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IMPACT OF URBANISATION ON HOUSES SPARROW (PASSER DOMESTICUS) POPULATION IN CHINIOT REGION

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Abstract

Urbanization markedly changes natural ecosystems, it alters the population dynamics of many species, such as the house sparrows (*Passer Domesticus*). Unlike the wild adaptations of other species. These birds mostly find themselves vulnerable to changes that occur due to the expansion of cities and their infrastructure-leading to depleted habitats, pollution, and changes in feed opportunities. This study investigates the effects of urbanization on the population of house sparrows in Chiniot, Pakistan, an area that rapidly urbanized during the last few decades. This research employs a combination of methods in field surveys, including point counts and habitat assessments, in urban, suburban, and rural landscapes. It is also to analyze population trends, habitat preferences, and noise and pollution effects on sparrow populations. Habitat availability, vegetation cover, levels of pollution, and human activity are core aspects that this study delves into to understand fairly well the relationship between urbanization and house sparrow population dynamics. It was discovered from the analysis of the data that the population of house sparrows has significantly reduced in urban areas. There is a strong correlation between reductions in urban house sparrow populations and an increase in urbanization indices like the vibration of buildings, scant availability of green areas, increase in noise, and air pollution. Rural and suburban areas have more or less steady populations because the ecological effects on habitats remain slight in these areas. These conclusions have led to a series of recommendations to reduce the adverse urbanization impacts-including the development of urban green space, encouragement of nest box programs, noise reduction strategies, and pollution control measures. It will help conserve house sparrows and other urban wildlife for many years in rapidly urbanizing conditions. These findings add weight to the study because they enrich the comprehension of urban biodiversity effects in Pakistan and serve as a model for other cities with similar problems.

INTRODUCTION

The House Sparrow (*Passer Domesticus*) has been part and parcel of towns and cities for centuries, being one of the small and gregarious birds often associated with human settlements. This species has deep adaptations and opportunistic behavior, and traditionally thrived in habitats completely dominated by humans and learned the art of man-made construction as an ideal niche for nesting and supplementing foraging from human activity. It has now stretched to a worrying level in recent decades, and it has been evident that the highly urbanized areas around the globe are where it has diminished the greatest. It raises environmental and conservation concerns because the House Sparrow is an important bio-indicator of the health and balance of urban ecosystems. Urbanization gives a whole lot of transformation of the natural landscape to the cities and is considered one of the important causes of such degradation. Quick-spread urbanization reduces the vegetation cover in the natural habitats for birds and naturally creates a habitat less friendly for many bird species.

Destruction of habit, pollution (air and noise), decreased amount of food availability, and no proper or suitable nesting sites are some of the factors that threaten the House Sparrow in urban settings. Though urbanization opens a lot of doors for economic growth and resource development, researchers must carefully investigate the environment. Especially biodiversity in terms of any possible detrimental effects. Urbanization is one of the first fundamental causes by which much natural landscape is transformed into urban areas. Quick rapid urbanization has posed a substantial change in natural habitats and reduced the vegetation cover where birds can survive and create a habitat that is less friendly to many birds. Some of the factors that destroy habitat and cause pollution (air or sound), hit decreased amounts of food availability, and eliminate appropriate or adequate nesting sites accumulate the threats of House Sparrows in metropolitan areas.

Researchers might have to investigate some important environmental things along with urbanization, especially biodiversity, which opens up a large number of doors for economic growth and resource development. The rapid pace of urbanization in Pakistan is due to the continuous change in the environment because of industrialization, growth of population, and developments in infrastructure. Cities like Chiniot are moving into such rapid urbanization in the Punjab province, hiding original wildlife like the House Sparrow. Chiniot, which is smaller than mega-cities like Lahore or Karachi, provides very good value for studying the impact of urbanization, given its fusion of urban, semi-urban, and rural landscapes. This gradient provides an opportunity to compare House

Sparrow populations at various urbanization levels and determine the specific causes of their decline.

The urban decline of House Sparrows is ecologically and anthropogenically complex. The substitution of natural landscapes for buildings and paved surfaces made nesting and foraging opportunities for sparrows extremely rare. Pollution: in addition to poor quality air and high noise levels, further damages behavioral and communicative issues; and affects fitness overall. The scarcity of natural food sources whose availability has declined through pesticide use and pollution further compounds the challenges of urban sparrows. Although much research on the downfall of the House Sparrow has been done in the Western world, very little research has been conducted in smaller cities of developing countries like Pakistan. Most of the research conducted in Pakistan is done in large cities and leaves studies in smaller but fast-urbanizing cities such as Chiniot. In this context, the present study intends to see the urbanization impacts on House Sparrows in Chiniot and the eventual environmental and anthropogenic correlates leading to their decline.

The results from this research will not only enlighten the local ecological impacts of urbanization in the Chiniot region but also contribute to the understanding of urban biodiversity issues at a broader level. In addition, the present study comparing the population of sparrows in and around urban, semi-urban, and rural areas, would prove the importance of habitat preservation and sustainable urban planning to mitigate the adverse effects of urbanization. According to this study, such conservation strategies must be strategized accordingly as per region to secure the existence of species such as the House Sparrow, which form essential elements in urban ecosystems.

1.1 Background

These birds live up to their name by Robbins and have become most familiar to man as the house sparrow or *Passer Domesticus*, as they are small and adaptable. Their association with humans has dictated their wildness, which they have drawn into the bustling urban towns and villages of the world, where they have lingered for several centuries. However, there is alarming and consistent evidence for a serious decline of house sparrows in recent decades in several cities across the world, and now, increasingly, such evidence is appearing in cities and towns within Pakistan's borders, including the Chiniot region. The house sparrow population is alarming because these birds are important bioindicators of the health of urban ecosystems, as well as indicators of wider environmental problems such as habitat loss and pollution caused by human activity and the availability of food. Urbanization, the process of transforming rural areas into urban centers through infrastructure development, population growth, and

industrialization, is one of the primary drivers behind the decline of house sparrow populations.

Urbanization leads to habitat fragmentation, the reduction of natural green spaces, and the proliferation of pollution—factors that create unfavorable conditions for sparrow survival. As cities expand, natural environments are replaced by concrete structures, roads, and industrial zones, which limit the availability of suitable nesting sites and reduce the diversity of food sources. Noise pollution, air pollution, and increased human activity further contribute to the disruption of sparrow behaviors, making urban environments less hospitable for these birds. In the last two decades, the development of Chiniot urbanization has resulted in increasing population density, industrialization, and proliferation of infrastructure. Urban development occurs with economic growth and modernization, but it has had its impact shown in the form of changing the natural landscapes, which in turn threaten biodiversity. As urbanization continues, further changes will likely occur in the region. Thus, understanding most of such changes by identifying the impacts on wildlife, especially urbanization, is important, particularly for a species like the house sparrow, which has always lived near human settlements. Therefore, this study aims to find out the urbanism effect on house sparrows of Chiniot and look beyond the ecological and environmental requirements that cause an impact on their reduction.

1.2 Research Problem

In Chiniot, like many other regions across Pakistan and the world, rapid urbanization has resulted in substantial changes to the natural environment. As residential, commercial, and industrial areas expand, they often encroach on the habitats that house sparrows and other wildlife rely on. Transformation of the landscape is coupled with increased pollution and reduced vegetation, resulting in the loss of architectural features traditionally used for nests. Such an environment has become more challenging for sparrows. These scenarios give rise to concerns about the health of local biodiversity. Edith Sparrow, once found everywhere in urban and suburban areas, is fast becoming a rare bird in many places. Although Europe's and other continents' great deals of research have been done on house sparrow declines, regional work is rather lacking in Pakistan, particularly in smaller cities like Chiniot. This makes the understanding of urbanization in Pakistan in connection with local wildlife, house sparrow though it may be, limited.

The research problem would be identifying and analyzing factors causing the decrease in house sparrow numbers in Chiniot and how urbanization is altering the natural habitats and resources on which the birds rely. The impact of environmental stressors,

including loss of habitat, pollution, and changes in food availability, would be studied on the immigrant population of sparrows as this area rapidly turns to urbanization.Urbanization is becoming swift in most parts of the world, including Chiniot in Pakistan. Over the past 20 years, urbanization has increased significantly in Chiniot, partly due to the growth of population, industry, and infrastructure. This fast urbanization has brought remarkable changes in land use, environmental conditions, and human behavior, which are likely to interrupt the local ecosystem as well as biodiversity. Birds are among the species that are most affected by urbanization; of these, the house sparrow (*Passer domesticus)*-long associated with human-dominated environments highly affected.

House sparrows have exhibited a distinct trend toward collapse in numbers over many urban centers like Chiniot. House sparrows that were once easily found in both types of habitat, rural and urban, have now found themselves facing hurdles that threaten their very existence because of increasing trends towards urbanization. This species of sparrow is now facing steep declines in urban environments and raises eyebrows not just at the sparrow being threatened, but also presents deeper critical thinking on what urbanization means for all forms of life, sparrows included. The House sparrows are known to serve as popular bioindicators and the trends in their population can offer vital information about the general well-being of the environment and ecosystem in urban areas. Their declines usually signify some form of underlying ecological imbalances that may have been brought about by urbanization-influenced habitat changes, pollution, and shortage of food.

There are various kinds of problems in Chiniot. The birdhouses have replaced the old architecture with modern buildings with fewer nesting locations because of urban expansion. The growing length and width of roads and commercial areas have taken away the vegetative land as well as green spaces, which are the sources of sparrows. Besides that, an increased level of noise and air pollution owing to vehicular traffic, industrial activity, and construction sites could have disturbed the way sparrows communicate, do activities, and forage ground. With the combination of these three factors, a growing human population, and the demands of urban life, such an environment has been formed in which house sparrows tend to live in survival mode.

Despite the increasing concerns about the decline of house sparrows, there is a notable lack of focused research on the specific causes and extent of this decline in Pakistan, particularly in the Chiniot region. While global studies have highlighted the negative impacts of urbanization on sparrow populations, the unique socio-economic and

environmental conditions in Pakistan require more localized research. Understanding how urbanization in Chiniot is influencing house sparrow populations is critical for devising targeted conservation strategies and ensuring the preservation of this iconic species.

This investigation is designed to proliferate the gap by recognizing the major factors that are contributing to the decline of house sparrows in Chiniot. This research is therefore considered to give new jobs in bringing out the real situation of the house sparrow population about urbanization with the sparrow population with the specific problems that these birds have been affected by urban development and develop possible solutions, which are to be made specific to this area. Habitat loss, pollution, food shortage, and human-induced changes in the environment are the factors under consideration that lead to house sparrows decline. This incorporates the expectation of how urbanization affects the biodiversity of the locality and how conservational measures can be oriented to address the issues that arise.

1.3 Research Objectives

The main goal of this research is to study the effects of urbanization on house sparrow (*Passer domesticus*) populations within the Chiniot areas of Pakistan. To realize the goal, several specific objectives are set:

The specificity of this objective is to assess house sparrow distribution in time and space as thrived with different levels of urban settings. It seeks to identify population densities, hotspots, and areas of decline by documenting patterns influenced by habitat characteristics, human activities, and seasonal variations. This includes examining how urban features such as building density, green spaces, and modern architectural designs impact nesting site availability and habitat preferences. The study also evaluates the abundance and diversity of food resources, including seeds and insects, in different urbanization gradients.

This objective involves investigating the influence of environmental stressors such as noise pollution, air pollution, and climate-related factors (e.g., urban heat islands) on sparrow populations. The aim is to establish a clear correlation between these stressors and key ecological parameters such as health, reproduction, and foraging behavior.

The study seeks to explore how human activities such as pesticide use, waste management practices, and changes in urban landscaping contribute to the decline of house sparrows. Understanding these practices can help pinpoint areas for intervention.

This specific objective seeks to explore, through involving localities, public attitudes toward the conservation of sparrows, the perceived roles of sparrows in urban

ecosystems, and the willingness of stakeholders to contribute to such conservation activities. Producing the findings, this objective focuses on recommending actionable measures tailored to the Chiniot region. These include habitat restoration, nest box programs, pollution mitigation, and community engagement initiatives. These objectives address the study's aims to generate a comprehensive understanding of the challenges faced by house sparrows in urbanizing landscapes and to develop sustainable solutions for their conservation. This research not only contributes to avian biodiversity preservation but also serves as a model for balancing ecological priorities with urban development in similar regions globally. To comprehensively assess the population trends of house sparrows (*Passer domesticus*) across urban, suburban, and rural areas. It is essential to analyze their spatial distribution and density within varying degrees of urbanization. Urbanization gradients—from densely populated city centers to sparsely inhabited rural landscapes—present different challenges and opportunities for sparrows. Urban areas, with their high levels of human activity, typically offer limited nesting sites, reduced vegetation cover, and increased pollution making them less favorable for sparrow populations. The rural areas often provide more abundant resources, including natural vegetation, traditional architecture with nesting niches, and lower pollution levels, supporting stable sparrow populations. Suburban areas, as transitional zones, may serve as critical refuges where sparrows find a balance of anthropogenic and natural resources.

These population trends involve employing systematic and repeatable methodologies, such as point-count surveys and transect walks, to measure sparrow densities in each zone. Geospatial tools like Geographic Information Systems (GIS) can be used to map their distribution and identify population hotspots or areas of significant decline. Seasonal variations. Such as breeding and non-breeding periods, must also be accounted for, as sparrow behavior and population dynamics may shift in response to climatic and environmental factors. Additionally, this assessment considers external factors influencing sparrow populations, such as the availability of nesting sites in urban buildings, vegetation cover in suburban gardens, and agricultural practices in rural areas. By comparing population densities across these gradients, the study can reveal how urbanization disrupts ecological balances, ultimately leading to targeted recommendations for conservation interventions in areas where sparrow populations are most threatened. This data-driven approach not only enhances understanding of sparrow ecology but also informs broader biodiversity management strategies in urbanizing regions.

- **To identify the factors contributing to population decline in urban areas**

Factors such as habitat loss, noise and air pollution, reduced vegetation cover, and nesting site unavailability will be examined in detail. To identify the factors contributing to the decline of house sparrow (*Passer domesticus*) populations in urban areas, a detailed investigation is required to uncover the multifaceted impacts of urbanization. "Habitat loss" emerges as a primary driver, as modern urban planning and architecture often prioritize aesthetics and functionality over ecological considerations. High-rise buildings and smooth, concrete structures lack the crevices and cavities that sparrows traditionally use for nesting. The replacement of old-style houses and the removal of derelict buildings further exacerbate the loss of suitable nesting sites. Noise pollution, primarily from vehicular traffic, construction activities, and industrial operations, disrupts sparrow communication, including mating calls and alarm signals.

Extended exposure to any noise can also develop stress in birds and disturb their normal behavior, hence decreasing their breeding success. Air pollution, again characterized by an increase in particulate matter, heavy metals, and toxic gases, has more negative health implications for sparrows, resulting in respiratory stress and reduced survival. High levels of noise over a lengthy period can also induce a condition in birds, which alters their normal behaviors and can bring down their breeding success. Air pollution, marked by increased particulate matter, heavy metals, and toxic gases, also adversely influences the sparrow's health to cause respiratory distress and so causes lower rates of survival.

Contaminated food and water sources in polluted environments further compromise their overall well-being. Reduced vegetation cover in urban areas deprives sparrows of essential resources such as seeds, grains, and insects, which form their primary diet. Urban landscaping most commonly prefers flashy ornamental plants which fail to support any insect populations at the planting site and, thus, also limit further food availability. Its advocate is the broad application of pesticides and herbicides that would, in turn, contribute to massive losses in insect availability to serve as food, at a time when sparrows need rich food sources during the breeding season.

Urbanization introduces competition from invasive species such as pigeons and mynas, which are better adapted to exploit urban resources. Climate change-related phenomena, such as increased urban heat island effects, can also alter microhabitats, making urban environments less hospitable for sparrows.This study examines the interplay of these urban stressors on sparrow populations. By identifying critical thresholds for habitat requirements and tolerable pollution levels, the research aims to

provide actionable insights for urban planners and conservationists to mitigate these impacts. Understanding these drivers is key to reversing population declines and fostering coexistence between urban development and avian biodiversity.

- To propose conservation strategies for the house sparrow in Chiniot

  Urban landscaping most commonly prefers flashy ornamental plants which fail to support any insect populations at the planting site and, thus, also limit further food availability. Its advocate is the broad application of pesticides and herbicides that would, in turn, contribute to massive losses in insect availability to serve as food, at a time when sparrows need rich food sources during the breeding season. One of the primary strategies involves enhancing habitat availability by promoting urban greenery. This includes increasing the number of native trees and shrubs in parks, residential areas, and along roadways to provide foraging opportunities and potential nesting sites. Establishing green roofs and vertical gardens in urban centers can further increase habitat complexity and connectivity. Old and abandoned buildings that historically served as nesting sites should be preserved where feasible, and incentives can be provided to homeowners to create sparrow-friendly spaces.

  As a temporary solution to the natural cavities, artificial nesting structures like sparrow nest boxes can prove to be effective. Their installations can take place in public and private spaces, including schools and households, ensuring that monitoring occurs alongside installation so that overuse would not be experienced. Nest box programs, together with public awareness activities, can get local communities involved in sparrow conservation, develop a sense of ownership toward the actual biodiversity, and build responsibility. The focus needs to be on the promotion of biodiversity-supporting landscaping practices that develop nurturing habitats for native plants that are insect-supporting. That would also require making the use of pesticides and herbicides, especially in suburban gardens and public parks, a thing of the past, towards campaigning for "healthy" food production which will always keep sparrows happy. This happened also to create awareness through education programs that will encourage the public to put up feeding and drinking stations for the sparrows during such extreme weather.

  The main topic of discussion is how to take care of food stinginess using biodiversity-enhancing landscape scales. These establish nurturing habitats for the native plants and their supporting insects. This demands, finally, that pesticides and herbicides leave their way of life, especially in suburbs and public parks - where nature would otherwise opt to promote "healthy" food production, always keeping to the wonderful sparrow. Awareness can also be created among people through education on the significance of

having food and water for sparrows during such harsh extremes. Mitigating pollution—a critical driver of sparrow population decline—requires targeted urban management policies. These actions translate into ideal noise control regulations and environmental conditions in urban residential neighborhoods. Accordingly, less stressful and heightened reproductive success environments are created as quieter habitats for sparrows. Also, reducing air pollution through stricter vehicle emissions standards and an increased use of cleaner energy sources sustains the welfare of both sparrows and urban biodiversity itself.

Civic Engagement

This is the cornerstone of effective conservation. The study consistently highlights the significance of including the local community, residents, schools, and businesses in initiatives promoting sparrow-friendliness through workshops, citizen science, and educational campaigns. Involving local governments and NGOs might ensure the continued implementation of such measures. At last, "policy-level interventions" have to be put in place for the integration of biodiversity conservation into urban planning. These could include impact assessments for new construction, the development of existing green areas, and the design of integrated ecological corridors within cities. The strategies proposed will attempt to balance urban development with ecological preservation in a way that supports coexistence while ensuring that future generations of house sparrows in the Chiniot region survive.

1.4 Significance of the Study

This study is highly valuable, especially in biodiversity conservation and urban planning. To conserve house sparrows and maintain ecology in urban areas, understanding the impact of urbanization on the populations of this bird species becomes crucial. Sparrows are vital to ecosystems, and they are also known as insect population controllers, pollinators, and seed dispersers for urban ecosystems' overall health.

This research will hence broaden the growing knowledge about the extent to which urbanization affects biodiversity in South Asia, a fast-urbanizing region. The findings will highlight some of the unique challenges sparrow populations face in urban contexts such as Pakistan's cities and towns. According to the urbanization-house sparrow decline relationships, the study was expected to provide guidelines for conservation policy and urban planning toward conserving biodiversity. The conservation strategies proposed will not only be for house sparrows but will also have implications for the urban wildlife in Chiniot and similar regions.

Furthermore, this research attempts to sensitize local communities, policymakers as well as urban planners about the need to conserve urban biodiversity and the coexistence of humans and wildlife. Ultimately, this research would offer actionable recommendations based on evidence for saving house sparrows and other related species from urban habitation in Chiniot; that, in turn, will make sure urbanization doesn't directly interfere with natural settings.

This study is important for many reasons:

1. Biodiversity Conservation

Highlight the effects of urbanization on house sparrows contributes to the larger efforts involved in conservative urban biodiversity. Sparrows help control insect populations and disperse seeds that maintain various ecosystem processes. City life modifies biodiversity, depleting green open spaces into artificial trapped habitats that promote habitat loss and fragmentation. The sparrow species is one of the few common urban species with an important environmental role. House sparrows reduce the pest population from urban and semi-urban places with good consumption of insects, as they mainly feed on insects during their breeding season when they need more protein-rich foods. This automatically reduces dependence among households on chemicals or poisons in pest management that make a place unfit for human habitation.In seed dispersal, house sparrows make an important ecological contribution to the regeneration and maintenance of plant diversity. They play their role in the urban setting by dispersing seeds of native plants into urban green spaces critical for urban biodiversity. The depletion of the population of house sparrows due to urbanization hence promises a chain of disrupted ecosystem services to imbalance insect population dynamics and proliferation in the invasive plant species. Keeping house sparrows saves the ecological functions imparted by them, but it also propagates the bigger vision of urban biodiversity conservation. Habitat restorations create green roofs, planting native species, and abandoning existing structures for nesting opportunities, all combat urbanization for sparrows by providing habitats for other species. The function of house sparrows in ecology informs one of the many reasons for conserving this species as part of safe planning for cities.

2. Ecological Indicators

House sparrows are bioindicator species that reflect the state of health of urban ecosystem habitats. Studying the declines among these species will show the ecological impacts of urbanization and help guide sustainable development planning. The truth cannot be told, but house sparrows do act as vital indicators of the environment, giving hints about the health and steadiness of urban ecosystems. Their population density,

presence, and behavior are viewed as a slice of the environmental condition, i.e., air and noise pollution, habitats, and availability of food resources. The decrease in their population often indicates wider environmental degradation, such as that of biodiversity, poor air quality, and reduced availability of natural resources. These birds are sensitive to any change in habitat structure, levels of pollution, or even a change in the sources of food; hence they are the best species for monitoring the changes of urbanization on the environment. For instance, the influence of nesting areas or food available with the urban expansion will surely hurt the survival and reproductive success of house sparrows. Such an illustration causes an imbalance in the ecological unit. Dependence on insects during the breeding season makes their population counts responsive to the activity of insect communities in the lower trophic levels but is also affected by urbanization.

To study house sparrows, one would not only identify the precise urban stresses but also learn the follow-up effects of such stresses on other organisms and ecosystem functions. They can be good bioindicators, which is considering such ecological parameters in urban planning environment-friendly spaces. House sparrow populations can be monitored to judge the effectiveness of green spaces, pollution control measures, and habitat restoration management within urban areas by policymakers and conservationists.

3. Regional Context

With limited research on avian populations in Pakistan. This study addresses a critical knowledge gap, offering data and recommendations specific to the Chiniot region that can be adapted for similar areas facing this rapid urbanization. Urbanization and industrialization continue unabated in developing countries like Pakistan particularly, in the vast plains of Punjab. The transformation has far-reaching effects on local ecosystems and biodiversity.

Chiniot, a mid-sized city in Punjab, provides a unique case because it exists in a transitional state between the associated urban and rural landscapes. Unlike other metropolitan areas like Lahore or Karachi, Chiniot's settlement types comprise densely populated urban centers, peri-urban settlements, and such agriculturally productive surroundings as rural areas. It thus affords a research opportunity to study the differential impact of urbanization on avian species within a particular region.

Ecological species such as the House Sparrow (*Passer domesticus*), are indicative of environmental health. One of the problems in Pakistan is the lack of baseline population data on birds to make conservation planning effective. Studies in the urban hubs indicate a decline in species diversity and abundance, but there is less research in small

cities and their surrounding areas. Chiniot-like any other conventionally growing towns-is indeed going through similar problems experienced by larger cities: habitat destruction, pollution, and lack of available food resources. At the same time, however, it retains pockets of natural and semi-natural habitats that provide a comparative edge in studying urbanization.

Working in City or Local Contexts

As a developing country, Pakistan is one of the countries where rapid urban growth and industrialization have been occurring, especially in the region of Punjab. Almost every aspect of the local ecosystem and biodiversity is affected very quickly. Just right under these conditions, Chiniot serves as an interesting case study because it is at a transitional stage between urbanism and ruralism. It is different from a city like Lahore or Karachi in that it has close urban centers, peri-urban settlements, and large areas of rural land production. From this mix, one can study different impacts of urbanization on avian species within one geographical region. Avian populations such as the House Sparrow, therefore, also hold ecological value as indicators of environmental well-being. As for Pakistan, the absence of baseline data regarding bird populations impedes effective conservation planning. Earlier studies on bird populations in larger urban centers pointed to a reduction in species diversity and numbers; however, such types of studies are lacking from smaller towns and their contributions as an area of research. Chiniot is presently urbanizing at a pace comparable to those of large cities, such as habitat destruction, pollution, and limited available food resources, but it also preserves natural and semi-natural pockets whereby it can on this comparative edge about impacts of urbanization.

Further, the socio-economic dynamics of Chiniot have an important influence on its environmental management. Habitat mosaics exist wherein industrial activity, agricultural practices, and urban sprawl coexist, each affecting wildlife differently. This work concentrates on the particular site not as an example but as an important study for understanding and developing the ecological dynamics of mid-sized cities as well as guiding the conservation effort of urban biodiversity similar to that across the country.

4. Policy and Community Engagement

Maximizing the potential conservationists would need to include factors such as having a multidisciplinary team, policymaking, urban planning, and conservation. Such institutions should integrate biodiversity conservation into the scheme of developing cities. Local awareness is key to creating a culture of care among them. Education campaigns, workshops toward such initiatives, and community action can help them

appreciate what nature does for them. Not only do these empower communities to take the right steps in conserving species like the house sparrow; they urge co-existence. Participating in activities like citizen science, informing citizens of their mortality concerning the well-ventilated houses built inside, would incite in people lifestyle changes, consumption-minimizing activities, such as reducing insecticide use, planting and encouraging the growth of native vegetation, and proper urban waste management, to make adaptation more pleasant for sparrows.

These partnerships will also involve the government, NGOs, and local communities in mainstreaming and amplifying all conservation efforts. Some of the joint program interventions may include creating incentives for urban greening initiatives, developing bird-friendly architecture, and establishing policies that minimize negative aspects of urbanization such as health hazards of air and noise pollution. This way, one guarantees that conservation is not merely about science, but about society, thus enabling humans and animals to coexist sustainably in urban life. These measures once scaled up, could then be a model for biodiversity conservation in other urbanized environments with the same problem.

The intricate relationship to investigate between urbanization and house sparrow populations. This study underscores the urgent need for harmonizing development with ecological preservation.

LITERATURE REVIEW

Urbanization is a global phenomenon that severely changes ecosystems and brings about fragmentation of habitats, loss of biodiversity, and disruption of ecological processes as reported in Chace & Walsh (2006). These changes such as the replacement of natural patterns to concrete structures countless and eliminate important habitats and thus invade species. It occurs that native fauna are displaced too. Loss of vegetation coupled with dependence on monoculture landscapes has robbed the urban community of poor expression of diverse food sources. Pollution in terms of air and water quality degradation, and also noise and light pollution raises the demands of wildlife. So, wildlife suffers from decreased health, reproductive performance, and foraging behavior. Birds including house sparrows are especially at risk. Because in natural and anthropogenic terms, all resources are usually disruptive to urban settings. The effects of urbanization on the ecosystem have a cascade effect not only on single species but also have broader implications for the ecological balance and services vital to human well-being.

House Sparrows and the like serve as bioindicators in their ecosystems. Their decline in urbanity becomes a harbinger of deteriorating environmental conditions. Urbanization creates urban heat islands that physiologically and behaviorally affect birds; hotter temperatures cause heat stress and less effective forage which results in low survival rates, especially in those without shade or water. Urban sprawl normally creates a reduced connectedness across habitats. High fragmentation in landscapes acts as a barrier to the movement of wildlife and hinders their access to resources and the exchange of genetic material. The house sparrow is one of those species that experience a reduced genetic pool and hence suffer from the phenomenon known as inbreeding depression. This in turn reduces the resilience of the population.

Such urban buildings would significantly affect bird populations. The methods of construction today, which are oriented more towards aesthetics rather than function utterly ignore the needs of urban wildlife. For example, glass facades increase bird collision risks and no eaves or crevices offer alternatives for nesting processes. Thus, artificial light also disturbs natural day length in urban areas. Which disturbs the circadian rhythms of birds. Light pollution alters migratory patterns and may disorient nocturnal migratory birds resulting in a decrease in their survival rates. Even non-migratory species face challenges when their breeding schedules are changed and sleep is disturbed. Which affects overall health and reproductive success.

It is competition from invasive species in urban areas. Such as the common one which endangers native birds.

2.2 House Sparrow Population Decline

House sparrows (*Passer domesticus*) are a distinguished species and once thrived in both urban and rural landscapes. Presently, due to various reasons, marked population declines have been observed for them worldwide. Research in Europe reported more than 60 percent depletion in urban sparrow density in recent decades with identical trends in South Asia (Robinson et al., 2005). Major factors include habitat loss due to modern architectural designs, lack of nesting niches, insect starvation due to pesticide application, and seed unavailability due to urban landscape. Apart from that, air pollution from vehicular and industrial emissions has also been related to the sparrows suffering from respiratory problems because of such emissions. Noise pollution, on the other hand, affects their communication as well as mating activities. These are major socio-cultural shifts affecting the society and culture of a South Asian country: how people manage their waste and the decline of small-scale farming. These findings bring

out the fact that the decline in sparrow populations is a multifactorial phenomenon, thus necessitating region-specific conservation strategies.

2.3 Conservation Efforts for House Sparrows

Conservation initiatives for house sparrows have increasingly focused on mitigating the impacts of urbanization through targeted interventions. Nest box programs, which provide artificial nesting sites, have proven effective in urban areas with limited natural nesting opportunities (Vincent et al., 2017).These programs, when combined with community awareness campaigns, have shown the potential to engage local populations in sparrow conservation. The creation of urban green spaces, including gardens, parks, and green roofs, enhances habitat availability and supports insect populations critical for sparrow diets. Moreover, biodiversity-enhancing policies in urban planning like conserving ancient trees and including ecological corridors in the design of cities have shown benefits for avian species for a long time. Successful examples of such case studies include the UK and India, where it has been demonstrated to be an important first step in jointly implementing successful sustainable conservation measures. This requires continuous monitoring of the implementation as well as adaptation because the cities face ongoing challenges from rapid urbanization and climate change.

METHODOLOGY

3.1 Study Area Description

The study was conducted in Chiniot, Pakistan, a region characterized by diverse landscapes including urban centers, suburban zones, and rural agricultural areas. Urban areas comprised densely populated regions with high-rise buildings, limited vegetation, and significant industrial activity. Suburban zones were marked by moderate housing density, green spaces, and proximity to agricultural land, while rural areas included traditional farming landscapes with open fields, small villages, and natural vegetation. The selected sites provided a comprehensive representation of varying urbanization gradients, ensuring a holistic understanding of its impact on house sparrow populations. The region's climatic conditions, with hot summers and mild winters, were also considered, as they may influence sparrow behavior and habitat preferences.

3.2 Sampling Methods

Point-count surveys were conducted across 30 pre-identified locations, evenly distributed among urban, suburban, and rural areas. Observations were performed early in the morning and late afternoon to maximize detectability during peak sparrow activity. Each survey involved systematically counting sparrows within a 50-meter radius for a fixed period of 10 minutes. Efforts were made to minimize observer disturbance,

and multiple observers were trained to ensure consistent data collection. The sampling frequency was biweekly over six months, capturing seasonal variations and trends. Stratified random sampling was employed to ensure equal representation of different habitat types across the study area.

3.3 Data Collection Tools

A structured checklist was designed to record detailed observations, including habitat type, nesting site availability, vegetation cover, food sources, noise levels (measured using a sound level meter), and air quality indices (e.g., particulate matter levels). GPS devices were used to geotag observation points, enabling spatial analysis. Photographic documentation of habitats and sparrows was performed for verification and qualitative analysis. Additionally, semi-structured interviews with residents provided supplementary insights into historical trends and anecdotal evidence of sparrow populations in the region.

3.4 Statistical Analysis

The data were analyzed using advanced statistical techniques to establish correlations and patterns. Linear and multiple regression models were employed to assess the relationship between urbanization indices (e.g., building density, vegetation loss, and pollution levels) and sparrow population densities. Spatial analysis using Geographic Information Systems (GIS) highlighted distribution patterns and hotspots of sparrow activity. Analysis of Variance (ANOVA) tests were conducted to compare population densities across urban, suburban, and rural areas, while time-series analysis examined seasonal variations. The results were validated through cross-checking and sensitivity analysis to ensure robustness.

3.5 Ethical Considerations

All observations adhered strictly to ethical guidelines for wildlife research. Noninvasive methods or activities that could disturb the sparrows or their habitats were conducted. Surveys were performed from a safe distance to avoid interfering with their natural behavior. Permissions were obtained from local authorities and landowners before accessing private properties. The study also respected the ecological integrity of the habitats, ensuring no damage to vegetation or nesting sites during fieldwork. Additionally, the findings were shared with local stakeholders to promote community awareness and conservation efforts.

RESULTS

4.1 Population Trends

The study revealed a sharp decline in house sparrow (*Passer domesticus*) populations in urban areas, particularly in highly industrialized and densely populated zones of Chiniot.

This decline was most pronounced in areas characterized by high-rise buildings, minimal green spaces, and heavy traffic. Conversely, rural regions with limited urban interference exhibited relatively stable populations, suggesting that traditional agricultural landscapes provide essential nesting sites and food resources. Suburban areas with intermediate urbanization showed transitional trends, with populations fluctuating depending on the availability of vegetation, water sources, and nesting opportunities. The findings indicate that urbanization intensity directly influences sparrow population densities, confirming a clear gradient of decline from rural to urban environments.

4.2 Habitat Preferences

House sparrows demonstrated a clear preference for suburban areas with moderate vegetation cover and access to both natural and anthropogenic resources. These areas provide a balance of open spaces for foraging and built structures for nesting. Sparrows were frequently observed near old residential buildings, gardens, and agricultural fringes where water and food sources, such as seeds and insects, were abundant. In urban cores, their presence was limited, attributed to the scarcity of green spaces and nesting sites. In rural settings, traditional housing styles with accessible roofs and eaves were favorable, though the increasing mechanization of agriculture and pesticide use pose emerging threats. The study underscores the importance of suburban habitats as potential refuges for sparrow populations amidst ongoing urbanization.

4.3 Impact of Noise and Pollution

Noise and air pollution emerged as critical factors negatively affecting house sparrow populations in the Chiniot region. High levels of vehicular and industrial noise disrupted sparrow communication, particularly during mating and nesting periods, potentially leading to reduced reproductive success. Prolonged exposure to noise pollution also caused behavioral stress, driving sparrows away from highly urbanized zones. Air pollution, which presents itself as having very high concentrations of particulate matter (PM2.5 and PM10) and toxic emissions, both from vehicles and industries, will correlate strongly with reducing population densities. This will lead to a decrease in air quality, which may also be detrimental to the health and survival of sparrows in terms of respiratory problems and the contamination of food and water supplies. These findings highlight the synergistic effects of urban pollutants in exacerbating the challenges faced by sparrow populations.

DISCUSSION

5.1 Key Findings

Urbanization significantly affects house sparrow (*Passer domesticus*) populations in the Chiniot region, primarily through habitat loss, decreased availability of nesting sites, and

reduced food resources. The replacement of natural vegetation with concrete structures has disrupted the ecological balance, leading to a sharp decline in sparrow populations. Pollution from vehicular emissions and industrial activities further degrades air and water quality, which indirectly impacts their health and reproduction. Noise pollution from urban areas may also interfere with sparrow communication, mating calls, and parental care. These combined factors highlight the multifaceted threat urbanization poses to this species in the region.

5.2 Comparison with Existing Studies

The findings from this study align with global research on the impact of urbanization on avian species, particularly house sparrows. For instance, studies such as Jokimäki et al. (2020) and Summers-Smith (2003) emphasize habitat fragmentation, limited food availability, and pollution as critical factors behind declining sparrow populations in urban settings. Similarly, research conducted in other South Asian regions, like India (Khera et al., 2010), corroborates these trends, citing urban architecture and modernization as significant contributors to population decline. This study adds a regional perspective, underscoring that urbanization's impacts in the Chiniot region are consistent with global patterns but exacerbated by rapid, unplanned urban expansion and minimal conservation efforts.

5.3 Implications for Conservation

Specific conservation steps need to be taken to offset the adverse effects of urbanization. For instance, there can be urban green spaces that consist of native vegetation that can support feeding and sheltering sparrows. Availing nest boxes for building bird-friendly structures in both residential and commercial areas would help compensate for the loss of nests. Public awareness of the ecosystem services provided by sparrows and their significance as bioindicators can stimulate public involvement in conservation activities. All the efforts should culminate with the attention of the policy-makers who should be concerned with sustainable urban planning integration of biodiversity concerns such as old tree renaissance and pollution minimization. Collaboration with schools, NGOs, and other community groups can ensure the grassroots approach of sparrow conservation within the region of Chiniot.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This research, without a doubt, establishes that urbanization is one of the leading causes of the decline of house sparrow (*Passer domesticus*) populations in the Chiniot area. Natural habitats have completely transformed and constructed urban infrastructures,

translating into no nests, less food, and exposure to environmental pollution. Among these anthropogenic pressures are habitat fragmentation, vehicular emissions, industrial pollution, and noise-related stress, which aggravates this particular species' problem. Thus, these results imply the pressing need to develop and adopt integrated conservation plans addressing socio-economic drivers of biodiversity loss in rapidly urbanizing areas, such as Chiniot.

Recommendations

1. Increase Urban Greenery

Spawn nationwide heterotopic afforestation programs to push planting native trees and shrubs that would serve as sites for natural nesting places and food resources for house sparrows. Design public parks and green belts ecological corridors as support systems for urban biodiversity, including avians.

2. Nest Box Schemes

Encourage residential and commercial property owners to establish savannah-specific nests to counterbalance the loss of natural nesting sites.

Collaborates with educational institutions and NGOs to distribute and monitor nest boxes with proper placement and use.

3. Afforded the Pollution Regulators

Tight-rope policy on reducing vehicular emissions and industrial emissions into cleaner air quality surroundings of urban places. One area is a noise control zone primarily within residential settings and green spaces to lower auditory stress on house sparrows and other urban wildlife.

4. Public Awareness and Community Participation

Education promotes ecological roles of house sparrows and happenings due to which these birds have become endangered within the periphery of urbanization.

Create community conservation programs such as a citizen science project monitoring house sparrow populations and tracking their recovery.

5. Sustainable Urban Planning

Integrate biodiversity conservation into urban development projects where construction processes prevent the loss of old trees and other important habitats. Include mandatory environmental assessments for each site with a significant urban development scale to locate and lessen potentially adverse effects on local wildlife. Through such initiatives, Chiniot can balance urban development and ecology. It also ensures the house sparrows thrive in an uninterrupted human-wildlife coexistence.

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APPENDICES

Appendix 1: Study Area Maps

Appendix 2: Data Collection Forms

Below are data collection forms that can be used for your thesis on the impact of urbanization on house sparrow (*Passer domesticus*) populations in the Chiniot region, Pakistan. These forms are designed to record the necessary data during field surveys.

1. House Sparrow Population Survey Form

This form is used for recording observations of house sparrow populations at specific survey locations.

Date **03-12-2024**	**Survey Location:** **Central Chiniot (Market Area)**	**Observer(s):** **Arslan Munir**

Location Coordinates (GPS): 31.7200 N, 72.9788 E	**Time of Survey:** 08:00 AM	**Weather Conditions:** Clear, 18 °C
Urban/Suburban/Rural: Urban	**Survey Method:** Point-Count/Transect Point Count	
Habitat Type: Urban/Suburban/Rural Urban	**Temperature (°C):** 23 °C	**Wind Speed (km/h):** Clear, 5km/h

House Sparrow Count

Time Interval	Number of Sparrows Observerved	Age Group	Behavior
0-5 minutes	2	Adult	Perching
5-10 minutes	3	Adult	Feeding
10-15 minutes	5	Juvenile	Flying
15-20 minutes	4	Adult	Nesting
Total Count	14		

Notes:

- Location Characteristics: High pedestrian traffic near food stalls.
- Nest Presence: Yes
- Presence of Predators: No

2. Habitat Assessment Form

This form is designed to assess the habitat characteristics at each survey site.

Survey Location: Central Chiniot (Market Area)	**Date: 05-12-2024**	**Time: 09:30 AM**
Urban/Suburban/Rural: Urban _____	**Vegetation Cover:** Low _____	
Habitat Type: Residential Area _____	**Dominant Vegetation:** Few shrubs near sidewalks _____	
Tree Density: 1-5 Trees _____	**Presence of Green Space:** No _____	

Additional Habitat Features

Features	**Present (Yes/No)**	**Notes/Description**
Grassland/Meadow	No	
Shrubs/Underbrush	Yes	Limited to sidewalks
Open Ground	Yes	Paved streets dominate
Water Source	No	No visible water sources nearby
Buildings (Density)	High	Crowded commercial buildings

3. Pollution and Noise Level Survey Form

This form records data about environmental factors that might affect the house sparrow population, including noise and pollution.

Survey Location: Central Chiniot (Market area)	**Date: 10-12-2024**	**Time: 10:00 AM**
Urban/Suburban/Rural Urban _____	**Noise Level:** High _____	
Pollution Type: Both Air and Noise _____	**Air Quality Index:** 130 (Moderate Pollution) _____	
Noise Pollution (db): 80 _____	**Main Source of Noise:** Traffic _____	

Notes:

- Traffic Density: High
- Industrial Activity Nearby: No

4. Nesting Site Availability Form

This form is used for documenting nesting sites and their condition.

Survey Location: Central Chiniot (Market area)	**Date: 12-12-2024**	**Time: 10:00 AM**
Urban/suburban/Rural Urban _____	**Nest Type:** Artificial _____	
Nest Condition: Fair _____	**Nest Material:** Dry grass, twigs _____	
Nest Size: Small _____	**Nest Location:** Building crevices _____	

Number of Active Nests: 1

Presence of Eggs/Chicks: Yes

Notes:

- Predator Presence: No predators observed.
- Human Disturbance: High due to nearby market activity.
- Nearby Vegetation: Sparse (a few shrubs near the location).

5. General Site Conditions Form

This form records general site conditions that may affect sparrow populations, such as human disturbance and vegetation.

Survey Location: Central Chiniot (Market area)	**Date: 12-12-2024**	**Time: 10:00 AM**
Urban/suburban/Rural Urban _____	**Human Disturbance level:** High _____	
Building Density: High _____	**Presence of Vehicles:** Yes _____	
Traffic Type: Heavy _____	**Vegetation Density:** Low _____	

Additional Notes:

- Presence of Pets (Dogs, Cats, etc.): Yes
- Presence of Domestic Waste: Yes (scattered waste near food stalls).

6. Food Source Availability Survey Form

This form records the type, availability, and sources of food in the study area.

Survey Location: Central Chiniot (Market area)	**Date: 12-12-2024**	**Time: 08:00 AM**
Urban/suburban/Rural Urban	**Dominant Food Source:** Both natural and artificial	

_____	_____	
Natural Food: Seeds, Insects, Fruits _____	**Anthropogenic Food:** Grains _____	
Availability of Food: Moderate _____	**Time of Observation:** 08:00 AM - 01:00 PM _____	

Notes on Food Source Quality and Quantity:

- Presence of Contaminated Food: Yes (Natural and Artificial)
- Seasonal Variability: No
- Competition for Food: Yes (House Sparrows with Other Birds).

7. Behavioral Observation Form

This form captures the behavior of house sparrows in various contexts.

Survey Location: Central Chiniot (Rural area)	**Date: 13-12-2024**	**Time: 08:40 AM**
Urban/suburban/Rural Rural _____	**Observed Activity:** Nesting, Perching, Dust Bathing and Flying _____	
Interaction Type: With same species _____	**Aggressive Behavior Observed:** No _____	

Notes on Behavior:

- Social Group Size: 5-10 sparrows observed together.
- Specific Behavior Patterns: Feeding in groups, frequently preaching on wires, and occasional dust bathing.

- Influence of Disturbances (e.g., humans, vehicles): Sparrows often fly away when vehicles or humans approach closely.

8. Climate and Weather Conditions Form

This form documents the weather and its potential impact on sparrow populations.

Survey Location: Central Chiniot (Rural area)	**Date: 13-12-2024**	**Time: 08:40 AM**
Urban/suburban/Rural Rural _____	**Temperature: (°C)** 21 °C _____	
Humidity (%) 7% _____	**Rainfall:** No _____	
Wind Speed (km/h): 6 km/h _____	**Cloud Cover:** Partly Cloudy _____	

Notes:

- Impact of Weather on Sparrow Activity: Difficulty to find food.
- Availability of Shelter During Adverse Weather: Yes

9. Breeding Success Monitoring Form

This form tracks breeding success by observing nests over time.

Survey Location: Central Chiniot (Rural area)	**Date: 13-12-2024**	**Time: 09:00 AM**
Urban/suburban/Rural Rural _____	**Nest ID:** 001 _____	
Number of Eggs: 03 _____	**Number of Hatchlings:** 0 _____	

Number of Fledglings 04 _____	**Nest Fate:** Successful _____	

Notes:

- Human Disturbance Near Nest: No
- Weather Impact on Nest: Yes, it affects the decline of species.
- Predators Observed Near Nest: No

10. Public Awareness Survey Form

This form gathers information about local knowledge and attitudes toward sparrows.

Survey Location: Central Chiniot (Market area)	**Date:** **15-12-2024**	**Time:** **11:00 AM**
Urban/suburban/Rural Urban _____	**Interview Type:** Local Resident _____	
Awareness of Sparrow Decline: Aware _____	**Belief in Conservation Importance:** Agree _____	

Questions:

- 1. Do you notice a decline in sparrows in your area?
  Yes
- 2. Do you take any steps to provide food or shelter for sparrows? Yes, provide grains and water.
- 3. What do you think are the major threats to sparrows in this region? Habitat loss, pollution, and food scarcity.

All aspects of the house sparrow's life from food availability to breeding success and public interaction, are recorded. They help create a comprehensive dataset for analyses of the impact of urbanization in Chiniot, Pakistan.These data collection forms allow you to systematically document the key factors influencing the house sparrow populations, including population counts, habitat characteristics, environmental factors, and human

disturbances. They are designed to collect consistent and comprehensive data, ensuring that your findings are reliable for the analysis of how urbanization affects sparrow populations in Chiniot, Pakistan.