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Assessing the Migratory Pattern of Birds in Kulik Wildlife Sanctuary During COVID-19 Period

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Abstract

Raiganj wildlife sanctuary is known as Kulik Forest and Kulik bird sanctuary or Kulik wildlife sanctuary. It is situated in Raiganj Uttar Dinajpur West Bengal. Mainly established in 1970 as a Kulik bird sanctuary but was officially designated as the "Raiganj Wildlife Sanctuary" in 1985. It extends over 1483.75 Acre legal status of the forest. The forest type is mainly mixed deciduous forest. Those birds which migrate from one location to feed, breed and raise their offspring are known as migratory birds. Mostly they are coming from unfavourable condition to some favourable place having sufficient food, water, resources and safety. The largest migrant birds are coming from 11 southeast Asian countries and coastal areas during monsoon. Increasing temperature is the main cause of migration. Nesting time is July to August and egg laying is from August to September. Asian openbill storks, night herons, egrets, and cormorants are the most important migrant birds. On one hand, we see the whole world is suffering from climate change issues mainly global warming and on other hand we see a green world, purifying air which is favourable for Aves. We all witnessed this incident. This paper describes a great biodiversity of plants (total of 34 species of trees), birds (164 species of birds), Amphibians (2 species), mammals (3 species), reptiles (10 species) and fish (19 species), and Molluscs (3 species). Other objective is why migrant birds are increasing day by day in Kulik wildlife sanctuary. Quantitative and qualitative data processing has been done and research work has been processed through Arc Gis, statistics, surveys, interviews and secondary sources. Tree species and number of migrant birds' data were collected by the DFO (District/Divisional Forest Officer) in Raiganj and temperature data were collected from the power access data site.

Keywords: Biodiversity; Migrant birds; Ecosystem; Asian openbill

1 Introduction

Those birds which migrate from one location to feed, breed and raise their offspring are known as migratory birds. Mostly they are coming from unfavorable condition to some favorable place

having sufficient food, water, resources and safety. In World and Asia, the largest migratory sanctuary is Chilka lake bird sanctuary in Odisha and second Khichan Bird Sanctuary located in Rajasthan, India. Kulik bird sanctuary is also 2nd

largest sanctuary in Asia. It is located in Raiganj Uttar Dinajpur. It is popularly known as Kulik Bird Sanctuary because the river Kulik flows beside the sanctuary. The shape of the sanctuary is that of the English alphabet "U". During monsoon the river water enters the sanctuary, which supports a wide variety of food for the birds. All know that biodiversity is the indicator of health of the ecosystem. Biodiversity supports ecological services including, purification of the water and air pollution, prevention of erosion, and stabilization of CO₂ levels. Biodiversity boosts ecosystem productivity for each species, no matter how small. All have an important role to play. Ecological life supports biodiversity. Rich biochemical cycle is noticed in the forest which keeps a balanced ecosystem, food chain, and biodiversity. It is important that necessary nutrients are provided by the soil and the roots of phototrophic green plants take the nutrients through the process of root osmosis from the soil. The term biochemical cycle because plants play an active role in the cyclic pathways of nutrients.

Birds generally migrate in flocks. Most migrations are latitudinal- from North to South also, some migrate from East to West.

- **Short-distance migrants:** May move only a short distance, as from higher to lower elevations on a mountain side.
- **Medium-distance migrants:** Some species may cover distances that span from one to several states.
- **Long-distance migrants:** Birds that typically have ranges that extend from one continent in the summer to another in the winter.

Winged species from different countries from southeast Asia have started flocking to the Kulik Bird Sanctuary near here a month ahead of their normal arrival with experts suggesting that conducive climatic conditions induced by lockdowns in different Asian countries propelled their flight. Every year, migratory birds, especially cormorant, night heron, egret, and open-billed stork, reach the sanctuary from July onwards. The sanctuary is spread over 370 acres on the banks of the Kulik.

The two major factors which support migration of the birds in these regions are as follows:

Availability of plenty of food supply: Food and nesting space are simple answers. And additional reason is Kulik river and agriculture field. agriculture field is source of apple snail. River water is source of bird's food like, fingerlings. Birds migrate to improve their chances of survival and reproductive success, and while temperature may influence bird migration, birds can survive in very cold conditions. The main reason for bird migrating is to follow their stomachs (aka food) and find safe spaces to nest.

Many birds migrate in line with vegetation changes. Wind, precipitation, and temperature affect the changes in vegetation and consequently availability of food and space

for nesting; which is why bird migration is seasonal. These resources and conditions make areas more live-able at various times of the year. Migrating to areas with more abundant resources improves chances of survival and also impacts breeding success. There has been less pollution in many Asian nations because of lockdowns induced by the novel coronavirus. Hence, it seems, climatic conditions became conducive to the birds' flight, and they reached Kulik earlier than the normal time. We hope the avian population in Kulik this year will surpass the record. "Around 10,000 birds have already reached the sanctuary about a month ahead of the usual time and more will fly in during the coming weeks," Raiganj divisional forest officer Somnath Sarkar said. Pramika Lama said strong two reasons for bird migration are – **fingerlings and apple snails**. Apple snail is favorite food of open bill bird. Mainly four types of birds are migrating- Open bill, Black crowned night Heron, Great egret and Cormorant.



Fig. 1. a. Apple snail, b. Fingerlings

A suitable place for nesting, Deciduous Trees: The study already discussed Kulik forest is mainly mixed deciduous forest. These broad-leafed trees lose their leaves in the winter, but in spring, they are filled with flowers and buds, and many of them produce fruit for birds. In the autumn and winter, the leaf litter from deciduous trees is also a fine source of food for ground-feeding birds, and it also provides nesting material in the spring. The best deciduous trees for birds include larches, mesquites, maples, oaks, and willows. They make their nest from softwood, and thorny plants in the surrounding area and make hard material. Every day they do repair their nest. Since trees are so helpful to birds, adding the appropriate trees to your landscaping will allow you to attract a wider variety of bird species that increase our Kulik sanctuary.

A bird won't build a nest if there is no safe, suitable place for that nest. There are many different locations that different types of birds prefer for nesting, and savvy birders will try to provide multiple nesting sites in their yard. Trees are critical for birds in many ways, and they meet all birds' basic needs for survival.

- **Food:** Trees provide sap, buds, nuts, and fruit for birds, as well as hosting insects in bark and leaves.
- **Water:** Leaves collect water that small birds can drink, and many birds will rub against wet leaves to bathe.

- **Shelter:** Thick branches and leaves provide shelter for birds in all weathers, and many birds roost in trees.
- **Nesting Sites:** Many cavity-nesting birds will drill holes in trees to nest, while others build nests on branches.

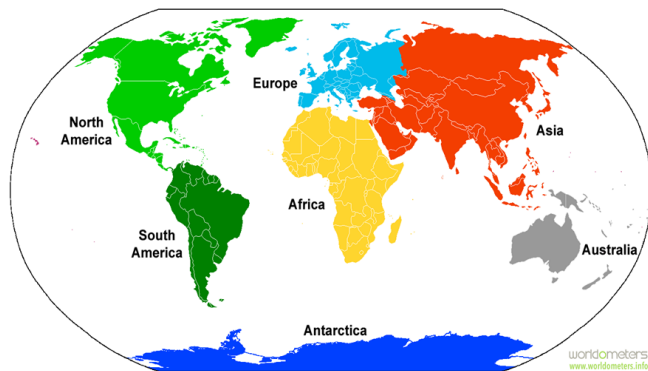


Fig. 2. World Map (Source: Worldometers)

2 Study of area

This study was about Raiganj located on the bank of Kulik river. It is situated at 25° 35' to 25° 57' N latitude and 88° 07' to 88° 17' E longitude. Raiganj town in Uttar Dinajpur District in West Bengal. The mean temperature of this site is 39°C maximum. Rainfall is more or less 1500 mm whereas the relative humidity is 89% and winter temperature of maximum 20°C.



Fig. 3. Source: www.getbengal.com

3 Data Collection and Methodology

Both primary and secondary data were used for Collecting data. Secondary data is collected from some journals, books, official websites, DFO office Raiganj. Premika Lama (Range Officer, Wildlife Raiganj) provided data on names of birds,

animals, fishes, and reptiles. With systematic sampling study and area visit (visited 5 times in a month), the nesting process and breeding in the different habitat are observed. Also AQI index, noise and water quality index surrounding forest area are verified. Mainly May and June data are studied to clarify the condition of weather, because of birds' arrival in these months.

4 Result and Discussion

Local birds are kites, owls, woodpeckers, Drongoes, Flycatchers, kingfishers Bulbul, Dove. Migrant birds are Asian open-bill, Night Geron, Egrets, and Cormorants. Every year 80000 to 90000 birds are migrating during monsoon.

Table 1. Migrant birds over the year (1984-2022)

Year	Asian Open Bill	Black Crowned Night Heron	Great Egret	Cormorant	Total
1984	22364	3432	2016	1216	29023
1988	37876	7808	5072	4516	55272
1993	21640	1362	1692	6544	31236
1998	37732	19060	2792	19576	72160
2003	54260	11080	9204	6892	81384
2008	58920	12804	9708	10108	91540
2013	44299	6192	7185	7185	65000
2018	67270	9990	10554	10554	98562
2022	64055	19841	8969	6528	99393

Source: Raiganj wildlife sanctuary

Table 1 depicts the population counts of different species of birds over the 5 years interval from 1984 to 2022. Asian open bill, Black crowned night heron, Great Egret and Cormorant count has been increasing over the years. Usually, birds move in search of wetlands and change in their population could reflect in environmental health.

In 1984, population of bird's species were recorded to be 29023 in total of which openbill numbered 22,364, night heron stood at 3,432, the great egret at 2,016 and cormorant at 1,216. Openbill account for the highest number. The data between 1984 to 1988 reflects the real increase in population of all four species. The Asian Openbill population has nearly doubled, it has reached 37,876 while the Black Crowned Night Heron, Great Egret and Cormorant showed a significant growth. In between 1993 to 1998 bird population of the Black Crowned night heron and Great Egret declined while the Asian Openbill and Cormorant populations remained stable. Between 1998 to 2003 there was significant increase in population count of all species. Asian Openbill was exceeded 50,000 and other three species of birds experienced notable growth. This period indicates successful conservation, or it is showing healthy habitat quality.

Other year also saw fluctuations in population counts between 2008 and 2013. There was slight decrease in the populations of the Asian Openbill and Great Egret, while the population of Black crowned Night heron and Comororant remained stable. Year of 2018 saw increase of population counts for all species expect Great Egret. These fluctuations could be influenced by climate conditions and human activities. Overall, the population of bird's species suggest multiple role play of environmental factors besides habitat quality and availability of food resources and human impacts.



Fig. 4. Migrant Birds

4.1 Vegetation found in the region

The most common species found within the forest are sis-soo (*Dalbergia sisso*), simul (*Bombex ceiba*), siris (*Albizia lebbeck*), Akashmoni (*Acacia auriculiformis*), KHAIR (*Acacia catechu*), Lali (*Amoora wallichii*), khadam (*Anthocephalus kadamba*), Mingiri (*Cassia Siamea*), *Eucalyphus* Spp., siddha (*Lagerstroemia parviflora*), JARUL (*Lagerstroemia speciosa*), Sal (*Shorea robusta*), Sheora (*Strobulus asper*), Arjun (*Terminalia arjuna*), Teak (*Tectona grandis*). Total 34 species of trees are there.

Over the year analysis of pollutant (Table 7) shows NO_2 with lowest concentration of $14.46 \mu\text{g}/\text{m}^3$ in 2018 and highest concentration of $43.77 \mu\text{g}/\text{m}^3$ in 2019. PM10 means particulate Matter 10; lowest concentration of $38.52 \mu\text{g}/\text{m}^3$ in 2021, highest concentration of $136.67 \mu\text{g}/\text{m}^3$ in 2022. Sulfur Dioxide (SO_2) showed lowest concentration of $2 \mu\text{g}/\text{m}^3$ in three consecutive years like 2016, 2017 and 2018, and then again in the year 2021 it was at the lowest level. The highest concentration was recorded ($10.35 \mu\text{g}/\text{m}^3$) in 2019. Actually data reflects that 2018 had least pollution overall and lowest

concentration of NO_2 , SO_2 where as PM10 concentration was highest as compared to other pollutants in 2018. It was not as extreme as in 2019 or 2022. Thus 2018 stands out as year with lowest pollution margin across all pollutants.

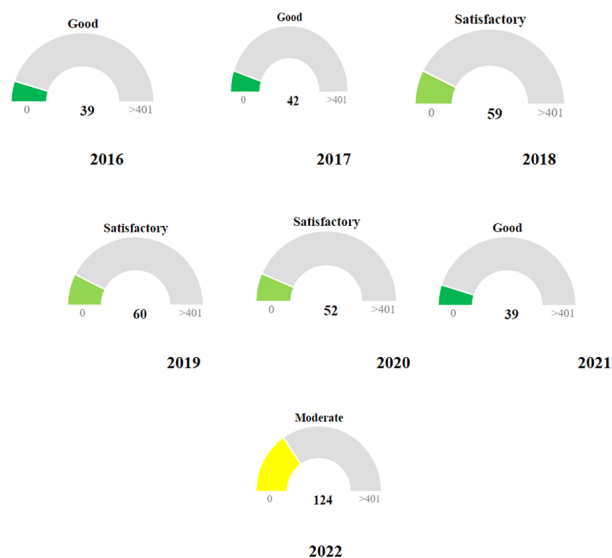


Fig. 5. Air quality index for the years 2016 to 2022

When air quality index is considered in the present study for the years 2016 to 2022, it was observed that good quantity of index was achieved in the years 2016, 2017 and 2021 whereas satisfactory index was seen between 2018 to 2020 and moderate in 2022. Least value indicates pollution free environment. As per Figure 5, 2016 and 2021 shows least value over the years considered for the study. In the years 2020, 2019, 2018, 2022 air quality was relatively poor than in 2016 and 2021. Looking at the data of migratory birds, it was witnessed that 2020 received highest inflow but the quality of air was at its satisfactory level only that year reaching the level of 52. The reason behind such finding is cleared when the study considered temperature data of Southeast Asian countries as depicted in Table 8.

The eleven years of average temperature data of the south Asian countries show very high temperature for these countries compared to India especially West Bengal in particular. The year wise temperature shows fluctuation in the southeast Asian countries whereas Kulick's rich environmental sustainability and strong forest-bio ecosystem provides a very pleasant weather. Overview of the temperature data in the Table 8 reflects that the highest average temperature was reported by Myanmar, Thailand, and Cambodia respectively. In Myanmar all the average temperature remained above 40 degrees ever since 2010 till 2022. This has been presented in the Figure 6 in red color. The least average temperature was recorded by Kulik which has been marked with blue color in Figure 6.

Table 2. Amphibians' community found in the region

Name	Scientific name	Family	Order	Kingdom	Phylum	Class
Asian common toad	<i>Duttaphrynus melanostictus</i>	Bufonidae	Anura	Animalia	Chordata	Amphibia
<i>Hoplobatrachus tigerinus</i>	<i>Hoplobatrachus tigerinus</i>	Dicroglossidae	Anura	Animalia	Chordata	Amphibia

Table 3. Mammals' community found in the region

Name	Scientific name	Trophic level	Conservation status	Family	Order	Class
Golden jackal	<i>Canis aureus</i>	Omnivorous	Least Concern	Canidae	Carnivora	Mammalia
Small Indian civet	<i>Viverricula indica</i>	carnivore	CITES Appendix III	Viverridae	Carnivora	Mammalia
Mongoose	Herpestidae	carnivore	Herpestidae	Herpestidae	Carnivora	Mammalia

Table 4. Reptile community found in the region

Name	Scientific Name	Family	Class	Kingdom	Order	Phylum
Oriental garden lizard	<i>Calotes versicolor</i>	Agamidae	Reptilia	Animalia	Squamata	Chordata
Bengal monitor	<i>Varanus bengalensis</i>	Varanidae	Reptilia	Animalia	Squamata	Chordata
Indian cobra	<i>Naja naja</i>	Elapidae	Reptilia	Animalia	Squamata	Chordata
Checkered keel-back	<i>Xenochrophis piscator</i>	Colubridae	Reptilia	Animalia	Squamata	Chordata
Rat snake		Colubridae	Reptilia	Animalia	Squamata	Chordata
<i>Lycodon capucinus</i>	<i>Lycodon capucinus</i>	Colubridae	Reptilia	Animalia	Squamata	Chordata
Rhabdophis	Colubridae	Colubridae	Reptilia	Animalia	Squamata	Chordata
Common krait	Elapidae	Colubridae	Reptilia	Animalia	Squamata	Chordata
<i>Dendrelaphis tristis</i>	<i>Dendrelaphis tristis</i>	Colubridae	Reptilia	Animalia	Squamata	Chordata
Bengal monitor	<i>Varanus bengalensis</i>	Varanidae	Reptilia	Animalia	Squamata	Chordata

Table 5. Fish community found in the region

Name	Scientific Name	Family
Indian flying barb	<i>Esomus danricus</i>	Cyprinidae
Mola carplet	<i>Amblypharyngodon mola</i>	Cyprinidae
<i>Channa gachua</i>	<i>Channa gachua</i>	Channidae
<i>Anabas testudineus</i>	<i>Anabas testudineus</i>	Anabantidae
Rice eel	<i>Monopterus albus</i>	Synbranchidae
Tank goby	<i>Glossogobius aureus</i>	Gobiidae
<i>Trichogaster fasciata</i>	<i>Trichogaster fasciata</i>	Osphronemidae
Walking catfish	<i>Clarias batrachus</i>	Clariidae
<i>Heteropneustes fossilis</i>	<i>Heteropneustes fossilis</i>	Heteropneustidae
Mud fish	<i>Channa striata</i>	Channidae
Mystus	<i>Mystus tengara</i>	Bagridae
<i>Channa punctata</i>	<i>Channa punctata</i>	Channidae
Mrigal carp	<i>Cirrhinus cirrhosus</i>	Cyprinidae
Rohu	<i>Labeo rohita</i>	Cyprinidae
Elongate glassy perchlet	<i>Chanda nama</i>	Ambassidae
<i>Parambassis ranga</i>	<i>Parambassis ranga</i>	Ambassidae
Ticto barb	<i>Pethia ticto</i>	Cyprinidae
Pool barb	<i>Puntius sophore</i>	Cyprinidae

Table 6. Mollusks Community found in the region ⁽¹⁾

Name	Scientific name	Family
<i>Filopaludina bengalensis</i>	<i>Bellamya bengalensis</i>	Viviparidae
gastropod	<i>Pila globosa</i>	Ampullariidae
freshwater snail	<i>Lymnaea acuminata</i>	Lymnaeidae

Table 7. AQI index at Raiganj, West Bengal (2016 to 2022)

Year	Pollutant	Concentration ($\mu\text{g}/\text{m}^3$)	Sub Index
2016	NO ₂	17.58	22
	PM10	42.02	42
	SO ₂	2	3
2017	NO ₂	17.58	22
	PM10	42.02	42
	SO ₂	2	3
2018	NO ₂	14.46	18
	PM10	59.18	59
	SO ₂	2	3
2019	NO ₂	43.77	55
	PM10	59.67	60
	SO ₂	10.35	13
2020	NO ₂	41.65	52
	PM10	48.67	49
	SO ₂	10.07	13
2021	NO ₂	19.94	25
	PM10	38.52	39
	SO ₂	2	3
2022	NO ₂	34.22	43
	PM10	136.67	124
	SO ₂	9.5	12

Source: West Bengal pollution control board

Table 8. 11 years average temperature data of

May (Average Temperature in °C)

Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
MYANMAR	43.4	42.9	43.9	42.67	42.12	43.33	43.25	42.69	41.18	44.4	43.05	43.78	43.89
THAILAND	41.47	35.8	38.23	41.15	39.51	40.32	42.13	40.08	37.53	41.12	40.33	37.64	37.7
CAMBODIA	40.44	38.1	39.04	39.73	38.98	40.98	42.87	41.3	39.27	39.55	39.02	40.72	41.22
LAOS	38.56	35.01	36.36	38.81	34.9	37.05	38.56	33.19	31.19	33.83	33.77	33.27	34.33
PHILIPPINES	36.22	33.49	33.44	33.93	35.06	35.08	35.23	33.46	34.51	34.45	33.16	34.66	34.33
VIETNAM	35.16	33.16	34.71	38.15	36.71	37.1	38.96	36.26	33.58	34.6	33.6	32.76	33.52
EAST TIMOR	31.6	27.87	27.3	28.25	27.44	28.02	28.44	27.65	27.94	28.07	30.08	26.92	27.22
SINGAPORE	32.93	31.33	31.8	31.55	33.03	31.8	33.12	31.03	32.37	32.36	33.87	31.91	32.33
BRUNEI	31.54	30.06	30	30.57	31.53	30.33	31.61	30.29	30.37	31.14	30.83	31.47	32.02
MALAYSIA	30.63	30.26	30.2	30.64	30.76	30.34	30.75	30.61	30.02	30.68	30.83	30.19	31.55
INDONESIA	30.22	29.93	29.72	30.03	30.43	30.09	30.28	30.09	29.79	30.33	30.44	30.32	31.52
KULIK	31.8	31.18	33.4	31.2	33.08	32.26	31.67	30.69	28.94	30.76	27.09	26.95	23.98

Source: NASA/POWER CERES/MERRA2 Native Resolution Monthly and Annual



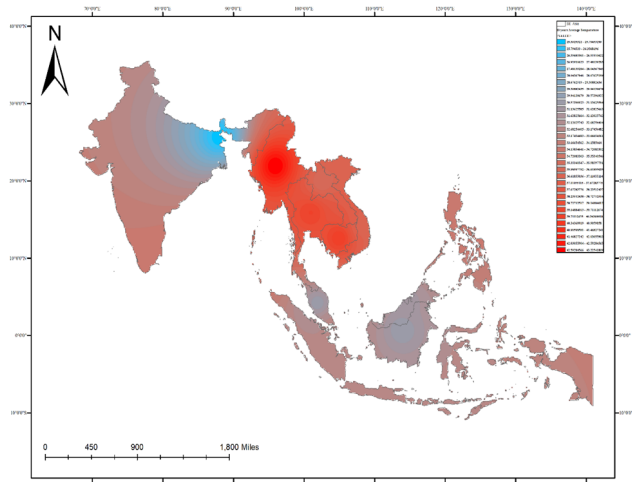


Fig. 6. 11 years average temperature data of Southeast Asian Countries (2010-2022) (Source: Computed by authors)

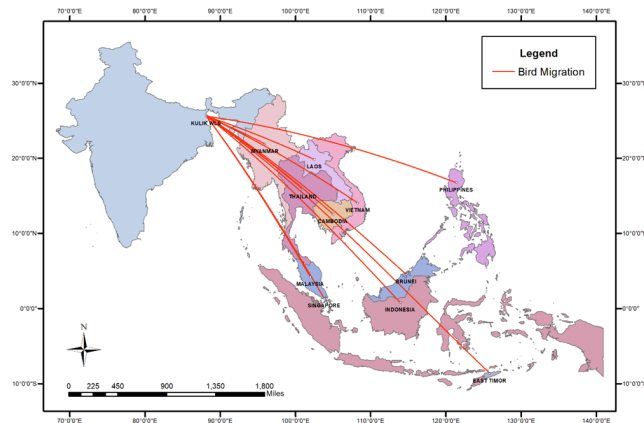


Fig. 7. Flow Map showing place of origin for the migratory birds coming to India (Source: Computed by authors)

4.2 Reason for Increased Migrant Birds at Kulik Wildlife Sanctuary in Covid-19:

- Pollution free environment due to covid 19 lockdown period. Absence of pollution gas from air.
- Less human movement and less disturbance to the bird. Poacher cannot catch birds in the pandemic situation. Birds are swaying in the pollution-free air and enhancing the beauty of the sky.
- Environment was free from functions, marriages, school sports, vehicle horns; as a result free from noise pollution. Birds can move from one country to another country freely, chirping joyfully.
- 68159 number Asian Openbill coming this year only for pollution free air and forest that has food supply like Snail, Snake, Insects and Fish. So, availability of food

source is the main reason for increase in migrant birds.

- Sufficient rainfall and temperature; as a result, trees are growing well, and sufficient foods are available. Suitable weather for insects, snail, and fish.
- Agroforestry helps to make their nest and provides security and food also.
- Apart from covid -19 period, migrant birds have increased in the year 2022, because of the source of food, security, and peace in the area. Still AQI index is moderate.

A healthy environment has been created for various species of birds, animals, and fish to live in Kulik. The biochemical cycle necessary for nutrients is provided from forest. This biogeochemical cycle is responsible for maintaining weather condition. Kulik forest has a strong ecosystem for healthy decomposing of minerals, dead plants and part of plants that fall from trees which are decomposed by bacteria and again join the soil pool. The waste materials excreted by animal dung, stool is decomposed by microbes and again converted into inorganic elements which find their way in soluble form to soil storage. Oxygen cycle helps the other cycling elements in biosphere. Formation of carbohydrates, fats, protein through respiration process of animals including man and through the process of photosynthesis by green plants of the terrestrial ecosystem. Nitrogen cycle leads to nutrient imbalance in trees, changes in forest health, and decline in biodiversity. With increased nitrogen availability there is often a change in carbon storage. Sufficient green plants and deep-rooted trees help for nitrogen fixation. Tree is taking nitrogen from the soil through the root and the animals and birds are taking nitrogen from the plant. This way Biocycling process is complete in Kulik that sustain environment.

Conclusion

Overall result and discussion of the study suggest a strong relation between inflow of birds and temperature variation. The average temperature in the Kulik region was found to be 15 to 20 degrees lesser than in Southeast Asian countries. Sufficient food, and fresh air along with silent, clam environment of Kulik makes it the home for numerous migratory birds. Huge numbers of birds came to Kulik bird sanctuary in the year 2019-2020 which was the time of pandemic- Covid-19. Less degree of noise pollution, air pollution, water pollution and soil pollution provided these birds a quiet place for nesting and sheltering from hot weather at their original countries. Another point to be noted is that bird foods are available because of sufficient rainfall. Fish laying eggs because of lot of rain and a lot of fish are appearing in the Kulik River. Because of sufficient rainfall, trees have grown nicely. As a result birds are able to build their beautiful nests in these trees. It is a bitter truth that

coronavirus has taken the lives of so many people. On the other hand, Covid-19 saved the environment and created pollution-free atmosphere. Nature is in favor of wildlife. Birds are swaying in the pollution-free air that soothes our eyes and enhances the beauty of the sky.

Acknowledgement

We are thankful to DFO office Raiganj and Premika Lama (Range Officer, Wildlife Raiganj) for providing data of

migrant birds from 2010 to 2020 and for providing reptile names, mammal names, and tree names.

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