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Journal of American Science

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Review of Literature on Factor Affecting Avian Biodiversity

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Abstract: Bird species will be able to survive in the urban landscape or not, depends on their ability to adapt or the available resources. Birds and their melodious song increase the quality of life, especially for people living in urban areas. Nowadays city planners are making these habitats attractive, so that this may increase the faunal diversity. The current review aims to provide an analysis of avian fauna recorded. Wetland birds and terrestrial species are included from various water bodies and greenspaces of this area.This review highlights various aspects of avian diversity which were enlisted over these years and it will also form a base for further research.

[SAAHIL MEHMOOD and Dr. SHIVARTI GAUTAM. **Review of Literature on Factor Affecting Avian Biodiversity.** *Am Sci* 2023;19(9):9-12]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). http://www.jofamericanscience.org 03.doi: 10.7537/marsjas190923.03.

Keywords: Literature, Avian, Biodiversity

Introduction:

Though Indian sub-continent contributes immensely to avian diversity and India alone accounts for 13% of world species richness and their taxonomy, distribution and general habitat characteristics are well documented in India. Contrary to well documented data, very scarce information is available regarding avian community structure and their dynamics in India. Bird community structure is considered as an inevitable component of vibrant ecosystem and is reflective of the quality of the habitats. Therefore any sort of fluctuation in avian community dynamics has serious ramifications for the entire ecosystem. Birds are truly considered as one of the best tools and parameters of environmental vitality of any ecosystem because of their sensitivity to various kinds of perturbances. Avian species diversity and richness varies greatly and not all species are uniformly distributed over a large ecological area because of varied nature of topography, vegetation composition and structure and availability of food and other factors influence species occurrence. Avian abundance is also affected by other factors such as migration, natality and mortality or due to changes in habitat structure and distribution pattern of food resources. Research data has pointed out strong patterns of association between bird community structure and the physical configuration of the environment. For thorough understanding of the bird community structure and niche relationships, in depth analysis of avian population in different habitats is akin not only to understand the avian community structure but it will be a catalyzing factor for effective management of avian populations. The current loss of biodiversity has been broadly acknowledged as the main cause of ecosystem change. To halt this trend, several international agreements have been made, and various biodiversity metrics have been developed to evaluate whether the targets of these agreements are being met. The process of developing good indicators is not trivial. Indicators should be able to synthesize and communicate our current knowledge, but they also need to meet both scientific and practical criteria. Since it would not be practical to monitor all species, indicators are mainly built on the monitoring of some well-known taxa, such as birds. Here we systematically review the wide spectrum of bird biodiversity indicators (hereafter indicators) available to: i) evaluate recent methodological advances; ii) identify current knowledge gaps jeopardizing indicator interpretation and use in guiding decision-making; and iii) examine challenges in their applicability across different spatial and temporal contexts. We pay particular attention to indicator characteristics such as site and species selection, spatial, seasonal and habitat coverage, and statistical issues in developing indicators and tools to tackle them, to provide specific recommendations for the future construction of indicators. Several methodological advances have recently been made to enhance the process of indicator development, including multiple ways to select sites and species to increase their robustness. However, we found that there are strong spatial, seasonal and habitat biases among the selected indicators. Most of them are from Europe, using mainly census data from the breeding season and typically covering farmland and forest habitats. The major challenges that we detected in their applicability were related to the modelling of the statistical uncertainty associated to the indicator. We recommend the use of quantitative methods in site and species selection procedures whenever possible. Current indicators should be expanded to areas outside Europe and to less studied habitats and should not neglect monitoring work outside the breeding season. Time-series analyses studying temporal trends and using multi-species data should in general account for temporal autocorrelation as well as for phylogenetic correlation. Multi-species hierarchical models are a good alternative for analysing and constructing indicators, but they need to include annual random effects allowing for unexplained annual variation in the average status of the community, i.e. the indicator target. Despite methodological and context-specific differences in the indicators reviewed, most of them seem to highlight the urgent need of devising strategic climate and conservation policies to improve the status and trends of biodiversity.

Review of Literature:

Climate change is a major global threat (Stern 2008) that has already had an observed impact on natural ecosystems. Global average temperatures have risen by 0.7ºC over the last century and are predicted to continue rising. The IPCC (2007) projectsthat temperatures are likely to have risen by 1.1ºC to 6.4ºC by the end of the 21st century relative to the 1980-1999 baseline. Although such projections do not account for mitigation policies, it is widely accepted that temperature rises are likely to surpass the lower bound, particularly as current models do not take into account climate-carbon cycle feedbacks. Temperature rises are linked to changes in precipitation regimes which can be predicted with less confidence asthey are largely influenced by regional processes (Fronzek and Carter 2007; Parra and Monahan 2008). Depending on the region, precipitation may be projected to increase, decrease and/or change in seasonal distribution. Increased incidence and severity of extreme events, such as hurricanes, tornadoes, catastrophic rainfall and drought, is also likely. Recent advances have improved understanding of the complex linkages between sea surface temperatures and precipitation regimes on land (Good et al. 2008; Harris et al. 2008) and helped to confirm that drought is indeed increasing in the Amazon (Li et al. 2008). Understanding precipitation regimes and their influence is vital for projecting changesin many natural systems (Knapp et al. 2008). It is also important to recognize that local climatic regimes comprising the full suite of climate variables are what influence the survival of species and ecosystems. With climate change, areas of rare climates are likely to shrink, and may result in the loss of rare endemic species (Öhlemüller et al. 2008).

The current loss of biodiversity has been broadly acknowledged as the main cause of ecosystem change (Hooper et al., 2012, Ceballos et al., 2015) and it has been suggested to undermine the ability of mankind to adapt to global change (Cardinale et al., 2012), accelerating ecosystem degradation (Hooper et al., 2012) and threatening human well-being (Díaz et al., 2006, Hanski et al., 2012). In 2002, signatory states agreed under the Convention on Biological Diversity (CBD) to tackle both human-induced extinction of species and the loss of natural habitats through a significant reduction of the current rate of biodiversity loss by 2010 (CBD, 2002, BirdLife International, 2013). A related target was set by European high-level delegations, who committed to halt biodiversity decline by 2010 (Pereira and Cooper, 2006, Mace and Baillie, 2007, van Strien et al., 2009). However, none of the targets were met (Butchart et al., 2010, Rands et al., 2010), and similar, but more explicit, goals were adopted within the CBD's Strategic Plan for Biodiversity 2011–2020 (CBD, 2010, Henle et al., 2013, Secretariat of the Convention on Biological Diversity, 2014), widely referred to as the Aichi Biodiversity Targets. So far, progress towards these goals has been poor, mainly because of the lack of a clear definition and operational indicators (Tittensor et al., 2014). To determine whether new targets formulated within the post-2020 Global Biodiversity Framework are accomplished, there is a need to develop summary statistics to describe trends in components of biodiversity as accurately and robustly as possible, while being at the same time useful and understandable for decision-makers (Reid et al., 1993, Gregory et al., 2005, Mace et al., 2018, Green et al., 2019).

Birds are a good candidate taxon for monitoring global environmental change, because they have long been monitored worldwide (Bibby, 1999, Pereira and Cooper, 2006, Schmeller et al., 2012). They are relatively easy to detect and identify, census methods are well developed and cheap, and many skilled volunteers are willing to count birds (Koskimies, 1989, Venier and Pearce, 2004, Gregory et al., 2005, Pereira and Cooper, 2006). Our understanding of their population biology, behaviour and life history (except in the tropics; Xiao et al., 2017) is good (Venier and Pearce, 2004, Gregory et al., 2005) and they are known to show predictable population responses to environmental change (Järvinen and Väisänen, 1979). They are also widespread and relatively diverse (~10,000 species globally) and tend to be at, or near, the top of the food chain, making them sensitive to changes at lower trophic levels (Koskimies, 1989, Gregory et al., 2005).

The need to measure biodiversity change has promoted the development of what are known as composite or multi-species indicators (Gregory et al., 2005, Maes and Van Dyck, 2005). The purpose of composite indicators is to integrate data of species and ecosystem change in such a way that information is reduced into simple meaningful, visual summaries or "indices" (Gregory et al., 2003, Pereira and Cooper, 2006, Fraixedas et al., 2015a, Fraixedas et al., 2015b). Some examples are the Biodiversity Intactness Index (BII; Scholes and Biggs, 2005) and the following associated Biodiversity Intactness Variance (BIV; Hui et al., 2008), the Red List Index (RLI; Butchart et al., 2004, Butchart et al., 2005, Butchart et al., 2007), the Living Planet Index (LPI; Loh et al., 2005), or the more recent Biodiversity Change Index (BCI; Normander et al., 2012).

Composite trend indicators are one example where a group of species population trends are taken together to describe environmental changes. The main goal is to reflect the population response, but also to mirror that of other species reacting to the same human disturbance, therefore acting as a surrogate for ecosystem health (Caro and D'Oherty, 1999, Gregory et al., 2005). Probably the best-known example among birds is the Wild Bird Index (WBI; Gregory et al., 1999, Gregory et al., 2003), which is one of the better summary statistics available at a regional scale (Butchart et al., 2010, Tittensor et al., 2014). WBIs have been adopted by the EU and incorporated in the 'abundance and distribution of selected species', one of the Streamlining European Biodiversity Indicators (SEBI) set to address the EU biodiversity targets (EEA, 2012). This indicator (SEBI 01) reflects the general state of common birds in two main habitats (forest and farmland), which together represent the predominant land types in Europe (Gregory et al., 2005, EEA, 2012, Vallecillo et al., 2016). Importantly, these indicators are used to inform and improve current management practices, as is the case of the European Farmland Bird Indicator (EFBI; Butler et al., 2010). WBIs have also been used in global biodiversity syntheses (Butchart et al., 2010, Secretariat of the Convention on Biological Diversity, 2014, Tittensor et al., 2014).

Composite indicators have been further developed to describe the impacts of climate change on biodiversity. Examples, also known as pressure indicators, include the Community Temperature Index (CTI; Devictor et al., 2008, Devictor et al., 2012) and the Climate Impact Indicator (CII; Gregory et al., 2009, Stephens et al., 2016). The latter, based on bird data, has been also taken up by the EU (SEBI 011), under the name 'impacts of climate change on bird populations' (EEA, 2012), and used in global biodiversity assessments (Butchart et al., 2010, Tittensor et al., 2014).

Given the degree of integration of bird indicators into national and international policies (Gregory and van Strien, 2010), the present study represents a systematic review of recent scientific literature published on multi-species indicators (i.e. multi-species indices or multi-species annual summaries of a community reflecting changes in space and/or time) including bird data at the global, regional and national levels. We review four different types of indicators (state, benefit, response and pressure; BirdLife International, 2013), specifically focusing on site and species selection methodologies, spatial, seasonal and habitat coverage, and statistical issues in developing indicators and tools to tackle them. For this purpose, we summarise the general characteristics of the selected indicators by evaluating recent methodological advances, identifying current knowledge gaps and recognizing the main challenges in their applicability. We believe that a review such as this one is long overdue, given the proliferation of different indicators, their inconsistent use and applications, and all the knowledge gaps that jeopardize their interpretation across multiple spatial and temporal scales.

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8/22/2023