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FACTORS INFLUENCING WHITE STORK POPULATION DENSITY ON THE BANKS OF THE SYRDARYA RIVER IN THE FERGANA REGION

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Abstract: This article examines factors influencing the white stork population density on the banks of the Syr Darya River in the Fergana Region. The white stork is an important indicator of the state of the region's natural ecosystems and biodiversity. The study aims to identify the key environmental and anthropogenic factors that determine the distribution and abundance of this species. It has been established that the proximity of agricultural lands has a significant impact on stork population density. The level of anthropogenic pressure, including human economic activity and infrastructure development, is also an important factor.

Key words: White stork, population, ecosystems, biodiversity, anthropogenic factors, natural ecosystems, environment .

Аннотация:В данной статье рассматриваются факторы, влияющие на плотность популяции белого аиста на берегах реки Сырдарьи в Ферганской области. Белый аист является важным индикатором состояния природных экосистем и биоразнообразия региона. Исследование направлено на выявление основных экологических и антропогенных факторов, определяющих распределение и численность данного вида. Установлено, что близость сельскохозяйственных угодий оказывает значительное влияние на плотность популяции аистов. Важным фактором также является уровень антропогенной нагрузки, включая хозяйственную деятельность человека и развитие инфраструктуры.

Ключевые слова: Белый аист, популяция, экосистемы, биоразнообразие, антропогенные факторы, природные экосистемы, окружающая среда

Introduction.

In the current context of natural ecosystem transformation, studying the factors that determine the spatial organization and population size of birds closely associated with anthropogenically altered landscapes is particularly relevant. One such species is the white stork (Ciconia ciconia asiatica), common in regions of Central Asia, including the Fergana Valley. This species performs an important ecosystem function, participating in the regulation of invertebrate and small vertebrate populations and also acts as an indicator of environmental health. Therefore, studying the factors influencing white stork population density in the Syr Darya River valley is of both scientific and practical importance. The Syr Darya River, one of the largest waterways in Central Asia, creates unique natural and anthropogenic landscapes that provide habitat for various avifauna species. However, intensive economic development of the basin, including irrigation, flow regulation, and changes in the hydrological regime, is leading to significant transformation of natural habitats. These changes have direct and indirect impacts on food supply, nesting habitats and the overall sustainability of bird populations [1, 2].

An analysis of the scientific literature shows that the white stork population in Uzbekistan is characterized by significant dynamism. Despite the existence of individual studies, the influence of a combination of environmental and anthropogenic factors on the white stork population density in the coastal ecosystems of the Syr Darya River remains insufficiently studied. T. Zakhidov was one of the founders of zoological research in the republic. Professor Abdulla Kiyamovich Sagitov, one of the founders of ornithological science in Uzbekistan, made a significant contribution to the development of ornithology and ecological research. Among contemporary researchers, Bunyod Nabi ugli Ganiev, whose work is devoted to the study of nesting birds, is noteworthy. O. Bogdanov played a special role in the development of zoological research. The Bird Conservation Society of Uzbekistan, which unites scientists and specialists in ornithology, also makes an important contribution to the study and conservation of birds. The organization is engaged in bird monitoring, environmental education, and the development of measures to preserve the country's avifauna. Furthermore, bird research is actively conducted at the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan, a leading scientific center for the study of fauna, including avifauna. [4,9]

The research methodology is based on general scientific methods (analysis, synthesis, comparison), as well as specialized ornithological methods, including route surveys, nesting site monitoring, and spatial analysis of population distribution. Studying the white stork in the Fergana Valley requires a combination of traditional field trips and modern remote sensing technologies. Given the high anthropogenic load in the region, ornithologists use the following primary methods:

1. Direct visual counting (Expeditionary)
2. Remote sensing and GIS technologies
3. Questionnaire method and citizen science
4. Tagging and ringing

To understand the migration routes of the "Fergana" population, the following are used:

Color ringing: A plastic ring with a large code, readable with binoculars, is placed on the bird's leg.

5. Biochemical analysis (Laboratory method)

Analysis and results. Most birds are migratory. The number of migratory birds increases as they move north. These birds migrate twice a year: in the fall to wintering grounds and in the spring to nesting or birthing grounds. Bird species found in Uzbekistan can be divided into several groups depending on their habitat:

Desert and semi-desert birds. These birds mainly inhabit deserts such as the Kyzylkum and Karakum deserts. Desert birds are primarily adapted to dry and hot conditions and survive by economically consuming food and water resources.

Steppe and forest-steppe birds - Steppe regions are predominantly rich in pasture and desert-steppe vegetation, home to various sparrows, eagles, and numerous birds of prey.

River valleys and lakeside birds - Waterfowl and wading birds congregate along the banks of Uzbekistan's major rivers, such as the Zarafshan, Syr Darya, and Amu Darya, as well as in the Arnasoi lakes. A variety of waterfowl inhabit reed beds and areas near water sources.

Birds of mountain and foothill regions - Uzbekistan's mountainous regions provide a comfortable habitat for many birds of prey and migratory birds. Eagles, falcons, and blue silver crows inhabit the Pamir-Alay and Tien Shan mountains. Mountain birds typically hunt for prey in mountainous areas, so they are well adapted to life at high altitudes [3, 5].

Storks (Ciconidae) are a family of birds in the order Ciconidae. It includes 17 species. They are primarily distributed in tropical, subtropical, and temperate zones. White storks are found in

most regions of Uzbekistan. Storks inhabit open spaces, mountains, and near populated areas. They build nests in trees, wooden poles, cliffs, and tower roofs.

External anatomy: The body is covered with white feathers, only the wingtips are black. This large bird has long legs, neck, and bill. The length of an adult bird is approximately 100–115 cm, with a wingspan of 195–215 cm. They weigh approximately 2.5–4.5 kg. Males are slightly larger than females, but are virtually identical in appearance. When walking, they bob their heads slightly. They can stand on one leg for a long time in the nest or on the ground. When flying, they spread their wings and glide on air currents. Adult birds show no seasonal color changes. Most of their feathers are white, with the flight feathers, shoulder feathers, and some of the forearm coverts being dark metallic. The feathers on the neck and chest are slightly elongated. The bill and legs are bright red. The skin around the eyes and the forepart of the chin are black. Chicks are covered with sparse, short, whitish-gray down. Their legs are pink, turning gray-black after a few days and assuming the appearance of adult birds with age.

The white stork (Ciconia ciconia asiatica) is an iconic species for the Fergana Valley. In recent years, ecologists have paid particular attention to this population, as it serves as a bioindicator of the region's aquatic and agricultural ecosystems.

The Fergana Valley also has its own unique avifauna, which differs from others in habitat, species composition, and number of species. We began our research by studying stork nesting sites in the Dangara district of Fergana Region. As of October 1, 2025, the permanent population of the Dangara district was 176,099. The Naymansoy, Oktepasoy, and Urgendzhi streams flow through the Dangara district. This area is very small, accounting for 0.1% of the total protected area, averaging 35 km2. State natural monuments are designed to represent natural sites in our republic, protect them, preserve them from damage, and serve to promote the development of indoor and outdoor species. Today, our country has many natural monuments. We analyzed the population dynamics of white storks in this area. One-third of the territory is occupied by a cemetery, the remaining part is covered by trees. The territory is fenced and isolated from the residential area.

The population dynamics of white storks currently inhabiting the area are presented in Table 1. In 2016-2017, the number of nesting pairs was 73, but this number increased in subsequent years. In 2021-2022, it reached 147 pairs, and according to data obtained in March 2025, the number of nests reached 228 pairs. Not including empty nests, the total number of white storks currently stands at 392 pairs.

№	Years	Total number of nests	Number of empty nests	Number of white storks
1	2016-2017	73	21	152
2	2021-2022	147	29	282
3	2023-2025	228	36	392

The distribution of birds depends largely on their diet, living conditions, reproduction, and migratory patterns. Some bird species remain in one area their entire lives, while others undertake long flights as part of seasonal migration. Some birds migrate to warmer regions during the cold season. While exploring other areas of the Fergana region, we observed storks building nests on 4-5 tree trunks in remote villages. Each nest contains two storks, and in the spring they lay 3-4 eggs. During the summer months, we observed that nests typically contain one, and in some cases, two, chicks. According to the latest censuses (2021-2025), the white stork population in the Fergana region is showing signs of recovery after a sharp decline in the mid-2010s.

Total population: The Fergana region is home to approximately 95% of the entire white stork population in Uzbekistan. According to 2025 data, approximately 830–900 nesting pairs were recorded in the region.

Nesting density: The average density is approximately 7.24 pairs per 100 square kilometers of suitable land. Along the Sirdarya River, there are approximately 37 pairs of nests with storks per 5 square kilometers. Among these nests, 5–7 pairs are stork-free. Storks congregate in the Dangara district, a place popularly known as "Laylak Mozor."

Key findings. The Fergana Valley is a critically important region for the conservation of the white stork in Central Asia. Over 90% of Uzbekistan's breeding population (approximately 830-900 pairs) is concentrated here. Following the sharp crisis of 2014, the population has demonstrated stable growth. The birds have demonstrated high ecological flexibility, successfully adapting to nesting on anthropogenic structures (power lines, towers). Namangan Region leads in population size, while Andijan Region experiences a shortage of suitable sites due to extremely high population density and development. The species' existence in the region is 100% dependent on symbiosis with humans—irrigation systems (canals, rice fields) and energy infrastructure. There is a high risk of bird mortality and fires on power lines (power lines) without the use of special protective platforms. Intensive agriculture with the use of pesticides remains a hidden threat affecting the reproductive health of the population. Changes in precipitation patterns and water shortages in dry years can lead to a sharp decline in food supply. Increase public environmental awareness so that the stork is perceived not just as a bird, but as an indicator of the region's environmental health.

Conclusion: The white stork in the Fergana Valley is an example of the successful, yet fragile, adaptation of wildlife to an industrial landscape. The future of the species depends on human willingness to integrate conservation solutions into the development of the region's infrastructure. Improving the stork's living conditions directly correlates with improved environmental conditions for the entire valley's population.

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