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CONTENT

GENERAL SITUATION OF AGGRAVATION OF ENVIRONMENTAL PROBLEMS IN AZERBAIJAN

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Abstract: Global environmental challenges have received a lot of attention in recent years. It is apparent that Azerbaijan's sustainable growth is inextricably linked to environmental challenges. Nonetheless, it is commonly accepted that comprehending specific ecosystems (biogeocenoses) and obtaining objective information about them is critical for effectively addressing the broader breadth of changes and trends within these ecosystems. Nature conservation is impossible to achieve without this understanding.
Keywords: global environmental challenges, sustainable growth, Azerbaijan, ecosystems, biogeocenoses, objective information, changes, trends, nature conservation**.**

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Introduction:

Throughout history, Azerbaijan has been in the center of global political and economic interests, with little respite from the tremendous problems that have arisen. Natural resources, both above and below ground, have played a critical part in the nation's historical trajectory. The mesmerizing natural beauty of the region has long served as an inspiration for incredibly gifted artists, contributing to the development of the country's rich cultural and spiritual history. Throughout the turbulent twentieth century, Azerbaijan faced numerous economic and spiritual issues.

Azerbaijan has faced a new set of environmental challenges since declaring independence. The previous century's environmental worries have now grown into global challenges. These challenges transcend national boundaries and have political, economic, legal, and spiritual elements, requiring global reflection.

As a result, when addressing Azerbaijan's eco-ethical quandaries, there is an urgent need for a scientific analysis that considers both global and national dimensions (Mammadov G.S. and Motuzova G.V., Bezuglova O.S., 2007.).

Materials and Methods:

G.Sh.Mammadov's approach includes identifying three unique ecological zones using recognized methodology. Following that, the study concentrated on following long-term changes in variables associated with potentially productive soil qualities inside one of these ecological zones. Meanwhile, S.Z. Mammadova investigated the long-term dynamics of particular potential fertility indicators in Lankaran black yellow soils.

Results and discussion:

Today, Azerbaijani society places a high value on the environment, natural ecosystems, and our subterranean and surface resources. The informatization of echoetic connections is quickly becoming a hot topic. Pollution of water and atmospheric basins, destruction of tropical forests, regarded as the "lungs" of our world, ozone layer breaking, global climate

change, global desertification, and reduction of global biodiversity have all reached unacceptably high levels. These are also critical challenges for Azerbaijan. The expansion of industry, transportation, and agriculture in the last 100-150 years, particularly during the twentieth century, has influenced Azerbaijan's socioeconomic development and cultural growth.

However, this growth has resulted in changes to the natural environment. The extensive use of both subterranean and surface resources, the construction of large industrial complexes, the construction of reservoirs, canals, and drainage networks, advances in energy and communication infrastructure, road construction in mountainous regions, urban expansion, and agricultural expansion due to deforestation in lowland and foothill regions have all contributed to increased anthropogenic pressures on the environment. This has resulted in significant environmental degradation and an increasing load on the environment's separate components: air, water, and soil.

As a consequence, in some areas, soil, air, and water bodies have become heavily polluted, reaching hazardous levels for human health. The result of these changes includes intensified erosion, salinization, and the transformation of land into desert areas. The coverage of soil, both for agricultural use and seasonal pastures, has been significantly affected. Furthermore, forest ecosystems in certain regions have faced either complete destruction or profound alterations in their natural-historical structure and distribution.

Concurrently, the ramifications of these changes in Azerbaijan have seen a notable increase. These consequences are linked to the reduction of biodiversity, desertification, aridization, fluctuations in the Caspian Sea's water level, the release of nitrogen gases, and other large-scale processes (Mammadov, 2017).

Forest cover holds a distinct and crucial place within Azerbaijan's natural resources. In comparison to other natural environments, the nation's forests have been relatively resilient to the impacts of human influence. Recent research, however, reveals a significant decline in forest coverage. While more than 30% of the country's territory was once covered by forests, this rate has seen a dramatic decrease.

It is evident that the lowland and foothill forests in various regions of Azerbaijan, with the exception of the extensive relict forests on the northeastern slopes of the Greater Caucasus and in the Gusar Plain, have either been entirely deforested or undergone significant alterations in their natural and historical structures, leaving only fragments behind. The geographical complexity of the Caucasus region further compounds the challenges faced by lowland forests in the Lankaran region. The combined factors of human economic activities, urban expansion, global climate changes, and the general state of these forests have severely deteriorated conditions in all natural and geographical zones, reaching hazardous levels for human health.

Moreover, there is a growing concern regarding the reduction of areas that fulfill vital roles in water and soil conservation in the middle and high mountainous regions. The intensive grazing and occasional practices in these regions, especially in border areas near Alpine, subalpine meadows, and the meadow-steppe belt, have had detrimental effects on their natural regeneration. These practices have led to an average drop in the border of high mountain areas (by 150-200 meters in some locations) by around 150-200 meters (Mammadov, 2012). Despite the fact that the oceans have not been subjected to major human interference, changes in species composition and the complicated web of natural-historical interactions within and between ecosystems have occurred. This phenomena is not limited to marine environments; similar changes can be seen in the Greater Caucasus and the Lankaran region of Azerbaijan. Examples of these ecological shifts include the replacement of mid-mountain Beech forests and beech-hornbeam-Oak compositions with hornbeam or hornbeam-Bush mixed communities, as well as the replacement of middle and low-mountain Oak and Oak-hornbeam compositions with tree-shrub plant formations of lesser significance.

Furthermore, as a result of economic activity in our country, rising symptoms of degradation

within natural ecosystems and large landscape complexes are evident in the soil cover. The degree and impact of erosion and salinization processes occupy center stage among these environmental change indicators.

In Azerbaijan, the complex relationship between nature and society can be categorized into three groups based on the nature of the environmental issues and the approaches to resolving them:

Group I: This group encompasses environmental problems that require internal solutions specific to Azerbaijan. These issues include the preservation and restoration of forests, addressing problems associated with soil erosion, effective management of natural grazing areas, rehabilitation of technically damaged soils, measures to mitigate soil contamination with radionuclides, combating issues related to soil salinization, and regulating the use of mineral fertilizers and pesticides.

Group II: This group includes organizations, scientific research, and practical efforts aimed at assisting in resolving environmental issues. These organizations are involved in environmental monitoring of land basins, conducting environmental assessments, and preparing documents related to soil ecological fertility.

Group III: This group comprises issues related to environmental culture, environmental law, education, and other aspects that influence and contribute to the resolution of environmental problems or the search for solutions. These problems involve fostering ecological awareness within society, enhancing environmental legislation and addressing environmental crimes, establishing Environmental Aid and Pension Funds, creating an Environmental Information Bank, and setting up an Environmental Coordination Center.

Environmental protection, which includes safeguarding land resources, has become a global concern transcending national borders. In recent years, the Republic of Azerbaijan has placed significant emphasis on environmental issues that affect all of humanity. Undoubtedly, the sustainable development of Azerbaijan is highly reliant on addressing environmental challenges. However, it is essential to recognize that practical interventions to address changes, trends, and the broader course of nature are nearly impossible without objective information about individual ecosystems (biogeocenoses), encompassing the land, both at the level of the biosphere and within the country.

It is a well-established fact that soil plays an essential role in the biosphere and in human society. It's important to highlight that the participation of soil in biological processes is indispensable. Furthermore, the life of organisms inhabiting the Earth's surface is intricately linked to the soil.

Also, a person cannot live without soil, both biologically and socially.In recent years, significant strides have been taken to establish a comprehensive soil monitoring system in our country. Among these initiatives is the establishment of the "State Agency for Soil Monitoring and Management" in the Republic of Azerbaijan. As outlined in the law, soil monitoring is conducted within the Land Fund of the Republic of Azerbaijan as part of environmental monitoring. This comprehensive approach includes regular on-site observations, aerial photogeodesics, and cartography, utilizing data layers from state, municipal, and special property land areas, among other structural changes (Motuzova, 2007)

The objectives of this soil monitoring endeavor encompass a range of activities, such as the systematic assessment of soil conditions in relation to climate, agrochemical factors, geobotanical characteristics, geomorphological features, and more. Through soil monitoring, vital environmental data are collected, including information on land conditions, land use, and protection. This information is then used to prepare forecasts, programs, maps, bulletins, and other relevant documents.

Key tasks of modern soil environmental monitoring include:

Assessing and evaluating annual soil loss due to erosion.

Monitoring the distribution or reduction of humus and essential nutrients.

Identifying regions experiencing a negative balance of organic substances and nutrients.

Monitoring the use of pesticides.

Controlling soil pollution in areas surrounding industrial facilities and major transportation routes, particularly concerning heavy metals and radionuclides.

Table 1. Soil Health Assessment Parameters and Measurement Methods

Controlled process	Indicator	Measurement method
I. Primary diagnostic indicators		
1. Soil reduction	Enzymatic activity (catalase, dehydrogenase); "Breathing" of the soil; Nitrogen fixation	- chemical; - gasometric; - photometric; - titrometric; - acetylene
2. Soil hardening or alkalization	pH	- Potentiometric
3. Development of recovery processes		- Potentiometric
4. Physical properties	Density, porosity	According to Kaczynski
5. Change in the quality of humus	Water-soluble humus, carbohydrate, phenol	-
II. Average attendance indicators (sizing duration every 2-5 years)		
6. Reduction of humus	Humus, in %	According to Tyurin
7. Change in the quality of humus	Fractional composition	According to Tyurin, Ponomarev
8. Balance of nutrients	-	-
9. Change of soil composition	Nitrogen, potassium, calcium, magnesium, iron, etc. engine forms	-
10. Soil pollution with heavy metals	Lead, cadmium, copper, zinc, etc.	-
III For a long period ofdifficult indicators (measurementfrom 5-10 yearsand more)		
11 Dehumidification	Humus Reserve, pH	According to Tyurin
12. Reduction of nitrogen reserves	pH	According to kyeldal
13. Mineralogical composition	Quantitative and qualitative analysis of large and circular refractions	- micromorphology; - mineralogical
14. Main page	Chemical composition of the soil	- chemical; - spectrametric

Table 2. Monitoring fertility indicators of Lankaran River Basin transit ecological region

Fertility indicators	Yellow mountain-forest			Pseudopodzol yellow		
	1985-1990	2014-2019	fərq	1985-1990	2014-2019	fərq
1	2	3	4	5	6	7
Amount of hummus, %	3,1	2,5	-0,6	2,4	1,9	-0,5
Humus Reserve, pH 0-20 sm	130,4	101,7	-28,7	105,8	79,4	-26,4
0-50 sm	199,9	161,2	-38,7	154,8	132,1	-22,7
0-100 sm	236,3	200,1	-36,2	211,3	196,6	-14,7
Total nitrogen, %	0,19	0,14	-0,05	0,17	0,13	-0,04
Total phosphorus, %	0,20	0,17	-0,03	0,16	0,13	-0,03
Total potassium, %	3,62	3,48	-0,14	2,55	2,42	-0,13
Total exchangeable bases, cmol(+)/100 g	31,4	27,7	-3,74	26,6	23,1	-3,62
$Ca^{+}+M^{+}$, %	97,3	94,5	-2,8	95,8	92,6	-3,2
Al^{+}, %	0,68	0,93	+0,25	0,75	1,00	+0,28
pH (water)	6,0	5,5	-0,5	5,9	5,3	-0,6
pH (salt)	4,9	4,5	-0,4	4,8	4,3	-0,5

Supervising irrigation agriculture and land improvement processes related to water-physical characteristics of the soil.

Overseeing the use of soil in different contexts.

Efforts to organize environmental monitoring based on various environmental indicators in different regions of the Republic have been initiated. Notably, Z. Mammadova provided comprehensive insights into the multi-year dynamics of yellow soil areas and highlighted the impact of these changes on tea plant productivity. Furthermore, subsequent research by Sh. Mammadov, which involved the allocation of three ecological regions, explored long-term changes in biodiversity indicators specific to each ecological region.

Conclusion:

Our republic's environmental status has deteriorated substantially in recent decades, and this trend is continuing. The degradation of the lands and their fertility has become a nearly insurmountable plague. However, the insufficient level of environmental management - soil monitoring - prevents us from obtaining entire information about the activities taking place, their magnitude and intensity. The absence of environmental monitoring does not diminish the significance of environmental protection work. This problem can only be solved holistically, with an approach to legal, socioeconomic, and property issues relating to land from an environmental standpoint.

References:

Mammadov G.S. (2004) Azərbaycanın ekoetik problemləri: elmi, hüquqi, mənəvi aspektlər. Bakı, Elm, 377 s.

Mammadov G.Sh., Mammadova S.Z. (2012) Ecoethic problems of erosion, salinization andal calination of soils in Azerbaijan. 6th SETAC world congress setac Europe 22ndannualmeeting, Berlin, p. 201

Mammadov G.Ş., Mammadova S.Z., Shabanov J.A. (2017) Ecological monitoring of soils. Baku, 278 p.

Mammadova S.Z., Shaabanov J.A., Guliyev M.B. (2005) Lənkərançay hövzəsi torpaqlarının ekoloji monitorinqi. Bakı, Elm, 166 p.

Motuzova G.V., Bezuglova O.S. (2007) Ekologicheskij monitoring pochv. Moskva, 237p.

IMPACT OF RESEARCH CENTERS ON ENVIRONMENTAL FACTORS

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Abstract: This paper examined the impact of research centers on environmental factors. During the research, the creation and activities of research centers were analyzed. It has been determined that depending on the areas of activity in scientific centers, various wastes are generated. This waste can be environmentally harmful. Methods for creating special conditions for working with chemicals and radioactive materials are shown. It has been determined that the construction of science cities is important for ensuring environmental safety. The possibilities of creating these cities in Azerbaijan are shown.
Keywords: research centers, environmental factors, nanomaterials, radioactive materials.

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Introduction:

Environmental issues are one of the common issues currently discussed in the world. Environmental change is one of the factors that most influences the health of living things. Therefore, solving these problems is one of the urgent tasks of modern science. Measures are being taken to address environmental problems. The use of alternative energy sources has helped solve a number of problems. It is known that during oil extraction and refining a large amount of waste is generated, causing soil pollution. When oil is used as fuel, a large amount of gases is formed, causing air pollution (Benton & ets, 2007; Efendiyeva, 2000; Nikolaichuk, 2016).

It is known that one of the main causes of environmental pollution is the problems arising in large cities. Therefore, it is considered advisable to form large enterprises around the city where people gather. One such institution is scientific institutions. Recently, higher education institutions are mainly built on the outskirts of cities. However, in this case, certain difficulties arise. Thus, proximity to the city center is important for solving the economic and social problems of employees of scientific institutions, as well as students and teachers of higher educational institutions. As you move away from the center, problems arise in solving a number of issues. The most suitable model for solving these problems is the creation of science cities. In the science city it is possible to create research centers, as well as the creation of higher educational institutions, sports complexes and recreation centers. The proximity of students' and researchers' places of residence and work forces them to engage in more useful work. These facts indicate the impact on the growth of scientific indicators. The most important of all these factors are environmental factors. They must be organized in such a way that environmental pollution is minimal. Because as a result of the influence of anthropological factors, environmental problems begin to arise in places where people live. Human activity causes additional problems. Therefore, when addressing these issues, it is necessary to take into account environmental factors and monitor environmental protection (Hall, 1997; Pickett & ets, 2016, Ellis, 2015).

Although the influence of a number of factors on the environment has been studied,

the impact on the environment during the activities of research centers has not been studied enough. Because there are areas of science where harmful materials are used in research. Great care is required when conducting research using chemicals. In some areas of science, the expiration date of used instruments and equipment leads to the formation of harmful materials. Recently, the rapid development of nanotechnology has caused new environmental problems. So, because nanomaterials are very reactive, they can interact more quickly with materials in the environment. At this time, the formation of harmful substances may occur. Therefore, it is necessary to study environmental problems that may arise in research centers and take measures to prevent them. This paper shows the environmental problems that arise during the activities of research centers. To minimize these problems, issues that should be considered when establishing research centers have been mentioned.

Material and methods:

Studies have been conducted to examine the impact of research centers on environmental factors. The study analyzed research centers. Various research centers were selected as model objects for analysis. These centers were compared and analyzed on similar and different aspects. The processes that can occur in these centers, including accidents, have been studied. Study sites were grouped according to the results obtained during the analysis. For centers of a similar nature, appropriate models have been created. Proposals have been put forward to prevent the occurrence of environmental problems. Two methods have been proposed to study environmental problems. One of them is related to taking into account the main factors when creating a research center. It should be proposed to build the center in such a way as to ensure environmental protection with minimal damage to the environment. The second method is that the waste generated during the operation of the center must be controlled. They must either be reused or disposed of. By applying the mentioned methods, the influence of research centers on environmental factors can be studied.

Results and discussion:

It is known that research centers can work in different directions. When creating and operating these centers, environmental factors must be taken into account. It is known that when building cities and creating settlements, one should choose suitable places in nature. Therefore, many cities are built on the banks of rivers or seas. Because water pools support the protection of a clean environment. It is known that when building cities, aesthetic factors should also be taken into account. These factors should also be taken into account when establishing research centers. For this reason, centers were analyzed that can be used as model objects in the creation and operation of scientific centers. One such center is the Joint Institute for Nuclear Research, located in Dubna, Russian Federation (https://www.jinr.ru/). Although the institute primarily conducts nuclear research, it also conducts research in materials science, biological mathematics, and information technology. When creating this center, environmental factors were taken into account in 2 areas. The first direction is that the center must be environmentally friendly and located in a place where scientists can live comfortably. The second direction is that waste generated during research should not cause environmental problems. Each of these factors was analyzed separately.

A general view of the city of Dubna, where the Joint Institute for Nuclear Research was created, is presented in Figure 1. As can be seen in the figure, the city of Dubna is located on the right and left banks of the Volga river. The research center is located on the left bank. As you can see, the city is covered with greenery. There are many trees around the buildings and on the banks of the Volga. Environmentally friendly conditions for people to live and work have been created here. Therefore, this place was chosen to create a science city.

Figure 1. Dubna city of Moscow region, Russian Federation.

In accordance with the nature of the city of Dubna, research centers are also being built in dense forest areas. The entire territory of the Joint Institute for Nuclear Research is located in a forest zone. In recent years, a number of new international projects have been implemented at this institute. One of such projects is the NICA project (Nuclotron-based Ion Collider fAcility). This project aims to conduct research by accelerating various particles. A schematic description of the laboratory in which the project is being implemented is presented in Figure 2.

Figure 2. NICA project of the Joint Institute for Nuclear Research.

These centers conduct research both with chemical materials and under the influence of radiation. During research at the IBR-2 reactor, high-intensity neutron radiation occurs, which

creates certain dangers. The center has taken a number of measures to minimize environmental damage. A biological shielding system was built in the reactor to protect against exposure to neutron rays. Remote control is used for radiation protection during research. The amount of radiation during experiments depends on the type of research being conducted. If during research the structure of solids is studied by neutron diffraction, then you can touch the samples immediately after the experiment. however, in neutron absorption studies, samples may remain active for a long time. Therefore, after the end of the experiment, the activity of the samples should be monitored. These samples must be stored in special chambers for a certain period of time.

We need to be more careful when researching with chemicals. Because these substances can cause certain complications. Chemically active substances must not be touched. Nano-sized materials can enter the body through the pores of human skin. Therefore, caution should be exercised when conducting research with these substances.

In the course of the above-mentioned studies, it was determined that the creation of science cities is the most optimal method for creating research centers. To conduct scientific research, calm and favorable living conditions are necessary. These conditions can be ensured in science cities. The possibilities for using this model in Azerbaijan are wide. It is known that the research centers of Azerbaijan are mainly located in Baku. However, some regions have universities or university branches. Therefore, research centers can be created at these universities. For this purpose, the Guba city was explored and the possibilities of this city as a city of science were determined. Figure 3 shows a general view of the Guba city.

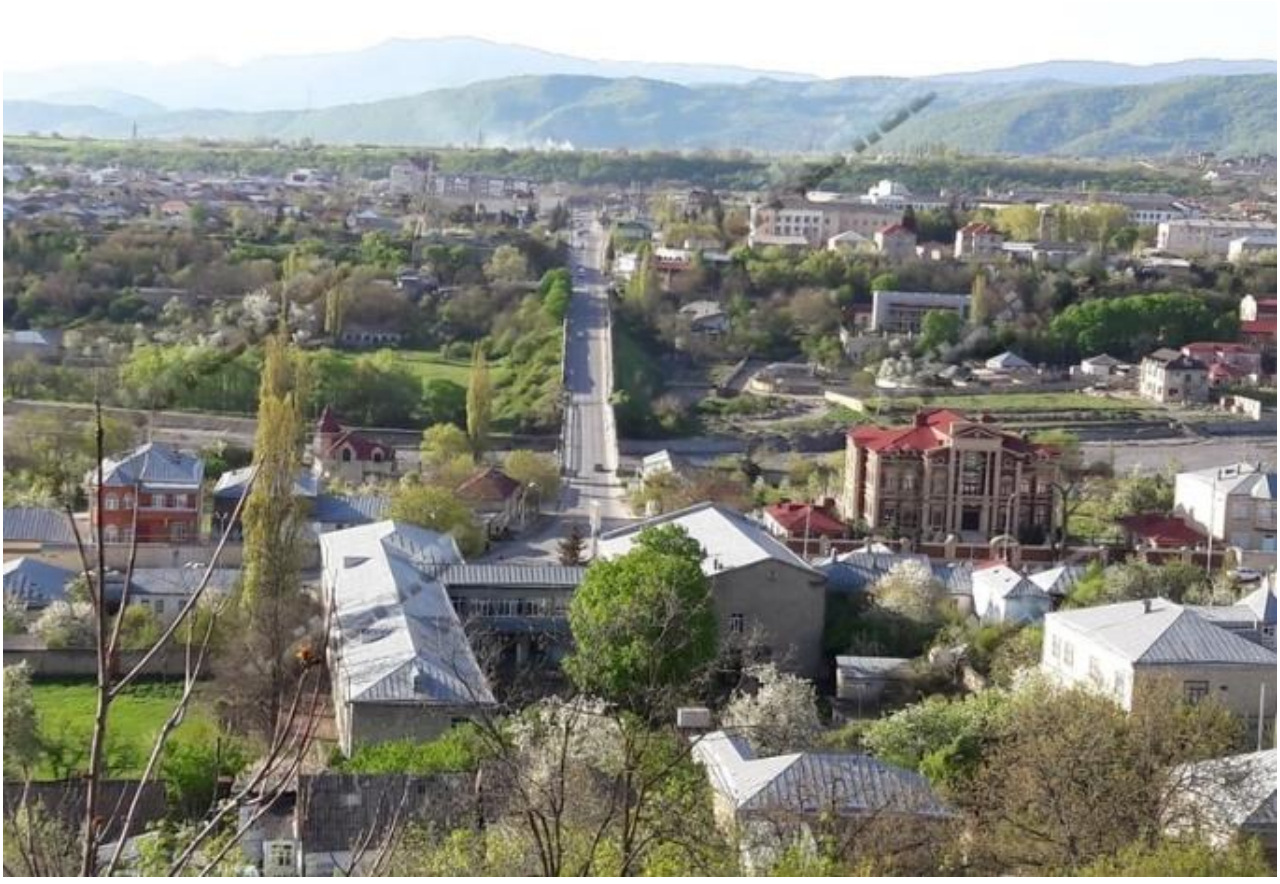

Figure 3. Guba city of Azerbaijan Republic.

From Figure 3 it can be seen that the Guba city is located on the banks of the Gudyalchay River near the Caucasus Mountains. It is possible to create research centers in this city. It is known that a branch of the Azerbaijan State Pedagogical University operates in the Guba city (https://adpuquba.edu.az/). Figure 4 shows a general view of the university. As you can see in the photo, the university territory has a beautiful natural landscape. Students of various specialties study in this department. Professors and teachers participate in the educational process. Therefore, there is scope for creating a research center.

Figure 4. Guba branch of the Azerbaijan State Pedagogical University.

The study determined that in order to address the environmental problems of research centers, two main issues should be addressed. Firstly, to create a research center it is necessary to select suitable natural conditions. Because depending on natural conditions, there may be more or less environmental problems. In big cities it is difficult to solve these problems. However, it was easier to solve these problems in small cities, including science cities. The second issue is that safety regulations must be followed when conducting research in research centers.

Conclusion:

Environmental problems arising in research centers are analyzed and ways to solve these problems are outlined. It has been determined that one of the ways to solve environmental problems in scientific centers is the creation of science cities. Because it is easier to solve environmental problems in science cities than in big cities. The Dubna city in the Russian Federation and the Guba city in Azerbaijan were compared as a model object. It is shown that the possibilities for creating research centers in these cities are wide. The nuclear center created in the city of Dubna was analyzed and it was considered expedient to create a similar center in the Guba city.

References:

Benton T.G., Solan M., Travis J.M.J., Sait S.M. (2007) Microcosm experiments can inform global ecological problems. Trends in Ecolog & Evolution 22: 516-520

Efendiyeva I.M. (2000) Ecological problems of oil exploitation in the Caspian Sea area. Journal of Petroleum Science and Engineering 28: 227-231

Nikolaichuk L.A., Tsvetkov P.S. (2016) Prospects of ecological technologies development in the Russian oil industry. International Journal of Applied Engineering Research 11: 5271-5276

Hall P. (1997) The university and the city. GeoJournal 41: 301-309

Pickett S.T.A., Cadenasso M.L., Childers D.L., Mcdonnell M.J., Zhou W. (2016) Evolution and future of urban ecological science: ecology in, of, and for the city. Ecosystem Health and Sustainability 2: e01229

Ellis E.C. (2015) Ecology in an anthropogenic biosphere. Ecological Monographs 85: 287-331

https://www.jinr.ru/

https://adpuquba.edu.az/

EXPLORING THE IMPACT OF ABIOTIC FACTORS ON *PYRUS* L. SPECIES IN EX SITU ENVIRONMENTS WITHIN THE GREATER CAUCASUS REGION

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Abstract: The study is devoted to a detailed examination of the reaction of *Pyrus* L. species occupying the northeastern sector of the Greater Caucasus region to various abiotic variables in controlled ex situ habitats. This study has important theoretical and practical implications for the conservation of genetic diversity among these uncommon species, as well as the effective implementation of environmental greening projects. The core focus lies in understanding the interplay between the introduced *Pyrus* L. species and a spectrum of environmental variables when subjected to ex situ conditions. By delving into this relationship, the study aims to contribute valuable insights that transcend theoretical boundaries and extend into practical applications. The protection of the gene pool of these rare species is a paramount objective, and the findings are anticipated to inform and enhance strategies for the successful implementation of greening efforts. In essence, the research not only seeks to deepen our theoretical understanding of how *Pyrus* L. species respond to abiotic factors but also strives to provide practical knowledge that can be harnessed for the preservation of biodiversity and the successful execution of environmental conservation initiatives."
Keywords: *Pyrus* L., *ex situ*, temperature, light, water.

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Introduction:

There are a number of factors that create different types of environmental problems in nature. Among these factors, anthropological factors occupy the main place. The growth of cities, the creation of factories and factories, and the increase in the number of automobiles have a serious impact on the environment. Environmental problems have a direct impact on all living things in nature, including plants. Therefore, these effects need to be investigated. Recently, more and more attention has been paid to environmental problems. Because pollution of the atmosphere and nature affects all living things. It is known that extensive research is being carried out to study the nature of the Caucasus. Recently, oil production and road construction in the Caucasus have also caused the emergence of new environmental problems. Therefore, as the economy and technology develop, it is necessary to solve environmental problems. Environmental issues need to be researched and the impact of these issues on people, animals and plants should be explored. The results obtained will be used in the study of the Caucasus. Therefore, in recent years, extensive experimental and theoretical research has been carried out in these areas (biological, geological, geographical, etc.).

Environmental factors are the sum of environmental components that affect living things. The ecological factors of the environment affect the biochemical and physiological processes in the body - nutrition, respiration, photosynthesis, etc. affects the processes, as well as its distribution, development, productivity, life, daily and annual activity. According to the mechanism of influence of factors on the body, there are some generalities as well as special cases. Whatever

the factor, its effect on the organism is debilitating when it deviates from the optimal (most favorable) part, and at the very edge it is lethal. As we know, living organisms are directly or indirectly affected by environmental factors in their environment. These influencing factors create abnormal changes in the life activity of plants. For this reason, it has a negative effect on the growth and development of plants. In the article was studied, the relationship of *Pyrus* L. species to various abiotic factors.

Materials and methods:

The research object is *Pyrus* L. which is naturally distributed in the northeastern part of the Greater Caucasus. 5 pear species belonging to the *Pyrus* L. genus (*Pyrus communis* L. – Common pear, *Pyrus caucasica* Fed. – Caucasian pear, *Pyrus georgica* Kuth. – Georgian pear, *Pyrus vsevolodii* Heideman – Vsevolod pear, *Pyrus salicifolia* Pall. – Willowleaf pear).

The research was conducted some ecological methods as to divide plants into ecological groups Walter (1967), K.A. Akhmatov (1972), when studying heat resistance, P.A. Genkel (1967), for drought resistance, N.A. Ploxinskiy (1998) and G.N. Zajcev (1984) for mathematical statistical calculation of experimental results .

Results and discussion:

The studied plants (*Pyrus caucasic*a Fed., *Pyrus communis* L., *Pyrus georgica* Kuth., *Pyrus vsevolodii* Heideman, *Pyrus salicifolia* Pall.) are mainly light-loving plants. As a result of the research, it has become clear that developmental retardation manifests itself in places where light deficit is observed.

However, it can be noted that the limiting factors of plants in different light conditions also have the characteristic of variability. Cultivation of light-loving plants in a shaded area is considered to be the introduction or adaptation of shade-loving plant traits to them as unnatural adaptive traits.

It can be said that light-loving plants, like other groups, have developed some adaptive features against the light factor. Naturally, those plants are resistant to high light intensity. Shade-loving plants do not tolerate high light intensity, because they cannot use the weak light potential to a high percentage. Of course, we can explain these characteristics by the fact that there is a high adaptation for maximum use of light intensity for those losses. Naturally, the light factor determines the location of both light-loving and shade-loving plant groups, the characteristic of leaf arrangement, and creates stratification in species under humidity conditions. We can note that the light intensity in natural conditions has an optimal value. This indicator is higher mainly in tropical and subtropical regions. It is for this reason that the role of the lower leaves of the tree in the shade can be noted in the process of synthesis (Isgandar, 2017).

In the research work, one day temperature changes were studied. Research work was conducted in July on 5 types of *Pyrus* L. species (Table 1). The highest temperature was observed at the closest distance to the ground almost before pm 2-3 o'clock in the afternoon. A decrease in the amount of heat was observed as we moved away from the ground. It was observed that temperature changes are higher on the surface closest to the soil surface. Of course, this feature has some differences depending on the species.

From the general observations, we can say that the temperature at the height from the soil surface to the hill can be 7-8°C lower than the part close to the soil surface. Of course, this feature can vary depending on the species.

As we know, if the temperature is too high, it creates conditions for the breakdown of proteins and the accumulation of ammonia in plants .

Table 1. Effect of temperature on the studied plant species (July 2017)

№	Species	Height above the ground (trunk)		
		rhizome	medium	top
		Temperature, °C		
1	*Pyrus caucasica* Fed.	31.0±1.5	27.0±1.3	24.0±1.2
2	*Pyrus communis* L.	32.0±1.6	27.0±1.3	25.0±1.3
3	*Pyrus georgica* Kuth.	32.0±1.6	27.0±1.3	25.0±1.2
4	*Pyrus vsevolodii* Heideman	33.0±1.6	28.0±1.4	26.0±1.3
5	*Pyrus salicifolia* Pall.	33.0±1.6	29.0±1.4	27.0±1.3

Thus, the Absheron area is distinguished by the fact that the soil is drier than other areas in the summer season. The amount of annual precipitation is 200-300 mm, and evaporation is equal to 1000 m, which adapts the plant species belonging to that area to climatic factors. Introduced to the Absheron Peninsula, they spend vegetation in a difficult situation. From our observations, it became clear that in ex situ conditions, leaves were falling or yellowing. Among such species, we can mention *Pyrus georgica* Kuth. and *Pyrus caucasica* Fed. Due to the increase in temperature, the growth and development process stops in those research species when the drought continues. Later, with the decrease in temperature, the growth process of those species starts again.

As a result of the observations, it became clear that burns are observed in some of the studied species (*Pyrus georgica* Kuth., *Pyrus caucasica* Fed., *Pyrus communis* L.). Those burns first start from the outer part of the leaf and go towards the middle part of the leaf. Then it already covers the entire mesophyll part of the leaf. As a result, leaf shedding occurs. In July 2017, when we conducted the research, the temperature indicator was in the range of 36-42°C, so it was found that burns appeared on the leaves. Akhmatov's method was used to determine the lethal effect of heat on the leaves of the studied plants. In this case, thermos containers were used (Table 2).

Table 2. Lethal effect of heat on the leaves of the studied plants

№	Species	Temperature, °C
1	*Pyrus caucasica* Fed.	52.0±2.6
2	*Pyrus communis* L.	52.0±2.6
3	*Pyrus georgica* Kuth.	52.0±2.6
4	*Pyrus vsevolodii* Heideman	54.0±2.7
5	*Pyrus salicifolia* Pall.	54.0±2.7

So, from the analysis of the research, it became clear that the leaves of the plants are divided into 2 parts according to the heat resistance feature:

1. Highly resistant ones (54°C) – *Pyrus salicifolia* Pall., *Pyrus vsevolodii* Heideman;
2. Moderately resistant (52°C) – *Pyrus caucasica* Fed., *Pyrus commu*nis L., *Pyrus georgica* Kuth.

It was clear from experience that the leaves of plants are damaged by heat in the range of 52-54°C. General results showed that the heat resistance feature of plants is related to their individual biological characteristics. Therefore, the species we studied have different characteristics due to heat and drought in the ex situ environment.

Unlike species that thrive in humid conditions, there are 2 types of adaptive features for birches in arid areas. The first is maintaining the turgor pressure, and the second is maintaining the vitality of the plants while protecting them from dehydration. It is for this reason that a number of symptoms occur in species found in arid areas. In those species, the root system develops well, the trunk and leaves shrink, become covered with wax or hairs and take the form of skin .

In addition to these, a number of adaptive features appear in the physiological signs of plants.

The development of underground and above-ground organs was studied by giving 10, 20, 30 liters of water every 10 days to the 2-3-year-old sprouts of the studied plants under *ex situ* conditions. According to the obtained results, the accumulation of dry matter was 2-5 times more depending on the species compared to the control plants.

Table 3.Grouping of studied pear species according to their attitude to water.

№	Species	Groups				
		Hygrophyte	Mesophyte	Xerophyte	Mesoxerophyte	Xeromesophyte
1	*Pyrus caucasica* Fed.				+	
2	*Pyrus communis* L.		+			
3	*Pyrus georgica* Kuth.					+
4	*Pyrus vsevolodii* Heideman.			+		
5	*Pyrus salicifolia* Pall.			+		

Conclusion:

From our visual observations and experiments, it became known that the research plants were divided into 4 groups according to their relationship to water (Table 3).

Among the studied plants, 1 species - *Pyrus communis* L. mesophyte was included in the group living in moderately moist places. In nature, these plants are found in open fields in the foothill forests. The root system, stem and leaves are well developed in *Pyrus communis* L., a mesophytic species.

Xerophyte - this group, which is not so demanding of water and can satisfy its need even in small amounts - is grouped under *Pyrus vsevolodii* Pall., *Pyrus salicifolia* Pall. species. Observations have shown that those species retain the characteristic of normal growth and development in arid areas. It was also clear from the observations that *Pyrus georgica* Kuth. is considered a xeromesophyte, and *Pyrus caucasica* Fed. is a mesoxerophytic species. As we know, the species included in the xeromesophyte and mesoxerophyte group constitute an intermediate stage between the xerophyte and mesophyte species. The mentioned plants have the characteristics of both groups, so they are included in those groups.

It was clear from the research results that all of the studied wild pear species are light-loving (5 species); high (2 species) and medium (3 species) resistant to heat; according to water, it is included in such ecological groups as mesophyte (1 type), xerophyte (2 types), mesoxerophyte (1 type), xeromesophyte (1 type).

References:

Ahmatov, K.A. (1972) Polevoj metod opredeleniya zharoustojchivosti rastenij, Baku, Byull. GBS, No.86, p.73-74.

Genkel', P.A. (1956) Diagnostika zasuhoustojchivosti kul'turnyh rastenij i sposoby ee povysheniya (metodicheskie ukazaniya), Moscow, AN SSSR, 69 p.

Isgandar E.O. Sadigova N.A. Bitki ekologiyası. Baku 2017 p 352

Plohinskij, N.A. Biometriya (1998) Moscow, MGU, 150 p.

Walter, H. (1967) Klimadiagram-weltatlas, Cena, 49 p.

Zajcev, G.N. (1984) Matematicheskaya statistika v eksperimental'noj botanike, Moscow, Nauka, p. 20-43.

SYNTHESIS OF COMPLEX OXIDE $La_{0.5}Ba_{0.5}MnO_3$ AND STUDY OF ITS SIZE EFFECT

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Abstract: In this work, the complex oxide $La_{0.5}Ba_{0.5}MnO_3$, which is a perovskite-type compound, was synthesized. Preliminary analyzes of the resulting sample were carried out. The crystal structure has been determined. Covalent bonds formed by metal and oxygen atoms were analyzed. The crystal structure is explained by MnO_6 octahedra. The effects that occur during cation-cation substitutions are indicated. To study the size effect, studies were carried out under an SEM microscope. Based on the surface structure obtained at different scales, it was determined that the crystallite sizes are on the order of microns.
Keywords: oxide, covalent bond, crystal structure, morphology.

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Introduction:

Recently, oxide materials have been widely studied. The main reason for the interest of these materials is that their chemical composition is stable over a long period of time. Because oxidation occurs on the surface of non-oxide materials. Therefore, changes in their chemical composition are observed after a certain period of time. Complex oxides are considered more interesting objects. In these compounds, piezoelectric, ferroelectric and other properties are observed. It is known from the chemistry of semiconductors that these compounds also have semiconducting properties (Heywang, 1971; Karpierz & ets, 2017; Yousaf Shah & ets, 2020; Fujioka & ets, 2001; Razak & ets, 2017).

It has been established that when metal atoms, such as Fe, Ni, and Co, are included in the composition of complex oxides, magnetic properties are also observed in these materials. Therefore, by changing the chemical composition of these oxides, materials with different functions can be synthesized. Ferro- and antiferromagnetic properties were observed in the compounds $BiMnO_3$, $BiFeO_3$, $BaMnO_3$ (Dash & ets, 2016; Haykal & ets, 2020; Sosnowska & ets, 1995; Chamberland & ets, 1970). To obtain new functions in these chemical compounds, it is necessary to study their physicochemical properties. It has been established that the physical properties of barium hexaferrite and its solid solutions are affected by their size. Therefore, the size effect was studied in these compositions. In studies carried out using a scanning electron microscope, it was found that the size effect also changes depending on the concentration of chemical elements in the composition (Trukhanov & ets, 2016; Ayyubova, 2021). As the concentration of magnetic ions in complex oxides increases, the crystallite size increases. This effect is associated with the formation of long-range magnetic order.

The information obtained about the surface structure of chemical compounds allows us to obtain information about a number of properties of these compounds. Therefore, it is important to study their size effect in the preparation of nanoparticles and thin films, as well as their physicochemical properties.

Although a number of chemical properties of the $La_{0.5}Ba_{0.5}MnO_3$ compound have been

studied, its size effects have not been sufficiently studied. In this work, polycrystals of the $La_{0.5}Ba_{0.5}MnO_3$ compound were synthesized and a structural-phase analysis of the resulting composition was carried out. The size effect of the resulting compound was studied using a scanning electron microscope. Size effects were studied using data obtained from surface structures obtained at the D = 10 μm and D = 1 μm scales. It has been established that, based on images obtained at different scales, it is possible to obtain information about the acquisition of polycrystals, the shape, size and degree of crystallization of crystallites.

Experiments:

The compound $La_{0.5}Ba_{0.5}MnO_3$ was obtained by chemical reactions using a procedure consisting of several stages. The reaction involved oxides La_2O_3, Mn_2O_3 and $BaCO_3$ of high purity (>99.999%). Based on the conditions of the chemical reaction, it was taken based on the molar mass of these oxides. La_2O_3 oxide was heated in open air at a temperature of 1000 °C for 2 hours, water and carbon dioxide molecules were removed from its composition. At the next stage, the oxides were mixed in the appropriate amount and pressed to a size of 20 mm. The material prepared in this way was heated in the open air for 5 hours at a temperature of 1000 °C until the barium carbonate completely decomposed. In the next step, the sample was again ground in a mortar and mixed with the powder. At the final stage, the sample was placed on a platinum substrate and heated in open air at a temperature of 1550 °C for 10 hours. After the synthesis process, the sample was cooled at a rate of 80 °C per hour.

An X-ray phase analysis of the sample obtained after the synthesis process was carried out. The structural phase analysis of the obtained samples was carried out by X-ray diffraction (D8 Advance, Bruker, Germany). Diffractometer parameters: 40 kV, 40 mA, CuKα – radiation, λ = 1.5406 Å. The experiments were carried out at room temperature. During the structural analysis of the $La_{0.5}Ba_{0.5}MnO_3$ solid solution, it was established that a single-phase compound was synthesized.

The surface structure and size effects of chemical compounds were studied using a scanning electron microscope. Experiments were carried out on SEM, ZEISS, ΣIGMA VP instruments. Data on polycrystalline compounds $La_{0.5}Ba_{0.5}MnO_3$ were obtained by analyzing images taken at different scales.

Results and discussion:

The morphology and crystal structure of polycrystals of the La0.5Ba0.5MnO3 compound have been studied. X-ray phase analysis established that the crystal structure of this compound corresponds to the Fm-3m space group and cubic system. The lattice parameter values are set to a = b = c = 3.9073 Å. Since this crystal structure has high symmetry, it is also used as a model object in solving a number of problems. This structure is suitable for studying the formation of covalent bonds in crystallography and the influence of ionic radii on the structure. It is known that the elements lanthanum and barium alternately participate in this chemical compound. The high symmetry of the crystal structure of the resulting compound indicates that the barium and lanthanum atoms in this compound can completely replace each other. Therefore, the synthesis and study of the structure of the $La_{0.5}Ba_{0.5}MnO_3$ compound are useful not only for studying the size effect that occurs in complex oxides, but also for studying cation-cation substitutions in these compositions. MnO_6 octahedra are formed when Mn atoms in this composition form covalent bonds with O atoms. Depending on the position of these octahedra in the crystal, physicochemical properties are formed. When the atoms forming the octahedron are arranged in ideal coordinates, the Mn atoms located at the center of the octahedron form long-range magnetic order. In this case, magnetic properties are formed. Ba and La atoms form the perovskite structure, standing at the sites of the elementary lattice. The results obtained from studying the structure of the $La_{0.5}Ba_{0.5}MnO_3$ compound have important scientific significance both for explaining other properties of this compound

and for explaining a number of properties inherent in complex oxides. Because the main structural elements in complex oxides are polyhedra. Perovskites consist mainly of octahedra. In hexaferrites there are tetrahedra, bipyramids and octahedra. Therefore, to explain the processes occurring in oxide materials, it is necessary to study polyhedra formed on the basis of covalent bonds formed in them by divalent oxygen atoms.

Structural analysis shows that the compound $La_{0.5}Ba_{0.5}MnO_3$ has interesting properties. Therefore, it is important to study other properties of this composition. It is known that the study of surface structure, as well as crystal structure, allows one to obtain extensive information about materials. Due to the fact that partial oxidation occurs on the surface of non-oxide materials, the data obtained are not sufficient to obtain accurate information. However, oxidation on the surface of oxide materials is minimal. Therefore, studying the surface processes occurring in them allows one to obtain accurate results. For this purpose, the morphology of the $La_{0.5}Ba_{0.5}MnO_3$ compound was studied. The surface structure obtained using a scanning electron microscope is shown in Figure 1.

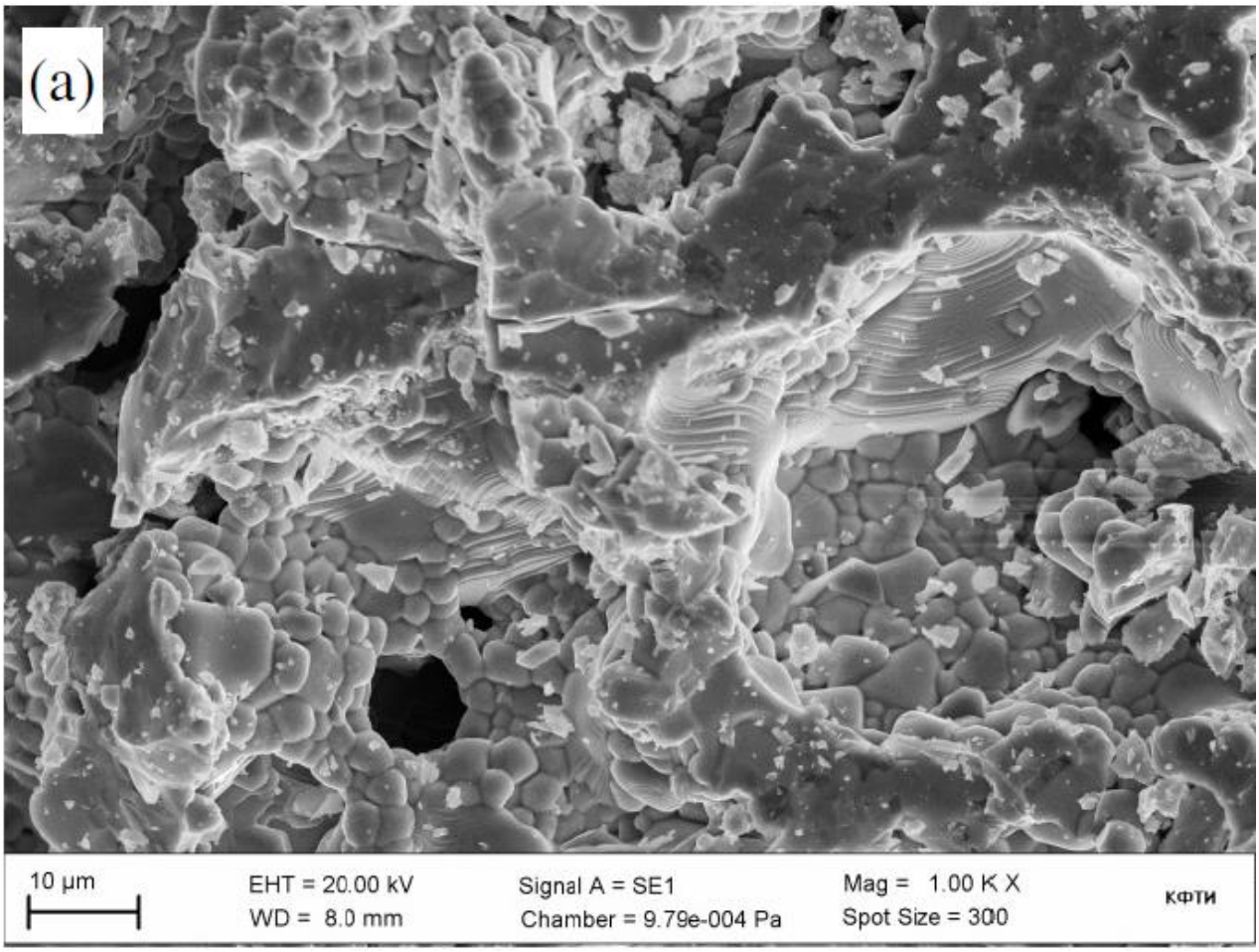

Figure 1. Surface structure of the $La_{0.5}Ba_{0.5}MnO_3$ compound on a scale of *D* = 10 μm.

From the surface structure shown in Fig. 1, it can be seen that the compound $La_{0.5}Ba_{0.5}MnO_3$ was synthesized in polycrystalline form. Despite the presence of voids in some parts, in general the distances between crystallites are very small. Obtaining samples depends on the synthesis conditions and technology. However, the formation of physicochemical properties is possible depending on the elements included in the chemical composition and the nature of the material.

The magnetic properties of materials also affect the formation of crystallites. Because

magnetic domains are also formed in these crystallites. In materials with ferroelectric properties, domains are formed in crystallites as a result of the polarization process. From Figure 1 it can be seen that the crystallite sizes are on the order of microns. However, it is impossible to determine the exact dimensions.

In the $La_{0.5}Ba_{0.5}MnO_3$ compound, smaller size studies were carried out in order to more accurately determine the crystallite size and determine the size effect. In order to study the surface structure of the $La_{0.5}Ba_{0.5}MnO_3$ compound on a scale of D = 1 μm, studies were carried out using a scanning electron microscope. The results obtained are shown in Figure 2. From the surface structure shown in Figure 2, it can be seen that the $La_{0.5}Ba_{0.5}MnO_3$ compound was synthesized in the form of a high-density polycrystal. In small sizes there are almost no gaps in this composition. It was determined that the crystallite size is in the range D = 1-3 μm. In some parts this composition was observed in layered form, which is an indication of the smaller crystallite sizes in these parts.

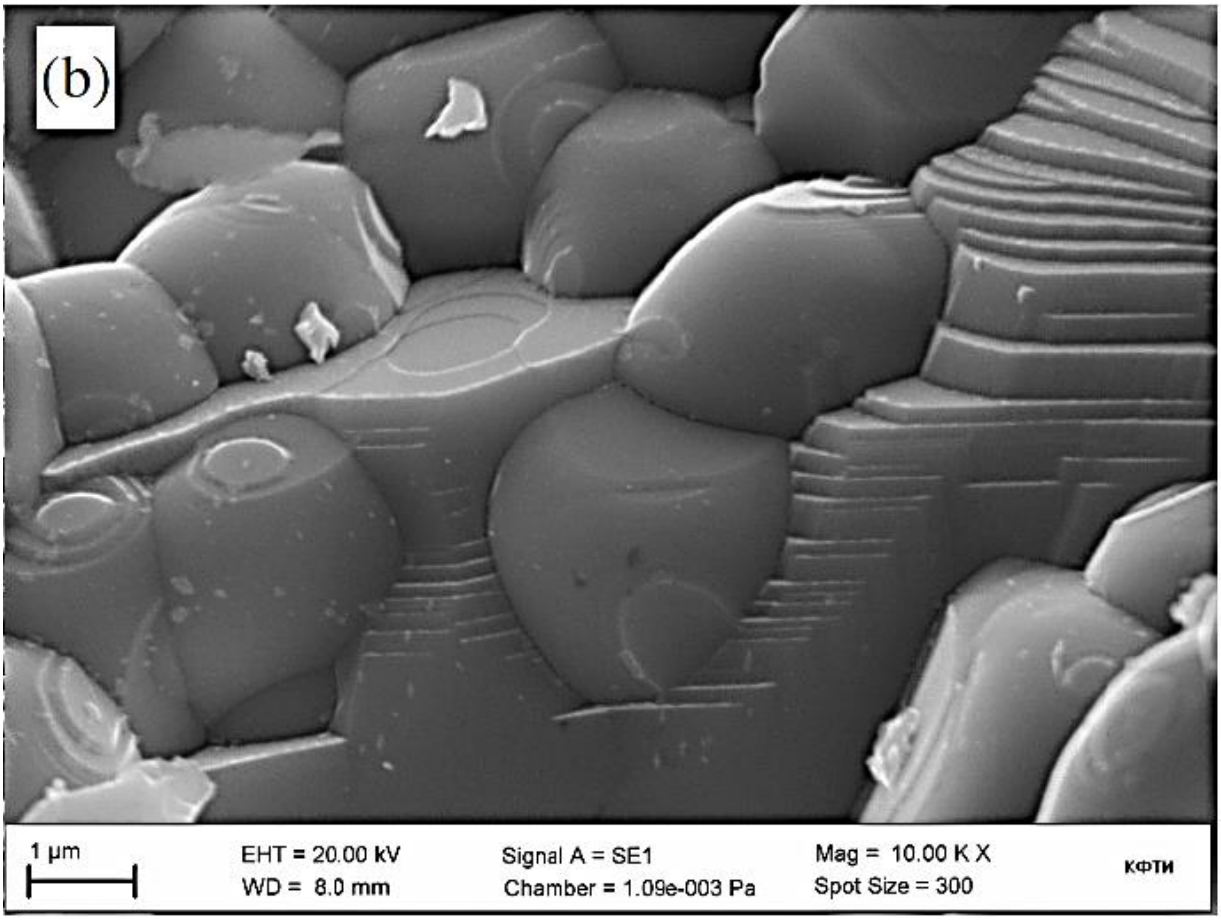

Figure 2. Surface structure of the $La_{0.5}Ba_{0.5}MnO_3$ compound on a scale of D = 1 μm.

Conclusions:

The compound $La_{0.5}Ba_{0.5}MnO_3$ was obtained, its crystal structure and morphology were studied. The study used X-ray diffraction and electron microscopy. It has been established that the structural elements of this crystal consist of MnO_6 octahedra. During cation-cation substitution, the metals La and Ba alternate at the sites of the crystal lattice. The crystal structure is formed by covalent bonds formed by metal atoms with oxygen atoms, and this structure is highly symmetrical. The morphology of the resulting sample was also studied. It was found that this compound has a densely formed shape. There are no voids between the crystallites. Crystallites are in the range D = 1-3 μm.

References:

Heywang W. (1971) Semiconducting barium titanate. Journal of Materials Science. 377 s.

Karpierz M., Suchanicz J., Konieczny K., Kluczewska K. (2017) Influence of PbTiO3 doping on semiconductor behavior of $K_{0.5}Bi_{0.5}TiO_3$ ceramics. Phase Transitions 90: 840-846

Yousaf Shah M.A.K., Rauf S., Mushtaq N., Tayyab Z., Ali N., Yousaf M., Xing Y., Akbar M., Lund P.D., Yang C.P., Zhu B., Asghar M.I. (2020) Semiconductor Fe-doped $SrTiO_{3-\delta}$ perovskite electrolyte for low-temperature solid oxide fuel cell (LT-SOFC) operating below 520 °C. International Journal of Hydrogen Energy 45: 14470-14479

Fujioka H., Ohta J., Katada H., Ikeda T., Noguchi Y., Oshima M. (2001) Epitaxial growth of semiconductors on $SrTiO_3$ substrates. Journal of Crystal Growth 229: 137-141

Razak N.A.A., Zabidi N.A., Rosli A.N. (2017) A first principle study of band structure of tetragonal barium titanate. AIP Conference Proceedings 1875: 020017

Tajiri T., Harazono M., Kitamura T., Deguchi H., Kohiki S., Mito M., Kohno A., Takagi S. (2009) Magnetic properties of $BiMnO_3$ nanoparticles in SBA-15 mesoporous silics. Journal of Physics: Conference Series 150: 042198

Dash U., Raveendra N.V., Jung C.U. (2016) A rigorous investigation of $BiMnO_3$ ferroelectricity through a development of a novel way to stabilize twin free and monoclinic thin film. Journal of Alloys and Compounds 684: 310-314

Haykal A., Fischer J., Akhtar W., Chauleau J.-Y., Sando D., Finco A., Godel F., Birkhölzer Y.A., Carrétéro C., Jaouen N., Bibes M., Viret M., Fusil S., Jacques V., Garcia V. (2020) Antiferromagnetic textures in $BiFeO_3$ controlled by strain and electric field. Nature Communications 11: 1704

Sosnowska I., Zvezdin A.K. (1995) Origin of the long period magnetic ordering in $BiFeO_3$. Journal of Magnetism and Magnetic Materials 140-144: 167-168

Chamberland B.L., Sleight A.W., Weiher J.F. (1970) Preparation and characterization of $BaMnO_3$ and $SrMnO_3$ polytypes. Journal of Solid State Chemistry 1: 506-511

Trukhanov A.V., Dang N.T., Trukhanov S.V., Jabarov S.H., Kazakevich I.S., Mammadov A.I., Mekhdiyeva R.Z., Turchenko V.A., Huseynov R.E. (2016) Crystal structure, magnetic properties, and raman spectra of solid solutions $BaFe_{12-x}Al_xO_{19}$. Physics of the Solid State 58: 992-996

Ayyubova G.Sh., Jabarov S.H. (2021) Crystal structure, surface structure and chemical analysis of $BaFe_{10.8}In_{1.2}O_{19}$ compound. UNEC Journal of Engineering and Applied Sciences 1: 49–53.

SPECIES COMPOSITION OF THE *OLIGOCHAETA* FAUNA OF THE MINGACHEVIR RESERVOIR

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Abstract: The article provides information on the species composition and quantitative distribution of oligochaetes in the Mingachevir reservoir by season. The studies were conducted in 2011-2018. after a long pause in the study of oligochaetes. The study is of great importance in determining the food supply of fish in the given reservoir.
Keywords: *Oligochaeta*, seasonal development, distribution, biomass, species composition**.**

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Introduction:

Oligochaetes are a group of segmented worms that play an important role in aquatic ecosystems, especially in freshwater environments. Oligochaete worms are used as indicators of water quality. Some members of the class are particularly sensitive to changes in environmental factors such as oxygen levels, high concentrations of nutrients and water pollution. Monitoring the presence of certain species and abundance of oligochaetes allows us to assess the health of a water body (Kang et al., 2017).

Oligochaetes are known for their burrowing activities, which promote bioturbation, which involves moving sediment and mixing organic and inorganic materials in the substrate. This process has several environmental consequences, including nutrient cycling, sediment aeration, and stimulation of microbial activity (Adamek & Marsalek, 2013; Mermillod-Blondin, 2011).

Oligochaete worms play a critical role in nutrient cycling in aquatic ecosystems. Burrowing through sediments, they consume organic matter, detritus and bacteria. The absorbed material is then processed and excreted from the body in a more decomposed form, facilitating the availability of nutrients in the water column and sediments (Bartoszek, 2023).

Oligochaetes serve as an important food source for a variety of aquatic predators, including fish, amphibians, and some aquatic insects. Their abundance and distribution can influence the composition and dynamics of higher trophic levels of an ecosystem (Chapman, 2001).

The burrowing activity of oligochaetes contributes to the saturation of sediments with oxygen. By creating channels and voids in the sediment, they facilitate gas exchange between the sediment and the overlying water, which is important for the survival of many benthic organisms and microbial processes (Mermillod-Blondin, 2011).

Some species of oligochaetes are filter feeders, that is, they extract suspended particles, algae and detritus from the water column. This feeding behavior may contribute to water clarification and influence the composition of phytoplankton communities (Attrill et al., 2009).

Oligochaetes are detritivores, feeding mainly on decaying organic matter. Their feeding activities help break down and decompose dead plant material, facilitating nutrient recycling in aquatic ecosystems (Benbow et al., 2020).

Thus, the study of the qualitative and quantitative composition, as well as the distribution of

oligochaetes in water bodies has a great practical importance, since they play an important role in nutrient cycling, sediment dynamics and the general condition of freshwater ecosystems. Their interactions with the environment make them important components of aquatic food webs and valuable indicators of water quality.

Mingachevir reservoir is the largest reservoir in Azerbaijan. It is located on the Kura River and was put into operation in 1953 - 1956. The reservoir is located in a depression between the Akhar-Bahar mountain ranges from the north, Bozdag from the south and Palantokan from the west. The reservoir serves for long-term regulation of the flow of the Kura River and the integrated use of water reserves (Aliyev et al., 2010).

The length of the reservoir is 75 km, the maximum width is 20 km, the average width is 8 km, the maximum depth is 75 m (in the part near the dam), the average depth is about 26 m. The length of the coastline is about 240-250 km, depending on the level fluctuations. The length of the reservoir dam is 1550 m, the width at the top is 16 m, and the maximum height is 80 m. With this dam, a hydropower station consisting of 6 hydrounits with a total capacity of 371 m kw was built.

Figure 1. Satellite view of reservoirs built on the Kura River (Shamkir, Yenikend, Mingachevir and Varvara) (Credit: Google Maps).

Starting from the reservoir, there are two main canals that have been put into operation since 1958: the Upper Karabakh and Upper Shirvan canals.

The Upper Karabakh canal (172 km long) provides irrigation of more than 100,000 hectares of cultivated land in the Mil-Karabakh plains. When there is a shortage of water in the Araz River, about 30 m^3/sec of water is discharged from the canal to the Bahramtepe hydrojunction to feed it with additional water.

The Upper Shirvan Canal (123 km long) supplies water to 127,000 hectares of irrigated land in the Shirvan Plain, starting from the Khanabad Bay. The end of the channel ends near the city of Agsu.

The main source of the Mingachevir reservoir is the water of Kura, Ganikh, Gabirri, and partially Ganjachay (Aliyev et al., 2010).

The macrozoobenthos of the reservoir was studied by A.H. Gasimov in the first years (1956-1959) (Kasimov, 1965; Kasımov, 1972). As a result of his research, the number of species of macrozoobenthos in the reservoir changed from 21 to 35. Further studies belong to A. Khalilov. He recorded 77 species and forms for the reservoir in 1971-75.

One of the main groups of the bottom fauna of the reservoir are small-horned worms. Some characteristics of these worms allow them to develop even in deep areas. Oligochaetes are the favorite food of benthic and baby fish (sea bream, bream, sole fish, etc.). Therefore, our goal is to provide detailed information about these creatures and their place and importance in the composition of the benthic fauna of the Mingachevir reservoir.

As a result of his research conducted in 1955-59, A.H. Gasimov noted 3 species of oligochaetes (*Chaetogaster* sp., *Limnodrilus* sp. and *Tubifex tubifex*) for the reservoir (Kasimov, 1965). As a result of the research conducted by A. Khalilov during the years 1971-1975, he noted that olichochaetes were represented by only 6 species. However, his information does not list the name of the species (Khalilov & Akhmedov, 1972; Khalilov, 1980).

According to information from the 70s and 80s of the 20th century, 9 species of

oligochaetes were recorded in the Mingachevir reservoir. They played a leading role in the formation of benthos. Thus, according to 1961, the total biomass of benthos was 3.08-12.09 g/m^2, the number was 1478-3728 ind./m^2, and the share of oligochaetes and chironomid larvae was 97.2% (Khalilov, 1980).

Naturally, certain changes occur in the reservoir's fauna and benthic fauna over the years. This can be mainly explained by the change of the biocenoses in the reservoir in the first years, as well as the commissioning of the Shamkir and Yenikend reservoirs on the Kura River in 1982 and in 2000 (Figure 1).

Studying the hydrofauna of the Mingachevir reservoir under new environmental conditions and comparing the obtained results with the results of previous years and other reservoirs can be valuable material for clarifying the processes occurring in the reservoir. Our work was planned for this purpose.

Materials and Methods:

Starting from 2011, materials on macrozoobenthos were collected at permanent stations from different parts (upper, middle and lower), depths and biotopes of the reservoir by seasons (winter, spring, summer and autumn) (Figure 2). During the research period, 565 samples (242 qualitative and 323 quantitative samples) were collected.

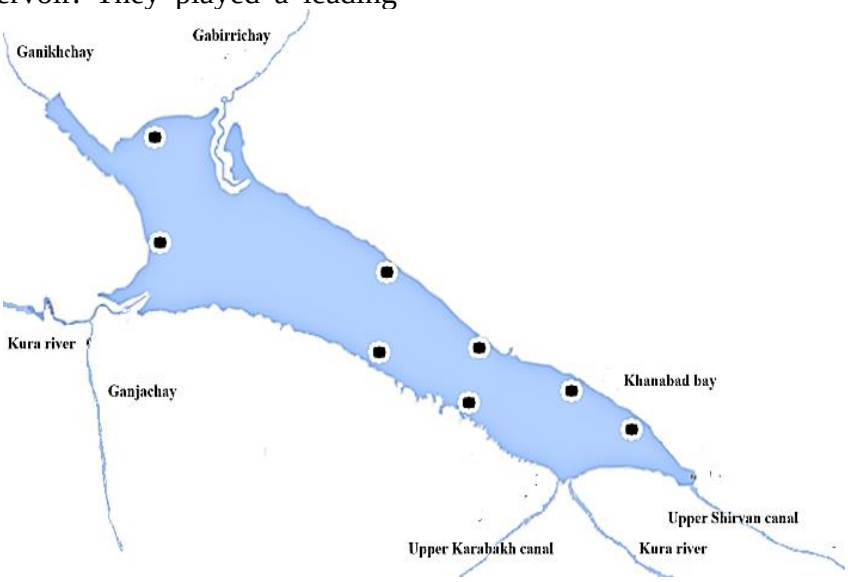


Figure 2. Map-scheme showing the location of permanent stations for collecting macrozoobenthos samples in the Mingachevir reservoir.

The materials were collected and analyzed based on Jadin's method (Jadin, 1956).

In the collection of the material, a mesh sieve and a scraper were used. With these tools, samples were collected from the coastal zones of water bodies. Samples from deep areas were collected with a Petersen type dredger. The materials collected with these tools are emptied into a bath, thoroughly washed with water, then sieved, the residual mass is filled into special containers, fixed with 4% formalin solution, labeled and prepared for processing in laboratory conditions. The samples brought to the laboratory were cleaned from the soil, the organisms were carefully removed with a knife and placed in special containers. Then the organisms were divided into groups and the species composition was investigated.

Samples were collected with a Petersen-type dredger (area 0.025 m^2) from the depths necessary to request the top and biomass of oligochaetes (Figure 3). The collected samples were cleaned from the soil, brought to the laboratory after the initial treatment. A magnifying glass is used for this purpose. The materials collected in this way were separated into species and their number and biomass were calculated.

A

B

Figure 3. Collection of benthic materials from the reservoir: A-Sovkhoz Kosa and B – Khanabad Bay

Before measuring the masses of organisms, they were dried on filter paper. Organisms were weighed on an electronic scale after the filter paper no longer shows signs of moisture.

O.V. Chekanovskaya's determination book and internet information were used to determine the species composition of oligochaetes (Chekanovskaya, 1962).

Results and discussions:

As a result of our research, 14 types of oligochaetes were recorded in the macrozoobenthos of the Mingachevir reservoir. 7 of these species belong to *Naididae* and 7 to *Tubificidae* families. Their species composition is given in table 1 below:

Table 1. Species composition of oligochaetes of the Mingachevir reservoir (comparative species composition)

Researches / Species	Research done before us (1955 – 1980)	Our research (2011 – 2018)
Oligochaeta		
Naididae		
1. *Stylaria lacustris* L.	+	+
2. *Nais communis* Piguet	+	+
3. ***N.elinguis* Müll.**	-	+
4. *N.iorensis* Patar	+	+
5. *Chaetogaster diastrophus* Grube	+	+
6. *Ophidonais serpentina* (Müll.)	+	+
7. ***Pristina rosea* (Piguet)**	-	+
Tubificidae		
8. ***Limnodrilus udekemianus* Clap.**	-	+
9. *L.hoffmeisteri* Clap.	+	+
10. *L.claparedianus* Ratz.	+	+
11. ***İlyodrilus hammoniensis* (Mich.)**	-	+
12. *Tubifex tubifex* (Müll.)	+	+
13. ***Peloscolex ferox* (Eisen.)**	-	+
14. *Branchiura sowerbyi* Bed.	+	+
Total:	9	14

As we can see, 5 new species were recorded for reservoir fauna. Among these species, there are only 2 more common species, *Nais elinguis* and *Limnodrillus udekemianus*.

Table 2.Occurrence of species of oligochaetes in the Mingachevir reservoir by year

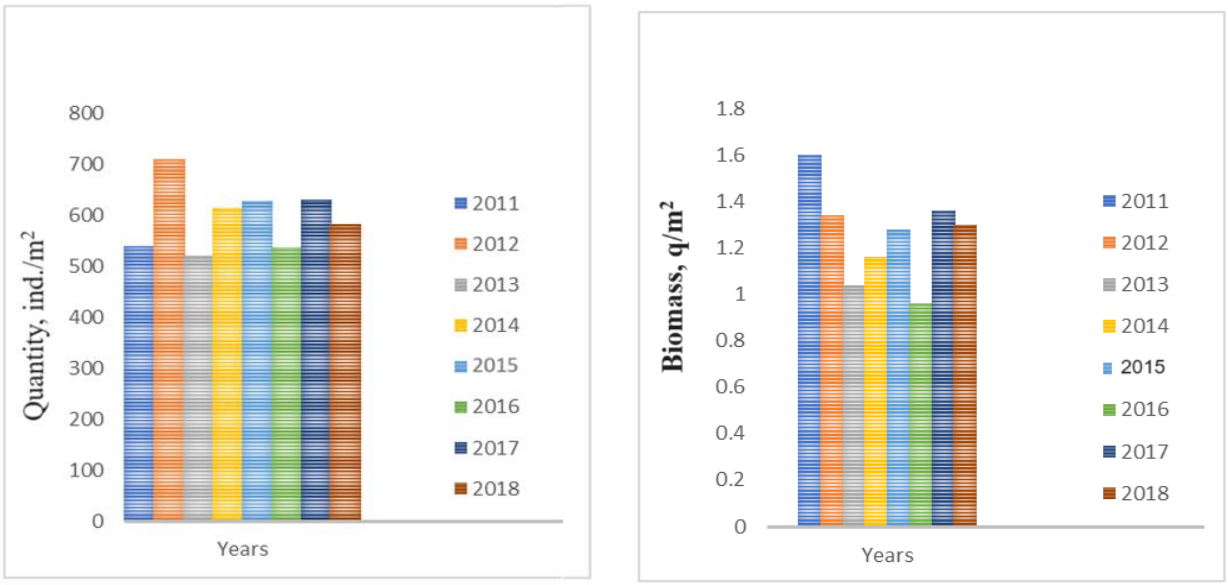
№	Years / Species	2011	2012	2013	2014	2015	2016	2017	2018
1	*Stylaria lacustris*	+	+	-	+	+	+	+	+
2	*Nais communis*	+	+	+	-	+	+	+	+
3	*N.elinguis*	-	+	-	+	-	-	-	+
4	*N.iorensis*	+	-	+	+	-	-	-	-
5	*Chaetogaster diastrophus*	-	+	-	+	-	+	+	-
6	*Ophidonais serpentina*	+	+	+	+	-	-	-	-
7	*Pristina rosea*	-	+	-	-	-	-	+	+
8	*Limnodrilus udekemianus*	-	-	+	+	-	-	+	+
9	*L.hoffmeisteri*	+	+	+	+	+	+	+	+
10	*L.claparedeanus*	+	-	-	-	+	-	-	-
11	*Potamothrix hammoniensis*	-	-	-	+	-	-	+	+
12	*Tubifex tubifex*	+	+	+	+	+	+	++	++
13	*Peloscolex ferox*	-	+	-	+	+	+	+	+
14	*Branchiura sowerbyi*	++	++	++	++	++	+	++	+
	Total:	8	10	7	11	7	7	10	10

***Limnodrilus hoffmeisteri* Claparede, 1862**

***Branchiura sowerbyi* Beddard, 1892**

Figure 4. Photos of oligochaetes which were taken during the research

Information about the number and biomass dynamics of oligochaetes in the Mingachevir reservoir is given in the following diagrams (Figure 5).



A **B**

Figure 5. Dynamics of quantity (A) and biomass (B) of oligochaetes in the Mingachevir reservoir in 2011-2018

The materials collected by us covered a depth of up to 27 m. As a result of the research, oligochaetes were found at all depths, but their high development was observed in coastal zones. In the deep zones, mainly *T. tubifex, L. hoffmeisteri* and *Branchiura sowerbyi* species were found, albeit in small numbers. In the samples we collected, the frequency of occurrence of oligochaetes was close to 70%. As for individual species, *Nais communis, Chaetogaster diastrophus, Ophidonais serpentina, Tubifex tubifex* and *B. sowerbyi* are dominant in terms of number and biomass.

Oligochaetes were mostly found at depths of 0.5-3 m and on plants. Sometimes we recorded up to 20 oligochaetes on one plant. Even now, oligochaetes play a leading role in the formation of macrozoobenthos in the reservoir.

The study of water quality in water catchments is of great importance. As we know, water quality assessment is performed by chemical, bacteriological and biological methods. But

the first two methods are relevant only when we get the water sample.

The biological balance of aquatic ecosystems is maintained because of various dynamic relationships of organisms, but this balance is sometimes disturbed as a result of anthropogenic influence. It is more appropriate to use macrobenthic animals during biological analysis because their life is longer, and their existence characterizes a longer period.

Oligochaetes are one of the main indicators of the condition of the water body. Their abundant development in wastewater is considered by most hydrobiologists as an indicator of pollution.

As a result of the research, it was revealed that the water of the Mingachevir reservoir is slightly polluted.

References:

Adamek Z., Marsalek B. (2013) Bioturbation of sediments by benthic macroinvertebrates and fish and its implication for pond eco-systems. A review. Aquaculture Interna-tional 21: 1-7 https://doi.org/10.1007/s10499-012-9527-3

Attrill M, Rundle S.D, Fraser A., Power M. (2009) Oligochaetes as a possible entry route for terrigenous organic carbon into estuarine benthic food webs. Marine Ecology Progress Series 384: 147-157. https://doi.org/10.3354/meps08019

Bartoszek L. (2023) The effect of natural organic matter (NOM) on the distribution and resources of mobile phosphorus in the bottom sediments of small retention reservoirs. Aquatic sciences: 85: 107

Benbow M.E., Receveur J., Lamberti G.A. (2020) Death and Decomposition in Aquatic Ecosystems. Front. Ecol. Evol., Sec. Population, Community, and Ecosystem Dynamics 8: https://doi.org/10.3389/fevo.2020.00017

Chapman P.M. (2001) Utility and relevance of aquatic oligochaetes in Ecological Risk Assessment. Hydrobiologia 463(1): 149-169 https://doi.org/10.1023/A:1013103708250

Əliyev A.R., Bağırova Ş.M. və b. (2010) Kür silsilə su anbarlarının biologiyası. Bakı, "Elm", 317 s.

Kang H., Bae M.J., Lee D.S., Hwang S.J., Moon J.S., Park Y.S. (2017) Distribution Patterns of the Freshwater Oligochaete Limnodrilus hoffmeisteri Influenced by Environmental Factors in Streams on a Korean Nationwide Scale. Water 9(12): 921. https://doi.org/10.3390/w9120921

Mermillod-Blondin F. (2011) The functional significance of bioturbation and biodeposition on biogeochemical processes at the water–sediment interface in freshwater and marine ecosystems. Journal of the North American Benthological Society 30(3): 770-778 https://doi.org/10.1899/10-121.1