

# THE COMPOSITION, DISTRIBUTION, AND FACTORS DETERMINING THE NUMBER OF SYNANTHROPIC BIRDS IN BUKHARA REGION

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## Abstract

The occupation of urban landscapes by birds and their adaptation to living there is a continuous evolutionary process. Especially in recent years, the activities of synanthropic species in urban landscapes have played a role in causing certain environmental pollution issues, making it crucial to identify the ecological factors that determine the species composition, distribution, and population size of these species. This knowledge can help optimize the relationship between humans and birds.

## Introduction

Analysis of the literature indicates that the factors determining the species composition, distribution, and number of synanthropic species in any region share similar characteristics [1,2]. Our research has shown that abiotic, biotic, and anthropogenic factors play a significant role in determining the species composition, distribution, and population size of synanthropic fauna.

Abiotic factors include globally recognized environmental issues that have emerged in recent years. The ecosystem under study is related to the Kyzylkum Desert, where global warming and desertification significantly impact the living organisms, including bird fauna. The decline of the Aral Sea, in particular, has had an abiotic-technogenic effect on the species composition, distribution, and number of birds in the region. These factors exacerbate climatic extremes in natural habitats and lead to an increased tendency for species to seek human habitats, consequently contributing to synanthropization. Some biotic factors in the Bukhara region, such as the complexities of trophic, topic, and other biocenotic relationships in birds' habitats, as well as intensified competition within these relationships, play a significant role in birds infiltrating urban landscapes.

Anthropogenic factors directly and indirectly influence species synanthropization. These factors are paramount in determining the current status of synanthropic birds. New residential areas, including the expansion of cities and the increasing population density within them, along with intensified economic activities create opportunities for synanthropic species. The various conditions created by humans, such as food resources, are particularly significant. Evidence from Eastern Chukotka shows the synanthropization process of the field sparrow supports this [5].

Artificial feeding of birds, creating various amenities for their breeding and resting, and the presence of diverse biotopes with mosaic features in residential areas, including cities, contribute to attracting birds to urban landscapes. Community-driven initiatives to protect species, such as the Musicha and the village swallow in the Bukhara region, based on national values also hold particular importance. For instance, it has been established that ethnic customs play a significant role in the adaptation of birds to humans in Mongolia. In this region, birds are neither hunted nor pursued, and local communities regard a high presence of birds around their homes as a symbol of wealth and peace [4,6].

The scale, location, and architecture of buildings, parks, and water bodies in urban ecosystems also play a key role in determining the species composition and numbers of synanthropic birds. Along with the ecological factors identified that influence the species composition, distribution, and numbers within a certain urban landscape, the individual characteristics specific to each species, such as their adaptations for breeding, feeding, wintering, roosting, and resting in urban landscapes, are crucial. Each species has distinct behavioral responses to humans and other environmental factors, which can be characterized by its ecological plasticity and adaptive reactions that help ensure its survival in urban landscapes. In our view, such characteristics are better developed in synanthropic species than others, allowing them to coexist with humans. Examples of these adaptive behaviors include:

1. Adaptations of synanthropic birds to humans: scientific literature contains numerous accounts regarding the unique adaptations of birds in human residential areas, including cities [7,8,9,11]. These adaptations manifest in their behaviors related to escaping from dangerous objects and estimating the distance of flight. Such adaptations develop through repeated interactions with humans and other objects. If these interactions are positive, the birds gradually become less skittish, with decreasing flight distances from humans and other objects (domestic animals, birds, moving and stationary vehicles, etc.) until this distance may completely disappear in some species. Of course, the adaptation varies between species, resulting in varied flight distances across each kind.

Determining birds' tolerance levels (ability to withstand disturbance) to disruptive factors posed by humans and other objects, where flight distance is considered a crucial criterion, can illustrate this adaptation further. Research shows that a given species' flight distance varies in different conditions and stages of life. For example, during winter in Bukhara, pigeons can approach humans within a 3-4 meter range, while in certain areas of Tashkent, this distance is only 0.5-1 meters, likely due to special feeding of these pigeons during winter.

During the research, behaviors of synanthropic species towards livestock, poultry, and other domestic animals were studied and analyzed. In the study area, livestock farming and poultry management are relatively well-developed, leading to birds often engaging in biocenotic relationships termed "companionship" and "symbiosis" with livestock and poultry. Particularly during winter, species such as mynas and field sparrows actively participate in this process. During this time, pigeons have increased skittishness towards humans while being less fearful of livestock, likely as a result of their frequent capture by humans, which amplifies their "escape response" to sources of perceived danger.

All synanthropic species are more cautious of pets, especially dogs and cats, and they maintain a strict distance from them through their flight distance assessments, serving to warn one another of impending danger (as seen in mynas). This behavior is explained by the additional risk that pets pose to birds.

Vehicles are a unique factor in the synanthropization of birds, playing an important role as ecological parameters that determine the species composition, distribution, and numbers of urban birds. The flight distance of synanthropic birds in response to vehicles is generally shorter than their flight distance from humans. In rural areas, mynas and carrion crows are often seen feeding in close proximity to tractors working the land. They take advantage of the insects disturbed by the tractors and larvae and grubs exposed in the tilled earth, indicating an adaptation to the noise. Similar adaptations can also be (and have been) observed near roadways, where birds are attracted to insects and other food sources revealed due to vehicular accidents.

2. Foraging behavior for food resources: the role of food resources in determining the composition and density of synanthropic fauna in urban landscapes is influenced by the quality and quantity of food resources available and the ease of access to them. In natural ecosystems of the Kyzylkum region, a sharp decline in food resources and difficulty in accessing them are particularly evident in winter and early spring. During these periods, the accumulation of synanthropic species near human habitation is observable in villages and cities. Household waste, various food production facilities—particularly those involved in grain processing—supply these birds in significant numbers through their byproducts. This process not only simplifies food gathering but also facilitates access to it. Similar characteristics have been noted in the Transbaikalia region and elsewhere [4,10].

3. Adaptations of synanthropic species for breeding in urban landscapes: in the study area, species like the rock pigeon (*Columba livia*), Eurasian collared dove (*Streptopelia decaocto*), laughing dove (*Streptopelia senegalensis*), common swift (*Apus apus*), barn swallow (*Hirundo rustica*), common starling (*Sturnus vulgaris*), myna (*Acridotheres tristis*), magpie (*Pica pica*), and carrion crow (*Corvus frugilegus*) have adapted to nesting and breeding in anthropogenic sites. In contrast, the field sparrow (*Passer montanus*), which has a partially natural origin, nests in excavated cavities made by various birds and other animals, although these nesting sites are also commonly located near human habitats. The participation of birds in nesting at anthropogenic sites results from alterations in their natural evolutionary adaptations.

In such environments, selecting suitable nesting sites, building nests, incubating eggs, and caring for chicks are achieved through various adaptations developed in synanthropic birds. These adaptations include atypical nesting site selections, the presence of anthropogenic materials in nests, prolonged breeding seasons, and communal nesting. The atypical nesting site selection is particularly evident in birds like the rock pigeon, Eurasian collared dove, common swift, barn swallow, common starling, myna, and magpie. Studies have shown that all identified nests of these species contained anthropogenic materials.

It is noteworthy that the high density of birds in a confined space can lead to a shortage of nesting sites, increasing competition for such locations. Synanthropic species adapt to such

situations. Although atypical nesting may not adversely affect synanthropic species, the increase in new construction technologies, building facades, and other developments in recent years has led to a drastic reduction in nesting sites for species like the barn swallow and Eurasian collared dove in cities and even rural areas. Similar situations have been observed regarding changes in nesting locations of magpies in northwestern Siberia and other urban areas [3].

4. Adaptations of synanthropic species for wintering in urban landscapes: synanthropic species tend to be better protected against harsh conditions, particularly severe cold and prolonged snow cover, than other species. Rock pigeons inhabit various building eaves, carrion crows occupy tall and dense tree groves, and mynas build roosting colonies in diverse structures and trees. The formation of nocturnal colonies in such locations showcases the manifestation of "group effects" in synanthropic species. During the 2022-2023 winter in Bukhara, as well as in Kogon, Jondor, and other district centers, 44 nocturnal colonies were identified across parks, markets, and similar structures. The largest of these colonies contained 140 rock pigeons, over 2060 carrion crows, and around 600 mynas.

Comparing the distribution and abundance characteristics of synanthropic species across newly established and older cities can also reveal their levels of adaptation to urban landscapes. For example, among synanthropic species, the swift (*Apus apus*), common starling (*Sturnus vulgaris*), magpie (*Pica pica*), and hooded crow (*Corvus cornix*) were notably absent in the relatively new Uchquduq city and only found in Zarafshon city, indicating a lower adaptation level for these species compared to others (such as the laughing dove, Eurasian collared dove, and field sparrow).

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