

The Repercussion of a Transformed Environment on the Diversity and Abundance of Common Avifauna in the Asansol - Burnpur Industrial Zone, West Bengal, India

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ABSTRACT

Birds are one of the most eye-catching creatures of the world and are a matter of study of the naturalists from the old days. Avifaunal diversity of any habitat can be used as a tool for ecological evaluation. Asansol-Burnpur industrial area is situated by the side of the river Damodar. The highly populated city is famous for its steel industry and many other small-large scale industries. Birds in the Asansol-Burnpur area were examined in 2014 and again in 2021 to record their diversity and the effect of environmental changes on them. A good diversity of 42 bird species belonging to 14 orders and 25 families are recorded from the locality. The majority of them

belong to the order Passeriformes. The IUCN status of one species (Indian Spotted Eagle) from the area is 'Vulnerable'. The study revealed that there is a clear decline in numbers and relative abundance of most of the common bird species in the area within 7 years. Bird species that have smaller population sizes seem more in danger. Habitat loss, excessive human intervention, electromagnetic pollution, and environmental pollution came out as some of the major threats to the bird population in the area. To protect the avifaunal diversity in the area, these matters need immediate attention. Awareness building among the community and following government guidelines for the conservation of birds is necessary.

Keywords Avifauna, Diversity, Relative abundance, Asansol-Burnpur, Environment change.

INTRODUCTION

Birds the feathered biped, are extensively studied due to their morphological beauty, unique physiology, interesting behaviors, and phylogeny. Worldwide, more than 11 thousand Avian species under 253 families and 44 orders are listed so far (Gill *et al.* 2022). The Indian sub-continent is home to a wide array of wildlife including avifauna. Approximately 13% of the world's avifauna are present in this country (Patra and Chakraborty 2014). Birds play a major role in our ecosystem, from acting as scavengers to pollinators to predators of plant pests, and so on. Some of them are remarkably good imitators of the human voice and sometimes domesticated. From ancient times birds

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become an integral part of our culture and literature.

The study of avifaunal diversity is an essential tool for the ecological evaluation of any particular habitat (Roy *et al.* 2012). Today, the global avifaunal diversity facing decline due to anthropogenic disturbances and climate change (Murphy and Romanuk 2014, Gaüzère *et al.* 2016). According to IUCN red list, 13% of the world's avifauna are threatened. Rapid urbanization and industrialization lead to environmental decline, which may have an impact on the diversity of birds. Birds respond very quickly to habitat changes (Isaksson 2018). The monitoring of species abundance along with their habitat provides important information about their population fluctuation (Norvell *et al.* 2003). Subsequently, this information may be helpful in formulating management as well as conservation strategies for threatened, endangered, and vulnerable species (Sauer and Link 2002).

Asansol is a metropolitan city and district headquarter of Paschim Bardhaman in West Bengal, India. It is the most populated and second-largest city in West Bengal. The elevation of the city is 111 meters. Burnpur is an industrial area including

the IISCO (Indian Iron and Steel Company) steel plant, basically a captive settlement of SAIL (Steel Authority of India Limited). The Asansol-Burnpur area possesses diverse habitats including scattered large tree coverage, fields, water bodies, dense human habitations, abundant coal mines. In the core of the city, vegetation is scanty nowadays. Some places in Asansol-Burnpur still with good green coverage and the water bodies surrounded by trees provide homage to a large number of bird species. The present study aims to provide a checklist of different birds found in this area and also to find out their abundance. The impact of the transformed environment on the diversity and abundance of the birds in the area will also be assessed. The results may create awareness for their conservation.

MATERIALS AND METHODS

Four sites within the Asansol-Burnpur industrial zone (Fig. 1) were selected for the study:

Site-1. *Nehru park and Burnpur township* (23.63432° N, 86.94681° E): Located in the close vicinity of SAIL-ISP on the bank of the Damodar River. Even

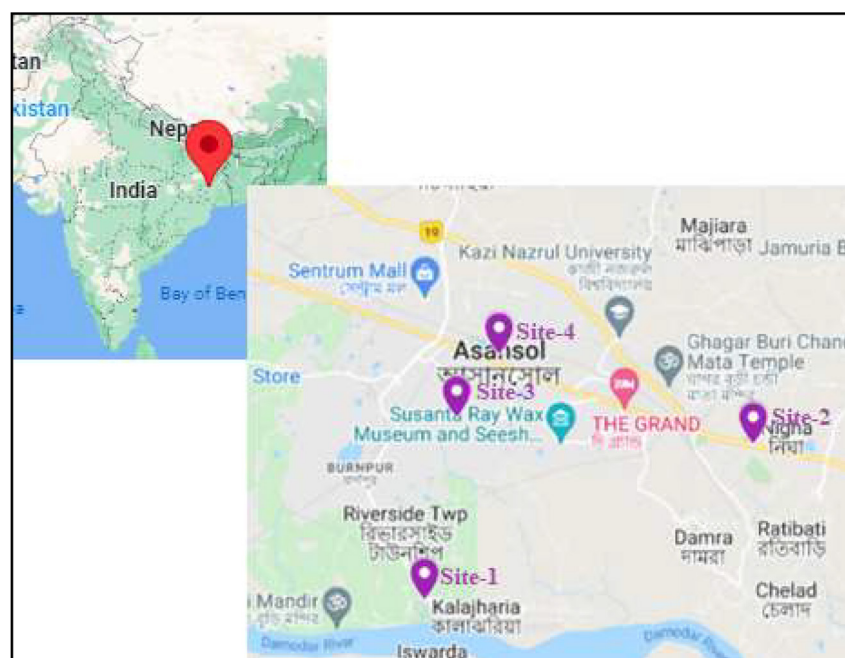


Fig. 1. Location of study sites in Asansol-Burnpur area, West Bengal, India (retrieved from Google maps).

though there are minor hiccups with the vehicle's mobility, these locations are overshadowed by the twittering of birds in the evening.

Site-2. *Gunjan ecological park and the surrounding area* (23.67083° N, 87.02672° E): Situated by the NH-19 (old NH-2), beside river Nunia. The area is covered with greenery, suitable for birds.

Site-3. *B. C. college pond, college campus, and surrounding areas* (23.6769° N, 86.9549° E): Located in the core of the city. This area is very crowded and with a large number of residential houses. Trees in the college campus and surrounding areas provide homage to birds.

Site-4. *Loco pond, and Durand Hall surrounding areas* (23.6897° N, 86.9673° E): Durand Hall is one of the oldest architectural landmarks of Asansol. River Nunia passes close to this site. Old railway quarters and a large number of old trees and bushes act as a home to a significant number of birds.

All the sites possess a significant amount of green coverage and a nearby water source. All the sites were regularly monitored for different bird species, in the morning and at the end of the day. The first series of surveys were carried out in the year 2014 and the second series in 2021 to find out the change in diversity and abundance of the local avifauna. Approximately 8 hours are employed for each site each year.

Birds were watched and then photographed by digital cameras (Nikon S3500, D3400). Identification was done by their external features and a few by their characteristic calls and behaviors (Ali and Ripely

1987, Ali 2002, Grimmett *et al.* 2011).

The relative abundance of a species was calculated using the formula: $n/N \times 10$

where n = Number of particular bird species, N = Total observations detected for all species (Zakaria *et al.* 2009).

RESULTS AND DISCUSSION

A total of 2342 birds were observed during the 2014 study and 2073 birds were observed during the 2021 study work. Birds belonged to 14 orders recorded from the Asansol-Burnpur industrial area during the study of 2014 and 2021. Among them, the number of species belonging to the order Passeriformes is the dominant one (35.71% and 37.50% in 2014 and 2021 respectively). More than half of the observed birds (in numbers) are from Passeriformes (10 families including 15 species) followed by the birds from the order Columbiformes (1 family including 2 species), Coraciiformes (3 families including 6 species), Psittaciformes (1 family including 2 species), Cuculiformes (1 family including 2 species), Pelecaniformes (1 family including 3 species), Galliformes (1 family including 2 species), Anseriformes (1 family including 2 species), Piciformes (1 family including 1 species), Suliformes (1 family including 2 species), Accipitriformes (1 family including 2 species) and Bucerotiformes, Gruiformes and Strigiformes (each with 1 species under single family) (Table 1). A comparative representation of each order

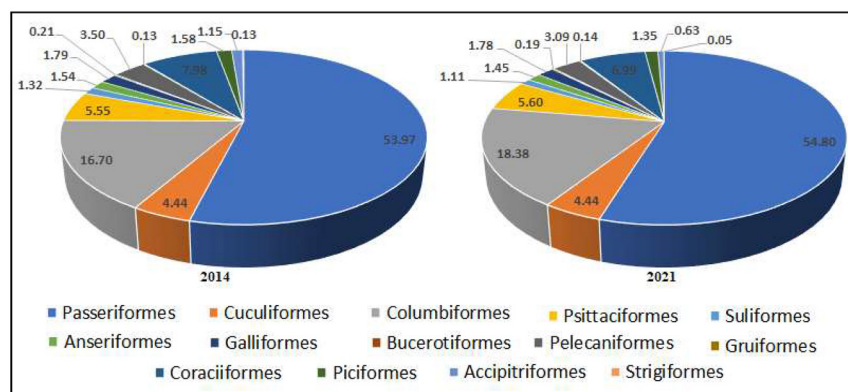


Fig. 2. Percentage of birds representing different orders.

Table 1. Checklist of common birds of Asansol-Burnpur industrial area observed in 2014 and 2021. NO = Number Observed, RA = Relative Abundance, SO = Sites of Observation.

Sl. No.	Common name	Scientific name	Order	Family	2014			2021		
					NO	RA (%)	SO	NO	RA (%)	SO
1	House Sparrow	<i>Passer domesticus</i>	Passeriformes	Passeridae	87	3.715	1,2,3,4	70	3.377	1,2,4
2	Indian Crow	<i>Corvus splendens</i>		Corvidae	164	7.003	1,2,3,4	130	6.271	1,2,3,4
3	Red-vented Bulbul	<i>Pycnonotus cafer</i>		Pycnonotidae	110	4.697	1,2,3,4	98	4.727	1,2,3,4
4	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>			9	0.384	1,2	8	0.386	1,2
5	Indian Pied Myna	<i>Gracupica contra</i>		Sturnidae	116	4.953	2,3,4	103	4.969	1,2,3,4
6	Common Myna	<i>Acridotheres tristis</i>			280	11.956	1,2,3,4	287	13.845	1,2,3,4
7	Brahminy Myna	<i>Sturnia pagodarum</i>			65	2.775	1,3	69	3.329	1,3
8	Jungle Babbler	<i>Argya striata</i>		Leiothrichidae	296	12.639	1,2,3,4	266	12.832	1,2,3,4
9	Purple Sunbird	<i>Cinnyris asiaticus</i>		Nectariniidae	22	0.939	1,2	16	0.772	1,2
10	Olive-backed Sunbird	<i>Cinnyris jugularis</i>			8	0.342	3	4	0.193	2
11	Oriental Magpie-Robin	<i>Copsychus saularis</i>		Muscicapidae	19	0.811	1,3	14	0.675	1,3
12	Pied Bush Chat	<i>Saxicola caprata</i>			39	1.665	2,4	37	1.785	2,4
13	Baya Weaver	<i>Ploceus philippinus</i>		Ploceidae	4	0.171	2	1	0.048	2
11	Common Tailorbird	<i>Orthotomus sutorius</i>		Cisticolidae	5	0.213	1,2	0	0.000	NA
15	Black Drongo	<i>Dicrurus</i>		Dicruridae	40	1.708	1,2	33	1.592	1,2
16	Asian Koel	<i>Macrocercus Eudynamis</i>	Cuculiformes	Cuculidae	89	3.800	1,2,3	76	3.666	1,2,3
17	Greater Coucal	<i>Scolopaceus Centropus sinensis</i>			15	0.640	1,3	16	0.772	1,3
18	Rock Pigeon	<i>Columba livia</i>	Columbiformes	Columbidae	201	8.582	1,3,4	186	8.973	1,3,4
19	Spotted Dove	<i>Spilopelia chinensis</i>			190	8.113	1,3,4	195	9.407	1,2,3,4
20	Rose Ringed Parakeet	<i>Psittacula krameri</i>	Psittaciformes	Psittaculidae	125	5.337	1,2,3,4	116	5.596	1,2,3,4
21	Alexandrine Parakeet	<i>Psittacula eupatria</i>			5	0.213	3	0	0.000	NA
22	Indian Cormorant	<i>Phalacrocorax Fuscicollis</i>	Suliformes	Phalacrocoracidae	16	0.683	1,3,4	11	0.531	1,3,4
23	Little Cormorant	<i>Microcarbo niger</i>			15	0.640	1,4	12	0.579	1,4
24	Indian Spot-billed Duck	<i>Anas Poecilorhyncha</i>	Anseriformes	Anatidae	22	0.939	1,3	20	0.965	1,3
25	Lesser Whistling Duck	<i>Dendrocygna Javanica</i>			14	0.598	1,4	10	0.482	1,4
26	Red Junglefowl	<i>Gallus gallus</i>	Galliformes	Phasianidae	30	1.281	2,3	25	1.206	2,3
27	Japanese Quail	<i>Coturnix japonica</i>			12	0.512	1,2	12	0.579	1,2
28	Hoopoe	<i>Upupa epops</i>	Bucerotiformes	Upupidae	5	0.213	1,2,4	4	0.193	1,2,4
29	Cattle Egret	<i>Bubulcus ibis</i>	Pelecaniformes	Ardeidae	29	1.238	1,3	29	1.399	1,3
30	Intermediate Egret	<i>Ardea intermedia</i>			26	1.110	3,4	15	0.724	3,4
31	Indian Pond Heron	<i>Ardeola grayii</i>			27	1.153	1,2,4	20	0.965	1,2,4
32	White-breasted Waterhen	<i>Amauornis Phoenicurus</i>	Gruiformes	Rallidae	3	0.128	2	3	0.145	2
33	Asian green bee-eater	<i>Merops orientalis</i>	Coraciiformes	Meropidae	29	1.238	1,2,3	22	1.061	1,2,3
34	Blue-tailed Bee-eater	<i>Merops philippinus</i>			23	0.982	1,2,4	17	0.820	1,2,4
35	Common Kingfisher	<i>Alcedo atthis</i>		Alcedinidae	39	1.665	1,2,4	41	1.978	1,2,4
36	Stork-billed Kingfisher	<i>Pelargopsis capensis</i>			20	0.854	1,2,4	16	0.772	1,2,4
37	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>			19	0.811	1,2,4	10	0.482	1,2,4
38	Indian Roller	<i>Coracias benghalensis</i>		Coraciidae	57	2.434	1,2,3,4	39	1.881	1,2,3,4
39	Common Flameback Woodpecker	<i>Dinopium javanense</i>	Piciformes	Picidae	37	1.580	1,2	28	1.351	1,2
40	Black Kite	<i>Milvus migrans</i>	Accipitriformes	Accipitridae	17	0.726	2,3	11	0.531	2,3
41	Indian Spotted Eagle	<i>Clanga hastata</i>			10	0.427	2,3	2	0.096	2,3
42	Indian Spotted Owl	<i>Athene brama</i>	Strigiformes	Strigidae	3	0.128	3,4	1	0.048	3
Total =					2342	100		2073	100	

is presented in Fig. 2.

In the area, 42 species were observed during 2014 but 40 in 2021 (Plates 1, 2). The grand total of observed birds, the total number of birds in case of 34 species, and the relative abundance of 26 species were noted to be decreased in 2021 in comparison to 2014 (Fig. 3). Statistical analysis shows that the change in relative abundances of different species from 2014 to 2021 is significant ($p < 0.05$). Of the 42 species recorded from the area, one species (Indian Spotted

Eagle) is designated as 'Vulnerable' on IUCN red list, and others are on 'least concerned'.

The decreased relative abundance of many bird species indicates that these birds' environments may have deteriorated significantly during the last few years. The prime factor behind the decline of bird abundance is habitat degradation. Because Asansol is a heavily populated city, the new construction or widening of roadways has been done to accommodate the tremendous pressure of traffic on the roads,



Plate 1. Birds of Asansol - Burnpur Industrial Zone, West Bengal, India. (A) House Sparrow, (B) Indian Crow, (C) Red-vented Bulbul, (D) Indian Pied Myna, (E) Brahminy Myna, (F) Jungle Babbler, (G) Purple Sunbird, (H) Olive-backed Sunbird, (I) Oriental Magpie-Robin, (J) Baya Weaver, (K) Common Tailorbird, (L) Black Drongo.

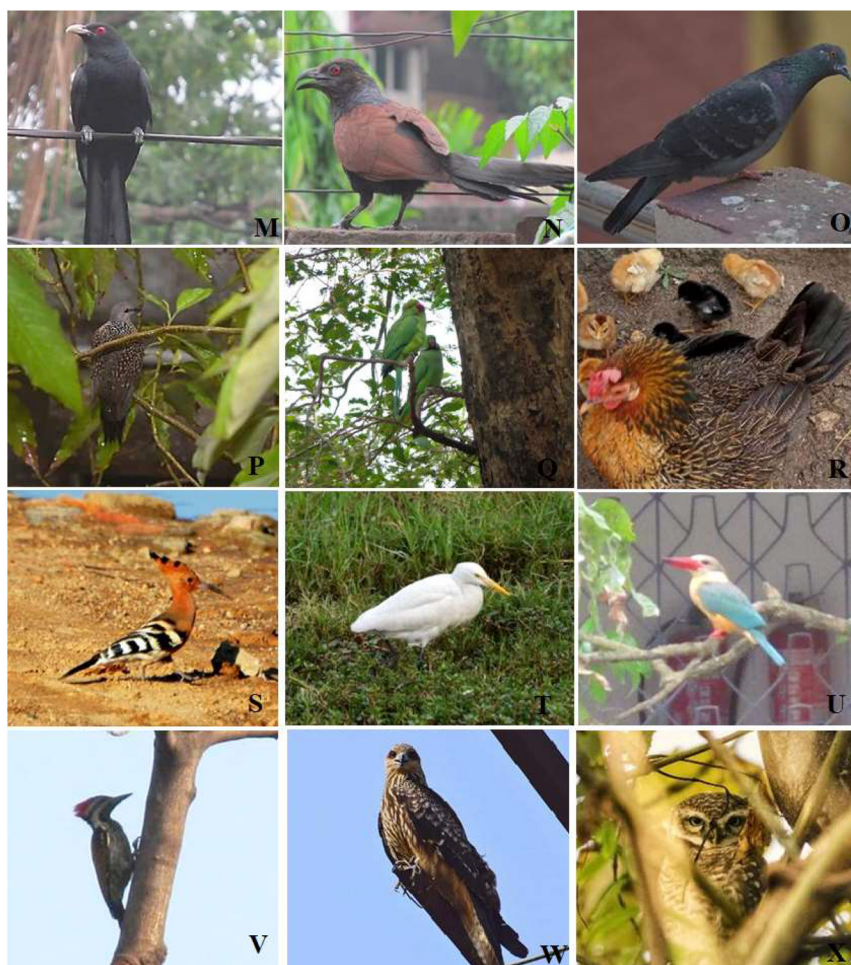


Plate 2. Birds of Asansol - Burnpur Industrial Zone, West Bengal, India. (M) Asian Koel, (N) Greater Coucal, (O) Rock Pigeon, (P) Spotted Dove, (Q) Rose Ringed Parakeet, (R) Red Junglefowl, (S) Hoopoe, (T) Cattle Egret, (U) Stork-billed Kingfisher, (V) Common Flameback Woodpecker, (W) Black Kite, (X) Indian Spotted Owl.

which lead to the removal of a large number of trees. The urbanization process is so extensive that most of Asansol's outskirts regions, which were originally densely forested or with many small water bodies, have been turned into flats or plots for residential use, which has resulted in the loss of bird habitats. The satellite image indicates the reduction of green coverage in the area (Fig. 4).

Electromagnetic waves from cell phone towers and mobiles are suspected to cause disturbance and health hazards in birds and other animals (Atwal 2018, Shivani and Sudarshanam 2012). Durgam *et*

al. (2017) and Verma *et al.* (2018) found electromagnetic pollution from mobile towers caused significant decline of the avifauna in Chhattisgarh, India. Migratory birds are affected by electromagnetic radiation (Hiscock *et al.* 2017, Surendran *et al.* 2020). The number of mobile towers and electromagnetic radiation increased manifold in recent years (especially with the surge of 4G networks in 2016) in the Asansol-Burnpur area, as also evident in other big cities of India. During the COVID-19 pandemic, usage of mobile phones, technology, and associated electromagnetic waves spiked many times (Tyagi *et al.* 2021). Hence, electromagnetic waves from cell

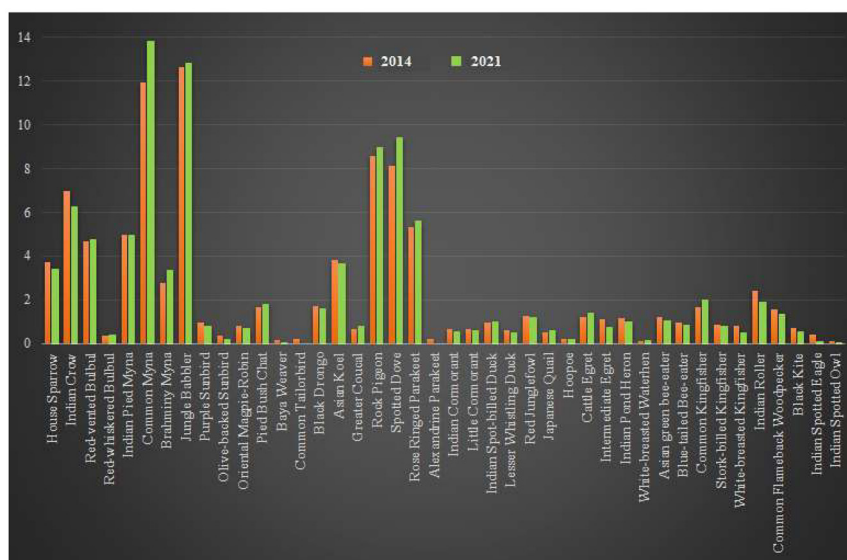


Fig. 3. Change of relative abundance of different bird species from 2014 to 2021.

phone towers and mobiles may be an unseen player behind the decline of avifauna in the study area. It is to be mentioned that governments of many countries have already taken steps to reduce the harmful frequencies of cell phone and tower radiation.

The pollution status especially the air pollution status is a matter of great concern in the area. A report by the West Bengal Pollution Control Board reveals that the annual average level of PM10 (particulate matter less than 10-micron size) shows an increasing trend in Asansol and all the values of PM10 are higher than the acceptable limit (EDGWB 2020). Water bodies of the area becoming increasingly polluted due to human activities (Paul and Nath 2021, Mukherjee and Paramanik 2022). These may have an impact on the survival of birds.

The four locations that were surveyed on a regular basis all exhibit varying degrees of human intervention. Sites 3 and 4 are in the core region of the city with peak human interactions throughout the year. But sites 1 and 2 are in protected and isolated areas and due to lesser human activity, more diverse species and numbers of birds have been reported from these locations (Table 1). However, in recent years human invasion becomes excessive in these two sites too and birds are definitely disturbed by the noise produced.

Sites 1 and 2 are literally crowded in the festive and winter seasons. Sound and air pollution by automobiles and sound of amplifiers used for amusement purposes noticeably become higher. During the study, it was found that sound pollution in some areas was not as bad in 2014 as it is now during the last study in 2021. The above factors singly or jointly may be the causes behind the lowering of the abundance of avifauna in the area.

CONCLUSION

This is the first record of avian fauna and the impact of the environment on them from the Asansol-Burnpur zone. The study shows a notable avian diversity in this area. The comparison results of the study in about a 7-year gap show that in 2014 the abundance and diversity were higher which has decreased in recent years. The observed number of almost all the species decreased in 2021. Although the relative abundance of a few species has increased (especially the species well-established in the area), birds with less relative abundance in 2014 become lesser abundant which can be considered alarming. The risk of vanishing some less abundant bird species from the area in near future is increasing. If unrelenting urbanization, human intervention, pollution, and the growing use of electromagnetic waves continue as they have in

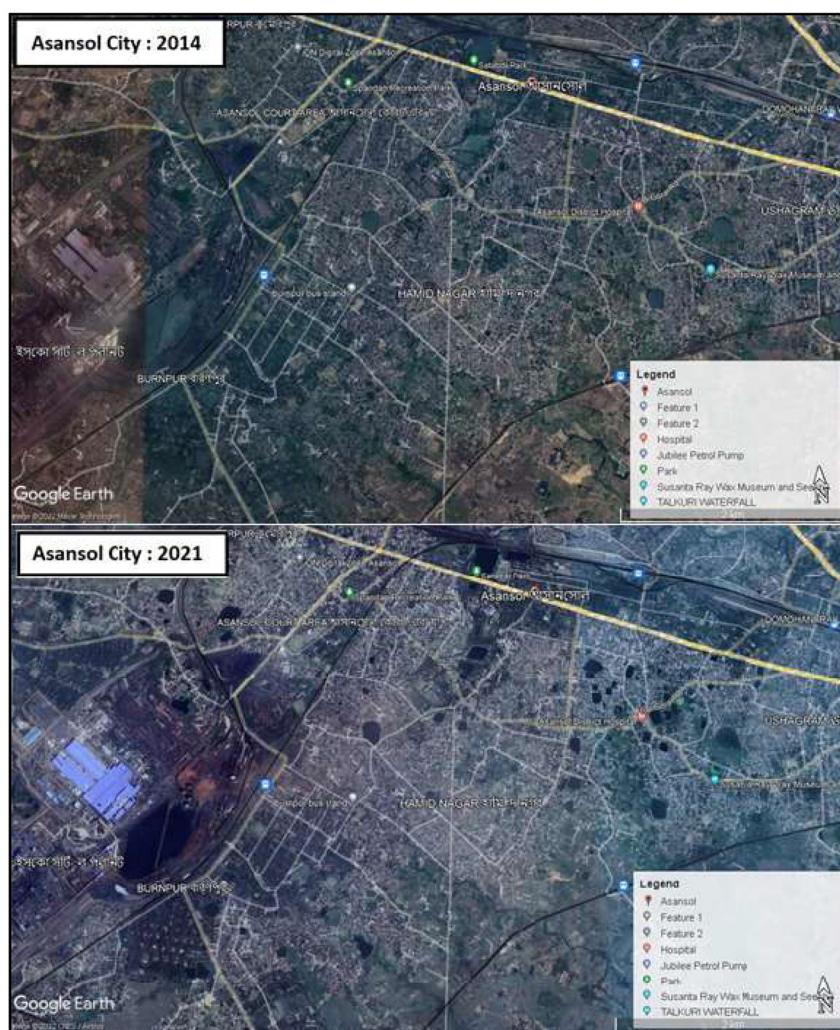


Fig. 4. Green coverage of Asansol in 2014 and 2021 (retrieved from Google earth).

recent years, the future of avian fauna diversity is jeopardized. Careful monitoring of the reasons for the decline of birds in the area and creating awareness among people is necessary. Anthropogenic alteration and interference in the birds' habitats should be minimized and the government-recommended conservation approaches must be strictly implemented in order to conserve these beautiful twittering creatures.

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