* in the flora of Northern Kazakhstan and the development of events for their preservation. As a result of processing the material from field research, herbarium collections and literary sources, it was established that on the territory of Northern and Central Kazakhstan there are 3 independent species of *Adonis* according to the international POWO database: *Adonis vernalis* L., *Adonis volgensis* Steven ex DC and *Adonis villosa* Ledeb. The populations of *Adonis villosa* Ledeb. and *Adonis vernalis* L. were studied for the first time. Currently, a critical review of herbarium collections has been carried out in large domestic and foreign herbarium funds, including the Herbarium of the Institute of Botany and Phytointroduction; Herbarium of the international scientific and production holding “Phytochemistry”, Herbarium of the Astana Botanical Garden, Depository of Living Systems of Moscow State University "Noah's Ark" (MW) (Seregin, 2020, Herbarium of Masaryk University).



The data obtained made it possible to establish the species diversity and distribution of *Adonis* in Northern and Central Kazakhstan. Thus, 308 habitats of *Adonis* in these regions were identified. The most common species in the study region is *Adonis vologensis* Steven ex DC – 210 locations, *Adonis villosa* Ledeb. is relatively less common – 80 locations. *Adonis vernalis* L. is found very rarely in the study region – 27 localities.

Also at the Department of Biodiversity and Bioresources are carried out scientific - research work to study the state of populations of rare red-listed species (plants and animals) in the framework of the dissertation work of doctoral students. Preliminary hearings of the results of doctoral dissertation of the following doctoral students of the department were held at the department:

1. **Kegenova Gulnar Bolatkyzy** passed preliminary approbation of dissertation work on specialty "8D08401 - Fishery and industrial fishery", on the theme: "Study of species diversity and taxonomic state of small water bodies of South-Eastern Kazakhstan"
2. **Shadmanova Laura Sharbatovna** on specialty "6D061300 - Geobotany" "Study of new varieties-clones *Malus sieversii* (Ledeb.) M. Roem of Dzungarian population under in-situ and ex-situ conditions";
3. **Bizhanova Nazerke Alimkyzy** passed preliminary approbation of the dissertation work on the specialty "8D05101 - Biology" on the theme: Distribution and taxonomic status of Turkestan lynx (*Lynx lynx isabellinus* Blyth 1847) in Northern Tien Shan. This thesis will be defended on November 7, 2023.

At the department in 2023, one doctoral dissertation, PhD Sharakhmetov Sayat Ermukhanbetovich, on the theme: "**Fish communities and the state of their populations in the Alakol basin**" on the specialty "8D08401 - Fishery and industrial fishing." This dissertation deals with the conservation of rare native fish species that require constant monitoring and protection.

<https://www.kaznu.kz/content/files/pages/folder17928/%D0%94%D0%B8%D1%81%D1%81%D0%B5%D1%80%D1%82%D0%B0%D1%86%D0%B8%D1%8F%20%D0%A8%D0%B0%D1%80%D0%B0%D1%85%D0%BC%D0%B5%D1%82%D0%BE%D0%B2%20C.E..pdf>

<https://www.youtube.com/watch?v=bbgsk5e6MLs>

OBLIGATIONS

As part of a global community, we work to address the conservation of terrestrial ecosystems as part of our contribution to all of the Sustainable Development Goals.

The conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, including forests, wetlands, mountains and drylands, must be ensured, in accordance with obligations under international agreements

Education. All our students study a module related to the disciplines of conservation of rare and endangered species, rational use, sustainable development goals, regardless of the direction of the educational program or level of study. We are committed to developing awareness and skills to address these issues. It is worth noting that 90% of students have the opportunity to study the sustainable use of natural resources, combat desertification, restore degraded lands and soils, including lands affected by desertification, droughts and floods, and strive to ensure that the world does not deteriorate the condition of the lands as part of their course; There are a number of interdisciplinary modules that offer students the opportunity to gain significant experience in the field of sustainable development, including positive engagement with the community.

Research. The scientific research of university scientists is related to global and regional changes in modern conservation of terrestrial ecosystems; conservation of mountain ecosystems, including their biodiversity, in order to increase their ability to provide the benefits necessary for sustainable development; combat desertification, restore degraded lands and soils, including lands affected by desertification, droughts and floods; use of genetic resources and promote adequate access to such resources on internationally agreed terms; measures to prevent the entry of alien invasive species and to significantly reduce their impact on terrestrial and aquatic ecosystems.

The results of research by teaching staff and young scientists are published annually in monographs and highly rated scientific publications, indexed in the Scopus and Web of Science databases.