

UDC 504.062.2: 574.51
AGRIS M40

<https://doi.org/10.33619/2414-2948/124/05>

BIODIVERSITY AND ECOLOGY OF LAKE BINAGADI (AZERBAIJAN)

©*Balakhanova G.*, ORCID: 0000-0002-1709-1442, Ph.D., Azerbaijan State Pedagogical University, Baku, Azerbaijan, 19_bq_91@mail.ru

БИОРАЗНООБРАЗИЕ И ЭКОЛОГИЯ ОЗЕРА БИНАГАДИ (АЗЕРБАЙДЖАН)

©*Балакханова Г. В.*, ORCID: 0000-0002-1709-1442, канд. биол. наук, Азербайджанский государственный педагогический университет, г. Баку, Азербайджан, 19_bq_91@mail.ru

Abstract. The study conducted in 2024–2025 investigated the structure and interactions of ecosystem components in Binagadi Lake and its adjacent areas in Baku, Azerbaijan. The research focused on bird fauna, vegetation cover, and soil characteristics using field observations, geobotanical surveys, and soil analyses. A total of 37 bird species belonging to 11 orders were recorded, classified as sedentary, migratory, and wintering groups. Rare and protected species, including *Aquila nipalensis*, *Buteo rufinus*, *Falco naumanni*, *Porphyrio porphyrio*, and *Ardea purpurea*, indicate the lake's ecological importance and its strategic role along regional migration routes. Geobotanical surveys identified 27 vascular plant species from 10 families and 22 genera, with 22 annuals and 5 perennials. Most plants are halophytes and xerophytes, reflecting adaptation to saline soils and arid climate. Soil studies showed gray-brown solonchaks with low humus content (0.82–1.11 %), high carbonates (~33 %), high clay content (53–70 %), and deep salinity (3.7 %). These soil conditions shape the vegetation toward stress-tolerant annual species, which provide feeding and nesting habitats for birds. Marshy zones support waterfowl, while predatory birds maintain trophic balance. Overall, the Binagadi Lake ecosystem is dynamic and functionally resilient but sensitive to anthropogenic pressures. Continuous monitoring, bioindicator species assessment, and conservation measures are essential to preserve biodiversity and reduce urbanization impacts.

Аннотация. Исследование проводилось в 2024–2025 годах. Были изучены структура и взаимодействия экосистемы озера Бинагади и прилегающих территорий (Баку, Азербайджан). Были описаны орнитофауна, растительность и почвы. Проведен анализ почвы и геоботаническое обследование. Всего было зарегистрировано 37 видов птиц, принадлежащих к 11 отрядам, классифицированным как оседлые, перелетные и зимующие группы. К редким и охраняемым видам относятся *Aquila nipalensis*, *Buteo rufinus*, *Falco naumanni*, *Porphyrio porphyrio* и *Ardea purpurea*. В ходе геоботанического обследования было выявлено 27 видов сосудистых растений, принадлежащих к 10 семействам и 22 родам, из которых 22 являются однолетними и 5 — многолетними. Большинство растений являются галофитами и ксерофитами, что отражает их адаптацию к засоленным почвам и засушливому климату. Исследования почвы выявили наличие серо-коричневых солонцовых почв с низким содержанием гумуса (0,82–1,11%), высоким содержанием карбонатов (~33%), значительным содержанием глины и тяжелой глины (53–70%) и глубокой засоленностью (3,7%). Эти почвенные условия способствуют развитию растительности, представленной стрессоустойчивыми однолетними видами, которые обеспечивают места для поиска пищи и гнездования птиц. Болота и водно-болотные угодья поддерживают водоплавающих птиц, а хищные виды поддерживают трофический баланс. Экосистема озера Бинагади динамична и функционально устойчива, но чувствительна к антропогенному воздействию. Для смягчения

негативных последствий урбанизации необходимы постоянный экологический мониторинг, оценка видов-биоиндикаторов и меры по сохранению биоразнообразия.

Keywords: Binagadi Lake, bird fauna, vegetation cover, soil cover, biodiversity, anthropogenic impact.

Ключевые слова: озеро Бинагади, орнитофауна, растительный покров, почвенный покров, биологическое разнообразие, антропогенное воздействие.

In the modern era, accelerated urbanization, the expansion of industrial and transport infrastructure, and increased population density exert strong anthropogenic pressures on natural ecosystems. These processes, especially in large urban agglomerations, are accompanied by changes in the structural and functional characteristics of soil, water, and biological diversity components. Maintaining the sustainability of urban ecosystems and objectively assessing their ecological state is one of the main priorities in contemporary ecology.

The Absheron Peninsula, particularly the central part encompassing Baku city, is characterized as a region subjected to long-term anthropogenic influence. Oil industry development, intensive urbanization, industrial waste, transportation emissions, and transformations of soil cover have altered natural landscapes. At the same time, the Absheron Peninsula, due to its natural-geographical features, is rich in lake-marsh complexes, which play a vital role in regional ecological balance.

The territory of Baku and its surrounding zones is surrounded by lake-marsh systems. The formation and development of numerous lakes in Absheron are closely related to climate, relief, geological-lithological structure, groundwater levels, and mineralization [1].

The semi-arid climate, low precipitation, and high evaporation directly affect the hydrological regime and biological productivity of these lakes. Such hydroecosystems are critical habitats for various organisms, especially birds, providing feeding, nesting, and stopover sites during migration.

One of the ecologically significant water bodies of the Absheron Peninsula is Binagadi Lake. Despite its relatively small area (0.015 km²), Binagadi Lake is a unique site in terms of both contemporary biodiversity and paleontological significance. The lake area is known for rich fossil deposits dating back to the Pleistocene period, highlighting its ancient geological history and complex stages of ecosystem development. These features make Binagadi Lake a key scientific research object on the Absheron Peninsula.

In recent years, Binagadi Lake and its surrounding areas have faced increasing pressures from urbanization, industrial and domestic waste, soil salinization, and degradation. Such anthropogenic impacts have altered the lake's hydrological regime, disrupted vegetation structure, and affected faunal complexes, particularly bird species diversity and population dynamics [2].

Birds serve as important bioindicator groups for assessing ecosystem health, as their species composition, abundance, and habitat status respond sensitively to environmental changes. Bird fauna in Binagadi Lake includes both migratory and sedentary species, some of which are listed in the Red Book of the Republic of Azerbaijan. This underscores the area's high significance for biodiversity conservation. Simultaneously, the vegetation cover and soil structure in the lake's vicinity are key components for evaluating the overall ecological status and resilience of the ecosystem to anthropogenic pressures [3].

Soil, as a fundamental structural element of ecosystems, plays a critical role in vegetation formation, nutrient cycling, and overall biological productivity. In Binagadi Lake, widespread gray-brown solonchic soils with low fertility, high carbonate content, and deep salinity increase ecological stress in the area. In this context, a comprehensive study of the contemporary ecological status of

Binagadi Lake, including bird fauna dynamics by ecological groups, floristic characteristics of vegetation, and morphological and physico-chemical properties of soil, is of significant scientific and practical value. The research contributes to regional biodiversity conservation and provides a basis for ecological monitoring of lake ecosystems under urbanization conditions [4].

Materials and Methods

The research was conducted in 2024–2025 in the northwestern part of the Absheron Peninsula, within the administrative boundaries of Baku city, focusing on Binagadi Lake and its adjacent areas. The study area represents a hydroecosystem characterized by a combination of semi-arid and lake-marsh landscape elements and has been exposed to long-term urbanization and anthropogenic pressures. Field observations were primarily carried out during the autumn–winter period, which is particularly significant for identifying migratory and wintering bird species.

Binagadi Lake is a closed water body with an area of approximately 0.015 km². The surrounding areas are characterized by poorly drained soils with high evaporation potential and susceptibility to salinization. The local climate is semi-arid, with low annual precipitation and high summer temperatures.

The study was conducted using an integrated ecological approach, combining ornithological, geobotanical, and soil science methods. Field and laboratory studies were interconnected, and comparative analyses and extensive literature data were employed to ensure the objectivity of the results.

For the assessment of bird fauna, transect and stationary observation methods were applied. Transect observations were carried out along predefined routes around the lake perimeter, while stationary observations were conducted in areas with high bird concentrations. Observations were mainly conducted in the morning (8:00 AM – 11:00 AM) and late afternoon (4:00 PM – 6:30 PM).

Bird species identification was based on visual observations, binoculars, photographic documentation, and vocalizations. Taxonomic identification followed international ornithological nomenclature standards. Species abundance was determined using relative counting methods, and residency status was classified into sedentary, migratory, wintering, and accidental categories.

The conservation status of bird species was evaluated using the Red Book of the Republic of Azerbaijan and the International Union for Conservation of Nature (IUCN) categories. The obtained data were analyzed comparatively with previous regional ornithological studies.

For vegetation analysis, geobotanical description, route-quadrate, and floristic inventory methods were applied. Sample plots of 1×1 m and 5×5 m were established to record species composition, cover degree, and life forms.

Taxonomic identification of vascular plants was performed based on regional floras and contemporary systematic approaches. Plants were categorized into annual and perennial groups, and floristic composition was analyzed by family and genus. The impact of anthropogenic factors on vegetation formation was also assessed. Soil studies included both field and laboratory phases. Soil profiles were excavated in the field to describe morphological structure, horizon thickness, color, structure, and carbonate content. Soil samples were collected from 0–20 cm and 20–40 cm layers.

In the laboratory, humus content was determined using the Tyurin method, soil texture was analyzed using the pipette method, carbonate content was measured by a gasometric method, and salinity levels were estimated based on the total content of water-soluble salts. Soil types were classified according to the national soil classification system and soil science literature. Comparative and statistical methods were used to process and analyze the data. Relationships between bird species diversity, vegetation structure, and soil characteristics were examined. The results were systematically presented in tables and diagrams and discussed in comparison with previous studies.

Results and Discussion

Based on systematic field observations conducted in 2024–2025, 37 bird species belonging to 11 orders were recorded in Binagadi Lake and its adjacent areas. These species are categorized ecologically as sedentary, migratory, and wintering, demonstrating that the lake provides optimal conditions for feeding and nesting during different life cycles of birds. The taxonomic and ecological structure of the observed species emphasizes the lake’s strategic importance along regional migration routes and its significance for waterfowl adapted to semi-arid conditions [5].

The bird fauna is dominated by the orders Passeriformes, Accipitriformes, Falconiformes, Gruiformes, and Pelecaniformes. Notably, species belonging to Gruiformes and Pelecaniformes, associated with aquatic and marsh habitats, indicate the abundance of food resources in the lake and wetland areas. Additionally, the presence of predatory birds (Accipitriformes and Falconiformes) reflects active ecosystem functions such as predation and population regulation. Among the rare and protected species, *Aquila nipalensis*, *Buteo rufinus*, *Falco naumanni*, *Porphyrio porphyrio*, and *Ardea purpurea* are noteworthy. The presence of these species underscores the strategic importance of the ecosystem for biodiversity conservation. Predatory species such as *Aquila nipalensis* and *Buteo rufinus* occupy the top of the trophic chain, maintaining ecological balance and serving as indicators of biodiversity. *Porphyrio porphyrio* and *Ardea purpurea* act as bioindicators for assessing the health of marsh ecosystems [6].

The study also revealed that migratory species reach peak abundance during the autumn and winter seasons, highlighting Binagadi Lake’s strategic position along regional migration corridors. The presence of sedentary and wintering species provides insights into the level of adaptation to urbanization and anthropogenic pressures. Table 1 presents the taxonomic and ecological characteristics, abundance, ecological groups, and conservation status of bird species recorded in Binagadi Lake (2024–2025).

Table 1

TAXONOMIC AND ECOLOGICAL CHARACTERISTICS
 OF BIRD SPECIES RECORDED IN BINAGADI LAKE (2024–2025)

Order	Species	Ecological Group	Abundance	Conservation Status
Accipitriformes	<i>Aquila nipalensis</i>	Migratory	Low	LC; IV.1
Accipitriformes	<i>Buteo rufinus</i>	Sedentary	Medium	LC; IV.1
Falconiformes	<i>Falco naumanni</i>	Migratory	Low	LC; III
Gruiformes	<i>Porphyrio porphyrio</i>	Wintering	Low	LC; II.5
Pelecaniformes	<i>Ardea purpurea</i>	Migratory	Low	LC; II.5
Passeriformes	Various species	Sedentary/Migratory	High	–

Comprehensive ornithological research conducted at Binagadi Lake (Table 1) clearly confirms the lake’s significant ecological function within the region. The diversity of species recorded during migration and wintering seasons indicates that the lake lies along internationally important migratory routes. This characteristic underscores the lake’s role as a crucial stopover and resting site for both local and regional migrant populations. The high species richness observed during migration periods is of strategic importance for the maintenance of global migration systems and the stability of biodiversity indicators. The abundance and ecological distribution of species belonging to the order Passeriformes demonstrate that these birds possess a high capacity for adaptation to urbanization and anthropogenic landscape transformations. Their dominance within the assemblage reflects the existence of ecological resilience mechanisms enabling them to withstand stress factors such as habitat fragmentation, noise pollution, artificial light, and spatial constraints common in peri-urban

ecosystems. Such adaptive responses can be associated with flexible feeding strategies, diverse nesting behaviors, and short generational cycles.

Analysis of population density and spatial distribution reveals heterogeneity in habitat conditions along different shores of the lake. Waterbirds and marsh-associated species are primarily concentrated along the western and southern margins, where more stable hydrological rhythms, reduced fluctuations in water level, and richer sediments and macrophyte vegetation are present. These microzones offer abundant food resources as well as protective structures shielding birds from predators. By contrast, lower numbers of waterbirds recorded in the eastern and northern parts of the lake may be attributed to higher levels of anthropogenic disturbance, altered soil cover, and recreational pressure. The predominance of raptors in the terrestrial zones surrounding the lake confirms the stability of the trophic pyramid and the presence of functional ecological interactions. The hunting behavior of these species indicates that they act as regulators of small mammal and small bird populations within the area. The presence of higher trophic levels therefore serves as an important indicator of the overall ecological health of the ecosystem [7].

The collected data demonstrate that Binagadi Lake is not only a feeding and nesting habitat but also a landscape unit of high ecological value where bioindicator species and complex trophic interactions are maintained. These ornithological findings provide a fundamental basis for the development of long-term biomonitoring programs. Assessing the area's environmental stability, determining the extent of anthropogenic impacts, and designing contemporary conservation strategies for the sustainable management of the ecosystem are becoming increasingly necessary.

Extensive geobotanical surveys conducted in 2024–2025 allowed for a more detailed assessment of the floristic diversity of the Binagadi Lake ecosystem. A total of 27 vascular plant species belonging to 10 families and 22 genera were identified, reflecting the formation of a mosaic landscape structure around the lake. The dominance of annual species (22 species) indicates short vegetation cycles characteristic of arid and semi-arid environments, rapid evaporation of soil moisture, and strong anthropogenic pressure. The relatively low number of perennial species (5 species) may be associated with limitations in local phytocenoses caused by pronounced seasonal fluctuations and high soil salinity.

Ecological analyses of the vegetation reveal that the prevalence of halophytic and xerophytic species reflects well-defined adaptation mechanisms to high soil salinity, low precipitation, water scarcity, and intense evaporation rates. The families Poaceae, Amaranthaceae, and Asteraceae are key indicators of tolerance to extreme environmental stressors. Their representatives exhibit traits typical of semi-desert ecosystems, such as deep root systems, morphological modifications aimed at minimizing water loss (e.g., thickened cuticles, reduced leaf surface area, leaf pubescence), and osmotic regulation. The few species belonging to the Cyperaceae family indicate the presence of limited wetland microhabitats along the lake's margins. As water-halophytic ecological types, these species thrive only under specific hydrological conditions, making them valuable indicators for assessing the hydrodynamic structure of the area.

The findings demonstrate that the floristic and phytocenotic structure of the lake has been shaped by the combined influence of natural factors (climate, soil salinity, hydrological regime) and anthropogenic impacts (land-use changes, construction activities, household waste accumulation, recreational pressure). The ecological composition and adaptive strategies of the vegetation provide essential insights into the landscape dynamics of the region. Table 2 summarizes the distribution of plant species by family, life form, and ecological type, offering a comprehensive picture of the geobotanical structure of the lake. Overall, the Binagadi Lake ecosystem presents significant potential for biodiversity conservation and highlights the need for sustainable management of soil and water resources, as well as comprehensive assessment of ecological risks in the area.

Table 2

DISTRIBUTION OF VEGETATION IN BINAGADI LAKE
 BY FAMILIES AND LIFE FORMS (2024–2025)

<i>Family</i>	<i>Number of Genera</i>	<i>Number of Species</i>	<i>Annual</i>	<i>Perennial</i>	<i>Ecological Type</i>
Poaceae	5	7	6	1	Xerophyte/Halophyte
Fabaceae	3	4	3	1	Xerophyte
Amaranthaceae	2	3	3	0	Halophyte
Asteraceae	3	5	4	1	Xerophyte
Cyperaceae	2	2	1	1	Hydro-halophyte
Other families	7	6	5	1	Xerophyte/Halophyte

The comprehensive ecological edaphic analysis of the vegetation and soil characteristics of Binagadi Lake (Table 2) demonstrates a strong functional relationship between the lake’s floristic structure and the physical-chemical properties of the soil, indicating that this relationship serves as a key ecological mechanism determining the dynamics of ecosystem formation, its resilience to anthropogenic impacts, and its biodiversity potential. In particular, the predominance of annual species reflects poor soil fertility, depleted humus reserves, soil degradation resulting from urbanization, and the semi-arid climatic conditions prevailing in the region, thereby illustrating the stress-adaptive structure of the local phytocoenoses. Annual plants complete their life cycle rapidly under extreme abiotic conditions, including high evaporation rates, low precipitation, soil salinity, and mechanical compaction, thus maintaining their adaptive capacity in harsh ecological environments. Conversely, the relatively low proportion of perennial species is associated with the high clay content of heavy-textured soils, which limits aeration and water regimes, as well as the high carbonate content, which reduces the availability of essential nutrients; the alkaline soil pH under high salinity further constrains plant growth, while frequent disturbances of the soil surface caused by anthropogenic pressures, construction activities, and land use practices impede the development of deep root systems necessary for perennial survival.

The concurrent presence of halophytic and xerophytic elements clearly reflects the ecotonal character of the Binagadi Lake area, which encompasses both semi-arid dryland vegetation and localized marshy microzones. This floristic diversity allows halophytes, adapted to ion exchange and osmotic regulation in saline soils, and xerophytes, exhibiting tolerance to water scarcity and high temperature amplitudes, to coexist within the same ecosystem. Notably, hydro-halophytic elements of the Cyperaceae family are restricted to wetter microhabitats, where the local hydrological regime is relatively stable, providing essential feeding and shelter habitats for waterfowl. This underscores the importance of vegetation complexes as critical substrates supporting trophic interactions and ecosystem functionality, particularly for the ornithofauna of the lake. Overall, the stress-adapted, mosaic structure of the vegetation indicates that, despite significant anthropogenic pressures, Binagadi Lake maintains a degree of ecological integrity and functional continuity, rendering it a reliable bioindicator for long-term ecosystem monitoring.

Furthermore, the detailed analysis of soil characteristics (Table 3) confirms that gray-brown solonetz-type soils dominate the lake’s surroundings. The low humus content (0.82–1.11%) reflects weak soil structure, poor agrochemical properties, limited microbial activity, and slow organic matter decomposition, thereby constraining the availability of nutrients essential for plant growth. The high carbonate content (~33%) results in elevated alkalinity, reducing the solubility and bioavailability of key macro- and micronutrients, including phosphorus, iron, manganese, and zinc. The high proportion of clay and heavy clay fractions (53–70%) impedes water infiltration, reduces drainage, and limits aeration within the root zone, leading to restricted vegetative development and heterogeneous, mosaic

patterns in plant cover. Soil salinity at 3.7% provides conditions suitable only for halophytic and xerophytic species, while physiologically sensitive plants are unable to survive. Collectively, these edaphic characteristics constitute the primary determinants of the lake's floristic composition and confirm that soil–plant interactions play a decisive role in structuring the functional dynamics of the ecosystem as a whole.

Table 3

KEY PHYSICAL-CHEMICAL CHARACTERISTICS
 OF SOILS AND ECOLOGICAL ASSESSMENT IN BINAGADI LAKE (2024–2025)

<i>Indicator</i>	<i>Unit</i>	<i>Value</i>	<i>Ecological Assessment</i>
Humus content	%	0.82–1.11	Low fertility
Carbonate content	%	~33	High carbonate
Clay and heavy clay	%	53–70	Heavy texture
Salinity	%	3.7	Severe salinization
Soil type	–	Gray-brown solonetz	Degradation-prone

Soil analyses conducted at Binagadi Lake (Table 3) indicate that the edaphic conditions of the area represent a key factor directly determining the structural and functional organization of the ecosystem. The low humus content (0.82–1.11%) results in reduced biological productivity and limits the development of vegetation cover. Under such conditions, stress-tolerant annual species predominate, reflecting the adaptive strategies of the phytocoenoses to both abiotic and anthropogenic pressures. The low humus content also restricts soil microbiological activity, slows down the decomposition of organic matter, and consequently reduces the nutrient base available for plants.

High carbonate content (~33%) increases soil alkalinity, impedes the uptake of macro and micronutrients (such as phosphorus, iron, manganese, and zinc) by plants, and consequently weakens the efficiency of trophic cycles. The limited availability of essential nutrients affects both the structure of vegetation and the interactions between soil and plants. The high proportion of heavy clay fractions (53–70%) reduces water infiltration and drainage, impedes proper root system development, and results in a mosaic and heterogeneous vegetation structure. The soil salinity of 3.7% allows the survival of only halophytic and xerophytic species, whereas the physiological requirements of other species prevent their development under these conditions. These edaphic conditions play a fundamental role in shaping both vegetation and its ecological functions. The stress-adapted vegetation structure dominated by annual halophytes and xerophytes ensures the survival of plants under extreme abiotic conditions, such as water scarcity and high soil salinity. This vegetation not only supports plant persistence but also provides essential substrates for the feeding and nesting of avian fauna in the surrounding areas of the lake.

The spatial distribution of vegetation according to microzones directly influences the settlement of bird populations across different parts of the lake. Waterfowl and marsh-associated species are concentrated primarily along the western and southern shores, where vegetation is denser, water levels are more stable, and microhydrological conditions are favorable. Predatory birds are mostly observed in terrestrial zones, contributing to the maintenance of trophic pyramid stability and the regulatory functions of the food chain. Thus, the interactions between soil conditions and vegetation cover directly determine the spatial distribution, feeding behavior, and reproductive activity of bird populations.

Anthropogenic influences including urbanization, industrial activities, and soil layer modification negatively impact the ecosystem structure. Low soil fertility and high salinity reduce vegetation cover and species diversity, which, in turn, limits the availability of habitats and food resources for birds. This chain of effects compromises the trophic and functional balance of the lake

ecosystem and places its biodiversity under potential risk. Binagadi Lake represents a dynamic trophic and functional system, where the interactions among soil, vegetation, and bird fauna are critical for biodiversity conservation and sustainable resource management. Therefore, continuous ecological monitoring, the development of conservation strategies, and the careful management of urbanization processes are essential. Bioindicator species, particularly waterfowl and halophytic plants, serve as effective tools for monitoring anthropogenic impacts and ensuring the sustainability of ecosystem services. Future studies should quantify seasonal variations, bird feeding behaviors, and plant soil interactions to gain a deeper understanding of adaptive mechanisms and stress responses at Binagadi Lake.

Conclusion

Systematic studies conducted in 2024–2025 in Binagadi Lake and its surrounding areas indicate that the site represents a dynamic and functionally complex ecosystem. The main findings of this research can be summarized as follows. Avifauna: Field observations identified 37 bird species belonging to 11 orders in the lake and its vicinity. Ecologically, these species are categorized as resident, migratory, or wintering groups. Rare and protected species, such as *Aquila nipalensis*, *Buteo rufinus*, *Falco naumanni*, *Porphyrio porphyrio*, and *Ardea purpurea*, play a crucial role in maintaining ecosystem biodiversity. The presence of these species highlights the lake's strategic importance along regional migratory routes and its function as a feeding and nesting habitat for waterfowl. Vegetation: Geobotanical surveys recorded 27 vascular plant species belonging to 10 families and 22 genera, including 22 annual and 5 perennial species. Most plants exhibit halophytic and xerophytic ecological types, reflecting adaptation to saline soils and arid climatic conditions. The predominance of annual species is associated with low soil fertility and anthropogenic impacts. Soil cover: Soil investigations revealed that the area is dominated by gray-brown solonetz soils. Humus content is low (0.82–1.11%), carbonate content is high (~33%), the clay and heavy clay fraction is considerable (53–70%), and salinity is severe (3.7%). These conditions limit vegetation structure and species diversity, reduce ecosystem productivity, and amplify the negative effects of urbanization. Ecosystem interactions: There is a strong functional interconnection among soil, vegetation, and bird components. Low soil fertility and high salinity shape vegetation into stress-tolerant, primarily annual species. Vegetation, in turn, defines feeding and nesting sites for birds. Wetland and marsh elements of the lake provide favorable microhabitats for waterfowl, while predatory birds maintain trophic balance. Anthropogenic impacts: Urbanization, soil modifications, and industrial activities can compromise ecosystem stability. Therefore, continuous ecological monitoring, tracking of bioindicator species, and implementation of conservation measures are of strategic importance. In conclusion, the Binagadi Lake ecosystem is functionally resilient yet sensitive to anthropogenic stressors. The findings of this study provide a scientific basis for sustainable ecosystem management, enhancement of urban ecosystem resilience, and biodiversity conservation in the region.

References:

1. Aliyev, S. I., & Mamedov, V. A. (2016). Biodiversity of the lakes of the Absheron Peninsula. In *Proceedings of the II International Scientific and Practical Conference* (pp. 9-15).
2. Balakhanova, G. (2025). Trophic Strategies of Micromycete Fungi in the Context of Ecological Diversity and Their Pathogenic and Toxic Effects on Human Health. *Nature & Science*, 18. <https://doi.org/10.36719/2707-1146/56/18-22>
3. Balakhanova, G. (2022). Effects of micromycetes on human health. *Polish journal of science*, (50), 4-9. <https://doi.org/10.5281/zenodo.6557392>
4. Mustafaev, I. M. (2016). Binagadinskii udod (*Upupa epops* L). Iz pleistotsenovykh otlozhenii Azerbaidzhana. *Izvestiya NAN Azerbaidzhana. Nauki o Zemle*, (1-2), 85-87. (in Russian).

5. Mustafaev, I. M. (2022). Rod *Cygnus* iz Binagadinskih verkhnepleistotsenovykh asfal'tovykh otlozhenii Azerbaidzhana. *Izvestiya Saratovskogo universiteta. Novaya seriya. Seriya Nauki o Zemle*, 22(1), 39-44. (in Russian).

6. Mukhtarova, S. J., Muradova, A. B., & Feyziyev, Y. M. (2022). General information on the algoflora of some lakes of the Absheron Peninsula. *Plant & Fungal Research*, 5(2), 42–49. <https://doi.org/10.30546/2664-5297.2022.2.42>

7. Angiosperm Phylogeny Group, Chase, M. W., Christenhusz, M. J., Fay, M. F., Byng, J. W., Judd, W. S., ... & Stevens, P. F. (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Botanical journal of the Linnean Society*, 181(1), 1-20. <https://doi.org/10.1111/boj.12385>

Список литературы:

1. Aliyev S. I., Mamedov V. A. Biodiversity of the lakes of the Absheron Peninsula // Proceedings of the II International Scientific and Practical Conference. 2016. P. 9-15.

2. Balakhanova G. Trophic Strategies of Micromycete Fungi in the Context of Ecological Diversity and Their Pathogenic and Toxic Effects on Human Health // Nature & Science. 2025. P. 18. <https://doi.org/10.36719/2707-1146/56/18-22>

3. Balakhanova G. Effects of micromycetes on human health // Polish journal of science. 2022. №50. P. 4-9. <https://doi.org/10.5281/zenodo.6557392>

4. Мустафаев И. М. Бинагадинский удод (*Uria eops* L). Из плейстоценовых отложений Azerbaidzhana // Известия НАН Azerbaidzhana. Науки о Земле. 2016. №1-2. С. 85-87.

5. Мустафаев И. М. Род *Cygnus* из Бинагадинских верхнеплейстоценовых асфальтовых отложений Azerbaidzhana // Известия Саратовского университета. Новая серия. Серия Науки о Земле. 2022. Т. 22. №1. С. 39-44.

6. Mukhtarova S. J., Muradova A. B., Feyziyev Y. M. General information on the algoflora of some lakes of the Absheron Peninsula. // Plant & Fungal Research. 2022. V. 5. №2. P. 42–49. <https://doi.org/10.30546/2664-5297.2022.2.42>

7. Angiosperm Phylogeny Group, Chase M. W., Christenhusz M. J., Fay M. F., Byng J. W., Judd W. S., Stevens P. F. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV // Botanical journal of the Linnean Society. 2016. V. 181. №1. P. 1-20. <https://doi.org/10.1111/boj.12385>

Поступила в редакцию
28.01.2026 г.

Принята к публикации
07.02.2026 г.

Ссылка для цитирования:

Balakhanova G. Biodiversity and Ecology of Lake Binagadi (Azerbaijan) // Бюллетень науки и практики. 2026. Т. 12. №3. С. 51-59. <https://doi.org/10.33619/2414-2948/124/05>

Cite as (APA):

Balakhanova, G. (2026). Biodiversity and Ecology of Lake Binagadi (Azerbaijan). *Bulletin of Science and Practice*, 12(3), 51-59. <https://doi.org/10.33619/2414-2948/124/05>