Ecological Importance of Birds

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Abstract: There are about 10000 bird species in the world. From the poles to the equatorial forests, from the deserts to the centres of the oceans, from the highest mountains to the hearts of our cities, everywhere birds are amongst the most conspicuous forms of animal life.

Of all the animals, birds have been the most well-known classis because human beings have used them for feeding, communication, pollinating plants, and decorate the home, etc. Also, birds are important to some animals for biological control, for example Rodentia.

Birds are important to continue ecologic circle, specially in food chain. For the last three centuries, industrial developments and anthropological effects have degraded habitats and caused the natural balance to deteriorate. Approximately 200 bird species had been affected directly or indirectly from these negative changes.

Key Words: Birds, Ecological importance, Aves, Ornithology.

Introduction

Ornithological research has always a central role in the development of certain aspects of our science. In other words, birds have attracted more than their fair share of our zoological attention. Reasons for this are: 1. most species are diurnal and conspicuous. 2. they can be trapped and marked with leg rings or other tags. 3. because in most species individuals raise their young in discrete nests, their individual reproductive rates can be measured accurately in a way not possible for most other organisms which lack parental care. 4. the huge popular interest that birds engender has given rise to an extensive network of skilled amateur observers (Newton 1995).

Given the significance of birds for conservation planning and environmental assessments, there is a need for a better ecological understanding of the role of avian community structure in conservation decision-making. Thus, they are widely used in conservation and population trends in farmland are one of the 15 'Quality of Life' indicators. In additon, small landbirds in particular have often been proposed as potential indicators for the presence of other unrelated taxa or as environmental change indicators to be integrated into broader monitoring schemes. Furthermore, they are frequently included in evaluation studies for overall biodiversity conservation (Gregory et al. 2004; Kati and Şekercioğlu 2006).

Although bird species have an important mission to continue for ecological balance, 1,012 species are being threatened by threats that habitat loss, human persecution and introduced predators. For example, habitat loss was cited as a source of risk for over 70% of threatened species, whereas human persecution and/or introduced predators were cited in 35% of cases. Overall, twice as many species (54%) were classified as being threatened by either habitat loss alone or human persecution/introduced predators alone than being threatened by both sources together (27%) (Owens and Bennett 2000).

The Role of Birds in Plant Distribution

Birds have a good system for spreading seeds. They eat berries and then when they dispose of their waste, the berry seeds are disposed along with it. Bird feces provide good fertilization for the seeds with which they are dropped, giving seeds very good conditions with which to grow. In addition, a lot of bird species may have been significant browsers of forest vegetation. For example, McEwen (1978) stated a large proportion of forest tree and shrub species had fleshy fruits which were attractive to birds. And also, Godley (1979) stated that birds performed a relatively minor role as pollinators in New Zealand forests and that foliage of all kinds was eaten mainly in late winter, spring and early summer, when fruit was least available.

Because of extensive dietary overlap between different herbivorous birds and the turnover of both bird and plant species through evolutionary time, it is unlikely that particular plant species have evolved adaptations to browsing by particular birds, although evolutionary responses to bird browsing in general are possible. With the extinction of moas and the recent decline of other birds such as kokako and kakapo, browsing by birds no longer has a great impact on forest plants (Clouth and Hay 1989).

The habitat heterogeneity hypothesis is one of the cornerstones of ecology. It assumes that structurally complex habitats may provide more niches and diverse ways of exploiting the environmental resources and thus increase species diversity (Bazzaz 1975).

In most habitats, plant communities determine the physical structure of the environment, and therefore, have a considerable influence on the distributions and interactions of animal species. For example, for bird species diversity in forests, MacArthur & MacArthur (1961) evidenced that the physical structure of a plant community, how the foliage was distributed vertically, might be more important than the actual composition of plant species. Depending on the taxonomic group, the structural parameter of the vegetation and the spatial scale, species diversity might also decrease with increase in habitat heterogeneity. Moreover, effects of habitat heterogeneity might vary considerably depending on what was perceived as a habitat by the species group studied. Structural attributes of the vegetation that constitute habitat heterogeneity for one group might be perceived as habitat fragmentation by another taxonomic group (Tews et all 2004).

Bird Extinction in Habitats

Ecosystem has biotic and abiotic compenents. There is constant interaction between. But, recently, this relationship has been changed negatively. For example, habitat loss is the major factor affecting directly or indirectly the global decline of biodiversity. Being complex to measure directly, biodiversity trends are often monitored as the extent and rate of species extinctions. Therefore, species’ responses to habitat loss are a central issue of contemporary conservation biology (Mikusiński and Angelstam 2004).

Critical thresholds for habitat loss have been demonstrated in a wide range of studies using theoretical models. Two kinds of thresholds have been addressed: 1) the fragmentation threshold, which is the amount of habitat below which habitat fragmentation (spatial pattern) may affect population persistence and 2) the extinction threshold, which is the minimum amount of habitat which the population goes extinct (Mikusiński and Per Angelstam 2004).

Owens and Bennett (2000) suggested that different lineages are vulnerable to different mechanisms of extinction, with lineages that are highly threatened by one source usually being relatively secure with respect to the other source. Such results point strongly to the possibility that different ecological factors will be associated with different sources of extinction risk.

Whereas extinction risk via habitat loss was positively correlated with the degree of habitat specialization and small body size but not significantly associated with residual generation time, extinction risk incurred via human persecution and/or introduced predators was correlated with large body size and slow life history but was not significantly associated with variation in ecological specialization. These results confirm the prediction that different ecological factors are responsible for making a lineage vulnerable to different sources of extinction (Owens and Bennett 2000).

The Role of Birds in Agriculture

Agricultural land currently occupies approximately 38% of the planet's land surface, or around half its habitable area (Clay 2004). The modification and management of landscapes to produce food or other agricultural commodities for human consumption represents one of the most severe and widespread threats to global biodiversity (BirdLife International 2004; Foley et al 2005). The distribution of agricultural land is a beter predictor of wildlife threat status than the distribution of people (Scharlemann, Balmford & Green 2005). Agriculture affects natural ecosystems in more diverse ways, including modifications of landscape, soils, and water supply through deforestation, erosion, channeling, flooding, draining, etc., as well as the elimination or propagation of selected species of plants and animals (Steadman 1996).

Agriculture impacts on biodiversity in two main ways. The first is through the clearance of pristine habitats for new planting, with the accompanying pressures of fragmentation of remaining habitats, pollution and disturbance. The second driver of biodiversity decline is the intensification of existing agricultural systems, aimed at increasing crop yields per unit area. This has contributed more to increasing overall productivity of most commodities over the last 30 years than the planting of new land (Donald and Evans 2006).

Birds patterns of behaviour, distribution, seasonal phenology and demography track closely onto the spatial and temporal scales of agricultural change. Foraging, nest-site selection or breeding performance reflect features within the patchwork of agricultural habitats. The pattern of events in the annual farming calendar interact with key events in their own lives such as breeding or migration. Their populations or communities vary in ways that reflect local, regional or international variations in land use or management. The effects of year-to-year drift in their demography means that their population trends match the march of agricultural change. Perhaps most importantly of all, the availability of well-organized and geographically extensive data on bird populations over time has drawn our attention to the major environmental changes that have occurred on agricultural land. When coupled with equally valuable long-term monitoring of land use, these data have special importance in illustrating how ecological trends and agricultural practices are so closely linked (Ormerod & Watkinson, 2000). The possible ecological effects of changing agricultural practice or land conversion are many. Some arise as a direct consequence of structural or composition changes to vegetation and the associated faunal communities. Others are mediated more subtly, for example through the changing phenology of crops. In addition, a wide array of indirect influences arise, for example through changing predator-prey dynamics or the chemical influences of agro-chemicals on species composition. There are also knock-on effects on other ecosystems, for example downstream or in adjacent bordering areas. Moreover, the major restructuring of land surfaces that accompanies agriculture is one of the principal ways through which the remaining semi-natural habitats are fragmented, with consequences for species' populations and dispersal (Ormerod and Watkinson 2000).

Negative effects of habitat heterogeneity may occur as a consequence of fragmentation, causing the disruption of key biological processes such as dispersal and resource acquisition. However, there is general consensus that not all species in an ecosystem are equally affected by spatial structures, depending on whether they cause heterogeneity or fragmentation (Tews et all 2004).

Birds have been widely used as indicators of agricultural environments, and increases in agricultural intensity have been linked with severe declines in farmland bird populations in Europe, North America, Africa and Asia (Donald & Evans 2006).

Kati and Sekercioglu (2006) determined that there are 10 specialist species that are highly characteristic and strongly dependent on the habitat types they are found in, as they are found in almost all sites of that habitat type and rarely in others.

When distinct ecosystems, such as forests or wetlands, are destroyed, the ecological roles of birds often disappear with them. In many cases, however, bird declines occur independent of habitat loss; exploitation, introduced species, pathogens, fragmentation, and other factors eliminate birds and their services from ecosystems. In fact, half of threatened species are threatened by a factor besides habitat loss. This result is particularly the case for scavengers (100%), piscivores (80%), herbivores (78%), omnivores (76%), granivores (56%), frugivores (53%), and birds that weigh 100 g (73%), all of which, except granivores, are groups significantly more threatened than average. Given the momentum of climate change, widespread habitat loss, and increasing numbers of invasive species, avian declines and extinctions are predicted to continue unabated in the nearfuture. By 2100, we expect 6–14% of all historic bird species to be extinct, 7–25% to be functionally extinct, and 13–52% to be functionally deficient (Şekercioğlu et all 2004).

The Importance of Birds for Biological Conservation

The resulting effect of habitat heterogeneity/diversity on species diversity is subject to the measurement of species diversity. In general, species diversity is a measure of the number of component species and their abundance at a defined point in space and time. On the smallest spatial scale the diversity of animal species measured is the result of individual behaviour, i.e. habitat selection, and of course sampling chance. On larger spatial scales species diversity depends on, e.g. the size of the regional species pool and evolutionary history. Considering these aspects, the measurement of species diversity is always a snapshot and results may vary even for similar habitats. Furthermore, correlations between species diversity and habitat heterogeneity in different locations are subject to equilibrium and nonequilibrium dynamics. For example, if species diversity patterns show year-to-year variations this will have great implications for across-study comparison (Tews et all 2004).

The 'structural extent' can be used when the gradient is characterized by a single variable, whereas 'structural gradients' apply to multivariate gradients. For instance, the structural complexity of the vegetation depends on a variety of parameters like height, coverage and vegetation types. While correlating carabid beetle diversity in a field study to gradients of any one of these variables did not yield significant results, the correlation with the multivariate structural gradient was highly significant (Tews et all 2004).

The ecosystem approach is also the only way to conserve organisms and processes in poorly known or unknown habitats and ecological subsystems. There are many examples from ecological science of the richness of previously unappreciated habitats, such as forest canopies, belowground subsystems, and the hyporheic zones (Franklin 1993).

Habitat reserves are an essential element in any comprehensive program to conserve biological diversity for the foreseeable future. The objective in designing a reserve system is to try to ensure that the reserves are sufficient in number and size and appropriately distributed over the landscape in terms of geography and ecosystem type. Much of the emphasis on reserves for maintenance of biological diversity is appropriate. Native habitats are disappearing at a rapid rate. Saving some pieces has a high priority if we are to retain the species and the processes dependent upon them. In the Pacific Northwest it is highly probable that there are species and processes that depend upon old-growth forest as habitat. Over the short term, existing old-growth forests are our only source of reserves. Hence, decisions about the amount and distribution of late successional forest habitats have high priority (Franklin 1993).

Conclusion

Based on the criteria used by the IUCN, 21% of 9,916 historic bird species are extinction-prone, a category that includes species that are extinct (1.3%), threatened with extinction in the next 10–100 years (12%), and close to qualifying or likely to qualify for a threatened category in the near future (7.4%, near threatened). Extinctionprone birds are not randomly distributed across different functional groups (based on primary diet) or guilds (based on diet and order of food preference). Even though primary diet is not a good predictor of threat status, some functional groups have more extinction-prone species than average: frugivores, herbivores (consumers of nonreproductive plant parts), omnivores, piscivores, and scavengers. Insectivores have slightly fewer extinction-prone species than average. Increased specialization is highly correlated with increased likelihood of extinction, and 41% of bird species limited to one habitat type are extinction-prone (Şekercioğlu et all 2004).

Higher concentrations of extinction-prone birds in certain groups may lead to community disassembly and to more pronounced ecological consequences than one would expect from global aggregated extinction probabilities. There are significant differences in the distribution of extinction-prone species among categories other than diet, such as habitat, region, altitudinal distribution, body mass, clutch size, and evolutionary uniqueness. Island birds are particularly at risk, although this is due to their small global ranges rather than an ''island effect''; in our stepwise regression model with forward selection (4,515 species), compared with ''range size'' alone, addition of ''island status'' was a negligible improvement (Şekercioğlu et all 2004).

Bird extinctions and population reductions in the 21st century may disrupt ecosystem processes and services of potential importance to society. Declines in bird species that are important for a particular ecosystem process service may not necessarily mean a decline in that process service if the populations of other functionally equivalent species increase in response. In addition, avian dispersers and pollinators for some plant communities have low equivalence, resulting in a high risk of plant extinctions from lost mutualisms. Because highly specialized and evolutionarily unique species are more likely to go extinct, the probability of others taking their place is reduced (Şekercioğlu et all 2004).

Among the bird functional groups that are expected to have more extinctions than average, nectarivores pollinate many plant species and frugivores are important seed dispersers, both of which have important consequences for plant populations and community dynamics. Declines in pollination and seed dispersal as a result of bird extinctions may lead to extinctions of dependent plant species. The former is particularly important in the Austral, New Zealand, and Oceanic regions, where the proportion of bird-pollinated plants is higher than other parts of the world, and, in the case of the latter two regions, most of the presettlement avifauna is already extinct (Şekercioğlu et all 2004).

Little is known about the potential consequences of widespread disappearance of fish eating and scavenging bird species. There is an urgent need to investigate whether ongoing declines in seabird populations may have unanticipated top-down or bottom-up consequences as a result of trophic cascades or significant reductions in nutrient deposition. Because most scavenging birds are highly specialized to rapidly dispose of the bodies of large animals, these birds are important in the recycling of nutrients, leading other scavengers to dead animals, and limiting the spread of diseases to human communities as a result of slowly decomposing carcasses. In South Asia, the combination of extremely rapid crash of vulture populations, highly virulent diseases, and high human population density may cause increases in incidences of anthrax, bubonic plague, and rabies, but this potentially crucial interaction has not been studied. In 1997, 30,000 of the world's 35,000–50,000 rabies deaths took place in India where feral dog and rat populations have exploded after the decline of vultures. Although less threatened than average, insectivorous birds include more extinction-prone species than any other group (Şekercioğlu et all 2004).

Because of their high ecological specialization, many tropical forest insectivores are highly sensitive to habitat fragmentation , and 26% of these species are extinction-prone. Exclusions of insectivorous birds from apple trees, coffee shrubs, oak trees, and other plants have resulted in significant increases in insect pests and consequent plant damage. Natural pest-control services are increasing in importance as invertebrate pests develop resistance to chemicals, and pesticide use is curbed by environmental regulations and consumer trends (Şekercioğlu et all 2004).

Overall, 21% of bird species are currently extinction-prone and 6.5% are functionally extinct, contributing negligibly to ecosystem processes. A quarter or more of frugivorous and omnivorous species and one-third or more of herbivorous, piscivorous, and scavenger species are extinctionprone. Furthermore, by 2100, 6–14% of all bird species will be extinct, and 7–25% (28–56% on oceanic islands) will be functionally extinct. Important ecosystem processes, particularly decomposition, pollination, and seed dispersal, will likely decline as a result (Şekercioğlu et all 2004).

Although much research has been carried out in the field of habitat heterogeneity and species diversity patterns, empirical support is almost restricted to studies of vertebrate communities and habitats under anthropogenic influence. In addition, the measurement of habitat heterogeneity is very inconsistent making across-study comparisons difficult. For example, across-study comparison may include the relative effect of habitat heterogeneity between species groups. Furthermore, there is a significant lack of studies that consider multiple spatial scales and species groups within one ecosystem. This approach, however, is particularly important, as it enables detection of keystone structures that are crucial for maintaining species diversity. Examples from temporary wetlands in agricultural fields and solitary trees in South African savannas have demonstrated that keystone structures may simplify biodiversity conservation by protecting a wide array of species and functional mechanisms at the same time(Tews et all 2004).

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