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WETLAND VEGETATION DIVERSITY AND ITS RELATIONSHIP WITH AVIAN FAUNA IN GOVINDGARH, REWA DISTRICT (M.P.)

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ABSTRACT :

Wetlands are vital ecosystems that support rich biodiversity, especially avian fauna, by offering a mosaic of habitats, nesting sites, and food sources. This study investigates the diversity of wetland vegetation in Govindgarh Wetland, Rewa (M.P.), and analyzes its relationship with bird species richness, distribution, and behavior over a 12-month period. Results reveal that a high diversity of macrophytes and aquatic vegetation correlates positively with avian abundance, particularly during migratory seasons. The findings emphasize the ecological interdependence between birds and vegetation and advocate for integrated wetland management.

KEYWORDS : *Wetland vegetation, Avian diversity, Govindgarh Wetland and Biodiversity.*

INTRODUCTION

Wetlands are dynamic and ecologically significant ecosystems that play a vital role in maintaining biodiversity, regulating hydrological processes, and supporting nutrient cycles. Defined by their unique hydric soils and vegetation adapted to saturated conditions, wetlands act as interfaces between terrestrial and aquatic systems. They provide critical habitats for a diverse range of flora and fauna, especially avian species, which utilize them for feeding, breeding, nesting, and migration stopovers. In tropical regions like India, wetlands offer refuge to thousands of bird species, many of which are sensitive to environmental changes, making them excellent ecological indicators.

The vegetation composition in a wetland directly influences its ecological functioning and biological productivity. Wetland vegetation can be classified into several functional groups—emergent, submerged, floating, and marginal plants—all of which play important roles in habitat structuring, nutrient cycling, sediment stabilization, and food web support. These plants provide foraging grounds and nesting materials, shelter from predators, and microclimates for avifauna. In turn, bird presence and diversity are often reflective of the vegetative health and complexity of the wetland environment.

Avian fauna is among the most visible and sensitive biotic components of wetland ecosystems. Birds respond quickly to changes in habitat conditions, water quality, and vegetation cover. Some bird species have specialized feeding habits and rely exclusively on certain plant types or aquatic vegetation

zones. For example, wading birds are often seen near emergent vegetation, while dabbling ducks prefer areas with floating plants, and piscivorous birds like kingfishers are found in regions rich in submerged vegetation that harbor fish. As such, the diversity and abundance of bird species in a wetland are inherently linked to the composition and health of its vegetative zones.

Govindgarh Wetland, located in the Rewa district of Madhya Pradesh, represents one of the lesser-known but ecologically significant wetlands of Central India. Spread over approximately 45 hectares and situated at an elevation of about 400 meters above sea level, this wetland is part of the Vindhyan Plateau ecosystem. It serves as a semi-natural freshwater reservoir that collects rainwater and supports hydrophytic vegetation along with aquatic and semi-aquatic species. The surrounding area includes agricultural land, scrub forests, and human settlements, which influence the ecological balance of the wetland.

Govindgarh Wetland hosts both resident and migratory birds, particularly during the winter season when migratory species from Central Asia and the Himalayas visit. It acts as a critical feeding and resting ground for various bird groups such as ducks, herons, cormorants, lapwings, and storks. However, despite its ecological importance, the wetland has not been extensively studied for its vegetative biodiversity or its relationship with birdlife. The encroachment of invasive species like *Eichhornia crassipes* (water hyacinth), seasonal drying, agricultural runoff, and lack of conservation awareness pose significant threats to its long-term health. Given the current environmental pressures and the ecological significance of both wetland vegetation and birds, there is a pressing need to investigate the interrelationship between the two. This research aims to document and analyze the diversity of wetland vegetation in the Govindgarh Wetland and study how it influences the distribution, abundance, and behavior of avian species across different seasons. By correlating bird presence and diversity with vegetation structure, this study seeks to understand the ecological balance and the dependency patterns between flora and fauna within the wetland.

The objectives of the study include:

1. To identify and classify the different types of wetland vegetation present in Govindgarh Wetland.
2. To assess the diversity and abundance of avian fauna across seasonal cycles.
3. To analyze the relationship between vegetation diversity and avian population richness.
4. To evaluate the role of wetland vegetation in providing critical ecosystem services for birdlife.
5. To generate recommendations for habitat conservation and integrated wetland management.

This study holds significant value from both a scientific and conservation perspective. Understanding how vegetation influences bird diversity is essential for wetland restoration, biodiversity protection, and sustainable ecotourism development. The findings from Govindgarh can serve as a model for similar small-scale wetlands that are often overlooked in conservation planning but play an essential role in regional ecological networks. By focusing on the bird-vegetation dynamic, this research also contributes to larger discussions on climate resilience, land-use planning, and community-based conservation efforts in Madhya Pradesh and beyond.

Wetlands like Govindgarh are not merely passive water bodies; they are living ecosystems that thrive on complex interactions between plants, animals, water, and human activities. This study underscores the importance of viewing wetlands as integrated systems and recognizing avian fauna as both beneficiaries and indicators of vegetative health. Through detailed field observations and data analysis, this paper will explore how the harmony between wetland vegetation and bird communities can be maintained and leveraged for sustainable biodiversity management.

MATERIALS AND METHODS:

Study Area: Govindgarh Wetland lies approximately 18 km from Rewa city in Madhya Pradesh, India (Latitude: 24.53° N, Longitude: 81.28° E), at an elevation of about 400 meters above sea level. The wetland is a semi-natural freshwater body surrounded by agricultural land and human settlements. It

receives seasonal inflow from monsoonal rain and supports a variety of aquatic and semi-aquatic flora and fauna.

Duration of Study: The study was conducted over a period of 12 months, from January 2024 to December 2024, to capture seasonal variations in bird populations and water parameters.

Vegetation Survey: To assess the diversity and distribution of wetland vegetation in the Govindgarh Wetland, a systematic survey was conducted using a combination of Quadrat sampling and Line transect methods. The quadrat method involved placing square plots of standard dimensions 1×1 meter for herbaceous and aquatic plants, and 5×5 meters for shrubs and marginal vegetation at randomly selected locations throughout the wetland area. These quadrats were surveyed monthly, ensuring representation across various seasonal stages including pre-monsoon, monsoon, post-monsoon, and winter. In addition to quadrats, line transects were laid along the marshy edges and open water zones of the wetland to capture spatial variations in vegetative composition and structure. These transects allowed for qualitative observations and provided insight into dominant plant species across different hydrological zones. Each identified plant species within the quadrats or along transects was recorded and classified according to growth form (emergent, submerged, floating, or marginal). The identification of wetland flora was carried out using standard botanical references including *Aquatic and Wetland Plants of India* and the *Flora of Madhya Pradesh*. These references aided in confirming the taxonomy, habitat preference, and ecological characteristics of each species encountered during the survey.

Avian Survey : To document the avian diversity and analyze its relationship with vegetation patterns, standard ornithological techniques were employed primarily the Point Count Method and Line Transect Method. These methods are widely recognized for surveying bird populations in wetland ecosystems. Bird observations were conducted twice daily, during early morning hours (6:30 AM to 9:00 AM) and late afternoon hours (4:30 PM to 6:30 PM), when birds are most active. Observers maintained a reasonable distance from the birds to avoid disturbance while recording species, numbers, behavior, and habitat preference. Field equipment included 10×50 binoculars for long-range identification and a DSLR camera for photo documentation. Identification was supported by widely acknowledged field guides such as *The Book of Indian Birds* by Dr. Salim Ali and *Birds of the Indian Subcontinent* by Grimmett, Inskipp, and Inskipp. Bird species were classified based on their feeding habits, habitat use, migratory status, and association with specific vegetation zones. Both resident and migratory bird species were recorded and categorized across different seasons. Particular attention was given to behavioral patterns such as feeding, nesting, and flocking that could reflect habitat preferences and the ecological role of vegetation.

Data Analysis : The data collected from vegetation and avian surveys were subjected to statistical analysis to determine species diversity, richness, and correlation between bird populations and vegetative composition. Vegetation data were analyzed using the Shannon-Wiener Diversity Index (H') to quantify species diversity. This index considers both species richness and evenness, providing a holistic picture of plant community structure. Dominance and frequency of individual species were also calculated to assess ecological significance. Avian data were analyzed seasonally to observe changes in abundance, richness, and species turnover. Pearson's correlation coefficient was used to determine the strength of association between bird diversity and vegetation diversity, aiming to highlight potential habitat dependencies and ecological interactions. Comparative analyses were also conducted across different seasons to evaluate how the temporal variation in vegetation structure influenced the presence and behavior of bird species. Statistical tools such as Microsoft Excel and PAST (Paleontological Statistics Software) were utilized for data computation, graphical representation, and diversity analysis.

RESULTS AND DISCUSSION:

Vegetation Composition and Diversity: The vegetation survey of Govindgarh Wetland revealed a diverse assemblage of plant species representing emergent, submerged, floating, and marginal forms. A total of 42 plant species were recorded during the study, comprising 18 emergent, 9 submerged, 6 floating, and 9 marginal species. Dominant emergent species included *Typha angustata*, *Cyperus rotundus*, and *Phragmites karka*, which formed dense patches in shallow zones. Submerged species like *Hydrilla verticillata* and *Najas indica* were more prevalent during the monsoon and post-monsoon seasons. Floating species such as *Eichhornia crassipes* and *Pistia stratiotes* showed explosive growth during the warmer months. The Shannon-Wiener Diversity Index (H′) for vegetation ranged from 1.45 (monsoon) to 2.25 (winter), indicating moderate to high diversity with noticeable seasonal variation. Higher diversity during winter was attributed to lower water levels exposing more ground for marginal plant colonization. Seasonal water fluctuation and nutrient inflow played a significant role in altering the plant composition across the year.

Avian Faunal Richness and Seasonal Patterns : A total of 64 bird species were observed throughout the year, belonging to 12 orders and 25 families, including migratory, resident, and local migratory birds. Key groups included Anatidae (ducks), Ardeidae (herons and egrets), Charadriidae (plovers), and Accipitridae (raptors). The most abundant species were Indian Pond Heron (*Ardeola grayii*), Spot-billed Duck (*Anas poecilorhyncha*), and Black-winged Stilt (*Himantopus himantopus*). Bird diversity showed seasonal fluctuations, with the highest richness recorded during the winter months (November–February) due to the arrival of migratory species such as Bar-headed Goose, Common Teal, and Red-crested Pochard. During summer and monsoon seasons, species richness decreased, but breeding and nesting behaviors were more prominent among resident species like egrets, lapwings, and cormorants.

Correlation Between Vegetation and Bird Diversity : Statistical analysis revealed a positive correlation ($r = 0.72$, $p < 0.05$) between the Shannon-Wiener Index of vegetation and avian species richness, indicating that greater plant diversity supported higher bird abundance and diversity. This trend was most evident during the winter season when both vegetation and avian diversity peaked due to optimal habitat conditions. Species such as Jacanas and Purple Swamphens were often associated with dense floating vegetation, while kingfishers and cormorants were more frequent in open water stretches. The variation in plant structure and zonation provided niches for different feeding guilds, including insectivores, piscivores, herbivores, and omnivores.

Water Quality and Its Influence on Vegetation : Analysis of water parameters supported the interpretation of habitat quality. Average monthly data are summarized below:

Parameter	Range Observed	Optimal Range
Temperature (°C)	17.6 – 30.8	15–35
pH	6.7 – 8.4	6.5–8.5
TDS (mg/L)	210 – 435	<500
Conductivity (µS/cm)	320 – 720	<1000
DO (mg/L)	3.5 – 7.8	>5
BOD (mg/L)	1.8 – 4.6	<6
COD (mg/L)	5.5 – 14.2	<20
Nitrate (mg/L)	0.2 – 2.5	<5
Phosphate (mg/L)	0.03 – 0.65	<0.7

Water parameters remained within the permissible limits for supporting aquatic life. Seasonal fluctuations, particularly a decline in DO during the monsoon, were associated with increased organic load and reduced photosynthetic activity due to turbidity. These changes impacted submerged and floating plant populations, which in turn influenced bird distribution and feeding activity.

Seasonal Guild Dynamics : Guild analysis revealed distinct seasonal shifts in bird activity. For instance:

- Wading birds such as herons and stilts were observed year-round, preferring shallow marshy zones.
- Dabbling ducks dominated winter months, feeding on aquatic vegetation and invertebrates.
- Piscivores like kingfishers and cormorants were more active in pre-monsoon when water clarity improved.
- Insectivorous passerines were abundant during post-monsoon, capitalizing on insect blooms in marshes.

These dynamics illustrate the functional connectivity between vegetation types and bird feeding behavior.

The multi-layered vegetation structure of the wetland creates microhabitats essential for nesting, foraging, and shelter. The migratory influx during winter not only boosts avian diversity but also suggests that Govindgarh Wetland lies on an important migratory route. Despite moderate anthropogenic disturbances, the wetland continues to sustain a resilient ecological web. The richness of wetland-dependent birds serves as a bioindicator of habitat quality, reaffirming the importance of maintaining vegetative heterogeneity. The study demonstrates a clear ecological linkage between vegetation composition and avian diversity in the Govindgarh Wetland. By supporting various plant communities, the wetland facilitates niche differentiation and seasonal congregation of diverse bird species. The health of the vegetation, influenced by hydrological and physicochemical factors, directly impacts bird behavior and abundance. These findings emphasize the need for holistic conservation approaches focusing on both floral and faunal components to ensure long-term ecological sustainability.

CONCLUSION:

The findings of the study emphasize that Govindgarh Wetland is a biologically rich and ecologically significant habitat supporting a diverse array of wetland vegetation and avian fauna. The composition and distribution of plant species varied seasonally, offering critical ecological services such as shelter, nesting grounds, and food resources to both resident and migratory bird species. The presence of a wide range of bird guilds waders, piscivores, granivores, insectivores reflects the structural complexity and productivity of the habitat. Such vegetative diversity acts as a foundation for sustaining avian biodiversity and overall wetland functioning. Furthermore, statistical analyses confirmed a positive correlation between vegetation richness and bird abundance, reinforcing the idea that healthy wetland vegetation directly influences avian diversity and population dynamics. This interrelationship is vital for maintaining the ecological balance of the wetland. However, the increasing anthropogenic pressure and changing climatic conditions pose serious threats to this fragile ecosystem. Hence, immediate conservation efforts, habitat restoration, and public awareness are essential to protect and preserve the integrity of the Govindgarh Wetland for future generations.

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