



Impact Of Electromagnetic Radiations Emitted From Communication Towers On The Rural Avifaunal Diversity Of Aligarh Region

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Abstract: A field investigation was conducted from January 2022 to December 2022 in the rural landscape of the Aligarh region to assess the effect of electromagnetic radiations emitted by communication towers on avifaunal diversity. Three significant sites in this area were chosen for the study, including one control site with no cell phone tower. At each site, avifaunal species abundance, richness, and evenness were recorded along with observations of certain bird behavioral features. The data was gathered using the point count and sighting approach. Shannon and Weiner's diversity index was used in the calculations. The LATNEX Triple Axis HF-B3GR meter was used to calculate electric field strength. The survey revealed high impact of electromagnetic radiations on the avifaunal diversity at sites under strong electromagnetic field whereas at the control site no such effect was noticed. Moreover, some distortions in the breeding & feeding patterns as well as migration rate were also observed.

Keywords: Avifauna • Electromagnetic Radiations • Communication towers • Biodiversity • Point Count

Introduction

Aligarh is located at 27.88°N and 78.08°E latitude and longitude. It is approximately 178 meters above sea level. The number of communication towers in the district's rural and urban areas has been increasing day by day, generating electromagnetic pollution and posing a significant threat to biodiversity. Human involvement has posed significant challenges to biodiversity throughout history, contributing to ecological imbalances. Major threats to biodiversity exploitation, as summarized in the scientific literature, are deforestation, overexploitation, air, water, and land pollution, climate change, and so on. However, there is an emerging pollution that is quite detrimental to biodiversity and is not being prioritized by the scientific research community to the best of its ability, which is electromagnetic radiation pollution caused by communication towers. Despite recent studies suggesting that EMF may be hazardous to various species, there is insufficient data on birds and other wildlife

species. The Aligarh region is rich in biodiversity and provides an ideal setting for such research. The current study focuses on the influence of communication tower radiations on avifaunal diversity in the Aligarh region's rural terrain. Along with this, emphasis is placed on the impact of electromagnetic radiations on behavioral and physiological changes.

Material and Methods:

The study was conducted from Jan 2022 to Dec 2022 in the rural landscape of Aligarh region. For the purpose of study three different sites has been selected. Two sites were considered with communication towers in the centre and one site without any communication tower was selected as control site (**Table 1**).

Diversity of avifauna at all sites was recorded on the basis of point count, transect walk and sighting method. Counting of birds within 200 meters radius of cell towers was made at each site. Identification of birds was carried out on the basis of their morphological characters such as shape, size, color, beak, wings, eyes, feathers,



legs and other body parts. Readings were taken once a week for one site at specified location alternatively during complete study period. In

summer data was recorded from 6-8 am and 5-7 pm whereas in winter data was recorded from 8-10 am and 4-6 pm.

Table 1: Sites under location:

Location	Sites
Rural landscape of Aligarh region Geographical Coordinates- 27°55'N and 78°03'E. Height from sea level- 178 m	1. Shahapur (<i>Center of village</i>)- Site-1 2. Barutha (<i>Agricultural fields</i>)- Site-2 3. Jatpura (<i>Control site</i>)- Site-3

To detect the electric field strength from tower instrument LATNEX Triple Axis HF-B3G RF meter was used. Calculations were done for following parameters:

- a) **Species richness:** Total number of species in the given area.
- b) **Relative abundance:** Using formula – $\frac{n_i}{N} \times 100$ where n_i represents number of species and N represents the total number of birds seen.
- c) **Species diversity:** It was calculated by Shannon-Weiner index as per formula- $H = -\sum P_i \log P_i$ where P_i is proportion of the i^{th} species of birds and H is the Shannon's index.
- d) **Species evenness:** Its determined by following equation:

$J = H/H^*_{max}$ where H is observed species diversity and H^*_{max} is the log of total number of species richness.

Results and Discussion:

In the rural landscape of Aligarh while undergoing comparative analysis for the species abundance, richness, diversity and evenness at the three selected sites it was noticed that at Site 3 (*control site*) the values were quite higher than the other two sites which is a clear indication that the area under strong Electromagnetic field was having reduced avifaunal diversity than the one where no such radiation effect was considered. Average power density at all the selected sites was recorded with the help of RF meter as depicted below (**Table 2**):

Table 2: Average Power density recorded at different sites at various distances from the transmitting towers:

Sites	Power density near the base of the cell phone tower	25 m away from the cell phone tower	50 m away from the cell phone tower	100 m away from the cell phone tower	200 m away from the cell phone tower
Site-1	0.19	0.09	0.034	0.008	0.00412
Site-2	0.28	0.15	0.039	0.011	0.00435
Site-3	No tower present at this site (control site)				

Power density P_d at a distance R is given by:

$$P_d = \frac{P_t \times G_t}{4\pi R^2} \text{ Watt/m}^2$$

Here P_t = Transmitter power in Watts, G_t = Gain of transmitting antenna, R = Distance from the antenna in meters.



Annual relative abundance percentage of birds at Site 1 –Shahapur from Jan. 2022 to Dec. 2022

Site 1 of study area Shahapur is a village in Dhanipur Block in Aligarh District of Uttar Pradesh. It is located 14 KM towards East from District headquarters Aligarh. The area consists of vegetation comprising trees, shrubs, grassland and weeds of different kinds. Along with residential land we found agricultural spaces here. At this Site we found a total of 17 avian species. Common Myna was found to be highest abundant species with annual relative abundance percentage of (27.82%), which was followed by House Crow (19.15%). Rose Ringed Parakeet was third abundant species (13.68%), then Jungle babbler (12.95%), Rock Pigeon (10.06%) and others. Among the least abundant include Indian Peafowl with annual abundance rate of (0.45%), Spotted Owlet (0.68%) and Purple Sunbird (1.19%)

Quarterly analysis of Community Characteristics observed at Site I:

In the Quarterly analysis species richness was found highest in the Quarter 2nd with 16 species followed by Quarter 3rd having 15 species. The least species richness was found in Quarter 4th having 13 species. So we can clearly depict that during the months of April, May and June there were more number of birds species at the Site I whereas during the months of October, November and December the species found were least in number. Species diversity was found highest during the months of April, May and June i.e. 2.16 followed by July, August and September i.e. 1.96, Species Evenness was found highest during the months of April, May and June with values 0.94 which was followed by July, August and September having values 0.90. (Table 3)

Table 3: Community characteristics observed at Site I from Jan 2022 to Dec 2022:

	Jan-Mar, 2021	Apr- Jun, 2021	Jul- Sep, 2021	Oct- Dec, 2021
Species Richness	14	16	15	13
Species Diversity	1.56	2.16	1.96	1.28
Species Evenness	0.88	0.94	0.90	0.72

Annual relative abundance percentage of birds at Site 2 -Barutha from Jan. 2022 to Dec. 2022

Barutha village is located in Koil tehsil of Aligarh district in Uttar Pradesh, India. It is situated 12.5 km away from district headquarter Aligarh. The vegetation of this village include trees such as Neem, Shisham, Peepal, Mango, Jamun, Amla, Dhak, Sal etc. with some shrubs and various types of weeds. During the study period at this Site we found a total of 15 avian species among which Common Myna was found to be highest abundant species with annual relative abundance percentage of (28.22%), which was followed by House Crow (21.29%).

Parakeet was third abundant species (12.86%), then Rock Pigeon (10.52%) and others.

Quarterly analysis of Community Characteristics observed at Site II:

Avifaunal species richness was found highest in the Quarter 2nd with 14 species followed by Quarter 3rd having 13 species. So we can clearly depict that during the months of April, May and June there were more number of species at this site whereas during the months of October, November and December the Species found were least in number. Species diversity was found highest during the months of July, August and September i.e. 1.96 followed by January, February and March i.e. 1.48. Evenness was recorded highest during the months of July,



August and September with values 0.96 (Tab- 4)

Table 4: Community characteristics observed at Site II from Jan 2022 to Dec 2022:

	Jan-Mar, 2021	Apr- Jun, 2021	Jul- Sep, 2021	Oct-Dec, 2021
Species Richness	13	14	13	12
Species Diversity	1.62	1.48	1.96	1.11
Species Evenness	0.74	0.92	0.96	0.68

Annual relative abundance percentage of birds at Site 3 Jatpura from Jan. 2022 to Dec. 2022

Jatpura village is located in Koil tehsil of Aligarh district in Uttar Pradesh, India. It is situated 11km away from district headquarter Aligarh. The main vegetation of the village includes trees, shrubs, grasses and weeds of several kinds along with the agricultural crops. At this Site we found a total of 21 avian species among which Common Myna was found to be highest abundant species with annual relative abundance percentage of (29.54%), which was followed by House Crow (21.19%). Jungle Babbler was third abundant species (11.97%). Among the least abundant include Lesser Golden Woodpecker with annual abundance rate of (0.35%), Common Tailorbird (0.19%) and Spotted Munia (0.38%)

Quarterly analysis of Community Characteristics observed at Site III:

During quarterly analysis species richness was found highest in the Quarter 2nd with 20 species observed followed by Quarter 3rd having 18 species. So we can clearly depict that during the months of April, May and June there were more number of species at the Site III. Species diversity was found highest during the months of July, August and September i.e. 2.90 followed by April, May and June i.e. 2.60 during the year 2022. Species Evenness was found highest during the months of April, May and June with values 0.96 which was followed by July, August and September having values 0.92. (Table 5)

Table 5: Average relative abundance, richness, diversity and evenness of avian species at Site III from Jan 2022 to Dec 2022:

	Jan-Mar, 2021	Apr- Jun, 2021	Jul- Sep, 2021	Oct- Dec, 2021
Species Richness	15	20	18	14
Species Diversity	1.86	2.60	2.90	1.68
Species Evenness	0.84	0.96	0.92	0.82

In the rural landscape of Aligarh we got a total of 17 species of birds at Site1 and 15 species at the Site2 where as at Site3 (control site) the maximum numbers of species observed were 21. This shows that the sites with strong EMR consist of lesser number of species than the sites

without the electromagnetic field. During the comparative analysis it was also found that species diversity and evenness was relatively higher at the Site without any electromagnetic field than the sites having strong electromagnetic field. (Table 5)

Table 5: Comparative analysis of average relative abundance, richness, diversity and evenness of avian species at three Sites from Jan 2022 to Dec 2022:



Community Characteristics	Site -1	Site- 2	Site-3 (control)
Species Abundance	8.64	7.23	9.75
Species Richness	10	07	14
Species Diversity	1.72	1.38	2.24
Species Evenness	0.86	0.78	0.96

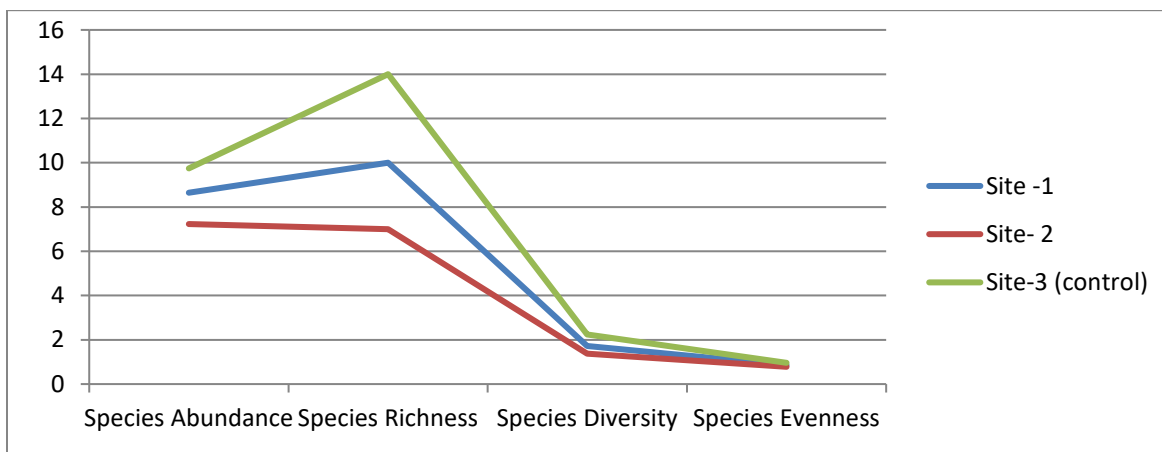


Fig 1: Graphical representation of avifaunal diversity, richness abundance and evenness at 3 sites

Behavioral Characteristics observed at the three Sites

While analyzing the behavioral characteristics it was noticed that the nesting activities at all the sites were normal. Breeding rate was little distorted at Site II but it seemed normal at the other two sites with normal incubation period of 12-18 days was observed in some birds by peaceful visualizing some nests on the trees with hatching success of 85%. Rate of migration was although normal at Control Site but it was distorted at Site I and Site II. Other activities like biting, feather fluffing regurgitation and perch balancing were observed as normal at all the three Sites under study except some bulging, sleepy and dilating eyes were observed at Sites under strong EMR field. In the course of study it was noticed that some fledgling and juvenile showed less development of feathers on their body along with discoloration in their feathers. Whereas at the control site a normal health and well being was observed in the birds.

Conclusion

Radiation is not only a serious hazard for the birds but also to other species. The unfortunate thing is that even the most common species are not visible in our surrounding today. The impact in the urban areas is manifold but the rural is also not far from that grip. In concern of biological effectiveness of EMR on the health and wellbeing it is observed that at sites within the Electromagnetic radiations, a lot of birds were found with distorted postures and dilating eyes. During continuous observation aggressive behavior with enhanced biting and feather plucking was also noticed among the birds of various species. Some birds accidentally hit with the communication towers which severely caused their deaths. Along with these anthropogenic activities also pose a great threat to avifauna in the rural landscapes. In order to maintain the ecological balance diversity of



birds needs to be maintained and a look towards alternate technologies is the need of hour.

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