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# Farmland Birds and their Importance in Agro ecosystem: A Review

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*ABSTRACT*

Avian fauna provides a variety of functions, including predators, pollinators, scavengers, seed dispersers, pests controller, nutrient cycling, ecosystem engineers, and many others. Birds play important ecological and economic functions however they are sometimes overlooked simply because of a lack of knowledge. However, as bird populations drop globally, so do the ecological advantages given by these species. To support bird conservation, this review study focuses on the role of birds in the agro-ecosystem and their benefits to humans. Biodiversity databases and existing literature were reviewed to establish baseline information on farmland bird species and their preferences. Searches were limited to articles published between 2005 to 2024. Healthy bird populations and habitats would help to safeguard a variety of ecological functions, ultimately benefiting human health. Farmland birds are disappearing. Due to the widespread use of pesticides, lack of habitat, birds and other animals are disappearing and unnecessary harmful pest species are increasing and the agricultural environment is deteriorating. So, this review paper tries to emphasize on urgent conservation measures that are necessary for the protection of agricultural birds which are essential for the health of both natural and agricultural environments.

## 1. INTRODUCTION

Avian fauna of Nepal is diversified and has 886 bird species recognized (DNPWC 2018). The country's avian diversity is due to vastly varied climatic and geographical variations, which have resulted in a variety of forest and habitat types. Nepal's physiographic features range from the Alpine high Himalayan peaks to the tropical lowlands of the Terai, and its geographical position, which overlaps the Palearctic and Oriental (Indomalayan) worlds, is particularly notable (Inskipp et al., 2016). Birds are ecologically very significant creature and play as an important part in the ecological functioning of our environment by acting as pollution indicators, seed dispersers, scavengers, and insect hunters.

Farmland birds, or bird species that inhabit agricultural areas, serve important functions in the agricultural environment. Their interactions with crops, pests, and the

surrounding environment can have both beneficial and bad consequences. Birds rely on agricultural ecosystems for foraging and breeding (Flohre et al., 2011). Birds play an important role in maintaining ecological balance in agricultural systems (Manning et al. 2006). According to Benton et al. (2003), birds forage on farms and nest in nearby hedges. Birds play an important role in the agricultural ecosystem by participating in a variety of ecological processes that benefit both crops and the wider environment. Farmland is presently considered the world's most common ecosystem (Weijden, 2010). Nearly one-third of all bird species use agricultural settings on a regular basis to provide essential eco-services such as pollination, pest control, seed dissemination, and so on (Sekercioglu, 2012). The intensification of farming practices, such as crop diversity loss, grassland destruction, and excessive use of pesticides and fertilizers, has resulted in the deterioration of agricultural and semi-natural ecosystems, as well as a drop in biodiversity across vast regions.

Healthy bird populations imply that the plants and invertebrates they consume are in good health condition. Bird populations on farmlands are regarded to be an effective indicator of the general state of wildlife and the countryside due to their varied range of habitats. Though agricultural birds have coexisted peacefully with humans for many years, most locals are ignorant of the importance and benefits of having such birds in their farming regions.

Conservation of farmlands birds should be mandatory since they play an important role in preserving ecological balance and agricultural viability. Here, it has been attempted to address some objectives such as ecosystem services provided by birds, the impact of agricultural practices on birds, population trends and dynamics of farmland bird species, policy recommendations to promote farmland bird conservation, and so on.

The study highlights the crucial role of farmland birds in agroecosystems, where they contribute to ecosystem services like pest control, seed dispersal, and pollination. These birds serve as bio indicators of ecosystem health, reflecting sustainable farming practices. The review explores the ecological and economic significance of these species and the negative effects of modern agriculture, habitat loss, and climate change. It emphasizes the need for sustainable farming methods that support both biodiversity and food production. The research calls for conservation strategies that balance agricultural productivity with wildlife preservation, benefiting both the environment and farming communities. This study is significant as it bridges the gap between agricultural practices and wildlife conservation, advocating for integrated approaches that benefit both the environment and farming communities.

### 1.1 LITERATURE REVIEW

The study of farmland birds and their involvement in agroecosystems has received a lot of interest in recent decades, with a growing body of studies demonstrating their ecological importance. Birds are not only an essential component of biodiversity in agricultural landscapes, but they also play important functional roles that help both the environment and agricultural output. Farmland birds are frequently regarded as markers of ecosystem health because of their sensitivity to environmental changes. Donald et al. (2001) found that diminishing bird populations frequently imply greater biodiversity loss in agroecosystems. Bird species richness is closely correlated with landscape diversity, with more diverse agricultural areas supporting more bird species (Benton et al., 2003). As a result, monitoring farmland bird populations has become an important technique for determining the sustainability of farming operations.

Birds make important contributions to agroecosystem functions by providing ecosystem services. Several studies emphasize their function in biological pest control. For example, Kross et al. (2016) shown that insectivorous birds can reduce pest populations in wheat areas, potentially

lowering the demand for chemical pesticides. Insectivorous birds, such as the barn swallow (Hirundo rustica) and the tree sparrow (Passer montanus), feed on a wide variety of agricultural pests, including aphids, caterpillars, and beetles (Sekercioglu, 2006). By controlling pest populations, these birds reduce the need for chemical pesticides, which can have negative environmental consequences. Moreover, birds contribute to seed dispersal and the control of weed populations. Granivorous birds, on the other hand, may assist control weed populations by eating their seeds (Pejchar et al., 2018). Granivorous species, such as the house sparrow (Passer domesticus) and finches, consume weed seeds, potentially reducing competition for crops (Wilson et al., 1999). These services promote more sustainable agriculture practices and increase crop yields. Chamberlain et al. (2000) and Newton (2004) found a persistent drop in bird numbers due to habitat loss, pesticide use, and monoculture techniques. Simplified landscapes with fewer hedgerows, field edges, and natural ecosystems result in fewer nesting locations and food sources for birds. Furthermore, widespread pesticide usage might have a direct or indirect negative impact on birds by diminishing their insect prey source.

To reduce the harmful effects of contemporary farming on bird populations, conservation techniques are being included into agricultural practice. The implementation of agri-environment systems (AES), as observed in European Union countries, encourages farmers to manage farmland in ways that promote bird conservation. Practices such as hedgerow maintenance, buffer strip creation, and pesticide reduction have been found to promote bird biodiversity (Batáry et al., 2011). Moreover, organic farming systems tend to harbor higher bird diversity than conventional systems, as they prioritize ecological balance and limit chemical inputs (Hole et al., 2005).

Within the larger context of agroecology, farmland birds play an important role in preserving ecosystem equilibrium. Agroecology, which promotes biodiversity, ecosystem services, and resilience in farming systems, is consistent with the need to protect farmland birds. Altieri and Nicholls (2012) found that increasing bird diversity on farms benefits ecological processes including nutrient cycling and pest regulation. This method replaces industrial monocultures with more diversified, multifunctional landscapes that benefit agriculture and biodiversity.

Despite growing awareness of the importance of farmland birds, challenges remain in reversing their population declines. A key issue is balancing the economic pressures on farmers with the need for conservation. Recent studies suggest that integrated farming systems, which combine productivity with biodiversity conservation, could provide a pathway forward (Fischer et al., 2008). Further research is needed to refine these systems and assess their long-term viability in different agroecological zones. Moreover, there is a need for policy frameworks that incentivize farmers to adopt bird-friendly practices without compromising food security. By integrating bird conservation into agroecological frameworks, it is possible to foster both biodiversity and agricultural resilience. As the global demand for food increases, maintaining biodiversity in agroecosystems, including the presence of farmland birds, will be essential for achieving food security and sustainability goals (Tscharntke et al., 2012).

## 2. MATERIAL AND METHODS

Biodiversity databases and existing literature were reviewed to establish baseline information on farmland bird species and their preferences. It was attempted to make this study more result-oriented by utilizing the experiences and information accumulated after a decade of study and research on Nepalese avian fauna. The review was conducted by performing a comprehensive literature search on scientific databases such as Google Scholar, Scopus, and Web of Science. Keywords and search terms

included combinations of the following: farmland birds, agroecosystems, biodiversity, ecosystem services, pest control, pollination etc. Searches were limited to articles published between 2005 to 2024. Trends, gaps in the literature, and areas for future research were identified.

### 2.1 STATUS OF AGRICULTURAL BIRDS IN NEPAL

Agricultural birds have an essential role in Nepal's ecosystems, especially in terms of agricultural operations. They help to control pests and insects while also providing other environmental benefits.

Nepal has a diverse bird population, with over 870 recorded species. Many of these birds, including Dove, Pigeon, Sparrows, Mynas, Bulbuls, Drongos, Egrets, White-throated Kingfishers, Owls, Kites and Finches etc. are abundant in agricultural areas and can be seen in fields, orchards, and gardens. 184 species (21% of the total documented birds) used agricultural areas for foraging at some time (Inskipp and Baral, 2010). Birds like strokes, which we used to see frequently as youngsters, are no longer visible nowadays. Birds like Lapwings and Larks, which used to be common in farmland, are very few nowadays. Habitat loss, changes in agricultural practices, pesticide use, climate change, and other variables can all have an impact on the status of these birds. However, farmers say that some birds like Parakeet coming from the forest and eat their crops and cause pain. To resolve this issue, adequate actions must be taken to ensure that both farmers and birds do not experience problems and that both can coexist together.

### 2.2 ECOSYSTEM SERVICES PROVIDED BY BIRDS

#### 2.2.1 PEST CONTROL

Birds play important roles in agricultural environments by delivering a variety of ecosystem services that improve the general health and productivity of these systems. Many bird species are insectivores, which means they eat on harmful insects and pests that can affect crops. Birds help to manage insect populations by feeding on them, minimizing the need for chemical pesticides and thus assisting in the prevention of pest outbreaks that might harm crops or other plants. It was found that different species of birds such as swallows, warblers, flycatchers, and many more helped to balance the number of insect species by eating them. Birds like Rufous-gorgetted Flycatcher, Blue-throated Flycatcher, Grey-headed Canary Flycatcher, Black Drongo, Ashy Drongo, Bronze Drongo, Ashy Wood Swallow, Large Wood Shrike, Long-tailed Shrike, Common Tailorbird, Tit etc. were directly observed in the field feeding on different insect's pest.

According to Genard et al. (2017), the Great Tit population may devour up to 1400000 insects per acre per year. According to the study undertaken by Martin Nyffeler of the University of Basel in Switzerland, every year, birds consume 400 to 500 million metric tonnes of beetles, flies, ants, moths, aphids, grasshoppers, crickets, and other arthropods (Martin et al., 2018). The study, published in Springer's journal 'The Science of Nature', emphasizes the critical role birds play in controlling plant-eating insect populations.

In 2010 to 2011, while conducting a survey in Amalatari village of Nawalparasi, it was found that the Tharu and Bote communities were rearing ducks and releasing ducks in paddy fields. They said that Ducks feed on insects, pests, and weeds in the paddy fields, reducing the need for chemical pesticides. Ducks help control weeds by uprooting them as they move through the fields. They also said that duck farming provides farmers with an additional source of income, and duck droppings serve as organic manure, enriching the soil with nutrients like nitrogen and phosphorus. This natural fertilization boosts soil fertility and reduces the need for synthetic fertilizers.

Similarly, Owls are another important member of agro-ecosystem. Twenty-three species of Owls are found in Nepal which are predatory birds, which mean they must prey on other creatures to survive. Invertebrates (such as insects, spiders, earthworms, snails, and crabs), fish, reptiles, amphibians, birds, and small mammals like rat make up their diet. The

most destructive agricultural pest like mice and rats are eaten by Owl, Jungle Crow and House Crow (Regmi, 2003). According to a casual survey in the fields, the number of rats eliminated from the fields by a breeding pair of barn owls every breeding season is in the range between 800-1500 rodents (Noor, 2019). It helps farmers by consuming 2000 to 3000 rodents on a farmland during the breeding season (G.C Som et al., 2023). We may deduce from this statistic that birds are highly essential members of the agro-ecosystem, and we should advocate conservation of these crucial species for the protection of human civilization as well as the entire environment.

### 2.2.2 WEED CONTROL

Weeds are undesirable plants that grow in cropland that try to limit or disturb the growth of growing crops. Birds that forage on the ground, such as Quail, Jungle fowl, Patridges, Francolins and certain species of sparrows, can help control weed populations by consuming weed and seeds. This is particularly beneficial in agricultural fields where weed management is crucial. Some aquatic birds like duck and geese help to control weeds and pest in the rice field. Integrating ducks and rice farming will result in continued decreasing investments for producers by also eliminating the weeds in the next crop because the ducks eat all parts of the weeds and grass seeds as shown by observations of the crop contents of scavenging ducks. From the results of the integrated rice-ducks farming experiment by (Men B X, 1999) have seen that using local ducklings even in the early brooding stage onwards dramatically reduced damage to the rice caused by insect pests and weeds during the early period of the spring-summer crop of directly-seeded, high-yielding rice.

### 2.2.3 POLLINATION AND SEED DISPERSAL

Birds serve critical roles in pollination and seed dissemination, helping many plant species reproduce successfully and maintain genetic variety. This is especially crucial for preserving biodiversity and guaranteeing agricultural ecosystem resilience. Many birds such as Warblers, Weavers, and Sunbirds etc. contribute to pollination by transferring pollen between flowers. Many fruit and grain eating birds such as Dove, Pigeon, Thrushes, Bulbul, etc. contribute to seed dispersal. They eat fruits, and the seeds pass through their digestive systems, eventually being deposited in new locations. This process is essential for the reproduction of flowering plants, including many food crops.

Figure 1: *Example of Some Farmland Birds of Nepal*

1. Black-shouldered Kite 2. Long-tailed Shrike with its feast 3. Greater Coucal

4. Asian Openbill

5. Barred Buttonquail

6. Scaly Munia

7. Lesser Adjutant Stork

8. Jungle Owlet

### 2.2.4 INDICATOR OF ECOSYSTEM HEALTH

Birds serve as ecosystem health indicators due to their sensitivity to environmental changes, various habitats, and varied diets. They reflect the condition of various ecosystem components, including air, water, vegetation, and prey availability. Birds' presence, behavior, population trends, and diversity offer valuable insights into the overall functioning and stability of ecosystems. Birds such as Adjutant Stork, White Stork, which were seen easily before, are decreasing, indicating that Nepal's agroecosystem is deteriorating. The reason for the decline is the widespread use of agrochemicals to control pests and weeds.

Bird presence and behavior in agro-ecosystems can be used to assess overall ecosystem health. Because of their sensitivity to environmental changes, birds can act as key markers of a healthy ecosystem. Climate change has an impact on birds. Changes in the distribution and behavior of bird species can be early indications of the impacts of climate change on ecosystems. Bird population variations may indicate changes in environmental circumstances and alert farmers to possible problems.

Nutrient Cycling and Fertilization: Bird droppings, or guano, contribute essential nutrients to the soil. The nutrient-rich droppings serve as a natural fertilizer, enhancing soil fertility and promoting healthier plant growth. Birds help the decomposition process by scavenging and eating carrion. When birds dine on dead animals, the organic substance is broken down into smaller particles. This promotes microbial breakdown and the release of nutrients back into the environment.

### 2.2.5 CULTURAL AND AESTHETIC VALUE

Farmland birds enhance agricultural environments and are typically valued for their cultural and recreational value. Tourists and environment enthusiasts may be drawn to bird watching in agricultural regions. Farmland birds are frequently entwined with cultural symbols and folklore. In many cultures, they can signify fertility, prosperity, and a connection to the natural world. Every year festivals related to

birds are celebrated in Nepal like Owl festivals, Sarus festivals that aid their value and promote coexistence. Many birds are associated with religious beliefs. Birds are considered to be sacred creatures and are mentioned in various Hindu texts, including the Vedas, Puranas, and the Ramayana, and the Mahabharata. The most prevalent appearances are as a vehicle (or vaahan) for various Gods, such as Garuda for Vishnu, Peacock for Kartikeya, Owl for Lakshmi, and Swan for Saraswati. There are many other stories in Hindu mythology in which birds are used to represent specific themes.

### 2.3 POPULATION TRENDS AND DYNAMICS OF FARMLAND BIRDS

Farmland bird population trends and dynamics vary widely and are impacted by a variety of variables such as changes in land use, agricultural practices, habitat loss, climate change, and pesticide usage. Farmland birds are dropping globally (Green et al., 2005; Reif and Vermouzek, 2019; Stanton et al., 2018), mostly as a result of growing anthropogenic pressures and activities like as intensive agriculture, hunting, pesticide and other agrochemical usage, and expanding urbanization (Stanton et al., 2018). Around 21% of Nepal's bird species use agricultural environments, with 11% already considered globally threatened (for example, Yellow-breasted Bunting Emberiza aureola, Lesser Adjutant Leptoptilos javanicus, and Sarus Crane Antigone antigone; Grimmett et al., 2016; Inskipp et al., 2016). However, conservation in Nepal is mostly focused on protected areas, which means farming systems and the animals that rely on them are often overlooked (MoFE, 2018), despite attempts to save the few vulnerable species (Baral et al., 2012). In Nepal, there is a paucity of government conservation initiatives that encourage farmers to adopt bird-friendly farming techniques (MoFE, 2018).

Kathmandu, being an urbanized area, has seen significant habitat loss for birds and other wildlife due to rapid urban expansion, deforestation, and pollution. To address this issue, Balendra Shah, popularly known as Balen, the mayor of Kathmandu Metropolitan City, has initiated a project to build bird homes across the Kathmandu Valley and installed artificial bird homes or nests in various parts of the city, especially in public spaces like parks, schools, and community areas. These bird homes provide a safe environment for different bird species to nest and breed, encouraging the growth of local bird populations. This kind of initiative helps strike a balance between urbanization and ecological preservation. Others should also learn from this work and such initiative can also be implemented in the agricultural sectors which help to re-store the damaged agricultural environment.

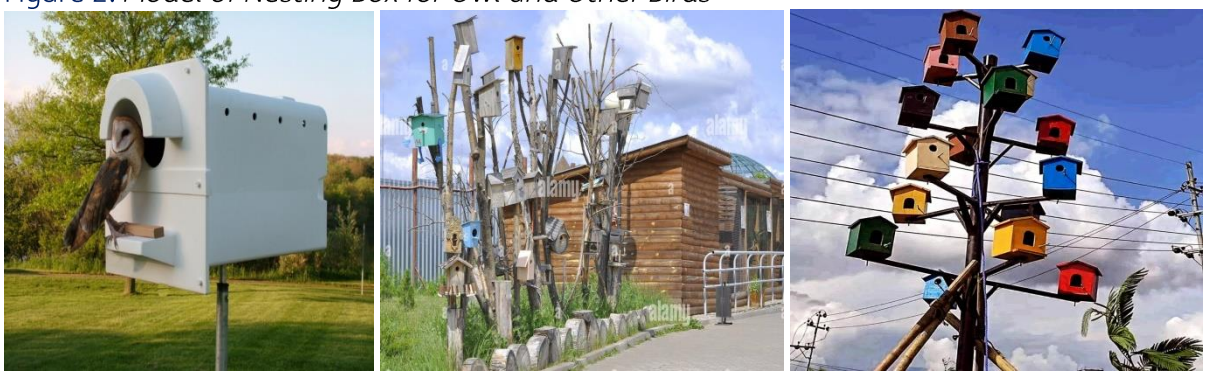
### 2.4 EFFECT OF AGRICULTURAL PRACTICES ON BIRDS

Agriculture is one of the most important human activities, and it has a significant influence on the environment and the terrain. Agriculture is a major contributor to the global loss of biodiversity nowadays. Many bird species lose nesting locations, feeding grounds, and general biodiversity as a result of intensive agricultural methods that convert natural ecosystems into monoculture farms. Agricultural intensification has resulted in a significant reduction in biodiversity, particularly farmland birds, in recent decades (Chamberlain et al., 2000; Donald et al., 2001). Because of the loss of natural forest, certain birds have evolved to adapt to the agro-ecosystem. Sparrow, Pigeon, Dove, Baya Weaver, Parakeet, and other birds that live in close proximity to humans and forage on agricultural land are good examples. There are many factors that threats to farmland birds but harmful chemical pesticides used in the agriculture alone damage 87% of the globally threatened bird species (BLI, 2008).

It has been found that birds feeding on invertebrates like insect are declining rapidly. This must be considered in conjunction with recent study that insect populations throughout the world have decreased, and pesticides are assumed to be major causes to significant decreases in

Nepalese insectivorous birds. Pesticides can accumulate in the tissues of birds over time, a process known as bioaccumulation. This occurs when birds consume contaminated prey over an extended period of time. The accumulated pesticides may reach concentration that can be lethal or cause long-term health issues. The accumulated pesticides may pass through different trophic level in ecosystem through food chain and can cause deleterious effect on whole ecosystem. One notable example is the impact of pesticides on birds of prey, particularly raptors. DDT insecticides were banned in the United States in 1972 under the Federal Insecticide, Fungicide, and Rodenticide Act due to its negative effects on bald eagles and other bird species. Following conservation initiatives, such as DDT bans and habitat protection, have led to the recovery of bald eagle numbers in the United States, demonstrating the necessity of tackling pesticide-related dangers to bird species. Poaching, overfishing and use of harmful chemical pesticides in the agricultural farm should be controlled and awareness program should be launched for long term conservation of birds (Parajuli, 2022). Sustainable and bird-friendly farming practices contribute to a healthier ecosystem and benefit both agricultural productivity and biodiversity conservation.

Figure 2: *Model of Nesting Box for Owl and Other Birds*



## 3. CONCLUSION AND RECOMMENDATION

Farmland birds contribute to the balance and sustainability of agricultural ecosystems by assisting with pest management, pollination, and biodiversity. The conservation and promotion of these birds' well-being is critical for the health of both natural and agricultural settings. Conservation efforts that focus on preserving natural habitats, reducing pesticide use, and promoting agro ecological practices can benefit both farmland birds and the agricultural ecosystem as a whole. Agro-tourism may be encouraged so that visitors can see agricultural production and processing, farmland biodiversity such as birds and small mammals as well as other invertebrates such as butterflies. Farmers may be encouraged to practice biodiversity-enhancing agro-ecological agricultural methods such as agroforestry, crop diversification, and organic farming. These measures help birds live in a more natural environment. Small nesting box can be built for birds like Owl, Sparrow, Starlings etc. in farmland that acts as biological control agent. Growing native plant hedgerows around the farmland's boundaries provide ideal places for farmland bird to nest. Farmers should encourage adopting integrated pest management (IPM) practices that reduce the usage of chemical pesticides. Pesticides can impact bird populations, and alternate approaches may be more environmentally friendly in the long term. Thus, for sustainable agriculture, we must establish an environment in which humans and birds may coexist and live in harmony.

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